BOTANISKA NOTISER

FÖR ÅR 1965

VOL. 118

UTGIVEN AV

LUNDS BOTANISKA FÖRENING

REDIGERAD AV

BERTIL NORDENSTAM

Tidskriften grundad 1839

DISTRIBUTÖR: C. W. K. GLEERUP, FÖRLAG · LUND

Utgivningstider:

Fasc. 1, sid. 1—138, den 14 april
Fasc. 2, sid. 139—272, den 20 aug.
Fasc. 3, sid. 273—328, den 29 okt.
Fasc. 4, sid. 329—493, den 22 dec.

LUND 1965
CARL BLOMS BOKTRYCKERI A.-B.

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1839—1938 Pris för medlemmar 10 kr.
Price for members 10 Sw. kr.
1939—1958 Pris för medlemmar 24 kr.
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Universitetsbiblioteket
11 JAN 1965

BOTANISKA NOTISER 1965 · VOL. 118 · FASC. 1 · LUND

Vegetationen i branter, talus och hällmark inom några kalkstens- och dolomitområden inom Torneträsk-området

AV KARL-GÖRAN BRINGER
Linköping

Inledning

I sådana områden i norra Sverige, som hyser en övervägande artfattig och trivial flora, är det i brantbergen, som förutsättningarna för fynd av sällsynta arter eller isolerade utpostlokaler är störst. Från sådana lokaler, främst de s.k. sydväxtbergen (DU RIETZ 1954), har ett stort antal fanerogamfloristiska uppgifter publicerats. I fråga om vegetationens sammansättning i brantbergen föreligger ett norskt material av beskrivningar och vegetationsanalyser, som sammanställts av i första hand NORDHAGEN i flera arbeten (1935, 1936, 1943, 1954). Hos NORDHAGEN (1936, 1943) finner vi också följande växtsociologiska system för subalpin-alpin chasmofytisk vegetation och talusvegetation i Skanderna:

1. *Saxifragion cotyledonis* för chasmofytisk vegetation på kalkfattiga och relativt kalkfattiga (subcalcifila) bergarter.
2. *Asplenion viridis subarcticum* omfattande den chasmofytiska vegetationen på klippor av Ca- eller Mg-rika bergarter.
3. En mycket fattig och osjälvständig vegetation i talusbranter av extremt hårda och kalkfattiga bergarter.
4. *Veronico-Poion glaucae* i det subalpina och de lägsta delarna av det lågalpina bältet på »næringsrikt, men kalkfattig eller svagt kalkholdig grus» (pH 5,35—6,26 i Sikilsdalen). Förbandet hyser i Sikilsdalen ett stort antal lokala eller regionala ledarter, av vilka åtskilliga även förekommer i klippspringor och på hyllor.
5. *Arenarion norvegicae* från talus av kalksten, dolomit och

glimmerskiffer med ledarterna *Arenaria norvegica, Braya linearis* och *B. purpurascens* och med skiljearter gentemot föregående förband som *Dryas octopetala, Saxifraga aizoides, S. oppositifollia, Astragalus-* och *Oxytropis*-arter, *Epipactis atrorubens* och *Gymnocarpium robertianum.*

Från Sverige finns endast fåtaliga uppgifter rörande vegetationens sammansättning i branter och talus. RUNE (1953) för vissa växtsamhällen på serpentin och närbesläktade bergarter till NORDHAGENS förband *Asplenion viridis subarcticum* och *Arenarion norvegicae.* Hos LUNDQVIST (1961) finner man några analyser av talusvegetation i Pite lappmark samt försök till jämförelser med NORDHAGENS material.

Under några somrar i mitten av 50-talet hade jag tillfälle att studera flora och vegetation på ett sydväxtberg norr om Torneträsk, Vakketjåkko (Ortovare). Jag har tidigare (BRINGER 1962, 1963) beskrivit naturförhållandena på fjället och kärlväxtfloran i dess dolomitbranter samt även angivit en del litteratur (BRINGER 1962, s. 319—320), där fjällets geologi och kärlväxtflora beröras. För att erhålla jämförelsematerial utvidgade jag så småningom mina undersökningar till att omfatta även andra delar av Torneträsk-området. I denna uppsats beskrivs och exemplifieras med vegetationsanalyser brantvegetation från tre lokaler inom Torneträsk-området. Jag vill rikta ett varmt tack till professor G. E. DU RIETZ, som tagit initiativet till mina undersökningar i Torne lappmark och på olika sätt stött dem. Ett hjärtligt tack går också till professor HUGO SJÖRS och lektor SVEN KILANDER, vilka under mitt arbete med denna uppsats bidragit med kritik och värdefulla synpunkter, samt till docent OLLE MÅRTENSSON för bestämning av några mossor.

Undersökningsområdena

I. Vakketjåkko. Det 993 m höga fjället är beläget på norra sidan av Torneträsk ungefär vid sjöns mitt. I fjällets sydsluttning går ett kraftigt dolomitstråk upp mot öster i fjällsidan till trakten kring skogsgränsen. Dolomiten går i dagen som en serie branter, en del utan men flertalet med större eller mindre kvantiteter talusmaterial nedanför väggen. De största talusanhopningarna finner man nedanför en kraftig brant i nivå med skogsgränsen, som här löper omkring 600 m. Vegetationen i de östligaste delarna av talusbranten är närmast av alpin karaktär med *Dryas*-fläckar (i fråga om dessas sammansättning, se BRINGER 1961), medan i de västliga delarna björkbestånden tätnar, och vegetationen blir rent subalpin med ökat inslag av sydlägegynnade arter. I det följande kommer endast subalpin vegetation att behandlas.

II. Lullihatjårro. Vid nordvästra ändan av Torneträsk ligger det 869 m höga fjället Lullihatjårro, som jämte Vakketjåkko är områdets förnämsta sydväxtlokal. Från Djupvikens lappläger vid stranden av sjön kan man strax nedom skogsgränsen se ett stråk av branter, som löper i stort sett horisontellt i fjällsidan. Branterna består här till stor del av kalksten av den inom Torneträsk-området vanliga gråaktiga typen. Lullihatjårros branter hyser inte lika stora talusanhopningar som vissa av Vakketjåkkos. De talusbranter, som finns, tycks vara väl stabiliserade och på väg att täckas av vegetationen. Sluten ängsvegetation går i stor utsträckning fram till väggen. Man finner den konkurrenssvaga sydbrantfloran på hyllor i väggen och i delvis jordblandad talus men också i viss utsträckning i hällmark med så tunt jordlager, att träd och buskar inte förmår bilda helt slutna bestånd. Vid en jämförelse med floran på Vakketjåkko frapperas man av den rikliga förekomsten av *Anthyllis vulneraria* ssp. *lapponica* och *Lotus corniculatus* v. *borealis* på Lullihatjårro, medan *Gymnocarpium robertianum,* som lokalt förekommer rikligt på Vakketjåkko, endast förekommer mycket sparsamt på Lullihatjårro. Den ofta högvuxna och frodiga ängsvegetationen i sluttningarna nedom branterna förefaller vara ganska likartad på bägge fjällen med bl.a. växtsamhällen dominerade av olika ormbunkar, såsom *Matteuccia struthiopteris, Athyrium filix-femina, Phegopteris polypodioides, Gymnocarpium dryopteris* och *Dryopteris dilatata.*

Lullihatjårro hör till de botaniskt bäst kända av fjällen kring Torneträsk. Bland den litteratur, som berör fjällets kärlväxtflora och vegetation, kan nämnas LAGERBERG (1909), FRIES & MÅRTENSSON (1910), ALM (1921, 1923, 1944), SAMUELSSON (1921), SMITH (1924), ALM & FRIES (1925), PERSSON & RUNEMARK (1950) och PERSSON (1961, 1962).

III. Kärketjårro. Den djupa dalgången mellan fjällen Kärketjårro och Vassitjåkko sydväst om Torneträsk är ett av områdets populäraste turistmål, bekant för sina väldiga block och erosionsrester och för sjön Rissajaure med sitt utomordentligt klara vatten. I fjällsidorna runt dalen finner man stora talusbranter. Rörelser och ackumulation i dessa har beskrivits av RAPP (1961), som i nämnda arbete i ord och bild ger detaljerade upplysningar om naturförhållanden, topografi och geologi i dalen. Botaniskt är framför allt de västexponerade talusanhopningarna i Kärketjårro-sidan av intresse. Talusmaterialet är tämligen finkornigt och utgörs främst av en blandning av kalksten och glimmerskiffer. Här växer bl.a. *Arenaria norvegica* och *Braya linearis.* Jag har

tidigare (BRINGER 1961) beskrivit talusbranternas *Dryas*-bestånd. Floran är här helt utan sydväxtinslag.

Berggrunden på de tre behandlade brantlokalerna utgörs av kalksten, dolomit eller kalkhaltiga skiffrar, och man kan alltså räkna med en cirkumneutral till basisk markreaktion. Några pH-mätningar från subalpin dolomittalus på Vakketjåkko visar värden omkring 7,5. Det är naturligt, om dessa områden hyser arter och vegetationstyper, som man eljest förgäves söker i brantberg, där endast en m.l.m. obetydlig kalktillförsel äger rum med bergsegan. Ståndorter av den typ, som de tre undersökta områdena representerar, är sällsynta i de svenska fjällen. Ytterligare någon sydbrant av dolomit med liknande vegetation som Vakketjåkkos brantkomplex torde inte finnas i Sverige. I den branta sydsidan av det botaniskt berömda dolomitfjället Ruopsuok 3 mil sydväst om Torneträsk tycks, efter vad jag kunde iakttaga vid ett ganska flyktigt besök, flora och vegetation vara av klart alpin typ. Bland lapska fjäll, som skulle kunna lämna jämförelsematerial till Vakketjåkko och Lullihatjårro, kan närmast Aranåive och Tjårgesvare i Lule lappmark samt Gräskevardo i Lycksele lappmark komma i fråga. Se t.ex. BJÖRKMAN (1939), SELANDER (1950 a och b) och RUNE (1948, 1963 s. 476).

A. Vegetationen i skrevor och på hyllor i bergväggen

De mest utpräglade chasmofyterna på en bergvägg finner man i de smala springorna och skrevorna, medan vegetationen med tilltagande hyllbredd förlorar sin särprägel i och med det ökade inslaget av fakultativa chasmofyter eller normalt icke chasmofytiska arter. Vi möter i skrevorna miniatyrsamhällen eller fragment av växtsamhällen, bestående av någon enstaka kärlväxt, mossa och lav. Bland kärlväxter, som förekommer på sådana ståndorter i Vakketjåkkos och (eller) Lullihatjårros subalpina dolomit- och kalkstensbranter, kan nämnas:

Woodsia alpina
Cystopteris fragilis
Asplenium viride
Asplenium ruta-muraria (end. Lullihatjårro)
Poa alpina
— *glauca*
Draba hirta
Potentilla crantzii
Erysimum hieraciifolium
Sedum rosea
Saxifraga oppositifolia
— *nivalis*
— *caespitosa*
Viola rupestris ssp. *relicta*
Campanula rotundifolia

Denna typ av väggvegetation kan ingå i det av NORDHAGEN uppställda förbandet *Asplenion viridis subarcticum*. Med stigande nivå och fuktighetsgrad eller vid en mera nordlig exponeringsriktning blir ofta *Saxifraga oppositifolia* dominerande, samtidigt som vegetationen blir mera osjälvständig, i och med att de obligata chasmofyterna försvinner och ersätts med andra konkurrenssvaga arter eller arter med vid ståndortsamplitud ur angränsande samhällen.

Ju bredare hyllorna blir, desto flera icke chasmofytiska element inkommer, medan även i detta fall de mera utpräglade chasmofyterna konkurreras bort. Vegetationen på breda hyllor kan ofta betraktas som fragment av kringliggande hed- eller ängssamhällen. På en del större solbelysta hyllor i subalpina branter kan man emellertid inom mitt undersökningsområde finna en vegetationstyp, som ännu innehåller några av de mera typiska chasmofyterna. *Poa glauca* och *Festuca ovina* uppträder som dominanter, tillsammans eller var för sig. De täta ruggarna av torra strån, som ofta hänger ut något över branten, ger samhället ett karakteristiskt utseende. De bägge gräsen blir aldrig lika dominerande i talusmaterialet nedom väggen, där i stället *Poa nemoralis,* som är en av talusvegetationens ängsbjörkskogsarter, kan spela en större roll. Den sistnämnda går däremot mera sällan upp på väggens hyllor. I själva bergroten kan man finna svårbestämda övergångsformer mellan de bägge *Poa*-arterna. (Jfr HYLANDER 1953 s. 264—265 och BENUM 1958 s. 134.) Med undantag för *Cystopteris fragilis* går klippspringornas ormbunkar inte in bland de täta grästuvorna på hyllorna. Som skiljearter gentemot de små skrevornas vegetation kan t.ex. *Juniperus communis* (småplantor), *Rubus saxatilis, Chamaenerion angustifolium, Solidago virgaurea* och eventuellt *Erigeron acre* ssp. *politum* användas. I det subalpina bältet kan arter som *Saxifraga nivalis, S. caespitosa* och *Sedum rosea* tjäna som skiljearter gentemot talusvegetationen. Den nyss beskrivna hyllvegetationen exemplifieras av vegetationsanalyserna i tabell 1.

B. Snårvegetation under subalpina branter

Nedom de subalpina sydexponerade branterna på Vakketjåkko och Lullihatjårro anträffas ofta ensnår, såväl i stabiliserad och ofta jordblandad talus som på talusfri mark, där mellan buskagen sluten ängsvegetation går ända fram till väggen. Enbestånd kan även utbildas på större hyllor i väggen (analyserna 2 och 3 i tabell 2 är exempel härpå).

Tabell 1. Vegetationen på sydexponerade subalpina hyllor av kalksten och dolomit

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Juniperus communis	.	.	.	.	+	.	.	.	.	+	+	.	+	+	+
Ribes spicatum ssp. *lapponicum*	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.
Sorbus aucuparia	+	+	.	.	.	.	.	.	.	.	.	.	+	+	.
Antennaria alpina	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.
Campanula rotundifolia	+	+	+	.	+	.	.	+	+	+	+	+	+	+	+
Cerastium alpinum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
Chamaenerion angustifolium	+	+	+	+	+	.	+	.	+	.	.	+	.	+	+
Cystopteris fragilis	.	+	+	+	+	+	+	+	+	.	.	.	.	+	+
Draba hirta	.	+	+	+	+	.	.	+	+	+	+	.	.	.	.
— *incana*	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.
Erigeron acre ssp. *politum*	+	.	+	+	.	.	+	+	.	.	.	.	.	+	.
Erysimum hieraciifolium	.	.	.	.	.	.	.	.	+	.	+	+	.	.	.
Potentilla nivea s. lat.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
Rubus saxatilis	.	+	+	.	+	+	.	+	.	.	.	.	+	+	.
Saussurea alpina	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.
Saxifraga caespitosa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
— *nivalis*	.	+	+	.	+	.	.	+	.	.	.	.	.	.	.
Sedum rosea	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.
Solidago virgaurea	+	.	.	+	+	+	.	.	.	.	.	.	.	+	.
Stellaria graminea	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.
Trientalis europaea	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.
Veronica fruticans	.	.	.	.	.	.	.	+	+	+	+	+	+	.	.
Carex rupestris	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.
Festuca ovina	D	D	D	D	D	D	+	+	+	D	D	+	+	D	+
Poa alpina	.	.	.	.	.	+	.	+	.	+	+	.	.	.	.
— *glauca*	+	D	D	+	.	D	D	+	D	+	.	D	D	D	D
Roegneria borealis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+
— *canina*	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.

Analyserna 1—12 är hämtade från dolomitbranter på Vakketjåkko mellan 390—550 m, nr 13 och 14 från kalkstensbranter på Lullihatjårro (c:a 500 m) och nr 15 från en dolomitklippa vid sjön Abiskojaures sydvästända (480 m). Kryptogamer har utelämnats. Hyllornas storlek varierar mellan 1/4—1 m². Närvaro av en art betecknas med + och dominans med D. Täckningsgraden är i de flesta fallen 1 (HULT-SERNANDER-DU RIETZ' skala).

Inte sällan ingår även *Sorbus aucuparia, Prunus padus* och *Ribes spicatum* ssp. *lapponicum* jämte *Juniperus.*

I större talusbranter har ensnåren åtskilliga arter gemensamma med övrig talusvegetation. Under Vakketjåkkos stora dolomitbrant anträffas t.ex. *Gymnocarpium robertianum* ofta inne bland enarna. Genomgående är dock artantalet i snåren lågt och förekomsten av åtskilliga arter förefaller vara tillfällig (10 av de 24 arterna i tabell 2 ingår endast i en ruta). Möjligen kan den stundom rikliga enbarrförnan påverka marken i för vissa arter ogynnsam riktning. Ängsbjörkskogsarterna är i stort sett de samma, som förekommer i annan stabiliserad talusvege-

Tabell 2. Snårvegetation under subalpina branter

	1	2	3	4	5	6	7	8	9	10
Betula pubescens	.	.	.	.	.	1	.	.	.	.
Juniperus communis	5	5	5	5	5	5	5	5	5	5
Prunus padus	.	.	1	.	.	.	.	.	.	.
Ribes spicatum ssp. *lapponicum*	.	.	1	1	.	.	.	.	.	.
Vaccinium vitis-idaea	1	.	.	.	.	.	.	.	1	.
Actaea sp.	.	.	1	.	.	.	.	.	.	.
Anthriscus silvestris	.	.	.	.	.	.	1	.	.	1
Asplenium viride	.	.	1	.	.	.	.	.	.	.
Campanula rotundifolia	.	1	1	.	.	.	.	.	.	.
Chamaenerion angustifolium	2	2	.	1	1	1	1	2	.	1
Cystopteris fragilis	.	1	.	.	1	.	.	.	.	.
Erigeron acre ssp. *politum*	.	1	.	.	.	.	.	.	.	.
Geranium silvaticum	.	.	.	.	.	.	1	.	.	.
Gymnocarpium dryopteris	.	.	.	1	.	.	.	.	.	.
Linnaea borealis	.	.	.	2	1	1	.	1	.	.
Paris quadrifolia	.	.	.	.	1	1	.	.	.	.
Rubus saxatilis	1	1	1	.	1	.	1	1	.	1
Saussurea alpina	.	.	.	.	1	.	.	1	.	.
Solidago virgaurea	1	1	1	1	1	1	.	1	1	.
Festuca ovina	1	3	2	.	.	.	.	.	.	.
Milium effusum	.	.	.	.	1	.	.	.	.	.
Poa glauca	.	.	.	.	1	.	.	.	.	.
— *nemoralis*	.	.	1	.	.	.	.	.	.	.
Roegneria canina	.	1	1	.	.	.	.	1	1	.

Analys 1—8 är hämtade från Vakketjåkkos dolomit mellan 380—570 m, medan 9 och 10 härrör från ensnår på Lullihatjårros kalksten c:a 500 m ö.h. Rutstorlek 4 m². Kryptogamer förekom mycket sparsamt och har inte medtagits i analyserna.

tation. *Gymnocarpium dryopteris, Trientalis europaea* och *Linnea borealis* representerar ett inslag av arter med huvudutbredning i torrare björkskogstyper.

Från Sikilsdalens talusbranter beskriver NORDHAGEN (1943) associationen *Cotoneastero-Juniperetum subalpinum,* som norr om *Cotoneaster integerrimus*' utbredningsområde uppges fortsätta i utarmad form till och med Finnmark. Ensnåren från Torneträskområdet utgör exempel på denna nordskandinaviska fas av associationen.

C. Subalpin talusvegetation

I de subalpina sluttningarna av Vakketjåkko och Lullihatjårro dominerar olika typer av ängsbjörkskog i anslutning till dolomit- och kalkstensstråken. De högvuxna ormbunkssamhällena med *Matteuccia stru-*

thiopteris och *Athyrium filix-femina* har behandlats av RUNEMARK (PERSSON & RUNEMARK 1950), medan ängssamhällena i övrigt är outredda. Fjällbjörkskogens högörtvegetation har av NORDHAGEN (1943) sammanfattats i förbandet *Mulgedion alpini,* i vilket också innefattas nyssnämnda ormbunkssamhällen.

Talusvegetationen har åtskilliga arter gemensamma med kringliggande högörtsamhällen, men många av dessas arter går sällan eller aldrig ut ens i väl stabiliserad talus. Se BRINGER (1962 s. 338). Ängsbjörkskogsarter, som däremot ofta och stundom rikligt förekommer i talusanhopningarna, är t.ex.:

Poa nemoralis
Milium effusum
Roegneria canina
Melandrium rubrum
Geranium silvaticum
Anthriscus silvestris
Chamaenerion angustifolium
Valeriana sambucifolia
Cirsium heterophyllum
Solidago virgaurea

Från Vakketjåkko kan ytterligare nämnas följande kärlväxter med huvudutbredning där inom subalpin högörtvegetation, vilka också utgör ett sparsamt men intressant inslag i stabiliserad ängsartad och något skuggig talusvegetation:

Urtica dioeca ssp. *Sondenii* (jfr WISTRAND 1962 s. 93).
Actaea sp. eller spp. *Actaea*-arternas förekomst och utbredning inom Torneträskområdet förefaller inte vara tillfredsställande klarlagd. Jag har själv aldrig sett exemplar med mogna frukter.
Rubus idaeus.

Polystichum lonchitis och *Rubus saxatilis* är två av ängsbjörkskogens arter, som visar klar preferens för vissa talussamhällen. *Rubus saxatilis* kan någon gång dominera över mindre ytor i frodig ängsvegetation men blir i väl stabiliserad och något fuktig talus den i särsklass viktigaste dominanten. Skottet bildar ett nätverk över stenarna men blir aldrig helt täckande. På mera finkornigt eller mindre stabilt talusmaterial minskar arten i betydelse. Detsamma är fallet i talus med rik inblandning av finkornig jord. *Geranium silvaticum* och *Solidago virgaurea* kan även lokalt dominera i sådana lägen, utan att vegetationens öppna karaktär går förlorad. *Polystichum lonchitis* har på Vakketjåkko sin rikligaste förekomst i den ängsartade vegetationen i talusbranternas nedre stabiliserade och skuggiga delar. Däremot finner man sällan arten isolerad från annan vegetation på öppna talusytor.

På Vakketjåkko är talusanhopningarna inom zonen från Torneträsk och cirka 125 m uppåt ofta små och beskuggade och lider brist på vad

man skulle kunna kalla typiska talusarter. Talusvegetationen i denna zon kan betraktas som transitorisk mellan björkskogens ängssamhällen och vegetationen i de större talusbranterna högre upp. Skiljearter gentemot kringliggande ängssamhällen är småvuxna och mera konkurrenssvaga arter som *Equisetum scirpoides, Draba hirta, Veronica fruticans* och *Antennaria dioeca,* medan *Equisetum variegatum, Cystopteris fragilis, Festuca ovina, Melica nutans, Poa alpina, Stellaria graminea, Euphrasia frigida, Campanula rotundifolia* och *Erigeron acre* ssp. *politum* stundom ingår i mera lågvuxna ängssamhällen men här visar klar preferens för talus.

I och med att talusbranterna blir större och glesare bevuxna, minskar inslaget av ängsbjörkskogsarter. Regelbundet men med minskad frekvens förekommer ännu t.ex. *Poa nemoralis, Rubus saxatilis, Geranium silvaticum* och *Solidago virgaurea,* men i den glesnande vegetationen inkommer ett ökat antal konkurrenssvaga, övervägande heliofila arter. Två lokala ledarter för denna vegetationstyp från Vakketjåkkos dolomit är *Gymnocarpium robertianum* och *Epipactis atrorubens.* I kalkstenstalus på Lullihatjårro finner vi i princip samma vegetationstyp med ganska riklig förekomst av sistnämnda art, medan *Gymnocarpium robertianum* där inte tycks förekomma i talus utan endast är funnen mycket sparsamt på en klippavsats enl. ALM (1921) samt i närmast ängsartad vegetation vid västra stranden av sjön 378 (se den fotogrammetriskt uppmätta kartan över Abisko-Björkliden-Riksgränsen - området). Som rent lokala skiljearter gentemot den tidigare nämnda transitoriska talusvegetationen kan nämnas *Erysimum hieraciifolium, Viola rupestris* ssp. *relicta, Fragaria vesca* och *Anthyllis vulneraria* ssp. *lapponica* samt arter med huvudutbredning på högre nivåer som *Carex rupestris, Cerastium alpinum* och *Draba incana. Arabis hirsuta,* som är vanlig i talussamhällena, går ofta även ut i måttligt tät ängsvegetation kring branterna och är tålig gentemot en viss beskuggning. Kryptogamer saknas vanligen helt i de undersökta talussamhällena eller förekommer enstaka och tillfälligt, ofta i form av nedrasade exemplar från väggens hyllor. De har i analyserna utelämnats.

Den typ av vegetation, som exemplifieras i tabell 3, kolumnerna 1—5 och a, kan kanske hellre betraktas som en enhet inom ängsbjörkskogens ännu föga utredda samhällen än som en del av ett verkligt talussamhälle. I den vegetationstyp, som representeras av analyserna 6—13 samt kolumn b i tabell 3, inkommer däremot ett antal för den slutna ängsbjörkskogen klart främmande växter, såsom utpräglade sydbrantarter och med stigande nivå alpina arter. Genom förekomsten

av *Gymnocarpium robertianum* och *Epipactis atrorubens* skulle vegetationen enligt NORDHAGENS indelning av talusbranternas växtsamhällen föras till förbandet *Arenarion norvegicae.* Den övriga artsammansättningen pekar dock snarare mot förbandet *Veronico-Poion glaucae,* så som detta exemplifieras i NORDHAGENS analyser från Sikilsdalen. En jämförelse mellan Vakketjåkkos av sydläget präglade subalpina talusvegetation och den rent alpina vegetationen med *Braya linearis* och *Arenaria norvegica,* som återfinns i tabell 4, visar mycket stora olikheter i artsammansättningen. Vill man sammanföra subalpin och alpin talusvegetation på Ca- och Mg-rika bergarter till ett förband, förefaller det att vara naturligt att dela upp detta i två vegetationsenheter av lägre rang, en med klart subalpin prägel (ev. med sydväxtinslag och utan större inblandning av alpina arter) med anknytning till ängsbjörkskogens växtsamhällen och en alpin, besläktad med förbanden *Dryadion* (DU RIETZ 1942) och (eller) *Potentilleto-Polygonion vivipari* (NORDHAGEN 1936). I talusbranter i trakten kring skogsgränsen kan dessa två vegetationstyper komma att flyta över i varandra. Se t.ex. rutanalys nr 11 i tabell II hos NORDHAGEN (1954, s. 258—259).

Man kan också tänka sig ett övervägande subalpint talusförband, omfattande vegetationen på såväl Ca- och Mg-rika bergarter som på sådant underlag, där *Veronico-Poion glaucae* normalt utbildas. Det finns dock otvivelaktigt brantarter inom mitt undersökningsområde, t.ex. *Sedum annuum* och *Silene rupestris,* som, trots att de har vissa krav på markens näringshalt, undviker direkt kontakt med kalksten och dolomit och alltså möjligen kan vara skiljearter mellan en basifil och en neutrofil till måttligt acidifil vegetationsenhet. Skiljearter kan säkert också hittas bland fakultativa talusarter som *Deschampsia flexuosa* och *Melampyrum pratense.*

D. Alpin talusvegetation

I de stora talusbranterna i fjället Kärketjårros västsida finns en förekomst av två av våra sällsyntaste fjällväxter, *Braya linearis* och *Arenaria norvegica,* på omkring 750 meters nivå (först funna av laborator GUSTAF SANDBERG). Dessa bägge arter betraktas som nämnts av NORDHAGEN som ledarter för förbandet *Arenarion norvegicae.* I Kärketjårros talusbranter förekommer omväxlande mindre fläckar av *Dryas* (se BRINGER 1961) och större ytor utan sluten vegetation med m.l.m. spridda individ av konkurrenssvagare arter och arter ur ängs-

Tabell 3. Subalpin talusvegetation

	1	2	3	4	5	a	6	7	8	9	10	b	11	12	13
Betula pubescens	.	.	.	.	.	10	.	1	.	.	.	10	.	.	.
Juniperus communis	.	.	.	.	.	—	.	.	.	1	1	25	.	.	.
Populus tremula	.	.	.	.	.	—	1	1	.	.	.	—	.	.	.
Salix hastata	.	.	.	.	.	—	.	.	.	.	.	20	.	.	.
— *myrsinifolia*	.	.	.	.	.	—	.	.	.	1	.	—	.	.	.
— *reticulata*	.	.	.	.	.	—	.	.	.	.	.	5	.	.	.
Vaccinium myrtillus	.	.	.	.	.	10	.	.	.	.	.	—	.	.	.
— *uliginosum*	.	.	.	.	.	—	.	.	.	.	.	5	.	.	.
— *vitis-idaea*	.	.	.	.	.	50	1	1	.	.	.	30	1	.	1
Actaea sp.	.	.	.	.	.	—	.	.	.	.	.	5	.	.	.
Antennaria alpina	.	.	.	.	.	—	.	.	.	.	.	5	.	.	.
— *dioeca*	.	.	.	.	.	—	2	1	1	1	.	40	.	.	.
Anthriscus silvestris	.	.	1	1	1	50	.	.	.	1	1	10	.	1	.
Anthyllis vulneraria ssp. *lapponica*	.	.	.	.	.	—	.	.	.	.	.	5	1	.	.
Arabis hirsuta	.	.	.	.	.	—	.	.	.	1	1	20	1	.	.
Asplenium viride	.	.	.	.	.	—	1	.	.	1	.	10	.	.	.
Astragalus alpinus	.	.	.	.	.	—	.	.	.	.	.	—	1	.	1
Campanula rotundifolia	.	.	1	.	1	30	1	1	.	1	1	80	1	.	1
Cerastium alpinum	.	.	.	.	.	—	.	.	.	.	.	10	.	.	.
Chamaenerion angustifolium	1	.	1	.	.	10	.	.	.	.	.	15	.	.	.
Cirsium heterophyllum	.	.	.	1	.	10	.	.	.	.	.	10	.	.	.
Cornus suecica	.	.	.	.	.	10	.	.	.	.	.	—	.	.	.
Cystopteris fragilis	.	.	.	.	1	10	.	.	.	.	.	—	.	.	.
— *montana*	.	.	1	1	.	10	.	.	.	.	.	—	.	.	.
Draba hirta	.	.	.	.	.	10	1	.	.	.	.	20	.	.	.
— *incana*	.	.	.	.	.	—	.	.	.	.	.	25	.	.	.
Epipactis atrorubens	.	.	.	.	.	—	1	1	1	1	1	55	1	1	1
Equisetum arvense	1	.	1	1	.	40	.	.	.	.	.	5	.	.	.
— *scirpoides*	.	.	1	.	.	30	.	.	.	.	.	5	.	.	.
— *variegatum*	.	.	.	.	.	10	.	.	.	.	.	—	.	.	.
Erigeron acre ssp. *politum*	.	1	1	.	1	20	1	.	.	.	.	10	1	.	.
Erysimum hieraciifolium	.	.	.	.	.	—	.	.	.	1	1	30	.	.	.
Euphrasia frigida	.	.	1	.	.	—	.	.	.	.	.	5	1	.	.
Fragaria vesca	.	.	.	.	.	—	.	.	.	.	.	—	.	.	1
Geranium silvaticum	2	1	1	1	3	90	.	.	1	1	1	65	2	3	1
Gymnadenia conopsea	.	.	.	.	.	—	.	.	.	.	.	5	.	.	.
Gymnocarpium dryopteris	.	.	.	1	1	60	.	.	.	.	.	5	.	.	.
— *robertianum*	.	.	.	.	.	—	.	1	.	1	.	35	.	.	.
Hieracium spp.	1	.	1	.	1	50	1	.	1	1	1	40	.	1	.
Linnaea borealis	.	1	.	1	.	10	.	.	.	.	.	—	.	.	.
Lotus corniculatus v. *borealis*	.	.	.	.	.	—	.	.	.	.	.	—	1	1	1
Melampyrum silvaticum	1	1	1	.	.	90	.	.	.	.	.	30	.	1	.
Melandrium rubrum	1	.	.	.	.	30	.	.	.	.	.	5	.	.	.
Paris quadrifolia	1	.	.	.	.	10	.	.	.	.	.	5	.	.	1
Parnassia palustris	.	.	.	.	.	—	.	.	.	.	.	10	.	.	.
Phegopteris polypodioides	.	.	.	.	.	10	.	.	.	.	.	—	.	.	.
Polystichum lonchitis	.	.	.	1	1	40	.	.	.	.	.	10	.	.	.
Potentilla crantzii	.	.	.	.	.	—	.	.	.	.	.	5	1	.	.
Ramischia secunda	.	.	.	.	.	10	.	.	.	.	.	—	.	.	.
Ranunculus acris	.	1	1	1	1	30	.	.	.	.	.	5	.	.	.
Rubus saxatilis	4	5	5	3	3	100	1	1	2	1	1	80	2	2	3
Rumex acetosa ssp. *lapponicus*	.	.	.	.	.	—	.	.	.	.	.	5	.	.	.
Saussurea alpina	1	.	.	1	.	40	.	.	.	.	.	5	.	.	.
Saxifraga aizoides	.	.	.	.	.	—	.	.	.	.	.	5	.	.	.
Solidago virgaurea	2	1	.	.	1	90	1	1	1	1	1	70	2	1	2
Stellaria graminea	.	1	.	.	.	—	.	.	.	.	.	10	.	.	.

	1	2	3	4	5	a	6	7	8	9	10	b	11	12	13
Thalictrum alpinum	.	.	.	.	.	—	.	.	.	.	.	10	.	.	.
Trientalis europaea	1	1	.	1	1	80	.	.	.	.	.	5	.	.	.
Trollius europaeus	.	.	.	.	.	—	.	.	.	.	.	30	.	.	.
Valeriana sambucifolia	.	.	.	2	.	30	.	.	.	.	.	5	.	.	.
Veronica fruticans	.	.	.	.	.	10	.	1	.	1	1	40	1	.	.
Viola biflora	.	3	.	3	.	40	.	.	.	.	.	—	.	.	.
— *rupestris* ssp. *relicta*	.	.	.	.	.	—	1	1	.	.	.	10	1	1	.
Carex rupestris	.	.	.	.	.	—	1	2	1	1	.	5	.	.	.
— *vaginata*	.	.	.	.	.	—	.	.	.	.	.	10	.	.	.
Deschampsia flexuosa	.	.	.	.	.	20	.	.	.	.	.	5	.	.	.
Festuca ovina	.	1	.	.	.	40	1	.	1	.	.	20	.	.	.
Luzula pilosa	.	1	.	1	1	20	.	.	.	.	.	—	.	.	.
Melica nutans	2	1	1	1	1	100	1	.	.	.	1	40	.	.	1
Milium effusum	.	.	1	.	.	70	.	1	.	.	.	5	.	.	.
Poa alpina	.	.	.	.	.	10	.	.	.	.	1	10	.	.	.
— *glauca*	.	.	.	.	.	—	.	.	.	.	.	5	.	.	.
— *nemoralis*	.	2	1	.	1	50	.	.	.	1	.	25	.	.	.
Roegneria canina	.	2	1	.	.	—	.	.	.	.	.	30	1	1	.
— *mutabilis*	.	.	.	.	.	—	.	.	.	.	.	5	.	.	.

I tabell 3 representerar analyserna 1—5 en transitorisk vegetationstyp mellan ängssamhällen och mera typisk talusvegetation. Kolumn a utgör ett sammandrag av ytterligare 10 rutanalyser från samma slag av vegetation. Siffran anger i hur många procent av dessa 10 rutor, som en art anträffats. Samtliga 15 analyser är hämtade från Vakketjåkkos dolomit mellan 370—500 m. Analyserna 6—10 representerar en mera självständig talusvegetation och är hämtade från Vakketjåkko mellan 475—600 m. Kolumn b ger ett sammandrag av 20 rutor av samma typ och från samma nivå på Vakketjåkkos dolomit. Analyserna 11—13 exemplifierar talusvegetation på kalksten från omkring 525 m nivå på Lullihatjårro. Rutstorlek är i samtliga fall 1 m².

och hedsamhällena nedanför talusbranterna. *Braya linearis* anträffas främst i anslutning till stråk av finkornigt och något fuktigt talusmaterial, som i samband med snösmältning och häftiga regn transporteras ned från bergroten. I dessa stråk växer *Dryas* sparsamt, medan *Saxifraga aizoides* ofta uppträder i mängd. *Arenaria norvegica* når däremot sin rikaste förekomst på torra, något grovkornigare talusytor mellan *Dryas*-fläckarna.

Talusfloran i Kärketjårros västsida visar i fråga om artsammansättningen stora likheter med några av de av NORDHAGEN beskrivna bestånden av *Arenarion norvegicae,* t.ex. från Junkerdalen. Jfr NORDHAGEN (1935, 1954).

I tabell 4 har kärlväxterna från ett antal öppna talusytor på c:a 4 m² noterats. De undersökta ytorna har utvalts så, att ett eller flera individ av *Arenaria novegica* (analys 1—5) eller *Braya linearis* (analys 6—10) befunnit sig i centrum. Man noterar den högre frekvensen av *Dryas* i *Arenaria*-rutorna och av *Saxifraga aizoides* och *S. oppositifolia* i *Braya*-rutorna. Kryptogamer saknas och uppträder inte, förrän vegetationen börjar övergå i sluten *Dryas*-hed vid talusbrantens nedre del.

Tabell 4. Alpin talusvegetation (Kärketjårro)

	1	2	3	4	5	6	7	8	9	10
Dryas octopetala	1	3	2	1	2	.	1	1	.	.
Salix reticulata	.	.	1	.	.	.	.	.	.	.
Arabis alpina	.	1	1	1	.	.	.	.	.	.
Arenaria norvegica	1	1	1	1	1	.	.	.	.	.
Astragalus alpinus	1	1	1	1	.	.	.	.	1	1
Braya linearis	.	.	.	1	.	1	1	1	1	1
Campanula rotundifolia	1	.	1	1	1	1	.	.	.	.
Cerastium alpinum	.	.	.	1	.	.	.	.	.	.
Draba norvegica	.	.	1	.	.	.	.	.	.	.
Euphrasia frigida	.	.	.	1	.	.	.	.	.	.
Melandrium apetalum	.	1	.	.	.	.	.	.	.	.
Polygonum viviparum	.	1	1	1	1	1	1	.	1	1
Ranunculus acris	1	.	.	.	.	.	.	.	.	.
Saussurea alpina	1	.	.	.	.	.	.	.	.	1
Saxifraga aizoides	.	.	.	1	1	1	2	1	2	2
— *oppositifolia*	.	.	.	.	1	1	1	1	1	1
Silene acaulis	.	.	.	.	.	.	.	.	.	1
Solidago virgaurea	.	.	.	.	.	1	.	.	.	.
Viola biflora	1	1	.	.	.	.	.	.	1	.
Festuca vivipara	.	.	.	1	.	.	.	.	.	.
Poa alpina	.	.	.	.	1	.	.	.	.	.

Inom utbredningsområdet för *Arenaria norvegica* och *Braya linearis* i Kärketjårros talus antecknades förutom de i tabellen ingående arterna följande kärlväxter: *Festuca ovina, F. rubra* v. *mutica, F. r.* v. *mutica* f. *prolifera, Poa alpina* f. *vivipara, P. glauca, Trisetum spicatum, Roegneria borealis, Kobresia myosuroides, Carex rupestris, Salix polaris, S. hastata, Oxyria digyna, Cerastium glabratum, Minuartia stricta, M. rubella, Thalictrum alpinum, Draba fladnizensis, Parnassia palustris, Potentilla crantzii, Oxytropis lapponica, Angelica archangelica, Arctostaphylos alpina, Vaccinium uliginosum, Bartsia alpina, Veronica alpina, V. fruticans, Euphrasia lapponica, Pinguicula vulgaris, Erigeron uniflorus, Antennaria alpina, Taraxacum* spp., *Hieracium* spp.

E. Subalpin hällmarksvegetation

I det alpina bältet förekommer på Vakketjåkko och Lullihatjårro hällmarksområden av dolomit resp. kalksten och dolomit. I dessa hällmarker domineras vegetationen av olika typer av *Dryas*-hed samt i sent utsmälta lägen av snölegesamhällen, ofta med *Salix polaris* som dominant. I det subalpina bältet finner man hällmark mera sparsamt. Vegetationen där visar en viss släktskap med brantvegetationen. Jag har tidigare (BRINGER 1961, s. 576—579) också beskrivit ett *Dryas*-samhälle, som är besläktat med den typ av subalpin hällmarksvegetation, som i det följande skall behandlas.

I omgivningen av uppdykande hällar av kalksten eller dolomit finner

man i björkskogen regelbundet ängssamhällen, ofta av högörttyp. Det tunna jordlagret på hällarna och i deras omedelbara närhet är självfallet orsak till, att hällmarkerna inte täcks av en vegetation av samma slag, som omger dem. Hällarna kommer därför att ligga som öar, där vissa småvuxna och i högörtsamhällena konkurrenssvaga arter kan finna existensmöjligheter. Träd och buskar glesnar också, varför hällmarkerna blir tillgängliga för vissa heliofyter. De kan i detta avseende jämföras med talusbranterna på samma nivå och av samma bergarter. Instabilitetsfaktorn, som i högre eller lägre grad kan påverka vegetationen i en talusbrant, saknar dock betydelse i hällmarken. Ståndortsförhållandena kan även i vissa avseenden jämföras med dem, som råder på breda avsatser i en bergvägg. De undersökta subalpina hällmarkerna torde dock ha bättre snöskydd vintertid än flertalet klipphyllor. Hällmarkerna kan hysa en rik kryptogamflora till skillnad från tidigare beskrivna talussamhällen.

Kärlväxtfloran i hällmarkerna visar många gemensamma drag med talusfloran i närliggande branter. Som framgår av tabellerna 3 och 5 förekommer talusbranternas av sydläge gynnade arter i stor utsträckning också i hällmarkerna, dock med de viktiga undantagen *Gymnocarpium robertianum* och *Epipactis atrorubens*. Man finner också några för väggvegetationen typiska men för talusvegetationen mera främmande kärlväxter, som *Saxifraga nivalis, Sedum rosea* och någon gång *Asplenium viride*. Men fältskiktet visar också vissa självständiga drag genom förekomsten av några småvuxna arter, av vilka *Botrychium lunaria, Selaginella selaginoides, Minuartia biflora, Gentiana nivalis* samt möjligen *Sagina saginoides* kan betraktas som skiljearter gentemot vägg- och talussamhällen inom undersökningsområdets subalpina del. Preferens för hällmark, framför allt sådan nära skogsgränsen, gentemot nyssnämnda vegetationstyper visar vidare åtskilliga arter, t.ex. *Trisetum spicatum, Saxifraga adscendens, Veronica alpina, Euphrasia frigida, Antennaria alpina* och *A. dioeca*. Detsamma gäller för övrigt om många av brantflorans alpina arter. *Poa alpina* är praktiskt taget konstant i hällmarksområdena. Mest iögonenfallande kärlväxt och vanlig fältskiktsdominant är *Veronica fruticans* tillsammans med *Festuca ovina* och *Campanula rotundifolia*.

Den här behandlade typen av subalpin hällmarksvegetation kan stundom i utarmad form följas ett stycke upp ovan skogsgränsen. Från fjället Påtjovare vid Abiskojaures sydända noterades t.ex. följande kärlväxter från några dolomithällar omkring 750 meters nivå:

Festuca ovina
Poa alpina
Trisetum spicatum
Hierochloë odorata
Anthoxanthum odoratum
Carex atrata
Polygonum viviparum
Minuartia biflora
Cerastium glabratum
Trollius europaeus
Sedum rosea
Saxifraga nivalis
— *cernua*
Rubus saxatilis
Potentilla crantzii
Sibbaldia procumbens
Gentiana nivalis
Veronica fruticans
— *alpina*
Euphrasia frigida
Antennaria alpina
Taraxacum spp.

Artsammansättningen påminner mycket om den lågvuxna fjällängsvegetation, som av NORDHAGEN (1936) fått namnet *Potentilleto-Polygonion vivipari.* Med ett tjockare jordlager över hällen hade troligen just denna ängstyp utbildats på lokalen. Nu utgör arter som *Rubus saxatilis, Sedum roseum, Saxifraga nivalis* och *Veronica fruticans* ett för *Potentilleto-Polygonion vivipari* främmande element. Det tunna jordlagret präglar även bottenskiktet, som på Påtjovare-lokalen dominerades av *Cladonia pyxidata* och *Polytrichum juniperinum* tillsammans med bl.a. *Peltigera malacea, Lecidea decipiens* och *Solorina saccata.*

En jämförelse av den subalpina hällmarksvegetationen med NORDHAGENS material från Sikilsdalen visar vissa överensstämmelser i fråga om fältskiktets sammansättning med talusförbandet *Veronico-Poion glaucae.* Större likheter finner man dock vid en jämförelse av vissa analyser från Lullihatjårro med en *Carex rupestris-Encalypta rhabdocarpa*-sociation (se NORDHAGEN 1943, s. 575—580) från sydexponerade hyllor och skrevor, där kalkhaltigt sippervatten förekommer. Man noterar även från denna sociation förekomsten av *Solorina saccata* och *Lecidea decipiens.*

Bottenskiktet i hällmarkerna är som nämnts ofta väl utvecklat med *Polytrichum juniperum, Tortula norvegica, Bryum*-arter, *Cladonia pyxidata* (nog mest v. *pocillum*) och *C. symphycarpia* som ofta återkommande dominanter. Överensstämmelserna i bottenskiktet med vissa typer av sydsvensk alvarvegetation är värd att notera. Man gör samma iakttagelse i fråga om en del *Dryas*-hedar, där rikedomen på busklavar, som *Cetraria*-arter, *Cornicularia aculeata* och *Thamnolia vermicularis* ger en beröringspunkt med ett samhälle som *Festucetum alvarense cetrariosum* (ALBERTSON 1950). I de tämligen väl snöskyddade subalpina hällmarkerna saknas dessa busklavar normalt, och vi finner i stället gemensamma drag med de sydsvenska kalkhällmarker-

Tabell 5. Subalpin hällmarksvegetation

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Dryas octopetala	1	.	1	.	.	.	.	.	.	.	.	.	.	.	.
Juniperus communis	.	.	.	.	1	.	.	.	.	1	.	.	.	.	.
Salix reticulata	.	3	.	4	.	.	.	.	.	.	.	.	.	.	.
Vaccinium vitis-idaea	2	3	.	.	.	.	.	.	.	.	.	.	.	.	.
Antennaria alpina	1	1	1	.	.	.	.	.	.	.	.	2	.	.	4
— *dioeca*	.	.	1	1	.	.	3	2	2	1	.	2	2	.	3
Anthyllis vulneraria ssp. *lapponica*	.	.	.	.	.	.	1	1	1	.	.	.	.	2	.
Arabis hirsuta	.	.	.	.	.	1	1	.	.	1	.	.	1	1	.
Astragalus alpinus	.	.	.	.	.	.	.	.	.	.	.	1	1	.	1
Bartsia alpina	.	2	.	1	.	.	.	.	.	.	.	.	.	.	.
Botrychium lunaria	.	.	1	.	.	1	1	1	1	.	.	.	1	.	.
Campanula rotundifolia	.	.	.	.	.	1	1	2	2	2	2	1	1	2	.
Cystopteris fragilis	.	.	.	.	.	1	.	1	.	.	1	.	.	.	.
Erigeron acre ssp. *politum*	.	.	1	.	.	1	1	1	.	.	.	.	2	1	.
— *uniflorum*	.	.	1	1	1	.	.	.	.	.	1	1	.	.	1
Euphrasia frigida	.	1	.	.	.	1	1	.	1	1	.	1	.	.	1
Gentiana nivalis	.	1	.	.	.	.	.	1	1	1	1	1	1	.	1
Hieracium spp.	.	.	.	.	.	.	1	.	.	1	.	.	.	1	.
Lotus corniculatus v. *borealis*	.	.	.	.	.	2	.	.	.	1	.	.	.	2	.
Minuartia biflora	.	.	.	.	.	.	.	.	.	1	.	1	.	.	1
Polygonum viviparum	.	1	.	1	1	.	.	.	2	3	.	1	.	.	1
Potentilla crantzii	.	1	1	2	.	.	.	1	1	1	.	1	1	.	1
Rhinanthus groenlandicus	.	.	.	.	.	1	.	1	.	1	.	.	.	.	.
Rubus saxatilis	.	.	.	.	.	1	1	1	.	.	.	.	.	.	.
Sagina saginoides	.	.	1	.	.	.	.	.	.	.	.	1	.	.	1
Saxifraga nivalis	1	.	.	.	.	.	.	.	.	.	1	1	.	.	1
— *oppositifolia*	.	.	1	1	.	.	.	.	1	.	.	.	.	.	.
Sedum rosea	.	.	.	.	.	.	.	1	2	.	1	1	.	.	1
Selaginella selaginoides	.	1	.	1	.	.	.	.	.	.	.	1	1	.	1
Silene acaulis	.	1	.	.	.	.	.	.	.	.	.	1	.	.	1
Solidago virgaurea	.	2	.	.	.	1	.	1	1	1	1	1	.	.	1
Taraxacum spp.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	1
Thalictrum alpinum	.	.	.	.	.	.	.	.	.	.	1	1	.	.	1
Trollius europaeus	.	.	.	1	.	.	.	.	1	.	.	.	.	.	.
Veronica alpina	.	.	.	.	.	.	.	.	.	.	1	1	.	.	1
— *fruticans*	1	.	1	1	1	4	2	2	1	1	2	1	2	1	.
Carex atrata	.	.	1	.	.	.	.	.	1	.	.	.	.	.	.
— *rupestris*	.	1	.	1	.	.	2	2	2	.	.	2	1	4	2
Festuca ovina	4	2	.	.	2	2	2	.	2	1	.	1	3	2	1
Melica nutans	.	1	.	.	.	1	.	.	1	1	.	.	.	1	.
Poa alpina	1	1	1	1	1	1	2	1	1	1	3	1	.	2	1
Roegneria canina	.	.	.	.	.	1	1	.	.	.	.	.	.	.	.
Barbula recurvirostris	.	.	.	.	.	1	.	.	.	.	.	.	.	1	.
Brachythecium reflexum	1	1	.	.	.	.	.	1	.	.	.	.	.	.	.
— *turgidum* coll.	.	.	.	.	.	.	1	.	1	.	.	1	1	1	1
Bryum spp.	1	.	1	1	1	1	1	3	2	1	.	1	.	1	1
Dicranum scoparium	1	.	.	1	.	.	.	.	.	.	.	.	.	.	.
— sp.	.	.	.	1	2	.	.	.	.	.	.	.	.	.	.
Distichium capillaceum	.	.	2	1	1	.	.	2	1	.	1	1	1	1	2
Ditrichum flexicaule	.	.	2	1	.	1	1	1	1	.	.	1	2	1	1
Encalypta affinis	.	.	.	.	.	1	1	.	.	1	1	.	2	.	1
— *rhabdocarpa*	.	.	.	1	.	.	.	.	.	1	.	.	.	.	.
Eurynchium pulchellum	.	.	.	.	.	1	1	.	.	.	1	.	.	.	.
Mnium orthorhynchum	1	.	.	2	1	.	.	.	.	.	.	.	.	.	.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Myurella julacea	1	.	.	.	.	2	1	.	1	.	2	1	.	.	.
Pohlia cruda	.	.	1	.	1	.	.	.	1	.	.	.	.	.	.
Polytrichum juniperinum	1	.	.	.	.	.	.	.	.	4	3	1	2	.	4
Schistidium apocarpum	.	1	.	.	.	1	1	.	.	.	.	.	.	.	.
Tortella fragilis	.	.	2	.	.	.	.	.	1	.	.	1	.	.	1
— *tortuosa*	.	1	.	1	.	.	1	1	2	.	.	1	1	.	1
Tortula norvegica	.	.	.	1	.	.	1	2	.	1	1	.	1	1	2
Asterella ludwigii	.	.	.	.	.	.	.	.	1	1	.	.	.	.	.
Barbilophozia lycopodioides	.	1	1	1	1	.	.	.	.	.	.	.	.	.	.
Mannia pilosa	.	.	1	1	.	.	.	2	1	.	1	.	1	.	.
Preissia quadrata	.	.	.	.	.	.	.	.	1	.	.	.	.	.	1
Blastenia leucorraea	1	.	1	1	.	.	.	1	1	1	1	1	1	.	1
Candelariella sp.	.	1	1	.	.	.	.	.	1	.	1	1	1	.	1
Cetraria islandica	.	1	1	.	1	.	.	.	.	.	.	.	.	.	.
Cladonia gracilis coll.	1	.	.	.	1	.	.	.	.	.	.	.	.	.	.
— *macrophyllodes*	.	.	.	.	.	.	.	.	.	1	1	.	1	.	.
— *pyxidata*	2	1	1	1	2	1	1	2	3	2	2	2	3	1	2
— *silvatica*	2	1	.	1	1	1	.	.	.	1	.	.	.	.	.
— *symphycarpa*	1	.	5	1	1	1	2	1	1	1	.	.	3	1	.
— *uncialis*	2	1	.	.	1	.	.	.	.	.	.	.	.	.	.
Collema sp.	.	.	.	1	.	1	.	.	.	.	.	.	.	.	.
Fulgensia bracteata	.	.	.	.	.	.	1	1	.	.	.	.	.	.	.
Lecanora epibryon	.	1	.	1	.	.	.	.	.	.	.	.	.	.	.
— *verrucosa*	.	1	1	.	.	.	.	.	.	.	.	.	.	.	.
Lecidea decipiens	.	.	1	.	.	.	.	.	.	.	.	1	.	.	1
— *lurida*	.	.	.	.	.	.	1	1	.	.	.	.	.	.	.
— *vernalis*	.	.	1	1	.	.	.	.	.	.	.	.	1	.	.
— *wulfenii*	.	1	1	1	1	.	.	.	.	.	.	.	.	.	.
Ochrolechia frigida	.	.	.	.	.	.	.	.	.	.	.	1	.	.	1
Peltigera canina	.	1	.	.	.	1	1	1	1	1	1	1	1	.	1
— *malacea*	1	.	.	1	.	.	.	.	.	.	.	.	.	.	.
— *spuria* v. *erumpens*	.	.	1	.	1	.	.	.	.	.	.	.	.	.	.
Psoroma hypnorum	1	.	.	1	.	.	.	.	.	.	.	.	.	.	.
Rinodina mniaraea	.	.	.	1	1	1	.	.	.	.	1	1	1	1	.
— *roscida*	.	.	1	.	.	.	1	1	.	.	.	1	.	.	1
Solorina saccata	.	.	1	.	.	.	1	.	.	.	.	.	.	.	.
Toninia lobulata	.	.	1	.	1	.	.	.	.	.	.	.	.	.	.

Tillägg till tabell 5. I samtliga fall täckningsgrad 1.

Empetrum hermaphroditum i ruta 5. *Alchemilla filicaulis* (6), *A. murbeckiana* (6), *A. wichurae* (10), *Cerastium glabratum* (11), *Draba incana* (3), *Geranium silvaticum* (2), *Minuartia stricta* (3), *Saxifraga cernua* (3), *S. caespitosa* (3), *Viola biflora* (1), *Carex vaginata* (2), *Poa glauca* (6), *Roegneria mutabilis* (11), *Trisetum spicatum* (1), *Hylocomium splendens* (1), *Hypnum fastigiatum* (1), *Myurella apiculata* (15), *Pseudoleskea* cf. *incurvata* (10), *Tortula ruralis* (2), *Barbilophozia hatscheri* (12), *Bacidia sphaeroides* (4), *Caloplaca jungermanni* (1), *C. cerina* (13), *Lecidea berengeriana* (4), *Nephroma expallidum* (2), *Peltigera lepidophora* (6), *Pertusaria bryontha* (3), *Rinodina turfacea* (5), *Sagiolechia rexoblephara* (3), *Solorina bispora* (4), *Stereocaulon* sp. (11).

nas *Tortellion*-federation (se ALBERTSON 1946, 1950), trots att *Tortella*-arter spelar en underordnad roll. Många av de sydsvenska kalkhällmarkernas »brokiga jordlavar», som sätter sin prägel på associationen *Sedetum tortellosum* (ALBERTSON l.c.), återkommer i fjälltrakterna, men man finner sällan så många av dem samlade inom ett begränsat växtsamhälle som på de aktuella subalpina hällarna. Som framgår av tabellen återfinns där t.ex. *Lecidea berengeriana, L. decipiens, L. lurida, Blastenia leucorraea, Fulgensia bracteata, Lecanora verrucosa, Toninia lobulata, Solorina saccata* och *Cladonia symphycarpia. Toninia coeruleonigricans,* som i Sydsverige ofta anträffas tillsammans med nyssnämnda lavar, har jag inte iakttagit i den ängsartade subalpina hällmarksvegetationen, medan den däremot inte är ovanlig i exponerade *Dryas*-samhällen, t.ex. på Vakketjåkko, Låktatjåkko, Ruopsuok, vid Torne hamn samt på Ljutatjårro.

Rutanalyserna i tabell 5 är hämtade från följande lokaler:

1—5. Vakketjåkkos sydsluttning. Dolomithällmark strax nedom skogsgränsen omkring 550—600 m. Rutstorlek 1/4 m². Jfr BRINGER (1961, analyserna 16—20 i tabell IV på s. 577—578). De analyserade bestånden förekommer omväxlande med rishedsfläckar med dominans av *Dryas, Empetrum hermaphroditum, Vaccinium uliginosum* och *Betula nana* samt olika ängssamhällen. Inga markerade sydbranter finns i närheten, och sydväxter saknas. I stället förekommer ett inslag av *Dryadion*-arter, speciellt i bottenskiktet.

6—14. Lullihatjårros sydsluttning. Kalkstenshällmark och i fråga om analys 14 en bred klipphylla av kalksten med ett tunt lager av vittringsgrus. Läge omkring och strax nedom skogsgränsen c:a 525—600 m ö.h. med sydbranter i omedelbar närhet. Rutstorlek 1 m².

15. Fjället Vassivartos sydsluttning strax nordost om Vassijaure järnvägsstation. Subalpin, sent utsmält dolomithällmark omkring 525 m. Rutstorlek 1 m².

Summary

The vegetation of precipices, talus and rocks in some limestone and dolomite areas in the surroundings of Lake Torneträsk, northern Swedish Lapland

The Torneträsk area is situated in the north-western part of the Swedish mountain chain. The author has studied the vegetation of some subalpine south facing precipices, talus slopes and areas of bare rock in a dolomite area on the side of Mount Vakketjåkko and a limestone area on the side of Mount Lullihatjårro, both mountains situated on the northern shore of Lake Torneträsk. The vegetation of alpine calcareous scree has been studied on Mount Kärketjårro west of the lake.

A. The vegetation of crevices and shelves on subalpine south facing precipices. Some vascular plants that are often observed in small crevices are mentioned on p. 4. On broad shelves communities dominated

by *Poa glauca* and (or) *Festuca ovina* are sometimes found. See table 1, where the presence of a species is marked by + and dominance by D.

B. *Juniperus* scrub below subalpine precipices (table 2). The degree of cover is in this and the following tables estimated according to the scale of HULT-SERNANDER-DU RIETZ.

C. Subalpine talus vegetation. The vegetation of well stabilized and shaded talus is often closely related to the surrounding meadow communities of the birch forest (table 3, nos. 1—5 and a). Larger, less stabilized scree slopes also harbour some heliophilous plants with a weak power of competition, which are differential species absent from the closed meadow communities, e.g., *Gymnocarpium robertianum, Epipactis atrorubens, Erysimum hieraciifolium, Fragaria vesca, Anthyllis vulneraria* ssp. *lapponica, Viola rupestris* ssp. *relicta* and, with increasing altitude, *Carex rupestris* and *Cerastium alpinum*. See table 3, nos. 6—13 and b. No bottom layer is normally developed in the talus communities.

D. The vegetation of alpine calcareous scree. On the western slope of Mount Kärketjårro extensive alpine talus slopes of limestone and mica shists are found. See RAPP (1961). At about 750 m *Braya linearis* and *Arenaria norvegica* are growing, two rare species, which by NORDHAGEN (1935, 1936) have been used as characteristic species of the talus alliance *Arenarion norvegicae*. The type of vegetation exemplified in table 4 alternates with stands of *Dryas octopetala* (see BRINGER 1961), also on the scree.

E. The vegetation of some subalpine areas of exposed limestone and dolomite rock on Mts. Vakketjåkko and Lullihatjårro. On flat rocks with a very thin earth layer, communities related to the talus vegetation as well as the meadow birch forest are found. See table 5. Among the species of the talus *Gymnocarpium robertianum* and *Epipactis atrorubens* are absent here, while on the other hand some species with a weak power of competition add to the species list, e.g., *Selaginella selaginoides, Botrychium lunaria, Minuartia biflora,* and *Gentiana nivalis*. The bottom layer is sometimes well developed. Several of the bryophytes and lichens listed in the table are also found in limestone areas in southern Sweden, especially in the "alvar" vegetation of the Baltic islands Öland and Gotland.

Litteraturförteckning

ALBERTSON, N. 1946. Österplana hed. Ett alvarområde på Kinnekulle. — Acta Phytogeogr. Suec. 20. Uppsala.

— 1950. Das grosse südliche Alvar der Insel Öland. — Sv. Bot. Tidskr. 44. Uppsala.

ALM, C. G. 1921. Floristiska anteckningar från Torneträskområdet. — Ibid. 15. Stockholm.

— 1923. Några ord om Braya glabella Richards. — Bot. Notiser. Lund.

— 1944. Om Carex macloviana d'Urv. och dess utbredning i Nordeuropa. — The Svedberg 1884 30/8 1944 (Festskrift). Uppsala.

— & FRIES, TH. C. E. 1925. Botanische Exkursionen in Torne Lappmark. — Vierte Intern. Pflanzengeogr. Exkursion (I. P. E.) Sommer 1925. Uppsala.

BENUM, P. 1958. The Flora of Troms Fylke. — Tromsö Museums Skrifter 6. Tromsö.

BJÖRKMAN, G. 1939. Kärlväxtfloran inom Stora Sjöfallets nationalpark jämte angränsande delar av Lule Lappmark. — K. Sv. Vet.-Akad. Avh. i naturskyddsärenden 2. Stockholm.

BRINGER, K-G. 1961. Den lågalpina Dryas-hedens differentiering och ståndortsekologi inom Torneträsk-området. I och II. — Sv. Bot. Tidskr. 55. Uppsala.

— 1962. Kärlväxtfloran i en serie sydexponerade branter och brantavsnitt på fjället Vakketjåkko, Torne Lappmark. — Bot. Notiser. 115. Lund.

— 1963. Fjällen norr om Torneträsk. — Natur i Lappland. II. Uppsala.

DU RIETZ, G. E. 1942. Rishedsförband i Torneträskområdets lågfjällbälte. — Sv. Bot. Tidskr. 36. Uppsala.

— 1954. Sydväxtberg. — Ibid. 48. Uppsala.

FRIES, TH. C. E. & MÅRTENSSON, S. 1910. Floristiska anteckningar från de alpina och subalpina delarna av Karesuando och Jukkasjärvi socknar norr om Torneträsk. — Ibid. 4. Stockholm.

HYLANDER, N. 1953. Nordisk kärlväxtflora. I. Uppsala.

LAGERBERG, T. 1909. Några anmärkningsvärda växtformer från Torne Lappmark. — Sv. Bot. Tidskr. 3. Stockholm.

LUNDQVIST, J. 1961. Flora och vegetation vid några sydväxtberg i Pite Lappmark. — Bot. Notiser 114. Lund.

NORDHAGEN, R. 1935. Om Arenaria humifusa og dens betydning for utforskningen av Skandinaviens eldste floraelement. — Bergens Mus. Årsb. 1935, Naturvid. rekke, 1. Bergen.

— 1936. Versuch einer neuen Einteilung der subalpinen-alpinen Vegetation Norwegens. — Ibid. 1936, 7. Bergen.

— 1943. Sikilsdalen og Norges fjellbeiter. — Bergens Mus. skrifter, 22. Bergen.

— 1954. Some New Observations Concerning the Geographic Distribution and the Ecology of Arenaria humifusa Wg. in Norway as Compared with Arenaria norvegica Gunn. — Bot. Tidsskr. 51. København.

PERSSON, Å. 1961. Mire and spring vegetation in an area north of Lake Torneträsk. I. — Opera Botanica 6: 1. Lund.

— 1962. Mire and spring vegetation in an area north of Lake Torneträsk. II. — Ibid. 6: 3. Lund.

— & RUNEMARK, H. 1950. Some interesting vegetation types on the northern side of Torneträsk. — Bot. Notiser. Lund.

RAPP, A. 1961. Recent development of mountain slopes in Kärkevagge and surroundings, northern Scandinavia. — Geogr. Annaler XLII: 2—3. Stockholm.

RUNE, O. 1948. Nya växtfynd i Lycksele lappmarks fjällområde. — Sv. Bot. Tidskr. 39. Uppsala.

— 1953. Plant life on serpentines and related rocks in the North of Sweden. — Acta Phytogeogr. Suec. 31. Uppsala.

— 1963. Tärnafjällen. — Natur i Lappland I. Uppsala.

SAMUELSSON, G. 1921. Floristiska fragment. II. — Sv. Bot. Tidskr. 15. Stockholm.

SELANDER, S. 1950 a. Floristic Phytogeography of South-Western Lule Lappmark. — Acta Phytogeogr. Suec. 27. Uppsala.

— 1950 b. Kärlväxtfloran i sydvästra Lule lappmark. — Ibid. 28. Uppsala.

SMITH, H. 1924. Bidrag till Torne lappmarks flora. — Sv. Bot. Tidskr. 18. Uppsala.

WISTRAND, G. 1962. Studier i Pite lappmarks kärlväxtflora, med särskild hänsyn till skogslandet och de isolerade fjällen. — Acta Phytogeogr. Suec. 45. Uppsala.

BOTANISKA NOTISER 1965 · VOL. 118 · FASC. 1 · LUND

New Facts and New Finds of Fossil Trapella Oliver in Europe

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Stockholm 50

When recently publishing the first finds of fossil *Trapella* from European Upper Tertiary deposits (TRALAU 1964) there was a priori no real certainty of finding any more specimens of this genus in the fossil state in Europe. I therefore decided to publish an account of the material available. However, the lectotype was poor and only permitted the determination of the genus. The specific name had to be a palaeobotanical one. Comparison with one of the two recent species was impossible as the flagella-like appendages of the lectotype were very fragmentary and their number unknown. Therefore it appeared desirable to collect more extensive material in order to learn more about the specific characters of the fossils in question. A journey to the place where *Trapella* is to be found, resulted in a collection of specimens which contribute considerably to our knowledge of its occurrence in the Tertiary of Europe.

The place where *Trapella* has been collected is identical with the locality described by FLIEGEL (1903) and GREBE (1955) which is Swisterberg/Weilerswist, Western Germany. Here the remains of *Trapella* occur in the lower part of the upper clay lens (see fig. 1) which is Pliocene in age. GREBE (1955) suggested that this deposit belongs to the Reuverian stage of the Pliocene period. The occurrence of *Trapella* is confined to a rather narrow stratum, which, by the composition of its floral remains, must have originated during the open water stage of the lake. Seeds of *Euryale* also occur in considerable quantities. This stratum is overlaid by layers of clayey detritus from which *Trapella,* as well as remains of *Euryale,* are unknown. The aquatic vegetation requiring open habitat conditions obviously has been forced out by a

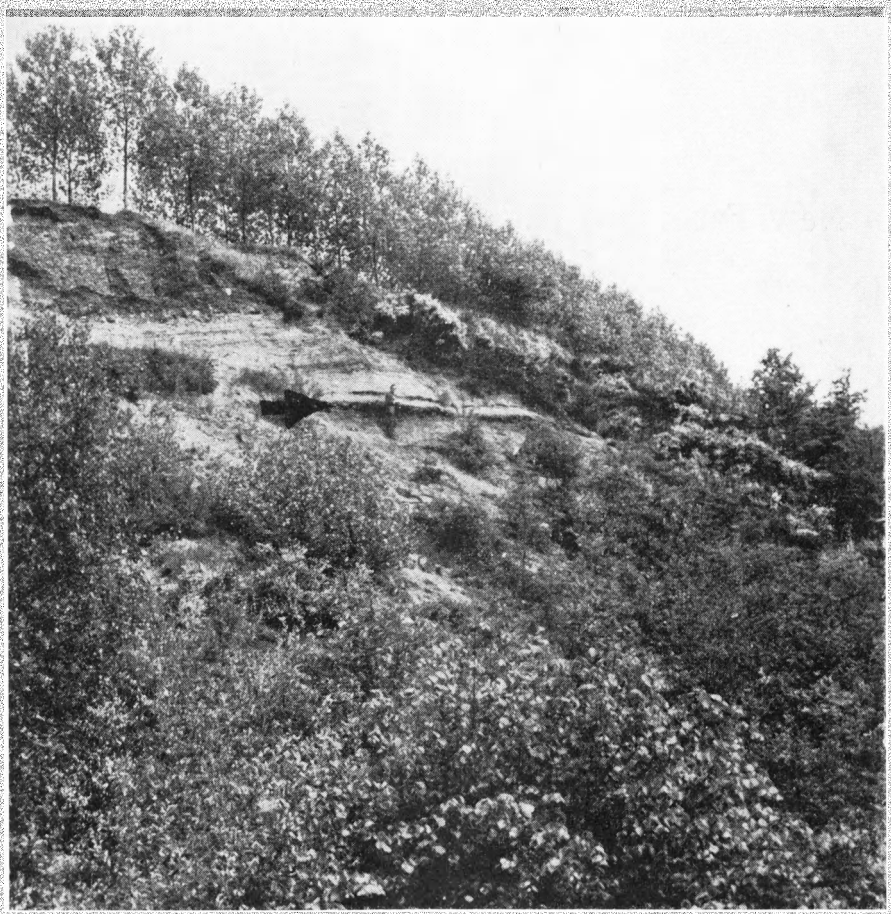


Fig. 1. Section of the gravel-pit of Swisterberg/Weilerswist. *Trapella* cf. *antennifera* occurs in the lower part of the upper clay lens (indicated by the person in the picture).

vegetation dominated by *Phragmites,* remains of which are to be found abundantly in these layers.

The remains of *Trapella* that the present writer obtained almost always show at least two flagella-like appendages (see fig. 2 a, b, c) visible in the level of fracture of the sample. Some specimens have been encountered in which the facture level is situated vertically in the apical part of the fruit (see fig. 2 d). From these specimens it is obvious that the fossils in question have five long flagella-like appendages and thus are referable to the recent species *T. antennifera* (Léveillé) Glück

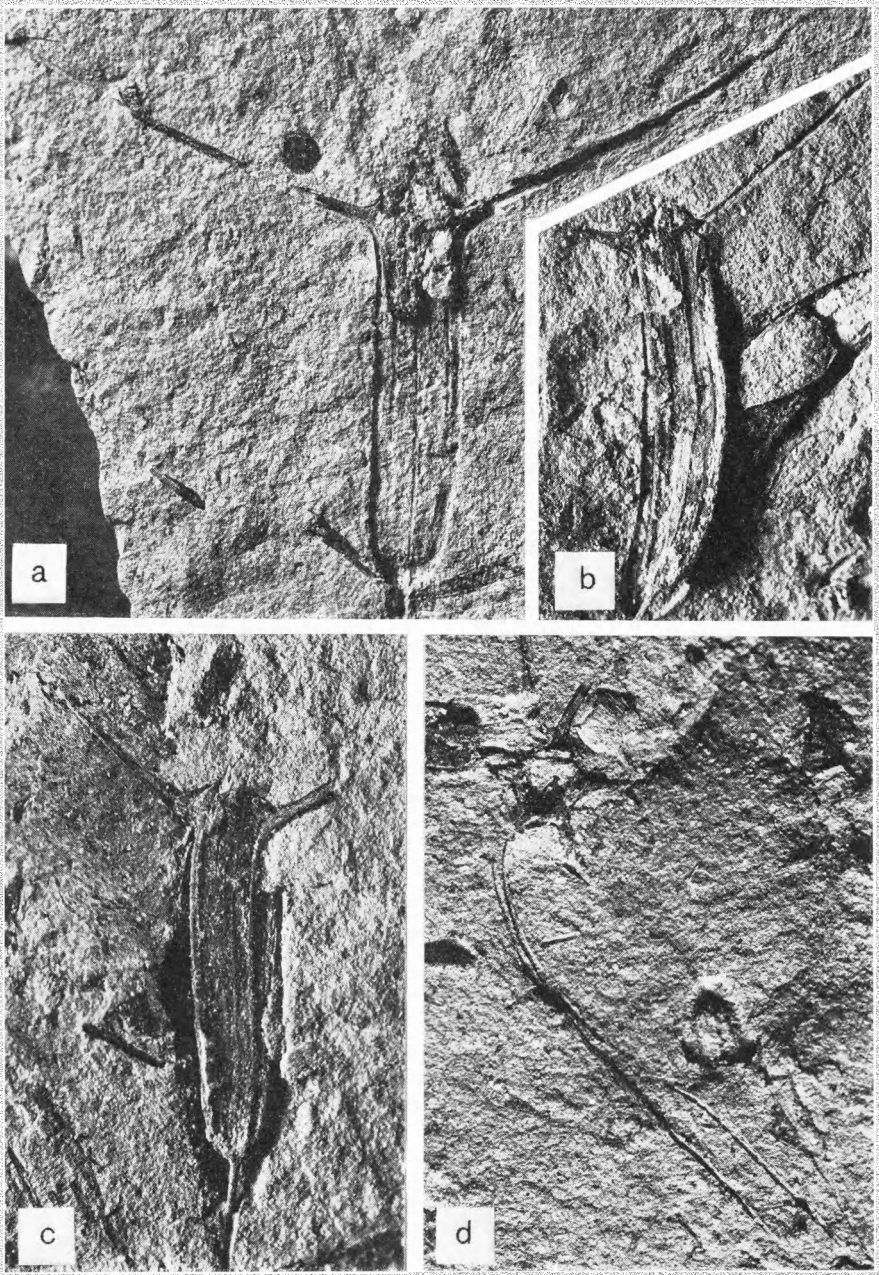


Fig. 2. *Trapella* cf. *antennifera* (Léveillé) Glück from the Pliocene (Reuverian) of Swisterberg/Weilerswist, Western Germany. — a—c. Full-sized fruits or fruit impressions with two flagella-like appendages, × 5. — d. Apical part of a fruit in vertical fracture section with five flagella-like appendages (the left upper half), × 5. — Coll. HANS TRALAU, 20—23.5.1964. Original material: Palaeobot. Dept., Swedish Museum of Natural History, Stockholm 50. — Photo K. E. SAMUELSSON.

from Japan. Otherwise the fossils in the new collection do not differ from the description given previously (TRALAU 1964, p. 121).

The peculiar fact that until now no specimens with longitudinal wings have been encountered from the locality in question deserves mentioning. The fossil fruits of *T.* cf. *antennifera* of this European site obviously all arose from cleistogamic flowers.

Acknowledgements

My thanks are due to the Royal Swedish Academy of Science and to Prof. O. SELLING, director of the Palaeobotanical Dept., Swedish Museum of Natural History, for financing the field work by grants from "Brandellska fonden".

Summary

Fossil remains of the present-day East Asiatic genus *Trapella* have been recently recognized from Pliocene deposits in Europe by the author. New collections make it clear that the fossils have five flagella-like appendages and thus are referable to the recent species *T. antennifera* (Léveillé) Glück, the occurrence of which now is confined to Japan.

Literature cited

FLIEGEL, F. 1903. Erläuterungen zum geologischen Kartblatt Sechtem. — Berlin 1903.

GREBE, H. 1955. Die Mikro- und Megaflora der pliozänen Ton- und Tongyttjalinse in den Kieseloolithschichten vom Swisterberg/Weilerswist (Blatt Sechtem) und die Altersstellung der Ablagerung im Tertiär der Niederrheinischen Bucht. — Geol. Jahrb. 70.

TRALAU, H. 1964. The genus Trapella Oliver in the Tertiary of Europe. — Bot. Notiser 117: 2.

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Bryologische Beobachtungen auf der Insel Mallorca

Von F. KOPPE

Bielefeld, Deutschland

In den letzten Jahren hatte ich die Möglichkeit, die Moosflora der spanischen Mittelmeerinsel Mallorca kennenzulernen und möchte hier über die bryofloristischen Beobachtungen berichten. Ich hielt mich auf

vom 26.3. bis 15.4. 1959 in Puerto de Andraitx
7.4. bis 20.4. 1962 in Cala Ratjada
21.4. bis 5.5. 1962 in Cala San Vicente
4.4. bis 10.4. 1964 in Cala d'Or
11.4. bis 17.4. 1964 in Felanitx
18.4. bis 1.5. 1964 in Soller

Von den einzelnen Orten aus wurde jeweils die nähere Umgebung eingehend untersucht, auf einigen Autobus- oder Taxifahrten konnte ich weitere Stellen flüchtig ansehen. Dabei ergab sich eine erhebliche Zahl von Arten, die von der Insel noch nicht bekannt war, und von anderen konnte die Verbreitung genauer festgestellt werden. Ich möchte daher zunächst das Arten- und Fundortsverzeichnis veröffentlichen und hoffe, später die ökologischen und bryogeographischen Beobachtungen ergänzen zu können.

Frau Professor Dr. CASAS DE PUIG, Barcelona, danke ich für die Übermittlung ihrer bryologischen Arbeiten, Madame JOVET-AST, Paris, bestimmte mir *Riccia lamellosa,* der rühmlichst bekannte Bryologe POTIER DE LA VARDE († 1961) bestimmte 2 *Fissidens*-Arten und Professor M. BIZOT, Dijon, bestätigte *Fissidens intralimbatus*. Ich danke allen auch an dieser Stelle für ihre Bemühungen.

In das Verzeichnis wurden einige Funde aufgenommen, die mir von anderer Seite zur Verfügung gestellt wurden. Frau Dr. ALMUTH DIRCKSEN, die 1961 an einer Exkursion des System.-Geobot. Instituts der Universität Göttingen teilnahm, übergab mir ihre dort gesammelten Moose, darunter *Antitrichia californica* neu für die Insel. Einige Arten erhielt ich von meiner Tochter und meinem Schwiegersohn, W. und R. LOEWE, die sie bei Cala Millor aufgenommen hatten. Im Verzeichnis sind die Angaben entsprechend gekennzeichnet.

Über Moose von Mallorca ist schon in einer größeren Zahl von Arbeiten berichtet worden. Das erste reichhaltigere Verzeichnis gab NICHOLSON (1907). In jüngster Zeit hat Frau CASAS DE PUIG Aufsammlungen anderer Botaniker bestimmt, auch selbst weitere Untersuchungen durchgeführt und mehrere Arbeiten darüber veröffentlicht, so besonders 1956, wo sie auch eine kurze Übersicht über die einschlägige Literatur bringt.

In dem folgenden Verzeichnis nenne ich die Fundorte in der Reihe von West nach Ost, und zwar zuerst die des südlichen Teiles der Insel, dann die des mittleren Streifens von Puerto de Andraitx bis Cala Ratjada und schließlich die der Nordküste von Estellence bis Formentor. Die Schreibweise der Ortsnamen ist bei den Autoren, auf Karten und in den geographischen Arbeiten nicht einheitlich. Ich benutze die der neueren spanischen Arbeiten oder die der amtlichen Karte 1 : 100 000. Die Höhenlage der Fundorte konnte meist nur geschätzt werden, sie ist den Karten oft überhaupt nicht zu entnehmen.

Abkürzungen im Verzeichnis

bei Orten: C.=Cala P.=Puerto
sonstiges: vbr.=verbreitet u.=und zw.=zwischen

Die einzelnen Fundorte sind durch Semikolon (;) voneinander getrennt, durch Komma (,) die Angaben, die zum gleichen Orte gehören.

* nach dem Moosnamen bedeutet: neu für Mallorca

** nach dem Moosnamen bedeutet: neu für die Balearen.

Bei den Neufunden wurde der erste Beobachtungstag, sonst das Beobachtungsjahr (abgekürzt: 59=1959) angegeben.

Verzeichnis der erwähnten Orte

Die Entfernungen sind in Luftlinie angegeben.

Alfabia, 6 km SSW von Soller
Andraitx, 19 km W von Palma
Arta, Stadt im Osten der Insel, 38 km E von Inca
Biniaraix, 2 km E von Soller
Bunyola, 8 km S von Soller
Cala d'Or, SE-Ecke der Insel, 13 km SE von Felanitx
Cala Millor, Ostküste, 11 km SSE von Arta
Cala Ratjada, Ostküste, 2 km E von Capdepera
Cala San Vicente, Nordküste, 6 km NNE von Pollensa
Calonge, 4,5 km WNW von Cala d'Or
Campanet, Stadt im NE, 45 km NE von Palma
Camp de Mar, Badeort 5 km S von Andraitx
Canyamel, Badeort der Ostküste, 9 km SE von Arta
Capdepera, 7 km ENE von Arta
Castillo d'es Rey, Ruine einer maurisch-mallorkinischen Burg, 5 km N von Pollensa
Cueva de Arta, Höhle bei Canyamel
Cueva del Drac, Höhle bei Porto Cristo
Deya, am Nordabfall der Hauptkette, 6 km WSW von Soller

Es Barraca, Waldtal 6 km N von Andraitx
Felanitx, Stadt im SE, 44 km ESE von Palma
Gorg Blau, Bachschlucht 5 km WSW von Lluch
Inca, Stadt 28 km NE von Palma
Lluch, 13 km SW von Pollensa
Lluch Alcari, Gutshof an der Nordküste, 5 km W von Soller
Miramar, Gutshof an der Nordküste, 9 km WSW von Soller
Ofre, Berg der Nordkette, 1091 m, 4,5 km E von Soller
Orient, 6,5 km NE von Bunyola
Paguera, Badeort 5 km SE von Andraitx
Petra, Stadt 16 km N von Felanitx
Pollensa, Stadt der NE-Ecke, 45 km NE von Palma
Porto Cristo, E-Küste, 18 km NE von Felanitx
Porto Petro, 2,5 km von Cala d'Or
Puerto de Andraitx, SW-Küste, 5 km SW von Andraitx
Puerto de Pollensa, Hafen der NE-Bucht, 6 km von Pollensa
Puerto de Soller, Nordküste, 4 km NNW von Soller
Puig Mayor, höchster Berg der Insel, 1445 m, 8,5 km NE von Soller
Reco de Massot, Schlucht 4,5 km S von Cala Ratjada
San Salvador, Berg im SE, 509 m, 3,5 km ESE von Felanitx
San Telmo, 7 km W von Andraitx
S'Arraco, 2,5 km von Andraitx
Soller, Stadt am Nordabfall der Nordkette, 22 km N von Palma
Son Marroig, Gutshof 2 km W von Soller
Ternellas, 3 km NW von Pollensa
Tomir, Berg der Nordkette, 1103 m, 9 km SW von Pollensa
Torrent de Pareis, Schlucht der Nordkette, 12 km NE von Soller
Torrent de Sitges, Bachtal 2,5 km S von Pollensa
Valldemosa, 10 km NW von Soller
Villafranca, Stadt 13 km NW von Felanitx

Hepaticae — Lebermoose

Anthoceros dichotomus Raddi — Auf lehmigem und tonigem Boden an nackten, aber schattig-feuchten Stellen. — Cala d'Or, Barranco nördl. vom Ort; Gebüsch an der Südseite der C. Llonga; am Wege nach Calonge (64).

var. *Beltrani* (Cas.-Gil als Art)** — Bei der Cueva del Drac (7.4.64).

Targionia Lorbeeriana K. M. — Kalkfelsen und Mauern an schattigen Stellen, vbr. — C. d'Or, Südseite der C. Llonga; Deya, 150—250 m (64); P. de Soller (59); Soller; Biniaraix und Barranco, 300—800 m (64); Lluch, am Wege nach Son Masip, 600 m; C. San Vicente (62).

Plagiochasma rupestre (Forst.) Steph. — In feuchten Bachschluchten auf Kalkfelsen und Tuff, auch an Mauern, vbr. — S'Arraco; San Telmo (59); Soller, Torrent (64); P. de Soller (59); Tomir, 600—650 m (62); Torrent de Pareis (64); Lluch, vor Son Masip und bei Font Oberta (62); Pollensa; Torrent de Sitges; C. San Vicente; Ternellas (62).

Conocephalum conicum (L.) Dum. — Gorg Blau (DIRCKSEN 61).

Lunularia cruciata (L.) Dum. — Auf Kalk und Lehmboden, an Mauern, gern in Bachtälern und an Brunnen; an feucht-schattigen Stellen die häufigste *Marchantiaceae*. — Felanitx; San Salvador (64); P. de Andraitx; Andraitx; San Telmo; S'Arraco; Paguera (59); C. Ratjada; Canyamel (62); Valldemosa (59); Deya (64); Soller; P. de Soller (59, 64); Biniaraix; zw. Bunyola u. Orient (64); Alfabia (59); Lluch (62); Torrent de Pareis (64); C. San Vicente; Ternellas (62).

Oxymitra paleacea Bisch.** — Felanitx, Nordhang der Mola, auf entkalktem Lehm, mit *Cheilothela chloropus* (13.4.64).

Riccia sorocarpa Bisch. — Zw. C. d'Or und Porto Petro, auf dem Lehmboden eines Brachackers (64).

R. atromarginata Lev. — Felanitx, Nordseite der Mola, Lehmboden (64); Canyamel, Kalkblockmauer; C. San Vicente, Mauer (62).

R. lamellosa Raddi — C. d'Or, Barranco am Wege nach Calonge, in großer Menge (5.4.64, det. S. JOVET-AST); Brachacker zw. C. d'Or und Porto Petro; C. d'Or, an der Südseite der C. Llonga (64).

R. glauca L.** — P. de Pollensa, auf feuchtem Lehm am Sumpf südl. vom Ort, nur wenige Thalli mit reifen Sporen (1.5.59).

Metzgeria furcata (L.) Dum.** — Lluch, am Wege nach Son Masip, 600 m, an *Quercus ilex* und auf Kalk (1.5.62).

Pellia Fabbroniana Raddi — Auf nassem kalkigem und mergeligem Boden, besonders an Bächen; anscheinend nur in der Nordkette. — Deya, mehrfach; Lluch Alcari (64); Soller, Torrent (59, 64); Barranco de Biniaraix; zw. Bunyola und Orient; Gorg Blau; Torrent de Pareis (64); Ternellas, mehrfach (62).

Petalophyllum Ralfsii (Wils.) Gottsche — Bachtal südl. S'Arraco, auf Tuff zw. *Pleurochaete* und *Brachythecium rutabulum*; San Telmo, Bachtälchen, auf Tuff zw. *Selaginella denticulata* (59).

Das Moos ist leicht zu übersehen, da es einzeln zwischen Gras und größeren Moosen wächst. In der Literatur wird es als mitunter halophil bezeichnet, an diesen beiden Wuchsorten war der Boden aber sicher frei von Kochsalz.

Fossombronia caespitiformis De Not. — Auf feuchtem lehmigem und kalkigem Boden, auch auf Mauern, häufig. — C. d'Or; Felanitx (64); P. de Andraitx; S'Arraco; San Telmo; Paguera (59); C, Ratjada (62); Deya; Soller; Biniaraix; Torrent de Pareis (64); Lluch; C. San Vicente; Ternellas (62).

Lophocolea heterophylla (Schrad.) Dum.** — Ternellas, am westlichen Quellbach auf feuchtem Humus eines Schattenhanges, 300 m (25.4. 62); an ähnlicher Stelle auch am nördl. Quellbach (62).

Leiocolea turbinata (Raddi) Buch — Auf feuchtem bis nassem Kalkboden, besonders auf Tuff, an Quellen und Bächen, aber oft nur einzeln zwischen anderen Moosen. — C. d'Or (64); P. de Andraitx; S'Arraco; San Telmo; Es Barraco (59); Porto Cristo; Deya; Soller, im Torrent; Biniaraix, besonders im Barranco; zw. Bunyola und Orient; Torrent de Pareis (64); zw. Lluch und Son Masip, 600 m; C. San Vicente; Ternellas vbr. (62).

Southbya tophacea Spr. — Beschattete feuchte Kalkfelsen und Mauern, vbr. — C. d'Or (64); P. de Andraitx; S'Arraco (59); Deya, mehrfach; Son Marroig; um Soller, besonders im Torrent; Biniaraix, Barranco; zw. Bun-

yola und Orient (64); Lluch, am Wege nach Son Masip, 600 m (62); Gorg Blau; Torrent de Pareis (64); Ternellas, öfters zw. 150—350 m (62).

S. *nigrella* (De Not.) Spr. — An ähnlichen Stellen wie die vorige Art, aber seltener. — Huerta südl. Andraitx, Lehm einer Mauer mit *Tortula marginata, Barbula revoluta* u.a. (59); Tomir, Nordfuß, 600 m; Lluch, am Wege nach Son Masip, 600 m (62).

Cephaloziella Baumgartneri Schffn. — Auf feuchtschattigem Kalk-, Lehm- und Mergelboden, meist einzeln zw. anderen Moosen, häufig, aber leicht zu übersehen. — C. d'Or (64); P. de Andraitx; S'Arraco; San Telmo; Camp de Mar; Paguera (59); C. Ratjada; Capdepera, am Castillo u.a. Kalkhügeln; Canyamel (62); Deya, 300 m; zw. Bunyola und Orient (64); Alfabia (59); Tomir, Nordfuß, 700 m; Ternellas, Talhänge, 150—300 m; C. San Vicente (62).

Radula Lindbergiana Gottsche — An *Quercus ilex* und auf Kalkfelsen, fast nur im höheren Bergland. — Capdepera, östl. vom Castillo; Tomir, 650—700 m; Lluch, 600 m; Ternellas, Schlucht westl. Sa Font, 200 m (62).

Madotheca thuja (Dicks.) Dum. — In der Eichenregion des Berglandes an *Quercus ilex* und auf beschatteten Kalkfelsen. — Tomir, 650—700 m; Lluch, 600 m (62); Gorg Blau (64).

M. platyphylla (L.) Dum. — An Eichen und beschatteten Kalkfelsen, anscheinend nur im Bergland, selten. — Barranco de Biniaraix, 500—800 m; zw. Bunyola und Orient (64); Tomir, Nordfuß, 650—700 m (62); Gorg Blau (64); Lluch, vor Son Masip, 600 m (62).

Frullania dilatata (L.) Dum. — An Oliven und *Quercus ilex,* fast nur in den niederschlagsreicheren Küstenbergen. — Felanitx, Eichengehölz (64); Miramar, 100 m (59); Deya, 400 m (64); Alfabia, 400 m (59); Soller, Torrent; Barranco de Biniaraix, 200—400 m (64); Tomir, Nordfuß, 650—700 m; C. San Vicente, Waldhang, 100 m (62).

F. tamarisci (L.) Dum.** — Soller, an Oliven im Torrent (64); Ternellas, im westlichen und nördlichen Bachtal, auf Gestein, 300—350 m (25.4. u. 3.5.62).

var. *sardoa* De Not.** — Bunyola, Waldhang an der Straße nach Orient, an Olive (28.4.64).

Lejeunea patens Ldbg — An feuchtschattigen Hängen über anderen Moosen und Humus, auch an *Quercus,* fast nur in der Nordkette, aber an den Wuchsstellen oft in ausgedehnten Rasen. — Nordhang des San Salvador, 300 m (64); Torrent de Soller, zw. *Ctenidium molluscum*; Barranco de Biniaraix, 300 m (64); C. San Vicente, in einer kleinen Schlucht; Ternellas, Waldhänge, 200—350 m vbr.; Tomir, Nordfuß, 600—700 m (62); Gorg Blau (64); Lluch, nach Son Masip hin, 600 m (62).

Cololejeunea calcarea (Lib.) Schffn.** — Auf feuchtschattigen Kalkfelsen und über anderen Moosen, selten und spärlich. — Tomir, Eichenregion am Nordfuß, 675 m; Ternellas, Hänge am nördl. Quellbach, 300 m, zw. *Lejeunea patens,* teilweise zusammen mit *C. Rosettiana*; C. San Vicente, Schluchthang, über *Lejeunea patens* (22.4.62).

C. Rosettiana (Mass.) Schffn. — An ähnlichen oder gleichen Stellen wie die vorige, etwas reichlicher. — Tomir, Nordfuß, 650—700 m; Lluch, Kalkhänge vor Son Masip, 600 m (62); Gorg Blau, Kalkhang (64); Ternellas, Bachhänge, mehrfach (62).

Musci — Laubmoose

Cheilothela chloropus (Brid.) Ldbg — Auf trocknem Lehmboden an lichten Stellen. — Felanitx, nördliche Vorberge und Fläche der Mola, 50—75 m, auch c. spor. (64); C. Millor, Kiefernwald südl. Hotel Sabina (R. u. W. LOEWE 62); Ternellas, Eichenwald, 300 m (62).

Seligeria pusilla (Hdw.) Br. eur.** — Ternellas, im nördl. Bachtal oberhalb des Ortes, an Kalkfelsen, 300 m (3.5.62).

Anisothecium varium (Hdw.) Mitt. — An schattigen Stellen auf Lehm- und Kalkboden, gern an Bachhängen, häufig. — C. d'Dor; Felanitx (64), P. de Andraitx; S'Arraco; San Telmo; Camp de Mar (59); Villafranca (64); Capdepera; C. Ratjada (62); Soller, Torrent (59, 64); Biniaraix und Barranco; P. de Soller; Torrent de Pareis (64); Tomir; Pollensa; Ternellas (62).

Fissidens minutulus Sull.** — Pollensa, feucht-schattige Mauer in der Huerta von Ternellas (25.4.62).

F. impar Mitt.* — Auf Kalk an etwas feuchten Stellen, unter Gebüsch, in Olivengärten, auf Mauern, vbr. — C. d'Or; Felanitx (64); P. de Andraitx, Kalkhügel westl. vom Ort, 150 m (det. POTIER DE LA VARDE); zw. P. de Andraitx und S'Arraco, Tälchen (31.3.59); Paguera (59); Cueva de Arta, auf Lehm unter einer Lampe; Capdepera; C. Ratjada; Tomir, Nordseite, 600 m; Lluch, nach Son Masip hin, 600 m; Pollensa; C. San Vicente (62).

F. Bambergeri Schpr. — An schattigen Lehm- oder Kalkhängen, meist spärlich zw. anderen Moosen, vbr. — C. d'Or; Calonge (65); P. de Andraitx; S'Arraco; San Telmo; Paguera (59); Capdepera; C. Ratjada (62); Soller, Torrent; Alfabia (59); Gorg Blau; Torrent de Pareis (64); Ternelles, Bachhänge (62).

F. ovatifolius Ruthe — Lluch, Kalkhänge am Wege nach Son Masip, 600 m, an etwas feuchter Stelle mit *Gymnostomum calcareum* (1.5.62).

F. Mildeanus Schpr.** — An Quellen und Bächen in den Kalkbergen der Nordkette, besonders auf Tuff und selbst tuffbildend. — Deya, Schattenhänge, 300—400 m; Soller, Torrent, Talsohle, 300 m; Biniaraix, Barranco, mehrfach, 100—600 m, auch c. spor.; zw. Bunyola und Orient; Torrent de Pareis (64); C. San Vicente, Bachbett SW vom Ort; Ternellas, Bachtal (3.5.62).

F. Warnstorfii Fleisch.** — Unter Gebüsch auf etwas feuchtem Kalkboden, besonders an Bächen, anscheinend vbr. — C. d'Or, Nordseite der C. Gran (64); P. de Andraitx, Kalkhügel westl. vom Hafen, in humosen Klüften, 250 m (2.4.59, det. P. DE LA VARDE), mehrfach; S'Arraco (59); Canyamel; Capdepera; C. Ratjada (62); Lluch Alcari (64); Soller, Torrent, 500 m (59, det. P. D. L. V.); Alfabia (59); Lluch, vor Son Masip, 600 m; Pollensa; Torrent de Sitges; C. San Vicente, mehrfach; Ternellas, mehrfach (62).

F. rufulus Br. eur. — Biniaraix, am Bach unter dem Ofre-Sattel, 800 m (64).

F. intralimbatus Ruthe** — Deya, Kalkhang, auf beschattetem Lehm zw. *Syntrichia inermis* und *Timmiella* (24.4.64, teste BIZOT).

F. cristatus Wils. — Kalkhänge, unter Gebüsch, in der Nordkette zerstreut. — San Salvador, Nordhang, 300 m (64); S'Arraco (59); Deya; Soller, Torrent; Biniaraix, besonders im Barranco; Puig Mayor, Südseite, 600 m (64); Tomir, Nordfuß, 600—700 m; Lluch (62); Gorg Blau (64); Ternellas (62).

var. *Velenovskyi* (Podp.) Wtf.** — C. San Vicente, Kiefern-Kalkhang am Wege nach Pollensa, schattige Schlucht (62).

F. taxifolius (L.) Hdw.* — Feucht-schattige Kalk- und Lehmhänge, besonders in den Tälern der Nordkette. — C. d'Dor; Calonge; Villafranca, am Bon Any, 200 m (64); Canyamel (62); Deya; Soller, Torrent vbr. (59, 64); Biniaraix, Barranco; P. de Soller (64); C. San Vicente vbr.; Ternellas (62).

Encalypta vulgaris (Hdw.) Hffm. — An wenig bewachsenen Kalkhängen und auf Mauern, fast nur in der Nordkette. — Felanitx; San Salvador, Nordseite (64); Soller, Torrent, mehrfach (59, 64); Biniaraix; Son Marroig; Bunyola (64); Lluch, bei Son Masip und Font Oberta (62); Gorg Blau (64).

Astomum crispum (Hdw.) Hpe.* — Auf mäßig beschattetem Lehm- und Kalkboden, oft einzeln oder in kleinen Rasen mit *Pottia Starkeana, Phascum rectum, Fissidens Bambergeri* u.a., nicht selten. — C. d'Or, Mandelgärten vbr.; Felanitx, Mola, Son Negro u.a. (64); P. de Andraitx; S'Arraco (59); Villafranca; Cueva del Drac (64); Canyamel; Capdepera; C. Ratjada vbr. (62); zw. Bunyola u. Orient; P. de Soller (64); C. San Vicente; Ternellas (62).

Weisia tortilis (Schwgr.) C. Müll. — Waldhänge, Gariguen, Olivengärten, Mauern, auf Kalk und Lehm, häufig. — C, d'Or; Porto Petro; Felanitx; San Salvador (64); P. de Andraitx; S. Arraco; Camp de Mar; Paguera (59); Villafranca, Bon Any; Porto Cristo (64); Capdepera; C. Ratjada; Reco de Masot (62); Miramar (59); Deya; Son Marroig; Soller; P. de Soller; Biniaraix; Bunyola (64); Alfabia (59); Puig Mayor, Südfuß (64); Tomir, Nordseite, 600 m (62); Gorg Blau (64); Pollensa; Torrent de Sitges; Ternellas; Castillo d'es Rey, 490 m (62).

Ändert an den Standorten erheblich ab, auf beschattetem Kalk trifft man 1 cm tiefe, fruchtende Räschen, an besonnten Kalkfelsen 1 mm große, sterile Pflänzchen.

var. *fallax* (Sehlm.) Mkm. [*W. crispata* (Br. germ.) Jur.]** — An ähnlichen Stellen wie die vorige, wohl häufiger, aber steril schwer von ähnlichen Trichostomeen zu unterscheiden; fruchtend: Felanitx, Anstieg zum Castillo, Kiefernwald (64); Capdepera, Kalkhügel 171 m, Lehm; C. San Vicente, Hang bei Can Botana (62).

W. microstoma (Hdw.) C. Müll.* — Auf Kalk- und Lehmhängen, unter Kiefern und an wenig beschatteten Stellen, vbr. — C. d'Or; Felanitx, am Castillo; San Salvador (64); Camp de Mar (59); Cueva del Drac (64); Capdepera vbr.; C. Ratjada; Biniaraix; am Ofre-Sattel, 850 m (64); Alfabia (59); C. San Vicente; Ternellas, bis zum Castillo d'es Rey, 350 m (62).

W. controversa Hdw. [*W. viridula* Hdw.] — An gleichen Standorten wie die vorige, aber selten. — C. d'Or, Südseite der C. Llonga; Biniaraix, am Ofre-Sattel, 850 m (64); C. San Vicente, Garigue am Wege nach Pollensa (23.4.62).

Gymnostomum calcareum Br. germ. — Auf beschatteten und etwas feuchten Kalk-, Lehm- und Mergelböden, auch auf Mauern. — Tritt in mehreren Formen auf:

var. *calcareum* — Selten: Son Marroig, auf Lehm am Kalkhang (64).

var. *longifolium* Meyl. — C. San Vicente, Hang am Wege nach Pollensa, an einer Quelle (62).

var. *viridulum* Br. eur. [var. *brevifolium* Schpr] — Häufig. C. d'Or; Felanitx; San Salvador (64); P. de Andraitx; S'Arraco; San Telmo; Camp de Mar (59); Villafranca (64); Canyamel (62); Deya; Son Marroig; Soller, Torrent; Biniaraix (64); Tomir, Nordfuß, 650 m; Lluch, 600 m (62); Gorg Blau (64); C. San Vicente; Ternellas (62).

G. curvirostre (Ehrh.) Hdw. var. *laeviusculum* Ldbg [*Hymenostylium curvirostre* Ldbg]** — Barranco de Biniaraix, auf Tuff (26.4.64); auch am Ofre-Sattel, 600 m (64).

Eucladium verticillatum (L.) Br. eur. — Auf nassem Kalkboden, besonders in Bächen und Quellen, tuffbildend. — Zw. P. de Andraitx und S'Arraco (59); Cueva de Arta, Höhlenvorhof; Capdepera, Kalkhügel und Brunnen (62); Valldemosa, Gemäuer des Klosters; Miramar (59); Deya; Son Marroig; Soller, Torrent vbr., auch fruchtend; Biniaraix, Barranco (64); Tomir, Nordseite, 650 m (62); Gorg Blau; Torrent de Pareis (64); C. San Vicente vbr. (62).

Trichostomum triumphans De Not. var. *monspeliense* (Schpr) Husn.** — P. de Andraitx, Westberge, an beschattetem Lehmabstich, c. spor., mit *Aloina aloides, Weisia microstoma* und *Cephaloziella Baumgartneri* (30.3.59).

T. crispulum Bruch — Auf beschatteten Kalkhängen, verlehmten Mauerkronen, in Gariguen und Kiefernwäldern, häufig und oft fruchtend; meist mit *T. brachydontium, Weisia microstoma* und *W. tortilis.*

Die Art ist sehr formenreich. Die Normalform mit mittellangen und mäßig schmalen Blättern hat deutlich kappenförmige Blattspitzen. Schattenformen haben sehr schmale und verlängerte Blätter. Wenn die Blattspitzen dabei kappenförmig eingebogen sind, entsprechen sie der f. *acuminatum* Meyl., sind sie aber nicht oder kaum kappenförmig, so entsprechen die Pflanzen dem *Trichostomum viridulum* Bruch, das hier nur als eine extreme Wuchsform erscheint. Var. *elatum* und var. *cucullatum* (Blattspitze sehr breit, ausgeprägt kappenförmig) scheinen nicht bloße Standortsmodifikationen zu sein, wachsen aber nur an schattig-feuchten Stellen.

var. *crispulum* — C. d'Or vbr. — Felanitx; San Salvador, nebst Vorbergen (64); P. de Andraitx; S'Arraco; San Telmo; Camp de Mar; Es Barraca (59); Cueva del Drac; Canyamel; C. Ratjada (62); Deya; Son Marroig; Soller, Torrent vbr.; P. de Soller; Biniaraix, Barranco; Bunyola, nach Orient hin (64); Tomir, Nordfuß, 650 m (62); Gorg Blau; Torrent de Pareis (64); C. San Vicente; Pollensa (62).

f. *tophaceum* — Pflanzen von Kalkabsatz umgeben, habituell wie ein lockeres *Eucladium,* leuchtend grün; Blätter lang und schmal, manchmal nur flach eingebogen, unteres Blattviertel entfärbt. — Deya, Kalkhänge, 400 m, am Bachrand (24.4.64).

f. *acuminatum* Meyl. — Kommt wie die Hauptform in allen besuchten Gegenden vor.

f. *angustifolium* Bruch [*Tr. viridulum* Bruch] — Ist auch durch das Gebiet vbr., aber seltener. — C. d'Or; Felanitx (64); S'Arraco (59); Canyamel; Capdepera; C. Ratjada; Reco de Massot (62); Biniaraix, Barranco; P. de Soller (64); Tomir, Nordfuß, 650 m; Lluch, nach Son Masip hin, 600 m (62).

var. *elatum* Schpr — Auf Kalk unter Gebüsch. — C. d'Or (64); P. de Andraitx, Westberge; San Telmo, Bachtälchen; Es Barraca (59); Cueva del Drac, Hang der kleinen Cala (64); Canyamel (62); Soller, Torrent, 400 m (59); Biniaraix (64); Tomir, Nordfuß, 600 m; Lluch, vor Son Masip; C. San Vicente, bei Can Botana (62).

var. *cucullatum* (Card.) Bizot — Huerta zw. P. de Andraitx und Andraitx, Mauer (59); Canyamel, an einer Bewässerungsrinne (62); P. de Soller, schattige Mauer (59); Lluch, Kalkfelsen vor Son Masip; Ternellas, Bachtal (62).

T. brachydontium Bruch [*T. mutabile* Bruch]

Die auffallende Wandlungsfähigkeit des Mooses in allen seinen Teilen hat wohl BRUCH veranlaßt, den 1829 gewählten, aber nur teilweise zutreffenden Namen aufzugeben und das Moos 1838 *T. mutabile* zu nennen. HERZOG (1907) hat der Art eine umfassende Studie gewidmet, ohne den Formenreichtum auszuschöpfen. Seine Hauptgliederung ist auch für die mallorkinischen Formen brauchbar: ssp. *brachydontium* [Typus *mutabile* Herzog] ist vbr., die von HERZOG als Übergänge gedeuteten Formen *densum — litorale, litorale — mutabile, mutabile — cuspidatum,* halte ich aber nicht für wirkliche Übergänge, sondern für zufällige Annäherungen der Blattformen, denn auch die Subspecies haben eine erhebliche Variationsbreite. Die echte ssp. *litorale,* die ich in Nordspanien sehr verbreitet fand, oder die echte ssp. *cuspidatum,* die mir aus Westdeutschland gut bekannt ist, traf ich auf Mallorca nicht an.

ssp. *brachydontium* [Typus *mutabile* Herzog] — Wächst auf Kalk und Lehm in Gariguen und Kiefernwäldern, an Bach- und Schluchthängen, auch auf Mauern, vbr. und häufig fruchtend.

HERZOG's var. *normale* bezieht sich auf die Kapselform: elliptisch-eilänglich. Das Peristom ist verschieden entwickelt, meist sind lange und glatte Zähne vorhanden, seltener sind sie halblang, gestutzt oder rudimentär.

C. d'Or; Felanitx; San Salvador (64); P. de Andraitx; S'Arraco; San Telmo; Camp de Mar; Paguera (59); Villafranca, Bon Any (64); Canyamel (62); Cueva del Drac (64); C. Ratjada (62); Deya; Soller, Torrent; Bunyola, nach Orient hin (64); Tomir, Nordfuß, 700 m; C. San Vicente; Ternellas; Torrent de Sitges (62).

ssp. *densum* Schpr. — Wächst an lichteren und trockneren Stellen als die vorige, häufig, aber oft steril. „Kapsel stets elliptisch" (HERZOG), Peristom rudimentär. — C. d'Or; Calonge; Felanitx (64); P. de Andraitx; S'Arraco; San Telmo; Es Barraca (59); Porto Cristo (64); Canyamel; Capdepera; C. Ratjada; Reco de Massot (62); Deya; Soller, Torrent; Biniaraix; P. de Soller; Torrent de Pareis (64); C. San Vicente; Pollensa; Ternellas (62).

ssp. *pusillum* F. Koppe n. ssp.

Typus: Cala San Vicente, kleine Nebenschlucht des Bachtales, 20 m s.m. (22.4.1962, leg. F. KOPPE).

Planta brevissima, 1—2 mm longa, *Weisia microstoma* simillima, folia lanceolata, 1,5—2,5 mm longa, 0,3—0,4 mm lata, apice cuspidata, non revoluta; costa valida, ut rigidum excedens. Capsula oblonga et ovalis, 0,6—0,8 mm longa, post elongata, brunnescens; peristomium nullum; sporae 16—22 μ in diam., leviter papillosae. Seta ca 2—3 mm longa, lutea.

Pflanzen nicht größer als *Weisia microstoma,* 1—2 mm hoch. Blätter oft schopfig stehend, etwa 1,5—2,5 mm lang und 0,3—0,4 mm breit, die kräftige Rippe als starker Dorn austretend. Seta gewöhnlich nur 2—3 mm lang, gelb, trocken etwas verbogen. Kapsel 0,6—0,8 mm lang, länglich-oval, nach der Sporenausstreuung fast lineal, gefurcht und bräunlich. Peristom stets fehlend. Sporen 16—22, meist 20 µ diam., fein papillös. Deckel mit aufrechtem oder schräg aufrechtem Schnabel von etwa 1/5 Kapsellänge.

Unterscheidet sich von allen anderen sspp. des *Tr. brachydontium* schon durch die Kleinheit. Diese ist aber nicht nur eine Modifikation trockner Standorte, denn in ihrer unmittelbaren Nähe wächst mitunter ssp. *densum,* die auch dann viel kräftiger ist und ihre Merkmale bewahrt. Von ssp. *brachydontium,* deren Blattform oft sehr ähnlich ist, trennt sie noch das Fehlen des Peristoms; von ssp. *densum,* der sie wohl am nächsten steht, noch die Blattform. Die Blattspitze ist immer scharf, wie bei f. *mutabile-densum* Herzog, niemals sind die Ränder der Spitze eingeschlagen, wie HERZOG das für ssp. *densum* abbildet. Der austretende Rippendorn ist relativ länger und breiter als bei *densum.*

Auf Lehm- und Kalkboden an trocknen Schattenstellen, meist zusammen mit anderen Kleinmoosen, z.B. *Tr. crispulum* und *Barbula fallax,* vbr. — C. d'Or, *Cistus*-Macchie nördl. C. Gran; San Salvador, nördl. Vorhügel, 180 m (64); Kalkhügel östl. und westl. von P. de Andraitx, meist unter Kiefern, 10—250 m (27.3.59); Camp de Mar, Olivenpflanzung; Paguera (59); C. Ratjada, an der C. Guya; Capdepera (62); Soller, Torrent (64); Tomir, Nordfuß, 700 m; C. San Vicente, bei Can Botana und am Wege nach Pollensa (62).

Tortella inflexa (Bruch) Broth.* — P. de Andraitx, kleine Schlucht in den Kalkbergen westl. vom Hafen, c. spor.; P. de Soller, Kalkblockmauer, mit *Scorpiurium, Funaria mediterranea, Fossombronia caespitiformis* u.a. (59).

Das Moos ist makroskopisch von manchen Formen der *Tortella flavovirens* nicht zu unterscheiden; mikroskopisch aber durch die kleinen, nur 6—8 µ messenden und glatten Sporen gut gekennzeichnet.

T. nitida (Schpr) Broth. — Auf trocknen Kalkfelsen an der Schattenseite der Berge, auch unter Kiefern und sogar an Eichen- und Olivenstämmen, nicht selten, aber nur einmal fruchtend. — C. d'Or vbr.; Felanitx; San Salvador (64); Andraitx; S'Arraco; P. de Andraitx; Camp de Mar; Es Barraca (59); Porto Cristo (64); Canyamel; Cueva de Arta; Capdepera vbr.; Reco de Massot (62); Miramar (59); Son Marroig; Soller, Torrent; Biniaraix, Barranco; P. de Soller; zw. Bunyola und Orient (64); Tomir, Nordfuß, 600 m; Lluch (62); Gorg Blau (64); Pollensa; Torrent de Sitges; C. San Vicente vbr.; Torellas vbr. (62). Fruchtend nur: C. d'Or, Barranco nördl. vom Ort auf beschatteten Kalkfelsen (10.4.64).

T. flavovirens (Bruch) Broth. — Auf Kalk- und Lehmboden, an Waldhängen, auf Mauern, aber auch auf humosem Sand; an schattigen Stellen manchmal in ausgedehnten, reich fruchtenden Rasen. Auf Mallorca eines der häufigsten Moose, doch habe ich es nie auf Salzboden angetroffen. — C. d'Or; Felanitx; San Salvador (64); P. de Andraitx; Andraitx; S'Arraco; San Telmo; Es Barraca; Camp de Mar; Paguera (59); Porto Cristo; Villafranca (64);

C. Millor (R. u. W. LOEWE 62); Canyamel; Reco de Massot; Capdepera; C. Ratjada (62); Deya; Soller, Torrent; Biniaraix, Barranco; P. de Soller; zw. Bunyola u, Orient (64); Tomir, Nordfuß, 650 m; C. San Vicente (62); P. de Pollensa (59).

var. *minor* Ldbg [*T. viridiflava* (De Not.) Ldbg] — An gleichen Stellen wie der Typus. — Es Barraca (59); C. Ratjada; Capdepera (62).

Als Art nicht haltbar, da die angegebenen Merkmale (Form der Blattspitze und die Gestaltung der Rippenendigung) nicht immer in der geforderten Weise gekoppelt sind.

T. tortuosa (L.) Lpr.* — Tomir, Steineichen-Region am Nordfuß, 650 m, auf Kalk in dichtem Rasen, daneben *Pleurochaete, Tortella nitida, Fissidens cristatus, Timmiella barbuloides* (29.4.62).

Pleurochaete squarrosa (Brid.) Ldbg — Auf Kalk unter Gebüsch oder in Felsklüften, vbr., aber immer steril. — C. d'Or; Calonge; Felanitx, Mola und Castillo; San Salvador (64); P. de Andraitx; S'Arraco (59); Villafranca (64); C. Millor (R. u. W. LOEWE 62); Capdepera (62); Deya; San Marroig; Soller, Torrent; Biniaraix; P. de Soller; zw. Bunyola u. Orient; Puig Mayor, Südfuß, 600 m (64); Tomir, Nordfuß; Lluch (62); Gorg Blau; Torrent de Pareis (64); C. San Vicente; Pollensa; Ternellas (62).

Timmiella barbuloides (Brid.) Mkm. — Beschattete Kalkfelsen, lehmige Hänge, Mauern, vbr. — C. d'Or (64); P. de Andraitx; Andraitx; S'Arraco; San Telmo; Paguera (59); Villafranca; Porto Cristo (64); Canyamel; Capdepera (62); Deya; Lluch Alcari; Soller, Torrent; Biniaraix, Barranco; P. de Soller; zw. Bunyola u. Orient (64); Tomir, Nordfuß; Lluch (62); Gorg Blau; Torrent de Pareis (64); Pollensa; Torrent de Sitges; Ternellas (62).

Leptobarbula tenuis (Hdw.) Schpr* — Auf lichtem Kalkgestein, selten, aber an den Standorten reichlich und immer fruchtend. — Felanitx, Feldmauern am Wege nach Son Negro; dgl., Vorberge und Fläche der Mola (64); Canyamel, Feldmauern in Flußnähe (19.4.62); Ternellas, Felsenschlucht, 200 m (62).

Barbula convoluta Hdw. — Auf Kalkboden, mäßig beschatteten Mauern, in ausgedehnten Rasen auf verlassenen Wohnstätten und alten Meilerplätzen, meist fruchtend. — C. d'Or; Porto Petro; Felanitx (64); P. de Andraitx; S'Arraco; Paguera (59); Villafranca; Porto Cristo (64); C. Millor (R. u. W. LOEWE 62); Deya; Soller, Torrent; zw. Bunyola u. Orient (64); Alfabia (59); Tomir, Nordfuß; Lluch; nach Son Masip hin (62); Gorg Blau; Torrent de Pareis (64); Pollensa; Ternellas; Castillo d'es Rey (62).

var. *sardoa* Schpr. — An ähnlichen Stellen wie die Hauptart, aber selten. — C. Ratjada, mehrfach (62); P. de Soller, Kalkhang am Leuchtturm (64); C. San Vicente, bei Can Botana (62).

B. revoluta (Schrad.) Brid.** — Auf Kalk und Mauern an lichten Stellen. — Felanitx, Mauern östl. und südl, der Stadt (64); Andraitx, Mauern in der Huerta (28.3.59); zw. P. de Andraitx und S'Arraco, Kalkhang (59); Biniaraitx, Trockenmauer mit *Grimmia Pitardi* (64); C. San Vicente (62).

B. Hornschuchiana Schulz — Auf lehmigem Boden, besonders auf Mauern, meist nur in kleinen Rasen. — C. d'Or; Calonge; Porto Petro;

Felanitx, Mola (64); P. de Andraitx, mehrfach; S'Arraco; Camp de Mar, Olivengarten (59); C. Ratjada, mehrfach (62); Puig Mayor, Nordfuß, 600 m (64); Pollensa, Olivengarten; Ternellas (62).

B. unguiculata Hdw. — Auf übererdeten Mauern, auf lehmigem und mergeligem Boden, meist an stärker beschatteten Stellen, vbr. — C. d'Or; Felanitx; San Salvador (64); P, de Andraitx (59); Villafranca (64); Capdepera; C. Ratjada (62); Deya; Son Marroig; Soller, Torrent; Biniaraix; Puig Mayor, Südfuß, 600 m (64); Tomir, Nordfuß; Lluch, vor Son Masip (62); Gorg Blau (64); C. San Vicente; Ternellas; Castillo d'es Rey (63); P. de Pollensa (59).

var. *apiculata* Hübn. — Soller, Torrent, unter Oliven (59).

var. *obtusifolia* (Schultz) Hübn. — Miramar, am Hang (59).

B. fallax Hdw. — Auf Kalk- und Lehmboden und übererdeten Mauern, besonders an etwas feuchten und schattigen Stellen, häufig. — C. d'Or; Porto Petro; Calonge; Felanitx, Mola; San Salvador, 260m (64); P. de Andraitx; Andraitx; S'Arraco; San Telmo; Es Barraca; Camp de Mar; Paguera (59); Villafranca, Bon Any, 200 m (64); Capdepera; C. Ratjada; Canyamel (62); Deya; Son Marroig; Soller, Torrent; Biniaraix; zw. Bunyola u. Orient (64); Tomir, Nordfuß (62); Gorg Blau; Torrent de Pareis (64); Lluch; Pollensa; C. San Vicente; Ternellas (62); P. de Pollensa (59).

var. *robusta* Wtf. — Capdepera, Blockmauer am Hügel 234 und Hügel 171; C. Ratjada, feuchter Sandboden zur C. Guya hin; dgl., an der C. Aguit (62); Deya, auf Tuff bei 400 m; Soller, Torrent, 550 m (64); Tomir, Nordfuß, 700 m, auf Kalk; Lluch, auf Kalk am Wege nach Son Masip, 600 m (62).

Die Pflanzen sind auch hier meist höher als bei der Normalform, stets ist die Rippe bedeutend kräftiger, und die Zellecken sind vielfach auffallend verdickt.

B. acuta (Brid.) Brid. [*B. gracilis* Schwgr.] — An Kalkhängen auf feuchtem Kalk, Mergel und Lehm, vbr. — C. d'Or; Calonge; Felanitx, Mola; San Salvador (64); Capdepera (62); Soller, Torrent; Biniaraix, Barranco; Puig Mayor, Südfuß, 600 m (64); Lluch, vor Son Masip (62); Torrent de Pareis (64); Torrent de Sitges; Ternellas (62).

B. vinealis Brid. — An Kalkhängen, auf Lehm, auf Mauern, meist an lichteren Stellen, vbr. — C. d'Or; Felanitx, Mola (64); P. de Andraitx; Andraitx; S'Arraco; San Telmo; Camp de Mar (59); Villafranca, Bon Any, 300 m (64); C. Ratjada (62); Soller, Torrent; Biniaraix, Mauern; P. de Soller; Bunyola, nach Orient hin (64); Pollensa, in der Stadt (62).

B. cylindrica (Tayl.) Schpr — An ähnlichen Stellen wie die vorige, aber schattiger und meist auch feuchter. — C. d'Or; Felanitx, Mauern und Mola (64); P. de Andraitx; Andraitx; S'Arraco (59); Deya; Soller, Torrent; Biniaraix, Barranco und am Ofre-Sattel, 900 m; Bunyola (64); Tomir, Nordfuß; Lluch, nach Son Masip hin, 600 m (62).

B. sinuosa (Wils.) Braithw. — Auf feucht-schattigem Kalkgestein der Nordkette, selten. — Deya, Quelle im Ort (64); Soller, Torrent, am Bach, mehrfach, 400 u. 550 m (59, 64); Biniaraix, Barranco, nasses Gestein mehrfach (64); Tomir, Nordfuß, 650 m; Lluch, am Wege nach Son Masip, 600 m (62).

B. rigidula (Hdw.) Mitt.** — Auf Mauern und Kalkboden an ziemlich

lichten Stellen, mit Keimkörnern. — Felanitx, am Wege nach Son Negro (64); P. de Andraitx, Mauern in der Huerta und zw. Hafen und Ort (59); zw. P. de Andraitx u. S'Arraco (59).

B. trifaria (Hdw.) Mitt. [*B. lurida* (Hornsch.) Ldbg] — Auf Kalk und übererdeten Mauern, oft an recht lichten oder völlig unbeschatteten Stellen, zerstreut. — C. d'Or; Calonge; Felanitx, vbr. auf Brachland; auch an der Mola und am Castillo (64); P. de Andraitx (59); Villafranca, Bon Any (64); C. Ratjada, mehrfach (62); Biniaraix, Barranco, 100—600 m; zw. Bunyola und Orient (64); Ternellas (62).

var. *cuspidata* Schpr — Biniaraix, Barranco, 300 m (64).

var. *brevifolia* Latzel — Felanitx, Brachland östl. der Stadt (64); Alfabia, Bachhang (59).

B. tophacea (Brid.) Mitt. — Auf Lehm, Kalk und Tuff an feuchten bis nassen, an übererdeten Mauern aber auch an recht trocknen Stellen, dann meist braun bis schwärzlich verfärbt; nicht selten. — C. d'Or; Felanitx (64); P. de Andraitx; Andraitx; S'Arraco; San Telmo (59); Canyamel; Capdepera; C. Ratjada vbr. (62); Valldemosa; Miramar (59); Deya; Soller, Torrent, Biniaraix; zw. Bunyola und Orient (64); Puig Mayor, Südfuß (64); Tomir; Lluch; Pollensa; C. San Vicente vbr.; Ternellas vbr. (62).

f. *elata* Boul. — Soller, Torrent, auf Tuff, 200 m (64).

var. *acutifolia* Schpr — zw. P. de Andraitx u. Andraitx, Mauer (59).

var. *lingulata* Boul. — Bachtal zw. P. de Andraitx und S'Arraco (59); Canyamel, Bach, auf Tuff; C. Ratjada Quelle (62).

var. *brevifolia* Br. eur. — Capdepera (62).

B. Ehrenbergii (Lor.) Fl. — An Bachufern und auf nassem Kalktuff, der wenigstens längere Zeit des Jahres überrieselt ist. — P. de Andraitx, kleine Schlucht; Bachtal südl. S'Arraco; San Telmo (59); C. Ratjada, mehrfach (62); Valldemosa, nasses Gemäuer; Soller, Torrent, mehrfach (59, 64); Gorg Blau (64); Ternellas (62).

Tortula atrovirens (Sm.) Ldbg — P. de Andraitx, auf Mauern am Wege nach Andraitx; S'Arraco, auf Kalkboden, mehrfach und auch c. spor. (59); Soller, Torrent, Lehmhang (64).

T. marginata (Br. eur.) Spr. — An lehmigen und kalkigen Hängen, auf Mauern, oft nur in einzelnen Pflänzchen, aber stets fruchtend. — Calonge; Felanitx (64); P. de Andraitx, öfters; S. Arraco (59); Cueva del Drac (64); Canyamel; Capdepera (62); Soller, Torrent (64); P. de Soller (59, 64); zw. Bunyola u. Orient (64); Alfabia (59); Lluch, Font Oberta; Torrent de Sitges (62).

T. Vahliana (Schultz) Wils.** — P. de Andraitx, lehmbedeckte Mauer an der Mündung des Baches in den Hafen, c. spor., mit *Pottia Starkeana, Cephaloziella Baumgartneri* u.a. (28.3.59).

T. muralis (L.) Hdw. — An Kalkfelsen, auf Gemäuer, ziemlich häufig. — C. d'Or; Calonge; Felanitx (64); P. de Andraitx; Camp de Mar (59); Villafranca; Porto Cristo (64); Capdepera; C. Ratjada (62); Deya; Soller, Torrent; Biniaraix; P. de Soller; Bunyola (64); Tomir, Nordfuß; Lluch, vor Son Masip; C. San Vicente; Pollensa (62).

var. *incana* Br. eu. — An den meisten Stellen.

var. *obcordata* Schpr — P. de Andraitx; Alfabia, Mauern (59).

var. *aestiva* (P. de B.) Hook. et Tayl. — Capdepera, Feldmauer, c. spor. (62).

Hier typisch entwickelt und hat dann mit *T. muralis* wenig Ähnlichkeit: Blätter flach, Rippe als kurzer Dorn austretend; wie *T. Solmsii,* aber die Blattrandzellen sind ebenfalls papillös. Es ist nicht nur eine Standortsmodifikation, denn entsprechende schattige Mauern mit *T. muralis* gibt es oft, ohne daß sich v. *aestiva* bildet.

Syntrichia subulata (L.) Web. et M. — Biniaraix, Kalkhang im Barranco, unter Oliven, 500 m (64). — Scheint auf Mallorca sehr selten zu sein.

S. inermis (Brid.) Bruch — An lichten Kalkhängen der Nordkette, selten. — Deya, auf trocknem Lehm; Son Marroig, 300 m; Biniaraix, Olivenhang, 350 m; dgl., im Barranco, 500 m (64); Tomir, Eichenregion am Nordfuß, 600 m (62); Gorg Blau (64).

S. laevipila (Brid.) Schwgr. — Im Bergland an *Quercus ilex* und Oliven, selten, aber stets fruchtend. — Deya, 400 m; Lluch Alcari; Soller, Torrent, 350 m und darüber; Biniaraix, Barranco, 500 m, und am Ofre-Sattel, 900 m (64); Lluch, Talkessel, 600 m; Pollensa, Olivengärten 3 km südl. der Stadt (62).

var. *laevipilaeformis* (De Not.) Mkm. — Alfabia, an Oliven (59).

S. pagorum Milde** — Miramar, an Oliven (14.4.59).

S. montana Nees — Auf beschatteten Kalkfelsen im Bergland, selten. — Zwischen P. de Andraitx u. S'Arraco (59); Biniaraix, Barranco, 300 m bis zum Ofre-Sattel, 900 m; Bunyola, Waldhang am Wege nach Orient; Puig Mayor, Südfuß, 600 m (64); Tomir, Nordfuß, 650 m; Lluch, am Wege nach Son Masip, 600 m (62).

S. ruralis (L.) Brid. — Auf Kalk und an Oliven im Bergland, ziemlich selten. — Olivenhang über Soller (DIRCKSEN 61); Soller, 550 m; Biniaraix, 300 m; zw. Bunyola u. Orient; Puig Mayor, Südfuß, 600 m; Gorg Blau (64); Lluch, Son Masip und Font Oberta; Pollensa (62).

var. *calcicola* (Grebe) Mkm. — Deya, Kalkfelsen, 400 m (64).

Crossidium squamigerum (Viv.) Jur. — Auf Mauern und an Kalkfelsen, selten. — P. de Andraitx, mehrfach; Miramar (59); Soller, Lehmhang im Torrent; Biniaraix, auf hartem Lehm; Bunyola, an der Straße nach Orient (64); Alfabia (59); C. San Vicente (62).

C. chloronotus (Brid.) Lpr.** — An gleichen Standorten wie die vorige, doch seltener. — P. de Andraitx, Mauer an der Chaussee 1 km nördl. vom Hafen, c. spor.; P. de Andraitx, Westberge, auf Kalk (30.3.59); Soller, Lehmhang an der Straße nach Palma (64).

Aloina aloides (Koch) Kdbg — Auf lehmigem, kalkigem und mergeligem Boden, auf übererdeten Mauern; oft an freien oder kaum beschatteten Stellen und dann rotbraun verfärbt; die häufigste Art der Gattung. — C. d'Or; Felanitx; dgl., Castillo (64); P. de Andraix vbr.; Camp de Mar; S'Arraco; San Telmo (59); Cueva del Drac (64); C. Ratjada vbr.; Deya; Soller, Torrent; Biniaraix; zw. Bunyola u. Orient (64); Lluch, Son Masip (62); Torrent de Pareis (64); C. San Vicente; Ternellas (62).

A. rigida (Schultz) Kdbg** — An ähnlichen Stellen wie die vorige, doch

seltener. — P. de Andraitx, mehrfach auf Mauern; Paguera, Bachtal östl. vom Ort, auf Lehm (59); C. Ratjada (62); Biniaraix (64); Alfabia (59); C. San Vicente, im Ort und am Wege nach Pollensa (62).

Phascum rectum Smith — Auf lehmigem und kalkigem Boden; erscheint schon früh im Jahr und verschwindet im Laufe des April. — C. d'Or vbr.; Porto Petro; Felanitx, Brachacker (64); P. de Andraitx vbr.; S'Arraco (59); Porto Cristo; Villafranca, Bon Any (64); Capdepera; C. Ratjada (62); Soller (64); C. San Vicente (62).

Ph. cuspidatum Schreb. v. *cuspidatum*** — Felanitx, Brachacker östl. der Stadt auf hartem Lehmboden, c. spor. (12.4.64).

Pterygneuron ovatum (Hdw.) Dix. [*P. cavifolium* (Ehrh.) Jur.]** — P. de Andraitx, Mauer 1 km nördl. des Hafens, mit *Bryum murale, Pottia Starkeana* u.a. (31.3.59).

Pottia Davalliana (Sm.) Broth. [*P. rufescens* (Schultz) Wtf]* — Auf Lehm an Hängen und auf Mauern. — P. de Andraitx, bei der Bachmündung (28.3.59); 1 km nördl. P. de Andraitx; S'Arraco; Paguera, Olivengarten; P. de Pollensa, Garigue (59); Capdepera, an der Höhe 343 (62).

P. Starkeana (Hdw.) C. Müll. — An ähnlichen Stellen wie die vorige Art, nicht selten. — C. d'Or vbr.; Porto Petro; Felanitx, Gariguen, Olivengärten vbr.; dgl. am Castillo (64); P. de Andraitx vbr.; S'Arraco (59); Cueva del Drac; Soller; Torrent de Pareis (64).

P. commutata Lpr. — An gleichen Stellen wie die beiden vorigen, oft auch mit *Phascum rectum*. — C. d'Or, Gariguen; Felanitx, Mola (64); P. de Andraitx; S'Arraco (59); Cueva del Drac (64); Canyamel; Capdepera, Castillo; C. Ratjada; C. San Vicente, mehrfach (62).

P. caespitosa (Bruch) C. Müll.** — Auf nacktem, hartem Lehmboden der Gariguen, nur bei C. d'Or: Nordseite der C. Gran (6.4.64); *Cistus*-Gebüsch NW vom Ort; Brachacker zw. C. d'Or und Porto Petro (64).

P. intermedia (Turn.) Fürnr.** — C. d'Or, Mandelgarten, auf hartem, rotem Lehm, c. spor. (5.4.64).

P. lanceolata (Hdw.) C. Müll.** — Deya, an Kalkhängen auf trocknem Lehm, 400 m (24.4.64).

Ich sah das Moos schon an Ort und Stelle als diese Art an, die mikroskopische Untersuchung ergab aber ein etwas abweichendes Peristom: die Zähne sind schmäler und haben feinere Papillen als bei westfälischen Pflanzen. Herr Professor Dr. BOROS, Budapest, den ich bat, das Material mit ungarischen Pflanzen zu vergleichen, ist aber auch der Meinung, daß die Abweichungen innerhalb der Variationsbreite der ziemlich veränderlichen Art lägen.

Cinclidotus fontinaloides (Hdw.) P. de B. — In Bächen des Kalkgebirges, ziemlich selten. — Deya, am Hang, 300 m (64); Soller, Torrent, 70 u. 400 m (59, 64); Biniaraix, Barranco, mehrfach (64); Tomir, Nordfuß, 650 m (62); Gorg Blau, c. spor.; Torrent de Pareis (64); C. San Vicente, in Menge SW vom Ort (62).

C. nigricans (Brid.) Lske [*C. riparius* (W. et M.) Arnott] — C. San Vicente, im Bach nahe am Hotel mit *Leptodictyum riparium* (62).

C. mucronata (Brid.) Mkm. — An Bächen und Quellen, aber auch an

trockneren Stellen auf Mauern, an Eichen und Oliven, fast nur in der Nordkette. — Canyamel (62); Son Marroig, 300 m; Soller, Torrent, 50—550 m; Biniaraix, im Barranco vbr., auch c. spor. und mit Keimkörnern, 160—800 m (64); Tomir, Nordfuß, 650 m; Lluch, vor Son Masip, 600 m, viel (62); Gorg Blau (64); 3 km südl. Pollensa, Olivengarten; Ternellas (62).

Schistidium apocarpum (Hdw.) Br. eur. — Feuchtschattige Kalkfelsen, besonders in Bachnähe, stets fruchtend; bisher nur in der Nordkette. — Miramar (59); Deya, 3—400 m; Soller, Torrent vbr.; Biniaraix, Barranco vbr.; zw. Bunyola und Orient; Puig Mayor, Südfuß, 600 m (64); Tomir, Nordfuß, 600 m (62); Gorg Blau (64).

f. *irrigatum* H. Müll. — Biniaraix, Barranco, 500 m (64).

var. *piligerum* De Not. — Lluch, Kalkfelsen vor Son Masip (62).

ssp. *confertum* (Funck) Dix. — Soller, Torrent, Mauer an der Chaussee bei km 30,0.

Grimmia Pitardi Corb.* — Auf ganz oder nahezu unbeschatteten Kalkblockmauern, auf hartem Lehm und Kalk, in kleinen, nur 1—4 qcm großen, schwärzlichen, reich fruchtenden Räschen. — Biniaraix, Mauern und Lehm, 120 m (19.4.64); Soller, auf Kalk an der Straße nach Deya, zw. km 0,8 und 1,0; dgl., im Torrent an der Straße nach Palma bei km 29,3 und 28,2 auf kalkigem Konglomerat; Bunyola, Mauer an der Straße nach Orient, bei km 3,0 (64).

An diesen 4 Orten traf ich das Moos an insgesamt 8 Wuchsstellen. Von den 30 Begleitmoosen traten 5 oder 6 Mal auf: *Barbula fallax, B. vinealis, Crossidium squamigerum*; *Encalypta vulgaris, Grimmia orbicularis, Gymnostomum calcareum* und *Weisia tortilis*. Mischrasen sind aber selten; bemerkenswert war ein Polster der *Weisia tortilis* von 8 qcm Fläche, aus dem ca 75 Sporogone der *Grimmia Pitardi* herausragten, ihre Blätter waren mit der *Weisia* völlig verwoben, nur die Kapseln waren sichtbar.

G. Pitardi zeigt westmediterrane Verbreitung. Sie wurde in Tunesien, Tripolis, auf Ibiza, bei Granada und in Süd-Frankreich festgestellt. (Mitteilung von Frau V. ALLORGE; siehe F. KOPPE, *Grimmia Pitardi* Corb. in Südspanien. Rev. Bryol. et Lichén. 1964, T. 33, S. 216—218.)

G. crinita Brid.** — P. de Andraitx, Mauer am Wege 1 km nördl. vom Hafen, spärlich (31.3.59).

G. orbicularis Bruch — Auf Kalkfelsen und Mauern, am lichten Stellen, in der Nordkette nicht selten. — Felanitx (64); P. de Andraitx, mehrfach (59); Deya; Son Marroig; Soller, Torrent vbr.; Puig Mayor, Südfuß, 600 m (64).

var. *longipila* Husnot — Bunyola, Mauer (64); Tomir, Nordfuß, 650 m, Kalk (62).

G. pulvinata (L.) Sm. — An gleichen Standorten und etwa von gleicher Häufigkeit wie die vorige. — Felanitx; San Salvador (64); Miramar (59); Son Marroig; Soller, Torrent vbr., viel an den Stützmauern der Chaussee; Biniaraix, Barranco bis zum Ofre-Sattel, 900 m; Puig Mayor, Südfuß, 600 m (64); Lluch, Font Oberta, 650 m; Pollensa (62). — Anscheinend nur var. *longipila* Schpr.

G. trichophylla Grev. var. *meridionalis* Schpr — In der Nordkette auf Kalkfelsen vbr. — Zw. P. de Andraitx und S'Arraco (59); Deya; Son

Marroig; Soller, Torrent vbr.; Biniaraix, Olivenhänge und im Barranco, 300—500 m; Bunyola, nach Orient hin (64); Tomir, Nordfuß, 650 m, viel und reich fruchtend; Lluch, Son Masip und Font Oberta (62); Puig Mayor, Südfuß, 600 m; Gorg Blau (64).

Entosthodon curvisetus (Schwgr.) C. Müll. — Auf Erde zw. Kalkfelsen an schattigen und etwas feuchten Stellen. — C. d'Or, oberhalb der C. Llonga; Cueva del Drac, an der kleinen Cala; zw. Soller u. P. de Soller; Torrent de Pareis (64); Pollensa, neben der römischen Brücke; Torrent de Sitges; C. San Vicente, Hang am SW-Bach (62).

E. pallescens Jur.* — Soller, Torrent, nasser Kalkfelsen an der Straße bei km 28,5, c. spor. (22.4.64).

Die Beschreibung des Mooses ist in LOESKE's Funariaceen-Monographie unvollständig, auch bei MÖNKEMEYER fehlt noch manches, sie kann hier vervollständigt werden:

Seta: reif: rotbraun, 1—1,4 cm lang, sehr dünn, gerade. Kapsel klein, 1,2—1,5 mm lang, das untere Drittel in die Seta verschmälert, blaß-gelb, zur Mündung hin bräunlich, Zellen gestreckt, schmal, an der Kapselmündung querbreiter, 4 Reihen 12×40 µ, rotbraun; Spaltöffnungen spärlich im verschmälerten Teil. Deckel flach, bräunlich. Peristomzähne bei der Entdecklung 50—60 µ lang, 3-gliederig, oberstes Glied entfärbt, sonst rötlich-gelb; innenseits längsgestreift, schwach punktförmig-rauh. Sporen gelbbräunlich, punktiert, fast glatt, 27—29 µ diam. Haube 1,75 mm lang, unteres Drittel breit, kaputzenförmig, strohfarben, etwas glänzend; die oberen 2 Drittel schnabelförmig, gerade gestreckt, strohfarben, Spitze dunkelbraun.

Funaria dentata Crome

var. *dentata* — Felanitx, Nordseite der Mola, 70 m, auf Lehm, z.T. unter Pistacien-Gebüsch (13.4.64); Deya, feuchte Kalkfelsen, 400 m (64).

var. *mediterranea* (Ldbg) Lpr. — Auf wenig beschatteten Lehm- und Kalkhängen, auch auf Mauern, zerstreut, aber meist nur spärlich. — C. d'Or, oberhalb C. Llonga; Felanitx, vor Son Negro und am Castillo (64); P. de Andraitx; S'Arraco (59); Villafranca, Bon Any, 120 m; Deya, bei 200 u. 400 m; P. de Soller; Biniaraix (64); Lluch, Son Masip; Pollensa, an der römischen Brücke; C. San Vicente vbr. (62).

var. *convexa* (Spruce) Bottini — Felanitx, nördliche Vorberge der Mola; Torrent de Pareis, Kalkwände (64).

F. hygrometrica (L.) Hdw. — Auf beschattetem Kalk- und Lehmboden, auch hier gern an alten Brandstellen. — C. d'Or; Calonge (64); P. de Andraitx; S'Arraco; Camp de Mar (59); C. Ratjada (62); Deya (64); Lluch, Son Masip; Tomir, Nordfuß, 650 m (62); Gorg Blau; Torrent de Pareis (64); C. San Vicente; Ternellas (62).

Mniobryum delicatulum (Hdw.) Dix. [*M. carneum* (W. et M.) Lpr.] — Nasser Kalk-, Mergel- und Tonboden. — Canyamel, Bachrand (62); Alfabia, dgl. (59); Soller, Torrent, c. spor.; Bunyola, nasse Mauer am Wege nach Orient; Torrent de Pareis, Kalkwand (64).

M. albicans (Whlnbg) Lpr.** — An ähnlichen Stellen, selten. — S'Arraco, Talsohle (59); Son Marroig, Tuff; Soller, Torrent, Talsohle; Bunyola, Bach nach Orient hin; Torrent de Pareis, nasser Kalkhang (64).

var. *calcareum* (Wtf.) Mkm.** — Deya, Kalkhang, 350 m, auf nassem Tuff (24.4.64).

Bryum capillare L. — Schattige Waldhänge, im Gegensatz zu *B. torquescens* selten. — P. de Andraitx, Ostberge, 200 m, var. *macrocarpum* Hübn. (59); dgl. NW von P. de Andraitx (59); Tomir, Nordfuß, 650 m, unter *Quercus ilex* (62).

B. torquescens Br. eur. — An schattigen Waldhängen oft in ausgedehnten, sehr reich fruchtenden Rasen, an anderen Standorten weniger üppig und spärlicher fruchtend; häufig. — C. d'Or; Porto Petro; Felanitx; San Salvador (64); P. de Andraitx; S'Arraco; Es Barraca; Camp de Mar; Paguera (59); Villafranca (64); Campanet, in der Höhle in einer etiolierten Schattenform (59); Capdepera; C. Ratjada (62); Miramar (59); Deya; Biniaraix; Soller; P. de Soller; Bunyola (64); Alfabia (59); Puig Mayor, Südfuß, 600 m (64); Lluch (62); Gorg Blau (64); C. San Vicente; Pollensa; Ternellas (62).

B. Donianum Grev. — Auf mäßig beschatteten Mauern und in Kalkfelsklüften, vbr. — C. d'Or; Felanitx (64); P. de Andraitx; S'Arraco (59); Canyamel; Capdepera; C. Ratjada (62); Valldemosa; Miramar (59); Deya; Soller, Torrent; Biniaraix, auch im Barranco bis zum Ofre-Sattel, 900 m; P. de Soller; zw. Bunyola und Orient (64); Alfabia (59); Tomir, Nordfuß, 650 m; P. Mayor, Südfuß, 600 m (64); Lluch, Son Masip; Ternellas (62).

B. rubens Mitt.** [Kleinart der *B. erythrocarpum*-Gruppe, vgl. CRUNDWELL & NYHOLM 1964] — C. San Vicente, auf lehmigem Boden am SW-Bach, mit vielen Rhizoid-Gemmen (4.5.62).

B. radiculosum Brid. [*B. murale* Wils.] — Auf Mauern, an Kalkfelsen und auf lehmigem Gariguen-Boden, oft an trocknen und unbeschatteten Stellen, häufig und oft fruchtend. — C. d'Or; Calonge; Porto Petro; Felanitx, Mola und Son Negro (64); P. de Andraitx; S'Arraco; Camp de Mar (59); Villafranca, Bon Any (64); Capdepera; C. Ratjada (62); Miramar (59); Deya; Soller, Torrent; Biniaraix, auch im Barranco (64); Alfabia (59); Puig Mayor, Südfuß, 600 m (64); C. San Vicente; Ternellas (62); P. de Pollensa (59).

B. gemmiparum De Not. — Auf Kalk und Tuff an Bachufern. Manchmal mit den charakteristischen bulbillenartigen Kurztrieben; in der Nordkette zerstreut. — P. de Andraitx, Westberge (59); Canyamel, in einem Bach; Capdepera, Bach am Kalkhügel 211 m (62); Son Marroig, 300 m (64); Soller, Torrent, 100—500 m (59, 64); Biniaraix, im Barranco vbr. bis zum Ofre-Sattel, 900 m; zw. Bunyola und Orient (64); Tomir, Nordfuß, 700 m; C. San Vicente, im Bach am Hotel; Ternellas, Felsschlucht (62).

var. *cuspidatum* Roth — S'Arraco, im Tal nach P. de Andraitx hin, auf Kalktuff (64).

B. bimum Schreb.* — Canyamel, auf Kalktuff in einem Bach nahe der Flußmündung (19.4.62).

B. caespiticium L. — Auf trocknem Lehmboden. — C. d'Or, *Cistus*-Macchie (64); P. de Andraitx (59); Canyamel, Garigue an der Höhle; Capdepera, am Kalkhügel 234, auf Lehm bei 100 m; C. Ratjada; Tomir, Nordfuß, 600 m (62).

B. bicolor Dicks. — Auf übererdeten Mauern, auf Lehm- und Kalkböden, auf Brachland, meist fruchtend. — C. d'Or; Calonge; Felanitx (64); P. de Andraitx (59); Capdepera; C. Ratjada; Ternellas (62).

B. argenteum Hdw. — Auf Brachäckern und Mauern, selten. — Felanitx (64); C. Ratjada (62); Soller, Torrent (64); C. San Vicente (62).

Mnium rostratum Schrad.** — Gorg Blau, an feucht-schattigen Kalkfelsen (27.4.64).

M. affine Bland.** — Lluch, beschattete und etwas feuchte Kalkhänge am Wege nach Son Masip, 600 m, unter *Quercus ilex* (1.5.62).

M. Seligeri Jur. — Deya, Kalkhänge, an Quellen im Ort und bei 300 m; Biniaraix, quellige Kalkhänge, 200—250 m; Gorg Blau, feucht-schattiger Kalkhang; Torrent de Pareis, nasser Kalkfels (64).

M. undulatum Weis** — An humosen Kalkhängen an Quellen und Bächen, selten. — Deya, 350 m; Biniaraix, 400 m (64); Lluch, Quellen am Wege nach Son Masip, 600 m (1.5.62); Ternellas, nördl. Bachtal, 300 m (62).

Philonotis fontana Brid. — Ternellas, am Bach im Talkessel und weiter oberhalb, 200 m (62).

Ph. marchica (Willd.) Brid.** — Deya, Kalkhänge, auf Tuff, 300 m (24.4.64); Torrent de Pareis, nasse Kalkhänge (64).

Ph. rigida Brid.** — Deya, Kalkhänge, 400 m, Bachrand (24.4.64).

Zygodon viridissimus (Dicks.) R. Br. — An Oliven, seltener an *Quercus ilex,* in der Nordkette häufig, sonst selten; oft auch mit Sporogonen, während die Keimkörner viel spärlicher als in Mitteleuropa auftreten.

var. *viridissimus* [var. *vulgaris* Malta] — Felanitx, am Wege nach Son Negro (64); S'Arraco; Miramar (59); Deya; Soller, Torrent; Biniaraix, auch im Barranco; zw. Bunyola u. Orient (64); Alfabia (59); Lluch; C. San Vicente; Ternellas (62).

var. *mediterraneus* Malta — An gleichen Stellen wie die Hauptform, aber etwas seltener. — Felanitx, Fruchtgarten an *Ceratonia*; dgl., am Wege zum Castillo, Oliven (64); S'Arraco; Es Barraca (59); Capdepera (62); Miramar (59); Deya (64); Soller, Torrent (59, 64); zw. Bunyola u. Orient (64).

Ortotrichum anomalum Hdw. — Auf Kalk, in der Nordkette zerstreut. — Deya (64); Soller, Torrent (59, 64); Biniaraix, Mauern in Olivengärten und im Barranco; zw. Bunyola u. Orient (64); Lluch, Son Masip und bei Font Oberta, 650 m (62).

var. *saxatile* (Brid.) Milde** — Tomir, Nordfuß, 650 m, auf Kalk; Ternellas, Felsenschlucht oberhalb des Ortes, 250 m, auf Kalk (62).

O. cupulatum Hoffm. — Auf Kalkfelsen und an Oliven in der Nordkette. — Son Marroig; Deya; Soller, Torrent, mehrfach; Biniaraix, im Barranco; zw. Bunyola u. Orient; Puig Mayor, Südfuß, 600 m; Gorg Blau (64).

var. *nudum* (Dicks.) Braithw.** — Soller, Torrent, an Kalkfelsen, besonders in Bachnähe, 4—500 m (59, 64); Tomir, Nordfuß, 600 m; Lluch, Son Masip, 600 m (62).

O. diaphanum Schrad. — An Oliven, besonders in der Nordkette, nicht häufig. — S'Arraco: Es Barraco (59); Capdepera (62); Deya; Lluch Alcari; Soller, Torrent (64); Alfabia (59).

Leucodon sciuroides (L.) Schwgr. — An Eichen und Oliven in der Nordkette. — Soller, Torrent (59); Biniaraix, Barranco; zw. Bunyola u. Orient (64); Alfabia (59); Tomir, Nordfuß, 650 m; Lluch, Son Masip und Font Oberta (62).

var. *morensis* (Schwgr.) De Not. — An gleichen Stellen wie der Typus. — Deya (64); Soller, Torrent (59, 64); Biniaraix, Olivenhang; zw. Bunyola u. Orient (64); Lluch, Oliven im Talkessel, 600 m; Pollensa, 3 km südl. der Stadt (62).

Antrichia californica Sulliv.** — Lluch, am Masanella, in der Steineichenstufe am Boden, 800 m (21.4.61 A. DIRCKSEN).

Pterogonium gracile Smith — An schattigen Hängen auf *Quercus ilex*, Oliven und Kalkfelsen, fast nur in der Nordkette. — Felanitx, Mola, 70 m; Deya, 400 m; zw. Bunyola u. Orient; Soller, am Wege nach Deya; Biniaraix, Barranco (64); Lluch, mehrfach, auch Son Masip und Font Oberta; Tomir, Nordfuß, 650 m (62); Gorg Blau (64); Pollensa, 3 km südl. der Stadt, an Oliven in dichten Behängen (62).

Leptodon Smithii (Hdw.) Mohr — An Oliven und *Quercus ilex*, in der Nordkette vbr., sonst selten. — S'Arraco; Miramar (59); Son Marroig; Deya; Soller, Torrent; Biniaraix, Barranco; zw. Bunyola u. Orient (64); Lluch, Son Masip und Font Oberta; Tomir, Nordfuß, 600 m; Pollensa, 3 km südl. der Stadt an Oliven (62).

Homalia lusitanica Schpr. — An feucht-schattigen Felsen der Nordkette, selten. — Lluch, vor Son Masip (62); Biniaraix, Barranco, 400 m; Gorg Blau (64).

Neckera crispa (L.) Hdw. — Lluch, am Masanella, Kalkfelsen der Eichenstufe, 900 m (A. DIRCKSEN 61).

Fontinalis antipyretica L. — In Bächen, selten.

var. *alpestris* Milde — Biniaraix, Bach am Ofre-Sattel, 900 m (1.5.64).

var. *latifolia* Milde — Bunyola, Bach an der Straße nach Orient, zw. km 26,2 u. 26,6 (28.4.64).

F. Duriaei Schpr. — Gorg Blau, Bach; Torrent de Pareis, Quelle im Mündungsgebiet (64).

Fabronia pusilla Raddi — An Oliven, *Quercus ilex* und auf Kalk in der Nordkette. — Deya, 400 m; Biniaraix, Kalkhänge, 400 m (64); Lluch, Hänge am Wege nach Son Masip, 600 m (62).

Habrodon perpusillus (De Not.) Ldbg — An Eichen und Oliven der Nordkette. — Miramar (59); Deya, 400 m; Biniaraix, Barranco, 500 m (64); Lluch, Hänge bei Font Oberta, 650 m (62).

Cratoneuron commutatum (Hedw.) Roth — Deya, Quelle im Ort; Biniaraix, Barranco, Quellen 150—400 m, z.T. in Massen (64).

var. *falcatum* (Brid.) Mkm,** — Deya, Bach bei 400 m, Tuff (64).

C. filicinum (L.) Roth — An Quellen der Nordkette, selten. — Lluch Alcari; Soller, Torrent, 300—550 m; Biniaraix, im Ort und im Barranco vbr. (64); Tomir, Nordfuß, 650 m (62).

Leptodictyum riparium (Hdw.) Wtf. — Bach zw. Bunyola und Orient in var. *elongatum* Br. eur. (64); C. San Vicente, Bäche am Hotel, NW und SW vom Ort, an letzterer Stelle haben die Blätter eine auffallend dicke Rippe (62).

Camptothecium aureum (Lag.) Br. eur. — Lluch, auf Kalk über Font Oberta, 650 m (62).

C. sericeum (L.) Kdbg — Auf Kalk und an Mauern, auch an Oliven-

und Eichenbäumen, vbr. — C. d'Or; Felanitx; San Salvador (64); P. de Andraitx; S'Arraco; Es Barraca; Camp de Mar (59); Villafranca; Deya; Son Marroig; Soller, Torrent; Biniaraix, auch im Barranco; zw. Bunyola u. Orient (64); Tomir, Nordfuß; Lluch, Son Masip und Font Oberta; Torrent de Sitges; Pollensa; C. San Vicente; Ternellas; Castillo d'es Rey (62).

var. *robustum* Lpr. — P. de Andraitx, auf Mauern in der Huerta.

Scorpiurium circinatum (Brid.) Fleisch. — In Wäldern, an buschigen Hängen, auf Mauern, an Olivenbäumen, sehr vbr., eines der häufigsten Moose der Insel. — C. d'Or; Felanitx; San Salvador (64); P. de Andraitx; S'Arraco; San Telmo; Es Barraca; Camp de Mar (59); Villafranca; Porto Cristo (64); Capdepera; C. Ratjada (62); Valldemosa; Miramar (59); Deya; Soller, Torrent; Biniaraix; P. de Soller, zw. Bunyola u. Orient (64); Tomir; Lluch; Pollensa; Torrent de Sitges; C. San Vicente; Ternellas (62).

var. *deflexifolium* (Solms) Boulay — Soller, Torrent, 450 m (59); Tomir, Nordfuß, 650 m; Pollensa, nasses Gemäuer (62).

Brachythecium salebrosum (Hffm.) Br. eur.** — P. de Andraitx, Kalkberge westl. vom Hafen, auf dem Humus einer Kluft im Walde, c. spor. (2.4.59).

B. glareosum (Bruch) Br. eur. — Beschattete, etwas feuchte Kalkfelsen der Nordkette. — Deya, im Ort; Biniaraix, unter dem Ofre-Sattel, 900 m; zw. Bunyola und Orient (64); Tomir, Nordfuß, 600 und 650 m; Lluch, Hang vor Son Masip, 600 m (62).

B. rutabulum (L.) Br. eur. — Unter Gebüsch auf Lehm, Mergel und Kalk, selten und nur in der Nordkette. — Soller, Torrent, mehrfach (59, 64); Gorg Blau; Torrent de Pareis (64); Ternellas, am nördl. Quellbach, 350 m in var. *robustum* Wtf. (62).

var. *flavescens* Br. eur. — Deya, auf Lehm; Son Marroig; Soller, Torrent, 350 u. 550 m (64).

B. rivulare (Bruch) Br. eur. — Gorg Blau, am Bach (64).

B. velutinum (L.) Br. eur. — Wie die vorige auf der Insel selten. — Soller, Torrent, 300 m, auf Lehm (59).

Scleropodium Tourettii (Brid.) L. J. Koch [*S. illecebrum* Schpr.] — Auf Kalk- und Lehmboden in lichten Wäldern, vbr. — Felanitx, Mola; San Salvador, 180 m (64); P. de Andraitx; S'Arraco (59); Es Barraca; Porto Cristo (64); Canyamel; Capdepera; C. Ratjada (62); Deya; Son Marroig; Soller, Torrent; Biniaraix, auch im Barranco; zw. Bunyola und Orient; Puig Mayor, Südfuß, 600 m (64); Tomir, Nordfuß; Lluch (62); Gorg Blau (64); C. San Vicente; Ternellas (62).

Sc. purum (Hdw.) Lpr. — Schattige, humose Waldhänge, selten. — San Salvador, Nordseite (64); P. de Andraitx, NW-Kalkberge; S'Arraco (59); Ternellas, am Nordbach, 300—350 m (62).

Cirriphyllum crassinervium (Tayl.) Lske et Fl. — Auf Kalk an Quellbächen der Nordkette, selten. — Deya, 400 m; Soller, Torrent vbr.; Biniaraix, Barranco, 400 m (64); Tomir, Nordfuß, 650 m; Lluch, vor Son Masip und im Talkessel, 600 m (62); Gorg Blau (64).

Eurhynchium meridionale (Schpr.) De Not. [*Orthothecium Duriaei* Besch., *Plasteurhynchium Duriaeanum* (Mont.) Allorge] — An schattigen

Hängen, auf Waldboden, aber auch an sehr lichten Stellen, z.B. auf Mauern, häufig. — C. San Vicente; Felanitx; San Salvador (64); P. de Andraitx; S.Arraco; Es Barraca; Camp de Mar (59); Villafranca; C. Ratjada; Canyamel (62); Miramar (59); Deya; Son Marroig; Soller, Torrent; Biniaraix und Barranco (64); Tomir, Nordfuß; Lluch (62); Torrent de Pareis (64); C. San Vicente; Ternellas (62). Fruchtend nur: Felanitx, Anstieg zum Castillo (64); P. de Andraitx, Ostberge; S'Arraco, Bachtal (59); immer an sehr schattigen Stellen.

Das Moos ändert nach den Standortsverhältnissen habituell stark ab, und die großen grünen Schattenformen sehen wesentlich anders aus als die kupferbraunen Rasen auf trocknen und viel der Sonne ausgesetzten Mauern und Lehmhängen. Immer aber haben die Blätter einen auffallenden Glanz und eine eigenartige knitterige Fältelung. Unserem mitteluropäischen *E. striatum* werden sie nie ähnlich.

E. praelongum (Hdw.) Hobk. [*E. Stokesii* (Turn.) Br. eur. vieler, besonders auch der deutschen Autoren] — Auf feuchtem, schattigem Erdboden, besonders in Bachschluchten, selten. — S'Arraco (59); Biniaraix, im Barranco, 400 m (64); Lluch, vor Son Masip, 600 m; Ternellas, im nördl. Bachtal, 320 m (62).

Oxyrrhynchium hians (Hdw.) Card. [*O. praelongum* (Br. eur.) Wtf.]** — Soller, Torrent, Lehmhang, 500 m (3.4.59); Ternellas, auf Lehm im Bachtal (62).

O. Swartzii (Turn.) Wtf.** — Biniaraix, auf quelligem Boden im Barranco, bei 400 m und am Ofre-Sattel, 900 m (64).

O. pumilum (Wils.) Wtf. [*Rhynchostegiella pallidirostris* (A. Br.)] — Auf feucht-schattigen Kalkfelsen der Nordkette. — Deya, 400 m (64); Soller, Torrent vbr. (59, 64); Biniaraix, Barranco und am Ofre-Sattel; Gorg Blau; Torrent de Pareis (64); Lluch, vor Son Masip, 600 m; Ternellas, oberhalb des Ortes und am NW-Bach (62).

O. speciosum (Brid.) Wtf. — Auf feucht-schattigem Kalk, besonders an Quellen und Bächen, selten. — Deya, 400 m, auf Tuff; Lluch Alcari; Torrent de Pareis (64); Alfabia (59); Torrent de Sitges, Kalkklüfte; C. San Vicente, SW-Bach (62).

O. riparioides (Hdw.) Jennings [*Rhynchostegium rusciforme* (Neck.) Br. eur.] — An und in Bächen der Nordkette, selten, aber manchmal in großer Menge. — Son Marroig (64); Soller, Torrent vbr. (59, 64); Biniaraix, Barranco bis zum Ofre-Sattel; zw. Bunyola und Orient; Gorg Blau (64); Ternellas, Bachtal vbr. (62).

var. *turgescens* Wtf. — Biniaraix, Bach am Ofre-Sattel (64).

Rhynchostegium megapolitanum (Bland.) Br. eur. — Auf trocknem aber beschattetem Lehm- und Kalkboden, nicht selten. — C. San Vicente; Calonge; Porto Petro; Felanitx; San Salvador (64); P. de Andraitx; S'Arraco; Camp de Mar; Paguera; Es Barraca (59); Villafranca, Bon Any (64); Reco de Massot; Canyamel; Capdepera; C. Ratjada (62); Deya; Soller, Torrent; Biniaraix, unter dem Ofre, 800 m; P. de Soller, am Leuchtturm (64); Tomir, Nordfuß; Puig Mayor, Südfuß; Torrent de Pareis (64); C. San Vicente (62).

Rh. confertum (Dicks.) Br. eur.** — Feucht-schattiges Kalkgestein der

Nordkette. — Soller, Torrent, 300 m (14.4.59); Lluch, am Wege nach Son Masip, 600 m; Tomir, Eichen-Region am Nordfuß, 700 m (62).

Rhynchostegiella tenella (Dicks.) Lpr. [*Rh. algiriana* (Brid.) Broth.] — Die Art ist auf Mallorca vbr. und formenreich.

var. *tenella* — Rasen mäßig dicht, glänzend; Rippe der Stammblätter (nicht immer auch der Astblätter) in die Blattspitze eintretend; Seta glatt; auf beschatteten Kalkfelsen.

var. *meridionalis* Brizi — Rasen dicht, mit starkem Goldglanz; Rippe vor der Blattmitte endend; Seta glatt; auf beschattetem Kalk- und Lehmboden.

var. *septentrionalis* Brizi — Rasen locker, dem Boden angedrückt, kaum glänzend; Rippe bis über die Blattmitte reichend; Seta glatt; auf beschattetem und etwas feuchterem Boden.

var. *litorea* (De Not.) Mkm. — Rasen vom Aussehen und mit dem Glanz der var. *tenella*; Seta schwach rauh; Blattrippe zart, etwa bis zur Blattspitze reichend; an gleichen Stellen wie var. *tenella*.

var. *tenella* — C. d'Or, an der C. Llonga (64); Felanitx, vor Son Negro und am Castillo (64); P. de Andraitx, Ostberge; S'Arraco; Camp de Mar (59); Canyamel; Capdepera (62); Biniaraix, im Barranco; C. d'Or, an der C. Llonga (64).

var. *meridionalis* Brizi — C. d'Or; Felanitx, Mauern im Fruchtland; San Salvador (64); P. de Andraitx vbr.; S'Arraco; Es Barraca; Camp de Mar (59); Canyamel; Capdepera (62); Deya (64); Soller, Torrent, 300 m (59); zw. Bunyola u. Orient (64); C. San Vicente (62).

var. *septentrionalis* Brizi — C. d'Or; Felanitx (64); P. de Andraitx; Es Barraca; Inca, Brunnengemäuer (59); Villafranca, Bon Any (64); Canyamel; Capdepera; C. Ratjada (62); Soller, Torrent (59); Biniaraix, Barranco, 400 m (64); C. San Vicente, Feldbrunnen (62).

var. *litorea* (De Not.) Mkm. — C. d'Or; Felanitx; San Salvador (64); P. de Andraitx; S'Arraco; San Telmo; Es Barraca; Camp de Mar; Paguera (59); Cueva de Arta, an einer Lampe; Capdepera vbr.; C. Ratjada, am Jaumeil (62); Deya; Soller, Torrent; Biniaraix; P. de Soller (64); Ternellas, Bachtal vbr. (62).

Rh. curviseta (Brid.) Lpr. — Feuchtes bis nasses Kalkgestein und Gemäuer. — Inca, Brunnen (59); Canyamel, auf Kalktuff; C. Ratjada; Capdepera (62); Deya, Tuff am Bach 300—400 m; Son Marroig; Soller, Torrent; Biniaraix, Barranco, auf Tuff bis zum Ofre-Sattel, 900 m; zw. Bunyola u. Orient; Gorg Blau; Torrent de Pareis (64); Lluch; Tomir, Nordfuß, 650 m (62); C. San Vicente (62).

Hypnum cupressiforme L.

var. *cupressiforme* — An Oliven und Eichen, selten auf Humus übergehend. — Felanitx, Eichengehölz südl. der Stadt (64); Miramar (59); Deya; Biniaraix, Barranco, 500 m (64); Alfabia (59); Puig Mayor, Nordfuß, 600 m (64); Tomir, Südfuß, 650 m; Pollensa, Olivengarten; Ternellas, 200 m (62).

var. *filiforme* Brid. — Deya, 400 m, an Oliven (64).

var. *imbricatum* Boulay

Hierher scheint eine recht verbreitete Form lichter Kalkfelsen zu gehören. Sie ist var. *lacunosum* habituell ähnlich: mittelgroß bis groß, hell- bis goldbraun, Stengel

mit zahlreichen, regelmäßig abstehenden Ästen. Stammblätter aus etwas verschmälertem Blattgrund eiförmig und in eine längere Spitze ausgezogen. Diese ist halbkreisförmig gebogen. Die Blattflügelzellgruppe ist relativ klein. Es handelt sich wohl um eine mediterrane Variante der var. *lacunosum*.

C. d'Or, an der C. Llonga: Felanitx, Mola; San Salvador, 300 m (64); P. de Andraitx (59); Capdepera, am Castillo (62); Deya; Son Marroig (64); Soller, Torrent, (59, 64); Biniaraix; zw. Bunyola u. Orient; Gorg Blau (64); Tomir, Nordfuß, 600 m; C. San Vicente; Ternellas (62).

Ctenidium molluscum (Hdw.) Mitt. — An schattigen Kalkhängen, besonders in bodenfrischen Schluchten, bisher nur in der Nordkette. — Deya (64); Soller, Torrent vbr. (59, 64); Biniaraix, 150 m, im Barranco bis zum Ofre-Sattel; zw. Bunyola u. Orient; Puig Mayor, Südfuß, 600 m; Gorg Blau, Torrent de Pareis (64); Lluch, nach Son Masip hin, 600 m; Tomir, Nordfuß, 600 m; Ternellas, mehrfach (62).

Zusammenfassung

Verf. hat die Moosflora der Insel Mallorca untersucht. Er führt die beobachteten Arten (27 *Hepaticae*, 140 *Musci*, zuzüglich 51 Varietäten) und ihre Fundorte auf. 6 *Hepaticae* und 40 *Musci* sind neu für die Insel, großenteils auch für die Inselgruppe der Balearen. Neu beschrieben wird ssp. *pusillum* F. Koppe von *Trichostomum brachydontium* Bruch.

Literatur

CASAS DE PUIG, C. 1956. Contribution al estudio de la flora briologica balear. — Pharmacia mediterranea, Barcelona, 1: 1—16.

CRUNDWELL, A. C. & NYHOLM, E. 1964. The European Species of the Bryum erythrocarpum Complex. — Transact. Brit. Bryol. Soc. Vol. 4, Part 4.

HERZOG, TH. 1907. Studien über den Formenkreis des Trichostomum mutabile Br. — Nova acta. Abh. Kais. Leop.-Carol. Dt. Akad. Nat.-forsch., Bd 73, Nr 3. — Halle a.S.

NICHOLSON, E. 1907. Contributions to a list of the mosses and hepatics of Majorca. — Rev. Bryol. 34: 1—6.

BOTANISKA NOTISER 1965 · VOL. 118 · FASC. 1 · LUND

Vegetationsundersökningar på Store mosse

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(Meddelande från Lunds Botaniska Museum, Nr 194)

Inledning

Store mosse även kallad Kävsjö mosse ligger i sydvästra delen av Jönköpings län c. 15 km nordväst om Värnamo (topografiska kartbladen 19 Landeryd och 26 Gislaved). Myrens sammanlagda areal uppgår till nära 10.000 hektar och är därmed den största i Sydsverige. Den utgör den nordligaste delen av ett nästan sammanhängande sankmarksområde norr om sjön Bolmen. Geomorfologiskt ligger detta område inom den del av Sydsvenska höglandet, som betecknas södra Smålands urbergsslätt (BEHRENS 1960). Myrpartierna norr om Kävsjön ligger 170 m ö.h. och Kävsjön med Stora gungflyet 164,5 m ö.h. Söder om järnvägen sänker sig mossen till 160 m ö.h. omedelbart norr om Herrestadsjön. Bortsett från enstaka toppar är områdena kring myren småkuperade och ligger blott något tiotal meter högre än myren. Store mosse ligger till största delen inom Storåns nederbördsområde och avvattnas genom denna å till Bolmen. Petrografiskt hör området till gneisprovinsen.

Förutom morän är de mest utbredda lösa avlagringarna inom området sand och mo. Mot slutet av sista isavsmältningen bildades stora issjöar i sydvästra Småland, som sedan delvis övergick i fornsjöar. På botten av dessa avsattes sand och mo. Genom den olikformiga landhöjningen uppkom de stora flacka sandvidderna norr om Bolmen, där det har funnits mycket lämpliga topografiska förutsättningar för uppkomsten av myrar (HJELMQVIST 1953, LUNDQUIST 1953, NILSSON 1953, JOHNSSON 1956).

Allmän översikt av Store mosse

Store mosse kan indelas i tre större mossemyrområden (DU RIETZ 1957). Det minsta av dessa ligger norr om Kävsjön och sträcker sig mot

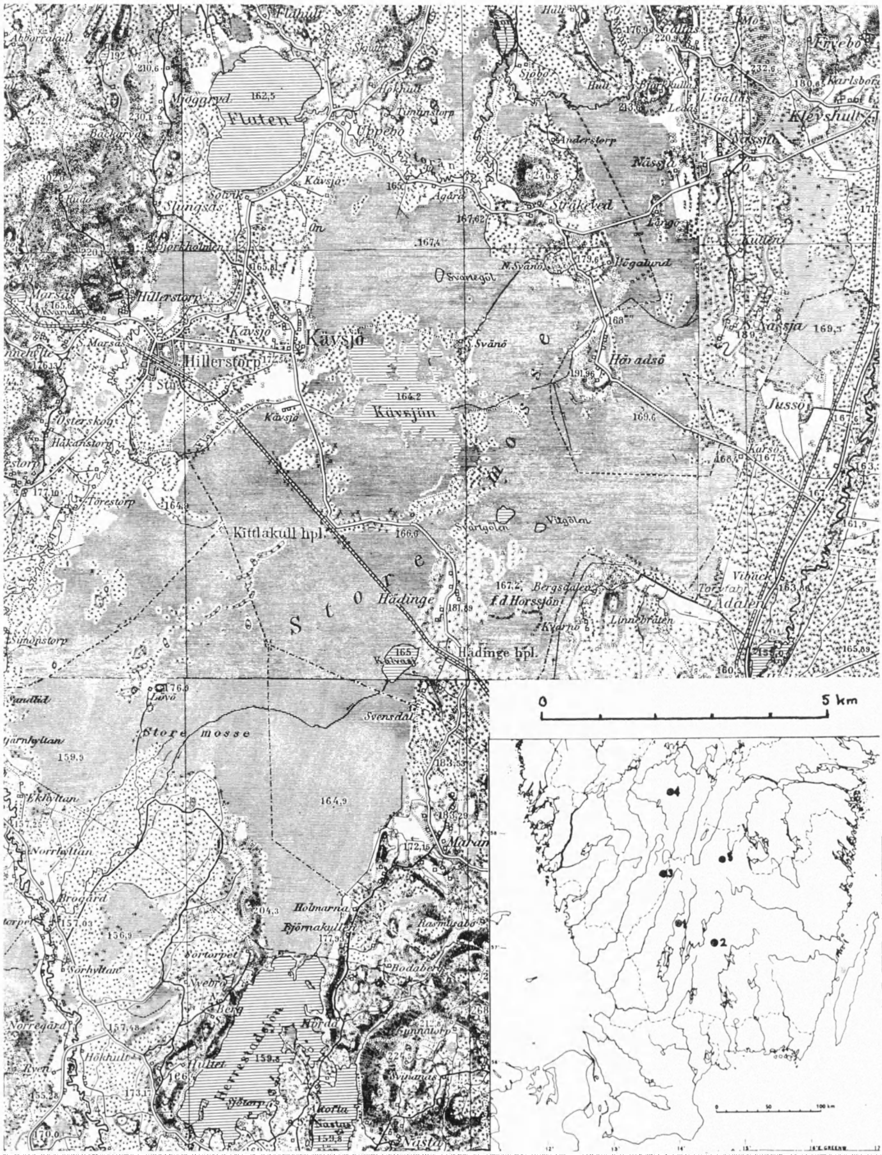


Fig. 1. Store mosse med närmaste omgivningar efter generalstabens kartblad i skala 1 : 100 000 uppmätta 1865, 1868—70, reviderade 1955 och 1956. Infällda kartan över södra Sverige visar läget av 1. Store mosse, 2. Åkhultmyren, 3. Komosse, 4. Blängen och 5. Breafallmossen. — (Publiceras med tillstånd av Rikets allmänna kartverk.)

öster fram till Häradsö (fig. 1). Torvdjupet är 3—3,5 m med ett maximidjup av 4,8 m. Området är helt sammanhängande och förmodligen inte tillräckligt stort för att några dråg skall ha kunnat bildas. I dess centrala del ligger en stor göl, Svartegöl, som förbinds med Kävsjön genom en grävd kanal.

Söder och öster om Häradsö utbreder sig ett betydligt större mossemyrområde skilt från föregående genom en rad sand- och moränkullar, som utgår från Häradsö. Torvdjupet närmar sig på flera platser 5 m. Vid Svartgölen nås maximidjupet 5,6 m. I den sydligaste delen ligger 2 gölar, Svartgölen och Vitgölen samt den utdikade Hornssjön, som är helt igenväxt av videsnår och starrkärr.

Det tredje och största mossemyrområdet ligger söder om Kävsjön skilt från sjön av en sandvall (fig. 2). Detta område är inte enhetligt, utan uppbyggt av tre excentriska mossar. En ligger väster om Lövö och skiljs från de andra genom raden av sandkullar från Lövö till torvfabriken. Högsta punkten, 168 m ö.h., ligger 1,4 km norr om Lilla Lövö endast c. 200 m norr om fastmarken vid ovannämnda rad av sandkullar. Härifrån sänker sig mossen 8,5 m, tills den når fastmarken vid Ekhyltan längst i söder. I anslutning till fastmarkskanten norr om Lövö har en lagg utbildats, som vid Lövöns västsida vidgar sig och övergår till ett dråg, som går tvärs genom mossen i rakt sydlig riktning. Dråget får snabbt en bredd av 200 m för att längst i söder inta större delen av myrpartiet.

Den andra excentriska mossen utbreder sig väster om Kalvsjön. Den begränsas av sandvallen söder om Kävsjön i norr, av kullarna från Lövö i väster och av Blådöpet i söder. Den högsta punkten, 168 m ö.h., ligger 1 km nordöst om Lilla Lövö mycket nära fastmarken och den tidigare beskrivna mossens högsta punkt. Härifrån sluttar mossen mot järnvägen i öster och Blådöpet i söder. Detta mosseparti avvattnas främst av Blådöpet, men dessutom av ett dråg, som börjar i mossens centrala delar c. 1 km väster om Kalvsjön och sedan förenar sig med Blådöpet. Från Lilla Lövö utgår ett annat dråg, som också mynnar i Blådöpet. Detta dråg avskär den västra delen av mossen, som därför kan betraktas som självständig med sin högsta punkt omedelbart väster om Lilla Lövö.

Den tredje excentriska mossen ligger söder om Blådöpet och begränsas av detta och fastmarken på båda sidor. Eftersom Blådöpet först sträcker sig mot sydväst för att sedan böja av mot västnordväst, har två centra utbildats. Det ena ligger 400 m sydväst om Kalvsjöns utlopp i Blådöpet, det andra 1 km norr om bestånd 11 nära fastmarken i

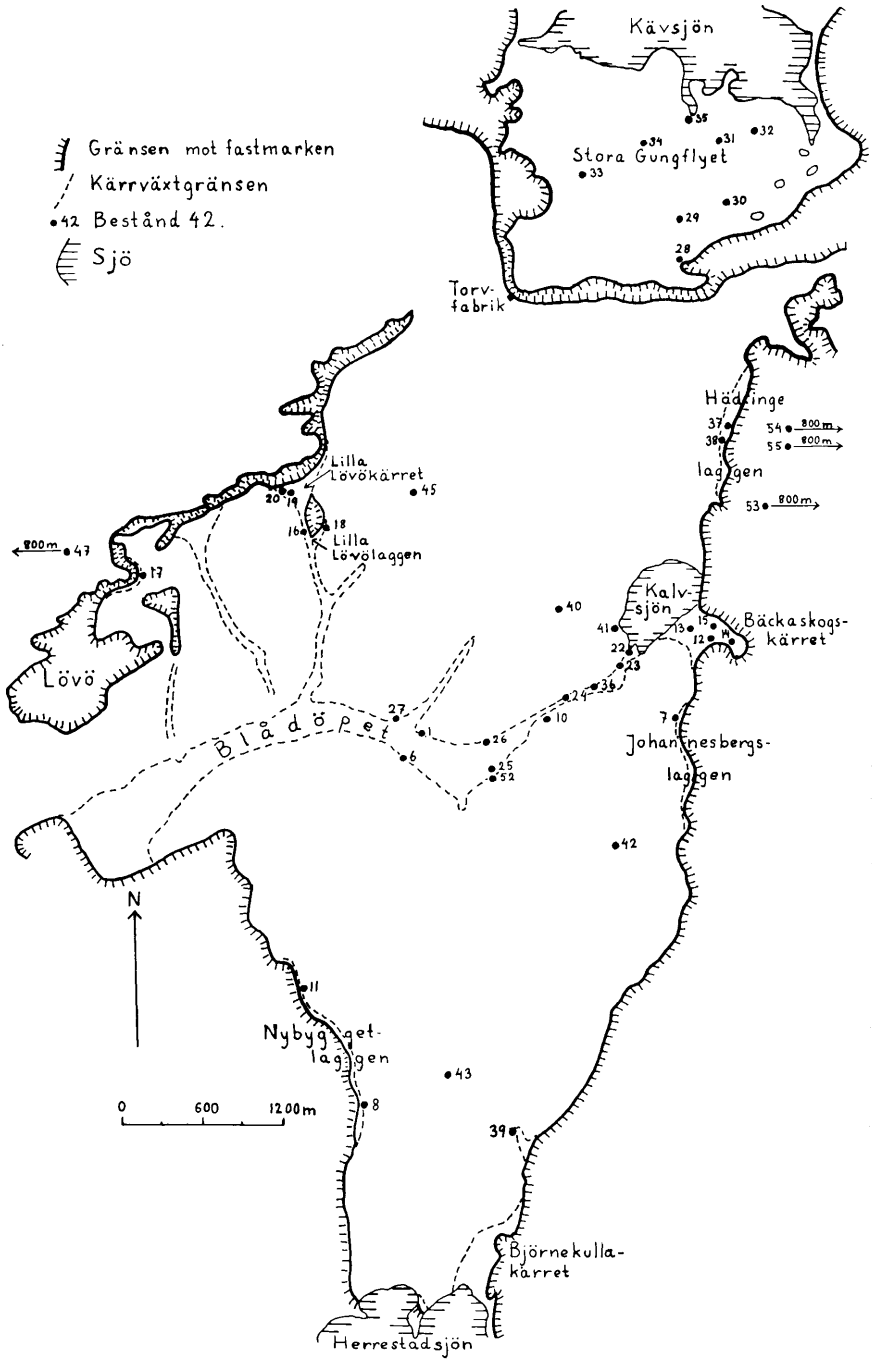


Fig. 2. Stora gungflyet och det tredje mossemyrområdet söder om Kävsjön. Samtliga undersökta bestånd är markerade.

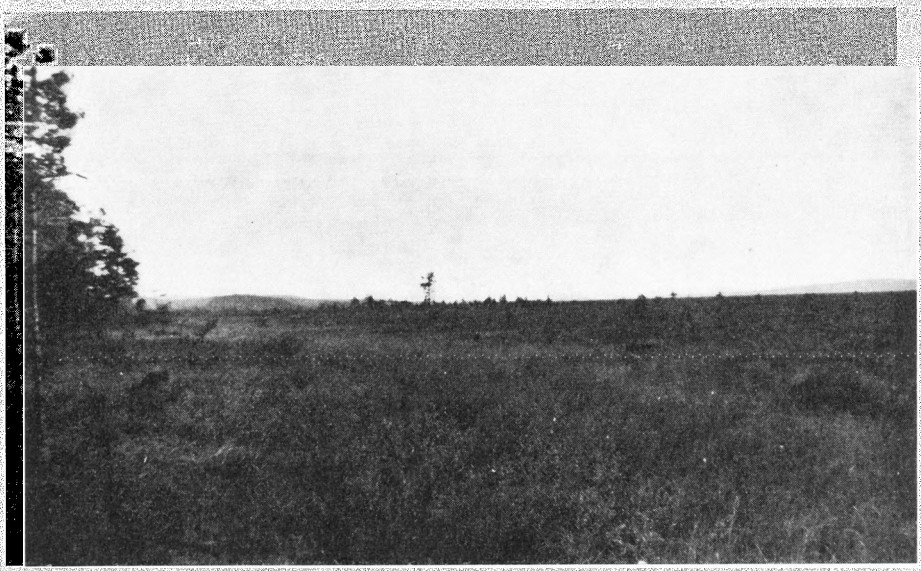


Fig. 3. Johannesbergslaggen vid bestånd 7. Till vänster fastmarken. I laggen *Carex rostrata*. Till höger den skoglösa mossekanten. — Foto förf. Sept. 1961.

väster. De skiljs från varandra genom ovannämnda bukt i Blådöpet. Båda dessa centra ligger 166 m ö.h. Man kan kanske i detta fall tala om en antydan till sadelformad mosse (SJÖRS 1956) eller skålmosse (OSVALD 1930). Från dessa centra sluttar mossen mot sin lägsta punkt vid Herrestadsjön 160 m ö.h. Omedelbart norr om Herrestadsjön är torvdjupet 6,9 m, vilket är det största uppmätta värdet inom hela Store mosse.

Blådöpet är ett typiskt kärrdråg. Det bildar dock ingen nedsänkning utan ligger i ungefär samma nivå som omgivande mosseplan (OSVALD 1925). Detta har till följd att gränsen mot mossen ofta är mycket diffus och svår att urskilja. Dråget börjar vid Kalvsjön, som det avvattnar. Det har här en bredd av 50 m. Sedan sker en successiv vidgning till 400 m i samband med att det svänger av mot väster. Bredden varierar sedan mellan 150 och 200 m, för att ånyo bli c:a 400 m strax innan fastmarken 1,5 km söder om Lövö. Totala längden uppgår till 4,2 km. Vid Kalvsjön är höjden över havet 165,8 m och torvdjupet 4,1 m. Dråget sluttar ned till 161,5 m ö.h. vid fastmarkskanten i väster. Torvdjupet är här 0,9 m.

Den södra mossemyren består till största delen av ombrogena myr-



Fig. 4. Lilla Lövölaggen vid bestånd 18. Till vänster fastmarken. I laggen *Menyanthes trifoliata, Carex lasiocarpa* och *C. rostrata.* Till höger den skogbeväxta mossekantsluttningen. — Foto förf. Sept. 1961.

partier. Kärren har en mycket ringa areal, och frånsett de redan nämnda drågen, finns det endast tre större kärrpartier: 1) Bäckaskogskärret öster om Kalvsjön från sjön till fastmarken, 2) Lilla Lövökärret norr och nordväst om Lilla Lövö och 3) Björnekullakärret norr om Herrestadsjön mellan mossen och fastmarken i öster. Björnekullakärret har ej varit föremål för närmare undersökning. De flesta laggarna inom området är utdikade. Orörda partier finner man endast på några få lokaler. En av dem finns väster om Hädinge by, Hädingelaggen, i nordöstra delen av mossemyren. Denna lagg är c. 600 m lång och på sina ställen upp till 80 m bred. Den erhåller ett ganska rikligt vattentillskott från källor i fastmarkskanten. Vattnet rinner dels mot söder och når då så småningom Kalvsjön, dels mot norr till Kävsjön. Söder om Kalvsjön nedanför torpet Johannesberg ligger ett annat laggparti, Johannesberglaggen (fig. 3). Denna är 10—15 m brett och svagt vattenförande. Vattnet rinner huvudsakligen mot norr till Kalvsjön. Laggens längd uppgår till c. 1 km. Områdets största sammanhängande laggparti, 1,6 km långt, finns på den tredje

excentriska mossens västsida, Nybyggetlaggen. Det är inom vissa delar kraftigt vattenförande. Större delen av laggpartiet avvattnas mot söder ned till ett laggdike, som för vattnet till Herrestadsjön. De nordligaste partierna avvattnas till Blådöpet. Lilla Lövölaggen (fig. 4) runt Lilla Lövö är den bäst utbildade laggen inom Store mosse. På östsidan av ön är laggen smal, men på västsidan betydligt bredare. De båda laggarna förenar sig vid öns sydspets och fortsätter i form av ett dråg (se ovan) ned till Blådöpet. I anslutning till sandkullarna från Lövö till torvfabriken finns på flera platser mindre laggpartier, som alla är mycket smala och svagt vattenförande.

På kartan figur 2 har kärrväxtgränsen markerats. Härvid har de ekonomiska kartbladen använts. Vid rekognoseringar i fält har det visat sig, att de olika färgtonerna på kartan mycket väl visar gränsen mellan kärr och mosse. Gränsdragningen har kompletterats med fältundersökningar, varvid förekomsten av exklusiva kärrväxter, såsom *Carex rostrata, Eriophorum angustifolium,* (»Mineralbodenwasserzeiger», Du Rietz 1954) har använts. Beträffande några arter är det tveksamt, om de skall anses som mosseväxter eller kärrväxter. *Carex pauciflora* har på några lokaler, t.ex. Nybyggetlaggen, Lilla Lövökärret, hittats så långt från övriga kärrväxter, att det förefaller uppenbart, att den växer under ombrotrofa (Du Rietz op.c.) förhållanden. *Carex limosa* och *Scheuchzeria palustris* är mycket allmänna på mossar i norra Sverige och även så långt söderut som på Komosse. På Store mosse har de inte hittats på mosseplanen. De finns dock i de stora höljor, som förekommer i början av dråget väster om Kalvsjön, långt innan övriga kärrindikatorer börjar uppträda. Här råder eventuellt ombrotrofa förhållanden. *Eriophorum angustifolium* har hittats under rent ombrotrofa förhållanden på en plats inom Store mosse, nämligen i bestånd 45 öster om Lilla Lövö. Den förekommer här som enstaka sterila individ. Torvdjupet är c. 4 m, varför de inte kan stå i förbindelse med underliggande fastmark. Inom beståndet finns inga andra kärrindikatorer. *Eriophorum angustifolium* har förut rapporterats från ett par verkligt ombrotrofa lokaler i sydvästra Götaland (Olausson 1957, Malmer 1962). *Myrica gale* förekommer inom Store mosse på ett flertal lokaler på mossen dock högst 100 m från kärrväxtgränsen. Den uppträder ganska ofta på mossar i sydvästra Götaland (Olausson 1957).

Kävsjön ligger inklämd mellan de tre mossemyrområdena. Sand- och moränkullar skiljer den från myrområdena väster, söder och öster om sjön (Svensson 1964). Mellan Kävsjön och mossemyrområdet norr där-

om utbreder sig ett brett sandområde, som täcks av fukthedar och inom de torrare delarna av magra tallskogar. Dessa fukthedar domineras närmast sjön av graminider. Något längre från sjön förekommer pors rikligt. Hela området söder om sjön intages av ett stort gungfly, Stora gungflyet. Dess yta uppgår till c. 300 hektar. Större delen av gungflyet är ett skoglöst starrkärr. Endast i de sydvästra delarna förekommer inom begränsade områden ett några meter högt buskskikt av björk och vide. Längs syd- och östkanten av gungflyet nära sandvallen finns en rad gölar med öppet vatten. Dessa står i förbindelse med sjöns östligaste del. Sjön är mycket grund med ett maximalt djup av 2—2,5 m, de organogena sedimenten inräknade. De djupaste partierna ligger vid övergången mellan sjön och gungflyet i anslutning till Fläsebäcken.

Kulturinflytande

Store mosses väldiga myrområde har naturligtvis inte undgått mänsklig exploatering. År 1840 skedde den första utdikningen, varvid Kävsjöns yta minskades betydligt. Härsjön, som tidigare stått i förbindelse med Kävsjön genom ett sund, torrlades nästan helt. Det var också vid denna tidpunkt, som de stora sandområdena norr om Kävsjön bildades. Då uppstod även förutsättningar för bildning av Stora gungflyet (ALLVIN 1852). År 1959 skedde en upprensning och fördjupning av Fläsebäcken. Vid omläggningen av landsvägen söder om Kävsjön 1960 flyttades den ut på Stora gungflyets sydvästligaste del, varvid ett mindre område kom att avskäras från övriga gungflyet. Horssjön torrlades relativt fullständigt 1871. Området har säkerligen blivit blötare under de sista årtiondena på grund av avloppsdikenas förfall. Den gamla sjön består nu av ett stort starrkärr, som är mycket likt Stora gungflyet.

Förutom de ovannämnda torrläggningsföretagen har ingrepp i Store mosses natur gjorts i form av torvtäkt. Den är lyckligtvis inskränkt till tre relativt små områden bortsett från mindre torvgropar för husbehov på ett flertal platser i mossekanterna. Det största området sträcker sig från Kalvsjön utmed järnvägens båda sidor några hundra meter förbi torvfabriken. Det andra är betydligt mindre och ligger omedelbart väster om Horssjön. Här är driften numera nedlagd. Det tredje området ligger norr om Lillån på mossemyren öster om Häradsö.

Växtsociologisk metodik

Vid de växtsociologiska undersökningarna har ett antal myrelement (SJÖRS 1948) eller delar av myrelement studerats. Varje detaljundersökt område be-

nämnes bestånd. Det motsvarar helt »site» hos MALMER (1962). Beståndens storlek har i allmänhet varit c. 700 m². Beståndens lägen är inritade på figur 2. Inom varje bestånd har rutanalyser utförts inom varje urskiljbart växtsamhälle. Analyserna har utförts under juli, augusti och första delen av septembér månader 1961 samt under första delen av september månad 1962. Rutstorleken har för flertalet myrviddsamhällen varit 1/4 m², med undantag av *Calluna vulgaris - Sphagnum magellanicum* - associationen där den varit 4 m². Inom myrkantsamhällena har 4 m² använts utom i *Potentilla palustris - Sphagnum apiculatum* - associationen där rutstorleken varit 1/4 m². Vid rutanalyserna har HULT - SERNANDER - DU RIETZ's 5-gradiga täckningsgradsskala använts. För varje växtsamhälle har smårutfrekvens och karakteristisk täckningsgrad beräknats (MALMER 1962, sid. 49). I denna uppsats redovisas inte primärmaterialet för de enskilda växtsamhällena utan endast sammanfattningstabeller. I dessa tabeller innebär t.ex. 25³ att arten förekommer i 25 % av de analyserade rutorna inom samhället och har karakteristiska täckningsgraden 3. + anger art, som förekommer utanför analysrutorna i bestånden.

Växtsamhällena har avgränsats och namngivits endast på grundval av vegetationens sammansättning. Associationen är den primära enheten. Den har fastställts med hjälp av skiljearter (DU RIETZ 1942) och preferensarter. Med preferensart menas en art, som föredrar ett växtsamhälle framför andra växtsamhällen (cf. STEEN 1954, SJÖRS 1954, PERSSON 1961, MALMER 1962). Associationerna är närmast jämförbara med MALMERS (1962) »small associations». De är följaktligen enheter av mindre omfattning än de associationer, som t.ex. DU RIETZ (1949, 1954) har uppsatt för svensk myrvegetation. Vissa associationer med mindre homogen vegetation har indelats i varianter. Dessa grundas på preferensarter och olikheter i täckningsgraden. Flertalet associationer har sammanförts till serier (tab. 2—5). Det har visat sig att dessa huvudsakligen kunnat karakteriseras av dominanter i bottenskiktet (PERSSON 1961, MALMER 1962). Serierna är mycket lika MALMERS (1962) »series».

Nomenklaturen för kärlväxterna följer HYLANDER (1955); bladmossorna NYHOLM (1954—1965), utom de bladmossläkten som ännu inte behandlats av NYHOLM, där JENSEN (1939) följes; *Sphagna* följer WALDHEIM (1944); levermossorna ARNELL (1956); lavarna MAGNUSSON (1936). *Sphagnum apiculatum* och *S. parvifolium* har inom några samhällen varit svåra att skilja från varandra. Vissa bladmossor har bestämts av fru ELSA NYHOLM.

Myrterminologin följer den i Sverige gängse vid ekologiska undersökningar (DU RIETZ 1949, 1954, SJÖRS 1946, 1948, MALMER 1962).

Myrviddens växtsamhällen

Myrviddens växtsamhällen intar större delen av Store mosse. De utmärks genom förekomst av vissa arter, som är inskränkta till dessa samhällen, t.ex. *Drosera anglica, Rhynchospora alba, Trichophorum caespitosum, Sphagnum balticum, S. cuspidatum, S. dusenii.* Andra arter är bundna till myrkantsamhällena, t.ex. *Vaccinium vitis-idaea, Lysimachia thyrsiflora, Peucedanum palustre. Potentilla palustris, Viola*

Tabell 1. Myrviddens växtsamhällen

Dubbelstrecket markerar kärrväxtgränsen.

fattig → rik				
Cladonia - serien	*Eriophorum vaginatum* - *Cladonia rangiferina* - ass.			
Sphagnum rubellum - serien [1]	*Eriophorum vaginatum* - *Sphagnum rubellum* - ass. *Trichophorum caespitosum* - var. | *Empetrum nigrum* - var.		*Carex lasiocarpa* - *Sphagnum rubellum* - ass.	*Carex panicea* - *Sphagnum rubellum* - ass.
Sphagnum magellanicum - *papillosum* - serien	*Eriophorum vaginatum* - *Sphagnum magellanicum* - ass.	*Scheuchzeria palustris* - *Sphagnum papillosum* - ass.	*Menyanthes trifoliata* - *Sphagnum papillosum* - ass. *Carex rostrata* - var. | *Carex lasiocarpa* - var.	*Carex panicea* - *Campylium stellatum* - ass.
Sphagnum apiculatum - *cuspidatum* - serien	*Eriophorum vaginatum* - *Sphagnum cuspidatum* - ass.	*Scheuchzeria palustris* - *Sphagnum dusenii* -ass.	*Menyanthes trifoliata* - *Sphagnum apiculatum* - ass. *Carex rostrata* - var. | *Eriophorum angustifolium* - var.	
Sphagnum auriculatum - *cuspidatum* - serien	*Eriophorum vaginatum* - *Sphagnum cuspidatum* - *Cladopodiella fluitans* - ass.	*Scheuchzeria palustris* - *Sphagnum auriculatum* - ass.	*Menyanthes trifoliata* - *Sphagnum inundatum* - ass. *Utricularia* - var. | *Carex lasiocarpa* - var.	*Carex panicea* - *Scorpidium scorpioides* - ass.
Sphagnum tenellum - serien	*Eriophorum vaginatum* - *Sphagnum tenellum* - ass.			
serier / zoneringar	*Eriophorum vaginatum* - zoneringen	*Scheuchzeria palustris* - zoneringen	*Menyanthes trifoliata* - zoneringen	*Carex panicea* - zoneringen

[1] *Calluna vulgaris* - *Sphagnum magellanicum* - ass. är ej medtagen i tabellen.

Tabell 2. Sphagnum auriculatum - cuspidatum - serien och Carex panicea - Scorpidium scorpioides - associationen

	Eriophorum vaginatum - Sphagnum cuspidatum - Cladopodiella fluitans - ass.	*Scheuchzeria palustris - Sphagnum auriculatum* - ass.	*Menyanthes trifoliata - Sphagnum inundatum* - ass.		*Carex panicea - Scorpidium scorpioides* - ass.
			Utricularia - var.	*Carex lasiocarpa* - var.	
Antal rutor och bestånd	25:5	16:2	45:6	21:4	16:2
Sphagnum cuspidatum	100[2]	—	—	—	—
Cladopodiella fluitans ..... *Gymnocolea inflata*	24[1]	—	2[1]	+	—
Utricularia minor	—	38[2]	13[1]	—	19[1]
Scheuchzeria palustris	—	100[1]	4[1]	10[1]	—
Sphagnum auriculatum	—	75[1]	+	38[1]	—
— *dusenii*	—	25[3]	+	5[2]	—
Menyanthes trifoliata	—	13[1]	80[4]	48[1]	19[1]
Carex lasiocarpa	—	—	42[2]	62[1]	—
Equisetum fluviatile	—	—	38[1]	14[1]	—
Carex livida	—	—	—	48[1]	25[1]
Molinia coerulea	—	—	—	24[1]	6[1]
Sphagnum inundatum	—	—	2[1]	38[1]	—
Myrica gale	—	+	4[1]	14[1]	81[1]
Carex panicea	—	—	13[1]	10[1]	94[1]
Phragmites communis	—	—	11[1]	—	38[1]
Trichophorum caespitosum	—	—	—	—	94[1]
Calliergon trifarium	—	—	—	—	56[1]
Campylium stellatum	—	—	—	—	44[1]
Scorpidium scorpioides	—	—	—	—	94[3]
Utricularia intermedia	—	94[3]	67[1]	33[1]	88[1]
Carex chordorrhiza	—	—	49[1]	—	—
— *limosa*	—	94[1]	84[2]	33[1]	81[1]
— *rostrata*	—	19[1]	22[1]	33[1]	75[1]
Eriophorum angustifolium	+	6[1]	31[1]	81[1]	88[1]
Andromeda polifolia	—	—	2[1]	+	25[1]
Vaccinium oxycoccos	4[1]	—	11[1]	38[1]	19[1]
Eriophorum vaginatum	40[1]	—	—	33[1]	—
Rhynchospora alba	64[1]	44[1]	2[1]	19[1]	38[1]
Drosera anglica	12[1]	+	2[1]	—	25[1]

Tillägg: *E. vag. - Sph. cusp. - Cladop. fluit.* - ass.: *Drosera intermedia* (4[1]), *Sphagnum balticum* (12[1]), *S. magellanicum* (8[1]), *S. papillosum* (12[1]), *S. tenellum* (20[1]); *Scheuch. pal. - Sph. auric.* - ass.: *Betula nana* (+), *Utric.* - var.: *Salix aurita* (+), *S. repens* (2[1]), *Calla palustris* (+), *Drosera rotundifolia* (2[1]), *Nymphaea alba* (+), *Peucedanum palustre* (2[1]), *Potentilla palustris* (7[1]), *Agrostis canina* (+), *Carex elata* (+), *C. echinata* (2[1]), *C. nigra* (+), *Eriophorum gracile* (20[1]), *Calliergon stramineum* (+), *Drepanocladus exannulatus* s.str. (+), *D. fluitans* (2[1]), *Sphagnum fimbriatum* (2[1]), *S. papillosum* (+), *S. pulchrum* (+), *S. subsecundum* (4[1]), *C. lasioc.* - var.: *Betula pubescens* (+), *Salix repens* (19[1]); *C. pan. - Scorp. scorp.* - ass.: *Erica tetralix* (19[1]), *Narthecium ossifragum* (31[1]), *Viola palustris* (6[1]), *Trichophorum alpinum* (6[1]), *Riccardia* spp. (25[1]).

palustris, Carex canescens, Sphagnum amblyphyllum, S. squarrosum. Många arter förekommer oberoende av denna variationsriktning, t.ex. *Myrica gale, Menyanthes trifoliata, Carex lasiocarpa, C. limosa, C. rostrata, Eriophorum angustifolium, Sphagnum apiculatum.* Myrkantsamhällena är i allmänhet artrikare än myrviddsamhällena. I tabell 1 ges en översikt av myrviddsamhällena. Där har också kärrväxtgränsen markerats.

Sphagnum auriculatum - cuspidatum - serien

Tab. 2. Bottenskiktet inom denna serie är aldrig slutet. *Utricularia intermedia, U. minor, Sphagnum auriculatum* och *S. inundatum* är bundna till serien. Vissa arter, såsom *Menyanthes trifoliata* och *Scheuchzeria palustris,* förekommer ofta mycket rikligt men finns även i andra serier. Serien har indelats i tre associationer.

Eriophorum vaginatum - Sphagnum cuspidatum-Cladopodiella fluitans-associationen är ytterst artfattig. I fältskiktet finns ej mer än 5 arter. Av dessa förekommer endast *Eriophorum vaginatum* och *Rhynchospora alba* mera allmänt. Bottenskiktet är lika artfattigt. Det är endast *Sphagnum cuspidatum,* som förekommer konstant inom alla rutor. *Cladopodiella fluitans* och *Gymnocolea inflata* har en ganska liten frekvens. Inom vissa områden, främst öster om Lilla Lövö men också väster om Lövö, förekommer stora höljor, där torven ligger naken. Dessa saknar helt vegetation, bortsett från att de ofta överdrages av ett lager av *Zygogonium ericetorum* och andra trådformiga alger. Vid regnig väderlek täcks de helt av vatten. — Denna associaton är mycket vanlig inom Store mosse ute på mosseplanen, där den intar de lägsta delarna av höljorna. Den täcker dock en relativt ringa areal (bestånd 40, 42, 43, 45, 47).

Jämförbara samhällen finns på Åkhultmyren (cf. MALMER 1962, sid. 91, 92) och Komosse (cf. OSVALD 1923, sid. 250—253).

Scheuchzeria palustris-Sphagnum auriculatum-associationen känns igen på den överallt förekommande *Scheuchzeria palustris. Utricularia intermedia* och *U. minor* når här sina högsta täckningsgrader inom Store mosse. I bottenskiktet, som är ytterst svagt utvecklat, märks främst *Sphagnum auriculatum.* — Associationen har analyserats enbart i Lilla Lövökärret (bestånd 19, 20) men observerats på andra platser, bl.a. i dråget väster om Lövö. Den finns också i några laggpartier men intar här en mycket liten areal.

Menyanthes trifoliata-Sphagnum inundatum-associationen utmärks av riklig förekomst av *Menyanthes trifoliata* och



Fig. 5. Norra kanten av Blådöpet vid bestånd 1. Till vänster i bakgrunden den skoglösa mossekanten. Sedan följer *Carex rostrata*-varianterna (det ljusa partiet) och *Utricularia*-varianten (i förgrunden och till höger). — Foto förf. Sept. 1961.

en stor mängd graminider. Bottenskiktet är mycket sparsamt och saknas ofta helt. Inom associationen har urskilts två varianter.

Carex lasiocarpa-varianten kännetecknas framför allt av högväxta graminider, såsom *Carex lasiocarpa, C. rostrata, Eriophorum angustifolium* och *Molinia coerulea.* Bland de lågväxta graminiderna märks främst *Carex livida,* en nordlig art (HULTÉN 1950), som har sin största förekomst inom denna variant. Då bottenskikt finns, utgöres det av *Sphagnum auriculatum* och *S. inundatum.* — Varianten förekommer främst i de blötaste partierna av Bäckaskogskärret, där den intar c. $^2/_3$ av arealen (bestånd 12, 13, 14, 15).

Jämförbara samhällen finns på Åkhultmyren (cf. MALMER 1962, sid. 120, 121, 126) och Komosse (cf. OSVALD 1923, sid. 174, 202).

Inom *Utricularia*-varianten intar *Menyanthes trifoliata* en mycket framträdande plats. Stora ytor täcks helt av denna art. *Carex limosa* är mycket allmän och uppvisar hög täckningsgrad. Denna variant växer fuktigare än den ovan beskrivna, vilket har fått till följd

att de båda *Utricularia*-arterna, speciellt *U. intermedia* har stor betydelse. Bottenskikt saknas helt. — Varianten gränsar ofta till myrkantsamhällen, vilket är anledningen till att *Carex chordorrhiza* och *Equisetum fluviatile* är allmänt förekommande. Den intar de blötare delarna av de laggar, som har en relativt konstant vattenföring, t.ex. Nybyggetlaggen, Lilla Lövölaggen (bestånd 11, 16, 18). Den finns också närmast mossekanten i Blådöpet och andra kärrdråg (bestånd 1, 6, 25, fig. 5).

Jämförbara samhällen finns på Åkhultmyren (cf. MALMER 1962, sid. 89, 120, 121, 126) och Komosse (cf. OSVALD 1923, sid. 153, 161—164).

Sphagnum apiculatum - cuspidatum - serien

Tab. 3. Denna serie karakteriseras framför allt av helt slutet bottenskikt av *Sphagna* tillhörande *Cuspidata*-gruppen. Den mest framträdande arten är *Sphagnum apiculatum,* som förekommer i alla associationer utom ute på mosseplanen, där den helt ersättes av *Sphagnum cuspidatum.* Inom kärrpartierna finns även *Sphagnum dusenii* och *S. pulchrum* ganska allmänt. Fältskiktet domineras av *Menyanthes trifoliata, Carex limosa, C. rostrata* och *Eriophorum angustifolium. Andromeda polifolia, Vaccinium oxycoccos* och *Drosera rotundifolia* kan vara allmänt förekommande men hör egentligen hemma i följande serier. Serien har indelats i tre assocationer.

Eriophorum vaginatum - Sphagnum cuspidatum - associationen har ett mycket sparsamt fältskikt. Endast *Rhynchospora alba* förekommer konstant inom alla analyserade rutor. *Eriophorum vaginatum* och *Drosera anglica* finns ganska allmänt liksom *Andromeda polifolia* och *Vaccinium oxycoccos.* Bottenskiktet domineras helt av *Sphagnum cuspidatum. Sphagnum balticum* och *S. tenellum* är i det närmaste konstanta men har alltid ytterst liten täckningsgrad. Bland levermossorna är *Cladopodiella fluitans* och *Gymnocolea inflata* de mest framträdande. Associationen, som mycket liknar *Eriophorum vaginatum - Sphagnum cuspidatum - Cladopodiella fluitans* - associationen, skiljer sig från denna genom slutet bottenskikt och förekomsten av *Andromeda polifolia* och *Vaccinium oxycoccos.* — Associationen förekommer på alla mosseplan inom Store mosse (bestånd 40, 42, 43, 45, 47). Den intar dock en ganska ringa areal.

Jämförbara samhällen finns på Åkhultmyren (cf. MALMER 1962, sid. 94).

Tabell 3. Sphagnum apiculatum - cuspidatum - serien

	Eriophorum vaginatum - Sphagnum cuspidatum - ass.	*Scheuchzeria palustris - Sphagnum dusenii* - ass.	*Menyanthes trifoliata - Sphagnum apiculatum* - ass.	
			Eriophorum angustfolium - var.	*Carex rostrata* - var.
Antal rutor och bestånd	25:5	12:2	15:2	74:8
Drosera anglica	44[1]	8[1]	—	—
Sphagnum balticum	92[1]	—	—	+
— *cuspidatum*	100[5]	25[4]	—	—
— *tenellum*	92[1]	—	—	—
Cladopodiella fluitans ..... } *Gymnocolea inflata* ..... }	80[1]	8[1]	—	15[1]
Scheuchzeria palustris	—	100[1]	13-	23[1]
Sphagnum pulchrum	—	67[3]	7[2]	22[4]
Menyanthes trifoliata	—	8[1]	73[1]	47[2]
Utricularia intermedia	—	17[1]	27[2]	—
Eriophorum angustifolium	—	25[1]	80[1]	24[1]
Sphagnum auriculatum	—	—	60[1]	—
— *inundatum*	—	—	40[1]	—
Calliergon stramineum	—	—	—	28[1]
Carex limosa	—	100[1]	100[1]	69[1]
— *rostrata*	—	33[1]	100[1]	76[2]
Drepanocladus fluitans	—	33[1]	—	32[1]
Sphagnum apiculatum	—	83[3]	40[1]	96[5]
— *dusenii*	—	83[4]	100[5]	8[1]
Andromeda polifolia	36[1]	—	7[1]	30[1]
Vaccinium oxycoccos	44[1]	42[1]	40[1]	89[2]
Drosera intermedia	16[1]	33[1]	—	—
— *rotundifolia*	4[1]	58[1]	—	28[1]
Eriophorum vaginatum	56[1]	—	+	18[1]
Rhynchospora alba	100[1]	75[1]	—	7[1]
Sphagnum papillosum	48[1]	58[1]	—	32[2]

Tillägg: *E. vag. - Sph. cusp.* - ass.: *Calluna vulgaris* (4[1]), *Sphagnum magellanicum* (28[1]), *S. rubellum* (20[1]), *Cephalozia* spp. (16[1]), *Odontoschisma sphagni* (24[1]); *Scheuch. pal. - Sph. dusenii* - ass.: *Sphagnum magellanicum* (+); *Erioph. angust.* - var.: *Betula nana* (+), *Myrica gale* (+), *Potentilla palustris* (33[1]), *Viola palustris* (7[1]), *Carex canescens* (+), *C. chordorrhiza* (7[1]), *C. lasiocarpa* (13[1]), *Sphagnum subsecundum* (7[1]); *Carex rostr.* - var.: *Betula nana* (8[1]), *Calluna vulgaris* (+), *Picea abies* (+), *Pinus silvestris* (+), *Calla palustris* (+), *Nymphaea alba* (+), *Peucedanum palustre* (+), *Potentilla palustris* (3[1]), *Rubus chamaemorus* (3[1]), *Carex canescens* (4[1]), *C. chordorrhiza* (11[1]), *C. echinata* (4[1]), *C. elata* (+), *C. lasiocarpa* (1[1]), *C. nigra* (+), *C. pauciflora* (1[1]), *Equisetum fluviatile* (8[1]), *Eriophorum gracile* (1[1]), *Pohlia sphagnicola* (4[1]), *Polytrichum strictum* (+), *Sphagnum imbricatum* (5[3]), *S. magellanicum* (5[1]), *S. parvifolium* (9[2]), *S. teres* (+); *Calypogeia* spp. (3[1]), *Cephalozia* spp. (3[1]), *Lepidozia* spp. (1[1]), *Mylia anomala* (1[1]).

Scheuchzeria palustris-Sphagnum dusenii-associationen. *Scheuchzeria palustris* är en god preferensart för associationen. I fältskiktet märks för övrigt *Vaccinium oxycoccos, Carex limosa* och *Rhynchospora alba.* I bottenskiktet är *Sphagnum dusenii* mest framträdande. *Sphagnum pulchrum* har sin allmännaste förekomst inom denna association. Inom de allra fuktigaste områdena kan *Sphagnum cuspidatum* vara dominerande. — Associationen är allmän i Lilla Lövökärret, där den täcker ganska stora arealer (bestånd 19, 20). Den har observerats väster om Lövö.

Jämförbara samhällen finns på Komosse (cf. OSVALD 1923, sid. 204, 237—238).

Menyanthes trifoliata-Sphagnum apiculatum-associationen karakteriseras av allmän förekomst av *Menyanthes trifoliata, Carex limosa, C. rostrata* och *Eriophorum angustifolium. Sphagnum cuspidatum* saknas. Associationen förekommer i laggar som en zon mellan mossesamhällena och kärrets fuktigaste samhällen. Den har uppdelats i två varianter, *Eriophorum angustifolium* - varianten och *Carex rostrata* - varianten. I typiska fall bildar varje variant en zon med *Carex rostrata* - varianten närmast mossen.

Eriophorum angustifolium-varianten växer fuktigast, vilket ger sig till känna i bottenskiktet, som domineras av *Sphagnum dusenii* ofta med inslag av *S. auriculatum* och *S. inundatum. Utricularia intermedia,* en art som hör hemma inom föregående serie, förekommer rikligt inom vissa rutor. — Varianten finns på spridda ställen i olika laggpartier och dråg i anslutning till *Menyanthes trifoliata - Sphagnum inundatum* - associationen, eller då denna saknas inom den blötaste delen av laggen (bestånd 7, 8). Detta innebär, att varianten i vissa fall kommer att gränsa till myrkantsamhällen, vilket är förklaringen till förekomsten av myrkantarter, t.ex. *Potentilla palustris.*

Jämförbara samhällen finns på Åkhultmyren (cf. MALMER 1962, sid. 93, 94) och Komosse (cf. OSVALD 1923, sid. 211—212).

Inom *Carex rostrata*-varianten saknas *Utricularia intermedia. Sphagnum dusenii* har ersatts av *Sphagnum apiculatum* och *S. pulchrum.* Variantens fältskikt domineras helt av *Carex rostrata.* Ofta är denna art tillsammans med *Vaccinium oxycoccos* allenarådande. Endast *Menyanthes trifoliata* och *Carex limosa* förmår ibland göra sig gällande, framför allt på gränsen till fuktigare växande samhällen. I bottenskiktet märks förutom ovannämnda *Sphagna* också *Calliergon stramineum, Drepanocladus fluitans* och *Sphagnum papillosum.* — Varianten är mycket utbredd på Store mosse inom en övergångszon mellan mossen och de fuktigare växande kärrsamhällena (bestånd 1, 6, 8, 11, 16, 17, 18, 25, fig. 5). Gränsen mot mossen, kärrväxtgränsen, är

på några platser markant. Kärrindikatorer som *Carex rostrata, Eriophorum angustifolium* och *Sphagnum apiculatum* upphör nästan på exakt samma plats. Oftast är gränsen emellertid diffus och ersatt av en mängd gränser för olika kärrindikatorer flera meter från varandra. Härvid har i några fall *Sphagnum* cf. *apiculatum* visat sig gå längst upp på mossen (t.ex. bestånd 6). Då kan en speciell typ av *Carex rostrata* - varianten urskiljas, där bottenskiktet domineras av *Sphagnum* cf. *apiculatum* med inslag av *Drepanocladus fluitans, Calypogeia* spp. och *Cephalozia* spp. I fältskiktet dominerar *Eriophorum vaginatum* och *Vaccinium oxycoccos. Carex rostrata* saknas. Denna typ motsvarar den av OSVALD (1923) beskrivna »*Eriophorum vaginatum* Rand».

Jämförbara samhällen finns på Åkhultmyren (cf. MALMER sid. 93, 94, 120) och Komosse (cf. OSVALD sid. 206, 207, 216—221).

Sphagnum magellanicum - papillosum - serien

Tab. 4. Denna serie har ett helt slutet bottenskikt av *Sphagna,* främst tillhörande *Palustria*-gruppen. I fältskiktet förekommer, till skillnad från föregående serie, *Andromeda polifolia, Vaccinium oxycoccos* och *Drosera rotundifolia* konstant inom alla associationer. *Eriophorum vaginatum* och *Rhynchospora alba* har ofta höga frekvenser. *Calluna vulgaris* förekommer mera sporadiskt inom serien. Tre associationer har utskilts.

Eriophorum vaginatum-Sphagnum magellanicum-associationen. Förutom av för serien konstanta arter, utmärks fältskiktet av *Eriophorum vaginatum* och *Rhynchospora alba. Calluna vulgaris* förekommer i hälften av de analyserade rutorna men alltid med låg täckningsgrad. Bottenskiktet domineras i regel av *Sphagnum magellanicum. Sphagnum papillosum* kan uppträda som dominant och i undantagsfall även *Sphagnum balticum. Sphagnum cuspidatum, S. rubellum* och *S. tenellum* har ganska höga frekvenser men alltid låga täckningsgrader. Bland levermossorna förekommer *Cladopodiella fluitans, Gymnocolea inflata* och *Odonthoschisma sphagni* i minst hälften av de analyserade rutorna. — Associationen är den mest utbredda inom Store mosse. Den finns på alla mosseplan från kantsluttningen över hela mosseplanet och intar minst $^3/_4$ av Store mosses areal (bestånd 40, 42, 43, 45 och 47).

Jämförbara samhällen finns på Åkhultmyren (cf. MALMER 1962, sid. 92) och Komosse (cf. OSVALD 1923, sid. 224—229).

Scheuchzeria palustris-Sphagnum papillosum-associationen. *Scheuchzeria palustris, Drepanocladus fluitans* och *Calypogeia* spp. skiljer associationen från övriga inom serien. I fältskiktet har *Carex rostrata* och *Eriophorum angustifolium* hög frekvens. *Eriophorum vaginatum* förekommer mycket sporadiskt. Bottenskiktet domineras av *Sphagnum papillosum. Sphagnum balticum* intar en framträdande plats. Levermossorna har kvantitativt stor betydelse. — Assocationen intar större delen av Lilla Lövökärret (bestånd 19, 20). Den finns även väster om Lövö.

Jämförbara samhällen finns på Komosse (cf. OSVALD 1923, sid. 237).

Menyanthes trifoliata-Sphagnum papillosum-associationen skiljer sig från övriga inom serien genom förekomst av *Myrica gale, Menyanthes trifoliata, Aulacomnium palustre, Calliergon stramineum* och *Sphagnum imbricatum. Eriophorum vaginatum, Carex limosa* och *C. rostrata* förekommer med relativt hög frekvens. Bottenskiktet domineras av *Sphagnum imbricatum* eller *S. papillosum. Sphagnum apiculatum* når stundom hög täckningsgrad, framför allt inom associationens lägre och fuktigare partier på gränsen till *Menyanthes trifoliata - Sphagnum apiculatum* - associationen. Typiskt är den totala frånvaron av levermossor.

Carex lasiocarpa-varianten kännetecknas av högväxta graminider. *Carex livida* är en god skiljeart gentemot nästa variant. Bottenskiktet domineras helt av *Sphagnum papillosum.* — Varianten förekommer bäst utbildad i Bäckaskogskärret, där den växer som en bård mellan de fuktigare svackorna och de ljungklädda tuvorna (bestånd 12, 13, 14, 15). Den finns även sällsynt inom några laggpartier, t.ex. Nybyggetlaggen.

Jämförbara samhällen finns på Åkhultmyren (cf. MALMER 1962, sid. 96, 121, 127—128) och Komosse (cf. OSVALD 1923, sid. 202—203, 237).

Inom *Carex rostrata*-varianten är *Menyanthes trifoliata* en karakteristisk art. *Vaccinium oxycoccos* förekommer i alla rutor ofta med förhållandevis hög täckningsgrad. Bottenskiktet domineras av *Sphagnum imbricatum* och *S. papillosum.* Den förstnämnda arten har störst betydelse. *Calliergon stramineum* är skiljeart gentemot övriga varianter och associationer inom serien. — Varianten förekommer närmast mossen i laggar och dråg, där den bildar tuvor inom *Menyanthes trifoliata - Sphagnum apiculatum* - associationens *Carex rostrata* - variant (bestånd 1, 7, 11, 25, fig. 5). Den intar en relativt liten areal. Samhället kommer i vissa fall att gränsa till myrkantsamhällena, vilket förklarar förekomsten av myrkantarter, t.ex. *Carex chordorrhiza.*

Tabell 4. Sphagnum magellanicum - papillosum - serien och Carex panicea - Campylium stellatum - associationen

	Eriophorum vaginatum - Sphagnum magellanicum - ass.	*Scheuchzeria palustris - Sphagnum papillosum* - ass.	*Menyanthes trifoliata - Sphagnum papillosum* - ass.		*Carex panicea - Campylium stellatum* - ass.
			Carex rostrata - var.	*Carex lasiocarpa* - var.	
Antal rutor och bestånd	26:5	12:2	35:4	32:4	15:2
Sphagnum magellanicum	96[4]	33[4]	11[5]	6[2]	—
— *cuspidatum*	81[1]	—	—	—	—
— *rubellum*	69[2]	—	—	—	—
— *tenellum*	77[1]	—	—	—	—
Odontoschisma sphagni	58[1]	—	—	—	20[1]
Scheuchzeria palustris	—	58[1]	—	19[1]	—
Drepanocladus fluitans	—	58[1]	9[1]	—	—
Calypogeia spp.	15[1]	92[1]	6[1]	9[1]	—
Cephalozia spp.	30[1]	33[1]	—	3[1]	—
Cladopodiella fluitans / *Gymnocolea inflata*	65[1]	92[1]	6[1]	9[1]	—
Carex chordorrhiza	—	—	37[1]	—	—
Aulacomnium palustre	—	+	23[1]	—	—
Calliergon stramineum	—	+	49[1]	3[1]	—
Pohlia sphagnicola	—	8[1]	29[1]	—	—
Menyanthes trifoliata	—	+	63[2]	34[1]	13[1]
Sphagnum imbricatum	—	8[1]	63[5]	25[3]	—
— *pulchrum*	—	—	3[1]	41[4]	—
Carex lasiocarpa	—	—	9[1]	50[1]	—
— *livida*	—	—	—	34[1]	7[1]
Erica tetralix	+	—	—	+	47[1]
Carex panicea	—	—	9[1]	3[1]	100[1]
Phragmites communis	—	—	3[1]	—	73[1]
Trichophorum alpinum	—	—	—	—	47[1]
Campylium stellatum	—	—	—	—	100[5]
Scorpidium scorpioides	—	—	—	—	100[1]
Riccardia spp.	—	—	—	—	53[1]
Carex limosa	—	42[1]	51[1]	19[1]	80[1]
— *rostrata*	—	83[1]	74[1]	25[1]	60[1]
Eriophorum angustifolium	+	75[1]	20[1]	47[1]	80[1]
Sphagnum apiculatum	—	50[3]	66[2]	13[4]	—
Myrica gale	—	+	23[1]	56[1]	73[1]
Molinia coerulea	—	—	—	25[1]	60[1]
Andromeda polifolia	96[1]	100[1]	89[1]	91[1]	80[1]
Betula nana	12[1]	50[1]	9[1]	22[1]	—
Calluna vulgaris	58[1]	+	—	22[1]	—
Vaccinium oxycoccos	96[1]	100[2]	100[3]	91[1]	73[1]
Drosera anglica	38[1]	—	—	—	40[1]
— *rotundifolia*	81[1]	100[1]	89[1]	81[1]	—
Eriophorum vaginatum	92[1]	8[1]	49[1]	53[1]	—
Rhynchospora alba	96[1]	75[1]	3[1]	88[1]	53[1]
Trichophorum caespitosum	19[1]	—	—	—	80[1]
Sphagnum balticum	100[2]	67[4]	14[1]	—	—
— *papillosum*	65[4]	83[5]	54[4]	88[5]	—

Jämförbara samhällen finns på Åkhultmyren (cf. MALMER 1962, sid. 96, 121, 127—128) och Komosse (cf. OSVALD 1923, sid. 194, 213—215, 229—230).

Sphagnum rubellum - serien

Tab. 5. Serien intar de översta delarna av tuvorna. Risen har en dominerande ställning på dessa torra platser. *Calluna vulgaris* är allestädes närvarande ofta med hög täckningsgrad. *Andromeda polifolia* och *Vaccinium oxycoccos* är lika vanliga men täcker alltid liten yta. *Empetrum nigrum* har en mera begränsad utbredning. I fältskiktet finns *Eriophorum vaginatum* och *Drosera rotundifolia* i samtliga associationer med hög frekvens. Bottenskiktet domineras av *Sphagnum rubellum,* även om *S. magellanicum* och *S. imbricatum* är rikligt företrädda. Levermossorna kan vara ymnigt representerade, främst genom *Cephalozia* spp. och *Mylia anomala.* Fyra associationer har urskilts.

Eriophorum vaginatum-Sphagnum rubellum-associationen förekommer endast inom ombrotrofa områden på Store mosse. *Rubus chamaemorus* är mycket utbredd. Associationen har indelats i två varianter.

Trichophorum caespitosum-varianten är den vanligaste. Den utmärks av *Trichophorum caespitosum,* som dock förekommer med relativt låg frekvens. Bottenskiktet domineras av *Sphagnum rubellum,* ibland med riklig förekomst av *Sphagnum magellanicum* och *S. fuscum. Sphagnum balticum* finns allmänt men alltid som enstaka individ. Levermossor, främst *Cephalozia* spp. och *Mylia anomala,* är allmänt förekommande. Lavar är företrädda i ett fåtal exemplar i fler-

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Tillägg: *Erioph. vag.* - *Sph. mag.* - ass.: *Betula pubescens* (+), *Pinus silvestris* (+), *Rubus chamaemorus* (8^1), *Lepidozia* spp. (30^1), *Mylia anomala* (19^1), *Cladonia rangiferina* (8^1), *C. sylvatica* coll. (4^1), *Cornicularia aculeata* (4^1); *Scheuch. pal.* - *Sph. pap.* - ass.: *Empetrum nigrum* (8^1), *Polytrichum strictum* (+), *Sphagnum parvifolium* (8^5), *Lepidozia* spp. (8^1); *Carex rost.* - var.: *Betula pubescens* (3^1), *Empetrum nigrum* (+), *Vaccinium uliginosum* (+), *Peucedanum palustre* (+), *Viola palustris* (6^1), *Carex canescens* (+), *C. dioeca* (3^1), *C. magellanica* (+), *C. nigra* (+), *C. pauciflora* (+), *Equisetum fluviatile* (6^1), *Drepanocladus fluitans* (9^1), *D. revolvens* s.str. (3^1), *Polytrichum commune* (3^1), *P. strictum* (+), *Sphagnum dusenii* (3^1), *S. parvifolium* (3^1), *S. teres* (3^5); *Carex lasioc.* - var.: *Salix aurita* (3^1), *S. repens* (3^1), *Narthecium ossifragum* (13^2), *Agrostis canina* (+), *Carex dioeca* (9^1), *Equisetum fluviatile* (9^1), *Drepanocladus fluitans* (+), *Sphagnum dusenii* (3^2), *Lepidozia* spp. (3^1); *Carex pan.* - *Camp. stellat.* - ass.: *Pinus silvestris* (7^1), *Drosera intermedia* (7^1), *Narthecium ossifragum* (20^1), *Peucedanum palustre* (7^1), *Utricularia intermedia* (27^1), *Viola palustris* (13^1), *Drepanocladus revolvens* s.str. (7^1), *Fissidens adianthoides* (7^1), *Hylocomium splendens* (7^1), *Sphagnum contortum* (+), *S. plumulosum* (7^1), *Scapania* spp. (13^1).

talet rutor. — Varianten finns inom alla mosseområden på Store mosse, men täcker en ringa areal (bestånd 40, 42, 43, 45, 47).

Jämförbara samhällen finns på Åkhultmyren (cf. MALMER 1962, sid. 100) och Komosse (cf. OSVALD 1923, sid. 119—126).

Inom *Empetrum nigrum*-varianten är *Empetrum nigrum* mycket utbredd och täcker efter *Calluna vulgaris* den största ytan i fältskiktet. *Drosera rotundifolia* förekommer som konstant i motsats till i föregående variant, där den ej är så vanlig. *Trichophorum caespitosum* saknas nästan helt. Beträffande bottenskiktet kan två typer urskiljas, en där *Sphagnum fuscum* dominerar och en med *Sphagnum imbricatum*-dominans. I båda typerna ingår *Sphagnum rubellum* och levermossorna *Cephalozia* spp. och *Mylia anomala*. — Varianten är mycket mer sällsynt än föregående. Den har inte hittats inom alla undersökta bestånd på mosseplanen (bestånd 42, 43, 45, 47). Då den finns, bildar den s.k. sekundära tuvor (DU RIETZ 1949), som syns på långt håll, genom att de höjer sig betydligt över övriga tuvor. Ofta finns det enbart ett tiotal sådana tuvor, vardera c. $^1/_2$ m^2 stora, inom ett bestånd.

Jämförbara samhällen finns på Åkhultmyren (cf. MALMER 1962, sid. 100) och Komosse (cf. OSVALD 1923, sid. 126—132, 137—139, 195—197).

Calluna vulgaris-Sphagnum magellanicum-associationen. Tab. 7. *Calluna vulgaris* är här mycket vanlig och ofta helt dominerande. Bland risen märks för övrigt *Andromeda polifolia* och *Vaccinium oxycoccos*. I fältskiktet förekommer också *Eriophorum vaginatum* och *Drosera rotundifolia* allmänt. Bottenskiktet domineras av *Sphagnum magellanicum*. *Dicranum bonjeani, Sphagnum* cf. *parvifolium, S. rubellum* och *Mylia anomala* är vanliga. *Pleurozium schreberi* är mindre utbredd inom associationen. — Denna association förekommer på flera av Store mosses mossekantsluttningar. Den är alltid trädlös. Stigningen från laggen upp på mosseplanet är svag och i regel ej märkbar för blotta ögat. Associationen har analyserats vid Johannesbergslaggen (bestånd 7, fig. 3). Den är speciellt välutvecklad längs drågen, främst Blådöpet (bestånd 1, 52, fig. 5).

Jämförbara samhällen finns på Komosse (cf. OSVALD 1923, sid. 119—126).

I *Carex lasiocarpa-Sphagnum rubellum*-associationen ingår förutom de i serien vanliga risen även *Myrica gale* som konstant. Graminiderna företräds i första hand av *Carex lasiocarpa*, men även *Eriophorum vaginatum* har hög frekvens och täcker inom

mindre områden stora sammanhängande ytor. *Sphagnum imbricatum* är den mest framträdande vitmossan. Den bildar tillsammans med *Sphagnum magellanicum* och *S. papillosum* bottenskiktet. *Sphagnum rubellum* har en underordnad betydelse liksom levermossorna. Detta tyder på att associationen står nära *Carex lasiocarpa* - varianten inom *Menyanthes trifoliata - Sphagnum papillosum* - associationen. Den allmänna förekomsten av ris samt mossorna *Calliergon stramineum* och *Pohlia sphagnicola* har dock motiverat att föra den till *Sphagnum rubellum* - serien. — Associationen har påträffats enbart på de högsta tuvorna i Bäckaskogskärret (bestånd 12, 13, 15).

Jämförbara samhällen finns på Åkhultmyren (cf. MALMER 1962, sid. 100, 121).

Carex panicea-Sphagnum rubellum-associationen karakteriseras av den allmänna förekomsten av *Carex dioeca, C. panicea* och *Phragmites communis.* I fältskiktet märks för övrigt *Myrica gale, Menyanthes trifoliata, Eriophorum angustifolium* och *Molinia coerulea. Eriophorum vaginatum* är ytterst sällsynt. Bottenskiktet domineras av *Sphagnum rubellum. Aulacomnium palustre* är i det närmaste konstant, medan *Calliergon stramineum* och *Polytrichum strictum* förekommer i c. hälften av de analyserade rutorna. Bland levermossorna märks främst *Lepidozia* spp. Lavar saknas helt. — Associationen är sällsynt inom Store mosse. Den har analyserats i Hädingelaggen (bestånd 37, 38) men finns även i Björnekullakärret.

Cladonia - serien

Tab. 5. Endast en association, *Eriophorum vaginatum - Cladonia rangiferina*-associationen, har urskilts. Den täcker tillsammans med *Eriophorum vaginatum - Sphagnum rubellum* - associationen tuvtopparna på mosseplanen. Fältskiktet är identiskt med det inom *Empetrum nigrum* - varianten med undantag för *Drosera rotundifolia,* som är mindre utbredd inom *Eriophorum vaginatum - Cladonia rangiferina* - associationen. Bottenskiktet är helt avvikande. Det domineras av *Cladonia sylvatica* coll. och *C. rangiferina.* Varje ruta domineras i regel endast av den ena arten, medan den andra förekommer som enstaka individ. *Dicranum bergeri* och *Pleurozium schreberi* når betydligt högre frekvens inom denna association än i de övriga. Bland levermossorna intar *Odontoschisma sphagni* en framträdande plats. — Associationen är inskränkt till ombrotrofa områden. Den täcker här en något mindre areal än *Eriophorum vaginatum - Sphagnum rubellum* -

Tabell 5. Sphagnum rubellum - serien och Cladonia - serien

	Eriophorum vaginatum - Sphagnum rubellum - ass.				
	Trichophorum caespitosum - var.	*Empetrum nigrum* - var.	*Carex lasiocarpa - Sphagnum rubellum* - ass.	*Carex panicea - Sphagnum rubellum* - ass.	*Eriophorum vaginatum - Cladonia rangiferina* - ass.
Antal rutor och bestånd	25:5	20:4	12:3	12:2	21:5
Rubus chamaemorus	64[1]	75[1]	—	—	76[1]
Sphagnum balticum	96[1]	15[1]	—	—	43[1]
— *fuscum*	44[3]	90[5]	—	—	10[1]
Carex lasiocarpa	—	—	75[1]	8[1]	—
Pohlia sphagnicola	—	—	67[1]	—	—
Sphagnum apiculatum	—	—	42[1]	—	—
— *papillosum*	8[2]	5[1]	92[3]	58[1]	—
Erica tetralix	+	+	—	33[1]	—
Carex dioeca	—	—	—	67[1]	—
— *panicea*	—	—	—	83[1]	—
— *rostrata*	—	—	—	25[1]	—
Eriophorum angustifolium	—	—	+	50[1]	—
Phragmites communis	—	—	—	42[1]	—
Myrica gale	—	—	100[2]	100[1]	—
Menyanthes trifoliata	—	—	25[1]	50[1]	—
Molinia coerulea	—	—	33[1]	83[1]	—
Aulacomnium palustre	4[1]	10[1]	25[1]	92[1]	—
Calliergon stramineum	—	—	67[1]	42[1]	—
Polytrichum strictum	—	—	25[1]	42[1]	—
Dicranum bergeri	4[1]	—	—	—	29[1]
Cladonia rangiferina	68[1]	60[1]	—	—	90[4]
— *sylvatica* coll	32[1]	35[1]	+	—	90[4]
— spp.	8[1]	—	—	+	76[1]
Cornicularia aculeata	8[1]	—	—	—	43[2]
Andromeda polifolia	100[1]	90[1]	50[1]	75[1]	95[1]
Betula nana	24[1]	10[1]	33[1]	8[1]	+
Calluna vulgaris	100[3]	90[2]	100[4]	100[4]	95[2]
Empetrum nigrum	8[1]	65[2]	58[1]	50[1]	67[1]
Vaccinium oxycoccos	100[1]	100[1]	100[1]	92[1]	100[1]
Drosera rotundifolia	64[1]	100[1]	42[1]	42[1]	19[1]
Eriophorum vaginatum	100[1]	100[1]	75[2]	+	100[1]
Trichophorum caespitosum	20[1]	5[1]	—	33[1]	10[1]
Pleurozium schreberi	4[1]	10[1]	—	42[1]	33[1]
Sphagnum imbricatum	16[1]	45[5]	92[4]	—	24[1]
— *magellanicum*	80[3]	15[2]	33[4]	17[5]	5[1]
— *rubellum*	100[5]	80[2]	25[2]	92[5]	86[1]
Calypogeia spp.	8[1]	5[1]	33[1]	58[1]	10[1]
Cephalozia spp.	80[1]	95[1]	8[1]	50[1]	62[1]
Lepidozia spp.	28[1]	15[1]	—	67[1]	24[1]
Mylia anomala	84[1]	100[1]	—	33[1]	24[1]
Odontoschisma sphagni	36[1]	—	—	17[1]	81[1]

Tillägg: *Trichoph. caesp.* - var.: *Betula pubescens* (+), *Picea abies* (+), *Pinus silvestris* (4[1]), *Drosera anglica* (4[1]), *D. intermedia* (4[1]), *Rhynchospora alba* (8[1]), *Dicra-*

associationen. I vissa kantområden kan den dock vara nästan allenarådande.

Jämförbara samhällen finns på Åkhultmyren (cf. MALMER 1962, sid. 101) och Komosse (cf. OSVALD 1923, sid. 78—95, 247).

Sphagnum tenellum - serien

Endast *Eriophorum vaginatum-Sphagnum tenellum*-associationen har studerats närmare. Den utmärks av en blandning av arter från associationerna inom ombrotrofa områden. *Eriophorum vaginatum* och *Vaccinium oxycoccos* förekommer som konstanter. I fältskiktet märks också *Andromeda polifolia, Calluna vulgaris* och *Rhynchospora alba.* Bottenskiktet visar samma blandning av bl.a. *Sphagnum balticum, S. cuspidatum, S. rubellum* och *Cladonia* spp. Speciellt utmärkande är dock *Sphagnum tenellum,* som ofta har hög täckningsgrad, och *Cladonia squamosa.* Den sistnämnda arten är särskilt karakteristisk för associationen. Inom denna association har levermossorna sin största kvantitativa utbredning, framför allt *Cephalozia* spp., *Cladopodiella fluitans, Gymnocolea inflata* och *Odontoschisma sphagni.* — Associationen finns endast på mosseplanen, där den är mycket sällsynt och intar ytterst små ytor (bestånd 40, 43, 47). Samhällen, som bör föras till denna serie, har observerats i dråget väster om Lövö. Inom dessa dominerar *Narthecium ossifragum.*

Jämförbara samhällen finns på Åkhultmyren (cf. MALMER 1962, sid. 105) och Komosse (cf. OSVALD 1923, sid. 132—135, 235—236, 238).

Carex panicea - Scorpidium scorpioides - associationen och *Carex panicea - Campylium stellatum* - associationen

Dessa båda associationer skiljer sig från ovan beskrivna serier genom att bottenskiktet utgöres av brunmossorna *Campylium stellatum* och

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num bonjeani (4[1]), *D. scoparium* (+), *Sphagnum tenellum* (4[1]), *Cladopodiella fluitans* och *Gymnocolea inflata* (12[1]), *Lophozia* spp. (+), *Cetraria islandica* (4[1]), *Cladonia alpestris* (4[1]); *Empetr. nigr.* - var.: *Betula pubescens* (+), *Pinus silvestris* (10[1]), *Dicranum fuscescens* (10[1]); *Carex lasioc.* - *Sph. rub.* - ass.: *Betula pubescens* (+), *B. nana* × *pubescens* (+), *Pinus silvestris* (+), *Narthecium ossifragum* (+), *Carex chordorrhiza* (8[1]), *C. echinata* (8[1]), *C. limosa* (8[1]), *C. livida* (+), *C. pauciflora* (+), *Rhynchospora alba* (17[1]), *Dicranum bonjeani* (8[1]), *Cladopodiella fluitans* och *Gymnocolea inflata* (8[1]); *Carex pan.* - *Sph. rub.* - ass.; *Juniperus communis* (8[1]), *Pinus silvestris* (+), *Narthecium ossifragum* (8[1]), *Peucedanum palustre* (+), *Viola palustris* (17[1]), *Agrostis canina* (8[1]), *Carex livida* (8[1]), *Trichophorum alpinum* (+), *Dicranum robustum* (17[1]), *D. rugosum* (+), *D. scoparium* (17[1]), *Hylocomium splendens* (8[1]), *Sphagnum nemoreum* (8[1]), *S. parvifolium* (8[1]), *Cladopodiella fluitans* och *Gymnocolea inflata* (17[1]), *Lophozia* spp. (8[1]); *Erioph. vag.* - *Clad. rang.* - ass.: *Betula pubescens* (+), *Picea abies* (+), *Pinus silvestris* (+), *Rhynchospora alba* (5[1]), *Cetraria islandica* (14[1]), *Cladonia squamosa* (5[1]), *C. uncialis* (10[2]).

Scorpidium scorpioides. *Sphagna* saknas helt. Utmärkande för fältskiktet är *Carex panicea, Phragmites communis* och *Trichophorum alpinum*.

Carex panicea-Scorpidium scorpioides-associationen (tab. 2) skiljes från den nedan beskrivna associationen genom dåligt utvecklat bottenskikt av *Scorpidium scorpioides* och *Calliergon trifarium*. Den sistnämnda arten är skiljeart för associationen jämfört med alla övriga associationer. *Myrica gale, Carex panicea* och *Trichophorum caespitosum* förekommer allmänt. Många arter, främst *Utricularia intermedia, Carex limosa, Eriophorum angustifolium*, är gemensamma med flertalet av *Sphagnum auriculatum - cuspidatum*-seriens associationer. Detta jämte det sporadiskt utbildade bottenskiktet visar att associationen närmast kan betraktas som en fortsättning på denna serie. — Associationen, som är mycket sparsamt företrädd inom Store mosse, har analyserats i Hädingelaggen (bestånd 37, 38). Den har dessutom observerats på västsidan av Horssjön och i Björnekullakärret.

Jämförbara samhällen finns på Komosse (cf. OSVALD 1923, sid. 180, 182—184).

Inom *Carex panicea-Campylium stellatum*-associationen (tab. 4) domineras bottenskiktet helt av *Campylium stellatum*. *Scorpidium scorpioides* finns i alla de analyserade rutorna, men alltid med liten täckningsgrad. *Trichophorum alpinum* är inskränkt till associationen. *Erica tetralix* och *Molinia coerulea* förekommer allmänt. Fältskiktet visar i övrigt stora likheter med *Carex panicea - Scorpidium scorpioides* - associationen. *Andromeda polifolia, Vaccinium oxycoccos* och *Phragmites communis* har dock större betydelse. De sistnämnda arterna liksom associationens allmänna utseende visar vissa likheter med *Sphagnum magellanicum - papillosum* - serien. — Associationen, som är sällsynt inom Store mosse, har analyserats i Hädingelaggen (bestånd 37, 38). Den finns även i Nybyggetlaggen, på Horssjöns västsida och i Björnekullakärret.

Jämförbara samhällen finns på Komosse (cf. OSVALD 1923, sid. 182—184).

Myrkantens växtsamhällen

Potentilla palustris-Equisetum fluviatile-associationen. Tab. 6. Associationen utmärks främst av stor mängd högväxta graminider, såsom *Carex lasiocarpa, C. rostrata, Equisetum flu-*

viatile, Eriophorum angustifolium. Även lågväxta graminider kan dominera inom stora områden, t.ex. *Agrostis canina, Carex canescens, C. chordorrhiza, C. limosa.* Bland risen täcker *Myrica gale* störst areal. *Salix repens* och *Vaccinium oxycoccos* har betydligt lägre frekvens. *Galium palustre* och *Lysimachia thyrsiflora* är skiljearter för denna association jämfört med övriga växtsamhällen. I fältskiktet märks för övrigt *Potentilla palustris* och *Menyanthes trifoliata.* Bottenskiktet är nästan alltid svagt utbildat eller saknas helt. Det är endast *Drepanocladus exannulatus* s.str., *Calliergon cordifolium* och *Amblystegium riparium,* som når högre frekvenser. Associationen har jag tidigare beskrivit mera ingående (SVENSSON 1964). Den har här uppdelats i tre varianter.

Sparganium minimum-varianten är den fuktigast förekommande inom associationen. Detta innebär att risen saknas bortsett från några enstaka förekomster av *Myrica gale,* medan *Utricularia intermedia* och *Equisetum fluviatile* fått stor betydelse. Bottenskiktet representeras enbart av några få exemplar av *Sphagnum platyphyllum. Juncus supinus* och *Sparganium minimum* är skiljearter jämfört med de två övriga varianterna. — Varianten har en begränsad utbredning inom de vattenrikaste delarna av Stora gungflyet i anslutning till sjön (bestånd 28, 31, 32).

Jämförbara samhällen finns på Komosse (cf. OSVALD 1923, sid. 151—154, 242).

Inom *Carex canescens*-varianten framträder associationen mest typiskt. Här täcks stora områden av de ovan nämnda graminiderna. Den skiljs från föregående variant genom ett sporadiskt förekommande bottenskikt av *Drepanocladus exannulatus* s.str., *Calliergon cordifolium, Amblystegium riparium* och *Bryum pseudotriquetrum. Sphagna* når aldrig en småtefrekvens över 20 %. Karakteristiska för varianten är *Sphagnum contortum* och *S. platyphyllum.* — Varianten täcker större delen av Stora gungflyet, Horssjön, Blådöpet och delar av de kärrdråg, som ligger närmast Blådöpet (bestånd 22, 23, 24, 26, 27, 29, 30, 31, 32, 33, 34, 35, 36, 54, 55).

Jämförbara samhällen finns på Åkhultmyren (cf. MALMER 1962, sid. 129) och Komosse (cf. OSVALD 1923, sid. 109, 158, 161—164, 167—173, 199—202, 207—208).

Calla palustris-varianten karakteriseras av ett helt slutet bottenskikt av *Sphagnum apiculatum* och *S. inundatum* med inslag av *Sphagnum amblyphyllum* och *S. fimbriatum.* I fältskiktet är *Myrica gale, Menyanthes trifoliata, Peucedanum palustre* och *Carex rostrata*

Tabell 6. Potentilla palustris - Equisetum fluviatile - associationen och Potentilla palustris - Sphagnum apiculatum - associationen

	Potentilla palustris - Equisetum fluviatile - ass.			*Potentilla palustris - Sphagnum apiculatum* - ass.	
	Sparganium minimum - var.	*Carex canescens* - var.	*Calla palustris* - var.	*Carex echinata* - var.	*Carex dioeca* - var.
Antal rutor och bestånd	16:3	85:15	10:2	43:4	24:5
Juncus supinus	31^{1}	—	—	—	—
Sparganium minimum	50^{1}	—	—	—	—
Sphagnum platyphyllum	13^{1}	10^{1}	—	—	—
Utricularia intermedia	88^{1}	56^{1}	10^{1}	7^{1}	—
Equisetum fluviatile	100^{1}	79^{1}	80^{1}	5^{1}	8^{1}
Lysimachia thyrsiflora	63^{1}	43^{1}	50^{1}	12^{1}	17^{1}
Carex limosa	25^{1}	64^{3}	60^{1}	26^{1}	4^{1}
Eriophorum angustifolium	25^{1}	61^{1}	80^{1}	35^{1}	—
Drepanocladus exannulatus s.str.	19^{1}	55^{1}	50^{1}	7^{1}	—
Carex canescens	6^{1}	54^{1}	20^{1}	14^{1}	8^{1}
Calliergon cordifolium	—	44^{1}	10^{1}	—	—
Sphagnum inundatum	—	20^{1}	40^{4}	21^{2}	—
Salix repens	—	39^{1}	40^{1}	2^{1}	8^{1}
Calla palustris	—	9^{2}	40^{2}	2^{1}	—
Sphagnum amblyphyllum	—	14^{1}	50^{5}	9^{5}	—
Salix aurita/S. cinerea	+	+	80^{1}	2^{1}	—
Carex echinata	—	—	—	30^{1}	—
Sphagnum apiculatum	—	8^{1}	40^{5}	44^{4}	50^{3}
Calliergon stramineum	—	15^{1}	70^{1}	53^{1}	50^{1}
Sphagnum imbricatum	—	9^{1}	—	33^{5}	83^{5}
Andromeda polifolia	—	13^{1}	10^{2}	19^{1}	54^{1}
Carex dioeca	—	—	—	7^{1}	37^{1}
Betula nana	—	11^{1}	10^{2}	7^{1}	75^{2}
Myrica gale	19^{1}	44^{3}	90^{2}	19^{2}	88^{2}
Vaccinium oxycoccos	—	28^{1}	90^{1}	72^{2}	96^{1}
Galium palustre	—	70^{1}	20^{1}	—	29^{1}
Menyanthes trifoliata	100^{3}	92^{2}	100^{2}	35^{1}	58^{1}
Peucedanum palustre	6^{1}	40^{1}	100^{1}	—	50^{1}
Potentilla palustris	44^{1}	98^{2}	100^{1}	53^{2}	54^{2}
Viola palustris	—	13^{1}	50^{1}	28^{1}	67^{1}
Agrostis canina	—	62^{3}	100^{1}	28^{1}	83^{1}
Carex chordorrhiza	—	75^{1}	25^{1}	9^{1}	67^{1}
— *lasiocarpa*	—	22^{2}	—	32^{1}	37^{1}
— *nigra*	6^{1}	40^{1}	10^{1}	21^{1}	—
— *rostrata*	100^{1}	94^{2}	100^{2}	98^{1}	46^{1}
Totala artantalet	22	68	47	74	38
Signaturer i tillägget nedan	I	II	III	IV	V

Tillägg: Kärlväxter. *Betula pubescens* II (+), III (10^{1}), IV (+); *Calluna vulgaris* II (1^{1}); V (13^{1}); *Empetrum nigrum* IV (8^{1}); *Juniperus communis* IV (+); *Picea abies* IV (+); *Pinus silvestris* IV (+); *Rhamnus frangula* IV (+); *Salix pentandra* I (+), II (1^{1}), III (+), IV (+); *Vaccinium myrtillus* IV (5^{1}); *V. uliginosum* IV (+); *V. vitis-idaea* IV (+); *Caltha palustris* II (5^{1}); *Cardamine palustris* II (7^{1}); *Drosera*

allmänt förekommande. — Varianten förekommer inom begränsade delar av Stora gungflyet och Horssjön oftast i närheten av kanterna (bestånd 28, 53).

Jämförbara samhällen finns på Åkhultmyren (cf. MALMER 1962, sid. 131) och Komosse (cf. Osvald 1923, sid. 197, 198—199).

Associationen är den enda som urskilts inom Stora gungflyet. Den intar också större delen av Blådöpet. Växtsamhällena på dessa båda lokaler är exakt lika varandra. Detta kan verka förvånande, då Stora gungflyet troligen uppkommit först efter 1840 genom utdikningen av Kävsjön (OSVALD 1925, WIBECK 1936, SVENSSON 1964), medan Blådöpet är ett typiskt kärrdråg bildat ungefär samtidigt med mossarna runt dråget. Några få arter, såsom *Salix pentandra, Lythrum salicaria, Juncus supinus, Sparganium minimum,* finns dock endast på Stora gungflyet.

Potentilla palustris - Sphagnum apiculatum-associationen. Tab. 6. Bottenskiktet är i de flesta fall slutet. Det består av *Sphagnum apiculatum, S. imbricatum* och i de lägre fuktigare delarna även *Sphagnum inundatum.* Fältskiktet utmärkes av *Potentilla palustris.* Risen har ofta stor betydelse, t.ex. *Betula nana, Myrica gale, Vaccinium oxycoccos.* Bland graminiderna märks främst *Carex lasiocarpa* och *C. rostrata.* Associationen skiljs från föregående, förutom av slutet bottenskikt, genom förekomst av *Potentilla erecta, Trientalis*

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rotundifolia III (30^1), IV (12^1), V (17^1); *Epilobium palustre* II (8^1), III (30^1); *Galium uliginosum* V (+); *Lycopus europaeus* II (2^1); *Lythrum salicaria* II (9^1), III (+); *Nuphar luteum* II (+); *Pedicularis palustris* II (2^1); *Potamogeton obtusifolius* II (+); *Potentilla erecta* IV (19^1); *Ranunculus flammula* v. *reptans* II (+), III (20^1); *Trientalis europaea* IV (19^1); *Utricularia minor* I (+), II (11^1); *Calamagrostis neglecta* II (1^4); *Carex lepidocarpa* s.str. V (2^1); *C. panicea* II (8^1), IV (9^1); *Equisetum silvatica* IV (+); *Eriophorum gracile* II (13^1); *E. vaginatum* IV (2^1); *Glyceria fluitans* IV (+); *Juncus articulatus* IV (+), V (6^1); *J. conglomeratus* IV (19^1); *J. effusus* IV (+); *J. filiformis* II (2^1); *Molinia coerulea* I (6^1), II (2^1), IV (12^1), V (4^1); *Phragmites communis* IV (5^1); *Rhynchospora alba* II (2^1), IV (+); *Scheuchzeria palustris* IV (2^1); *Scirpus lacustris* II (+); *S. palustris* II (1^1); *Typha latifolia* II (+); *Dryopteris spinolusa* IV (+).

Mossor. *Aulacomnium palustre* III (10^1), IV (14^1), V (+); *Brachythesium rivulare* II (5^1); *Bryum pseudotriquetrum* II (9^1), IV (5^1); *Calliergonella cuspidata* IV (5^2); *Campylium stellatum* IV (2^1); *Drepanocladus fluitans* IV (2^1); *D. revolvens* s.str. IV (5^1); *Hylocomium splendens* IV (+), V (4^1); *Mnium punctatum* II (1^1), III (10^2); *M. rugicum* III (30^1); *Pleurozium schreberi* IV (5^1); *Pohlia sphagnicola* III (10^1); *Polytrichum commune* III (20^1), IV (9^2); *P. strictum* IV (5^1), V (8^1); *Sphagnum auriculatum* II (7^1), III (20^1); *S. contortum* II (9^1); *S. dusenii* IV (9^3); *S. fimbriatum* II (+), III (20^2), V (+); *S. magellanicum* II (1^1), IV (5^4), V (8^1); *S. palustre* IV (2^5), V (4^1); *S. papillosum* II (3^1), III (10^1), IV (12^4), V (4^5); *S. parvifolium* V (4^5); *S. pulchrum* III (10^1), V (17^1); *S. robustum* IV (+), V (+); *S. squarrosum* II (5^1), III (+), IV (5^1); *S. subsecundum* II (3^1), III (20^1), IV (7^1); *S. teres* V (19^4); *Cladopodiella fluitans* och *Gymnocolea inflata* II (6^1), *Pellia* spp. II (7^1); *Riccardia* spp. III (40^1); *Scapania* spp. III (50^1), IV (2^1).

europaea, Carex dioeca, C. echinata och *Juncus conglomeratus*. Den har uppdelats i två varianter.

Carex echinata-varianten skiljer sig från övriga samhällen genom förekomsten av *Trientalis europaea, Potentilla erecta, Carex echinata* och *Juncus conglomeratus. Carex limosa, C. nigra, Sphagnum amblyphyllum* och *S. teres* är inskränkta till denna variant inom associationen. Bottenskiktet domineras av *Sphagnum apiculatum. Sphagnum imbricatum* kan dock täcka stora, ofta något högre belägna ytor, medan *Sphagnum inundatum* finns i de lägre fuktigare områdena. *Calliergon stramineum* finns ofta tillsammans med *Sphagnum imbricatum*. — Varianten finns i flertalet laggar inom Store mosse, där den intar en mer eller mindre bred zon mellan fastmarken och laggens centralparti (bestånd 7, 8, 11, 18).

Jämförbara samhällen finns på Åkhultmyren (cf. MALMER 1962, sid. 131) och Komosse (cf. OSVALD 1923, sid. 65, 141, 198—199, 202—204, 233, 234—235).

Carex dioeca-varianten har alltid ett slutet bottenskikt av *Sphagnum imbricatum* med inslag av *Sphagnum apiculatum,* som i undantagsfall kan dominera. Ofta ingår spridda individ av *Calliergon stramineum.* Bland risen märks speciellt *Myrica gale. Vaccinium oxycoccos* finns nästan konstant i varianten men har alltid låg täckningsgrad. *Viola palustris, Carex chordorrhiza* och *C. dioeca* förekommer allmänt och kan betraktas som skiljearter gentemot *Carex echinata*-varianten. — Varianten finns inom drågen, framför allt i Blådöpet (bestånd 22, 23, 24, 26, 36), där den intar högre belägna områden. WIBECK (1936) har i dessa högre områden sett vissa likheter mellan Blådöpet och nordsvenska revelmyrar. Liknande samhällen finns nära fastmarkskanten i laggarna.

Jämförbara samhällen finns på Åkhultmyren (cf. MALMER 1962, sid. 131—132) och Komosse (cf. OSVALD 1923, sid. 208—210).

Vaccinium - Sphagnum parvifolium-associationen. Tab. 7. Associationen är helt skild från de övriga myrkantsamhällena, genom att den förekommer under ombrotrofa förhållanden. I regel finns ett trädskikt av c. 5 m höga *Pinus silvestris* med inblandning av *Picea abies.* I enstaka fall (bestånd 11) består trädskiktet av förkrympta tallar. Risen förekommer ibland med höga frekvenser men i regel som enstaka individ, t.ex. *Calluna vulgaris, Betula nana, Andromeda polifolia, Empetrum nigrum, Vaccinium oxycoccos.* Speciellt intresse har *Vaccinium myrtillus, V. uliginosum* och *V. vitis-idaea,* som i det närmaste är inskränkta till associationen. De finns endast i undantagsfall

Tabell 7. Mossekantsluttningarnas växtsamhällen

	Vaccinium - Sphagnum parvifolium - ass.	*Calluna vulgaris - Sphagnum magellanicum* - ass.		*Vaccinium - Sphagnum parvifolium* - ass.	*Calluna vulgaris - Sphagnum magellanicum* - ass.
Antal rutor och bestånd	29:6	16:3	Antal rutor och bestånd	29:6	16:3
Picea abies	21[1]	—	*Andromeda polifolia*	59[1]	75[1]
Vaccinium myrtillus	17[1]	—	*Betula nana*	97[1]	38[1]
— *uliginosum*	21[1]	—	*Calluna vulgaris*	86[1]	100[4]
— *vitis-idaea*	45[1]	—	*Empetrum nigrum*	41[1]	81[1]
Dicranum rugosum	72[1]	—	*Pinus silvestris*	52[1]	25[1]
— *scoparium*	24[1]	—	*Vaccinium oxycoccos*	83[1]	100[1]
Hylocomium splendens	17[1]	—	*Rubus chamaemorus*	90[1]	81[3]
Isopterygium elegans	24[1]	—	*Eriophorum vaginatum*	100[2]	100[1]
Sphagnum parvifolium	97[5]	67[3]	*Aulacomnium palustre*	86[1]	81[1]
Lophozia spp.	14[1]	—	*Pleurozium schreberi*	100[2]	69[1]
			Pohlia sphagnicola	72[1]	100[1]
Drosera rotundifolia	3[1]	81[1]	*Polytrichum strictum*	28[1]	13[1]
Calliergon stramineum	—	31[1]	*Sphagnum* cf. *parvifolium*	21[4]	56[2]
Dicranum bonjeani	14[1]	88[1]	*Calypogeia* spp.	55[1]	44[1]
Sphagnum balticum	3[1]	69[1]	*Cephalozia* spp.	65[1]	75[1]
— *magellanicum*	76[1]	100[5]	*Odonthoschisma sphagni*	38[1]	19[1]
— *rubellum*	72[1]	94[3]	*Cladonia rangiferina*	69[1]	25[1]
Mylia anomala	21[1]	100[1]	— *sylvatica* coll.	55[1]	—
			— spp.	65[1]	31[1]

Tillägg: *Vaccin. - Sph. parvif.* - ass.: *Betula pubescens* (7[1]), *Dicranum bergeri* (10[1]), *D. fuscescens* (3[1]), *D. robustum* (17[1]), *D.* spp. (3[1]), *Sphagnum cuspidatum* (7[1]), *S. fuscum* (21[1]), *S. nemoreum* (7[1]), *Lepidozia* spp. (10[1]), *Lophozia* spp. (14[1]), *Orthocaulis* spp. (3[1]); *Call. vulg. - Sph. mag.* - ass.: *Myrica gale* (19[1]), *Trichophorum caespitosum* (6[1]), *Cladopodiella fluitans* och *Gymnocolea inflata* (6[1]), *Dicranum bergeri* (13[1]), *Sphagnum fuscum* (6[1]), *S. papillosum* (6[1]), *S. tenellum* (19[1]).

i de tidigare beskrivna myrkantsamhällena. Fältskiktet domineras i övrigt av *Eriophorum vaginatum*. Bottenskiktet domineras helt av *Sphagnum parvifolium*. Denna art jämte *Hylocomium splendens* och *Isopterygium elegans* är preferensarter för associationen. *Pleurozium schreberi* når inom begränsade områden hög täckningsgrad. I bottenskiktet förekommer ofta *Dicranum rugosum, Sphagnum magellanicum* och *S. rubellum*. Bland levermossorna märks främst *Cephalozia* spp. och *Calypogeia* spp. De växer i djupare liggande gropar. Lavar finns i mer än hälften av de analyserade rutorna, främst *Cladonia rangiferina*.

— Associationen är typisk för alla skogar, som finns på mossen (bestånd 8, 10, 11, 18, 39, 41, fig. 4). Skogarna är inskränkta till ganska smala zoner närmast laggarna och drågen. De intar bredare partier

Tabell 8. Eriophorum vaginatum - zoneringen

	Eriophorum vaginatum - Sphagnum cuspidatum - Cladopodiella fluitans - ass.	*Eriophorum vaginatum - Sphagnum cuspidatum* - ass.	*Eriophorum vaginatum - Sphagnum magellanicum* - ass.	*Eriophorum vaginatum - Sphagnum rubellum* - ass.		*Eriophorum vaginatum - Cladonia rangiferina* - ass.
				Trichophorum caespitosum - var.	*Empetrum nigrum* - var.	
Antal rutor och bestånd	25:5	25:5	26:5	25:5	20:4	21:5
Eriophorum vaginatum	40[1]	56[1]	92[1]	100[1]	100[1]	100[1]
Sphagnum cuspidatum	100[2]	100[5]	81[1]	—	—	—
Rhynchospora alba	64[1]	100[1]	96[1]	8[1]	—	5[1]
Cladopodiella fluitans ..... / *Gymnocolea inflata*	24[1]	80[1]	65[1]	—	—	—
Sphagnum tenellum	20[1]	92[1]	77[1]	—	—	—
Drosera anglica	12[1]	44[1]	38[1]	4[1]	—	—
Sphagnum papillosum	12[1]	48[1]	65[4]	8[2]	5[1]	—
— *balticum*	12[1]	92[1]	100[2]	96[1]	15[1]	43[1]
— *magellanicum*	8[1]	28[1]	96[4]	80[3]	15[2]	5[1]
Andromeda polifolia	—	36[1]	96[1]	100[1]	90[1]	95[1]
Vaccinium oxycoccos	4[1]	44[1]	96[1]	100[1]	100[1]	100[1]
Calluna vulgaris	—	4[1]	58[1]	100[3]	90[2]	95[2]
Drosera rotundifolia	—	4[1]	81[1]	64[1]	100[1]	19[1]
Trichophorum caespitosum..	—	—	19[1]	20[1]	5[1]	10[1]
Sphagnum rubellum	—	20[1]	69[2]	100[5]	80[2]	86[1]
Cephalozia spp.	—	16[1]	30[1]	80[1]	95[1]	62[1]
Lepidozia spp.	—	—	30[1]	28[1]	15[1]	24[1]
Odonthoschisma sphagni ...	—	24[1]	58[1]	36[1]	—	81[1]
Sphagnum fuscum	—	—	—	44[3]	90[5]	10[1]
— *imbricatum*	—	—	—	16[1]	45[5]	24[1]
Mylia anomala	—	—	19[1]	84[1]	100[1]	24[1]
Betula nana	—	—	12[1]	24[1]	10[1]	95[1]
Empetrum nigrum	—	—	—	8[1]	65[2]	67[1]
Rubus chamaemorus	—	—	8[1]	64[1]	75[1]	76[1]
Cladonia rangiferina	—	—	8[1]	68[1]	60[1]	90[4]
— *sylvatica* coll.	—	—	4[1]	32[1]	35[1]	90[4]
— spp.	—	—	—	8[1]	—	76[1]
Cornicularia aculeata	—	—	4[1]	8[1]	—	43[2]
Dicranum bergeri	—	—	—	4[1]	—	29[1]
Pleurozium schreberi	—	—	—	4[1]	5[1]	33[1]

endast då laggarna utdikats. De finns väster om Björnekullakärret, Nybyggetlaggen, Lilla Lövölaggen, Hädingelaggen, väster om Kalvsjön och Blådöpets övre delar. Stigningen från laggen upp på mosseplanet uppgår sällan till mer än 1 m och är oftast betydligt mindre.

Jämförbara samhällen finns på Åkhultmyren (cf. MALMER 1962, sid. 132, 136—139) och Komosse (cf. OSVALD 1923, sid. 69, 73—76, 135—137, 230—232).

Store mosses vegetation jämförd med några andra sydsvenska myrars

För att ge en bild av hur de olika växtsamhällena förekommer tillsammans på Store mosse, har de grupperats i zoneringar motsvarande de av MALMER (1962) beskrivna. Zoneringarna är angivna nederst i tabell 1. Av denna tabell framgår också vilka associationer som ingår i dem.

Ute på mosseplanen förekommer endast *Eriophorum vaginatum*-zoneringen (tab. 8). Alla serierna är representerade. *Eriophorum vaginatum - Sphagnum tenellum* - associationen är dock ej medtagen i denna tabell, då endast ett fåtal rutor har analyserats. Zoneringen är, särskilt vad *Sphagnum*-arternas frekvens beträffar, mycket lik »*Eriophorum vaginatum* zonation» på Åkhultmyren (MALMER op. c. sid. 111). *Erica tetralix* saknas emellertid där. Denna art förekommer spridd över alla mosseplan på Store mosse men är ej så vanlig som på Komosse, där den i vissa fall är dominerande (cf. OSVALD 1923, sid. 95). *Carex limosa* och *Scheuchzeria palustris* saknas på mosseplanen på Store mosse men finns på Komosse, Blängen och Breafallmossen (OSVALD 1923, DU RIETZ 1950 a, b). På Blängen förekommer också *Sphagnum dusenii* på mosseplanet (DU RIETZ 1950 a).

Mosseplanens vegetation är mycket likartad på Komosse och Blängen (DU RIETZ 1949, 1950 a). De är typexempel för förbandet *Rubellion,* som även finns i västra Småland (DU RIETZ 1950 c) och nordvästra Skåne (WALDHEIM & WEIMARCK 1943). Detta förband skiljer sig från *Rubello-Fuscion,* som det beskrivits t.ex. från Breafallmossen, genom förekomst av bl.a. *Erica tetralix, Drosera anglica, D. intermedia, Sphagnum imbricatum* och *S. papillosum.* Inom *Rubello-Fuscion* har *Sphagnum balticum* och *S. fuscum* större betydelse än i *Rubellion,* medan *Sphagnum magellanicum* och *S. rubellum* är mindre framträdande (DU RIETZ 1949, 1950 a, b). Mosseplanens växtsamhällen på Store mosse får anses höra till *Rubellion,* även om det finns vissa likheter med *Rubello-Fuscion,* eftersom *Erica tetralix* har relativt liten betydelse och *Sphagnum balticum* finns allmännare än på t.ex. Komosse. Mosseplanets vegetation på Store mosse står dock närmare *Rubellion,* än vad »*Eriophorum vaginatum* zonation» på Åkhultmyren gör.

Mossekantsluttningen på Store mosse beväxes dels av kantskog med *Vaccinium - Sphagnum parvifolium* - associationen dels av den trädlösa *Calluna vulgaris - Sphagnum magellanicum* - associationen. *Ledum palustre* har ingen nämnvärd betydelse inom kantskogarna, medan där-

emot *Betula nana* kan vara helt dominerande i fältskiktet. Sistnämnda art bildar på Store mosse de största bestånden i södra Sverige. Kantskogsvegetationen överensstämmer i övrigt med den på Åkhultmyren (MALMER 1962). Den liknar också mycket mossekantskogen på Blängen (cf. DU RIETZ 1950 a, 1959) och bör föras till det *Ledum*-fria *Parvifolion* (DU RIETZ 1949). *Calluna vulgaris - Sphagnum magellanicum* - associationen intar stora delar av Store mosses kantsluttningar. Vegetationen inom dessa överensstämmer närmast med »Der heidenartige Randkomplex» på Komosse (OSVALD 1923, sid. 290). Dylika trädlösa mossekantsluttningar är typiska för mossarna i västra Götaland (cf. DU RIETZ 1950 c, 1959).

Scheuchzeria palustris-zoneringens växtsamhällen representerar en typ av extremfattigkärrvegetationen (*Euapiculation,* DU RIETZ 1949), som har en mycket begränsad utbredning i kärren på Store mosse. Liknande samhällen finns på Komosse men förefaller att saknas på Åkhultmyren och Blängen (opp. c.).

Växtsamhällena inom *Menyanthes trifoliata*-zoneringen tillhör likaledes extremfattigkärrvegetationen (*Euapiculation,* DU RIETZ op. c.). Den karakteriserar laggar och dråg på Store mosse. Både »*Eriophorum angustifolium* zonation» och »*Menyanthes trifoliata* zonation» på Åkhultmyren liknar denna zonering. Jämförelsen är dock svår att göra, eftersom vissa arter, främst *Sphagnum apiculatum,* förekommer allmännare på Store mosse. DU RIETZ (1950 a, b, 1959) har urskilt tre zoner i laggkärren. »The lagg zone adjacent to the bog» motsvarar på Store mosse *Carex rostrata* - varianterna. »The central lagg zone» utgöres av *Eriophorum angustifolium* - varianten och *Utricularia* - varianten. Vissa samhällen inom kärrdrågen på Blängen är också jämförbara med samhällen inom *Menyanthes trifoliata* - zoneringen. »The lagg zone adjacent to the mineral ground» har stora likheter med myrkantsamhällena på Store mosse. Samhällena på Stora gungflyet och i Blådöpet har också myrkantkaraktär. De motsvarar närmast medelfattigkärrvegetationen (*Subsecundo-Apiculation,* DU RIETZ 1949, 1954).

Inom *Carex panicea*-zoneringens växtsamhällen domineras bottenskiktet delvis av brunmossor. Dessa växtsamhällen representerar en typ av medelrikkärrvegetation (*Warnstorfio-Scorpidion,* DU RIETZ op. c.), som saknar motsvarighet på Åkhultmyren, men har en viss likhet med många av samhällena inom »Moosreiche Kraut-Grasmoore, Eubryo-paludiherbosa» på Komosse (OSVALD 1923, sid. 178—186) och medelrikkärrvegetationen på Blängen. Även på Store mosse förekommer de blott på få platser. I Björnekullakärret finns en ännu rikare kärrtyp, som ej beskrivits här.

Vattenkemiska undersökningar

Metodik

I anslutning till vegetationsanalyserna har vattenprov tagits inom flertalet av de undersökta bestånden. Proven har tagits från det fria vattnet ovan torven inom några av de analyserade rutorna inom bestånden. Då mossor nått ovan vattenytan har dessa avlägsnats före provtagningen. Inom randskogarna har hål grävts varefter vattnet fått sippra ut i hålen under några dagar, innan proven tagits.

pH har bestämts elektrometriskt med hjälp av glaselektrod direkt i det insamlade vattnet.

Elektriska ledningsförmågan har mätts mellan platinaelektroder kopplade i en Wheatstone-brygga. Cellkonstanten var c. 0.24. Värdena har räknats om för att gälla vid 20° C och multiplicerats med 10^6. De har reducerats med ledningsförmågan förorsakad av vätejonerna (SJÖRS 1948, 1952, MALMER 1960). De betecknas med $\varkappa_{red}$.

Allmän översikt

De lägsta pH-värdena (3,7) härrör från mossens kantområden. Dessa värden är 0,4 pH-enheter lägre än de lägsta värdena ute på mosseplanen. Detta tyder på att en surare miljö är förhärskande inom kantområdena, vilket är helt i överensstämmelse med vad MALMER (1962) funnit på Åkhultmyren.

Inom kärrvegetationen är pH och $\varkappa_{red}$ ganska varierande. Låga pH-värden har uppmätts i nära anslutning till mossen men också inom det vidsträckta kärrpartiet vid Lilla Lövö. Stora pH-skillnader kan föreligga på kort avstånd. Detta märks främst inom övergångszonerna mellan mosse och kärr. I en bandprofil från Nybyggetlaggen steg pH från 4,1 till 6,1 och $\varkappa_{red}$ från 14 till 39 på 5 m. Vid övergången mellan mossen och Blådöpet har också stora skillnader noterats. Den största differensen föreligger inte mellan mosse- och kärrvegetation utan mellan *Menyanthes trifoliata - Sphagnum apiculatum* - associationen med pH 4,1 och $\varkappa_{red}$ 23 och *Menyanthes trifoliata - Sphagnum inundatum* - associationen i Blådöpets kant med pH 5,0 och $\varkappa_{red}$ 32. Liknande differenser har beskrivits både av MALMER (1962) och SJÖRS (1948). De högsta värdena på pH och $\varkappa_{red}$ har konstaterats inom Hädingelaggen.

Av figur 6 framgår att det föreligger en god korrelation mellan pH och $\varkappa_{red}$. MALMER (1962) har konstaterat, att vid pH c. 6 håller sig $\varkappa_{red}$ vid c. 70. Detta gäller också i viss mån för Store mosse. Inom en del myrkantsamhällen, främst på Stora gungflyet, föreligger dock en markant avvikelse, eftersom pH ligger omkring 6,5 medan $\varkappa_{red}$ håller sig omkring 35.

Variationen i vegetationen i relation till pH och $\varkappa_{red}$

I fråga om pH och $\varkappa_{red}$ visar mätningarna inte några större skillnader mellan myrvidd- och myrkantsamhällena. Detta är helt i överensstämmelse med vad MALMER (1962) funnit. Inom myrkantsamhällena når $\varkappa_{red}$ aldrig så låga värden som inom myrviddsamhällena. Inom zoneringarna har inga större differenser konstaterats mellan pH, $\varkappa_{red}$ och de olika växtsamhällena. Det tycks dock föreligga lägre värden inom *Sphagnum magellanicum - papillosum* - serien än inom *Sphagnum auriculatum - cuspidatum* - serien. Det föreligger en tydlig relation mellan växtsamhällen utefter fattig - rik - variationsriktningen och pH och $\varkappa_{red}$. *Eriophorum vaginatum* - zoneringen uppvisar låga värden både för pH och $\varkappa_{red}$. Mätvärdena visar sedan en kontinuerlig höjning till de högsta inom *Carex panicea* - zoneringen (fig. 6). Inom *Scheuchzeria palustris* - zoneringen är både pH och $\varkappa_{red}$ lika låga som inom samhällen på mosseplanen. Detta visar, att det inte finns någon distinkt gräns mellan växtsamhällen tillhörande mossarna och kärren, då det gäller pH och $\varkappa_{red}$. Inom *Carex panicea* - zoneringen varierar pH och $\varkappa_{red}$ omkring 6,9 respektive 65. Myrkantsamhällena är också fördelade längs fattig - rik - variationsriktningen. Denna variation har också konstaterats vid de vattenkemiska undersökningarna. Inom *Vaccinium - Sphagnum parvifolium* - associationen är pH 3,9 och $\varkappa_{red}$ 25 medan *Potentilla palustris - Equisetum fluviatile* - associationen har ett pH på omkring 5,5 och $\varkappa_{red}$ 36.

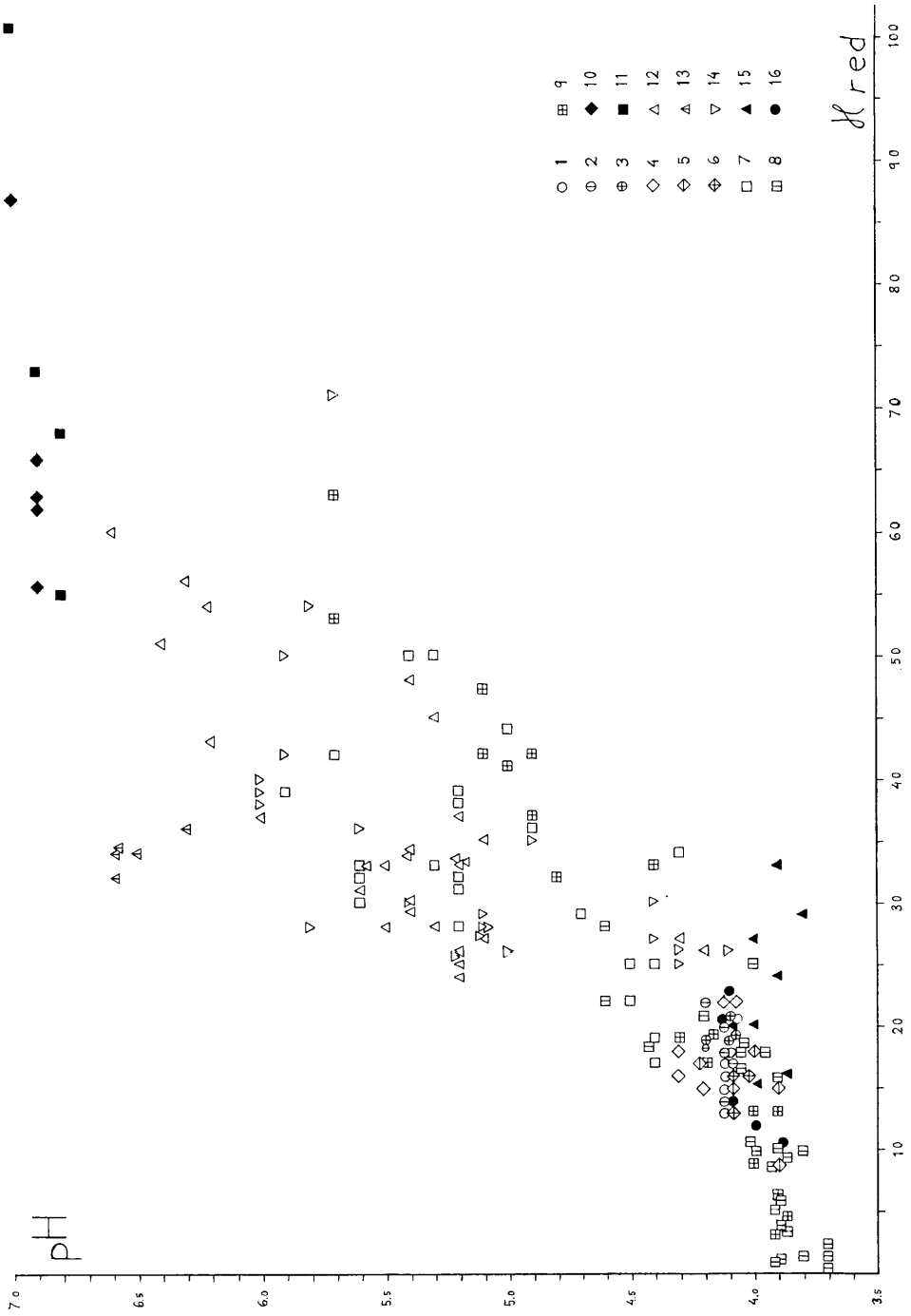
Inom Åkhultmyren föreligger en tydlig korrelation mellan fattig - rik - variationsriktningen inom vegetationen och pH och $\varkappa_{red}$ (MALMER 1962). En pH-differens på 2 enheter och en skillnad i $\varkappa_{red}$ på upp till 40 enheter har konstaterats mellan de fattigaste samhällena inom »*Eriophorum vaginatum* zonation» och de rikaste inom »*Menyanthes trifoliata* zonation».

Summary

Store mosse is situated in southwestern Götaland (South Sweden) in Jönköping county about 15 km NW of the town of Värnamo.

From a geomorphologic point of view this area is situated within the South Småland archaean plain (BEHRENS 1960). The height above sea-level is 165 m. The bedrocks consist of gneiss. The loose deposits are composed of morain and sand.

Store mosse is built up of 3 bogmire areas around the partly drained lake Kävsjön (fig. 1). For the main part the mire consists of bogs. The fens (Sw. kärr), which are extremely poor, occupy only small areas in the margins of


pH
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
10
20
30
40
50
60
70
80
90
100
Hred
1
2
3
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the mire (fig. 2). The fen plant limit (Sw. kärrväxtgränsen) is indicated on the map. Blådöpet is a fen soak. Such fen soks are typical of large mires in southwestern Götaland.

The vegetation has been studied within a number of sites (Sw. bestånd) (cf. MALMER 1962) marked on figure 2. The plant communities have first been divided into two groups, mire expanse communities and mire margin communities. The mire expanse communities have been grouped in 6 series (tab. 1). The series have been divided into a varying number of assocations (tab. 2—5). In the mire margin communities 3 associations have been distinguished (tab. 6 and 7). The tables 2—8 are based on small square frequency and characteristic degree of cover (cf. MALMER 1962, p. 49).

Within most of the studied sites pH and specific conductivity ($\varkappa_{red}$) have been measured on water taken in the open water above the peat surface or in pits dug some days before. The results of these measurements are given in figure 6.

Litteraturförteckning

ALLVIN, J. 1852. Beskrifning öfver Östbo Härad i Jönköpings Län. Jönköping.

ARNELL, S. 1956. Illustrated moss flora of Fennoscandia. I. Hepaticae. — Lund.

BEHRENS, S. 1960. The main features of the bedrock morphology in South and Central Sweden. — Sv. Geogr. Årsbok 36. Lund.

DU RIETZ, G. E. 1942. Rishedsförband i Torneträskområdets lågfjällbälte. — Sv. Bot. Tidskr. 36. Uppsala.

— 1949. Huvudenheter och huvudgränser i svensk myrvegetation. — Ibid. 43.

— 1950 a. Phytogeographical mire excursion to the Billingen-Falbygden district in Västergötland (Southwestern Sweden). — 7. Int. Bot. Congr. Stockholm 1950. Excursion Guides. A II b 1. Uppsala.

— 1950 b. Phytogeographical mire excursion to northeastern Småland and Östergötland. — Ibid. A II 2 (second part).

— 1950 c. Småländska myrar. — Natur i Småland. Göteborg.

— 1954. Die Mineralbodenwasserzeigergrenze als Grundlage einer natürlichen Zweigliederung der nord- und mitteleuropäischen Moore. — Vegetatio 5—6. Den Haag.

— 1957. Vegetation analysis in relation to homogenousness and size of sample areas. — 8. Congr. Intern. Bot. Paris 1954. Compt. rend. des séances et rapp. et comm. déposés lors du congrès dans les sec. 7 et 8. Paris.

Fig. 6. Relationen mellan pH och $\varkappa_{red}$. Prov från: 1. *Eriophorum vaginatum - Sphagnum cuspidatum - Cladopodiella fluitans* - associationen, 2. *Eriophorum vaginatum - Sphagnum cuspidatum* - associationen, 3. *Eriophorum vaginatum - Sphagnum magellanicum* - associationen, 4. *Scheuchzeria palustris - Sphagnum auriculatum* - associationen, 5. *Scheuchzeria palustris - Sphagnum dusenii* - associationen, 6. *Scheuchzeria palustris - Sphagnum papillosum* - associationen, 7. *Menyanthes trifoliata - Sphagnum inundatum* - associationen, 8. *Menyanthes trifoliata - Sphagnum apiculatum* - associationen, 9. *Menyanthes trifoliata - Sphagnum papillosum* - associationen, 10. *Carex panicea - Scorpidium scorpioides* - associationen, 11. *Carex panicea - Campylium stellatum* - associationen, 12. *Calla palustris* - varianten och *Carex canescens* - varianten inom *Potentilla palustris - Equisetum fluviatile* - associationen, 13. *Sparganium minimum* - varianten inom *Potentilla palustris - Equisetum fluviatile* - associationen, 14. *Potentilla palustris - Sphagnum apiculatum* - associationen, 15. *Vaccinium - Sphagnum parvifolium* - associationen, 16. *Calluna vulgaris - Sphagnum magellanicum* - associationen.

— 1959. Blängen, ett mossemyrreservat på Billingen. — »Från Falbygd t. Vänerkust» utg. Skarab. l. naturskyddsfören. Lidköping.
— 1961. Växtgeografins grunder — Stencilerad.
HJELMQVIST, S. 1953. Berggrunden utanför fjällkedjan. — Atlas över Sverige 7—8. Stockholm.
HULTÉN, E. 1950. Atlas över växternas utbredning i Norden. Fanerogamer och ormbunkar. — Stockholm.
HYLANDER, N. 1955. Förteckning över Nordens växter. 1. Kärlväxter. — Lund.
JENSEN, C. 1939. Skandinaviens bladmossflora. — København.
JOHNSSON, G. 1956. Glacialmorfologiska studier i södra Sverige. — Medd. f. Lunds univ. geogr. inst. Avh. 30. Lund.
LUNDQUIST, G. 1953. Jordarterna. — Atlas över Sverige 15—16. Stockholm.
MAGNUSSON, A. H. 1936. Förteckning över Skandinaviens växter. 4. Lavar. — Lund.
MALMER, N. 1959. De svenska Sphagnum-arternas systematik och ekologi. — Stencilerad.
— 1960. Some ecologic studies on lakes and brooks in South Swedish uplands. — Bot. Notiser 113. Lund.
— 1962. Studies on mire vegetation in the archaean area of southwestern Götaland (South Sweden). I. Vegetation and habit condition on the Åkhult mire. — Opera bot. 7: 1. Lund.
NILSSON, N. 1953. Om södra Sveriges senkvartära historia. — Geol. fören. i Stockholm förhandl. 75. Stockholm.
NYHOLM, E. 1954—1965. Illustrated moss flora of Fennoscandia. II. Musci. Fasc. 1—4. — Lund.
OLAUSSON, E. 1957. Das Moor Roshultmyren. — Lunds univ. årsskr. N.F. Avd. 2 53: 12. K. Fysiogr. sällsk. handl. N.F. 68: 12. Lund.
OSVALD, H. 1923. Die Vegetation des Hochmoores Komosse. — Sv. växtsoc. sällsk. handl. 1. Uppsala.
— 1925. Käfsjö Stormosse. — Sveriges natur 1925. Stockholm.
— 1930. Södra Sveriges mossetyper. — Sv. Geogr. Årsbok 1930. Lund.
PERSSON, Å. 1961. Mire and spring vegetation in an area north of Lake Torneträsk, Torne lappmark. Sweden. I. Description of the vegetation. — Opera bot. 6: 1. Lund.
SJÖRS, H. 1946. Myrvegetation i övre Långanområdet i Jämtland. — Ark. bot. 33 A: 6. Uppsala.
— 1948. Myrvegetation i Bergslagen. — Acta phytogeogr. suec. 21. Uppsala.
— 1952. On the relation between vegetation and electrolytes in North Swedish mire waters. — Oikos 2. Lund.
— 1956. Nordisk växtgeografi. — Stockholm.
STEEN, E. 1954. Vegetation och mark i en uppländsk beteshage med särskild hänsyn till betesgångens inverkan. — Stat. Jordbruksförsök. Medd. Nr. 49. Stockholm.
SVENSSON, G. 1964. Vegetationsundersökningar inom Kävsjöområdet 1964. — Utredning utförd på uppdrag av Statens Naturvårdsnämnd. Stencilerad.
WALDHEIM, S. 1944. Die Torfmoosvegetation der Provinz Närke. — Lunds univ. årsskr. N.F. Avd. 2 40: 6. K. Fysiogr. sällsk. handl. N.F. 55: 6. Lund.
— & WEIMARCK, H. 1943. Bidrag till Skånes Flora 18. Skånes myrtyper. — Bot. Notiser 1943. Lund.
WIBECK, E. 1936. Kring Kävsjön, Smålands märkligaste fågelsjö. — Sv. Skogsvårdsfören. tidskr. 1936, häfte II. Stockholm.

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Contributions to the Genus Astragalus L. from West Pakistan

I. Subgenera Pogonophace and Astragalus

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Recently the author published a revision of the genus *Astragalus* L. from West Pakistan and N.W. Himalayas (ALI 1961). Here 106 species have been recognized from the area under consideration. Since the publication of this paper some more material, collected by the British Museum Expedition to Chitral in 1958, was received for identification from the British Museum (Natural History), London. The present opportunity has been taken to give an account of the additional material belonging to the subgenera *Pogonophace* and *Astragalus*. The subgeneric classification followed is the same as outlined earlier by ALI (1958, 1961), thus all the taxa having penicillate stigma and basifixed hairs have been placed under *Pogonophace*. The subgenus *Astragalus* (=*Phaca*) has been accepted in a broader sense including *Hypoglottis* and *Trimeniaeus*.

Out of fifteen species of the two subgenera referred to above, two species are new to science and two species, hitherto known from Central Asia, are being recorded for the first time from West Pakistan. The distribution range of four of the species, viz., *A. falconeri* Bunge, *A. affghanus* Boiss., *A. ammophilus* Kar. & Kir., and *A. macropterus* DC., has considerably enlarged.

The species representing the recently collected material only have been enumerated. In each case information about the geographical distribution and flowering period has also been given.

Enumeration of species

Subgenus *Pogonophace*

1. *Astragalus* (*Sesbanella*) *falconeri* Bunge, Astrag. 1: 4. 1868; 2: 2. 1869.

Representative Specimens: Chitral: Yarkhun, between 36°30′N, 72°40′E and 36°48′N, 73°5′E, 8,500 ft., magenta, pale green underneath, rocky river bed in sandy soil, 17.6.1958, S. A. BOWES LYON 944 (BM); Urtsun Gol, S.W. of Drosh, 7,000 ft., on dry stony ground, corolla pink, 1.9.1958, J. D. A. STAINTON 3195 (BM).

Distribution: Kashmir (ALI 1961) and Chitral.

Flowering Period: June—September.

2. *Astragalus* (*Coluteocarpus*) *coluteocarpus* Boiss. Diagn. Pl. Orient. Nov. 1(9): 65. 1849.

Representative Specimens: Chitral: Yarkhun (Gurawr), between 36°30′N, 72°40′E and 36°48′N, 73°5′E, 10,000 ft., pale green and dull purple, moist stony pasture land, height 4 ft., 16.6.1958, S. A. BOWES LYON 924 (BM); Shoghot Aviret, 36°1′N, 71°45′E, 7,500 ft., stream bed, flowers pale yellow changing to dull purple, height 4 ft., 30.5.1958, S. A. BOWES LYON 743 (BM).

Distribution: W. Pakistan, N.W.F. Province; Kashmir; India, N. Punjab; Russia, Pamir Alai (GONTSCHAROV 1946); Turkestan.

Flowering Period: May—June.

3. *Astragalus* (*Falcinellus*) *amherstianus* Royle ex Benth. in Royle, Illustr. Bot. Himal. Mount.: 199. 1835.

Representative Specimen: Chitral: Arkari Gol, W. of Tirich Mir, 8,500 ft., on stony ground, calyx pink, corolla pale pink, 8.6.1958, J. D. A. STAINTON 2597 (BM).

Distribution: W. Pakistan, Punjab, N.W.F. Province, Baluchistan; Kashmir; India, Kumaun, Tehri Garhwal, N. Punjab, 6,000—13,000 ft.

Flowering Period: April—June.

4. *Astragalus* (*Pendulina*) *mirabilis* Lipsky in Acta Horti Petropol. 26: 155. 1910.

[Syn. *A. shohotensis* Ali MS. (nomen nudum)]

Type: Southern Tadzhikistan-Baldschuan, Kulab and Darwaz (LE-not seen).

Lipsky has cited nine specimens along with the original description. All these specimens are in the Leningrad Herbarium. It is desirable to choose one of them as lectotype.

Representative Specimens: Chitral: Shoghot, 36°1′N, 71°45′E, 10,000 ft., pale greenish yellow, growing beneath kennel, 30.5.1958, S. A. BOWES LYON 872 (BM); Chitral Gol, west of Chitral, 10,000 ft., amongst dense herbs, corolla yellowish white, 14.6.1958, J. D. A. STAINTON 2675 (BM).

Distribution: Central Asia, Pamir Alai (BORISSOVA 1946); Chitral.

Flowering Period: May—June.



Fig. 1. Holotype of *A. gahiratensis* Ali.

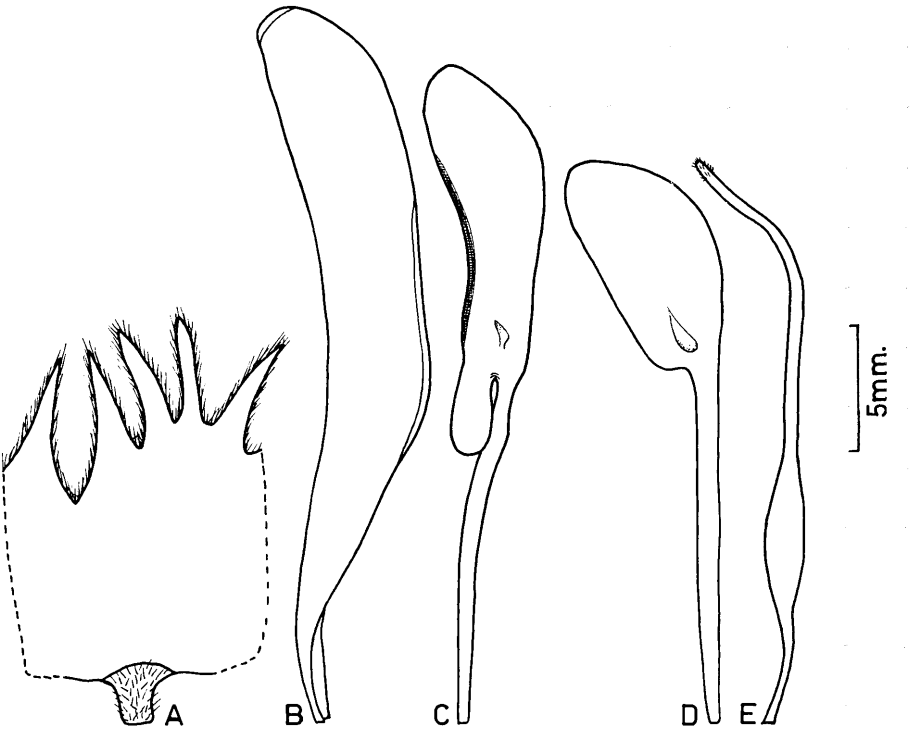


Fig. 2. Floral parts of *A. gahiratensis* Ali (Holotype). A Calyx. — B Vexillum. — C Wing. — D Keel. — E Ovary.

This is the first record of this species from West Pakistan (Chitral); previously it was regarded as a Central Asian endemic (BORISSOVA 1946).

5. *Astragalus* (*Pendulina*) *gahiratensis* Ali sp. nov.

Radix crassa et lignosa. Caulis reductus. Folia imparipinnata, stipulis lateralibus c. 10—15 mm. longis, linearis vel obovatis, acutis, glabris vel sparse pilosis; rhachide c. 1.7—7.0 cm. longa, albo-pilosa; petiolo c. 1.7—4.0 cm. longo. Foliola 13—19, petiolulo quam c. 1 mm. longiore, lamina c. 7—32 mm. longa, c. 2—3 mm. lata, lineata, margine integra, apice acuto. Inflorescentia 3—8-flora, racemosa, pedunculo c. 3—7 cm. longo. Bracteae c. 4—7 mm. longae, nigro-pilosae. Pedicelli c. 1—2 mm. longi. Calyx pilosus, parte connata obliqua, supra c. 7 mm. longa, subtus c. 10 mm. longa, dentibus c. 5—6 mm. longis, plerumque nigro-pilosis. Vexillum c. 26—29 mm. longum, c. 8—9 mm. latum; alis c. 24—26 mm. longis, c. 4 mm. latis, clave c. 13—14 mm. longa, auriculis c. 3 mm. longis. Carina c. 21—23 mm. longa, c. 4—5 mm. lata, clave c. 13—14 mm. longa.

Stamina diadelphia, 9+1, filamentis c. 21—23 mm. longis. Ovarium stipitatum (stipite c. 4—5 mm. longo), c. 6 mm. longum, c. 1.5 mm. latum, glabrum, partim biloculare; stylus c. 12—13 mm. longus, c. 4—5 mm. ab apice superne curvatus; stigma barbatum. Fructus non vidi.

Holotype: West of Gahirat, 35°40′N, 71°46′E, 8,500 ft., cool position in woodland clearing; buds pale dull purple, opening greenish white, 21.5.1958, S. A. BOWES LYON 696 (BM). (Fig. 1).

It is closely related to *A. mirabilis* Lipsky, from which it differs in (i) size and shape of leaflets (ii) size of peduncle and (iii) number of flowers per inflorescence.

Flowering Period: June.

Subgenus ***Astragalus***

6. *Astragalus (Oxyglottis) tribuloides* Delile, Fl. Aegypt. Illustr.: 70. 1813.

Representative Specimen: Chitral: Gasin, 36°36′N, 70°55′E, 9,300 ft., pale lilac, dry sandy soil, 17.6.1958, S.A. BOWES LYON 937 (BM).

Distribution: Libya; Tunisia; Egypt; Israel; Jordan; Syria; Iraq; Arabia; Persia; Afghanistan; Kashmir; W. Pakistan, Baluchistan, Punjab, N.W. F. Province; Russia.

Flowering Period: February—June.

7. *Astragalus (Oxyglottis) ammophilus* Kar. & Kir. in Bull. Soc. Nat. Moscou 15: 335. 1842.

var. *persipolitanus* (Boiss.) Ali in Kew Bull. 1958: 306. 1958.

Representative Specimens: Chitral: Agram, Arkari Gol, W. of Tirich Mir, 10,500 ft., on stony ground, corolla red, 10.6.1958, J. D. A. STAINTON 2640 (BM).

Distribution: W. Pakistan, Baluchistan, Chitral; Afghanistan; Persia, Russia (GROSSHEIN 1946).

Flowering Period: May—June.

8. *Astragalus affghanus* Boiss. Fl. Or. 2: 1095. 1872.

Representative Specimens: Chitral: Arkari Gol, W. of Tirich Mir, 8,500 ft., on stony ground, corolla pink, 8.6.1958, J. D. A. STAINTON 2601 (BM); Lutko, between 35°55′N, 71°18′E and 36°6′N, 71°48′E, 8,000 ft., pale bluish pink, dry barren hillside, 4.6.1958, S. A. BOWES LYON 1053 (BM).

Distribution: W. Pakistan, Baluchistan, Chitral.

Flowering Period: March—June.

9. *Astragalus (Hemiphaca) macropterus* DC. Prodr. 2: 283. 1825.

Representative Specimens: Chitral: Othor Gol, S. of Tirich Mir, 9,000 ft., on dry rocks, dumps 3 ft. high, 3 ft. across, flowers white, 25.6.1958,

J. D. A. STAINTON 2736 (BM); Shah Jinali, 36°46′N, 72°50′E, 10,500 ft., dry stony bank facing north, flowers yellow, 28.6.1958, S. A. BOWES LYON 1020 (BM).

Distribution: W. Pakistan, Chitral; Kashmir; Russia, Irtysh, Altai, Angara-Sayan, Balkash, Pamir Alai, Tien Shan, Dzungaria-Tarbagatai; Chinese Turkistan (GONTSCHAROV & BORISSOVA 1946).

Flowering Period: June—July.

10. *Astragalus* (*Hemiphaca*) *melanostachys* Benth. ex Bunge, Astrag. 1:21. 1868; 2:22. 1869.

Representative Specimens: Chitral: Golen Gol, 36°1′N, 72°10′E, 12,500 ft., stream bed, dull pale purple, 14.7.1958, S. A. BOWES LYON 77 (BM); Shandur, 36°4′N, 72°30′E, 12,200 ft., edge of lake, pale pink, also in Hindu Raj (Drosh), 23.7.1958, S. A. BOWES LYON 85 (BM); Shishi, between 35°35′N, 71°48′E and 35°45′N, 72°0′E, 7,000 ft., stream bed, dull purple, 7.5.1958, S. A. BOWES LYON 215 (BM); Shandur, 36°4′N, 72°30′E, 12,200 ft., edge of lake, moist soil with stones, pale pink, 23.7.1958, S. A. BOWES LYON 92 (BM); north eastern Afghanistan, Prov. Nuristan, Wanasgul valley, 10,000 ft., beside stream, 12.8.1956, WILFRED THESIGER 1606 (BM).

Distribution: W. Pakistan, N.W.F. Province; Kashmir; India, N. Punjab, Kumaun, Garhwal; Afghanistan; Tibet; Russia, Pamir Alai (BORISSOVA 1946).

Flowering Period: May—August.

11. *Astragalus* (*Diplotheca*) *graveolens* Buch.-Ham. ex Benth. in Royle, Illustr. Bot. Himal. Mount.: 199. 1835.

Representative Specimen: Chitral: Ziarat (Lowari Pass), 6,500 ft., amongst shrubs, height 3 ft., corolla yellow, J. D. A. STAINTON 2583 (BM).

Distribution: W. Pakistan, W. Punjab, N.W.F. Province, Baluchistan; Kashmir; India, E. Punjab, Kumaun; Afghanistan; China, Yunnan.

Flowering Period: May—August.

12. *Astragalus* (*Cenantrum*) *frigidus* (L.) A. Gray in Proc. Amer. Acad. Sc. 6:219. 1864.

Representative Specimens: Chitral: Chumarkhan Pass, E. of Mastuj, 13,000 ft., on deep ground, calyx bluish green, corolla yellow, 16.7. 1958, J. D. A. STAINTON 2922 (BM); Shandur Pass, S.E. of Mastuj, 12,000 ft., amongst willows, at edge of stream, height 3.5 ft., corolla yellow, 10.8.1958, J. D. A. STAINTON 3087 (BM); North-eastern Afghanistan, Prov. of Panshir, Chamar Pass, 13,000 ft., 2.8.1956, WILFRED THESIGER 1324 (BM).

Distribution: W. Pakistan, N.W.F. Province; Kashmir; China, Yunnan, Szechuan (PETER-STIBEL 1938); India, N. Punjab; Russia, Siberia, Anadyr, Karelian Lapland, Dvina-Pechora; Okhotsk, Kamchatka; Balkan Peninsula; Asia Minor; Sweden; Norway; Denmark; Finland; Estonia; Latvia; Germany; Lithuania; Poland; Czechoslovakia; Hungary; Austria; Switzerland;



Fig. 3. Holotype of *A. pseudochlorostachys* Ali.

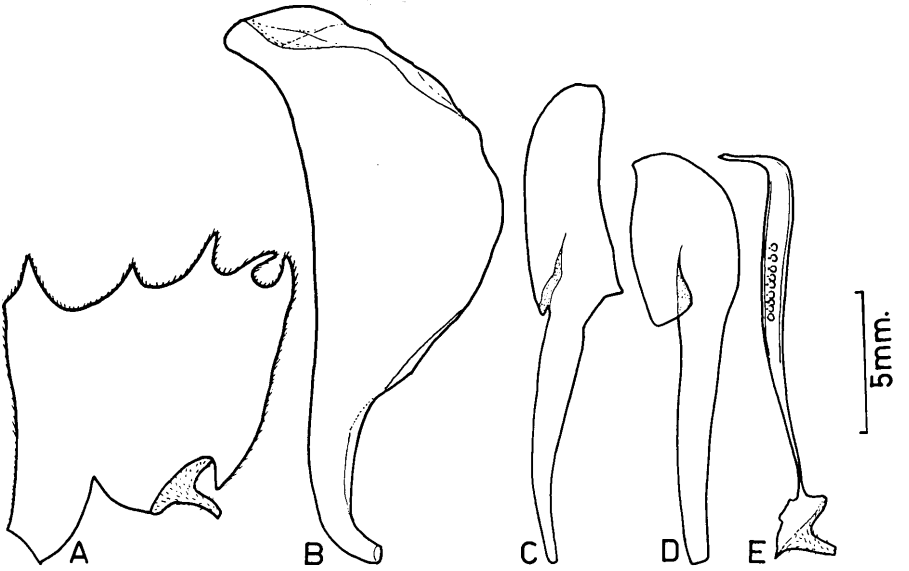


Fig. 4. Floral parts of *A. pseudochlorostachys* Ali (Holotype). A Calyx. — B Vexillum. — C Wing. — D Keel. — E Ovary.

Canada; U.S.A., Rocky mountains from Yukon to Wyoming, South Dakota, Gaspe Peninsula, Quebec, Coronation gulf to Bering Strait, South to Mount St. Elias (BARNEBY 1952).

Flowering Period: July—September.

13. *Astragalus* (*Cenantrum*) *pseudochlorostachys* Ali sp. nov.

Herba c. 30 cm. alta. Radix lignosa. Caulis costatus, albi-pilosus; internodia c. 5 cm. longa. Folia imparipinnata, stipulis lateralibus, c. 7—11 mm. longis, glabra vel subglabra, margine pilosa; rhachide c. 1.5—3.5 cm. longa, petiolo c. 1—2 cm. longo. Foliola 7, petiolulo quam 1 mm. longiore, lamina c. 18—24 mm. longa, c. 6—9 mm. lata, elliptica vel ovata, supra glabra, infra pilosa, margine integra, apice acuto vel obtuso. Inflorescentia racemosa, pedunculo quam 15 cm. longo. Flores pedicellis c. 3—5 mm. longis, bracteis c. 7—10 mm. longis, c. 2—3 mm. latis, supra parce pilosis, infra glabris, margine integra, apice acuto. Calyx pilosus, parte connata c. 7—8 mm. longa, dentibus c. 1—2 mm. longis, nigro-pilosis. Corolla (in sicco) pallida, vexillo c. 2 cm. longo, c. 14 mm. lato; alis c. 17 mm. longis, c. 4 mm. latis, raro in utroque unguis latere auricula provisa; carina c. 15 mm. longa, c. 4—5 mm. lata, clave c. 9 mm. longa. Stamina diadelphia, 9+1, filamentis c. 14 mm. longis. Ovarium stipitatum, c. 7 mm. longum, c. 1—2 mm. latum, glabrum, stipite c. 5 mm. longo, glabro. Stylus

glaber, c. 2—3 mm. ab apice in angulo recto superne curvatus, stigma globosum. Fructus maturos non vidi.

Holotype: Khotan, N. of Mastuj, between Turikho and Mastuj rivers, 11,000 ft., amongst dense herbs, corolla pale yellow, 11.7.1958, J. D. A. STAINTON 2861 (BM). (Fig. 3)

This species is related to *A. tecti-mundi* Freyn from which it can easily be distinguished by fewer number of leaflets per leaf (7) and by the glabrous ovary. In *A. tecti-mundi* Freyn 9—11 leaflets are present and the ovary is provided with black hirsute hairs.

Flowering Period: July.

14. *Astragalus* (*Scheremeteviana*) *scheremetevianus* B. Fedtsch. in Trav. Mus. Bot. Acad. Petersb. 1: 125. 1902.

[Syn. *A. patule-luteus* Ali MS. (nomen nudum)]

Type: In the valley of the R. Toguz-bulak, from the pass Kah-Tezek to the region of Dziland; in the region of Dziland to Bankat, 11—12,000 ft., on stony slopes (LE-not seen).

Representative Specimen: Chitral: Yarkhun, 10,000 ft., by hillside facing north, bright yellow, 9.6.1958, S. A. BOWES LYON 961 (BM).

Distribution: Central Asia, Pamir Alai (BORISSOVA 1946); Chitral.

Flowering Period: June.

This is the first record of this species from W. Pakistan (Chitral). Hitherto it has been regarded as a Central Asian endemic.

15. *Astragalus* sp. (Section *Komaroviella* Gontsch.) — Insufficient material.

Chitral: Ziarat, Lowari Pass, 6,500 ft., on sandy bank, calyx brown, corolla pale yellow, 29.4.1958, J.D.A. STAINTON 2318 (BM).

Acknowledgements

I am grateful to the authorities of British Museum (Natural History), London, for kindly sending the specimens on loan and for attending to my various queries. I beg to express my indebtedness to Sir GEORGE TAYLOR, Director, Royal Botanic Gardens, Kew, for his kind advice and encouragement. I am thankful to Dr. A. G. BORISSOVA of the Botanical Institute of the Academy of Sciences of the U.S.S.R., Leningrad, who has kindly checked and corrected the identification of some of the taxa. My thanks are also due to Mr. B. L. BURTT of Edinburgh, Dr. K. H. RECHINGER of Vienna, Dr. W. WEIBEL of Geneva and Dr. A. MELDERIS of London for helping me in various ways.

Summary

Two new species, *A. gahiratensis* Ali and *A. pseudochlorostachys* Ali are described. *A. mirabilis* Lipsky and *A. scheremetevianus* B. Fedtsch., hitherto considered Central Asian endemics, are reported for the first time from W. Pakistan.

Literature cited

ALI, S. I. 1958. Notes on the genus Astragalus Linn. from W. Pakistan and N.W. Himalayas. — Kew Bull. 1958 (2): 303—318.

ALI, S. I. 1961. Revision of the genus Astragalus L. from W. Pakistan and N.W. Himalayas. — Biologia 7 (1 & 2): 7—92.

BARNEBY, R. C. 1952. *Astragalus* in GLEESON, H. A., Illustrated Flora of United States 2: 416.

BORISSOVA, A. G. 1946. Section *Brachycarpus* of the subgenus *Phace*, in KOMAROV, V. L., Flora of U.S.S.R. 12.

GONTSCHAROV, N. 1946. Part of the genus *Astragalus* in KOMAROV, V. L., Flora of U.S.S.R. 12.

GONTSSCHAROV, N. & BORISSOVA, A. G. 1946. Part of the genus *Astragalus* in KOMAROV, V. L., Flora of U.S.S.R. 12.

GROSSHEIM, A. 1946. Part of the genus *Astragalus* in KOMAROV, V. L., Flora of U.S.S.R. 12.

PETER-STIBEL, E. 1938. Revision der Chinesischen Astragalus und Oxytropis Arten. — Acta Horti Gotob. 12: 21—85.

BOTANISKA NOTISER 1965 · VOL. 118 · FASC. 1 · LUND

The Riddle of Walpersia Harv.

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(Meddelande från Lunds Botaniska Museum, Nr 195)

Abstract

The type material of the monotypic genus *Walpersia* Harv. has been examined. It is shown that it represents a form of the Australian genus *Phyllota* DC. It falls within the variation range of *Phyllota phylicoides* (Sieb. ex DC.) Benth. sensu latissimo. The locality record which has been combined with *Walpersia* is "Glassenbosch" on the Cape Peninsula. The label has probably been attached to the Australian plant by mistake. — *Walpersia* Harv. is included in *Phyllota* DC.

Historical Background

The genus *Walpersia* with its single species *W. burtonioides* was first described by HARVEY in Flora Capensis, vol. 2 (1862, p. 26). The description was rather detailed. *Walpersia* was placed at the end of the tribe *Liparieae,* a group of genera often treated as a subtribe, *Liparii-nae,* under *Genisteae.* It has usually been treated in the same group also in later works.

In HARVEY's diagnosis the stamens were described as monadelphous, which is correct in so far as they are united with each other basally for a few millimetres into a short sheath. Five were said to be longer than the others. In that respect HARVEY probably alluded to the filaments rather than the anthers. The anthers of the type specimen are all of about the same size and form. HARVEY regarded the genus as closely allied to *Coelidium,* but he also concluded that it has "more the look of an Australian *Burtonia* than any of the S. African species known".

A label with the locality "Glassenbosch" was attached to the type

specimen. It was written by ZEYHER, who botanized in the Cape Province for many years in the 19th century. "Glassenbosch" (=Klassenbosch) is located near Wynberg Hill on the Cape Peninsula. As will be pointed out below, the label has probably nothing to do with the type specimen, but has been attached to it by mistake.

In HARVEY 1868, p. 72, the genus was more briefly described. The descriptions in this and all later comprehensive works were doubtless based on the information in Flora Capensis only. In BENTHAM & HOOKER (1862—67, p. 473), where the genus was placed after *Coelidium* in the tribe *Genisteae*, the anthers were described as alternately long and basifixed and short and versatile. This statement is probably a misinterpretation of HARVEY's description of the stamens. TAUBERT (1894, p. 216) and PHILLIPS (1926, p. 319; 1951, p. 403) made no changes in the position or description of the genus in relation to BENTHAM & HOOKER, except that PHILLIPS described the staminal tube as "sometimes short".

HUTCHINSON (1964, p. 347) removed *Walpersia* and *Coelidium* from the tribe *Liparieae* to *Bossiaeae* (often treated as subtribe *Bossiaeinae* in *Genisteae*), a group which otherwise consists exclusively of Australian genera. The description of *Walpersia* was not amplified, but according to HUTCHINSON it comprises two species. The "second species" alludes to a PHILLIPS specimen in the Kew herbarium. This specimen belongs to *Coelidium*.

In ADAMSON & SALTER 1950, p. 508, SALTER made the following remark: "*Walpersia burtonioides* Harv. is said to have been recorded by ZEYHER at Klassenbosch, but it has not been seen since." SALTER accordingly hesitated to regard *Walpersia* as a member of the Cape Peninsula flora. It has also been difficult to fit the monotypic genus into the systematic-morphological pattern of the South African *Papilionaceae*.

In spite of that the problematic genus has not aroused the curiosity of the botanists. The statement that the anthers are unequal originated from a wrong interpretation of the original description and was accepted, which may be one of the reasons why the originally proposed affinity with *Coelidium* and *Amphithalea* has not been questioned. These genera have ovules with a carnose appendage (strophiole), which is not the case in *Walpersia*.

The genus has also apparently been represented by only one herbarium specimen, which belongs to SONDER's herbarium in Stockholm. Therefore it is not surprising that only the descriptions have been consulted.



Fig. 1. Type specimen of *Walpersia burtonioides* Harv. and the label which has been attached to it. The branch is reduced to about $^{2}/_{3}$.

The single find in connection with the problematic position of the genus demanded an investigation, which was not based on descriptions but on the type material, and in which the locality record was not accepted a priori as true.

The Identity of Walpersia

A description of the single *Walpersia* species with its single specimen will not be given here. The type specimen is seen in figure 1 and the details of the flower in figure 2. Some complementary information may be added to these figures, however.

The leaves on the lower parts of the branches are of the same shape as those on the branch ends, where flowers are situated in the axils (fig. 2 B—C). At the base of the leaves, below the short petiole portion, there is on each side a small tooth, which is apparently stipular in nature. The branchlets and branch ends are rather densely pubescent. The bracteoles have no distinct petiole (in the figure part of the pedicel is seen below the bracteole). They possess a similar couple of small (stipular?) teeth, but these are situated on the middle or lower rather broad part, which indicates that the basal portion or leafbase may be "dilated longitudinally" (fig. 2 D). The sinus between the upper two calyx lobes is not as deep as the other sinuses. The ala and carina claws are attached to the short staminal sheath. There is no appendage on the ovules. Fruits were lacking in the material.

An investigation shows that exactly these features are found in a few members of the Australian genus *Phyllota* DC., treated in the tribe *Podalyrieae* by BENTHAM & MUELLER (Flora Australiensis, vol. 2, 1864, p. 93).

The type of *Walpersia burtonioides* no doubt belongs to *Phyllota phylicoides* (Sieb. ex DC.) Benth. in the sense that this species was conceived in BENTHAM & MUELLER 1864, p. 95. In this work a large number of species were included under *P. phylicoides*. Among these are *P. squarrosa* (Sieb. ex DC.) Benth., the type of which is very similar to that of *Walpersia burtonioides*. It is more hairy and has longer calyx lobes than the typical *Phyllota phylicoides* as well as the types of some of the other synonyms, e.g., *Phyllota aspera* (Sieb. ex DC.) Benth.

Fig. 3 A—J represents a rather hairy form of *P. phylicoides* s. lat. from near Brisbane. It is apparently closely related to the types of *P. squarrosa* and *Walpersia burtonioides*. In fig. 3 K—O another *Phyllota* species, *P. barbata* Benth., is shown for comparison.

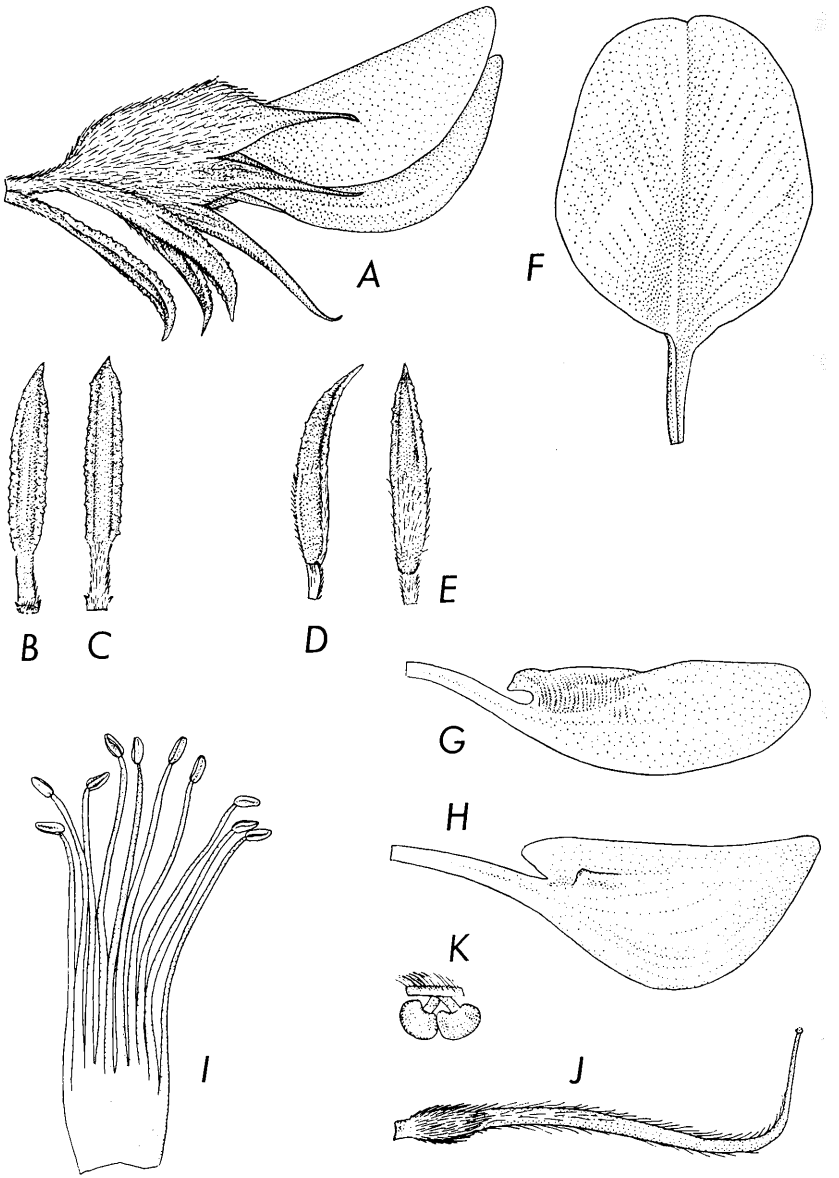


Fig. 2. Details of the type specimen of *Walpersia burtonioides* Harv. — A: Flower. — B and C: Bract, upper and lower side. — D and E: Bracteole, inner and outer side. — F: Vexillum, front side. — G: Ala. — H: Carina petal. — I: Staminal sheath, spread open, inside. — J: Pistil. — K: Ovules. (A—J × 5; K × 10.)

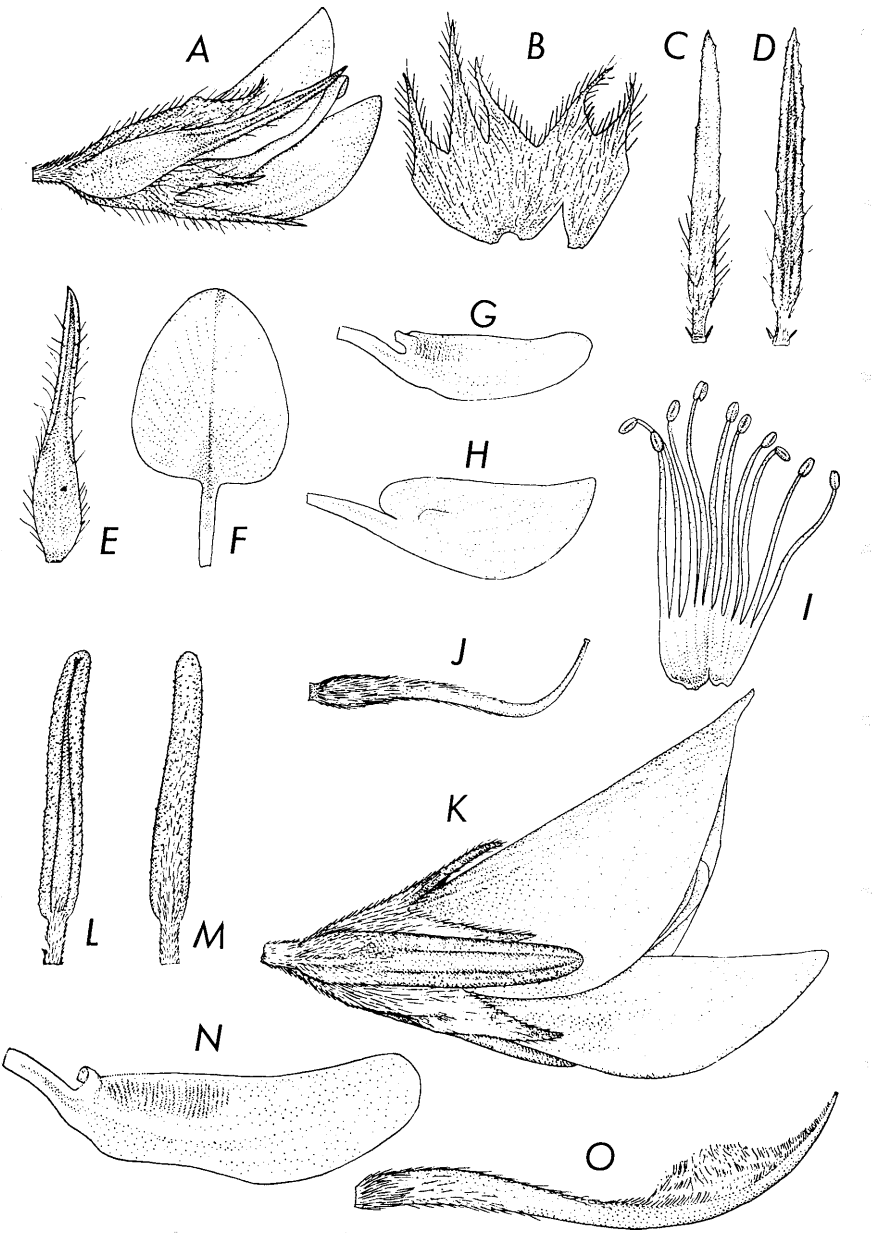


Fig. 3. *Phyllota phylicoides* (Sieb. ex DC.) Benth. (A—J) and *Phyllota barbata* Benth. (K—O). — A—J: MAURITZON, 22/12 1936 from near Brisbane, Queensland. — K—O: PRITZEL no. 207 from "District South West Plantagenet". — A and K: Flowers. — B: Calyx, upper two lobes to the right. — C and M: Bracts, upper side. — D and L: Bracts, lower side. — E: Bracteole, outer side. — F: Vexillum, front side. — G and N: Alae. — H: Carina petal. — I: Stamens. — J and O: Pistils. (All × 5.)

Phyllota phylicoides s. lat. possibly needs to be revised. If it is accepted as a single variable species, as was done in BENTHAM & MUELLER 1864, the type of *Walpersia* falls within its variation range.

The label attached to the type has probably been combined with it by mistake. There is also a very slight possibility that the plant actually was collected at Klassenbosch on the Cape Peninsula, in which case it must have been introduced. It is surely not indigenous to South Africa.

Literature cited

ADAMSON, R. S. & SALTER, T. M. 1950. Flora of the Cape Peninsula. — Wynberg.

BENTHAM, G. & MUELLER, F. 1864. Flora Australiensis, II. — London.

BENTHAM, G. & HOOKER, J. D. 1862—67. Genera plantarum. (Leguminosae print. 1865.) — London.

HARVEY, W. H. 1868. The genera of South African plants, ed. 2. — London.

— in HARVEY, W. H. & SONDER, O. W. 1862. Flora Capensis, II. — Dublin.

HUTCHINSON, J. 1964. The genera of flowering plants. Dicotyledones, I. — Oxford.

PHILLIPS, E. P. 1926. The genera of South African flowering plants, ed. 1. — Bot. Surv. S. Afr., 10. — Cape Town.

— 1951. The genera of South African flowering plants, ed. 2. — Bot. Surv. S. Afr., 25. — Pretoria.

TAUBERT, P. 1894. Leguminosae in ENGLER & PRANTL, Nat. Pfl.-Fam. 3: 3. — Leipzig.

BOTANISKA NOTISER 1965 · VOL. 118 · FASC. 1 · LUND

Studies in the Aegean Flora

VI. Notes on Some Genera of Labiatae

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(Meddelande från Lunds Botaniska Museum, Nr 196)

Introduction

The present investigation is based mainly upon material collected in Greece between 1957 and 1963 by workers from the Institute of Systematic Botany, Lund. The chromosome numbers of 22 species, belonging to nine different genera of the family *Labiatae,* have been determined. Morphological studies on living and dried material have also been carried out, particularly in the case of critical species groups.

Material and Methods

The following material has been examined cytologically: *Ajuga* (2 spp.), *Ballota* (1 sp.), *Lamium* (3 spp.), *Micromeria* (3 spp.), *Nepeta* (1 sp.), *Phlomis* (2 spp.), *Sideritis* (2 spp.), *Stachys* (4 spp.) and *Teucrium* (4 spp.). Usually 5—6 specimens from each collection have been investigated. The plants have been cultivated in the greenhouses of the Botanical Garden, Lund. After pretreatment for 12—24 hours at 2—4°C, root tips have been fixed in the Svalöf modification of Navashin-Karpechenko, cut by means of a microtome (sections 14 μ) and stained overnight in 1 % crystal violet. In a few cases Feulgen staining and the squash technique has been applied (cf. ÖSTERGREN & HENEEN 1962). Herbarium material at the Institute of Systematic Botany, Lund has been investigated morphologically. Dried material and slides as well as seeds from cultivated specimens are preserved at the Institute. For references to geographical names etc., see the map in RUNEMARK, SNOGERUP & NORDENSTAM (1960). These authors' names are abbreviated to R., S., and N., respectively, in the lists of collections.

Results

Ajuga chia (Poir.) Schreb.

The morphology and distribution of *Ajuga chia* (Poir.) Schreb. and the closely related species *A. chamaepitys* (L.) Schreb. have been extensively investigated by TURRILL (1934). Distinguishing characters are size of the corolla (larger in *A. chia*), appearance of the leaves (usually broader in *A. chia*), surface structure of the fruit, and certain relatively undefined characteristics concerning growth habit and pubescence. Furthermore, *A. chamaepitys* is reported to be annual, whereas *A. chia* is perennial. *A. chia* has a pronounced eastern distribution extending from the Balkan Peninsula to the regions south of the Caspian Sea, whereas *A. chamaepitys* occurs around the western Mediterranean, in West and Central Europe and northwards to southern England, northern Germany, and Poland. Within the markedly polymorphic species *A. chia* a number of more or less locally restricted taxa have been described. Specimens intermediate between *A. chia* and *A. chamaepitys* have been reported from widely separated parts of the distribution areas of the two species, e.g., the northern Balkan Peninsula, Sicily, and southern Italy. Herbarium specimens in Lund, determined as *A. chamaepitys* (L.) Schreb. var. *grandiflora* Vis., have been collected as far east as the Crimea and Ukraine. With respect to corolla, leaf and fruit characters they are strictly intermediate between typical individuals of *A. chia* and *A. chamaepitys*. Consequently intermediate forms are represented further to the east than stated by TURRILL.

It seems doubtful whether *A. chia* and *A. chamaepitys* should be regarded as separate species. The quantitative nature of the distinguishing characters and the abundance of intermediate forms make it highly probable that a more detailed investigation would reduce them to the rank of subspecies. No material typical of *A. chamaepitys* has been observed from Greece, which is in agreement with TURRILL. However, intermediate forms occur in the northern part of the country.

In the herbarium material investigated the corolla length of *A. chia* varies between 14 and 28 mm, and in *A. chamaepitys* between 10 and 15 mm.

Particularly large-flowered specimens of *A. chia,* which have been described under varietal names, occur on the northern Aegean Islands, on Peloponnisos and in Mesopotamia. The material examined for chromosome number is typical of *A. chia,* with a corolla length of 18—20 mm.

Cytologically investigated material:

Cyclades, N a x o s: W Ozia, 300—400 m (coll.no. R. & S. 5755, cult.no. R. 1578)

— N a x o s: 2 km NNW Kato Potamia, 50 m (coll.no. R. & S. 4696, cult.no. R. 1580)

The chromosome number is 2n=30, suggesting the basic number x=15, which has not been previously reported for the genus. The chromosomes are all of about equal size, rod-shaped to elliptical, about 0.7 μ long and 0.5 μ broad (fig. 1 A). For *A. chamaepitys,* RUTLAND (1941) gives the number 2n=28. However, this record is doubtful, because the chromosome morphology in RUTLAND's figure differs very markedly from that observed in *A. chia.* Possibly this may be a case of confusion or erroneous determination.

Ajuga orientalis L.

Ajuga orientalis L. is a polymorphic species distributed in the eastern Mediterranean and the Near East as far as the region of the Black Sea. Vegetative characters like the length of internodes on fertile branches, leaf-shape, and pubescence are highly variable. Modificative plasticity is evidently considerable and an essential part of the variation must probably be attributed to environmental factors. Forms with dense foliage and strongly contracted internodes, occurring in the main part of the distribution area, have been described as *A. orientalis* L. var. *condensata* Boiss. Extreme *condensata* types differ very markedly from typical *A. orientalis,* but probably only comparative experiments will answer the question of their taxonomic value. In the same way, a number of herbarium specimens from the Crimea, differing by small, pronouncedly double-sawed leaves in the inflorescence, are probably best regarded as extreme types in an almost continuously varying series.

Cytologically investigated material:

Eastern Islands, I k a r i a: N Kampos (coll.no. R. & S. 6978, cult.no. R. 1590)
— I k a r i a: Avlaki, 20—50 m (coll.no. R. & S. 6311, cult.no. R. 1588)

Cyclades, N a x o s: Ammomaxis Oros, the spring, 650 m (coll.no. R. & S. 9876, cult.no. R. 1591)

The chromosome number is 2n=32, which is in agreement with the numbers reported for the related species *A. pyramidalis* L., *A. reptans* L., and *A. genevensis* L. (see references in DARLINGTON & WYLIE

1955, LÖVE & LÖVE 1961). The chromosomes are rod-shaped, with a length of 0.8—1.8 μ and a breadth of about 0.5 μ. One chromosome pair differs conspicuously from the rest of the complement by having a very marked centromere constriction dividing the chromosome in the proportions of about 3:2 (fig. 1 B). Such a deviating chromosome pair has not been reported for the three species cited above.

Ballota acetabulosa (L.) Benth.

Ballota acetabulosa (L.) Benth. is distributed on the Aegean Islands and the Greek mainland as far as Euboea and Tessalien in the north.

Cytologically investigated material:

Cyclades, Keros: The islet of Andreas (coll.no. R. & S. 10900, cult.no. R. 2134)
— Levitha: "Porto di Levitha" (coll.no. R. & S. 11978, cult.no. R. 2135)
— Amorgos: Maritime rocks, W of Akr. Xodotos (coll.no. R. & S. 12243, cult.no. R. 2136)
— Paros: E of the peak of Prof. Elias, 700 m (coll.no. R. & S. 12734, cult.no. R. 2137)

The chromosome number is 2n=28. The chromosomes are quite variable in size and shape. The smallest ones are elliptical, with a length of 0.8 μ and a breadth of 0.7 μ, whereas the largest ones are rod-shaped, with a marked centromere constriction, about 1.7 μ long and 0.7 μ broad (fig. 1 C). The only chromosome number hitherto known in the genus *Ballota* is 2n=22, for *B. nigra* L. (e.g., PÓLYA 1949), which, however, belongs to a different section of the genus.

Lamium amplexicaule L.

The Aegean material is morphologically constant and closely similar to that from Central and North Europe.

Cytologically investigated material:

Cyclades, Paros: Prof. Elias, E slope, 700 m (cult.no. R. 1256)

The chromosome number is 2n=18 (fig. 1 D), which has been reported earlier by BERNSTRÖM (1944).

With the present cytological technique the chromosomes of *Lamium* appear conspicuously thinner and paler than those of other species included in the investigation. Only in *Nepeta melissaefolia* Lam. has the same chromosome type been observed.

Lamium garganicum L.

Lamium garganicum L. occurs on the southern mainland of Greece, on the Aegean Islands, in Asia Minor and in Italy. The species includes ssp. *glabratum* (Gris.) Briq. with entire upper lip and ssp. *striatum* (S. & S.) Hay. with split upper lip. The material examined for chromosome number belongs to ssp. *striatum*.

Cytologically investigated material:

Eastern Islands, Samos: N slope of Ag. Ilias, S Vurliotes (coll.no. R. & S. 19907)
— Samos: E range of Mt. Kerki, 800—1200 m (coll.no. R. & S. 19364)

The chromosome number is 2n=18 and the karyotype is very similar to that of the preceding species (fig. 1 E).

Lamium moschatum Mill.

Lamium moschatum Mill. is erect, relatively tall, and has slenderer calyx teeth than *L. garganicum*. Its distribution area coincides in the main part with that of *L. garganicum*.

Cytologically investigated material:

Attica: 4 km SE Markopoulo, N slope, 500 m (coll.no. S. 20111)
Peloponnisos: 6 km NNW Achladokampos, 700—1250 m (coll.no. S. 20496)

The chromosome number is 2n=18, with one pair of satellite chromosomes (fig. 1 F).

Micromeria juliana (L.) Benth.

Micromeria juliana (L.) Benth. occurs in coastal districts all over the Mediterranean area. It is a highly variable species with respect to length of the internodes, size, shape and degree of incurvation of the leaves, pubescence, number of flowers in the whorls, and floral size. In Flora Aegaea (RECHINGER 1943 a) three varieties are distinguished, viz., var. *canescens* (Guss.) Hay., var. *velutina* Tocl. & Rohl., and var. *minoa* (Gand.) Rech. fil. According to RECHINGER (1943 b) several of the variable characters are highly influenced by environmental factors, which makes the limits between the varieties indistinct.

Cytologically investigated material:

Cyclades, Naxos: 3—4 km WNW Orm. Mountsounis, 100—200 m (coll.no. R. & S. 10625, cult. R. 2526)
— Amorgos: Coastal cliffs, W of Akr. Xodotos (coll.no. R. & S. 12238, cult.no. R. 2538)

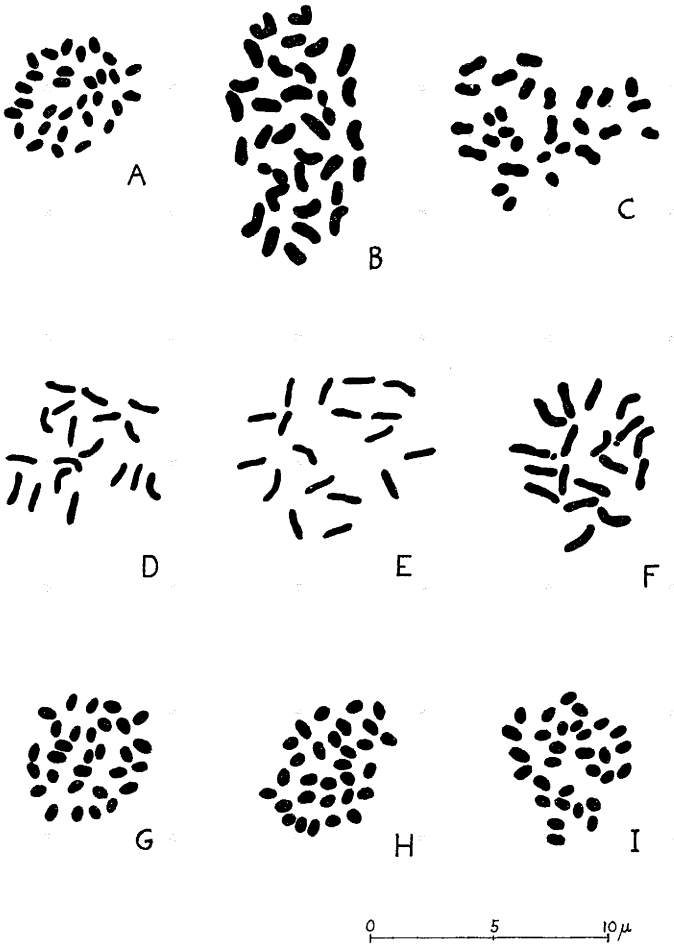


Fig. 1. Metaphase plates from root-tips. A: *Ajuga chia*; B: *A. orientalis*; C: *Ballota acetabulosa*; D: *Lamium amplexicaule*; E: *L. garganicum*; F: *L. moschatum*; G: *Micromeria juliana*; H: *M. myrtifolia*; I: *M. nervosa*.

The chromosome number is 2n=30. The chromosomes are all of about equal size, elliptical to almost spherical, about 0.8 μ long and 0.6 μ broad (fig. 1 G). No chromosome numbers of the genus *Micromeria* have previously been reported.

Micromeria myrtifolia Boiss. & Hohen.

Micromeria myrtifolia Boiss. & Hohen. is distributed in the eastern Mediterranean and the Orient with its western limit in Greece. It differs

from *M. juliana* by being taller and more robust and by having longer internodes, dense-flowered whorls, and larger, rhomboid leaves.

Cytologically investigated material:

Cyclades, Naxos: 3—4 km WNW Orm. Mountsounis, 100—200 m (coll.no. R. & S. 10611, cult.no. R. 2525)
— Naxos: N of W point of Mt. Koronos (coll.no. R. & S. 9984, cult.no. R. 2542)
Eastern Islands, Ikaria: 4—5 km E Ag. Kirikos, 20 m (cult.no. R. 1424)
— Ikaria: Kerame Orm. (coll.no. R. & S. 12520, cult.no. R. 2543)
Crete, Sitia: S of Ag. Nikolaus, 0—20 m, garigue, soft limestone (coll.no. R. & S. 17548)

The chromosome number is 2n=30 and the karyotype is closely similar to that of the preceding species (fig. 1 H).

Micromeria nervosa (Desf.) Benth.

Micromeria nervosa (Desf.) Benth. is distributed around the eastern Mediterranean with its western limit in southern Italy.

Cytologically investigated material:

Cyclades, Folegandros: SE point, Pelagia, cliffs, hard limestone (coll.no. R. & N. 14655)
— Anafi: Kalamos, S precipices, 0—400 m (coll.no. R. & N. 14879)
— Naxos: 2 km NNW Kato Potamia, 50 m (coll.no. R. & S. 4683, cult.no. R. 2539)
— Sifnos: Ormos Kamares, S of the village (coll.no. R. & S. 8797, cult.no. R. 2541)
— Antimilos: 450—550 m (coll.no. R. & S. 8769, cult.no. R. 2521)
— Amorgos: Ag. Elias, S exposed cliff WSW of the peak, 600—750 m (coll.no. S. 20273)

The chromosome number is 2n=30 and the karyotype is closely similar to that of the two species of *Micromeria* cited above (fig. 1 I).

Nepeta melissaefolia Lam.

The distribution of *Nepeta melissaefolia* Lam. is restricted to Crete and the Cyclades.

Cytologically investigated material:

Crete, Sitia: The cliff W of the village Zakro, limestone (coll.no. R. & S. 17881)
— Sitia: E of Chamaetulo, cliffs, 200—500 m (coll.no. R. & S. 17672)

The chromosome number is 2n=18 and the karyotype is similar to that of the genus *Lamium* (fig. 2 K). As in *Lamium,* diploid and tetraploid species with, respectively, 2n=18 and 2n=36 are known within the genus.

Phlomis fruticosa L.

Phlomis fruticosa L. occurs in the Mediterranean area from Eastern Spain to Asia Minor and Israel. It is abundant in Greece and an important member of the garigue element, often constituting very large populations.

Cytologically investigated material:

Peloponnisos: 0.5 km S of Xilokerisa, N exposed cliff, hard limestone, 200—500 m (coll.no. S. 20434)
Cyclades, Amorgos: Krikelas, at the mine, 300 m (coll.no. R. & S. 12246, cult.no. R. 2752)
— Amorgos: E of Prof. Elias, 400 m (cult.no. R. 1451)
Euboea, Petalides: Prassonisi (coll.no. R. & S. 11566, cult.no. R. 2750)

The chromosome number is 2n=20. The chromosomes are 5—6 μ long with a median to submedian centromere (fig. 2 L). Two pairs of chromosomes have satellites visible in squash preparations (fig. 2 M). The numbers 2n=20, 2n=22 and 2n=24 are known within the genus. LÖVE & LÖVE (1961) incorrectly cite a record by REESE (1953) of *Ph. fruticosa* having 2n=22. REESE's record concerns *Ph. tuberosa* L.

Phlomis lanata Willd.

Phlomis lanata Willd. is endemic to Crete and some neighbouring islands. It is quite variable, but RECHINGER (1943 b) is of the opinion that the variability may, to a considerable extent, be caused by environmental factors. Too little material has been available to verify or contradict this statement.

Cytologically investigated material:

Crete, Herakleion: The islet of Dia, Middle Bay, cliffs (cult.no. R. 3713)

The chromosome number is 2n=20 and the karyotype is closely similar to that of *Ph. fruticosa* (fig. 2 N).

Sideritis curvidens Stapf

Sideritis curvidens Stapf occurs in large parts of the Mediterranean area, mainly as a weed.

Cytologically investigated material:

Crete, Sitia: S of Ag. Nikolaus, 0—20 m, garigue (coll.no. R. & S. 17480) — Sitia: S of Ag. Nikolaus, sandy fields (coll.no. R. & S. 17726)
Eastern Islands, Samos: N precipice of Ag. Ilias, S Vurliotes, 400—900 m (coll.no. R. & S. 18635)
Cyclades, Amorgos: 1.5 km NNE highest peak of Mt. Krikelas (coll.no. R. 20256)

The chromosome number is 2n=28 (fig. 2 O). The chromosomes have a tendency to stickiness, a phenomenon that has not otherwise been observed in the material studied of the family *Labiatae*. They are rod-shaped, 1—1.5 μ long, and often clustered together in loose aggregates, which may make the determination of chromosome number difficult. In the genus *Sideritis* the numbers 2n=22, 2n=28, 2n=30 and 2n=32 have previously been reported, the latter, however, with some reservation (REESE 1953).

Sideritis lanata L.

Like the preceding species, *Sideritis lanata* L. is a common weed on open fields in large parts of the Mediterranean area. It is easily identified by its dark, almost black flowers and small, elliptic, densely hairy leaves.

Cytologically investigated material:

Eastern Islands, Samos: Heights and small valleys 1—3 km W Maratokampos, 300—450 m (coll.no. R. & S. 19028)
— Ikaria: Peranora Vuono, S and SW precipices, 600—700 m (coll.no. R. & N. 16418)

The chromosome number is 2n=30 and, except for the different basic number, the karyotype is closely similar to that of *S. curvidens* (fig. 2 P).

Stachys arvensis L.

The Aegean material is homogeneous and closely similar to that from Central and North Europe.

Cytologically investigated material:

Crete, Sitia: The valley W of Maronia, 250—300 m (coll.no. R. & S. 17982)
Cyclades, Naxos: Fields W of Chalki (coll.no. R. & N. 13097)

The chromosome number is 2n=10. Two pairs of chromosomes have satellites and a number of secondary constrictions occur (fig. 2 R). The karyotype has been studied in detail by LANG (1940).

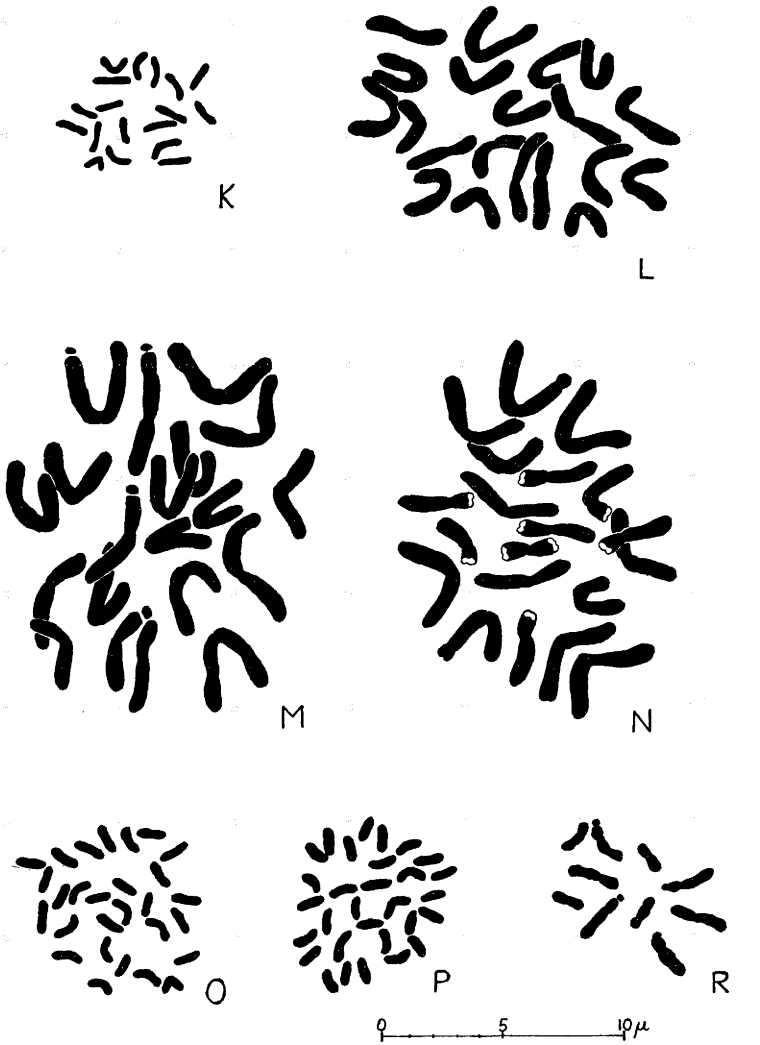


Fig. 2. Metaphase plates from root-tips. K: *Nepeta melissaefolia*; L: *Phlomis fruticosa*; M: *Ph. fruticosa* (squash prep.); N: *Ph. lanata*; O: *Sideritis curvidens*; P: *S. lanata*; R: *Stachys arvensis*.

Stachys mucronata Sieb.

The distribution of *Stachys mucronata* Sieb. is restricted to Crete, Karpathos, and some small islands in the neighbourhood. It is a low shrub with hard, sharp calyx teeth.

Cytologically investigated material:

Crete, Sitia: Dri (Drises), 350—450 m (coll.no. R. & S. 17040)
— Sitia: The valley SW of Leopetra (coll.no. R. & S. 18469)

The chromosome number is 2n=30, and the chromosomes are of the same type as those of *S. arvensis*. One pair of satellites has been observed (fig. 3 S). The number 2n=30 has also been reported for *S. alpina* L. and *S. germanica* L. (LANG 1940), which, however, belong to different sections of the genus.

Stachys swainsonii Benth. (coll.)

Within this complex are included also *S. spruneri* Boiss. and *S. argolica* Boiss. Probably also *S. decumbens* Pers. and *S. tetragona* Boiss. & Heldr. are closely related. The complex consists of obligate chasmophytes and is distributed over the southern part of the Greek mainland, Corfu and Euboea. The material is extremely variable, and a reasonable taxonomic subdivision can not be proposed at present. Further studies will be carried out as soon as more material becomes available.

Cytologically investigated material:

Peloponnisos: Akrokorinth, cliffs of hard calcareous rocks, 300—450 m (coll. no. S. 20347)
— 1 km NE of Sophikon, N precipice, 650 m (coll.no. S. 20378)
— Small cliff NW of Loutraki, 10—50 m (coll.no. S. 20445)
— 2—3 km NE of Loutraki, 500—650 m (coll.no. S. 20449)

The chromosome number is 2n=34 and the chromosomes are rod-shaped with a length of 1—1.5 μ (fig. 3 T). The number 2n=34, suggesting the basic number x=17, has previously been reported by LANG (1940) and FAVARGER (1959) for *S. recta* L. and *S. annua* (L.) L.

Stachys euboica Rech. fil.

The species has been described recently by RECHINGER (1961) and is only known from the type locality.

Cytologically investigated material:

Euboea: 5 km S of Kaphireos — type locality — (cult.no. R. 1435)

The chromosome number is 2n=34, confirming the number given by RUNEMARK in RECHINGER (1961). The karyotype is closely similar to that of *S. swainsonii* (fig. 3 AB).

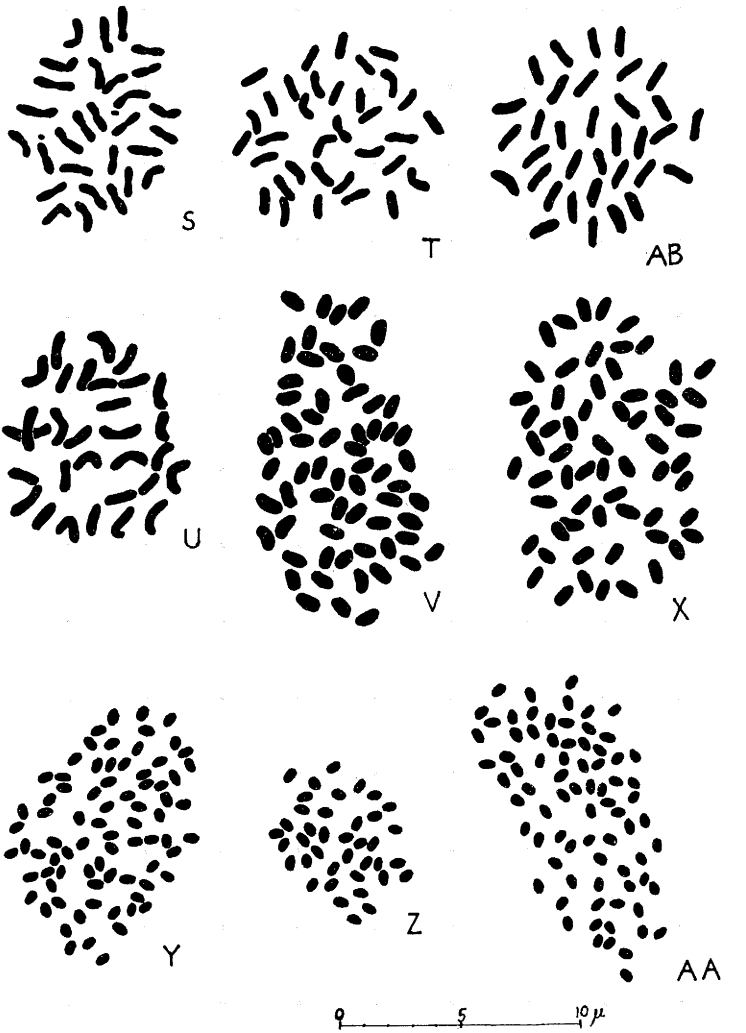


Fig. 3. Metaphase plates from root-tips. S: *Stachys mucronata*; T: *S. swainsonii* (coll.); U: *Teucrium brevifolium*; V: *T. divaricatum* (2n=64); X: *T. divaricatum* (2n=62); Y: *T. polium* (2n=78); Z: *T. polium* (2n=39); AA: *T. gossypinum*; AB: *Stachys euboica.*

Teucrium brevifolium Schreb.

Teucrium brevifolium Schreb. occurs on the southernmost mainland of Greece and on the Aegean Island as far as Crete in the south.

Cytologically investigated material:

Cyclades, I r a k l i a: S precipice, limestone cliffs (cult.no. R. 1457)

The chromosome number is 2n=30. The chromosome morphology differs from that of other species of the genus *Teucrium* investigated. The chromosomes are rod-shaped, often bent, 1.5—2 μ long and about 0.5 μ broad, without conspicuous centromere constriction (fig. 3 U). The number 2n=30 has also been reported for *T. montanum* L. ssp. *montanum* (BAKSAY 1956), which, however, belongs to a different section of the genus.

Teucrium divaricatum Sieb.

Teucrium divaricatum Sieb. is distributed in Greece (mainly in the eastern parts), western and southern Asia Minor, Israel, Syria and Lebanon. Like the other species of the section *Chamaedrys, T. flavum* L. and *T. chamaedrys* L., it is highly variable. Variation comprises form and size of the leaves (fig. 4), size of the flowers, number of flowers in the whorls, and kind and degree of pubescence. *T. divaricatum* gives the impression of being built up from a number of more or less locally isolated taxa, some of which are pronouncedly geographically restricted. The complex has been studied by ČELAKOVSKY (1883), BORNMÜLLER (1927) and RECHINGER (1941). In his monographic treatment of *Teucrium* sect. *Chamaedrys,* RECHINGER distinguishes five subspecies within *T. divaricatum,* viz., ssp. *Sieberi* (Čelak.) Bornm., ssp. *villosum* (Čelak.) Rech. fil., ssp. *canescens* (Čelak.) Holmboe, ssp. *graecum* (Čelak.) Bornm., and ssp. *athoum* (Hausskn.) Bornm. Of the five subspecies, ssp. *canescens* is endemic to Cyprus, ssp. *athoum* to the Athos peninsula, and ssp. *graecum* to the eastern parts of Central Greece. Typical specimens of the different subspecies are clearly distinguishable, but individuals occur which are difficult to place in any of the subspecies described. However, the material has been too restricted to permit safe conclusions.

Cytologically investigated material:

Eastern Islands, I k a r i a: Ag. Kirikos (cult.no. R. 1254)
— I k a r i a: Praya Ormos, 2 km NNW Praya Pt. (coll.no. R. & S. 11378)
Cyclades, L i a d i: Limestone, garigue, 30 m (coll.no. R. & S. 12210)
— A m o r g o s: Krikelas, garigue at the mine (coll.no. R. & S. 12262)

The material examined for chromosome number belongs to ssp. *villosum* (R. & S. 12210) and ssp. *Sieberi* (other collections). The chro-

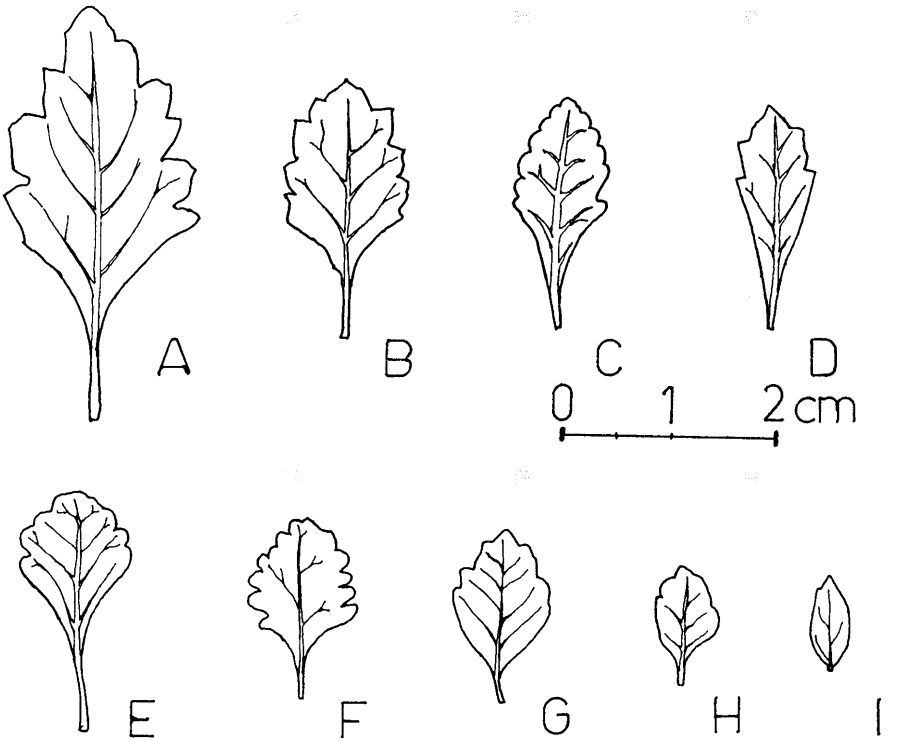


Fig. 4. Variation in leaf shape in *Teucrium divaricatum*. A: ssp. *athoum*; B: ssp. *graecum*; F: ssp. *villosum*; G: ssp. *canescens*; H: ssp. *Sieberi* var. *vulgare*; C, D, E, and I: *T. divaricatum* s. lat.

mosome number is 2n=62 (R. & S. 12262) and 2n=64 (other collections). The chromosomes are rod-shaped with a length of 1—1.4 μ and a breadth of about 0.6 μ. The normal chromosome number is certainly 2n=64 (fig. 3 V), but the presence of a collection with 2n=62 (fig. 3 X) shows that, at the present high degree of polyploidy, a loss of two chromosomes may occur without any deleterious effect. For the closely related species *T. chamaedrys* the numbers 2n=64 and 2n=60 have been reported (REESE 1952, BAKSAY 1958) and for *T. flavum* 2n=32 (JUNELL 1934).

Teucrium Sect. *Polium*

The investigated material of *Teucrium* sect. *Polium* is treated in context. Within the polymorphic and systematically difficult sect. *Po-*

lium, T. polium L. is the most variable and widespread species. It constitutes a pronouncedly variable complex of taxa, distributed all over the Mediterranean area from Portugal to Persia. Variation comprises size, form and pubescence of the leaves, size of the flowers, number of flowers in the clusters, length of internodes, degree of branching, etc. In large parts of the Mediterranean area *T. polium* is a very common species. Extensive collections have been made and a large number of varieties and forms have been described. Considering the kind and extent of variation, however, it is evident that a taxonomic subdivision of *T. polium* can only to a very limited extent be built upon vegetative characters. Environmental factors obviously have a great influence in differentiating morphologically dissimilar types within the complex. The modificative plasticity revealed by greenhouse cultivation may be referred to as an indication of this. Seeds from herbarium specimens characterized by their compact, scrubby mode of growth, with woody stems and heavily pubescent, small, incurved leaves, have developed into individuals with slender, herbaceous stems and flat, dark green, almost smooth leaves. The differences are conspicuous compared with other species cultivated under the same condition and probably far beyond what might be called "normal greenhouse modification". As the vegetative variation is thus very difficult to overlook, and may be almost without taxonomic value, the interest has been concentrated upon characters belonging to the floral system. Calyx and corolla of about 100 individuals, representing the entire distribution area of the species have been studied in detail. The observations may be summarized as follows.

1. The main characters of calyx and corolla are constant. In this respect the material is strikingly homogeneous.

2. This homogeneity stands out against a very pronounced vegetative polymorphism.

3. Significant differences between material from diverse geographical areas have not been observed in any of the details of calyx or corolla.

4. Particularly remarkable is the fact that Spanish material, which has once been determined as 26-chromosomic (LORENZO 1950), does not differ markedly from Aegean material, which is 78-chromosomic (see below).

5. The flowers are often markedly protogynous, and may develop mature seeds while the anthers are still functional.

A number of phenomena in *T. polium* may possibly be explained by assuming the presence of at least facultative apomictic seed formation.

A 39-chromosomic individual occasionally occurring in the cultivated material is probably best explained as a spontaneous haploid, generated from 78-chromosomic material. This opinion is strengthened by the fact that the individual was conspicuously weak and died before reaching maturity, while the maternal individual was highly fertile and closely similar to other Aegean material, that has been proved to be 78-chromosomic.

The variational picture observed within *T. polium* seems to justify some scepticism about the large number of intraspecific taxa described. However, only extensive experimental studies are likely to clarify the taxonomic relationships within the complex.

The following discussion concerns morphological characters, mutual delimitation, and relations to *T. polium* of the three species *T. gracile* Barb. & Fors.-May., *T. alpestre* S. & S., and *T. gossypinum* Rech. fil. Characters useful for the delimitation of taxa within sect. *Polium* are length of side lobes of the lower corolla lip, appearance of calyx teeth and nerve structure and, to a certain extent, pubescence of calyx. The corolla character is noteworthy, as it seems to offer a safe possibility of distinguishing *T. polium* from the other species investigated in the section.

The specific rank of *T. gracile* has been regarded as doubtful by RECHINGER (1943) after the discovery of certain forms, summarized by the name *T. polium* L. var. *dumulosum* Rech. fil., that vegetatively are more or less intermediate between *T. polium* and *T. gracile*. ("Unter dem Namen var. *dumulosum* fasse ich die von *T. polium* zu *T. gracile* überleitenden Formen zusammen, die untereinander ebensowenig einheitlich wie die Formen des *T. polium*, geographisch auf die südöstlichen Kykladen von Amorgos bis Astypaläa und Karpathos beschränkt zu sein scheinen." — Flora Aegaea, p. 500). According to the original description, var. *dumulosum* differs from typical *T. polium* by its recumbent mode of growth, dense pubescence, slenderer branches and frequently smaller corolla, and from *T. gracile* by thicker branches, somewhat larger corolla and more rich-flowered clusters. Judging from floral characters, two of the collections cited in the original description (Karpathos: Felstriften bei Vrondi, RECH. 8257 and Karpathos: Phiniki, RECH. 8304) correspond completely to *T. gracile* from "*locus classicus*" (Karpathos: M. Hag. Elias bei Menetes), while a third one (Amorgos: Kalkfelstriften zwischen Exomeria und Potamos bei Langada, RECH. 2341 — Holotypus) must clearly be included in *T. polium*. The position of *T. gracile* as a well-defined unit outside *T. polium* seems

to be evident. It differs from *T. polium* by repeated branching, numerous and conspicuously thin secondary branches, few-flowered clusters and small leaves, frequently with an incurved edge. The side lobes of the lower corolla lip are of uniform slenderness and 2—2.5 times as long as broad (fig. 5 B). In all material investigated of *T. polium* they are rounded triangular and of about equal length and breadth (fig. 5 A). Only minute differences in nerve structure and pubescence of calyx are present.

T. alpestre and *T. gossypinum* are both endemic to Crete. The latter, which has been given specific rank by RECHINGER (1943 b), differs according to the original description from *T. alpestre* "durch die gelbliche Färbung der ganzen Pflanze, höheren Wuchs, grössere Blätter, Kelche und Korollen". It is synonymous with *T. alpestre* S. & S. var. *maius* Boiss. According to available herbarium material, which has, however, been quite limited, the floral characters coincide almost completely, and the specific rank of *T. gossypinum* appears uncertain. Both taxa are characterized by the side lobes of the lower corolla lip being of uniform slenderness and about 2.5 times as long as broad. The corolla is slenderer than that of *T. polium* and the calyx is sparingly long-haired, not densely woolly as in *T. polium*. Hairiness is mainly restricted to the five prominent main nerves and to the edges of the sharply triangular calyx teeth (fig. 5 C).

Cytologically investigated material:

T. polium:

Euboea: Mantili Nisos, 80 m (coll.no. R. & S. 11596)
Cyclades, Skinousa: S point (coll.no. R. & N. 15914)
— Liadi (E of Amorgos): 30 m (coll.no. R. & S. 12162)
Eastern Islands, Karpathos: SW Pegadia (coll.no. R. & N. 16679)

T. gossypinum (determined as *T. gossypinum,* but very similar to *T. alpestre*):

Crete, Sitia: Cap Sidero, garigue, soft limestone (coll.no. R. & N. 16579)

The chromosome number for both species is 2n=78 (fig. 3 Y and 3 AA, respectively) and their karyotypes are indistinguishable. The chromosomes are very small, and elliptical, with a length of about 0.8 μ and a breadth of about 0.6 μ. One individual from collection R. & S. 12162 has been proved to have 2n=39 (fig. 3 Z) (see above). For Spanish material of *T. polium* the number 2n=26 has been reported (LORENZO 1950).

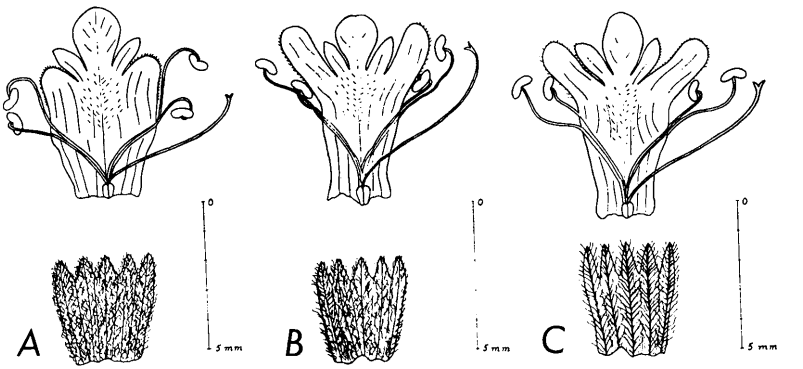


Fig. 5. Calyx and corolla from taxa in *Teucrium* sect. *Polium*. A: *T. polium*; B: *T. gracile*; C: *T. gossypinum*.

Acknowledgements

The cytologically investigated material has been raised from seeds collected by workers from the Institute of Systematic Botany, Lund, viz., Dr. H. RUNEMARK, Dr. S. SNOGERUP, and Mr. B. NORDENSTAM, who have also critically read the manuscript. I should particularly like to thank Dr. RUNEMARK for valuable advice and stimulating discussions. The English text has been checked by Mr. ANTHONY M. CARTER. The field work has been made possible by grants from the Swedish Natural Sicence Research Council.

Summary

22 Aegean species of the family *Labiatae* have been investigated, and their chromosome numbers have been determined as follows:

Ajuga chia (Poir.) Schreb.	2n=30	*Phlomis lanata* Willd.	2n=20
— *orientalis* L.	2n=32	*Sideritis curvidens* Stapf	2n=28
Ballota acetabulosa (L.) Benth.	2n=28	— *lanata* L.	2n=30
Lamium amplexicaule L.	2n=18	*Stachys arvensis* L.	2n=10
— *garganicum* L.	2n=18	— *mucronata* Sieb.	2n=30
— *moschatum* Mill.	2n=18	— *euboica* Rech. fil.	2n=34
Micromeria juliana (L.) Benth.	2n=30	— *swainsonii* Benth. (coll.)	2n=34
— *myrtifolia* Boiss. & Hohen.	2n=30	*Teucrium brevifolium* Schreb.	2n=30
— *nervosa* (Desf.) Benth.	2n=30	— *divaricatum* Sieb.	2n=64
Nepeta melissaefolia Lam.	2n=18	— *polium* L.	2n=78
Phlomis fruticosa L.	2n=20	— *gossypinum* Rech. fil.	2n=78

Within *Teucrium* sect. *Polium* a more detailed morphological analysis has been carried out. *T. gracile* Barb. & Fors.-May. has been found to be morphologically well defined, whereas the distinctness of *T. gossypinum* Rech. fil. is more uncertain.

Literature cited

BAKSAY, L. 1956. Cytotaxonomical studies in the flora of Hungary. — Ann. Hist.-Nat. Mus. Natl. Hung. S. N. 7: 321—334.

— 1958. The chromosome numbers of Ponto-Mediterranean plant species. — Ann. Hist.-Nat. Mus. Natl. Hung. 50 (S. N. 9): 121—125.

BERNSTRÖM, P. 1944. Two new hybrids in Lamium. — Hereditas 30: 257—260.

BORNMÜLLER, J. 1927. Zur Kenntnis einiger orientalischer Teucrium-Arten der Section Chamaedrys. — Mitteil. Thüring. Bot. Ver., n. F., 37: 55—61.

ČELAKOVSKY, L. 1883. Über einige Arten der Gattung Teucrium. — Bot. Centralbl. 14: 187—190.

DARLINGTON, C. D. & WYLIE, A. P. 1955. Chromosome atlas of flowering plants. — London.

FAVARGER, C. 1959. Notes de la caryologie alpine. III. — Bull. Soc. Neuchât. Sci. Nat. 82: 255—285.

JUNELL, S. 1934. Zur Gynäceummorphologie und Systematik der Verbenaceen und Labiaten. — Symb. Bot. Upsal. 4: 1—219.

LANG, A. 1940. Untersuchungen über einige Verwandtschafts- und Abstammungsfragen in der Gattung Stachys L. auf cytogenetischer Grundlage. — Bibl. Bot. 118: 1—94.

LORENZO-ANDREU, A. & GARCÍA-SANZ, P. 1950. Chromosomas somaticos de plantas espontaneas en la estepa de Aragon. II. — Ann. Aula Dei 2: 12—20.

LÖVE, Á. & LÖVE, D. 1961. Chromosome Numbers of Central and Northwest European Plant Species. — Opera bot. 5.

ÖSTERGREN, G. & HENEEN, W. K. 1962. A squash technique for chromosome morphological studies. — Hereditas 48: 332—341.

PÓLYA, L. 1949. Chromosome numbers of some Hungarian plants. — Acta Geobot. Hung. 6: 124—137.

RECHINGER, K. H. (fil.) 1941. Monographische Studie über Teucrium sect. Chamaedrys. — Bot. Archiv 42: 335—420.

— 1943 a. Flora Aegaea. — Denkschr. Akad. Wiss., Wien, 105: 1.

— 1943 b. Neue Beiträge zur Flora von Kreta. — Denkschr. Akad. Wiss., Wien, 105: 2.

— 1961. Die Flora von Euboea. — Bot. Jahrb. 80: 294—382.

REESE, G. 1952. Ergänzende Mitteilungen über die Chromosomenzahlen mitteleuropäischer Gefässpflanzen. I. — Ber. Deutsch. Bot. Ges. 64: 241—256.

— 1953. Ergänzende Mitteilungen über die Chromosomenzahlen mitteleuropäischer Gefässpflanzen. II. — Ber. Deutsch. Bot. Ges. 66: 66—73.

RUNEMARK, H., SNOGERUP, S. & NORDENSTAM, B. 1960. Studies in the Aegean Flora. I. Floristic Notes. — Bot. Notiser 113: 421—450.

RUTLAND, J. P. 1941. The Merton catalogue. A list of the chromosome numbers of British plants. Suppl. 1. — New Phytol. 40: 210—214.

TURRILL, W. B. 1934. The Correlation of Morphological Variation with Distribution in Some Species of Ajuga. — New Phytol. 33: 218—230.

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Från Lunds Botaniska Förenings förhandlingar 1964

13 februari. Försöksledare BJARNE LANGVAD, Landskrona, höll föredrag om »Våra vägars gröna ytor, gräs- och blomsterflora». Föredraget behandlade olika problem av teknisk och biologisk art i samband med sådd av vägslänter och liknande områden för att åstadkomma en täckande och bindande vegetation.

2 mars. Professor HENNING WEIMARCK presenterade ett förslag till utformning av upplaga nr 2 av »Skånes flora», vilket diskuterades. Därefter gav professor WEIMARCK en översikt av Skånes växtgeografiska ställning.

20 mars. Revisionsberättelse avseende 1963 års räkenskaper föredrogs. Föreningen beviljade tacksamt den föreslagna ansvarsfriheten.

Fil. mag. JAN ERICSON höll föredrag om »Vattnet i marken som ekologisk faktor». Föredraget berörde vissa markfysikaliska data, och vidare diskuterades vitsippans utbredningsmönster inom ett litet område och detta mönsters samband med markens vattenhushållning.

Fil. lic. STIG OLOF FALK höll föredrag om »Växternas transpiration». Föredraget gav dels en allmän översikt över transpirationsstudier, dels berörde det föredragshållarens specialstudier i ämnet bl.a. över Ivanoff-effekten.

5 maj. Professor J. JALAS, Helsingfors, höll föredrag om »Variationen hos *Melampyrum pratense* i östra och norra Fennoskandien». Föredraget behandlade de mycket ingående och omfattande undersökningar av vissa morfologiska drag hos *M. pratense* - populationer och deras geografiska fördelning, vilka föredragshållaren och hans medhjälpare företagit i Finland.

10 maj. Exkursion till nordöstra och mellersta Skåne, med professor HENNING WEIMARCK som exkursionsledare. Exkursionsdeltagarna samlades vid Trolle-Ljungby slott. Färdväg: Trolle-Ljungby—Tosteberga—Svenstorp (stärkelsefabriken)— Tosteberga — Åhus — Everöd—Ö. Sönnarslöv—Maltesholm—Tollarp (där exkursionen upplöstes).

Första anhalt gjordes vid stärkelsefabriken vid Svenstorp (i Trolle-Ljungby sn), och på fälten öster om Svenstorp studerades floran på sandfläckar. Här kunde bl.a. iakttas *Cerastium semidecandrum, Erodium »danicum», Erophila verna, Sedum acre, Stellaria apetala, Teesdalia nudicaulis, Veronica arvensis, Vicia lathyroides*; *Aira praecox, Carex caryophyllea* och *Luzula campestris.* I ängsmarkerna c. 500 m nordost om Svenstorp förekom bl.a. *Anemone hepa-*

tica, A. nemorosa, A. ranunculoides, Orchis mascula, Primula veris, Ranunculus auricomus och *Viola hirta.* I kanten av ett bestånd med albuskar växte den vackert svavelgult blommande hybriden *Anemone nemorosa* × *ranunculoides.* Närmare stranden i den fuktiga starrängen med *Carex panicea* och *Sesleria caerulea* sågs blommande exemplar av *Primula farinosa.*

Efter denna rundvandring förflyttade sig exkursionen c. 800 m söderut till den planterade talldungen vid Ålahaken. Vid botaniserandet i den kringliggande terrängen tilldrog sig ett relativt rikligt bestånd av *Senecio integrifolius* det största intresset. Denna art förekom på de öppna betesytorna mellan buskagen av slån och hagtorn. I vegetationen ingick här (c. 400 m norr om triangelpunkten 7.53 Tosteberga) bl.a. *Crataegus monogyna, C. oxyacantha, Prunus spinosa*; *Anemone pulsatilla, Campanula rotundifolia, Carlina vulgaris, Filipendula vulgaris, Galium verum, Helianthemum chamaecistus* ssp. *hirsutum, Hieracium pilosella, Linum catharticum, Polygala amarella, Primula veris, Thymus serpyllum, Viola rupestris*; *Carex caryophyllea, C. ericetorum, C. montana, Festuca ovina, Helictotrichon pratense, Phleum phleoides* (av mossor iakttogs bl.a. *Camptothecium lutescens* och *Rhytidiadelphus triquetrus*). Under det fortsatta floristiska flanerandet påträffades ett inte så litet bestånd av *Carex obtusata,* som tidigare mig veterligen icke uppgivits för denna plats (c. 200 m nordost om triangelpunkten 7.53 Tosteberga). Lokalen utgjordes av öppen, betespåverkad »gräsmark» av liknande slag som den närmast ovan beskrivna, kanske något artfattigare.

Senare besöktes en av de klassiska lokalerna för *Carex obtusata* vid Transvaal i Åhus, där den växer på »sand».

Dagens florastudier avslutades vid Maltesholm i regnväder (medan förmiddagen varit vacker). På gräskanterna invid uppfartsvägen kunde jämförande studier bedrivas mellan *Gagea lutea* och *minima,* och lundfloran i bokskogen därnedanför blev också uppmärksammad med bl.a. *Allium ursinum, Corydalis cava, Lunaria rediviva, Mercurialis perennis* och *Pulmonaria officinalis.*

13 september. Exkursion till Vombsjödistriktet och till Linderödsåsen i Skåne med fil. mag. SIGURD JÖNSSON som färdledare. Route: Lund—Dalby—Skälbäck (Veberöds sn)—Vasaholm—Vaselund (Hällestads sn)—Silvåkra—Silvåkragården — Krankesjön — Silvåkra—Harlösa—Övedskloster—Öveds stn (f.d.)—Frualid—Vollsjö—Fränninge—Starrarp—Tattarp (Ö. Sallerups sn)—Östraby—Lund.

Vid Skälbäck på avhyvlad mark intill ett sandtag växte bl.a. *Erodium cicutarium, Hypochoeris glabra, Ornithopus perpusillus, Papaver dubium, Spergula arvensis, Trifolium arvense, Viola tricolor, Agropyron repens* och *Agrostis gigantea.*

I Hällestads sn c. 600 m ostsydost om Vaselund demonstrerades ett rikligt och vackert blommande bestånd av *Gentiana pneumonanthe.* I vegetationen ingick här dessutom bl.a. *Salix repens, Vaccinium uliginosum, Achillea ptarmica, Lythrum salicaria, Potentilla anserina, P. erecta, P. palustris, Succisa pratensis, Viola palustris, Agrostis canina, Carex leporina, C. nigra, C. panicea, Deschampsia caespitosa, Molinia caerulea, Sieglingia decumbens* och *Calliergonella cuspidata.*

I Silvåkra sn (c. 2,1 km söder om kyrkan) studerades floran på en övergiven åker, med *Erigeron acre, E. canadense, Hypochoeris radicata* m.fl.

Vid Krankesjön ostnordost om Silvåkragården besöktes ett ovanligt stort bestånd av *Cladium mariscus*; och strax öster om samma gård i ett potatisfält (med ovanligt mycket frukter på potatisen) fanns anmärkningsvärt nog *Arnoseris minima.*

Det sedan långt tillbaka kända exkursionsmålet Frualid med sin massförekomst av *Festuca altissima* var lika imponerande som alltid.

Tid blev det också till ett par anhalter på Linderödsåsen, innan gästgivaregården i Östraby kallade.

19 oktober. Dr WERNER GREUTER höll föredrag »Über Land, Geschichte und Pflanzenwelt Kretas». Föredraget gav en översikt över Kretas geologi, dess fascinerande kulturhistoria och dess flora och vegetation, som föredragshållaren är sysselsatt med att undersöka.

20 november. Styrelse för 1965 valdes: Samtliga styrelsemedlemmar omvaldes. Likaså valdes revisorer och deras suppleanter enligt samma mönster.

Professor HENNING WEIMARCK demonstrerade material av släktet *Epipactis.*

Docent OVE ALMBORN höll föredrag om »Några utbredningstyper i Sydafrikas lavflora».

Föredragshållaren, som är sysselsatt med en grundlig utredning av Sydafrikas lavflora, gav en historisk överblick av dess utforskande och presenterade en preliminär växtgeografisk indelning av Sydafrikas lavar.

11 december. Fil. mag. BERTIL NORDENSTAM höll föredrag om »En botanisk resa i Sydafrika».

Föredraget utgjordes av glimtar från föredragshållarens botaniska forskningsfärder under en 2-årig vistelse i Sydafrika.

JAN ERICSON

BOTANISKA NOTISER 1965 · VOL. 118 · FASC. 1 · LUND

Smärre uppsatser och meddelanden

Fynd av Epipogium aphyllum i Äppelbo socken, Västerdalarna

De hittills kända och beskrivna förekomsterna av skogsfrun, *Epipogium aphyllum*, i Västerdalarna begränsar sig till socknarna Transtrand och Järna. I Transtrand upptäcktes skogsfrun 1932 av FOLKE LUNDBERG. Senare, 1940, sågs växten av fru LISA PERSSON nära Vansbergets fäbodar i Järna. Ytterligare två fynd inom Järna socken, bägge nära Kilfallets fäbodar, gjordes 1943 och troligen 1945 av AXEL KRISTIANSSON.

Samtliga ovannämnda förekomster har förut beskrivits i denna tidskrift av FOLKE LUNDBERG (1947, 1957).

Västerdalslokalerna anges även i Dalarnes Flora (ALMQUIST 1949) och i Tillägg till Dalarnas flora (ALMQUIST & BJÖRKMAN 1960). I tillägget finns dessutom en uppgift om skogsfrun i Malung (utan närmare angivelse av lokalen). Undersökningar, som företagits inom socknen angående detta fynd, har tyvärr ej gett några positiva resultat.

I slutet av augusti år 1964 upptäckte skogsförman LARS BERG strax söder om Risbergets fäbodar i Äppelbo socken ett flertal blommande exemplar av skogsfrun. BERG räknade till över 15 st utspridda över ett område av c:a 500 m^2.

Den 22 aug. bjöds tillfälle att besöka området tillsammans med BERG och några intresserade ortsbor. Vi kunde då ytterligare studera vegetationen på platsen och det intressanta fyndet.

Lokalen, som sluttar något åt sydost, är en fuktig, skuggig och örtrik granskog med svagt inslag av björk. Fuktigheten gör sig starkast gällande mot södra och västra kanten av området, där bl.a. *Filipendula ulmaria, Valeriana sambucifolia* och *Alnus incana* (låga buskar) framträder starkt. Lokalen kan möjligen räknas till den s.k. örtrika blåbärs-granskogen (SJÖRS 1956 sid. 120) eller till den skogstyp av frisk (-fuktig) *Dryopteris*-ristyp, som beskrivs av ARNBORG (bl.a. ARNBORG 1940). Det skulle dock kunna anmärkas, vid Äppelbolokalens jämförelse med dessa skogstyper, att förekomsten av blåbär vid Västerdalslokalen var ganska sparsam.

De blommande exemplaren av skogsfrun uppträdde såväl enstaka som i grupper på 2—5 st. Stjälkarnas längd varierade mellan 15 och 20 cm och uppbar i regel 2—3 blommor. Skogsfruexemplaren växte dock icke i de våtaste partierna; ett ståndortsförhållande, som även påpekats av LUNDBERG i hans beskrivning av Kilfallslokalerna (LUNDBERG 1957 sid. 485).

Vid besöket på platsen noterades följande kärlväxter (med undantag av ovannämnda):

Athyrium filix-femina
Carex echinata
— *pauciflora*
— *flava*
— *pallescens*
Cirsium palustre
Corallorhiza trifida
Crepis paludosa
Deschampsia caespitosa
Dryopteris dilatata
Equisetum silvaticum
Geranium silvaticum
Geum rivale
Goodyera repens
Lastrea dryopteris
— *phegopteris*
Linnaea borealis
Listera cordata
Lycopodium annotinum
Majanthemum bifolium
Melica nutans
Orchis maculata
Oxalis acetosella
Paris quadrifolia
Parnassia palustris
Platanthera bifolia
Polygonatum verticillatum
Potentilla erecta
Prunella vulgaris
Pyrola minor
— *rotundifolia*
— *secunda*
Rubus saxatilis
Salix sp.
Solidago virgaurea
Sorbus aucuparia
Trientalis europaea
Vaccinium myrtillus
— *vitis idaea*
Veronica officinalis
Viola palustris

Bland mossorna i bottenskiktet dominerade *Hylocomium splendens, Pleurozium Schreberi* och *Rhytidiadelphus triquetrus.* I de något fuktigare partierna syntes *Plagiochila major, Mnium punctatum* var. *elatum, Calliergon cordifolium* och *Sphagnum squarrosum.* Bland övriga mossarter märktes *Dicranum major, Ptilium crista-castrensis, Fissidens adianthoides, Rhytidiadelphus calvescens* och *Plagiothecium succulentum.*

Bottenskiktets arter tillhör det ubikvistiska förbundet *Pleurozion* inom Hedserien (v. KRUSENSTJERNA 1945 sid. 112—117). VON KRUSENSTJERNA nämner där tre unioner, förut uppställda av ARNBORG (1940), av vilka *Ptilium crista-castrensis - Hylocomium splendens* - unionen bäst torde motsvara Äppelbolokalens artsammansättning. Det rikliga uppträdandet av *Rhytidiadelphus triquetrus* inom området för tanken till v. KRUSENSTJERNAS intressanta *Rhyt. triq.* societet inom ovannämnda union (v. KRUSENSTJERNA 1945, sid. 116).

För samtliga ovan angivna mossarter har beläggexemplar tillställts Naturhistoriska Riksmuseum. För kontroll och bestämning av mossorna tackas NILS HAKELIER, ELSA NYHOLM och HERMAN PERSSON.

Citerad litteratur

ALMQUIST, E. 1949. Dalarnes flora. — Lund.
ALMQUIST, E. & BJÖRKMAN, G. 1960. Tillägg till Dalarnas flora. — Svensk Bot. Tidskr. 54. Uppsala.
ARNBORG, T. 1940. Der Vallsjö-Wald, ein nordschwedischer Urwald. — Acta Phytogeogr. Suec. 13. Uppsala.
VON KRUSENSTJERNA, E. 1945. Bladmossvegetation och bladmossflora i Uppsalatrakten. — Acta Phytogeogr. Suec. 19. Uppsala.
LUNDBERG, F. 1947. Ny lokal för Epipogium aphyllum i Dalarna. — Bot. Notiser. Lund.
— 1957. Epipogium aphyllum i Västerdalarna. — Bot. Notiser. Lund.
SJÖRS, H. 1956. Nordisk Växtgeografi. — Stockholm.

PELL ALGOT ERIKSSON

Litteratur

Recent Advances in the Embryology of Angiosperms. Editor P. MAHESHWARI. — Int. Soc. of Plant Morphologists, Delhi. 1963. 10+467 s.

När P. MAHESHWARI år 1950 utgav sitt arbete »An Introduction to the Embryology of Angiosperms», betydde det, att en klar och överskådlig sammanfattning av embryologiens aktuella resultat blev tillgänglig. Under följande år har emellertid många nya landvinningar gjorts på det embryologiska området, och ett supplement har därför varit påkallat. Det föreliggande arbetet är att betrakta som ett sådant: det behandlar i en rad kapitel, författade av olika forskare, de nyare resultaten inom olika delar av embryologien.

Arbetet inledes med en historisk översikt över embryologiens utveckling från dess begynnelse till nuvarande tid, författad av verkets redaktör. Om den hanliga gametofyten skriver K. STEFFEN, som gör en allmän översikt med hänsyn även till före 1950 utkommen litteratur; samme förf. har även skrivit ett kapitel »Fertilization», som huvudsakligen behandlar nyare resultat, bl.a. av PODDUBNAJA-ARNOLDI, GERASSIMOVA-NAVASHINA (vars teorier dock ej helt accepteras) och förf. själv. Om fröämnet skriver R. N. KAPIL och I. K. VASIL och om den honliga gametofyten B. M. JOHRI; den senare förf. ger en god översikt över olika embryosäcktyper, även om man känner sig litet skeptisk inför upphöjandet av *Endymion*-typen till jämställdhet med *Allium*-typen — av vilken den väl snarare är en obetydlig variant —, medan *Eriostemones*-typen och *Peperomia hispidula*-typen ej får en självständig ställning.

De apomiktiska företeelserna behandlas av E. BATTAGLIA. Förf. proponerar en del nya termer utöver den förut rikhaltiga terminologien och ger f.ö. en god och detaljerad översikt över olika typer, där utvecklingen, uppdelad på sporogenesis och somatogenesis, klart framställes i en serie schematiska bilder. Några av de av förf. uppställda *Rudbeckia*-typerna är väl dock snarast att betrakta som tillfälliga anomalier och ej egentliga utvecklingstyper. Kapitlet om polyembryoni, av P. MAHESHWARI och R. C. SACHAR, innehåller en grundlig sammanställning av olika fall och typer, fördelade på verklig och falsk polyembryoni, d.v.s. sådan som uppstår inom en embryosäck eller genom medverkan av två olika embryosäckar eller nucelli. Den viktiga skillnaden mellan embryobildning från reducerade och oreducerade celler framhålles givetvis, och åtskilliga exempel citeras på förekomst av haploida embryoner tillsammans med diploida eller även triploida sådana.

I kapitlet »Embryo» av P. CRÉTÉ ges en detaljerad framställning av olika embryotyper och deras utveckling. Störst allmänt intresse har här diskussionen av sambandet mellan embryogeni och systematik: det framhålles hur vissa familjer eller ibland större grupper, såsom *Compositae* eller *Campanulaceae*-

Lobeliaceae, utmärkes av en enhetlig embryogeni, medan i andra fall, som när det gäller familjerna *Papaveraceae* och *Papilionaceae,* embryogenien är starkt varierande och ej synes ansluta sig till andra systematiska karaktärer.

I ett annat kapitel, »Embryology and Taxonomy» av B. M. JOHRI, diskuteras också systematikens förhållande till embryologien, här dock ej blott med hänsyn till embryogenien utan till samtliga embryologiska karaktärer, vilket givetvis ger en säkrare grund. En hel rad exempel blir anförda på hur embryologien bidragit till att lösa systematiska problem, även om förf. givetvis inser att den inte ensam är tillräckligt kriterium. Bl.a. talar embryologien för att familjen *Loranthaceae* skall delas i två: *Viscaceae* och *Loranthaceae,* att *Limnanthaceae* skall skiljas från *Sapindales* och *Geraniales* och bilda en egen ordning och att underfam. *Nelsonioideae* inom *Acanthaceae* ej skall som det föreslagits överföras till *Scrophulariaceae* utan bör ha sin plats inom *Acanthaceae.*

Bland övriga kapitel kan nämnas ett avsnitt om »Artificial Culture of Embryos» av MARY E. SANDERS och NANCY K. ZIEBUR och ett kapitel »Fruit Development» av J. P. NITSCH, båda fysiologiskt inriktade och även med vissa praktiska aspekter.

Den översikt som ges över embryologiens senaste utveckling är således allsidig och ger många intressanta bidrag från olika områden. Givetvis blir framställningen något ojämn, när en rad olika författare medverkar: somliga kapitel blir mer utförligt behandlade än andra, och uppläggningen varierar något från en författare till en annan. Ett önskemål kunde kanske vara att prof. MAHESHWARI själv gav ut en ny upplaga av sitt grundläggande arbete, med inarbetande av de resultat som redovisas i det föreliggande supplementet.

H. HJELMQVIST

PAUL OZENDA: L i c h e n s. — Handbuch der Pflanzenanatomie. 2. Auflage. Bd. VI: 9. Berlin-Nikolassee (Gebr. Borntraeger) 1963. 199 pp. 123 figures. 8 plates. Price DM. 105: —.

Nearly four decades have passed since the publication of NIENBURG, Anatomie der Flechten (1926) in the first edition of LINSBAUER's wellknown "Handbuch der Pflanzenanatomie". Apart from TOBLER, Die Flechten (1934), DES ABBAYES, Traité de lichénologie (1951) and some chapters in taxonomic and general works on lichens, e.g., HALE, Lichen handbook (1961, reviewed in Bot. Not. 1963, p. 110), no major handbook of lichen anatomy has appeared since the "Nienburg". There has been rapid progress in the anatomy and cytology of the fungi, and many (sometimes too many) papers have been published in lichen taxonomy, but in several respects, our knowledge of the anatomy and reproduction of the lichens has not increased essentially for many years. The problem of the lichen synthesis has recently come much nearer its solution through the works of AHMADJIAN, but other problems (e.g., the function of the pycnoconidia) are quite as obscure as in the 19th century.

The present handbook of lichen anatomy by Professor P. OZENDA (Grenoble) is much more than a new edition of the "Nienburg". The disposition of the material is about the same. The lichen fungi, the lichen algae and the

relation between hyphae and "gonidia" (a somewhat old-fashioned term!) are discussed briefly. The important paper by QUISPEL (1945) on the lichen symbiosis is not mentioned. Comprehensive chapters have been devoted to the anatomy of different types of lichen thalli, to pathology (including lichenicolous parasitic fungi, parasymbionts, cecidia and cephalodia) and to the structure of apothecia and spores. A considerable amount of recent researches have been included, and, on the whole, the volume gives a good survey of the present state of lichen anatomy. Related topics, as physiology and biochemistry of lichens, have not been dealt with.

Some objections can be raised as to the quotation of literature. The many advances in lichen anatomy published in recent years by French authors, have been duly considered, but several important contributions from other countries have been omitted. A Scandinavian reader would observe that a number of works from this part of the world have been ignored or treated scantily. DU RIETZ's classical paper on soredia and isidia (1924) has been quoted in the bibliography but is not considered in any way in the text. On the other hand, NANNFELDT's (the name is consistently mis-spelt!)important treatise on the inoperculate *Discomycetes* (1932) is mentioned briefly but is omitted in the bibliography. Contrary to most modern lichenologists, Dr. OZENDA is not convinced of the usefulness of the concepts of *Ascohymeniales* and *Ascoloculares* for lichen taxonomy. DEGELIUS' extensive study of *Collema* (1952), which is a most essential contribution to lichen anatomy and to the symbiosis problem, has evidently escaped the attention of the author when writing the main part of his book. It is discussed briefly in the appendix. THOMSON's papers on the formation of isidia in some *Peltigera* species are mentioned, but not those of LINDAHL, who has obtained other results.

The illustrations are well chosen and well reproduced. A few drawings by classical 18th century anatomists (e.g., TULASNE, BORNET, and REINKE) are met with, but the majority of the figures have been taken from recent works, many of them from GALLÖE's magnificent "Natural history of the Danish lichens". A minor part of the drawings are original. The eight plates contain excellent black-and-white photographs illustrating different types of external lichen morphology.

OVE ALMBORN

KLARA VERSEGHY: Die Gattung Ochrolechia. — Beihefte zur Nova Hedwigia 1. Weinheim (J. Cramer) 1962. 146+5 pp. 12 plates. Price DM. 40: —.

In the series "Beihefte zur Nova Hedwigia", which started in 1962, a number of major works on various groups of cryptogams have been published, i.a., monographs of the lichen genera *Anaptychia* (KUROKAWA 1962) and *Physcia* (J. W. THOMSON 1963; N. American species only). When reviewing these papers (Bot. Not. 1964 pp. 102—103) I emphasized the need for comprehensive and critical monographs also of crustaceous lichen genera. With the exception of *Acarospora* (MAGNUSSON 1929 and later supplements) there still exists no monograph of a large genus of crustaceous lichens.

Ochrolechia was earlier considered as a small genus. ZAHLBRUCKNER (ENGLER, Nat. Pflanzenfam., 1926) estimated the number of species to 10. Later, in his Catalogus (1928—1940), he listed 38 species. The present monograph by Dr. KLARA VERSEGHY (Dept. of Botany, Natural Science Museum, Budapest) recognizes 59 species. 17 new species have been described by the author. 16 former subspecific units have been risen to specific level. 7 species are listed as species incertae, as the author has not been able to trace the type material.

Morphology and chemistry are treated briefly. The main part of the volume is devoted to description of the species (often, but not always, founded on type material) and enumeration of stations of the specimens studied. The author has seen the material of a number of (mainly Central European) herbaria.

Is is evident that there are still several problems to be clarified within *Ochrolechia*. *O. tartarea* is described as non-sorediate (not including the sorediate *O. androgyna*), but the description by LINNAEUS and a specimen in the Linnaean herbarium in London refer to a sorediate species. *O. turneri* is a good species, which has been misunderstood and forgotten for more than 150 years, until it was reestablished recently (LAUNDON 1958; not quoted). There is little reason to place it under *O. alboflavescens*, as Dr. VERSEGHY does. *O. subviridis*, which is a real *Ochrolechia* (apothecia described by ERICHSEN in 1942), has been placed in *Pertusaria*, without any comments.

O. austroamericana (Malme) Vers. is an illegitimate combination, owing to the older homonym *O. austroamericana* Räs. *O. africana* Zahlbr. (1926) is a homonym of (not identical with) *O. africana* Vainio (1926). The latter species is not mentioned by VERSEGHY. One of them will need a new name.

OVE ALMBORN

CARROLL W. DODGE: Some lichens of Tropical Africa. IV. *Dermatocarpaceae* to *Pertusariaceae*. — Beihefte zur Nova Hedwigia 12. Weinheim (J. Cramer) 1964. 282 pp. No illustrations. Price DM. 80: —.

Dr. C. W. DODGE (Burlington, Vermont, U.S.A.) has published a series of publications under the title "Some lichens of Tropical Africa". Parts I—III (II dealing with *Usnea*, III with *Parmelia*) appeared in Annals of the Missouri Botanical Garden 40—46 (1953—1959). They were founded mainly on undetermined material sent from the Kew Gardens, the New York Botanical Garden, and the East African Herbarium in Nairobi, Kenya. Keys including the species recorded from Central Africa (later also from Southern Africa, Madagascar, etc.) were given to the genera treated. The keys have mainly been compiled from literature. Only exceptionally has type material been consulted. A considerable number of new species have been described.

The present volume is founded on material from the same sources. The keys have been revised, and, at least in some cases, they include all species recorded from Africa S. of the Sahara. In the reviewer's opinion, a critical examination of the types would have reduced a good deal of these taxa to synonymy. In many cases they are identical with species known from other

tropical regions, whereas the endemic African lichens will prove to be fairly few. It is a wellknown fact that many lichenologists have worked more or less independently of one another, without considering the results of their colleagues. Especially in the *Graphidineae,* a cleansing would have been desirable in the jungle of "species" described mainly on the external shape of the apothecia, a most variable character.

As in the previous volumes, numerous species have been described as new. The descriptions are detailed but, despite the keys, it is often difficult to get a view of the systematic position of the new species. A discussion of the distinguishing characters against related species would have been highly needed. An example: *Diploschistes Almborni* Dodge is described on one specimen of ALMBORN, Lichenes Africani no. 27 (distributed as *D. actinostomus* var. *caesioplumbeus*). There is no discussion of the affinity of the n.sp., nor does the key mention *D. actinostomus*, which is a variable species widely distributed in arid regions and recorded from several stations in Africa.

Some "endemic species", which have previously been reduced to synonymy, are still listed as species in the keys. *Solorina sorediifera* is a *Peltigera* (GYELNIK 1932; checked by the reviewer). *Umbilicaria* (*Lasallia*) *rubiginosa* is not specifically different from *U. papulosa*, as there exist all intergrades between red and grey colour (FREY 1949).

As a rule, ZAHLBRUCKNER's system has been followed. In the *Stictaceae,* however, we meet with some genera, *Lobarina, Cyanisticta* and *Stictina* (why not also *Solorinina*?) founded only on differences in the algal component, a taxonomic principle quite out of date in modern lichenology.

In many cases it is not stated where the types of the n.spp. are preserved (in the author's own herbarium?). This information would have been most useful to future workers on African lichens.

The author has devoted too little attention to formal details. There is often quite an arbitrary changing between male and female endings of the epithets within the same genus (e.g., in *Diploschistes*). Mis-spellings of some generic names, like "*Arthropyrenia*" (almost consistently, also in the index) are severely trying to the reader's patience.

OVE ALMBORN

The collected lichenological papers of EDWARD TUCKERMAN edited and prefaced by W. L. CULBERSON. Vols. I—II. — Historiae naturalis classica IX: 1—2. Weinheim (J. Cramer) 1964. 534+756 pp. Price DM. 198: —.

This series of reprints of important old botanical works published by J. CRAMER and H. K. SWANN is a welcome aid to plant taxonomy. Many of the classical floras, monographs, etc. have now become extremely rare and expensive. Some of them are hardly ever found in the secondhand booksellers' catalogues. To a botanist not working in an institute with a well-furnished library, the lack of literature can often become a serious handicap.

This problem is especially relevant in lichenology. Publications by many 19th century authors, e.g., ACHARIUS, NYLANDER, KOERBER, MASSALONGO,

STIRTON, and MÜLLER ARGOVIENSIS are often difficult to find in libraries and almost impossible to buy. This is true concerning many major works and, still more, several small papers scattered in rare journals or privately printed in very small editions. The search for literature often takes considerable time from real scientific work.

The reissue of the collected papers of E. TUCKERMAN is a great event in lichenology. TUCKERMAN was the first American lichenologist, and internationally he is counted as one of the five or six leading authors of the past century. Dr. W. L. CULBERSON (Durham, N. Carolina, U.S.A.) has edited the present issue of TUCKERMAN's lichenological works. As an introduction he has written a biography of TUCKERMAN, with a portrait and a complete bibliography. Vol. I contains 35 minor works, as a rule published in American journals. Vol. II contains the two major works "Genera Lichenum" (1872) and "Synopsis of the North American Lichens. I—II." (1882, 1888).

All seriously working lichenologists owe sincere thanks to Dr. CULBERSON and the publisher CRAMER for these useful volumes. It is hoped that they will soon be followed by similar reissues of the collected works of other classical authors, which would highly contribute to the promotion of lichenology.

OVE ALMBORN

KARL BERTSCH: Flechtenflora von Südwestdeutschland. — 2. Auflage. Stuttgart (Verlag Eugen Ulmer) 1964. 251 pp. Price DM. 20:—.

There are few good handbooks, concise and not too expensive, suitable to put in the hands of students or amateur botanists, who want an introduction to lichen taxonomy. Some decades ago, LINDAU, Die Flechten (Kryptogamenflora für Anfänger 3; 2nd ed., 1923; now out of print) was a useful, though not always adequate, introduction to the lichen flora of Central Europe. Scandinavian botanists have often used MAGNUSSON's lichen flora (1929, out of print; macrolichens only) and elementary cryptogamic floras by ROSTRUP (1925, Denmark), URSING (1949, 1962, Sweden) and KROK-ALMQUIST (1947, 1962, Sweden), which, however, treat only a limited number of species. POELT, Höhere Flechten von Europa (1963, reviewed in Bot. Not. 1963 p. 536) is an excellent guide to the genera treated, but it does not include the crustaceous lichens.

Professor K. BERTSCH (Ravensburg), otherwise known as the author of an elementary moss flora, published a "Flechtenflora von Südwestdeutschland" in 1955. It contained keys to the major groups, to the genera (covering the whole system) and to 1093 species. Each species was described very briefly (in 2—4 lines). The present second edition has considered a good deal of recent progress in lichen taxonomy. The number of species treated now amounts to 1290. The recognition of some species is facilitated by 66 line drawings (mainly apothecia and spores, sometimes also habitus) in the text. A special key to sterile crustaceous lichens should be mentioned.

Like all compilations, this small flora should be read with a good deal of caution. In spite of its condensed style, it gives a useful introduction to the lichens of southern Germany and adjacent districts. To some extent, it may

be helpful also to botanists in southern Scandinavia, where most of the German species are met with.

OVE ALMBORN

URSULA K. DUNCAN: Lichen illustrations. — Arbroath, Scotland (T. Buncle & Co.) 1963. 152 pp. Price 25 sh.

The author of "A guide to the study of lichens" (1959; reviewed in Bot. Not. 1960 p. 125) has published a supplement containing line drawings of 142 (for the most part) common British lichens. They show the habitus and often also some anatomical details (sections of apothecia, asci, spores, etc.). The drawings are unpretentious, and sometimes they give very vague ideas of the general appearance of these lichens. They cannot in any way be compared to the fine illustrations in A. L. SMITH, British lichens, or GALLÖE, Natural history of the Danish lichens.

OVE ALMBORN

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Notiser

Göteborgs Botaniska Trädgård. Till prefekt vid Göteborgs Botaniska Trädgård har utsetts dr phil. PER WENDELBO, Bergen.

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Tisd.	8 juni	Konstituerande sammanträde, demonstration av institutionen för systematisk botanik.
Onsd.	9 juni	Föredrag.
Torsd.	10 juni	Exkursion till östra Skåne.
Fred.	11 juni	Föredrag.
Lörd.	12 juni	Exkursion till nordvästra Skåne.

Bindande anmälan om deltagande insändes senast den 30 april 1965 till professor HENNING WEIMARCK, Institutionen för systematisk botanik, Lund. Deltagaravgift sv. kr. 50: — för varje deltagare sändes samtidigt härmed per postgiro 53 12 88.

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BOTANISKA NOTISER 1965 · VOL. 118 · FASC. 2 · LUND

Studies in the Aegean Flora

VII. Chromosome Morphology in the Nigella arvensis Complex

By ARNE STRID

Institute of Systematic Botany, Lund

Introduction

The genus *Nigella* belongs to the tribe *Helleborae* of the family *Ranunculaceae*. Together with the closely related monotypic genus *Komaroffia* it holds a relatively isolated position within the tribe (cf. LEVITSKY 1931, GREGORY 1941). The genus contains about 25 species, all of which are annual and distributed mainly in the Mediterranean area. Most of them are comparatively distinctly delimited and easily identifiable entities, but the complex of forms grouped around *N. arvensis* L. exhibits extensive regional and local differentiation, making taxonomic subdivision extremely difficult. RECHINGER (1943) lists 7 Aegean species in the *Nigella arvensis* complex, but MEIKLE (1954) argues that they should probably all be united into a single species with a number of infraspecific taxa. Nomenclatural and taxonomic problems in the complex will be discussed elsewhere, and the working names used in this paper should thus to some extent be regarded as provisional. A definite opinion on the taxonomic subdivision is not, however, essential for the present investigation.

HOCQUETTE (1922) gives a chromosome number of 2n=12 for *N. sativa* L., *N. arvensis* L. and *N. nigellastrum* Willd. This observation has been confirmed by a number of workers (LANGLET 1927, LEVITSKY 1931, GREGORY 1941, PEREIRA 1942, DELAY 1947, KURITA 1956, 1957 and 1959, BHATTACHARJYA 1958, et al.). All the species investigated are diploid with 2n=12 and their karyotypes are very similar. KURITA (1957) did not find differences in chromosome morphology between the quite distantly related species *N. sativa* L. and *N. ciliaris* DC., despite using a modern squash technique. PEREIRA (1942) noticed, however, that

some species have two pairs of satellite chromosomes, while others have three or four pairs. BHATTACHARJYA (1958) also found slight differences in chromosome morphology between *N. sativa* L. and *N. damascena* L. Several workers have noted that the karyotype of *Nigella* is pronouncedly "asymmetric" (STEBBINS 1950) with five pairs of more or less metacentric chromosomes and one pair of telocentric to subtelocentric ones. The latter pair is noteworthy as this type of chromosome is very rare among plants (cf. STEBBINS 1950). The basic number x=6 is unknown in other genera of the tribe *Helleboreae*. The closely related genus *Komaroffia* has the basic number x=7 and three pairs of subtelocentric chromosomes (PEREIRA 1942).

Material and Methods

The present investigation is based mainly upon material raised from seeds collected by Mr. R. v. BOTHMER and the author in the summer of 1964. Part of the material was collected by Dr. H. RUNEMARK, Dr. S. SNOGERUP and Mr. B. NORDENSTAM between 1958 and 1964. The plants were cultivated in the greenhouses of the Botanical Garden, Lund, during the winter of 1964—65. The values given below for the time from sowing to flowering should only be mutually compared as in nature development is much faster. A total of about 520 individuals from 54 populations were examined for chromosome number, all of them having 2n=12. In the sense of RECHINGER (1943) the material represents *N. aristata* S. & S. (42 collections), *N. degenii* Vierh. (10 collections), *N. cretica* Mill. (one collection) and *N. fumariaefolia* Kotschy (one collection). Fig. 1 shows the distribution of the material investigated (in several cases a single point represents more than one collection). With respect to external morphology, *N. aristata* is a very variable species, whereas *N. degenii,* which is endemic to the Cyclades, seems to be more homogeneous. Within *N. aristata* five populations from different islands were selected for a particularly careful cytological examination. Measurements of the chromosomes were made from camera lucida drawings (× 4770) and arm index values as well as relative length values were calculated. The arm index was defined as the ratio of the long arm to the short arm. In the case of satellite chromosomes the length of the satellite was included in the length of the arm to which it was attached, but the gap between the arm and the satellite was excluded as its extension may vary considerably. The relative length value of an individual chromosome is given as a percentage of the total length of the haploid complement. As there is considerable variation in the degree of chromosome contraction between different metaphase plates, absolute length values cannot be used. Table 1 gives the arm indices and the relative length values for the chromosomes of *N. fumariaefolia, N. degenii* and *N. cretica.* Table 2 gives the arm index values for the chromosomes in five populations of *N. aristata* as well as t values (with conventional signs for statistical significance) obtained by comparing homologous chromosomes from

Table 1. Relative length and arm index values of the chromosomes of N. fumariaefolia, N. degenii and N. cretica

Relative length

Species	Chromosome No. 1	2	3	4	5	6
N. fum.	18.48±0.18	18.64±0.20	17.60±0.19	18.69±0.14	17.65±0.14	9.01±0.22
N. deg.	19.71±0.21	19.43±0.17	17.14±0.18	16.58±0.13	16.00±0.15	11.14±0.19
N. cret.	18.90±0.16	18.98±0.20	19.73±0.22	16.58±0.17	15.57±0.18	10.22±0.23

Arm index

Species	Chromosome No. 1	2	3	4	5	6
N. fum.	1.15±0.03	1.26±0.03	1.08±0.02	1.23±0.03	1.05±0.02	15—20
N. deg.	1.05±0.02	1.13±0.02	1.21±0.03	1.06±0.02	1.03±0.01	15—20
N. cret.	1.21±0.02	1.12±0.03	1.25±0.03	1.07±0.02	1.04±0.01	15—20

Table 2. Arm index values (long arm/short arm ratio) of the chromosomes in five populations of N. aristata and t values obtained by comparing the different populations

Population	Chromosome No. 1	2	3	4	5	6
AD	1.19±0.03	1.18±0.03	1.15±0.02	1.06±0.02	1.02±0.01	15—20
BE	1.44±0.02	1.08±0.02	1.19±0.02	1.11±0.02	1.04±0.01	15—20
BK	1.09±0.03	1.06±0.02	1.12±0.03	1.07±0.02	1.03±0.02	15—20
BU	1.23±0.02	1.05±0.01	1.21±0.02	1.07±0.01	1.03±0.01	15—20
BB	1.45±0.03	1.13±0.01	1.20±0.02	1.13±0.02	1.06±0.01	15—20
t (AD/BE)	6.92***	2.77*	1.41	—	—	—
t (AD/BK)	2.36*	3.32**	0.83	—	—	—
t (AD/BU)	1.11	5.81***	2.12*	—	—	—
t (AD/BB)	5.46***	1.58	1.77	—	—	—
t (BE/BK)	9.75***	0.71	1.94	—	—	—
t (BE/BU)	7.42***	1.34	0.71	—	—	—
t (BE/BB)	0.28	2.24*	0.35	—	—	—
t (BK/BU)	3.88**	0.45	2.50*	—	—	—
t (BK/BB)	6.74***	3.13**	2.22*	—	—	—
t (BU/BB)	6.09***	5.66***	0.35	—	—	—

the different populations. Table 3 gives the corresponding values for relative chromosome length. The figures represent mean values from 10 measurements.

The low chromosome number and the large size of the chromosomes make *Nigella* favourable for cytological investigation. The squash technique described by ÖSTERGREN & HENEEN (1962) was used with the following modifications:

1. Before fixation the roots were pretreated for 3—4 hours with a 1.7 mM solution of 8-hydroxy-quinoline at 10°C. ÖSTERGREN & HENEEN recommend 2 mM solution (for *Agropyron*) and 1 mM (for *Secale*) at 15°C. With *Nigella* the somewhat lower temperature prevents tendencies for stickiness although, on the other hand, too low a temperature causes overcontraction of the chromosomes.

Table 3. Relative length values of the chromosomes in five populations of N. aristata and t values obtained by comparing the different populations

Population	Chromosome No. 1	2	3	4	5	6
AD	18.33±0.13	19.37±0.22	17.54±0.18	17.48±0.19	17.34±0.20	9.95±0.19
BE	18.46±0.17	17.19±0.17	16.95±0.16	19.37±0.18	16.47±0.11	11.13±0.26
BK	17.76±0.19	17.76±0.22	17.26±0.13	18.24±0.19	18.32±0.15	10.20±0.20
BU	19.03±0.16	18.68±0.09	17.28±0.12	16.69±0.11	17.34±0.13	11.09±0.09
BB	17.17±0.14	18.55±0.11	17.50±0.17	18.05±0.13	18.12±0.13	10.60±0.10
t (AD/BE)	0.78	7.84***	2.44*	—	—	3.68**
t (AD/BK)	2.37*	5.42***	1.26	—	—	0.91
t (AD/BU)	3.40**	2.90*	1.20	—	—	5.42***
t (AD/BB)	6.07***	3.33**	0.16	—	—	3.03**
t (BE/BK)	2.75*	1.83	1.50	—	—	2.84*
t (BE/BU)	2.44*	7.75***	1.60	—	—	0.15
t (BE/BB)	5.86***	6.72***	2.36*	—	—	1.90
t (BK/BU)	5.11***	3.87**	0.11	—	—	4.06***
t (BK/BB)	2.50*	3.29**	1.12	—	—	1.79
t (BU/BB)	8.75***	0.92	1.06	—	—	3.64**

2. Carnoy (3 parts acetic acid: 1 part absolute alcohol) was used instead of the special fixative recommended by ÖSTERGREN & HENEEN. The latter fluid did not give satisfactory results with *Nigella* roots as it was difficult to obtain well stained and flattened preparations. Furthermore, the roots can only be left in this fixative for a few days without a deleterious effect. Using the simple Carnoy fixative the objects may be preserved in well stoppered vials at —15°C for at least a few months without damage. The chromosomes were well stained by means of the Feulgen reaction, exhibiting smooth outlines and bringing out morphological landmarks distinctly.

After staining the roots were placed in a 5 % pectinase solution for 2—6 hours (depending on the quality of the pectinase) and squashed in 45—50 % acetic acid using a dissolvable cover slip of Astralon plastic. The preparations were sealed by means of a rubber frame, the plastic cover slip was dissolved in acetone, and the preparations were mounted in Permount, using an ordinary cover slip of glass, as described by ÖSTERGREN & HENEEN.

Results

Nigella fumariaefolia Kotschy

Crete: Cape Sitia, poorly developed garigue on hard limestone. 7.6.1964. (Code designation AB).

N. fumariaefolia is a comparatively rare species, known from a few localities on Cyprus, Rhodes and easternmost Crete. The single collection obtained in nature was heavily modified by extreme drought, the plants being only a few cm high. Only dry capsules were obtained.

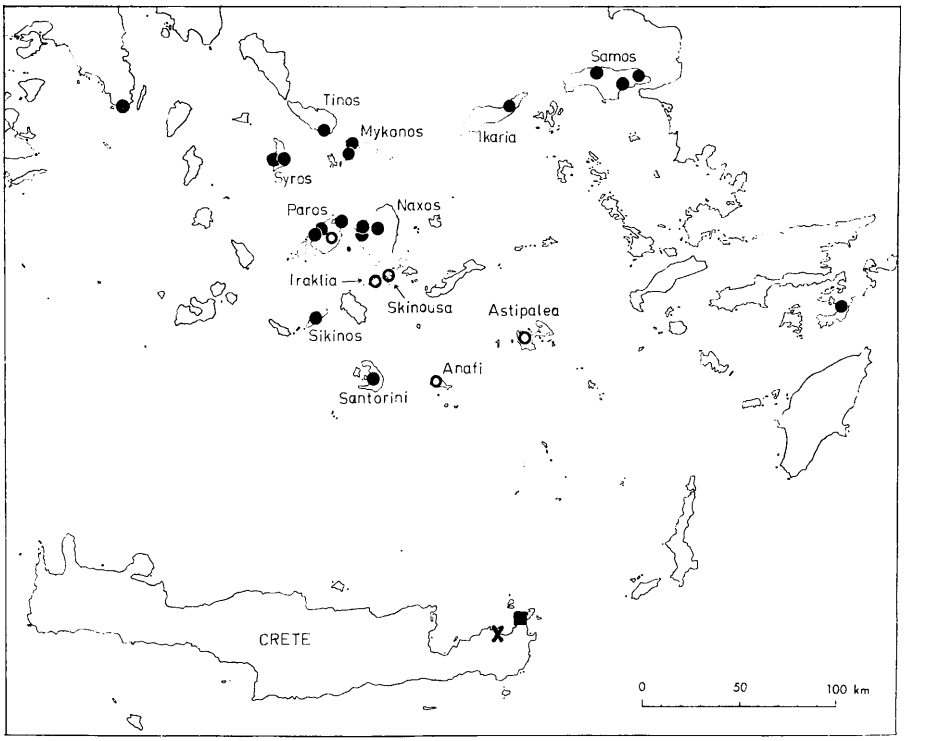


Fig. 1. Distribution of the material examined for chromosome number. Solid circles= *N. aristata.* Open circles=*N. degenii.* Square=*N. fumariaefolia.* Cross=*N. cretica.*

On cultivation about 20 cm high, sparsely branched, with bright green, about 2 mm broad leaves. Flowers 12—15 mm in diameter, almost always with five white, obtuse, somewhat down-bent petals. Nectaries small, pointed, scarlet. Anthers dark violet. Follicles united for $^1/_5$—$^1/_3$ of their length, bending outwards at a right angle to the long axis as the fruit ripens. Time from sowing to flowering 130—150 days.

Compared to the other species investigated *N. fumariaefolia* shows a higher frequency of root tip cells undergoing division. Thanks to good morphological differentiation of the chromosomes, all six pairs can be identified with certainty (see fig. 2). The chromosomes have been numbered as follows:

Chromosome 1. Arm index 1.15 ± 0.03. Relative length 18.48 ± 0.18. The short arm has a marked secondary constriction, dividing it in the proportions of about 1 : 2. Near the end of the short arm a faint

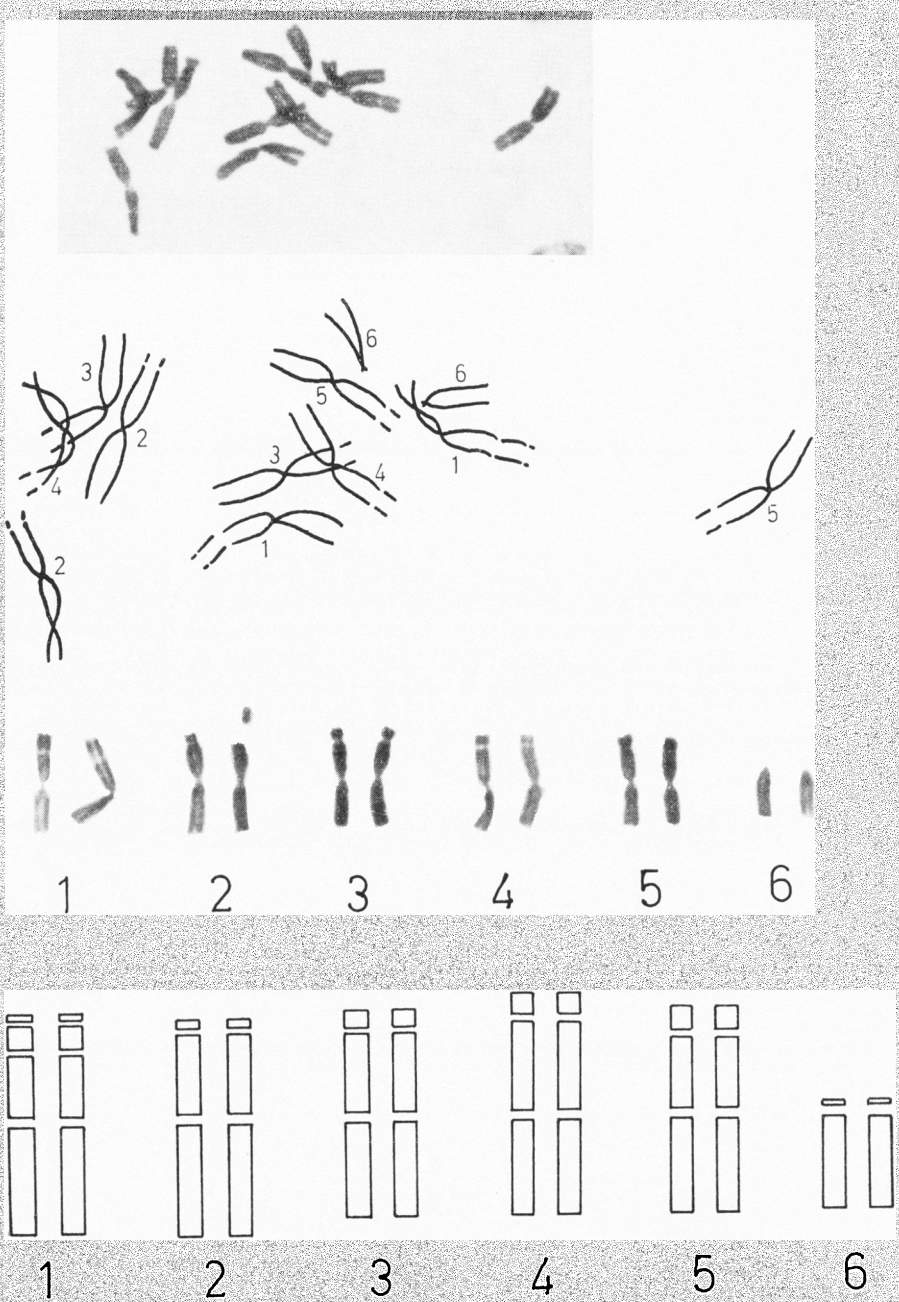


Fig. 2. The chromosomes of *N. fumariaefolia*. From the top: Photo of a metaphase plate (×2850). Diagrammatic drawing of the same plate (×4770). The chromosomes arranged as karyotype. Diagrammatic drawing of the karyotype (idiogram).

secondary constriction is sometimes visible, making the satellite double. In one case a structure like half-chromatids was obvious in the satellite region, the satellite being split into a four-stranded formation.

Chromosome 2. Arm index 1.26 ± 0.03. Relative length 18.64 ± 0.20. The short arm has a small satellite, occupying about one sixth of its length.

Chromosome 3. Arm index 1.08 ± 0.02. Relative length 17.60 ± 0.19. The somewhat shorter arm has a satellite, occupying $^1/_4$—$^1/_5$ of its length.

Chromosome 4. Arm index 1.23 ± 0.03. Relative length 18.69 ± 0.14. Similar to chromosome 2, but with a bigger satellite, situated on the long arm.

Chromosome 5. Arm index 1.05 ± 0.02. Relative length 17.65 ± 0.14. Similar to chromosome 3, but with a somewhat bigger satellite.

Chromosome 6. Almost telocentric, the short arm being minute. Arm index 15—20. Relative length 9.01 ± 0.22. Sometimes a faint secondary constriction appears near the end of the long arm.

Thus the variation in relative chromosome length is rather small, viz., between 17.60 and 18.69, except for the subtelocentric chromosome 6. It is not possible to homologize the individual chromosomes Nos. 1—5 with those of the other species investigated. Cytological data support the opinion that *N. fumariaefolia* is quite distinct from the other species investigated.

Nigella degenii Vierh.

Cyclades, Irakli a: Venetico. 9.6. 1960. (Code designation CE, coll. no. R. & N. 15530.)

N. degenii is endemic to the Cyclades. In nature it flowers in May (earlier than *N. aristata* and somewhat earlier than *N. fumariaefolia*). Some variation is found with respect to external morphology, viz., plant height, degree of branching and angles between the branches, but no significant chromosome morphological differences were found between different populations. However, less material of *N. degenii* was studied than of *N. aristata*.

On cultivation 35—45 cm high, erect, rather slender, sparsely branched. Leaves with few lobes, about 2 mm broad, more or less withered at the time of flowering. Flowers 9—13 mm in diameter, with white, shortly stalked, bluntly pointed petals. Nectaries small, white, with a light green cross-band. Anthers light brown. Follicles united to the middle of their length, their free part at an angle of about 135° to the long axis of the fruit.

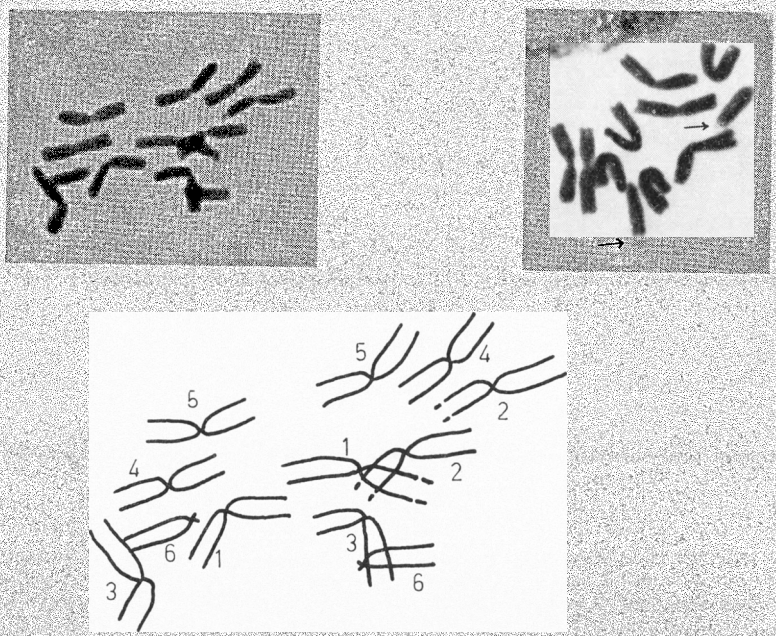


Fig. 3. The chromosomes of *N. degenii*. From the top: Photo of two metaphase plates (×2850). In the plate to the right the satellites attached to chromosomes Nos. 6 are indicated by arrows. Diagrammatic drawing of the plate to the left (×4770). The chromosomes arranged as karyotype. Diagrammatic drawing of the karyotype (idiogram).

The chromosomes of *N. degenii* are frequently more heavily contracted than those of the other species investigated. Two pairs of satellite chromosomes are present (see fig. 3).

Chromosome 1. Arm index 1.05 ± 0.02. Relative length 19.71 ± 0.21. The short arm has a satellite occupying about one fifth of its length.

Chromosome 2. Arm index 1.13 ± 0.02. Relative length 19.43 ± 0.17. The short arm has a small satellite.

Chromosome 3. Arm index 1.21 ± 0.03. Relative length 17.14 ± 0.18. Secondary constrictions do not occur. Distinguished from chromosomes Nos. 4 and 5 by a higher arm index value.

Chromosome 4. Arm index 1.06 ± 0.02. Relative length 16.58 ± 0.13.

Chromosome 5. Arm index 1.03 ± 0.01. Relative length 16.00 ± 0.15. Very similar to chromosome 4. Some uncertainty is inherent in the identification of chromosomes Nos. 4 and 5. Of the four chromosomes remaining after the identification of Nos. 1, 2, 3 and 6, the two with the highest arm index have been called No. 4. Thus chromosomes Nos. 4 and 5 are not identified in the same sense as the others (cf. *N. cretica* and *N. aristata* below).

Chromosome 6. Arm index 15—20. Relative length 11.14 ± 0.19. A secondary constriction occurs near the end of the short arm, giving the chromosome the appearance of a short rod with a knob attached to each end. This constriction is more conspicuous than that occasionally present in chromosome 6 of *N. fumariaefolia, N. cretica* and *N. aristata* (see above and below).

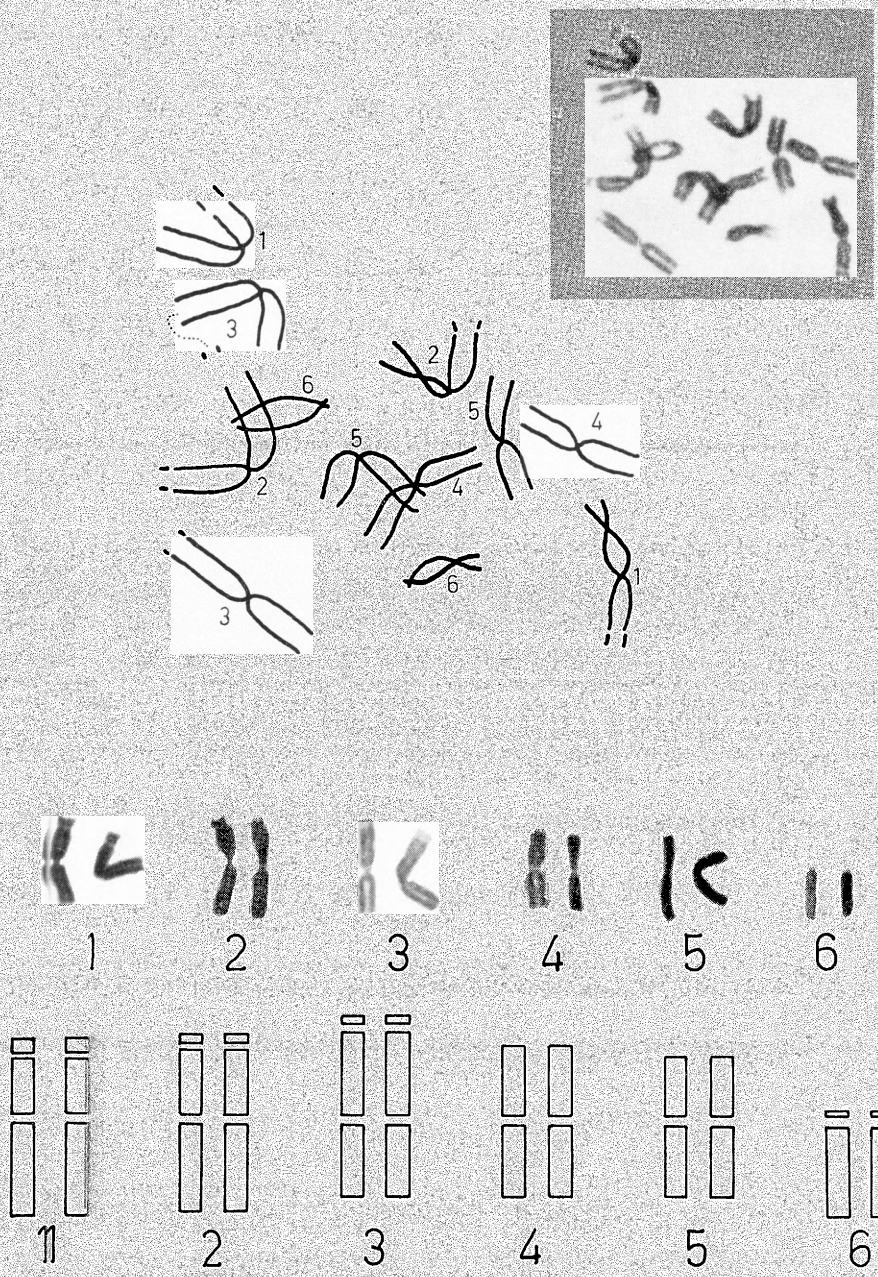
One or more satellites may sometimes have fused with their respective chromosome arms, the secondary constrictions being invisible. This is particularly true in the case of heavily contracted metaphase plates, which are often found in *N. degenii*. Best results are obtained by studying premetaphase stages, where the chromosomes are not yet fully contracted. The karyotype of *N. degenii* is similar to that of *N. cretica* and *N. aristata* (see below).

Nigella cretica Mill.

Crete: Cape Sidero, very dry garigue on hard limestone. 6.6. 1964. (Code designation AC).

The plants obtained from nature were heavily modified dwarfs. Only dry capsules were obtained.

On cultivation 20—30 cm high, slender, basally branched 2—5 times. Leaves small, with few lobes, more or less withered at the time of flowering, about



Figg. 4. The chromosomes of *N. cretica*. From the top: Photo of a metaphase plate (×2850). Diagrammatic drawing of the same plate (×4770). The chromosomes arranged as karyotype. Diagrammatic drawing of the karyotype (idiogram).

2 mm broad. Flowers about 10 mm in diameter with white, shortly stalked, relatively pointed petals. Upper flowers with five carpels and petals, the lower ones often with three to four. Nectaries as in *N. degenii*. Anthers brown. Follicles transversely rugose, united almost to the middle of their length, their free part bending outwards at an angle of about 120° to the long axis of the fruit. Develops from sowing to flowering in 95—100 days.

N. cretica is similar to *N. degenii*. Crossing experiments, the results of which are not yet available, are expected to clarify the taxonomic relationships. In the present paper *N. cretica* is kept as a working name. *N. cretica* may be distinguished cytologically from the other species investigated, for example, by the presence of three pairs of satellites (see fig. 4).

Chromosome 1. Arm index 1.21 ± 0.02. Relative length 18.90 ± 0.16. The short arm has a rather large satellite, occupying $^1/_4$—$^1/_5$ of its length.

Chromosome 2. Arm index 1.12 ± 0.03. Relative length 18.98 ± 0.20. The short arm has a small satellite.

Chromosome 3. Arm index 1.25 ± 0.03. Relative length 19.73 ± 0.22. The long arm has a very small satellite.

Chromosome 4. Arm index 1.07 ± 0.02. Relative length 16.58 ± 0.17. No secondary constrictions have been found.

Chromosome 5. Arm index 1.04 ± 0.01. Relative length 15.57 ± 0.18. Very similar to chromosome 4, but somewhat shorter. However, as in *N. degenii*, chromosomes Nos. 4 and 5 cannot be identified with certainty. They have been defined in the same way as in *N. degenii*.

Chromosome 6. Arm index 15—20. Relative length 10.22 ± 0.23. Sometimes a faint secondary constriction is visible near the end of the long arm.

Except for the extra pair of satellites, *N. cretica* is thus similar to *N. degenii* in its cytology (and also to *N. aristata*; see below). The chromosomes are, however, frequently less heavily contracted than those of *N. degenii*.

Nigella aristata S. & S.

More material of *N. aristata* was available than of the other species investigated. Five populations from different islands were selected for a particularly careful cytological examination. In fig. 5 the mean relative length values of the long and short arms of chromosomes Nos. 1, 2, 3 and 6 in the five populations are represented diagrammatically. *N. aristata* is similar to *N. degenii* in its cytology, but considerable

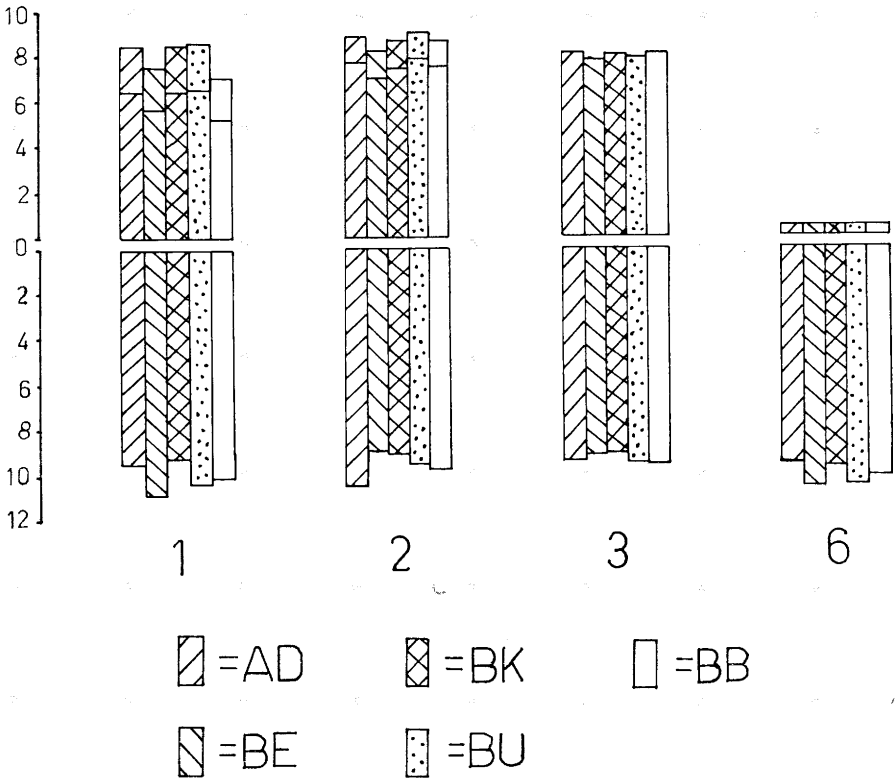


Fig. 5. Diagrammatic representation of chromosomes Nos. 1, 2, 3 and 6 in five populations of *N. aristata*. Scale in relative length units. Further explanation in the text.

variation is found between different populations (see below). Fig. 6 shows the variation in arm index of a single chromosome (No. 1) in 27 populations. The lowest arm index values represent mainly populations from the island of Syros and the highest ones populations from Mykonos and Ikaria.

1. Population AD.

Cyclades, Naxos: The chapel N of Ozia. 4.8. 1958.

Only seeds were obtained.

On cultivation about 40 cm high, erect, rather slender, sparsely branched. Leaves slender, with few, gradually pointed, 1—2 mm broad lobes, those at the base soon withering. All floral parts bigger than those of the other

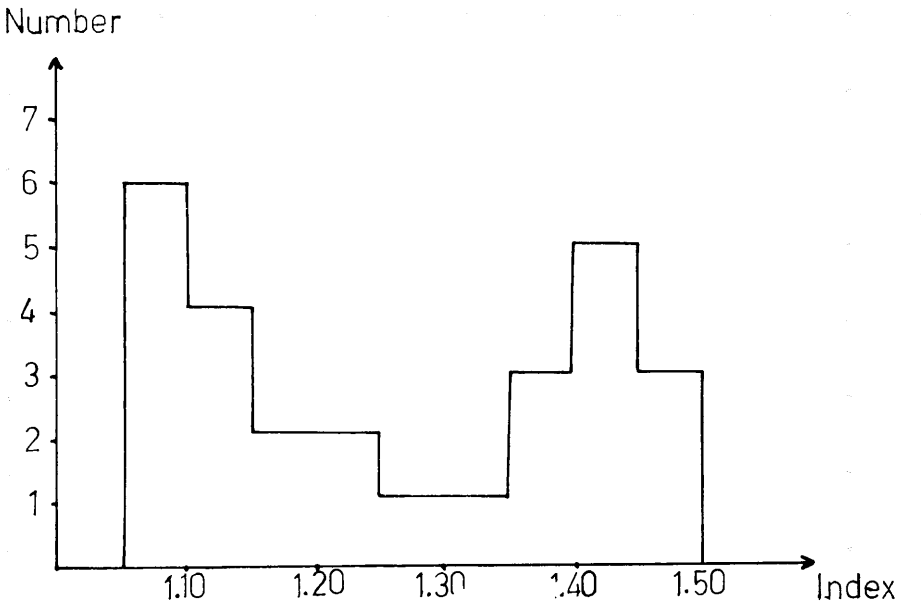


Fig. 6. Arm index values for chromosome 1 in 27 populations of *N. aristata*. Further explanation in the text.

species investigated. Flowers about 20 mm in diameter with white to greenish, stalked, broad, bluntly pointed petals. Nectaries light blue-violet at the base, light green with a brown, central cross-band in the middle, and above this darker green. Anthers light blue-violet. Follicles united to the middle of their length, their free part being of uniform slenderness, obliquely directed upwards.

One individual cultivated in the spring of 1964 proved to be structurally heterozygous in the satellite region of chromosome 2, one satellite being bigger than the homologous one. Population AD is the progeny obtained by enforced self-fertilization of this single divergent individual. Among 12 individuals produced after isolation of a single flower the different chromosome types were distributed as follows (A=big satellite; a=small satellite):

Chromosome structure	AA	Aa	aa	uncertain
Number	2	6	2	2

Although the material was rather limited, the distribution does not differ from the expected 1 : 2 : 1-segregation (cf. fig. 7). In two indi-

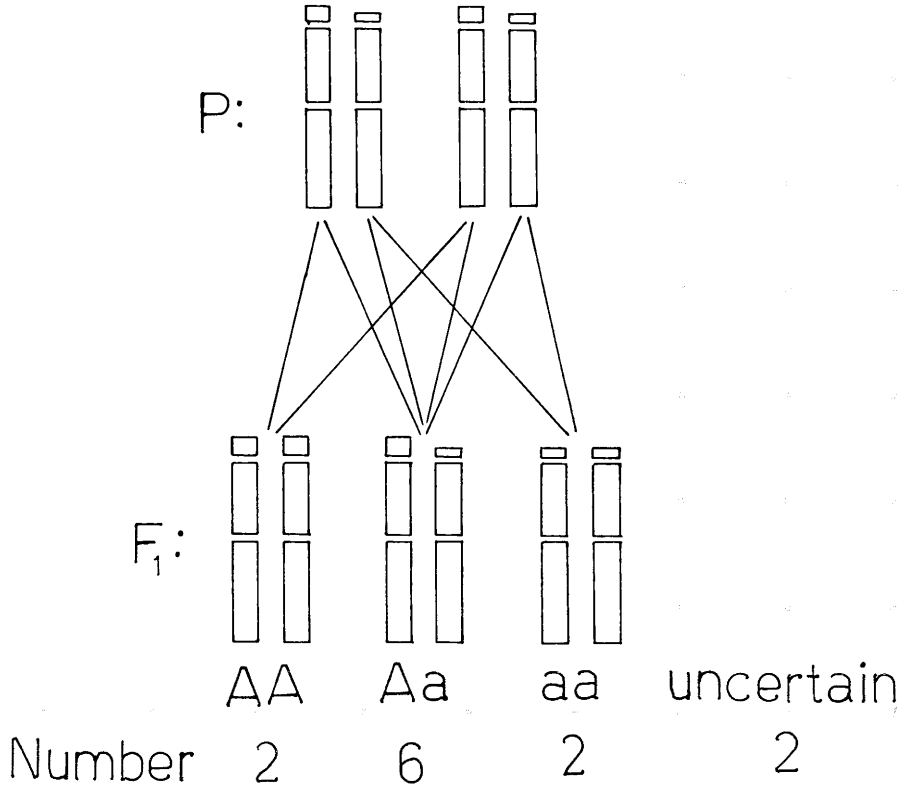


Fig. 7. Recombination of different chromosome types in F_1 after enforced self-fertilization of one individual of *N. aristata* structurally heterozygous in the satellite region of chromosome 2.

viduals it was not possible to identify the structure of chromosome 2 because the preparations were indistinct.

It is noteworthy that individuals with two small satellites (aa) differ morphologically from individuals with the constitution AA or Aa. Individuals of the AA- or Aa-type start flowering about 160 days after sowing, while the development of aa-individuals is more retarded (see fig. 8). No conspicuous differences have been observed between AA- and Aa-individuals. Probably the a-type of chromosome 2 suffers from a deficiency in the satellite region, which causes considerable delay of development in the homozygote.[1]

The karyotype of *N. aristata* is closely similar to that of *N. degenii*. Two pairs of satellites are present.

[1] The aa-individuals started flowering about 250 days after sowing. The flowers were normal in shape, but rather small.



Fig. 8. Four individuals of *N. aristata* (population AD; Naxos) about 160 days after sowing. From the left: Two individuals of the aa-type. One individual of the Aa-type. One individual of the AA-type. Further explanation in the text.

Chromosome 1. Arm index 1.19 ± 0.03. Relative length 18.33 ± 0.13. The short arm has a rather big satellite, occupying 1/4—1/5 of its length.

Chromosome 2. Arm index 1.18 ± 0.03. Relative length 19.37 ± 0.22 (both values calculated for the A-type). The short arm has a satellite, occupying about one sixth of its length. In the deficient chromosome type the satellite is only little more than half as big.

Chromosome 3. Arm index 1.15 ± 0.02. Relative length 17.54 ± 0.18.

Chromosome 4. Arm index 1.06 ± 0.02. Relative length 17.48 ± 0.19.

Chromosome 5. Arm index 1.02 ± 0.01. Relative length 17.34 ± 0.20. Very similar to chromosome 4. As chromosomes Nos. 4 and 5 are almost impossible to distinguish in most cases, they have been excluded in the calculation of t values obtained by comparing different populations of *N. aristata*. They have been defined in the same way as in *N. degenii* and *N. cretica*.

Chromosome 6. Arm index 15—20. Relative length 9.95 ± 0.19. As in *N. fumariaefolia* and *N. cretica* a faint secondary constriction sometimes appears near the end of the long arm. This is also true of the other *N. aristata* populations cited below.

It may be noted that in the metaphase plate shown in fig. 9 the subtelocentric chromosomes Nos. 6 lie in close proximity to each other. This has been observed to be a constant tendency in all *Nigella* material investigated, although it is frequently disturbed as a consequence of the squash technique. As may be seen from the chromosome plates drawn by, for example, GREGORY (1941) and PEREIRA (1942), other authors have noticed the same phenomenon, although they have not commented on it. Presumably rather weak, but specific, attraction forces are acting, the nature and origin of which still remain obscure.

2. *Population BE.*

Cyclades, Mykonos: Path about 3 km NE of the town. 4.7. 1964 (coll. no. B. & St. 21790).

On cultivation 30—40 cm high, suberect, slender, sparsely branched. Leaves rather short, with few lobes, about 2 mm broad. Flowers 15—20 mm in diameter, with white, long-stalked, rather obtuse petals, greenish towards the tip. Nectaries blue-violet at the base, with a light central cross-band; above this brown-violet. Anthers red-violet. Follicles as in population AD, but somewhat smaller.

Chromosome 1. Arm index 1.44 ± 0.02. Relative length 18.46 ± 0.17. The short arm has a reatively big satellite. The arm index value is remarkably high. Four populations from Mykonos have been studied with special regard to the structure of chromosome 1, and all of them

have arm indices between 1.40 and 1.50. The differences between, for example, populations BE and AD or between BE and BK (see below) are highly significant.

Chromosome 2. Arm index 1.08 ± 0.02. Relative length 17.19 ± 0.17. The short arm has a small satellite. Chromosome 2 is quite variable. Highly significant differences are found in several cases between different populations (see table 2 and 3).

Chromosome 3. Arm index 1.19 ± 0.02. Relative length 16.95 ± 0.16. This chromosome is somewhat shorter than the homologous ones in the other populations investigated, but, on the whole, chromosome 3 is less variable than chromosomes Nos. 1 and 2. The variation in arm index between the five populations is rather small, viz., between 1.12 and 1.21.

Chromosome 4. Arm index 1.11 ± 0.02. Relative length 19.37 ± 0.18. This chromosome is unusually long and has a comparatively high arm index.

Chromosome 5. Arm index 1.04 ± 0.01. Relative length 16.47 ± 0.11. In this case it is possible to distinguish chromosomes Nos. 4 and 5 satisfactorily.

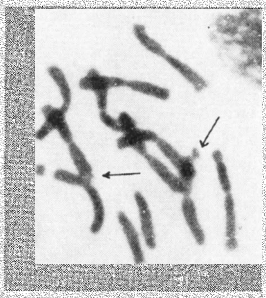
Chromosome 6. Arm index 15—20. Relative length 11.13 ± 0.26. In this case and, to a lesser extent in the others, the relative length value of chromosome 6 varies considerably within a single population. The mean values vary between 9.95 and 11.13. As in the other cases, it is not possible to calculate arm indices accurately because of the minuteness of the short arm.

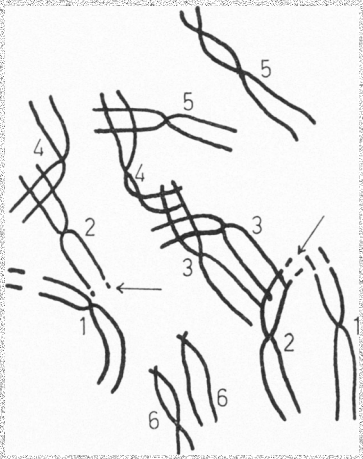
Thus the Mykonos type is cytologically principally characterized by the high arm index of chromosome 1, rather short chromosomes 2, 3 and 5, and an unusually long chromosome 4, which is possible to distinguish from No. 5 (see fig. 10).

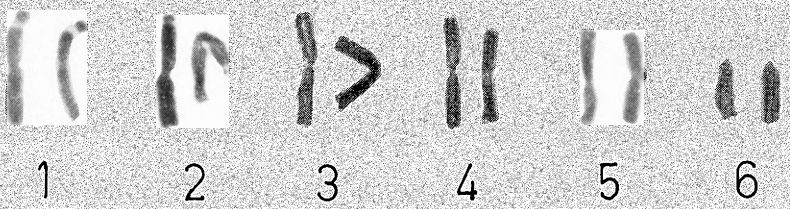
3. Population BK.

Cyclades, Syros: Roadsides W of Foinikia. 19.6.1964 (coll. no. S. 21135).

On cultivation 30—40 cm high, suberect, richly branched from the base. Leaves with numerous lobes, about 1 mm broad, rather withered at the time of flowering. Flowers about 20 mm in diameter, bluish white. Petals long-stalked, more or less squared, shortly pointed. Nectaries blue at the base, with a brown central cross-band; above this yellowish green. Anthers blue to blue-violet. Follicles similar to population AD, but their free part somewhat longer and slenderer.







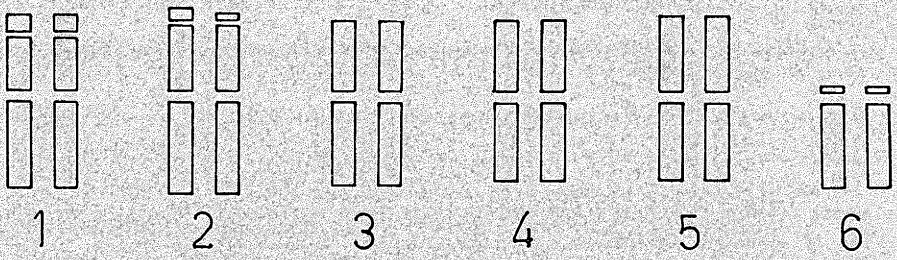


Fig. 9. The chromosomes of *N. aristata* (population AD; Naxos; structurally heterozygous individual). From the top: Photo of a metaphase plate (×2850). Diagrammatic drawing of the same plate (×4770). The chromosomes arranged as karyotype. Diagrammatic drawing of the karyotype (idiogram). Note the satellites attached to chromosome 2 (indicated by arrows).

Chromosome 1. Arm index 1.09 ± 0.03. Relative length 17.76 ± 0.19. The short arm has a rather big satellite. The arm index value is among the lowest ones found in the whole *aristata* material. Six populations from Syros have been checked with respect to the structure of chromosome 1, and all of them have been found to have indices around 1.10.

Chromosome 2. Arm index 1.06 ± 0.02. Relative length 17.76 ± 0.22. The somewhat shorter arm has a small satellite. The chromosome is comparatively short with a low arm index. Significant differences from population AD are found in both respects.

Chromosome 3. Arm index 1.12 ± 0.03. Relative length 17.26 ± 0.13. This chromosome is fairly constant throughout the *aristata* material investigated. Highly significant differences are found neither with respect to arm index nor to relative length when population BK is compared with any of the other four populations.

Chromosome 4. Arm index 1.07 ± 0.02. Relative length 18.24 ± 0.19.

Chromosome 5. Arm index 1.03 ± 0.02. Relative length 18.32 ± 0.15.

Chromosomes Nos. 4 and 5 are very difficult to distinguish. They have been defined in the same way as chromosomes Nos. 4 and 5 in *N. degenii*. However, as may be seen from the close similarity both in arm index and relative length, this "identification" is by no means unassailable.

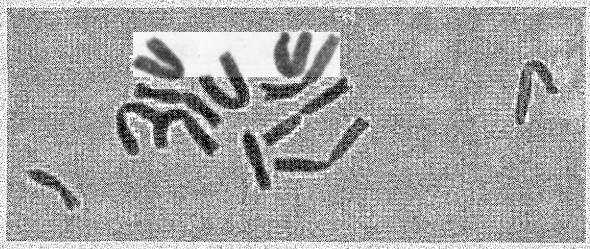
Chromosome 6. Arm index 15—20. Relative length 10.20 ± 0.20. This chromosome is slightly shorter than the homologous one from population BE (weak significance).

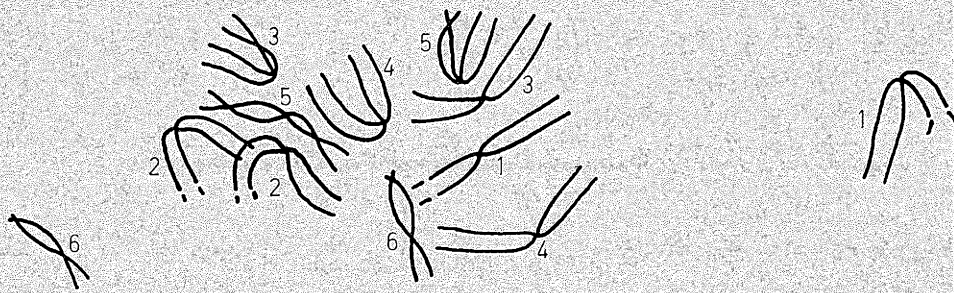
Population BK is characterized mainly by the low arm index of chromosome 1 and a rather short chromosome 2 with almost equal arms. The other four chromosomes have values which scarcely discriminate them from the homologous ones in the other populations investigated (see fig. 11).

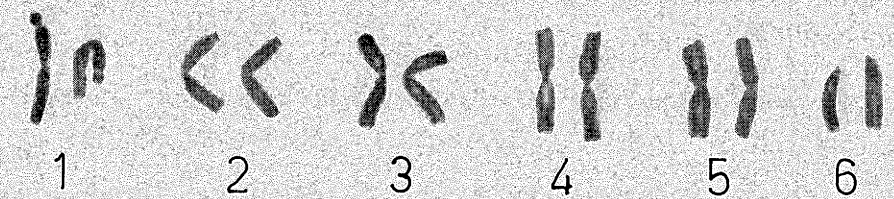
4. Population BU.

Cyclades, Santorini: Roadsides 1 km SE Thira. 2.7. 1964 (coll. no. S. 21204).

On cultivation 70—80 cm high, erect, almost unbranched. Leaves 2 mm broad, with numerous, pointed lobes, rather freshly green at the time of flowering. Flowers 30—35 mm in diameter, with large, broad, bluish white petals. Nectaries dark blue at the base, with a faint brown-violet central cross-band; above this impurely green. Follicles as in population AD, but bigger, like all parts of the flowers. Time from sowing to flowering 210—230 days (150—180 days for the other *aristata* populations).







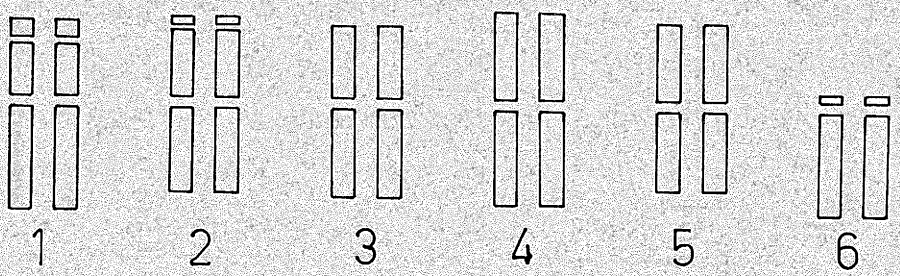


Fig. 10.

Chromosome 1. Arm index 1.23 ± 0.02. Relative length 19.03 ± 0.16. This chromosome is exceptionally long, but intermediate with respect to arm index.

Chromosome 2. Arm index 1.05 ± 0.01. Relative length 18.68 ± 0.09. The arm index value is fairly low. The chromosome is significantly shorter than the homologous one from population AD, but longer than those from populations BE and BK.

Chromosome 3. Arm index 1.21 ± 0.02. Relative length 17.28 ± 0.12. The arm index is the highest one found in the *aristata* material, although the variation is rather small. The relative length value is intermediate.

Chromosome 4. Arm index 1.07 ± 0.01. Relative length 16.69 ± 0.11.

Chromosome 5. Arm index 1.03 ± 0.01. Relative length 17.34 ± 0.13. With regard to chromosomes Nos. 4 and 5, the facts stated for population BK also hold for population BU.

Chromosome 6. Arm index 15—20. Relative length 11.09 ± 0.09. This chromosome is significantly longer than the homologous ones from populations AD and BK.

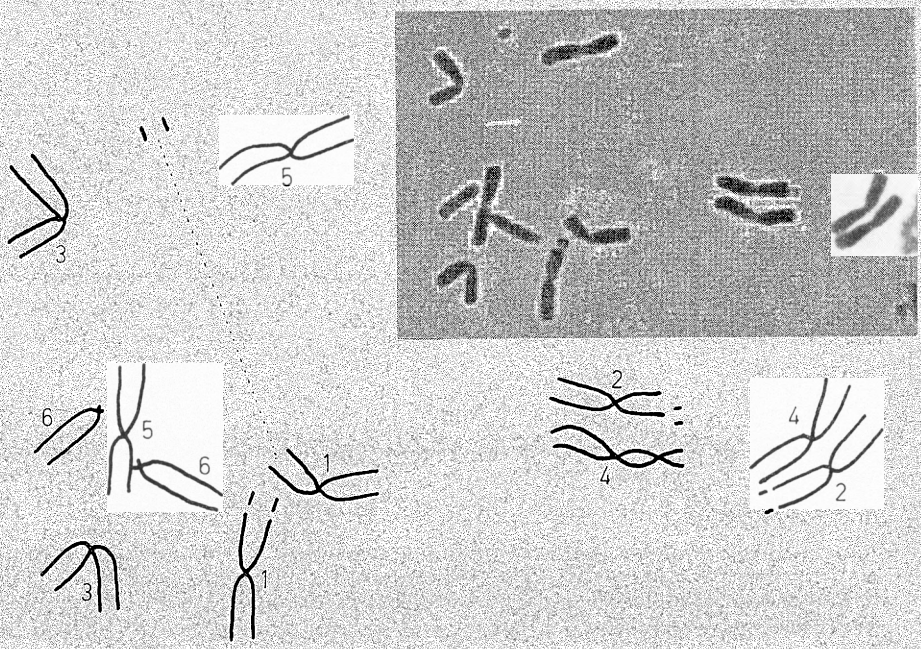
Population BU is strikingly different from all the other *aristata* collections available with respect to external morphology, but cytologically intermediate in most respects. Some chromosome morphological peculiarities are found, for example, chromosomes Nos. 1 and 6 are unusually long and chromosome 2 has a rather low arm index. On the whole, however, there seems to be no obvious correlation between the degree of gross morphological and chromosome morphological differences between any two populations.

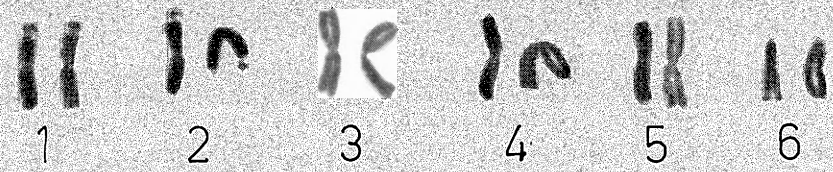
5. *Population BB.*

Eastern Islands, Ikaria: 3 km NNW Ag. Kirikos. 10.7. 1964 (coll. no. B. & St. 21819).

On cultivation 15—25 cm high, more or less decumbent, richly branched from the base, with a dense leaf rosette. Leaves 1—2 mm broad, dark green, rosulate leaves broadest towards the apex. Flowers 12—18 mm in diameter, white. Nectaries rather small, greenish white, with one prominent and one or two faint blue cross-bands. Follicles small, with relatively few, flat seeds.

Fig. 10. The chromosomes of *N. aristata* (population BE; Mykonos). From the top: Photo of a metaphase plate (×2850). Diagrammatic drawing of the same plate (×4770). The chromosomes arranged as karyotype. Diagrammatic drawing of the karyotype (idiogram).





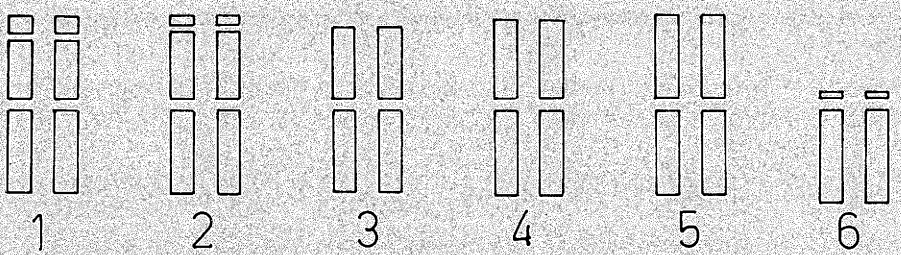


Fig. 11.

Population BB differs very markedly from all the other *aristata* material studied, and should possibly be referred to a taxon of its own. Extensive hybridization experiments, the results of which are not yet available, are likely to give the answer to this question.

Chromosome 1. Arm index 1.45 ± 0.03. Relative length 17.17 ± 0.14. This chromosome is unusually short. With respect to arm index it is closely similar to the homologous one from population BE.

Chromosome 2. Arm index 1.13 ± 0.01. Relative length 18.55 ± 0.11. With respect to arm index this chromosome is intermediate between population AD on the one hand and populations BE, BK and BU on the other. It is significantly shorter than the homologous one from population AD, but longer than the ones from populations BE and BK.

Chromosome 3. Arm index 1.20 ± 0.02. Relative length 17.50 ± 0.17. The arm index is slightly higher than that of the homologous chromosomes from populations BE and BK. The chromosome is somewhat longer than the one from population BE.

Chromosome 4. Arm index 1.13 ± 0.02. Relative length 18.05 ± 0.13. The arm index is unusually high, and comparable to that found for chromosome 4 in population BE.

Chromosome 5. Arm index 1.06 ± 0.01. Relative length 18.12 ± 0.13. In this case, as in population BE, it is possible to distinguish chromosomes Nos. 4 and 5 with certainty.

Chromosome 6. Arm index 15—20. Relative length 10.60 ± 0.10. This chromosome is intermediate in length.

Population BB is characterized by a short chromosome 1 with a high arm index and by the possibility of discriminating between chromosomes Nos. 4 and 5. It is cytologically closely similar to population BE from Mykonos, although quite outstanding from a morphological point of view.

Discussion

All four species investigated manifest good seed setting after self-fertilization enforced by isolation. In the few cases where a second generation was available for study, no indication of deleterious inbreeding effects were observed. Thus it is highly probable that no genetically

Fig. 11. The chromosomes of *N. aristata* (population BK; Syros). From the top: Photo of a metaphase plate (×2850). Diagrammatic drawing of the same plate (×4770). The chromosomes arranged as karyotype. Diagrammatic drawing of the karyotype (idiogram).

controlled self-incompatibility mechanism is acting, and that the *Nigella arvensis* group is mainly self-fertilized. This statement is strengthened by the fact that most populations obtained from seeds collected in nature were strikingly homogeneous. In a few cases, however, variation in floral characters (colour of anthers and nectaries) was observed within a single collection of *N. aristata*. For example, among 18 individuals from population BK, the cytology of which is described above, 15 had rather light flowers with light blue as the dominant colour of anthers and nectaries, whereas the remaining three had dark violet anthers and much darker nectaries. In this case, as well as in a few others, the original material must have been heterozygous, indicating that outcrossing had occurred. In the cultivated material, a large number of artificial crosses have been made, both between different species and between different populations within a single species, and in most cases mature seeds have developed. WAISEL (1959), working with ecotypic differentiation in *N. arvensis,* found forms intermediate between sspp. *divaricata* and *tuberculata* near to the Mediterranean coast of Israel. These intermediates were supposed to be of hybrid origin, and artificial crosses between sspp. *divaricata* and *tuberculata* gave fertile, intermediate F_1 hybrids.

The facts and findings listed above exclude the possibility that the *N. arvensis* group consists of obligate self-fertilizers. Different *N. aristata* collections from the same island (e.g., 6 collections from Syros, 4 from Mykonos, 4 from Naxos) exhibit close morphological and cytological similarity. Thus cross-fertilization is likely to occur frequently enough to prevent permanent isolation of sub-populations on one and the same island. In fact there probably exists a theoretical possibility of gene exchange in all directions. On the other hand, populations of *N. aristata* from different Aegean islands are in most cases effectively isolated and have often developed into morphologically very dissimilar types. As the variation in climatic and edaphic conditions is insignificant, the differentiation can only to a very limited extent be explained by the action of selective forces.

In the chasmophytic genus *Cheiranthus,* SNOGERUP (unpublished) found great morphological variation and partial sterility in crosses between populations from different Aegean islands. In this case the differentiation is likely to be largely due to random changes of gene frequencies because of the very limited population size (the so-called genetic drift or Sewall Wright effect).

In favourable years, at least, *Nigella* does not occur in small popu-

lations, and the above argument cannot be directly applied to it. However, according to RUNEMARK (personal communication), the size of the populations may vary considerably from year to year, as a consequence of the time when severe summer drought sets in. Under such circumstances, random changes of gene frequencies and frequencies of structurally different chromosome types may occur when the populations are at their minimal size. CLAUSEN (1951) gives a marked example of this kind of evolutionary mechanism for the North American genus *Layia*.

Parallel to the variation in external morphology, obvious chromosome morphological variation was observed, which probably reflects structural differences. HENEEN & RUNEMARK (1962) found similar differences in the satellite chromosomes of *Elymus Rechingeri* between populations from different Aegean islands. These authors also found cases closely parallel to the one reported above for population AD of *N. aristata*, with unequal satellites on two homologous chromosomes.

In the opinion of the present author, the arm index is a more significant chromosome morphological character than the relative length value. Now and then metaphase plates are found in which some chromosomes have either contracted less than the others, or been artificially stretchened as a consequence of the squash technique, but differences in the degree of contraction between the arms of a single chromosome are less likely to occur.

Partial or absolute sterility in crosses between or within species may be due to chromosome structural differences, i.e., lack of homology between the combined genomes. When F_1 hybrids become available, their chromosome morphology, meiosis and pollen fertility will be studied in detail in order to determine the effect of the combination of genomes which are probably structurally different.

Acknowledgements

The author wishes to express his thanks to Dr. H. RUNEMARK, who suggested the study, and to other members of the "Aegean team" from the Institute of Systematic Botany, Lund, who are mentioned in the text. The English text was checked by Mr. ANTHONY M. CARTER. The field work was supported by grants from the Swedish Natural Science Research Council.

Summary

The chromosome morphology of four Aegean species of the genus *Nigella*, viz., *N. fumariaefolia* Kotschy, *N. degenii* Vierh., *N. cretica* Mill., and *N. aris-*

tata S. & S. was investigated. All four species have the diploid chromosome number 2n=12 and their karyotypes are similar. Five pairs of metacentric to submetacentric chromosomes and one pair of almost telocentric ones occur. However, differences were found between the species, for example, with respect to the number and position of secondary constrictions.

N. fumariaefolia is cytologically distinct from the other species investigated, because of the high number of secondary constrictions. All six chromosome pairs can be identified.

N. degenii frequently exhibits heavily contracted metaphase plates. Two pairs of satellites occur, as well as a secondary constriction in the small, subtelocentric chromosome.

N. cretica is morphologically closely similar to *N. degenii*, but cytologically somewhat different. Three pairs of satellites occur.

N. aristata is very variable both with respect to external morphology and chromosome morphology. The karyotype is similar to that of *N. degenii*, but morphologically the two species are quite distinct. Five populations of *N. aristata* from different Aegean islands were selected for a particularly careful cytological examination. Significant differences were found in several cases. The progeny obtained by enforced self-fertilization of one individual structurally heterozygous in the satellite region of chromosome 2 was studied. The different satellite types were distributed according to the expected 1 : 2 : 1 ratio.

The four species investigated are apparently normally self-fertilizers, but in several cases artificial crosses have resulted in good seed setting. Populations from different Aegean islands are in most cases effectively isolated. Random changes of gene frequencies and frequencies of structurally different chromosome types due to fluctuation in population size have probably played an important role in the morphological and cytological differentiation of *N. aristata*.

Literature cited

BHATTACHARJYA, N. K. 1958. Cytology of two species of Nigella. — Genetica Iberica 10: 179—190.

CLAUSEN, J. 1951. Stages in the evolution of plant species. — Cornell University Press.

DELAY, C. 1947. Recherches sur la structure des noyaux quiescent chez les phanérogames. — Revue Cytol. et Cytophys. Végét. 9: 169—223, 10: 103—229.

GREGORY, W. C. 1941. Phylogenetic and cytological studies in the Ranunculaceae Juss. — Trans. Am. Philos. Soc., N. S. 31: 443—520.

HENEEN, W. K. & RUNEMARK, H. 1962. Chromosomal polymorphism and morphological diversity in Elymus Rechingeri. — Hereditas 48: 545—564.

HOCQUETTE, W. 1922. Observations sur le nombre des chromosomes chez quelques Ranonculacées. — C. r. Soc. Biol. Fr. 87: 1301—1303.

KURITA, M. 1956. Cytological studies in the Ranunculaceae. XI. The karyotypes of Nigella damascena and some other species. — Jap. Journ. Genet. 31: 330—333.

— 1957. Chromosome studies in Ranunculaceae. IV. Karyotypes of the three genera Paeonia, Nigella and Clematis. — Rep. Biol. Inst. Ehime Univ. 2: 9—16.

— 1959. Chromosome studies in Ranunculaceae. XII. Karyotype of Nigella and kinetochore structure of its metaphase chromosomes. — Rep. Biol. Inst. Ehime Univ. 8: 1—5.

LANGLET, O. F. 1927. Beiträge zur Zytologie der Ranunculaceen. — Sv. Bot. Tidskr. 21: 1—17.

LEVITSKY, G. A. 1931. The "karyotype" in systematics. — Bull. Appl. Bot. Genet. Plant Breeding 27: 187—240.

MEIKLE, R. D. 1954. A Survey of the Flora of Chios. — Kew Bull. No. 1, 1954: 85—199.

ÖSTERGREN, G. & HENEEN, K. W. 1962. A squash technique for chromosome morphological studies. — Hereditas 48: 332—341.

PEREIRA, A. DE L. 1942. Contribuçao ao connecimento cariologico do genero Nigella L. — Bol. Soc. Brot. 16: 5—40.

RECHINGER, K. H. (fil.) 1943. Flora Aegaea. — Denkschr. Akad. Wiss., Wien, 105: 1.

STEBBINS, G. L. 1950. Variation and evolution in plants. — Columbia Univ. Press, New York.

WAISEL, Y. 1959. Ecotypic variation in Nigella arvensis L. — Evolution 13: 469—475.

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Floral Anatomy of Zephyranthes carinata Herb. with Special Reference to Gynoecium

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Introduction

Previous work on the Floral Morphology of some species of *Amaryllidaceae* with special reference to its gynoecium has been only meagre (NEWMAN 1928; JOSHI & PANTULU 1941; CHATURVEDI 1945). The present work is an attempt at a proper elucidation of the exact morphological relationship between the gynoecium and floral whorls in *Zephyranthes carinata* Herb. on the basis of floral anatomy.

Material and Method

Flower buds of *Zephyranthes carinata* Herb. at different stages of development were collected in the Botanic Garden of the Annamalai University campus and were fixed in F.A.A. Microtome sections of the flower buds were taken (thickness 10—12 μ) and stained with Delafield haematoxylin.

Observations

The flower stalk has a continuous ring of 12 vascular bundles (Fig. 1 a). Six of these bundles are larger and alternate with six smaller bundles. These bundles branch and anastomose without any regularity only to reorganize at the base of the inferior ovary (Fig. 1 b). The ovary is trilocular. At the base of the ovary within the ovary wall are six large bundles forming the outer ring of vascular strands and are situated outside the three locules. Out of the six bundles, three bundles are opposite the loculi and hence in the position of the dorsal bundles of the carpels (Fig. 1 c). The other three bundles are opposite the septum,

parietal in position (Fig. 1 c). On the inner margins of the carpels there are six bundles forming an inner ring (Fig. 1 c). These bundles represent the fused product of the carpellary laterals and the ventral bundles and constitute the placental supply. A short distance higher up, all the six bundles of the outer ring divide and each bundle gives rise to two lateral traces (Fig. 1 d, e). These vascular traces represent the perianth laterals. Each locule of the ovary has two ovules. Although the ovules are very close to the placentae almost throughout their length, their actual attachment is only to their upper ends. The placentation, of course, is to be regarded as axile. Near the top of the ovary but before the loculi have ended, all the six placental strands, after supplying the ovules, divide into two strands each (Fig. 1 f) and disappear at the sterile neck region of the ovary. After the closing up of loculi, the bundle standing opposite to each locule divides into an outer perianth midrib bundle and an inner stamen-carpellary midrib bundle (Fig. 1 f, g). Almost at the same level, the stamen-carpellary dorsal strand divides into an inner dorsal strand (carpellary) and an outer staminal strand. The carpellary dorsals enter the style. Again at this level only, all the three bundles standing opposite to the septum divide to form an outer perianth midrib and an inner staminal strand. A short distance above, the style separates out from the perianth-stamen tube (Fig. 1 g). The style is hollow with three stylar canals. These canals lie in the positions of the ovarian locules. It is interesting to note that from the middle of the ovary, the carpels have maintained their individuality by not fusing with each other completely (Fig. 1 d). The perianth-stamen tube contains an inner ring of six bundles representing the staminal supply and an outer ring of eighteen bundles which constitute the perianth supply (Fig. 1 h). All the perianth bundles are of equal size and shape. The perianth midrib can be distinguished only by its position and not by its shape or size.

Discussion

There are two main views regarding the origin of the inferior ovary or perigynous flower. According to the first view, the calyx tube is receptacular in origin and it is formed through the invagination or involution of the receptacle around the gynoecium. According to the second view, the inferior ovary is appendicular in nature, i.e., it is formed through adhesion or cohesion of floral parts.

In *Polianthes tuberosa* and in *Eucharis amazonica,* the vascular

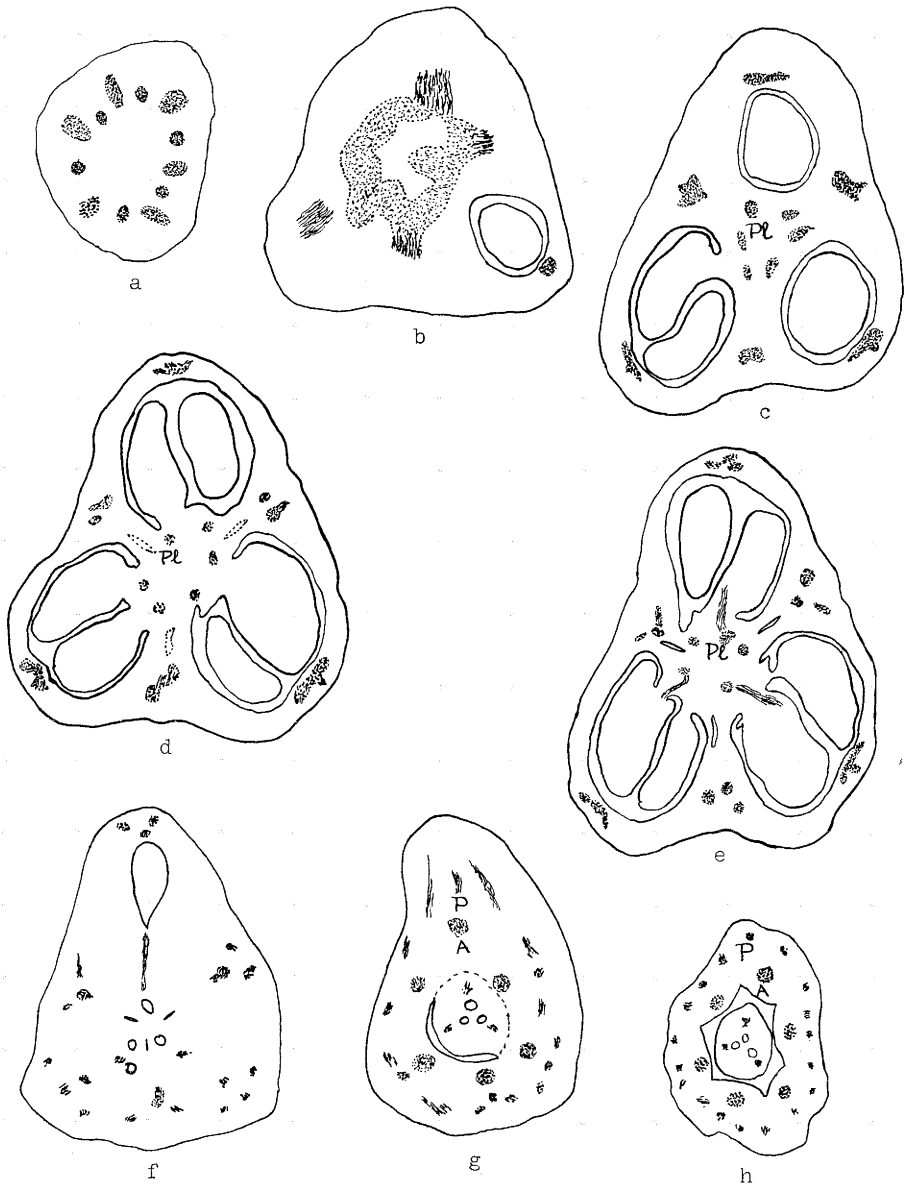


Fig. 1. a: Stele of the pedicel. — b: Vascular strands have fused at the base of the ovary. — c: Showing the three loculi, the ovarian wall with six bundles, and the six placental strands. — d, e: Showing the branching of all the vascular strands and the independent nature of the carpels. — f, g: Showing the sterile region of the ovary, the separation of the style, and the branching of the perianth staminal strands. — h: Showing the perianth tube with eighteen perianth traces and six staminal traces. — (All ×10.) — Abbreviations: P=Perianth bundle; Pl=Placental bundle; A=Staminal bundle; D=Dorsal bundle of the carpel.

bundles for the various floral parts have been shown to separate out from the stele of the receptacle below the ovary. It has been indicated further, that in the wall of the inferior ovary the bundles of the outer and the inner whorls of perianth leaves, stamens and carpels are present quite distinct from one another (JOSHI & PANTULI 1941, CHATURVEDI 1945). This appears to be the simplest type of anatomical organization of an inferior ovary, although the family *Amaryllidaceae* itself might not be a primitive one. This type illustrates clearly the origin of the inferior ovary by an adnation of the outer floral parts with the wall of the ovary without involving fusions of vascular bundles of different whorls. In the next stage, one can imagine a fusion for varying distances in the ovary wall of the traces on the same radius but belonging to different floral whorls, which condition is clearly exhibited by *Zephyranthes*. In *Zephyranthes* the perianth midribs have fused with the staminal bundles lying on the same radii. The dorsal bundles of the three carpels have fused with the perianth stamen traces which are nearest to them and also lie on the same radii.

In *Amaryllidaceae* one can expect a variety in the origin and behaviour of the bundles of the ovary wall. In *Polianthes tuberosa* and *Eucharis amazonica* the vascular bundles for different floral parts separate at the very base of the ovary and they maintain their individuality throughout. In *Zephyranthes*, on the other hand, the vascular bundles lying on the same radii fuse with each other. In *Viburnum* of *Caprifoliaceae,* WILKINSON (1948) observed a fusion of the dorsal traces of the carpels with the peripheral bundles and a separation from them only in the upper part of the ovary.

In *Begonia* (GAUTHIER 1950) and in *Hillebrandia* (GAUTHIER 1959) the dorsal bundles of the carpels are fused with the sepal traces. In *Drosera cystiflora*, HALL (1949) found a fusion of sepal midribs with staminal traces and of petal traces with sepal lateral traces. In fact, in many families with inferior ovaries such adnations are common and *Zephyranthes* appears to be no exception.

Summary and Conclusion

The inferior ovary in *Zephyranthes* is best explained under the appendicular theory as due to an extreme adnation of the outer floral parts with the ovary, involving also extensive fusions of the vascular bundles of different floral whorls. Thus the type of inferior ovary seen in *Zephyranthes* appears to be more advanced than that of e.g. *Polianthes tuberosa* and *Eucharis amazonica.*

Acknowledgement

The junior author thanks the senior author Dr. K. RANGASWAMI AYYANGAR, M. Sc., Ph. D., F. B. S., Head of the Department (In-charge) of Botany, Annamalai University, for his valuable guidance and critical suggestions. He is grateful also to the Council of Scientific and Industrial Research, Government of India, for the award of a Senior Research Fellowship.

Literature

CHATURVEDI, S. B. 1945. The Nature of the Inferior Ovary in Amaryllidaceae. — Current Sci. 14: 207.

GAUTHIER, R. 1950. The Nature of the Inferior Ovary in the Genus Begonia. — Contrib. Inst. Bot. Univ. Montréal 66: 1—93.

— 1959. L'anatomie vasculaire et l'interprétation de la fleur pistillée de l'Hillebrandia sandwicensis Oliv. — Phytomorph. 9: 72—87.

HALL, B. A. 1949. The Floral Anatomy of Drosera and Begonia and its Bearing on the Theory of Carpel Polymorphism. — Amer. Jour. Bot. 36: 416—421.

JOSHI, A. C. & PANTULU, J. V. 1941. A Morphological and Cytological Study of Polianthes tuberosa Linn. — Jour. Ind. Bot. Soc. 20: 37—71.

NEWMAN, I. V. 1928. The Life-history of Doryanthes excelsa. Part I. Some Ecological and Vegetative Features of Spore Production. — Proc. Linn. Soc. New South Wales 53: 499—538.

WILKINSON, A. M. 1948. Floral Anatomy and Morphology of the Genus Viburnum of the Caprifoliaceae. — Amer. Jour. Bot. 35: 455—465.

BOTANISKA NOTISER 1965 · VOL. 118 · FASC. 2 · LUND

Halesia cf. carolina L. (Styracaceae) im oberen Pliozän von Weilerswist in Westdeutschland

Von HANS TRALAU

Naturhistoriska Riksmuseet, Stockholm 50

Einleitung

Die Gattung *Halesia* kommt gegenwärtig mit 3 Arten im atlantischen Nordamerika und mit einer Art in SO-China vor. Im Mitteleuropäischen Tertiär ist die Gattung bis jetzt zweimal durch das Vorkommen von flügellosen Steinkernen bekannt geworden. Die als *Camptotheca crassa* von REID & REID (1915) beschriebenen Reste aus dem Pliozän von Swalmen in Holland wurden von KIRCHHEIMER (1943) zu *Halesia* geführt. Gleichzeitig beschreibt der gleiche Verfasser flügellose Steinkerne aus dem Oligozän von Spremberg bei Kausche in Deutschland und fasst diese Vorkommen mit denen von Holland unter dem Namen *Halesia crassa* zusammen. Die Gattung ist ebenfalls fossil in Nordamerikas Miozän durch den Abdruck einer Frucht bekannt geworden, die BROWN (1946) mit der nordamerikanischen *Halesia diptera* vergleicht. Das hier mitzuteilende Vorkommen stammt aus dem oberen Pliozän von Weilerswist, woraus kürzlich das fossile Vorkommen von *Trapella* beschrieben wurde (TRALAU 1964). Es handelt sich um eine Süsswasserablagerung, in der sich die Reste sowohl der Seevegetation, z.B. *Trapella, Euryale,* als auch die eingewehten Teile der Ufervegetation, z.B. *Halesia, Alnus, Nyssa* u.s.w. befinden. Der hier gefundene *Halesia*-Rest ist eine mit den Flügeln erhaltene Frucht, die von der rezenten *Halesia carolina* L. nicht zu unterscheiden ist, wohl aber von den übrigen Arten der Gattung.

Das rezente Vorkommen

Halesia carolina unterscheidet sich von *H. monticola* durch bedeutend geringere Länge der Früchte. Die von *H. carolina* sind 2,5—3,5 cm lang

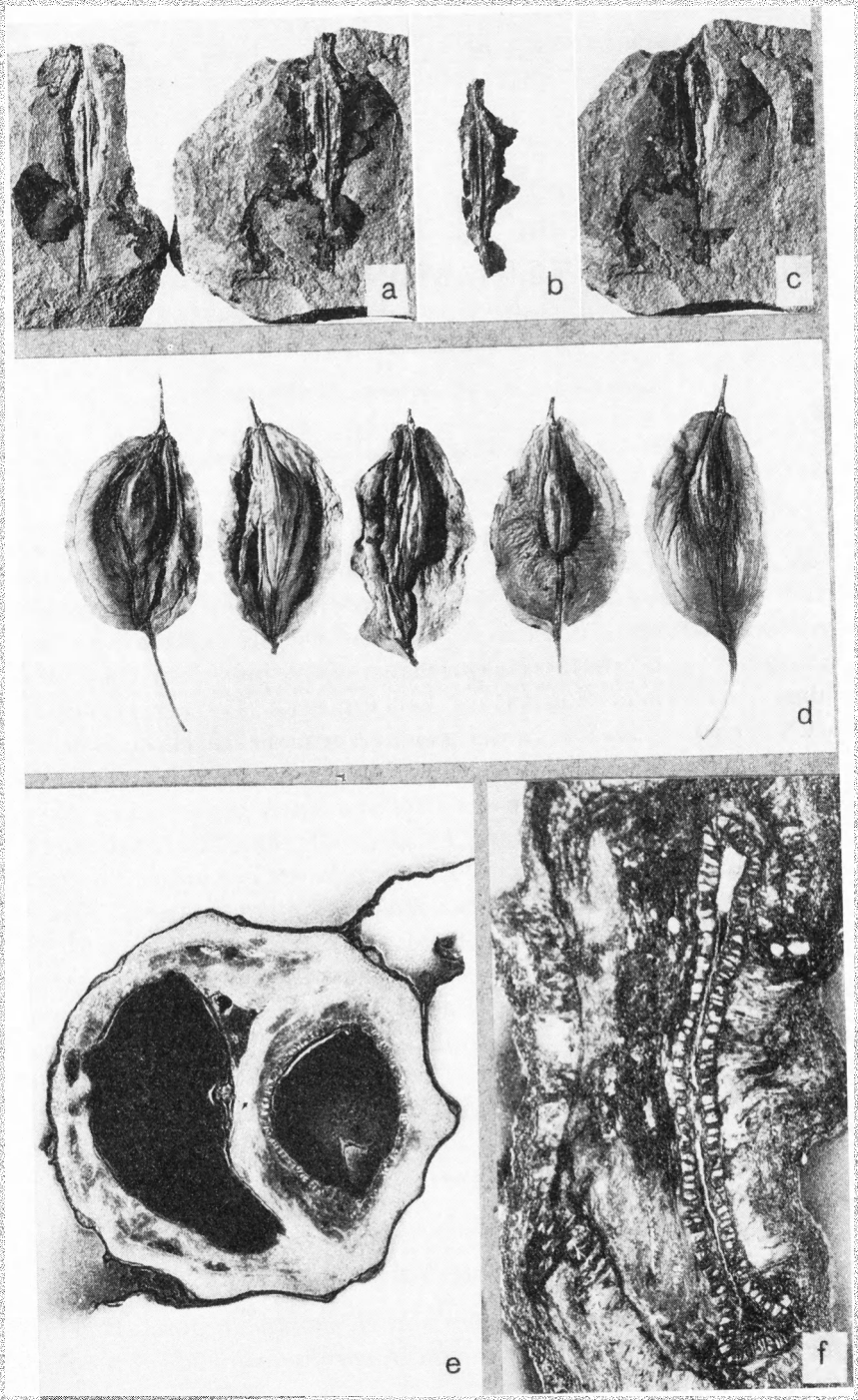
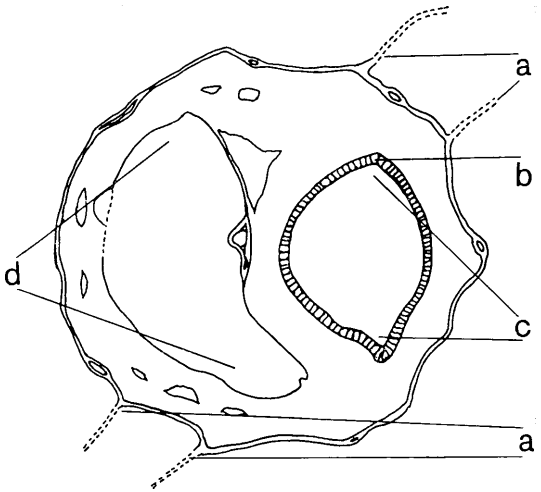
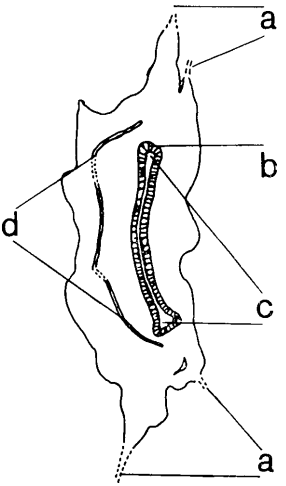


Fig. 1.



2



3

Fig. 2. Querschnitt durch den rezenten Steinkern von *Halesia carolina*. a=Flügelansätze, b=Samenschale des fertilen Faches, c=fertiles Fach, d=steriles Fach. 10:1.

Fig. 3. Querschnitt durch den fossilen Steinkern von *Halesia*. a=Flügelansätze, b=Samenschale des fertilen Faches, c=fertiles Fach, d=steriles Fach (oder Fächer). 10:1.

und die von *H. monticola* im Durchschnitt 1 cm länger. Von *H. diptera* unterscheidet sich *H. carolina* durch vier Flügel (Fig. 1 e und 2 a). Ein deutlicher Nerv verläuft ± parallel den Flügelrand entlang. *H. diptera* hat hingegen nur zwei Flügel. Die Steinkerne von *H. carolina* sind 0,2 bis 0,5 cm breit und 1,0 bis 2,5 cm lang und haben an der Spitze verholzte Reste des Griffels. Die Steinkerne sind in der Regel in der oberen Hälfte der Flügelfrucht gelegen (Fig. 1 d). Die Frucht enthält meistens ein fertiles Fach und ein bis drei sterile Fächer. Bis zu vier fertile Fächer können vorkommen. Die sterilen Fächer enthalten

Fig. 1. a: Abdruck der fossilen *Halesia*-Frucht mit dem Steinkern in der einen Hälfte (rechts). — b: isolierter Steinkern mit ausstehenden Exokarpresten. — c: Abdruck nach Entfernung des Steinkerns. 1:1. — d: rezente Früchte von *Halesia carolina* L. (Riksmuseets bot. avd., Stockholm 50: A. RUTH No. 6812, Knoxville, Tennessee, U.S.A.). 1:1. — e: Querschnitt durch den Steinkern einer rezenten *Halesia carolina* L. (von Fig. 1 d). 10:1. — f: Querschnitt durch den fossilen Steinkern der *Halesia*. 30:1.



Fig. 4. Die rezente Verbreitung von *Halesia carolina* L. (▨) und das pliozäne Vorkommen von *Halesia* cf. *carolina* (◓).

Reste abortierter Embryonen. Das fertile Fach (Fig. 1 e und Fig. 2 c) ist von einer Schicht breiter, fast viereckiger Zellen umgeben. Sie haben eine Höhe von 40—80 μ und eine Breite von 30—80 μ (Fig. 1 e und Fig. 2 b). Diese „Samenschicht" hat ihren Ursprung im Integument und ist daher als Samenschale zu betrachten.

Das fossile Vorkommen

Diagnose: Geflügelte Frucht. Ohne Stengel und den verholzten Griffel 3,1 cm lang und ± 2 cm breit. Der zentralplazierte, längliche Stein-

kern im oberen $^2/_3$ der umgebenden Flügel. Steinkern längsgefurcht, zusammengepresst auf ± 1,5 mm, enthält Fächer, von denen eines fertil und eines (zwei oder drei) steril ist.

Beschreibung: Die dünnen, verkohlten Flügel sind zum grossen Teil zerstört und Epidermis hat sich nicht preparieren lassen. Dagegen ist ein deutlich zum Flügelrand ± parallel verlaufender Nerv sowohl im inkohlten Material als auch im Abdruck des Tons zu sehen. Die verholzten Reste der Griffels sind nicht bewahrt. Der Steinkern hat zwischen 8 und 10 Längsrippen, die teilweise ganz von den apikalen zu den basalen Teilen des Steinkerns laufen. Im Querschnitt (Fig. 1 f und 2 b) zeigt der Steinkern deutlich die Samenschale des fertilen Faches. Die Zellen dieser Schicht zeigen die gleichen Grössenverhältnisse wie die der rezenten Exemplare. Die Höhe variiert zwischen 40 und 80 µ und die Breite zwischen 30 und 80 µ. Eine an diese Zellen sich nach aussen anschliessende Faserschicht (Fig. 1 f) lässt sich auf Grund der Fossilisation nur undeutlich erkennen. Die Anzahl der sterilen Fächer ist ungesichert. Eine deutliche Faltungsebene lässt sich erkennen (Fig. 1 f und Fig. 3 d). Ob diese Faltungsebene aber durchgehend ist und also ein steriles Fach repräsentiert oder unterbrochen ist und daher zwei oder drei sterile Fächer anzeigt, lässt sich wiederum auf Grund destruktiver Vorgänge bei der Einkohlung nicht nachweisen.

Die hier gezeigten morphologischen und anatomischen Merkmale des Fossils machen es wahrscheinlich, dass dieses mit der rezenten nordamerikanischen Art *H. carolina* identisch ist. Da aber die übrigen Merkmale der fossilen Population von Weilerswist, d.h. Blüten, Blätter u.s.w., unbekannt sind, soll das aktuelle Fossil nur als *Halesia* cf. *carolina* bezeichnet werden. Zur Frage der artlichen Zusammengehörigkeit dieses Fossils mit den anderen fossilen Vorkommen der Gattung kann nicht Stellung genommen werden, da bei diesen die Form und Anzahl der Flügel unbekannt sind. Bei den Vorkommen vom Pliozän von Swalmen ist sogar die Anatomie unbeschrieben.

Das hier publizierte Fossil wurde auf einer im Mai 1964 vorgenommenen Reise nach Weilerswist vom Verfasser gesammelt. Mittel für diese Reise wurden von dem Direktor der Paläobotanischen Abt., Naturhistorisches Reichsmuseum, Professor Olof H. Selling aus Fonden der Abteilung zur Verfügung gestellt, wofür ich an dieser Stelle meinen verbindlichen Dank sage.

Literatur

BROWN, R. W. 1946. Alterations in some fossil and living floras. — Journ. Washingt. Acad. Sci., 36: 10.

KIRCHHEIMER, F. 1943. Über den Nachweis der Styracaceen-Gattung Halesia Ellis im Tertiär Mitteleuropas. — Planta, 33: 4.

REID, C. & REID, E. M. 1915. The Pliocene floras of the Dutch-Prussian border. — Meded. Rijsopsp. Delfst., 6.

TRALAU, H. 1964. The genus Trapella Oliver in the Tertiary of Europe. — Bot. Notiser, 117: 2.

BOTANISKA NOTISER 1965 · VOL. 118 · FASC. 2 · LUND

Pollen Morphological Studies in Indian Urticales

By P. K. K. NAIR and MITHILESH SHARMA
National Botanic Gardens, Lucknow, India

Introduction

The plants contained in the order *Urticales* (ENGLER & PRANTL, cit. LAWRENCE 1958), are classified in three families, namely *Ulmaceae*, *Moraceae* and *Urticaceae*. However, BENTHAM & HOOKER (1880—1883) had recognized only one family, *Urticaceae,* comprising all the above mentioned taxa. HUTCHINSON (1926), and RENDLE (1952) separated the genus *Cannabis* into a separate family, *Cannabinaceae*.

Several investigators have studied the pollen grains of the families of *Urticales,* of whom may be mentioned, WODEHOUSE (1935), SELLING (1947), and ERDTMAN (1952). The present study covers 28 species of Indian members of the orders.

Material and Method

Polliniferous material has been procured from dry plant specimens deposited in the herbaria of the National Botanic Gardens, Lucknow, and the Botanical Survey of India, Poona. Pollen preparations have been made by the acetolysis method (ERDTMAN 1952). The relevant data and slides are deposited in the Palynology Laboratory of the National Botanic Gardens, Lucknow. However, a few sporomorphs are unacetolysed. Terminology used in pollen descriptions is in accordance with NAIR (1964, 1965).

Observations

Ulmaceae

Holoptelea Planch.

H. integrifolia Planch. (Sl. 3744;[1] Acetolysed). Fig. 1: Grains 4-zonoporate. Spheroidal, size 27 μ (range 26—31 μ). Pore tenuimarginate,

[1] Slide number.

slightly wavy. Pore diameter 2.2 μ. Exine thickness 1.1 μ, being membraneous in some grains. Endine very thin. Ectine surface rugulate (Ulmoid, cf. ERDTMAN 1952).

Trema Lour.

T. orientalis Blume (Sl. 4197; Acetolysed). Fig. 2: Grains 2-porate, spheroidal, size 19.1 μ (range 18.88—21.2 μ). Pore annulate, diameter 1.5 μ. Exine thickness 1.1 μ. Endine very thin. Ectine surface faintly granulose.

Moraceae

Artocarpus Forst.

A. altilis (Parkinson) Fosberg (Presented by T. M. VARGHESE; Sl. 4594; Acetolysed). Fig. 3: Grains 2-porate. Longest axis 20.5 μ (range 18.88—23.6 μ). Pores operculate in some grains, diameter 2.2 μ. Exine thickness 1.5 μ, surface with a faint LO-pattern.

A. lakoocha Roxb. (Presented by T. M. VARGHESE; Sl. 4592; Acetolysed). Fig. 4: Grains (3—)4(—5)-zonoporate. A few abnormally parasyncolpate grains also occur. Pore diameter 1.1 μ. Exine thickness 2.2 μ, being thinner towards pore margins. Ectine thicker than endine, tegillate. Ectine surface granulose, granules being sparse.

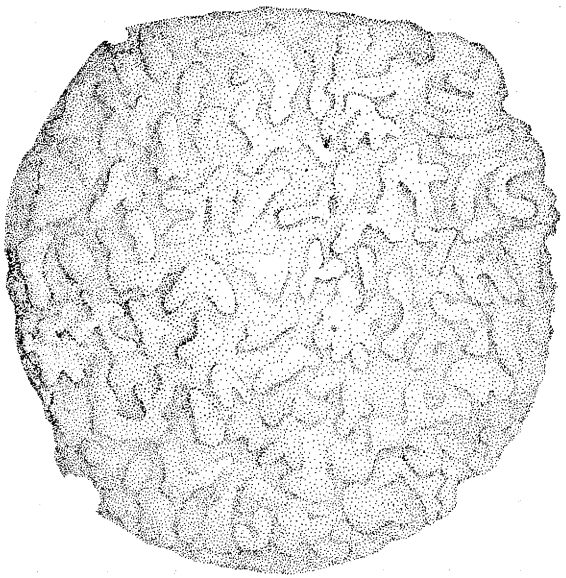
A. odoratissima Blanko (Presented by T. M. VARGHESE; Sl. 4593; Acetolysed). Fig. 5: Grains (2—)3(—4)-zonoporate. Few grains trichotomocolpate. Longest axis 17.4 μ (range 16.5—18.8 μ). Even after acetolysis, protoplasm is symmetrically contracted in each grain. Pore diameter 1.1 μ. Exine thickness 1.1 μ. Exine surface minutely spinulose, spinules almost reduced to granules.

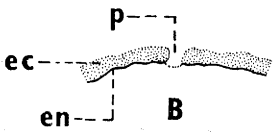
Broussonetia L'Herit.

B. papyrifera Vent. (Fresh; Sl. 3652; Unacetolysed). Fig. 6: Grains 2-zonoporate (Pororate?). Longest axis 11.7 μ (range 9.9—13.2 μ). Pore diameter 2 μ. Exine very thin, surface pattern obscure (probably faintly granulose).

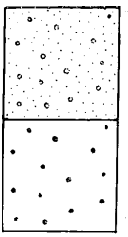
Cannabis (Tourn.) Linn.

C. sativa Linn. (Sl. 2023; Acetolysed). Fig. 7: Grains 3-zonoporate, spheroidal. Diameter 22.4 μ (range 21.2—23.6 μ). Pore annulate, diameter 2.2 μ. Exine very thin, membraneous. Exine surface faintly granulose.

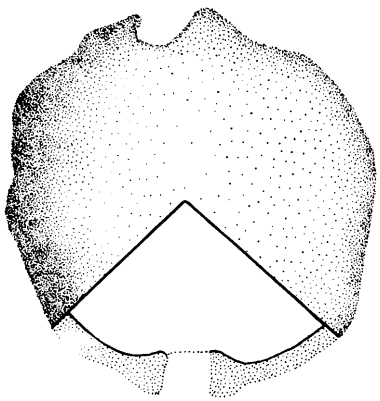




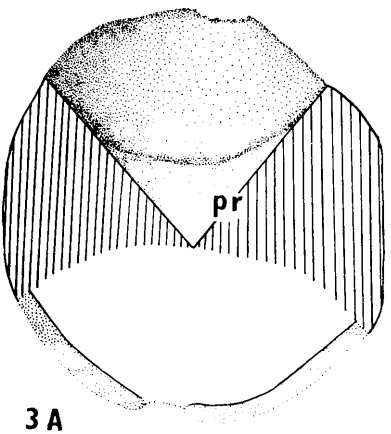
1 A



3 B



2



3 A

Figs. 1—10. Pollen grains of *Urticales*. — a. annulus, ec. ectine, en. endine, p. pore, pr. protoplasm, t. trichotomous aperture.

Fig. 1. *Holoptelea integrifolia:* A. Polar view (×2475); B. Exine strata with a pore (×2475).

Fig. 2. *Trema orientalis:* Grain showing surface and exine strata (×2475).

Fig. 3. *Artocarpus altilis:* A. Grain showing contracted protoplasm and exine strata (×2475); B. LO-pattern (×2475).

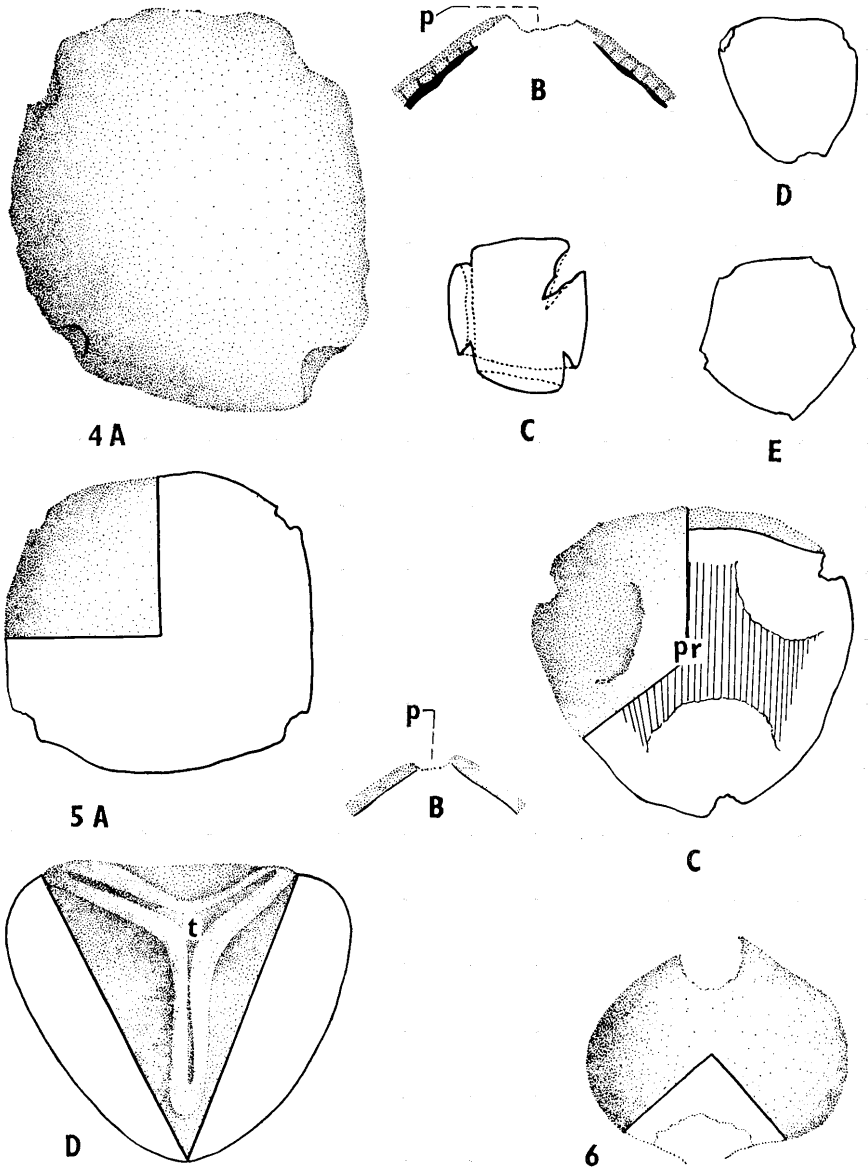


Fig. 4. *A. lakoocha:* A. Polar view (×2475); B. Exine strata with a pore (×2475); C. Abnormally 4-parasyncolpate grain (×1125); D. 3-porate grain (×1125); E. 5-porate grain (×1125).

Fig. 5. *A. odoratissima:* A. 4-porate grain (×2475); B. Exine strata (×2475); C. 3-porate grain (×2475); D. Trichotomocolpate grain (×2475).

Fig. 6. *Broussonetia papyrifera:* Grain showing surface and the thin exine (×2475).

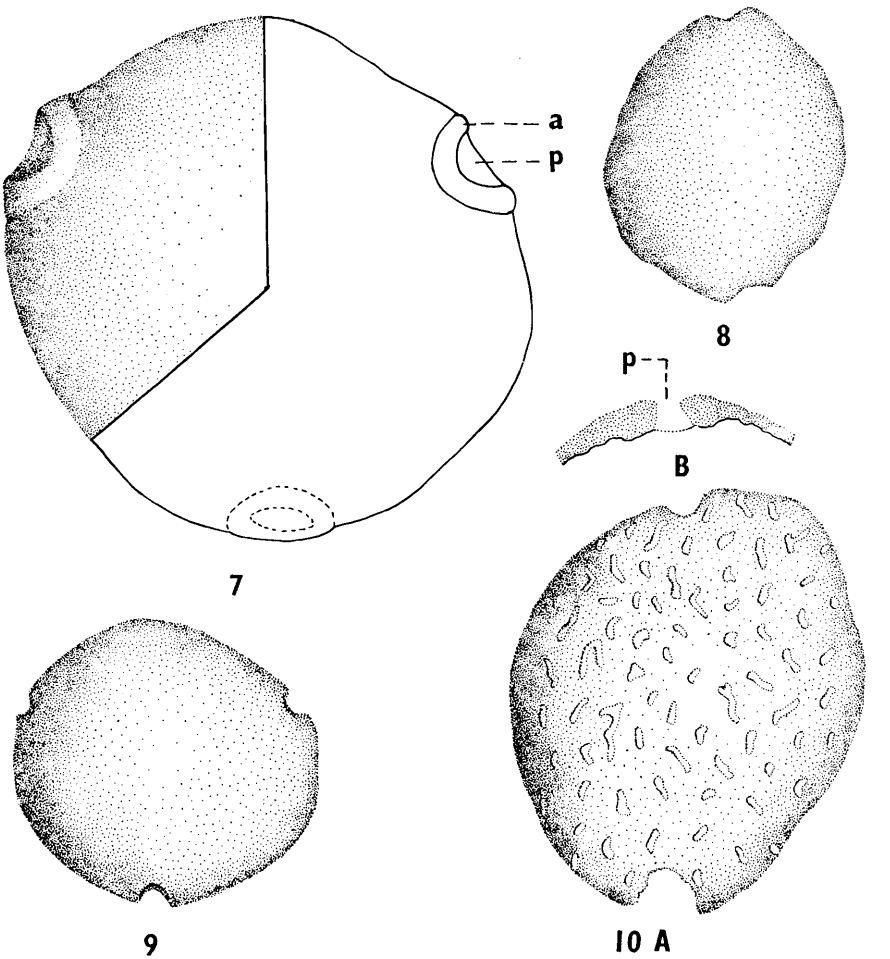


Fig. 7. *Cannabis sativa:* Polar view (×2475).
Fig. 8. *Ficus tomentosa:* Surface view (×2475).
Fig. 9. *Boehmeria nivea:* Polar view (×2475).
Fig. 10. *Pilea umbrosa:* A. Surface view (×2475); B. Exine strata (×2475).

Chamabainia Wight

C. cuspidata Wight (Sl. 3634; Acetolysed): Grains shrunken, aperture indiscernible, longest axis 10.7 μ (range 9.9—12.1 μ). Exine very thin. Exine surface pattern obscure.

Elatostema Forst.

E. surculosum Wight (Sl. 3637; Acetolysed): Grains 3-zonoporate.

Longest axis 9 μ (range 7.7—9.9 μ). Pore diameter 1.1 μ. Exine very thin, membraneous. Exine surface with a faint LO-pattern.

Ficus Tourn. ex Linn.

F. hispida Linn. (Sl. 3647; Acetolysed): Grains 2-porate. Longest axis 15.7 μ (range 14.3—17.6 μ). Pore diameter 2.2 μ. Exine very thin, membraneous. Exine surface psilate.

F. tomentosa Roxb. ex Willd. (Sl. 3640; Acetolysed). Fig. 8: Grains 2(—3)-porate. Longest axis 15.7 μ (range 13.2—19.8 μ). Pore diameter 2.2 μ. Exine very thin. Exine surface with a faint LO-pattern.

Laportea Gaudich.

L. crenulata Gaudich. (Sl. 4583; Acetolysed): Grains 3-zonoporate. Longest axis 17 μ (range 15.4—18.7 μ). Pores faint. Exine very thin, surface pattern obscure.

Maoutia Wedd.

M. puya Wedd. (Sl. 2025; Acetolysed): Grains 2-porate. Longest axis 16.5 μ (range 14.3—18.7 μ). Pores slightly annulate, diameter 1.1 μ. Exine very thin, surface faintly granulose.

Morus (Tourn.) Linn.

M. alba Linn. (Sl. 243; Acetolysed): Grains 2(—3)-porate. Longest × shortest axes 18.26×15.4 μ (range 16.5—20.9×15.4 μ). Pore diameter 2.2 μ. Exine very thin, surface with a faint LO-pattern.

M. laevigata Wall. (Sl. 4657; Acetolysed): Grains 2-porate. Longest axis 15.29 μ (range 13.2—17.6 μ). Pore diameter 1.5 μ. Exine very thin, surface with a faint LO-pattern.

M. nigra Linn. (Sl. 4657; Acetolysed): Grains 4-zonoporate. Longest axis 31.4 μ (range 28—33 μ). Pore diameter 5.5 μ. Exine very thin, surface with a faint LO-pattern.

Streblus Lour.

S. asper Lour. (Sl. 4196; Acetolysed): Grains 3-zonoporate. Most of the grains are shrunken. Longest axis 17 μ (range 14.2—18.8 μ). Pore diameter 2.2 μ. Exine very thin, surface faintly granulose.

Urticaceae

Boehmeria Jacq.

B. malabarica Wedd. (Sl. 4588; Acetolysed): Grains 3-zonoporate, pro-

late. Size 16.8×12.4 μ (range 15.4—19.8×11—14.3 μ). Pore diameter 2.2 μ. Exine very thin, surface psilate (faint LO).
B. platyphylla D. Don (Sl. 4577; Acetolysed): Grains 3-zonoporate, spheroidal, size 15.3 μ (range 11—18.7 μ). Pores very faintly marked. Exine very thin, membraneous. Exine surface with a faint LO-pattern.
B. nivea Gaudich. (Sl. 2019; Acetolysed). Fig. 9: Grains 3-zonoporate. Longest × shortest axes 17×11.1 μ (range 14.3—20.9×8.8—13.2 μ). Pores faintly marked. Exine very thin, surface faintly granulose.

Debregeasia Gaudich.

D. hypoleuca Wedd. (Sl. 3635; Acetolysed): Grains (2—)3-zonoporate. Most grains are shrunken. Longest axis 19.3 μ (range 16.5—21.2 μ). Pore diameter 2.2—3.3 μ; being apparently operculate in some grains. Exine very thin, surface with a faint LO-pattern.
D. velutina Gaudich. (Sl. 2024; Acetolysed): Grains 3-zonoporate. Longest axis 17.7 μ (range 16.5—19.8 μ). Pores ill defined, diameter about 2 μ. Exine very thin, surface with a faint LO-pattern.

Pilea Lindl.

P. scripta Wedd. (Sl. 3737; Acetolysed): Grains 3-zonoporate. Longest axis 16.5 μ (range 14.3—18.7 μ). Pore diameter 2.2 μ. Exine very thin, surface with a faint LO-pattern.
P. umbrosa Wedd. (Sl. 3738; Acetolysed): Fig. 10: Grains 2-porate, longest axis 20 μ (range 18.88—23.6 μ). Pores ill defined. Exine thickness 1.65 μ, being thinner in some crumpled grains. Ectine thicker than endine, surface granulose-rugulate.

Pouzolzia Gaudich.

P. hirta Hassk. (Sl. 3735; Acetolysed): Grains 3-zonoporate. Longest axis 13.5 μ (range 12.1—15.4 μ). Pores faintly demarcated, diameter 2 μ. Exine very thin, surface with a faint LO-pattern.
P. indica Gaudich. (Sl. 4587; Acetolysed): Grains 3-zonoporate. Longest axis 13 μ (range 11—15.4 μ). Pore diameter 1 μ. Exine very thin, surface with an obscure pattern.
P. pentandra Benn. (Sl. 3733; Acetolysed): Grains 3-zonoporate. Longest axis 15.8 μ (range 14.3—17.6 μ). Pore diameter 2 μ. Exine very thin, surface with a faint LO-pattern.

Urtica (Tourn.) Linn.

U. parviflora Roxb. (Sl. 3726; Acetolysed): Grains 3-zonoporate. Longest

axis 17.1 μ (range 15.4—20.9 μ). Pores ill marked, diameter 1.5 μ. Exine very thin, surface pattern obscure.

Discussion

Pollen grains are 2-porate (pores feebly annulate) or 4-zonoporate in *Ulmaceae;* usually 2—3—4-zonoporate, rarely 5-zonoporate, trichotomocolpate, and abnormally parasyncolpate in *Moraceae,* and 2—3-porate in *Urticaceae.* Pores are sometimes annulate or operculate. Exine is thick, i.e., "resistant" to acetolysis, or thin and membraneous, i.e., "nonresistant" to acetolysis. In resistant exine, columella is hardly noticeable (probably fused, becoming homogeneous), except in a few species.

Variations in the apertures are common in several species of *Moraceae,* grains being 2—3—4-zonoporate in the same species, and most pronounced in *Artocarpus* spp. In *A. lakoocha,* 3—5-zonoporate grains occur along with the normal 4-zonoporate ones, apart from a few abnormally parasyncolpate grains. Similarly, in *A. odoratissima,* 2—4-zonoporate and rarely trichotomocolpate pollen grains occur along with the common 3-zonoporate pollen types. It is interesting to note, that among the *Moraceae,* all the three species of *Artocarpus,* studied here, possess "resistant" exine. The endine is thin in *A. altilis* and *A. odoratissima,* and thick in *A. lakoocha.* Variations in apertural types are also observed in *Morus alba* and *Ficus tomentosa.* It may be noted that all plants having the apertural variations in their pollen, are cultivated (except *Ficus tomentosa*).

Among the members of *Moraceae, Cannabis sativa* appears to be palynologically different from other species, by the presence of prominently annulate pores, which might provide an additional support to separate the genus into a family *Cannabinaceae,* as done by RENDLE (1952), and HUTCHINSON (1926). Similarly, members of *Ulmaceae* are characterized by the "Ulmoid" (ruguloid) exine pattern (ERDTMAN 1952). Within the family, grains are 2-porate and faintly granulose in *Trema orientalis,* and 4-zonoporate with a ruguloid pattern in *Holoptelea integrifolia.* Exine is "resistant" in both species. Within the *Urticaceae,* grains are either 2-porate (e.g., *Broussonetia papyrifera, Maoutia puya,* and *Pilea umbrosa*), or 3-zonoporate (e.g., *Boehmeria, Debregeasia*). In *Chamabainia cuspidata,* apertures are not discernible as all the grains are shrunken.

The porate condition in pollen is considered to be an advanced character (WODEHOUSE 1936) over the colpate type. *Urticaceae* is composed of plants with porate pollen (pores 2—5 in number). According to HUTCHINSON (1926), the *Urticales* are phylogenetically related to *Fagales* which is composed of the taxa possessing both 3-porate (e.g., *Betulaceae*), and 3-colpate (e.g., *Fagaceae*) pollen grains. ERDTMAN (1952) noted palynological similarities between the *Ulmaceae* and the *Betulaceae*. Pollen grains do not offer any evidence to support the view, based on vascular supply to the ovule, that the *Urticales* are not a natural order (BECHTEL 1921). If it is considered that the 3-colpate types are primitive, the evolution of the *Urticales* may be traced from the *Ranales* (3-colpate) through the *Fagaceae*. The alliance of the families of *Urticales* with *Malvales* (BESSEY 1915), or their inclusion in the *Terebinthales* (HALLIER 1912) does not find support from pollen morphology.

The "resistant" exine is prevalent in the *Ulmaceae*. In the *Moraceae*, most species have "non-resistant" exine. However, the exine is thick in species of *Artocarpus* (*Moraceae*) of which, one shows clearly marked columellae. The "resistant" exine should be considered a primitive character, as this exine character tends to give more protection to the germ plasm. In such an event, *Ulmaceae* appear to be primitive, and the *Moraceae* and *Urticaceae* are advanced within the *Urticales*. BECHTEL (1921) noted that the *Urticaceae* are higher than the *Moraceae*, which in turn are more advanced than the *Ulmaceae*.

Acknowledgements

We are grateful to Prof. K. N. KAUL, F. L. S., Director, National Botanic Gardens, Lucknow, for his encouragement during the course of this work. Our thanks are due to Mr. T. M. VARGHESE (Meerut College, Meerut) and Mr. R. SESHAGIRI RAO (Regional Botanist, Botanical Survey of India, Poona) for the material they have very kindly supplied to us.

Literature cited

BECHTEL, A. R. 1921. The floral anatomy of the Urticales. — Amer. Jour. Bot. **8** (8): 386—410.

BENTHAM, G. & HOOKER, J. D. 1880—1883. Genera Plantarum. Vol. III. London.

BESSEY, C. E. 1915. The phylogenetic taxonomy of flowering plants. — Ann. Mo. Bot. Gard., **2**: 109—164.

ERDTMAN, G. 1952. Pollen morphology and plant taxonomy. Angiosperms. Waltham Mass., Stockholm.

HALLIER, H. 1912. L'origine et le système phylétique des angiospermes. — Arch. Néerl. Sci. Exct. Nat. Ser., III B, 1: 146—234.

LAWRENCE, G. H. M. 1958. Taxonomy of vascular plants. New York.

NAIR, P. K. K. 1964. Pollen morphology. — In 'Advances in Palynology', edited by P. K. K. Nair, pp. 203—224. Lucknow.

— 1965. Pollen grains of western Himalayan plants. A monograph. Asia Publishing house (In press).

RENDLE, A. B. 1952. The classification of flowering plants. Vol. II. Cambridge (second printing).

SELLING, O. H. 1947. Studies in the Hawaiian pollen statistics. Pt. II. The pollens of the Hawaiian Phanerogams. — Spec. Publ. Bishop Mus. Honolulu, **38**.

WODEHOUSE, R. P. 1935. Pollen grains, their structure, identification and significance in science and medicine. New York and London.

— 1936. Evolution of pollen grains. — Bot. Rev., **2**: 67—84.

BOTANISKA NOTISER 1965 · VOL. 118 · FASC. 2 · LUND

Nye bidrag til Bornholms flora

Af ALFRED HANSEN, ARNE LARSEN og ANFRED PEDERSEN

Bornholm har forståeligt nok altid haft en særlig tiltrækning for florister og botanisk interesserede, der to gange har oplevet at se artsfortegnelser for øen publiceret, nemlig N. H. BERGSTEDT's flora fra 1883 (Bot. Tids. 13) og ARNE LARSEN's flora fra 1956 (Bot. Tids. 52).

Siden 1956 er der gjort en hel del nye og interessante fund, dels af arter, der er nye for Bornholm og Erteholmene, dels af arter, der kun kendes fra få fund. Hertil kommer, at Bot. Museum i 1963 fra Herlufsholm Kostskole modtog et omfattende herbarium, samlet af apoteker J. BAAGØE (1838—1905), der inden sin død skænkede det til Herlufsholm. BAAGØE opholdt sig på Bornholm i årene 1859—1865, og en meget stor del af hans herbarium består af indsamlinger fra disse år. Selv om alle hans fund angives at have været stillet til rådighed for BERGSTEDT, da denne i sin tid udarbejdede sin flora, indeholder herbariet — ud over hidtil ukendte fund — en del beviseksemplarer for ældre angivelser af bornholmske plantefund, om hvis pålidelighed der hidtil har hersket tvivl. Endvidere er der i 1964 tilgået museet en samling planter, samlet af afdøde lektor, dr. phil. P. GELTING, mest fra Erteholmene og med adskillige for disse øer nye arter. Endelig bringes en del fund gjort af afdøde Sv. ANDERSEN og hentet dels fra et utrykt manuskript »Et tillæg til Bornholms karplanteflora» (1950) og dels fra hans samling af notater (samlet og renskrevet af fhv. lærer S. M. RASMUSSEN, opbevares ligesom manuskriptet på Bot. Museum). SV. ANDERSEN's fund stammer fra årene 1928—1948.

Floraen på den 12 ha store ø Græsholm har særlig interesse, fordi øen er videnskabeligt fuglereservat (siden 1935, fredet i 1926). Den første floraliste stammer fra skoledirektør SOFUS FRANCK, der i 1902 og 1903 besøgte øen. I P. GELTING's herbarium fra 1937 repræsenteres øens flora af 35 arter, medens vores floraliste stammer fra et besøg

15/8 1964. De to floralister fra 1902—03 og 1964 er meget forskellige; til brug for sammenligning bringes oversigten over øens flora for sig.

Efterfølgende liste fremtræder som et supplement til ARNE LARSEN: Bornholms flora (1956), hvorfor artsangivelserne er placeret i samme familierækkefølge som i denne. For flere arter og slægter bringes der en ny taxonomi. De nye fund, der omtales i en ekskursionsberetning i Bot. Tids. *54*: 80 ff., 1958, er medtaget her. En tak skal bringes til prof. VALD. M. MIKKELSEN for oplysninger om plantefund og til prof. R. SPÄRCK for velvillig tilladelse til besøg på Græsholmen.

Følgende forkortelser er anvendt:

SA.=SV. ANDERSEN	L.=ARNE LARSEN
JB.=J. BAAGØE	M.=VALD. M. MIKKELSEN
NB.=N. B. BERGSTEDT	P.=ANFRED PEDERSEN
G.=P. GELTING	W.=K. WIINSTEDT
H.=ALFRED HANSEN	Ø.=HANS ØLLGAARD
J.=TH. JENSEN	

En * foran et artsnavn eller lavere enhed betyder, at nævnte plante er ny for Bornholm (distr. 47) og ikke medtaget hos ARNE LARSEN 1956.

Pteridophyta

Lycopodiaceae:

Lycopodium clavatum, Strandmarken v. Dueodde 1963 (K. LIND).

Ophioglossaceae:

Botrychium lunaria, Storefos i Rø (Bot. For. eksk. 1957), Christiansø: Mange ekspl. på en lille plet mell. klipperne udan f. muren v. Næsset (L.).

Polypodiaceae:

Asplenium septentrionale, Hammerens Stenbrud 1962 (Ø.).

— *trichomanes,* v. stien s. f. Vang 1960 (P.).

**Athyrium filix-femina* var. *imbricata* Lange (=var. *bornholmiensis* A. Lange), Kleven på vejen mell. Rønne og Allinge v. Spellingemosen (under Splitgårds jorder) i begyndelsen af 1880'erne, ERICHSEN leg. (Senere indplantet i Bot. Have). Også samlet 1890 af K. JESPERSEN.

Dryopteris thelypteris, Bastemose 1962 (Ø.).

Polystichum lobatum, Christiansø 1893 (H. EILSTRUP, sml. C. CHRISTENSEN, Bot. Tids. *24*, 372, 1902).

Equisetaceae:

Equisetum arvense, Christiansø 1937 (G.).

— *hiemale,* Mølledalen v. Hammershus 1958, Rutsker Højlyng (begge L.).

— *pratense,* Torpe Bakker ø. f. Hasle (M.), Christiansø 1960 (P.).

Gymnospermae

**Taxus baccata,* selvsået v. Hammershus (M.).

Monocotyledones

Gramineae:

**Agrostis canina* ssp. *montana* (*A. canina* var. *arida*), Christiansø 1964 (H. & P.).

Alopecurus myosuroides, Rønne Havn 1962 (Ø.) og 1964 (H.).

Arrhenatherum pratense (*Avena p.*), Christiansø 1961 (P.).

**Bromus inermis,* ruderat v. Rønne Sydhavn 1964 (H.).

*— *mollis* var. *leiostachys,* Christiansø 1961, Boderne 1963 (begge P.). Næppe sj., jvf. W., Bot. Tids. *55:* 45, 1959.

— *ramosus,* Dronteskov i Vestermarie, Randkleve (SA.).

Dactylis aschersoniana, Dronteskov i Vestermarie, skov. Olskirke, Storedal v. Sandkås, Jomfrubjerget, Christianshøj, v. f. Åremyre (alle SA.), Kobbeå og Sandflugtsskoven v. Villa Nova (Bot. For. eksk. 1957), Louisenlund 1958 (P.).

Festuca polesica, spredt i klitterne fra ca. 2 km n. f. Dueodde til ca. 5 km v. f. Dueodde (SA.).

— *trachyphylla,* Galløkken, Hammeren, langs banen v. Balka (SA.).

Hordelymus europaeus (*Hordeum e.*), Kobbeå n. f. Stavehøl (M.) skov v. parkeringspladsen i Stavehøl i Østerlars 1958 (L.).

**Hordeum jubatum,* ruderat v. Rønne Havn 1960 (L.).

*— *secalinum* (*H. pratense*), NB. anfører: »Skibsbroen v. Rønne (J.). Denne angivelse beror på en forveksling m. følgende, d.v.s. *H. murinum* (H. HJORTH).» — I BAAGØE's herb. ligger et ekspl. af *H. secalinum* m. påskriften: »Langs strandkysten i nærheden af Rønne Havn mell. *H. murinum* (J.) leg. 1856.» Planten har muligvis været indslæbt og er ikke siden genfundet.

Lolium strictum, som hos L. er angivet af H. DAHL fra Grisby, må formentlig udgå, da den formentlig er identisk m. *L. multiflorum* ssp. *gaudinii.*

Melica uniflora, Christiansø 1961 (P.).

Panicum miliaceum, optrådte i have i Rønne allerede i 1860, ifølge BAAGØE's herb., Melsted og sø. f. Kobbeå's udløb v. et hønseri (SA.), Hasle 1964 (H. & P.).

Phalaris canariensis, Svaneke (SA.), gammelt sandstensbrud i Snogebæk 1958 (B.).

Phleum arenarium, ø. f. Boderne (SA.).

— *phleoides,* skrænt s. f. Blanch's Hotel (SA.).

Poa bulbosa, Frederiksø 1960 (P.), første fund fra Erteholmene; på klipper og langs stier s. f. Svaneke 1958 (L.), i mængde på strandklint v. Boderne 1962 (L.), første fund uden for granitområdet.

— *chaixii,* Fuglesangsrenden (SA.).

— *pratensis* ssp. *angustifolia,* Almindingen, Lilleborg, Bølshavn, Christiansø (P.), sandsynligvis t. alm. på Bornholm.

*— — ssp. *irrigata,* Rantzau's Bastion på Christiansø 1937 (G.), i 1964 bemærket adskillige steder på Bornholm og næppe sj. på øen.

Puccinellia maritima, et fund fra Røsted v. f. Gudhjem samlet af H. i 1958 (oprindelig henført til *P. distans*) blev publiceret i Fl. og Fauna 65: 93, 1959 som *P. maritima.* En fornyet undersøgelse af materialet bekræfter

dog den oprindelige bestemmelse til *P. distans*. Udover en angivelse af WARMING i »Strandvegetationen» (p. 15, 1906) fra Malkværn n. f. Neksø (uden bevismateriale) samt en angivelse af NEUMAN, Bot. Notiser 1896, p. 92 af et fund (1 ekspl.) fra stranden ikke langt fra Neksø (=Malkværn?) kendes således indtil videre ingen sikre fund af denne art på Bornholm. Ved besøg ved Malkværn i juni og aug. 1964 blev kun fundet *P. retroflexa* (sparsom).

— *retroflexa,* stranden v. Melsted 1964 (H. & P.), Listed Havn 1962 (P.).

Setaria glauca, ruderat v. Rønne Sydhavn 1964 (H.).

*— *italica,* roemark ø. f. Robbedale (SA.).

*— *viridis* var. *major,* Rønne Havn, Neksø (SA.).

Vulpia myurus, ruderat v. Svaneke Havn 1964 (P.).

Cyperaceae:

Carex appropinquata, Gammelmose og Duedalsvandet i Almindingen (SA.).

— *contigua,* Christiansø 1964 (H. & P.).

— *elongata,* Gamleborg, Kohullet, Langemose, Pykkekullekær og Duedalsvandet i Almindingen (SA.).

— *hirta,* Christiansø 1937 (G.).

Carex hostiana, Bøgebjerg i Østerlars 1961 (L.).

— *nigra* var. *recta* (*C. caespitosa*), Ølene 1964 (H.).

— *otrubae,* Præstedammen på Christiansø 1937 (G.).

— *vulpina,* Sdr. Muregaard ø. f. Rutsker 1962 (M.), på Sydbornholm v. Risebæks udløb (Bot. For. eksk. 1957).

Eriophorum latifolium, i Bodilsker, Ølene (SA.).

Scirpus fluitans, Ølene i nord og Pykkekullekær (SA.), Ellesmyr i Paradisbakkerne 1960 (L.).

Typhaceae:

Sparganium minimum, rockpool v. Bølshavn 1961 (L.).

Typha angustifolia, Torneværket i Knudsker 1958 (L.).

Lemnaceae:

Lemna gibba, Skovgårdsløkken i Knudsker (Bot. For. eksk. 1957).

Araceae:

Arum maculatum ssp. *danicum,* Christiansø (P.), sandsynligvis indplantet,

Potamogetonaceae:

Groenlandia densa (*Potamogeton d.*), en angivelse af denne art fra Hammersøen hos J. LANGE 1888 (meddelt af V. HENNINGSEN) og gengivet hos HYLANDER 1953 betvivles meget stærkt. Intet herbarieekspl. foreligger, og Bornholm ligger ikke inden for artens naturlige udbredelseområde.

Potamogeton panormitanus, St. Myregaard i Knudsker 1958 (L.) og 1962 (Ø.).

— *pectinatus,* Graamyr v. Gudhjem 1964 (J. PEDERSEN).

— *pusillus,* vandhul i randen af plantage nø. f. Boderne 1957 (TH. SØRENSEN), publiceret af W. som *P. friesii* i Bot. Tids. *54*: 178, 1958; endv. Øleaa v. Slusegaard 1964 (H. & P.).

Zannichellia palustris var. *major,* rockpool v. Listed 1962 (P.).

Zostera. Slægten er ved Bornholms kyster formentlig kun repræsenteret ved *Z. marina.* Et ekspl. i BAAGØE's herb. samlet af J. 1856 v. Gudhjem og benævnt *Z. minor* virker ikke overbevisende, og ekspl. af såkaldt *Z. hornemanniana* fra Øleaa 1901 og Rønne 1901, begge samlet af L. KOLD. ROSENVINGE, er formentlig identiske med *Z. marina,* som specielt i Østersøen optræder i meget smalbladede former, som ikke tillægges nogen systematisk værdi. Nævnte herbarieekspl. er uden frugter, som er de eneste sikre kendetegn til adskillelse af *Zostera*-arterne, jvf. HYLANDER 1953.

Juncaceae:

Juncus conglomeratus×inflexus, Risebæk 1957 (L. INGERSLEV, 1958).
— *effusus×inflexus,* Ginesminde 1957 (L. INGERSLEV, 1958).

Liliaceae:

Allium carinatum, 2 ekspl. i BAAGØE's herb.: Rabækkegård v. Rønne 1858 (HAMANN) og Rønne 1860.
— *schoenoprasum.* Det første Bornholmsfund menes sædvanligvis at stamme fra 1937: Kystklipper s. f. Svaneke Fyr (M. SKYTTE CHRISTIANSEN). BAAGØE's herb. rummer imidlertid et ekspl. fra Bornholm fra 1859, dog uden nærmere findestedsangivelse. Ekspl. tilhører utvivlsomt »den baltiske kysttype».
Lilium martagon, naturaliseret i Svaneke Sydskov v. Hullehavn 1963 (P.).
Ornithogalum nutans, Melsted (SA.).

Convallariaceae:

Asparagus officinalis, Madsegrav v. Arnager 1962 (Ø.), mon spontan?
Polygonatum odoratum, gravhøj v. St. Bakkegaard i Aaker, Ekkodalen (SA.).

Orchidaceae:

**Dactylorchis incarnata* var. *subextensa* Hartm., Læså 1924 (M. P. CHRISTIANSEN), Ølene 1937 (W.) og 1964 (H.), Svaneke 1964 (H.).
— *maculata* angives hos L. 1956 coll. alm. på Bornholm. Den omfatter på øen formentlig følgende taxonomiske enheder:
D. maculata ssp. *maculata* (engformen), 2 fund i herb.
D. fuchsii, næppe sj., 8 fund i herb.
(*D. maculata* ssp. *ericetorum,* surbundsformen, er ikke med noget herbariebevis kendt fra øen).
*— *majalis* var. *pinguis,* Saltuna Strand, v. Sdr. Aasedam og eng v. Aaremyr (SA.).
— *sambucina,* talrig i både rød- og gulblomstrede ekspl. v. Lillegaard i Bodilsker 1962, 1964 (J. HØRBERG).
— *traunsteineri,* opretholdelsen af denne art for Bornholms vedkommende er næppe holdbar. Den svenske botaniker N. HYLANDER vil henføre de bornholmske ekspl. til ovenstående *D. incarnata* var. *subextensa.*
Goodyera repens, arten er på Bornholm ud over Sandflugtsskoven v. Rønne og Loftgårdsskoven v. Boderne kendt fra Dueodde, første fund 1933, nu ret hyppig her.

Dicotyledones

Salicaceae:

Populus nigra var. *italica*, v. Præstedammen på Christiansø cult. 1937 (G.).
Salix pentandra, Ølene 1960 (L.).

Cannabaceae:

Humulus lupulus, Ypnasted 1959 (L.).

Polygonaceae:

**Polygonum bistorta*, naturaliseret i Robbedale-Skoven v. Rønne 1963 (J. CHR. NIELSEN).
— *convolvulus*, Christiansø 1937 (G.).
— *cuspidatum*, forv. v. Onsbæk, Hammersholm og Rømersdal (SA.), v. kysten nær Svaneke 1962 (P.), v. Neksø og Snogebæk 1964 (H.) og vejkanter v. Robbedale, Hasle, i Pedersker og i Østermarie 1964 (H. & P.).
— *dumetorum*, Ekkodalen (SA.).
— *lapathifolium*, i kartoffelhaver på Christiansø 1937 (G.).
— *minus*, Kroggårdsløkken i Knudsker (Bot. For. eksk. 1957).
*— *persicaria* var. *incanum*, Dueodde 1962 (P.), bækudløb v. Balka Strand 1964 (H. & P.).
*— *sachalinense*, forv. i stor mængde v. vejkant s. f. Hammersøen nær Hammersholm 1964 og v. vejkant v. f. Sandvig 1964 (H. & P.).
Rumex domesticus, Ormebækkens udløb (SA.).
— *hydrolapathum*, stranden v. Tyrevig på Christiansø 1937 (G.) og Christiansø 1963 (P.).
— *thyrsiflorus*, Christiansø 1964 (P.).

Caryophyllaceae:

Cerastium glutinosum, n. f. Svaneke 1961 (P.), Christiansø 1961 (P.).
Honkenya peploides, Christiansø 1961 (P.).
Lychnis flos-cuculi, Tyrevig på Christiansø 1937 (G.).
Melandrium album, Frederiksø 1937 (G.).
— *noctiflorum* (*Silene n.*), Møllegaard i Klemensker 1959, Randkleve i mængde 1960, Allinge i mængde 1963 (L.), grusgrav v. Østervang, Allinge 1962 (M.), ruderat v. Rønne Sydhavn (H.) og have i Svaneke 1964 (H. & P.).
*— *rubrum* var. *crassifolium*, her i landet kun kendt fra Nordbornholms klippekyst fra Jons Kapel over Hammeren til Helligdomsklipperne ved Rø.
— *album*×*rubrum*, mark i Ibsker 1962 (Ø.).
Sagina ciliata, v. fyret på Christiansø 1937 (G.).
Scleranthus polycarpos, Christiansø 1958 (P.).
Silene armeria, BAAGØE's herb.: Seiersgaard i Knutsker 1859, dyrket?
Spergula vernalis, nye fund på Nordbornholm: Lyngbakker v. Grønnedal mell. Allinge og Sandkås 1958, Borrelyng v. Vang og Smedens Lyng (M.), i mængde på klippeknude v. Blaaholtsgaard i Olsker 1960 (L.).
Stellaria alsine, Paradisbakkerne 1960 (L.).
— *pallida*, Christiansø 1937 (G.) og 1961 (P.).

Portulacaceae:

**Claytonia perfoliata,* ukrudt på Rønne Kirkegård 1964 (L.). Planten spredes her i landet utvivlsomt med stauder og buske fra planteskoler.

Montia fontana (*M. lamprosperma*), næppe særlig sj., Bot. Museum har 11 fund.

**Portulaca oleracea,* v. havnen og i haver i Gudhjem 1933, i haver i Melsted, i haver i Boderne 1948 (SA.), Rønne Kirkegård 1959 (L.).

Amaranthaceae:

Amaranthus albus, hønseri i Østerlars (SA.).

— *retroflexus,* grusgrav s. f. Svaneke 1964 (H. & P.).

Chenopodiaceae:

Atriplex calotheca, er ikke med herbariebevis fundet på Bornholm, angivelserne må bero på fejlbestemmelser af *A. deltoidea*-former.

— *deltoidea* (*A. hastata* hos L. 1956), alm. v. kysterne, kaolinbruddet v. Rabekkeværket 1964 (P.). Andre arter hørende til *A. hastata*-gruppen er ikke kendt fra Bornholm.

— *glabriuscula,* ud over de hos L. 1956 angivne fund desuden kendt fra Bæle, Helligpeder, Ginesminde, Vang, Hammeren, Salene Bugt, Svaneke, Neksø og Christiansø, alle 1964 (H. & P.). På flere af de angivne steder er den en hyppig plante.

— *hortensis,* ruderat i Allinge Havn 1964 (H. & P.).

**Chenopodium album* ssp. *virgatum,* Rønne 1957 (L. INGERSLEV).

— *hybridum,* i blomsterbed foran toldbygningen i Rønne Havn 1964 (H.).

*— *schraderianum* (*Ch. foetidum*), BAAGØE's herb.: Smedehaven i Bodilsker, u. årst. (NB.).

**Salsola kali* var. *polysarca* (den glatte var.), stranden v. Arnager 1959 (K. DAMSHOLT), Balka Strand og Dueodde 1964 (H. & P.).

Ranunculaceae:

**Anemone hepatica* f. *rosea* Neum., Tornegaards Skov v. Salene 1964 (G. FUNCH ANDERSEN).

— *nemorosa,* Christiansø 1961 (P.), sandsynligvis udplantet.

— *ranunculoides,* Christiansø 1963 (P.), sandsynligvis udplantet.

Aquilegia vulgaris, forv. i ret stor mængde i Dynddal og Paradisbakkerne 1960 (L.), tilsyneladende spontan mell. strandklipperne s. f. Svaneke 1964 (P.).

**Caltha palustris* var. *radicans,* bækkløft v. Jons Kapel, mell. hotellet og stranden, ret fåtallig på kilderig bund sammen med hovedarten 1948 (SA.).

Clematis vitalba, forv. i stor mængde på strandklipper v. Svaneke Nordhavn 1964 (H. & P.) og Neksø havneplads 1964 (L.).

Myosurus minimus, v. fyret på Christiansø 1937 (G.).

Ranunculus sardous, Neksø Havn, Hundsemyre, Lisegaard i Paradisbakkerne og grusgrav s. f. Svaneke 1964 (H.).

**Thalictrum aquilegiifolium,* forv. på stranden n. f. Gudhjem 1961 (O. EGEDE JENSEN).

Ceratophyllaceae:

Ceratophyllum demersum, Rønne 1859 (JB.).

Papaveraceae:

**Meconopsis cambrica,* forv. v. Svaneke 1961 (O. EGEDE JENSEN).
Papaver somniferum, forv. på Frederiksø 1937 (G.).

Fumariaceae:

**Corydalis pumila* var. *latiloba,* strandkrat n. f. Randkleve 1938 og stengærder v. Vang 1948 (SA.). NB. 1883 nævner fl. fund og tilføjer: Ikke sj.
**Fumaria capreolata,* ukrudt i stenhøj v. hotel Halleklippen, Neksø 1956 (L.).
*— *muralis,* haveukrudt i Svaneke 1954 (L. INGERSLEV).

Cruciferae:

**Arabis alpina,* forv. på Christiansø 1963 (K. FREDERIKSEN).
Barbarea intermedia, Kalbygaard 1957 (P.), Frederiks Stenbrud v. Neksø 1957 (P.), Sømarken, Sandvig 1948 og Frennegaards Strand 1943 (SA.).
— *stricta,* s.f. Svaneke Fyr 1964 (H.).
Brassica juncea, Svaneke (SA.).
Camelina (revideret).
Med herbariebeviser er følgende arter kendt fra Bornholm:
C. alyssum, 7 fund i herb. fra årene 1847—1890.
— *macrocarpa* (*C. alyssum* ssp. *macrocarpa*), 3 fund i herb. fra årene 1848—69.
— *microcarpa,* mark v. Sose Odde 1955, v. Almindingen St. 1955 og 4 km nv. f. Aakirkeby 1955 (alle P.).
Øvrige angivelser af arter af denne slægt er uden herbariebeviser højst usikre.
**Cardamine flexuosa,* Sdr. Borgdal i Rø Plantage 1958 (P. NØRGAARD).
— *hirsuta,* Bolsterbjergs have 1958 (L.).
— *pratensis* ssp. *palustris* (incl. var. *dentata* hos L. 1956), Vallensgaards Mose 1962 (P.); Bot. Museum har fund fra Almindingen 1862 (A. BENZON) og Strandmarken v. f. Dueodde 1936 (SA.).
Coronopus squamatus, ret alm. på gårdspladser over hele øen (L.).
Crambe maritima, Frederiksø 1961 (P.), Ypnasted 1963 (P.), Saltuna og Frennemark (SA.).
Dentaria bulbifera, Christiansø 1963 (P.), sandsynligvis indplantet.
Diplotaxis tenuifolia, Rønne Havn 1929 (SA.), stadig i 1964 (L.).
**Eruca sativa,* sandstensbrud ø. f. Snogebæk 1958 (L.).
**Iberis umbellata,* forv. på Christiansø 1865 (JB.).
Isatis tinctoria, Lange Skanse s. f. Neksø i en 400 m lang og 4 m bred, meget tæt bevoksning som en tæt sennepsmark 1961 (L.), 1 ekspl. v. Balka Strand 1964 (H.), Ginesminde 1964 (H. & P.), første fund v. vestkysten.
Lepidium heterophyllum, mark v. Neksø 1943 (J. OLSEN).
Neslia paniculata, i mængde og i kæmpeekspl. v. Blemme Mølle (L.).
Rorippa silvestris, ukrudt på Rønne Kirkegaard 1961 (L.).
Sinapis arvensis, Christiansø 1937 (G.).
Sisymbrium loeselii, ruderat v. Dueodde Fyr 1962 (P.).
— *orientale,* Gudhjem Havn 1962 (P.).

Thlaspi arvense, alm. haveukrudt på Christiansø 1937 (G.) og 1960 (P.).
Turritis glabra, i mængde langs vejen v. »Vandmøllen» n. f. Rønne 1963 (L.).

Violaceae:

Viola palustris, Segen 1959, planten er blevet sj. på Bornholm (L.); fl. steder i Almindingen (P.).

Cistaceae:

Helianthemum chamaecistus ssp. *hirsutum* (*H. nummularium* ssp. *ovatum*), Almegaard i Knudsker, Helligpeder samt iagttaget i 1960 i Nordskoven v. Rønne v. Sorthat Huse (L.).
— — ssp. *chamaecistus* (*H. nummularium, H. vulgare*) kendes kun med 2 fund: Lilleborg 1960 (L.) og bakke n. f. Hammershus 1962 (Ø.).

Hypericaceae:

Hypericum humifusum, Vasegård i Åker (L.), Ø. Sømarkshuse (Bot. For. eksk. 1957).

Oxalidaceae:

Oxalis stricta, have på Christiansø 1937 (G.).

Geraniaceae:

Geranium columbinum, fyrmesterens have på Christiansø 1937 (G.).

Balsaminaceae:

**Impatiens parviflora,* i A. P. JENSEN's Arboret, Dynddalen (sydskrænt v. Dynddalåen) 1957, udsået af arboretejeren; i mængde v. skovvej s. f. Segen skovfogedhus i Almindingen 1960, efter skovfoged NIELSEN's udsagn optrådte den første gang ved hans hus i 1948 (L.). Sidstnævnte sted har planten bredt sig yderligere i 1964 (H. & P.).
*— *glandulifera,* forv. v. Klippeløkkens Granitbrud 1964 (P.).

Euphorbiaceae:

Euphorbia cyparissias, Gudhjem (SA.).
— *dulcis,* Rønne, ukrudt i haven ved Dams Hotel (SA.).
Mercuralis annua, Tejn (S. M. RASMUSSEN).

Callitrichaceae:

Callitriche stagnalis er med herbariebevis kun kendt fra Borregård.

Aceraceae:

**Acer circinnatum,* forv. i Blykobbe Plantage (Bot. For. eksk. 1957).
— *campestre,* et enkelt gammelt, forkrøblet ekspl. i strandkrat ca. 1/2 km n. f. Vang, spontan? (L.).

Aquifoliaceae:

Ilex aquifolium, Stamperegårdsskoven i Ø. Marie 1959 (L.), 2 ekspl. i skovudkant v. Lobbæk 1962 (Ø.).

Crassulaceae:

Sedum album, v. strandstien mell. Sandkaas og Allinge, i sand mell. klipperne nær højeste vandstand ca. 400 m fra bebyggelse 1962 (D. LAURIDSEN).

*— *anglicum,* 4 findesteder på Christiansø 1961 og 1962, G. TURESSON 1963, som anser planten for at være kommet til øen med trækfugle fra plantens svenske, norske el. engelske forekomster. I Bot. Museum ligger den indsamlet fra øen i 1960 af H. ØDUM og i 1964 (H. & P.). GILLNER 1964 har påvist, at den er udplantet mell. 1910 og 1930 af den svenske maler O. HULLGREN, hentet i Cornwall og Bretagne. Jvf. TURESSON 1964. Planten indgår helt i naturlige plantesamfund.

*— *dasyphyllum,* forv. på Christiansø 1865 (JB.), fandtes endnu 1937 (G.).

*— *sexangulare,* Christiansø 1962 (P.), muligvis spontan.

— *spurium,* forv. v. stranden v. Melsted 1961 (L.).

Saxifragaceae:

Parnassia palustris, baneterræn v. Aakirkeby 1955 (E. VESTERAGER), Bølshavn i strandeng 1958 (L.).

Ribesiaceae:

Ribes nigrum, Lindesdal på Hammeren, Storedal v. Sandkås og Juelsgårde Skov i Bodilsker (SA.).

Pomaceae:

**Crataegus coccinea,* plantet på Hammershusklippen 1960 (M.).

*— *monogyna,* Christiansø 1937 (G.) og 1963 (P.).

**Malus prunifolia,* forv. i Gudhjem Plantage 1930 (C. GUDMANN).

Sorbus aria, kan i dag karakteriseres som t. sj. på Bornholm, idet den kun kendes fra Helligdomsklipperne 1961, hotel Finnedalen 1961, Stevelen i Rø 1961 (L.); M. angiver den fra Hammeren og Jons Kapel.

— *hybrida,* Sandflugtsskoven 1962 (L.), et godt og vel mandshøjt individ med 2 næsten lige tykke stammer. Stedets skovfoged har oplyst, at træet ikkeer plantet, hvorfor man må regne med, at det er spontant indvandret.

**Cotoneaster horizontalis,* forv. nær Ferskesø v. Neksø 1964 (H.).

— *melanocarpa,* mange særligt veludviklede, indtil 2 m høje individer v. kysten n. f. Vang 1961 (L.).

*— *simonsii* (art fra Syd-Asien), stranden v. hotel Finnedalen 1928 (C. O. PLENGE) i *Rubus*-bevoksning i birkeskov n. f. Finnedalen 1948 (SA.).

*— *tomentosa,* (art fra SØ. Europa og V. Asien), forv. v. Hammershus 1860 og 1888 (JB.) og (R. T. HOFF); også iagttaget forv. i det øvrige land.

**Amelanchier spicata,* forv. v. Gudhjem 1946 (L. INGERSLEV) og v. Svaneke Fyr 1964 (H.).

Rosaceae:

Alchemilla (revideret):

A. acutiloba, Spidslappet Løvefod, t. alm. i nord.

— *filicaulis,* Trådstænglet L., t. sj., kendt med 5 herbarieekspl. fra øen: V. og ø. f. Ols Kirke 1919, Tejn 1919 (alle A. LANGE), Jons Kapel 1924 (L.) og Louisenlund i Vestermarie 1959 (K. LARSEN).

— *glabra,* Glat L., alm. *f. *miripila,* Fævogten v. Rønne 1859 (R. T. HOFF).
— *glaucescens,* Flöjlshåret L., alm.
— *gracilis* (*A. micans*), Glanshåret L., t. alm. i nord.
— *monticola* (*A. pastoralis*), Grå L., t. alm. i Almindingen og i nord. Der kan næppe være tvivl om, at den er spontan på Bornholm.
— *subcrenata,* Bølgebladet L., sj. og kun kendt med 3 herbariebeviser: Gudhjem 1931 (A. LANGE), Svaneke 1943 (L.) og v. f. Østermarie 19? (L. INGERSLEV).
— *vestita,* må stryges fra den bornholmske flora, da den ikke er kendt med noget herbariebevis.
— *xanthochlora,* Gulgrøn L., hyppig i Almindingen og i nord.
Aphanes microcarpa, Svaneke 1953 (L.), s. f. Melsted og s. f. Neksø 1964 (H. & P.).
Fragaria ananassa (*F. grandiflora*), Christiansø 1963 (P.).
— *viridis,* Kongens Have på Christiansø 1937 (G.).

Potentilla (revideret):

**P. anglica*×*erecta* (×*P. suberecta*), Kanegård i Knudsker 1861 (JB.).
— *arenaria,* der regnes nu med følg. sikre fund: Lindholmsbakkerne i Rø 1850 (TH. SCHIØTZ) og 1878 (JB.), Rispebjerg 1867 (NB.), Gudhjem 1887 (H. KLÆRSKOU), skrænter v. Kobbeåen i Østerlarsker 1869 (NB.), Frennemark v. Svaneke 1938 (SA.) og 1943 (W.), skrænter n. f. Bobbeåens udløb 1887 (J. LANGE) og 1920 (W.).
— *subarenaria* (*P. arenaria*×*tabernaemontani*), se L. 1956.
*— *subargentea* (*P. arenaria*×*impolita*). Botanisk Museum har 24 ark af denne plante indsamlet i årene 1854—1948 på Hammershusklippens sydskrænter, Hammersholm og fra sydsiden af Hammerknuden (P. 1964), Hammershus og Hammerknuden 1955 (L.).
*— *collina* ssp. *leucopolitana,* går ind i stedet f. *P. collina ssp. wiemanniana* (L. 1956), der ikke er kendt fra Bornholm (P. 1964).
*— *argentea* coll., tetraploid type morfologisk set svarende til de af A. MÜNTZING fra Blekinge dyrkede tetraploider: Klinten s. f. Aakirkeby 1960 (P.), Hammershus (Aarhus-herb.).
— — ssp. *argentea,* diploid, t. alm.
— — ssp. *demissa,* diploid, t. alm.
— *impolita* ssp. *impolita,* pentaploid, hexaploid, alm. Flere konstante typer kendes.
*— — ssp. *decora,* i herb. kendt fra Hasle, Hammershus, Rø, Gudhjem, s. f. Melsted, Saltuna, Frennegård v. Svaneke, Neksø, Soldatergården og Christiansø.
— *canescens,* fundet på Christiansø 1860 og 1876 (JB. og NB.), fandtes dér endnu i 1961 (P.).

Rosa (revideret):

R. canina ssp. *canina,* alm., Christiansø (P.).
— — ssp. *dumetorum,* t. alm.

— *dumalis* ssp. *coriifolia,* alm., Christiansø (P.).
— — ssp. *dumalis* (*R. glauca* hos L. 1956), alm., Christiansø (P.).
*— — ssp. *subcanina,* ialt 7 fund, også Christiansø 1963 (P.).
*— — *subcollina,* ialt 4 fund.
— *elliptica* ssp. *inodora,* er med herbariebevis kun kendt fra Ypnasted 1868 (P. NIELSEN). NB. angiver ca. 8 fund og J. LANGE 1888 3 fund.
— *majalis* (*R. pendulina* hos L. 1956 er ikke synonym f. *R. majalis*). Signaturen hos HULTÉN 1950 angiver, at han anser den for at være spontan på Bornholm. Muligheden for, at den er oprindelig på moselokaliteter på øen, er stor, og nye fund har derfor interesse. De af L. angivne fund fra Hammershus og Onsbæk findes ikke på Bot. Museum. Ved Norske Dam blev den forgæves eftersøgt i 1964.
— *obtusifolia,* t. alm.: Ypnasted, Rø, Snogebæk, Teglkås, Helvedesbakker, Randkleve, Gudhjem, alle Bot. Museum, endv. Almindingen, Kroggårdsløkken, n. f. Neksø og Christiansø (P.). HERRING angiver den som alm. i sin bog »Danske roser» 1934.
— *rugosa,* ud over angivelser hos L. 1956 følgende nye fund: Stranden v. Kobbeå's udløb (SA.), Hammeren, Ypnasted, s. f. Svaneke, Sose Odde, v. f. Arnager og Christiansø, alle 1962—63 (P.), Slusegaard 1964 (H. & P.).
— *rubiginosa,* hh.
— *rubrifolia,* forv. v. Hammersøen og v. Onsbækkens udløb 1916.
*— *tomentosa* ssp. *sherardi,* alm., Christiansø; ssp. *tomentosa* ap. Herring er ikke kendt fra Bornholm.
— *villosa* ssp. *villosa* (*R. pomifera*), forv. fra dyrkning, Christiansø 1962 (P.).
— — ssp. *mollis,* t. alm., Christiansø.
*— *virginiana* (*R. lucida*), forv. v. Hammershus 1876 (NB.) og 1890 (O. GELERT).
**Rubus idaeus* var. *maritimus,* kysten mell. Tejn og Allinge 1885 (O. GELERT). Hidtil eneste kendte fund af denne plante i Danmark.
— *laciniatus,* forv. i Blemmelyng 1962 (L.).
*— *parviflorus,* Mølledalen v. Hammershus 1960 (M.).
Sanguisorba minor ssp. *minor* (*Poterium sanguisorba* ssp. *dictyocarpum* hos L. 1956), samtlige fund på Bornholm synes at tilhøre f. *virescens* Nordb., der muligvis repræsenterer den indigene race i Danmark.
— — ssp. *muricata,* v. Allinge vandværk 1938 (M.).
**Spiraea alba,* Hammershus, pl. (JB), Havbakker v. Rønne 1860 (JB.), forv. i Nordskoven v. Rønne 1935 (S. DAL-PEDERSEN) og 1963 (K. LIND) samt naturaliseret over et stort areal i klitterne v. Sommerodde v. f. Dueodde 1964 (H.).
— *salicifolia,* en kløft i klitterne mod havet i Sandflugten n. f. Rønne 1859 (J.B).

Amygdalaceae:

**Prunus mahaleb,* forv. på Hammershusklippen 1960 (M.).
*— *serotinus,* forv. v. Hammershus 1959 (K. DAMSHOLT) og v. Snogebæk 1964 (H.).

Papilionaceae:

**Cicer arietinum,* gade i Gudhjem 1912 (H. MØLLER), indsl.

**Cytisus nigricans,* forv. i krat på klipperne v. Gudhjem 1931 (M. LANGE).
**Genista tinctoria* ssp. *elatior,* forv. i Galløkken v. Rønne 1926 (M. WEITZE).
**Lathyrus sativus,* klipper v. villa Fredebo s. f. Aarsdale 1936 (O. HAMMER PEDERSEN), indsl.
Lotus tenuis, utvivlsomt spontan v. landeveje, skovveje og på græspladser i Almindingen, f.eks. v. Aaremyre, fl. st. i Fuglesangsrenden, Segen (1948), desuden Brudesengen i Vestermarie (1938), Vallensgaards Mose og fl. st. i Ølenes østl. del, repræsenterende den hos os sædvanlige strandform og ikke kulturformen (SA.).
Medicago falcata, mell. Risebæk og Læså (Bot. For. eksk. 1957).
Medicago falcata×*sativa,* fra Hammerhavnen over Sandvig hen mod Allinge (SA.).
Vicia angustifolia var. *bobartii,* Stampen, Arnager, Hammershusskrænterne, Hammeren, Olsker, s. f. Allinge, Balka og omegn, Dueodde, Frennemark, vistnok øens almindeligste *Vicia* (SA.) — dens f. *lutescens* Sv. And., der hidtil kun har været kendt fra Stampen, er også noteret på Christiansø 1960 (P.).
*— *lathyroides* var. *cirrhata,* Boderne (Bot. For. eksk. 1957).
— *pseudocracca* ssp. *varia* (*V. villosa* ssp. *dasycarpa, V. dasycarpa*), sandmark v. Stampen (SA.).

Oenotheraceae:

Circaea intermedia, i den udtørrede Øleaa v. Slusegaard 1964 (H. & P.).
Epilobium adnatum (*E. tetragonum*), grusgrave v. Listed og s. f. Svaneke 1962 og 1964 (P.); Christiansø 1964 (H. & P.), Rønne Havn, Balka Strand, Snogebæk, Frennegaard, Storedal v. Sandkaas, Segen i Almindingen (SA.).
— *hirsutum,* Christiansø 1937 (G.).
*— *lamyi,* Ormebækken v. Rønne 1860 (JB.), endv. angivet mell. Hammershus og Allinge af WINKELMANN (Deut. Bot. Monatschr. *17:* 36, 1899).
— *montanum,* Christiansø 1964 (P.).
— *obscurum,* Rønne, Ølene, Egeby, Ekkodalen, Fuglesangsrenden, Lilleborg, Aaremyr, Langemose ø. f. Kohullet, Christianshøj, Jomfrubjerget (SA.).
— *palustre*×*parviflorum,* grusgrav v. Snogebæk 1964 (H.).
*— *parviflorum* var. *brevifolium,* en karakteristisk var., som træffes på fugtig sandbund, især i grusgrave; grusgrav v. Snogebæk 1964 (H.), Bølshavn 1959 (K. LARSEN).

Haloragidaceae:

Myriophyllum alterniflorum, Christiansø 1963 (H. RIIS).
— *verticillatum,* vandhul v. Hammeren 1859 (JB.).

Cornaceae:

Cornus suecica, arten er kun fundet en gang på Bornholm, nemlig af J. W. HORNEMANN i 1817. Fundet har hidtil ikke været repræsenteret ved noget kendt herbarieekspl., men et sådant befandt sig i BAAGØE's herb., dog uden nærmere findestedsangivelse.

Umbelliferae:

Aegopodium podagraria, Christiansø 1961 (P.).

Archangelica litoralis, n. f. Bølshavn, n. f. Aarsdale, Aarsdale, Hundsemyre (SA.), Bæle Strand, n. f. Hasle 1960 (L.) og 1964 (H. & P.), vel identisk m. findestedet v. Helligpeder (Bot. For. eksk. 1957), sidstnævnte repræsenterer første fund på vestkysten.

Bupleurum tenuissimum, Allinge 1960 (L.), 1 stort ekspl. på opfyldt areal v. Neksø Sydhavn 1964 (H.).

Cicuta virosa, i grøft i gammel grusgrav v. Snogebæk 1964 (H.).

Eryngium maritimum, Boderne 1963 (M).

Falcaria vulgaris, n. f. Pedersker St., Kæmpemøllen i Poulsker (SA.).

Heracleum mantegazzianum, forv. v. Præstedammen på Christiansø allerede 1937 (G.), Neksø (SA.), s. f. Bølshavn, Nyker, Sorthat 1964 (H. & P.).

*— *speciosum* (*H. pubescens*), forv. på Christiansø 1964 (H. & P.).

— *sphondylium* ssp. *sphondylium,* s. f. Hasle, s. f. Blanchs Hotel, Bodilsker, Christianshøj, Aaremyr (SA.). — *var. *elegans,* Helligdommen i Rø 1860 (JB.), Rø 1919 (J. LASSEN), Hammerhavnen 1958 (H.).

Levisticum officinale, forv. v. Allinge 1860 (HJORTH).

Myrrhis odorata, Allinge, Tejn, Bølshavn (SA.).

Petroselinum crispum, Rønne Sydhavn, Gudhjem (SA.), blomstrende individer forv. i mængde på Frederiksø 1964 (P.).

Scandix pecten-veneris, Frennemark (SA.).

Selinum carvifolia, skov sv. f. Ny Kirke 1859 (JB.), ø. f. Loftgaardsskoven i Vestermarie 1916 (H. MØLLER).

Pyrolaceae:

Pyrola media, Gamleborg-området og ø. f. Jomfrubjerget i Almindingen (SA.).

Ericaceae:

Calluna vulgaris, Christiansø 1962 (P.).

Erica tetralix, Frydenlund v. Rønne 1859 (JB.); m. sj., L har kun 2 fund fra 1900-tallet, er ikke set siden 1940 og må formodentlig anses som forsvundet fra øen.

Empetraceae:

Empetrum nigrum, Allinge og s. f. Gudhjem (SA.).

Vacciniaceae:

Vaccinium uliginosum, 1 ekspl. fra Almindingen 1863 (JB.).

Primulaceae:

Centunculus minimus, Hammershus 1860 (JB.).

Primula farinosa, 57 ekspl. talt v. Sdr. Aasedam 1962 (Ø.), pletvis talrig v. klippekysten mell. Neksø og Aarsdale 1964 (J. HØRBERG).

Plumbaginaceae:

Armeria maritima, grusgrav v. Baggaard i Nyker 1959, første fund i indlandet i vor tid (L.), sml. NB. 1883.

Convolvulaceae:

Calystegia pulchra (*Convolvulus silvestris*), forv. på klipper v. Gudhjem 1953 (K. LARSEN), Snogebæk 1962 (P.), Ypnasted 1963 (L.), ruderat v. Rønne Sydhavn, Svaneke Havn og Bæle Strand 1964 (H. & P.).

*— *sepium* ssp. *baltica* (*Convolvulus sepium* var. *americana*), strandvold v. Store Fos i Rø 1918 (C. H. OSTENFELD).
— *sepium* ssp. *sepium*, Erteholmene 1937 (G.).

Cuscutaceae:

**Cuscuta australis*, indslæbt i gartneri i Gudhjem snyltende på Asters 1957 (L.).
— *epithymum* ssp. *epithymum*, Madsegrav ø. f. Arnager 1958 (L.).

Solanaceae:

**Datura stramonium* f. *tatula*, 1 ekspl. på mark v. Staalesgaard i Nyker 1959 (L.).
Hyoscyamus niger, Klippeløkken 1962 (P.), ø. f. Hasle 1964 (H. & P.).
Physalis alkekengi, forv. v. Ormebækkens udløb sø. f. Rønne 1964 (H. & P.).
**Solanum dulcamara* var. *marinum*, Neksø Havn, Balka Strand, Allinge (SA.), Dueodde 1961 og Ypnasted 1963 (P.).
*— — — — f. *aurantiibaccatum*, stranden s. f. Allinge 1939 (H. NILAUS JENSEN).
— *nigrum* var. *chlorocarpum*, Fynegaard, mark v. f. Ormebæk, Boderne (SA.).
*— *nitidibaccatum*, Rønne Sydhavn 1946 (L.), hos L. 1956 henført til *S. luteum*.

Scrophulariaceae:

Cymbalaria muralis (*Linaria cymbalaria*), forv. i have på Christiansø 1937 (G.), v. Ferske Sø v. Neksø 1964 (H.), v. havnekajerne i Allinge, Svaneke og på Christiansø 1964 (H. & P.), endv. forv. på kirkegaardsmur i Aakirkeby 1964 (J. HØRBERG).
Digitalis purpurea, Bølshavn (SA.).

Euphrasia (revideret):

E. curta, t. alm.
*— *curta*×*vernalis* ssp. *brevifolia* (×*E. murbeckii*), Almindingen 1890 (O. GELERT), Hammershus 1901 (E. WARMING).
— *micrantha*, t. alm.
*— *micrantha*×*stricta* (×*E. gratiosa*), Rønne 1866 (J. HENRIKSEN), s. f. Neksø 1964 (H. & P.).
*— *rostkoviana* ssp. *montana*, Kjøllergaard i Bodilsker 1867 (NB.), Lilleborg 1890 (O. GELERT), ny f. Danmark. Begge i Bot. Mus. herb.
— *stricta* ssp. *stricta*, hist og her.
— *vernalis* ssp. *brevipila*, alm.
— — ssp. *vernalis* (*E. tenuis*), Hundsemyre 1901 (O. PAULSEN).
**Linaria maroccana*, Sandvig 1937 (K. GRAM s. n. *L. versicolor*).
*— *repens*, klipper v. Gudhjem 1946 (L. INGERSLEV).
Melampyrum cristatum, Kirkebogaarddalen i Olsker 1959 (L.).
Misopates orontium (*Antirrhinum o.*), haver på Christiansø 1937 (G.), Rønne 1962 (P.).
**Odontites verna* ssp. *rothmaleri*, Malkværn 1964 (H. & P.).
Rhinanthus minor coll. findes hist og her, underarterne *ssp. *elatior* og *ssp. *minor* er kendt.

— *serotinus* coll., angivet som alm. på Bornholm, kun *ssp. *vernalis* og *ssp. *apterus* er kendt ved herbariebeviser.

Veronica aquatica (V. *comosa, V. catenata*), Ølene 1961 (M.).

— *persica,* haveukrudt på Christiansø 1937 (G.).

— *polita,* marker v. Jons Kapel og v. Randkleve (P.).

— *scutellata,* dammen bag fyret på Christiansø 1937 (G.).

*— *spicata* var. *latifolia,* Jons Kapel, Hammershusklippen, Langemyre i Åker (NB.), Vang 1901 (O. MØLLER), Kleven i Klemensker 1861 (R. T. HOFF) og 1918 (E. HANSEN).

— *triphylla,* Madsegrav 1958 og Aarsdale 1958 (P.).

Verbascum speciosum, Listed 1964 (H. & P), Bølshavn 1964 (L.).

Lentibulariaceae:

Utricularia minor, Ølene 1959 (L.).

Plantaginaceae:

**Plantago lanceolata*-form fra Hammershusklippen 1960, 1962 (P.), lav, stærkt håret, *dubia*-lignende, men mere bredbladet og kortakset; særlig race fra Hammershusklippen?

— *major* ssp. *intermedia,* Christiansø 1937 (G.), alm. i strandengene på Nordkysten (P.).

— *media,* indslæbt på græsplæne v. hotel Helligdommen (L.), vejkant v. Aasedammene i Almindingen (SA.).

Boraginaceae:

Lithospermum officinale, Ginesminde i Rutsker 1961 (L.).

Lycopsis arvensis, Frederiksø 1937 (G.).

Symphytum (revideret):

S. asperum, Ru Kulsukker, kun kendt m. herbariebeviser fra Rønne 1922 (L.) og Gudhjem 1964 (P.).

— *officinale,* Læge-Kulsukker, kun kendt m. herbariebeviser fra Hammersøen 1959 (L.) og v. Øleaa n. f. Pilemølle 1964 (H.).

— *uplandicum* (*S. peregrinum, S. asperum*×*officinale*), Alm. Kulsukker, hist og her, f.eks. Rønne Havn 1922 (L.), v. Præstedammen på Christiansø 1937 (G.), Bølshavn 1959 (K. LARSEN), Snogebæk, n. f. Neksø, s. f. Bølshavn, n. f. Listed, Rispebjerg, Trekanten, Rønne, Svaneke, alle st. v. vejkanter 1964 (H. & P.).

Labiatae:

Galeopsis bifida, Tyrevig på Christiansø 1937 (G.). Sandsynligvis alm. på Bornholm.

— *tetrahit,* Bot. Museum har ingen herbarieekspl. af denne art fra Bornholm, hvor den formentlig er sj.

**Lamium amplexicaule* var. *clandestina,* Pythuset (SA.).

Mentha gentilis, Rønne Havn og Sydhavn, vejkant v. Vang, grøftekant ved gård i Balka (SA.).

— *spicata,* Ormebækkens udløb og Helligpeder 1964 (H. & P.).

Salvia pratensis, n. f. Aabygård i Nyker 1920 (H. MØLLER), opført hos L. 1956 som *S. verbenaca,* der ikke er fundet i Danmark.

— *verticillata,* forv. på bastionen v. præstegården på Christiansø 1937 (G.), Grisby 1958 (L.).

Stachys arvensis, Blemmelyng 1958, Almindingen 1958 og Skørrebro i Aaker 1963 (L.).

— *palustris,* Christiansø 1964 (P.).

— *silvatica,* oven for Hestehuset på Christiansø samt i granplantning v. præstegården 1937 (G.).

Thymus pulegioides, angivelserne fra Bornholm: Skrænter v. Blanchs Hotel, mell. Risebæk og Lilleaa, Arnagerskrænterne og Bodilsker betvivles indtil videre, da ingen herbariebeviser foreligger. Ved Risebæk samledes i 1964 kun *Th. serpyllum.*

Oleaceae:

Ligustrum vulgare, forv. v. Møllevig s. f. Hammershus, s. f. Blanchs Hotel, Lindesdal på Hammeren og v. stien sø. f. Gudhjem (SA.).

Rubiaceae:

Galium aparine var. *marinum,* Christiansø 1964 (P.).

— *mollugo,* Splitsgård i Klemensker 1961 (M.).

— *mollugo* var. *angustifolium,* Christiansø 1923 (L.).

— *mollugo*×*verum,* alm. på Christiansø 1937 (G.).

*— *saxatile,* brandlinie i lyngbevoksning nær Aasedam i Almindingen 1961 (L.). Første sikre fund på Bornholm, hvorfra den tidl. med tvivl har været angivet (planteliste af LIEBMAN på Bot. Museum).

Valerianaceae:

Valerianella dentata, marker v. Dueodde Fyr (SA.).

Compositae:

Ambrosia artemisifolia, ruderat v. Rønne Sydhavn 1964 (H.).

Anaphalis margaritacea, forv. på Christiansø 1865 (JB.) og udplantet i flyvesandet v. Dueodde 1865 (JB.), ikke set i dette årh.

**Arctium minus*×*nemorosum,* v. Hotel Hammersø (SA.).

*— *nemorosum*×*tomentosum,* stranden mell. Vang og Finnedalen (Bot. For. eksk. 1957).

**Artemisia vulgaris* var. *coarctata,* Bodilsker 1850 (TH. SCHIØTZ), Christiansø 1962 strandklipper v. Listed og s. f. Svaneke, Frederiks Stenbrud v. Neksø 1964 (H. & P.), sandsynligvis hyppig v. klippekysten, men v. mellemformer forbundet m. hovedformen.

**Aster novi-belgii,* forv. v. Rønne Sydhavn 1964 (H.).

**Chrysanthemum macrophyllum,* forv. på strandskrænt v. Salene 1947 (Bot. Tids. *48*: 333, 1949). *C. maximum,* der er omtalt som forv. v. kysten mell. Risebæk og Læsaa (Bot. For. eksk. 1957), er formentlig identisk m. *C. macrophyllum.*

*— *vulgare* var. *crispum,* forv. på Frederiksø 1962 (P.).

Centaurea nigra, vejkant v. jernbanen v. f. Robbedale 1964 (H. & P.).

**Cirsium arvense* var. *horridum,* v. vejen mell. Svaneke og Almindingen 1886 (E. ROSTRUP), Svaneke, Bølshavn (P.).

*— — var. *integrifolium,* ruderat v. Rønne Sydhavn 1964 (H.).

— *oleraceum,* småskove v. f. Kjøllergaard i Bodilsker, Frennemark (SA.).

*— *vulgare* var. *hypoleucum,* skoven v. Salene Bugt 1962 (P.).

Crepis setosa, de bornholmske fund af denne art omtales hos L. 1956 som tvivlsomme. Bot. Museum har imidlertid 6 sikre indsamlinger, alle fra »Kløvermark, Fævogten v. Rønne» 1866.

Doronicum pardalianches, Bølshavn 1947 (H. P. KRISTENSEN).

Echinops sphaerocephalus, Allinge Havn og vejkant ø. f. Stamperegård i Østermarie 1964 (H. & P.).

**Erigeron acre* var. *strictus,* klinter v. Risegård 1964 (H. & P.).

— *canadensis,* s. f. Snogebæk 1964 (H. & P.).

Filago minima, Christiansø 1937 (G.).

Galinsoga ciliata, haveukrudt i Svaneke 1964 (H. & P.).

— *parviflora,* haveukrudt i Sandvig 1963 (K. LIND), ruderat v. Rønne Havn 1964 (H.).

**Hieracium cymosum,* skrænter i Døvredal i Bodilsker (Bot. Tids. 5: 48, 1867).

— *pilosella,* Rantzau's Bastion på Christiansø 1937 (G.).

*— *umbellatum* var. *eurobalticum,* Dueodde, Boderne, v. Aasedam (L. INGERSLEV).

*— *virgultorum,* skovvej nær Ølene 1964 (J. HØRBERG). Bot. Museum har et herbarieekspl. samlet af NB. i Smedehaven i Bodilsker, men arket bærer påskriften »Indplantet».

Hypochoeris glabra, Sømarken og Stampen (SA.), Rønne Sydhavn 1962 (L.) og 1964 (H.).

Inula helenium, vejkant v. Sejersgård i Ibsker 1964 (H. & P.).

Lactuca muralis, den røde lysbundsform er kendt fra fl. steder på Bornholms klippekyster, således n. f. Gudhjem Havn 1964 (H.).

*— *sativa,* ruderat v. Rønne Sydhavn 1964 (H.).

— *serriola,* forv. v. stranden v. Boderne 1963 (K. DAMSHOLT).

Petasites hybridus. Der kendes nu 4 fund fra Bornholm: 1. Ved landevejen ø. f. Listed 1957; bevoksningen her stammer fra en nærliggende have, hvortil den er kommet fra Bolsterbjerg Planteskole i Almindingen (L.). 2. Grøftekant nær Lyngholt i Klemensker 1960; det vides ikke, hvorfra denne bevoksning stammer, men antagelig har den samme oprindelse som foregående (L.). 3. Krat mell. Bækkegård og Kodalhuse i Ibsker, tæt uden for en ejendom, der ligger ved en vej, som fortsætter ind i Paradisbakkerne som »Linds Vej», 1963 (L.). 4. Mell. sten i strandengsvegetation s. f. Helligpeder 1964 (H. & P.). — Sandsynligvis er planten på Bornholm i alle tilfælde udkommet fra haver i nyere tid (L.).

**Senecio aquaticus* ssp. *barbareifolius,* Vallensgårds Mose 1962 (J. HØRBERG). Indsamlet på øen allerede i 1938 u. nærmere findestedsangivelse (A. VESTERDAL). Ssp. *barbareifolius* er østdansk i sin hjemlige udbredelse, og det bornholmske fund knytter forbindelse mell. plantens forekomst i Nordtyskland-Polen og Skåne.

— *silvaticus,* Christiansø 1937 (G.).

— *viscosus,* stenbrud s. f. Segen Skovfogedhus 1964 (H. & P.).

**Sonchus arvensis* ssp. *uliginosus,* Christiansø 1883 (NB.).

— *asper* ssp. *inermis,* vejkant v. Rabekkeværket 1964 (P.).

*— *palustris,* er ikke omtalt hos L. 1956. Den angives fundet i Hundsemyre 1872 (NB., Bot. Tids. 5: 293).

**Taraxacum euryphyllum,* Krogsgårdsløkken (Bot. For. eksk. 1957, M. P. CHRISTIANSEN det.).

*— *hybridum,* Rø Plantage (Bot. For. eksk. 1957, M. P. CHRISTIANSEN det.).

*— *sublaeticolor,* Christiansø 1961 (P.), (M. P. CHRISTIANSEN det.).

**Telekia speciosa,* forv. v. lejrplads, Sletten pr. Gudhjem 1953 (K. LARSEN).

Tragopogon pratensis ssp. *minor,* mell. Nylars og Åkirkeby, Galløkken, Ugleenge, Bodilsker, mell. Melsted og Ypnasted, eng v. Åremyre (SA.).

Tripleurospermum maritimum (*Matricaria* m. coll.).

ssp. *ambiguum* var. *boreale,* Arktisk Strandkamille. Varieteten er muligvis kun kendt fra Kullen i Skåne, Nordbornholms klipper (Jons Kapel, Vang, klipperne mell. Vang og Hammershus, Hammeren, Rø) samt fra Christiansø.

ssp. *salinum,* Alm. Strandkamille, har ikke hidtil været kendt fra Bornholm med noget herbariebevis. NB. 1883 angiver den som alm. på sandstrand og i klipperifter ved havet. SA. angiver den i sine noter fra Saltuna, Rø, Svaneke, Balka Strand og Snogebæk. Med sikkerhed fundet 1964 v. Rønne Havn, Hasle, Listed, Balka Strand og Slusegaard (H. & P.).

Græsholmen

Ialt kendes der nu 118 arter fra Græsholmen, men kun 6 arter er fælles i nedenstående lister fra de 3 foretagne undersøgelser: *Agrostis stolonifera, Carex otrubae, Elytrigia repens, Holcus lanatus, Leontodon autumnalis* og *Poa annua.* De fleste fælles arter findes i listerne fra 1937 og 1964 (20). Af de 56 arter fra FRANCK's floraliste er de 16 (mærket *) fra ferskvandsprægede fugtigbundslokaliteter, der næsten ikke findes på øen i dag. Af de 15 arter, der er fælles for listerne fra 1902—03 og 1964, er over halvdelen fra strandlokaliteter. I 1902—03 var øen næppe i lige så høj grad som nu præget af fuglenes tilstedeværelse, men efter fredningen er især siden 1940 antallet af ynglende sølvmåger steget betydeligt (fra 300 par til ca. 2500 par i 1955), og plantevæksten kan have ændret sig i forbindelse hermed. Skal fuglenes indflydelse på floraens sammensætning vurderes, bør man se bort fra strandplanterne (mærket °), hvorfor 20 arter af de i 1964 fundne 63 arter kan udelades i bedømmelsen. Nitrofilt begunstigede er nogle få, meget udbredte og kraftigt voksende græsser som *Avena elatior, Calamagrostis epigeios, Baldingera arundinacea, Hordeum murinum, Holcus lanatus og Dactylis glomerata.* Bortset fra de to sidstnævnte er disse græsser indvandret til øen efter 1903, og *Holcus lanatus,* der i dag er ret dominerende, spillede næppe dengang nogen større rolle i vegetationen. Nyindvandret er også den klart nitrofile *Tripleurospermum maritimum* ssp. *ambiguum* var. *boreale.* Iøvrigt skal følgende planter hørende til det nitrofile element nævnes, alle kendt fra undersøgelserne i 1937 eller 1964: *Erodium cicutarium, Festuca rubra, Galeopsis bifida, Poa annua, Puccinellia distans, Rumex crispus, Sedum acre, Galium aparine, Senecio silvaticus, Stellaria media* og *pallida* samt *Urtica dioica.* En række arter med frugter, der har endozoisk spredning, kan tænkes at være kommet til øen med

mågeekskrementer, således *Sambucus nigra, Prunus spinosa, Rubus plicatus, Rosa obtusifolia* samt *Crataegus monogyna* og *oxyacantha.* I tilknytning hertil kan nævnes indvandringen af en række *Polygonum*-arter, *Chenopodium album, Fragaria vesca* (1902—03) samt *Stellaria media* og *pallida,* medens forekomsten af *Juncus*-arter og *Galium aparine* kan hidrøre fra epizoisk spredning. Menneskets færden spores måske kun i forekomsten af *Matricaria matricarioides.*

Artsliste

	S. Franck 1902—03	P. Gelting 1937	A. Hansen & A. Pedersen 1964	
Agrostis gigantea	—	+	—	
°— *stolonifera*	+	+	+	
**Alopecurus geniculatus*	+	—	+	
Anthemis arvensis	+	—	—	
Anthoxanthum odoratum	+	—	—	
Anthriscus silvestris	—	—	+	få ekspl.
Artemisia vulgaris	—	—	+	
°*Aster tripolium*	+	—	+	
Athyrium filix-femina	—	—	+	få ekspl.
°*Atriplex deltoidea*	—	—	+	
°— *glabriuscula*	—	—	+	
°— *litoralis*	—	—	+	
Avena elatior	—	+	+	alm.
Baldingera arundinacea	—	+	+	alm.
**Briza media*	+	—	—	
**Brunella vulgaris*	+	—	—	
Calamagrostis epigeios	—	—	+	alm.
**Callitriche* sp.	+	—	—	
Capsella bursa-pastoris	+	—	—	
°*Carex distans*	+	—	—	
°— *extensa*	—	+	—	
— *flacca*	—	+	—	
*— *nigra*	+	+	—	
°— *otrubae*	+	+	+	
Chamenerion angustifolium	—	—	+	
Chenopodium album	—	—	+	få ekspl.
**Cicuta virosa*	+	—	—	
°*Cochlearia danica*	—	+	+	
°— *officinalis*	—	+	—	
Crataegus monogyna	—	+	+	
— *oxyacantha*	—	—	+	
**Cynosurus cristatus*	+	—	—	
Dactylis glomerata	+	—	+	alm.
Deschampsia caespitosa	+	—	—	
— *flexuosa*	+	—	—	
Dryopteris dilatata	—	—	+	få ekspl.
**Eleocharis palustris*	+	+	—	
°*Elytrigia repens*	+	+	+	
Erodium cicutarium	—	—	+	få ekspl.
°*Festuca arundinacea*	—	+	+	
— *pratensis*	+	+	—	
— *rubra*	—	+	+	
Fragaria vesca	+	—	—	
Galeopsis bifida	—	+	—	

	S. Franck 1902—03	P. Gelting 1937	A. Hansen & A. Pedersen 1964	
Galium aparine	+	—	+	
— *boreale*	+	—	—	
*— *uliginosum*	+	—	—	
— *verum*	+	—	+	
°*Glaux maritima*	+	—	+	
Holcus lanatus	+	+	+	
Hordeum murinum	—	+	+	alm.
°*Hydrocotyle vulgaris*	+	—	—	
**Juncus articulatus*	+	—	—	
— *bufonius*	+	—	—	
— *conglomeratus*	+	—	—	
— *effusus*	—	—	+	
— *glaucus*	+	—	—	
°— *gerardii*	—	+	+	
Juniperus communis	+	—	—	
Lemna minor	+	—	—	
°*Leontodon autumnalis*	+	+	+	
Lolium multiflorum	—	+	—	
— *perenne*	+	—	+	få ekspl.
Lotus corniculatus	+	—	—	
*— *uliginosus*	+	—	—	
Matricaria matricarioides	—	—	+	få ekspl.
Medicago lupulina	+	—	+	få ekspl.
°*Phragmites communis*	—	—	+	
°*Plantago coronopus*	+	—	—	
°— *major* ssp. *intermedia*	—	—	+	
°— *maritima*	+	—	+	
Poa annua	+	+	+	
— *pratensis*	—	+	+	
— *trivialis*	+	+	—	
Polygonum heterophyllum	—	+	+	
*— *hydropiper*	+	—	—	
— *lapathifolium*	—	—	+	få ekspl.
— *neglectum*	—	—	+	få ekspl.
— *persicaria*	—	—	+	få ekspl.
Potentilla argentea	+	—	—	
*— *palustris*	+	—	—	
Prunus spinosa	—	—	+	
°*Puccinellia distans*	—	+	+	
°— *retroflexa*	—	—	+	
Ranunculus acer	+	—	—	
*— *flammula*	+	—	—	
*— *repens*	+	—	—	
Rosa canina	+	—	—	
— *obtusifolia*	—	—	+	
Rubus plicatus	—	—	+	
Rumex acetosa	—	—	+	
— *acetosella*	—	+	+	
— *crispus*	—	—	+	
— *thyrsiflorus*	—	—	+	
°*Sagina maritima*	—	+	—	
Salix repens	+	—	—	
Sambucus nigra	—	—	+	alm.
°*Scirpus maritimus*	—	—	+	
Sedum acre	—	+	—	
Senecio silvaticus	—	—	+	

	S. Franck 1902—03	P. Gelting 1937	A. Hansen & A. Pedersen 1964
Spergularia rubra	—	+	+
°— *salina*	—	+	+
Stellaria media	—	+	+
— *pallida*	—	+	—
°*Trifolium fragiferum*	+	—	—
*— *repens*	+	—	—
°*Triglochin maritimum*	—	—	+
Tripleurospermum maritimum ssp. *ambiguum* var. *boreale*	—	—	+ alm.
Typha latifolia	—	—	+
Urtica dioica	—	—	+
Vicia cracca	+	+	—
— *tetrasperma*	+	—	—
°*Zostera marina*	+	—	—
Antal arter	56	35	63

Botanikeren F. Diderichsen (1814—1887), som var overskibslæge i den danske flåde i 1849 og 1854, besøgte Græsholmen i juni—juli 1849 og har efterladt sig nogle få indsamlede planter, således *Athyrium filix-femina, Polystichum lobatum, Luzula campestris* og *Aster tripolium.* Endvidere er *Plantago major* ssp. *intermedia* samlet på øen af J. Baagøe allerede i 1860, og endelig kendes følgende 2 fund fra øen: *Rubus griffithianus* (1931, N. Petersen) og *Beta vulgaris* ssp. *vulgaris* (1948, B. Fredskild).

Ny floristisk litteratur om Bornholm

(tillæg til Bot. Tids. **52:** 311—312, 1956)

Böcher, T. W. 1947. Festuca polesica Zapal., its chromosome number and occurrence in Denmark. — Bot. Notiser 1947: 353—360.

— 1957. Jordbund og skrænttvegetation ved Bornholms sydkyst. — Festskr. udg. af Bornholms Naturh. Foren., p. 27—30.

Gelting, P. 1942. Aakirke Klint. — Småafh. om Bornholm til Peter Thorsen 8. juli 1942, p. 17—29.

Gillner, V. 1964. Sedum anglicum Huds. inplanterad på Christiansö. — Bot. Notiser *117*: 222—224.

Harild, A. A. 1957. Lidt om indsamling af lægeplanter på Bornholm. — Festskr. udg. af Bornholms Naturh. Foren., p. 31—34.

Herring, P. 1927. Bidrag til de danske rosers historie I. (Rosa sherardi på Bornholm). — Bot. Tids. *39*: 446—462.

Hüser, W., Untersuchungen über die Anatomie und Wasserökologie einiger Ostseestrandpflanzen. (Omhandler bl.a. Tripleurospermum maritimum ssp. ambiguum var. boreale på Bornholm). — Planta *11*: 485—508.

Ingerslev, L. 1958. To Juncus inflexus hybrider fundet på Bornholm. — Bot. Tids. *54*: 68—69.

Iversen, Johs., 1957. Istidsrelikter i Bornholms flora. — Festskr. udg. af Bornholms Naturh. Foren., p. 35—37.

Jensen, H. Nilaus, 1944. Ny form af Solanum dulcamara L. — Bot. Tids. *46*: 272.

KJØLLER, F. 1957. Skrulle, en bornholmsk landskabstype. — Festskr. udg. af Bornholms Naturh. Foren., p. 43—44.
— 1959. Basta Mose. — Art., Bornholms Tid. 31/7 1959.
— 1959. De bornholmske heder. — Art., Bornholms Tid. 30/10 1959.
— 1963. Fra lyngmark till plantage. Nogle træk fra Vestermarie Udmark. — Jul på Bornholm 1963: 13—21.
LARSEN, ARNE 1959. Planteliv. — Læså, Bornholm fra tidernes morgen, p. 93—98.
— 1960. Bornholms natur. — Fagl. Læsning *33.* årg., no. *39*: 1—32.
MIKKELSEN, VALD. M. 1957. Bidrag til Højlyngens historie. — Festskr. udg. af Bornholms Naturh. Foren., p. 69—72.
— 1957. Planteliv. — Bogen om Bornholm, p. 33—72.
— 1958. Et nyt findested for Spergula vernalis. — Bot. Tids. *54*: 400—401.
— 1959. Planterne omkring Hammershus. — Art., Bornholms Tid. 18/11 og 19/11 1959.
— 1960. Vedplanter på Hammershus. — Bot. Tids. *55*: 316—319.
— 1963. Beech as a natural forest tree in Bornholm. — Ibid. *58*: 253—280.
PEDERSEN, ANFR. 1964. Potentilla collina, Potentilla subargentea og Potentilla subarenaria i Danmark. — Ibid. *60*: 90—98.
THOLLE, JOHS. 1958. Bornholmske haver og havedyrkning gennem vexlende tider. — Bornh. Saml. *36*: 7—72.
TURESSON, G. 1963. Sedum anglicum Huds. funnen på Christiansö. — Bot. Notiser *116*: 105—106.
— 1964. Sedum anglicum Huds. på Christiansö. — Bot. Notiser *117*: 426—427.
VEDEL, H. 1960. Vedplantevegetationen på nogle bornholmske græsningsarealer før og nu. — Bot. Tids. *56*: 105—116.
— 1963. Landskabsændringer på Bornholm fra 1869 til 1959. — Jul på Bornholm 1963: 4—10.

Ekskursionsberetninger

LAKOWITZ, W. Die Vereinsfahrt nach Bornholm im Sommer 1932. — 55. Ber. Westpreuss. Bot.-Zool. Ver. Danzig, p. 109—114, 1933.
LARSEN, ARNE. Beretninger fra Bornholms Naturhist. For. ekskursioner 1958, Fl. og Fauna *65* og 1959—60, ibid. *67*.
Ekskursionsberetning, Bornholm. — Bot. Notiser 1951: 90—91.
Højsommer-ekskursion til Bornholm 2.—4. august 1957 v. S.-E. SANDERMANN OLSEN og V. M. MIKKELSEN (med supplement til ARNE LARSEN Bornholms flora). — Bot. Tids. *54*: 80—84, 1958.
Bornholm 22. og 23. august 1959, ekskursionsberetning v. K. GRAM og J. ØSTERGAARD. — D. Dendrol. Årsskr. *5*: 608—612, 1961.

BOTANISKA NOTISER 1965 · VOL. 118 · FASC. 2 · LUND

Bemerkungen zur Gliederung der Gattung Trisetum Pers.

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Die Gattung *Trisetum* Pers. umfasst, in dieser Auffassung, nur ausdauernde Arten, am öftesten solche mit grossen Ährchen, gewöhnlich mit ± lockeren Ährchenrispen und ausdrucksvoll behaarten Ährchenspindeln. Die einjährigen Arten mit kleinen Ährchen, mit oft auffallend zusammengezogenen Ährchenrispen und oft nur zerstreut behaarten oder stacheligen Ährchenspindeln werden in die Gattung *Trisetaria* Forsk. eingereiht. Der Unterschied zwischen beiden Gattungen liegt auch in ihrer Verbreitung. Das Vorkommen der Arten der Gattung *Trisetaria* ist vor allem an das Mediterrangebiet gebunden und nur wenige Arten wachsen ausserhalb dieses Gebietes. Die Arten der Gattung *Trisetum* sind, ausser dem Mediterrangebiet, auch in der gemässigten und kalten Zone der nördlichen Halbkugel häufig verbreitet, u.zw. sowohl in der Alten als auch in der Neuen Welt. Nur einige Arten reichen bis auf die südliche Halbkugel, inbesondere in montane Gebiete. Bei den, hauptsächlich in montanen bis hochmontanen Lagen vorkommenden Arten der Gattung *Trisetum,* ist ausserdem noch eine grosse Tendenz zu einem Endemismus vorhanden. So z.B. *Trisetum glaciale* Boiss., *T. antoni-josephii* F. Q. et Muñ. Med. (Sierra Nevada); *T. gracile* (Mor.) Parl. (Sardinien); *T. burnoufii* Req. (Korsika); *T. baregense* Laf. et Miég. (Pyrenäen); *T. fuscum* (Kit.) R. et S., *T. macrotrichum* Hackel (Karpaten); *T. alpestre* (Host) Pal.-Beauv. (Mitteleuropa); *T. velutinum* Boiss., *T. hispidum* Lge. (Spanien) usw.

Das wichtigste Unterscheidungsmerkmal zwischen den Gattungen *Trisetum* und *Trisetaria* ist schliesslich das Dauern der Pflanzen. Dieses Merkmal hat im gegebenen Falle einen hohen taxonomischen Wert. Die übrigen angeführten Merkmale und einige weitere kann man nur

für die Charakteristik der Gattung benützen. Trotzdem weist aber der Komplex dieser Merkmale eine ganz abweichende Entwicklungstendenz innerhalb beider Gattungen auf.

In der botanischen Literatur, auch in der derzeitigen, werden die beiden angeführten Gattungen, trotz ihrer ganz abweichenden Entwicklungstendenz oft in eine umfangreiche Gattung zusammengefasst und zwar entweder unter der Bezeichnung *Trisetum* Pers. oder *Trisetaria* Forsk. (cf. z.B. PAUNERO 1950; MAIRE 1953). Als selbständige Gattungen werden sie in der neueren botanischen Literatur z.B. von HOLUB (1958) gewertet, der eine Übersicht der Entwicklungsbeziehungen zwischen den einzelnen Gattungen der Tribus *Aveneae* anführt. Die Art *Trisetum myrianthum* (Bert.) Parl. ist in die selbständige Gattung *Parvotrisetum* Chrtek abgetrennt.

In dieser Arbeit untersuchte ich vor allem die europäischen Arten der Gattung *Trisetum,* von denen ich mangels Materials nur die griechische Art *T. laconicum* Boiss. et Orph. und die serbische Art *T. rufescens* (Panč.) Adam. nicht werten konnte; die letztere hat aber vom taxonomischen Gesichtspunkt auf Grund der Literatur bisher einen unklaren Wert.

Die amerikanischen und auch die asiatischen Arten habe ich nur orientierungshalber studiert. Im ganzen kann man sagen, dass man die meisten morphologischen Typen u.zw. im Bau der Blätter, der Epidermis der Blattspreiten, der Endodermiszellen des Wurzelquerschnittes u.ä. bei den europäischen Arten findet. Die asiatischen und amerikanischen Arten sind viel einheitlicher und zeigen keine so reiche Skala der morphologischen Typen.

Im weiteren führe ich eine kurze Übersicht der Einteilung der Gattung *Trisetum* in niedrigere taxonomische Einheiten an. Die Gattung *Trisetum* (enger aufgefasst) wurde von ASCHERSON & GRAEBNER (1899) in zwei selbständige Sektionen geteilt: *Eu-Trisetum* Asch. et Gr. mit *T. flavescens*-Komplex und *Trisetaera* Asch. et Gr. mit *T. spicatum* (L.) Richt. HERMANN (1956) vertritt eine sehr breite Auffassung der Gattung *Trisetum* (er bezieht auch die Gattung *Ventenata* ein). Er teilt die Gattung in vier Untergattungen (wahrscheinlich, die taxonomische Kategorie ist hier nicht klar bezeichnet) und zwar *Ventenata* (mit der Art *Ventenata dubia*), *Rostraria* (einjährige Arten, die zur Gattung *Trisetaria* gehören), *Argentaria* (mit den Arten *T. distichophyllum* und *T. argenteum*) und *Trisetum* (mit ausdauernden Arten). Beachtenswert an dieser Teilung ist die Abtrennung der Arten *T. distichophyllum* und *T. argenteum* von den übrigen Arten der Gattung *Trisetum.* Die Abtrennung führte der Autor hauptsächlich auf Grund der Gestaltung

der Blattspreiten durch. Bei der Gruppe *Argentaria* sind die Blätter nach HERMANN „gefalzt", bei *Trisetum* „gerollt". CHRTEK & JIRÁSEK (1963) teilten die hochmontanen mediterranen Arten *T. gracile, T. glaciale* und *T. antoni-josephii,* in die selbständige Sektion *Gracilia* Chrtek et Jirásek ein.

Wertung der Variabilität einiger Merkmale des äusseren und inneren Baues der Pflanzen

Ein gründlicheres Studium zeigt aber, dass einige der angeführten Gruppen sehr heterogen sind und ihr Umfang eine Revision erfordert. Bei der Wertung der verwandtschaftlichen Beziehungen ging ich vor allem von den folgenden Merkmalen aus: Gestaltung der Blattspreiten der Innovationsblätter, Verteilung des Sklerenchymgewebes der Blattspreiten (am Querschnitt), Bau der Epidermiszellen auf der abaxialen Blattspreitenseite, Bau der Endodermiszellen am Wurzelquerschnitt, Behaarung der Vorspelzenkiele, Länge des Blatthäutchens, Stellung der Blätter an Halmen und sterilen Trieben, Behaarung der Ährchenspindel und Charakter der Ährchenrispe. Diesen Merkmalen wurden in einigen Fällen weitere zugefügt, die sich für eine nähere Klärung der verwandtschaftlichen Beziehungen bestimmter Artengruppen eignen. Auch die Verbreitung der einzelnen Arten wurde in Betracht gezogen.

1. Gestaltung der Blattspreiten der Innovationsblätter. Ein sehr wichtiges Merkmal ist die Vernation der Innovationsblätter in der Knospe. Innerhalb der Gattung kann man zwei Typen unterscheiden: Blattspreite geschlossen, d.h. zusammengerollte Knospenanlage (vernatio convoluta) und Blattspreite zusammengefaltet, d.h. zusammengelegte Knospenanlage (vernatio conduplicata). Der erste Typ ist der häufigste (Abb. 1), sehr typisch z. B. bei den Arten *T. flavescens, T. alpestre, T. sibiricum, T. macrotrichum, T. rigidum, T. fuscum, T. spicatum, T. baregense* usw. Den zweiten Typ findet man z.B. bei den Arten *T. glaciale, T. distichophyllum, T. argenteum, T. gracile* (Abb. 2). Bei *T. gracile* bildet die Gestaltung der Blattspreiten manchmal einen gewissen Übergang zwischen den beiden angeführten Typen (Abb. 2, Fig. 4). Das Merkmal der Gestaltung der Blattspreite kann man aber zur Unterscheidung einiger Artengruppen sehr gut verwenden; es sind dies hauptsächlich die bereits angeführten Arten mit geschlossener Blattspreite. Auf Grund dieses Merkmales teilte z. B. HERMANN (1956) die Arten *T. distichophyllum* und *T. argenteum* in eine selbständige Gruppe ein.

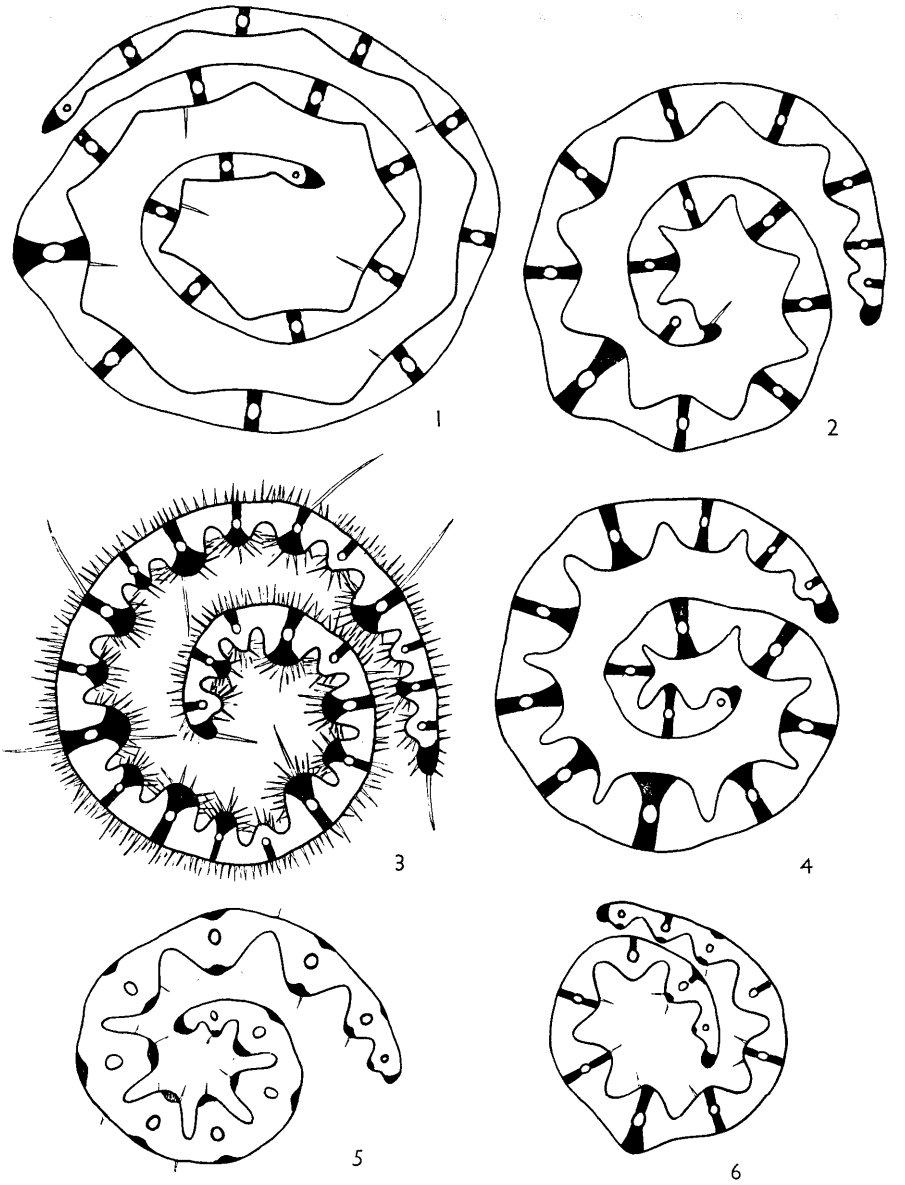


Abb. 1. Schematische Veranschaulichung der Gestaltung der Blattspreiten der Innovationsblätter: 1. *Trisetum macrotrichum*, 2. *T. fuscum*, 3. *T. hispidum*, 4. *T. rigidum*, 5. *T. spicatum*, 6. *T. agrostideum*.

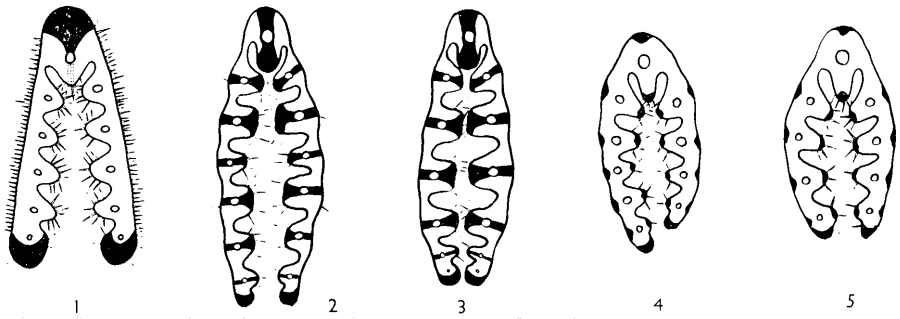


Abb. 2. Schematische Veranschaulichung der Gestaltung der Blattspreiten der Innovationsblätter: 1. *Trisetum glaciale*, 2. *T. distichophyllum*, 3. *T. argenteum*, 4–5. *T. gracile*.

2. Verteilung des Sklerenchymgewebes der Blattspreiten der Innovationsblätter (am Querschnitt). Bei den europäischen Arten kann man drei Typen unterscheiden.

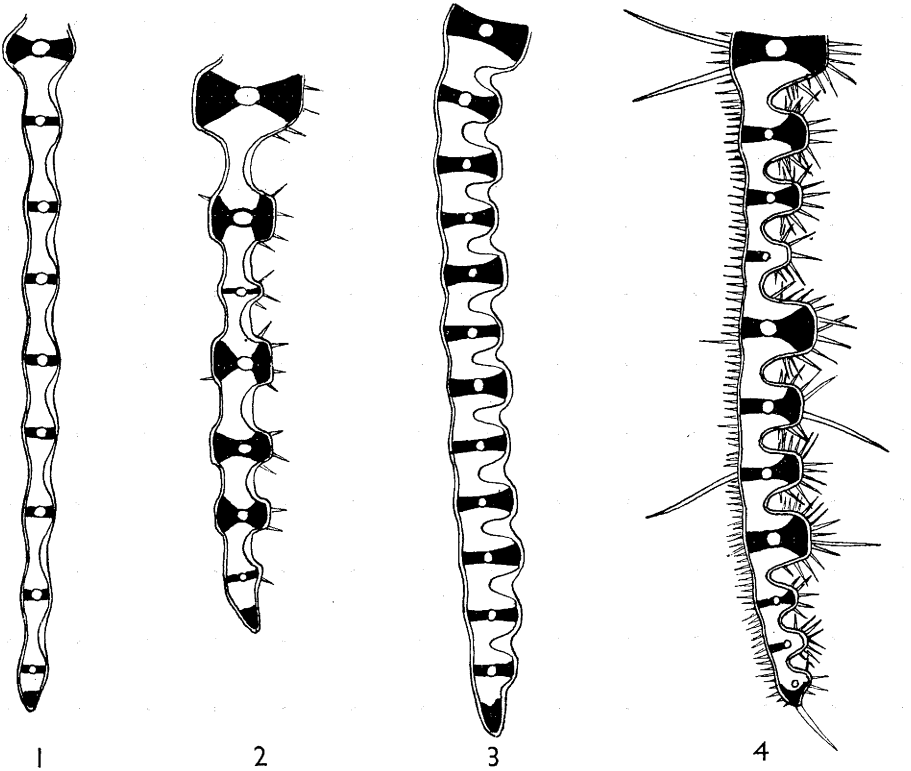
a) Das Sklerenchym ist auf den Kielteil und Blattränder beschränkt (Abb. 3, Fig. 8). Auf der abaxialen Blattspreitenseite reicht das Sklerenchym bis an die Scheide des Gefässbündels, auf der adaxialen Blattspreite findet man gegenüber diesem zentralen Gefässbündel öfters einen schmalen Streifen mit langgezogenen Zellen, mit etwas verdickten Wänden. Das Sklerenchym an den Blatträndern ist mächtig entwickelt.

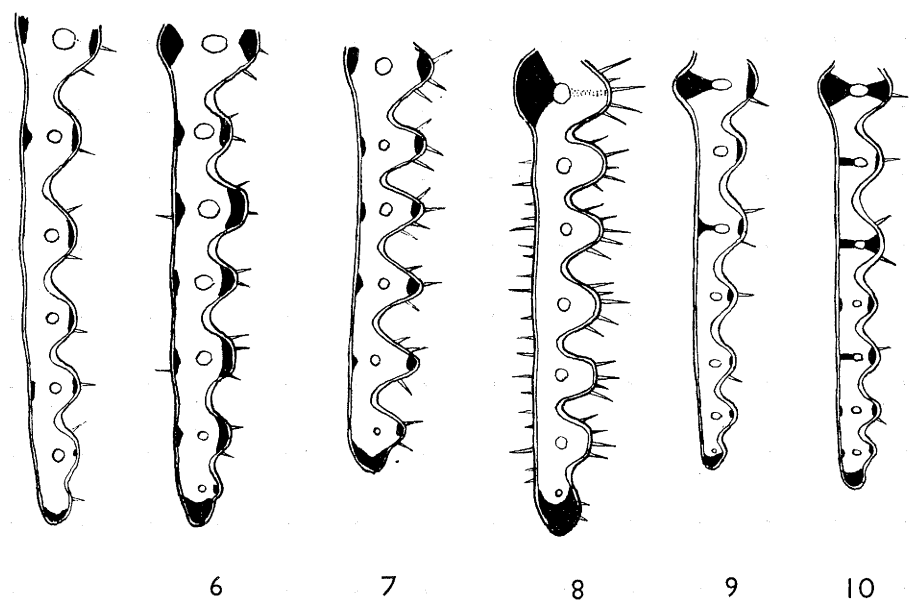
Diesen Typ findet man nur bei den Arten *T. glaciale* und *T. antonijosephii*.

b) Das Sklerenchym bildet gegenüber den Gefässbündeln kleine Inselchen u.zw. sowohl auf der abaxialen als auch auf der adaxialen Blattspreitenseite, reicht aber nicht bis zu den Scheiden der Gefässbündel (es reicht nur ausnahmsweise an die Scheiden der Gefässbündel). Das Sklerenchymgewebe gegenüber den Gefässbündeln fehlt aber oft, insbesondere bei den Bündeln einer höheren Ordnung, oder es ist nur auf einige Zellen beschränkt. Schliesslich ist das Sklerenchymgewebe auch an den Blatträndern (Abb. 3, Fig. 5—7).

Diesen Typ findet man z.B. bei *T. gracile* und *T. spicatum*. Diese Arten haben zwar den ähnlichen Typ der Verteilung des Sklerenchymgewebes, zwischen ihnen bestehen aber auf Grund anderer Merkmale

Abb. 3. Schematische Veranschaulichung der Verteilung des Sklerenchymgewebes am Blattspreitenquerschnitt: 1. *Trisetum fuscum*, 2. *T. distichophyllum*, 3. *T. rigidum*, 4. *T. velutinum*, 5–6. *T. spicatum*, 7. *T. gracile*, 8. *T. glaciale*, 9–10. *T. agrostideum*.


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keine rechten verwandschaftlichen Beziehungen. Bei der Art *T. spicatum* ist die Variabilität der Mächtigkeit des Sklerenchymgewebes besonders gross. In einigen Fällen ist das Sklerenchym nur auf einige Zellen über den Gefässbündeln unter der Epidermis beschränkt, oder es fehlt sogar bei den Gefässbündeln der höheren Ordnung des Sklerenchyms ganz. Manchmal reicht das Sklerenchym bis an die Scheide des Gefässbündels.

c) Der letzte meist verbreitete Typ der Verteilung des Sklerenchymgewebes ist der folgende. Das Sklerenchymgewebe erreicht zumindest bei den Gefässbündeln der I. und II. Ordnung die Scheide der Gefässbündel und zwar sowohl von der abaxialen als auch von der adaxialen Seite der Blattspreite (Abb. 3, Fig. 1—4, 9—10). Nur bei den Gefässbündeln höherer Ordnung erreicht das Sklerenchymgewebe die Scheide der Gefässbündel manchmal nur von der abaxialen Seite, oder es ist nur auf die Zellengruppe unter der Epidermis begrenzt. Vereinzelt kann das Sklerenchym fehlen. Das Sklerenchymgewebe ist auch an den Blatträndern.

Diesen Typ der Verteilung des Sklerenchymgewebes findet man bei den meisten europäischen Arten. Die typischeste Ausbildungsform findet man z.B. bei den Arten *T. velutinum, T. hispidum, T. distichophyllum, T. argenteum, T. flavescens, T. fuscum, T. rigidum, T. sibiricum, T. alpestre;* etwas weniger ausdrucksvoll z.B. bei den Arten *T. baregense* und *T. agrostideum.* Bei der letztgenannten Art ist das Sklerenchym bei den Gefässbündeln der höheren Ordnung manchmal sehr schwach entwickelt oder es fehlt ganz. Die angegebene Verteilungsform des Sklerenchyms kennzeichnet die um die Art *T. distichophyllum* und weiter um die Arten *T. flavescens, T. fuscum, T. rigidum* und *T. hispidum* konzentrierten Gruppen. Dieser Übersicht kann man entnehmen, dass zwischen dem b) und c) Typ Übergangsformen bestehen, besonders aber bei *T. agrostideum.*

3. Bau der Epidermiszellen auf der abaxialen Blattspreitenseite bei Flächenansicht. Bei der überwiegenden Mehrheit der Arten ist der Epidermistyp ± gleich. Die Epidermis setzt sich aus langen und kurzen Zellen zusammen, die untereinander ± unregelmässig abwechseln. Die langen Zellen haben gewöhnlich die Form langgezogener Sechsecke oder Rechtecke. Die Wände sind gerade (Abb. 4, Fig. 1—7). Die kurzen Zellen sind entweder ± quadratisch oder schmal rechteckig und den langen Zellen gegenüber quergestellt. Die kurzen Zellen enden am öftesten in einen kleinen Stachel oder in ein Haar. Diesen Typ findet man z.B. bei den Artengruppen *T. flavescens, T. distichophyllum, T. spicatum, T. agrostideum, T. rigidum, T. fuscum;* doch manchmal können die kurzen

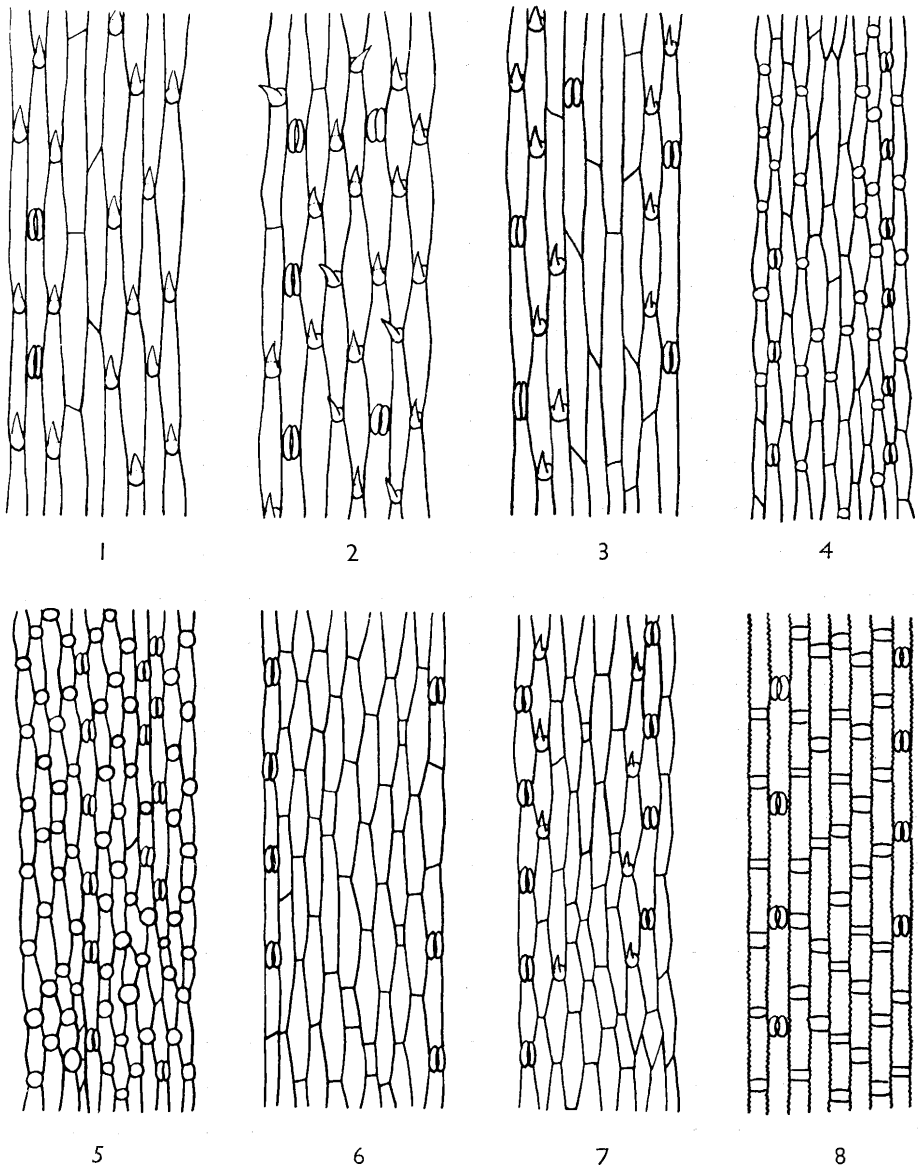


Abb. 4. Schematische Veranschaulichung des Baues der Epidermiszellen auf der abaxialen Blattspreitenseite: 1. *Trisetum fuscum,* 2. *T. distichophyllum,* 3. *T. spicatum,* 4–5. *T. glaciale* (Haare nicht eingezeichnet), 6–7. *T. gracile,* 8. *T. velutinum.*

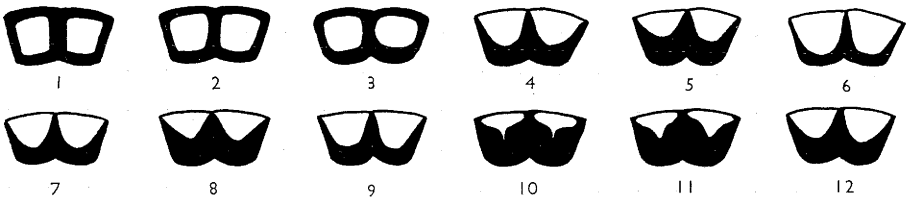


Abb. 5. Schematische Veranschaulichung des Baues der Endodermiszellen am Wurzelquerschnitt: 1–3. *Trisetum gracile,* 4–5. *T. glaciale,* 6–7. *T. flavescens,* 8–9. *T. argenteum,* 10–12. *T. velutinum.*

Zellen fehlen oder sie sind nur vereinzelt vorhanden. Bei wenigen Arten besteht zwar die Epidermis aus langen und kurzen Zellen (auch aus ± quadratisch und schmal rechteckigen), jedoch sind die Wände der langen Zellen, am öftesten aus auffallend langgezogenen Rechtecken, gewellt, so z.B. bei zwei nahe verwandten spanischen Arten *T. velutinum* und *T. hispidum* (Abb. 4, Fig. 8).

Einen etwas abweichenden Bau der Epidermiszellen findet man oft bei der Art *T. glaciale,* wo die langen Zellen, im Hinblick zu anderen Arten, oft verhältnismässig kurz und die kurzen Zellen meistens ringformig und oft auffallend gross sind. Manchmal wechseln kurze und lange Zellen regelmässig ab (Abb. 4, Fig. 5).

4. Bau der Endodermiszellen am Wurzelquerschnitt. Bei fast allen studierten Arten sind die Zellen am Wurzelquerschnitt in Form des Buchstabens C, bzw. U typisch verdickt, d.h., dass die innere Tangentialseite viel mehr verdickt ist als die äussere, wobei die Radialseiten in der Richtung von der Mitte zum Rande der Wurzel sich allmählich verschmälern. Durch das Wort Verdickung in Form des Buchstabens U oder C soll angedeutet werden, dass es sich um Zellen handelt, die in radialer (Form des Buchstabens U) oder i tangentialer Richtung (Form des Buchstabens C) langgezogen sind (Abb. 5, Fig. 4—12). Bei einigen Arten, insbesondere bei *T. velutinum* und *T. hispidum* ist die innere Tangentialseite der Endodermiszellen auffallend verdickt.

Nur bei der Art *T. gracile* findet man einen abweichenden Verdickungstyp u.zw. in Form des Buchstabens O, d.h., dass die Endodermiszellen rundum ± gleichmässig verdickt sind (Abb. 5, Fig. 1—3). Gewöhnlich sind die Wände an der inneren Tangentialseite etwas dicker als an der äusseren.

Der Typ der Verdickung der Endodermiszellen ist ein sehr wichtiges

Merkmal, das sehr oft bestimmte Beziehungen zwischen den einzelnen Arten aufzeigt. Insbesondere innerhalb der Tribus *Aveneae* erweist es sich vorderhand, dass man diesem Merkmal einen bedeutenden taxonomischen Wert beimessen muss.

5. Behaarung der Vorspelzenkiele. Alle studierten Arten, ausser der Art *T. fuscum,* haben am Kielrande kurze nach vorne gerichtete Zähnchen, manchmal sind sie kaum kennbar. Etwas verlängerte Zähnchen findet man bei *T. alpestre,* wo sie manchmal noch auffallend dicht sind. Nur bei *T. fuscum* findet man auf den Kielen ausser verlängerten Zähnchen oft Haare. Durch dieses Merkmal unterscheidet sich *T. fuscum* deutlich von allen anderen Arten.

6. Länge des Blatthäutchens. Bei den meisten Arten ist das Blatthäutchen kurz, ± abgestutzt, oft mit einer Reihe verlängerter Randzellen endigend. Bei der Art *T. fuscum* ist aber das Blatthäutchen auffallend verlängert.

7. Behaarung der Ährchenspindel. Die Ährchenspindeln sind immer behaart. Die meisten Arten (*T. spicatum, T. flavescens, T. agrostideum, T. baregense* uzw.) haben aber kurze Haare, so dass sie bei einer flüchtigen Beobachtung des Ährchens nicht merklich sind. Auffallend verlängerte Haare der Spindeln haben die Arten der Artengruppe *T. rigidum.* Die Haare sind schon beim ersten Blick gut sichtbar. Bei den Arten *T. distichophyllum* und *T. argenteum* liegt die Länge der Haare an den Spindeln in der Mitte zwischen der Haarlänge der beiden Artengruppe von *T. flavescens* und *T. rigidum.* Die Länge der Haare auf den Spindeln ist ein wichtiges taxonomisches Merkmal, welches die geschlossenen Artengruppen von *T. rigidum* und *T. distichophyllum* gut kennzeichnet.

8. Stellung der Blätter an den Halmen und sterilen Trieben. Bei einigen Arten, insbesondere an den sterilen Trieben sind die Blätter auffallend zweireihig angeordnet, sodass Formen wie „kleine Leitern" entstehen. Die sehr typisch ausgebildete Form dieser Zweireihigkeit findet man bei den Arten *T. distichophyllum* und *T. argenteum;* weiter auch, doch nicht so typisch, in der Artengruppe von *T. rigidum,* teilweise auch bei *T. hispidum.* Ähnlich wie das vorherige Merkmal kennzeichnet auch dieses gewisse Artengruppen, die auf Grund anderer Merkmale sehr nahe verwandt sind.

9. Charakter der Ährchenrispe. Bei den meisten Arten ist die Ährchenrispe ± locker, mit deutlich gestielten Ärchen. Durch den Charakter

der Ährchenrispe unterscheidet sich die Art *T. spicatum,* die eine zusammengezogene Ährchenrispe hat. Eine zusammengezogene Ährchenrispe findet man auch bei *T. velutinum.*

Aus dieser Übersicht kann man ersehen, dass man bei der Aufteilung der Gattung *Trisetum* viele Merkmale verwenden kann, denen besonders innerhalb der Familie *Poaceae* eine grosse taxonomische Wichtigkeit zukommt. Als wichtigstes Merkmal zur Teilung der Gattung *Trisetum* in niedrigere Einheiten erachte ich die Gestaltung der Blattspreiten der Innovationsblätter, die Verteilung des Sklerenchymgewebes auf dem Blattspreitenquerschnitt und den Bau der Endodermiszellen am Wurzelquerschnitt. Diese durch einige weitere ergänzten Merkmale bieten die Möglichkeit, die Gattung *Trisetum* in 4 Gruppen zu teilen.

Die artenreichste und am meisten verbreitetste Gruppe ist durch die geschlossene Blattspreite eindeutig gekennzeichnet. Hierher gehören die Arten aus dem Bereiche von *T. flavescens, T. rigidum, T. fuscum, T. spicatum, T. velutinum.* Die weiteren Gruppen sind viel weniger artenreich und auch weniger verbreitet. Es ist dies z.B. die Gruppe mit den Arten *T. distichophyllum* und *T. argenteum,* gekennzeichnet durch eine zusammengefaltete Blattspreite, mit einem am Blattspreitenquerschnitt auffallend reich entwickeltem Sklerenchym. Die Endodermiszellen haben am Querschnitt die Form des Buchstabens C oder U. Diese Gruppe ist auf die Alpen, das Jura-Gebirge und die Gebirge der Balkanhalbinsel (westlicher Teil) beschränkt. Weiter ist es die Gruppe mit den Arten *T. glaciale* und *T. antoni-josephii,* die in der Sierra Nevada wachsen. Ihre Blattspreiten sind zusammengefaltet, das Sklerenchym ist nur auf den Kielteil und auf die Blattränder beschränkt. Die Endodermiszellen haben am Wurzelquerschnitt die Form des Buchstabens C oder U. Die letzte Gruppe ist durch *T. gracile,* die einzige endemische Art Sardiniens repräsentiert. Die Gestaltung der Blattspreiten ist zusammengefaltet oder zusammengefaltet mit einer Neigung zur geschlossenen Blattspreite. Das Sklerenchym am Blattspreitenquerschnitt ist unter der Epidermis über den einzelnen Gefässbündeln inselartig verteilt. Die Endodermiszellen haben am Wurzelquerschnitt die Form des Buchstabens O.

Die angeführten Gruppen betrachte ich wegen einer ganzen Reihe von wichtigen Merkmalen als sehr gute Untergattungen, die ich wie folgt bezeichne: *Trisetum, Distichotrisetum, Glaciotrisetum* und *Graciliotrisetum.* Die Untergattung *Trisetum* kann man noch in einige weitere Gruppen vom Werte einer Sektion unterteilen. Zur Charakterisierung

der Sektionen wurden als Hauptmerkmale vor allem verwendet: die Verteilung des Sklerenchymgewebes und die Grösse der Gelenkzellen auf dem Blattspreitenquerschnitt, der Bau der Epidermiszellen auf der abaxialen Blattspreitenseite, die Behaarung der Ährchenspindeln, die Länge des Blatthäutchens, die Behaarung der Vorspelzenkiele, die Stellung der Blätter an den Halmen und sterilen Trieben und der Charakter der Ährchenrispe. Auf Grund dieser Merkmale kann man die Untergattung *Trisetum* in folgende 5 Sektionen teilen: *Trisetum, Trisetaera, Rigida, Hispanica* und *Carpatica.*

Die systematische Gliederung der Gattung *Trisetum* Pers.

Subgenus *Trisetum*

Vernatio convoluta; sclerenchyma in parte laminarum abaxiali adaxialique in trabeculis singulis nervos attingens (nonnumquam ad nervos superiorum ordinum non perveniens), vel sclerenchyma in parte laminarum abaxiali adaxialique nervis adversum ad eos non pervenit (aut sclerenchyma praecipue apud nervos superiorum ordinum deest) et etiam in marginibus laminarum instructum; membrana cellularum endodermidis radicium (sectio transversalis) crassa, cellulae formam litterae U aut C imitantes.

Sectio *Trisetum*

Panicula ± effusa; sclerenchyma in parte laminarum abaxiali adaxialique in trabeculis singulis nervos attingens, solum apud nervos superiorum ordinum ad eos non pervenit; epidermidis cellulae in parte laminarum foliorum abaxiali longae cum membranis rectis; ligula brevis; cellulae bulliformes perspicuae.

Typus sectionis: *Trisetum flavescens* (L.) Pal.-Beauv.

Es ist die am meisten verbreitete Sektion; hierher gehören die Arten *T. flavescens* (L.) Pal.-Beauv., *T. alpestre* (Host) Pal.-Beauv., *T. sibiricum* Rupr., *T. agrostideum* Fr., *T. baregense* Laf. et Miége. Bemerkenswert ist die Art *T. agrostideum,* die durch den Charakter der Verteilung des Sklerenchyms am Blattspreitenquerschnitt manchmal an die Art *T. spicatum* erinnert.

Sectio *Trisetaera* Asch. et Gr.

Panicula ± contracta; sclerenchyma in parte laminarum abaxiali adaxialique in trabeculis singulis nervis adversum (sed apud nervos superiorum ordinum deest), sed nervos non attingens (singulariter nervos attingens); epidermidis cellulae in parte laminarum foliorum abaxiali longae cum membranis rectis; ligula brevis; cellulae bulliformes perspicuae.

Typus sectionis: *Trisetum spicatum* (L.) Richt.

Hierher gehört nur die Art *T. spicatum* (L.) Richt. s.l., die in ihrem Areal viele bedeutende Typen bildet, die oft als selbständige Arten gewertet werden. Verbreitung des *Trisetum spicatum*-Komplexes (sec. HULTÉN 1959): Gebirge Europas (seine Absenz in den Karpaten und auf dem Balkan ist beachtenswert), Asiens, Amerikas und Australiens und im ganzen arktischen Teil der nördlichen Halbkugel.

Sectio *Rigida* sect. nova

Sclerenchyma in parte laminarum abaxiali adaxialique in trabeculis singulis nervos attingens (nonnumquam ad nervos superiorum ordinum non perveniens); epidermidis cellulae in parte laminarum foliorum abaxiali longae cum membranis rectis; ligula ± brevis; cellulae bulliformes perspicuissimae; pili spicularum rhachillae prolongati; folia innovatiorum culmorumque ± distincte disticha.

Typus sectionis: *Trisetum rigidum* (M.B.) R. et S.

Hierher gehören die Arten *T. rigidum* (M.B.) R. et S.-Komplexes (cf. SEREDIN 1961) und *T. macrotrichum* Hackel. In Europa sind die Arten dieser Sektion auf der Halbinsel Krim und im Kaukasus und weiter in den benachbarten Gebirgen verbreitet, am weitesten gegen Westen bis in die Karpaten.

Sectio *Hispanica* sect. nova

Sclerenchyma in parte laminarum abaxiali adaxialique in trabeculis singulis nervos attingens; epidermidis cellulae in parte laminarum foliorum abaxiali longae cum membranis undatis; ligula paulo prolongata; cellulae bulliformes inconspicuae; folia conspecte hirsuta.

Typus sectionis: *Trisetum velutinum* Boiss.

In diese Sektion gehören nur zwei, in Spanien verbreiteten Arten: *T. velutinum* Boiss. und *T. hispidum* Lge.

Sectio *Carpatica* sect. nova

Sclerenchyma in parte laminarum abaxiali adaxialique in trabeculis singulis nervos attingens (nonnumquam ad nervos superiorum ordinum non perveniens); epidermidis cellulae in parte laminarum abaxiali longae cum membranis rectis; ligula prolongata; cellulae bulliformes perspicuae, in palearum carinis nonnumquam etiam denticuli prolongati usque pili.

Typus sectionis: *Trisetum fuscum* (Kit.) R. et S.

In die letztere Sektion gehört nur die Art *T. fuscum* (Kit.) R. et S., die in den Karpaten wächst.

Beachtenswert wird wahrscheinlich auch die Stellung der Art *T. burnoufii* Req. aus Korsika sein, die sich von einigen verwandten Arten

durch eine Reihe von Merkmalen unterscheidet; es ist nicht ausgeschlossen, dass sie zu einer selbständigen Sektion gehören wird; sie hat bestimmte Beziehungen zur Sektion *Hispanica*.

Subgenus *Distichotrisetum* subgen. novum

Syn.: *Trisetum Argentaria* Hermann, Flora v. Nord.- und Mitteleuropa, p. 120.

Vernatio conduplicata; sclerenchyma in parte laminarum abaxiali adaxialique in trabeculis singulis nervos attingens et etiam in marginibus laminarum instructum; membrana cellularum endodermidis radicium (sectio transversalis) crassa, cellulae formam litterae U aut C imitantes; epidermidis cellulae in parte laminarum foliorum abaxiali longae cum membranis rectis; pili spicularum rhachillae satis prolongati; folia innovatiorum culmorumque conspecte disticha.

Typus subgeneris: *Trisetum distichophyllum* (Vill.) Pal.-Beauv.

In diese Untergattung gehören nur zwei Arten, *T. distichophyllum* (Vill.) Pal.-Beauv. (incl. *T. albanicum* Jáv.) und *T. argenteum* (Willd.) R. et S.; sie sind in den Alpen, im Jura und in den Gebirgen der Balkanhalbinsel verbreitet. Ihr Vorkommen in den Pyrenäen und besonders in den Karpaten ist zweifelhaft.

Subgenus *Glaciotrisetum* subgen. novum

Vernatio conduplicata; sclerenchyma in carina in parte laminarum abaxiali in trabeculo singulo ad nervum attingens et etiam in marginibus instructum; membrana cellularum endodermidis radicium (sectio transversalis) crassa, cellulae litterae U aut C imitantes; epidermidis cellulae in parte laminarum foliorum abaxiali longae cum membranis rectis; folia brevia, rigida.

Typus subgeneris: *Trisetum glaciale* Boiss.

In diese Untergattung gehören nur in der Sierra Nevada wachsenden Arten *T. glaciale* Boiss. und *T. antoni-josephii* F. Q et Muñ. Med.

Subgenus *Graciliotrisetum* subgen. novum

Trisetum sectio *Gracilia* Chrtek et Jirásek, Webbia 17: 574, 1963, p.p.

Vernatio conduplicata usque inconspicue convoluta; sclerenchyma in parte laminarum abaxiali adaxialique in trabeculis singulis nervis adversum (nervos non attingens) et etiam in marginibus laminarum instructum; membrana cellularum endodermidis radicium (sectio transversalis) crassa, cellulae formam litterae O imitantes; epidermidis cellulae in parte laminarum foliorum abaxiali longae cum membranis rectis; folia brevia, rigida.

Typus subgeneris: *Trisetum gracile* (Mor.) Parl.

In diese Untergattung gehört nur die einzige in Sardinien endemische Art, *T. gracile* (Mor.) Parl.

Zusammenfassung

Die Gattung *Trisetum* wird auf Grund einiger morphologischer und anatomischer Merkmale in 4 Untergattungen geteilt und zwar: *Trisetum, Distichotrisetum, Glaciotrisetum* und *Graciliotrisetum*. Die Untergattung *Trisetum* weiter in 5 Sektionen und zwar: *Trisetum, Trisetaera, Rigida, Hispanica* und *Carpatica*. Die einzelnen Untergattungen und Sektionen sind auch durch ihre Verbreitung charakterisiert.

Literatur

ASCHERSON, P. & GRAEBNER, P. 1899. Synopsis der Mitteleuropäischen Flora 2 (1). Leipzig.

CHRTEK, J. 1965. Die Gattung Parvotrisetum, eine neue Gattung der Familie Poaceae. — Preslia (im Druck).

CHRTEK, J. & JIRÁSEK, V. 1963. On Taxonomy of the Genus Trisetum Pers. — Webbia 17: 569—580.

HERMANN, F. 1956. Flora von Nord- und Mitteleuropa. Stuttgart.

HOLUB, J. 1958. Bemerkungen zur Taxonomie der Gattung Helictotrichon Bess. — In KLÁŠTERSKÝ, I. Philipp Maxmilian Opiz und seine Bedeutung für die Pflanzentaxonomie. P.: 101—133. Praha.

HULTÉN, E. 1959. The Trisetum spicatum Complex. — Svensk Bot. Tidskr. 53: 203—228.

MAIRE, R. 1953. Flore de l'Afrique du Nord 2. Paris.

PAUNERO, R. E. 1950. Las especies españolas del género Trisetaria Forsk. — An. Jard. Bot. Cav. Madrid 9: 503—582.

SEREDIN, R. M. 1961. Novye vidy zlakov Kavkaza. — Bot. mat. gerb. bot. inst. AN SSSR 21: 51—59.

BOTANISKA NOTISER 1965 · VOL. 118 · FASC. 2 · LUND

Släktet Mentha i det nordiska floraområdet

AV NILS HYLANDER

Då arbetet på min Nordisk kärlväxtflora för mer än 20 år sedan sattes i gång, var avsikten närmast att med detta verk ge en modern flora av ungefär samma typ som 11. upplagan av HARTMANS Handbok fastän omfattande ett betydligt större geografiskt område; den tänktes publicerad i ett enda band eller möjligen två, som dock skulle utkomma med kort mellanrum. För att så fort som möjligt kunna meddela ett par prov på hur utformningen var tänkt, utförde jag, när beslutet om utgivningen fattats, ett par avsnitt, omfattande några släkten, som jag då hade aktuella, bl.a. *Mentha*. Sedan emellertid floran under hand kommit att anta en avsevärt förändrad karaktär och visat sig komma att bli betydligt större än från början avsetts, blevo dessa redan färdigställda (t.o.m. i form av ett provtryck utförda) avsnitt liggande opublicerade; genom forskningens fortskridande förlorade också en del av dem sin aktualitet. I fråga om släktet *Mentha* sökte jag emellertid tid efter annan att föra framställningen up to date; sålunda ha resultaten av HÅRDS arbete om *M. aquatica* och *M. aquatica* × *arvensis*, A. HANSENS upptäckt av *M. aquatica* × *longifolia* i Danmark och MARKLUNDS studier över de östfennoskandiska formerna av *M.* × *gentilis* och *M.* × *dalmatica* arbetats in, liksom jag också så vitt möjligt tagit del av till museerna nyinkommet material. I november 1964 gjorde jag också ett besök i Oslo, speciellt för att studera det norska *Mentha*-materialet i därvarande botaniska museum, vilket jag också kunde genomgå och bestämma. Då det synes mycket osäkert när (eller överhuvud om) jag skall få tillfälle att i floran nå fram till en så högtstående grupp som labiaterna, har det synts mig motiverat att i en särskild uppsats publicera framställningen av de nordiska myntorna, så som den nu föreligger, i hopp om att den skall kunna vara till nytta för Nordens florister och stimulera till fortsatt forskning i denna förvisso långt ifrån utredda, intrikata grupp. Uppställningen följer så noga som varit möjligt den i första delen av Nordisk kärlväxtflora (och i den snart föreliggande andra) brukade. Tecknet * markerar som där förvildade men nu naturaliserade taxa.

Mentha L. 1753.

Fleråriga örter med hela blad; foder tvåläppigt el. (oftast) nästan radiärt, femtandat; krona vanl. ± violett (rödviolett—nästan blå), en-

dast otydl. tvåläppig, de tre nedre flikarna sinsemellan lika, hela, ung. jämnhöga med den ngt bredare, nästan platta, vanl. urnupna överläppen; stånd. åtskilda, med parallella knapprum (blr ofta ♀); delfrukter kala, rundade—äggrunda.

A. Foder tydl. tvåläppigt (de båda övre tänderna tydl. bredare än de nedre), i svalget tätt långhårigt; bladskivor svagt sågade—nästan helbräddade, vanl. ej > 2 cm långa ..... **pulegium** 1.

AA. Foder nästan radiärt (alla tänder nästan likformiga), i svalget kalt el. glest korthårigt; bladskivor vanl. större

B. Blomkransarna bilda ett (åtm. upptill) smhängande, toppställt ax med förkrympta högblad (endast hos × *piperita* det nedersta stödbladsparet väl utvecklat)

C. Foderpip utanpå kal; bladskivor på båda sidor gröna, kala el. endast på nerverna glest håriga

D. Foderpip kort klocklik med svaga o. glesa nerver; blad oskaftade ..... **spicata** 8.

DD. Foderpip nästan cylindrisk, starkt tätnervig; blad skaftade × **piperita** 5.

CC. Foderpip utanpå hårig; bladskivor undertill grå- el. vitludna

D. Foderpip mkt kort, rundat klocklik; bladskivor starkt rynkiga, naggade, ± rundat ovala, i spetsen brett avrundade **rotundifolia** 11.

DD. Foderpip mer utdraget klocklik; bladskivor ej tydl. rynkiga, ± vasst sågade, med tydlig spets

E. En del hår greniga ..... × **villosa** 10.

EE. Alla hår enkla, långt utdragna i en vass, mkt fin spets **longifolia** 9.

BB. Blr antingen bildande en toppställd huvudlik ställn. (ev. under denna en enda, ofta upplöst blomkrans) el. ordn. i kransar i vecken av vanliga mlnblad o. vanl. alla (mera sällan endast de nedre) tydl. åtskilda

C. I stj:s topp en huvudlik, ± klotrund ställn., därunder inga blr el. en enda, ofta upplöst blomkrans i vecken av mlnblad; foder långt (c. 3,7—4 mm) med nästan cylindrisk, kraftigt tätnervig pip o. nästan syllika tänder ..... **aquatica** 4.

CC. Blr i ± talr., åtskilda kransar, alla el. flert. med stora, mlnbladsartade stödblad (de översta stundom med ± reducerade stödblad o. ngt axlikt närmade)

D. Foder klocklikt med svaga nerver, dess tänder ± brett triangulära, nästan alltid trubbiga; fruktsättn. god **arvensis** 2.

DD. Fodrets pip klocklik—trattlik el. nästan cylindrisk med åtm. 5 kraftigt markerade nerver; fodertänder spetsiga; blr vanl. ♀ el. könlösa; frukt mkt sällan utvecklad

E. Foder 3,5—4 mm långt; foderpip smalt klocklik—nästan cylindrisk med 10(—13) tättliggande, mkt kraftiga nerver; fodertänder smalt—syllikt triangulära × **verticillata** 3.

EE. Foder c. 2—3 (sällan, hos *gentilis* nm. *submascula,* intill 3,5) mm långt, dess pip med 5 kraftiga nerver o. mln dem vanl. 5 svagare
F. Bladskivor under gröna, gleshåriga × **gentilis** 6.
FF. Bladskivor under starkt gråludna × **dalmatica** 7.

I. Subg. **Pulegium** (Mill.) Briq. 1891 (*Pulegium* Mill. 1768 pro gen.): Foder tydl. tvåläppigt, i svalget med en tott av vita hår.

1. **M. pulegium** L. 1753 (*Pulegium vulgare* Mill. 1768). — Polejmynta (N, D: poleimynte; F: puolan minttu).

Stj. från långa jordstammar upprätta el. ± uppstigande, vid basen med ovanjordiska, rikbladiga utlöpare; nedre stj.blad kort el. otydl. skaftade, deras skiva sällan > 2 cm lång, ovalt lansettlik, nedtill kilformigt avsmalnande, svagt naggsågad—nästan helbräddad, kal el. svagt korthårig, med endast 1—3 par sidonerver; blomkransarnas stödblad ngt mindre med ± rundad skiva, de översta ofta ± förkrympta; blomkransar talr., långt åtskilda, mkt rikblommiga; foderpip ± smalt klocklik—trattlik, med täta o. kraftiga, i tänderna utlöpande nerver, ± tätt korthårig; fodertänder spetsiga, de nedre nästan syllika, de övre smalt triangulära med udd; krona med smala flikar, även den övre i spetsen hel, avrundad; nötter äggrunda, släta. Lukt kraftig, behaglig, ngt syrlig. — Krom. 2n=20, 40. — HS, ES.

Utöver den ovan beskr. typrasen (även kallad var. *communis* Bth. 1832—36) har inom omr. även som adv. anträffats den starkt håriga var. **villosa** Bth. ap. DC. 1848.

Typrasen fordom off. o. odl. i apoteks- o. herrgårdsträdg. i **D** o. s. **S**; en gång (c. 1800) funnen i **D** (Fyn: Korselitze) till synes spont. men säkerligen tillf. förv., i modern tid funnen adv., mestadels helt tillf., på rud.mark i **S** (Gbg från 1930-t. flerst., på några lok. flera år i följd), **D** (Kbhvn) o. **F** (Nyl Drumsö vid Hfors); var. **villosa S** Göteborg tillf. — [Arten inhemsk i s. o. mell. Eur., v. As., n. Afr., Etiop., därutanför flerst. odl. som kryddväxt o. för utvinning av olja (polejolja); typrasen mest i mell. Eur., var. *villosa* i s. Span., n. Afr. samt odl. i Tyskl., Engl. o. NAm.]

II. Subg. **Menthastrum** (Coss. & Germ. 1845 pro sect.) Briq. 1891: Foder nästan radiärt (alla fodertänder ung. lika breda), i svalget kalt(—glest korthårigt).

A. Sect. **Verticillatae** L. 1763: Alla blomkransar åtskilda, i vecken av mlnblad; krona utanpå o. i svalget hårig; blad skaftade.

2. **M. arvensis** L. 1753. — Åkermynta (N: åkermynte; D: agermynte; F: peltominttu).

Utlöpare underjordiska; stj. vanl. 10—40 cm hög, täml. vek, ofta grenig; bladskivor mkt växl. till form, hårighet o. serratur, brett lansettlika—äggrunda, oftast täml. grunt o. trubbigt sågade; foder kort (vanl.

c. 3 mm långt), dess pip ± öppet klocklik, ± tätt hårig, med fem svaga (på pressat material knappt framträdande) nerver, dess tänder täml. brett triangulära (ung. lika långa som breda el. ngt bredare), ngt trubbiga (sällan med kort spets); blr ♂ el. ♀; fruktsättning rikl.; nötter avlånga, släta (under lupp finstrimmiga). Lukt hos vissa ff. angenäm (melissartad), hos andra från. — Krom. 2n=*12, 60—62, 72,* 54, 64, c. 90, 92. — HS—H.

Även inom omr. ytterligt mångformig, men någon rationell systematisering av de olika typerna låter sig, åtm. f.n., ej gmföra. N-ut synas emellertid lång- o. smalbladiga typer överväga o. vara de eg. inhemska.

Stränder, fuktig skogsmark etc. samt allehanda (helst fuktig) kulturjord: åkrar, diken, beteshagar; mkt hemerofil o. ofta besvärligt ogräs. — **K.** HULT. 1950, nr 1518. — **S** Götal. o. Sveal. allm.; Norrl. i kustprov. till Nb Pajala, (ännu i Mpd t. allm.), i inl.prov. till LyL sälls. o. nästan endast på (sjö- o.) flodstränder, mkt sällan nående upp i subalp. reg.; PL Arvidsjaur: Glommersträsks stn (adv.), möjl. även Arjeplog. — **N** N-ut till NTrd Nærøy, i s. del. allm.; Nrd tillf. — **D** hela landet allm. — **FR** nästan alla prov. (till Lk, Lp, Lm), i de s. o. mell. del. (till 64° n. br.) ± allm. — [Nästan hela Eur. (mot NV till Orkn., i medit.omr. endast som ± sälls. ogräs), Madeira, Kauk., n. As. (mot S till Him.); natural. i NAm. — Den närst. *M. canadensis* L. som typisk inhemsk i NAm., i ± avvikande ff. (även smfattade som *M. haplocalyx* Briq. 1889) i ö. As.]

B. Sect. **Capitatae** × sect. **Verticillatae.**

3. **M.** × **verticillata** L. 1759 (pro sp.;=*M. aquatica* × *arvensis*; *M. sativa* L. 1763). — Kransmynta.

Utlöpare vanl. underjordiska; stj. vanl. hög o. grov som hos nr 4 men ofta rikt långgrenig (även i nedre delen); blomst.typ mkt växl. från »subcapitat», d.v.s. med översta stödbladen förkrympta o. en—flera kransar saml. till en huvud- el. axlik ställn. (men då alltid med flera ± skilda kransar under topphuvudet), till »verticillat»: med alla blomkransar åtskilda, i vecken av mlnblad; från nr 2 alltid skild gm det långa ribbnerviga fodret, som liknar det hos nr 4 men ofta är ngt kortare o. har mot basen bredare tänder; blr oftast ♀; frukt ej sedd av förf. — Krom. 2n=c. *96*, c. *120*, 26. — HS—H.

Ytterst mångformig hybr., i **S** vanligare än *M. aquatica* o. förekommande långt utanför dennas omr. Gm sin mkt rika veg. förökning o. den lätthet, med vilken utlöparbitar spridas o. rota sig, kan hybr. bilda rika enhetliga bestånd o. vissa kloner stundom uppträda som lokalraser; en sådan är den i Ög Ombergs-tr. uppträdande s.k. *M. gothica* Neum. 1901.

Växeställen ung. som för *M. aquatica*; förr odl. som kryddväxt (åtm. i Sm). — **K.** HÅRD 1955, s. 9 (**S**, med lf.). — **S** ± spridd i alla prov. (även Dls o.

Vrm) till Dlr o. Upl (här mest vid kusten o. i skärg.; då i regel hybr. med *aq.* var. *litoralis*); enst. fynd i Gstr, Hls (*lit.*-hybr.) o. Ång. — **N** i kusttr. från Oslofjorden till Hrd Fana o. Fjell; SoFj Gudvangen i Sogn (*subarvensis*-f.). — **D** uppg. från de flesta distr. men mindre allm. än nr 4. — **F** Al sälls. (även *lit.*-hybr.: *M. litoralis* f. *interrupta* Lindb. fil. ap. Hjelt 1919—23); St Luvia (*lit.*-hybr.).

C. Sect. **Capitatae** L. 1763: Stj. avslutad med en ± halvklotformig, tätt huvudlik (sällan ngt förlängd o. nedtill ± avbruten) blomst. med förkrympta stödblad, därnedanför ofta en ensam (ej sällan upplöst) blomkrans i vecken av vanliga mlnblad; krona utanpå o. inuti hårig; blad skaftade.

4. **M. aquatica** L. 1753 (*M. aq.* A. *capitata* Fr. 1828). — Vattenmynta (Fs: hästmynta; N: vassmynte; D: vandmynte; F: vesiminttu; Fär: hestamynta).

Utlöpare talr., mkt långa o. långledade, småbladiga, vanl. ovanjordiska (stundom nedsänkta i vattnet o. då med ± förkrympta o. bleka blad); stj. grov o. stadig, intill 80 cm hög, ogrenad el. upptill med täml. korta, ofta blombärande grenar; blomskaft täthåriga; foder långt (vanl. 3,7—4 mm), oftast ± purpurbrunt anlupet, dess pip (smalt klocklik—) nästan cylindrisk, tätt strävhårig—nästan kal, tätt ribbig av 10 ung. jämnstarka, grova nerver, dess tänder mkt spetsiga, (triang.) syllika (mera sällan triangulära med syllikt hopdragen överdel); krona stor (vanl. 6—6,5 mm lång) med täml. smala (± äggrunt avlånga) flikar; blr nästan alltid ♂; nötter rundat ovala, ngt knottriga. — Krom. 2n= c. *96,* 36. — HS—S.

Till storlek, hårighet o. bladform ytterst växl., stundom svår att avgränsa från *aquatica* × *arvensis*. En täml. utpräglad ras är

var. **litoralis** (Hartm.) C. A. West. 1863 (*M. aq.* ssp. *lit.* Hartm. 1846; *M. lit.* (Hartm.) Neum. 1901): stj. nästan fullst. kal, ogrenad el. fågrenig; bladskivor undertill på nerverna ± glesh åriga, f.ö. (nästan) kala, smalt—täml. brett äggrunda med rundad—nästan tvär bas o. täml. tät men grund o. trubbig sågning; foder mkt kort glesh årigt. — Krom. 2n=. . .

Kärr, stränder, bäckar, diken, helst i kalk- o. kusttr.; var. **litoralis** endast på havsstränder. — **K.** HULT. 1950, nr 1517; HÅRD 1955, s. 6 (**S**, med lf.). — **S** (exkl. var. *litoralis*) Gtl, Öl o. Sk ± allm.; n. Hl—Bh spridd (nästan endast vid kusten); Bl:s kusttr. flerst.; s. Klm o. Vg sälls.; Dls (alltjämt?) Ör o. Dalskog; Ög Ö. Ryd o. Vreta kloster; Srm Nyköping; Upl Lidingö o. Möja (Ramsmoraö). — **N** sälls. i kusttr. från Oslofjorden till AuAgd Hövåg o. från Rog

Modla till Hrd Stord. — **D** allm. — **F** (exkl. var. *lit.*) Al sälls.; Ab Hirvensalo vid Åbo (trol. förv.); Nyl Lappvik. — **Fär** sälls.: Strömö, Vågö. — var. **litoralis**. **S** Klm Loftahammar-tr.; Ög vid Bråviken; Srm Torö (enl. HÅRD även Tunaberg o. Bälinge); Upl särsk. Sthms skärg. o. n. kusten (här rikl.); Gstr Gävle skärg. flerst.; Hls Skog o. Ljusne. — **F** Al sälls.; St Eurajoki o. Luvia. — [Eur. (åt NÖ utom vårt omr. till Ösel, Estl., Ingermanl.), v. As. (till v. Sib. o. n. Pers.), n. Afr., Kap; natural. på Madeira, i NAm., SAm. (även Juan Fernandez) o. Austr. — var. *litoralis* ej känd utom omr.]

M. aquatica × **arvensis** — se ovan nr 3.

M. aquatica × **arvensis** × **spicata** (=*M. aquatica* × *gentilis;* M. × s m i t h i a n a R. A. Grah. 1949; »*M. rubra*» s. Sm. et auct. mult. poster. — non Mill. 1768, nec Huds. 1778).

Hit synas höra några ex. från Gtl (Visby o. Lummelunda), avvikande från *M.* × *gentilis* nm. *verticillata* gm mer förlängd, starkt mångribbig foderpip; huvudskottets övre blomkransar starkt närmade varandra, med helt små, helbräddade stödblad.

M. aquatica × **longifolia** (M. × d u m e t o r u m Schult. 1809 pro sp.; *M. hirta* Willd. 1809; *M. pubescens* Willd. 1809).

I blomst. o. bladtyp ± intermediär; fodertänder mera triangulära än hos *M. longifolia,* foderpip kortare o. mindre ribbig än hos *M. aquatica.* — Bladskivor hos de föreliggande nord. ex. som unga (liksom de unga skottaxlarna) tätt gråludna, som äldre glesare håriga (mest på nerverna), även de övre tydl. skaftade, de nedre avlångt äggrunda o. med antydan till dubbelsågning, de övre brett—hjärtlikt äggrunda; blr ♀.

Sälls. bland stamarterna. — **D** Jl (distr. 21) N om Stjære Söskov nära Tåstrup Sö; möjl. hör hit även ett av WIINST. som *aquatica* × *longifolia* bestämt ex. från distr. 13 vid Glenstrup Sö med ytterst snarlik bladform men till synes helt *longifolia*-lik blomst.- o. fodertyp.

[**M. aquatica** × **rotundifolia** (M. × m a x i m i l i a n e a F. W. Schultz 1854).

Uppgiven från **D** Brnh Ormbækken vid Rönne; beläggen synas mig för outvecklade för säker bestämning men torde vara *M. aquatica.*]

D. Sect. **S p i c a t a e** × sect. **C a p i t a t a e.**

5. **M.** × **piperita** L. 1753, em. Huds. 1762 (=*M. aquatica* × *spicata*). — P e p p a r m y n t a (N: peppermynte; D: pebermynte; F: piparminttu).

Utlöpare talr., huvudsakl. ovanjordiska, småbladiga; stj. nästan kal, vanl. purpurbrunt anlupen, ofta täml. rikgrenig (de översta grenarna axbärande); bladskivor äggrunt lansettlika el. på de nedre bladen ± avlånga, med tydligt (vanl. 6—8 mm långt) skaft, sågade med låga men vassa o. långa tänder (stundom med antydan till dubbelsågning), på u.sid:s nerver glest enkelhåriga, f.ö. kala, på ö.sid. mörkgröna, undertill ngt blekare; blomkransar saml. i ett vanl. c. 4—6 cm långt o. c. 1,5 cm brett, upptill tätt, nedtill avbrutet ax i stj.toppen, de nedersta kransarna ofta ± tydl. upplösta i ± skaftade delknippen, den nederstas (el. de två nederstas) stödblad ofta ± mlnbladslika; foderpip nästan cylindrisk, ribbig av de täta, starka nerverna, vanl. mörkt

purpurbrun, starkt hartsprickig, kal; fodertänder syllikt triangulära, ± glest styvhåriga; krona 4—4,5 mm lång; blr ♀; frukt 0. Lukt frisk (»pepparmynt»). — Krom. 2n=36 (»var. *officinalis*»), 72 (»var. *vulgaris*»), 86. — HS, ES.

Off. **S** (drog torkade blad: Folium menthae piperitae), **N**, **D** o. därför odl. (stundom även som kryddväxt) men sälls.; någon gång ngt förv. (**S** Gtl Ganthem, Vg Stenstorp). Beskrivningen passar till den typ. formen, även kallad nm. *vulgaris* Sole 1798 (pro var.; *M. pip.* subsp. *eupiperita* Briq. var. *officinalis* Sole f. *rubescens* Camus), den enda inom omr. förek. (o. off.) rasen; urspr. uppkommen i Engl. på 1600-t., sedan förökad på veg. väg (»black mint»).

Till hybr.kombinationen *M. aquatica* × *spicata* hör sannol. följ., om *M. spicata* var. *crispa* erinrande, åtm. förr i **S** o. **D** som med.växt odl. krusbladiga form:

M. crispa L. 1753, s. Lge 1886—88 (*M. piperita* γ *crispa* (L.) Koch 1837), g r å k r u s m y n t a, skild från *M. piperita* gm undertill starkare håriga, ngt gråaktiga, hjärtlikt rundade, nästan parallellnerviga, veckiga, i kanten oregelbundet inskuret smalsågade o. krusiga bladskivor på mkt kort, långhårigt skaft samt tätare, endast c. 3 cm långt ax o. mkt korthåriga fodertänder. — Jämte *M. spicata* var. *crispa* förr off. som krusmynta. Kulturform av okänd härstamning, enl. LGE l.c. i **D** (Sj) ofta odl. i gamla trädg. o. därifrån förv.; nuvarande status obekant.

E. Sect. **S p i c a t a e** × sect. **V e r t i c i l l a t a e.**

6. ***M.** × **gentilis** L. 1753 (pro sp.), s. coll. Hyl. 1941 (=*M. arvensis* × *spicata*). — Ä d e l m y n t a (N, D: engmynte; F: — se nedan).

Utlöpare underjordiska (sällan någon enst. ovan jord), ofta grova; bladskivor ovan täml. tätt håriga—(nästan) kala men alltid med mittnerven (särsk. mot basen) korthårig med delvis glandulösa hår; blomkransar åtskilda i mlnbladens veck, sällan de övre ngt närmade med ngt reducerade stödblad; foder c. 2,5—3 (hos nm. *submascula* ända till 3,5) mm långt, dess pip kal el. ± tätt hårig, klocklik med avrundad bas el. nästan trattlik, med 5 grova, i tänderna utlöpande nerver o. mln dem 5(—7) svagare; fodertänder åtm. i kanten ± tätt styvhåriga, ± smalt

Fig. 1. a. *Mentha arvensis* ♀. Skåne, Sireköpinge: Kläsinge 1903 N. ALVTHIN. — b. D:o. Dalarna, Stora Skedvi 29/7 1902 G. SAMUELSSON. — c. *M. aquatica* × *arvensis*. Skåne, Vitaby 7/9 1902 FR. E. AHLFVENGREN. — d. D:o. Skåne, Bårslöv 21/8 1901 O. J. HASSLOW. — e. *M. gentilis* nm. *anderssoniana*. Dalarna, Falun aug. 1916 E. HELLSTRÖM. — f. *M. gent.* nm. *Arrhenii*. Stockholm, Djurgården: Oakhill 27/8 1926 T. VESTERGREN. — g. *M. gent.* nm. *verticillata*. Östergötland, Linköping 30/8 1919 HJ. HOLM. — h. D:o. Skåne, Brunnby: Krapperup s.a. N. GYLLENSTIERNA. — i. *M. gent.* nm. *submascula*. Gotland, Alva: kornåker vid stationen 18/8 1929 E. TH. FRIES. — j. *M. gent.* nm. *subspicata*. Skåne, Svalöv: Holgerstorp 23/8 1921 N. SYLVÉN. — k. *M. gent.* nm. *parviflora*. Finland. Nyland, Kyrkslätt: Österby, Nygård H. LINDBERG (Pl. Finl. Exs. 879). — × 6 1/3. (Från HYL. 1941).

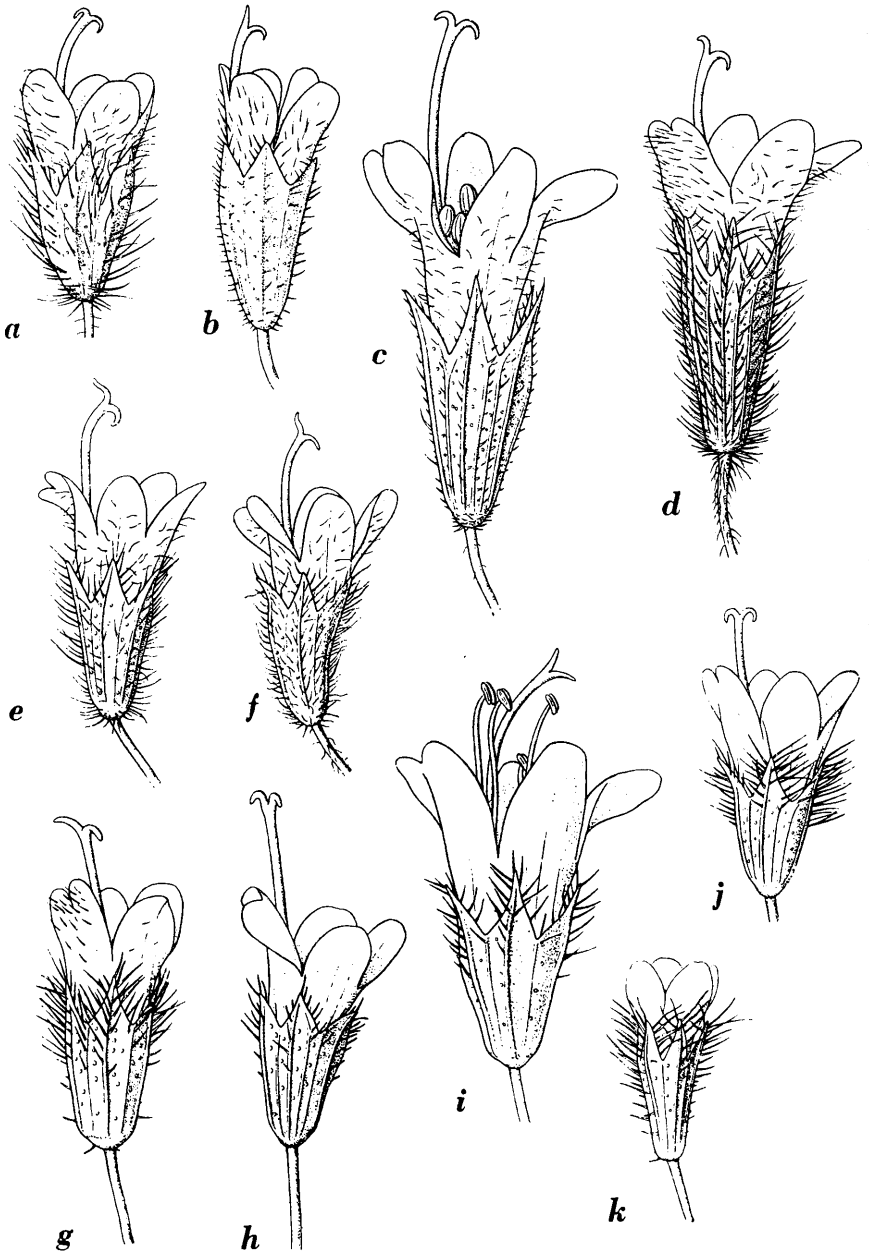


Fig. 1.

triangulära, ± spetsiga (tydligast på unga blr); blr oftast ♀; fruktsättning nästan alltid 0. — ES, H.

M. × *gentilis,* som här fattas i sma vida mening som hos HYL. 1941, där avgränsningen närmare motiveras, utgör av allt att döma ett från *M. arvensis* × *spicata* härst. formkomplex, vars inom omr. funna ff., att döma av herb.-materialet, till allra största delen kunna fördelas på följ., här som nothomorfer (nm.) upptagna men kanske ej helt likvärdiga taxa (jfr nedan under nm. *verticillata* o. nm. *subspicata*). Dessa ha ordnats på ett sätt, som i möjligaste mån motsvarar den här använda artföljden, d.v.s. begynnande med de mest *arvensis*-lika ff. o. avslutat med de ± *spicata*-lika, nm. *subspicata* o. nm. *parviflora.* De båda sistn. äro hos oss utan tvivel, i den mån de förek. vilda, rester av en ännu i sen tid bestyrkt odling som doftväxter; nm. *parviflora* har över huvud endast sällan lyckats sprida sig utanför tomtgränserna. Även nm. *verticillata* torde vara en sådan kulturrelikt, fastän den i långt högre grad emanciperats o. i stor utsträckning uppträder som åkerogräs o. även neofyt. De tre ± *arvensis*-lika ff.: nm. *anderssoniana,* nm. *hirtella* o. nm. *Arrhenii* äro endast kända som ogräs, o. det kan väl ej uteslutas, att de (el. någon av dem) uppkommit inom vårt omr. efter återkorsning av en odl. (o. förv.) *gentilis*-form, närmast då nm. *verticillata,* med *M. arvensis.* På förekomsten av sådan återkorsning tyda måhända de i herb. föreliggande ströex., som — fastän hörande till *gentilis* — ej kunna hänföras till någon av de nedanst. formerna o. vilka ej synas ha vunnit en sådan utbredning som dessa. Cytol. undersökningar kunna här kanske bringa klarhet liksom i fråga om de redan urskilda nothomorfernas inbördes förhållande o. genesis.

a. Blr ♀ med ur kronan utskjutande stift men inneslutna, förkrympta st.knappar; foderpip klocklik, även vid basen ± tätt långhårig; krona i svalget med talr. långa hår.

nm. **anderssoniana** (H. Br.) Hyl. 1941 (pro var.; *M. and.* H. Br. 1890; *M. dalmatica* var. *and.* (H. Br.) Briq. 1896; [*M. gent.* var. *vermlandica* Hyl. in sched. et ex Hult. 1950, n. nud.;] »*M. Arrhenii*» s. auct. suec. quoad pl. suec. — non s. orig.; »*M. aquatica* × *austriaca* (f. *verticillata*)» et »*M. agrestis* × *aquatica*» s. Neum. 1901; »*M. agrestis* Sole» s. Neum. 1901 — non s. orig.).

Stj. nedom den blombärande regionen vanl. med (stundom sent utväxande), slutl. i regel starkt förlängda, ± bågigt uppstigande grenar, nedtill glest, upptill (särsk. i blomreg.) tätt hårig av ± nedåtriktade hår; bladskivor från rundad (på kraftiga ex. stundom vid själva bladskaftsfästet ngt killik) bas ± utdraget äggrunda med ngt utdragen, helbräddad, täml. spetsig toppdel, ovan täml. tätt o. långt håriga, under på nerverna ± tätt långhåriga, f.ö. ± gleshåriga; bladskivans tänder långa men låga, med rak el. vanl. ngt insvängd rygg o. utsvängd, vass spets; blomkransar talr., åtskilda, vanl. täml. täta o. starkt grå av de tät-

håriga fodren; blomskaft kala el. med ngt enst. hår; krona c. 4,5 mm lång, utanpå (särsk. på överläppen) vanl. rikhårig. — Krom. 2n=...

Trädg.land, åkrar (i sht potatis-), diken. — **K.** HYL. 1941, s. 12 (med lf.). — **S** Sm Växjö- o. Nässjö-tr.; s. Ög Kisa; Gbg, Bh, Dls, Vg, Vrm o. Dlr ± spridd o. ofta rikl.; v. Nrk Nysund. — [Ej känd utanför **S**.]

nm. **hirtella** Markl. [ex Hyl. 1955, n. nud., et] 1963 (pro var.; »*M. Arrhenii*» s. auct. finl. p.p. et s. Lindb. fil. 1906 p.p. sed non quoad typum).

Intar en mlnställn. mln nm. *anderssoniana* o. nm. *Arrhenii,* från den förra skild gm ej så tydl. utdragna bladskivor med trubbigare, mindre utsvängda tänder, från den senare skild gm de ngt starkare håriga, vid basen ± rundade, ej nedlöpande, ± äggrunda bladskivorna med tätare o. mera framåtriktade tänder, mera lång- o. täthårigt foder o. större (c. 5 mm lång), mörkare blåviolett krona samt längre utskjutande, tydl. violett stift; blomskaft kala el. med ngt enst. hår; lukt (enl. MARKLUND) behagligare än hos nm. *Arrhenii*, ngt pepparmyntsartad. — Krom. 2n=. . .

Växeställen som för nm. *anderssoniana.* — **K.** MARKLUND 1963, s. 6 (med lf.). — **F** ö. Ab Pusula, Lojo o. Vihti; Nyl spridd (kring Hfors ± allm.); Ka Karhula o. Aspö (=Haapasaari); St Hämeenkyrö; Ta Teisko o. Tammerfors. — [Ej känd utanför **F**.]

nm. **Arrhenii** (Lindb. fil.) Hyl. 1941 (pro var.; *M. Arrh.* Lindb. fil. 1906, quoad coll. typ.: Pl. Finl. Exs. n:o 880). — (F: Suomen minttu.)

Habituellt o. i fråga om bladskivornas tandning mkt lik nm. *verticillata,* från de båda föreg. nm. skild gm att bladskivornas bas är ± killikt utdragen, så att bladskaften (i sht på skuggex.) bli ngt vingade; blomskaft tätt håriga; krona ljusviolett (på skuggex. stundom nästan vit); stift blekt. — Krom. 2n=. . .

Växeställen som för nm. *anderssoniana.* — **K.** MARKLUND 1963, s. 7 (med lf. för **F**); HYL. 1941, s. 12 (**S**, med lf.). — **S** endast känd från Sthms-tr., trol. i sen tid (1800-t.?) ink. från **F**; ej sedd efter 1930-t. — **F** s. Ab—Ik spridd (särsk. i kusttr.); St Tyrvis; Ta Luhanka o. Heinola; Sa o. Sb sälls.; Tb Jyväskylä. — [Ej känd utanför vårt omr.]

b. Blr ♀ liksom hos a (el., hos nm. *submascula,* ♂ med utskjutande stånd.) men foderpip vid basen kal; krona inuti med helt korta (± pigglika) hår el. kal.

nm. **verticillata** F. Aresch. 1866 (ut [var.] β; *M. gent.* var. *agardhiana* Lge 1883; *M. ag.* Fr. 1842 — non s. orig. Fr. 1819; *M. gent.* β *lincopensis* Neum. 1901; *M. arvensis* δ *subgentilis* A. Blytt 1874).

Stj. vanl. 30—50 cm hög, oftast rikgrenig, nedtill (nästan) kal, upptill med ± (ofta mkt) gles hårighet av helt korta, ± nedåtböjda hår, vanl. i hela sin längd ± starkt purpuranlupen; bladskivor vanl. föga håriga, äggrunda—äggrunt elliptiska, täml. trubbiga med jämn sågning av täml. låga, trubbiga tänder med ngt kullrig rygg o. vanl. ngt inböjd spets (endast på de övre stödbladen stundom med ngt konkav rygg o. utåtböjd spets), alla likformiga o. mot toppen endast föga avtagande i storlek, åtm. de nedre tydl. skaftade; blomkransar långt åtskilda, täml. glesa (stundom ± upplösta); blomskaft kala (utom hos vissa norska ex.); fodertänder vanl. rikt styvhåriga; krona c. 4,5 mm lång, utanpå kal el. ngt hårig, i svalget med korta hår ung. i jämnhöjd med st.knapparna. — Krom. 2n=. . .

Vissa gotländska (o. öländska) ex. med sma foderhårighet avvika gm ngt spetsigare fodertänder, ngt större krona samt glesare men vassare o. mer utsvängda bladtänder o. närma sig därigenom nm. *submascula*; möjl. representera de en egen ras. Även *verticillata*-materialet från **S**:s fastl. o. **N** visar emellertid en större variation, åtm. i fråga om fodrets (särsk. fodertändernas) form o. hårighet, än övr. här upptagna nm. o. kan möjl. — i motsats till vad som synes vara fallet med dessa (möjl. med undantag av den föga kända nm. *submascula*) representera mer än en klon, fast en uppdelning därav på tydl. skilda grupper ej varit mig möjlig; först jämförande odling av olika provenienser kan avgöra i vad mån skillnaderna äro av modifikativ natur o. om ärftliga olikheter finnas — ev. också i krom.talet — vilka kunna tillåta en vidare uppdelning. — Några snarlika gotl. ex. med nästan cylindriskt klocklik, tätnervig foderpip synas vara *aquatica* × *gentilis* (se ovan efter *M. aquatica*).

Åkrar, trädg.land, stundom vid bäckar o.d. — **K**. HYL. 1941, s. 14 (**S**, med lf.). — **S** känd från Götal:s samtl. prov. utom Dls (särsk. Sk o. Ög, sälls. i Vg); Nrk, Srm sälls. — **N** (lf. HYL. 1941) spridd i kustprov. från Akh till NTrd Frosta; Nrd Bodö. — **D** Sj flerst.; Brnh Rönne. — [Ej med säkerhet känd utom vårt omr.]

nm. **submascula** (Neum.) Hyl. 1965 (*M. gent.* var. *agardhiana* f. *subm.* Neum. ap. K. Joh. 1910; *M. gent.* var. *verticillata* f. *subm.* (Neum.) Hyl. 1941).

Från omr:s övr. *gentilis*-ff. skild gm utskjutande stånd. o. större blr (krona c. 5,5 mm lång). — Habituellt närmast lik nm. *verticillata* men stödbladsskivor ngt smalare o. spetsigare med ngt rakare o. mer utstående tänder. — Krom. 2n=. . .

Åkrar etc. — **S** Gtl flerst.

nm. **subspicata** F. Aresch. 1866 (ut [var.] α; *M. comatula* (Briq.) Neum. 1901; *M. gent.* var. *com.* Briq. 1896). — Skånsk ädelmynta.

Stj. (30—)50—100 cm hög, i övre delen med (ofta talr.) smån. starkt förlängda, ngt utstående, (nästan) raka fert. grenar, glest el. (på solex.) ej sällan täml. tätt klädd med täml. korta, ± nedåtböjda hår, ofta starkt rödanlupen; blad kortskaftade (de nedersta ofta, liksom åtm. de övre stödbladen, nästan oskaftade); nedre o. mell. stj.bladens skivor ± avlångt elliptiska, med låga men långa o. vassa tänder, mot den avsmalnande — nästan rundade basen helbräddade o. med ngt utdraget, tydl. spetsat ändparti; stödblad med glesare tandning o. tydligare spets, i sht på solex. till större delen (men särsk. de översta) tydl. reducerade o. på var sida med endast 1—2 tänder el. helbräddade; blomkransar mkt talr., gm högbladens reduktion nästan bildande ett avbrutet ax, mkt täta o. starkt grå av fodertändernas täta hårighet; fodertänder vasst tillspetsade; krona utanpå o. i svalget kal, c. 4 mm lång, mera rödaktig än hos övr. nm. — Krom. 2n=. . .

Mkt lik nm. *subspicata* i bladen men med både absolut o. i förhållande till fodertänderna tydl. längre, brett vaslik fodertyp, mindre håriga fodertänder, glesare blomkransar o. större, mindre röd krona är en typ, som samlats i Gbg Landvetter (i potatisland; jfr H. FRIES 1945, s. 366, not). I sin tur mkt lik sistn. men med nästan fullst. kalt (på tänderna helt svagt hårigt) foder är en av R. OHLSÉN samlad f. från Vg Alingsås-tr. (Västerled i Rödene samt därifrån inflyttad i Alingsås). Även på Al (Vårdö) är en snarlik f. funnen (se MARKLUND 1963), från nm. *subspicata* skild gm mera håriga, mindre utdragna bladskivor.

Täppor, tomter, vägkanter etc. — **K**. HYL. 1941, s. 13 (**S**, med lf.). — **S** från äldre tid endast sv. Sk o. här spridd, i sen tid plant. o. kvarst. i nö. Sk Kviinge; Gbg Hinsholmen i V. Frölunda. — **D** Jl Åbenrå; Sj sälls. — [Uppg. för Harz o. Thüringen men osäker.]

c. Blr könlösa med stånd. o. pist. helt reducerade; krona mkt liten, nästan radiär, utanpå o. inuti helt kal.

nm. **parviflora** Hartm. 1846 (ut [var.] β; *M. gent.* var. *Friesii* Briq. 1894; *M. gent.* δ *baltica* Neum. 1901; *M. gent.* L. s. str. Fr. 1828 etc.). — Småblommig ädelmynta (F: jalominttu).

Från de föreg. skild gm de ytterst små, helt könlösa blrna o. nästan trattlik, gleshårig — nästan kal foderpip. — Stj. vanl. 40—70 cm hög, ofta starkt rödanlupen o. i sht i övre delen ofta täml. starkt hårig av korta, ± nedåtriktade hår, med mkt lång fert. region, nedom denna förr el. senare med vanl. talr., slutl. långa, bågigt uppåtböjda fert. grenar; bladskivor ovan täml. tätt korthåriga; nedre stj.bladsskivor ± brett elliptiska med ± kilformig bas, de övre ± äggrunt lansettlika—brett äggrunda; bladtänder mkt vassa, med insvängd—nästan rak rygg

o. ± utstående spets, på de nedre bladen täta o. ofta grova, på de övre stödbladen få (ofta endast 2—4 på var sida) o. låga men mkt spetsiga; blomkransar mkt talr., de övre ofta med ± reducerade stödblad, alla långt åtskilda, mkt täta, starkt grå av fodertändernas täta hår; krona endast c. 3,5 mm lång, blekt (röd)violett. — Krom. 2n=. . .

Allt material jag sett av nm. *parviflora* har haft blr av ovan beskriven typ med helt förkrympt pistill. Nyligen har emellertid MARKLUND från **F** omtalat några ex., där stiftet i vissa blr är väl utvecklat o. utskjutande men som enl. hans mening ej på ngt sätt i övr. avvika från nm. *parviflora* o. därför av honom räknas till denna.

Trädg.täppor, tomter, kvarst. efter odl. men numera sälls. o. ej längre avsiktligt odl.; någon gång sek. på rud.mark, åkrar el. landsvägskanter. — **K.** HYL. 1941, s. 13 (**S**, med lf.); MARKLUND 1963, s. 12 (**F**; d:o). — **S** belagd från c. 40 lok. (delvis mkt gamla fynd) på Öl. o. i Klm, Sm, Hl, Gbg, Bh, Vg, Ög, Nrk, Srm, Upl, Vsm, Gstr o. Hls. — **N** endast sedd från Vestf Eian o. AuAgd Lyngör. — **F** spridd på Al o. i fastl:s v. prov., mot NV till Oa Vasa-tr., mot NÖ till Sb Pielavesi o. Heinävesi, i SÖ blott till Nyl Borgå. — [Ej känd utom omr.]

[*M.* × *gentilis* i talr. ff. spridd i större delen av Europa, som spont. väl uppkommen flerst. inom omr. för *M. spicata*.]

7. ***M.** × **dalmatica** Tausch 1828, s. ampl. Briq. 1896 (=*M. arvensis* × *longifolia*; *M.* × *Kerneri* Topiz 1915, n. illeg.).

Till blad- o. blomst.typ närmast motsv. *M.* × *gentilis* men skild gm de undertill starkt gråluddiga bladskivorna o. den starkare hårigheten hos stj:s övre del; foder täthårigt på både pip o. tänder.

Den inom omr. förekommande representanten för denna, utom vårt omr. mkt mångformiga, med *M.* × *gentilis* analoga formserie synes, att döma av materialets enhetlighet, utgöra en enda klon, vilken — så länge den ej med säkerhet kan identifieras med någon från trakter utanför vårt omr. beskriven f. — i klarhetens intresse må ges ett särskilt namn:

nm. **fennica** Hyl. 1965: stj. vanl. 45—75 cm hög, stadig, tätbladig; stj. o. grenar åtm. som unga tätt långhåriga; bladskivor kortskaftade, de nedre ± brett (äggrunt) ovala o. nästan trubbiga, de övr. äggrunda, kortspetsade, med talr., långa men låga, i en vass spets utsvängda tänder; övre stödblad täml. starkt reducerade o. de mkt täta blomkransarna därigm i viss mån tenderande att bilda en avbrutet axlik ställn.; blomskaft håriga; blr ♀ med utskjutande stift o. förkrympta stånd. (med i pipöppn. ofta skymtande knappar); foder c. 2,5—3 mm långt; krona blekt violett, c. 4,5(—5) mm lång. — Krom. 2n=. . . — ES, H.

Täppor vid gårdar o. torp, fordom odl., sedan kvarst. men mkt sällan spridd utanför tomterna. — **K.** MARKLUND 1963, s. 13. — sö. **F** spridd (särsk. i Sb o. Kb) från Ka o. Ik upp till Sb Nilsiä o. Kb Pielisjärvi (här talr. lok., se lf. hos

SONCK 1964, s. 166, o. **k.** 91), mot NV till Tb Hankasalmi o. Sb Suonenjoki (Viipero). — [*M.* × *dalmatica* spridd i mell. o. ö. Eur.; nm. *fennica* ej fastställd utanför **F.**]

F. Sect. **Spicatae** L. 1763: Blomkransar i vecken av små högbladsartade stödblad o. bildande ett långsträckt ax i stj:s topp; krona inuti kal; mlnbladsskivor med bred bas, oskaftade (sällan helt kort skaftade).

8. ***M. spicata** L. 1753, em. L. [Nathhorst] 1756 (*M. spic.* α *viridis* L. 1753; *M. vir.* L. 1763). — Grönmynta (N: grönmynte; D: grön mynte; F: vihreä minttu).

Utlöpare underjordiska, fjälliga; stj. 40—100 cm hög, nästan kal el. ± rikl. klädd med raka, långt tillspetsade, nedåtriktade hår, oftast purpurbrunt anlupen; stj.bladsskivor oskaftade, från ± hjärtlik—brett avrundad bas jämbrett lansettlika—avlånga, ovan kala o. mörkgröna, under ngt blekare gröna (el. ofta ngt purpurbrunt anlupna) o. kala el. på nerverna med glesa raka enkelhår, spetsiga, ± vasst sågade; ax som helt utvuxet vanl. 5—10 cm långt, c. 1 cm brett, som ungt med utdragen smal topp, i regel med tydl. åtskilda kransar (den nedersta ofta ngt avlägsnad o. ej sällan med ngt förstorade stödblad); foderpip klocklik med 10 täml. svaga nerver, åtm. vid basen (liksom blomskaftet) kal; fodertänder syllikt triangulära; krona 4 mm lång, violett, kal; nötter fint punkterade. Lukt stark, ofta »oljig». — Krom. 2n=*36, 48,* 84. — HS—H.

Täml. mångformig; även inom omr. äro flera (även i lukten) olika typer funna. En anmärkningsvärd kulturf. är var. **crispa** (Bth.) Mansf. 1959 (*M. viridis* var. *crispa* Bth. 1832—36; *M. spic.* var. *crispata* (Schrad.) Sch. & Th. 1914; *M. crispata* Schrad. 1808 et ex Willd. 1809), vanlig krusmynta: bladskivor ± hjärtlikt triangulära—triang. äggrunda, liksom veckade mln de ± parallellt förlöpande huvudnerverna, i kanten krusiga, ± inskuret vasssågade. Fordom off. (**S**: Folium menthae crispae).

Rud.mark, vägkanter, gårdar etc., i sen tid förv. el adv. men numera flerst. stationär i s. **S** o. **D**; någon gång alltjämt odl. som kryddväxt. — **K.** HULT. 1950, nr 1521. — **S** Öl, Sk:s slättbygd o. Bl t. sälls., f.ö. som ± konst. på enst. lok. upp till Vg o. Ög, längre N-ut funnen ± tillf. på rud.mark i Sthms-tr. o. Mpd (Timrå, barlast). — **N** tillf. adv. (Oslo-tr., Skåtöy vid Kragerö, Bergen). — **D** t. sälls.; känd från Jl (flert. distr.), Fyn, Ærö, Lang, Loll, Flst, Sj (alla distr.) o. Brnh. — var. **crispa** åtm. förr stundom odl. som med.växt o. någon gång förv. el. adv. (**S** Visby, Srm Villa Plania i Nacka). — [Inhemsk el. arkeofyt i s. o. mell. Eur.; var. *crispa* endast känd i kultur.]

9. **M. longifolia** (L.) L. [Nathhorst] 1756 (*M. spicata* β *long.* L. 1753; *M. sylvestris* L. 1763). — Gråmynta (N: gråmynte; D: grå mynte; F: harmaa minttu).

Utlöpare underjordiska, fjälliga; stj. 40—100 cm hög, åtm. upptill ± tätt besatt med långa, mångcelliga, enkla, i en vass spets smån. avsmalnande, raka el. föga krusiga hår, i de översta bladens veck vanl. med korta, axbärande grenar; stj.bladsskivor oskaftade (sällan mkt kortskaftade), ovan gröna—gråludna, under ± tätt (grå- el.) vitludna, jämbrett lansettlika el. ± brett avlånga (el. äggrunda), ngt spetsiga, sågade, med vanl. långa, täml. låga, ± vassa o. i spetsen ofta ngt utböjda tänder; ax vanl. ngt bredare, tätare o. mera kortspetsat än hos nr 8; foder 3 mm långt, liksom blomskaftet ± tätt korthårigt, dess pip klocklik med 10 svaga nerver, dess tänder spetsiga, ± syllika; krona 4 mm lång, ljust rödviolett, utanpå hårig; nötter ung. som hos nr 8. — Krom. 2n=*24*, 18, 48. — ES.

Ytterligt mångformig art, även inom omr. med flera ± distinkta ff. Vanlig i **S** är en ♀-typ med brett(—äggrunt) avlånga, vassågade, undertill täml. löst gråulliga bladskivor: var. **latissima** Hartm. 1846; till denna höra flert. svenska fynd från mera naturl. lok. (Öl, Sk, Vg, Ög).

Fuktig mark (särsk. vid åar o. bäckdrag), vid gårdar, rud.mark etc., särsk. i kalktr., ofta till synes inhemsk men möjl. alltid från början förv.; numera dock knappast odl. inom omr. — **K.** Hult. 1950, nr 1519. — **S** fullt natural. (el. inhemsk) på Gtl o. Öl, i Sk, Vg, Ög o. Vsm (Ramsberg); dessutom åtsk. lok. på rud.mark upp till Upl samt (åtm. förr) Hls Hudiksvalls-tr. — **D** nästan hela landet, till synes inhemsk (0: Als, Ærö, Mön, Samsö, Anholt, Læsö). — [Utom omr. i s. o. mell. Eur. (i V upp till Storbrit. men här möjl. ej inhemsk), v. o. mell. As., n. Afr. (även Etiop. o. Egypten), s. Afr.]

10. **M. × villosa** Huds. 1778 (pro sp.), s. ampl. Janchen (=*M. longifolia* × *rotundifolia* et *M. rotundifolia* × *spicata*; *M. niliaca* s. ampl. Briq. 1891 — an s. orig. Jacq. 1776?; n. dub.).

Mångformig, ster. hybr., habituellt ± pendlande mln nr 9 o. 11; bladskivor undertill ± tätt vitludna, stundom täml. tydl. nätnerviga, på ö.sid. gröna—gråa men ej tydl. rynkiga; stj. med ± tät o. krusig hårbeklädnad. — De inom omr. funna ff. likna i högsta grad *M. longifolia* men kunna igenkännas som *rotundifolia*-hybr. på stj:s beklädnad av krusiga, täml. jämntjocka o. i enst. fall greniga hår. — Krom. 2n=24, 56.

Adv. på rud.mark. — **S** Lund, Sölvesborg, Mölndal, Östersund; säkerligen ej uppkommen på fyndplatsen utan ink. i form av utlöparbitar. — [Som inhemsk känd från s. o. mell. Eur., i V upp till Skottl.]

11. ***M. rotundifolia** (L.) Huds. 1762 (*M. spicata* γ *rot.* L. 1753). — Rundmynta (N: rundmynte; D: rundbladet mynte; F: pyöreälehtinen minttu).

Vitt kringkrypande med dels underjordiska, fjälliga, dels ovanjordiska, småbladiga utlöpare; stj. 25—60 cm hög, tätt vitullig av krusiga, mångcelliga, täml. jämntjocka, ± greniga hår, med axbärande grenar i de översta bladvecken; mlnbladsskivor oskaftade, rundat ovala med brett hjärtlik, omfattande bas, rundtrubbiga, svagt naggsågade, ovan gröna o. (nästan) kala, starkt rynkiga, undertill nätlikt tätnerviga o. (grå- el.) vitludna; ax täta, smala (vanl. 3×1 cm); foder korthårigt, med klocklik—halvklotformig, otydl. nervig pip o. korta, ngt spetsiga, ± (syllikt—)smalt triangulära tänder; krona mkt liten, vit, ofta ♀; nötter släta. Lukt kraftig, obehaglig. — Krom. 2n=*24*, 18, 54. — ES, H.

Odl. (mest förr o. nästan blott i omr:s sydl. delar) o. gärna länge kvarst. på el. kring odl.platsen, i Sk o. **D** flerst. tydl. förv. på ± långt avstånd från bebyggelse (på renar, banvallar etc.) o. i en del fall natural. på ± naturliga lok. (ängar, alkärrs- o. bäckkanter etc.) men säkerl. ingenst. inhemsk; förr stundom adv. med barlast. — **K.** HULT. 1950, nr 1520. — **S** Sk som ± förv. o. delvis neofytisk flerst. i S, V o. SÖ; f.ö. uppg. el./o. belagd från enst. lok. upp till Jmt, i flert. fall säkerligen odl. el. i någon mån förv., någon gång kanske (Gävle 1893) ink. med barlast. — **N** förr tillf. adv. på barlast: Östf Kråkeröy vid Fredrikstad, Oslo, Kristiansund. — **D** som förv.: Brnh flerst. (nära Rönne sedan länge natural. på fuktig mark), f.ö. känd från några lok. på s. Fyn, Ærö o. s. Sj (Stevns, Kbhvn). — **F** tillf. adv. Nyl Drumsö vid Hfors (o. Ab Kimito?). — [Inhemsk i s. o. mell. Eur. o. n. Afr.]

Appendix

Mentha × **gentilis** L. nm. **submascula** (Neum.) Hyl., n. comb. (*M. gentilis* var. *agardhiana* f. *submascula* Neuman ap. K. Johansson in Bot. Not. 1910, p. 220; *M. gentilis* var. *verticillata* f. *submascula* (Neum.) Hyl. in Acta Phytogeogr. Suec. XIV, p. 44).

Mentha × **dalmatica** Tausch nm. **fennica** Hyl., n. nm. (= *M. dalmatica* s. Marklund 1963 quoad pl. fenn.): caulis plerumque 45—75 cm altus, firmus, densefoliatus, una cum ramis saltem juventute dense et longe pilosus; laminae foliorum brevipetiolatae, inferiores ± late (ovate) ovales et subobtusae, ceterae ovatae, breviter acutatae, dentibus numerosis, longis, arcuatim elongatis argute sed sat leviter serratae; bracteae superiores sat reductae, verticillis florum densissimis sic quasi spicam interruptam formantibus; pedunculi pilosi; flores ♀, stylo exserto, staminibus reductis (antheris non raro in fauce corollae visibilibus); calyx c. 2,5—3 mm longus; corolla pallide violacea, c. 4,5(—5) mm longa.

Habitat in cultis in provinciis naturalibus Karelia austr. et ladog., Isthmo karel., Savonia austr. et bor. et Karelia bor. Fennoscandiae

orientalis (vide MARKLUND 1963, p. 13 et 15); olim odoris causa culta. — Typus in H (prov. Karelia bor.: Värtsilä, in pago, leg. H. ROIVAINEN 9. VIII. 1937; vide tab. 5 in MARKLUND 1963).

Summary

The genus Mentha in the Scandinavian flora

The genus *Mentha* is represented in the Scandinavian flora by two undoubtedly indigenous, polymorphic species, *M. arvensis* L. and *M. aquatica* L. The former is not known from the northernmost parts of the Scandinavian peninsula, Iceland and the Faeroes but is otherwise common in most districts, both in natural habitats and as a weed. The main type of *M. aquatica* is common in Denmark and occurs in the coast districts of Norway north to Hordaland; in Sweden it is common in the provinces of Gotland, Öland and Skåne and has more scattered occurrences, mainly along the coast, up to Dalsland and Stockholm. It also occurs in Finland (Åland, Nyland) and the Faeroes. A glabrous seashore race, var. *litoralis* (Hartm.) C. A. West., grows in the Swedish east coast from north Kalmar district up to Hälsingland and also in SW Finland: Åland and Satakunta. The hybrid *M. aquatica* × *arvensis* (*M.* × *verticillata* L.) is known in Sweden up to Dalarna and Ångermanland, from most districts of Denmark and the coast districts of Norway up to Hordaland (one locality also in Sogn); it is also known from Åland and Satakunta in Finland. The Swedish distribution of this extremely variable hybrid thus extends further north than that of *M. aquatica,* and even in their common area it often occurs independently of the parents. It was formerly grown as an odoriferous plant in the province of Småland.

In the same way, forms of the polymorphic hybrid *M.* × *gentilis* L., i.e. *M. arvensis* × *spicata,* have long been grown in Sweden, namely nm. *subspicata* F. Aresch. (also known from Denmark) and nm. *parviflora* Hartm. (also in south Finland and Norway); they are now rare as relicts from cultivation near old habitations. Other forms of this hybrid are nowadays mainly or exclusively weeds (esp. in potato fields): nm. *anderssoniana* (H. Br.) Hyl. (in Sweden), nm. *Arrhenii* (Lindb. fil.) Hyl. (in south Finland and a few places in east Sweden) and nm. *hirtella* Markl. (in Finland), all of which remind of *M. arvensis* by their calyx being hairy even at the base. This is glabrous in nm. *subspicata* and in nm. *verticillata* F. Aresch., which is widespread in south Sweden and also occurs in Denmark and the coast districts of Norway; it grows mainly as a weed but sometimes as a neophyte along rivulets etc. In nm. *parviflora* the flowers are very small and totally asexual, in the other nothomorphs mentioned the flowers are female. The nm. *submascula* (Neum.) Hyl., known only from Gotland, deviates by bisexual flowers. From this province there are also two collections which seem to be *M.* × *smithiana* R. E. Grah., i.e. *M. aquatica* × *arvensis* × *spicata.*

The other parent species of *M.* × *gentilis, M. spicata* L., is nowadays naturalized in many parts of Denmark and south Sweden (up to Västergötland and Östergötland) and has been found as a casual further north in Sweden (Stock-

holm, Medelpad) and Norway but is certainly everywhere an escape from former cultivation; it occurs as "wild" mainly in ruderal places, along roads etc. On the other hand, *M. longifolia* L., which also may be found in such localities, grows in Denmark and south Sweden, esp. in lime districts, seemingly indigenous in damp places, such as borders of streams and rivulets — in Sweden mainly as var. *latissima* Hartm., a broad-leaved ♀ form. In Denmark a spontaneous hybrid with *M. aquatica* has been found. The hybrid *M. arvensis* × *longifolia, M.* × *dalmatica* Tausch, is known from numerous localities in SE Finland in form of one clone, nm. *fennica* Hyl., which was grown in the same way as *M.* × *gentilis* and now remains near habitations. The third species of the *Spicatae* group, *M. rotundifolia* (L.) Huds., has been found as a casual (partly introduced with ballast) in Sweden, Norway and Finland but occurs as an escape from earlier cultivation and partly naturalized in moist places in Denmark and Skåne, the southermost province of Sweden. Its hybrid with *M. longifolia* has been found in a few places in Sweden as casually introduced.

The subgenus *Pulegium* is only represented by casual occurrences of *M. pulegium* L., which has been found near Copenhagen and Helsingfors (Helsinki) and in several years near Göteborg (Gothenburg). It was formerly officinal and sometimes grown for medicinal purposes like *M.* × *piperita* L. and *M. spicata* var. *crispa* (Bth.) Mansf., which have also been found rarely as escapes in ruderal places in Sweden.

For further information on the *M. gentilis* and *dalmatica* complexes see HYLANDER 1941 and MARKLUND 1963, on *M. aquatica* and *M. aquatica* × *arvensis* HÅRD 1955.

Litteratur

Arbeten som endast anföras i de nomenklatoriska avsnitten, äro ej upptagna i nedanstående förteckning; de återfinnas med få undantag hos HYL. 1941 o. 1945.

H. FRIES 1945. Göteborgs och Bohus läns fanerogamer och ormbunkar. — Göteborg.

HULT[ÉN, E.] 1950. Atlas över växternas utbredning i Norden. — Stockholm.

HYL[ANDER, N.] 1941. De svenska formerna av Mentha gentilis L. coll. — Uppsala (=Acta Phytogeogr. Suec. XIV).

— 1945. Nomenklatorische und systematische Studien über nordische Gefässplanzen. — Uppsala (=Uppsala Univers. Årsskrift 1945: 7).

HÅRD [AV SEGERSTAD, F.] 1955. Ett par myntors historia i Sverige. — Göteborg (=Göteb. Kungl. Vet. o. Vitt.-Samh. Handl. 6 följden. Ser. B. Bd 6. N:o 11).

MARKLUND, [G.] 1963. Mentha gentilis-komplexet och M. dalmatica i Östfennoskandien. — Mem. Soc. pro Fauna et Fl. Fenn. 38, 1961—1962. Helsinki — Helsingfors.

SONCK, [C. E.] 1964. Die Gefässpflanzenflora von Pielisjärvi und Lieksa, Nordkarelien. — Helsinki — Helsingfors (=Acta Bot. Fenn. 67).

BOTANISKA NOTISER 1965 · VOL. 118 · FASC. 2 · LUND

Chromosome Studies in Eleocharis, Subser. Palustres

IV. A Possible Case of an Extra, Reductional Division Giving Rise to Hemi-haploid Pollen Nuclei

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(Received May 12th, 1965)

I. Introduction

1. Normal Meiosis and Pollen Development

It may be appropriate as an introduction to recapitulate the principal features of meiosis (cf. STRANDHEDE 1965 a) and pollen mitosis (cf. STRANDHEDE 1965 b) in *Eleocharis*.

The first meiotic division is, from a cytological viewpoint equational. The metaphasic associations pass quite regularly to the poles. The second division is cytologically reductional, and it is here that irregularities become observable if present. After a short interphase, one tetrad nucleus passes into first pollen mitosis, while the other three tetrad nuclei degenerate. The resulting pseudomonad thus has three abortive nuclei and one viable nucleus. At the time of first pollen mitosis, cell membranes may be observed between the tetrad nuclei.

The generative nucleus of the pollen grain undergoes yet another division before shedding, the second pollen division, and a normal pollen grain thus has a total of six nuclei: three degenerate tetrad nuclei, which often almost disappear, one large, but often diffuse, vegetative nucleus, and two small, lens-shaped, sperm nuclei.

2. Material and Methods

The plant discussed below belongs to *Eleocharis palustris* (L.) R. & S. ssp. *palustris* (cf. STRANDHEDE 1960) and was collected in Morastrand,

Dalarna, Sweden, in a shallow pool beside the road near Grophus (plant no. 069901). The somatic chromosome number is 2n=16 (4 L+12 M-S) and thus quite normal. The 16 chromosome taxa within *Palustres* seem to be tetraploid, being secondarily obtained from the basic number X=5 by chromosome fusions (cf. STRANDHEDE 1965 c).

Squash preparations were made in 1958 of immature anthers of the plant discussed. These reveal strange irregularities in the pollen formation in that year, which have not, however, been observed in preparations made later. Although it has thus been impossible to complete the observations, a report on the conditions observed, which seem to be rather unique, should be of some theoretical interest.

The cytological technique used has previously been presented (STRANDHEDE 1965 a, b, c). Young spikes are fixed in a Carnoy solution (3:1), and the anthers are then squashed and stained in acetocarmine.

II. Observations

1. Deviating Pollen Formation

In addition to conditions which fall within the variation in the common, cytological appearance of *Palustres,* a quite deviating type of pollen grain is frequently observed in preparations from this plant. According to meiotic principles, there should be 4 tetrad nuclei at interphase after the second meiotic division, but many pollen grains of this plant have 8 nuclei at this stage (fig. 1 a). The density and structure vary between the nuclei.

One of the "octad" nuclei usually passes into a mitosis with 4 chromosomes (fig. 1 b), viz., half the normal number of n=8. 3 or 5 chromosomes may rarely be observed in metaphases of this division (cf. figs. 1 d and e). During the mitosis, seven nuclei normally remain undivided, most commonly gathering in the proximal (apical) part of the pollen grain (figs. 1 b, d, e, and f).

Single pollen grains have only 6 observable resting nuclei during the mitosis, but this number is not quite definite, as two adjacent nuclei may possibly be mistaken of only one (cf. fig. 1 f). Mitosis may, however, occasionally take place contemporarily in two of the "octad" nuclei (cf. figs. 1 a and c), in which case the number of undivided nuclei is actually six.

No other chromosome numbers have been found in this type of deviating pollen apart from those mentioned. The anaphase (fig. 1 f) is

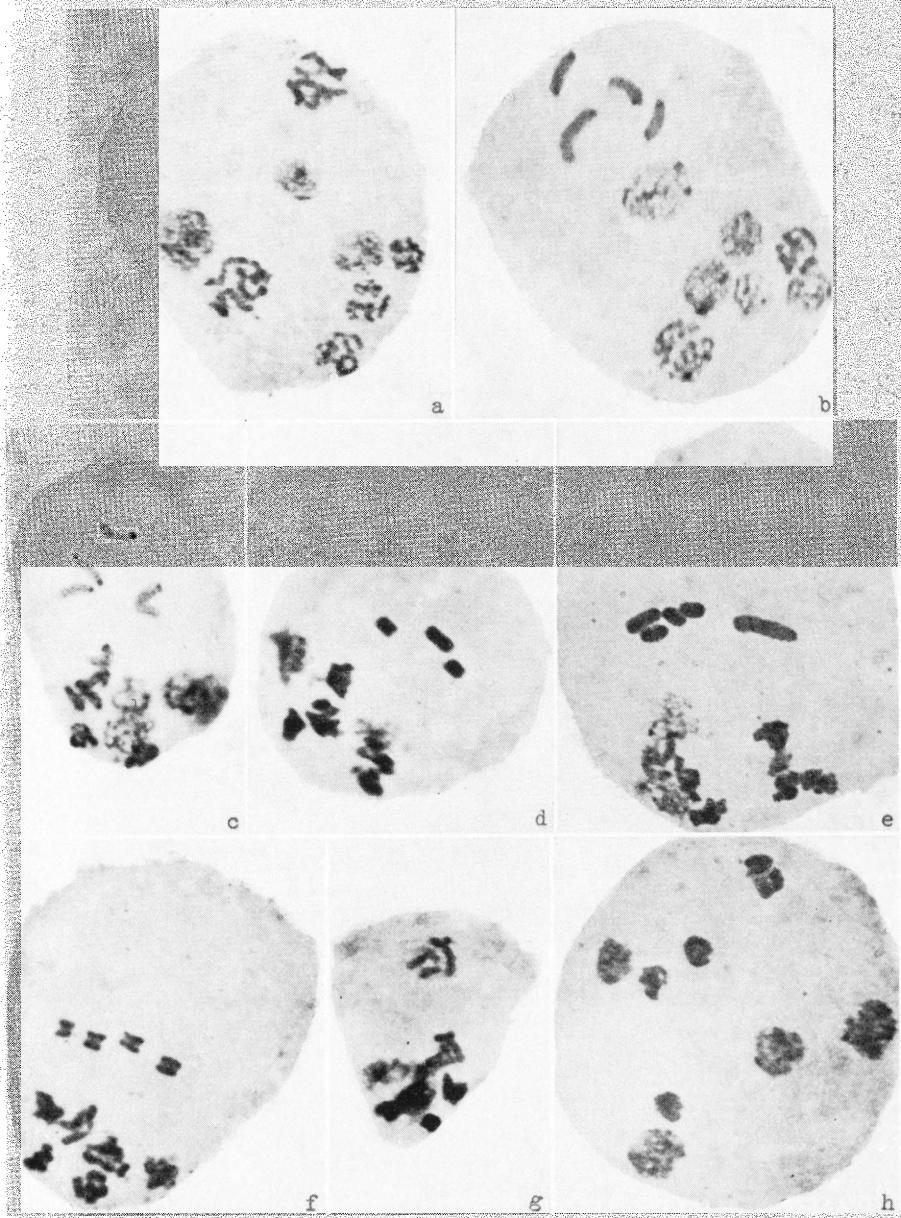


Fig. 1. Hemi-haploid pollen grains. — *a*: An "octad" with two nuclei in beginning first pollen mitosis. — *b*—*e*: First pollen metaphase. — *b*: 4 metaphasic chromosomes (1 L+3 M-S), the common hemi-haploid number, and seven degenerating nuclei. — *c*: Two "octad" nuclei developed into metaphase. — *d*—*e*: The rarely occurring chromosome numbers 3, respectively 5 at metaphase. — *f*: First pollen anaphase. — *g*: First pollen telophase. — *h*: Interphase between first and second pollen mitosis with 9 nuclei extremely dispersed in the whole pollen grain. (×c. 850)

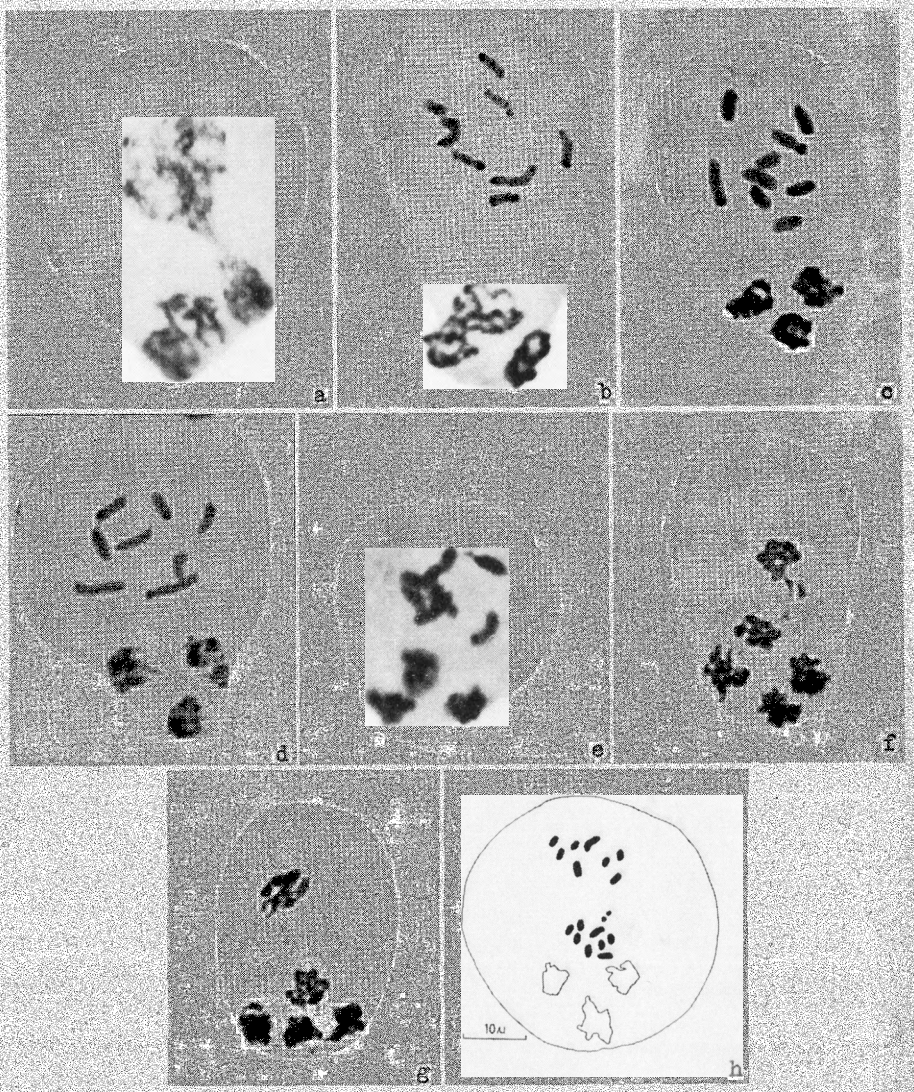


Fig. 2. *a*: Interphase with a dumb-bell formed nucleus after irregular second meiotic division. — *b*—*e*: First pollen metaphases. — *b*: n=8; *c*: n=9. — *d*—*e*: Chromatic extensions and connections because of stickiness. — *f*—*h*: Mitotic irregularities during first pollen telophase (fig. *h* is drawing). (×c. 850)

regular, and the 4 chromosomes pass to the poles (fig. 1 g). Pollen grains of this type have 9 nuclei after this mitosis (fig. 1 h).

In one of the preparations from 1958, many aborting pollen grains are present. Other pollen preparations have been made from the same

plant but not until two years after the squash preparations discussed. The pollen was quite normal at that time, and no deviating pollen mitoses were observed.

2. A Few Notable Observations on Normal Pollen Grains of the Plant

Meiosis was unfortunately unavailable for direct study, but the results of meiotic irregularities are obvious in many tetrads. In some cases, meiosis seems to be so disorientated that the second division fails completely. A dumb-bell formed restitution nucleus is shown in fig. 2 a as an example. Quite normal tetrads are also noted in the preparations, and many first pollen mitoses are quite normal with n=8 (fig. 2 b). A few pollen mitoses with one or a few supernumerary chromosomes are also observed (fig. 2 c). Fragments occur in single pollen mitoses, and a somewhat sticky appearance is observed in a few metaphases (figs. 2 d and e).

The anaphase passes regularly in most cases but, in a very few mitoses, fragments lag during anaphase and telophase (figs. 2 f, g and h).

III. Discussion

1. Deviating Pollen Formation

The results of meiotic irregularities are obvious within the preparations though meiosis has not been available for direct study in this plant. The dumb-bell shaped restitution nucleus in fig. 2 a shows one result of severe meiotic irregularities during the second division. Such meiotic irregularities seem not, however, to be responsible for the occurrence of 8 nuclei at the tetrad stage observed in several pollen mother cells. The "octad" is probably produced by an additional division of the tetrad.

The occurrence of 8 nuclei at the interphase after the tetrad stage is reminiscent of a phenomenon described by JOHNSSON (1944) in the diploid species *Alopecurus myosuroides* (n=7). He calls it polymitosis in accordance with BEADLE who had previously described similar behaviour in maize. In *Alopecurus* the meiosis is normal, but after an exceedingly short resting stage the chromosomes are reorganized into a metaphasic plate. No pairing or longitudinal division occurs, but the chromosomes separate at random during anaphase. The result is an octad in which the nuclei have 1—7 chromosomes with a mode at 3—4

chromosomes. Whether this extra division is to be regarded as a premature pollen mitosis after an abnormally shortened resting stage, or as a double meiosis, is a matter for discussion. It is of interest that RESENDE has advanced the opinion that chromonemata do not divide during the second meiotic division (ref. in RESENDE 1956). In that case, an additional second meiotic division in diploids could perhaps give rise to chromosome numbers like those found in *Alopecurus*.

It is a well-known fact that three of the four tetrad nuclei become abortive in *Eleocharis* and other genera of *Cyperaceae*. These nuclei are usually found in the proximal part of the pollen grains. The additional division of the tetrad, resulting in 8 nuclei in the plant under observation, may rarely give rise to a tendency for mitosis in two nuclei (figs. 1 a and c), and the six undivided nuclei may seem to correspond directly to the three degenerating nuclei of the normal tetrad. As previously pointed out (STRANDHEDE 1965 b), however, a complete mitosis has never been observed in the abortive, proximal nuclei of *E. palustris*. These nuclei may reach a stage simulating metaphase during pollen mitosis but do not divide. It thus seems most improbable that the "octad" is produced by a simple mitosis of the tetrad nuclei. Very special conditions seem to be prevailing during the additional division of the tetrad nuclei, as such "octad" nuclei which pass into the subsequent mitotic metaphase stage have half the haploid, or "hemihaploid", chromosome number of 4. A mitotic division of the tetrad nuclei would not lead to such an additional reduction of the chromosome number.

Seven of the "octad" nuclei usually behave quite similarly to the three abortive tetrad nuclei of the normal pollen grains. They normally gather in the proximal part of the pollen grains. Less frequently, they are dispersed as in fig. 1 h, but the same thing may also occur in the pollen grains of quite regular and normal plants. One "octad" nucleus passes into a mitosis that in all details corresponds to a first pollen mitosis (cf. figs. 1 and 2). It is also notable that, sporadically, a second "octad" nucleus passes into a metaphase (fig. 1 c) as if, at the "octad" stage, a certain after-effect remains in two (daughter?) nuclei of the special physiological conditions, which normally cause one of the tetrad nuclei to undergo first pollen mitosis.

There are similarities between the cases reported in *Alopecurus* and *Eleocharis,* but there are also important differences. In *Eleocharis,* the "octad" stage is the earliest stage observed, and no nuclei have been seen in which the chromosome number is extremely small or high as

in *Alopecurus*. The normal condition is that 4 chromosomes are found, seldom 5 or 3. No chromosome numbers between n=5 and n=8, or below n=3 have been observed. The rarely occurring mitoses with n=3 or n=5 may probably be explained by a restricted affinity between the chromosomes of the tetrad nuclei (cf. below), but this fluctuation is also a parallel to the normal conditions in ssp. *palustris,* where single subnumerary and supernumerary chromosomes occur sporadically at first pollen mitosis of otherwise quite regular plants. One of the 4 chromosomes is often long (L), the other 3 chromosomes are shorter (M-S), and the hemi-haploid karyotype (1 L+3 M-S) (fig. 16) is similar to half the normal karyotype of *E. palustris* ssp. *palustris* (2 L+6 M-S) (cf. STRANDHEDE 1965 c).

As previously discussed (STRANDHEDE 1965 c), the chromosome number 2n=16 may be regarded as tetraploid. As no multivalents are normally found at the meiotic metaphase, no signs of autopolyploidy remain. It seems, however, conceivable that the 8 chromosomes of haplophase should be able to pair with each other, giving the extra division found in the plant discussed the character of an additional reduction division, during which the two basal genomes of the haplophase of the stabilized tetraploid cytotype segregate. Such haploid pairing may be possible between the basal genomes of old polyploids because of a residual homology which is normally hidden because of the differential homology between the recent, differentiated genomes of the diploidized polyploid. A residual homology between the two genomes on which the recent haplophase of *E. palustris* ssp. *palustris* is based may explain the regularity of the hemi-haploid chromosome number found. In *Alopecurus*, on the other hand, no such regularity occurs, but all chromosome numbers between n=1 and n=7 are found (JOHNSSON 1944). This may perhaps be explained by a lack of residual homology because the basic number of *Alopecurus* coincides with the chromosome number of the haplophase (X=n=7).

From a cytological viewpoint, the second meiotic divison in plants with localized centromeres is mitotic, or equational. In *Eleocharis,* however, the second meiotic division is reductional, while the first division is equational (STRANDHEDE 1965 a). These pecularities may be another reason for the differences observed between *Alopecurus* and the plant of *Eleocharis* under discussion. In *Eleocharis* homologues are paired until the second meiotic division during which they segregate. If this division is repeated for certain, unknown, exceptional reasons, a new pairing may occur because of the residual homology discussed above.

Still another condition is observed in *Eleocharis* which may facilitate such additional pairing in a stage where no pairing normally occurs. It is the notable tendency for somatic pairing observed (cf. STRANDHEDE 1965 c).

After the hemi-haploid mitosis discussed, corresponding to first pollen mitosis of normal pollen grains, the deviating pollen grains have 9 nuclei: seven of them correspond to the normal three, degenerate nuclei, and of the other two nuclei, one is the generative nucleus and the other one the vegetative nucleus of the hemi-haploid pollen grain. Normal pollen grains have 5 nuclei at this stage (cf. STRANDHEDE 1965 b).

MARTENS (1939) has reported supernumerary nuclei in pollen grains of *Carex picta*. These pollen grains have two vegetative nuclei, two generative nuclei, and they germinate with two tubes. This type of twin pollen grain does not seem to have any similarity to the present case of *Eleocharis*.

Pollen grains that have only half the normal genome should be lethal, which is probably the case as many empty pollen grains have been observed in the preparations made in 1958. Two years later, however, the pollen grains of the plant were quite normal and morphologically well developed. A probable explanation is that the aberrant spike from which the preparations were made in 1958 was quite unique. All later attempts to complete the observations discussed here have proved fruitless.

2. Normal Pollen Formation in the Plant Discussed

The cytological behaviour of the plant discussed is heterogeneous. Cytologically normal as well as deviating pollen mother cells are found within one and the same anther. A treatise on the normal, cytological conditions within *E. palustris* ssp. *palustris* has recently been published (STRANDHEDE 1965 c). These conditions will not be discussed again here, but a few notable observations in this plant will be mentioned though they are obviously independent of the curious hemi-haploid pollen mitoses discussed.

The first observation deserving comment is the sticky appearance of several chromosomes at first pollen mitosis. The sticky appearance of the chromosomes of *Eleocharis* and other genera with "diffuse" centromeres has been observed by several cytologists (cf. STRANDHEDE 1965 c). Under certain circumstances, as in figs. 2 d and 2 e, this sticki-

ness may be similar in appearance to small satellites. Satellites have not been found with any certainty by the author, but TANAKA (1942), HÅKANSSON (1954), BERNARDINI (1959), and others have reported satellites in *Palustres*.

Another observation is the sporadic occurrence of fragments that have a tendency to lag during anaphase of first pollen mitosis. Such lagging may have several causes. One may be a persisting stickiness of the kind just discussed. Another possibility is the occurrence of difficulties during the longitudinal division of such mitotic fragments. Very rarely, similar mitotic irregularities have been observed both in first pollen mitoses and in root mitoses when small fragments occur in otherwise normal samples of *Palustres*. One explanation, supported by observations on other strains within *Palustres,* is that the centromeric activity is restricted in small fragments. The observations support the idea that the centromeric activity is not quite uniform along the whole chromosomes but restricted to special points or parts along the chromosomes (cf. STRANDHEDE 1965 a, c).

IV. Conclusions

As no stages prior to the "octad" stage were available for study, the conclusions drawn must be hypothetical in several respects, and no definite explanation of the cytological phenomenon of plant 069901 can be given. A possible explanation is the occurrence of an additional division during meiosis with reductional effect, resulting in an octad instead of the normal tetrad and a hemi-haploid chromosome number at first pollen mitosis.

As mentioned above, JOHNSSON has described a similar case in *Alopecurus myosuroides,* but hemi-haploid chromosome numbers do not occur as regularly in that genus as in *Eleocharis*. In spite of this, it seems possible to explain that case and the present one in *Eleocharis* in the same way. The strong variation in chromosome number of the "octad" nuclei of *Alopecurus* is possibly caused by lack of homology between the chromosomes of the haplophase, viz., the chromosome number of the haplophase is the same as the basic number (n=X). The pronounced regular hemi-haploid chromosome numbers found in the *Eleocharis* plant, on the other hand, may be a result of a residual homology causing pairing between the two basic genomes found in the haplophase of the old tetraploid taxon *E. palustris* ssp. *palustris* with

2n=16 (cf. STRANDHEDE 1965 c), viz., n=2X. The regularity during this additional division in *Eleocharis* is probably supported by the normal course of cytological post-reduction during meiosis and perhaps also by the tendency for somatic pairing observed.

Though less probable in the present case, pairing should also be possible because of a partial, haploid homology between chromosomes as a result of certain chromosomal mutations such as reduplications of homologous segments (DARLINGTON 1937). If such a sectional meiotic pairing is established it may also be continued between non-homologous sections as shown in meiotic prophases of structural hybrids of maize (MCCLINTOCK 1933).

Summary

The aim of the paper is to demonstrate and discuss the occurrence of pollen grains with an "octad" instead of a tetrad stage in a plant of *Eleocharis palustris* ssp. *palustris* in 1958. The first pollen mitosis has half the haploid (hemihaploid) chromosome number and, instead of three abortive tetrad nuclei, these deviating pollen grains have seven degenerating nuclei during first pollen mitosis.

The author suggests that an abnormal meiotic course, consisting of three divisions, two of which are reductional, may result in the conditions observed. The 8 chromosomes of the normal haplophase seem to be capable of pairing with each other because of a residual homology between the two basal genomes which are included in the recent normal haplophase.

(Stickiness of chromosomes and irregular anaphasic movements of small mitotic fragments are briefly discussed.)

Literature cited

BERNARDINI, J. V. 1959. Studies of the kinetochore in Eleocharis macrostachya Britt. — Proc. Minnesota Acad. Sc. 27: 104—114.

DARLINGTON, C. D. 1937. Recent advances in cytology. Ed. II. London.

HÅKANSSON, A. 1954. Meiosis and pollen mitosis in X-rayed and untreated spikelets of Eleocharis palustris. — Hereditas 40: 325—345.

JOHNSSON, H. 1944. Meiotic aberrations and sterility in Alopecurus myosuroides Huds. — Hereditas 30: 469—566.

MARTENS, J. L. 1939. Some observations on sexual dimorphism in Carex picta. — Amer. Jour. Bot. 26: 78—88.

MCCLINTOCK, B. 1933. The association of non-homologous parts of chromosomes in the mid-prophase of meiosis in Zea Mays. — Zeits. Zellf. u. mikr. Anat. 19: 191—237.

RESENDE, F. 1956. Endomitose e exomitose. — Revista Biol. 1: 93—95.

STRANDHEDE, S. O. 1960. A note on Scirpus palustris L. — Bot. Not. 113: 161—171.
— 1965 a. Chromosome studies in Eleocharis, subser. Palustres. I. Meiosis in some forms with 15 chromosomes. — Hereditas 53: 47—62.
— 1965 b. Chromosome studies in Eleocharis, subser. Palustres. II. Pollen mitosis with special reference to some strains with 15 chromosomes, and formation of secondarily unreduced pollen grains. — Ibid. 53 (in press).
— 1965 c. Chromosome studies in Eleocharis, subser. Palustres. III. Observations on western European taxa. — Opera Bot. 9: 2, 86 p. (in press).
TANAKA, N. 1942. Chromosome studies in Cyperaceae, XVII. Chromosome numbers in the genus Heleocharis and allied genera. — Med. & Biol. 2: 96—100.

BOTANISKA NOTISER 1965 · VOL. 118 · FASC. 2 · LUND

Physiological and Genetical Effects on Seed of Soft X-rays Used for Radiography

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Introduction

For determining seed quality by radiography, the material is exposed to soft x-rays. The dose given is small, but in cases where the seed is to be used for further experiments, it is important to know, if the irradiation has produced any physiological or genetical effects. The results of other radiation studies can only be of limited importance here, as the effects of irradiation vary with a number of factors, e.g., radiation quality, moisture content of seed, degree of seed ripeness, temperature, etc. (cf. GUSTAFSSON & SIMAK 1958). The present investigation was undertaken to study the effect of soft x-rays with the same equipment and under the same conditions as are usually used by us for seed radiography.

Material

Three samples, one each of Scots pine (*Pinus silvestris* L.), Norway spruce (*Picea abies* L.) and celery (*Apium graveolens* L.), were used for the experiment. The details of the samples are given in table 1.

For the present study it was necessary to use fresh and homogeneous material. This was obtained in the case of pine and spruce by radiographying freshly collected samples and selecting only such seed, as had fully developed embryo and endosperm (cf. fig. 1 b, class IV A, GUSTAFSSON & SIMAK 1956). For celery, no similar classification of embryo types with the help of x-ray radiography is available. However, it is possible by this method to distinguish between empty and filled seed (cf. fig. 1 a). The empty seed was mostly shrivelled and, consequently, the latter was removed from the sample by microscopical examination and only the rest was used for the experiment.

[1] Visiting scientist.

Table 1

Species	Locality	Latitude	Altitude in metres	Year of collection
Pinus silvestris	Södermanland	59° 3′	55	1964
Picea abies	Småland	57° 32′	260	1964
Apium graveolens	Commercial sample obtained from State Seed Testing Station, Solna			1964

Methods

Seed was irradiated with soft x-rays from the same equipment as used for radiography (KAMRA 1964). The conditions of exposure were: kV=14, mA=10, focus=25 cm, and time=3, 6, 12, 24, 48, 96, 400 and 800 seconds. (These values also include the exposure of 3 seconds used for taking radiographs in order to select the material.) After irradiation, the seed was put for germination immediately. As control non-irradiated seed (O) was used. In order to make this series comparable with the material selected radiographically in the irradiated series, empty and insect-damaged seed was removed from the control samples of pine and spruce by macroscopical examination as far as possible. Moreover, at the end of the germination period, all ungerminated seed was dissected out and examined. In this way, the exact number of filled seed was determined. This procedure was, naturally, unnecessary in the case of celery, as here the shrivelled (empty) seed had already been removed from the entire sample.

The dose rate of the x-ray apparatus used was determined by Mr. AHNSTRÖM of the Biochemical Institute of the University of Stockholm, with the method of ionisation chambers specially constructed for measuring low-kilovolt radiation. The measurement showed the x-ray dose to be of the order of 1,95 R per second (±7 %).

Water content of the samples was determined at the time of irradiation by drying seed for 16 hours at 105°C and it gave the following values:

Pine=4.8 %. Spruce=4.6 %. Celery=5.3 %

Physiological effects of irradiation: The physiological effects were studied on the germination percentage and the germination rate of the different series. The germinated seeds were counted every day beginning with the 4th day. For pine and spruce a seed was considered as germinated, when the length of the root was equal to the length of the seed itself; in celery, when the length of the root was three times that of the seed.

Germination test was performed on JACOBSEN apparatus under the following conditions:

(a) For pine and spruce:
Temperature=20°C constant.
Light=1000 Lux (continuous).
Number of seeds germinated=4×50.
Period of germination=30 days.

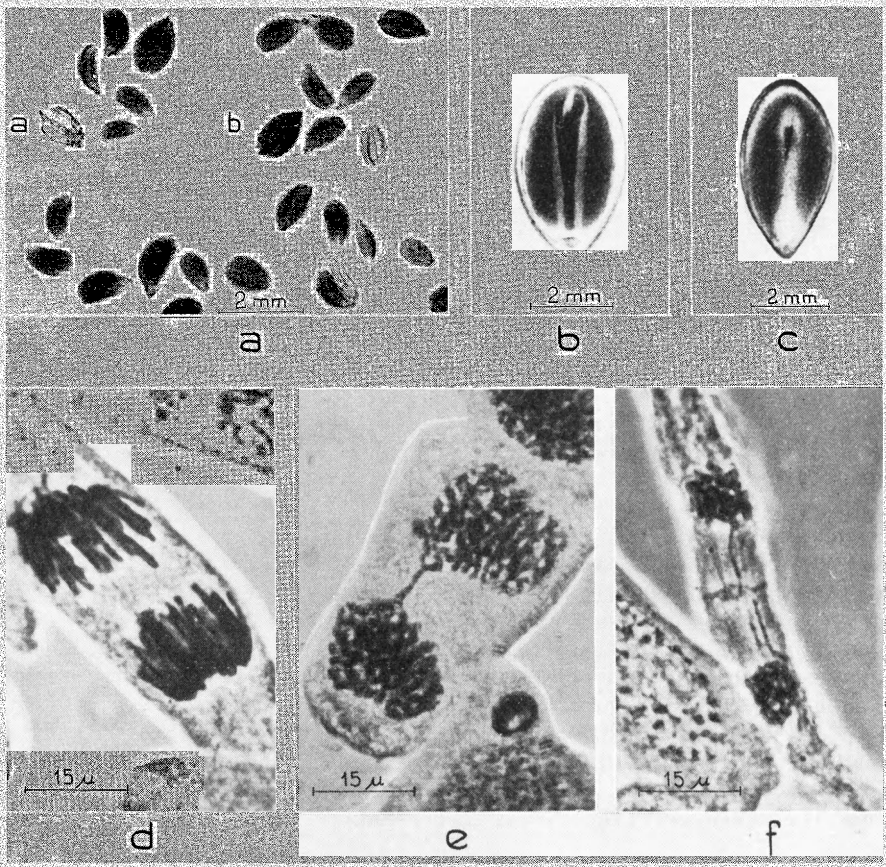


Fig. 1. a: X-ray radiograph of celery seed. (a. empty. b. filled seed.) — b: Fully developed seed (class IV A). — c: Seed with incompletely developed embryo. (Seed types b. and c. are valid both for pine and spruce.) — d: Normal cell division in pine. — e: Note simple bridge and micronucleus in pine. — f: Chromosome bridge in spruce.

(b) For celery:

Pretreatment = Germination substratum moistened with 0.2 % KNO_3.
Temperature = Alternate, 20°C for 16 hours, 30°C for 8 hours.
Light = 1000 Lux (given for 8 hours when temperature was 30°C).
Number of seeds germinated = 4 × 50.
Period of germination = 21 days.

Genetical effects of irradiation: Cytological investigations on the root tips of seedlings were undertaken in order to study the genetical effects. The cytological analysis was carried out in all the three species on such seedlings in which the length of the root was almost equal to that of the seed and

which grew on the day when the germination culminated. The material was fixed in CARNOY's solution (3 parts of absolute alcohol and 1 part of acetic acid) and hydrolysed in equal parts of absolute alcohol and conc. hydrochloric acid. Squashing was done in 2 % orcein. Anaphase and telophase were investigated in order to find out, if bridges and in connection with them any fragments existed. Even the micronuclei in the telophase and interphase were looked for.

Results

(i) Physiological effects of irradiation with soft x-rays

(a) Germination percentage:

The irradiation had no effect on the final percentage of germination in all the three species, as will be seen from the following table.

Table 2

Period of irradiation in seconds	R-Dose 1.95 R/sec (± 7 %)	Germination percentage		
		Picea abies after 30 days	*Pinus silvestris* after 30 days	*Apium graveolens* after 21 days
0	0	99	100	75
3	5.8	99	99	74
6	11.7	99	100	80
12	23.4	100	100	71
24	46.8	100	100	72
48	93.6	100	100	74
96	187.2	99	100	78
400	780.0	99	99	80
800	1560.0	100	100	72

(b) Rate of germination:

The curves for the rate of germination of the irradiated series of each species were very close, so that the differences were not easy to make out. In view of this, three characteristic points were chosen from the germination curves in order to get an idea of the germination rate. These points were as follows:

1) The day on which the germination in the control series culminated. It was the 7th day for spruce and celery, and the 5th day for pine.
2) Three days after the culmination of germination (10th and 8th day respectively).
3) The 21st day.

Spruce: As will be seen from the curve for the 7th day (fig. 2), short periods of irradiation (3—24 seconds) showed a stimulative effect; the difference between the germination value of the control and that

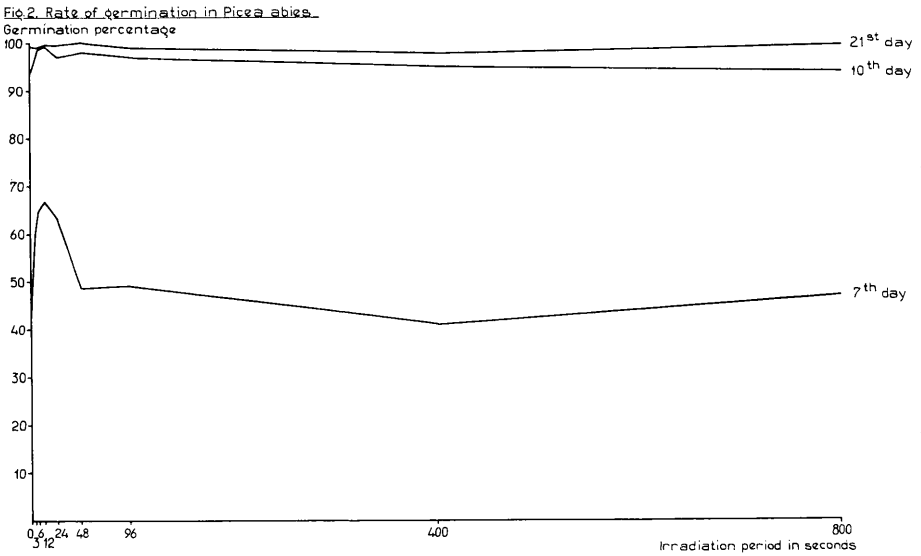


Fig. 2.

of the series with 12 seconds of irradiation being more than 20 % (maximum stimulation). After this, the curve falls, at first very rapidly up to 48 seconds of irradiation and later very slowly. The low value of germination for 400 seconds of irradiation is to be considered insignificant, because of the large variation among the replicates of 400 seconds series. Even with the longest irradiation period (800 seconds), the germination percentage was about the same as that of the control.

Already three days later (10th day), the stimulative and delaying effects had disappeared. After 21 days, the germination percentages in all the series practically reached the maximum.

Pine: The curve for the 5th day (fig. 3) shows a constant fall in germination with increasing time of irradiation except for a weak favourable effect after 3 seconds of exposure. The value of germination in the case of 800 seconds of irradiation is about 45 % less than that of the control. The curves for 8 and 21 days do not show any stimulation or delay in germination.

Celery: This species has a very irregular germination with large variations among replicates (cf. fig. 4). No clear differences in the germination rates of the various series are shown by the curves for 7, 10 and 21 days.

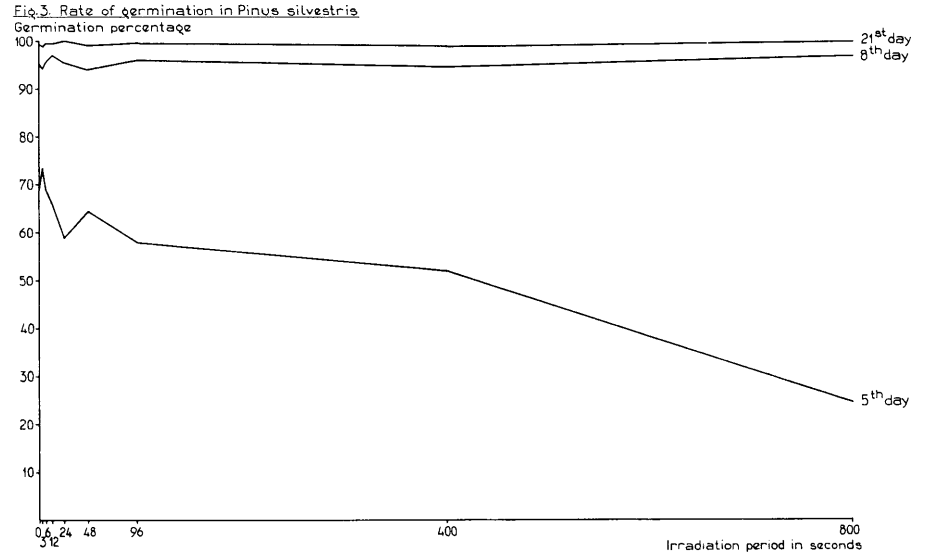

Fig.3. Rate of germination in Pinus silvestris
Germination percentage
100
90
80
70
60
50
40
30
20
10
21st day
8th day
5th day
0,6
3
12
24
48
96
400
800
Irradiation period in seconds

Fig. 3.

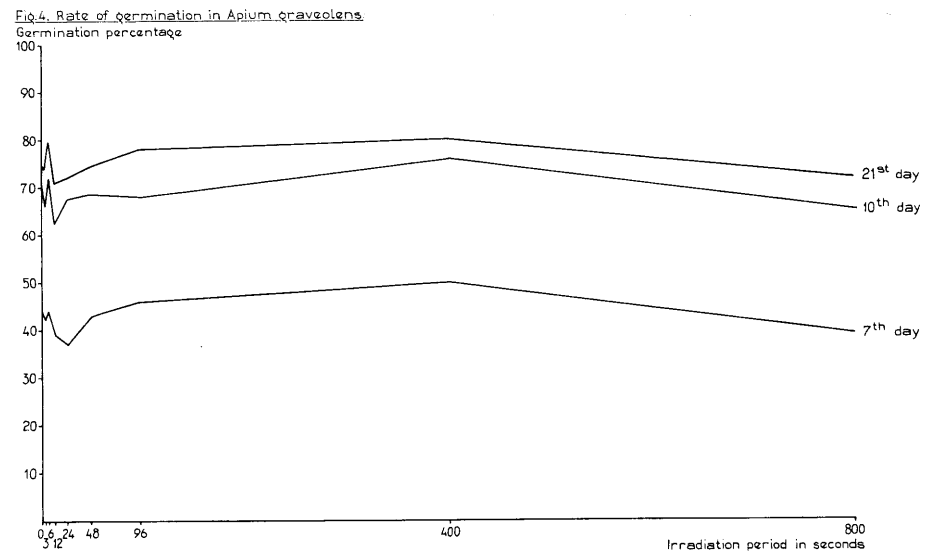

Fig.4. Rate of germination in Apium graveolens
Germination percentage
100
90
80
70
60
50
40
30
20
10
21st day
10th day
7th day
0,6
3
12
24
48
96
400
800
Irradiation period in seconds

Fig. 4.

(ii) Genetical effects of irradiation with soft x-rays

Cytological analyses showed different results for the three species. Investigations were carried out on 10 seeds of each irradiation series and on an average 30 plates/seed were studied. The results (fig. 5) show that in spruce and pine disturbances in cell division occur already with short irradiation periods. In spruce even the presence of a spontaneous chromosome aberration (one bridge in one seed out of 30 plates analysed) was observed. In celery, there was no irregularity in cell-division noticeable even with the longest period of irradiation.

Discussion

From the forestry plants pine and spruce were selected as the experimental material in view of the fact that their seed has been extensively studied by x-ray radiography. Celery was chosen as a representative of the agricultural plants.

The commonly used time of exposure for the radiography of several species of seed is about 2—3 seconds, depending upon such factors as the structure of the seed, type of film, the adjustments of the x-ray machine, etc. The adjustment of the machine in our usual work is at kV=14, mA=10 and focus=25 cm. An exposure of 2—3 seconds under these conditions corresponds to a dose of 3.90 to 5.85 R (±7 %). However, in the present investigation such a long exposure time as 800 seconds (=1560 R) was used, in order to have a very safe margin for the judgement of the effects of x-rays on the radiographed seed.

No effect on germination percentage was observed in all the three species even with the longest irradiation period (800 seconds). This would mean that the commonly used exposure time for radiography (2—3 seconds) can be increased at least a hundred times without damaging the germination value of the investigated seed.

The rate of germination did not show any distinct delay in spruce and celery. In the case of pine, a delay in the rate of germination was observed clearly on the 5th day with 800 seconds of irradiation. Already 3 days later this effect practically disappeared. However, from these results it should not be generalized that pine seed is more sensitive than that of spruce. Earlier investigations pointed out that there can be differences in the radiation sensitivity between populations of a species (OHBA & SIMAK 1961) and among the individuals of a population (SIMAK et al. 1961). Moreover, the pine seed collected during 1964

Fig. 5. Cytological analysis on roots of germinated seed.

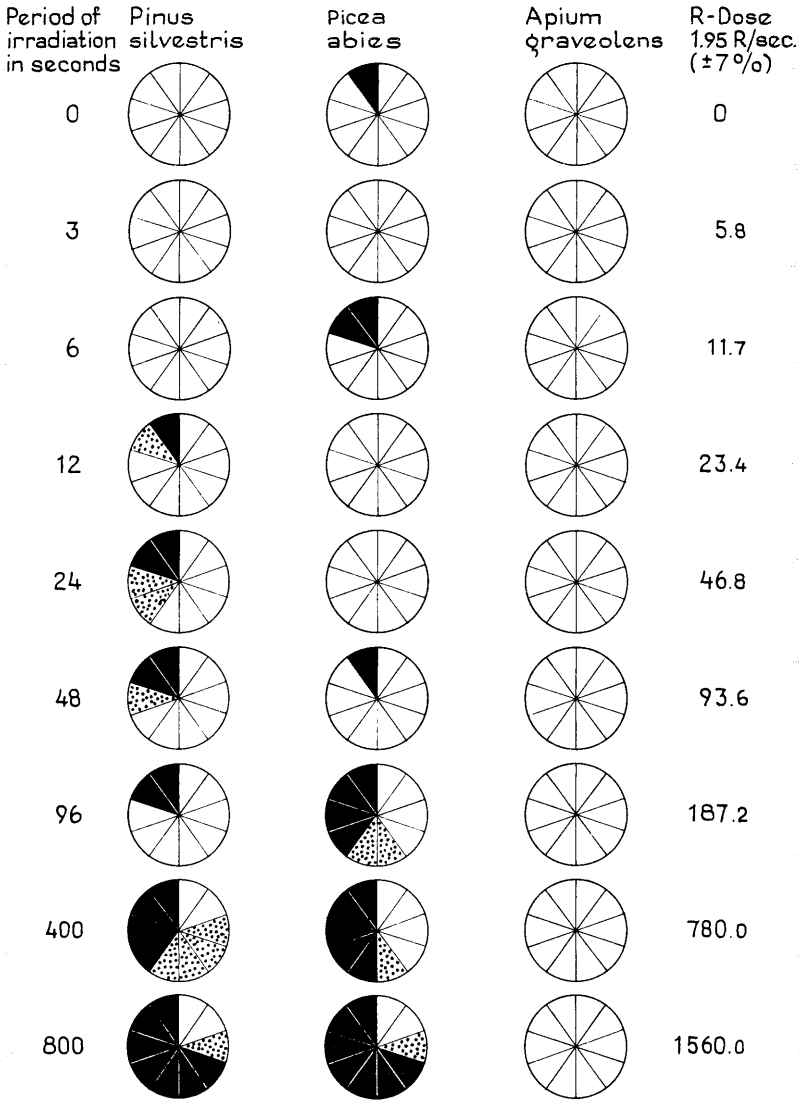


Fig. 5. Each section in the circle represents one analysed seed.
White: Seed with normal cell division only.
Dark: Seed with at least one abnormal cell division (chromosome bridge).
Dotted: Seed with normal cell division but with micro-nuclei.

was in general of poor anatomical and physiological development and its radiation sensitivity can be variable.

The purpose of the present investigation was to determine, if short periods of irradiation in the range of those used for radiography have any physiological or genetical effects on seed. For spruce the rate of germination seems to be stimulated with short irradiation up to 12 seconds as is shown by the 7 days curve in fig. 2. It increases continuously from 45 % for the control to 67 % for 12 seconds of irradiation.

The germination value of the control in the case of pine is perhaps lower than could be expected. This is due to the fact that the selection of filled seed in the control sample could not be carried out radiographically for apparent reasons. In view of the poor seed quality in the year of collection, it is probable that some of the seed is filled but the embryo is not fully developed (cf. fig. 1 c). Such seed grows more slowly than that of class IV A. The eventual presence of this incompletely developed seed in the control sample would explain the delay in the germination rate.

Before discussing the results of the cytological investigation, it is necessary to mention an important point about the technique used. The chromosome aberrations should be studied at a specified germination stage. In the present investigation only such seedlings were analysed in which the length of the root was almost equal to that of the seed itself and which grew on the day when the germination culminated in each species. As is well-known the highest frequency of chromosome aberrations occurs just after the cell divisions in the germinating seed start. Later the repair of the radiation damage begins (cf. SOBELS 1963, MERGEN & STRØM JOHANSEN 1964) and after some days of germination the chromosome aberrations may be partially or completely eliminated, which is indicated by the high frequency of micro-nuclei in the cells (cf. fig. 1 e). In view of this, the results given in fig. 5 may be considered as relative for the different series of each species and not as absolute.

The genetical effect of soft x-ray irradiation expressed itself in the frequency of chromosome aberrations. These were, however, of a type with simple bridges (cf. fig. 1 e). In pine the first abnormal cell division was observed after 12 seconds of irradiation, in spruce after 6 seconds and in celery not all. Of special interest are the results of spruce. It is true that the first chromosome aberration was detected with 6 seconds of irradiation, but in the following two series (12 and 24 seconds), none was noted. The real continuous increase in the frequency of aberrations begins with 48 seconds (cf. fig. 5). The presence of chromosome bridges

in two seeds of the 6 seconds series could perhaps be related with the spontaneous chromosome mutation observed in the control.

The differences in the radiation sensitivity of pine and spruce on one hand and celery on the other, which did not show any aberrations, agree with the fact that the conifers in general are more sensitive than the angiosperms. This can be due to the bigger nuclear volume in the conifers (cf. GUSTAFSSON & SIMAK 1958).

Summary and conclusions

The present investigation was undertaken to study the effects of soft x-rays used for radiography of seed. As experimental material seed of *Pinus silvestris, Picea abies* and *Apium graveolens* was used. Although the usual time of exposure for seed radiography is about 2—3 seconds, the study was conducted with 3, 6, 12, 24, 48, 96, 400 and 800 seconds, in order to have a safe margin for the judgement of the effects of irradiation. The seed was irradiated with the same x-ray equipment and under the same conditions of exposure, as are usually used by us for radiography.

It was observed that: (i) Even the longest period of irradiation had no effect on the percentage of germination in all the three species. The germination values were determined after 30 days for pine and spruce and after 21 days for celery seed.

(ii) There was a weak tendency towards the stimulation of germination rate with short periods of irradiation in *Picea* and a delay in it with long exposure in *Pinus,* but no effect on germination rate was observable in *Apium.*

(iii) Already relatively short irradiation produced chromosome aberrations in the mitotic cell divisions of pine and spruce. No chromosome mutation was observed in celery even with the longest exposure.

From the results summarized above, it can be concluded that short exposure to soft x-rays used for seed radiography does not damage the seed as far as germination rate and germination percentage are concerned. The same seed can, hence, be utilized for other studies as well, which is not possible in the case of seed treated with tetrazolium or other methods for determining seed quality.

Genetical damage in the form of chromosome aberrations can arise in seed already with relatively short periods of irradiation. It is, therefore, important to keep this point in view in the genetical experiments. Of course, the degree of damage will vary with the species and the conditions used.

Literature

GUSTAFSSON, Å, & SIMAK, M. 1956. X-ray diagnostics and seed quality in forestry. — Int. Union Forest Res. Organ., 12th Congr., Oxford. Mimeographed, pp. 1—12.

GUSTAFSSON, Å. & SIMAK, M. 1958. Effect of x- and gamma rays on conifer seed. — Medd. Statens Skogsforskningsinst. 48(5): 1—20.

KAMRA, S. K. 1964. The use of x-rays in seed testing. — Proc. Int. Seed Test. Ass., 29 (1): 71—79.

MERGEN, F. & STRØM JOHANSEN, T. 1964. Effect of ionizing radiation on seed germination and seedling growth of Pinus rigida (Mill) — Radiation Botany, 4: 417—427.

OHBA, K. & SIMAK, M. 1961. Effect of x-rays on seeds of Scots pine from different provenances (Pinus silvestris L.) — Silvae Genet., 10 (3): 84—90.

SIMAK, M., OHBA, K. & SUSZKA, B. 1961. Effect of X-irradiation on seeds of different weight from individual trees of Scots pine (Pinus silvestris L.). — Bot. Notiser 114 (3): 300—312.

SOBELS, F. H. 1963. Repair from Genetic Radiation Damage and Differential Radiosensitivity in Germ Cells. — Proc. Int. Symp. Univ. Leiden, Netherlands, Pergamon Press, London.

BOTANISKA NOTISER 1965 · VOL. 118 · FASC. 2 · LUND

Smärre uppsatser och meddelanden

Om en ny inlandslokal för Myosotis baltica Sam.

Denna art påträffades i början av aug. 1964 nära sjön Vikern mellan Råskog och Bengtstorp i Vikers s:n, Nora bergslag, Västmanland. Arten finns inte tidigare uppgiven för vare sig detta landskap eller de båda närliggande, Värmland och Närke.

Myosotis baltica betecknas av HULTÉN (1950) som en för Norden endemisk strandväxt, vars utbredning endast är fragmentariskt känd. För närvarande är arten blott känd från ett fåtal inlandslokaler, de flesta i östra Norge.

På dess ståndort i Viker förekommer arten rikligt på ett några tiotal m^2 stort område i fuktig, lerig, söndertrampad betesmark, samt mindre starkväxande på några närliggande åkrar, som övergivits sedan de försumpats genom att vattenståndet i sjön Vikern genom reglering höjts. Fältskiktet på dessa åkrar saknas mestadels, och bottenskiktet utgöres av en tät matta av mossan *Climacium dendroides*.

Om *Myosotis baltica* sedan gammalt har hemortsrätt i Vikers flora är det svårt att uttala sig om. Men förekomsten är så riklig, att den inte kan betraktas som tillfällig.

Möjligen kan man i analogi med t.ex. vissa *Potamogeton*-arter, som förekommer i bräckt vatten men också i inlandet i sjöar i kalktrakter, anta att samma gäller för en strandväxt som *Myosotis baltica,* då Vikers-lokalen är belägen på urkalkområdet i nämnda socken och lokalen är klart kalkgynnad.

Citerad litteratur

HULTÉN, E. 1950. Atlas över växternas utbredning i Norden. Stockholm.

PER ERIK PERSSON

Veronica praecox All. på Stora Karlsö

Denne sjældne *Veronica*-art er i Norden kun kendt fra Gotland (HYLANDER 1941 i SBT 35, PETTERSSON i Acta Phytogeogr. Suec. 40), Öland (ALBERTSON 1944 i BN, STERNER 1944 i BN), samt med et par fund fra marker i Skåne (MERKER 1959 i BN 112) og på Sjælland (Bot. Tids. 59, s. 78). PETTERSSON fremhæver, at forekomsten på Gotland temmelig sikkert er synantrop og næppe indigen, en opfattelse, der ikke ganske deles af HYLANDER og for Ölands vedkommende af ALBERTSON og STERNER. I maj 1965 fandt jeg den i ret stor

mængde på Stora Karlsö, dels på sydskrænterne af Marmorberget SV for grotten Lilla Förvar, dels på skrænterne ved Lerberget og ned mot Suderslätt. Den voksede her på åben bund med et tyndt muldlag over kalken, iblandet kalkgrus og i selskab med *Sedum album, Sedum acre, Cladonia* sp. og annuelle arter som *Hornungia petraea, Cerastium pumilum, Saxifraga tridactylites, Lithospermum arvense* var. *coerulescens, Draba muralis, Erophila verna, Scleranthus polycarpos* og *Myosotis stricta.* Der har næppe været marker på Stora Karlsö i historisk tid, og der er for mig ingen tvivl om, at man i modsætning til, hvad der er tilfældet for Danmarks vedkommende, kan medregne arten til Sveriges indigene flora. Iøvrigt refereres *Veronica praecox* af PETTERSSON som fundet en gang tidligere på Stora Karlsö.

ANFRED PEDERSEN

Litteratur

T. T. KOZLOWSKI: Water metabolism in plants. — Harper & Row, New York, 1964. xx+227 sidor.

Titeln på denna bok är något förbryllande. Med metabolism brukar man mena ämnesomsättning, men någon sådan behandlas inte i denna bok. Dessutom är det svårt och ganska ointressant att i metaboliskt sammanhang enbart behandla vatten.

Boken behandlar växterna i deras relation till vatten. I de olika kapitlen diskuteras vattenbalans, osmotiska förhållanden i celler och vävnader, växternas vattenupptagning, vattentransport och avgivande av vatten, samt inverkan av vattendeficit på växterna.

Boken är mycket ojämnt skriven. Många problem behandlas rapsodiskt och litteraturhänvisningarna sker mest till egna och kollegers arbeten. Som exempel kan nämnas påståendet att först i och med KRAMERS och CRAFTS et al. 1949 utgivna monografier problemet angående växternas förhållande till vatten började undersökas på bred front. Inte ett ord nämns om sådana forskare som MAXIMOV, SEYBOLD och WALTER!

En onödig bok, som inte ger den presentation och översikt av teorierna och problemen man kunde ha rätt att vänta sig.

STIG OLOF FALK

M. J. PURVIS, D. C. COLLIER & D. WALLS: Laboratory techniques in botany. — Butterworths & Co. Ltd, London, 1964. viii+371 sidor. Pris 57 s. 6 d.

Det är naturligtvis omöjligt att i en så liten bok utförligt behandla den laboratorieteknik som användes inom botaniken. Det måste med nödvändighet bli korta presentationer av de vanligaste metoderna och den apparatur som fordras för dessa.

Boken innehåller kapitel om allmän laboratorieapparatur (vågar, centrifuger, mikroskop etc.) och allmän laboratoriemetodik (Warburgmetodik, kromatografi, destillationsteknik), anatomisk och histologisk teknik (fixering, inbäddning, snittning, färgning etc.), mikrobiologisk laboratoriemetodik, växtfysiologiska undersökningsmetoder, skötsel av växthus och akvarier m.m. Varje kapitel avslutas med hänvisningar till litteratur där metoderna beskrives mera utförligt.

Framställningen är klar men kortfattad. Författarna som är tekniker be-

härskar inte alltid de biologiska resonemangen, men det kan man ju bortse från i en bok som denna. Litteraturhänvisningarna är inte särskilt up to date.

Boken kan kanske rekommenderas till sådana personer som snabbt vill lära känna huvuddragen av de vanligaste metoderna som botanister använder.

STIG OLOF FALK

C. P. WHITTINGHAM: The chemistry of plant processes. — Methuen & Co. Ltd, London, 1964. 209 sidor. Pris 25 s.

Professor WHITTINGHAM, professor i botanik vid Queen Mary College i London, ger i sin bok en översikt av valda kapitel inom växtfysiologin, som antingen är speciellt aktuella ur forskningssynpunkt eller som intresserat honom personligen. Boken avser alltså inte att vara en fullständig lärobok i växtfysiologi, utan förutsätter elementära kunskaper i ämnet hos läsaren.

Boken inleds med en historik av den experimentella botanikens utveckling. Därefter behandlas cellens struktur och metabolism. Kapitlet om jäsning och andning innehåller många fakta men saknar en klar och överskådlig framställning, vilket gör att det blir mycket tungläst. Fotosyntesen (prof. WHITTINGHAMS specialområde) däremot behandlas i ett välskrivet kapitel. Mörkerreaktionerna i fotosyntesen kan numera anses så gott som klarlagda genom bl.a. CALVINS och hans medarbetares undersökningar medan de fotokemiska reaktionerna bjuder forskningen på många olösta gåtor.

Boken avslutas med några kapitel om »växtprocesser», där sådana saker som osmotiska förhållanden, transport av vatten och lösta ämnen samt tillväxt behandlas. Dessa kapitel är inte av samma klass som de tidigare och faller väl egentligen utanför den ram som bokens titel låter antyda.

WHITTINGHAMS bok kan rekommenderas för den som vill sätta sig in i några av de aktuella forskningsområdena inom växtfysiologin.

STIG OLOF FALK

HUTCHINSON, JOHN: The Genera of Flowering Plants. Dicotyledones. Vol. I. — Oxford, Clarendon Press, 1964. Price 126 s.

This work is to be regarded as an up-to-date Genera plantarum. It follows the same system as that used by the same author in his well-known "Families of Flowering Plants", the second edition of which was printed as late as 1959. The work is admirable in several ways. The task of writing such a work is gigantic, and the fact that it has been done by a single person makes it the more impressive.

The descriptions of the families and genera are based on those in BENTHAM and HOOKER's Genera plantarum but are written in English, not in Latin. They are often abbreviated in relation to those in the latter work and also modified from observations in the Kew herbarium and from diagnoses in modern floras or monographs. The leading principles in the work and in the arrangement of the groups have been the same as those presented in the "Families of Flowering Plants", and they are briefly summarized in the

introduction. Emphasis is placed on those characters which should be regarded as "primitive" in relation to others. The basic ideas are that once united organs seldom separate into their constituents again, that organs once lost seldom return, that zygomorphic flowers seldom become actinomorphic, etc. An uncritical or unrestricted acceptance of them all might shackle systematical work, although most of them are probably sound. The division of the dicotyledons into fundamentally woody and fundamentally herbaceous ones, characteristic of HUTCHINSON's arrangement of the orders in his "Families", is followed also here.

Seven orders are treated in this first volume: *Magnoliales, Laurales, Dilleniales, Coriariales, Rosales,* and *Leguminales,* the last two of which comprise the greater part of the volume. Keys are given to the families, tribes and genera. The synonyms of each genus are enumerated, and the approximate number of species and the distribution in large are given. Important literature on the larger genera is also cited. The diagnoses, written in smaller style, are concise and in most of the cases checked they have been found to be accurate.

Working in a nomenclatural centre the author has been able to give rich information on generic synonyms, which will be of great help in future taxonomic work. However, the synonymy should be carefully re-examined before accepted. This is obvious in *Aspalathus,* for example. The most recent publications on this genus have naturally not been consulted by HUTCHINSON. Of the cited synonymous genera *Acropodium* Desv. and *Lapasathus* C. Presl were based on *Lotononis* species, and *Nefrakis* Raf. on the species now called *Brya ebenus.* Also *Semetor* Raf. does not belong to the synonyms of *Aspalathus.* (See DAHLGREN 1963 B.) Also orthographic or typographic variants of previous genera are sometimes cited among the synonyms without indication of the original author or of the status. Such details show that there is sometimes need for further investigations and controle. Even such a modern work as the present one is not — and could not possibly be — definite.

The number of species given for each genus is usually up to date, but sometimes the numbers in major monographs or certain standard works have been accepted without consideration of later contributions. An example is *Cliffortia,* where the number of species (c. 80) in WEIMARCK's monograph of 1934 has been accepted, although WEIMARCK's further contributions have rised the number to about 113.

A detail is worth mentioning in connection with the otherwise distinct and usually adequate terminology. In the rose-hips the achenes are considered to be "included in the berry-like calyx-tube". It is doubtless not *only* the calyx tube that takes part in the fleshy part of the hips, on the edge of which the (free parts of the) sepals, petals, and stamens are situated. The terms "hypanthium" and "receptacle" may be more adequate, although especially the latter is usually considered to represent only the variously enlarged end of the flower axis. The truth in this case may be that the receptacle cups correspond to a combination of the flower axis and part of the perianth and stamens.

The difficulties in deciding the size and circumscription of many genera have been great. A middle course between "splitting" and "lumping" has been the aim. Different opinions are natural in many cases. The rank is sometimes of great importance in principle, in other cases of less importance. Practical

reasons only may sometimes be decisive in the choice of rank. The genus rank in some cases seems too high. According to Mrs. G. NORDBORG (oral communication), this is the case in part of the *Poterieae* (*Rosaceae*), where otherwise the conception of the groups of species agrees in the main features with the conclusions reached by her, which are based on morphological as well as experimental studies. In the key to the genera of this tribe it seems impossible, however, to identify *Poteridium*. In the description the flowers are (correctly) said to be bisexual, but one of the conditions for arriving at *Poteridium* in the key is that the flowers are considered "monoecious or polygamous".

My own special interest is part of the *Papilionaceae*. In this family HUTCHINSON lowers the level of the tribus rank more than one step in relation to other works. It is instructive to compare the treatment with that of the same group (by G. K. SCHULZE-MENZ) in the 12th edition of ENGLER's "Syllabus der Pflanzenfamilien", Berlin-Dahlem 1964. In this work subfam. *Faboideae* (corresponding to *Papilionaceae*) is divided into 10 tribes, a division which agrees rather closely with that in BENTHAM and HOOKER's Genera plantarum as well as that in TAUBERT's treatment in ENGLER's "Die natürlichen Pflanzenfamilien". HUTCHINSON distinguishes 50 tribes. It is regrettable — and must be confusing for students — that in two almost contemporary important and general treatments of such an important plant group the authors have so different concepts of rank. Which is the more appropriate concept is difficult to tell, but 50 tribes are hardly convenient to survey.

I find it difficult to accept especially one of the tribes distinguished by HUTCHINSON, *Borbonieae*. The genera of this tribe are usually treated among those which constitute the tribe *Lotononideae* in HUTCHINSON's work. The difference between these two tribes: "*leaves primitively simple, stipules and stipels absent*" for *Borbonieae*, "leaves *digitately* 3-foliolate or rarely 1-foliolate, sometimes sessile; stipules present or absent" for *Lotononideae* (italics in cited parts by HUTCHINSON). In *Borbonieae*, typified by *Borbonia*, are assembled the genera *Borbonia, Rafnia,* and *Euchlora*. Certain *Borbonia* species actually show such a great resemblance to some species of *Aspalathus* that I have incorporated *Borbonia* in *Aspalathus* (cf. DAHLGREN 1963 A). The simple leaves of *Borbonia* in this case doubtless correspond to the terminal (middle) leaflets of the trifoliolate sessile leaves in most *Aspalathus* species. A similar reduction in leaflet number occurs also in other groups within *Aspalathus* and also in other genera, e.g. *Lebeckia* (where the leaves are petiolate, however). Certain forms of the monotypic genus *Euchlora* have trifoliolate or trilobate leaves, occasionally with stipules (cf. DAHLGREN 1964). My recent study on *Euchlora* cannot be, and that on *Borbonia* has probably not been, known to HUTCHINSON. They are mentioned here only to show how hazardous it may be to classify leaves as "primitively" or secondarily simple without performing a thorough study.

The present remarks may indicate that a work of this general type has its value more in the rich contents of material for further investigations than in being a final presentation in short of all the genera of higher plants. When completed, "The Genera of Flowering Plants" will represent an indispensible handbook in botanical institutes and herbaria and it will be of great help in future scientific work. It gives a representative picture of how the angio-

spermous genera are usually conceived to-day, and its useful descriptions and most of the synonymy will probably stand the time. A long-felt need will be filled, and the work will certainly become basic in systematic research.

References

DAHLGREN, R. 1963 A. The genus Borbonia L. incorporated in Aspalathus L. — Bot. Notiser, 116: 2.

— 1963 B. Studies on Aspalathus and some related genera in South Africa. — Opera Bot. 9: 1.

— 1964. The genus Euchlora Eckl. & Zeyh. as distinguished from Lotononis Eckl. & Zeyh. — Bot. Notiser, 117: 4.

TAUBERT, P. 1894. *Leguminosae* in ENGLER & PRANTL, Nat. Pfl.-Fam., 3: 3. Leipzig.

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Vol. 10. R. DAHLGREN: Revision of the Genus Aspalathus. II. The Species with Ericoid and Pinoid Leaflets. 4. 1965. (To be continued.)

BOTANISKA NOTISER 1965 · VOL. 118 · FASC. 3 · LUND

A Striking Polyploid Complex in the Alpine Flora: Arenaria ciliata L.

By C. FAVARGER

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In a previous paper (FAVARGER 1963) the author has demonstrated that the taxon *Arenaria ciliata* L. sensu stricto (viz. after exclusion of *Arenaria moehringioides* Murr which in the opinion of HALLIDAY (1961) and of the author deserves specific recognition)[1] is represented in Central Europe by several "chromosome races" having, respectively, n=20, 40, 60, and ca 120 chromosomes. The diploid (n=20) has hitherto been found only in the Tatra mountains of Poland and Czechoslovakia. The author has proposed (FAVARGER 1963, p. 174) to name this last taxon *A. ciliata* L. ssp. *tatrensis* (Zapal.) Favarger, putting it on the same level as ssp. *pseudofrigida* Ostenf. et Dahl from the arctic region and ssp. *hibernica* Ostenf. et Dahl from Ireland (which are also diploid), in spite of the very slight morphological differences separating these three taxa.

The tetraploid "race" (n=40) extending from the Gran Paradiso mountains to the "Canton des Grisons" in Switzerland, and the hexaploid "race" (n=60) from the Basse Engadine (National Swiss Park) are difficult to distinguish from each other and the author has classified them provisionally in ssp. *ciliata*. As to the dodecaploid "race" (n=ca 120) that was discovered by the author in the "Préalpes bernoises", it represents a very striking plant on account of its size, its loose growth, its very large flowers, and also by its ecology. It has been named ssp. *bernensis* Favarger. However, in 1963, the author had not studied the populations of the Austrian Alps. It was only stated, on account of an approximate count on plants from seeds gathered at the Rax-Schnee-

[1] The author thinks that it is simply for reason of commodity that CHATER & HALLIDAY have subordinated again *Arenaria moehringioides* to *Arenaria ciliata* in Flora europaea (1964).

berg by the Botanical garden in Vienna, that there should exist a high polyploid taxon in the calcareous North-eastern Alps. On the other hand, one could wonder where the eastern limit of the hexaploid "race" is situated.

In August 1964, during a journey with Mr. A. BAUDIÈRE and Mr. L. ZELTNER, we had an opportunity to gather living material of *Arenaria ciliata* at two places in the Austrian Alps, viz., on the Wiener Schneeberg and on the Hochtor (Gross Glockner). The result of the cytological observations on these collections is presented below.

Material from the Wiener Schneeberg

Not having been able to detect good pictures of meiosis, the author has concentrated his interest on the mitosis of root tips. Twelve metaphase plates have been drawn and carefully analysed. On the best ones, 196 to 205 chromosomes were counted. The average of the 12 plates is 200, the extreme values being 189 and 213. The author feels justified to conclude that the population from the Wiener Schneeberg is decaploid with $2n=200$. The variation observed is due either to technical difficulties in the interpretation, or to the fact that in such high polyploids, the chromosome number is not absolutely constant.

Morphologically, the plants from the Wiener Schneeberg are strikingly resembling those of the "Préalpes bernoises" (Gantrisch). They have the same loose and trailing appearance, the very numerous stems and the large flowers. Cultivated as well as dried herbarium specimens are easily recognizable from the other Alpine populations of *Arenaria ciliata*.

As for the ecology, the populations of the Wiener Schneeberg are growing chiefly in the alpine zone, on limestone, in the *Carex firma* association (*Firmetum*) and also at the limit of the subalpine zone, in meadows with scattered individuals of *Pinus mugo*. These habitats are not unlike those where ssp. *bernensis* is growing on the Gantrisch in Switzerland.

On account of the important analogies between the plants of Wiener Schneeberg and those of the Gantrisch, the author has counted again the chromosomes of ssp. *bernensis* to verify whether this taxon (at its 'locus classicus') is really dodecaploid. On the plants 60/779, not studied in 1960, numbers near $2n=240$ were counted, e.g., $2n=222$, 227 and 231 (once only 207). The author believes that these plants are really

dodecaploid, but it is not impossible that their chromosome number showed unimportant variations as in the preceding case.

In spite of the slight difference in the degree of polyploidy, the plants of the Wiener Schneeberg and those of the Gantrisch seem to belong to a single taxon, ssp. *bernensis*. At the most, it was observed that the flowers from the Wiener Schneeberg have often wider petals, with overlapping edges, not unlike those of *Cerastium arvense* ssp. *strictum*.[2]

Material from the Hochtor

The examination of the mitoses of root tips gives 2n=ca 160. On the clearest plates 155 and 158 chromosomes were counted, and on a metaphase of division I of meiosis, one can observe a minimum of 72 bivalents. So, it seems doubtless that this race is octoploid. The variations observed in the number of chromosomes are attributable to reasons stated above.

It should be noted, that in the hexaploid taxon, besides n=60, the author has also counted n=62, whereas the mitosis of root tips sometimes showed 129 chromosomes. Moreover (cf. FAVARGER 1963, p. 163), the same kinds of variation have been observed about the number 2n=80 in the tetraploid taxon.

The detection of octoploids on the Gross Glockner has induced the study of a plant found by Mr. VILLARD at Murtèr (National Park in Switzerland), which the author had in culture in Neuchâtel but which was not yet examined. On root tip mitoses, the number 2n=ca 160 was counted.

From the above follows that the octoploid race very likely ranges from the Basse Engadine to Obere Tauern, replacing in the East the western race with n=40. On the other hand, the plants with n=60 have a much narrower area, and, which is very striking, they occur in the frontier zone between the tetraploid race and the octoploid one. It would be unreasonable not to conclude that this race with n=60 is the result of a crossing between the western race and the eastern one: 40+80=120.

In conclusion, the different Alpine races of *Arenaria ciliata* have the following chromosome numbers:

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[2] While writing this paper, the author has been able to study also material of *Arenaria ciliata* gathered on the Raxalpe by the Botanical garden in Vienna. On this collection the number 2n=ca 200 was counted.

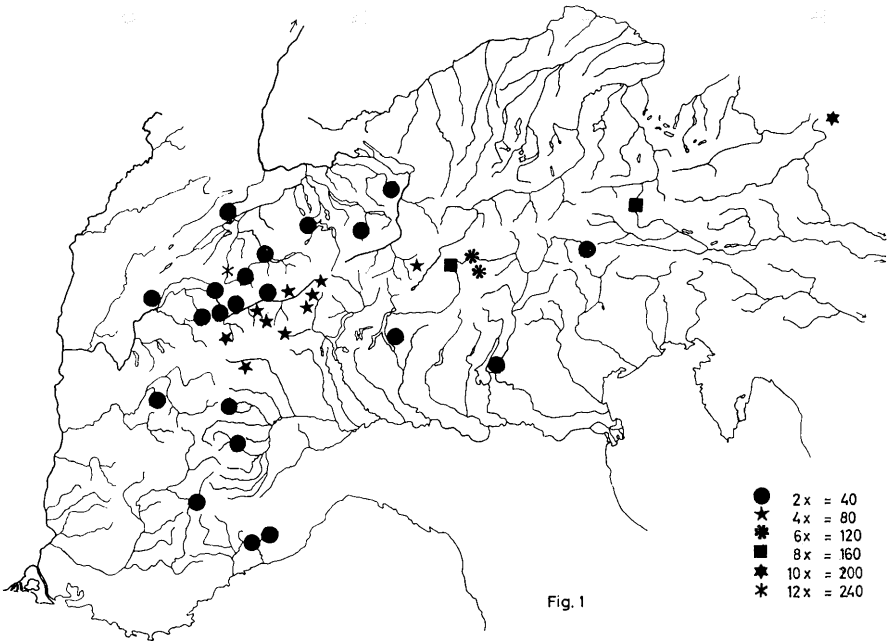


Fig. 1. Distribution in the Alps of the *Arenaria ciliata* complex. The diploid taxon (2n=40) is *A. moehringioides* Murr. The cytotypes with 2n=80, 120 and 160 are corresponding to *A. ciliata* L. ssp. *ciliata*; the cytotypes with 2n=200, 240 to *A. ciliata* L. ssp. *bernensis* Favarger.

Race [3]	2n
4x: Alpes graies, Valais, W. Grisons	80 ± 3
6x: Basse Engadine (Ofenpass and Val dal Botsch)	120 ± 9
8x: Gross Glockner and Murtèr Alp	ca 160
10x: Wiener Schneeberg, Raxalpe	ca 200
12x: Gantrisch	ca 240

The distribution of these races is shown on the map (Fig. 1), which completes the one published in FAVARGER 1960.

Discussion

The taxonomical problems in the group studied are rather intricate. Contrary to the hypothesis stated earlier (FAVARGER 1963), it has not yet been possible to distinguish, either by morphology or by ecology,

[3] Following HALLIDAY (1961), the author regards n=20 as the basic number of the group, instead of n=10, which has been observed in *A. serpyllifolia*.

the tetra-, hexa-, and octoploid races. They should be considered as simple cytotypes within ssp. *ciliata*. However, these cytotypes, contrary to those of *Caltha palustris* (REESE 1954) seem to have each a special geographical distribution. At any rate, neither the octoploid has been found westward from long. 10° nor the tetraploid eastward from the designated longitude. On the other hand, there is no important morphological difference between the population of the Wiener Schneeberg (10x) and that of the Gantrisch (12x). From a strictly taxonomical point of view, the cytotypes deserve no special status, since they can not be differentiated either on living plants or in the herbarium. Thus, in the Alps the whole group of *Arenaria ciliata* includes definitely three taxa, differing by their morphology, chromosome number, and distribution:

	n
Arenaria moehringioides Murr	20
Arenaria ciliata L. ssp. *ciliata*	40, 60, 80
Arenaria ciliata L. ssp. *bernensis* Favarger	100, 120

It would be rather convenient to consider these taxa as three distinct species. However, the Alpine problem cannot be dissociated from the northern and Carpathian problems. If the arctic, the Carpathian, and the Irish populations are considered as subspecies of *Arenaria ciliata,* it would not be convenient to give specific recognition to the taxon *bernensis*.

In conclusion, the propositions made in an earlier paper (FAVARGER 1963), which were completing those of HALLIDAY (1961), will be resumed and specified.

Arenaria ciliata L.[4]

	n	
ssp. *pseudofrigida* Ostenf. et Dahl	20	Grönland, Arctic Europe, Novaya-Zemlya
ssp. *hibernica* Ostenf. et Dahl	20	Ireland
ssp. *tatrensis* (Zapal.) Favarger	20	Tatra
ssp. *ciliata*	40, 60, 80	Central and Eastern Alps
ssp. *bernensis* Favarger	100, 120	Prealps of Berne (Switzerland), Calcareous Northeastern Alps (Austria)

The first three taxa are diploid and allopatric. Morphologically, they are not very different from each other, but the geographical isolation together with some morphological differences justify, in the author's

[4] *A. moehringioides* excluded.

opinion, the subspecific level. One might also treat them as varieties of *A. ciliata,* but this would not take into consideration the differences in chromosome number (diploid and polyploid taxa).

With regard to biosystematics and cytogeography, the group of *Arenaria ciliata* in the Alps presents numerous interesting problems. It is noteworthy, that cytotypes may have special geographical distributions without showing morphological or ecological differences.

HABELER (1963) has recently given a rather similar example in *Cardamine amara.* The tetraploid she has found in the Eastern Alps is not morphologically different from the diploid. However, this cytotype has its own geographical distribution.

It is possible that we are dealing with an incipient state of species formation, but before drawing this conclusion, it would be advisable to investigate whether the cytotypes with n=40, 60 and 80 are separated by genetical barriers, which is as yet uncertain. At any rate, these cytotypes represent an intermediate stage between cytotypes without any geographical separation (distribution at random) and true geographical subspecies.

A glance on the map (Fig. 1) shows that the diploid *Arenaria moehringioides* is growing on the western and southern Alpen ranges and in the North on the Prealpine range, which is said to have been ± unglaciated during the Quaternary glaciations.

The polyploid *A. ciliata* ssp. *ciliata,* with its three cytotypes, is growing in the most central ranges of the Alps. As to the two cytotypes of ssp. *bernensis,* they are growing at comparable places, on the northern limit of the Alps. One is led to consider the possibility that such local high polyploids could have originated there by a crossing between a taxon which could have remained on the place during the glaciations and an immigrant taxon which might have come from the arctic region or arisen in the free land between the Alpine and the northern glaciers.

At present any attempt to reconstruct the origin of these different taxa seems premature. The following statements, however, seem justified:

1) The separation of the northern taxa (*A. ciliata* ssp. *pseudofrigida* and *A. humifusa*) from the Alpine-Pyrenean taxon *A. moehringioides* is certainly old and most probably took place during the Tertiary.

2) It seems most likely that the Alpine *Arenaria ciliata* ssp. *ciliata* arose during the ice age by polyploidization from ssp. *pseudofrigida* when the latter immigrated to Central Europa. Moreover, the northern diploid taxon has left a remainder in the Tatra with ssp. *tatrensis.*

3) The fact that ssp. *ciliata* is represented by a higher polyploid in the Eastern Alps is worth noticing. The two cytotypes with n=40 and n=80 behave like pseudovicariads of the western-eastern type (FAVARGER 1962). On the other hand, it is not surprising that in the border-line between the two cytotypes, hybridogenous individuals have arisen.

4) The question arises whether ssp. *bernensis* is polytopic, i.e., the Gantrisch cytotype and that of the Wiener Schneeberg having independents origins. However, the great morphological similarity between the two cytotypes speaks against such an assumption. Another possibility is that ssp. *bernensis* originated in the calcareous northern Austrian Alps,[5] having spread from east to west and in the Bernese Prealps given rise to the cytotype with n=120, through a second crossing with a diploid taxon.

5) Unless intermediate stations should be discovered, *Arenaria ciliata* ssp. *bernensis* shows one of the most important disjunctions known in the Alpine flora. This disjunction resembles the one exhibited by *Heracleum austriacum* L. (MERXMÜLLER 1952) though it is larger. The presence in the Bernese Prealps of species with discontinuous areas (*Cerastium alpinum* L. ssp. *glabrescens*,[6] *Cochlearia officinalis* ssp. *alpina* (Bab.) Hook. f. var. *alpina*, *Androsace lactea*, *Arenaria ciliata* ssp. *bernensis*) is very interesting and speaks in favour of the theory that this region would have been a nunatak at least during the last glaciation. Ssp. *bernensis* very likely represents an apoendemic taxon whose origin dates back to the glaciations.

Literature cited

CHATER, O. & HALLIDAY, G. 1964. *Arenaria*, in Flora europaea 1, 116—123. Cambridge.

FAVARGER, C. 1960. Recherches cytotaxinomiques sur les populations alpines d'Arenaria ciliata L. (sens. lat.) — Bull. Soc. bot. suisse 70, 126—140.

— 1962. Contribution de la biosystématique à l'étude des flores alpines et jurassiennes. — Rev. Cyt. Biol. végét. 25, 397—410.

— 1963. Nouvelles recherches sur les populations alpines et carpathiques d'Arenaria ciliata L. (sens. lat.). — Bull. Soc. bot. suisse 73, 161—178.

HABELER, E. 1963. Cytotaxonomie von Cardamine amara des Alpen-Ostrandes. — Phyton 10, 161—205.

[5] Perhaps by allopolyploidy between the cytotype with n=80 and ssp. *pseudofrigida* (n=20).

[6] FAVARGER, in *Schedis Herbarii monacensis*.

HALLIDAY, G. 1961. Taxonomic and ecological studies in the Arenaria ciliata and Minuartia verna complexes. Thesis, Cambridge.

HAYEK, A. VON 1965. Exkursion auf den Wiener Schneeberg. Führer zu den Wiss. Exk. II. internat. bot. Kongr., 1—11. Wien.

MERXMÜLLER, H. 1952. Untersuchungen zur Sippengliederung und Arealbildung in den Alpen, 1—105. München.

REESE, G. 1954. Euploidie, Aneuploidie und B-Chromosomen bei Caltha palustris L. — Planta 44, 203—268.

BOTANISKA NOTISER 1965 · VOL. 118 · FASC. 3 · LUND

Pollen Morphology of Some Families of Monochlamydeae

By P. K. K. NAIR
National Botanic Gardens, Lucknow, India

Introduction

Considering the various aspects of plant morphology including pollen morphology, the *Monochlamydeae* (BENTHAM & HOOKER 1883, RENDLE 1952), is composed of a heterogeneous group of families. Among these families, the *Aristolochiaceae, Piperaceae* (including *Saururaceae*), *Chloranthaceae* and *Myristicaceae,* are significant by having 1-aperturate (colpate and porate) and sometimes inaperturate (ERDTMAN 1952) pollen grains, which form the subject of the present investigation. Regarding the systematic position of these monochlamydous families, there has been considerable divergence of opinion among systematists (Table 1).

BENTHAM & HOOKER (1883) placed the family *Aristolochiaceae* along with *Nepenthaceae* and *Cytinaceae* (*Rafflesiaceae* and *Hydnoraceae*) in the series *Multiovulatae Terrestris* (corresponding to the *Aristolochiaceae* of HUTCHINSON, 1926), while the families *Piperaceae, Chloranthaceae* and *Myristicaceae* along with *Monimiaceae* and *Lauraceae* have been placed in *Micrembryae* (corresponding to the *Piperales* and *Laurales* together of HUTCHINSON, 1926). Excluding the *Nepenthaceae,* all other families of *Multiovulatae Terrestris* are placed in *Aristolochiaceae* by ENGLER & PRANTL (1889—1911) and HALLIER, and in *Myrtales* by BESSEY, associated with which are other families of *Monochlamydeae,* namely *Lacistemaceae* (ENGLER & PRANTL) or *Balanophoraceae* (HALLIER). All the families of *Micrembryae* are considered in the order *Ranales* by BESSEY. ENGLER & PRANTL include the *Myristicaceae, Monimiaceae* and *Lauraceae* in *Ranales* leaving the *Piperaceae, Saururaceae* and *Chloranthaceae* in the order *Piperales.* HALLIER includes the *Piperaceae* and *Saururaceae* alone under *Piperineae,* and leaves the rest in the *Anonales* (cit. LAWRENCE 1958).

Table 1. System of classification
(Based on LAWRENCE 1958)

BENTHAM & HOOKER Families	Series	ENGLER & PRANTL Order	BESSEY Order	HALLIER Order	HUTCHINSON Order
Aristolochiaceae	*Multiovulatae Terrestris*	*Aristolochiales*	*Myrtales*	*Aristolochiales*	*Aristolochiales*
Piperaceae	*Micrembryae*	*Piperales*	*Ranales*	*Piperineae*	*Piperales*
Chloranthaceae				*Anonales*	
Myristicaceae		*Ranales*			*Laurales*

Pollen morphological study of the plants belonging to the families considered here have previously been made mainly by ERDTMAN (1952), and important data on pollen and other aspects of morphology have been given by JOSHI (1946), SWAMY & BAILEY (1949, 1950), SINCLAIR (1958), and MURTY (1959).

Material and Method

Polliniferous material has been procured from the herbarium of the National Botanic Gardens (abbrev. NBG), the Botanical Survey of India, Western circle, Dehra Dun (BSIW) and Southern circle, Coimbatore (BSIS). Pollen preparations have been made by the acetolysis method, and the terminology used in pollen descriptions is after that of NAIR (1961). The plants studied and the details regarding its source (Herbarium; Coll. No.; Locality of collection; Sl.=serial number of the pollen slide deposited in the Palynology Laboratory, National Botanic Gardens, Lucknow) are listed below:

Aristolochia bracheata Retz., NBG 14507; Rajkote, Sl. 3747.
A. elegans Mast., Abu, Sl. 4322.
A. grandiflora Swartz, BSIW; Fresh plants used; Sl. 4294.
A. indica L., Rajasthan, NBG, Acc. No. 37069; Sl. 3748.
A. ridicula N.E. Br., BSIW; Sl. 4293.
Apama siliquosa Lamk. (*Bragantia wallichii*), BSIS 14146; Sl. 4296.
Peperomia pellucida H. B. & K., Lucknow; Fresh coll.; Sl. 3628.
Piper argyrophyllum Miq., BSIS 5547; Sl. 4302.
P. betel L., Institute of science, Bombay; Dist. Nasik; Sl. 4312.
P. hymenophyllum Miq., BSIS 5458; Sl. 4303.
P. methysticum Forst, NBG 56377; Sl. 497.
P. subpeltatum Willd., BSIS 16080; Sl. 4313.
P. sylvestre Lam, BSIW; Sl. 4424.
P. trichostachyon Cas. DC., BSIS 12705; Sl. 4301.

P. wightii Miq., BSIW; Sl. 4299.
Sarcandra irvingbaileyii Swamy (*Chloranthus brachystachys* Bl.), BSIS 15844; Sl. 4307.
**Knema attenuata* (Wall.) Warb., Kerala; Sl. 4247.
**K. sphaerula* HK. f., Burma; Sl. 4248.
**Myristica prainii* (Warb.) King, Malaya; Sl. 4246.

Observations

Considering all the genera and species studied, pollen grains are dimorphic, being 1-colpate - ellipsoidal, or 1-porate - spheroidal. The colpus is variously shaped, being either elliptical, or ovate. Similarly, the pores are either triangulate, or circulate, almost covering one face of the grain. There are a few grains with trichotomocolpate apertures along with the porate and colpate forms.

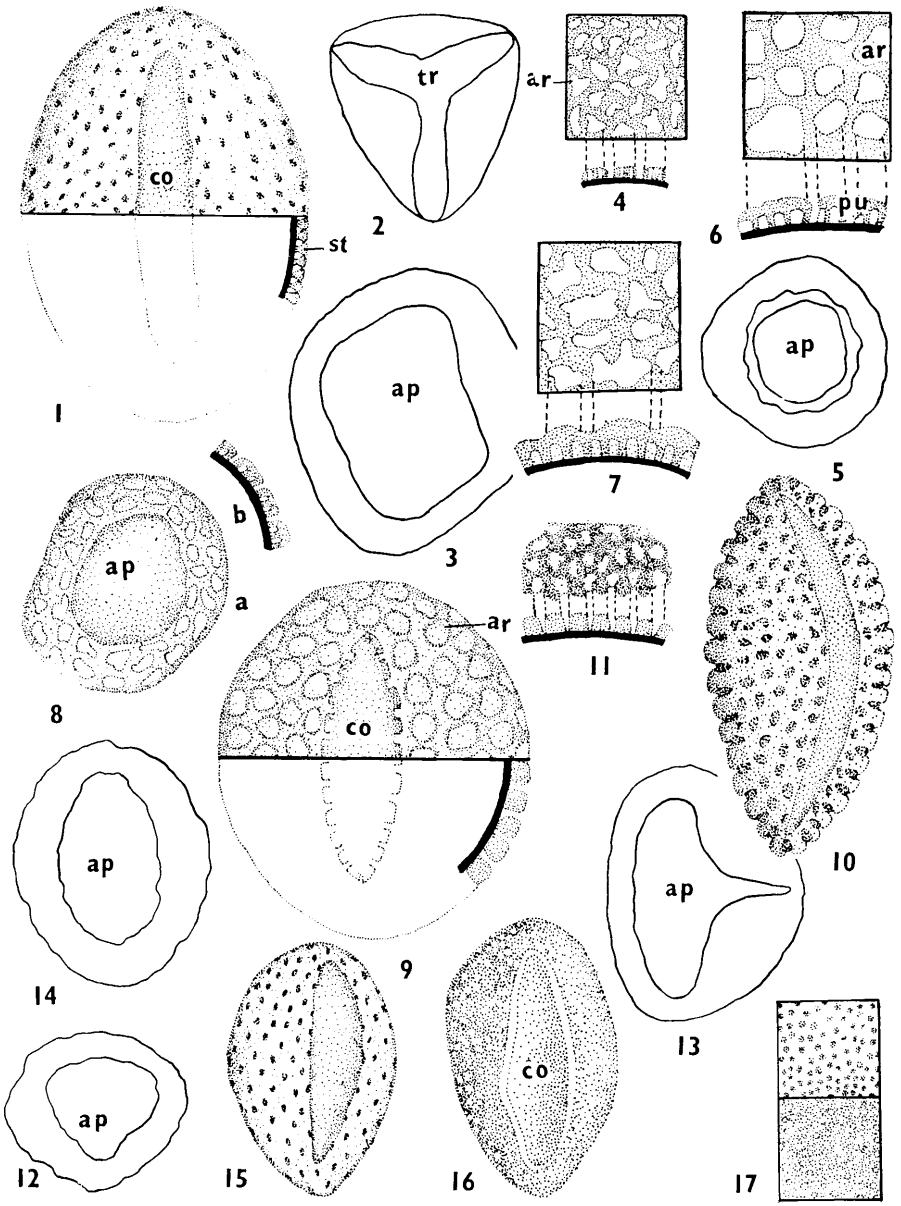
Aristolochiaceae

Aristolochia bracheata Retz. Figs. 1—3: Pollen grains 1-colpate, ellipsoidal or sphaeroidal (largest diameter 49 μ; range 43—56 μ). Exine 1 μ thick, surface faintly foveolate. — *A. elegans* Mast.: Dimorphic in size (diameter 60 μ, range 57—64 μ; & 49 μ, range 32—50 μ). Ectine dissected, being formed of small, closely placed, irregularly shaped units, giving an areolate appearance (Fig. 4). Aperture forms include the trichotomocolpate, 1-porate (Fig. 5), and colpate ones and their intermediaries. — *A. grandiflora* Swartz.: Largest diameter 60 μ (range 53—68 μ). Exine 5.6 μ thick. Ectine dissected as in *A. elegans,* but the areoles are circular (Fig. 6). — *A. indica* L.: largest diameter 47 μ (range 39—56 μ). Exine surface foveolate. Other characters as in *A. elegans.* — *A. ridicula* N. E. Br.: Grains dimorphic in size (diameter 72 μ, range 68—78 μ; & 55 μ, range 46—60 μ). Exine surface rugulate (Fig. 7). Other characters as in *A. elegans.* — *Apama siliquosa* Lamk. Fig. 8: Largest diameter 34 μ (range 28—36 μ). Ectine dissected being formed in isolated, closely placed, circular or rectangular (seen in surface view) units. Aperture forms as in *Aristolochia elegans.*

Piperaceae

Peperomia pellucida H. B. & K. Fig. 9: Grains dimorphic, being 1-colpate or 1-porate. Largest diameter 14 μ. Exine 1.4 μ thick. Ectine thicker

* Material obtained from the personal collection of Dr N. C. Nair, Botanical Survey of India, Northern Circle, Poona.



Figs. 1—17. Pollen morphology of *Aristolochiaceae* (1—8), *Piperaceae* (9—15) and *Chloranthaceae* (16—17). — 1—3. *Aristolochia bracheata* (1. grain showing general exine surface in upper half; 2. trichotomocolpate grain; 3. 1-porate grain). — 4—5. *A. elegans* (4. strata and exine surface showing areoles; 5. operculate grain). — 6. *A. grandiflora.* Strata and exine surface showing areoles. — 7. *A. ridicula.* Exine strata and surface showing areoles. — 8. *Apama siliquosa* (a. grain showing general surface; b. exine strata). — 9. *Peperomia pellucida* (grain showing general surface

than endine, dissected into closely placed units, appearing rectangular or circular in surface view. The aperture types include the colpate and the porate ones (pollen grains few in the slide). — *Piper argyrophyllum* Miq. Figs. 10—14: Largest diameter 14 or 18 μ. Exine surface foveolate; foveoles often deep-seated (punctate). Aperture types include porate, colpate and trichotomocolpate ones (colpus-like on one side of the aperture). — *P. betel* L.:Largest diameter 8 μ (range 7—9.5 μ). Exine very thin; surface psilate. — *P. hymenophyllum* Miq. Fig. 15: Largest diameter 9 μ (range 7—11 μ). — *P. methysticum* Forst: Largest diameter 10.5 μ. — *P. subpeltatum* Willd.: Largest diameter 10 μ. Exine surface foveolate. — *P. sylvestre* Lam.: Grains sphaeroidal (diameter 10.5 μ) or ellipsoidal (14×9 μ). — *P. trichostachyon* Cas. DC.: Largest diameter 14 μ (range 13—16 μ). Exine surface foveolate. — *P. wightii* Miq.: Largest diameter 15 μ. Exine surface foveolate.

Chloranthaceae

Sarcandra irvingbaileyii Swamy. Fig. 16—17: 1-colpate or 1-porate (few only). Largest diameter 14 μ. Exine 1 μ thick, faintly granulose.

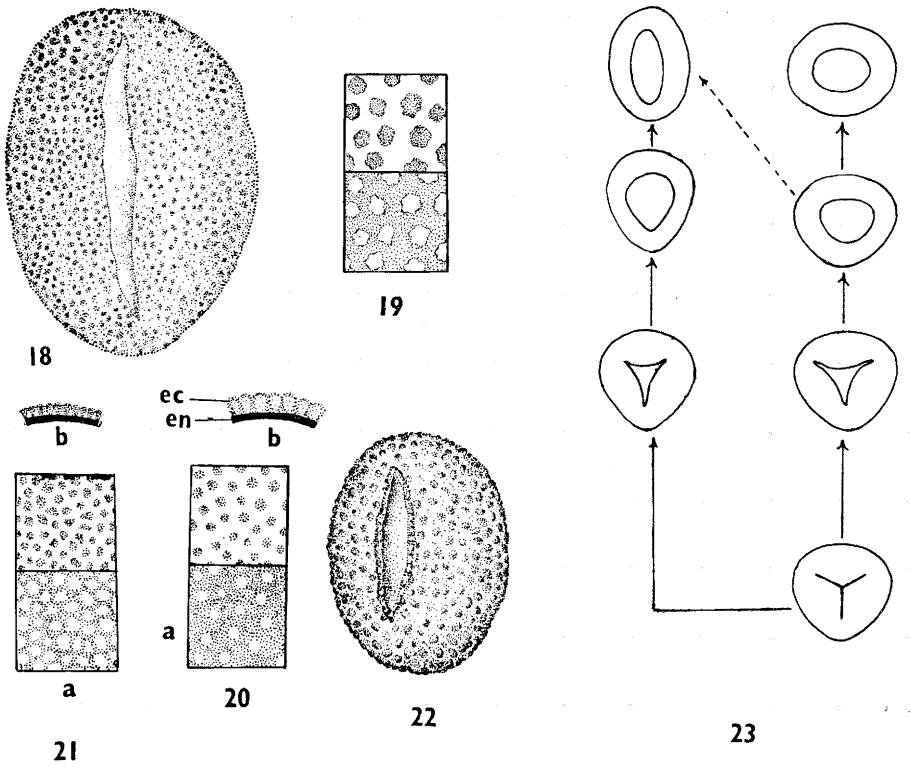
Myristicaceae

Knema attenuata (Wall.) Warb. Figs. 18—19: Grains 1-colpate or 1-porate. Longest diameter 57 μ (range 47—57 μ; longest×shortest diameter in another material obtained from BSIW, Poona is 35×33 μ). Ectine reticulate. Aperture types include porate, colpate and their intermediaries. — *K. sphaerula* HK. f.: Grains ellipsoidal (largest size 40 μ; range 32—43 μ). Exine 5 μ thick (Fig. 20). — *Myristica prainii* (Warb.) King. Figs. 21—22: Largest size 27×34 μ (range 14×23—27×34 μ). Smallest size 23 μ (range 23—34 μ).

Discussion

The palynological observations presently made have significance, both taxonomically and pollen morphologically. The 1-colpate type of aperture is not very characteristic of the dicotyledons. Among the families of *Monochlamydeae,* the four families namely *Aristolochiaceae, Piperaceae* (BENTHAM & HOOKER 1883), *Chloranthaceae* and *Myristicaceae,*

in upper half). — 10—14. *Piper argyrophyllum* (10. general surface; 11. exine strata and surface ornamentation; 12—14. apertural types). — 15. *P. hymenophyllum.* — 16—17. *Sarcandra irvingbaileyii.* (16. general surface; 17. LO-pattern). ap. aperture; ar. areole; co. colpus; pu. puncta; st. strata; tr. trichotomous aperture. — Magnification: ×1000 (Figs. 2, 3, 6, 12—14), ×1500 (1, 8, 10, 15, 16), ×2000 (4, 5, 7, 9, 11, 17).



Figs. 18—22. Pollen morphology of *Myristicaceae*. — 18—19. *Knema attenuata* (18. general surface; 19. LO-pattern). — 20. *K. sphaerula* (a. LO-pattern; b. strata). — 21—22. *Myristica prainii* (21. a. LO-pattern, b. strata; 22. general surface). — Fig. 23. Possible lines of apertural evolution. ec. ectine; en. endine. — Magnification: ×1000 (Figs. 2, 3, 6, 12—14), ×1500 (Figs. 1, 4, 5, 7, 11, 17), ×2000 (Fig. 9).

alone contain 1-colpate sporomorphs, and among other dicots such grains are known in the families *Magnoliaceae, Anonaceae* including *Himantandraceae, Canellaceae, Centrolepidaceae* (colpus-like), and *Cynastraceae*. The 1-furrowed grains are common in the monocotyledons. Apart from the 1-colpate type, inaperturate types are known in *Peperomia* (along with doubtfully 1-colpate types), while in *Chloranthaceae* both inaperturate and stephano-zonocolpate types along with intermediary forms occur (ERDTMAN 1952). The affinities of the *Aristolochiaceae, Chloranthaceae, Piperaceae,* and *Myristicaceae* have been the subject of discussion of taxonomists. HUTCHINSON derived the *Aristolochiaceae* from the ranalian plexus through the *Berberidaceae*. The

Piperaceae is considered by most botanists to be an 'independent and terminal offshot of direct ranalian ancestry' (cit. LAWRENCE 1958, p. 445), contrary to the views of ENGLER & PRANTL. The ranalian affinity of the *Myristicaceae* and *Chloranthaceae* also has been favoured by BESSEY and HALLIER, but HUTCHINSON considered the *Myristicaceae* to be closer to *Lauraceae*.

The 1-aperturate (colpate, porate with large pores or trichotomocolpate) sporomorphs are observed only in the *Magnoliaceae* and *Nymphaeaceae* among the ranalian families. Pollen morphology does not seem to offer evidence to support the affinity of *Aristolochiaceae* with *Berberidaceae* (pollen grains 3-colpate or spiraperturate) as assumed by HUTCHINSON. The occurrence of inaperturate grains (ERDTMAN 1952) in some of *Chloranthaceae* and *Piperaceae* (*Peperomia*; 1-colpate in the Indian species) might be considered to indicate affinities with the *Anonaceae*; similarly, the inaperturate pollen types in the *Lauraceae* (with which the *Myristicaceae* is considered to show affinities) may possibly indicate its affinity to the *Anonaceae*. On embryological evidences CAMPBELL (1900) indicated the affinity of *Piperaceae* with *Gnetum*, but such a view does not find sufficient palynological evidence (although both taxa contain inaperturate sporomorphs). SWAMY & BAILEY (1949, 1950) have indicated the possible affinities of the *Piperales* with "certain categories of the Ranales", from morphological studies including those of pollen grains. The bulk of palynological evidence suggests that the families *Aristolochiaceae, Piperaceae, Chloranthaceae* and *Myristicaceae* have each originated directly from those ranalian families having 1-colpate (or inaperturate) sporomorphs.

In all the families under consideration, there occur both the 1-colpate and 1-porate grains. In these families a few trichotomocolpate grains also have been noticed. The intermediary aperture forms, between the trichotomocolpate (trilete) and 1-porate types, have provided important suggestions regarding the possible lines of evolution of apertures in pollen. It is presumed that the trichotomous form of aperture is the basic type, from which have evolved the 1-colpate form, by the widening and elongation of the trichotomous aperture, corresponding to which is a change from the spheroidal to ellipsoidal shapes. The porate form (pore covering the whole of one face), might have evolved from the trichotomous type by the widening of the triletous aperture. The porate types having smaller pores might have evolved from the colpate or the porate form by the processes of reduction (Fig. 23).

Acknowledgements

I am grateful to Prof. K. N. KAUL, Director, National Botanic Gardens, Lucknow, for encouragement and facilities, and thankful to Mr. H. A. KHAN and Mrs. K. RASTOGI for the technical assistance given to me. I am grateful to Dr. N. C. NAIR, Botanical Survey of India, Dehra-Dun, for giving me some material of *Myristicaceae* from his personal collections.

Literature cited

BENTHAM, G. & HOOKER, J. D. 1880—1883. Genera plantarum. Vol. III. London.

BESSEY, C. E. 1893. Evolution and Classification. — Bot. Gaz. **18:** 329—332.

CAMPBELL, D. H. 1900. A peculiar embryo sac in Peperomia pellucida. — Ann. Bot. London **13:** 626.

— 1901. The embryo sac of Peperomia. — Ibid. **15:** 103—118.

ENGLER, A. & PRANTL, K. 1889—1911. Die natürlichen Pflanzenfamilien. Leipzig.

ERDTMAN, G. 1952. Pollen morphology and plant taxonomy of Angiosperms. Stockholm.

HUTCHINSON, J. 1926. The families of flowering plants. London.

JOSHI, A. C. 1946. A note on the development of pollen of Myristica fragrans Von Houtten of the family Myristicaceae. — Jour. Indian bot. Soc. **25:** 139—143.

LAWRENCE, G. H. M. 1958. Taxonomy of vascular plants. New York.

MURTY, Y. S. 1959. Studies in the order Piperales. — Jour. Indian bot. Soc. **38:** 120—139.

NAIR, P. K. K. 1961. Pollen grains of Indian plants. I. — Bull. Nat. Bot. Gardns. No. 53.

NAIR, N. C. & NARAYANA, K. R. 1962. Study on the Aristolochiaceae. Nodal and floral anatomy. — Proc. Nat. Inst. Sci. India pt. B. **28:** 211—27.

RENDLE, A. B. 1952. The classification of flowering plants. Vol. II. Cambridge.

SINCLAIR, S. 1958. Revision of the Malayan Myristicaceae. — Gardns. Bull. **16:** 205—450.

SWAMY, B. G. L. & BAILEY, I. W. 1949. The morphology and relationships of Cercidiphyllum. — Jour. Arnold Arbor. **30:** 187—210.

— 1950. Sarcandra, a vesselless genus of the Chloranthaceae. — Ibid. **31:** 117—129.

BOTANISKA NOTISER 1965 · VOL. 118 · FASC. 3 · LUND

Meiotic Chromosome Numbers in Some Vascular Plants of Indus Delta I.

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Introduction

An investigation of the chromosome numbers of the vascular plants of Indus delta has been carried out. This region is yet unexplored. Very little information appears to be existing as far as the cyto-morphological and cyto-genetical behaviour of plants of this region is concerned. In this connection a general survey of the plants, with special reference to those of medicinal importance, has been initiated. The present paper is the first in a series designed to establish the basic chromosome pattern with a view to characterize the major phyletic lines in the flora of this area. In this work chromosome numbers of 25 species distributed over 12 families are reported. The important role played by polyploidy during the course of evolution in the indigenous flora is also under investigation, the results of which will be published separately.

Material and Method

Chromosome counts were made from pollen mother cell squashes. Buds were collected in the field from plants growing in their natural habitats. They were fixed in Carnoy fluid (Alcohol-Chloroform-Acetic acid in a ratio of 6 : 3 : 1) and stored in 75 % alcohol. Suitable young anthers were subsequently removed and squashed in aceto-carmine. Camera lucida drawings were made at a magnification of approximately 2000 ×. For nomenclature and identification of plants HOOKER's "Flora of British India" (1887) was used. Type specimens are deposited in the Herbarium of Central Laboratories, Pakistan Council of Scientific and Industrial Research, Karachi.



Fig. 1. a. *Cocculus pendulus* n=13 (Met I), b. *Cadaba farinosa* n=16 (Met I), c. *Cleome brachycarpa* n=30 (Met I), d. *Gossypium stocksii* n=13 (Met II), e. *Fagonia cretica* n=11 (Diakinesis), f. *Peganum harmala* n=12 (Met I), g. *Tribulus terrestris* n=6 (Met II), h. *Zygophyllum simplex* n=8 (Met I), i. *Alhagi camelorum* n=8 (Met I), j. *Crotalaria burhia* n=8 (Met II), k. *Sesbania aegyptiaca* n=6 (Met II), l. *Citrullus colocynthis* n=11 (Met I), m. *Cucumis prophetarum* n=12 (Met I), n. *Mollugo hirta* n=18 (Met I), o. *Oldenlandia aspera* n=9 (Met II), p. *Enicostema littorale* n=ca 38 (Met I), q. *Trichodesma indicum* n=11 (Met II), r. *Convolvulus microphyllus* n=18 (Met II), s. *Convolvulus pluricaulis* n=20 (Diakinesis), t. *Cressa cretica* n=14 (Met II), u. *Solanum nigrum* n=12 (Met I), v. *Solanum xanthocarpum* n=12 (Met II), w. *Physalis minima* n=24 (Met I), x. *Withania somnifera* n=24 (Diakinesis), y. *Lycium barbarum* n=18 (Met II).

Results

Menispermaceae

1. *Cocculus pendulus* Diels (Syn. *C. leaeba* DC.) n=13

This is a rare species in this region and displays great morphological variation in leaf shape, marginal lobes and pubescence. HAGERUP (1932) reported 2n=26 for this species which agrees to our finding of a basic number of 13.

Capparidaceae

2. *Cadaba farinosa* Forsk. n=16

MIEGE (1962) reported 2n=16 for this species. Our investigation of pollen mother cells (Metaphase I) also shows clearly 16 bivalents. This gametic number of 16 is a new record.

3. *Cleome brachycarpa* Vahl ex DC. n=30

This species does not appear to have been studied before. From the counts reported by various workers (cf. DARLINGTON & WYLIE 1955) for other allied species the basic numbers 9, 10 and 11 have been established. This suggests that the population of *Cleome* presently investigated lies at a triploid level.

Malvaceae

4. *Gossypium stocksii* Mast. n=13

This is a rare but wild species of *Gossypium* occurring in arid regions especially on limestone rocks of Sind and Indus delta. The basic number n=13 found by us agrees to the previous report of 2n=26 (SKOVSTED 1935) for this species as well as for other species of *Gossypium*.

Zygophyllaceae

5. *Fagonia cretica* L. n=11

The only count reported for this species is 2n=18 (NEGODI 1939), which suggests a basic number of 9. REESE (1957) recorded a somatic number of ca 24 for *F. glutinosa* Delile and ca 20 for *F. longispina* Batt., which suggests the occurrence of the basic numbers 12 and 10. Our investigation showed clearly 11 bivalents at Metaphase I. From the above information it would appear that aneuploidy is playing a part in this genus having a possible basic set of 9, 10, 11 and 12 chromosomes.

6. *Peganum harmala* L. n=12

A glabrous, dichotomously and corymbosely branched medicinal herb with perennial roots. The number n=12 is a confirmation of the previous reports of WARBURG 1938 (2n=24) and REESE 1957 (n=12).

7. *Tribulus terrestris* L. n=6

Previous counts as reported by various workers show 24 (NEGODI 1937, 1939; SUGIURA 1940 a, b; HEISER & WHITAKER 1948) and 48 (SCHNACK & COVAS 1947) as the somatic numbers. Our investigation shows 6 and not 12 to be the basic number, which is a new record for this species. It shows a great cyto-morphological variation which is under investigation and will be dealt with separately.

8. *Zygophyllum simplex* L. n=8

Z. simplex is a frequently occurring species of this region. The chromosome number n=8 found by us appears to be a new record. MIEGE (1960) reported 2n=20 for this species. Other species of *Zygophyllum,* as *Z. fabago* L. with 2n=22 (WARBURG 1938) and *Z. album* L. with 2n=20 (REESE 1957), show a basic set of 11 and 10 chromosomes, respectively, which is different to our finding. This basic difference suggests the presence of aneuploidy in the genus *Zygophyllum.*

Papilionaceae

9. *Alhagi camelorum* Fisch. n=8

A low shrub armed with numerous pungent spines. Quite common in lower Sind and Indus delta. This species does not appear to have been studied before. The gametic number n=8 is a new record.

10. *Crotalaria burhia* Hamilt. n=8

A tomentose, unarmed deciduous under-shrub, which is frequently occurring in dry sandy plains of W. Pakistan, ascending up to about 4000 ft. The chromosome count for this species is a confirmation of the previous report of n=8 by MALIK (1960).

11. *Sesbania aegyptiaca* Poir. n=6

This is a very common under-tree growing usually near the inhabited areas. It displays a very anomalous meiotic cycle. HAQUE (1946) and RAO (1946) reported a somatic number of 12 for this species. Our investigation confirms 6 to be the basic number for this taxon.

Cucurbitaceae

12. *Citrullus colocynthis* Schrad. n=11

This species has been investigated by various workers, as WHITAKER (1933), KOZHUCHOW (1934), KHOSHOO (1955), FURUSATO & MIYASAWA (1956), REESE (1957), and SHIMOTSUMA (1958), who reported a somatic number of 22. SHIMOTSUMA (1961) also recorded a gametic number of 22. Our study reveals 11 to be the basic number for this species.

13. *Cucumis prophetarum* L. n=12

Out of the four species of *Cucumis* namely: *C. melo, C. sativus, C. trigonus* and *C. prophetarum* only the last two are indigenous to the region while the first two are cultivated. *C. prophetarum* is a very common scabrous herb with a very characteristic ellipsoid fruit, which is usually green with paler vertical stripes. Somatic counts reported by KOZHUCHOW (1930) and MIEGE (1960) shows 2n=24, which falls in line with our record.

Ficoideae

14. *Mollugo hirta* Thunb. n=18

SHARMA & BHATTACHARYYA (1956) reported a gametic number of 18 and somatic number 36 which is also confirmed by our investigation.

Rubiaceae

15. *Oldenlandia aspera* (Heyne) DC. (Syn. *O. retrorsa* Boiss.) n=9

A basic number of 9 for *O. aspera* is a new record although for other allied species as *O. crystallina* and *O. senegalensis* a diploid number of 18 has already been reported by RAGHAVAN & RANGASWAMY (1941) and HAGERUP (1932), respectively. First mentioned authors also recorded 2n=36 for *O. aspera*. Our investigation of this population of *Oldenlandia* confirms the basic number to be 9.

Gentianaceae

16. *Enicostema littorale* Blume n=ca 38

The genus *Enicostema* is represented by a single species, *E. littorale,* which is endemic throughout Sind and Indus delta with a greater frequency near the coastal region. It appears to have been studied only once before, by SRINAVASAN (1941), who reported a somatic number of 38.

Boraginaceae

17. *Trichodesma indicum* R.Br. n=11

This basic number, n=11, is in accordance with the previous finding of MALIK et al. (1959) for this species. REESE (1957) reported n=12 for *T. calcaratum* Coss. which suggests that more than one basic number occurs in the genus *Trichodesma.*

Convolvulaceae

18. *Convolvulus microphyllus* Sieb. ex Spreng. n=18

This is a very common species in Sind and Delta region and at times creates some difficulty in its identification with *C. pluricaulis.* It is distinguished, however, in flower colour, which is rose yellow, and length of the stem being 6—24 inches in contrast to *C. pluricaulis,* which has pale rose coloured corolla and rarely longer stem than 6 inches. Pubescence, leaf texture and bracts are also distinguishable. The meiotic chromosome number of 18 is a new record as this species does not seem to have been studied before.

19. *Convolvulus pluricaulis* Choisy n=20

This species appears to display aneuploidy as more than one basic number (9 & 10) has been reported. SINGH 1951 recorded 2n=20 which falls in line with our finding of n=20. TANDON & MALIK (1959) and MALIK & TANDON (1959) on the other hand reported 9 and 18 as gametic numbers.

20. *Cressa cretica* L. n=14

Cressa is a predominant genus of sandy and saline areas and is represented by a single species, *C. cretica,* in this region. It displays great cyto-morphological aberrations. Although this particular species has not been studied before, the basic number of n=14 is in accordance with the results of HEISER & WHITAKER (1948), who reported 2n=28 for *Cressa truxillensis.*

Solanaceae

21. *Solanum nigrum* L. n=12

This species has been investigated by a large number of workers and many counts are available on record (Table 1). All the numbers 24, 48, 72, 96 and 144 indicate an example of euploidy except n=20 reported by RAI (1959) which is a variation from normal and, according to him, has originated from a poly-haploid (n=36) plant. The material

Table 1. Chromosome counts in Solanum nigrum

n	2n	Author	
—	24, 48, 72	BAHADURI	1933
—	24, 72	STEBBINS & PADDOCK	1949
—	(96, 144)	JORGENSEN	1928
12	—	NANDA	1962
20	—	RAI	1959
36	—	GOTTSCHALK	1954

examined by us shows clearly 12 bivalents at Metaphase I. Whether 12 is the basic number and not 6 is yet to be confirmed.

22. *Solanum xanthocarpum* Schrad. (Syn. *S. surrattense* Burman) n=12

A very common prickly, diffuse herb with typical yellow or whitish and green-blotched berry. The only previous report of a chromosome count for this species is from BAHADURI (1933), who recorded 2n=24.

23. *Physalis minima* L. n=24

A pubescent annual herb which is quite common in this region and is distributed throughout the tropical region. Previous somatic count 48 (BAHADURI 1933) and gametic number 24 (GOTTSCHALK 1954) agree with our present record of n=24.

24. *Withania somnifera* Dun. n=24

One of the most common unarmed shrubs of lower Sind and Indus delta. It is distributed throughout the drier subtropical Indo-Pakistan subcontinent. BAHADURI (1933) and MIEGE (1960) reported 2n=48 and GOTTSCHALK 1954 recorded n=24, which agrees to our finding. This species displays great cyto-morphological anomalies which will be published elsewhere.

25. *Lycium barbarum* L. (Syn. *L. europeum* L.) n=12, 18

This perennial armed shrub is also common throughout the dry sandy expanse of this region. The gametic number 18 is a new record, while 12 was reported before by MALIK (1960). The basic number n=12 reported (DARLINGTON & WYLIE 1955) for this species of *Lycium* apparently holds good until plants having n=6 are found. It is certain, that this species displays polyploidy apart from various cytological aberrations.

Summary

Chromosome counts for 25 indigenous species of Indus delta are presented for the first time. These include new records for 12 species (marked with *), while the chromosome numbers of the remaining 13 are the confirmation of previous counts. Some genera, apart from various meiotic anomalies, display polyploidy of either eu- or aneuploidy type. The polyploidal analysis and the cytomorphological aberrations will be published separately.

Cocculus pendulus Diels ..... n=13
**Cadaba farinosa* Forsk. ..... n=16
**Cleome brachycarpa* Vahl ex DC. ..... n=30
Gossypium stocksii Mast. ..... n=13
**Fagonia cretica* L. ..... n=11
Peganum hermala L. ..... n=12
**Tribulus terrestris* L. ..... n=6
**Zygophyllum simplex* L. ..... n=8
**Alhagi camelorum* Fisch. ..... n=8
Crotalaria burhia Hamilt. ..... n=8
Sesbania aegyptiaca Poir. ..... n=6
Citrullus colocynthis Schrad. ..... n=11
Cucumis prophetarum L. ..... n=12
Mollugo hirta Thunb. ..... n=18
**Oldenlandia aspera* (Heyne) DC. ..... n=9
**Enicostema littorale* Blume ..... n=ca 38
Trichodesma indicum R.Br. ..... n=11
**Convolvulus microphyllus* Sieb. ex Spreng. ..... n=18
**Convolvulus pluricaulis* Choisy ..... n=20
**Cressa cretica* L. ..... n=14
Solanum nigrum L. ..... n=12
Solanum xanthocarpum Schrad. ..... n=12
Physalis minima L. ..... n=24
Withania somnifera Dun. ..... n=24
**Lycium barbarum* L. ..... n=12, 18

Literature

BAHADURI, P. N. 1933. — Jour. Ind. Bot. Soc. **12:** 56.

DARLINGTON, C. D. & WYLIE, A. P. 1955. Chromosome atlas of flowering plants. London.

FURUSATO, K. & MIYAZAWA, A. 1956. F_2 offspring of the hybrid between water melon and colocynthis. — Natl. Inst. Genet. (Japan) Ann. Rep. **6:** 71.

GOTTSCHALK, W. 1954. Die Chromosomenstruktur der Solanaceen unter Berücksichtigung phylogenetischer Fragestellungen. — Chromosoma **6:** 539—626.

HAGERUP, O. 1932. Über Polyploidie in Beziehung zu Klima, Ökologie, und Phylogenie. — Hereditas **16:** 19—40.

HAQUE, A. 1946. Chromosome numbers in Sesbania sps. — Curr. Sci. **15:** 78.

HEISER, C. B. & WHITAKER, T. W. 1948. Chromosome number, polyploidy and growth habit in California weeds. — Am. Jour. Bot. **35:** 179—187.

JORGENSEN, C. A. 1928. The experimental formation of heteroploid plants in the genus Solanum. — Jour. Genet. **19:** 133—211.

KHOSHOO, T. N. 1955. Cytotaxonomy of Indian species of Citrullus. — Curr. Sci. **24:** 377—378.

KOZHUCHOW, Z. A. 1930. Karyological investigations of the genus Cucumis. — Bull. Appl. Bot. Genet. Plant Breeding **23:** 357—366.

— 1934. Zur Karyosystematik der Cucurbitaceen. — Jour. Inst. Bot. Acad. Sci. Ukraine **9:** 63—73.

LÖVE, Á. & LÖVE, D. 1961. Chromosome numbers of Central and Northwest European plant species. — Opera Bot. **5.** Lund.

MALIK, C. P., SEHGAL, S. M. & TANDON, S. L. 1959. Chromosome number in Trichodesma indicum (Linn.) R. Br. and Nonnea pulla Lamk. et D.C. — Sci. Cult. **25:** 215—216.

MALIK, C. P. & TANDON, S. L. 1959. Morphological and cytological studies of a natural polyploid complex in Convolvulus pluricaulis Chois. — Cytologia **24:** 523—531.

MALIK, C. P. 1960. Chromosome number of some dicotyledons. — Sci. Cult. **25:** 437.

MIEGE, J. 1960. Nombres chromosomiques de plantes d'Afrique Occidentale. — Rev. Cyt. Biol. Veg. **21:** 373—384.

— 1962. Quatrième liste de nombres chromosomiques d'espèces d'Afrique Occidentale. — Rev. Cyt. Biol. Veg. **24:** 149—164.

NANDA, P. C. 1962. Chromosome number of some trees and shrubs. — Jour. Ind. Bot. Soc. **41:** 271—277.

NEGODI, G. 1937. Lineamente sulla cariologia delle Rutaceae e delle Zygophyllaceae. — Arch. Bot. **13:** 93—102.

— 1939. Cariologia delle Rutaceae e delle Zygophyllaceae. — Scient. Genet. **1:** 168—185.

RAGHAVAN, T. S. & RANGASWAMY, K. 1941. Studies in the Rubiaceae. Part I. — Jour. Ind. Bot. Soc. **20:** 341.

RAI, U. K. 1959. A 40-Chromosome variant in Solanum nigrum. — Nature **184:** 1587.

RAO, Y. S. 1946. Chromosome number in Sesbania species. — Curr. Sci. **15:** 78.

REESE, G. 1957. Über die Polyploidiespektren in der nordsaharischen Wüstenflora. — Flora **144:** 598—634.

SHARMA, A. K. & BHATTACHARYYA, N. K. 1956. Cytogenetics of some members of Portulacaceae and related families. — Caryologia **8:** 257—274.

SHIMOTSUMA, M. 1958. Cytological studies in the genus Citrullus I. F_1 hybrid in the reciprocal crosses, C. colocynthis Schrad.×C. vulgaris Schrad. — Seiken Ziho **9:** 17—22.

— 1961. Cytogenetical studies in the genus Citrullus V. Chromosome conjugation and fertility in induced autotetraploids. — Jap. Jour. Genet. **36:** 63—71.

SKOVSTED, A. 1935. Chromosome number in Malvaceae I. — Jour. Genet. **31:** 263—296.

SRINIVASAN, A. R. 1941. Cyto-morphological features of Limnanthemum cristatum Griseb. and Enicostema littorale Blume. — Proc. Ind. Acad. Sci. B **14:** 529.

STEBBINS, G. L. & PADDOCK, E. P. 1949. The Solanum nigrum complex in Pacific North America. — Madroño **10:** 70—81.

SUGIURA, T. 1940 a. Studies in chromosome numbers in higher plants V. — Cytologia **10:** 363—370.

— 1940 b. A list of chromosome number in angiospermous plants VI. — Proc. Imp. Acad. Tokyo **16:** 304.

TANDON, S. L. & MALIK, C. P. 1959. Intraspecific polyploidy and evolution of diverse morphological forms in Convolvulus pluricaulis Chois. — Nature **184:** 481.

WARBURG, E. F. 1938. Taxonomy and relationship in the Geraniales in the light of their cytology. — New Phytol. **37:** 189—209.

WHITAKER, T. W. 1933. Cytological and phylogenetic studies in the Cucurbitaceae. — Bot. Gaz. **94:** 780—790.

BOTANISKA NOTISER 1965 · VOL. 118 · FASC. 3 · LUND

Förteckning över den epifytiska diatoméfloran vid svenska västkusten

AV HANS EDSBAGGE
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Diatoméerna utgör enligt GESSNER (1959) den alggrupp, som är ekologiskt och systematiskt bäst känd. Detta påstående kan äga berättigande när det gäller planktoniska diatoméer (huvudsakligen centriska). Den fundamentala betydelse dessa utövar inom havens fria vattenmassor är väl känd genom talrika undersökningar av mycket varierande slag. Utforskningen av litorala diatoméer, sessila och bottenlevande former, har emellertid ännu så länge förbisetts och frågan är om vi i vår kunskap om dessa nått över begynnelsestadiet. Inte desto mindre torde betydelsen av de sessila och bottenlevande diatoméerna (huvudsakligen pennata) vara av grundläggande natur för de biologiska skeendena inom litoralen.

De tidigaste bidragen om diatoméfloran vid svenska västkusten lämnades av C. A. AGARDH under förra delen av 1800-talet. Den bristfälliga metodiken och mikroskopens begränsade möjligheter gjorde att blott ett fåtal arter kunde identifieras och beskrivas. Först senare blev det möjligt att noggrannare studera diatoméfloran och år 1868 kunde P. T. CLEVE för Sverige angiva 189 olika arter varav 80 som marina. Ytterligare 114 marina arter lämnades 1875 av N. LAGERSTEDT, som under sommaren 1871 vistats i Bohuslän för algologiska studier. P. T. CLEVES pionjärarbeten inom diatoméforskningen fortsattes under 1900-talet av ASTRID CLEVE-EULER. Hennes största arbete, »Die Diatomeen von Schweden und Finnland» publicerades under åren 1951—1955 i Kungliga Svenska Vetenskapsakademiens Handlingar och innehåller beskrivningar av inte mindre än omkring 1600 olika arter. Det bör emellertid framhållas, att av dessa arter finnes flera, vilka inte alls iakttagits inom Sveriges eller Finlands gränser men vilka A. CLEVE på goda grunder anser bör finnas inom undersökningsområdet.

Nedan lämnas en förteckning över de epifytiska diatoméarter som förf. identifierat genom undersökningar av olika substrat, huvudsakligen från området kring Kristinebergs Zoologiska Station vid Fiskebäckskil och från Göteborgs skärgård. Antalet diatoméer (inklusive former och varianter) med sessilt levnadssätt, som iakttagits utgör 95 fördelade på 29 släkten. Av dessa 95 har 51 tidigare inte varit kända från svenska västkusten eller från Sveriges kuster. Anledningen härtill är dels att söka i tidigare bristfälliga undersökningar, dels säkerligen också i förändrade miljöförhållanden under de senaste decennierna, t.ex. i de klimatförändringar som ägt och ännu äger rum. Vad den högre algfloran beträffar vet vi nämligen att nya arter på senare tid tillkommit medan andra avtagit i frekvens.

I hydrografiskt hänseende är svenska västkusten att betrakta som mycket heterogen. Detta avspeglar sig också i diatoméflorans sammansättning. I den följande artförteckningen finns således arter, vilka är att karaktärisera som »högmarina» med krav på salthalter över 30 ‰, dels också arter som kännetecknar typiska brackvattensområden t.ex. Östersjön. De utpräglade typiska brackvattensarterna påträffas oftast i vikar eller inom andra områden, som påverkas av sötvattenstillförsel från land, de »högmarina» arterna finner man däremot bara på djup under cirka 15 meter.

Som metodik vid undersökningar av epifytiska diatoméer har behandling med svavelsyra visat sig lämplig, då syran bränner bort organiskt material, således inte endast cellinnehållet hos diatoméerna utan också fytosubstratet, vilket diatoméerna är vidhäftade.

Den följande taxonomiska uppställningen följer olika arbeten av F. HUSTEDT (1930, 1930—1962) och A. CLEVE-EULER (1951—1955). För arterna anges dessutom förekomsterna i gradation »vanlig, mindre vanlig och sällsynt». Vidare anges kraven på olika salthalter och om arterna tidigare inte varit kända från Sveriges kuster.

	Tidigare inte känd från: Sveriges kuster	Sveriges västkust	Toleransintervall: F sötvattensart; B brackvattensart; S saltvattensart (> 17—20 ‰ S)	Förekomster: + vanlig; ++ mindre vanlig; +++ sällsynt
Centrales				
Melosira Ag.				
nummuloides (Dillw.) Ag.	—	—	B S	+++
moniliformis (Müll.) Ag.	—	×	B S	++
Podosira Ehr.				
stelliger (Bail.) Mann.	—	—	S	++
Hyalodiscus Ehr.				
scoticus (Kutz.) Grun.	—	×	B S	+++
Triceratium Ehr.				
reticulum Ehr.	—	—	S	+
f. *trigona*	—	—	S	+
f. *tetragona*	—	—	S	+
alternans Bail.	—	—	S	+
Biddulphia Gray.				
aurita (Lyng.) Breb. et God.	—	—	S	+++
v. *obtusa* (Kütz.) Hu.	—	—	S	+++
Isthmia Ag.				
enervis Ehr.	—	—	S	++
Pennales				
Rhabdonema Kütz.				
minutum Kütz.	—	—	S	+++
arcuatum (Ag.) Kütz.	—	—	S	+++
f. *constricta* Fricke	—	—	S	++
adriaticum Kütz.	—	—	S	++
Tabellaria Ehr.				
fenestrata (Lyng.) Kütz.	—	×	F B S	+
Striatella Ag.				
delicatula (Kütz.) Grun.	—	×	B S	+
unipunctata (Lyng.) Ag.	—	—	S	+++
Grammatophora Ehr.				
angulosa Ehr.	×	—	S	++
arcuata Ehr.	×	—	S	+
marina (Lyng.) Kütz.	—	×	B S	++
oceanica (Ehr.) Grun.	—	—	B S	++
v. *macilenta* (W. Sm.) Grun.	—	—	B S	+++
serpentina (Ralfs.) Ehr.	—	—	S	+++
longissima (Petit.)	×	—	S	+
Licmophora Ag.				
flabellata (Carm.) Ag.	×	—	S	+
gracilis (Ehr.) Grun.	—	×	S	++
v. *anglica* (Kütz.) Perag.	—	×	S	++
juergensii Ag.	×	—	S	++
abbreviata Ag.	—	—	S	+++
ehrenbergii (Kütz.) Grun.	×	—	S	++
f. *angustata* Grun.	×	—	S	++

	Tidigare inte känd från: Sveriges kuster	Sveriges västkust	Toleransintervall: F sötvattensart, B brackvattensart, S saltvattensart (> 17—20 ‰ S)	Förekomster: + vanlig, ++ mindre vanlig, + sällsynt
paradoxa (Lyng.) Ag.	—	—	S	+++
v. *tincta* (Ag.) Hu.	×	—	S	++
communis (Heib.) Grun.	—	—	S	+++
hyalina (Kütz.) Grun.	—	—	S	+++
Diatoma DC.				
vulgare Bory.	—	×	F B	+
elongatum (Lyng.) Ag.	—	×	F B	+
Plagiogramma Grev.				
staurophorum (Greg.) Heib.	—	—	S	++
robertsiana Grev.	×	—	S	+
Dimmerogramma Ralfs.				
minor (Greg.) Ralfs.	×	—	B S	++
Opephora Petit				
marina (Greg.) Petit.	—	—	S	+++
Fragilaria Lyng.				
hyalina (Kütz.) Grun.	—	—	S	+++
Rhaphoneis Ehr.				
surirella (Ehr.) Grun.	×	—	B S	++
v. *australis* Petit.	×	—	S	+
amphiceros Ehr.	—	—	S	++
nitida (Greg.) Grun.	×	—	S	+
Synedra (Ralfs.) Kütz.				
pulchella . (Ralfs.) Kütz.	—	×	B S	++
v. *naviculacea* Grun.	—	×	B S	+
gaillonii (Bory) Ehr.	×	—	B S	+++
investiens W. Sm.	—	—	S	+++
tabulata (Ag.) Kütz.	—	—	B S	+++
v. *fasciculata* (Kütz.) Grun.	—	—	B S	+++
hennedyana Greg.	×	—	S	+
undulata Bail.	—	—	S	++
fulgens (Grev.) W. Sm.	—	—	S	+++
crystallina (Ag.) Kütz.	—	—	B S	+++
Campyloneis Grun.				
grevillei (W. Sm.) Grun.	×	—	S	++
Cocconeis Ehr.				
costata Greg.	—	—	S	+++
scutellum Ehr.	—	—	B S	+++
v. *sturoneiformis* W. Sm.	—	×	B S	+++
distans Greg.	×	—	S	+
v. *bahusiensis* (A. Cl.) Edsb.	—	—	S	+++
placentula Ehr.	×	—	F B S	++
v. *euglypta* (Ehr.) Cl.	×	—	F B	++
molesta (Kütz.) Grun.	×	—	S	++
v. *crucifera* Grun.	×	—	S	++
dirupta Greg.	×	—	S	+
pseudomarginata Greg.	—	—	S	+++

	Tidigare inte känd från: Sveriges kuster	Tidigare inte känd från: Sveriges västkust	Toleransintervall: F sötvattensart, B brackvattensart, S saltvattensart (> 17—20 ‰ S)	Förekomster: + vanlig, ++ mindre vanlig, +++ sällsynt
pelta A. Schmidt.	×	—	S	+
peltoides Hu.	×	—	B S	+
Achnanthes Bory.				
hauckiana Grun.	—	×	B S	++
delicatula (Kütz.) Grun.	—	×	B S	++
groenlandica (Cl.) Grun.	×	—	S	+
brevipes Ag.	—	—	B S	+++
v. *intermedia* (Kütz.) Cl.	—	—	B S	++
v. *parvula* (Kütz.) Cl.	×	—	B S	++
v. *elliptica* Cl.	×	—	S	++
longipes Ag.	—	—	S	++
Rhoicosphenia Grun.				
curvata (Kütz.) Grun.	—	×	F B S	+++
marina (W. Sm.) M. Schmidt.	×	—	S	++
pullus (M. Sm.) A. Schmidt.	×	—	S	+
Mastogloia Thwaites.				
elliptica (Ag.) Cl.	—	×	B S	++
apiculata W. Sm.	×	—	S	+
pumila (Grun.) Cl.	—	×	B S	++
Diploneis Ehr.				
smithii (Bréb.) Cl.	—	—	S	++
Amphipleura Kütz.				
rutilans (Trent.) Cl.	—	—	B S	+++
Brebissonia Grun.				
boecki (Ehr.) Grun.	—	×	B	+
Navicula Bory.				
directa W. Sm.	—	—	B S	+++
grevillei Ag.	×	—	S	++
comoides (Ag.?) Perag.	×	—	S	++
crucigera (W. Sm.) Cl.	—	—	S	+++
complanatula Hu.	×	—	S	++
Amphora Ehr.				
exigua Greg.	—	—	B S	+++
Rhopalodia O. Müll.				
gibberula (Ehr. Kütz.) O. Müll.	—	—	B S	+
musculus (Kütz.) O. Müll.	—	—	B S	++

Summary

The article gives a list of epiphytic diatoms on the Swedish westcoast. The water along the coast is to be regarded as very heterogeneous. Genuine marine conditions are to be found only below about 15 meters depth. Brackish water is to be found in places influenced by fresh water from land. These facts can be observed in the composition of the diatom flora. Of the 95 mentioned diatoms 51 have not earlier been recorded from the Swedish westcoast or from Swedish sea waters at all.

Citerad litteratur

AGARDH, C. A. 1810—1812. Disposito Algarum Sueciae. Lund.

— 1817. Synopsis Algarum Scandinaviae. Lund.

CLEVE, P. T. 1894, 1895. Synopsis of the Naviculoid Diatoms. — Kgl. Svenska Vet. Akad. Handl. 26, 27.

CLEVE-EULER, A. 1951—1955. Die Diatomeen von Schweden und Finnland. — Kgl. Svenska Vet. Akad. Handl. 4:e ser., 2:1 (1951), 3:3 (1952), 4:1, 5 (1953), 5:4 (1955).

GESSNER, F. 1959. Hydrobotanik II. Berlin.

HUSTEDT, FR. 1930. Bacillariophyta (Diatomeae). I PASCHERs Süsswasserflora Mitteleuropas. 2. Aufl., Jena.

— 1930—1962. Die Kieselalgen Deutschland, Österreichs und der Schweiz etc. Del 1 till 3. Bd VII i RABENHORSTs Kryptogamenflora. Leipzig.

LAGERSTEDT, N. G. W. 1875. Saltvattensdiatomaceer från Bohuslän. — Bih. Kgl. Svenska Vet. Akad. Handl. Bd. 3. No. 15.

BOTANISKA NOTISER 1965 · VOL. 118 · FASC. 3 · LUND

Notes on the Limnology and Post-Glacial Development of Lake Trummen

(Preliminary report)

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Lake Trummen, situated near Växjö, Kronoberg county in central South Sweden, has since long been an attractive object for limnological and paleolimnological investigations. Like the adjacent lakes Växjösjön and Södra Bergundasjön Lake Trummen has been utilized as recipient for sewage. This has resulted in an auxotrophication with striking quantitative and qualitative changes in, for example, the plankton, the macrophyte vegetation and the waterfowl fauna. The pollution effect is in this case accentuated by the fact that the highly productive Växjö Lakes are situated in the fairly uniform oligotrophic region of central South Sweden.

Lake Trummen has an area of 1.2 km^2, a greatest depth of about 2 m and is situated 161 m above sea level. It belongs to the drainage area of the River Mörrumsån.

A general survey of the limnological conditions of Lake Trummen and analyses of its summer net plankton are given by THUNMARK (1945 a, b). BRUNDIN (1947, 1949) has studied the chironomide fauna and has also described environmental conditions. Planktological notes are given by LANG (1928) and the lake is mentioned in the Växjö Lake study by GESSNER (1934). The sediment investigations by LUNDQVIST (1926, 1927) are referred to below.

In 1951 one of the authors (BJÖRK) started investigations on the macrophyte vegetation in Lake Trummen. These also included studies on the bottom substratum and the formation of floating stands of hyperhydates (plaur). Observations made during the sediment studies,

among other things the presence of subfossil fruits of *Trapa natans,* inspired DIGERFELDT to carry out investigations on the development of Lake Trummen, including the water level fluctuations, by means of pollen- and macro-fossil analysis.

In this precursory report a general survey of present limnological conditions (notes on water quality, plankton, macrophyte vegetation and plaur formation) is given by BJÖRK and the results from the studies of the history of development (micro- and macro-fossil analysis) are described by DIGERFELDT.

General survey of present limnological conditions

The water. In 1960—1961 a reconnoitring investigation on water quality and plankton in the central part of northern Lake Trummen was made. In 1960 samplings were carried out monthly from the time before the break-up of the ice in the spring until the lake was ice-coated the following winter (i.e. March—December). The samplings in 1961 included the months March—August. Some results concerning the surface water from these preliminary studies are given in Fig. 1 to show characteristic features in the environmental conditions.

The water colour, expressed as mg Pt/l, varied between 25 and 80. In 1960 the colour curve has a fairly regular course. The colour is low in early spring, high in May and June and then successively lower until a minimum is reached in September—October, whereupon the colour again becomes higher.

From June and September 1944 THUNMARK (1945 a, b) gives the values 178 and 197 concerning specific conductivity (here calculated in μS_{20}) of the surface water in Lake Trummen. These values are both higher than those obtained in 1960—1961 which varied between 121 and 149. No doubt the lowering of the specific conductivity is due to the decrease in the sewage discharge to the lake which has taken place since the fourties. Values as great as those given by THUNMARK (opp. cit.) have, however, been obtained in water sampled near the bottom during winter, when, under the ice, there is developed a stratification with respect to different environmental and organism conditions. Under ice-free conditions no more permanent stratification persists in the lake, but there is constantly an exchange of water between the surface and the bottom layers.

The changes during the year in the composition and the quantitative development of the plankton (for plankton bloom during the summer,

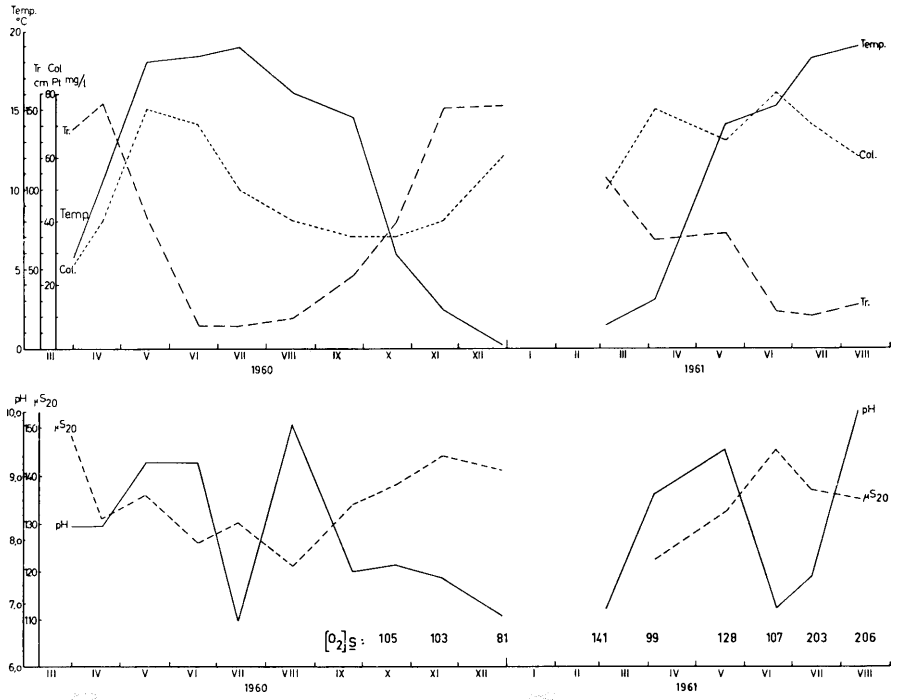


Fig. 1. Temperature, Secchi disk transparency (Tr), colour, specific conductivity, pH, and oxygen saturation of surface water in Lake Trummen. The values of oxygen saturation, $[O_2]_S$, are corrected with respect to the atmospheric pressure.

see below), changes in weather conditions as well as the physiologic response of the plankton to these, are the main reasons for the variations in Secchi disk transparency, pH, and oxygen content which are illustrated in Fig. 1. When the weather is windy the superficial sediment layer is often whirled up, causing a turbidity of the water, which also contributes to a lowering of the transparency. On such occasions there is also a marked drop in pH (cf., e.g., July 1960 and June 1961).

On the whole the environmental conditions in the central part of northern Lake Trummen in several respects resemble those which are well known from other shallow polluted lakes with plankton blooms, e.g. the Danish lake Lyngby Sø (cf. OLSEN 1955, JOHNSEN et al. 1962).

The plankton. In great tracks the most characteristic features in the plankton development during different seasons in 1960 and 1961 were as follows.

In early spring (March 1960) there was, under the ice, a rich development of nanoplankton, especially small centric diatoms, causing a greenish colour of the water from ice to bottom. After the break-up of the ice (April 1960) the nanoplankton community was succeeded by a mass development of rotifers (above all *Brachionus angularis, B. calciflorus, Keratella quadrata* and *Polyarthra dolichoptera,* cf. Fig. 2). Among the *Microcystis* spp., which often characterize the summer plankton community in Lake Trummen, *Microcystis flos-aquae* was rather frequent already in the middle of April 1960. In May the same year the frequence of rotifers was still high. The volumetrically dominating phytoplankton species in the net plankton was *Micractinium pusillum.* During the summer months there are in Lake Trummen regularly plankton blooms caused by *Microcystis* and *Anabaena* spp., in 1960 by *Microcystis flos-aquae.* In October 1960 the high production of cyanophytes was followed by diatoms (*Asterionella formosa* and *Melosira* spp.) and in November and December the rotifers formed a new maximum and again constituted the totally dominating part of the net plankton. In November *Keratella quadrata* and *Polyarthra dolichoptera* had about the same frequency, but in December the latter was in absolute majority.

The ice conditions during the winter 1960—1961 were fairly irregular and periods with thin ice coating alternated with periods when the ice broke up or ice-holes occurred. Due to this, among other things, the course in the first part of 1961 concerning the changes in the environmental conditions as well as the aspect changes in plankton in some respects considerably differed from those observed during the corresponding time in 1960.

In March 1961 a mass development of *Synura uvella* characterized the plankton. In April there was a *Melosira* maximum and in May a *Micractinium pusillum* maximum. During June and above all in July *Anabaena planctonica* was responsible for a vigorous plankton bloom, which in August was continued by *Microcystis flos-aquae.*

Macrophyte vegetation. The notes on the macrophyte vegetation given here exclusively refer to the conditions in the northern part of the lake. In the bays here luxuriant stands of *Equisetum fluviatile, Phragmites communis, Schoenoplectus lacustris* and *Typha latifolia* are expanding lakewards. The outer front of the hyperhydate belt usually consists of *Equisetum fluviatile,* while the other species form the shoreward part of the belt (cf. Fig. 3). In openings in the hyperhydate stands there is a thick layer of *Riccia fluitans,* and *Lemna*

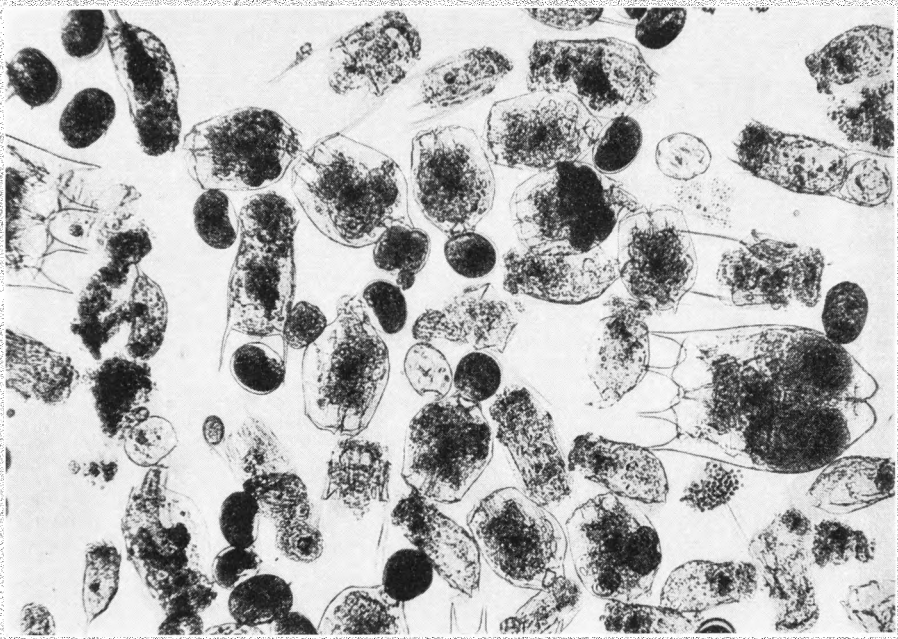


Fig. 2. Detail picture of net plankton with *Brachionus angularis, B. calciflorus, Keratella quadrata,* and *Polyarthra dolichoptera.* Lake Trummen 19/4 1960. — S. Björk photo.

minor is frequent (Fig. 4). Since about 1960 *Ricciocarpus natans* occurs in Lake Trummen and is now common in the north part. This species, new to the flora of central South Sweden (Björk 1955), is nowadays found in several localities within the region, e.g. in the drainage area of the River Emån (in 1961, e.g., common at Markestad, north of Lake Solgen).

The vegetation in the zone of ephydates consists of large-leaved stands of *Nuphar luteum* and *Nymphaea alba.* These species also occur in the hyperhydate zone.

In the highly productive macrophyte communities in the northern part of Lake Trummen the accumulation of organic matter is considerable and a rapid growth of the sediments takes place.

Plaur formation. From the Danube delta Antipa (e.g. 1910) has described the floating hyperhydate stands, which are termed plaur (from popular Roumanian idiom). A description, including instructive figures, of the development of these formations, characteristic for the



Fig. 3. The inner part of the bay at the St. Sigfrid hospital. In the foreground *Equisetum fluviatile* plaur and along the shore reeds of *Phragmites communis* and stands of *Typha latifolia*. — S. Björk photo. 17/8 1954.

Danube delta (cf., e.g., Rodewald-Rudescu 1958, 1961, Bârcă 1962), has been given by Rodewald (1943). From Swedish eutrophic lakes Thunmark (1952) reported the occurrence of plaur and also pointed out that conditions for plaur formation often arise in polluted lakes (Thunmark 1955).

Broadly speaking a plaur is a hyperhydate (in known cases graminide) stand or part of such, which with its rhizome and root system, including the bottom substratum penetrated by this, has been lifted and lost its contact with the bottom and continues to grow floating on the water surface. The cause of the lifting is gas development in the sediment.

A multiplicity of "floating islands" with different appearance and developed under different conditions is reported in the literature. (Cf., e.g., Olsen 1955 and 1964 and the literature referred to there. As to lakes with quagmires, cf. Alm 1943.) With respect to the environmental conditions in which it develops as well as to its physio-

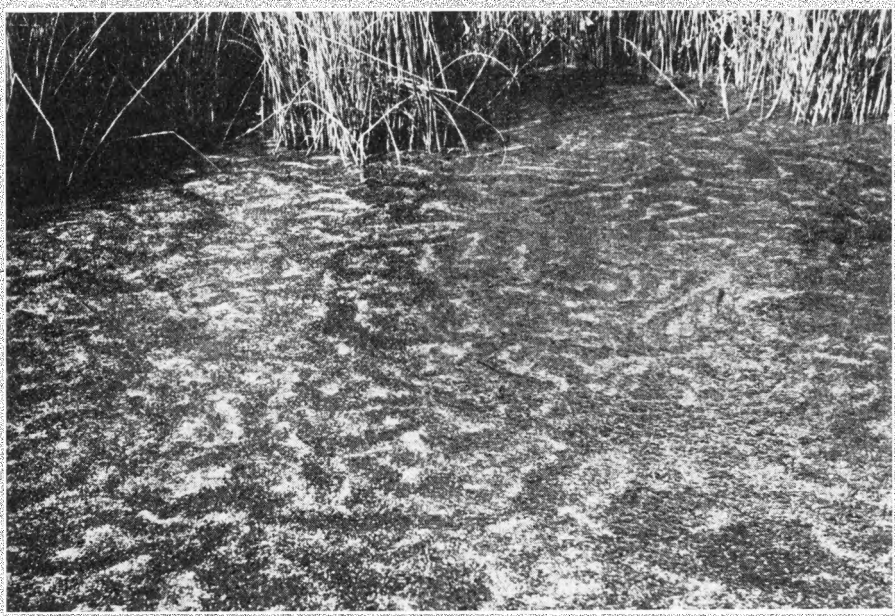


Fig. 4. Opening in the hyperhydate stands shown in Fig. 3. In the surface water layer a c. 3 cm thick felt of *Riccia fluitans*. Swimming tracks of *Fulica atra* are indicated by the arrangement of *Lemna minor*. — S. BJÖRK photo. 17/8 1954.

gnomy the plaur is a uniform and well defined formation which ought to be the subject of more attention. The appearance of plaur is an indication of certain environmental conditions, it has consequences concerning the stratigraphy of the sediments, and it offers possibilities of ecologic studies in unique biotopes.

In Sweden the formation of plaur takes place in fresh as well as in mixohaline waters. Along the coast of Blekinge, in the south-east of Sweden, e.g., plaur often occurs in the inner part of the bays.

Due to the auxotrofication of Lake Trummen there are good conditions for plaur development in the northern bays. Fairly large areas of dense *Equisetum fluviatile* as well as stands of luxuriant *Typha latifolia* and *Schoenoplectus lacustris*, all superficially rooted in the loose upper gyttja layers, are lifted up and developed as characteristic plaur formations (cf. Fig. 3 and 5).

In Fig. 6 a section from 1954 through a plaur area is shown diagramatically. In the shoreward zone the hyperhydate vegetation consists of *Typha latifolia*, floating in its outer margin. The main part of

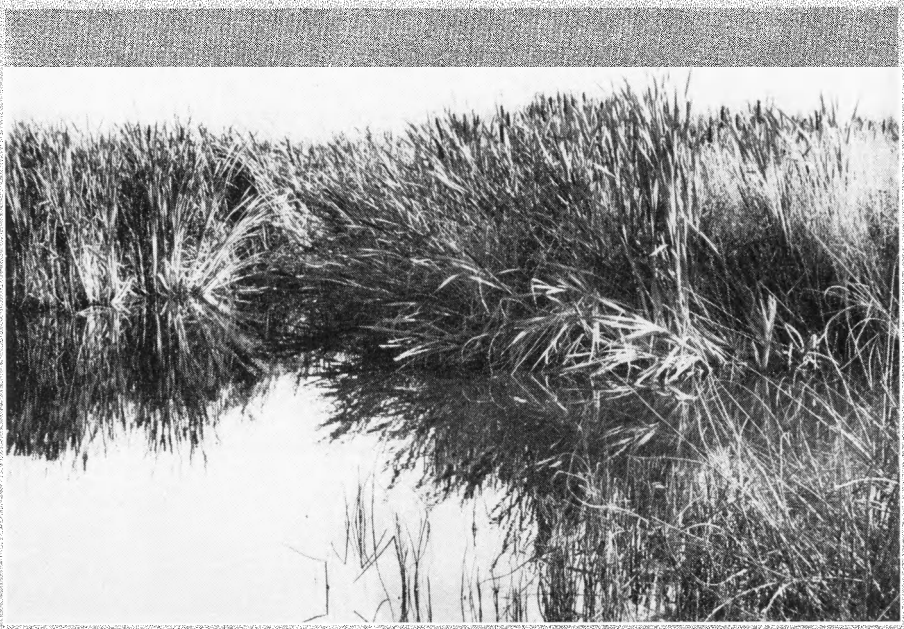


Fig. 5. Plaur formation in stands of *Typha latifolia*, turning over in their outer margin. — S. Björk photo. 17/8 1954.

the middle zone is developed as *Equisetum* plaur. Different phases in plaur formation are represented here. In one section the rhizome and root layer with the gyttja penetrated by it has not yet lost the contact with the bottom, and fixed as well as unfixed (detached) plaur occurs. It ought to be noted that the whole sediment layer is lifted up from the mineral bottom in the inner part of the plaur area. In the lakeward zone of the section there is *Equisetum* which is rooted in the bottom and intermingled with *Nuphar luteum* and *Nymphaea alba*. The area within which this section was laid out is shown in Fig. 3.

From the Danube delta (e.g. Antipa 1910) as well as from Swedish eutrophic lakes (Thunmark 1952, 1955) the occurrence of a rich flora on the plaur has been described. *Bidens cernua, B. tripartita, Calla palustris, Calystegia sepium, Carex pseudocyperus, Cicuta virosa, Epilobium hirsutum, Galium palustre, Lastrea thelypteris, Mentha aquatica, Myosotis palustris, Naumburgia thyrsiflora, Rumex hydrolapathum, Solanum dulcamara, Scutellaria galericulata, Sparganium erectum* and *Veronica anagallis-aquatica* are examples of species observed

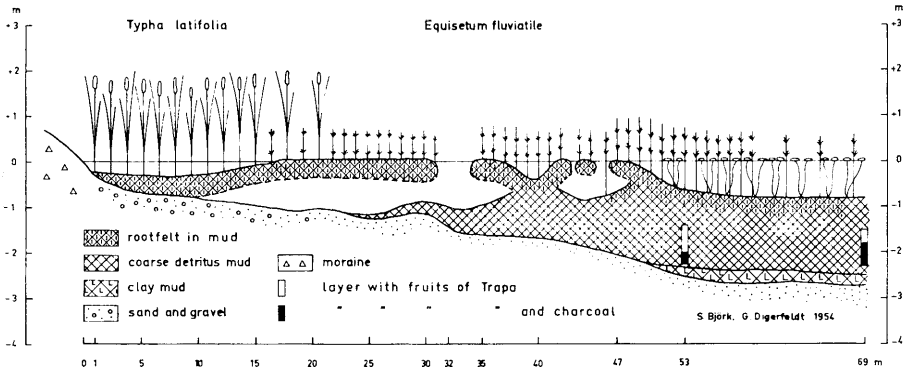


Fig. 6. Section through the *Typha-Equisetum* plaur area shown in the right half of Fig. 3.

on plaur by the author (BJÖRK) in eutrophic lakes in Sweden (Scania and Södermanland). Especially in the margin of the plaur the above-mentioned plant species and even others form a qualitatively as well as quantitatively well developed fringe, the parafyllion according to THUNMARK (opp. cit.).

In Lake Trummen the paraphyllion is, however, weakly developed. Besides the graminides forming the plaur, single specimens of the following plant species were observed on the *Equisetum* plaur shown in Fig. 3: *Bidens cernua, Calla palustris, Dryopteris cristata, Epilobium* sp., and *Lycopus europaeus. Marchantia polymorpha* was, however, frequent.

Equisetum fluviatile is, together with *Phragmites communis,* one of the most common hyperhydates of the lakes in central South Sweden. From a quantitative point of view, and with respect to standing crop as well as to shoot qualities, both species markedly react to different environmental conditions. As to *Equisetum fluviatile* this is here demonstrated in Table 1 by means of some biometric data collected from the lakes Fiolen, Bodasjön, Trummen, and Jägern in order to compare the Trummen plaur biotope with other *Equisetum* biotopes.

Lake Fiolen, situated 30 km NNW of Lake Trummen, is a typical *Lobelia* lake, with oligohumic water and still fairly little affected by human activity. It is recognized internationally as a lake to be preserved for research purposes. For further information concerning this lake, see, e.g., THUNMARK (1931) and MALMER (1960).

The water level of Lake Bodasjön, situated 40 km NNW of Lake Trummen,

Table 1. Biometric data on Equisetum fluviatile from five biotopes

Biotope	Date	Sampling area m²	Water depth cm	Shoots per m²		
				S	F	T
Lake Fiolen, middle reach of east shore. Minerogenous bottom (hard archaean morain)	23/8 1954	16	28—50	9.7	3.9	13.6
Lake Fiolen, south-west shore. Minerogenous bottom (hard archaean morain)	24/8 1954	16	32—51	15.8	6.6	22.4
Lake Bodasjön. Organogenous bottom (coarse — fine detritus gyttja)	19/7 1955	4	19—31	431	44	475
Lake Trummen. Fixed plaur	11/8 1954	4	0	213	329	542
Lake Jägern. Organogenous bottom (coarse — fine detritus gyttja)	12/9 1957	2	42—50	212	267	479

has been lowered several times since the 1870's. The whole lake is now densely overgrown by graminides, in the main by *Equisetum fluviatile*. The character of the lake was originally oligotrophic.

For comparison some data from Lake Jägern are also given. This lake is situated in the county of Södermanland. It has been described by THUNMARK (1952) and given as an example of an eutrophic lake. The *Equisetum* sampling was here carried out relatively later than in the other lakes. For the comparisons made here, this circumstance is, however, of fairly little importance.

In all the four lakes the samples have been collected in pure or practically pure stands. From the data given in Table 1 it is quite clear that *Equisetum fluviatile* grows under favourable conditions in the Trummen plaur area. There it shows the greatest shoot density, highest fertility, dry matter and ash weights per biotope area as well as the highest degree of branchiness.

Results of chemical analyses of the sediments within the plaur area in Lake Trummen will be treated elsewhere. In this connection it will only be mentioned, that the potassium content in the lifted up young layers of gyttja is markedly higher than in the underlying layers.

During the observation period 1951—1964 great changes in the distribution of different macrophyte species have taken place in the northern bays of Lake Trummen. The inner *Equisetum* stands and also part of the plaur area have, for instance, been overgrown by *Phragmites*. In lowered as well as in polluted lakes in south Sweden this type of succession is very common.

in four lakes in South Sweden. S=sterile. F=fertile. T=total

Fertility %	Shoots without branches S+F %	Branches per branched shoot S+F			Dry matter per m² S+F g			Ash per m² S+F T g
		min.	mean	max.	Stems	Branches	T	
29	78	1	2.3	9	7.4	0.19	7.6	1.1
30	83	1	4.5	17	14.7	0.23	14.9	2.2
9.3	13	1	29	111	668	62	730	79
61	3	1	56	170	760	217	977	137
56	39	1	7.4	42	956	19	975	127

In the last few years the innermost parts of the bays, where the accumulated sediments reach the water surface, have in some reaches been filled up with stones, soil and wastes and the shore line has moved lakewards as much as 70 m. The area within which the section shown in Fig. 6 was situated, is now also covered with a thick layer of stone and soil.

Notes on the History of Development

During the investigation of the plaur ("floating island") described above, several subfossil fruits of *Trapa natans* L. were found in the mud (section Fig. 6 and Fig. 7). Even if a rather large number of finds are already known from adjacent regions (cf. MALMSTRÖM 1920), the find reported here constitutes a new former habitat for the species in question.

For some years the author (DIGERFELDT) has been occupied with a fairly intensive investigation of the Post-glacial development of Lake Trummen, based on pollen- and macro-fossil analyses and certain other micro-fossil analyses. The profile described in this paper originates from a reconnoitring boring made at the very beginning of this investigation.

A paleolimnological investigation of Lake Trummen, as well as of the adjacent Lake Växjösjön and Lake Södra Bergundasjön, was earlier

made by G. LUNDQVIST (1926, 1927 pp. 107—108). The principal aim of that investigation was an examination of the composition of the microphyte vegetation and its development during different periods, and the conclusions concerning trophic and similar conditions that could be drawn therefrom. On the basis of both quantitative and qualitative changes in the microphyte vegetation, LUNDQVIST considered it possible to state that all the lakes investigated with regard to trophic conditions diverged from the normal course of development. Around the transition from the Sub-boreal to the Sub-atlantic period, changes in the microphyte vegetation should thus have taken place indicating not, as is normally the case, a continued meiotrophication, but, on the contrary, a noticeable increase in the trophic potential. Furthermore, according to LUNDQVIST, in all the lakes the mud deposited during the following Sub-atlantic period, was dark coloured on account of the presence of FeS. LUNDQVIST considered that the cause of the conditions mentioned was to be found in an auxotrophication by cultural influence in so far as there was already at that time (i.e. around the transition from Bronze Age to Iron Age) unusually dense settlement within the region in question, and this had led to pollution of the water of the lakes. Later, THUNMARK (1945 a, pp. 65—82) thoroughly examined and criticized this investigation by LUNDQVIST, mentioned here only briefly; and in doing so — on good grounds as it seems to the author — came to a different conclusion. The criticism covers not only the interpretation of the micro-fossil diagrams, but also the interpretation of the causes possibly underlying eventual changes in the microphyte vegetation.

The profile described by the present author makes no contribution to this problem, but perhaps this will be possible after finishing the present investigation. So much can already be said, however, that in connection with reconnoitring borings undertaken covering the largest part of Lake Trummen, a FeS colouring of the surface sediments was observed only in the inner part of the north-western bay which has received most of the sewage from the hospital. The FeS colouring includes at most the upper 10—20 cm, certainly only representing the most recent sedimentation.

The boring point is situated 50—60 m south of the section through the investigated plaur at a distance of 40 m from the eastern shore. It lies outside the plaur region in an accidental gap in the ephydate vegetation. The water depth was 42 cm.

1. 42—185 cm Brown detritus mud, the lower 10—15 cm sligthly sandy.
2. 185—195 cm Brown detritus mud, very sandy.
3. 195— cm Grey slightly muddy clay, the upper 3—5 cm rather sandy.

The macro-fossil sampling covered 95—205 cm of the sequence. Only samples for pollen-analysis were taken of the upper very soft mud (not the uppermost, however).

The zoning of the pollen diagram has been carried out according to the Scanian zone system (T. NILSSON 1935, 1961, 1964). As is usual in profiles situated near the shore, more or less extensive gaps in the sequence, due to erosion and/or interrupted deposition are to be found. Even if these gaps may complicate the correlation, they are nevertheless of great interest, as they can provide valuable criteria for the interpretation of the development of the lake itself. As a result of the present investigation, a main diagram from the deepest part of the lake is almost finished. With the help of this diagram, which includes an unbroken Post-glacial zone succession, it has been possible to carry out the zoning of the actual shore profile with a considerable degree of certainty.

According to this interpretation, there is a considerable gap between the Late-glacial clay and the immediately superposed Post-glacial detritus mud, corresponding to the Pre-boreal (zone PB), the Early Boreal (zone BO 1) as well as a great part of the Late Boreal period (zone BO 2). The Sub-boreal zones cover only a very small part of the sequence. A division of these (into zone SB 1 and SB 2) has not been considered possible, which also applies to the following Sub-atlantic zones (into zone SA 1 and SA 2). The additional profile material that will be available when the present investigation is finished may possibly lead to minor adjustments, but on the whole the correlations so far made would seem to be correct.

At the boring, a new type of sampler designed by the author (a description is in the press) was used. With the help of this sampler it was easy to obtain sample volumes large enough for the macro-fossil analysis. The free area of intersection of the model used amounts to 200 cm^2. Each macro-sample included 5 cm of the sequence; the volume thus amounted to 1000 cm^3. Washing was carried out immediately after the return to the laboratory (net 40 meshes per inch). The frequency of different macro-fossils has, as usual, been stated in absolute values. In the diagram only frequent or for some other reason important or interesting species are included.

The quantity of coarse detritus in the samples has been determined in accordance with the pattern of similar earlier investigations by FRÖMAN (1936), SELLING (1938, 1940), and WENNER (1939). As for practical reasons the determinations has been made after the sorting out of the macro-fossils, the term "coarse detritus" is perhaps — as SELLING (1939) has pointed out — not quite correct, as fruits and seeds must also be included in the fraction in question. SELLING therefore suggests the term "vegetative macro-fossils" for the part of the washed material that remains after the sorting of fruits and seeds. Normally, this fraction diverges only slightly from the absolute amount of coarse detritus. In spite of this, the author has chosen to use the more easily handled term "coarse detritus", supplemented with a reference to how the determination has been made.

The determination of quantity includes both volume and dry weight. The volume was determined after the material had settled for 24 hours in water-filled bottles. The reliability of the values obtained in this way was discussed earlier by WENNER (1939) and SELLING (1940). Here it needs only be mentioned that the author has changed the method in the present investigation so far as the material, prior to measuring, is also exposed to a certain pressure with the help of a simple construction — for the purpose of reducing the effect that the nature of the material ("fibrousness") certainly has at uninfluenced sedimentation (cf. WENNER 1939, SELLING 1940).

The coarse detritus curve and the different fruit and seed curves are intended to interpret the development of the lake. A prerequisite for investigations of this kind giving good results is that they are carried out very intensively with several borings in a profile from the shore towards the central and deeper part of the lake. Separate borings can, of course, give interesting information, but they rarely give a complete picture of the development. The water depth at a given point and its relation to the range of the different vegetation belts during a fluctuation of the water level are some of the factors decisive for the way in which this change has been registered in the sequence of layers. The conditions prevailing during different periods in the history of the lake may have differed, and there is rarely more than part of the development collected in the sequence at one and the same point. Near the shore apparently unitary changes can turn out to be of a complex nature when followed up in a profundal direction — among other things because traces of earlier development have here been entirely or partially removed due to erosion during periods of low water level.

Changes in the range of the vegetation belts, which happen occasionally unconnected with fluctuations in the water level can further give rise to misinterpretations if only one or a few borings are considered.

As previously mentioned, the profile described here was made for the purpose of reconnoitring, and this must be born in mind when interpreting it. The description will only contain the main features.

The extensive gap between the Late-glacial clay and the immediately superposed Post-glacial mud must certainly be connected with the low water level period, which has proved to be generally registered in the sequence of lakes and bogs during the older part of the Post-glacial period (cf. among others SUNDELIN 1917, LUNDQVIST 1925, T. NILSSON 1935). During this period the bottom at the boring point came to lie above the limit of sedimentation. The deposition of mud was interrupted and erosion of earlier deposited layers may also have occurred. A closer dating of this period is not possible here. However, this may very well be possible if, as is intended, the investigation is followed up in a profundal direction to a water depth which even during the culmination of the lowering of the water level permitted the deposition of mud, and where the fluctuation in question ought in principle to be registered not as a gap in the sequence, but, on the contrary, by turns of the different curves in the macro-fossil diagram.

A comparatively high proportion of coarse detritus and mineral matter indicates a location rather near the shore during the time immediately after the beginning of mud deposition.

The decrease in the quantity of coarse detritus and mineral matter after that can probably be interpreted as caused by a rise in the water level proceeding into the Late Atlantic period. The question of what is behind the marked turn of the detritus curve, as well as of several of the other macro-fossil curves, around the level of 1.55—1.60 m, must be left open for the present.

The interpretation of a rise in the water level, in the way mentioned above, is generally easy and indisputable. It is considerably more difficult to decide whether an increase in the quantity of coarse detritus is to be connected on the same grounds with a lowering of the water level. This may be the case, but the cause may also be the normal development of the lake, with a gradually reduced water depth due to the proceeding sedimentation and filling-up, without any connection whatever with changes in the water level. A combination of these two events is, of course, also possible. A follow-up in a littoral and profundal direction is also necessary here.

Therefore the cause of the marked increase in the coarse detritus fraction during the latter part of the Late Atlantic period must also for the present be left undetermined. The slight mud deposition in the following Sub-boreal period indicates, at all events, that during the corresponding time the bottom came up near the limit of sedimentation, with the result that the deposition of mud could no longer take place or proceeded only sporadically. Erosion may, of course, also have occurred.

The marked decrease in the amount of coarse detritus that occurred after a culmination some time in the Sub-boreal period is certainly connected with a new rise in the water level. A general observation may be justified here. As has been pointed out, all frequences in the macro-fossil diagram are expressed in absolute values. They will consequently depend on the rate of accumulation, but also on the degree of consolidation of the sediment and its water content. A certain reduction in all frequencies in the upper part of the sequence which is very soft and not yet consolidated is thus always to be expected, and this is also the case with the profile described here. It is true that an increase in the water content begins to be noticeable around the level of 0.90—1.00 m. However, the change is small at the beginning and proceeds slowly; it can possibly have contributed to, but not be by any means the main cause of, the marked decrease in the proportion of coarse detritus and contemporary changes in the occurrence of some of the macro-fossils.

The interpretation of the other curves in the macro-fossil diagram, i.e. the curves for different fruits and seeds and other determinable objects, will also be dealt with. The *Scirpus* curve reflects quite distinctly the two shallow water periods mentioned above; the question about the marked turn during the first part of the Early Atlantic period must be left open for the time being, as has previously been pointed out. The *Equisetum* curve reflects only the younger period.

During the corresponding time reeds of the species in question have spread over or occurred in the immediate vicinity of the boring point. The retreat of these reeds enforced by the increased water depth in connection with the rising water level in the late part of the Post-glacial period shows up specially well in the diagram. Since it has not been possible to obtain samples of the uppermost mud, the later development is, unfortunately, not known. As mentioned before, the boring point is at present situated within the ephydate belt.

Concerning the curves of the ephydates (*Trapa natans, Potamogeton natans, Nymphaea alba,* and *Nuphar luteum*), these ought to have had

a course alternating with the hyperhydates. However, this is not the case, which may be explained at least partly by the fact that the sampling point is situated rather close to the shore. Sediments deposited within the shore zone itself or just outside a dense reed belt will often contain in addition to fruits and seeds from the vegetation of the very place, also a variable amount originating from the drift. It may be that similar circumstances have had an unsettling effect also on the present profile.

The presence of *Trapa natans* (Fig. 7) always attracts special attention because of its evidence of the climate during different parts of the Post-glacial period. Already in the oldest Post-glacial samples its fruits appear with increasing frequency. They occur most abundantly in layers from the Early Atlantic and the first half of the Late Atlantic period. This occurrence certainly registers a local habitat, even if it is perhaps partly composed of fruits from the drift, as mentioned above. The oldest occurrence dates back to some part of the Late Boreal period. Because of the existing gap in the sequence nothing can yet be said about the development prior to that.

During the investigation of the plaur a fairly large amount of charcoal was found in the mud. In connection with the macro-fossil analysis all the charcoal has been sorted and its dry weight recorded. As can be seen, the occurrence is concentrated to the lowest part of the mud sequence. The charcoal most certainly originates from a dwelling-place situated near the shore, from which it was washed out. The author will not be able to give positive information about the age of this dwelling-place until the present investigation is finished.

A very interesting point is that separate completely or partially "roasted" fragments of *Trapa* fruits have been found in the same layer where charcoal occurs. The explanation must be that these fragments originate from fruits which were collected for food and brought home to the dwelling-place, from where they were washed out at the same time as the charcoal. The idea that the highly nutritious fruits were used for food has been put forward several times before (cf. among others JÄGGI 1884, SUNDELIN 1920), and there is no reason to doubt this, even if only a few direct proofs of it have so far been published.

A description of the recent plaur ("floating island") in Lake Trummen has been given in this paper by BJÖRK. In this connection it may finally be mentioned that in recent years separate fossil "floating islands" have been discovered (TROELS-SMITH 1951, 1953, 1960, MAGNUSSON 1962, JØRGENSEN 1963). In all cases their formation has been

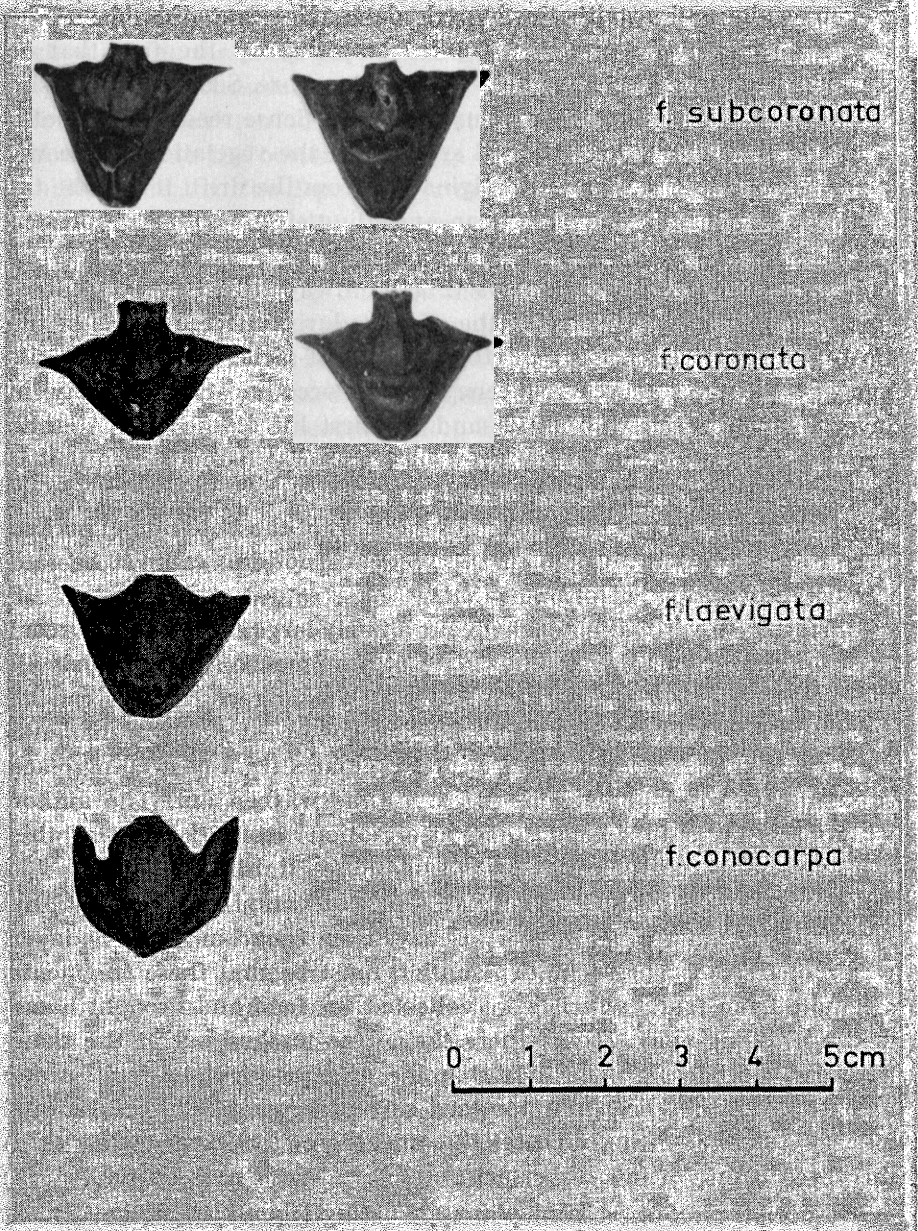
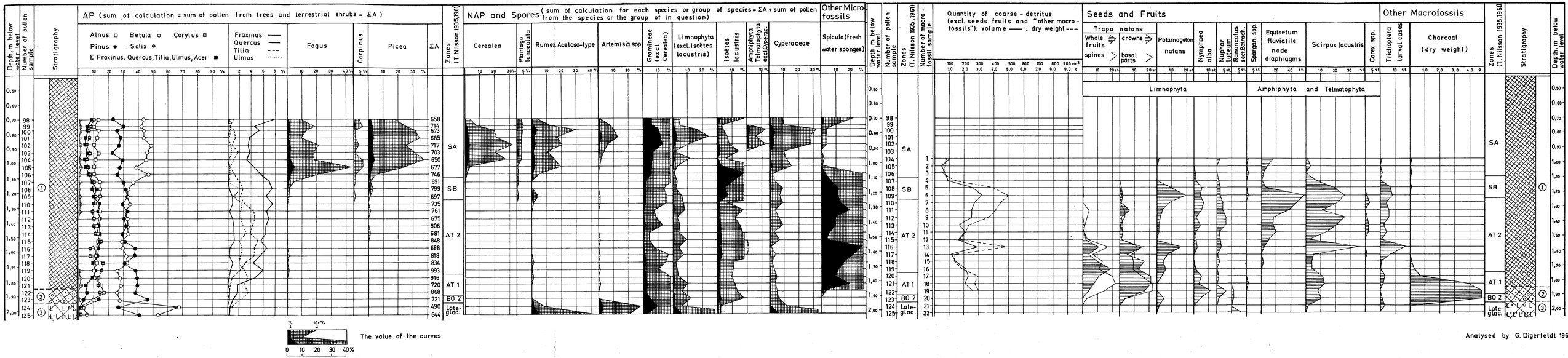


Fig. 7. Subfossil fruits of *Trapa natans* found in Lake Trummen.


per 1000 cm³
Depth, m below water level
Number of pollen sample
Stratigraphy
AP (sum of calculation = sum of pollen from trees and terrestrial shrubs = ΣA)
Alnus □ Betula ○ Corylus ■
Pinus ● Salix ⊛
Σ Fraxinus, Quercus, Tilia, Ulmus, Acer ■
Fraxinus
Quercus
Tilia
Ulmus
Fagus
Carpinus
Picea
ΣA
Zones (T. Nilsson 1935, 1961)
NAP and Spores (sum of calculation for each species or group of species = ΣA + sum of pollen from the species or the group of in question)
Cerealea
Plantago lanceolata
Rumex, Acetosa-type
Artemisia spp.
Gramineae (excl. Cerealea)
Limnophyta (excl. Isoëtes lacustris)
Isoëtes lacustris
Amphiphyta and Telmatophyta excl. Cyperaceae
Cyperaceae
Other Microfossils
Spicula (fresh water sponges)
SA
SB
AT 2
AT 1
BO 2
Late-glac.
The value of the curves
Number of macro-fossil sample
Quantity of coarse-detritus (excl. seeds fruits and "other macro-fossils"): volume ——— ; dry weight - - -
Seeds and Fruits
Trapa natans
Whole fruits
spines
crowns
basal parts
Potamogeton natans
Nymphaea alba
Nuphar luteum
Ranunculus sect. Batrach.
Sparganium spp.
Equisetum fluviatile node diaphragms
Scirpus lacustris
Carex spp.
Limnophyta
Amphiphyta and Telmatophyta
Other Macrofossils
Trichoptera larval cases
Charcoal (dry weight)
Analysed by G. Digerfeldt 196

considered to be conditioned by a rise in the water level, an explanation which it has also been possible to fit into the picture of the development given by pollen diagrams and other conditions. Nevertheless, in the account of the general conditions for the formation of a "floating island" terms have often been used that can easily lead the reader to believe that the cause is always (TROELS-SMITH 1960, p. 590) or in most cases (TROELS-SMITH 1951 p. 178) a rise in the water level. However, as has been shown, the causes can vary. Consequently, the evolutionary interpretation must be made with a certain degree of caution. In no circumstance can the formation be placed in connection with water level fluctuations without other conditions being taken into account.

Literature cited

ALM, G. 1943. Beiträge zur Kenntnis der Limnologie kleiner Schwinguferseen. — Arch. Hydrobiol. 40.

ANTIPA, G. 1910. Die Biologie des Inundationsgebietes der unteren Donau und des Donaudeltas. — Proc. Int. Congr. Zool. 8.

BÂRCĂ, G. 1962. Curs de amenajări piscicole şi stuficole. Bucureşti.

BJÖRK, S. 1955. Om förekomsten av spirodelider i Södra Sveriges Fiskeriförenings dammar i Aneboda. (With German summary.) — Skr. Söd. Sver. FiskFör. 1953—1954.

BRUNDIN, L. 1947. Zur Kenntnis der schwedischen Chironomiden. — Ark. Zool. 39 A: 3.

— 1949. Chironomiden und andere Bodentiere der südschwedischen Urgebirgsseen. Ein Beitrag zur Kenntnis der Bodenfaunistischen Charakterzüge schwedischer oligotropher Seen. — Rep. Inst. Freshwat. Res. Drottningholm. 30.

FRÖMAN, I. 1936. Geologklubben vid Stockholms Högskola. Mötet den 19 februari 1935. — Geol. För. Stockh. Förh. 58.

GESSNER, F. 1934. Nitrat und Phosphat im dystrophen See. — Arch. Hydrobiol. 27.

JOHNSEN, P., MATHIESEN, H. & RØEN, U. 1962. Sorø-Søerne, Lyngby Sø og Bagsværd sø. Limnologiske studier over fem kulturpåvirkede, sjællandske søer. (With English summary.) — Dansk IngForen. Spildevandskomiteen. Skrift 14.

JÄGGI, J. 1884. Die Wassernuss, Trapa natans L. und der Tribulus der Alten. — NeujBl. Naturf. Ges. Zürich. 86.

JØRGENSEN, S. 1963. Early Postglacial in Aamosen. Geological and Pollen-Analytical Investigations of Maglemosian Settlements in the West-Zealand Bog Aamosen. — Danm. geol. Unders. Række 2. 87.

LANG, K. 1928. Beiträge zur Kenntnis der Süsswasserrotatorien Schwedens. — Acta Univ. lund. N.F. Avd. 2, 23.

LUNDQVIST, G. 1925. Utvecklingshistoriska insjöstudier i Sydsverige. (With German summary.) — Sver. geol. Unders. Ser. C. 330.

— 1926. Sjöarna Trummen, Växjösjön och Södra Bergundasjön. Ur de förorenade sjöarnas historia. (With German summary.) — Skr. Söd. Sver. FiskFör. 1926.

— 1927. Bodenablagerungen und Entwicklungstypen der Seen. Binnengewässer. 2.

MAGNUSSON, E. 1962. Lyby mosse. En vegetations- och utvecklingshistorisk undersökning. — Sver. geol. Unders. Ser. C. 588.

MALMER, N. 1960. Some ecologic studies on lakes and brooks in the South Swedish uplands. — Bot. Notiser 113.

MALMSTRÖM, C. 1920. Trapa natans L. i Sverige. — Svensk bot. Tidskr. 14.

NILSSON, T. 1935. Die pollenanalytische Zonengliederung der spät- und postglazialen Bildungen Schonens. — Geol. För. Stockh. Förh. 57.

— 1961. Ein neues Standardpollendiagramm aus Bjärsjöholmssjön in Schonen. — Acta Univ. lund. N.F. Avd. 2, 56.

— 1964. Standardpollendiagramme und C^{14}-Datierungen aus dem Ageröds mosse im mittleren Schonen. — Acta Univ. lund. N.F. Avd. 2, 59.

OLSEN, S. 1955. Lake Lyngby Sø. Limnological studies on a culturally influenced lake. General description and the ecological conditions of the water and the bottom deposits. — Folia limnol. scand. 7.

— 1964. Vegetationsændringer i Lyngby Sø. Bidrag til analyse af kulturpåvirkninger på vand- og sumpplantevegetationen. (With English summary.) — Bot. Tidsskr. 59.

RODEWALD, L. 1943. Das Schilfproblem in Rumänien mit besonderer Berücksichtigung des Donaudeltas, im Lichte der Fischwirtschaft und Jagd dieses Landes und seine Beziehung zur Wirtschaft Mitteleuropas. — Anal. Inst. Cerc. pisc. Rom. 2.

RODEWALD-RUDESCU, L. 1958. Schilfrohr und Fischkultur im Donaudelta. — Arch. Hydrobiol. 54.

— 1961. Schilfrohr und Fischkultur im Donaudelta. — Proc. int. Ass. theor. appl. Limnol. 14.

SELLING, O. H. 1938. Entwicklungsgeschichtliche Studien im Molken-See mit besonderer Rücksicht der Frequenzwechsel der Makrofossilien. — Geol. För. Stockh. Förh. 60.

— 1939. Berichtigung. — Geol. För. Stockh. Förh. 61.

— 1940. Till kännedom om Trapa natans L. i Börjesjön. — Geol. För. Stockh. Förh. 62.

SUNDELIN, U. 1917. Fornsjöstudier inom Stångåns och Svartåns vattenområden med särskild hänsyn till den sen- och postglaciala klimatutvecklingen. — Sver. geol. Unders. Ser. Ca. 16.

— 1920. Om stenåldersfolkets och sjönötens invandring till småländska höglandet. — Ymer 1920.

THUNMARK, S. 1931. Der See Fiolen und seine Vegetation. — Acta phytogeogr. suec. 2.

— 1945 a. Die Abwasserfrage der Växjö-Seen in hydrobiologischer Beleuchtung. Grundzüge in der regionalen Planktologie von Südschweden. — Meddn Lunds Univ. Limnol. Instn. 4.

— 1945 b. Zur Soziologie des Süsswasserplanktons. Eine methodologisch-ökologische Studie. — Folia limnol. scand. 3.

— 1952. Karaktärsdrag i sörmländsk sjövegetation. — Natur i Södermanland. Göteborg.

— 1955. Limnologiens betydelse för lösandet av vattenföroreningsproblemen. — Meddn IngVetenskAkad, FKO-med. 19.

TROELS-SMITH, J. 1951. Fossile Hængesække i Aamosen. (Fossil floating peat in the Aamosen). — Meddr dansk geol. Foren. 12.
— 1953. Ertebøllekultur — Bondekultur. Resultater af de sidste 10 Aars Undersøgelser i Aamosen. — Aarb. Nord. Oldkynd. 1953.
— 1960. The Muldbjerg Dwelling Place: An Early Neolithic Archeological Site in the Aamosen Bog, West-Zealand, Denmark. — Smithsonian report 1959.
WENNER, C.-G. 1939. Börjesjön — en växtpaleontologisk studie av en fornsjö med Trapa natans. — Geol. För. Stockh. Förh. 49.

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Smärre uppsatser och meddelanden

Ny inlandslokal i Västergötland för Elymus arenarius

Under en bilfärd mellan Jönköping och Falköping den 23/8 1963 fick jag från bilen se ett bestånd av strandråg strax ö. om Leaby, Karleby s:n, Västergötland. Den 23/7 1964 gjorde jag en närmare undersökning av lokalen. Denna utgör nu en rest av den gamla vägen Jönköping—Falköping, där denna går över en åldrig valvbro över ett tillflöde till Slafsan. Genom en tidigare vägomläggning har denna gamla väg kommit att ligga s. om den till 1963 använda. Genom ny vägomläggning 1964 ligger lokalen helt n. om den nya vägen Jönköping—Falköping. Största delen av *Elymus*-beståndet befinner sig på ömse sidor om valvbron. Jag räknade c:a 260 blommande, och minst 50 äldre, icke blommande ax på en areal av omkr. 15 kvm. Marken hör till gården Klövhålan, c:a 300 m sö. om valvbron. Vid mitt samtal med ägaren till gården, Fru ELNA KRALL, framgick det, att hon observerat detta gräs på platsen sedan c:a 20 år tillbaka. Hon visade mig också på ett gräs, som hon trodde vara detsamma, växande c:a 50 m ö. om gården vid den nu privata väg, som går omedelbart intill gården, men som tidigare var den allmänna vägen Jönköping—Falköping och fortsatte över valvbron. Det var ett mindre bestånd av *Elymus* på vardera vägkanten med c:a 50 blommande och lika många gamla icke blommande ax.

Elymus arenarius förekommer vid Valstad, c:a 10 km från nyssnämnda lokal, men är där enl. kyrkoherde L. FRIDÉN, god kännare av traktens flora, inplanterad för att binda flygsand. Någon sådan förekommer ej vid Leabylokalen, ej heller har man behövt transportera vägmaterial ss. sand och grus från annat håll, då sådant stått till buds på platsen. Man får väl i alla fall antaga, att *Elymus* hamnat på de båda lokalerna vid Klövhålan genom antropochor spridning.

Lokalen vid Valstad finns med en prick angiven i HULTÉNS Atlas över växternas utbredning i Norden. Enligt uppgift från Riksmuséet är materialet för denna markering uteslutande från Valstad och ej från Leabylokalen, som annars inneslutes av kartpricken.

A. JYLLMAN

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Notiser

Riksmuseets botaniska avdelning. Docent TYCHO NORLINDH har förordnats till professor och föreståndare för Riksmuseets botaniska avdelning.

Docentförordnande. Till docent i paleobotanik vid Lunds Universitet har förordnats fil. dr. HANS TRALAU.

Forskningsanslag. Statens naturvetenskapliga forskningsråd har vid sammanträde den 10 maj 1965 utdelat bl.a. följande anslag: till doc. O. ALMBORN, Lund, 25.137 kr. för utarbetande av en flora över Sydafrikas lavar; till doc. KARIN ASCHAN-ÅBERG, Uppsala, 22.436 kr. för studium av imperfekta dermatofyter; till prof. K. BJÖRLING, Uppsala, 22.860 kr. för fortsatta undersökningar av spontana och nitritinducerade mutationer av tobaksmosaikvirus; till försöksledare S. BLIXT, Landskrona, 10.000 kr. för genanalytiska undersökningar av ärt, samt 10.000 kr. för den Lamprechtska *Pisum*-kollektionens bevarande; till prof. H. BURSTRÖM, Lund, 29.300 kr. för undersökningar över verkningssättet av naturliga och syntetiska tillväxtämnen; till doc. T. DENWARD, Lund, 17.036 kr. för studier över *Trifolium pratense* och *Phytophthora infestans,* samt 6.650 kr. för in-vitro-odling av växtceller och -vävnad för virusförsök; till prof. H. ERDTMAN, Stockholm, 60.000 kr. för kemotaxonomiska studier inom barrträdsgruppen; till prof. F. FAGERLIND, Stockholm, 14.500 kr. för växtmorfologisk forskning; till doc. P. FRANSSON, Lund, 2.130 kr. för studier över naturliga växthormoner; till doc. LISBETH FRIES, Uppsala, 16.456 kr. för undersökning över rödalgernas näringsfysiologi under kontrollerade betingelser; till prof. N. FRIES, Uppsala, 14.352 kr. för studier över vävnads- och cellkulturer hos fröväxter; till doc. S. FRÖST, Lund, 11.300 kr. för undersökning av accessoriska kromosomer och undersökning av inavlad råg; till doc. P. HALLDAL, Göteborg, 43.538 kr. för undersökning av fotosyntes hos alger; till doc. O. HEDBERG, Uppsala, 26.496 kr. för växtsystematiska undersökningar; till doc. ANGELICA VON HOFSTEN, Uppsala, 15.000 kr. för elektronmikroskopiska undersökningar av svampar; till doc. L. HOLM, Uppsala, 3.000 kr. för fortsatt elektronmikroskopisk undersökning av aecidiospormembranen hos vissa rostsvampar; till agr. dr. G. JULÉN, Svalöf, 7.000 kr. för fortsatta undersökningar rörande yttre förhållandens inverkan på den embryologiska utvecklingen hos *Poa pratensis*; till doc. A. KYLIN, Stockholm, 13.296 kr. för undersökning av växternas jonupptagning; till prof. H. LUNDEGÅRDH, Penningby, 7.000 kr. för undersökningar över de energikonverterande enzymsystemen i mitokondrier och kloroplaster; till doc. BRITTA LUNDBLAD, Stockholm, 640 kr. för insamling av växtfossil av mesozoisk ålder i Skåne; till laborator N. MALMER, Lund, 9.124 kr. för växtekologiska undersökningar i Sydsverige; till prof. J. A. NANNFELDT, Uppsala, 10.000 kr. för genomgång av fil. dr. A. H. MAGNUSSONS lavsamling för att göra den tillgänglig för forskningen; till laborator T. NILSSON, Lund, 16.074 kr. för forskning

rörande senkvartär vegetationshistoria i sydöstra Sverige; till amanuens T. NITZELIUS, Göteborg, 4.000 kr. för taxonomiska och växtgeografiska undersökningar även som insamling av vissa mediterrana lignoser; till fil. lic. GERTRUD NORDBORG, Lund, 2.766 kr. för studium av släktavgränsning och sektionsindelning i *Sanguisorba*; till doc. HEDDA NORDENSKIÖLD, Uppsala, 11.952 kr. för studium av fertilitetsstörningar hos nyframställda tetraploider av korn samt deras uppträdande hos stammar av olika ursprung; till doc. B. NORÉN, Lund, 15.443 kr. för studier över antocyanfärgämnenas sammansättning hos släktena *Rubus* och *Ribes*; till doc. Å. PERSSON, Lund, 9.124 kr. för växtekologiska undersökningar i Skäralidsdalen i Skåne; till doc. B. PETTERSSON, Uppsala, 38.028 kr. för forskning inom ekologisk botanik; till doc. H. RUNEMARK, Lund, 14.652 kr. för cytologisk bearbetning av botaniskt material från Grekland; till prof. F. SANDBERG, Stockholm, 27.775 kr. för fytokemisk undersökning över afrikanska *Strychnos*-arter; till doc. R. SANTESSON, Uppsala 4.495 kr. för lichenologiska och mykologiska studier i USA okt.-nov. 1965; till fil. lic. S.-O. STRANDHEDE, Lund, 2.565 kr. för fält- och museistudier av *Eleocharis*; till fil. dr. GUNHILD WEIMARCK, Lund, 23.829 kr. för skogsvetenskapliga forskningar inom Örkeneds socken; till prof. D. VON WETTSTEIN och laborator H. ZECH, Stockholm, 28.162 kr. för elektronmikroskopiska undersökningar över tobaksmosaikvirusreproduktion, samt till doc. G. ZETTERBERG, Uppsala, 29.629 kr. för studier över enzymmutationer hos *Neurospora* och *Ophiostoma*.

BOTANISKA NOTISER 1965 · VOL. 118 · FASC. 4 · LUND

Studies on Variation in Embryo Sac Development

Second Part[1]

By HAKON HJELMQVIST and FRANCO GRAZI

Botanical Museum, Lund, and Unilever Research Lab., Zevenaar, The Netherlands

4. Oxybaphus nyctagineus

In his investigation of the embryology of Centrospermae ROCÉN (1927, p. 23) states that in *Oxybaphus nyctagineus* the megaspore tetrad formation as a rule takes place in a normal way through formation of 4 megaspores, but that certain deviations occur. One case is described and illustrated where the wall formation is suppressed after the first meiotic division but not after the second, so that the tetrad is made up of one binucleate cell in the middle with one uninucleate on each side, thus a tetrad of "Tridax type". In another case the wall formation is lacking not only after the first division but also after the second, at least between the upper nucleus pair; an indication of wall formation could be observed between the two lower nuclei. In spite of extensive investigative work, the author could not follow the further development of these deviating cases and so far regards them as anomalies, which however may have a certain theoretical interest.

In a later investigation of the same species COOPER (1949) has observed only the normal type of development and illustrates also tetrads with 4 megaspores, separated by walls.

In view of the different statements concerning the tetrad formation and the incomplete knowledge of the further development of the possibly occurring deviations, an investigation was made of the embryo sac formation of *Oxybaphus nyctagineus*. The aim of the investigation was also to state whether the external conditions could play some role in the development. Plants were cultivated in pots from seeds obtained

[1] The first part of the investigation was published in Botaniska Notiser 117, 1964, p. 141—166.

from Beal-Garfield Botanical Garden, East Lansing, Michigan, and placed in two greenhouses with regulated and controlled temperature, air humidity and light conditions in the Plant Physiological Institute in Lund, one with higher, the other with lower temperature. The experiment began November 19, 1964. In the cooler greenhouse the temperature was 11—15°C. in the first part of the experiment and about 13—17° in the latter, from December 7 onwards. The temperature variations were as a rule very small; the exceptionally occurring fluctuations were of very short duration. In the warmer house the temperature was about 19—22°C., with brief fluctuations up to 24—26° and down to 17 or 18°. Fixations of flower buds were made in the solution of Navashin-Karpechenko and after embedding in paraffin they were cut in the usual way and stained with hematoxylin according to Heidenhain; counterstaining was made with light-green.

General development

An investigation of the material showed that the tetrad of Tridax type, with the nuclei arranged after the scheme 1 : 2 : 1, was by far the most common. The wall formation thus as a rule is suppressed after the heterotypic division (Fig. 1 *b*), but not after the homotypic (Fig. 1 *c*), resulting in the formation of one binucleate cell in the middle and one uninucleate on either side (Fig. 1 *e*). In all 218 tetrads were observed in the two investigation series, and among these 196, thus 90 per cent, were of the Tridax type. However, observations of the further development never showed any instance of the formation of an embryo sac from the 2-nucleate cell. The embryo sac instead arose from the basal cell, as in

Fig. 1. *Oxybaphus nyctagineus*. *a* Megaspore mother cell. *b* Dyad without wall formation. *c* Tetrad formation. Wall formation after the second division but not after the first. *d* Tetrad formation. In the second division wall formation between the upper nucleus pair but not between the lower. *e* Tetrad of Tridax type. *f* 1-nucleate embryo sac, arisen from a tetrad of Tridax type, the two upper cells degenerated. *g* In a tetrad of Tridax type both 1-nucleate cells have developed into 1-nucleate embryo sacs, the 2-nucleate cell between them has degenerated. *h* Two dyad nuclei in division. No wall formation between them, but an annular swelling of the primary cell wall and an almost complete cytoplasmic separation. *i* Tetrad of the type 2 : 1 : 1, yet with a stripe in the upper cell that possibly corresponds to a degenerated wall. *j* Dyad with wall formation. *k* 4-celled tetrad. *l* In a 4-celled tetrad the basal cell has developed into a 1-nucleate embryo sac, the 3 upper have degenerated. *m* An abnormal case with a tetrad of Tridax type where there is a connection between the two upper cells. — About×1020.

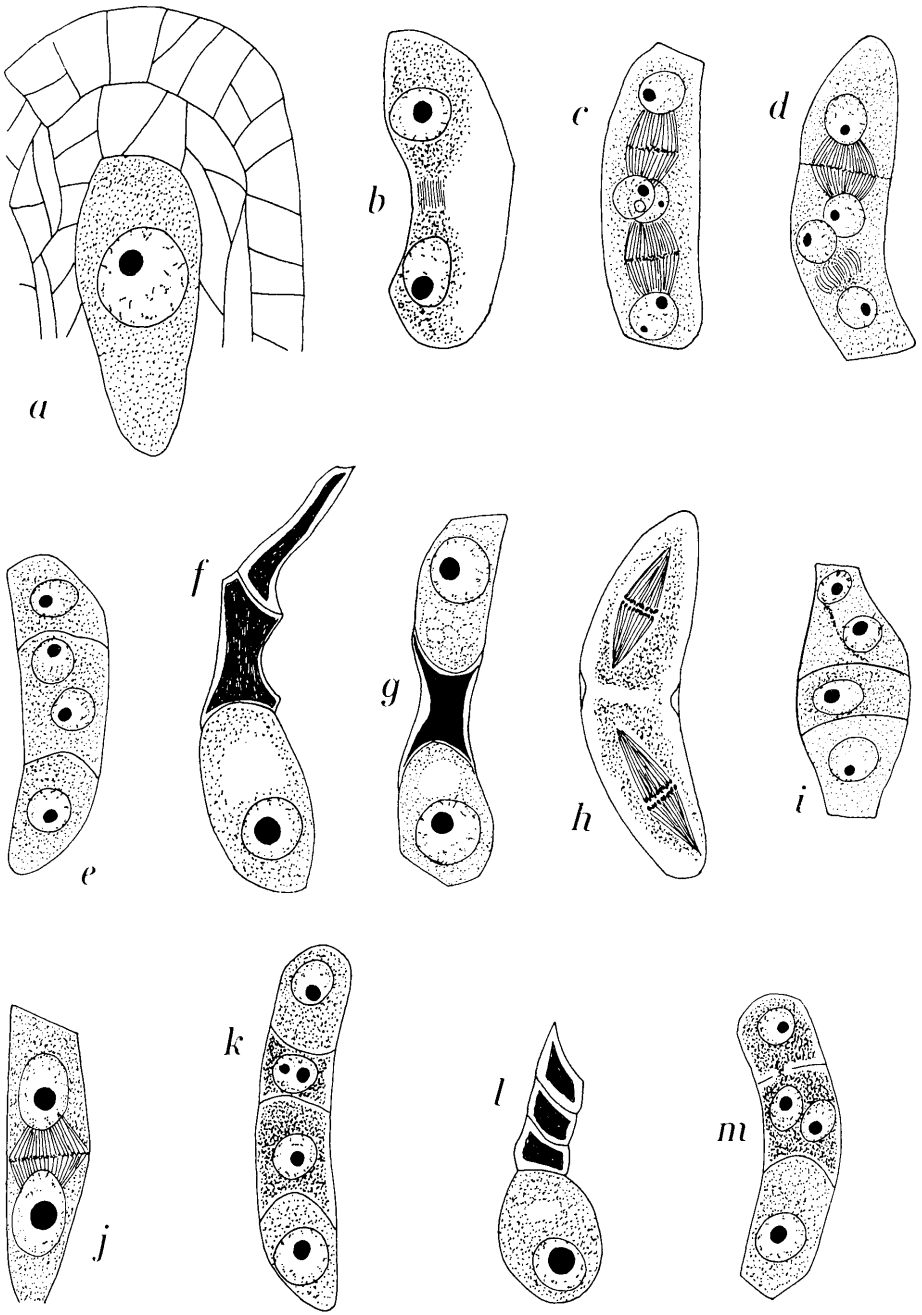


Fig. 1.

the Normal type (Fig. 1 *f*); the sole possibly occurring exception was a case (Fig. 1 *g*) where the upper 1-nucleate cell was equally vigorous as the basal cell in a later developmental stage, while the 2-nucleate central cell was quite degenerated; in this case thus there may be a chance for embryo sac formation from the upper 1-nucleate cell.

In less numerous cases there occurred under both experimental conditions tetrads with 4 separate cells, thus with the formula 1 : 1 : 1 : 1 (Fig. 1 *k*). In total 17 such cases were observed among 218 tetrads, thus about 8 per cent only. In those cases where the embryo sac had begun to develop it was stated that the basal cell formed the embryo sac (Fig. 1 *l*); the development was thus completely in agreement with the Normal type.

In some cases transitions between the two tetrad types occurred, so that an incomplete wall was formed after the first division. In two cases (both at the lower temperature) there thus was in the central cell an incision, about to the middle of the cell lumen, that divided the cytoplasm incompletely. In another case (under the same conditions) there was an almost complete interruption in the cytoplasm in the middle of the cell, but no cell membrane occurred; the wall, however, had an annular swelling in the middle of the cell (Fig. 1 *h*).

In rare cases some further tetrad types were found to occur. In two cases (at the lower temperature) thus tetrads were observed where walls had been formed after the first division, but no wall formation had taken place after the second division in the upper part of the tetrad, the result being a 2-nucleate cell above and two 1-nucleate megaspore cells below, thus with the formula 2 : 1 : 1. In one of the cases, however, there was a narrow stripe in the cytoplasm of the 2-nucleate cell which may be a degenerated wall formation (Fig. 1 *i*). In both cases the nucleus of the basal cell was bigger than the other nuclei, and consequently the development was apparently also in these cases of the monosporic type, the basal cell winning in the competition.

In one case (at the lower temperature) where the four megaspore nuclei were just formed, wall formation occurred between the two upper nuclei but not between the two lower ones (Fig. 1 *d*). In other cases, when there is a difference in time between the development in the upper and lower part, the latter is usually more advanced. Thus it seems probable that no wall would be formed between the lower nucleus pair and a tetrad of the formula 1 : 3 would arise. Possibly, however, a delayed membrane formation would take place in the lower part, so that a tetrad of the common type, 1 : 2 : 1, would be the result.

Another case (at the higher temperature) shows a tetrad that on the whole agrees with the common type, 1 : 2 : 1. However, there is a connection between the two upper cells; the wall between them is incomplete and thus there is here an intermediate type that approaches type 3 : 1 (Fig. 1 *m*). Also in this case the development is certainly monosporic, since the basal cell is largest, has the biggest nucleus, and is in vigorous growth.

With regard to the fact that the most common difference in the tetrad organization concerns the wall formation after the heterotypic division, it may also be of interest to investigate the dyads, where this wall formation may likewise be observed. In order to obtain definite proof that a wall is really lacking in a dyad, it is of course necessary to examine only stages that are comparatively advanced, so that the division is fully complete. In all, 10 cases of such dyads without wall formation were observed and in addition 16 cases where the second division was already in progress but no wall formation had taken place after the first division. Against these 26 cases were 9 where in the dyad stage or a little later a wall had been formed after the first division. The percentage of cases with wall formation thus is higher when the dyads are taken into consideration; this may partly be due to the mentioned aim to record only certain — and consequently late — stages of dyads without a wall, which may reduce the number of this type.

In two dyads (both at the cooler temperature) a transition between the two alternatives was observed: no wall had been formed between the dyad nuclei, although these were already in the next division, but there was an interruption in the cytoplasm and in one of the cases also an annular thickening around it.

The conditions at different temperatures

A comparison was made between the tetrad formation of those plants that were cultivated at the higher and the lower temperature respectively. The frequency of the different types is visible from tab. 1.

As is evident from the table, the normal tetrad formation, with 4 cells separated by walls, was more rare at the higher temperature and had a somewhat greater frequency at the lower. In the colder conditions this type occurred in 13 cases (=13 per cent of the classified cases), in the warmer in 5 cases (=4 per cent), while the tetrad of Tridax type was observed in 82 cases (=84 per cent) at the lower, 114 cases (95 per cent) at the higher temperature. The difference is even somewhat more

Table 1. Oxybaphus nyctagineus. Tetrad development at different temperatures

	Lower temperature (about 12—16°)		Higher temperature (about 19—22°)	
	Number	Per cent	Number	Per cent
Tetrads 1 : 2 : 1	82	84	114	95
Tetrads 1 : 1 : 1 : 1	13	13	5	4
Other tetrads	3	3	1	1
Total	98	100	120	100
Dyads without wall	14	64	12	92
Dyads with wall	8	36	1	8
Total	22	100	13	100
No wall after first division	97	81	127	95
Wall after first division	23	19	6	5
Total	120	100	133	100

evident, if the total number of cases where a wall has been formed after the heterotypic division is compared with those where this wall is lacking; in this case thus the dyads are also taken into consideration. In such a calculation the percentage with wall formation at the lower temperature is 19, at the higher 5, while the cases without wall formation are represented by 81 per cent at the lower and 95 per cent at the higher temperature.

It may appear astonishing that the normal and complete megaspore formation is more common at a lower temperature. In other cases — when the question was of the development of the tetrasporic embryo sac — on the contrary a simpler development was found to be more common at the lower temperature (HJELMQVIST & GRAZI 1964). It is, however, apparently possible to explain the conditions observed by a direct influence of temperature on nuclear division and cell formation, even though the explanation at present must be regarded as only a working hypothesis. The nuclear division no doubt is accelerated by the higher and delayed by the lower temperature. Since the nuclear division is a sensitive and delicate procedure, it is however reasonable to assume that it is more strongly affected than cell division and wall formation. In the unstable conditions that distinguish *Oxybaphus,* where the wall formation sometimes occurs, sometimes is lacking after the first division, it may be conceivable that in a rapid nuclear division the chances of a wall formation between the nuclei are smaller, in a slow nuclear division on the contrary greater. In the former case there is perhaps no time at all for the formation of a wall, or only an incomplete

wall formation takes place, before the beginning of the second nuclear division; in the latter case there is with the prolonged time greater possibilities for a complete wall formation. — This theory is, as will be shown later, in agreement with certain other conditions in parallel cases.

5. Mirabilis jalapa

Mirabilis jalapa has also been investigated by ROCÉN (1927) as to its embryology. This author states that the megaspore formation generally is normal, with a 4-celled tetrad, but that the wall formation sometimes is suppressed, either in the second meiotic division or in both divisions (ROCÉN, 1. c., p. 23, 25, Fig. 37 b, e). Also in this case the further development of the deviating tetrad could not be followed; in solitary cases the author, however, observed mature embryo sacs with up to 5 antipodals (1. c., p. 28, Fig. 44 b).

An investigation was undertaken of the embryo sac development of *Mirabilis jalapa* in order to obtain a more complete picture of the variations that occurred and further with the aim of studying possibly existing differences between different races and between plants cultivated under different temperature conditions.

In the autumn of 1964 fixations were made of different proveniences, cultivated in the Botanical Garden of Lund. The cultivated samples had been grown from seed obtained from different botanical gardens and it was obvious, even from their general appearance, that genetical differences were present: there were variations in flower colour between different samples (red, rose, white, and variegated), further in leaf colour (quite green or more or less yellowish green), in growth vigour etc.

The fixations were made from September 29 to October 3 and the same methods were used as in the case of *Oxybaphus*: the fixation fluid was that of Navashin-Karpechenko and staining was made with hematoxylin according to Heidenhain.

General development of the tetrad

The common condition proved to be that the megaspore tetrad was made up of 4 separate cells (Fig. 2 *a*) and thus was of normal organization. Many deviations occurred, however, as a result of suppression

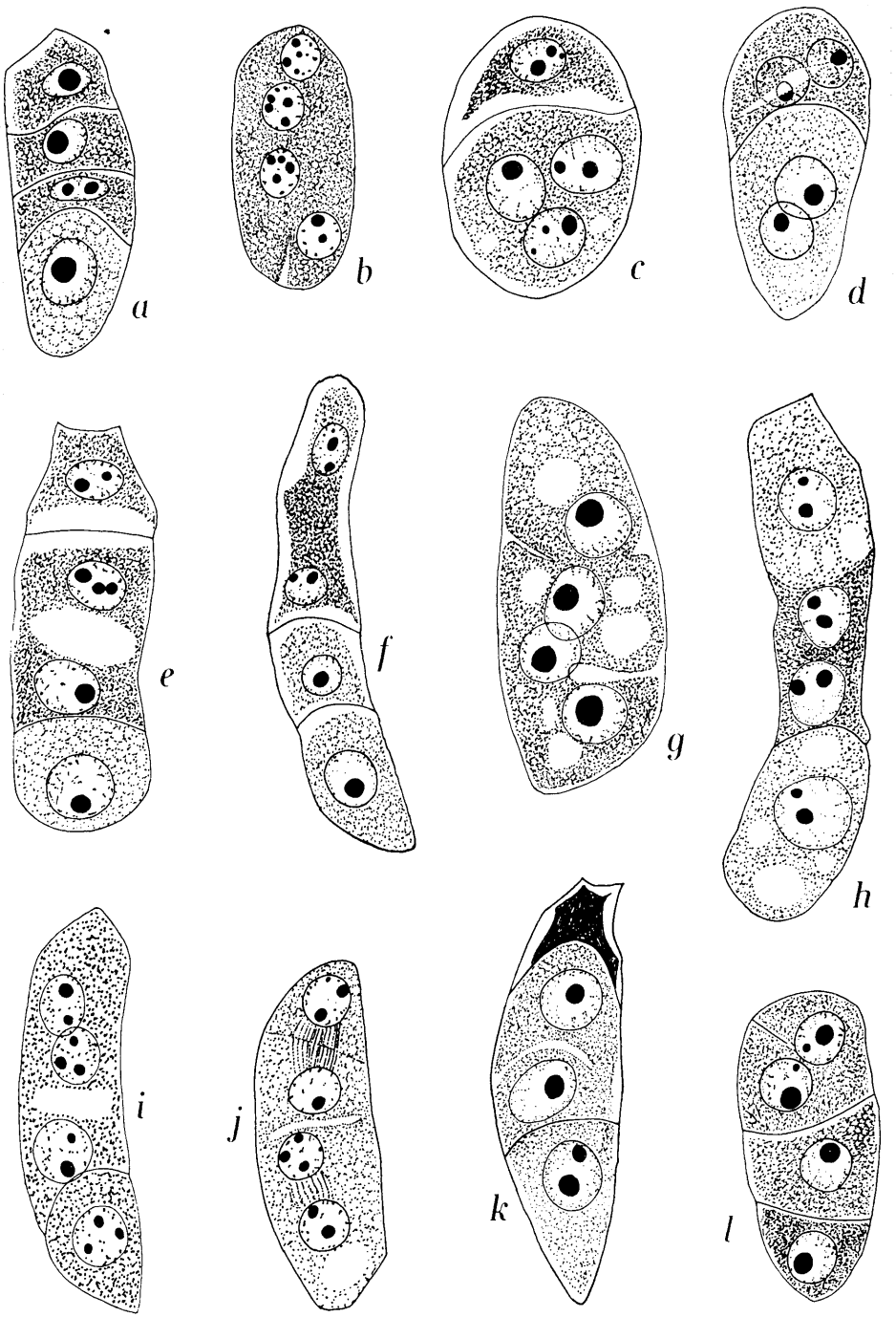


Fig. 2.

of different walls in the tetrad. In rare cases all separating walls were lacking, so that a 4-nucleate coenomegaspore arose. An instance of this is shown in Fig. 1 *b*, where, however, there is a narrow fissure in the cytoplasm in the lower part. About equally rare were the cases where the wall formation had failed to appear after the heterotypic division and after one of the homotypic ones, so that one 3-nucleate and one 1-nucleate cell were formed (Fig. 2 *c*). In other cases there was no wall formation after the first division, but after the second walls were formed in both dyad cells, a tetrad of Tridax type thus being the result (Fig. 2 *e*). In most of the deviating cases, however, a wall was laid down after the first division, whereas no wall formation occurred after the second divisions or after one of them. Fig. 2 *d* thus shows a case where two 2-nucleate cells have been formed and the development is bisporic, of Allium type: a deviation, however, is that in the upper dyad cell there is a fissure in the cytoplasm. In Fig. 2 *f* a case is illustrated where the megaspore nuclei are arranged in the position 2 : 1 : 1; after the second division a wall has been formed in the lower dyad cell but not in the upper. Often also intermediate forms between the different types were found. Besides the deviations already mentioned, the case illustrated in Fig. 2 *g* may be demonstrated as an instance which must me regarded as a tetrasporic embryo sac but where cytoplasm separations have arisen after the second division, reaching about to the middle of the cell. Fig. 2 *h*, on the other hand, shows a transition between a tetrad of Tridax type and a trisporic-monosporic development: in the second division a wall has been formed between the two lowermost nuclei, but between the two upper nuclei only an incomplete wall has arisen. Fig. 2 *i* shows another case; there is here a lacune in the cytoplasm in the middle, where the first wall should have arisen, and in the upper part there is no transversal wall at all: the tetrad type is thus in reality 3: 1. A transition between trisporic and tetrasporic development is shown in Fig. 2 *j*, where the first wall is lacking and is represented by only a separation in the

Fig. 2. *Mirabilis jalapa*. *a* Normal tetrad. *b* 4-nucleate coenomegaspore with a small fissure in the cytoplasm below. *c* Tetrad of the type 3 : 1. *d* Tetrad of the type 2 : 2, with a fissure in the cytoplasm of the upper cell. *e* Tetrad of the type 1 : 2 : 1. *f* Tetrad of the type 2 : 1 : 1. *g* 4-nucleate coenomegaspore with the cytoplasm incompletely divided at two places. *h* Tetrad of Tridax type, but with the upper wall incomplete. *i* Tetrad with a 3-nucleate and a 1-nucleate cell, the upper with a cytoplasmic separation at the middle of the tetrad. *j* Tetrad with a fissure in the cytoplasm at the middle and trace of a wall between the upper nucleus pair. *k* Tetrad of the type 1 : 2 : 1 with a cytoplasmic separation at the middle. *l* Young tetrad of the type 2 : 1 : 1 with an incomplete wall in the upper cell. — About×1020.

cytoplasm and a trace of a wall is found between the two upper megaspore nuclei. It also happens that two 1-nucleate cells are present in the upper or lower part of the tetrad, but that the two remaining nuclei are separated by only an incomplete wall (Fig. 2 *l*). And finally, also a tetrad of Tridax type may have in the middle an incomplete division in the shape of a cytoplasmic interruption (Fig. 2 *k*). All separating walls in the tetrad may thus be incompletely developed and all conceivable combinations may apparently occur between developed walls and incomplete separations.

The further development

In those cases where a normal 4-celled tetrad is formed, the basal cell develops into embryo sac, according to the Normal type. A special interest, however, is linked to the development that takes place when the tetrad has a deviating organization, especially when it is divided by incomplete partitions. In those rare cases when the tetrad has no transverse walls at all, the development is of course tetrasporic. When a tetrad with one 3-nucleate and one 1-nucleate cell occurs, the development is at least in some cases trisporic; this is thus certainly the case in the tetrad reproduced in Fig. 2 *c*. A nuclear arrangement of 2 : 2 in the tetrad of course implies a bisporic development and if two 1-nucleate and one 2-nucleate cells occur with the arrangement 2 : 1 : 1 or 1 : 1 : 2, the development may be both bi- and monosporic. An instance of a monosporic embryo sac formed from this tetrad type is shown in Fig. 2 *f*, a bisporic development is, on the other hand, seen in Fig. 3 *a*: the two basal nuclei have begun to grow out to a common bisporic embryo sac, without any interference from the weak wall trace that is found between them. The tetrad of Tridax type (1 : 2 : 1) also shows the same variation: sometimes the basal 1-nucleate cell forms the embryo sac and the binucleate cell degenerates (Fig. 2 *e*), sometimes the binucleate cell develops, as in the embryo sac shown in Fig. 3 *b*, where the two 1-nucleate cells have begun to degenerate and the middle cell grows out into embryo sac, notwithstanding the fact that an incomplete partition is present.

In Fig. 3 *c*, however, a condition is shown that probably is a stage of a development that is more clearly evident in later stages and implies that two incompletely separated cells grow out into two embryo sacs that communicate and partly fuse. The case reproduced in Fig. 3 *c* obviously is a tetrad that on the middle has been incompletely divided

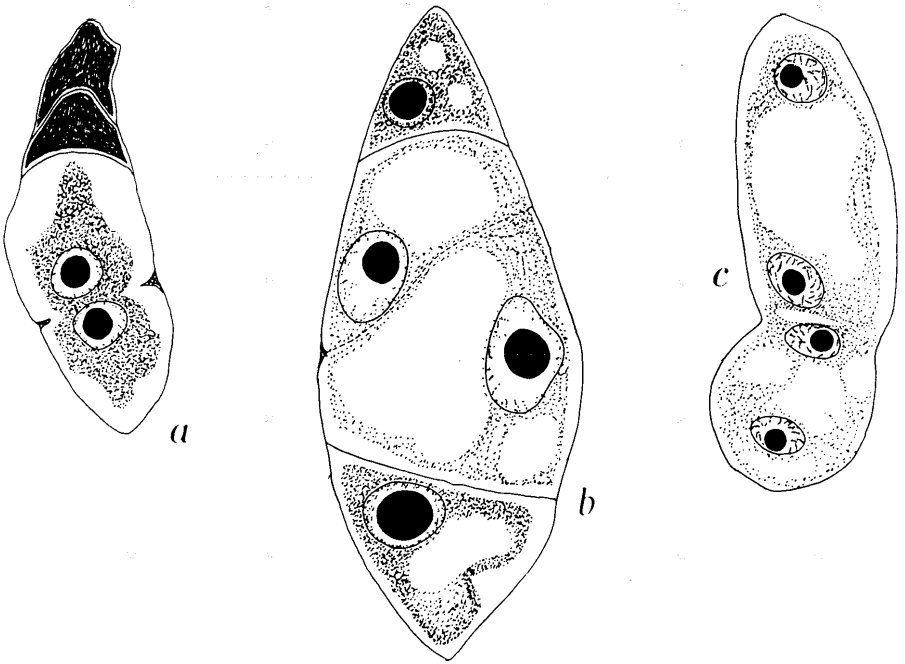


Fig. 3. *Mirabilis jalapa*. *a* 2-nucleate embryo sac arisen from the two lower tetrad cells, with an incomplete wall separation. *b* In a tetrad of Tridax type but with an incomplete wall at the middle a 2-nucleate embryo sac has developed from the middle cell, while the two 1-nucleate cells begin to degenerate. *c* A 4-nucleate coenomegaspore with incomplete separation at the middle has developed into a two-parted embryo sac. — *a*—*b*×1020, *c*×650.

into two 2-nucleate cells, each of which grows out into a bisporic embryo sac.

Later stages are represented in Figs. 4—5. Fig. 4 *a* shows a normal 8-nucleate embryo sac, the other cases illustrate a development of two embryo sacs, the one beside the other, which are united into a common structure. Fig. 4 *b* shows one 8-nucleate and one 4-nucleate embryo sac which are situated alongside each other and have fused together. The 4-nucleate embryo sac has quite small nuclei (designated with *n*) and it is uncertain whether it is going to develop further; perhaps it is beginning to degenerate. The remaining three figures show a very peculiar embryo sac formation. Two incompletely separated embryo sacs have developed from the same tetrad and both have reached the 8-nucleate stage and organized in the usual way. In the apical part,

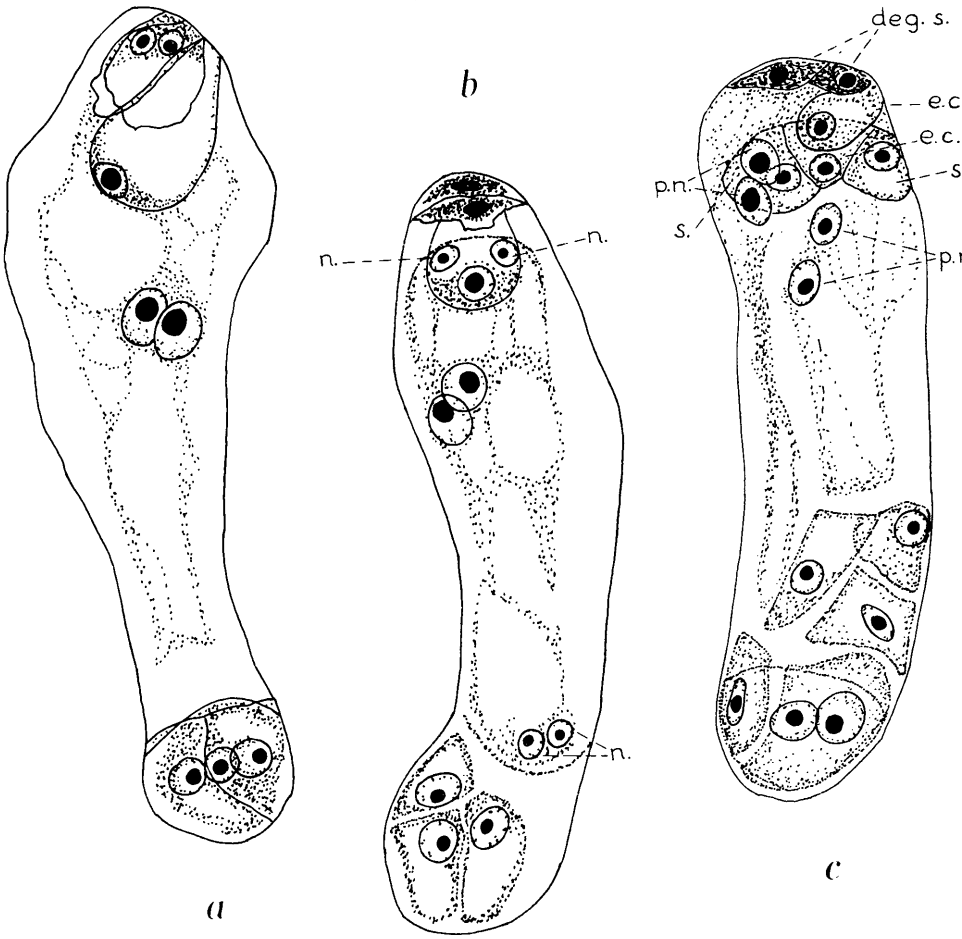


Fig. 4. *Mirabilis jalapa*. *a* Normal mature embryo sac. *b* Mature embryo sac, arisen from two through fusion, the one 8-nucleate, the other 4-nucleate, with small nuclei (*n*). *c* Mature embryo sac arisen through fusion from two. In the basal part 6 antipodals, in the upper part 2 pairs of polar nuclei (*p.n.*) and two egg apparatuses, the one quite normal with egg cell (*e.c.*) and synergids (*s.*), the other with degenerated synergids (*deg. s.*) but the egg cell not yet degenerated (*e.c.*). — About×410.

however, one of the two egg apparatuses have degenerated or is going to degenerate and only one egg apparatus is normally developed. In the basal part, on the other hand, all antipodals are present and those that belong to the two embryo sacs have joined into quite a harmonically developed antipodal group with 6 antipodal cells or with a smaller

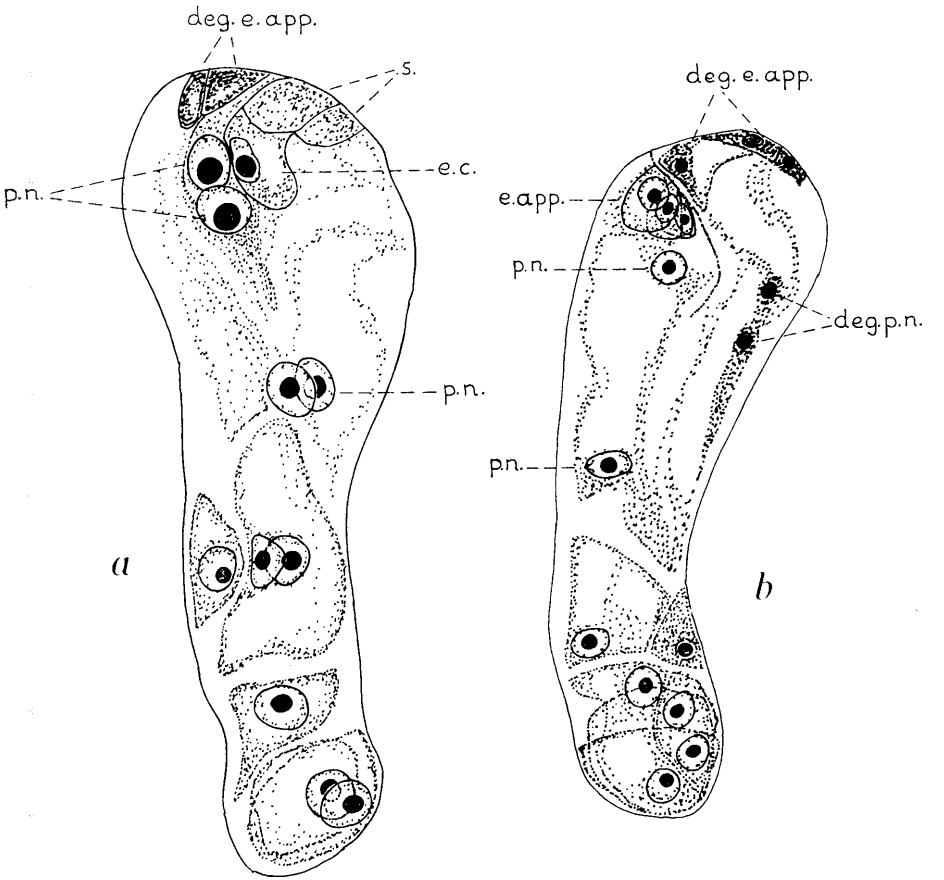


Fig. 5. *Mirabilis jalapa*. *a* Mature embryo sac, arisen through fusion of two. Above one degenerated egg apparatus (*deg. e. app.*) and one functioning (*e.c.* and *s.*). Further 2 pairs of polar nuclei (*p.n.*) and 5 antipodal cells, one of them 2-nucleate. *b* Mature embryo sac of the same kind. In the apex one functioning and one degenerating egg apparatus. 2 degenerated polar nuclei (*deg. p. n.*) and 2 normal (*p.n.*) 6 antipodals. — About×410.

number of cells with together 6 nuclei. The behaviour of the polar nuclei is somewhat varying: sometimes (Figs. 4 *c*, 5 *a*) all 4 polar nuclei (*p.n.*) are present, sometimes (Fig. 5 *b*) the two polar nuclei that belong to one of the embryo sacs have degenerated and only the other two persist. Perhaps this latter alternative is a later stage that will come about later on, even if in younger stages all 4 nuclei are present. The conditions, however, seem to show that in the fusion between two embryo sacs the

basal elements may very well join into a common unity, but that such a harmonic co-operation is impossible in the apical part, where only one egg apparatus can function.

The described peculiar development probably explains the fact, related in earlier investigations, that the antipodal number in *Mirabilis jalapa* as well as in some related species sometimes is greater than 3.

Differences in different proveniences and at different temperatures

In addition to the investigation of the general development a comparison was also made between the various proveniences that were in cultivation as to embryo sac development. A few proveniences were also cultivated in greenhouses with different temperatures and the embryo sac development was studied under the different conditions. A difficulty in such investigations is the limited number of appropriate stages: only one embryo sac is as a rule developed in a flower and there is no strict correlation between the development of flower and embryo sac, so that it is difficult to find the correct fixation time. Most of the investigated samples are on this account represented by a rather small number of cases, in spite of a large material of fixations.

In a comparison between the various samples the deviating cases were first classified according to the number of walls that had been suppressed. When only one wall was lacking, a subdivision was further made into those cases where a wall was formed after the first nuclear division and the tetrad thus formed after the formula 2 : 1 : 1 (the 2-nucleate cell above) or 1 : 1 : 2 (the 2-nucleate cell below), and secondly cases with Tridax tetrad (1 : 2 : 1), where no wall arose after the first division. In the same way the cases with two suppressed walls were subdivided into two classes: on the one hand the type 2 : 2, with wall formed after the first meiotic division, on the other type 3 : 1 (a 3-nucleate cell above) and 1 : 3 (the 3-nucleate cell below), where wall formation had failed after the first division and after one of the second ones. Finally, as a class of their own there were those cases where all walls were lacking within the tetrad and a 4-nucleate cell had arisen. When incomplete partitions occurred, no respect was paid to them in this connection: a 2-nucleate cell with incomplete partition was thus regarded as nothing more than a 2-nucleate cell.

Table 2 shows the occurrence of the different types in the investigated samples cultivated out of doors in the Botanical Garden of Lund. The

Table 2. Mirabilis jalapa. Tetrad types of different proveniences

Type	No. 1 Karlsruhe		No. 2 Poznan		No. 3 Stuttgart		No. 4 Mainz		No. 5 Graz		No. 6 Budapest	
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
1 : 1 : 1 : 1 ..	19	83	54	62	14	74	21	88	19	83	30	70
2 : 1 : 1 1 : 1 : 2	2	9	9	10	—	—	3	13	1	4	5	12
1 : 2 : 1	—	—	2	2	2	11	—	—	—	—	2	5
2 : 2	1	4	11	13	—	—	—	—	3	13	1	2
3 : 1 1 : 3	—	—	6	7	1	5	—	—	—	—	3	7
4 : 0	1	4	5	6	2	11	—	—	—	—	2	5
Total	23		87		19		24		23		43	

fixations were made in the autumn of 1964, at the end of September and beginning of October.

As seen from the table, three of the samples, Nos. 1, 4, and 5 show a rather agreeing percentage of normal tetrads, 83—88 per cent. The samples 2 and 6, however, are more deviating: the former has 62 per cent normal cases against 38 per cent deviating; for the latter the corresponding figures are 70 and 30 per cent. Also in the extent of the deviations No. 2 surpasses No. 6; while in the latter the cases with 2 or 3 walls suppressed are 14 per cent, they in No. 2 amount to 26 per cent. No. 3 agrees rather closely with No. 6 in the occurrence of the different tetrad types; especially in this case, however, a reservation must be made for the small number in the sample.

Three samples of *Mirabilis jalapa* were further cultivated in greenhouses with regulated temperature for the study of the influence of temperature on the embryological development. All 3 samples were grown from seed received from the Agrobotanical Garden, Gödöllö, Hungary, and belonged to types with different flower colour. The plants were cultivated under the same conditions as *Oxybaphus nyctagineus,* on the one hand in a greenhouse with about 12—16°C., on the other in a house with about 19—22°C. (see above p. 330). The fixations were made in December 1964 and January 1965. The investigated cases were classified in the same way as in the preceding table. As "3 cells" those cases are designated that have a tetrad with 3 cells only but where owing to degeneration it was not possible to say which of the cells was 2-nucleate.

Table 3. Mirabilis jalapa. Occurrence of different tetrad types at different temperatures

	1 : 1 : 1 : 1	2 : 1 : 1 1 : 1 : 2	1 : 2 : 1	2 : 2	3 : 1	4 : 0	3 cells	Other cases
Higher temperature								
No. 41	20	8	2	—	3	—	4	1
No. 42	—	—	—	—	—	1	—	1
No. 43	24	6	1	1	—	—	1	2
Lower temperature								
No. 41	4	1	—	—	—	—	—	—
No. 42	2	1	—	—	—	—	—	—
No. 43	—	—	—	—	—	—	—	—

The percentage of deviating cases, thus, was at the higher temperature 47 in No. 41 and 31 in No. 43. At the lower temperature the deviating cases in No. 41 were only 20 per cent, but owing to the small number at this temperature the material is scarcely fit for comparison, and the same is true about the samples cultivated out of doors — at a considerably lower temperature —, as they belong to other proveniences and genetically founded differences between different proveniences no doubt exist. Even though any certain conclusions are not possible in this case, it should however be pointed out that the percentage of deviating cases at the higher temperature was considerable, in one of the cases higher than in anyone of the other investigated samples, in the other higher than in all except one. It may thus be said that the results are not contradictory to the assumption that in *Mirabilis jalapa* the same conditions exist as in *Oxybaphus nyctagineus,* viz., that the complete tetrad formation with 4 cells is more common at lower temperature; probably the conditions are here the same, so that the deviating development is favoured by higher temperature. If this is the case, the variation found between different proveniences when cultivated in the open may quite simply be due to different temperature demands of the different samples; a variation in temperature sensitivity should, if the proposed view is correct, bring about varying embryo sac formation in different proveniences.

6. Ulmus glabra

For several *Ulmus* species it has been stated that the embryo sac may develop according to two different types, the Drusa and the Adoxa type (D'AMATO 1940, WALKER 1950, also HJELMQVIST 1964). Tihs

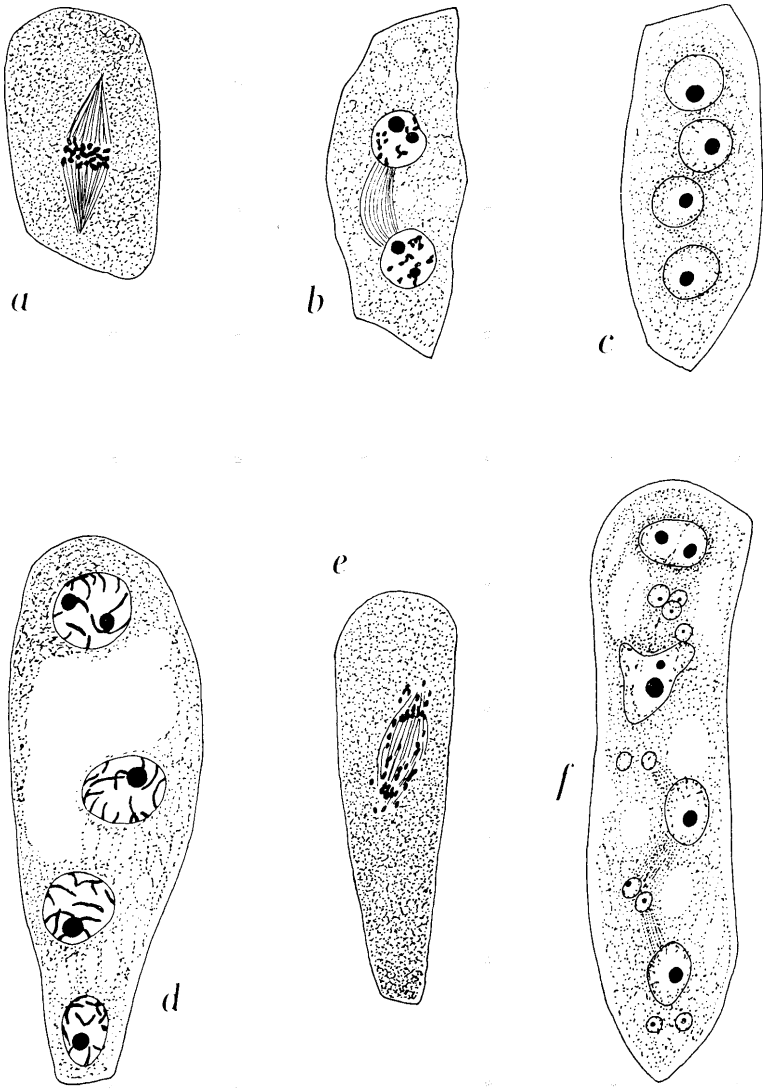


Fig. 6. *Ulmus glabra*. *a* Megaspore mother cell with the nucleus in metaphase, regular division. *b* Dyad. *c* Young tetrad. *d* Embryo sac of Drusa type, with the nuclei in 1 : 3-position. *e* Megaspore mother cell with irregular division, the chromosomes spread over the spindle. *f* Tetrad with 4 bigger nuclei and 10 micronuclei. — ×1020.

statement also has reference to a variety of *Ulmus glabra,* var. *Camperdownii,* that was investigated by WALKER (l.c.). For the main form of *Ulmus glabra,* however, EKDAHL (1941) reports only the Drusa type,

and LELIVELD (1935) has apparently also in *U. hollandica* var. *belgica* only observed this type. On this account a study was made of *U. glabra* in order to make clear whether more than one type occur here and, if this was the case, to investigate whether the occurrence of the types may be influenced by the temperature conditions, which might be thought to explain the divergent statements of earlier authors. For fixation and staining the same methods were used as in the preceding cases.

The Drusa type

Development according to the Drusa type in *Ulmus glabra* has earlier been described by EKDAHL (l.c.) and we do not have much to add to this. After the formation of the dyad and tetrad nuclei (Fig. 6 *a-c*) the nuclei take up the 1 : 3-position (Fig. 6 *d*) and then divide into 8, in the position 2 : 6 (Fig. 7 *a*). After a further division the number is 16, 4+12, if no reduction has occurred. This complete number is however rare and has by us been observed only in one case (Fig. 7 *d*); the usual condition is that division strikes and nuclear degenerations reduce the number. EKDAHL (l.c.) in his material observed that two among the basal nuclei in the 8-nucleate embryo sac did not divide further but degenerated; if they took part in the formation of the mature embryo sac at all, the nuclear number was 14; as a rule, however, it was not more than 12, as these two nuclei had degenerated. Often also further degenerations occurred, so that the number was still smaller. In our material the development was similar; only a somewhat greater variation was observed in earlier as well as in later stages. Instead of a 4-nucleate tetrad, thus, in some cases only three megaspore nuclei were observed, no doubt as a consequence of degeneration of one of the 4 nuclei. In the subsequent stage, that with normal development should consist of 2+6 nuclei, a reduction in the basal group is more common, and it may be reduced to 5, 4 (Fig. 7 *b*), or only 3 nuclei (Fig. 7 *c*). This is of course due to the fact that one or more of the megaspore nuclei have not taken part in the division. If only three nuclei are present in the basal part, it may be due to a failing division of all 3 basal megaspore nuclei, but it is perhaps more probable that there have only been three megaspore nuclei and that one of the two basal nuclei has divided, the other has not. Even when 6 nuclei occur in the basal group of the 8-nucleate embryo sac, two of these are usually smaller than the others and show signs of a beginning degeneration (Fig. 7 *a*). The

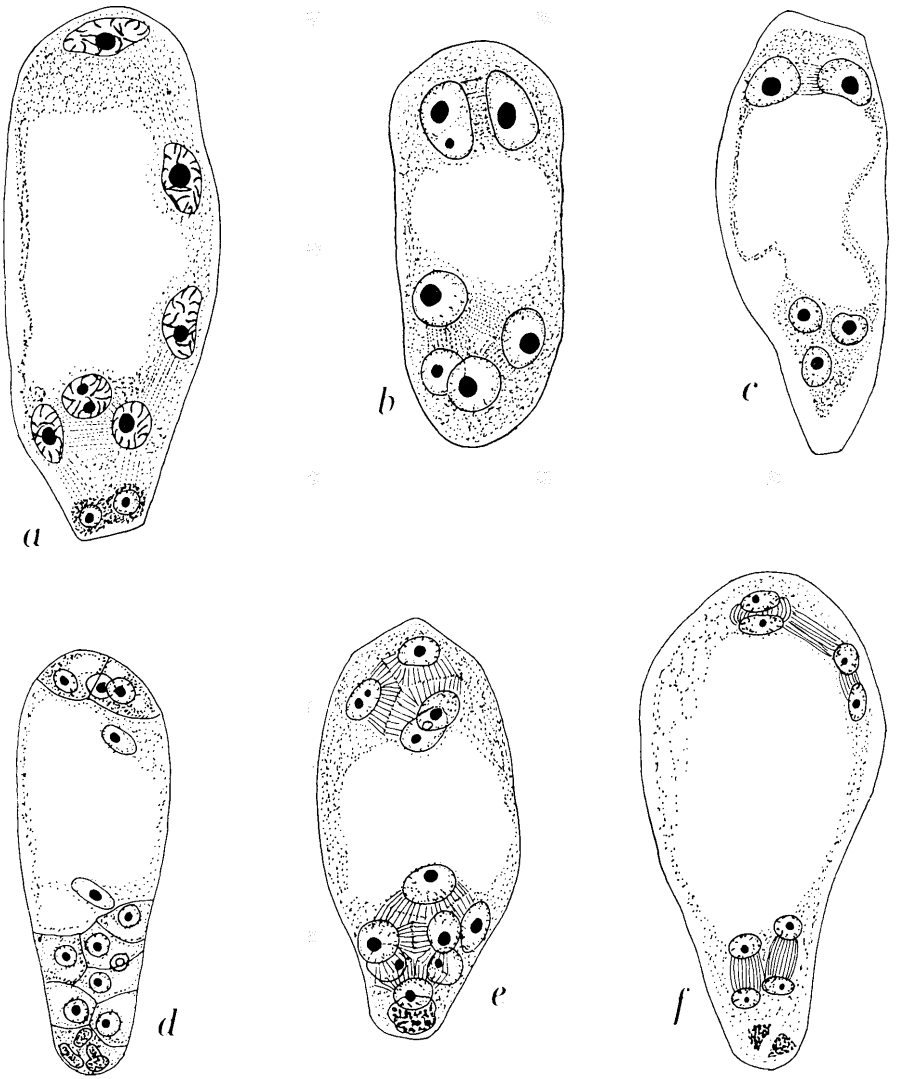


Fig. 7. *Ulmus glabra*. *a* Embryo sac of Drusa type with 2+6 nuclei. The 2 lowermost nuclei small and in beginning degeneration, the other nuclei bigger and in prophase. *b* Embryo sac with 2+4 nuclei. *c* Embryo sac with 2+3 nuclei. *d* Mature embryo sac with 4+12 nuclei, the 4 basal in degeneration. *e* Almost mature embryo sac with 4+8 nuclei, the lowermost in degeneration. *f* Embryo sac with 4+6 nuclei, 2 of the lower in strong degeneration. — *a*—*b*, *e*—*f*×1020, *c*—*d*×650.

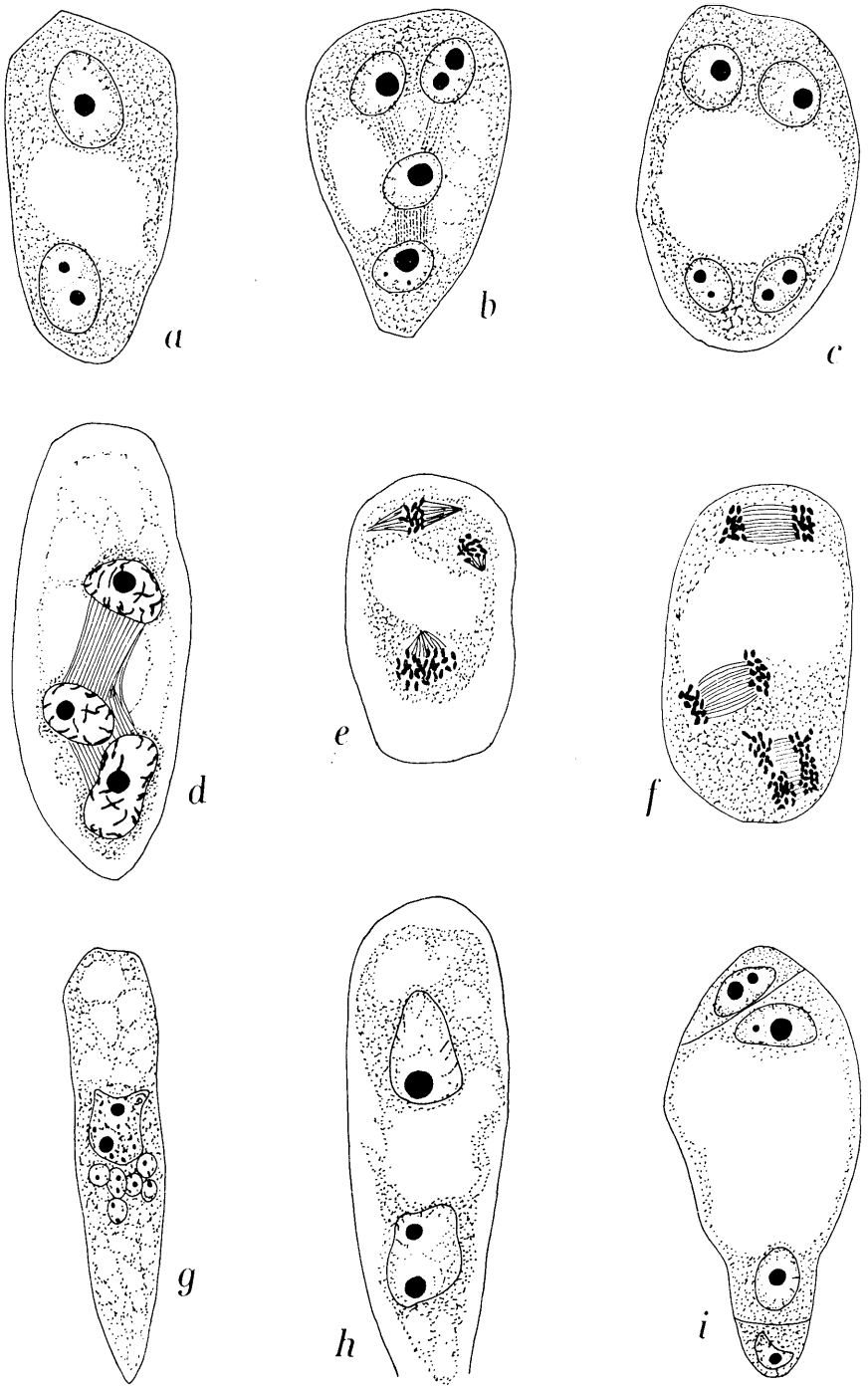


Fig. 8.

reductions in the mature embryo sac are as a rule still stronger. Even in the mentioned 16-nucleate embryo sac (Fig. 7 *d*) the 4 basal nuclei are obviously in degeneration. And in the case shown in Fig. 7 *e* the nucleus number in the embryo sac is 4+8 and among the nuclei in the basal part one, the most basal one, is in beginning degeneration. Several cases with 4+7 nuclei were further observed, as well as with 4+6 nuclei; in one of the latter two nuclei were in degeneration when the cell formation started (Fig. 7 *f*), so that the mature embryo sac would finally be only 8-nucleate and of the same appearance as the normal type, though resulting from another development. A common anomaly is the formation of micronuclei. There may be, for instance, 1—3 such nuclei at the meiosis, which later divide so that the number increases. However, the number may also be greater as in the case reproduced in Fig. 6 *f* where 10 micronuclei are present. The cause of the appearance of these micronuclei is of course irregular nuclear divisions; some chromosome material is not included in the nuclei in formation but forms small nuclei of its own.

The Adoxa type

The Drusa type was in our material of *Ulmus glabra* the dominating. Parallel to this, however, there occurred in some cases a development of Adoxa type. The first sign of this development is the migration of the two dyad nuclei to different poles of the embryo sac and the formation of a vacuole between them (Fig. 8 *a*). In the subsequent development two nuclei are formed in the upper and two in the lower part of the embryo sac, separated by the central vacuole (Fig. 8 *b*—*c*). The basal nuclei sometimes are smaller than the apical ones (Fig. 8 *c*), in agreement with the general tendency to favour the micropylar part as against the chalazal part of the embryo sac, which also could be observed in the Drusa type. Through a further division an 8-nucleate embryo sac is formed of normal appearance. However, this 8-nucleate embryo sac

Fig. 8. *Ulmus glabra*. *a* 2-nucleate embryo sac of Adoxa type. *b* 4-nucleate embryo sac with 2 nuclei at the side of each other in the upper part, 2 in the lower part. Adoxa type. *c* 4-nucleate embryo sac of Adoxa type, a little older stage. *d* 3-nucleate embryo sac with the basal nucleus bigger, certainly arisen through fusion of two. *e* 3-nucleate embryo sac with the nuclei in division, in the two upper nuclei about 14 chromosomes, in the basal about the double number. Chrys. cinerariifolium type. *f* Another case of the same type, the same division. *g* Megaspore mother cell with restitution nucleus and 6 micronuclei. *h* 2-nucleate embryo sac with big and irregular nuclei. *i* Mature embryo sac with 4 nuclei only. — *a*—*h*×1020, *i*×650.

may be difficult to recognize with certainty, as also the development of Drusa type through degeneration may result in an embryo sac of similar structure. However, if an 8-nucleate embryo sac is just in formation or has just been formed, but no degenerating nuclei are perceivable, it in all probability is a case of the Adoxa type.

Also in this type micronuclei sometimes occur: in one case there were in addition to 4 bigger nuclei, 2 above and 2 below, 2 quite small micronuclei.

The Chrysanthemum cinerariifolium type

A third type, the Chrysanthemum cinerariifolium type, was also found to occur in *Ulmus glabra* now and then. When the megaspore nuclei were in division, it could in a few cases be observed that there were three division figures, two small and one bigger (Fig. 8 *e* and *f*). The two smaller chromosome groups contained — even if no exact calculation was possible — certainly the haploid chromosome number. This number is according to earlier investigators 14, which we have had an opportunity to confirm, in megaspore mother cells as well as in pollen mother cells. The greater chromosome group had about twice the number. This group was situated at the base of the embryo sac, one of the smaller in the apex, the other between these two. The fusion between the two megaspore nuclei can obviously take place as early as in their resting stage; Fig. 8 *d* shows a coenomegaspore with three nuclei, one of which, the basal one, apparently has arisen through fusion of two. One embryo sac of this type was further observed in the 6-nucleate stage; it contained at the base two big, somewhat irregular nuclei with several nucleoli and in the same basal group, beneath the main vacuole, two smaller nuclei with one nucleolus each; in the upper part of the embryo sac the nuclei were indistinct, but there were here probably two smaller nuclei. This embryo sac type should through a further division become 12-nucleate, with 8 haploid and 4 diploid nuclei, the latter in the basal part; it is however difficult to recognize, since differences in size between the antipodals occur also when they are of the same chromosome level and reductions of the basal nuclei in both types make the antipodal number undecided.

The occurrence of diploid antipodals, as a result of a development according to the Chrys. cinerariifolium type, has a special interest with regard to the statements given by EKDAHL (l. c.) about embryo formation from antipodals in *Ulmus glabra*. He found that one or two

of the antipodals, which were big and resembled eggcells, could grow out into embryos, as big and vigorous as the embryo formed from the egg cell. When an extra embryo was formed beside the normal one, thus from a synergid, it on the contrary was considerably more weakly developed. A reasonable explanation is that such an embryo owing to its haploid nature is weakly developed and that the antipodal embryos are diploid and on this account equally vigorous as that one that is formed from the egg cell. The diploid character of some antipodals, thus, should be the explanation of the fact that from here sometimes embryos are formed with quite a normal appearance. It is here — if this explanation is correct — not a case of true apomixis, but of pseudomixis in the sense of WINKLER; a reduction division has taken place and after that a fusion between two nuclei in the embryo sac.

Special deviations

In one case a mature embryo sac was observed that had a peculiar structure, only 4 nuclei, one egg cell, two polar nuclei, and one antipodal (Fig. 8 *i*). Such an embryo sac is of the same organization as an embryo sac of the Plumbagella type, but a fusion of 3 nuclei according to the Bambacioni phenomenon, which is characteristic of the Plumbagella and Fritillaria types, has not been observed in the species, and nothing in the size of the nuclei indicates a precedent fusion. We should rather interpret this embryo sac as having arisen without reduction as a stage in a rare apomictic development. The meiosis is in *U. glabra* frequently rather irregular, the chromosomes are often irregularly spread over the spindle (Fig. 6 *e*), lagging chromosomes may occur, and micronuclei are not seldom formed. In connection with these irregularities is the fact that restitution nuclei occasionally occur. An instance of this is shown in Fig. 8 *g*, where a big irregular restitution nucleus and 6 micronuclei have been formed as a result of the first meiotic division. Fig. 8 *h* may represent a later stage in the development of the restitution nucleus: there are here two big, somewhat irregular nuclei that have migrated to the poles of the embryo sac, separated by a large vacuole. A development of unreduced embryo sacs thus does not appear impossible, and if the observed deviating embryo sac is such a one, this could explain its peculiar structure, without synergids and with only 4 nuclei. It may be pointed out that many partially apomictic grass species (BROWN & EMERY 1958) on the one hand have normal 8-nucleate embryo sacs, on the other unreduced embryo sacs which as a rule have

Table 4. Ulmus glabra. Occurrence of various embryo sac types in different temperatures

Treatment	Drusa type		Adoxa type		Chrys. cin. type		Chrys. cin. or Drusa type		Others		Cell formation	
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
15—19°	62	78	14	18	1	1	1	1	—	—	1	1
26—27°	46	87	3	6	1	2	—	—	1	2	2	4

only 4 nuclei (yet with another organization than the 4-nucleate embryo sac of *Ulmus).* If the interpretation of the 4-nucleate embryo sac is correct, it should correspond to an embryo sac of the Adoxa type with one division less than normal. That the development in an embryo sac arisen from a restitution nucleus is abbreviated is rather plausible with regard to the fact that the formation of the restitution nucleus corresponds to the first meiotic division and the subsequent 2-nucleate stage may be regarded as a correspondence to the tetrad formation, with 2 diploid spore nuclei instead of 4 haploid ones. In both unreduced and reduced embryo sacs, thus, one division takes place after the spore formation.

Influence of temperature conditions

In order to study the influence of the temperature conditions on the embryo sac development an experiment was made in February 1964 with cut off branches which were put in climatic chambers with different temperatures.

The branches were taken from one tree only, cultivated in Lund, and were placed in water, one sample in a climatic chamber with 26—27°C., another in a chamber with 15—19°C. The experiment began February 20 1964. Fixations were made with short intervals; appropriate stages were obtained in the fixations from Febr. 24—26 in the higher temperature, from Febr. 26—29 in the lower. The occurrence of different embryo sac types in the two temperatures is visible from Tab. 4. Dubious cases were left out of account.

As visible from the table, the Drusa type is the dominating, with 78 and 87 per cent, respectively, of the determined cases, whereas the Adoxa type is comparatively infrequent and the Chrys. cinerariifolium type still more rare. It is however possible that some cases of mature embryo sacs that have been classified as the Drusa type belong in reality to the

Chrys. cinerariifolium type, since, as mentioned above, it is very difficult to distinguish between the two types in later stages. Thus, in a comparison it seems most correct to put these two types together; in the higher temperature the number then vill be 64, i.e. 81 per cent, in the lower 47, making 89 per cent.

In a comparison between the two temperatures the great difference as to the Adoxa type is especially conspicuous. In the lower temperature it occurs in 18 per cent of the cases, in the higher only in 6 per cent. If the Adoxa type is compared with the total number of Drusa and Chrys. cinerariifolium cases in the lower temperature the percentage is 22 (14 out of 64), in the higher 6 (3 out of 47).

Those cases which have been designated in the table as "cell formation" no doubt represent a break-down of meiosis, with formation of a cell row from the megaspore mother cell instead of an embryo sac. This development was more common in *Ulmus laevis* and will on this account have a more detailed treatment in the following chapter.

7. Ulmus laevis

An investigation of the embryo sac development was also made in *Ulmus laevis,* a species that has not been treated earlier. Material was obtained from two trees cultivated in the Botanical Garden of Lund and the investigation was performed in the beginning of the years 1964 and 1965; branches of the trees were then cut off and placed in water in greenhouses with regulated temperature. Fixation and staining methods were the same as in *U. glabra.*

The Drusa type

The development of *Ulmus laevis* was on the whole the same as in *U. glabra.* The tetrad arose without wall formation (Fig. 9 *a*); also here there were sometimes only 3 megaspore nuclei, probably owing to degeneration of one of the original 4 nuclei, a degeneration that could be observed in some case. A formation of micronuclei was also here not rare. The Drusa type was dominating: the 4 megaspore nuclei took up a 1 : 3-arrangement (Fig. 9 *b*) and after a new division the number was 2+6 (Fig. 9 *c*). Also in this stage some degeneration phenomena were observed in the basal part, or at least a less good development here; thus in one or two cases there were 4 small nuclei at the base that did

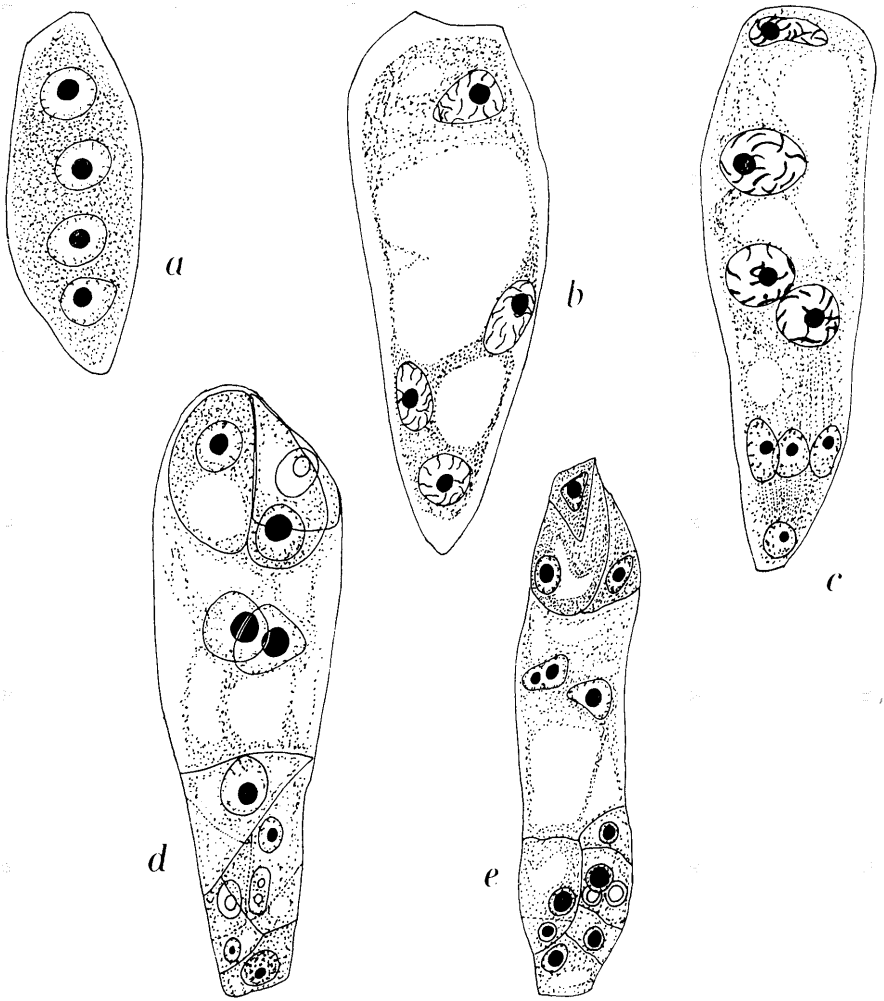


Fig. 9. *Ulmus laevis*. *a* Young tetrad. *b* The tetrad nuclei arranged in 1:3-position. Drusa type. *c* 8-nucleate embryo sac with 2+6 nuclei, the 4 lower nuclei smaller and in resting stage, the remaining larger and in prophase. *d* Mature embryo sac with 6 antipodals. *e* Embryo sac with 8 antipodals. — ×1020.

not show any signs of division, while two bigger nuclei above them as well as the two apical nuclei were in prophase of the next division (Fig. 9 *c*). If the 4 small nuclei persist in the mature embryo sac, the number of nuclei will be 12, 4+8,: however a degeneration of one of them or more may reduce the number. It was observed that the number

of antipodals could vary between 4 and 8; if the lower polar nucleus was included, the nucleus number in the lower part of the embryo sac was thus 5—9 instead of 12, as a consequence of division strikes and degenerations. Fig. 9 *d* shows an embryo sac where only 6 antipodals are present, Fig. 9 *e* an embryo sac with 8 antipodals.

Development according to the Adoxa type

As in *Ulmus glabra,* in rare cases there occurs a development according to the Adoxa type also in *U. laevis.* The total number of cases with Drusa development that were observed was 69, while the Adoxa type was stated in 5 cases only. An instance of this type is shown in Fig. 10 *a,* a 4-nucleate embryo sac with 2 nuclei above, 2 below the large central vacuole. It is here also a case of favouring of the apical part of the embryo sac in relation to the basal region; the two upper nuclei are greater and in prophase of division, whereas the basal nuclei are distinctly smaller and still in resting stage. Two excluded chromosome fragments are visible outside the nuclei; in other cases micronuclei are formed, as in the embryo sac reproduced in Fig. 10 *b,* which has two larger nuclei in the upper and two in the lower part and consequently belongs to the Adoxa type, but where there in addition is one micronucleus. Mature embryo sacs of Adoxa types no doubt also occurred; also in this species they are, however, difficult to distinguish from embryo sacs of Drusa type with strong nuclear degeneration.

The Chrysanthemum cinerariifolium type

In one or two cases also in *Ulmus laevis* a development according to the Chrysanthemum cinerariifolium type could be stated. In one of the cases the embryo sac in question was 6-nucleate (Fig. 10 *c*), with 2 nuclei in the upper part, 4 in the lower. The two upper nuclei as well as 2 of the lower ones were in division and the chromosomes were here certainly of the haploid number. One of the two remaining nuclei was in prophase to division; it was very great and contained approximately 28 chromosomes, while the other, at the base of the embryo sac, was also comparatively large, but was in resting stage, possibly going to degenerate, as often happens with the basal nuclei of *Ulmus.* In all probability this embryo sac has developed according to the Chrysanthemum cinerariifolium type. The division of the megaspores has given rise to 4 haploid and 2 diploid nuclei, most of which now undergo a

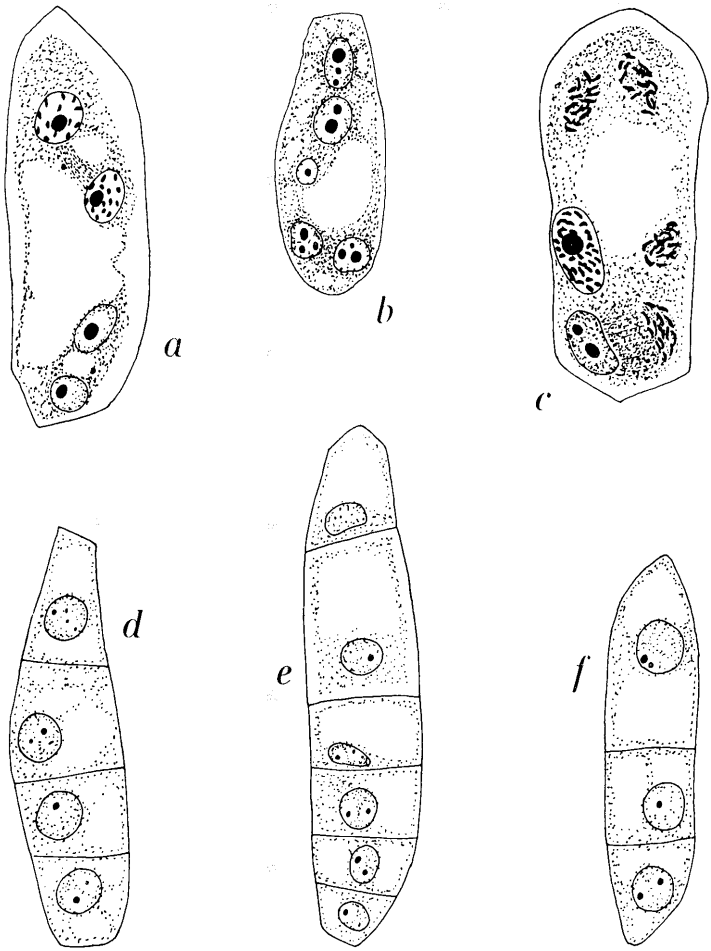


Fig. 10. *Ulmus laevis*. *a* 4-nucleate embryo sac of Adoxa type. *b* Embryo sac of Adoxa type with 4 big nuclei and one micronucleus. *c* Embryo sac of Chrys. cinerariifolium type with 6 nuclei, 4 of them in metaphase (obliquely cut), one in prophase with about 28 chromosomes, one in resting stage. *d*—*f* Cell formation from the megaspore mother cell with 4, 6, and 3 cells, respectively. — ×1020.

new division, probably giving 11 nuclei as a result. — In another case a younger stage was observed where the megaspore nuclei were just in division. There were here 3 division figures: one haploid chromosome plate in the apex, one division figure of about the same size in the middle, and a third division figure in the lower part. This basal group was seen from the side and the closely packed chromosomes were

Table 5. Ulmus laevis. Trials with different temperature.

Treatment	Drusa type	Adoxa type	Chrys. cin. type	Early stages without wall	Cell formation
30°C.	15	2	1	32	48
20°C.	40	—	1	21	28
10°C.	14	3	—	35	—

impossible to count, but apparently they were of a considerably higher number than in the two other division figures. Probably it was a case of the Chrys. cinerariifolium type, with one diploid and two haploid nuclei.

Influence of temperature

Also in the case of *Ulmus laevis* a few experiments were made concerning the influence of different temperatures on the embryo sac devevlopment. One of the trials began December 31, 1963, when twigs from two trees cultivated in the Botanical Garden of Lund were placed in two climatic chambers, one of them with a temperature of about 30°C., the other with about 20°. In the former the fixation of the flower buds was made January 7, 1964, in the other January 8—14. In the beginning of 1965 a new trial was made with twigs from the same trees that had been used in the preceding year. The trial began January 23. This time a lower temperature was used, about 10°C. The fixations were made February 6—9 and the temperature had then since January 27 been almost constant, 10—11°C. The results are evident from table 5.

As seen from the table, a comparatively great number of megaspore mother cells (designated "cell formation") had not developed in the usual way through meiosis without wall formation, but had divided through mitotic divisions, forming a row of 1-nucleate cells. Often the number of cells in such a row was 4, as in a megaspore tetrad (Fig. 10 *d*), but it could also be greater, 5—6 (Fig. 10 *e*) or smaller, only 3 (Fig. 10 *f*). As a rule the cells and nuclei that arose in this way had quite the same appearance as common somatic cells and nuclei. Obviously it was here a case of break-down of meiosis, which — in the actual conditions — was more common in *Ulmus laevis* than in *U. glabra*. In exceptional cases the nucleoli in these cells were somewhat deviating, bigger than the nucleoli of somatic cells, and in a few cases the nuclei had divided into two and the cell grown out into a structure similar to a 2-nucleate embryo sac. No further development was however observed,

and the instances mentioned should perhaps be regarded as a reminiscence of a development that was never fulfilled. From the table is clear that the break-down of meiosis occurred especially in higher temperatures. In the highest temperature, 30°, in no less than 48 cases or about half the total number, the meiosis was replaced by common cell divisions. In a temperature of 20° the number was lower, 28 of 90, thus 31 per cent, and in the lowest temperature, 10°, no such cases were observed.

As to the relation between the different embryo sac types it is firstly evident that the Drusa type was also here considerably more common than the Adoxa type. In the intermediate temperature, 20°, as a matter of fact no case at all of Adoxa type was observed, whereas 40 cases of development of Drusa type occurred. In the lower temperature, 10°, however, the Adoxa type appeared in 3 cases against 14 for the Drusa type, in agreement with the conditions stated for *Ulmus glabra* that the Adoxa type is favoured by lower temperature. Also in the highest temperature, 30°, there were however two cases of the Adoxa type, against altogether 16 of Drusa and Chrys. cinerariifolium type. It is possible that a high temperature that is above the optimal conditions to some extent may also favour the Adoxa type.

Discussion

The theory that was used to explain the variations in *Oxybaphus nyctagineus* may also be applied to the conditions in *Ulmus*. We should thus explain the varying frequency of the Drusa and Adoxa types at different temperatures with the balance that is present between the nuclear division on the one hand and the cell growth on the other. Our theory is that the nuclear division as a more sensitive process is more strongly affected by a change in temperature than the cell growth and the vacuolization associated with this. At low temperature the nuclear division is on this account delayed in relation to the cell growth and in a megaspore mother cell of *Ulmus* it comparatively often occurs that after the formation of the dyad nuclei the cell already is so large that a central vacuole is formed; with that a development according to the Adoxa type is decided. At higher temperature the nucleus divides rather rapidly in relation to the cell growth and the 4-nucleate stage has then in numerous cases been reached before vacuolization takes place; consequently the nuclei can without interference take up the 1 : 3-position and the Drusa (or Chrys. cinerariifolium) type may arise. It is possible that in very high temperature the nuclear division is again

delayed in relation to the cell growth and the Adoxa type on this account has a greater frequency.

This theory may apparently also be applied to other genera with varying embryo sac development, as *Tamarix*. In *Tamarix* the Plumbagella type also occurs and especially in *T. parviflora* it showed a considerable increase at lower temperature. This may be explained by a delay of the nuclear divisions in relation to the growth of the embryo sac, implying a tendency to cell formation even at the (secondary) 4-nucleate stage. In any case the variation in embryo sac formation should certainly not be explained by a capacity of the plant to choose at lower temperature a simpler development; the plant does not reflect and choose the one or the other way of development. A direct influence of external conditions must instead be the deciding factor for the development and an assumption about different sensitivity of the nuclear division and the cell growth appears to give a reasonable explanation of the variations.

Summary

In *Oxybaphus nyctagineus* the megaspore tetrad usually consists of one 2-nucleate cell in the middle and one 1-nucleate on either side. The 2-nucleate cell, however, never devlops further, but the development is monosporic. In less numerous cases a tetrad was also found that was made up of four 1-nucleate cells. A comparison between the development in two different temperatures showed that the normal, 4-celled tetrad was more common in the lower temperature.

In *Mirabilis jalapa* the tetrad is in most cases formed according to the normal type, but numerous deviations occur, distinguished by the suppression of one or more of the transversal walls. The development may be mono-, bi-, tri-, or tetrasporic. Incomplete partitions often occur and the mature embryo sac may then sometimes be formed by fusion of two embryo sacs and have 6 antipodal nuclei, and 4 polar nuclei, but only one functioning egg apparatus, the second having degenerated. A certain difference in the occurrence of deviations was found between different proveniences and also in this species there is probably an increase of the deviating types at higher temperatures.

In *Ulmus glabra* the Drusa type is dominating but the Adoxa type sometimes occurs and the Chrysanthemum cinerariifolium type was found in some cases. When the latter type occurs, a formation of diploid antipodal embryos may be thought to occur. Degeneration of nuclei is common, especially in the basal part of the embryo sac, and the occurrence of micronuclei is not rare. In one case a 4-nucleate embryo sac was observed that was assumed to have arisen without reduction as a link in an apomictic development. A comparison of the development at two different temperatures showed that the Adoxa type was more rare in the higher temperature.

In *Ulmus laevis* the conditions are, broadly spoken, the same as in *U. glabra*. The same embryo sac types occurred here and the Adoxa type was also here rare: it was totally absent in a trial with about 20° temperature and occurred in a few cases in a lower as well as in a higher temperature.

In both *Ulmus* species a break-down of meiosis was observed in a number of cases. This phenomenon was more common in *Ulmus laevis* and occurred there especially at higher temperatures.

The variation between different types of embryo sac development in the same species and even individual can perhaps be due to changes in the balance between nuclear division and cell growth.

Literature quoted

BROWN, W. V. & EMERY, W. H. P. 1958. Apomixis in the Gramineae: Panicoideae. — Amer. Jour. Bot. 45, 253—263.

COOPER, D. C. 1949. Flower and seed development in Oxybaphus nyctagineus. — Amer. Jour. Bot. 36, 348—355.

D'AMATO, F. 1940. Embriologia di Ulmus campestris L. — Nuovo Giorn. Bot. Ital. N. S. 47 (2), 247—263.

EKDAHL, I. 1941. Die Entwicklung vom Embryosack und Embryo bei Ulmus glabra Huds. — Sv. Bot. Tidskr. 35, 143—156.

HJELMQVIST, H. 1964. Variations in embryo sac development. — Phytomorphology 14, 186—196.

HJELMQVIST, H. & GRAZI, F. 1964. Studies on variation in embryo sac development. — Bot. Notiser 117, 141—166.

LELIVELD, J. A. 1935. Cytological studies in the genus Ulmus. II. The embryo sac and seed development in the common Dutch elm. — Rec. Trav. Bot. Neerl. 32, 543—573.

ROCÉN, T. 1927. Zur Embryologie der Centrospermen. — Diss. Uppsala.

WALKER, RUTH I. 1950. Megasporogenesis and development of megagametophyte in Ulmus. — Amer. Jour. Bot. 37, 46—52.

WINKLER, H. 1908. Parthenogenesis und Apogamie im Pflanzenreiche. — Progressus rei botanicae II: 3. Jena.

BOTANISKA NOTISER 1965 · VOL. 118 · FASC. 4 · LUND

Floran i Stoby socken

Ormbunkar och fröväxter

AV ALF OREDSSON

Botaniska museet, Lund

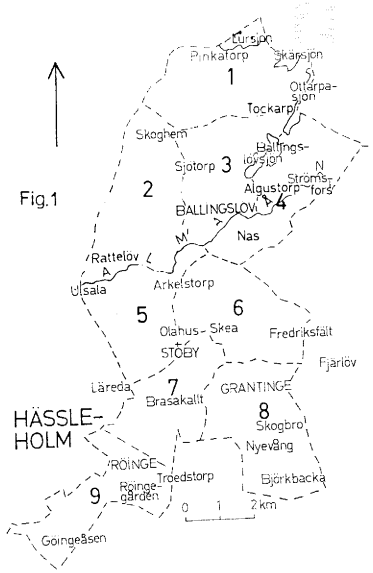
Inventering

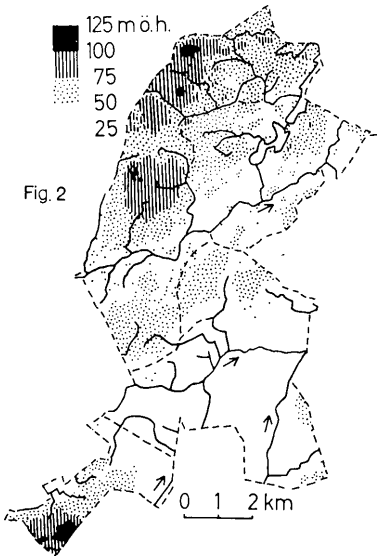
Floran i Stoby socken inventerades 1952—56 av en grupp ungdomar från socknen, bestående av ÅKE LÖNN, THORSTEN PERSSON, ÅKE PERSSON, KURT SVENSSON, ROLF WITTSTRÖM och förf. Den del av socknen som ligger söder om järnvägen Hässleholm—Kristianstad (sekt. 9) ingick i H. WEIMARCKS undersökning av flora och vegetation i Nävlingeåsområdet 1942. Ett 20-tal botanister har vid enstaka tillfällen fört anteckningar i Stoby socken, flitigast F. HÅRD AV SEGERSTAD 1920. Från Ballingslöv har åtskilliga lokaler meddelats av en ortsbo, NILS KARLSSON (†).

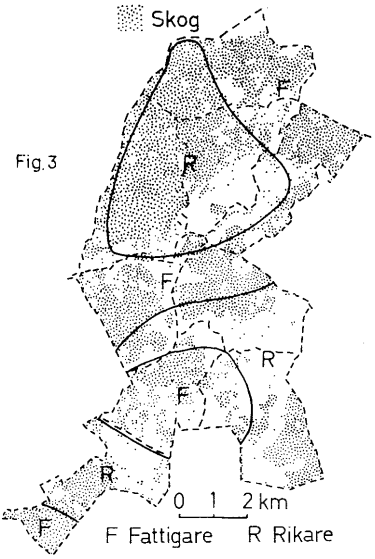
Geografi

Stoby socken är belägen i det inre av nordöstra Skåne. Från en punkt 4 km S Hässleholm sträcker sig socknen 17 km åt NNO till Lursjön. Ytan är 73 km², sedan staden 1942 inkorporerat 13 km² mellan Finjasjön och Ljungdala mosse. Almaån, som avvattnar Finjasjön till Helga å, ringlar i ostnordostlig riktning genom socknen. I norra delen av Stoby socken finns 4 större sjöar. De ligger i rad på kortare inbördes avstånd än 1 km. Tre av dem delas med grannsocknar. Två järnvägslinjer passerar genom Stoby, nämligen Malmö—Stockholm med 10 km och Hässleholm—Kristianstad med 2,5 km. Socknen har indelats i 9 sektioner. Fig. 1 och 10.

Lägst höjd över havet har bäcken mellan sekt. 6 och 8 med 27 m. Lägre än 50 m ligger drygt hälften av socknens yta. Av återstoden når större delen ej 75 m. Sålunda är endast 1/10 av socknens yta belägen







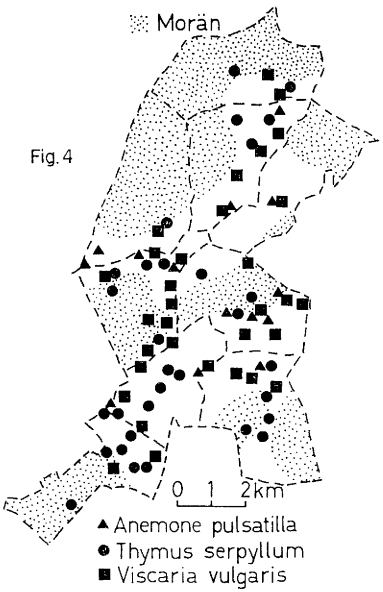


Fig. 1. Stoby socken, indelad i 9 sektioner.
Fig. 2. Höjdförhållanden. Vattendrag.
Fig. 3. Skog. Områden med fattigare, resp. rikare vegetation.
Fig. 4. Områden med nästan enbart morän, med smärre insprängda torvpartier. Några arter som växer på torra, öppna platser, vanligen på sand eller rullsten.

mellan 75 och 100 m ö.h., medan knappt 1 km^2 överstiger 100 m. Högst når en punkt på Göingeåsen i södra sekt. 9 med c. 120 m. Fig. 2.

På över 50 meters höjd finns nästan enbart morän, med smärre insprängda torvpartier. Skogen, som täcker omkring hälften av socknens yta, växer huvudsakligen på morän. *Fagus sylvatica* är det dominerande trädslaget i sekt. 1, 2 och 3, samt på Göingeåsen. I övrigt förekommer mest blandskog med *Betula verrucosa, Pinus sylvestris* och *Quercus robur*. Planterad eller självsådd *Picea abies* är vanlig. Fig. 3 och 4.

Lägre områden täcks huvudsakligen av sand och torv. Rullsten finns i ett åssystem från Röinge till Ballingslövsjön, i ett kortare åssystem i Rättelöv, samt mellan dem i sekt. 5. På torra, öppna platser, vanligen på sand eller rullsten, förekommer över hela socknen *Anemone pulsatilla, Filago minima, Jasione montana, Teesdalia nudicaulis, Thymus serpyllum, Veronica verna* och *Viscaria vulgaris*. Fig. 4.

Hornbländegnejs går i dagen flerstädes i sekt. 1, 2 och 3, samt i södra sekt. 9. Inom både det större området i nordväst och det mindre i söder finns *Carex elongata* i många av kärren. I övrigt är arten känd från 3 lokaler. *Asplenium trichomanes, Cardamine hirsuta* och *Carex digitata* är i det närmaste begränsade till nämnda nordvästra område och är där ganska vanliga. Fig. 5.

Med avseende på vegetationen kan socknen indelas i 4 fattigare och 3 rikare områden. Ett underjordiskt kalkbrott finns i det södra rikare området, vid Röinge. Smärre kalktag förekommer både i det mellersta och det norra rikare området. Fig. 3.

Fattigare vegetation

Hedskog är förhärskande. Vanliga i socknen och karaktäristiska för urbergsbygder är *Equisetum sylvaticum, Lycopodium annotinum, Phegopteris polypodioides, Pteridium aquilinum, Ramischia secunda, Trientalis europaea, Vaccinium myrtillus* och *V. vitis-idaea*. *Goodyera repens* har påträffats i Arkelstorp, *Listera cordata* i Arkelstorp och Algustorp, *Lycopodium clavatum* i sekt. 1, 2, 4, 6 och 9, *Moneses uniflora* vid Pinkatorp. *Quercus petraea* är vanlig längst i nordost.

På hedar i fattigare områden förekommer flerstädes *Antennaria dioica, Arctostaphylos uva-ursi, Arnica montana* och *Hypochoeris maculata*.

Fukthed, vanligen använd som betesmark, finns huvudsakligen i fattigare delar av sekt. 5, 6, 7 och 8. I dessa sektioner har *Erica tetralix* noterats på 14 lokaler, i övriga sektioner på 4, *Juncus squarrosus* på 3

Fig. 5

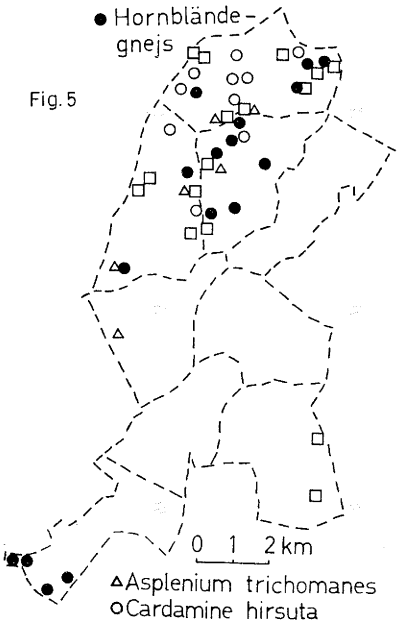


Fig. 6

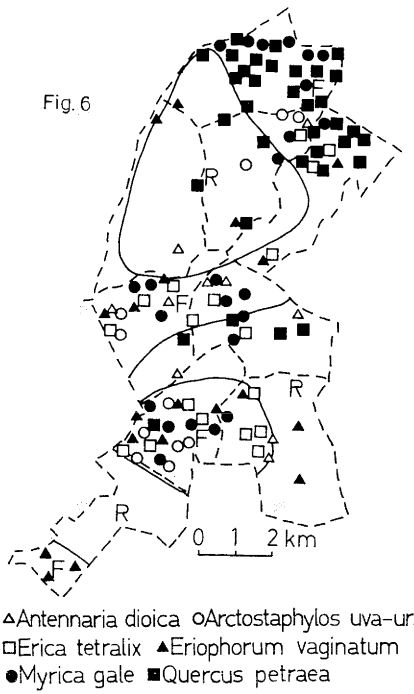


Fig. 7

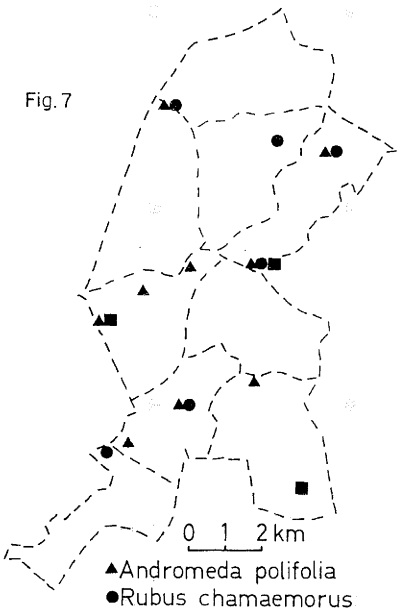


Fig. 8

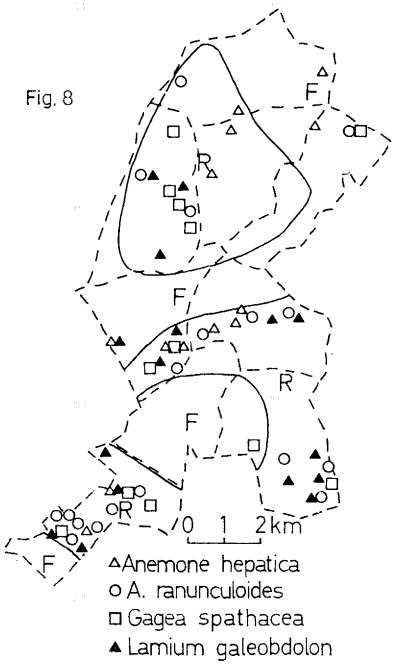


Fig. 5—8.

resp. 1, *Pedicularis sylvatica* på 4 resp. 2, samt *Vaccinium uliginosum* på 20 resp. 8.

Dikning och torvtäkt har förekommit på alla större och de flesta mindre mossar. På Näs mosse, bäst bevarad av de större, domineras planet av *Calluna vulgaris, Empetrum nigrum* och *Eriophorum vaginatum,* med inslag av *Andromeda polifolia, Betula verrucosa, Erica tetralix, Pinus sylvestris, Rubus chamaemorus, Trichophorum caespitosum* ssp. *caespitosum* m.fl. I torvgravarna växer, förutom mera triviala arter, *Drosera intermedia, D. rotundifolia, Ledum palustre, Oxycoccus palustris* och *Rhynchospora alba.*

Fattigkärren, gärna i anslutning till fukthed eller mosse, närmar sig oftast magra typer av rikkärr. Mest utpräglat är ett fattigkärr, till en del övergående i mosse, beläget NV Brasakallt. Här förekommer *Andromeda polifolia, Betula pubescens, Calluna vulgaris, Carex canescens, C. diandra, C. limosa, C. nigra, C. rostrata, Deschampsia flexuosa, Drosera intermedia, D. rotundifolia, Dryopteris spinulosa, Erica tetralix, Eriophorum angustifolium, E. vaginatum, Equisetum fluviatile, Ledum palustre, Menyanthes trifoliata, Oxycoccus palustris, Peucedanum palustre, Pinus sylvestris, Potentilla erecta, P. palustris, Rhynchospora alba, Rubus chamaemorus, Salix aurita, Vaccinium uliginosum* och *V. vitis-idaea.*

Osmunda regalis växer i Almaån vid Algustorp och Strömsfors, samt i en bäck 1 km NV Tockarp, *Potamogeton alpinus* i samma bäck mellan Pinkatorp och Tockarp, *P. polygonifolius* 1 km SV Ballingslöv, Ö Sjötorp och 1,5 km NNO Strömsfors, *Sparganium glomeratum* NNO Skoghem och 1 km NNV Skoghem. Samtliga lokaler för dessa 4 arter är sålunda belägna i norra hälften av socknen. *Calla palustris* förekommer inom samtliga fattigare områden, men har endast i sekt. 1 observerats inom ett rikare.

Lursjön (55 m ö.h.) är socknens enda växtplats för *Sparganium Friesii.* I Lursjön och Skärsjön (51 m) är *Lobelia dortmanna* vanlig, medan arten i Ottarpasjön och Ballingslövsjön (båda 41 m) påträffats på 3 lokaler. *Carex elata,* som föredrar näringsrikt vatten, förekommer flerstädes i de båda lägre sjöarna, men saknas i Lursjön och Skärsjön.

Arter karaktäristiska för den fattigare vegetationen har karterats på fig. 6 och 7.

Fig. 5. Hornbländegnejs. Arter som i det närmaste är begränsade till det större, nordvästra området med denna bergart och där är ganska vanliga.
Fig. 6. Några arter karaktäristiska för den fattigare vegetationen.
Fig. 7. Några arter begränsade till torvmossar.
Fig. 8. Ängsskogsarter.

Fig. 9

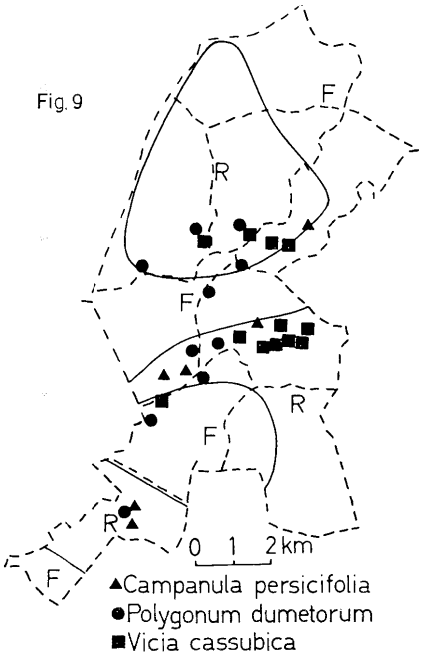


Fig. 10

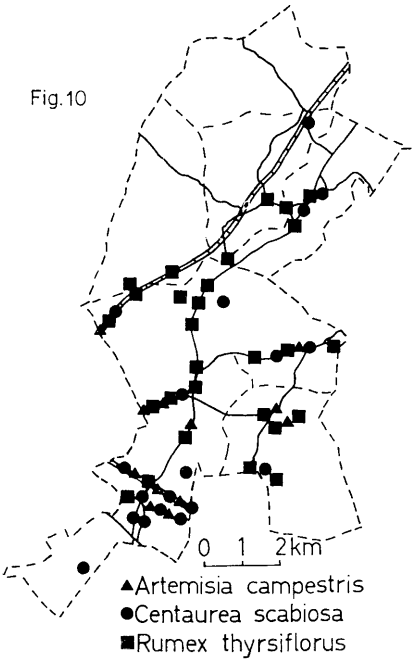


Fig. 11

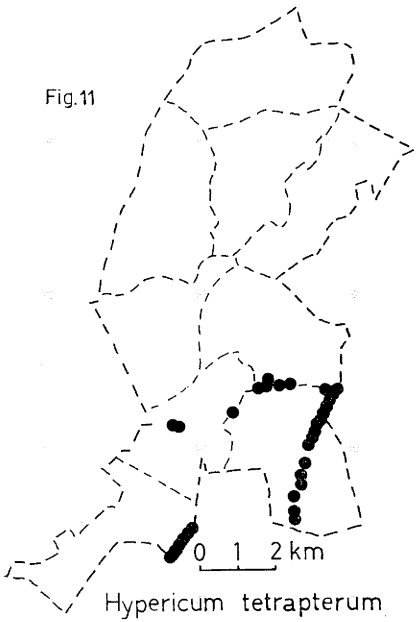


Fig. 12

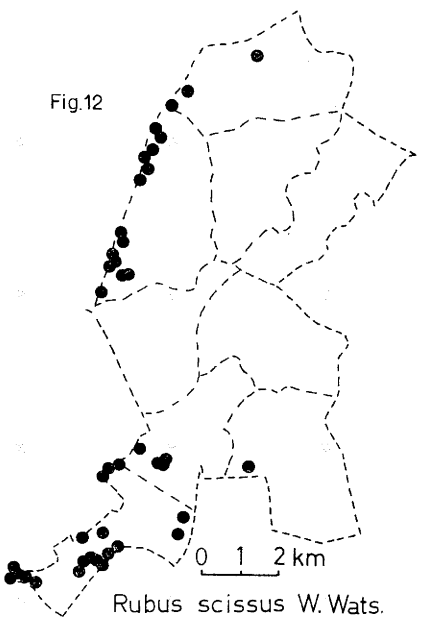


Fig. 9—12.

Rikare vegetation

Lövbackarna NV Röingegården har socknens rikaste lundvegetation. Här förekommer, tillsammans med trivialare arter, *Acer platanoides, Adoxa moschatellina, Alliaria petiolata, Allium oleraceum, Anemone hepatica, Arctium vulgare, Campanula persicifolia, C. trachelium, Corydalis fabacea, Crataegus monogyna, Cuscuta europaea, Fraxinus excelsior, Euonymus europaeus, Gagea lutea, G. spathacea, Geranium sanguineum, G. sylvaticum, Lamium galeobdolon, Melampyrum nemorosum, Melica nutans, Milium effusum, Paris quadrifolia, Polygonatum multiflorum, P. odoratum, P. verticillatum, Polygonum dumetorum, Primula veris, Ranunculus ficaria, Rhamnus cathartica, Stachys sylvatica, Satureja vulgaris, Ulmus glabra, Valeriana officinalis, V. sambucifolia* och *Viola odorata.* Av dessa är *Alliaria petiolata, Melampyrum nemorosum* och *Milium effusum* begränsade till denna lokal. 1 km OSO Röingegården finns socknens enda lokal för *Orchis mascula.*

I det mellersta rikare området förekommer i ängsskogsfragment *Adoxa moschatellina,* V Olahus, *Agropyron caninum,* N Skogbro och S Nyevång, *Allium oleraceum,* V Olahus, VNV Fredriksfält och N Skogbro, *Campanula trachelium,* SV kyrkan och V Olahus, *Lathyrus niger,* V Olahus, samt *Mercurialis perennis,* SV kyrkan, 1 km NV Fredriksfält och VNV Björkbacka. Ingen av dessa arter har påträffats i det norra rikare området, medan 3 iakttagits i det södra.

Huvudsakligen inom de rikare områdena förekommer i ängsskogspartier *Anemone hepatica, A. ranunculoides, Carpinus betulus, Corydalis fabacea, Gagea lutea, G. spathacea, Lamium galeobdolon, Melica nutans, Primula veris, Ranunculus ficaria* och *Stachys sylvatica.* Fig. 8.

På torrängar, ofta i anslutning till ängsskog, växer flerstädes *Campanula persicifolia, Filipendula vulgaris, Polygonum dumetorum, Saxifraga granulata, Turritis glabra, Veronica spicata* och *Vicia cassubica. Geranium sanguineum* finns i östra sekt. 9 och på rullstensåsar från Läreda till Näs. Fig. 9.

Av arter som är sällsynta eller saknas i urbergsbygder må nämnas *Agrimonia odorata,* vid Skogbro, *Helianthemum chamaecistus* ssp.

Fig. 9. Några arter som växer på torrängar, ofta i anslutning till ängsskog.

Fig. 10. Allmänna vägar och järnvägar. Arter som mest förekommer utmed dem och som i Skåne är allmänna i kalktrakter och sällsynta i urbergsbygder.

Fig. 11. I bäckar i södra hälften av socknen har denna art, karaktäristisk för skånska extremrikkärr, sina västligaste lokaler i anslutning till kristianstadskritan.

Fig. 12. Denna atlantiska art (i Sverige tidigare felaktigt benämnd *R. fissus*) har i socknen en del av sin skånska östgräns.

hirsutum, i Arkelstorp och 1 km ONO Brasakallt, *Helictotrichon pratense,* SV kyrkan och 1 km ONO Brasakallt, *Hypericum montanum,* 1 km SSV Ballingslöv, *Melampyrum cristatum,* V Näs, *Saxifraga tridactylites,* NV Röingegården, samt *Silene nutans,* Ö Röingegården och 1 km NV Röinge. Samtliga lokaler för dessa 7 arter är belägna söder om Almaån.

Mest utmed större vägar, men även vid järnvägarna, i grustag och på andra torra ställen, växer 3 arter som alla är allmänna i kalktrakter men sällsynta i urbergsbygder, nämligen *Artemisia campestris, Centaurea scabiosa* och *Rumex thyrsiflorus.* Fig. 10.

Mellan Ulsala och Ottarpasjön har utmed järnvägen påträffats 21 arter, vilka eljest saknas. Tretton av dem har endast observerats på en utfyllnad S Ulsala, nämligen *Bromus inermis, Carduus acanthoides, Carex arenaria, C. flacca, Diplotaxis muralis, Geranium columbinum, G. pyrenaicum, Medicago falcata, Melilotus albus, Ononis repens, Potentilla reptans, Scabiosa columbaria* och *Trifolium spadiceum.* På enstaka lokaler spridda utmed järnvägen har iakttagits *Bunias orientalis, Carex disticha, Chaenorrhinum minus, Diplotaxis tenuifolia, Euphrasia micrantha, Lepidium densiflorum, Salvia pratensis* och *Senecio viscosus.*

Förhärskande är magra typer av rikkärr. *Epilobium parviflorum* förekommer endast i de rikaste och saknas i norra hälften av socknen. Arten har påträffats NNV Röingegården, i bäcken S Troedstorp, V kyrkan, NNO kyrkan, S Skea, 1 km NV Fredriksfält, i en bäck 1 km S Fredriksfält, samt flerstädes utmed Skogbroån.

Av forna ängsmarker, vilka nästan undantagslöst blivit åker, finns rester kvar kring vissa rikkärr. *Trollius europaeus* är funnen på 7 lokaler, alla i socknens södra hälft.

Veronica beccabunga finns på åtskilliga ställen utmed bäckar i det södra och i det mellersta rikare området, men endast på ett fåtal lokaler i angränsande fattigare områden. Arten förekommer dessutom i sekt. 1 och norra sekt. 4.

Skogbroån, som rinner norrut genom sekt. 8 på 29—27 m ö.h., har rikast vegetation av socknens bäckar. Tillflöden kommer från Röinge, Gulastorp, Ignaberga och Sjunkaröd. Bäcken löper ut i Almaån vid Fjärlöv. De vanligaste arterna utmed Skogbroån är *Achillea ptarmica, Alisma plantago-aquatica, Angelica sylvestris, Carex acutiformis, Centaurea jacea, Cirsium oleraceum, Eupatorium cannabinum, Filipendula ulmaria, Glyceria fluitans, Hypericum maculatum, H. perforatum,*

Lathyrus pratensis, Linaria vulgaris, Lysimachia vulgaris, Lythrum salicaria, Mentha arvensis, Myosotis palustris, Myriophyllum alterniflorum, Phalaris arundinacea, Rhinanthus serotinus, Rumex crispus, Scirpus silvaticus, Scrophularia nodosa, Sparganium simplex, Valeriana sambucifolia och *Veronica anagallis-aquatica.* Vidare växer i Skogbroån, förutom ett drygt 50-tal mera triviala arter, *Carex riparia, Epilobium hirsutum, E. parviflorum, E. roseum, Hypericum tetrapterum, Lemna trisulca, Mentha aquatica, Poa palustris, Rorippa islandica, R. sylvestris, Sium latifolium, Solanum dulcamara, Sparganium erectum, Thalictrum flavum* och *Veronica beccabunga. Carex riparia, Lemna trisulca* och *Rorippa sylvestris* har endast iakttagits i denna bäck.

Av arter helt eller i det närmaste begränsade till kalktrakter förekommer, förutom i Skogbroån, *Cirsium oleraceum* i bäcken S Troedstorp, *Epilobium hirsutum* i bäcken S Troedstorp, i en bäck N Röinge och 1 km ONO Röinge, samt i ett kärr NNO kyrkan, *E. roseum* i bäcken S Troedstorp, vid Brasakallt och 1 km SV Fredriksfält, *Hypericum tetrapterum* i bäcken S Troedstorp, samt flerstädes utmed en bäck från Läreda till Fjärlöv, samt *Veronica anagallis-aquatica* i bäcken S Troedstorp. Samtliga lokaler för dessa 5 arter är belägna i södra hälften av socknen. Fig. 11.

Utmed Almaån (41 m ö.h. vid Rättelöv, 36 m efter Strömsfors) finns spridda lokaler för 11 arter, som är sällsynta eller saknas i urbergsbygder, nämligen *Bidens cernua, Butomus umbellatus, Elodea canadensis, Glyceria maxima, Mentha aquatica, Potamogeton gramineus, Rorippa amphibia, Rumex hydrolapathum, Sium latifolium, Thalictrum flavum* och *Valeriana sambucifolia.*

Sålunda är den nordöstligaste delen av Stoby socken i det närmaste ren urbergsbygd, medan de rikare områdena i socknens södra hälft anknyter till floran på Kristianstadsslätten. Dock saknas åtskilliga kalkgynnade arter, som förekommer i Ignaberga (grannsocken i söder ingående i Nävlingeåsområdet).

Jämförelse mellan Stoby och Norra Sandby socknars flora

En komplett artlista för Norra Sandby (grannsocken i öster) har tidigare redovisats (OREDSSON 1961).

I Stoby påträffades omkring 660 arter under inventeringen. *Rubus scissus* W. Wats., vars östgräns i Skåne passerar genom socknen, har karterats 1959 och senare. Fig. 12.

Av före 1952 uppgivna arter har 21 inte kunnat återfinnas. Skånes Floras arkiv innehåller uppgifter om *Anemone vernalis, Blechnum spicant, Carex lepidocarpa, Circaea intermedia, Juncus capitatus, Lycopodium tristachyum, L. inundatum, Peplis portula, Petasites hybridus, Radiola linoides, Senecio palustris* och *Utricularia neglecta.* NILS KARLSSON har meddelat *Chamaepericlymenum suecicum, Gentiana pneumonanthe, Gentianella campestris, Linnaea borealis, Listera ovata, Pinguicula vulgaris* och *Serratula tinctoria.* MARTIN P:SON-NILSSON har angivit *Botrychium lunaria* och *Narthecium ossifragum.*

Förutom 8 av de arter som inte kunnat återfinnas *saknas* i Stoby 46 som påträffats i Norra Sandby 1957—60, nämligen *Alchemilla micans, Anthemis cotula, Arctium lappa, Brassica nigra, Campanula patula, Carex caespitosa, C. chordorrhiza, C. dioica, C. pulicaris, Chenopodium urbicum, Dactylorchis majalis, Eleocharis multicaulis, Epilobium adenocaulon, E. collinum, Equisetum palustre, Eriophorum gracile, Festuca trachyphylla, Galinsoga parviflora, Hieracium sylvaticum, Juncus compressus, Lathraea squamaria, Lathyrus vernus, Leersia oryzoides, Lonicera xylosteum, Melampyrum sylvaticum, Melandrium rubrum, Melica uniflora, Myriophyllum verticillatum, Nymphaea alba* ssp. *candida, Ornithopus perpusillus, Pilularia globulifera, Rhynchospora fusca, Sagina nodosa, Salix starkeana, Scheuchzeria palustris, Sherardia arvensis, Spirodela polyrrhiza, Stachys arvensis, Symphytum asperum, Taraxacum Erythrosperma, T. Obliqua, Trichophorum alpinum, T. caespitosum* ssp. *germanicum, Vicia lathyroides, Viola mirabilis* och *V. stagnina.*

I Stoby har påträffats 85 arter som saknas i Norra Sandby. Av dem har hittills inte nämnts *Agrostemma githago, Anthemis tinctoria, Aquilegia vulgaris, Arabis arenosa, Arctium tomentosum, Arnoseris minima, Asplenium septentrionale, Berberis vulgaris, Bromus tectorum, Calystegia sepium, Cardamine flexuosa, Cardaria draba, Centaurera nigra, Ceratophyllum demersum, Cirsium heterophyllum, Cuscuta epithymum, Echium vulgare, Eleocharis uniglumis, Equisetum hyemale, Euphorbia peplus, Galinsoga ciliata, Heracleum sphondylium* ssp. *sibiricum, Herniaria glabra, Hypericum humifusum, Juncus alpinus* ssp. *nodulosus, Lathyrus sylvestris, Lamium hybridum, Lithospermum arvense, Malva pusilla, Myriophyllum spicatum, Pastinaca sativa, Poa supina, Rubus radula, Satureja acinos, Silene dichotoma, S. pendula, Sisymbrium altissimum, Symphytum officinale, Thalictrum aquilegiifolium, Tragopogon pratensis* ssp. *minor, Trifolium aureum, Ulex*

europaeus, Verbascum thapsus, Vicia sylvatica, V. villosa och *Viola reichenbachiana.*

Carex tumidicarpa och *Rumex tenuifolius* förekommer i båda socknarna, liksom *Epilobium obscurum* (i artlistan för Norra Sandby benämnd *E. tetragonum* L.). Ett tillägg till artlistan upptar 4 ruderatväxter, av vilka inte någon anträffats i Stoby. I båda socknarna finns *Bromus arvensis, Carum carvi, Sambucus nigra* och *S. racemosa.* Odlingsrester som endast påträffats i Stoby är *Levisticum officinale, Nepeta cataria* och *Onopordon acanthium.*

Av växter i bryn, på hedar och ängar har Stoby sålunda omkring 15 fler än Norra Sandby, medan förhållandet är det omvända beträffande kärrväxter. I Norra Sandby saknas 18 av de 21 arter som i Stoby endast påträffats utmed järnvägen Malmö—Stockholm. Av kulturbetingade arter därutöver har Stoby 15—20 fler än Norra Sandby.

Antalet urbergsbygdsväxter är ungefär samma i de båda socknarna. Av kalktraktsväxter har Stoby, järnvägsfloran oräknad, 15—20 fler än Norra Sandby.

Summary

Vascular Plants in the Parish of Stoby

The parish of Stoby is situated in the inner part of northeastern Scania, between the South-Swedish uplands and the Kristianstad plain. The parish can be divided in four poorer parts and three richer ones (see fig. 3 that also shows the occurrence of forests). The connection with the rich flora of the Kristianstad plain is obvious in the southern part, while the northeasternmost part of the parish belongs to the poor area of north Scania. *Hypericum tetrapterum,* which in Sweden occurs only in Scania and merely in extreme-rich-fens, is found along streamlets in the south (fig. 11). *Rubus scissus* W. Wats., an oceanic species, has its eastern limit in Scania partly in the parish (fig. 12). The investigation has revealed about 660 species of vascular plants. 21 species earlier reported for the district could not be refound in 1952—56. 46 species that were found in the neighbouring parish of Norra Sandby, situated east of Stoby, could not be found in the latter parish. But 85 species not found in Norra Sandby 1957—60, are reported from Stoby during the investigation. Except 18 species, found along a railway, Stoby has 15—20 species more than Norra Sandby of the group that prefers lime occurrences.

Citerad litteratur

HULTÉN, E. 1950. Atlas över växternas utbredning i Norden. Fanerogamer och ormbunksväxter. — Stockholm.

LUNDEGREN, A. 1934. Kristianstadsområdets kritbildningar. — Stockholm.

OREDSSON, A. 1961. Floran i Norra Sandby socken. Fanerogamer och ormbunksväxter. — Bot. Notiser 115.

WALDHEIM, S. & WEIMARCK, H. 1943. Bidrag till Skånes Flora 18. Skånes myrtyper. — Bot. Notiser.

WATSON, W. C. R. 1958. Handbook of the Rubi of Great Britain and Ireland. — Cambridge.

WEIMARCK, H. 1944. Bidrag till Skånes Flora 25. Flora och vegetation i Nävlingeåsområdet. — Bot. Notiser.

— 1963. Skånes Flora. — Malmö.

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Phlebopteris angustiloba (Presl) Hirmer et Hörhammer (Matoniaceae) from "Olstorp" Shaft, Bjuv, Scania

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Introduction

In the spring of 1965 workers at "Olstorp" shaft in Bjuv, Scania, found a "new and unknown fossil" in the upper coal bed of the shaft. The specimen was handed over to staff members of the Palaeontological Institute of the University of Lund during a collecting trip through Scania. This fossil turned out to be *Phlebopteris angustiloba* (Presl) Hirmer et Hörhammer, which actually was unknown in this part of the Rhaeto-Liassic coal field of NW Scania. Previous records are known from the Upper deposits at Pålsjö (NATHORST 1878, p. 22) Munka Tågarp (MÖLLER & HALLE 1913, p. 8), and Billesholm (LUNDBLAD 1950, p. 23 ff.), and from the Lower Liassic beds of Höör (ANTEVS 1919, p. 16, 17), Sofiero (CHOW 1924, p. 3), and Stabbarp (LUNDBLAD in TROEDSSON 1947, p. 292). The Lower Liassic occurrence from Rödalsberg (MÖLLER & HALLE 1913) is doubtful according to the opinion of LUNDBLAD (1950, p. 23). All specimens mentioned above are kept at the Swedish Museum of Natural History, Palaeobotanic section, Stockholm.

The occurrence of the species outside Scania, according to the point of view held by HIRMER & HÖRHAMMER (1936, p. 33, text plate D), is in the island of Bornholm, on Greenland, in Poland, Germany, Italy and Japan. However HARRIS (1937, p. 22) feels some doubt about "a good many poorly figured specimens" in the list of synonymy given by HIRMER & HÖRHAMMER.

Description

Provenience: Scania, Bjuv, Shaft Olstorp, upper coal bed.

Macroscopic remains: Two fragmentary pinnae (fig. 1 A) ±11.0 cm

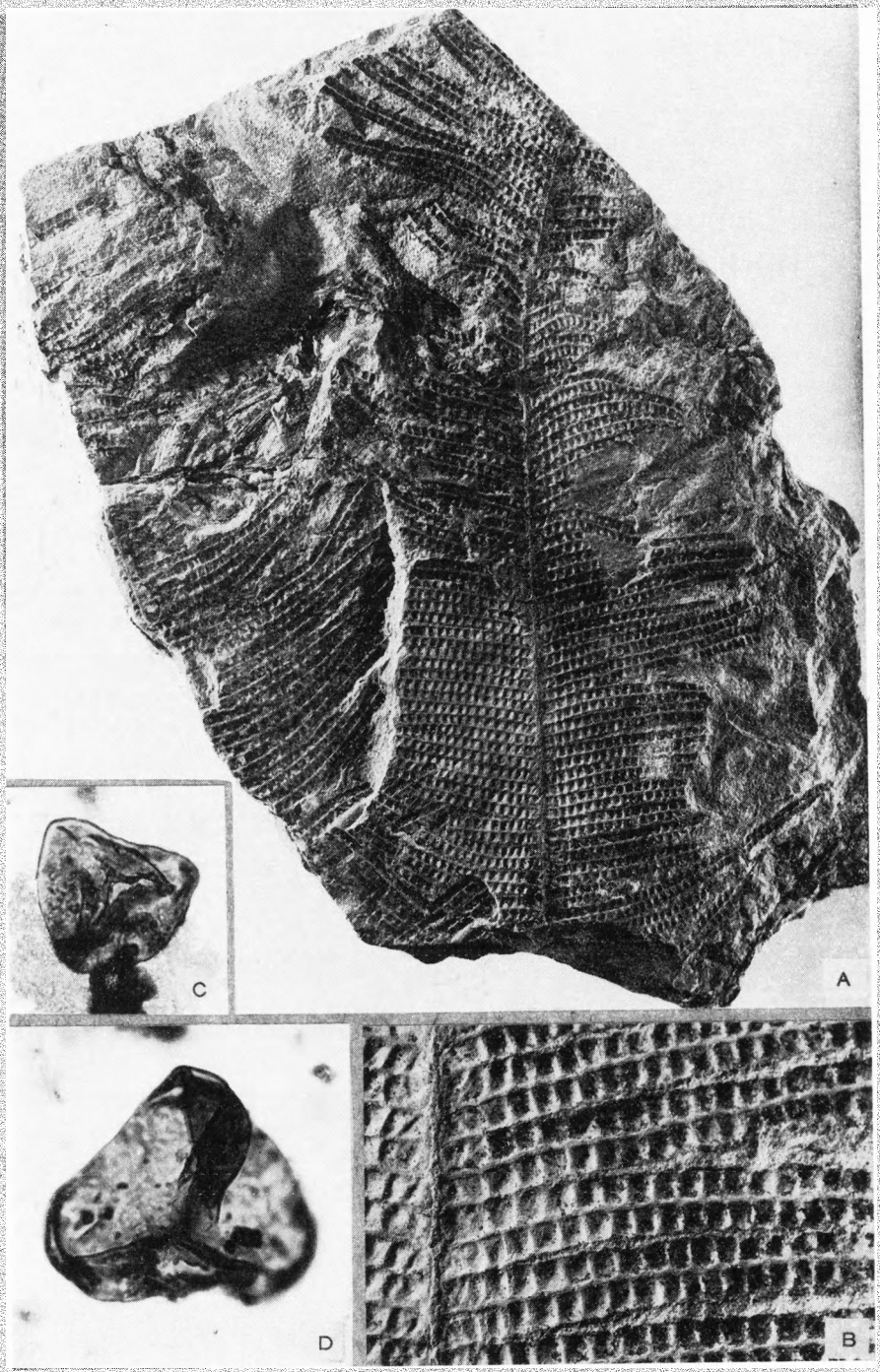


Fig 1 a—d.

long, reconstructed original breadth (half the length of pinnules) ±9.0 cm. Pinnules making almost a right angle with the midrib, ±0.3 cm broad, with characteristic pit-like, deeply convex square "fields", markedly coalescent in basal parts (fig. 1 B), margin entire and somewhat incurved, venation indistinct.

Microscopic remains: Spores trilete, ±40 μ. Roundish triangular in polar view. Triradiate mark obviously formed by cutinized ridges (fig. 1 C). Exine smooth.

Remarks: The specimen can be referred to the "*Andriana*" type (cf. HARRIS 1931, p. 76), because of the crowded pinnules of the leaf. The pinnules show, however, convex "fields" typical of the "*Gutbiera*" type. The leaves also, as almost all Scanian specimens, differ in size from the specimens described from Scoresby Sound, East Greenland, by HARRIS (1931, p. 74 ff.). The pinnules of the Greenland material are about 15—25 mm, of the Billesholm material about 50 mm, and the pinnules of the present material are about 45 mm long. These size differences may be due to ecological factors.

A relatively limited number of spores obtained show a remarkable variation in size, which is 40±10 μ. Still, they compare well with spores of this species described previously (cf. POTONIÉ 1962). They are similar to spores of *Phlebopteris muensteri* (Schenk) Hirmer et Hörhammer, but are distinguished from these by their smaller size.

References

ANTEVS, E. 1919. Die liassische Flora des Hörsandsteins. — Kungl. Sv. Vet. Akad. Handl. Bd 59. Uppsala & Stockholm.

CHOW, T. C. 1924. The Lower Liassic Flora of Sofiero and Dompäng in Scania. — Kungl. Vet. Akad. Arkiv f. Bot. Bd 19. Uppsala & Stockholm.

HARRIS, T. M. 1931. The Fossil Flora of Scoresby Sound, East Greenland. Part 1. — Meddelelser om Grønland. Bd 85. København.

— 1937. The Fossil Flora of Scoresby Sound, East Greenland. Part 5. — Meddelelser om Grønland. Bd 112. København.

HIRMER, M. & HÖRHAMMER, L. 1936. Morphologie, Systematik und geographische Verbreitung der fossilen und rezenten Matoniaceen. — Palaeontographica. Bd 81, Abt. B. Stuttgart.

LUNDBLAD, ANNA BIRGITTA 1950. Studies in the Rhaeto-Liassic Floras of Sweden. I. — Kungl. Sv. Vet. Akad. Handl. 4. Ser. Bd 1. Stockholm.

Fig. 1. A: *Phlebopteris angustiloba* (Presl) Hirmer et Hörhammer, Shaft "Olstorp", Bjuv, Scania; two fragmentary pinnae, nat. size; B: pinnules of the same specimen, 3 ×; C—D: spores of the same specimen, 600 ×. — Original material: Palaeontological Institute, University of Lund. — K. E. SAMUELSSON phot.

MÖLLER, HJ. & HALLE, T. G. 1913. The Fossil Flora of the Coalbearing Deposits of South-Eastern Scania. — Kungl. Vet. Akad. Arkiv f. Bot. Bd 7. Uppsala & Stockholm.

NATHORST, A. G. 1876. Bidrag till Sveriges fossila flora. — Kungl. Vet. Akad. Handl. Bd 14. Stockholm.

POTONIÉ, R. 1962. Synopsis der Sporae in situ. — Beih. Geol. Jahrb. H. 52. Hannover.

TROEDSSON, G. 1947. De kolförande bildningarna i Stabbarp. — Geol. För. Stockholm Förh. Bd 69. Stockholm.

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The Usefulness of Thin-Layer Chromatographic Analysis of Phenolic Compounds in European Lathyrus L.

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With this work the present author wants to illustrate the usefulness in plant taxonomy of biochemical analysis of phenolic compounds in the leaves of European *Lathyrus* L. (*Papilionaceae*). Could such a method be helpful in efforts to separate genera, subgenera, species and subspecies? This examination would also show the variation between and to some extent within collections, which has not been emphasized in earlier works. Samples with different chromosome numbers in the same species were compared from a biochemical point of view.

The use of chromatographic separations of various compounds obtained from plant materials in taxonomy has received considerable attention in recent years. BLANK (1947) described the anthocyanin pigments of plants from a chemical and physiological point of view. Methods for the identification of phenolic substances on paper chromatograms were introduced by BATE-SMITH (1948, 1950). The possibilities of identification of anthocyanidins formed from leuco-anthocyanins in plant tissues was shown by BATE-SMITH (1954 a). BATE-SMITH & LERNER (1954) and BATE-SMITH (1956) have studied the systematic distribution of leuco-anthocyanins in leaves and analysed about 500 species. They say that leuco-anthocyanins occur much more commonly in the tissues of woody plants than in those of herbaceous plants. Later thin-layer chromatography using cellulose-coated glass plates instead of free hanging paper has much improved the analyses. Such examinations using fruits and flowers have been made by NYBOM (1964).

With help of paper-chromatographic analysis of phenolic compounds e.g. STEBBINS, HARNEY et al. (1963) identified the ancestry of an amphiploid *Viola,* and HARNEY & GRANT in 1964 studied the *Lotus corniculatus* group. RILEY & BRYANT (1961) separated nine species of the *Iridaceae* by paper chromatography.

In *Lathyrus,* by paper chromatography PECKET (1959, 1960) analysed the constituents of leaf extracts in 28 species and the nature of the variation in

flower colour of 19 species. He found only two flavonols and two coumaric acids that occur frequently in the analysed leaf extracts. PECKET says: "Similar complements of these substances were present in species which have been considered to be closely related on the basis of morphology, cytology and genetics. This is regarded as an indication of the usefulness of such biochemical data in checking species relationship based on more obvious criteria. The data for four species (*L. hirsutus, L. pratensis, L. palustris* and *L. maritimus*), which have been placed in different sections of the genus by different workers, provide support for these classifications in which these species have been allotted to the section Eulathyrus. Support is also provided for the view that in the Papilionaceae, leucoanthocyanins are generally lacking in leaves of species of the tribe Vicieae." In flowers PECKET found the anthocyanidins delphinidin, petunidin and malvidin. He writes, "Thus, even where the standard and wings were markedly dissimilar in colour, pH differences are unlikely to play any part (except perhaps in *L. hirsutus*) and in view of what has been said earlier it can be assumed that the effect is due to co-pigmentation alone. . . . Although a correlation exists between flower and occurrence of co-pigments, the division of the species according to flower colour does not correspond with any taxonomic arrangement."

BELL (1962) divided the species of *Lathyrus* examined by him into five groups on the basis of ninhydrin-positive compounds in seed extracts.

Material and Methods

The plants used in this study include nearly all of the known European species of the genus *Lathyrus*. The plants were cultivated in greenhouses in the Botanical Garden, Lund, Sweden. All plants were grown from seeds, and where possible, the seeds were collected from naturally occurring populations. Species determinations were made from comparison with herbarium material and the existing monographs (e.g. HITCHCOCK 1952). There is no monograph of the European species of *Lathyrus* so the author had to follow the nomenclature of the partially obsolete work, "Synopsis der Mitteleuropäischen Flora" from 1906—10 by ASCHERSON & GRAEBNER.

The material used must be correctly determined and compared with herbarium material available and existing monographs and also be kept dried to verification. In such a genus as *Lathyrus* where many synonyms occur it is important that the names of the taxa are followed by the names of the authors. Otherwise they may be difficult to compare with other examinations. For example, BELL (1962) did not give the names of the authors in his work on ninhydrin-reacting compounds in seeds in *Lathyrus*. In his table of examined species there are synonyms treated as separate species (e.g. *L. maritimus* and *L. japonicus*). Another example is *L. variegatus* without the name of the author which can mean *L. sylvestris* L., *L. multiflorus* Peterm. or *L. hirsutus* Lam.

In order to get comparable results of the biochemical analyses it is necessary to use as nearly identical conditions as possible in cultivation. The formation of anthocyanins in plants is influenced by temperature and light (wave-length,

Table 1. Analysed spots and their R_f-values in solvent I and II. The variation of the R_f-values were ±0.02 up to ±0.03. The letters mean A white, absorbing, R red and Y yellow spots

Compound	Spot number and colour	R_f-values in solv. I	R_f-values in solv. II
Unknown	A_1	0.94	0.46
Sinapic acid	A_2	0.84	0.73
Ferulic acid	A_3	0.79	0.78
Unknown	A_4	0.71	0.87
Caffeic acid	A_5	0.66	0.78
Unknown	A_6	0.16	0.21
„	R_1	0.93	—
„	R_2	0.81	0.76
Cyanidin	R_3	0.52	0.60
Delphinidin	R_4	0.40	0.36
Unknown	Y_1	0.64	0.58
„	Y_2	0.50	0.67
„	Y_3	0.40	0.70
Kaempferol	Y_4	0.35	0.85
Unknown	Y_5	0.28	—
Quercetin	Y_6	0.24	0.69
Myricetin	Y_7	0.19	0.76

intensity and duration of the illumination), pH, and fertilizers, e.g. nitrogen (BLANK 1947). Many authors describe an increase in anthocyanin formation in plants attacked by parasites, in infected plants and those which have suffered some sort of injury.

For analyses of this kind the method used must be reliable. The results should be the same when one plant is analysed at different times. Usually phenolic compounds occur in plants as glycosides with a great variation of the bonds. Glycosylation occurs at the end of the biosynthesis (HARBORNE 1962). At hydrolysis the sugar is split up from the phenolic compound and the more primary structure can be analysed.

All plants used in this study had the same soil (50 % sand and 50 % humus), water supply, atmospheric humidity, temperature, and light. Leaves from the middle regions of well-developed plants were harvested in the mornings. They were weighed immediately, and hydrolysed. Extracts of 0.5 g fresh leaves were prepared by hydrolysing the tissue with 3.5 ml of 2N HCl for 20 minutes at 100°C in a water bath in order to split the glucosides into aglycones and their sugar components. After centrifugation, 2 ml of the cooled extracts were transferred to a test tube and extracted with 0.2 ml of amyl alcohol. For chromatographic analysis 3 µl was used.

For the thin-layer chromatographic analyses smooth glass plates (20×20 cm) were covered with an even, thin layer of cellulose powder by spreading a well-stirred mixture of 15 g of cellulose powder (Machery, Nagel & Co., MN 300) and 90 ml of distilled water with a thin-layer applicator. The plates were dried at 110°C for one hour. One spot of the amyl alcohol extract was applied at a distance of 3 cm from the corner of each plate. After drying the

plates were placed in jars and were developed in the first direction with a modified "Forestal" solvent composed of formic acid — hydrochloric acid — water (10 : 1 : 3). When the solvent front had travelled about 15 cm, the plates were removed from the jars and air-dried. After that the plates were rotated 90° and developed in the second solvent composed of amyl alcohol—acetic acid—water (2 : 1 : 1). Each solvent required about two hours for development. After air-drying the chromatograms were examined in visible and ultraviolet light. Ammonia vapor did not reveal any previously undetected spots. It was found valuable to examine plates with ultraviolet light after development in each solvent, because some compounds that occurred in low concentrations were "diluted" by the second development to a point at which they were not detectable.

The spots were identified by their colours and R_f-values (distance spot travelled/distance solvent front travelled) (table 1). Various factors such as thickness of the cellulose layer, equilibration of the solvent inside the chromatographic chamber, temperature, etc., may influence the R_f-values. Therefore the above mentioned factors were as constant as possible during all trials. As a reference compound, cyanidin was used, giving a R_f-value of 0.52 in the modified "Forestal" solvent and 0.60 in the other solvent. [BATE-SMITH (1954 a) has given R_f of cyanidin of 0.50 in "Forestal" solvent, while NYBOM (1964) stated R_f of cyanidin in the second solvent of 0.53.] Each compound was given a number. In the tables the spots that absorb and give a light flourescence in ultraviolet light have the numbers A_1—A_6. The red spots visible in daylight are R_1—R_4 and the yellow coloured spots in ultraviolet light have the numbers Y_1—Y_7. Table 1 gives the R_f-values obtained. Chromatographic comparison with pure samples of some common phenolic compounds (BATE-SMITH 1954 a, b, 1956) made it possible to identify some spots (tab. 1). No spots were identical with pure samples of malvidin and p-coumaric acid. It can be added that at the hydrolysis caffeic acid and ferulic acid were decomposed to a small degree. The artefacts were seen as yellow spots near the front and were excluded at the interpretation of the chromatograms. The other identified compounds remained stable to this treatment. Eventually, some unidentified compound may in the same manner be decomposed and may be seen as more than one spot on the chromatograms.

In the tables the European species are tabulated according to the classification of ASCHERSON & GRAEBNER (1906—10) using their nomenclature. The genus *Lathyrus* was there after TAUBERT (1894) divided into the two sections: *Archilathyrus* Taub.[1] and *Orobus* (L. as genus). *Archilathyrus* Taub. was divided into six subsections: *Aphaca* Tourn., *Cicerula* Mnch., *Clymenum* DC., *Eulathyrus* Ser.,[1] *Nissolia* Tourn. and *Orobastrum* Gren. & Godr. The species order within the groups is that of the present author. In most cases several samples of each species were analysed and each collection was biochemically analysed three or more times. The number of plus signs in the tables is roughly proportional to the amounts of the substances that were found on examination of the chromatograms in visible and ultraviolet light. One plus sign indicates a small amount of substance or even a trace. The names of the

[1] The correct name is *Lathyrus*.

Table 2. Some taxa in Lathyrus the somatic chromosome numbers of which have not been published earlier

2n=14	
L. alpestris Rchb.	*L. neurolobus* Boiss. & Heldr.
L. binatus Pančić	*L. palustris* var. *myrtifolius* Gray
L. davidii Hance	*L. pannonicus* var. *versicolor* Maly
L. hallersteinii Baumg.	*L. pseudoaphaca* Boiss.
L. incurvus Willd.	*L. quadrimarginatus* Ch. & B.
L. inermis Roch ap. Friv.	*L. saxatilis* (Vent.) Vis.
L. laetiflorus Greene	*L. sphaericus* var. *stenophyllus* Boiss.
L. luteus var. *aureus* Beck	*L. undulatus* Boiss.
L. luteus var. *laevigatus* Beck	*L. vernus* var. *flaccidus* Arcang.
L. luteus var. *transsylvanicus* Beck	*L. vernus* var. *gracilis* Arcang.
L. mulkak Lipsky	

countries are abbreviated in the same manner as in TUTIN et al. (1964). The names of regions and localities are generally after the atlas "The Times" (BARTHOLOMEW 1955—56). The material examined was commonly spontaneous but in some cases seeds from botanical gardens or institutes (in the tables marked with Bot. Gn. or Bot. In.) were used. It should be pointed out that in the last case the different samples of one taxa may have the same origin. The analysed plants were dried and are kept in the Botanical Museum, Lund, Sweden.

The chromosome numbers of all collections used were determined. All countings were done in 15 μ thick sections of root tips fixed in the Svalöv modification of the Navashin-Karpechenko fixative and stained in crystal violet. The root tips were pre-treated in 5°C water for three hours to contract the chromosomes.

Results

The results of the two-dimensional thin-layer chromatographic analysis of phenolic compounds in leaves of species in *Lathyrus* are shown in the tables 3—10. At the same time the chromosome numbers of all analysed collections and information of the localities are given. Earlier unpublished chromosome numbers of some taxa in *Lathyrus* are presented in table 2.

About fifty taxa of the genus *Lathyrus* were analysed and it is clear that the distribution of different pigments is variable (tabs. 3—10). In all sections and subsections (except *Nissolia*) the following spots were found: A_2 (20), A_3 (56), A_5 (43), R_1 (26), Y_2 (38), Y_4 (52) and Y_6 (49) (tab. 11). The numbers in parenthesis show the number of taxa in which phenolic compounds were found.

The absorbing spot A_1 in ultraviolet light occurred only in *L. luteus* Peterm. and *L. pannonicus* Garcke while sinapic acid (A_2) was represented in all groups except *Nissolia* and existed in 35 % of the analysed taxa. Ferulic acid (A_3) was found in all examined species. The unknown compound A_4 was seen only in *L. luteus* var. *aureus* Beck and in *L. montanus* Bernh. Caffeic acid (A_5) was found in 77 % of the studied taxa and occurred in all the groups but *Nissolia*. The unknown compound A_6 was found in *L. luteus* var. *aureus* Beck and in *L. montanus* Bernh. like A_4, but also in *L. davidii* Hance and in some collections of *L. vernus* Bernh.

The anthocyanidins were not found in many of the species of the genus *Lathyrus*. The unknown compound R_1 appeared in 46 % of the analysed taxa. The red spot R_2 was rare, occurring in *L. alpestris* Rchb., *L. luteus* var. *laevigatus* Beck, *L. nissolia* L., *L. palustris* L. var. *palustris*, *L. vernus* var. *gracilis* Arcang. and *L. undulatus* Boiss. Cyanidin (R_3) was only found in eleven of the analysed species. NYBOM (1964), who has analysed some flowers and fruits of species from different families, reported cyanidin in 90 % of the investigated species. SUOMALAINEN & KERÄNEN (1961) considered that cyanidin is the primary anthocyanidin from a biosynthetical point of view and therefore it should be common. In *Lathyrus*, cyanidin was found in the following species: *L. aphaca* L., *L. binatus* Pančić, *L. hallersteinii* Baumg., *L. incurvus* Willd., *L. inermis* Roch. ap. Friv., *L. maritimus* Bigel., *L. neurolobus* Boiss. & Heldr., *L. pratensis* L., *L. sphaericus* Retz., *L. tuberosus* L., and *L. venetus* Rouy. The anthocyanidin delphinidin (R_4) was found in leaves of *L. incurvus* Willd., *L. maritimus* Bigel., *L. neurolobus* Boiss. & Heldr., *L. odoratus* L., *L. pratensis* L., *L. tingitanus* L., *L. tuberosus* L., *L. venosus* Muhl. ex. Willd., and *L. vernus* Bernh.

In this biochemical analysis of *Lathyrus* seven different yellow spots were found. The sharply yellow spot Y_1 occurred in *L. annuus* L., *L. cicera* L., *L. nissolia* L., *L. saxatilis* (Vent.) Vis., and *L. undulatus* Boiss. The unidentified spots Y_2 and Y_3 were found in about two thirds and one fourth, respectively, of the analysed taxa. Kaempferol (Y_4) was seen in all species except in *L. davidii* Hance, *L. incurvus* Willd., *L. neurolobus* Boiss. & Heldr., and *L. saxatilis* (Vent.) Vis. The unknown compound Y_5 was generally occurring in *L. maritimus* Bigel., *L. binatus* Pančić and *L. hallersteinii* Baumg. and was rare in *L. pratensis* L., all of which are included in the subsection *Orobastrum*. Besides, Y_5 occurred in *L. niger* Bernh. (section *Orobus*) and *L. undulatus* Boiss. and was common in the whole *L. sylvestris* group that includes *L. hetero-*

Table 3. Analysed spots in the subsections Aphaca Tourn., Cicerula Mnch. and Clymenum DC.

	Coll. no.	A_1	A_2	A_3	A_4	A_5	A_6	R_1	R_2	R_3	R_4	Y_1	Y_2	Y_3	Y_4	Y_5	Y_6	Y_7
APHACA Tourn.																		
L. aphaca L. 2n=14																		
Ga, Aude, Sonnac	R 938	.	+	++	.	++	.	+	.	++	.	.	.	.	+	.	+	.
Lu, Bussaco	R 1190	.	+	++	.	++	.	+	.	+	.	.	.	.	+	.	+	.
L. pseudoaphaca Boiss. 2n=14																		
Gr, Sámos, Kerki	R 1189	.	+	++	.	++	.	.	.	.	.	.	+	.	+	.	.	.
CICERULA Mnch.																		
L. annuus L. 2n=14																		
It, Bologna, Bot. Gn.	R 1222	.	.	+	.	++	.	+	.	.	.	+	+	.	++	.	+	.
Br, Kew, Bot. Gn.	R 1209	.	.	+	.	++	.	.	.	.	.	+	+	.	++	.	++	.
L. cicera L. 2n=14																		
Ga, Vaucluse, Pernes	R 949	.	.	+	.	+	.	+	.	.	.	.	++	++	+	.	+	.
Ga, Cantal, Ytrac	R 945	.	.	++	.	++	.	+	.	.	.	.	+	+	+	.	++	.
Gr, Kikladhes, Anafi, Kalamos	R 1219	.	.	+	.	+	.	+	.	.	.	+	+	.	+	.	+	.
L. hirsutus L. 2n=14																		
Ga, Cantal, Ytrac	R 965	.	.	++	.	++	.	++	.	.	.	.	+	.	++	.	++	.
Lu, Estremadura, Amadora	R 967	.	+	+	.	+	.	++	.	.	.	.	+	.	++	.	++	.
L. sativus L. 2n=14																		
Ga, Doubs, Beure	R 864	.	.	+	.	.	.	+	.	.	.	.	+	.	+	.	+	.
Ge, Berlin, Kopenick	R 1034	.	.	+	.	.	.	+	.	.	.	.	.	.	+	.	+	.
Ju, Hrvatska, Zadar	R 1071	.	.	++	.	.	.	.	.	.	.	.	+	.	+	.	++	.
L. quadrimarginatus Ch. & B. 2n=14																		
Lu, Coimbra, Bot. Gn.	R 1143	.	.	+	.	+	.	+	.	.	.	.	.	.	+	.	++	.
Ge, Berlin, Bot. In.	R 1161	.	.	+	.	+	.	+	.	.	.	.	.	.	+	.	++	.
CLYMENUM DC.																		
L. articulatus L. 2n=14																		
Su, Uppsala, Bot. Gn.	R 959	.	.	++	.	++	.	+	.	.	.	.	+	.	++	.	++	.
L. clymenum L. 2n=14																		
Su, Uppsala, Bot. Gn.	R 972	.	.	+	.	.	.	.	.	.	.	.	+	+	++	.	+	.
L. ochrus DC. 2n=14																		
Su, Uppsala, Bot. Gn.	R 958	.	.	++	.	++	.	.	.	.	.	.	+	.	+	.	+	.
Ga, Drome, Crest	R 1159	.	+	++	.	++	.	+	.	.	.	.	+	.	+	.	+	.

phyllus L., *L. latifolius* L. and *L. sylvestris* L. in the subsection *Eulathyrus*. Quercetin (Y_6) appeared in most of the studied taxa. Myricetin (Y_7) was only found in *L. incurvus* Willd. and in two samples of *L. pratensis* L.

Subsect. *Aphaca* Tourn.

Adult plants of *L. aphaca* L. and *L. pseudoaphaca* Boiss. have no laminae, so their stipula were hydrolysed instead and the pigments analysed. PECKET (1959) found the four compounds caffeic acid, ferulic acid, kaempferol and quercetin in the genus *Lathyrus,* but did not find kaempferol in *L. aphaca* L. It was found in the three collections examined here (tab. 3).

Subsect. *Cicerula* Mnch.

About the same red and ultraviolet absorbing spots were found in all species in this subsection (tab. 3). In *L. sativus* L., however, caffeic acid was not found in any examination. PECKET (1959) did not find ferulic acid in *L. cicera* L. and *L. sativus* L., but it was seen clearly on thin-layer chromatograms in the present investigation. PECKET says: "The leaf extracts of *L. cicera* and *L. sativus* are indistinguishable from one another. This confirms the close relationship of the species which was indicated by their ability to hybridize (Saw Lwin, 1956)." In the present study there were some differences between the two species, for instance the compounds Y_2 and Y_3 were common in *L. cicera* L. like caffeic acid.

Subsect. *Clymenum* DC.

The three species, *L. articulatus* L., *L. clymenum* L. and *L. ochrus* DC., had about the same phenolic compounds in their leaves (tab. 3). This is evident from this investigation and that by PECKET (1959), who, however, only found quercetin and kaempferol in this group. BELL (1962) has in his examination of ninhydrin-reacting compounds in seeds found exactly the same components in the three species, too.

Subsect. *Eulathyrus* Ser.

The most obvious result (tab. 4) was the remarkable correlation between *L. heterophyllus* L., *L. latifolius* L., *L. sylvestris* L. and also *L. odoratus* L. The first three species are very similar in several characteristics and the biochemical results support the generally accepted view that the species are closely related to one another. In the literature, taxa of the *L. sylvestris* group have often been subdivided. The three species are to a high degree autogamous. On isolation of their flowers to

Table 4. Analysed spots in the subsections Eulathyrus Ser. and Nissolia Tourn.

	Coll. no.	A_1	A_2	A_3	A_4	A_5	A_6	R_1	R_2	R_3	R_4	Y_1	Y_2	Y_3	Y_4	Y_5	Y_6	Y_7
EULATHYRUS Ser.																		
L. cirrhosus Ser. 2n=14																		
He, Genève, Bot. Gn.	R 943	.	.	+	.	+	.	.	.	.	.	.	+	.	+	.	+	.
L. grandiflorus Sibth. et Sm. 2n=14																		
Po, Poznan, Bot. In.	R 768	.	.	+	.	.	.	.	.	.	.	.	++	++	+	.	++	.
L. odoratus L. 2n=14																		
It, Sicilia, Palermo	R 1036	.	.	+	.	.	.	+	.	.	+	.	+	.	+	.	+	.
Tu, Istanbul, Boyalik	R 1172	.	.	+	.	+	.	.	.	.	.	.	+	.	+	.	+	.
L. heterophyllus L. 2n=14																		
He, Valais, Val de Réchy	S 99	.	.	++	.	++	.	.	.	.	.	.	+	.	+	+	++	.
Rs, Rostov	S 437	.	.	++	.	++	.	.	.	.	.	.	+	.	+	+	++	.
L. latifolius L. 2n=14																		
Ga, Rhône, Millery	S 366	.	.	++	.	++	.	+	.	.	.	.	+	.	+	+	++	.
Ju, Hercegovina, Brocanac ..	S 337	.	.	++	.	++	.	.	.	.	.	.	.	.	+	+	++	.
L. sylvestris L. 2n=14																		
Su, Södermanland, Ösmo ...	S 1	.	.	++	.	++	.	.	.	.	.	.	+	.	+	+	++	.
Br, Wales, Montgomeryshire	S 247	.	.	++	.	++	.	.	.	.	.	.	+	.	+	+	++	.
L. sylvestris var. *platyphyllus* Aschers. 2n=14																		
Cz, Slovensko, Bratislava ...	S 183	.	.	++	.	++	.	.	.	.	.	.	.	.	+	+	++	.
L. tingitanus L. 2n=14																		
Rs, Minsk, Bot. Gn.	R 1146	.	.	+	.	+	.	.	.	.	+	.	++	+	+	.	+	.
L. tuberosus L. 2n=14																		
Ga, Lozère, Ca Mende	R 1180	.	+	++	.	.	.	.	.	.	.	.	.	.	+	.	++	.
Cz, České Země, Roudnice ..	R 762	.	.	+	.	.	.	.	.	.	.	.	.	.	+	.	++	.
Rs, Thbilissi	R 838	.	.	+	.	.	.	.	.	+	+	.	.	.	+	.	+	.
NISSOLIA Tourn.																		
L. nissolia L. 2n=14																		
Ge, Hessen, Wetterau	R 1228	.	.	+	.	.	.	.	+	.	.	+	+	.	++	.	+	.
Ga, Orne, Le Pin	R 1230	.	.	+	.	.	.	.	.	.	.	+	+	.	+	.	+	.

prevent pollination from other individuals, fruits develop from nearly all the flowers. In nature most individuals have probably arisen by autogamy, but occasionally a crossing occurs and gives a variable offspring (e.g. F_1, I, F_2). The many taxonomic problems in the *L. sylvestris* group may be due to the fact that few plants arise by crossing in nature and that various individuals from crossings have often been given new names. PECKET (1959) does not mention kaempferol in the *L. sylvestris* group, which was found in this analysis. He also says that

L. tingitanus L. lacks quercetin, which however was seen in the collection analysed here. PECKET (1959) also contends that *L. hirsutus* L. (A_3, A_5, Y_4, Y_6) belonging to *Cicerula,* and *L. pratensis* L. (A_5, Y_4, Y_6), *L. palustris* L. (A_5, Y_4, Y_6) and *L. maritimus* Bigel. (A_5, Y_6), which all belong to *Orobastrum,* should be placed in the subsection *Eulathyrus.* (Markings in parenthesis are the compounds that PECKET has found in his investigation of these species.) The four compounds (A_3, A_5, Y_4, Y_6) are very common in the genus *Lathyrus* and were found in all the four above mentioned species by thin-layer chromatographic analysis. The species belonging to the subsection *Eulathyrus* were placed in three different groups by BELL (1962).

Subsect. *Nissolia* Tourn.

In *L. nissolia* L. the laminae are reduced and instead the leaflike phyllodia were analysed. *L. nissolia* L. was characterized by the yellow spot Y_1 and absence of sinapic acid (A_2) and the red spot R_1 (tab. 4).

Subsect. *Orobastrum* Gren. & Godr.

The *L. pratensis* group belonging to *Orobastrum* is presented in table 5, where thirty collections were biochemically analysed. The author distinguishes *L. binatus* Pančić and *L. hallersteinii* Baumg. from *L. pratensis* L. ASCHERSON & GRAEBNER (1906—10) included these two taxa in *L. pratensis* L. A detailed investigation of this group in cytology, ecology, geographical distribution, morphology and crossing experiments reveals that *L. binatus* Pančić, *L. hallersteinii* Baumg. and *L. pratensis* L. are distinct species. These results will be published later. There were also biochemical differences between the species. It is necessary to point out, which has not been done in earlier biochemical analyses of this sort, that there was some variation between collections from the same species, although there was little or no variation in pigments of the leaves of individuals in the same collection (table 10). Autogamy occurs in many species of the genus *Lathyrus* and is probably a main cause of the slight intravariation. There were no recognizable differences between diploid and tetraploid *L. pratensis* L. Thus, *L. pratensis* L. with both the somatic chromosome number $2n=14$ and $2n=28$ had delphinidin (R_4), which was not found in *L. binatus* Pančić and *L. hallersteinii* Baumg. Similarly, *L. pratensis* L. had the yellow spot Y_2, while the other two species had instead the yellow compound Y_5. The

Table 5. Analysed spots in thirty collections of the L. pratensis group (subsection Orobastrum Gren & Godr.)

	Coll. no.	A_1	A_2	A_3	A_4	A_5	A_6	R_1	R_2	R_3	R_4	Y_1	Y_2	Y_3	Y_4	Y_5	Y_6	Y_7
L. pratensis L. 2n=14																		
Su, Skåne, Mölle	PCO	.	.	+	.	++	.	+	.	+	+	.	+	.	+	.	+	.
Da, Mön	PEY	.	.	+	.	++	.	.	.	+	+	.	+	.	+	.	.	.
Ge, Niedersachsen, Celle, 10 km S	PKS	.	.	++	.	++	.	.	.	+	+	.	+	.	+	.	+	.
Ge, Niedersachsen, Hildesheim, 20 km S	PKT	.	.	+	.	+	.	.	.	+	+	.	+	.	+	.	.	.
He, Zürich, Lägern, Niederweningen	PRB	.	.	+	.	+	.	.	.	+	+	.	++	.	+	.	+	+
Au, Steiermark, Vordenberg	PTQ	.	.	+	.	++	.	+	.	+	+	.	+	.	+	.	.	.
Rm, Brasov, Făgăras	PUJ	.	.	+	.	+	.	.	.	++	+	.	+	.	+	.	+	.
Rm, Piteşti, Rîmnicu Vîlcea, Gurano	PUN	.	.	+	.	+	.	.	.	++	++	.	++	.	++	.	++	.
Ju, Srbija, Kragujevac, Grošnica	PYM	.	.	+	.	+	.	.	.	++	+	.	+	.	+	.	++	+
Ju, Slovensko, Storje	PXB	.	.	+	.	++	.	.	.	++	+	.	+	.	+	+	+	.
L. pratensis L. 2n=21																		
Su, Blekinge, Lösen	PCG	.	.	++	.	++	.	.	.	++	+	.	+	.	+	.	++	.
L. pratensis L. 2n=28																		
Ho, Zuidholland, Noordwijk	PHM	.	.	++	.	++	.	+	.	+	+	.	++	.	++	.	+	.
Be, Oost-Vlandern, Ursel	PJG	.	.	+	.	+	.	.	.	+	+	.	+	.	+	.	.	.
Ga, Nord, Au-Bac	PPC	.	.	+	.	++	.	.	.	++	+	.	+	.	+	.	+	.
Ga, Rhône, Irigny	PQK	.	.	+	.	+	.	.	.	++	+	.	+	.	+	.	+	.
He, Valais, Champex-Lac	PSD	.	.	+	.	+	.	.	.	+	+	.	+	.	+	.	.	.
He, Uri, Ursental, Hospenthal	PSG	.	.	+	.	+	.	.	.	+	+	.	+	.	+	.	++	.
It, Valle d'Aosta, Col de Petit St Bernhard	PVD	.	.	+	.	+	.	+	.	++	+	.	+	.	+	.	+	.
L. pratensis L. 2n=42																		
Ga, Paris, Forêt de Sénart	PPR	.	.	+	.	+	.	.	.	++	++	.	+	.	+	.	+	.
L. binatus Pančić 2n=14																		
Ju, Bosna, Trebević	BAA	.	.	++	.	++	.	.	.	++	.	.	.	.	+	+	++	.
Ju, Bosna, Trebević	BAF	.	.	+	.	++	.	.	.	+	.	.	.	.	+	+	++	.
Ju, Bosna, Ljubogosča	BAD	.	.	++	.	++	.	.	.	++	.	.	.	.	+	+	++	.
Ju, Srbija, Mokra Gore	BAE	.	.	++	.	++	.	.	.	++	.	.	.	.	+	+	++	.
L. hallersteinii Baumg. 2n=14																		
Rm, Cluj, Aghires	HAA	.	.	+	.	++	.	.	.	+	.	.	.	.	+	+	++	.
Rm, Hunedoara, Gura Zlata	HAE	.	.	+	.	++	.	.	.	+	.	.	.	.	+	+	++	.
Rm, Ploesti, Sinaia	HAJ	.	.	+	.	++	.	.	.	+	.	.	.	.	+	+	++	.
Ju, Srbija, Titovo Užice	HBA	.	.	+	.	+	.	.	.	++	.	.	.	.	+	+	++	.
Ju, Srbija, Kragujevac, Grošnica	HBC	.	.	+	.	+	.	.	.	++	.	.	.	.	+	+	++	.
Ju, Srbija, Ozren, Soko Banja	HBD	.	.	+	.	++	.	.	.	++	.	.	.	.	+	+	++	.
Ju, Srbija, Ozren, Soko Banja	HBE	.	.	+	.	++	.	.	.	++	.	.	.	.	+	+	+	.

amount of quercetin (Y_6) was much larger in the collections of *L. binatus* Pančić and *L. hallersteinii* Baumg. Thus, a biochemical examination of phenolic compounds in leaves in the *L. pratensis* group is a good

Table 6. Analysed spots in twenty collections of L. sphaericus Retz. (subsection Orobastrum Gren & Godr.)

	Coll. no.	A_1	A_2	A_3	A_4	A_5	A_6	R_1	R_2	R_3	R_4	Y_1	Y_2	Y_3	Y_4	Y_5	Y_6	Y_7
L. sphaericus Retz. 2n=14																		
Su, Bohuslän, Brattön	E 16	.	.	+	.	.	.	.	.	+	.	.	.	.	++	.	.	.
Su, Skåne, Kullaberg	E 2	.	.	+	.	.	.	.	.	+	.	.	.	.	++	.	.	.
Da, Bornholm, Hammershus.	E 15	.	.	+	.	.	.	.	.	+	.	.	.	.	++	.	.	.
Da, Sjælland, Rörvig	E 14	.	.	+	.	.	.	.	.	+	.	.	.	.	++	.	.	.
Da, Hesselö	E 13	.	.	+	.	.	.	.	.	+	.	.	.	.	++	.	.	.
Da, Samsö, Maarup	E 12	.	.	+	.	.	.	.	.	+	.	.	.	.	++	.	.	.
Ju, Srbija, Beograd, Košutnjak	E 17	.	.	+	.	.	.	+	.	.	.	.	.	.	++	.	.	.
Ju, Srbija, Kragujevac, Grošnica	E 18	.	.	+	.	.	.	+	.	.	.	.	.	.	++	.	.	.
Ju, Dalmatia, Rudine	E 19	.	.	+	.	.	.	+	.	.	.	.	.	.	++	.	.	.
Ju, Dalmatia, Makarska	E 20	.	.	+	.	.	.	+	.	.	.	.	.	.	++	.	.	.
Ju, Hrvatska, Karlobag	E 21	.	.	+	.	.	.	.	.	.	.	.	+	.	++	.	.	.
It, Friuli Venezia Giulia, Gorizia	E 22	.	.	+	.	.	.	.	.	.	.	.	+	.	++	.	.	.
It, Trentino Alto Adige, Bolzano	E 23	.	.	+	.	.	.	.	.	.	.	.	+	.	++	.	.	.
It, Sicily, Piana di Catania, Palagonia	E 7	.	.	+	.	.	.	.	.	.	.	.	+	.	++	.	.	.
Lu, Beira Litoral, Coimbra, Cerna	E 9	.	.	+	.	.	.	.	.	.	.	.	+	.	++	.	.	.
Marocco, Zaërs, Bni-Abid ...	E 3	.	.	+	.	.	.	.	.	.	.	.	+	.	++	.	.	.
Gr, Sámos, Kerki	E 4	.	.	+	.	.	.	.	.	.	.	.	+	.	++	.	.	.
Bu, Blago-Evgrad, Sandanski	E 8	.	.	+	.	.	.	.	.	.	.	.	+	.	++	.	.	.
Rs, Ashkhabaq, Bot. Gn.	E 10	.	.	+	.	.	.	.	.	.	.	.	+	.	++	.	.	.
L. sphaericus var. *stenophyllus* Boiss. 2n=14																		
Da, Köbenhavn, Bot. Gn. ..	E 24	.	.	+	.	.	.	+	.	.	.	.	+	.	++	.	.	.

additional criterion to other methods used in taxonomy, viz., studies in anatomy, cytology, ecology, physiology, morphology, palynology, and crossing experiments.

The results of twenty analysed populations of *L. sphaericus* Retz. (*Orobastrum*) are shown in table 6. In Europe, this species is common in the Mediterranean area with few localities to the north e.g. the south valley of the Rhine. Besides, there are six known localities in Denmark and Sweden. The biochemically analysed collections can be divided into three groups, which also have different geographical distribution. One group with populations from northern Europe had cyanidin (R_3) but not the red spot R_1 or the yellow spot Y_2. Four collections from Dalmatia and Serbia in Yugoslavia were characterized by R_1 but lacked R_3 and Y_2. The last group from the southern part of Europe had Y_2 but no red spots (fig .1). All the collections had the somatic chromo-

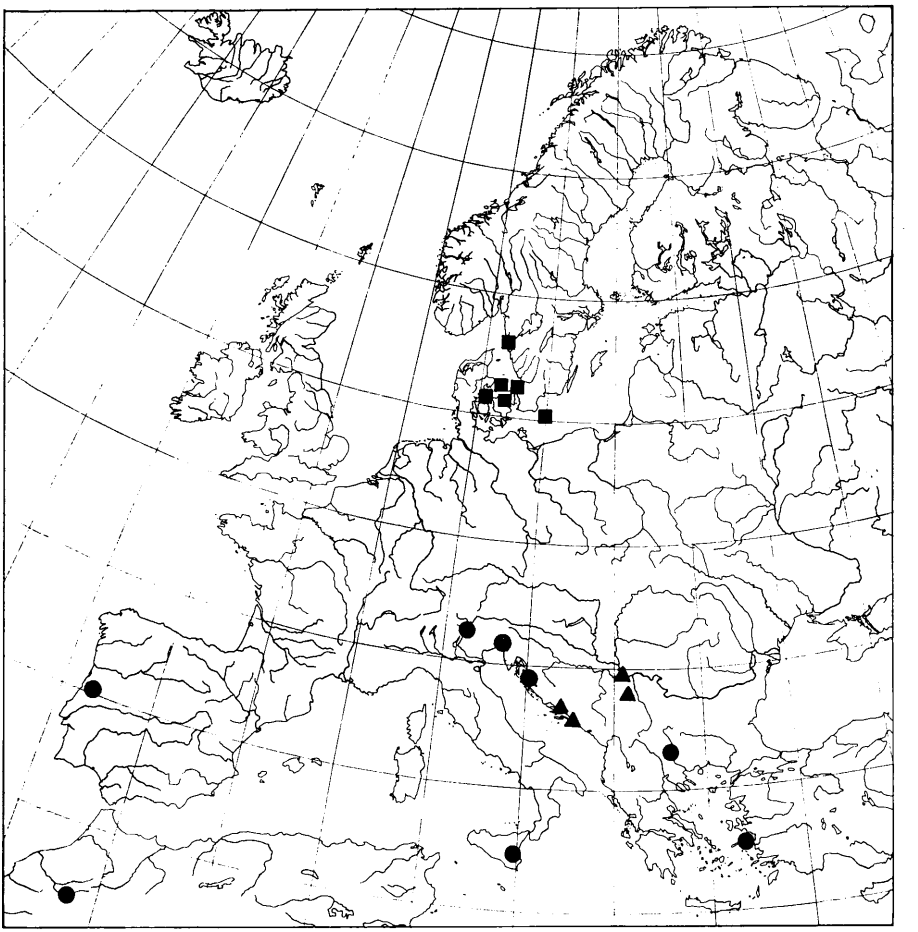


Fig. 1. The geographical distribution of the analysed samples of *L. sphaericus* Retz. The collections were characterized by the following spots, square (■) R_3, triangle (▲) R_1 and circle (●) Y_2.

some number 2n=14. The six populations from Denmark and Sweden are morphologically differentiated from the other collections. Their leaves are shorter and wider than samples from south Europe. It is not possible at this time to separate other groups on morphological grounds. Further investigations are going on in *L. sphaericus* Retz.

In the *L. palustris* group [1] (tab. 7) only the variety *palustris* with the somatic chromosome number 2n=42 grows in Europe. From these

[1] The taxonomy follows HITCHCOCK (1952).

Table 7. Analysed spots in some species of the subsection Orobastrum Gren. & Godr.

	Coll. no.	A_1	A_2	A_3	A_4	A_5	A_6	R_1	R_2	R_3	R_4	Y_1	Y_2	Y_3	Y_4	Y_5	Y_6	Y_7
OROBASTRUM Gren. & Godr.																		
L. incurvus Willd. 2n=14																		
Su, Blekinge	R 814	.	+	+	.	++	.	.	.	+	++	.	.	.	.	.	+	++
L. maritimus Bigel. 2n=14																		
Fe, Uusimaa, Tammisaari	R 1150	.	.	++	.	.	.	.	.	.	.	.	.	.	+	.	++	.
Fe, Oulu	R 1186	.	.	++	.	.	.	.	.	.	.	.	++	.	+	+	+	.
Fe, Uusimaa, Oulunkylä	R 1148	.	.	++	.	.	.	.	.	+	++	.	++	+	+	+	+	.
Su, Skåne, Vitemölla	R 861	.	.	++	.	.	.	.	.	.	.	.	+	.	+	+	+	.
Po, Gdansk, Rozewie	R 1098	.	+	+	.	.	.	.	.	.	.	.	.	.	+	.	+	.
L. maritimus f. *albo* 2n=14																		
Da, Köbenhavn, Bot. Gn.	R 1156	.	.	++	.	+	.	.	.	.	.	.	++	.	+	.	+	.
L. neurolobus Boiss. & Heldr. 2n=14																		
He, Genève, Bot. Gn.	R 969	.	.	+	.	.	.	.	.	++	++	.	.	.	.	.	+	.
Gr, Kríti, Iráklion, Cnossos	R 974	.	.	+	.	.	.	.	.	++	++	.	.	.	.	.	+	.
L. palustris L. var. *palustris* 2n=42																		
Su, Uppland, Lidingö, Ekholmsnäs	L 419	.	.	+	.	+	.	.	.	.	.	.	+	+	+	.	++	.
Fe, Oulu, Kempele	L 918	.	.	+	.	+	.	+	.	.	.	.	+	.	+	.	+	.
Rs, Lithuania, Kaunas	L 874	.	+	++	.	++	.	.	.	.	.	.	.	.	+	.	++	.
Br, Huntingdonshire, Wicken Fen	L 880	.	+	++	.	++	.	+	+	.	.	.	.	.	+	.	++	.
Ho, Drenthe, Selter Wijde	L 765	.	.	++	.	++	.	.	.	.	.	.	+	++	++	.	++	.
Ge, Schleswig-Holstein, Lübeck, 3 km NW	L 827	.	.	++	.	++	.	+	.	.	.	.	.	+	++	.	++	.
L. palustris var. *pilosus* Ledeb. 2n=14																		
Rs, Vladivostok	L 919	.	.	+	.	+	.	.	.	.	.	.	+	.	+	.	+	.
L. palustris var. *myrtifolius* Gray 2n=14																		
U.S.A., Alaska, Palmer	L 849	.	.	++	.	++	.	+	.	.	.	.	+	.	++	.	++	.
U.S.A., Michigan, Oakland Co	L 836	.	.	+	.	+	.	.	.	.	.	.	+	+	+	.	++	.
L. pisiformis L. 2n=14																		
Hu, Ursotallumar	R 1113	.	+	++	.	++	.	.	.	.	.	.	+	+	+	.	++	.
Rs, Omsk, Kirov	R 713	.	.	+	.	.	.	.	.	.	.	.	+	+	+	.	+	.
Rs, Leopolis	R 819	.	.	+	.	.	.	.	.	.	.	.	.	+	++	.	+	.
L. saxatilis (Vent.) Vis. 2n=14																		
Rs, Turcomania, Ashkhabaq, Bot. Gn.	R 1232	.	.	+	.	+	.	+	.	.	.	+	+	.	.	.	.	.

few analyses it was not possible to distinguish that variety from the varieties *pilosus* and *myrtifolius,* both with 14 chromosomes. Morphologically the American variety *myrtifolius* is characterized by its rela-

Table 8. Analysed spots in the section Orobus (L.)

	Coll. no	A_1	A_2	A_3	A_4	A_5	A_6	R_1	R_2	R_3	R_4	Y_1	Y_2	Y_3	Y_4	Y_5	Y_6	Y_7
OROBUS (L.)																		
L. inermis Roch. ap. Friv. 2n=14																		
Ju, Srbija, Priština	P 3024	.	+	++	.	++	.	.	.	++	.	.	.	+	+	.	++	.
L. luteus var. *aureus* Beck 2n=14																		
Rm, Cluj, Aghires	R 1135	+	+	++	++	++	++	.	.	.	.	.	.	.	++	.	++	.
Br, Manchester, Bot. Gn. ...	R 1039	.	+	++	++	++	+	.	.	.	.	.	+	.	++	.	++	.
Rm, Cluj, Făgăras	R 1041	.	+	++	++	++	+	++	.	.	.	.	.	.	++	.	++	.
Po, Wroclav-Kanonia	R 807	.	+	+	++	++	+	.	.	.	.	.	.	.	++	.	++	.
L. luteus var. *laevigatus* Beck 2n=14																		
Rm, Cluj, Făget	R 1020	.	.	++	.	+	.	.	+	.	.	.	.	.	++	.	.	.
Ge, Berlin, Bot. Gn.	R 1024	.	.	++	.	++	.	+	.	.	.	.	.	.	+	.	.	.
L. luteus var. *transsylvanicus* Beck 2n=14																		
Rm, Cluj, Făget	R 1046	++	.	++	.	.	.	.	.	.	.	.	+	+	+	.	++	.
L. montanus Bernh. 2n=14																		
Ga, Saone-et-Loire, Gray	R 628	.	.	+	++	+	++	.	.	.	.	.	.	.	+	.	++	.
Ge, Hessen, Marburg	R 716	.	.	+	++	+	++	.	.	.	.	.	.	.	+	.	++	.
Ge, Mecklenburg, Reinberg ..	R 738	.	.	+	++	+	++	.	.	.	.	.	.	.	+	.	++	.
L. niger Bernh. 2n=14																		
Su, Bohuslän, Holm	R 736	.	.	+	.	.	.	.	.	.	.	.	.	+	++	.	++	.
Rm, Cluj, Aghires	R 1132	.	.	+	.	+	.	.	.	.	.	.	+	+	+	+	+	.
Hu, Ursotallumar	R 1122	.	.	.	.	.	.	.	.	.	.	.	+	.	++	.	++	.
Cz, České Země, Karlštejn ..	R 1107	.	.	.	.	.	.	.	.	.	.	.	+	+	+	.	++	.
L. pannonicus var. *versicolor* Maly 2n=14																		
Hu, Ursotallumar	R 1118	+	.	++	.	++	.	.	.	.	.	.	+	+	+	.	+	.
L. venetus Rouy 2n=14																		
He, Genève, Bot. Gn.	R 1029	.	.	++	.	++	.	.	.	.	.	.	+	.	+	.	+	.
Rm, Ploesti, Caragiale	R 1059	.	.	++	.	++	.	.	.	+	.	.	+	+	++	.	++	.
Ju, Srbija, Soko Banja	R 871	.	+	++	.	++	.	.	.	.	.	.	+	.	++	.	+	.
Ju, Srbija, Mokra Gore	R 1068	.	.	++	.	++	.	.	.	.	.	.	+	+	+	.	++	.
Ju, Hercegovina, Konjic	R 866	.	.	++	.	++	.	.	.	.	.	.	+	+	++	.	++	.
L. vernus Bernh. 2n=14																		
Rs, Leningrad, Kolpino	R 882	.	++	++	.	+	.	.	.	.	.	.	.	.	++	.	+	.
Cz, Morava, Jihlava	R 874	.	+	++	.	+	.	++	.	.	.	.	.	.	++	.	+	.
Au, Oberösterreich, Steyr ...	R 894	.	+	++	.	+	.	+	.	.	.	.	.	.	++	.	+	.
Rm, Cluj, Făget	R 1052	.	+	++	.	+	.	+	.	.	.	.	.	.	++	.	+	.
It, Lombardia Brescia, Valvestino, Torano	R 1075	.	+	++	.	+	+	.	.	.	.	.	.	.	++	.	++	.
L. vernus f. *albidus* Döll 2n=14																		
Ge, Halle, Bot. Gn	R 918	.	+	++	.	+	.	+	.	.	.	.	+	+	++	.	++	.

Table 8. Continued.

	Coll. no.	A_1	A_2	A_3	A_4	A_5	A_6	R_1	R_2	R_3	R_4	Y_1	Y_2	Y_3	Y_4	Y_5	Y_6	Y_7
L. vernus f. *roseus* Beck 2n=14																		
Su, Stockholm, Bot. Gn.	R 916	.	+	++	.	+	.	++	.	.	+	.	.	+	++	.	+	.
Ge, Halle, Bot. Gn.	R 910	.	+	++	.	+	.	++	.	.	+	.	.	.	++	.	+	.
L. vernus var. *flaccidus* Arcang. 2n=14																		
Su, Stockholm, Bot. Gn.	R 900	.	+	++	.	+	.	+	.	.	.	.	.	.	++	.	+	.
Be, Gent, Bot. Gn.	R 1005	.	+	++	.	+	.	+	.	.	.	.	.	.	++	.	+	.
It, Lombardia Brescia, Valvestino, Torano	R 999	.	+	++	.	+	.	++	.	.	.	.	.	.	++	.	+	.
L. vernus var. *gracilis* Arcang. 2n=14																		
Ho, Utrecht, Bot. Gn.	R 896	.	+	+	.	.	.	+	.	.	.	.	.	.	++	.	+	.
Ho, Utrecht, Bot. Gn.	R 995	.	+	+	.	.	.	+	+	.	.	.	.	.	++	.	+	.
L. alpestris Rchb. 2n=14																		
Ga, Strasbourg, Bot. In.	R 1090	.	.	+	.	+	.	+	+	.	.	.	.	.	++	.	.	.

tively short and wide leaves. PECKET (1959) considered that *L. maritimus* Bigel., *L. palustris* L. and *L. pratensis* L. from this subsection ought to be brought to the subsection *Eulathyrus*. BELL (1962) placed species from *Orobastrum* in three different groups.

Sect. *Orobus* (L.)

PECKET (1959) has found that . . . "This section shows some variation in the constitution of leaf extracts but there are a number of similarities between the species". Remarkably many absorbing compounds were seen in ultraviolet light in *L. luteus* Peterm. and *L. montanus* Bernh. (tab. 8). The variation in pigments was small in the latter species. *L. luteus* var. *aureus* Beck had A_1—A_6, *L. luteus* var. *laevigatus* Beck had only A_3 and A_5, and *L. luteus* var. *transsylvanicus* Beck had A_1 and A_3. This taxon is partially biochemically separated from other varieties in *L. luteus* Peterm., e.g. it had no anthocyanidins but did have the additional yellow spot Y_3. Morphologically, *L. luteus* var. *transsylvanicus* Beck is recognizable by its size, light flowers and abundant pubescence. This autonomous taxon has a limited distribution with its few localities in Transsylvania. The opinion of the author is that it should be treated as a separate species. In BELL's work (1962) it is interesting that taxa from the *L. luteus* group are placed in three of his

Table 9. Analysed spots in some Extra-European species of Lathyrus and in Pisum sativum L. and Vicia angustifolia L.

	Coll. no.	A_1	A_2	A_3	A_4	A_5	A_6	R_1	R_2	R_3	R_4	Y_1	Y_2	Y_3	Y_4	Y_5	Y_6	Y_7
L. davidii Hance 2n=14																		
Rs, Vladivostok, Bot. Gn. ...	R 1181	.	+	+	.	+	++	.	.	.	.	.	.	.	.	.	+	.
L. laetiflorus Greene 2n=14																		
U.S.A., California, Claremont	R 1152	.	.	++	.	+	.	.	.	.	.	.	++	+	+	.	.	.
L. mulkak Lipsky 2n=14																		
Rs, Tadzhikistan, Duschanbe	R 852	.	+	++	.	.	.	+	.	.	.	.	.	.	+	.	+	.
L. venosus Muhl. ex Willd. 2n=28																		
Canada, Montreal, Bot. Gn...	R 1185	.	+	++	.	.	.	.	.	.	+	.	+	.	++	.	+	.
L. undulatus Boiss. 2n=14																		
Br, Kew, Bot. Gn.	R 1225	.	.	++	.	++	.	.	+	.	.	+	+	.	++	+	+	.
Pisum sativum L. 2n=14																		
Su, Lund, Bot. Gn.	R 1500	.	.	++	.	+	.	.	.	.	.	.	+	.	+	+	++	.
Vicia angustifolia L. 2n=14																		
Su, Blekinge, Lösen	R 1501	.	.	++	.	.	.	+	.	+	.	.	+	+	++	.	+	.

five groups. BELL does not give the names of any authors and a comparison with other works is difficult.

Many yellow spots occurred in *L. niger* Bernh. In the *L. vernus* group R_1 was common but not in *L. venetus* Rouy. These species are generally considered as closely related to each other. The two yellow spots Y_2 and Y_3 were common in *L. venetus* Rouy but not in *L. vernus* Bernh. Ferulic acid (A_3) was also more common in the *L. vernus* group. It may be mentioned that ASCHERSON & GRAEBNER (1906—10) brought these two species together as "Gesammtart *L. vernus*". Morphologically the two taxa are dissimilar in the form of the leaves, the size of the flowers, the number of flowers per peduncle and the colour of the flowers. Their geographical distributions are partly different. *L. vernus* Bernh. exists in most of Europe but is rare or missing in the south-east area, that is, in the south part of Roumania, Yugoslavia, Bulgaria and Greece, while *L. venetus* Rouy grows in south-east Europe. A more detailed investigation of *L. vernus* Bernh. and *L. venetus* Rouy is planned.

In table 9 there are some analysed taxa that have no natural distribution in Europe. There are also analyses of *Pisum sativum* L. and *Vicia angustifolia* L. The genus *Pisum* is considered to be the nearest related genus to *Lathyrus*.

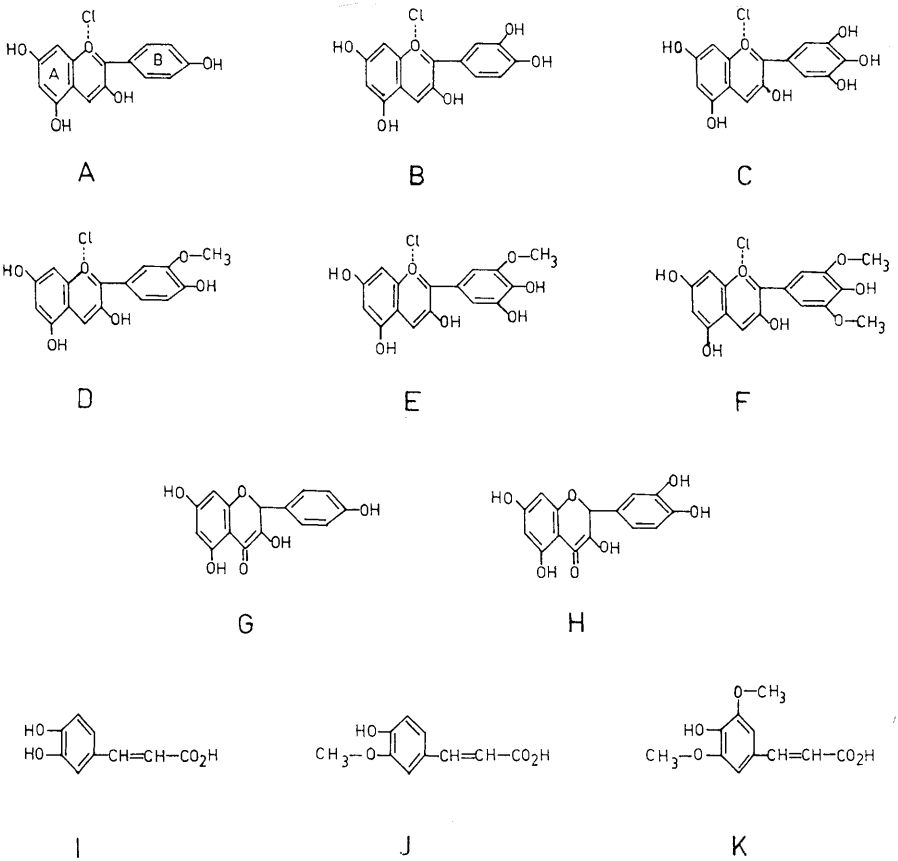


Fig. 2. The chemical structures of some common phenolic compounds. A pelargonidin, B cyanidin, C delphinidin, D peonidin, E petunidin, F malvidin, G kaempferol, H quercetin, I caffeic acid, J ferulic acid and K sinapic acid.

Discussion

The genetic background of biochemical differences in plants have been stated in only relatively few cases. SANYAL, GHOSH & KUNDU (1961) studied inheritance of anthocyanin pigmentation patterns in *Hibiscus sabdariffa* L. and said that 18 factors are responsible for the colour production in that species.

The variation of flower colour in *Lathyrus odoratus* L. is treated in several works. BEALE, ROBINSON, et al. (1939) reported that the genes affecting the anthocyanidin type do not influence the flavonol composition in *Lathyrus odoratus* L. and remarked: "In conclusion it may be

stated that a genetical and chemical analysis of *L. odoratus* shows it to accord admirably with the majority of other plants which have been investigated in a similar way. In this connexion it is perhaps important to recall the fact that all variations which occur in the modern sweet peas have most likely arisen as mutations from a single wild form . . . Interspecific hybridization, which succeeds only rarely within the genus *Lathyrus* (see Senn, 1938), has apparently not been involved." SCOTT-MONCRIEFF in 1936 stated that nine factors are responsible for the variation in flower colour in *Lathyrus odoratus* L.

The resemblance in chemical structures of some commonly occurring phenolic compounds is shown in fig. 2. In the last few years C^{14}-tracer studies have shown the early precursors of the anthocyanins and of related flavonoids. The A-ring (fig. 2) of anthocyanidins originates from three acetate units, while the B-ring (fig. 2) and the central three-carbon moiety are derived from a phenylpropanoid unit. The nature of the intermediates between these precursors and the intact pigment are still largely unknown. The biosynthesis of flavonols and anthocyanins probably differ at the C_9 level. Glycosylation appears to occur nearly at the end of the synthesis and may be associated with methylation and acylation (HARBORNE 1962).

The genetic background of biochemical differences in plant pigments is probably very variable in different genera and species. When the genetic basis of these differences is known, the possibility of determining the systematic significance of biochemical differences will be much greater. In evolution the selective value of phenolic compounds may be limited.

Phenolic compounds may have a restricted value in plant taxonomy to separate genera and subgenera. The author also believes that while the qualitative distribution of amino acids is of limited value, peptids, proteins and enzymes will eventually serve as primary characteristics for taxonomic evaluation.

Some specific compounds may have a good but limited taxonomic value. The amino acid lathyrine was identified in *Lathyrus tingitanus* L. (BELL 1961, BELL & FOSTER 1962). About 300 species of *Leguminosae* have been tested for the presence of lathyrine but this acid has only been detected in some species of *Lathyrus*.

Writing about the disease lathyrism SELYE (1957) says: ". . . it is clear that *L. odoratus* produces predominantly (if not exclusively) osteolathyric changes, particularly in the rat. It is not known whether this pea is poisonous to man. *L. sativus, L. cicera, L. clymenum, L. lati-*

folius, L. splendens, L. sylvestris and *L. sphericus* appear to produce only neurolathyrism in animals and in man. *L. pusillus* and *L. hirsutus* are claimed to damage the bones and the nervous system." SELYE states that probably different factors are responsible for the skeletal and the nervous disease. In seeds of *L. odoratus* L. this factor is described as β-(N-γ-L-glutamyl)-aminopropionitrile (SCHILLING & STRONG 1955) and the same toxic component is found in *L. pusillus* Elliot (DUPUY & LEE 1956). The neuroactive factor in *L. latifolius* L. has been identified as L-α,γ-diaminobutyric acid. This amino acid has also been found in the seeds of *L. sylvestris* L. (RESSLER et al. 1961). These toxic components exist in species that taxonomically are placed in several subsections of the genus *Lathyrus*. It can be pointed out that the two related species *L. latifolius* L. and *L. sylvestris* L. have the same toxic factor, while *L. odoratus* L. in the same subsection has the other toxic component.

In this investigation no characteristic differences in the nature of the analysed phenolic compounds between the two related genera *Lathyrus* and *Pisum* were found, which was also valid for *Vicia*. This result cannot be generalized, and such an analysis may have a systematic value in other genera. However, to separate genera there are often other and perhaps better criteria, such as cytology, morphology and palynology. On a higher taxonomic level than the genus qualitative differences may exist between separate groups from a biochemical point of view.

From this investigation in which 17 different spots were seen it is clear that it is impossible to separate sections and subsections in *Lathyrus*. PECKET (1959), who has also analysed leaves in *Lathyrus,* has found four different compounds by paper chromatographic analysis. From those results he implied that the four species *L. hirsutus* L., *L. maritimus* Bigel., *L. palustris* L. and *L. pratensis* L. which all have been placed in other subsections of the genus may be brought to the same subsection, *Eulathyrus*. However, the four compounds seen by PECKET are very common in the whole genus and all of them were found in the four mentioned species with help of the improved analytic method of thin-layer chromatography in the present study. Thus, it is dangerous to draw conclusions and to separate subsections based on so few components.

BELL (1962) studied ninhydrin-reacting compounds of the seeds in

Table 10. Examples of intravariation in Lathyrus

	Coll. no.	A_1	A_2	A_3	A_4	A_5	A_6	R_1	R_2	R_3	R_4	Y_1	Y_2	Y_3	Y_4	Y_5	Y_6	Y_7
L. binatus Pančić 2n=14																		
Ju, Bosna, Trebević	BAA: 1	.	.	++	.	++	.	.	.	++	.	.	.	.	+	+	++	.
	BAA: 2	.	.	+	.	++	.	.	.	++	.	.	.	.	+	+	++	.
	BAA: 3	.	.	+	.	++	.	.	.	++	.	.	.	.	+	+	++	.
L. pratensis L. 2n=28																		
He, Urserenthal, Hospenthal Reuss	PSG: 1	.	.	+	.	++	.	.	.	++	.	.	+	.	+	.	++	.
	PSG: 2	.	.	+	.	+	.	.	.	++	.	.	+	.	+	.	++	.
	PSG: 3	.	.	+	.	++	.	.	.	++	.	.	+	.	+	.	++	.
	PSG: 4	.	.	+	.	++	.	.	.	++	.	.	+	.	+	.	++	.
L. sphaericus Retz. 2n=14																		
Da, Samsö, Maarup	E 12: 1	.	.	+	.	.	.	.	.	+	.	.	.	.	++	.	.	.
	E 12: 2	.	.	++	.	.	.	.	.	+	.	.	.	.	++	.	.	.
	E 12: 3	.	.	+	.	.	.	.	.	+	.	.	.	.	++	.	.	.
	E 12: 4	.	.	+	.	.	.	.	.	+	.	.	.	.	++	.	.	.
L. luteus var. *transsylvanicus* Beck 2n=14																		
Rm, Cluj, Făget	R 1046: 1	++	.	+	.	.	.	.	.	.	.	.	+	+	+	.	++	.
	R 1046: 2	++	.	++	.	.	.	.	.	.	.	.	+	+	+	.	+	.
	R 1046: 3	++	.	++	.	.	.	.	.	.	.	.	+	+	+	.	++	.
	R 1046: 4	++	.	++	.	.	.	.	.	.	.	.	+	+	+	.	++	.

Lathyrus and he found at most five such components in some species. He writes: "... within the genus there existed well defined groups of species that were characterized, not by the presence of an arbitrary concentration of one specific ninhydrin-reacting compound, but rather by the presence of associated groups of such compounds. These groups of associated compounds appeared as characteristic patterns after the seed extracts had been chromatographed or subjected to ionophoresis on paper. In the extracts of most, but not all, of the species examined the spots forming the characteristic patterns were of comparable size and intensity." It can be pointed out that BELL's classification does not agree with the limits of the sections and subsections of *Lathyrus*. In this investigation it has not been possible to divide the analysed species after associated different groups of compounds.

On examination of the critical groups of species a biochemical analysis of phenolic compounds may be a good complement to the taxonomic work. From this investigation it is evident how great the resemblance is between *L. heterophyllus* L., *L. latifolius* L. and *L. sylvestris* L. These species are very similar in several morphological charac-

teristics, too. Thus, the biochemical analysis here is a good support to the commonly accepted view that these species are closely related.

In the *L. pratensis* group the author has made a detailed investigation in cytology, ecology, geographical distribution, morphology and crossing experiments (unpublished). Based on these examinations the author distinguishes the three species *L. binatus* Pančić, *L. hallersteinii* Baumg. and *L. pratensis* L. (LINNAEUS 1753, BAUMGARTEN 1816, PANČIĆ 1874). The test of phenolic compounds in leaves gave good differences between these taxa. *L. pratensis* L. had delphinidin and the yellow spot Y_2. *L. binatus* Pančić and *L. hallersteinii* Baumg. lacked these compounds but had, instead, the yellow spot Y_5. Thus, a biochemical analysis of phenolics in leaves of the *L. pratensis* group is a good additional criterion to other systematic methods.

Generally *L. vernus* Bernh. and *L. venetus* Rouy are considered to be closely related and ASCHERSON & GRAEBNER (1906—10) even bring the two species together to "Gesammtart *L. vernus*". In addition to some morphological differences between the species their phenolic compounds in leaves were partly different. The red spot R_1 was common in *L. vernus* Bernh. but lacked in *L. venetus* Rouy which instead had the yellow spots Y_2 and Y_3.

In the *L. luteus* complex there were some differences between the analysed taxa. Thus, the variety *aureus* had the absorbing spots A_1—A_6, while the other varieties analysed only had two such spots. The variety *transsylvanicus* is both morphologically and biochemically distinct from the others. That variety also has a limited distribution occurring only in Transsylvania. The opinion of the author is that *transsylvanicus* ought to be treated as a separate species. There are clear differences between the two other taxa analysed, but as no relation with studies in cytology, ecology and morphology can be made at this time it is impossible to evaluate their taxonomical importance.

Some few species in *Lathyrus* had relatively characteristic systems of phenolic compounds in leaves; e.g. in *L. montanus* Bernh. many absorbing spots were found.

A comparison was made in species with more than one chromosome number. Collections of *L. pratensis* L. in Europe have either 14 or 28 chromosomes in somatic tissue (seldom 21 or 42). From table 5 it is clear that there were no differences in the phenolic compounds of the leaves of taxa with different chomosome numbers. However, the resem-

Table 11. The distribution of chromatographic spots in relation to the numbers of taxa analysed in different groups

Groups	No. of taxa	A_1	A_2	A_3	A_4	A_5	A_6	R_1	R_2	R_3	R_4	Y_1	Y_2	Y_3	Y_4	Y_5	Y_6	Y_7
Aphaca Tourn.	2	.	2	2	.	2	.	1	.	1	.	.	1	.	2	.	1	.
Cicerula Mnch.	5	.	1	5	.	4	.	5	.	.	.	2	4	1	5	.	5	.
Clymenum DC.	3	.	1	3	.	2	.	2	.	.	.	.	3	1	3	.	3	.
Eulathyrus Ser.	9	.	1	9	.	7	.	2	.	1	3	.	7	2	9	4	9	.
Nissolia Tourn.	1	.	.	1	.	.	.	.	1	.	.	1	1	.	1	.	1	.
Orobastrum Gren. & Godr.	17	.	4	17	.	13	.	7	1	10	7	1	13	4	14	4	14	2
Orobus (L.)	14	3	8	14	2	12	3	8	3	2	1	.	6	7	14	1	12	.
Extra-European species	5	.	3	5	.	3	1	1	1	.	1	1	3	1	4	1	4	.
Sum total	56	3	20	56	2	43	4	26	6	14	12	5	38	16	52	10	49	2

blance in morphology between diploid and tetraploid *L. pratensis* L. is great.

L. palustris L. has in Europe only the chromosome number 2n=42. In America and Asia there are also populations with 14 chromosomes in somatic tissue. Their phenolic compounds in leaves are about the same. In the species examined with different chromosome numbers in *Lathyrus* it was not possible to draw any conclusions from differences in phenolic compounds in leaves. However, the results of a such a comparison of species with several chromosome numbers in other genera may be different. A study of anthocyanidins in *Lathyrus* showed that they are distributed in about the same number of annuals and perennials.

In studies of variation between collections in the same taxon biochemical tests with thin-layer chromatography can give interesting results. From this investigation in *Lathyrus* it is evident that there is some variation between collections in the same species. This fact has not been emphasized enough in earlier works. To get reliable results it is necessary to analyse several samples of the same taxon. In most of the earlier examinations only one collection of every species has been analysed.

Twenty collections of *L. sphaericus* Retz. were analysed and from a biochemical point of view they could be divided into three groups which had different geographical distribution (tab. 6, fig. 1).

The variation of phenolic compounds between populations in the same taxon in some cases may be determined by relative simple genetic factors. Certainly the variation between collections is different in autogamous and allogamous species.

In the same way there was little variation between individuals in the

same collection in the mainly autogamous genus *Lathyrus* (tab. 10). The intravariation in allogamous genera might be larger.

A thin-layer chromatographic analysis of phenolic compounds in leaves is a good additional criterion to other accepted ones in taxonomy particularly in studies on the level of species or taxa of lower ranks. The method may also be used in studies of hybrids or for identification of the ancestry of some taxa (STEBBINS et al. 1963) and may be used to detect species-specific compounds for diagnostic purposes.

All biochemically analysed collections were determined as to their chromosome numbers. All taxa had the somatic chromosome number 2n=14 with the exception of *L. palustris* L. which also had 2n=42, *L. pratensis* L. with 2n=14 or 2n=28 (seldom 2n=21 or 42) in somatic tissue, while *L. venosus* Muhl. ex Willd. only had 2n=28. Thus, the genus *Lathyrus* has very unitary chromosome numbers, cf. also SENN (1938 a, b).

Summary

Species of the genus *Lathyrus* mainly from Europe were analysed as to their phenolic compounds in leaves. The material used was when possible spontaneous and was sown and cultivated in the Botanical Garden, Lund, Sweden, under comparable conditions. The alcohol-phases of hydrolysed extracts of leaves were analysed, using two-dimensional thin-layer chromatography. The spots received were identified by their colours and R_f-values and chromatographic comparison with pure samples of some common phenolic compounds made it possible to identify some spots (tab. 1). The results of the analyses are given in the tables 3—11, where the number of plus signs is roughly proportional to the amounts of the substances that were found on examination of the chromatograms in visible and ultraviolet light. The nomenclature used is after ASCHERSON & GRAEBNER (1906—10) and the names of the countries are abbreviated in the tables in the same manner as in TUTIN et al. (1964).

The investigation was intended to illustrate the usefulness of biochemical analyses of phenolic compounds in leaves for taxonomic works with *Lathyrus* on generic, subgeneric, specific and subspecific levels and to illuminate the variation between and to some extent within populations. Comparisons with other biochemical works within *Lathyrus* are done (e.g. SELYE 1957, PECKET 1959, 1960, BELL 1962). In this study no characteristic differences in the nature of the analysed phenolic compounds between the genera *Lathyrus, Pisum* and *Vicia* were found (tab. 9). In the same manner it was not possible to separate different groups within the genus *Lathyrus* (tabs. 3—9, 11). Some commonly occurring phenolic compounds resemble each other in chemical structure (fig. 2) and may be dependent on relatively simple genetical factors. Thus, phenolic compounds may have a restricted value in plant taxonomy to separate genera and subgenera. On examination of the critical groups of species a biochemical analysis of phenolic compounds may be a good additional criterion to other accepted ones such as anatomy, cytology, ecology, palynology, physiology,

morphology and crossing experiments e.g. in the *L. pratensis* group (tab. 5). Species with different chromosome numbers showed no differences of phenolic compounds (tab. 5, 6). In *Lathyrus,* anthocyanidins were distributed in the same number of annuals and perennials. Some variation of the occurring spots between collections in the same taxon was often found. Thus, twenty collections of *L. sphaericus* Retz. could be divided into three groups which had different geographical distributions (tab. 6, fig. 1). The variation between individuals in the same collection was small in the mainly autogamous genus *Lathyrus,* but the intravariation in allogamous genera might be larger (tab. 10). Besides the usefulness of thin-layer chromatographic analyses, especially on the levels of species or taxa of lower ranks, the method may be successful for identification of the ancestry of some taxa (STEBBINS et al. 1963) and to detect specific compounds for diagnostic purposes. All biochemically analysed collections were determined as to their chromosome numbers (tabs. 3—10). Earlier unpublished somatic chromosome numbers of some taxa in *Lathyrus* are presented in table 2.

Acknowledgements

The author wishes to express her great gratitude to Dr. H. RUNEMARK, Institute of Systematic Botany, Lund, for checking the manuscript, to Dr. C. FOX, Clark University, Texas, for correcting the language, and to her husband fil. lic. U. BRUNSBERG, Institute of Biochemistry, Lund, for advice at the biochemical analyses and for help with collecting the plant material. — The field work was made possible by grants from the Royal Swedish Academy of Science and the University of Lund.

Literature cited

ASCHERSON, P. & GRAEBNER, P. 1906—10. Synopsis der Mitteleuropäischen Flora, VI: 2: 1000—1063. Leipzig.

BARTHOLOMEW, J. 1955—56. The Times. Atlas of the World, III and IV. London.

BATE-SMITH, E. C. 1948. Paper chromatography of anthocyanins and related substances in petal extracts. — Nature 161: 835. London and New York.

— 1950. Anthocyanins, flavones and other phenolic compounds. — Biochem. Soc. Symp., 3: 62. Cambridge.

— 1954 a. Leuco-anthocyanins. 1. Detection and identification of anthocyanidins formed from leuco-anthocyanins in plant tissues. — Biochem. Jour., 58: 122—125. Cambridge.

— 1954 b. Ferulic, sinapic and related acids in leaves. — Chem. & Ind., 1457—58. London.

— 1956. The commoner phenolic constituents of plants and their systematic distribution. — Sci. Prod. R. Dublin Soc., 27: 165—176. Dublin.

BATE-SMITH, E. C. & LERNER, N. H. 1954. Leuco-anthocyanins. 2. Systematic distribution of leuco-anthocyanins in leaves. — Biochem. Jour., 58:126—132. Cambridge.

BAUMGARTEN, J. C. G. 1816. Enumeratio stirpium Magno Transsilvaniae, II: 330—337. Vindobonae.

BEALE, G. H., ROBINSON, G. M., ROBINSON, R. & SCOTT-MONCRIEFF, R. 1939. Genetics and chemistry of flower colour variation in Lathyrus odoratus. — Jour. Genet., 37: 375—388. Cambridge.

BELL, E. A. 1961. Isolation of a new amino acid from Lathyrus tingitanus. — Biochim. Biophys. Acta, 47: 602—603. Amsterdam.

— 1962. Associations of ninhydrin-reacting compounds in the seeds of 49 species of Lathyrus. — Biochem. Jour., 83: 2: 225—229. London and New York.

BELL, E. A. & FOSTER, B. G. 1962. Structure of lathyrine. — Nature, 194: 91—92. London and New York.

BLANK, F. 1947. The anthocyanin pigments of plants. — Bot. Rev., 13: 5: 241—317. New York.

DUPUY, H. P. & LEE, J. G. 1956. The toxic component of the singletary pea (Lathyrus pusillus). — Jour. Amer. Pharm. Asso. 45: 236—239. Easton.

HARBORNE, J. B. 1962. Anthocyanins and their sugar components. — ZECHMEISTER, L. Fortschritte der Chemie organischer Naturstoffe. 20: 165—199. Wien.

HARNEY, P. M. & GRANT, W. F. 1964. A chromatographic study of the phenolics of species of Lotus closely related to L. corniculatus and their taxonomic significance. — Amer. Jour., Bot., 51: 6: 621—627. Baltimore.

HITCHCOCK, C. L. 1952. A revision of the north American species of Lathyrus. — University of Washington Publications in Biology, 15: 1—104. Seattle.

LINNAEUS, C. 1753. Species plantarum. Holmiae.

NYBOM, N. 1964. Thin-layer chromatographic analyses of anthocyanidins. — Physiol. Plant., 17: 157—164. Lund.

PANČIĆ, J. 1874. Flora princip. 255—260. Beograd.

PECKET, R. C. 1959. The constituents of leaf extracts in the genus Lathyrus and their bearing on taxonomy. — New Phytol. 58: 182—187. Oxford.

— 1960. The nature of the variation in flower colour in the genus Lathyrus. — New Phytol., 59: 138—144. Oxford.

RESSLER, C., REDSTONE, P. A. & ERENBERG, R. H. 1961. Isolation and identification of a neuroactive factor from Lathyrus latifolius. — Science, 134: 188—190. Washington.

RILEY, H. P. & BRYANT, T. R. 1961. The separation of nine species of the Iridaceae by paper chromatography. — Amer. Jour. Bot., 48: 133—137. Baltimore.

SANYAL, P., GHOSH, K. & KUNDU, B. C. 1960. Inheritance of anthocyanin pigmentation patterns in Hibiscus Sabdariffa Linn. — Jour. Genet., 57: 313—326. Calcutta.

SCHILLING, E. D. & STRONG, F. M. 1955. Isolation, structure and synthesis of a Lathyrus factor from L. odoratus. — Jour. Amer. Chem. Soc. 77: 2843—2845. Easton.

SCOTT-MONCRIEFF, R. 1936. A biochemical survey of some mendelian factors for flower colour. — Jour. Genet., 32: 117—170. Cambridge.

SELYE, H. 1957. Lathyrism. — Revue Canadienne de Biologie, 16: 1—82. Montréal.

SENN, H. A. 1938 a. Experimental data for a revision of the genus Lathyrus. — Amer. Jour. Bot., 25: 2: 67—78. Baltimore.

— 1938 b. Chromosome number relationships in the Leguminosae. — Bibliographia Genetica XII: 175—336. The Hague.

STEBBINS, G. L., HARNEY, B. L., COX, E. L., RUTGER, J. N., JELENCOVIC, G. & YAGIL, E. 1963. Identification of the ancestry of an amphiploid Viola with the aid of paper chromatography. — Amer. Jour. Bot., 50: 830—839. Baltimore.

SUOMALAINEN, H. & KERÄNEN, A. J. A. 1961. The first anthocyanins appearing during the ripening of blueberries. — Nature 191: 498—499. London and New York.

TUTIN, T. G., HEYWOOD, V. H., BURGES, N. A., VALENTINE, D. H., WALTERS, S. M. & WEBB, D. A. 1964. Flora Europaea. Vol. I. Cambridge.

BOTANISKA NOTISER 1965 · VOL. 118 · FASC. 4 · LUND

Arctotis venusta T. Norl. spec. nova, an Ornamental Plant from Southern Africa

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The first collections of *Arctotis venusta* date back to 1824 and to the 1830's, when ZEYHER gathered them in three localities, i.e. in the south-eastern and north-eastern parts of the Cape Province in the Somerset East and Aliwal North districts and in the southernmost part of the Orange Free State in the Rouxville district. Those of his specimens which are kept in SONDER's herbarium (S),[1] were collected at an early flowering stage, when they appeared as rosette plants. Their seeming lack of stems caused them to be misinterpreted and they were originally named *Arctotis acaulis,* which is a perennial herb quite different from the species in question.

When LEWIN published his monograph on the genus *Arctotis* in 1922, he made several nomenclatural mistakes and named the plant, now to be called *A. venusta, "A. stoechadifolia"* (p. 69). This is surprising, as BERGIUS' exhaustive and excellent diagnosis does not fit this plant (NORLINDH 1963, p. 193). The latter name *"A. stoechadifolia"* has, since LEWIN started his work on *Arctotis,* quite naturally been used by most botanists, for instance DINTER and MARLOTH. As a matter of fact DINTER had three years earlier used this erroneous name for the same species (DINTER 1919, p. 341) but as LEWIN at that time had already begun his work on the tribe *Arctotideae,* one must suppose that it was LEWIN and not DINTER who originally perpetrated this misinterpretation of *A. stoechadifolia.*

For the true *Arctotis stoechadifolia* Berg., LEWIN used the name *A. decumbens* Thunb. (p. 67), which is merely a synonym. This is a perennial plant, only known from the Cape proper, where it mainly

[1] Herbarium abbreviations according to LANJOUW & STAFLEU, Index Herbariorum I, ed. 5 (1964), pp. 205—228.

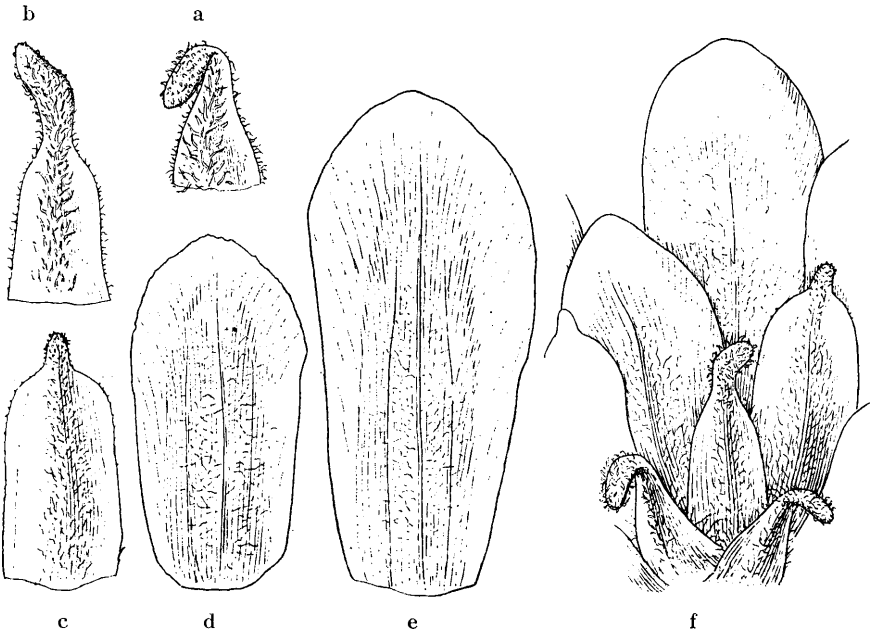


Fig. 1. *Arctotis venusta* T. Norl. *a*—*e* form series of involucral scales, arranged approximately into five rows. — *a* outermost triangular scale ending in a fairly short linear—elliptic appendix, only about half as long as the remaining part of the scale. — *b* next to outer triangular-oblong scale ending in a linear-oblanceolate appendix. — *c* median oblong scale with a mucro. — *d, e* next to inner and innermost obovate-oblong membrane-tipped scales, lacking appendix or mucro. — *f* part of involucre. — [*a*—*f* drawings from a cultivated specimen raised from seed of a collection from Bloemfontein, NORLINDH, n. 5834 (S)]. — *a*—*e* ×5; *f* ×4.2.

occurs in sand dunes or other sandy localities. It is characterized i.a. by a decumbent stem, more or less lignified, which already from its basal parts sends out decumbent branches of up to a metre's length in various directions.

A detailed account of the differences between *A. stoechadifolia* Berg. and *A. venusta* T. Norl. has already been given by the author (NORLINDH 1964, pp. 199—202). As is evident from the diagram in this paper (p. 200), these species differ with regard to so many essential characteristics that there is good reason for placing them in different sections of the genus.

Arctotis venusta is an annual herb, usually with an erect stem. It does not occur wild in the Cape proper. This species grows mainly in semi-

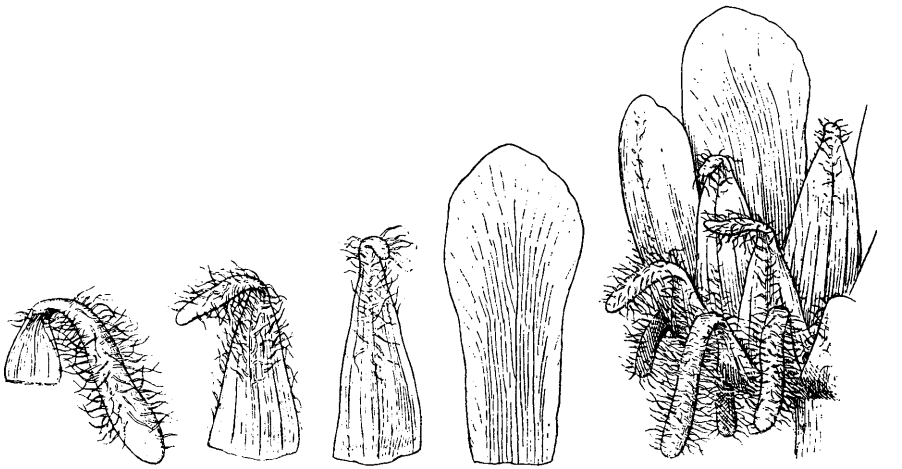


Fig. 2. *Arctotis leiocarpa* Harv. *a*—*d* form series of involucral scales. — *a* outermost ovate-triangular scale ending in a long appendix, more than 2 times longer than the remaining part of the scale. — *b* next to outer triangular scale with a linear appendix. — *c* median elongated triangular scale with a short appendix. — *d* obovate-oblong membrane-tipped scale representative of the two inner rows, lacking appendix. — *e* part of involucre (about 5-seriate). — [*a*—*e* drawings from a cultivated specimen raised from seed of a collection from the Prince Albert District, NORLINDH, n. 5643 (S)]. — *a*—*d* ×5; *e* ×4.2.

arid regions. The main distribution area extends from the Orange Free State to far up in South West Africa and its southernmost outposts as a wild species seem to be in the Karroo. The indigenous name "the gousblom of the Karroo" (MARLOTH 1932, p. 278), does not fit this species well, because the Karroo only forms a small part of its distribution area.

Already in 1939—1940, in connection with the naming of a profuse material of *Arctotis,* gathered, among others, by ADOLF HAFSTRÖM and ERIK WALL, and after a close study of BERGIUS' type specimen, as well as of his diagnosis of *Arctotis stoechadifolia,* I realized that LEWIN had completely misinterpreted this species. The plant which LEWIN had in mind, I gave the preliminary name *Arctotis venusta,* and I also gave the ACOCKS et HAFSTRÖM collection (S), 1936, n. 908, Griqualand West, from sandy soil along a road at Dronfield, this name. However, at that time I did not consider my knowledge of the genus sufficient for the description of this plant as a new species. It was possible that among the large

number of *Arctotis* species described in the past, particularly by JACQUIN, there might perhaps be one identical with *Arctotis venusta*. This has not, however, proved to be the case. In 1963, before my second journey to Southern Africa, I recommenced my study of *Arctotis*, and since then I have been able to make such a profound investigation of the numerous species in this genus that I feel sure that the species preliminarily named *Arctotis venusta* by me has not previously been described. Therefore I now consider it time to publish this species validly.

Arctotis venusta T. Norl. spec. nova

T. NORLINDH in Svensk Bot. Tidskr., Bd 58 (1964), pp. 199—202.

S y n.: "*Arctotis stoechadifolia*" (non Berg.) Dinter in Fedde, Repert. spec. nov. regn. veg., Fasc. 15 (1919), p. 341; op. cit., Beih. 3 (1921), pp. 41, 123, 134, 136, 139, 142 et Beih. 53 (1928), pp. 11, 13. — LEWIN in Fedde, op. cit., Beih. 11 (1922), pp. 69—70. — MARLOTH, Fl. S. Africa, Vol. III: 2 (1932), pp. 221, 278. — "*Arctotis grandis*" (non Thunb.) Wittmack, Gartenflora 49 (1900), p. 557. — BOYNTON in Addisonia, Vol. 3 (1918), pp. 45—46. — BAILEY, Stand. Cyclop. Hortic., Vol. 1 (1950), p. 386. — "*Arctotis stoechadifolia* var. *grandis*" (non Less.) Warren in Ann. Natal Mus., Vol. VI (1929), p. 171.

I c o n.: WITTMACK, op. cit., p. 556, Fig. 71. — BOYNTON, op. cit., Tab. 143. — LEWIN, op. cit., Tab. 3, 4. — WARREN, op. cit., Fig. 1—7 (partly) and Tab. 12 (partly). — BAILEY, op. cit., Fig. 386. — Fig. nostrae 1 *a*—*f*, 3 *a*.

T y p u s s p e c i e i: South Africa, Griqualand West, along road at Dronfield, ACOCKS et HAFSTRÖM, 1936, n. 908, in herb. Holm. (S).

H e r b a annua 1—6 dm alta; radix perpendicularis lignescens; caules singulares vel pauci e collo herbaceo exeuntes erecti vel adscendentes usque 1 cm crassi e basi ramosi vel (in speciminibus junioribus vel depauperatis) simplices; caules et rami fistulosi striato-sulcati; planta tota tenuiter cano-arachnoideo-tomentosa vel in partibus vetustioribus glabrata. F o l i a alterna crassiuscula valde variabilia; basalia conferta ± conspicue rosulata elliptica—obovata obtusa margine grosse sinuato-dentata—pinnatilobata, dentibus vel lobis obtusis utrinque 3—5, petiolata, petiolo usque 5 cm longo; folia caulina et ramealia ± remota, internodiis usque 7 cm longis, inferiora basalibus similia, cetera (summis exceptis) ambitu oblanceolata—anguste oblonga sinuata—pinnatilobata—lyrata sessilia vel basin versus in petiolum angustata semiamplexicaulia saepe ± auriculata; nervus medius subtus valde elevatus, nervi laterales vulgo duo conspicui. C a p i t u l a spectabilia in apicibus caulium et ramorum solitaria vel rarissime in corymbum laxum disposita pedunculata; pedunculi (rami capituliferi) longitudine valde variabiles usque 14 cm longi subnudi, bracteis foliaceis 1—2 linearibus vel lineari-oblanceolatis integerrimis vel sinuato-dentatis instructi. I n v o l u c r i s q u a m a e virides et herbaceae (marginibus et apice interiorum exceptis) inaequilongae ± conspicue 5-seriatae, dorso (interioribus exceptis) tenuiter floccoso-tomentosae; exteriores fere triangulares in appendicem breviter lineari-ellipticam obtusam obscure viridem elongatae; subexteriores triangulari-oblongae in appendicem line-

arem productae; mediae oblongae ±conspicue mucronatae marginibus anguste hyalino-scariosae; subinteriores et interiores obovato-oblongae dorso subglabrae marginibus et apice sat late hyalino-scariosae; squamae interiores exterioribus multo longiores; appendix squamarum exteriorum parte cetera fere dimidio brevior. Flores radii involucrum plus duplo superantes; ligulae supra albae basi flavae subtus cupreo-purpureae vel rubro-lilacinae vel ± violaceae; discus obscurus caeruleo-lilacinus vel purpureus vel atro-purpureus. Achaenia dura obscura subobovoidea c. 3 mm longa, lateribus tangentialibus glabris vel subglabris, latere ventrali ±dense piloso, basi fasciculo pilorum copioso ornata et apice pappo hyalino biseriato, paleis interioribus 3—4 mm longis exterioribus multo minoribus, coronata; cavities oblongae, parietes laterales cavitierum margine involuti et ±distincte dentati.

Cape Province: Somerset East: "Heideartig an Höhen der 1:sten Region unweit Sommerset", (ECKLON et) ZEYHER, 1824, s.n. (S). — Herschel: 17.2 miles SE. of Tele Police St. on Lundean's Nek road. Dry scrubby hillside. MARAIS, 1955, n. 1058 (LD). — Aliwal North: "Cis-Garipina, vom nördlichen Fuss der Stormbergen bis Buffelvalei am Garip", 4000—5000′ [119.9], ZEYHER, s.n. (S). — Albert: District of Albert, COOPER, 1861, n. 666 (W). — Colesberg: Colesberg, SHAW, s.n. (W). — Griqualand West: North of Kimberley, HAFSTRÖM, 13 Oct. 1936, s.n. (S). — Sandy soil along road at Dronfield, ACOCKS et HAFSTRÖM, 1936, n. 908 (PRE, S). — Riverton, 20 miles W. of Kimberley, HALL, 1953, n. 647 (NBG, S). — Bushweld an der Pad Warrenton-Kimberley, MERXMÜLLER, 1957, n. 682 (W). — Gordonia: Upington, STEYN, 1950, n. 980 (NBG).

Basutoland: Leribe, DIETERLEN, n. 426 (NH, SAM). — Maseru, COMPTON, 1951, n. 22552 (NBG).

Orange Free State: Rouxville: "Trans-Garipina, Nieuwejaarspruit, zwischen Garip und Caledonriver, am Fuss der Witbergen," 4000—5000′ [114.10], ZEYHER, s.n. (S). — Reddersburg: 12 miles W. of Reddersburg, BARKER, 1959, n. 8849 (NBG, S). — Bloemfontein: Near Bloemfontein. Common roadside plant. PROSSER, 1950, n. 1524 (NBG). — Near Bloemfontein, roadside, NORLINDH, 1963, n. 5834 (S). — Eod. loco, NORLINDH et VAN ZINDEREN BAKKER jr, 1963, n. 5835 (S). — Betlehem: Between Kestell and Betlehem. At foot of Loskop, c. 1700 m s.m., DAHLGREN et PETERSON, 1957, n. F179 (LD). — Harrismith: Rensburgskop, c. 13 miles SE. of Harrismith, JACOBSZ, comm. NORLINDH, 1963, n. 5815.

Transvaal: Chunes Poort, South of Pieterburg, at edge of river, 4500 ft, WALL, 1938, s.n. (S).

S. W. Africa: Windhoek: Okahandja. An und in Rivieren, 1300 m s.m., DINTER, 1907, n. 427 (SAM). — Windhoek: Windhoek, Neudam Exp. Farm. Growing in vlei, v. VUUREN, 1960, n. 1050 (W). — 16 miles east of Windhoek, farm Ludwig 64. Road side, gravel, sand on rocky ground. Locally common, c. 2000 m s.m., KERS, 1963, n. 863 (S). — Gobabis: Witvlei. Witnossob River. Growing plenty as annuals on a dried up river bed, c. 1200 m s.m., KERS, 1963, n. 889 (S). — Furthermore there are 10 collections of this species, sub nom. *"A. stoechadifolia"*, from S. W. Africa cited by LEWIN (1922, pp. 69—70) in his monograph of the genus *Arctotis*. Those collections, which were kept in Berlin-Dahlem, were unfortunately destroyed during the last world war and it is uncertain if more than one of them, i.e. above mentioned DINTER n. 427, is in keeping as a duplicate.

Arctotis venusta often occurs as a weed in corn-fields and in certain regions this species can be included in the more common weeds, e.g. in the Orange Free State.

This species seems to have been introduced in Europe for the first time at the turn of the century. In WITTMACK's "Gartenflora", the 49th issue (1900), p. 556, it is pictured under the name *"Arctotis grandis"*. Besides a description of this "ausserordentlich schöne neue Annuelle" and its cultivation, one also finds there the interesting information that it originates from S. W. Africa. *Arctotis grandis* Thunb. is, however, as I have proved in an earlier investigation, only to be considered as a luxuriant habitat modification of the true *A. stoechadifolia* Berg. (NORLINDH 1964, p. 199).

Arctotis venusta is an easily cultivated annual with very beautiful flowers. It can therefore in course of time be expected to become a popular ornamental plant in European and North-American gardens. For instance at such a northerly degree of latitude as central Scandinavia (about 60°) the seeds ought, however, to be germinated in a hot-bed already during March or April in order to enable the plant to reach its most beautiful flowering. In Europe and America it has hitherto mostly been cultivated in botanical gardens, where it has been given the erroneous names of *"A. stoechadifolia"* and *"A. grandis"*. In seed catalogues it has long been offered under those names.

As a participant of the Botanical Tour in South Africa in 1963, arranged by the Kirstenbosch Golden Jubilee Council, I was happy to have the opportunity of studying numerous specimens of *Arctotis venusta,* which were growing on the outskirts of Bloemfontein in the Orange Free State. In so doing I got a good insight into the great variation within this species. A profuse material of the plant was gathered at different stages of development and in various habitat modifications, from depauperated to luxuriant forms. Furthermore, germinable seeds were gathered for the purpose of experimental cultivation of the plant in Swedish botanical gardens.

During two very rainy summers I have now had this plant from Bloemfontein under cultivation in the botanical gardens of Lund and Stockholm (Hortus Bergianus) and it has developed into a luxuriant form. The specimens have grown to about 3/4 metre's height, with considerable ramification and have produced a profusion of flowering heads. In their habit they deviate considerably from the mother plant, the wild form, growing on the steppe at Bloemfontein, i.a. through their greater ramification, their larger and more lobate, less hairy and greener

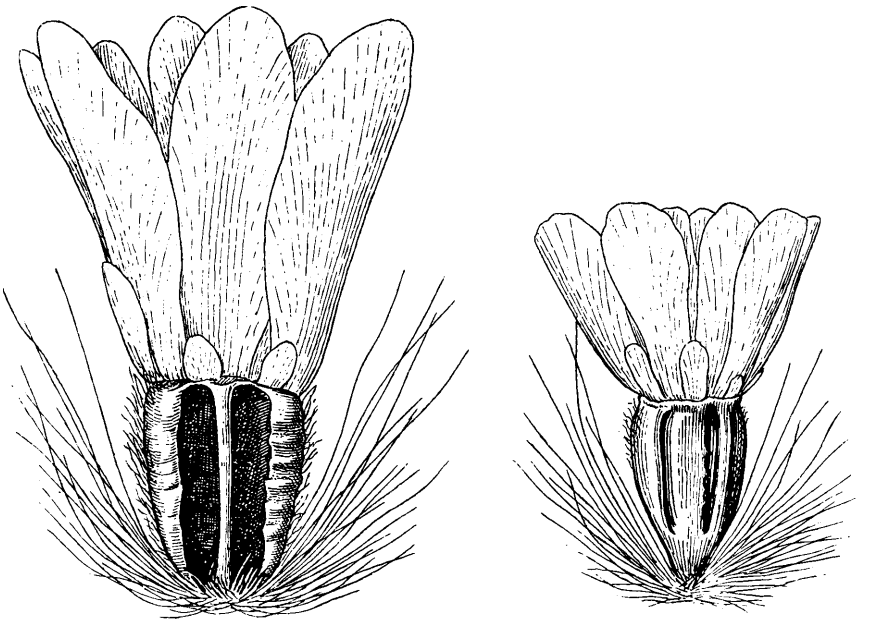


Fig. 3. Achenes of *Arctotis* figured from dorsal side, showing: 1) the basal tuft of long hairs (but anterior ones not drawn out) 2) the body with three vertical, dilated ridges (wings), of which the two lateral ones bend toward the central one, forming two longitudinal cavities 3) the biseriate pappus with an inner ring of large and an outer ring of small paleae. — *a A. venusta* T. Norl., achene obovoid, slightly hairy on the tangential sides. — *b A. leiocarpa* Harv., achene obconic, only slightly hairy on upper part of the tangential sides. — *a A. venusta* T. Norl. Bloemfontein, NORLINDH, n. 3534 (S). — *b A. leiocarpa* Harv. Prince Albert Distr., in Karroo, NORLINDH, n. 5643 (S). — *a—b* ×10.

leaves. With regard to the habit of growth, the coarse stems and branches, these cultivated specimens are most reminiscent of the luxuriant specimens, gathered by rivers, e.g. KERS n. 889 from S. W. Africa, the Gobabis district, Witnossob, on a dried up river bed, and WALL, 4/10/38, from Transvaal, Chunes Poort, at the river's edge; the latter two collections, however, show somewhat more canescent leaves.

During cultivation in Lund and Stockholm of the closely allied species *Arctotis leiocarpa* Harv., collected by the author in Karroo in the Prince Albert District (NORLINDH n. 5643), the plant has under the influence of the damp climate been modified in a corresponding manner, i.e. developed a highly luxuriant form.

A cytological examination of my cultivated specimens of *Arctotis venusta* from Bloemfontein (NORLINDH n. 5834) and *A. leiocarpa* from Karroo (NORLINDH n. 5643) has proved them to have the same number of chromosomes, 2n=18. Their areas of distribution partly overlap, contrary to the case of *A. venusta* and *A. stoechadifolia,* which have quite separate areas.

From a morphological point of view *Arctotis venusta* is more closely allied to *A. leiocarpa* than to any other species in this genus. The most essential distinguishing characters regard the involucre and disc. In involucres of *A. venusta,* when normally developed, the appendix of the outermost scales are considerably shorter than the remainder, ± triangular part of the scale (usually about half as long; see Fig. 1 *a*). However, in *A. leiocarpa* the appendix of the outermost scales is considerably longer (about two times) than the other part of the scale (see Fig. 2 *a*).

The disc of *A. venusta* is obscure with the colour of the corolla lobes varying considerably, e.g. dark blue-lilac, mauve blue, blue-black or purple. In *A. leiocarpa* the disc is usually yellow. However, this species population also comprises forms, in which the cucullate lobes of the central disc florets are somewhat obscure. The collection of *A. leiocarpa* I made in Karroo in the Prince Albert district, about 5 miles east of the northern end of Seven Weeks Poort Pass, NORLINDH n. 5643, comprises both forms. When cultivated in the botanical gardens of Stockholm and Lund these forms proved to stay constant and seemed to be identical in all characteristics, except in the colour of the central disc florets.

The characteristics of the indumentum are less essential and useful for the purpose of distinguishing these species. According to HARVEY the achenes of *A. leiocarpa* are quite glabrous on the surface. But this characteristic has not proved to be quite constant. As a rule the achenes are glabrous on the tangential sides, but often pubescent on the ventral side. In *A. venusta* the achenes are usually slightly hairy on the tangential sides, but more densely hairy or woolly on the ventral side. Contrary to *A. venusta, A. leiocarpa* is provided with more or less crispid hairs on branches, leaves and involucre, but in some extreme forms these hairs are very sparse and sometimes difficult to detect.

The achenes of *Arctotis venusta* and *A. leiocarpa* usually appear different in shape as seen from the illustrations (Fig. 3 *a* and *b*), those of the latter being ± obconic and somewhat smaller. However, the achenes vary considerably in shape as well as indentation of their two lateral ridges (wings). In some cases the differences between the achenes of these species have proved to be slight.

Arctotis venusta is able to form hybrids with other species in the genus. It is surprising that a hybridization has taken place with *Arctotis aurea* (DC.) Lewin (syn. *Venidium Wyleyi* Harv.) which belongs to the group *Hirsutae,* differing considerably from *A. venusta,* above all in the morphology of its achenes. This hybrid has been exhaustively treated by E. WARREN in his paper "On a Natural Hybrid between the Genera Venidium and Arctotis" (Ann. Natal Museum, Vol. VI: 2, 1929).

Acknowledgements

I beg to tender my sincerest thanks to the Directors and Curators of the above mentioned herbaria and museums for having made *Arctotis* material available for my research. I also wish to thank Mr S. EKBLOM, Stockholm, for his drawings of the floral parts of the species.

Summary

This beautiful ornamental plant seems to have been introduced from South West Africa to Europe for the first time at the turn of the century. From a morphological point of view *Arctotis venusta* T. Norl. is more closely allied to *A. leiocarpa* Harv. than to any other species in the genus. These species also have the same chromosome number, 2n=18. They mainly differ in regard to the length of the appendices of the outermost involucral scales (see Fig. 1 *a* and 2 *a*) and the colour of the disc. In *Arctotis venusta* the appendix of these scales is only about half as long as the remaining, ±triangular part of the scale, but in *A. leiocarpa* it is about twice as long as the other part of the scale. As to the colour of the flowers, *Arctotis venusta* differs from *A. leiocarpa* in having a non-yellow disc.

Literature

BERGIUS, P. J. 1767. Descriptiones Plantarum ex Capite Bonae Spei. — Stockholmiae.

DINTER, K. 1919. Index der aus Deutsch-Südwestafrika bis zum Jahre 1917 bekannt gewordenen Pflanzenarten II. — Fedde, Repert. spec. nov. regn. veg., Vol. 15. Dahlem bei Berlin.

— 1921. Botanische Reisen in Deutsch-Südwest-Afrika. — Fedde, op. cit. Beih. 3.

— 1928. Sukkulentforschung in Südwestafrika II. — Fedde, op. cit. Beih. 53.

HARVEY, W. H. et SONDER, O. W. 1865. Flora Capensis III. — Dublin.

LESSING, C. F. 1832. Synopsis generum Compositarum. — Berolini.

LEWIN, K. 1922. Systematische Gliederung und geographische Verbreitung der Arctotideae-Arctotidinae. — Fedde, Repert. spec. nov. regn. veg., Beih. 11. Dahlem bei Berlin.

MARLOTH, R. 1932. The Flora of South Africa, Vol. III: 2. — Cape Town.

NORLINDH, T. 1964. On the identity of Arctotis stoechadifolia Berg. — Svensk Bot. Tidskr. Bd 58. Uppsala.

BOTANISKA NOTISER 1965 · VOL. 118 · FASC. 4 · LUND

Embryology of Frankenia Linn. with Some Comments on the Systematic Position of the Frankeniaceae

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The family *Frankeniaceae* is named after a Swedish botanist J. FRANKENIUS. Due to the presence of a decussate, heath-like foliage on the stem of *Frankenia* it is commonly referred to as the 'sea heath' family. Of the 5 genera comprising this family, *Frankenia* has the widest distribution, covering north and south temperate regions as well as the warm and dry parts of all the continents. HOOKER (1875) reports *F. pulverulenta* from the plains of Punjab and Sind. The other genera, however, are much restricted in distribution: *Hypericopsis* to S. Persia, *Beatsonia* to the Island of St. Helena (Africa), *Anthobryum* to W. South America, and *Niederleinia* to Patagonia (S. America).

The systematic position of the *Frankeniaceae* has been an unsettled problem since the time of BENTHAM & HOOKER (1862—1883). Studies on floral morphology and anatomy have indicated its possible affinities with some polypetalous families such as the *Tamaricaceae, Caryophyllaceae* and *Elatinaceae,* as well as a sympetalous family, the *Plumbaginaceae.* GUNDERSEN (1927) considers the *Frankeniaceae* "as a link in the classification of dicotyledons" especially between the *Parietales* and the *Caryophyllaceae.* Yet there is hardly any work on the embryology of this family. MAURITZON (1933) provides meagre data on the development of the embryo sac in *Frankenia hirsuta* which is of the Polygonum type; the pollen grains are 2-nucleate. DAHLGREN (1928) mentions the presence of hooked synergids in *F. hirsuta.* This investigation was, therefore, undertaken with a view to fill up, as far as possible, this lacuna in the existing literature on the embryology and to elucidate the systematic position of the family.

Materials and methods

Flowering specimens of *Frankenia hirsuta* Linn. were very kindly fixed in formalin-acetic-alcohol by Professor P. MAHESHWARI from the botanical gardens at Cambridge and Kew in August, 1961, and by one of us (R.N.K.) from the Kew Gardens in September, 1963. Some material of *F. pulverulenta* Linn. was collected by Professor P. MAHESHWARI from Berlin in August 1961, and subsequent collections were obtained by him from Germany through the courtesy of Professor THEODORE ECKARDT, Director of the Botanical Gardens and Museum, Berlin. We extend our grateful thanks to them.

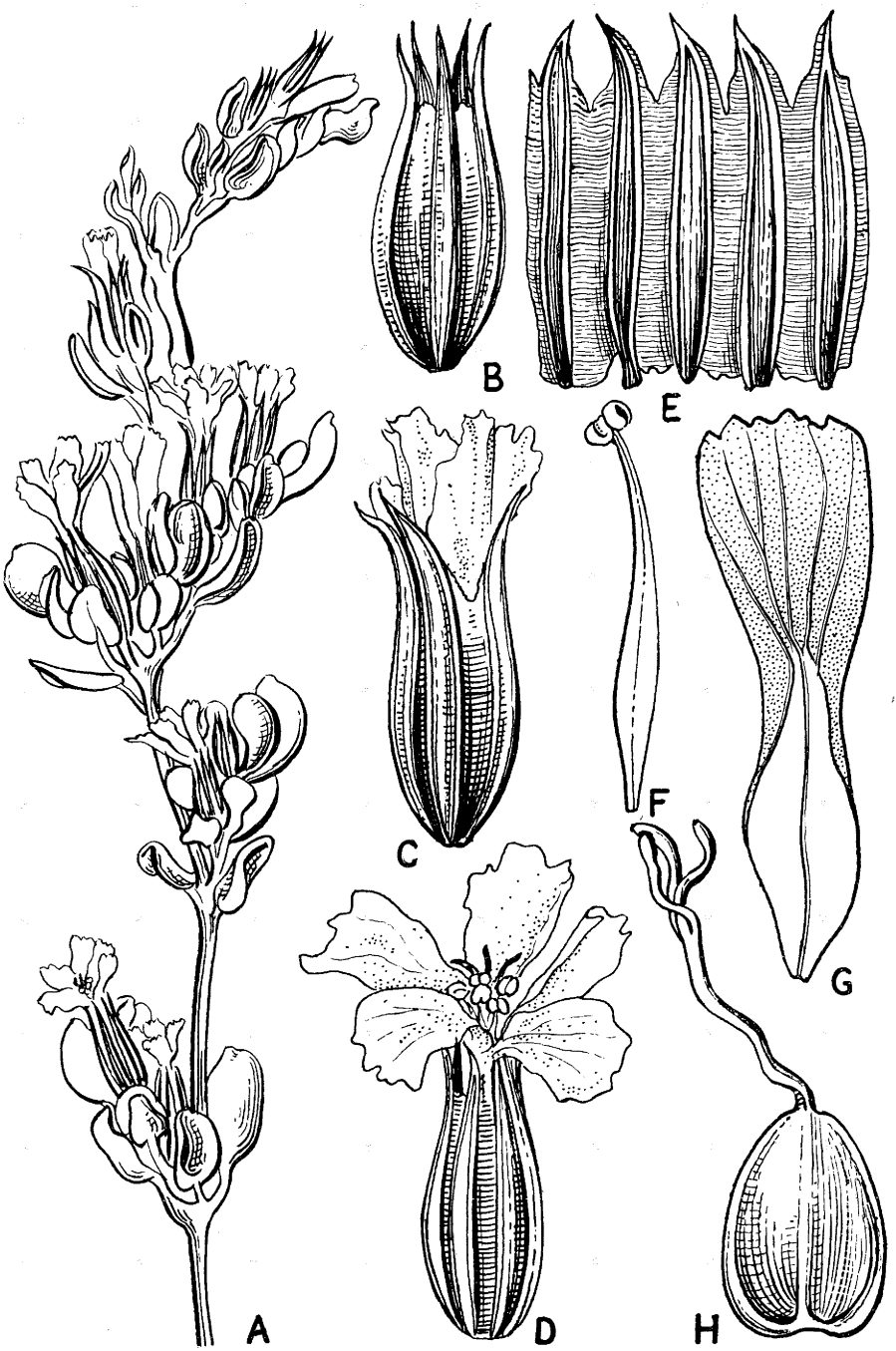
The material was dehydrated by passing through the alcohol-xylene series and imbedded in paraffin wax of 56—58°C melting point. To facilitate infiltration through the crustaceous seed coat, the young and old fruits were imbedded in rubber wax. This was prepared by dissolving 5 gms of vulcanized rubber in smoking hot paraffin to obtain a stock solution. Five grams of this stock solution were added to 100 grams of paraffin before use. Serial transverse and longitudinal sections of buds and flowers of different ages were cut between 7 and 30 microns. Both safranin-fast green and haematoxylin-fast green combinations were used for staining. ERDTMAN's (1960) schedule was employed for making acetolysed preparations of pollen grains.

Floral morphology

Frankenia is a small xerophytic herb blooming in the months of June and July. The leaves are opposite and decussate and their axils are adorned by small but conspicuous pink blossoms (Fig. 1 A). The flowers are sessile, bisexual, actinomorphic and bracteate (Fig. 1 B—D). The calyx consists of 5 coriaceous sepals (Fig. 1 E) which are united for most of their length to form a tube around the floral parts. There are 5 free petals which are clawed and have a scale-like appendage on the inside (Fig. 1 G). The androecium consists of 5 stamens, each of which consists of an elongated, flattened filament terminated by a small, round, versatile anther (Fig. 1 F). The gynoecium is tricarpellary, syncarpous and superior. The style is sinuous and terminated by three clavate lobes of the stigma (Fig. 1 H).

Microsporangium

A transection of the youngest anther available revealed a group of microspore mother cells surrounded by a tapetum, 2 or 3 middle layers, endothecium and an epidermis (Fig. 2 A, C). The cells of the epidermis become cutinized and persist in the dehiscing microsporangia. Except in the region of the stomium, the cells of the endothecium develop fibrous thickenings (Fig. 2B, D). The middle layers degenerate at the


A
B
C
D
E
F
G
H

uninucleate stage of the pollen grains. With the inception of meiosis in the microspore mother cells, the tapetum becomes binucleate and 2-layered at places (Fig. 2 E—G). At the completion of reduction divisions, however, the tapetal cells commence degeneration in situ. Thereafter, the partition wall between two adjacent microsporangia disorganizes and dehiscence is effected in the region of the stomium by means of 2 longitudinal slits.

Microsporogenesis and male gametophyte

The microspore mother cells secrete a thick mucilaginous wall, undergo reduction divisions (Fig. 2 H, I) and yield tetrahedral, decussate or isobilateral tetrads by simultaneous furrowing (Fig. 2 J—L). Abnormal meiosis sometimes results in lagging chromosomes and chromatin bridges (Fig. 2 H) distributed in the cytoplasm.

The young microspore enlarges, becomes rounded and develops a thick exine and a thin intine with 3 germ pores (Fig. 2 M). Its nucleus divides to cut off a smaller generative and a larger, vacuolate vegetative cell. Sometimes an extra nuclear body which might have resulted from a lagging chromosome is also seen in a pollen grain (Fig. 2 N). Subsequently, the generative cell, surrounded by a characteristic halo, moves into the cytoplasm of the vegetative cell and elongates (Fig. 2 O) prior to its division engendering the 2 male gametes. The pollen grains are tricolpate (Fig. 2 P, Q) and are shed at the 3-celled stage.

Megasporangium

A young ovary shows several ovular primordia arising from the parietal placentae. While the primordia are still curving, the initials of the inner integument become distinguishable. Subsequently, the outer integument makes its appearance (Fig. 3 A, B), and very soon, the locule of the ovary becomes packed with anatropous and biteguminal ovules (Fig. 3 C). A characteristic feature of these ovules is the development of long funiculi. In *Frankenia hirsuta* we frequently came across ovules with an incipient third integument which arises from the outer integu-

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Fig. 1. *Frankenia pulverulenta*. — A. Portion of a flowering shoot. — B, C. Young and old buds. — D. Flower at the time of anthesis. — E. Calyx tube opened out. — F. Stamen. — G. Petal with scale-like appendage (unshaded). — H. Pistil after pollination. — A ×6; B, C ×17; D, E ×15; F ×24; G ×19; H ×15.

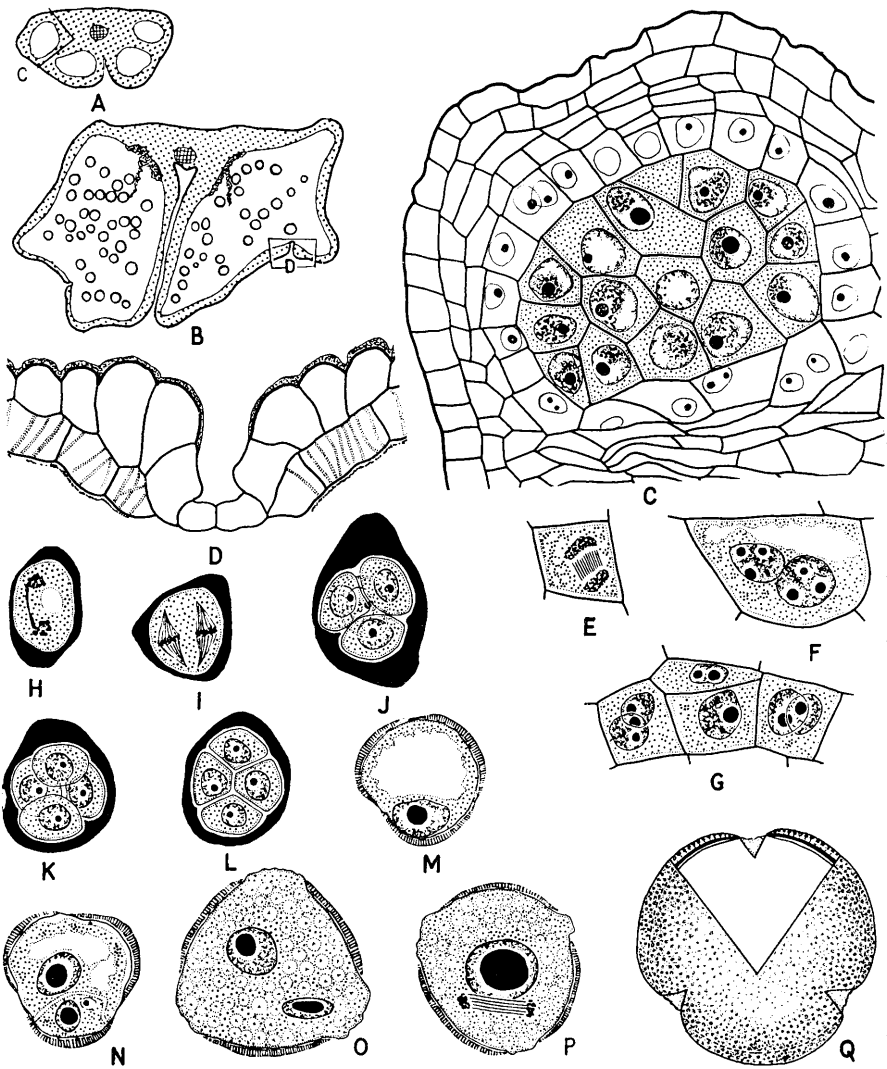


Fig. 2. *Frankenia hirsuta.* — A, B. T.s. young and old anthers (diagrammatic). — C. Portion marked "C" in A enlarged to show wall layers and sporogenous cells. — D. Portion marked "D" in B enlarged to show the region of stomium. — E—G. Divisions in tapetal cells leading to binucleate and bicelled condition. — H, I. Meiosis in microspore mother cells; H shows a chromatin bridge. — J—L. Tetrahedral, decussate and isobilateral tetrads. — M—P. Formation of 3-celled pollen grains; note extra nuclear body in generative cell in N. — Q. Palynogram. — A, B ×66; C, D ×544; E—Q ×681.

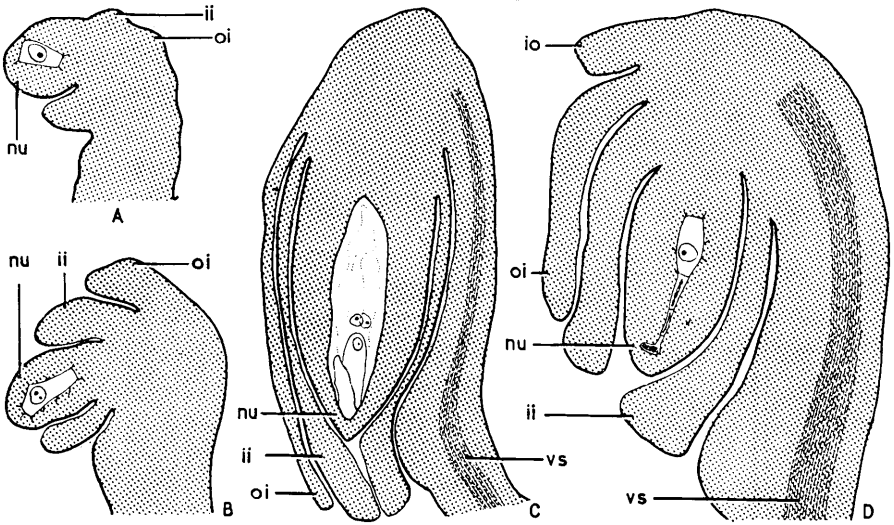


Fig. 3. *Frankenia hirsuta.* (*ii,* inner integument; *io,* integumentary outgrowth; *nu,* nucellus; *oi,* outer integument; *vs,* vascular supply). — A—C. Stages in the development of ovule which is anatropous, and bitegminal. — D. L.s. ovule showing primordium of the third integument. — A, B ×232; C ×135; D ×300.

ment (Fig. 3 D). However, the growth is invariably arrested at the primordial stage and it is never seen to develop into a full-fledged integument. Sometimes the cells of the inner integument may also proliferate in the micropylar region.

Megasporogenesis and female gametophyte

The archesporial cell is hypodermal and functions directly as the megaspore mother cell (Fig. 4 A, B). An unusual feature observed during gametogenesis is the enlargement of 2 or 3 nucellar cells. These accumulate dense cytoplasm, acquire prominent nuclei, and simulate megaspores but do not develop further. Frequently, a cell of the nucellar epidermis, lying immediately above the megaspore mother cell, undergoes a periclinal division giving rise to 2 superposed cells (Fig. 4 C). The megaspore mother cell undergoes Meiosis I to form a dyad (Fig. 4 D) which gives rise to linear (Fig. 4 E—H) or T-shaped tetrads. The 3 micropylar megaspores of the tetrad do not show any uniformity in their order of degeneration (Fig. 4 E—G). Ultimately, however, all the three are crushed and the chalazal megaspore alone functions (Fig. 4 H).

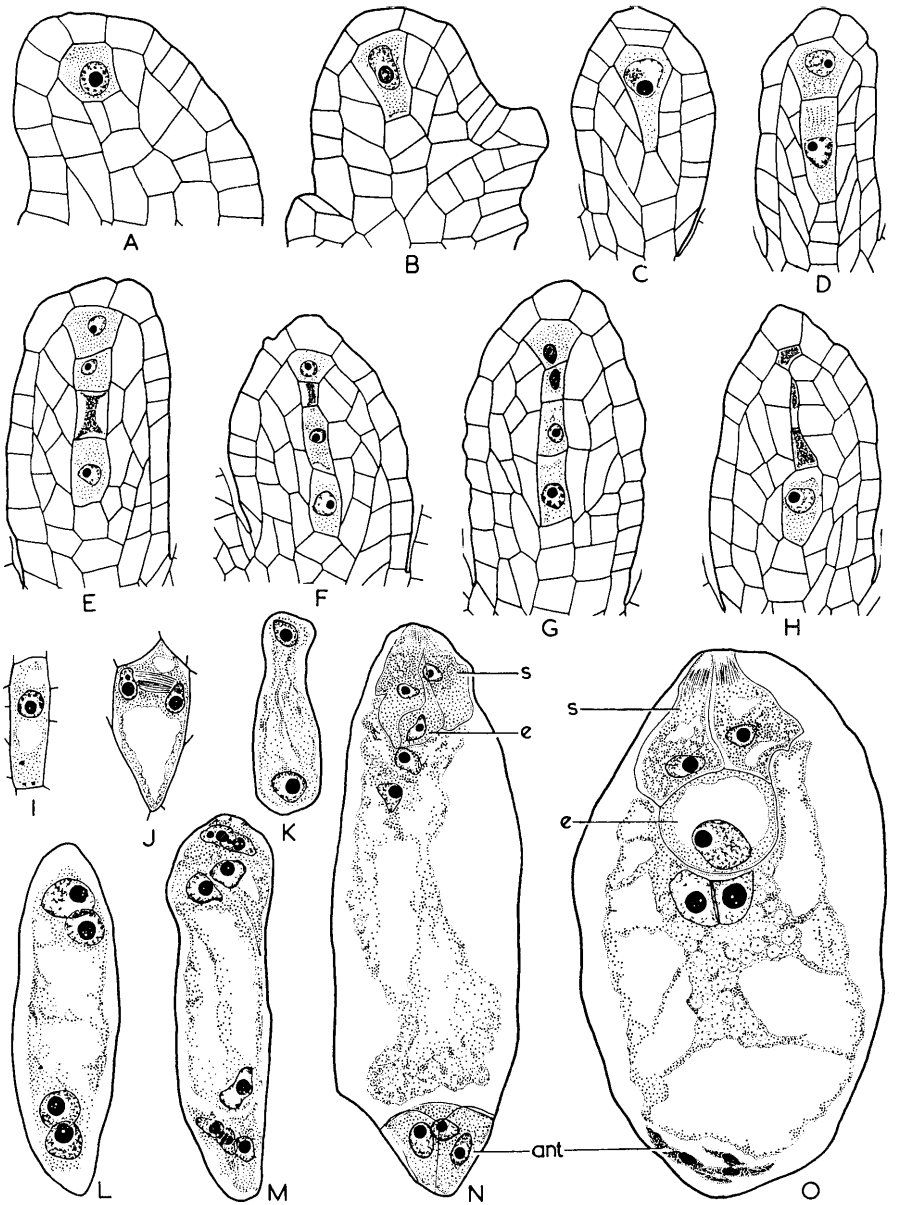


Fig. 4. *Frankenia hirsuta*. (*ant,* antipodal cells; *e* egg; *s* synergid). — A—C. L.s nucelli at the archesporial, sporogenous and megaspore mother cell stages respectively. No parietal cell is cut off. — D. Dyad cells. — E—H. Tetrads of megaspores; note lack of uniformity in the order of degeneration of upper 3 megaspores. — I. Functional megaspore. — J, K. Two-nucleate embryo sacs showing lateral and polar disposition of the 2 nuclei respectively. — L. Four-nucleate embryo sac. — M—O. Mature embryo sacs; the antipodal cells have degenerated in O. — A—O ×475.

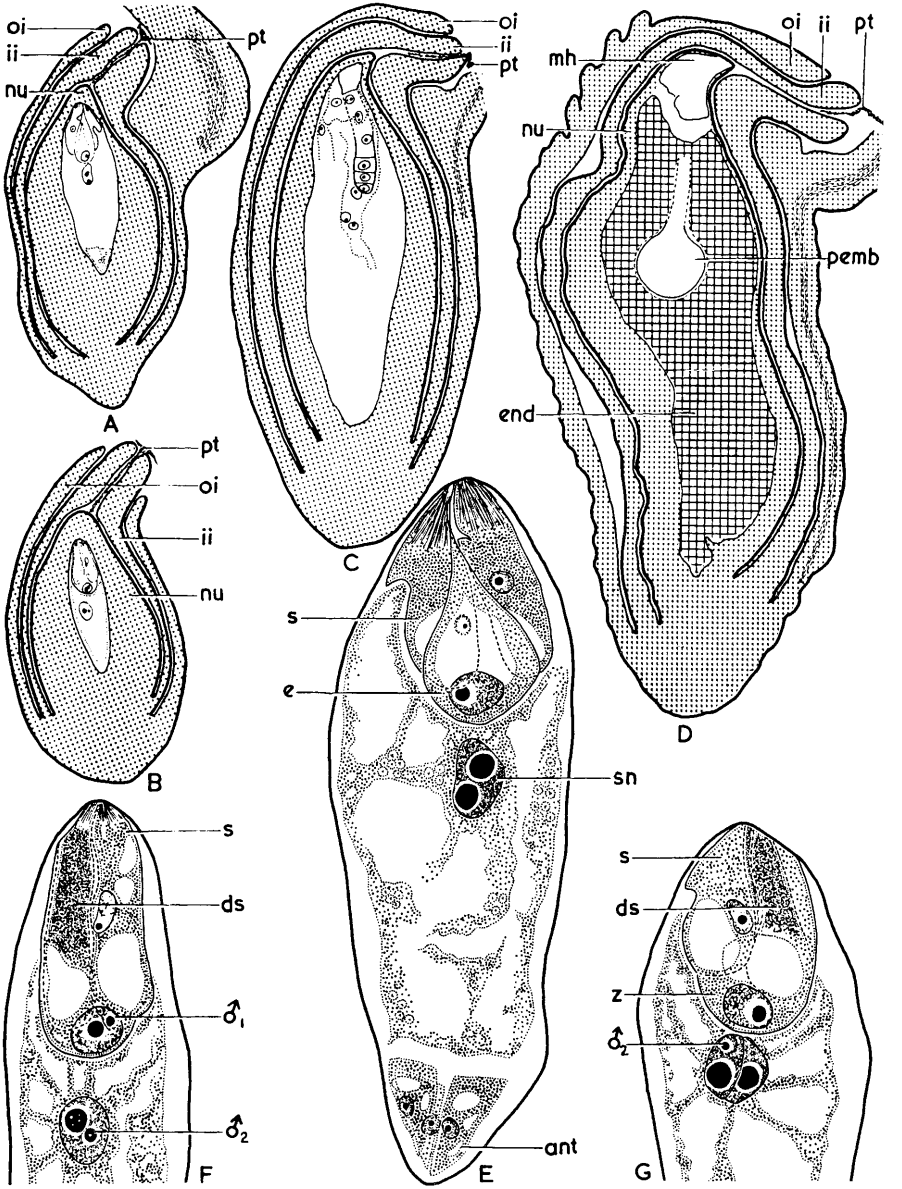


Fig. 5. *Frankenia pulverulenta.* (*ant,* antipodal cells; *ds,* degenerated synergid; *e,* egg; *end,* endosperm; *ii,* inner integument; *mh,* micropylar haustorium; *nu,* nucellus; *oi,* outer integument; *pemb,* proembryo; *pt,* pollen tube; *s,* synergid; *sn,* secondary nucleus; *z,* zygote; δ_1 and δ_2, male gametes). — A, B. L.s. ovules at the time of fertilization to show the entry of pollen tube. — C, D. Young and old seeds showing persisting remnants of pollen tube in the micropyle. — E. Embryo sac at the time of arrival of pollen tube in the micropyle. — F. Upper portion of embryo sac enlarged from B to show double fertilization. — G. Part of embryo sac showing triple fusion after syngamy has taken place. — A—D ×145, E—G ×627.

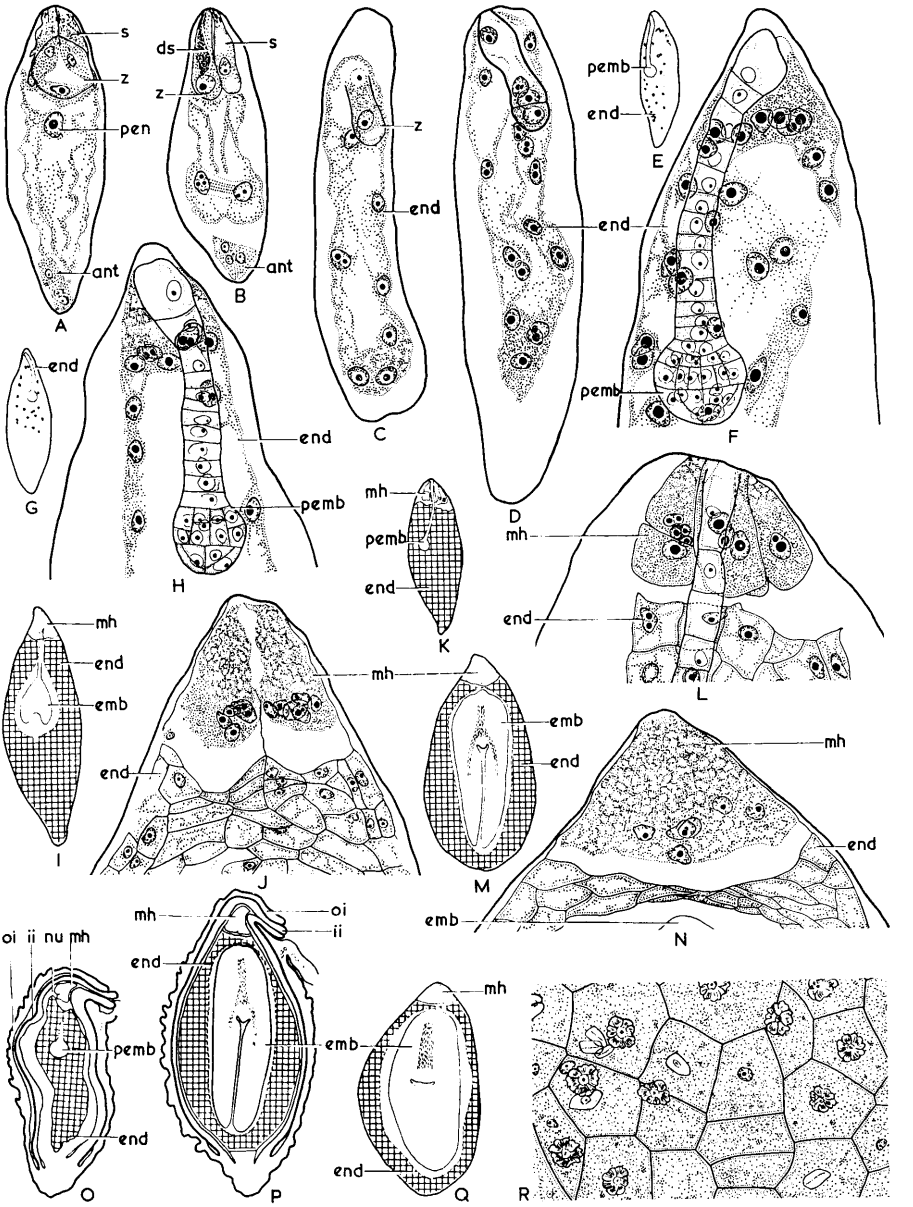


Fig. 6. *Frankenia pulverulenta.* (*ant,* antipodal cells; *ds,* degenerated synergid; *emb,* embryo; *end,* endosperm, *ii,* inner integument; *mh,* micropylar haustorium; *nu,* nucellus; *oi,* outer integument; *pemb,* proembryo; *pen,* primary endosperm nucleus; *s,* synergid; *z,* zygote). — A. Embryo sac showing zygote and primary endosperm nucleus. — B—D. Two, 8 and 16-nucleate endosperm. — E, G, I, K, M, Q. Outline diagrams of endosperm at various stages of development. — F. Micropylar portion

The first mitotic division in the functional megaspore (Fig. 4 I) results in 2 nuclei which become separated towards the 2 poles (Fig. 4 K). Rarely, however, the 2 daughter nuclei occupy lateral positions (Fig. 4 J). Two successive mitoses give rise to the 4- (Fig. 4 L) and 8-nucleate embryo sacs in which the chalazal quartet may organize earlier than the micropylar. The mature embryo sac shows an egg apparatus, 2 polar nuclei and 3 uninucleate antipodal cells (Fig. 4 M, N). The cytoplasm is usually packed with starch grains. The synergids show well developed filiform apparatus. The antipodal cells degenerate before or soon after fertilization (Fig. 4 O).

Fertilization

The pollen tube enters the embryo sac through the micropyle (Fig. 5 A, B) and presumably destroys one of the synergids on its way. Syngamy and triple fusion may or may not take place simultaneously (Fig. 5 E—G). Except for a small length of the pollen tube which persists at the tip of the micropyle (Fig. 5 C, D), the rest of it invariably degenerates after releasing the male gametes.

Endosperm

The primary endosperm nucleus divides to form 2 free nuclei (Fig. 6 A, B). Successive mitoses produce a large number of free nuclei which become distributed along the periphery of a central vacuole (Fig. 6 C—F). The nuclei at the micropylar and chalazal ends, however, become embedded in a dense mass of cytoplasm. The micropylar region of the endosperm develops striations closely simulating the filiform apparatus of the synergids (Fig. 6 G—J). The nuclei in this region of the cytoplasm fuse amongst themselves to produce polyploid masses. Meanwhile, wall formation commences at the chalazal end of the embryo sac and gradually proceeds upwards. However, the micropylar portion of the endosperm remains free nuclear and appears haustorial. Subsequently 1 or 2 vertical walls may be formed giving rise to a 2- or 4-celled structure (Fig. 6 I, J). Nuclear fusions continue in these cells

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of embryo sac showing aggregation of endosperm nuclei. — H. A filiform apparatus-like structure is developing from the cytoplasm at the micropylar end. — J. Cellular endosperm and 2 coenocytic cells of the micropylar haustorium. — L. Enlargement from K showing cellular endosperm and 5-celled micropylar haustorium. — N. Micropylar haustorium from mature seed. — O, P. L.s. young and old albuminous seeds. — R. Cells of mature endosperm showing crystals of varying shapes. — A—D ×241; E, G, I, K, M, O, P, Q ×57; F, H, J, L, N ×273; R ×241.

and rarely 1 of them may undergo a transverse division (Fig. 6 K, L). This structure at the micropylar end remains active up to the mature stage of the embryo (Fig. 6 M—P). The chalazal end of the endosperm shows a layer of large, multinucleate cells. At maturity, the endosperm contains numerous starch grains and crystals (Fig. 6 Q, R).

Embryo

The zygote divides transversely to procreate the cells *ca* and *cb* (Fig. 7 A, B). Further transverse divisions in both these cells produce a filamentous proembryo of about 9 cells (Fig. 7 C—E). The terminal cells undergo 2 vertical divisions leading to the quadrant and octant stages (Fig. 7 F, G). Subsequent transverse and longitudinal divisions in the tiers *l* and *l'* engender the globular embryo (Fig. 7 H—J) which later differentiates into the heart-shaped and cotyledonary embryos (Fig. 7 K—M). The embryogeny, thus, corresponds to the Solanad type. The mature embryo is devoid of a suspensor, has 2 cotyledons (Fig. 7 N), and a well developed vascular supply.

Seed coat

Both the inner and outer integuments in a young, unfertilized ovule are characterized by 2 or 3 layers of cells (Fig. 8 A, E). The cells at the tips of both the integuments, however, tend to divide, this tendency being more pronounced in *Frankenia hirsuta* than in *F. pulverulenta*.

The trigger of fertilization entails marked changes in the seed coat. The cells of the inner epidermis of the inner integument enlarge radially become filled with tannin and develop a thick cuticle on their inner tangential walls (Fig. 8 B—D, F—H). The cells of the outer epidermis of the inner integument gradually become stretched and ultimately collapse (Fig. 8 C, G). Thus, in the mature seed the inner integument is represented by a single layer of tanniniferous cells.

The outer epidermis of the outer integument undergoes considerable modification. Its cells enlarge, become papillate and the nucleus migrates to the tip of the papilla. These cells elongate further and thickening is deposited at their tips in such a way that it gives them the curious appearance of a human finger and its nail (Fig. 8 D, H). The cells of the inner epidermis of the outer integument become tangentially elongated and persist as such in the mature seed.

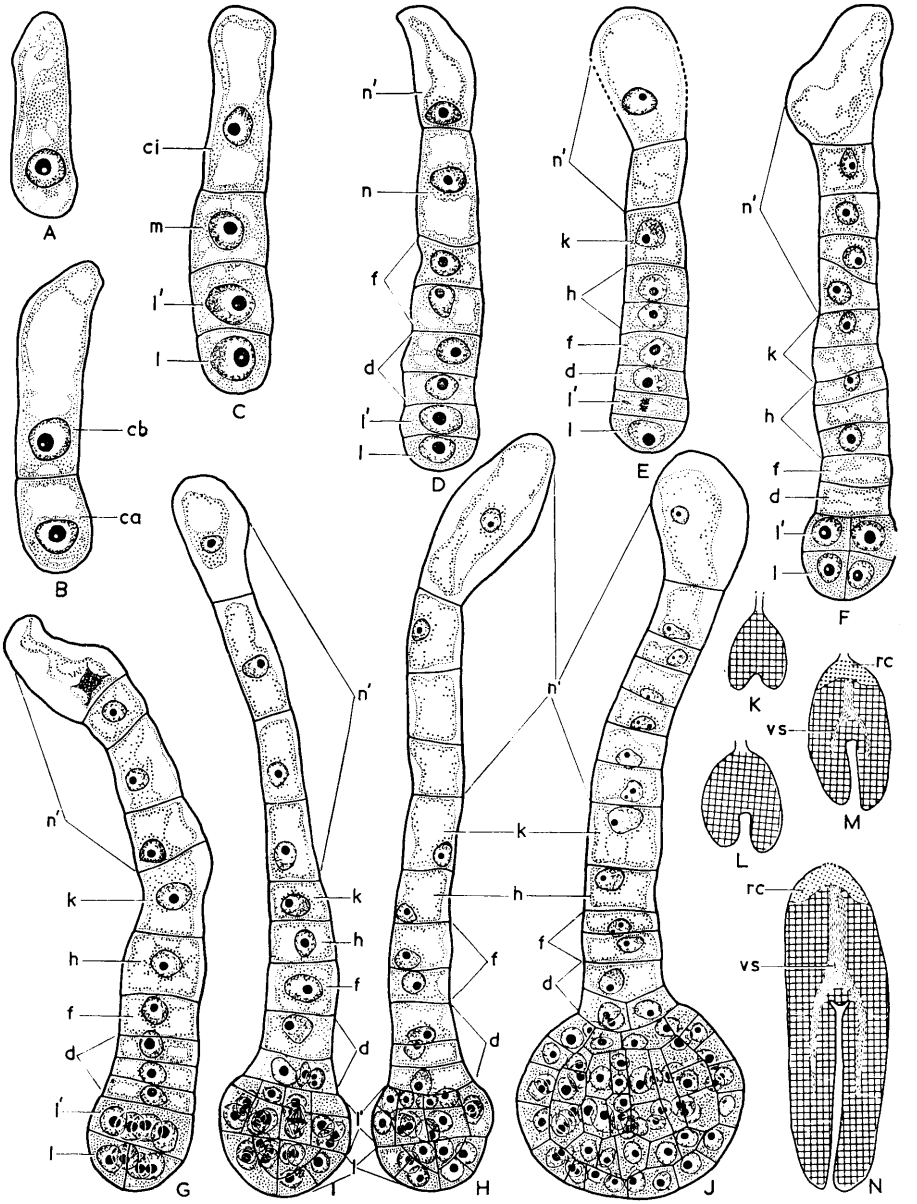


Fig. 7. *Frankenia pulverulenta*. (*rc*, root cap; *vs*, vascular supply). — A. Zygote. — B—D. Two, 4 and 8- celled proembryos. — E—J. Stages leading to the formation of a globular embryo; the suspensor is long and uniseriate. — K—N. Formation of a mature dicotyledonous embryo, the suspensor has degenerated in N. — A—J ×523, K—N ×97.

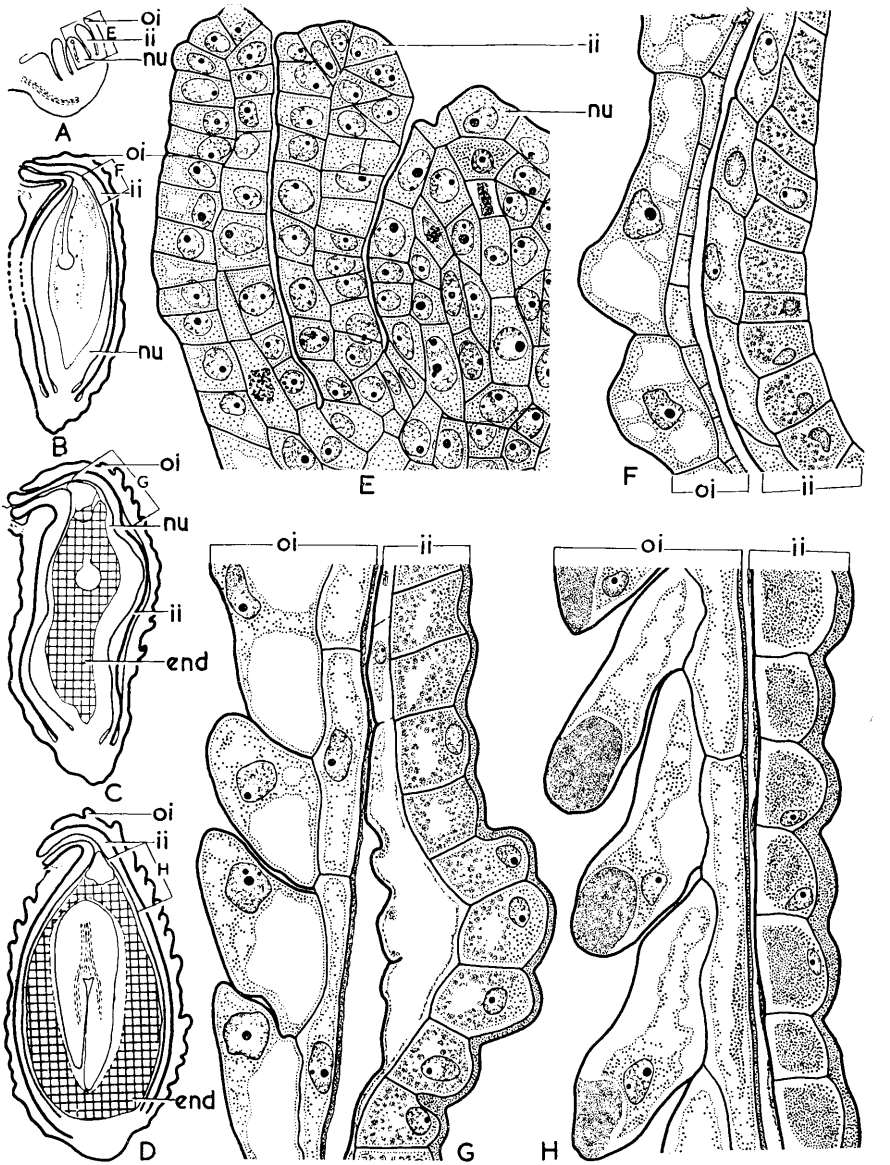


Fig. 8. *Frankenia.* — A, E, *Frankenia hirsuta*; B—D, F—H, *F. pulverulenta.* (*end,* endosperm; *ii,* inner integument; *nu,* nucellus; *oi,* outer integument). — A—D. L.s. developing seeds (diagrammatic). — E. Enlargement of portion marked "E" in A to show 2 or 3-layered outer integument and 2-layered inner integument. — F. Enlargement of portion marked "F" in B. Cells of the outermost layer of the seed coat are becoming papillate and those of the innermost layer are filled with tannin. — G. Portion marked "G" in C enlarged to show degeneration of outer epidermis of inner integument. — H. Magnified view of portion marked "H" in D. The outer epidermis of the seed coat shows finger-like outgrowths with nail-like thickening at the tip. The inner epidermis of the inner integument has developed thick cuticle. — A—D ×83; E—H ×681.

Discussion

Some of the embryological features of *Frankenia* and the systematic position of the *Frankeniaceae* are discussed below.

Embryology: The ovules of *F. hirsuta* show the presence of an incipient third integument although this does not grow beyond the primordial stage. In some members of the *Anonaceae,* viz. *Canangium, Mezzettia* and *Xylopia,* a middle integument develops just after fertilization (CORNER 1949). In *Cananga* also, PERIASAMY & SWAMY (1961) find that a third integument arises in between the inner and outer integuments during megasporogenesis.

Although the Cellular endosperm is frequently known to give rise to haustorial structures, only a few taxa show haustoria arising from the Nuclear endosperm. In the *Leguminosae, Cucurbitaceae, Proteaceae* and some members of the *Malpighiaceae* (SINGH 1959) and *Euphorbiaceae* (VENKATESWARLU & NARASIMHA RAO 1963) they arise at the chalazal end. In *Frankenia* the haustoria are micropylar. They resemble the synergids in possessing a filiform apparatus and can thus be easily mistaken for synergid haustoria. It may be mentioned that COOPER (1942) described synergid haustoria in *Lobelia* but these were later proved to be derived from the endosperm cells by MAHESHWARI (1944) and SUBRAMANYAM (1951). Earlier, a similar mistake was made by HEINRICHER (1931) in *Lathraea* and the correction came from GLIŠIĆ (1932).

Systematic position: BENTHAM & HOOKER (1862—1883) observed some resemblances between the *Frankeniaceae* and *Caryophyllaceae* and assigned the former to their *Caryophyllinae.* According to them (BENTHAM & HOOKER 1947) *Frankenia* is a monogeneric member of the *Frankeniaceae* and differs from the *Caryophyllaceae* only in the parietal placentation of the ovary and capsular fruit. However, WILLIS (1948) remarked that the likeness is only superficial. EICHLER (1875) contends that an assignment of the *Frankeniaceae* near the *Caryophyllaceae* is contradicted by the placentation.[1] GUNDERSEN (1927) emphasized the similarities between these two families and added that with respect to placentation also "there are suggestive resemblances" since in the *Basigonia* section of *Frankenia* there are usually 3 basal ovules as in the *Alsine* subfamily of *Caryophyllaceae* which has a

[1] The placentation in the *Frankeniaceae* is parietal whereas in the *Caryophyllaceae* it is free central (HUTCHINSON 1959).

Table 1

	Frankenia	*Tamaricaceae*
Pollen grains	3-celled	2-celled
Parietal cells	Absent	Present
Embryo sac	Monosporic	Tetrasporic
Endosperm	Nuclear; haustoria present	Nuclear; haustoria absent
Embryogeny	Solanad type, polyembryony absent; mature embryo straight and without suspensor	Solanad type, polyembryony frequent; mature embryo straight with massive suspensor
Seed	Albuminous	Exalbuminous
Seed coat	Derived from both integuments	Derived only from outer integument
Chromosome number	n=5(?)	n=12

single basal ovule. Moreover the calyx in *Frankenia* is similar to that of *Plumbago,* a genus belonging to the gamopetalous family *Plumbaginaceae.* METCALFE & CHALK (1950) observed that the characteristic epidermal glands of *Frankenia* also occur in the *Tamaricaceae* and *Plumbaginaceae,* but add: "The glands are probably to be regarded as an ecological specialization which may quite well have arisen independently in each of these families." WETTSTEIN (1935), followed by RENDLE (1952), included the *Frankeniaceae* in the order *Parietales* between the *Elatinaceae* and *Tamaricaceae.* On the basis of habit, the presence of small exstipulate leaves and a parietal placentation, HUTCHINSON (1959) as well as TAKHTAJAN (1959) assigned the *Frankeniaceae,* along with *Fouquieriaceae* and *Tamaricaceae,* to the order *Tamaricales.* The comparative embryological features of the *Frankeniaceae* and *Tamaricaceae* are given in Table 1 above (for literature see JOHRI & KAK 1954, DARLINGTON & WYLIE 1955).

As Table 1 shows, the embryology of *Frankenia* differs radically from that of the *Tamaricaceae.* Its assignment to the order *Tamaricales* (HUTCHINSON 1959, TAKHTAJAN 1959) is, therefore, unjustifiable.

The *Caryophyllaceae* are characterized by the following features: free central placentation, 3 to 6 or 12-porate pollen grains, multicelled archesporium, presence of parietal cells in the nucellus, Caryophyllad type of embryogeny (Solanad in *Polycarpon*), curved embryo, exalbuminous seeds, perisperm, seed coat formed only by the outer integument, and absence of endosperm haustoria (JOSHI 1936 a, b; PAL 1952). However, none of these characters occurs in the *Frankeniaceae.* Therefore, BENTHAM & HOOKER's (1862—1883) assignment of this family to the *Caryophyllinae* is also unjustified.

On the other hand, the family *Elatinaceae* appears to resemble the *Frankeniaceae* in several embryological characters. These are: presence of 3-celled pollen grains; bitegminal ovules; absence of parietal cells; monosporic embryo sac; Nuclear endosperm; and wall formation in endosperm at the chalazal end (see SCHNARF 1931). Thus the most appropriate place for the *Frankeniaceae* is in the order *Parietales* near the *Elatinaceae* as also suggested by WETTSTEIN (1935) and RENDLE (1952).

Very little is known about the embryology of the *Fouquieriaceae* which differs from the *Frankeniaceae* in having 3-colporate pollen grains and tenuinucellar ovules (JOHANSEN 1936, KHAN 1943). However, more data are needed before considering the validity of HUTCHINSON's (1959) view.

The possibility of relationship between the *Frankeniaceae* and *Plumbaginaceae* seems to be ruled out by their markedly dissimilar embryological characters. The *Plumbaginaceae* are characterized by an amoeboid tapetum, circinotropus ovules, presence of parietal cells, tetrasporic embryo sac and chalazal endosperm haustoria (see SCHNARF 1931). None of these characters is seen in the *Frankeniaceae*.

It may be concluded that the *Frankeniaceae* should be included in the *Parietales* near the family *Elatinaceae*.

Summary

In *Frankenia* the flowers are bisexual and actinomorphic. The sepals are fused, but the petals are free and clawed. The fruit is a capsule.

The anther wall consists of 5 or 6 layers. The tapetum is binucleate and irregularly 2-layered. The middle layers degenerate at the uninucleate stage of the pollen grains. The epidermis persists in the dehiscing anther. Cytokinesis in the microspore mother cells is simultaneous. Lagging chromosomes during meiosis frequently give rise to extranuclear bodies. The pollen grains are tricolpate and 3-celled.

The ovules are anatropous, and bitegminal. The primordium of an incipient third integument sometimes originates from the outer integument. The archesporial cell functions directly as the megaspore mother cell. The development of the embryo sac is of the Polygonum type.

Fertilaztion is porogamous and syngamy and triple fusion may or may not take place simultaneously. A portion of the pollen tube persists in the seed at the tip of the micropyle.

The endosperm is Nuclear. Wall formation commences at the chalazal end and proceeds upward. A 2 to 4-celled haustorium containing polyploid nuclei is delimited at the micropylar end. The cells of mature endosperm contain starch and crystals. The embryogeny conforms to the Solanad type.

Both integuments contribute to the formation of the seed coat. The outer epidermis of the seed is thrown into finger-like outgrowths with nail-like thickenings at the tip which give a warty appearance to the seed.

The present study supports the inclusion of the *Frankeniaceae* in the order *Parietales* near the family *Elatinaceae* as also done by WETTSTEIN (1935) and RENDLE (1952).

Acknowledgements

We are grateful to Professor P. MAHESHWARI F.R.S. for guidance and encouragement, and to Dr N. N. BHANDARI for helpful suggestions. Thanks are also due to the Council of Scientific and Industrial Research for the award of a research fellowship to one of us (K.W.).

Literature cited

BENTHAM, C. & HOOKER, J. D. 1862—83. Genera Plantarum. London.

— 1947. Handbook of the British Flora. England.

COOPER, G. O. 1942. Microsporogenesis and development of seed in Lobelia cardinalis. — Bot. Gaz. **104:** 72—81.

CORNER, E. J. H. 1949. The annonaceous seed and its four integuments. — New Phytol. **48:** 332—364.

DAHLGREN, K. V. O. 1928. Hakenformige Leistenbildungen bei Synergiden. — Ber. dtsch. bot. Ges. **46:** 434—443.

DARLINGTON, C. D. & WYLIE, A. P. 1955. Chromosome Atlas of Flowering Plants. London.

EICHLER, A. W. 1875. Blütendiagramme. Leipzig.

ERDTMAN, G. 1960. The acetolysis method — a revised description. — Svensk Bot. Tidskr. **54:** 561—564.

[1] GLIŠIĆ, L. M. 1932. Zur Entwicklungsgeschichte von Lathraea squamaria L. — Bull. Inst. Jard. Bot. Univ. Beograd. **2:** 20—56.

GUNDERSEN, A. 1927. The Frankeniaceae as a link in the classification of dicotyledons. — Torreya **27:** 65—71.

[1] HEINRICHER, E. 1931. Monographie der Gattung Lathraea. Jena.

HOOKER, J. D. 1875. The Flora of British India. Vol. I. England.

HUTCHINSON, J. 1959. The Families of Flowering Plants. London.

JOHANSEN, D. A. 1936. Morphology and embryology of Fouquieria. — Amer. Jour. Bot. **23:** 95—99.

JOHRI, B. M. & KAK, D. 1954. The embryology of Tamarix Linn. — Phytomorphology **4:** 230—247.

JOSHI, P. C. 1936 a. Contribution to the life history of Stellaria media L. — Proc. Indian Acad. Sci. B **3:** 8—22.

— 1936 b. Some phases of the life history of two Tibetan Caryophyllaceae — Arenaria musciformis Wall. and Thylacospermum rupifragnum Schrenk. — Proc. Indian Acad. Sci. B **4:** 471—482.

KHAN, R. 1943. The ovule and embryo sac of Fouquieria. — Proc. nat. Inst. Sci. India B **9:** 253—256.

[1] Not seen in original.

MAHESHWARI, P. 1944. The origin of the haustoria in the ovule of Lobelia. — Curr. Sci. **13:** 186—187.

MAURITZON, J. 1933. Über die Embryologie der Turneraceae und Frankeniaceae. — Bot. Notiser: 543—554.

METCALFE, C. R. & CHALK, L. 1950. Anatomy of the Dicotyledons. Vol. I. Oxford.

PAL, N. 1952. A contribution to the life histories of Stellaria media Linn. and Polycarpon loeflingiae Benth. & Hook. — Proc. nat. Inst. Sci. India B **43:** 363—378.

PERIASAMY, K. & SWAMY, B. G. L. 1961. Studies in the Annonaceae — II. The development of ovule and seed in Cananga odorata and Miliusa wightiana. Jour. Ind. Bot. Soc. **40:** 206—216.

RENDLE, A. B. 1952. The Classification of Flowering Plants. Vol. II. Cambridge.

SCHNARF, K. 1931. Vergleichende Embryologie der Angiospermen. Berlin.

SINGH, B. 1959. Studies in the family Malphighiaceae — I. Morphology of Thryallis glauca Kuntze. — Hort. Adv. **3:** 1—29.

SUBRAMANYAM, K. 1951. The origin and nature of haustoria in Lobelia cardinalis L. — Bot. Gaz. **112:** 319—322.

TAKHTAJAN, A. 1959. Die Evolution der Angiospermen. Jena.

VENKATESWARLU, J. & NARASIMHA RAO, P. 1963. Endosperm in Euphorbiaceae and occurrence of endosperm haustoria in two species of Croton Linn. — Curr. Sci. **32:** 514—516.

WETTSTEIN, R. VON 1935. Handbuch der Systematischen Botanik. Leipzig.

WILLIS, J. C. 1948. A Dictionary of the Flowering Plants and Ferns. Cambridge.

BOTANISKA NOTISER 1965 · VOL. 118 · FASC. 4 · LUND

Smärre uppsatser och meddelanden

Några skånska fynd av adventivväxter

Under slutet av 1800-talet och början av 1900-talet ägnade många botanister stort intresse åt den adventiva floran. Detta intresse har åter uppblossat, vilket framgår av moderna floror (HYLANDER 1953, WEIMARCK 1963). Tyvärr har åtskilliga lokaluppgifter från sekelskiftet om tillfälliga invandrare gått förlorade. Fynden är endast sällan publicerade och våra offentliga herbarier hade förr ej resurser att annat än undantagsvis lägga in herbariematerial. Det kan därför vara berättigat att lämna en lista över några skånska lokaler.

Här nämnes endast fynd, som ej tidigare publicerats (HYLMÖ 1947, LANGE, FLINCK & HYLMÖ 1954, HYLMÖ 1958, WEIMARCK 1963). Tyvärr har jag ej systematiskt fört anteckningar, varför åtskilliga arter och lokaler fallit ur minnet. Bland lokalerna skall särskilt nämnas Malmö, där stadens soptipp Sjölunda — numera industriområde vid hamnen — var ett eldorado och träffpunkt för amatörbotanister under 1930-talet. Alldeles säkert finns i glömda eller redan förstörda herbarier åtskilliga i vårt land sällan iakttagna inkomlingar. Jag besökte endast Sjölunda avstjälpningsplats ett fåtal gånger. En andra lokal är Malmö-Limhamn, Vik d.v.s. den remsa som lämnats outfylld av kalkbrottets enorma fyllnadsmassor söder om badplatsen Sibbarp. Här har många amatörbotanister samlat mängder av intressanta ruderatväxter.

Setaria verticillata (L.) Beauv. — Hälsingborg vid Ramlösa järnvägsstation 1950.

S. glauca (L.) Beauv. — Saxtorp, Flygeltofta gård i lökodling 1951 (K. E. FLINCK).

Panicum miliaceum L. — Malmö, Sjölunda 1932.

Echinochloa crus-galli (L.) Beauv. — Löddeköpinge, sandiga åkrar, massförekomst 1949—1955. Bjuv, Mörshög 1947. Arten uppträdde som ogräs i köksväxter på ett flertal ställen i västra Skåne 1947—1957.

Anthoxanthum aristatum Boiss. — Malmö, Sjölunda 1934.

Bromus japonicus Thunb. — Malmö, turbinen 1909 (D. HYLMÖ).

B. squarrosus L. — Malmö, turbinen 1907 (D. HYLMÖ).

Hordeum jubatum L. — Malmö, Sjölunda, massförekomst 1933—1945 (jfr ASKER 1959).

Fagopyrum esculentum Moench — Fleninge, i konservärter (amerikanskt utsäde) 1944.

Chenopodium murale L. — Malmö, Sjölunda 1936. Lackalänga, ullruderat 1953.

Ch. pratericola Rydb. — Malmö, Sjölunda 1933.
Axyris amaranthoides L. — Malmö, Sjölunda 1932.
Amaranthus retroflexus L. — Malmö, Limhamn 1932.
Claytonia perfoliata Donn — Falsterbo, tångvall (F. ÅBOM) 1932—1955.
Silene dichotoma Ehrh. — Allmän i klövervallar Bjuv, Mörarp och Hässlunda socknar 1945—1960.
Brassica juncea (L.) Czern — Malmö, Sjölunda 1933, 1934.
Erucastrum gallicum (Willd.) O. E. Schulz — V. Klagstorp, Klagshamn hamnområdet, massvis 1931.
Diplotaxis tenuifolia (L). DC. — Limhamn, hamnen 1930—1945.
Lepidium perfoliatum L. — Malmö, Sjölunda 1932.
Erysimum repandum L. — Malmö, Sjölunda 1932.
Sisymbrium orientale L. — Malmö, Sjölunda 1934.
Camelina sativa (L.) Cr. ssp. *sativa* — Svedala 1934.
Reseda lutea L. — Malmö, Sjölunda 1938.
R. luteola L. — Lackalänga, ullruderat 1949.
R. alba L. — Limhamn hamnområde 1931.
Potentilla norvegica L. — Barsebäck, Oxhagslyckan 1947.
P. intermedia L. — Malmö, Sjölunda 1934.
Trifolium scabrum L. — Lackalänga, ullruderat 1949.
Coronilla varia L. — Åkarp, banvall 1952.
Vicia pannonica Cr. ssp. *pannonica* — Limhamn, mängder i rågåker 1936 (F. ÅBOM).
ssp. *striata* (Bieb.) Gris. — Malmö, Sjölunda 1932; Simrishamn 1934.
V. dasycarpa Ten. — Malmö, Sjölunda 1934.
Lathyrus heterophyllus L. — Norra Vram, Söderåsen, i granskog 1943—1962.
Oxalis europea Jord. — Mörarp, Magnehill 1947—1960; Halmsta by 1960—1965.
O. corniculata L. — N.V. Ringsjön, dominerande hektarvis i ett flertal flerårsvallar 1937.
Chaerophyllum bulbosum L. — Lomma, Alnarps Mellangård, förvildad 1937.
Anthriscus cerefolium (L.) Hoffm. — Limhamn, Sibbarp 1934, kvar på 1950-talet.
Scandix pecten-veneris L. — Lomma, rågåker, massvis 1938.
Smyrnium perfoliatum L. — Alnarp 1936—1950.
Falcaria vulgaris Bernh. — Limhamn, Hyllie kyrkoväg, en planta, ca 1905 (D. HYLMÖ), kvar 1955; Malmö, Bellevuevägen ca 1905—1945 (under de sista åren brukades ej angränsande åker och den ursprungliga plantan förökade sig vegetativt för att slutligen täcka en yta av flera 100 m^2).
Cuscuta australis R. Br. — Kropp sn, Mörarp sn, Tågarp sn och Eslöv, massförekomst i rödbetor, utsäde från Holland 1963.
Phacelia tanacetifolia Benth. — Limhamn, hamnen 1931.
Lappula myosotis Moench — Malmö, Sjölunda 1932.
Dracocephalum thymiflorum L. — Malmö, Sjölunda 1932.
Stachys annua (L.) L. — Lund, veteåker 1936; Lomma, rågåker 1936.
Salvia verticillata L. — Kvarnby, banvall 1936.
Mentha spicata L. — Malmö, Sjölunda 1932; Limhamn 1932.

M. gentilis L. — Limhamn 1932.
M. longifolia (L.) L. — Limhamn 1932.
Solanum adventitium Polgán. — Lomma, Alnarps Mellangård, kvarleva från genetiska undersökningar 1937—1950.
Scrophularia vernalis L. — Alnarps park 1938—1962.
Dipsacus fullonum L. ssp. *sativus* (L.) Thell. — Malmö, Sjölunda 1932.
D. strigosus Willd. — Åkarp, banvall 1931—1965; Limhamn 1932—1965 (jfr ASKER 1959).
Erigeron annuum (L.) Pers. — Malmö, Slottsparken, stationär vid fågeldamm 1931—1965, Sjölunda 1938; Bjuv, inkommen med plantskolematerial från Schweiz 1957—1965.
Telekia speciosa (Schreb.) Baumg. — Norra Vram, i bokskog 1949—1960.
Ambrosia psilostachya DC. — V. Klagstorp, Klagshamn, hamnen, massvis 1931—1932 (först felaktigt bestämd till *A. artemisiifolia* L; WEIMARCK 1963).
Xanthium spinosum L. — Malmö, Sjölunda 1934.
Rudbeckia hirta L. — Bjuv, Lilla Mörshög 1947.
Chrysanthemum macrophyllum W. & K. — Alnarp 1927; Mölle hamn 1936—1955.
Carduus leiophyllus Petrov. — Malmö, Sjölunda 1933.
Centaurea nigra L. — Limhamn, Sibbarp 1936 (F. ÅBOM).
C. jacea×*nigra* — Limhamn, Sibbarp 1936.
C. rhenana Bor. — Kvarnby, massvis 1936—1945.
Leontodon nudicaulis (L.) Banks ex Lorve — Malmö, Slottsparken, stationär 1934—1965.
Tragopogon porrifolius×*pratensis* ssp. *pratensis* — Lomma Mellangård 1938.

Litteratur

ASKER, S. 1959. Flora och vegetation i Malmö. — Bot. Notiser 112, 257.
HYLANDER, N. 1953. Nordisk kärlväxtflora I. Stockholm.
HYLMÖ, B. 1947. Notiser om ullfloran i Lackalänga. — Bot. Notiser 100, 81.
— 1958. Några intressanta ogräs i konservväxtgrödor. — Ibid. 111, 393.
LANGE, TH., K. E. FLINCK & B. HYLMÖ 1954. Om ullfloran vid Lackalänga i Skåne. — Ibid. 107, 186.
WEIMARCK, H. 1963. Skånes Flora. Malmö.

BERTIL HYLMÖ
Findus-Nordreco, Bjuv

En nyupptäckt lokal för Scutellaria minor på Bjärehalvön i Skåne

NILS DAHLBECKS sensationella fynd av *Scutellaria minor* i nordvästra Skåne år 1944 — tidigare ej funnen i Skandinavien — publicerades i Botaniska Notiser 1944 av HELGE RICKMAN med orden: »S. minor: en klimax i en botanists liv att i naturen få skåda denna i år för Skandinavien nyupptäckta växt.» Växtlokalen, ett kärr utmed stranden söder om Torekov, besöktes d. 20.9.1944. »Trots årstiden funnos ännu gott om blommande exemplar och hela individantalet torde uppgå till flera 100-tal.»

STEN SELANDER har i en vacker och intressant essay i form av understreckare i Svenska Dagbladet den 3.7.1948 skildrat bl.a. detta märkliga nya växtfynd: »Särskilt kärren mot landsidan, där källflöden ur grusbacken silar över den svaga sluttningen, hyser en artrik och ytterst spännande flora; varje gång jag varit här nere har jag hittat någon växt, som jag tidigare gått förbi. Häromåret fann Nils Dahlbeck vid en av sumparna en frossört, Scutellaria minor, som förut inte var känd från närmare håll än från England och en eller annan lokal i Västtyskland. Ännu har jag inte uppgivit hoppet om att lyckas leta reda på den också vid någon annan göl, fast den frossört som växer vid ett par av dem opassande nog visat sig ha blå blommor som våra två vanliga svenska arter och inte skära som minor.»

Inspirerade av SELANDERS understreckare lyckades jag och min fru efter systematiskt sökande på strandängarna söder om Torekov den 5.7.1948 uppspåra den sällsynta lilla växten med de små skära blommorna vid Påarp i V. Karup, sannolikt vid samma sump som ovan nämnts.

STEN SELANDER hade för sin år 1959 postumt utgivna essaysamling »Mark och rymd» bearbetat den förut omnämnda essayen »Strand vid Kattegatt» och där gjort bl.a. följande tillägg: »Och sedan har jag hittat den (S. minor) i många av de kärr där källflöden ur grusbacken silar över den svaga sluttningen. När kom den hit, och hur? Och varför växer den bara här, längs någon halvmil av stranden, och inte likaväl uppåt Hov, där det finns gott om alldeles likadana strandgölar? Fråga mig inte: varken jag eller någon annan kan ge ett svar.»

HENNING WEIMARCK har i sin år 1963 utkomna »Skånes Flora» infört bl.a. följande uppgifter: »S. minor. Huds. 1762 — Småfrossört. — Oceanisk; fukthedar, kärr; från Påarp till Dagshög i V. Karup, upptäckt av DAHLBECK 1944 (RICKMAN BN 1944), f r i d l y s t 1944; närmaste fyndorter i n.v. Tyskland, Belgien, Holland och England.» I floran finns även uppgifter om hybriden »S. galericulata×minor. — Påarp (WEIMARCK 1952, HYLANDER 1955 BN 1959, LÖVKVIST 1958 1960) och Dagshög (WEIMARCK 1952) i V. Karup.»

Åren 1948—1965 (undantag 1964) har jag inspekterat Påarpslokalen och med tillfredsställelse kunnat konstatera, att *S. minor* hållit sin position. Individantalet har givetvis växlat år från år, men någon tydlig tendens till ökning eller minskning har jag ej kunnat fastställa; den rätt hårda kreatursbetningen utgör kanske en reglerande faktor för status quo.

År 1963 företog jag tillsammans med tandläkaren FOLKE HARBOE, Ängelholm, den sedvanliga inspektionen den 19 juli. Från Påarpslokalen i V. Karup gick färden vidare samma dag till Hov socken, där vi strövade på strandängarna s.v. Hovshallar. Och döm om vår glädje, när vi helt plötsligt och oväntat stod öga mot öga med *Scutellaria minor*! Beståndet var fåtaligt; endast två exemplar kunde vi finna, det ena vackert blommande, det andra naggat i toppen av beteskreatur.

S. minor är alltså funnen »likaväl uppåt Hov». Med hänsyn till det nya fyndet behöver kanske för arten gällande fridlysningsbestämmelser kompletteras.

Den 30 augusti 1965 gjorde vi tillsammans ett nytt besök på exakt samma plats men kunde då tyvärr inte finna något exemplar av *S. minor*. Växtplatsen för 1963 års fynd var till följd av det myckna regnandet starkt vattendränkt

och dessutom trampad av kreatur. Av allt att döma torde *S. minor* vara en känslig och i många avseenden ytterst kräsen liten växt, som detta år måhända föredrog att avvakta gynnsammare betingelser för sitt framträdande. Vid Påarpslokalen, som även besöktes ovannämnda dag, funno vi vackert blommande exemplar på torrare mark, däremot inte i själva kärret, som var ovanligt blött. Vi ha dock ansett det vara av intresse att registrera vårt fynd från 1963, vilket kanske kan tolkas så, att arten kan vara stadd i spridning.

CARL VON DELWIG
Sigurdvägen 14, Djursholm

BOTANISKA NOTISER 1965 · VOL. 118 · FASC. 4 · LUND

Nordisk förening för taxonomisk botanik 1965

Föreningens tillkomst

Förslag om bildandet av en nordisk sammanslutning av för systematisk botanik intresserade väcktes vid en diskussion i Lund våren 1964. Närvarande vid diskussionen var prof. WEIMARCK, doc. DAHLGREN och doc. RUNEMARK, alla Lund, samt doc. HEDBERG, Uppsala.

I dec. 1964 utsändes en cirkulärskrivelse till kolleger i Norden med förfrågan om intresset för en sådan förening och med förslag att förlägga det första mötet i Lund i juni 1965. Ett stort antal positiva svar inkom.

I en skrivelse i febr. 1965 inbjöds nordiska växtsystematiker till ett konstituerande möte i Lund den 8—12 juni 1965. 55 deltagare från Danmark, Finland, Norge och Sverige anmälde sig. Alla kunde dock ej infinna sig.

En organisationskommitté för detta möte, bestående av prof. WEIMARCK, doc. RUNEMARK och fil. kand. KARIN NILSSON, bildades.

Protokoll fört vid föreningens första möte den 8—12 juni 1965

Den 8 juni. Sammanträde på Histologiska institutionens föreläsningssal (reparationsarbetena på Botaniska institutionen hade ännu ej avslutats). Närvarande omkr. 50 personer.

§ 1. Prof. WEIMARCK hälsade de närvarande hjärtligt välkomna.

§ 2. Prof. WEIMARCK frågade deltagarna, om de ville bilda en nordisk förening. Frågan besvarades enhälligt jakande.

§ 3. Det föreslogs, att organisationskommittén för mötet skulle fungera som presidium denna gång, med prof. WEIMARCK som ordf. och doc. RUNEMARK som sekr. Beslut fattades i enlighet med detta förslag.

§ 4. Ett stencilerat utkast med i vissa fall alternativa förslag till stadgar hade tillställts deltagarna vid ankomsten till Lund. Föreningen beslöt att diskutera stadgarnas utformning med utgångspunkt från detta förslag.

§ 5. Prof. WEIMARCK föreslog, att en kommitté skulle bildas med en representant för varje deltagande nordiskt land och att denna med ledning av en

inom föreningen förd diskussion skulle utarbeta definitivt förslag till stadgar. Föreningen beslöt i enlighet med detta.

§ 6. Vid den följande diskussionen föreslog prof. NANNFELDT åtskilliga formella ändringar i det ursprungliga stadgeförslaget. Beträffande § 1 ansåg stipendiat SKOGEN, att vissa delar av växtgeografin borde innefattas i föreningens intresseområde. Beträffande § 3 föreslog prof. NANNFELDT, att ordinarie sammanträde bör hållas vartannat år, att vid ett sammanträde plats bestämmes för det nästkommande och att under mellanliggande år exkursion kan anordnas. Prof. LARSEN stödde prof. NANNFELDTS mening, och doc. RUNEMARK framhöll värdet av exkursioner.

Prof. NANNFELDT föreslog ang. § 4 att en styrelseledamot från varje nordiskt land utses av resp. länders representanter, medan föreningen i dess helhet utser ordförande och sekreterare.

Beträffande § 6 ifrågasatte prof. NANNFELDT lämpligheten av förslaget att ett medlemsblad skulle innehålla recensioner och förteckning över nordisk systematisk och floristisk litteratur. Doc. RUNEMARK argumenterade för en ovannämnd dylik förteckning, och denna mening stöddes av prof. LARSEN och dr KNABEN. Doc. HEDBERG ansåg en förteckning önskvärd men betvivlade, att föreningens ekonomi skulle tillåta ett sådant projekt.

§ 7. Till stadgekommitté utsågs prof. LARSEN, prof. VAARAMA, dr KNABEN och prof. NANNFELDT med prof. NANNFELDT sammankallande. Kommittén åtog sig att framlägga förslag sista sammanträdesdagen, d.v.s. fred. den 11 juni.

§ 8. Föreningens medlemmar deltog i en av Lunds stad anordnad lunch på restaurang Åke Hans.

§ 9. Prof. WEIMARCK redogjorde för de olika forskningsriktningarna vid institutionen för systematisk botanik i Lund och lämnade en redogörelse för de pågående undersökningarna över Skånes flora.

§ 10. Institutionen med trädgård och växthus demonstrerades av prof. WEIMARCK, doc. RUNEMARK, lic. SNOGERUP och lic. STRANDHEDE.

Den 9 juni. Sammanträde på Histologiska institutionen.
Närvarande omkr. 50 personer.

§ 1. Föredrag av dr KNABEN om »Cytotaksonomiske studier i Pyrolaceae». Efter föredraget yttrade sig prof. WEIMARCK och doc. RUNEMARK.

§ 2. Föredrag av lic. STRANDHEDE om »Problem inom Eleocharis palustris-komplexet». I den efterföljande diskussionen yttrade sig prof. NANNFELDT, prof. MUNK och mag. TENGNÉR.

§ 3. Föredrag av lic. NORDBORG om »Artavgränsning inom Sanguisorba minor-komplexet». Efter föredraget yttrade sig prof. WEIMARCK.

§ 4. Föredrag av intendent SPARRE om »Linnés Tropaeolum-arter och deras historiska bakgrund».

§ 5. Föredrag av amanuens ALFRED HANSEN om »De i Danmark fundne Amaranthus-arter».

§ 6. Föredrag av mag. TENGNÉR om »Dacrydium — anatomi och systematik».

§ 7. Lunds universitet representerat av prorektor prof. STJERNQUIST och universitetsrådet HAMMAR, anordnade mottagning för föreningen i universitetets pelarsal.

Den 10 juni. Exkursion till östra Skåne under ledning av prof. WEIMARCK. Deltagare 46 personer.

Vid Bäckahalladalen och Gladsax hallar studerades oligotrof flora på vittringsjord från sandstenen och eutrof flora på den kalkrika moränen. Bland mera anmärkningsvärda arter märktes *Drosera rotundifolia, Juncus squarrosus, Trichophorum caespitosum, Helianthemum nummularium, Orchis morio* samt den naturaliserade *Ulex europaeus.*

Vid Stenshuvud, som utgör ett naturskyddat område, sågs en av Sveriges största skogar av *Carpinus betulus.* Bland övriga arter märktes *Hedera helix, Montia minor* och *Orchis majalis.* På de sydexponerade branterna med kalkrik sand vid Galgbacken i Brösarp sågs bl.a. *Alyssum calycinum, Androsace septentrionalis, Anthericum liliago* (ännu ej i blom), *Festuca polesica, Hutchinsia petraea, Poa bulbosa* och *Koeleria glauca.*

Vid Ravlunda skjutfält betonade prof. WEIMARCK, att samarbetet mellan naturskydd och militära myndigheter varit gott, och en stor del av skjutfältet i söder utefter Skepparpsån (Verkeån) hade kunnat skyddas och undantagas från militära övningar. Exkursionen följde ett stycke av den väg, nu kallad Linnés väg, som LINNÉ kom 1749 på sin färd från Maglehem till Ravlunda. På backarna intill denna väg iakttogs bl.a. *Botrychium lunaria, Hutchinsia petraea* och *Silene conica.* Vid Havängsdösen sågs mängder av *Anemone pratensis* och *Dianthus arenarius.*

Vid Breabäck i Andrarum stannade exkursionsdeltagarna vid en rik lövskog på fuktig mark. Här fanns bl.a. *Campanula latifolia, Lunaria rediviva, Lysimachia nemorum, Petasites albus* och *Thalictrum aquilegiifolium.*

Vid Vitemölla slutligen studerade man växtligheten på kalkhaltig sand. Särskilt *Astragalus arenarius* tilldrog sig uppmärksamhet. Exkursionen avslutades med gemensam middag på Vitaby hotell.

Den 11 juni. Sammanträde på Histologiska institutionen.

§ 1. Föredrag av doc. MÄKINEN om »Morfologisk variation av finska Phragmidiumarter». Efter föredraget yttrade sig prof. NANNFELDT och doc. RUNEMARK.

§ 2. Föredrag av doc. ALMBORN om »Artproblemet inom lavsystematiken». I diskussionen deltog prof. MUNK och doc. RUNEMARK.

§ 3. Föredrag av prof. MUNK: »Om taksonomiske kriterier». Efter föredraget yttrade sig prof. LARSEN.

§ 4. Prof. NANNFELDT föredrog stadgekommitténs förslag till stadgar. Synpunkter framfördes av prof. LARSEN, prof. VAARAMA, doc. MÄKINEN och stipendiat SKOGEN. Stadgeförslaget godkändes enhälligt i föreliggande skick.

§ 5. Föreningen beslöt att med tacksamhet acceptera prof. VAARAMAS erbjudande att ordna nästa sammanträde för föreningen 1967 i Åbo.

§ 6. Prof. LUTHER, Helsingfors, valdes enhälligt till föreningens ordförande för den kommande perioden.

§ 7. Till sekreterare valdes, likaledes enhälligt, doc. AARNO ROUSI, Åbo.

§ 8. Till suppleant för sekreteraren valdes enhälligt doc. TEUVO AHTI, Helsingfors.

§ 9. Till styrelseledamöter jämte suppleanter valdes: för Danmark prof. LARSEN — suppl. prof. MUNK, för Finland prof. VAARAMA — suppl. prof. JALAS, för Norge dr KNABEN — suppl. stipendiat SKOGEN, för Sverige prof. WEIMARCK — suppl. prof. NANNFELDT.

§ 10. Till revisorer valdes prof. NORLINDH och konservator KAASA och till suppleanter för dessa doc. ALMBORN och dr JACOBSEN.

§ 11. Prof. MUNK föreslog, att stadgarna genom styrelseledamöternas försorg skulle översättas till de olika nordiska språken. Föreningen beslöt enligt förslaget.

§ 12. Föredrag av mag. NORDENSTAM om »Synpunkter på Karroofloran». Efter föredraget yttrade sig prof. NORLINDH.

§ 13. Föredrag av assistent STRID om »Populationsstudier inom Nigella arvensis-gruppen».

§ 14. Föredrag av doc. RUNEMARK om »Statistiska synpunkter på spridning». I diskussionen deltog civ.ing. RYVARDEN, stipendiat SKOGEN, mag. NORDENSTAM, doc. DAHLGREN och prof. NANNFELDT.

Den 12 juni. Exkursion till Skäralid och Kullen under ledning av prof. WEIMARCK.

Omkr. 35 deltagare.

Sprickdalen vid Skäralid demonstrerades av doc. ÅKE PERSSON. Bl.a. påpekade han förekomsten av dels oceaniska och dels nordliga växter, framförallt bland mossor och lavar. Särskilt nämndes *Porella laevigata, Cladonia alpestris, C. bellidifolia* och *Normandina pulchella.* I bäckdalen växte rikligt *Thalictrum aquilegiifolium.* Deltagarna vandrade förbi Forshall och tog den lättgångna stigen upp till Kopparhatten, där bussen väntade.

Vid Kullen startade man från Mölle och vandrade längs stranden till Badviken, där bussen mötte. Krattskogen och främst *Quercus petraea* och *Fraxinus excelsior* studerades med dess fältskikt av bl.a. *Alliaria officinalis, Allium ursinum* och *Lathyrus niger. Lathyrus sphaericus* eftersöktes förgäves. Vid Ablahamn besågs det praktfulla beståndet av *Lunaria rediviva.*

Exkursionen avslutades vid Systrarna Lundgrens berömda kaffestuga, Skäret.

Deltagare i symposiet med Nordisk förening för taxonomisk botanik 8—12 juni 1965

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DAHLGREN, ROLF, docent, Inst. för syst. bot., Ö. Vallg. 18, Lund, Sverige
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LAINE, KAIJA, hum. kand., Bot. inst., Turku universitet, Turku, Finland
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WIDÉN, KARL-GUSTAV, fil. kand., Lönnrotsg. 9 D 1S, Helsingfors, Finland

Senare tillkomna medlemmar, som ej deltog i symposiet[1]

AFZELIUS, KARL, fil. dr, Riksmuseets bot. avd., Stockholm 50, Sverige
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[1] Sedan denna lista färdigställts har ett flertal nya medlemmar tillkommit.

RÖNNING, OLAF I., dr. philos., Det Kgl. Norske Videnskabers Selskab, Museet, Den bot. avd., Trondheim, Norge
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Stadgar för Nordisk förening för taxonomisk botanik

§ 1. Föreningens uppgift är
att främja den rena och tillämpade taxonomiska botaniken med därtill anknutna vetenskapsgrenar och bevaka dessa vetenskapers intressen samt att underlätta och stärka kontakten och samarbetet mellan Nordens växttaxonomer.

§ 2. Medlem av föreningen kan varje person eller institution bli, som är intresserad av föreningens syfte och som anmäler sig till någon styrelseledamot eller suppleant.

§ 3. Ordinarie sammanträde med exkursion(er) hålles vartannat år på plats, som alternerar mellan de nordiska länderna. Vid ordinarie sammanträde bestämmes plats för nästa sammanträde.
Mellanliggande år kan en exkursion ordnas inom Norden eller till annat område, där nordiska botanister bedriva forskning.

§ 4. Föreningens styrelse består av ordförande, sekreterare och en ledamot från varje nordiskt land. Ordföranden och sekreteraren jämte en suppleant för den senare väljas av föreningen i dess helhet, övriga styrelseledamöter jämte en suppleant för var och en av dem väljas av föreningsmedlemmarna från respektive land. Alla val förrättas å ordinarie sammanträde och avse tiden till nästa ordinarie sammanträde.
Styrelsen utser inom sig vice ordförande.

§ 5. Sammanträden och exkursioner organiseras i samråd med styrelsen av medlemmar från berörda institutioner.

§ 6. Föreningen utger ett årsmeddelande innehållande föreningsangelägenheter, förteckning över aktiva forskare, deras aktuella adresser och arbetsuppgifter och andra meddelanden av intresse för medlemmarna. Föreningens sekreterare tjänstgör som redaktör.

§ 7. Årsavgiften är 10 sv. kronor för enskilda medlemmar och 100 sv. kronor för institutioner.
§ 8. Föreningens sekreterare tjänstgör som kassör. Räkenskaperna skola avslutas kalenderårsvis.
§ 9. Vid ordinarie sammanträde väljas 2 revisorer jämte 2 suppleanter för löpande och nästkommande kalenderår.
Revisionsberättelsen skall föreligga vid följande ordinarie sammanträde.

Autoreferat av föredrag hållna vid symposiet med Nordisk förening för taxonomisk botanik 8—12 juni 1965

Organisation och verksamhet vid Institutionen för systematisk botanik i Lund

Institutionen inrymmes i flera byggnader i Botaniska trädgården. Trädgården och de äldsta byggnaderna, Agardhianum och växthusen, tillkom under J. G. AGARDHS tid på 1860-talet. Före denna tid hade trädgården legat mellan Akademiska föreningen och nuvarande universitetsbyggnaden. Vid trädgårdens sydvästra hörn ligger den vita institutionsbyggnaden, f.d. Botaniska laboratoriet, som till 1964 var Institutionen för fysiologisk botanik och nu inrymmer undervisningslokaler för systematisk botanik och ekologisk botanik samt laboratorier för det senare ämnet. I trädgårdens mitt vid Ö. Vallgatan ligger Botaniska muséet, som byggdes under prof. MURBECKS tid och blev färdigt 1912. Nära muséet ligger de äldre, nu till en del helt ombyggda växthusen och nära Agardhianum de nya experimentväxthusen samt trädgårdskontoret och den nytillkomna personal- och verkstadsbyggnaden.

Vid institutionen bedrivs växttaxonomi, grundad på morfologi och växtgeografi, cytotaxonomi och på senare tid även kemotaxonomi.

Morfologin och växtgeografin har hemvist på Botaniska muséet. Där arbetar doc. ALMBORN med lavar, f.n. särskilt med lavar från Afrika, doc. DAHLGREN med sydafrikanska fanerogamer, framför allt med papilionacésläktet *Aspalathus,* doc. HJELMQVIST med morfologiska och embryologiska problem samt med kulturväxternas, särskilt våra sädesslags historia, fil. kand. LINDBERG med kompositésläktet *Phagnalon,* assistent ÖRJAN NILSSON med fam. *Portulacaceae,* fil. mag. NORDENSTAM med kompositéer från Aegeis och Sydafrika, fru ELSA NYHOLM (f.n. tjänstledig) med Skandinaviens mossflora samt undertecknad med fanerogamer och Skånes flora.

Cytotaxonomi och kemotaxonomi hör hemma på Agardhianum, och dess representanter har experimentodlingar i trädgården, bänkgården och de nya växthusen. Här bearbetar lic. BJÖRKQVIST *Alismataceae,* fil. kand. v. BOTHMER *Allium* från Aegeis, mag. BRUNSBERG *Lathyrus,* mag. ENGLESSON *Cerastium semidecandrum*-gruppen, lic. KJELLQVIST *Festuca rubra*-komplexet, fil. kand. KARIN NILSSON *Artemisia,* lic. NORDBORG *Sanguisorbeae,* mag. ULF OLSSON *Mentha,* doc. RUNEMARK evolutionsproblem inom Aegeis, lic. SNOGERUP *Juncus* och *Cheiranthus,* lic. STRANDHEDE *Eleocharis palustris*-gruppen, fil. kand. STRID *Nigella,* mag. WEIMARCK *Hierochloë* och mag. VÄRENDH *Valeriana.*

Därefter redogjordes för undersökningarna över floran i Skåne, vilka pågått sedan 1938. 1963 kom en första upplaga av Skånes Flora, omfattande omkr. 1200 indigena och naturaliserade arter samt ett stort antal adventiver och hybrider. Av Skånes 11250 kvkm återstår nu omkr. 900 kvkm att undersöka. Det är meningen, att en ny upplaga med illustrationer och kartor skall komma ut, när hela fältarbetet är genomfört.

Skåne har högst skiftande jordar och växlande klimat. De högre belägna delarna är i allmänhet täckta av urbergsmorän och hör edafiskt och klimatiskt till Fennoskandia, de mellersta och de lägre belägna områdena har i regel ±kalkrika, ofta leriga jordar och hör till Skanodania och därmed växtgeografiskt till Mellaneuropa.

Prov på utbredningskartor visades. Omkr. 800 arter har en sådan utbredning, att kartering är motiverad.

Många för landskapet nya arter har upptäckts under arbetets gång, åtskilliga klassiska fynd har kunnat verifieras, medan andra arter försvunnit.

HENNING WEIMARCK

Cytotaxonomical Studies in Pyrolaceae

Genera, species and taxa of lower rank in *Pyrolaceae* vary clearly in quantitative characters. The distinguishing characters are measurable and surely multifactorial: size of leaves, length of racemes, number of flowers, length of styles and calyx lobes, likewise, size of anthers, etc. In *Pyrolaceae* there are all transitions from the contrasting characters separating genera and remote species to those e.g. of the *Pyrola rotundifolia* complex which have been difficult to analyse and appreciate taxonomically. The rank of the taxa in this group has also been difficult to ascertain, some of them having been by some authors regarded as species, by others as subspecies.

The Linnean *P. rotundifolia* complex comprises a large number of taxa in temperate and arctic areas in the northern hemisphere. Today they are treated as specifically distinct: *incarnata, japonica, asarifolia, americana, elliptica, picta, grandiflora, norvegica* and *rotundifolia* s.str. The latter is now identical with subsp. *rotundifolia* in temperate Eurasia westwards to Central Europe and Southern Scandinavia. The eastern boundary in Asia is uncertain. Along the British Channel and on or near the shores in Jutland, Scania and South Norway it is replaced by subsp. *maritima* (Kenyon) Warb. (syn. var. *arenaria* Koch). It can be mentioned that the latter taxon was given under the name *arenaria* also from the valleys of the lower Alps by Dr. ALEFELD and later by HEGI, and in accordance with this, by Polish and Czecho-Slovak manuals, from Tatra. Dr. B. KŘÍSA refers the Central European subalpine taxon to *P. intermedia,* a nomen nudum first published in SCHLEICHER's flora lists from Helvetia in 1815. KŘÍSA holds that *P. intermedia* also occurs in Scandinavia in arctic, subarctic and montane areas where *norvegica* belongs. The latter has been given subspecific rank in the combination *P. grandiflora* Rad. subsp. *norvegica* (Knaben) Löve & Löve in agreement with professor E. HULTÉN who thinks that *P. grandiflora* is circumpolar, and that *norvegica* has arisen through introgression in the Scandinavian area, where *P. grandiflora* and *P. rotundi-*

folia meet. It is true that *P. norvegica* in some respects shows transition as to some characters standing between *P. rotundifolia* and *P. grandiflora.*

The present author has come to the conclusion that the three taxa, *P. grandiflora, P. norvegica* and *P. rotundifolia* s.str., are standing on the same step in evolution. They are to be treated as taxa with the same rank, either species, or subspecies of a broad *P. rotundifolia* L. Through thorough analyses, on cytological and morphological grounds, she has found clear discontinuities separating them. This is discussed in a paper now in print in Bergen University Annals.

Here only a few comments. The taxa have all n=23 chromosomes, but they are distinct as to chromosome structure. The present author pays great attention to this fact, because she has unravelled a similar karyotypical variation in all investigated *Pyrolaceae* taxa at the specific and generic level. She does not agree with KŘÍSA's points of view. There is no reason for splitting up the *P. grandiflora—P. norvegica* complex in northern Eurasiatic areas introducing a third taxon, *P. intermedia,* there. All the herbarium specimens determined to *P. intermedia* by KŘÍSA, which belong to the Scandinavian Botanical Museums, is seen by the present author. They are either *P. norvegica* or *P. grandiflora.*

In the opinion of the present author subsp. *maritima* is a good morphological-ecological race of *P. rotundifolia.* It shows the same leaf and calyx characteristics as this species, and agrees also in anther morphology. The few dried specimens available from the lower Alps of the subalpine form of *P. rotundifolia* s.str. are not identical with *P. norvegica* from subalpine districts in Scandinavia. Whether the type deserves a specific name of its own in line with *P. norvegica-grandiflora* cannot be ascertained on the available material.

The author had in 1960 opportunity to see the herbarium material of *P. rotundifolia* from Great Britain, belonging to British Museum and to the Royal Botanical Garden in Edinburgh. The collections from Scotland in many respects show agreement with *P. norvegica.* It would be of interest to analyse mass collections from this area after the same methods as used in treating the occurrences in Scandinavia.

Pyrolaceae are not suitable for experimental studies, because the germination physiology of the seed in relation to the growth of mycorrhiza is not known. There are considerable difficulties in raising plants from seeds. *P. norvegica* and *P. rotundifolia* have, therefore, been analysed on morphological grounds on the large herbarium material available from the Scandinavian area, — of *P. grandiflora,* on material from Alaska, Greenland, and the few localities known of it in the Siberian area. Besides, mass collections of single individuals of different clones from series of populations of *P. norvegica* and *P. rotundifolia* have been investigated. These species have been studied also in extensive field studies in the Norwegian area.

In *P. norvegica* and *P. rotundifolia* the population studies on the Scandinavian material revealed significant differences in the following characteristics: length of petioles, length and breadth of laminas, thickness and length of the scapes, length and number of flowers of the racemes, and number of free vein ends in the petals. Length of anthers and length of petioles and laminas were treated statistically on specimens from collections evenly distributed in Norway. The material for this explicit treatment was chosen as follows: three leaves from each of three specimens from 100 localities through-

out Scandinavia were picked out. In this material the length of petioles and laminas and the ratios: length of petiole/length of lamina show highly significant differences in the two taxa.

The anthers also show significant differences as calculated on 300 anthers of each taxon from 20 localities evenly distributed throughout Scandinavia.

The field studies have revealed the great individual modifiability of all the investigated taxa. The specimens of *P. norvegica* from sunny, dry or rocky habitats are of low stature, short-leaved and with thick scapes. The floral characters: calyx and calyx lobes vary also in accordance with the change in environments. In sunny habitats the calyx wall becomes yellowish red, almost as red as the style, and gets an uneven surface. It seems as if the epidermis is too wide, and it forms a corolla-like fold at the base. This fold may appear in single individuals of *P. rotundifolia*, but it is never as pronounced in this species as in *P. norvegica*. Individuals of *P. norvegica* in subalpine birch and pine woods stretch, seemingly, becoming taller with more flowers in the racemes and more leaves in the rosettes. The graphs of the length of the petioles and laminas show a conspicuous positive skewness due to the fact that there is a limit for the modification of the petiole to the left, — it cannot be shorter than half a centimeter —, whereas the petioles in specimens growing up from under twigs or in a thick moss carpet can be curiously long. The measurements show that the petioles in *P. norvegica* vary in length between 0.4 and 6 cm, with mean $\bar{x}=2.25$ cm and median $M=3{,}2$ cm.

The leaves and calyx in *P. rotundifolia* and *P. grandiflora* are modified in the same way as *P. norvegica*. This is one of the reasons why *P. norvegica* seems to constitute a transition, connecting the two species.

The petioles in *P. rotundifolia* vary in length between 1.6 and 9.6 cm, with mean $\bar{x}=5.00$ cm and median $M=5.6$ cm.

P. grandiflora stands out as to vegetative and floral characters by the characteristics generally mentioned in the manuals. The leaves in the specimens from the westernmost occurrences in Siberia on the shores of the Arctic Sea at Kolgujev Island, Novaya Zemlya and Waigatch, are small with the characteristic red tinge of this species. The stature of the plants is low, the scapes, however, with the characteristic broad scales and large but few flowers. The specimens are modified in the same direction as *P. norvegica* is in the Kola Peninsula (Ponoj and Murmansk) and Rybachi Peninsula, i.e. at its eastern boundary. The fact that the two taxa do not show continuous variation is best seen from the morphology of the calyx lobes and the anthers. The calyx lobes are broader and longer acuminate in *P. grandiflora* than in *P. norvegica*. The anthers are terminating in short tubes of the same breadth as the pollen sacks in *P. grandiflora*. In *P. norvegica* they terminate in tubes much narrower than the pollen sacks and are therefore more conspicuous than in *P. grandiflora*. Further the flowers are smaller in *P. norvegica* from Kola, with a longer style than in *P. grandiflora* growing farther east.

Judged from the records in the literature it is evident that the *Pyrola* species do not find suitable conditions on the shores of the Siberian Arctic Sea. They are rare here, and flower scarcely on the localities where they have been found. They are absent in the Svalbard Islands.

The present studies have shown that *P. grandiflora* seems to belong to the

group of the arctic species which has penetrated along the Siberian coast from the Bering Strait, but has not reached Scandinavia over a land bridge Cape Kanin—Kola Peninsula, whereas *P. norvegica* has not come to Scandinavia either from east or from the west. Its relation to the montane-subalpine types in Scotland and Central Europe, founded on the species concept of the present author will be treated on a later occasion.

GUNVOR KNABEN

Problem inom Eleocharis palustris-komplexet

Med anknytning till de cytologiska förhållanden, som presenterats i en serie uppsatser, »Chromosome Studies in Eleocharis, subser. Palustres I—IV» (STRANDHEDE 1965 a—d), konstaterade föredragshållaren det anmärkningsvärda förhållandet, att de cytologiskt mest variabla enheterna (*E. palustris* ssp. *vulgaris* och *E. uniglumis* ssp. *sterneri*) är de morfologiskt mest konstanta, en egenskap, som också tillkommer *E. mamillata* ssp. *mamillata* och ssp. *austriaca*. Dessa enheter är vidare självfertila i motsats till de övriga (*E. palustris* ssp. *palustris* och *E. uniglumis* ssp. *uniglumis*), vilka är självsterila. Självbefruktning i de först nämnda arterna motverkas emellertid av en förlängning av tiden mellan gynes och anthes hos de självfertila enheterna.

Hybridbildningen i naturen diskuterades (cf. STRANDHEDE 1965 c), och pågående experimentella hybridförsök presenterades samt, i anslutning till dessa, följande specialförsök. Försöket omfattar frösådd från enstaka plantor efter fri avblomning i experimentodlingarna. Förutsättningarna för spontan hybridbildning torde ha varit optimala, och försöket avser att giva en uppfattning om arternas benägenhet att spontant bilda hybrider. Resultaten är att betrakta som preliminära, och någon ingående analys har ännu ej företagits.

Ur en sådd av 500 frukter från *E. uniglumis* ssp. *uniglumis* (2n=46) har hittill endast 16 plantor kromosomtalsbestämts. 8 av dessa plantor är emellertid hybrider med *E. palustris* ssp. *vulgaris* och har 2n=42 eller 2n=43. Denna tendens att bilda hybrider med ssp. *vulgaris* kommer också till synes i naturen.

I en sådd av 500 frukter från en *E. palustris* ssp. *vulgaris*-planta med 2n=38 påträffades inga hybrider men däremot en kromosomtalsvariation, som är direkt proportionell mot den som konstaterats i det insamlade spontana materialet av denna subspecies (tab. 1). Någon förklaring till detta unika förhållande kan ej givas för närvarande, men föredragshållaren hänvisade till de säregna cytologiska förhållanden, som konstaterats i *E. palustris* ssp. *vulgaris* (STRANDHEDE 1965 c). Försöket fortsätter.

Avslutningsvis diskuterade föredragshållaren, vilken taxonomisk rang en-

Tabell 1. Jämförelse mellan frekvensen av olika kromosomtal i fröplantor från en moderplanta med 2n=38 och spontant material av E. palustris ssp. vulgaris

Kromosomtal bestämt i	somatiska kromosomtal (%)					
	36	37	38	39	40	41
fröplantor	2	9	56	26	6	1
spontant material	1	6	57	26	9	1

heterna i komplexet bör ha med utgångspunkt från konstaterade morfologiska och cytologiska förhållanden samt förekomsten av spontana hybrider. Alla enheterna tillhör biologiskt sett samma coenospecies, men ur genetisk synvinkel kan komplexet uppdelas i tre grupper, (1) *E. mamillata* s.l., (2) *E. palustris* ssp. *palustris* och (3) *E. uniglumis* s.l., vilken innefattar *E. palustris* ssp. *vulgaris*. Denna indelning sammanfaller ej med hävdvunna artgränser och är ur floristisk synpunkt opraktisk, då *E. palustris* ssp. *vulgaris*, före utbrytningen såsom eget taxon, alltid inordnats i *E. palustris* s.l. Föredragshållaren föreslog en floristiskt användbar kompromisslösning, som också kan motiveras biologiskt. Under *E. mamillata* Lindb. fil. infogas såsom subspecies *E. mamillata* s. str. och *E. austriaca* Hayek, då dessa taxa är morfologiskt, cytologiskt och av allt att döma även fylogenetiskt närstående och väl differentierade från övriga taxa i komplexet. Under *E. palustris* (L.) R.&S. infogas såsom subspecies *E. palustris* ssp. *palustris* (STRANDHEDE 1960) och *E. palustris* ssp. *vulgaris* Walters, då dessa två enheter morfologiskt är mycket närstående och även genetiskt och fylogenetiskt uppvisar ett samband. Emellertid är gränsen mellan *E. palustris* ssp. *vulgaris* och *E. uniglumis* ssp. *uniglumis* oskarp ur genetisk synpunkt. *E. uniglumis* (Link) Schult. omfattar likaledes två subspecies i Skandinavien: *E. uniglumis* ssp. *uniglumis* och *E. uniglumis* ssp. *sterneri* Strandh., vilka morfologiskt är mycket närstående, men väl skilda kromosomtalsmässigt, ehuru de spontant bildar fertila hybrider. Komplexets taxonomi har tidigare behandlats i ett separat arbete (STRANDHEDE 1961).

SVEN-OLOV STRANDHEDE

Citerad litteratur

STRANDHEDE, S.-O. 1960. A note on Scirpus palustris L. — Bot. Notiser 113: 161—171.
— 1961. Eleocharis Palustres in Scandinavia and Finland. Taxonomical units within the area. — Ibid. 114: 417—434.
— 1965 a. Chromosome studies in Eleocharis, subser. Palustres. I. Meiosis in some forms with 15 chromosomes. — Hereditas 53: 47—62.
— 1965 b. Chromosome studies in Eleocharis, subser. Palustres. II. Pollen mitosis with special reference to some strains with 15 chromosomes, and formation of secondarily unreduced pollen grains. — Ibid. 53: 374—388.
— 1965 c. Chromosome studies in Eleocharis, subser. Palustres. III. Observations on western European taxa. — Opera bot. 9: 2.
— 1965 d. Chromosome studies in Eleocharis, subser. Palustres. IV. A possible case of an extra, reductional division giving rise to hemi-haploid pollen nuclei. — Bot. Notiser 118: 243—253.

Artavgränsning inom Sanguisorba minor-komplexet

Det s.k. *Sanguisorba minor*-komplexet är en polymorf grupp av taxa, som är varandra så lika, att de ej med säkerhet kan skiljas i andra morfologiska karaktärer än fruktbägarens utseende. Även beträffande denna karaktär är intermediärer mellan taxa vanliga.

Huvudkomponenterna i komplexet är *S. minor* Scop. ssp. *minor* (2n=28), ssp. *muricata* (Spach) Rouy (2n=28 och 56) och ssp. *magnolii* (Spach) Rouy (2n=28), tillsamman utbredda i större delen av Europa. Övriga arter och underarter är m.l.m. lokala endemer, de flesta mediterrana.

Varken traditionella morfologiska skiljekaraktärer, cytologi, anatomi eller palynologi ger några distinkta skillnader. Den i naturen förekommande variationen kan delvis förklaras genom korsningsexperiment. Inga sterilitetsbarriärer råder mellan lika kromosomtal. Korsningar och återkorsningar uppvisar praktiskt taget samma variation i fruktbägarutseende som funnits i naturen. Genom att plantorna är helt självfertila och i stor utsträckning autogama stabiliseras eventuellt bildade hybrider.

Framställda hexaploider är nästan helt sterila. Vid pollination med en tetraploid som fader har dock i enstaka fall grobara frön erhållits, som kan ge upphov till individ med varierande kromosomtal, av vilka endast oktoploider utvecklas normalt och blir fertila. En stark tendens till apospori finns i komplexet, och nämnda oktoploider har troligen uppkommit genom att en oreducerad äggcell befruktats av en reducerad gamet från tetraploiden. Experimentellt har oktoploiderna också framställts genom allopolyploidi och genom autopolyploidi. Oktoploiderna, som i naturen är mycket heterogena, kan tänkas ha ett polyfyletiskt ursprung.

Det taxonomiska resultatet har blivit, att de flesta av de c:a 30 beskrivna arter (synonymer undantagna), som bör föras till komplexet, har fått reduceras till underarter eller indragas som synonymer i någon av huvudkomponenterna. Tetraploider och oktoploider av ssp. *muricata* är ej morfologiskt urskiljbara, och de ingår båda i samma subspecies. Kvar som arter blir endast enstaka ekologiskt specialiserade endemer.

GERTRUD NORDBORG

Linnés Tropaeolum-arter och deras historia

LINNÉ presenterade i Species plantarum (1753) 3 arter av släktet *Tropaeolum: T. minus, T. majus* och *T. peregrinum*. De första två baserades dels på odlat material, dels på tidigare planschverk. Bortsett från en del förvirrande problem i slutet av 15- och början av 1600-talet för *T. minus* — som första gången omtalas säkert av LOBEL 1576 — råder ingen tvekan om vad LINNÉ menade. *T. minus* typifieras lämpligast med ett exemplar i BURSER's herbarium i Uppsala, med paratyper i Cliffordherbariet i British Museum, Linnéherbariet i Stockholm och Linnean Society i London. *T. majus,* som beskrevs första gången av HERMANN 1687, måste lämpligast typifieras med det vackra exemplaret i Cliffordherbariet; dessutom finns en paratyp i Linnean Society. *T. hybridum,* ett nytt namn, som skapades av LINNÉ 1767 för BERGII *T. quinquelobum* (1765), måste uppfattas som en monstrositet av *T. majus*. Vad gäller den nu allmänt odlade formen av *T. majus,* morfologiskt knappast skiljbar från de vilda populationerna runt Callao och Arequipa i Peru, bör ett nytt namn sökas, då den genetiskt är helt skild som ett resultat av flitig inkorsning med *T. minus* och *T. peltophorum* (*T. lobbianum*), framför allt under mitten av 1800-talet.

Beträffande *T. peregrinum* är problemet större. Den beskrevs 1753 på en bild av FEUILLÉE (1714) utan att LINNÈ sett material. 1771, sedan LINNÉ fått material från DUCHESNE, beskrev han en ny art under samma namn — denna har långt senare (1843) döpts till *T. hayneanum* av BERNHARDI. Trots det goda material, som finns i Linnean Society, måste den lämpligast typifieras med ett exemplar i Missouri Botanical Garden, som härrör från BERNHARDIS trädgård i Erfurt. Ytterligare material, denna gång från MUTIS i Colombia, inkorporerades i LINNÉS herbarium och döptes senare (ej av LINNÉ!) till *T. peregrinum* av J. E. SMITH; denna kallades senare av DE CANDOLLE (1824) för *T. smithii* och typifieras med ett av MUTIS' exemplar, trots en viss konfusion i DE CANDOLLES uppfattning. På grund av sin missuppfattning av Linnématerialet och framför allt FEUILLÉES bild, beskrev så SMITH den rätta *T. peregrinum* på nytt (1819) som *T. aduncum* (typen i SMITHS herbarium i Linnean Society). Även en del andra, mindre allvarliga, misstag uppstodo. Typmaterial för den äkta *T. peregrinum* saknas alltså helt, och arten måste typifieras med FEUILLÉES bild. På grund av de talrika misstagen ha flera olika arter beskrivits som *T. peregrinum* eller *T. hayneanum*; dessa ha nu reviderats och i flera fall nybeskrivits. *T.* »*canariense*» slutligen är endast ett synonymt trädgårdsnamn för den äkta *T. peregrinum,* utan någon antagbar beskrivning.

BENKT SPARRE

Om de i Danmark fundne Amaranthus-arter

Amaranthus-slægten omfatter ca. 100 arter, der især bebor de varme og tempererede egne af kloden. Flere arter har vist en fantastisk evne til at brede sig og erobre nye arealer, er blevet til kosmopolitter; andre arter har som kulturflygtninge eller som opgivne nytteplanter kunnet erobre nye arealer. I Europa regner man kun med 2 hjemmehørende arter (og kun i Middelhavsegnene), nemlig *Amaranthus graecizans* (var. *silvestris*) og *A. lividus* (var. *adscendens*). Men siden de store opdagelsesrejsers tid har Europa modtaget en større invasion af fremmede arter, en invasion, som især i de sidste årtier er blevet påfaldende intensiveret, et udtryk for den stærkt øgede samfærdsel mellem verdensdelene. Ingen af arterne spiller dog i Danmark og de øvrige skandinaviske lande nogen økonomisk eller praktisk rolle, og ingen af dem kan siges at være naturaliseret. De kommer og går, og deres fortsatte eksistens er vel mest afhængig af fortsat tilførsel udefra af frø. Amarant-arterne er sentblomstrende planter, der først når i blomst i august-september og oktober, og da de er stærkt frostfølsomme, forsvinder de med den først efterårsnattefrost. Visse arter er dog sikkert i stand til at modne frø under nordiske klimaforhold.

Følgende 17 arter er hidtil påvist i Danmark: *A. albus* L., *A. blitoides* Wats., *A. caudatus* L., *A. deflexus* L., *A. gracilis* Desf., *A. graecizans* L. (var. *graecizans,* var. *silvestris*), *A. hybridus* L. (incl. *A. chlorostachys* Willd., *A. patulus* Bertol., *A. paniculatus* L.), *A. lividus* L. (*A. blitum*), *A. macrocarpus* Benth., *A. muricatus* Gill., *A. quitensis* H.B.K., *A. retroflexus* L., *A. spinosus* L., *A. standleyanus*

Parodi (*A. vulgatissimus* auct. non Speg.), *A. thunbergii* Moq., samt *A. palmeri* S.Wats. og *A. tamariscinus* Nutt. De hyppigst optrædende arter er følgende: *A. albus, A. hybridus, A. retroflexus* og *A. standleyanus*. Ældst kendte art i Danmark er *A. caudatus,* kendt siden 1825.

ALFRED HANSEN

Dacrydium — Anatomy and Taxonomy

The conifer genus *Dacrydium* of the *Podocarpaceae* comprises 22 described species from S.E. Asia (*Malaysia:* 8 spp.; *New Caledonia:* 5 spp.), Australia (*New Zealand:* 7 spp.; *Tasmania:* 1 sp.) and South America (*Chile:* 1 sp.). There are at least 3 new species (from Borneo and N. Guinea) to be added to this number.

Evidence from external morphology of vegetative and reproductive organs as well as from pollen morphology and cytology has shown that the genus with its present delimitation is very heterogeneous. Accordingly most botanists (e.g., PILGER 1926, FLORIN 1931) have divided the species into three groups (designated A, B, and C; cf. table 1).

Investigations by the present writer into the anatomy of certain vegetative organs have confirmed this heterogeneity. The following anatomic characters were especially studied:

A. Secondary xylem:
   1. Occurrence of distinct annual ring boundaries.
   2. „ „ wood parenchyma.
   3. Type and number (per cross field) of cross field pits.

B. Primary axis:
   4. Occurrence of phloem fibres.

C. Adult leaf:
   5. Occurrence of leaf hypodermis.
   6. „ „ vascular fibres.
   7. „ „ resin ducts.

D. Pollen grains of most species have furthermore been studied as to (8) type and (9) the occurrence of well delimited air bladders.

The results of the anatomic studies are finally compared with chromosome conditions within the genus, as described by HAIR & BEUZENBERG 1958.

A summary of the above-mentioned characters is to be found in the accompanying table (table 1).

From this table is evident that the genus *Dacrydium* s.lat. divides quite naturally into two main parts (I and II), which should indubitably be treated as different genera. The deviating leaf morphology and anatomy within group I A (*D. falciforme, D. taxoides,* etc), together with pollen conditions in the same group, furthermore makes it probable that it should be separated from the rest of group I to form a genus of its own.

Two of the groups within the genus (I B and II) may further be divided into a number of subgroups, considering anatomic conditions as to cross field

Table 1. Summary of Certain Anatomic Characters in Dacrydium Compared with Pollen Morphology and Chromosome Characters

Dacrydium Groups and species	Secondary xylem			Axis	Adult leaves			Pollen		Chromosomes (acc. to HAIR)		
	Ring boundary	Wood parenchyma	Cross field pits (type and number)	Phloem fibres	Leaf hypodermis	Vascular fibres	Resin ducts	Type	Well delimited air bladders	2n	V+I (types of chromosomes)	"sum" of chromosome arms
A.												
falciforme	—	+	T. 0—2	+	+	—	+	A	—			
nov. spec.	—	+	T. 0—2	+	+	—	+	A	—			
taxoides	—	+	T. 0—2	+	+	—	+	A	—	20	10+0	20
B. 1. a												
araucarioides	—	+	T. 1—2	+	+	+	+	B	—	20	10+0	20
Balansae	—	+	T. 0—2	+	+	+	+	B	—	20	10+0	20
lycopodioides	—	+	T. 0—2	+	+	+	+	B	—	20	10+0	20
B. 1. b												
Guillauminii	—	+	T. 0—4	+	+	+	+	C	—	20	10+0	20
B. 2.												
Beccarii	—	+	T. 0—3	+	+	+	+	D	—			
comosum	—	+	T. 0—1	+	+	+	+		(—)			
nov. spec.	—	+	T. 0—2	+	+	+	+					
Gibbsiae	—	+	T. 1—4	+	+	+	+		(—)			
xanthandrum	—	+	T. 0—2	+	+	+	+					
elatum	—	+	T. 0—2	+	+	+	+	D	—	20	10+0	20
Pierrei	—	+	T. 0—2	+	+	+	+		—			
novo-guineense	—	+	T. 0—2	+	+	+	+					
B. 3.												
cupressinum	—	+	C. 0—2	+	+	(+)	+	E?	—	20	10+0	20
(C) 1. a.												
intermedium	+	—	C. 1—8	(+)	—	—	—	F	+	30	5+10	20
laxifolium	+	—	C. 2—8	+	—	—	—	F	+	30	5+10	20
1. b.												
Fonkii	+	—	C. 2—5	—	—	—	—	F?	+			
1. c.												
Colensoi	+	—	F. 1(—2)	+	—	—	+	F	+	20	10+0	20
2.												
Franklinii	+	— (+)	F. 1(—2)	+	—	—	+	G	+	30	5+10	20
3.												
biforme	+	—	F. 1—2	—	—	—	+	F	+	24	4+8	16
Kirkii	+	—	F. 1—2	—	—	—	+	F	+	22	5+6	16
Bidwillii	+	—	F. 1—2	—	—	—	+	F	+	18	7+2	16

=taxodioid, C=cupressoid, F=fenestriform pits

pits, phloem fibres, and resin ducts of the leaves, as well as pollen types and chromosome conditions. It is to be hoped that further investigations into the morphology and anatomy of vegetative as well as reproductive organs will elucidate the taxonomic status of these subgroups.

JAN TENGNÉR

References

FLORIN, R. 1931. Untersuchungen zur Stammesgeschichte der Coniferales und Cordaitales. I. — K. Vet. Akad. Handl., 3. ser., Vol. 10.

HAIR, J. B. & BEUZENBERG, E. J. 1958. Chromosomal evolution in the Podocarpaceae. — Nature, Vol. 181.

PILGER, R. 1926. Gymnospermae. — Nat. Pflanzenfam., 2. ed., Vol. 13.

On the Evolutionary Relationships of the Finnish Phragmidium Species

Evolutionary relationships among the Finnish rose-parasitizing species of the genus *Phragmidium* (*Uredinales*) were examined morphologically by spore measurements. In the following, emphasis will mainly be on *P. fusiforme* with some remarks also about *P. mucronatum* and the account is based on the results of MÄKINEN (1965 and unpublished).

Correlation analyses indicated that the following teliospore characters are generally in a very significant correlation and are thus valuable taxonomic characters: length of spore, breadth of spore, length of pedicel, length of apiculus, and number of cells. Measurements were also made on aecio- and urediospores.

P. fusiforme is found in Finland in two separate areas: in the larger, eastern area it is common on *Rosa acicularis* but also occurs on *R. majalis*; in the smaller, western area it is rare on *R. majalis*. This distribution raises the following questions: (1) Are the rusts of the western and eastern areas identical? (2) Are the rusts attacking *R. majalis* and *R. acicularis* identical? (3) If differences will be found, what will be their probable explanation?

In the eastern area the rusts on *R. majalis* and *R. acicularis* resemble each other fairly closely, even when they differ in two of the seven teliospore characters tested (Fig. 1): the spores on *R. acicularis* are relatively longer and contain more cells than on *R. majalis*. This is probably due to some genetical specialization since on *R. majalis* both the shape of the spores and the number of the cells differ so as to resemble *P. mucronatum* (of which the main host in Finland is *R. majalis*). We can thus suppose that as a result of hybridization between *P. mucronatum* and *P. fusiforme* a new race of *P. fusiforme* has arisen which morphologically deviates only slightly from the main race on *R. acicularis* but physiologically has become capable of infecting a new host, *R. majalis*. Another evidence suggests for an ancient hybridization between *P. fusiforme* and *P. mucronatum*. Almost all of the Finnish specimens of *P. mucronatum* differ from the Central European specimens in that they show features of *P. fusiforme*. It is further interesting to note that only the telio- and urediospores exhibit these deviating characters, but not the aeciospores.

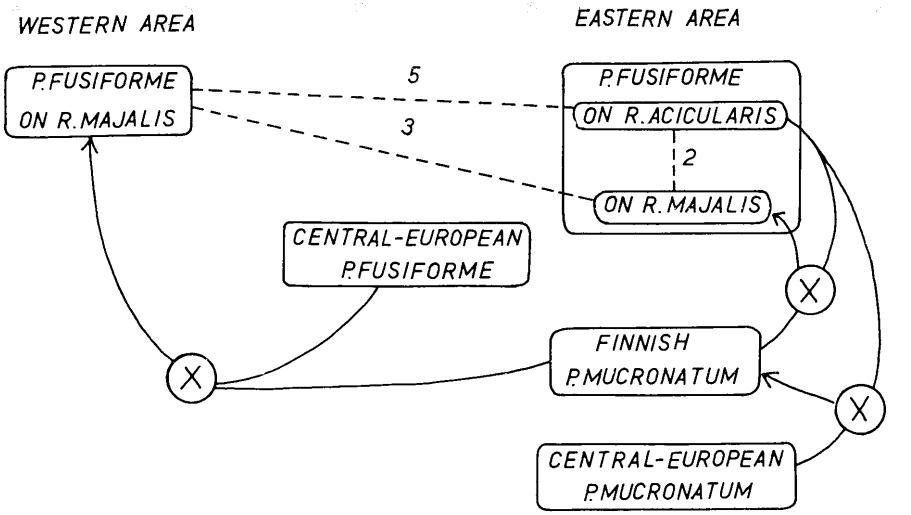


Fig. 1. Probable evolutionary relationships in the Finnish *Phragmidium fusiforme*. The figures at the broken lines show the number of the differentiating characters; the crosses indicate possible ancient hybridizations.

This is explained by the fact that most of the aecial specimens belong to races which have lost their sexual cycle and thus have no direct possibility of obtaining genes from *P. fusiforme* through hybridization.

The rusts on *R. majalis* in eastern and western Finland differ in 3 teliospore characters, and the rusts on *R. majalis* in western Finland and on *R. acicularis* in eastern Finland differ in 5 characters (Fig. 1). The last-mentioned differences are thus probably partly due to the different host species, but partly due to some other factors.

In Central-Europe, *P. fusiforme* (=*P. rosae-alpinae*) is fairly common on *Rosa alpina*. All of the Finnish specimens of *P. fusiforme* clearly differ from the Central European *P. fusiforme*. For example the spores are shorter, the apiculus is shorter and the cells fewer in Finland than in Central Europe. These differences are, I think sufficient to separate these two rusts into different taxa at a varietal level.

Among the Finnish races, the rust on *R. acicularis* most resembles the Central-European forms since both have longer spores and more numerous cells than the other races. Ever since the latest glaciation both of these races have probably been in a very close connection. However, the western *majalis* group also shows some features (long spores and long apiculus) which point to the Central European population of *P. fusiforme* (Fig. 1). It seems as if the western population in Finland has received genes from the Central European population, and perhaps has arisen through hybridization between *P. mucronatum* and the Central European *P. fusiforme*.

YRJÖ MÄKINEN

Reference

MÄKINEN, Y. 1965. On Finnish micromycetes 6. The Phragmidium species on roses in Eastern Fennoscandia, with special reference to the variation in the size of the spores. — Ann. Univ. Turku. A, II: 33, 1—62.

The Species Concept in Lichen Taxonomy

LINNAEUS (1753 pp. 1140—1156), which is the starting-point of the lichenological nomenclature, recorded 80 species of lichens under the genus *Lichen* (as "*Algae*"). ACHARIUS, the "father of lichenology" (1810, 1814), described 906 species from all parts of the world. NYLANDER (1857, the first "check-list" of the world's lichens) counted with 1361 species. ZAHLBRUCKNER's wellknown catalogue (1921—1940) listed 17364 species. LAMB (1963) listed an addition of 8205 species described in the years 1932—1960.

These increasing figures do not only reflect the increased material available to the lichenologists during the last two centuries, not least from exotic countries, but also a species concept changing towards more and more "narrow" species. As the criterion of a lichen species seems to be more vague and deliberate than in many other plant groups, a critical examination of the current species concept in lichenology may be justified.

Broadly speaking, we can conceive four principles:

1. Characters from external morphology.

LINNAEUS, ACHARIUS and authors up to the middle of the past century founded nearly all taxonomy on externally visible characters, such as colour, pilosity, cilia, cyphellae, pseudocyphellae, soredia, isidia, external shape of apothecia, etc. The evaluation of such characters has changed considerably. The presence or absence of soredia and/or isidia was considered as good specific criteria by ACHARIUS but was almost entirely neglected towards the end of the 19th century. DU RIETZ (1924) rightly emphasized the importance of soredial and isidial characters in lichen taxonomy. HALE & KUROKAWA (1964) and HALE (1965) pointed out that good specific characters can be derived from the shape of the rhizines. The present author believes that most, perhaps all, good lichen species should be recognized by the trained eye (aided with a lens or a binocular) without a detailed microscopic examination.

2. Characters from internal morphology.

The rapid development of lichen anatomy, especially the morphology of apothecia and spores, in the 1840's to 1860's caused fundamental changes in lichen taxonomy. Different spore types proved to be useful for the delimitation of a large number of genera. Many of them (e.g., *Diploschistes, Catillaria, Lopadium, Phlyctis*) are well-established in the lichen taxonomy of to-day.

Many lichenologists have also used anatomical characters as main criteria for specific segregation. MAGNUSSON (1929 and several other papers) often used data such as thickness of the cortex, height of the hymenium, size of

the spores, etc., as essential or only specific characters. WEBER (1962), who has worked on a large material of crustose lichens from arid districts in the U.S., has rightly emphasized that ecologic factors can cause a considerable modificative variation in the internal as well as in the external morphology of the species. Many descriptions, though often long and detailed, have been founded on very scarce material. In many cases they describe a specimen, not a species.

The author means that microscopic characters, such as those mentioned above, should be used with great caution if they are not combined with characters from external morphology. Some examples: *Parmelia tuckermanii* Du R., which differs from *P. crinita* Ach. only in having smaller spores, should not have a specific rank (HALE 1965 p. 284). *Opegrapha devulgata* Nyl. differs from *O. vulgata* Ach. only in having shorter pycnoconidia. (Cf. REDINGER 1938 p. 358.) Such variations, if constant, should not be given higher taxonomic rank than *forma.*

3. Characters from the algal component.

The recognition of the lichen symbiosis towards the end of the past century gave rise to several problems in lichen taxonomy. ZAHLBRUCKNER (1926) recorded some genera (e.g., *Allarthonia* and *Lobarina*) differing (from *Arthonia* and *Lobaria,* respectively) only in having another algal genus as symbiont. In other cases (e.g., *Sticta,* sect. *Eusticta* and sect. *Stictina*) he used similar differences for the subdivision of a genus. As the present Code of Botanical Nomenclature (§ 13) states that "names given to lichens shall be considered as applying to their fungal components", such genera (subgenera, sections) are untenable.

Also species, whose main or only criteria are different algal symbionts, should be reduced to synonymy, e.g., *Lobaria retigera* (Bory) Trevis. (syn. of *L. pulmonaria* (L.) Hoffm.) and *Solorina simensis* Hochst. (syn. of *S. saccata* (L.) Ach.).

4. Characters from lichen chemistry.

Since the 1860's, colour reactions with chemical reagents (first potassium hydroxide, calcium hypochlorite and iodine, later also paraphenylenediamine) have been used in identifying lichen species. During the last three decades our knowledge of the substances in the lichen thalli causing such reactions has increased considerably. In many cases their chemical structure is known, and accurate methods for their identification have been tested.

The numerous results from lichen chemistry have been frequently used to describe lichen species founded mainly or only on chemical criteria. Some trends in the present lichen taxonomy concerning the evaluation of the "chemical characters" can be summarized thus:

a. A constant chemical difference should be regarded as a specific character even if the lichens are morphologically identical. Cf. ASAHINA (earlier works), and CULBERSON (1960). Example: *Thamnolia vermicularis* (Sw.) Ach. (containing thamnolic acid) and *Th. subvermicularis* Asahina [sec. CULBERSON=

Th. subuliformis (Ehrh.) Culb] (lacking thamnolic acid but containing squamatic and baeomycetic acids).

b. A constant chemical difference not correlated with any morphological difference can be used for specific segregation if it is correlated with a different distribution (HALE 1965). Example: *Parmelia arnoldii* Du R. (containing alectoronic acid; distributed in many oceanic districts) and *P. margaritata* Hue (containing salacinic acid; distribution restricted to N. America).

c. A constant chemical difference not correlated with any morphological difference but with a distinct distribution should be quoted as a subspecies or a variety [ASAHINA 1964: subspecific division of *Haematomma puniceum* (Sm.) Mass.].

d. A constant chemical difference in morphologically indistinguishable individuals should not be given any nomenclatural status but be quoted as a "chemical strain" (LAMB 1951: species of *Stereocaulon*).

The present author would agree with LAMB. In my opinion, the principles under a—c should not be used to distinguish any taxonomic units under the Code of Nomenclature. It should be emphasized, however, that data from lichen chemistry often give valuable aid to lichen taxonomy if they are correlated with constant morphological characters.

Such a restrictive attitude towards the "chemical taxa" together with stronger observance of the modificative variation caused by environmental factors would reduce a considerable number of the lichen "species" described in recent years to synonymy. It is essential that lichen taxonomy be founded on firm principles not deviating too much from those generally accepted in other plant groups.

OVE ALMBORN

References

ACHARIUS, E. 1810. Lichenographia universalis. Gottingae.

— 1814. Synopsis methodica lichenum. Lundae.

ASAHINA, Y. 1964. Lichenologische Notizen (§ 194). — Jour. Jap. Bot. 39. Tokyo.

CULBERSON, W. L. 1960. Parmelia pseudoborreri Asahina, lichen nouveaux pour l'Europe. — Rev. Bryol. et Lichén. 29. Paris.

DU RIETZ, G. E. 1924. Die Soredien und Isidien der Flechten. — Sv. Bot. Tidskr. 18. Uppsala.

HALE, M. E. 1965. A monograph of Parmelia subgenus Amphigymnia. — Contrib. U.S. Nation. Herb. 36: 5. Washington.

HALE, M. E. & KUROKAWA, S. 1964. Studies on Parmelia subgenus Parmelia. — Ibid. 36: 4. Washington.

LAMB, I. M. 1951. On the morphology, phylogeny and taxonomy of the lichen genus Stereocaulon. — Canad. Jour. Bot. 29. Ottawa.

— 1963. Index lichenum inter annos 1932 et 1960 divulgatorum. New York.

LINNAEUS, C. 1753. Species plantarum. Holmiae.

MAGNUSSON, A. H. 1929. A monograph of the genus Acarospora. — K. Svenska Vet.-akad. Handl. 3:e ser. Bd 7: 4. Stockholm.

NYLANDER, W. 1857. Enumération générale des lichens. — Mém. Soc. Nat. Cherbourg 5. Cherbourg.

REDINGER, K. 1938. Arthoniaceae. Graphidaceae. — Rabenhorst's Kryptogamenflora von Deutschland etc. Ed. 2. Bd. 9. Abt. 2: 1. Leipzig.

ZAHLBRUCKNER, A. 1921—1940. Catalogus lichenum universalis 1—10. Jena.

— 1926. Lichenes (Flechten). B. Spezieller Teil. — ENGLER & PRANTL, Die natürlichen Pflanzenfamilien. Ed. 2. Bd. 8. Leipzig.

Om taxonomiske kriterier

Med udgangspunkt i de højere svampes taxonomi behandledes nogle principielle spørgsmål vedrørende anvendelsen af taxonomiske kriterier og udformningen af taxonomisk litteratur.

Taxonomiens første mål var af diagnostisk art: Man heftede sig ensidigt ved de karakterer, som fandtes hos alle medlemmer af et taxon, og som derfor kunne tjene til genkendelse og bruges i bestemmelsesnøgler. Nu derimod har taxonomien i høj grad opmærksomheden henledt på den information, som foreligger i de karakterer, der udviser variation inden for et taxon; de faste diagnostiske karakterer spiller erfaringsmæssigt en ret beskeden rolle i nyere overvejelser vedrørende opdeling eller sammenknytning af højere taxa. Det skønnes at være vigtigt, ikke mindst med henblik på det rent praktiske aspekt, at denne forskel mellem taxonomien før og nu erkendes: Den tradition for formulering af mykologisk taxonomisk litteratur, som stammer fra taxonomiens »diagnostiske fase», er stadig fremherskende, trods de nye signaler i selve forskningen; og, som det var at vente, resultatet er ofte uhensigtsmæssigt. Et eksempel: Det forringer en bogs anvendelighed, hvis dens bestemmelsesnøgler (som læseren henvises til til diagnostisk brug) tilsigter at afspejle resultaterne af forfatterens taxonomiske overvejelser (som har drejet sig om variationsmønstre).

Heller ikke når en forfatter vil dokumentere sine anskuelser, fungerer den traditionelle »litterære stil» hensigtsmæssigt: De diagnostiske karakterer kommer let til at indtage en utilsigtet hædersplads; og den egentlige dokumentation kommer dels til at stå som en perspektivløs opremsning, der ikke lader ane meget om forfatterens eventuelle dybtgående overvejelser, dels kommer den til at befinde sig ufremhævet og diffust i teksten, hvorfra den alt for ofte kun lader sig uddrage af den læser, som af selvsyn kender de pågældende organismer.

Med den mangelfulde viden, vi endnu i dag har om svampenes taxonomi, vil en klart fremsat dokumentation oftest være langt fra at kunne tilkendes objektiv gyldighed. Men den bør kunne udformes, således at den bliver o b j e k t i v t v u r d e r b a r.

Med henblik på de højere svampe, hvor konvergens, divergens og parallelevolution i eminent grad tilslører de naturlige slægtskabsforhold, blev gennemgået nogle eksempler på, hvorledes kendskabet til disses svampes biologi og økologi kan være til nytte som en rent foreløbig rettesnor for taxonomisk arbejde: De karakterer, som har indlysende biologisk selektionsværdi, har vist sig at være upålidelige som taxonomiske kriterier.

Der føles et behov for en ny »litterær stil», i lærebøger såvel som i videnskabelige afhandlinger, som er mere hensigtsmæssig end den traditionelle til

kommunikation af taxonomisk information. Hertil vil, så vidt det ses, en omfattende teoretisk analyse af taxonomisk metode være nødvendig. En sådan analyse vil iøvrigt kunne vise sig nyttig også på helt andre fronter; det kan således formodes, at taxonomiens stilling blandt de biologiske discipliner også rent politiskt ville nyde godt af, om der som for disse kunne henvises til et velformuleret teoretisk arbejdsgrundlag.

ANDERS MUNK

Synpunkter på karroofloran

Sydafrikas karroo-områden hyser en flora, som i sammansättning, ursprung och historia skiljer sig markant från kapfloran och den tempererade skogsfloran. Karroofloran har en vidsträckt utbredning i Sydafrikas inland och i nordväst längs kusten upp i Sydvästafrika. De mest typiska och välkända karroo-områdena är Great Karroo, Little Karroo och Ceres-Calvinia Karroo.

Särskilt Little Karroo är bekant för sin rikedom på intressanta suckulenter, framförallt tillhörande *Crassulaceae, Asclepiadaceae* tribus *Stapelieae*, och *Mesembryanthemaceae*. Endemismen är påfallande, och t.o.m. endemiska släkten förekommer, t.ex. *Gibbaeum* (c. 30 arter), *Rhinephyllum* (9 arter) och *Muiria* (2 arter). Andra släkten har ett markerat centrum i Little Karroo, t.ex. *Glottiphyllum* (c. 50 arter).

Endemism, artbildning och differentiering inom lokala populationer kan med fördel studeras inom begränsade karroo-områden. Ett sådant område är Vanrhynsdorp Karroo, även kallat Kners Vlakte, norr om Olifants River's nedre del. Området är flackt, c. 8 sv. mil långt och brett, och till största delen täckt av mäktiga sandlager. Här och var förekommer emellertid fasta fläckar av kvartsitgrus, ibland i samband med smärre kopjes, åsar eller stenryggar. Dessa isolerade lokaler hyser en rik och särpräglad flora av framförallt små suckulenter. Endemrikedomen är mycket stor. Inte mindre än fem endemiska släkten förekommer inom detta begränsade område, samtliga tillhörande *Mesembryanthemaceae: Argyroderma* (c. 50 arter), *Oophytum* (3 arter), *Dactylopsis* (2 arter), *Antimima* (1 art) och *Maughaniella* (1 art).

Inom området är de lokala populationerna ofta helt små, ibland blott ett hundratal individ eller ännu färre. Några exempel på morfologisk differentiering inom småpopulationer kan nämnas.

Av den endemiska *Othonna hallii* är två populationer kända, belägna ungefär en halvmil från varandra, och vardera bestående av något hundratal individ. Populationerna skiljer sig något i flera karaktärer, t.ex. bladstorlek, suckulensgrad, bladtandning, korgstorlek, och strålblommornas längd.

Ett liknande exempel finns inom en ännu obeskriven *Chrysanthemum*-art.

Det monotypiska släktet *Maughaniella* är känt från ett par lokaler. I en population har samtliga individ (under gynnsamma år, t.ex. 1962, omkring ett 100-tal, ofta säkerligen färre) avvikande färg på staminodierna. I övrigt överensstämmer populationen morfologiskt helt med den närmast belägna, några km därifrån. En slumpmässig fixering av en icke adaptiv karaktär förefaller föreligga.

Släktet *Oophytum*, slutligen, har tre populationer, som betraktas som skilda arter. Skillnaderna är dock relativt obetydliga. *O. oviforme* har rosa blommor, *O. nanum* skiljer sig främst genom sin litenhet, och *O. nordenstamii* har större, vita blommor.

Kvartsitgruslokalerna inom Vanrhynsdorp Karroo uppvisar knappast några klimatiska eller edafiska skillnader. Därför är området väl lämpat för studier av differentiering inom små isolerade populationer, eller den evolutionsmekanism, som benämnts »Sewall Wright-effekt» eller »genetic drift».

BERTIL NORDENSTAM

Populationsstudier inom Nigella arvensis-gruppen

Förf. har undersökt kromosommorfologin hos fyra egeiska arter av *Nigella*, nämligen *N. fumariifolia* Kotschy, *N. degenii* Vierh., *N. cretica* Mill. och *N. aristata* S.&S. Arterna har samma diploida kromosomtal, 2n=12, och likartade karyotyper. Fem par metacentriska till submetacentriska och ett par nästan telocentriska kromosomer förekommer. Skillnader mellan arterna har dock påvisats, t.ex. i antal och läge av sekundära konstriktioner.

N. fumariifolia skiljer sig cytologiskt från de övriga undersökta arterna genom det stora antalet sekundära konstriktioner. Alla sex kromosomparen kan identifieras.

N. degenii uppvisar ofta kraftigt kontraherade metafasplattor. Två par satelliter förekommer, samt en sekundär konstriktion i den lilla subtelocentriska kromosomen.

N. cretica är morfologiskt mycket lik *N. degenii*, men cytologiskt något olik. Två par satelliter förekommer.

N. aristata är mycket variabel, både i yttre morfologi och kromosommorfologi. Till karyotypen liknar den *N. degenii*, men dessa båda arter är klart skilda morfologiskt. Fem populationer av *N. aristata* från olika egeiska öar utvaldes för en särskilt noggrann cytologisk undersökning. I flera fall påvisades signifikanta skillnader. En planta, som var strukturheterozygot i satellitregionen i kromosom 2, självbefruktades och avkomman studerades. I denna var de olika satellittyperna fördelade enligt det väntade förhållandet 1 : 2 : 1.

De fyra undersökta arterna är uppenbarligen normalt självbefruktare, men i flera fall har utförda korsningar givit god frösättning. Populationer från olika egeiska öar är i de flesta fall effektivt isolerade. Slumpvisa förändringar i genfrekvenser och frekvenser av strukturellt olika kromosomtyper beroende på fluktuationer i populationsstorlek har förmodligen spelat en viktig roll för den morfologiska och cytologiska differentieringen inom *N. aristata*.

ARNE STRID

Litteratur

STRID, A. 1965. Studies in the Aegean Flora VII. Chromosome Morphology in the Nigella arvensis Complex. — Bot. Notiser 118: 2.

Statistiska synpunkter på spridning

Växtgeografiska diskussioner om långspridning avslutas ofta med antagandet, att någon gång kan genom en kombination av gynnsamma omständigheter diasporer spridas över stora avstånd, komma att hamna i en lämplig miljö och där ge upphov till nya individ.

Även om man accepterar en sådan möjlighet innebär detta inte att en lyckad kolonisation skett. Det kan nämligen matematisk-statistiskt visas, att i biotoper med stabiliserade växtsamhällen kommer avkomman till sådana enstaka kolonisatörer i de allra flesta fall att elimineras i följande generationer på grund av rena slumpfaktorer.

Detta ger en rimlig förklaring till att havsarmar på endast någon el. några få mils bredd ger en effektiv isolering (även för växter med relativt lättspridda diasporer) i områden, som under lång tid haft förhållandevis stabila miljöförhållanden. Som exempel kan nämnas isoleringen mellan olika öar i vissa ögrupper (bl.a. Hawaii, Galapagos, Kanarieöarna och de egeiska öarna).

Det bör betonas att det matematisk-statistiska resonemanget endast kan tillämpas på relativt stabila miljöer och därför ej appliceras på sådana problemställningar som invandringen av den skandinaviska floran efter istiden eller kolonisation av biotoper, vilka starkt förändrats eller nyskapats av människan.

HANS RUNEMARK

BOTANISKA NOTISER 1965 · VOL. 118 · FASC. 4 · LUND

Svensk Botanisk Litteratur 1964

Swedish Botanical Bibliography 1964

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Kompletteringar av föreliggande och uppgifter avseende nästa förteckning mottas tacksamt av undertecknad.

The bibliography comprises the scientific botanical literature printed in 1964 in Sweden, as well as such papers published by Swedish authors in foreign countries. Additions to previous lists are marked out with an asterisk. The year of publishing is put down only to these additions. Popular science and book reviews as a rule are not included in the list.

Starkare förkortningar — Shorter abbreviations

AAS: Acta Agriculturae Scandinavica, Stockholm.
ACS: Acta Chemica Scandinavica, Köbenhavn (tr. i Helsinki).
AHG: Agri Hortique Genetica, Landskrona.
BN: Botaniska Notiser, Lund.
ECR: Experimental Cell Research, New York (tr. i Uppsala).
GP: Grana Palynologica, Stockholm.
Her.: Hereditas, Lund.
PP: Physiologia Plantarum, Köbenhavn (tr. i Lund).
SBT: Svensk Botanisk Tidskrift, Stockholm.
TIBC: Tenth International Botanical Congress. Abstracts of papers. Edinburgh.

Morfologi. Anatomi. Embryologi — Morphology. Anatomy. Embryology

1. BEDNAR, T. W., and JUNIPER, B. E.: Microfibrillar structure in the fungal portions of the lichen Xanthoria parietina (L.) Th. Fr. ECR 36, 680—683.
2. BRADFUTE, O. E., CHAPMAN-ANDRESEN, C., and JENSEN, W. A.: Concerning morphological evidence for pinocytosis in higher plants. ECR 36, 207—210.

3. BURSTRÖM, H. G., and ODHNOFF, CAMILLA: Vegetative Anatomy of Plants, 149 s. Appendix: Ordlista i växtanatomi, 9 s. Stockholm.
4. CRAWLEY, J. C. W.: Cytoplasmic fine structure in Acetabularia. ECR 35, 497—506.
5. ERDTMAN, G.: Ein Beitrag zur Kenntnis der Pollenmorphologie von Lactoris fernandeziana und Drimys winteri. GP 5, 33—39.
6. — Palynology. Vistas in Botany 4, 23—54, 7 pl.
*7. — Sporomorphology and phytomorphology. Journ. Ind. Bot. Soc. 42 A, 35—38, 2 pl. 1963.
8. FREYTAG, K.: Polarisationsmikroskopische Beobachtungen an Nexinen von Malvaceen-pollen. GP 5, 277—288.
9. GULLVÅG, BARBRO M.: Morphological and quantitative investigations of pollen grains and spores by means of the Françon-Johansson interference microscope. GP 5, 3—23.
10. — The fine structure of the pollen grain of Clivia miniata. GP 5, 253—263, 13 pl.
11. HALL, W. T., and WITKUS, E. R.: Some effects on the ultrastructure of the root meristem of Allium cepa by 6 aza uracil. ECR 36, 494—501.
12. HJELMQVIST, H.: Einige Bemerkungen über das Vorkommen von Brennharen im Pflanzenreich. BN 117, 307—314.
13. — Variations in embryo sac development. Phytomorphology 14, 186—196.
14. HJELMQVIST, H., and GRAZI, F.: Studies on variation in embryo sac development. BN 117, 141—166.
15. HOLMQVIST, CARIN: Some facts about the embryology of Gesneriaceae. TIBC, 96.
16. JALAN, S., and KAPIL, R. N.: Pollen grains of Schisandra Michaux. GP 5, 216—221.
17. KAPIL, R. N., and JALAN, S.: Schisandra Michaux — its embryology and systematic position. BN 117, 285—306.
18. LARSON, D. A.: Further electron microscopic studies of exine structure and stratification. GP 5, 265—276, 8 pl.
19. LEWIS, W. H.: Oldenlandia corymbosa (Rubiaceae). GP 5, 330—341.
20. LÖW, H., and AFZELIUS, B. A.: Subunits of the chromatophore membranes in Rhodospirillium rubrum. ECR 35, 431—434.
21. MALKOFF, D. B., and BUETOW, D. E.: Ultrastructural changes during carbon starvation in Euglena gracilis. ECR 35, 58—68.
22. MUNDKUR, B.: Electron microscopical studies of frozen-dried yeast V. Localization of protein-bound sulphydryl. ECR 34, 155—181.
23. NAYAR, B. K., and DEVI, SANTHA: Spore morphology of Indian ferns I. Aspidiaceae. GP 5, 80—120.
24. — — D:o II. Aspleniaceae and Blechnaceae. GP 5, 222—246.
25. — — D:o III. Polypodiaceae. GP 5, 342—395.
26. NILSSON, S.: On the pollen morphology in Lomatogonium A. Br. GP 5, 298—329.
27. NYGREN, A.: Apomixis. TIBC, 299.
28. ODA, T., and HORIO, T.: Electron microscope observation of chromatophores of Rhodospirillium rubrum. ECR 34, 414—417.
29. REIMANN, B. E. F.: Deposition of silica inside a diatom cell. ECR 34, 605—608.

30. SCHULZE, W.: Beiträge zur taxonomischen Anwendung der Pollenmorphologie. I. Die Gattung Iris L. GP 5, 40—79.
31. STIX, ERIKA: Polarisationsmikroskopische Untersuchungen am Sporoderm von Echinops banaticus. GP 5, 289—297.
32. — Pollenmorphologie von Borago officinalis. GP 5, 24—32.
*33. WARDROP, A. B.: Morphological factors involved in the pulping and beating of wood fibres. Proceed. 6. EUCEPA Symp. and 8. Europ. TAPPI Meeting Stockholm 1962 I, 1—17. Stockholm. 1963.

Se även nr. 218, 219, 290, 333, 336, 339, 363.

Fysiologi. Biokemi — Physiology. Biochemistry

34. AGURELL, S. L.: Costaclavine from Penicillium chermesinum. Experientia 20, 25—26.
35. ALLEN, MARY B., FRIES, LISBETH, GOODWIN, T. W., and THOMAS, D. M.: The carotenoids of algae: pigments from some Cryptomonads, a Heterokont and some Rhodophyceae. Journ. General Microb. 34, 259—267.
36. ALLERUP, S.: Induced transpiration changes: effects of some growth substances added to the root medium. PP 17, 899—908.
37. ANDERSEN, A. S.: Growth responses of etiolated crucifer hypocotyl sections to indole-3-acetic acid, indole-3-acetonitrile and indole-3-acetaldehyde. PP 17, 891—898.
38. — Pea-stem sections as test object for indole-3-acetaldehyde. PP 17, 875—883.
39. ANTOINE, A.: La resistance de la levure aux ions cuivriques. Saccharomyces ellipsoideus. ECR 36, 73—85.
40. AUDUS, L. J.: Geotropism and the modified sine rule; an interpretation based an the amyloplast statolith theory. PP 17, 737—745.
41. AUGUSTINUSSEN, E.: On the formation of chlorophyll-a and chlorophyll-b in etiolated leaves. PP 17, 403—406.
42. BARTON, R.: Electron microscope studies on the uptake of ferritin by plants roots. ECR 36, 432—434.
43. BEN-YEHOSHUA, S.: Respiration and ripening of discs of the avocado fruit. PP 17, 71—80.
44. BERGQUIST, N. O.: Absorption of carbon dioxide by plant roots. BN 117, 249—261.
45. BHAVANADAN, V. P., BOUVENG, H. O., and LINDBERG, B.: Polysaccharides from Polyporus giganteus. ACS 18, 504—512.
*46. BJÄLFVE, G.: The effectiveness of nodule bacteria. Plant and Soil 18, 70—76, 2 pl. 1963.
47. BJÖRN, L. O.: Effects of light on the concentration of chlorophyll and iron porphyrins in wheat roots. 4th Intern. Photobiol. Congr. Oxford 1964. Author's Abstracts, 93.
48. BRADFUTE, O. E., and MCLAREN, A. D.: Entry of protein molecules into plant roots. PP 17, 667—675.
49. BRANTON, D., and RUCH, F.: The localization of deoxyribonucleic acid and ultraviolet absorptive granules in Vicia faba root tips. ECR 36, 285—296.

50. BUETOW, D. E., and BUCHANAU, P. J.: Isolation of mitochondria from Euglena gracilis. ECR 36, 204—206.
51. BURSTRÖM, H. G.: Calcium, water conditions, and growth of pea seedling stems. PP 17, 207—219.
52. BURSTRÖM, H. G., and GABRIELSSON, B. E. S.: Localization of reactivation after UV-inhibition of root growth. PP 17, 964—974.
53. BÖSZÖRMÉNYI, Z., and CSEH, E.: Studies of ion-uptake by using halide ions changes in the relationships between ions depending on concentration. PP 17, 81—90.
54. CASTENHOLZ, R. W.: The effect of daylength and light intensity on the growth of littoral marine diatoms in culture. PP 17, 951—963.
55. CEDAR, O.: Polyene macrolide antibiotics: the structure of fungichromin, pimaricin and filipin. Svensk Kem. Tidskr. 76, 428—441. Diss., Stockholm.
56. CHRISTIANSEN, K.: Isolation of red beet mitochondria in sucrose solutions. PP 17, 884—890.
57. CLELAND, R.: The role of endogenous auxin in the elongation of Avena leaf sections. PP 17, 126—135.
58. CREASY, M. T., and SOMMER, N. F.: Growth of Fragaria vesca L. Receptacles in vitro with reference to gibberellin inhibition by unfertilized carpels. PP 17, 710—716.
59. CUMMINS, J. E., and MITCHISON, J. M.: A method for making autoradiographs of yeast cells which retain pool components. ECR 34, 406—409.
60. CURNUTT, S. G., and SCHMIDT, R. R.: Possible mechanisms controlling the intracellular level of inorganic polyphosphate during synchronous growth of Chlorella pyrenoidosa. Endogenous respiration. ECR 36, 102—110.
61. DAVIDSON, D.: RNA synthesis in roots of Vicia faba. ECR 35, 317—325.
62. DERBYSHIRE, E., and STREET, H. E.: Studies of the growth in culture of excised wheat roots V. The influence of light on nitrate uptake and assimilation. PP 17, 107—118.
63. EAGLES, C. F., and WAREING, P. F.: The role of growth substances in the regulation of bud dormancy. PP 17, 697—709.
64. EHRENBERG, L., and EHRENBERG, A.: Factors modifying sensitivity of plant seeds. TIBC, 318—319.
65. EMMERT, F. H.: Water utilization and calcium-strontium uptake in Phaseolus vulgaris. PP 17, 746—750.
66. ENGVILD, K. C.: Growth and chlorophyll formation of dark-grown pine embryos on different media. PP 17, 866—874.
67. EVANS, H. J.: Uptake of ^{3}H-thymidine and patterns of DNA replication in nuclei and chromosomes of Vicia faba. ECR 35, 381—393.
68. FADEEL, A. A.: Measurements of the carbon dioxide concentration in the intercellular spaces of wheat roots. PP 17, 1—13.
69. — Studies on the Metabolism of Chlorophyllous Roots, 6 s. Diss., Lund.
70. FORSBERG, C.: Phosphorus, a maximum factor in the growth of Characeae. Nature 201, 517—518.
71. FORSSBERG, A., STANKOVIC, V., and PEHAP, A.: The radiation response of Phycomyces — structural and biochemical effects. Radiation Bot. 4. 323—330.

72. FRIEND, D. J. C.: The promotion of floral initiation of wheat by far-red radiation. PP 17, 909—920.
73. FRIES, LISBETH: Polysiphonia urceolata in axenic culture. Nature 202, 110.
74. FRIES, N., and JOHANSSON, HJÖRDIS: Some nutritional requirements of two Onygena species. SBT 58, 31—43.
*75. GATENBECK, S., and MOSBACH, K.: The mechanism of biosynthesis of citromycetin. Biochem. Biophys. Res. Comm. 11, 166—169. 1963.
76. GATENBECK, S., and SJÖLAND, S.: Studies of factors determining the biosynthesis of secondary metabolites in moulds. Biochim. et Biophys. Acta 93, 246—250.
77. GENTILE, A. C., and KLEIN, R. M.: Absence of effect of visible radiation on elongation of decapitated Avena coleoptile sections. PP 17, 299—300.
78. GERONIMO, J., CATLIN, P. B., and MAXIE, E. C.: Metabolism of indoleacetic acid-2-C^{14} in plum stem cuttings. PP 17, 644—653.
79. GORTER, C. J.: Studies on abscission in explants of Coleus. PP 17, 331—345.
80. GRAHM, L.: Measurements of geoelectric and auxin-induced potentials in coleoptiles with a refined vibrating electrode technique. PP 17, 231—261.
81. GRAHM, L., and HERTZ, C. H.: Measurements of the geoelectric effect in coleoptiles. PP 17, 186—201.
82. HALEVY, A. H., MONSELISE, S. P., and PLANT, Z.: Effects of gibberellin on translocation and on dry matter and water content in several plant species. PP 17, 49—62.
83. HALLDAL, P.: Ultraviolet action spectra of photosynthesis and photosynthetic inhibition in a green and a red alga. PP 17, 414—421.
84. HAREL, E., MAYER, A. M., and SHAIN, Y.: Catechol oxidases from apples, their properties, subcellular location and inhibition. PP 17, 921—930.
85. HEIDE, O. M.: Effects of light and temperature on the generation ability of Begonia leaf cuttings. PP 17, 789—804.
86. HENRIKSSON, ELISABET: Studies in the physiology of the lichen Collema. Abstracts of Uppsala Diss. in Science 38, 13 s.
87. — Studies in the physiology of the lichen Collema. V. Effect of medium, temperature, and pH on growth of the mycobiont. SBT 58, 361—370.
88. HERTZ, C. H.: Graviperception and the geoelectric effect. TIBC, 193.
89. VON HOFSTEN, ANGELICA: Some aspects of the morphogenesis in Ophiostoma. Abstracts of Uppsala Diss. in Science 33, 10 s.
90. — The effect of fluorodeoxyuridine and deoxyadenosine on growth and morphogenesis of Ophiostoma multiannulatum. PP 17, 177—185.
91. — The effect of ultraviolet light and X-rays on growth and morphogenesis of Ophiostoma multiannulatum. PP 17, 221—230.
92. HOLST, A.: The effect of sodium, potassium and calcium ions on the fluidity of the protoplasm. SBT 58, 409—431.
93. INGESTAD, T., and NILSSON, H.: The effects of soil fumigation, sucrose application, and inoculation of sugar fungi on the growth of forest tree seedlings. Plant and Soil 20, 74—84.
94. JACOBSON, B. S., SALMON, R. J., and LANSKY, L. L.: Antimitotic effects of chloramphenicol and other inhibitory agents in Chlamydomonas. ECR 36, 1—13.

95. JARVIS, P. G.: Interference by Deschampsia flexuosa (L.) Trin. Oikos 15, 56—78.
96. — The adaptability to light intensity of seedlings of Quercus petraea (Matt.) Liebl. Journ. Ecol. 52, 545—571.
97. JARVIS, P. G., and JARVIS, MARGARET S.: Growth rates of woody plants. PP 17, 654—666.
98. JENSEN, G.: Relationship between water absorption and uptake of potassium or calcium in root systems. PP 17, 779—788.
99. JENSEN, H. L.: Studies on soil bacteria (Arthrobacter globiformis) capable of decomposing the herbicide endothal. AAS 14, 193—207.
100. JOHANSSON, M.: Growth and alkaloid production by Claviceps purpurea (Fr.) Tul. Abstracts of Uppsala Diss. in Science 43, 8 s.
101. — Growth and alkaloid production by Claviceps purpurea (Fr.) Tul. I. The effect of whey and whey fractions. PP 17, 493—506.
102. — D:o II. The effect of chelating agents, especially 8-hydroxyquinoline (oxine). PP 17, 507—529.
103. — D:o III. Reversal of the action of 8-hydroxyquinoline (oxine). PP 17, 530—546.
104. — D:o IV. Some metabolic changes caused by oxine. PP 17, 547—559.
105. JØRGENSEN, E. G.: Adaptation to different light intensities in the diatom Cyclotella Meneghiniana Kütz. PP 17, 136—145.
106. — Chlorophyll content and rate of photosynthesis in relation to cell size of the diatom Cyclotella Meneghiniana. PP 17, 407—413.
107. KAMIMURA, S., and GOODMAN, R. N.: Influence of foliar characteristics on the absorption of a radioactive model compound by apple leaves. PP 17, 805—812.
108. KAWASE, M.: Centrifugation, rhizocaline and rooting in Salix alba L. PP 17, 855—865.
109. KIHLBERG, R.: Mikrobiell framställning av aminosyror. Svensk Kem. Tidskr. 76, 321—337.
110. KNYPL, J. S.: Coumarin-induced respiration of sunflower. PP 17, 771—778.
111. KYLIN, A.: An outpump balancing phosphate-dependent sodium uptake in Scenedesmus. Biochem. Biophys. Res. Comm. 16, 497—500.
112. — Sulphate uptake and metabolism in Scenedesmus as influenced by phosphate, carbon dioxide, and light. PP 17, 422—433.
113. — The effect of phosphate on ion uptake in relation to conditions of photosynthesis. TIBC, 172.
114. — The influence of phosphate nutrition on growth and sulphur metabolism of Scenedesmus. PP 17, 384—402.
115. LAMPORT, D. T. A.: Cell suspension cultures of higher plants: isolation and growth energetics. ECR 33, 195—206.
116. LANE, F. E., and BAILEY, L. F.: Isolation and characterization studies on the β-inhibitor in dormant buds of the silver maple, Acer saccharinum L. PP 17, 91—99.
117. LARSEN, P., and KLUNGSÖYR, SIGRID: Quantitative determination of indole-3-acetaldehyde. PP 17, 151—156.
118. LEWIS, L. N., and TOLBERT, N. E.: Nitrogen requirement and metabolism of Erwinia amylovora. PP 17, 44—48.

119. LIBBERT, E.: Kontrolliert Auxin die Apikaldominanz? PP 17, 371—378.
120. LINDAHL, P. E. B.: Effects of aquatic plants on tetramethylthiuram disulphide and sodium dimethyldithiocarbamate. Lantbrukshögsk. Annaler 30, 375—404.
121. LINDBERG, B., SILVANDER, B.-G., and WACHTMEISTER, C. A.: Studies on the chemistry of lichen 19. Mannitol glycosides in Peltigera species. ACS 18, 213—216.
122. LJUNGCRANTZ, I., and MOSBACH, K.: Synthesis of four ethyl-dimethylbenzenetriols in relation to a new phenolic metabolite of Penicillium baarnense. ACS 18, 638—642.
123. LONZO, C., and ARRIGONI, O.: Functional properties of isolated plant mitochondria. High amplitude swelling. ECR 35, 572—579.
124. LUNDEGÅRDH, H.: Action spectra of the reducing and oxidizing systems in spinach chloroplasts. Biochim. et Biophys. Acta 88, 37—56.
125. — Light-induced spectral changes in chloroplasts. PP 17, 202—206.
126. — Non-activity of cytochrome oxidase in the photosynthesis. PP 17, 379—383.
127. — The cytochromes of chloroplasts. Proc. Natl. Acad. Sci. 52, 1587—1590.
128. — The effect of light on chloroplast carotenoids. PP 17, 482—491.
*129. — The response of chloroplast cytochromes to light substrates and oxygen. Colloq. Intern. Centre Nat. Rech. Scient. 119 (La Photosynthèse), 449—465, 4 pl. 1963.
*130. — The response of photosynthetic pyridine nucleotide to light and substrates. Biochim. et Biophys. Acta 75, 70—87. 1963.
131. LÜNING, B.: Studies on Orchidaceae alkaloids I. Screening of species for alcaloids 1. ACS 18, 1507—1516.
132. LÖFROTH, G., EHRENBERG, A., and EHRENBERG, L.: Analysis of radiation induced electron spin resonance spectra in plant seeds. Radiation Bot. 4, 455—467.
133. MATHUR, S. N., and MITTAL, S. P.: Effect of gibberellin on flowering in cotton. PP 17, 275—278.
134. MCILRATH, W. J., and SKOK, J.: Distribution of boron in the tobacco plant. PP 17, 839—845.
*135. MELIN, E.: Some effects of forest tree roots on mycorrhizal Basidiomycetes. Symbiotic Associations (13. Symp. Soc. Gen. Microb. London 1963), 125—145, 3 pl. Cambridge. 1963.
136. MILLBANK, J. W.: DNA and protein synthesis in the growing yeast protoplast. ECR 35, 77—83.
137. MITCHISON, J. M., and CUMMINS, J. E.: Changes in the acid-soluble pool during the cell cycle of Schizosaccharomyces pombe. ECR 35, 394—401.
138. MOLIN, N.: Acquired and natural resistance to N_{α}-acyldipeptides. PP 17, 468—481.
139. — Antimicrobial effects of N_{α}-acyldipeptides I. Antimicrobial spectrum. PP 17, 443—455.
140. — D:o II. The influence of molecular configuration on antimicrobial activity. PP 17, 456—467.
141. — The influence of various nutritional components on the biological activity of N_{α}-palmitoyl-L-lysyl-L-lysine-ethylester. PP 17, 931—939.

142. — Uptake of N_{α}-palmitoyl-L-lysyl-L-lysine-ethylester by some microorganisms and its relation to uptake of some amino acids. PP 17, 940—950.
*143. MOSBACH, K.: Die Rolle der Malonsäure in der Biosynthese der Orsellinsäure. Die Naturwiss. 48, 525. 1961.
144. — On the biosynthesis of lichen substances Part I. The depside gyrophoric acid. ACS 18, 329—334.
145. — D:o Part II. The pulvic acid derivative vulpinic acid. Biochem. Biophys. Res. Comm. 17, 363—367.
*146. — Purification and some properties of laccase from Polyporus versicolor. Biochim. et Biophys. Acta 73, 204—212. 1963.
147. — Studies on the Biosynthesis of Aromatic Compounds in Fungi and Lichen, 30 s. Diss., Lund.
148. — The role of propionic acid in Penicillium baarnenese. Formation of homo-orsellinic acid by utilization of propionic acid. ACS 18, 1591—1595.
149. MURASHIGE, T.: Analysis of the inhibition of organ formation in tobacco tissue culture by gibberellin. PP 17, 636—643.
150. MUSZYNSKI, S.: A survey of anthocyanidins in Petunia. PP 17, 975—979.
151. MYTTENAERE, C.: Influence du rapport strontium - calcium sur la localisation du strontium et du calcium chez Pisum sativum. PP 17, 815—826.
152. NEUMANN, J.: The effect of actinomycin D on lettuce seedlings and its differential uptake by roots and shoots. PP 17, 363—370.
153. NISHIDA, K., and KOSHII, K.: On the volume-changes of isolated spinach chloroplasts caused by electrolytes and sugars. PP 17, 846—854.
*154. NORDSTRÖM, K.: Formation of esters, acids and alcohols from α-keto acids by brewer's yeast. Journ. Inst. Brew. 69, 483—495. 1963.
*155. — Formation of esters from acids by brewer's yeast I. Kinetic theory and basic experiments. Journ. Inst. Brew. 69, 310—322. 1963.
156. — D:o II. Formation from lower fatty acids. Journ. Inst. Brew. 70, 42—55.
157. — D:o III. Formation by various strains. Journ. Inst. Brew. 70, 226—233.
158. — D:o IV. Effect of higher fatty acids and toxicity of lower fatty acids. Journ. Inst. Brew. 70, 233—242.
159. — Formation of esters from alcohols by brewer's yeast. Journ. Inst. Brew. 70, 328—336.
*160. — Formation of ethyl acetate in fermentation with brewer's yeast. Journ. Inst. Brew. 67, 173—181. 1961.
*161. — D:o II. Kinetics of formation from ethanol and influence of acetaldehyde. Journ. Inst. Brew. 68, 188—196. 1962.
*162. — D:o III. Participation of coenzyme A. Journ. Inst. Brew. 68, 398—407. 1962.
*163. — D:o IV. Metabolism of acetyl-coenzyme A. Journ. Inst. Brew. 69, 142—153. 1963.
164. — D:o V. Effect of some vitamins and mineral nutrients. Journ. Inst. Brew. 70, 209—221.
165. — Studies on the formation of volatile esters in fermentation with brewer's yeast. Svensk Kem. Tidskr. 76, 510—543. Diss., Stockholm.
166. NORÉN, B.: Effect of metabolic products of Eubacteria on the bacteriolytic activity of Myxococcus xanthus. PP 17, 262—268.
*167. NORÉN, B., and RAPER, K. B.: Antibiotic activity of myxobacteria in relation to their bacteriolytic capacity. Journ. Bact. 84, 157—162. 1962.

168. NORIN, T.: Studies on the Chemistry of Terpenes, 24 s. Diss., Stockholm.
169. NWACHUKU, N. I. C., and LOXKHART, J. A.: Hypocotyl elongation in mustard and mung bean seedlings as influenced by light, gibberellin, and chlorocholine chloride. PP 17, 725—736.
170. NYBOM, N.: Amino acid analysis by means of thin-layer electrophoresis combined with chromatography. PP 17, 434—442.
171. — Thin-layer chromatographic analysis of anthocyanidins. PP 17, 157—164.
172. OLERED, R.: Studies on the development of α-amylase activity in ripening wheat. Arkiv för Kemi 22(: 15), 175—183.
173. PAASCHE, E.: A tracer study of the inorganic carbon uptake during coccolith formation and photosynthesis in the coccolithophorid Coccolithus huxleyi. PP Suppl. 3, 82 s.
174. PERSSON, K. Ö. U.: A comparative investigation of the acid-soluble nucleotides of Penicillium daleae and Penicillium urticae. ACS 17, 2750—2762.
175. PETTERSSON, G.: On the biosynthesis of toluquinones from Aspergillus fumigatus I. The biogenetic role of orsellinic acid and orcinol. ACS 18, 1202—1207.
176. — D:o II. Hydroquinone forms of the pigments. ACS 18, 1428—1436.
177. — D:o III. Autoxidation of the hydroquinone forms of the pigments. ACS 18, 1839—1850.
178. PHARIS, R. P., BARNES, R. L., and NAYLOR, A. W.: Effects of nitrogen level, calcium level and nitrogen source upon the growth and composition of Pinus taeda L. PP 17, 560—572.
179. PILET, P. E., et GASPAR, T.: Analyse critique de l'activité auxines-oxydasique des racines du Lens. PP 17, 324—330.
180. PLAUT, Z., and ORDIN, L.: The effect of moisture tension and nitrogen supply on cell wall metabolism of sunflower leaves. PP 17, 279—286.
181. POGO, A. O., and ARCE, A.: Synchronization of cell division in Euglena gracilis by heat shock. ECR 36, 390—397.
182. PRENSKY, W., and SMITH, H. H.: Incorporation of ^{3}H-arginine in chromosomes of Vicia faba. ECR 34, 525—532.
183. RAMSTAD, E., and AGURELL, S.: Alkaloid biogenesis. Ann. Rev. Plant Phys. 15, 143—168.
184. RAPPE, G.: A yearly rhythm in production capacity of gramineous plants B I. Experiments in photothermostats on artificial seedbeds. Oikos 15, 140—161.
185. RISSER, P. G., and WHITE, P. R.: Nutritional requirements of spruce tumor cells in vitro. PP 17, 620—635.
186. ROBERTS, E. H.: A survey of the effects of chemical treatments on dormancy in rice seed. PP 17, 30—43.
187. — The distribution of oxidation-reduction enzymes and the effects of respiratory inhibitors and oxidising agents on dormancy in rice seed. PP 17, 14—29.
188. ROBINSON, P. M., and WAREING, P. F.: Chemical nature and biological properties of the inhibitor varying with photoperiod in sycamore (Acer pseudoplatanus). PP 17, 314—323.

189. ROGOZINSKA, J. H., HELGESON, J. P., and SKOOG, F.: Test for kinetin-like growth promoting activities of triacanthine and its isomer, 6-(γ,γ-dimethyl-allylamino)-purine. PP 17, 165—176.
190. RONONEN, I. E., and VIRTANEN, A. I.: Growth of Hedysarum coronarium L. with combined nitrogen. PP 17, 146—150.
191. ROYCHOUDHURY, R., and SEN, S. P.: Studies on the mechanism of auxin action: auxin regulation of nucleic acid metabolism in pea internodes and coconut milk nuclei. PP 17, 352—362.
192. RUFELT, H.: The use of chemical differentiators of growth and metabolism to elucidate mechanisms. TIBC, 194.
193. SACHSENMAIER, W., and RUSCH, H. P.: The effect of 5-fluoro-2′-deoxyuridine on synchronous mitosis in Physarum polysephalum. ECR 36, 124—133.
194. SADDIK, K.: Absorption of cesium by wheat and pea plants as affected by some cations. Lantbrukshögsk. Annaler 29, 247—257.
195. SADDIK, K., and STENLID, G.: Sugars and uncoupling agents as inhibitors of cesium uptake by excised wheat roots. Lantbrukshögsk. Annaler 29, 241—246.
196. SÁGI, F., and GARAY, A. S.: Enzymatic indole-3-acetic acid destruction in the different, genetically determined growth types of Lupinus luteus L. PP 17, 269—274.
197. SAHLMAN, KARIN, and FÅHRÆUS, G.: An electron microscope study of root-hair infection by Rhizobium. Journ. General Microb. 33, 425—427, 1 pl.
*198. SANDBERG, F., and MICHEL, K.-H.: Phytochemische Studien über die Flora Ägyptens. VI. Über die Saponine und Prosaponine von Anabasis articulata. Lloydia 25, 142—150. 1962.
*199. SANDBERG, F., and THORSÉN, R.: Phytochemical and pharmacological investigations of the water-soluble cardiac glycosides of Adonis vernalis. Lloydia 25, 201—208. 1962.
200. SCHRANK, A. R.: Growth and geotropic curvature of Avena coleoptiles in the presence of 2,6-dichlorobenzoic acid. PP 17, 346—351.
201. SCHREIBER, R. W., NUGENT, N. A., and CHAPMAN, C. J.: An improved technique for the culture of Acetabularia. ECR 36, 421—422.
202. SCOPES, A. W., and WILLIAMSON, D. H.: The growth and oxygen uptake of synchronously dividing cultures of Saccharomyces cerevisiae. ECR 35, 361—371.
203. SCOTT, D., and EVANS, H. J.: Influence of the nucleolus on DNA synthesis and mitosis in Vicia faba. ECR 36, 145—159.
204. SHAW, G., and YEADON, A.: Chemical studies on the constitution of some pollen and spore membranes. GP 5, 247—252.
205. SHEOPSHIRE, W., JR., KLEIN, W. H., and EDWARDS, J. L.: Photomorphogenesis induced by flavin-mono-nucleotide fluorescence. PP 17, 676—682.
206. SHIMABUKURO, R. H., and LINCK, A. J.: The interaction of temperature and carbohydrate concentration with absorption and translocation of 3-amino-1,2,4-triazole in bean. PP 17, 100—106.
207. SJÖSETH, H.: Studies on frost hardening in plants. AAS 14, 178—192.
208. SLANKIS, V., RUNECKLES, V. C., and KROTKOV, G.: Metabolites liberated by roots of white pine (Pinus strobus L.) seedlings. PP 17, 301—313.

209. SOROKIN, CONSTANTINE: Buffering activity of algal cells and its effect on cell division. ECR 33, 508—515.

210. SPEER, H. L., and JONES, R. F.: Studies on the respiration of whole cells and cellfree preparations of the red alga Porphyridium cruentum. PP 17, 287—298.

211. SPOMER, G. G.: Physiological ecology studies of alpine cushion plants. PP 17, 717—724.

212. SRB, V.: Effect of storage of X-ray irradiated onions Allium cepa L. on changes in cell permeability. ECR 36, 270—274.

213. STENMARK, C. G., SAMUELSSON, G., and CARLSSON, U.: Isolation of a hemiagglutinin from Laburnum alpinum. Lloydia 27, 226—232.

214. VAN STEVENINCK, R. F. M.: A comparison of chloride and potassium fluxes in red beet tissue. PP 17, 757—770.

*215. STÅLFELT, M. G.: Die Abhängigkeit des osmotischen Potentials der Stomatazellen vom Wasserzustand der Pflanze. Protoplasma 57, 719—729. 1963.

216. — Reactions participating in the photoactive opening of the stomata. PP 17, 828—838.

217. SUNDMAN, VERONICA, KUUSI, T., KUHANEN, S., and CARLBERG, GUNNEL: Microbial decomposition of lignins IV. Decomposition of lignin by various micropopulations. AAS 14, 229—248.

*218. SUNDSTRÖM, K. R.: Physiological and morphological studies of some species belonging to the genus Exobasidium. Phytopath. Zeitschr. 40, 212—217. 1960.

219. — Studies of the physiology, morphology and serology of Exobasidium. Symb. Bot. Upsal. 18: 3, 89 s., 8 pl.

220. TAKAHASHI, T., and HIRAI, T.: Respiratory increase in tobacco leaf epidermis in the early stage of tobacco mosaic virus infection. PP 17, 63—70.

221. TIMELL, T. E.: Studies on some ancient plants. Svensk Papperstidn. 67, 356—363.

222. ULRICH, J. M., LUSE, R. A., and MCLAREN, A. D.: Growth of tomato plants in presence of proteins and amino acids. PP 17, 683—696.

223. UNESTAM, T.: Kräftpestproblemet. Svensk Naturvetenskap 17, 317—327, summary 327.

224. WAGNE, C.: The distribution of the light-effect in partly irradiated grass leaves. PP 17, 751—756.

225. WANG, C.-S., and MILES, P. G.: The physiological characterization of dikaryotic mycelia of Schizophyllum commune. PP 17, 573—588.

*226. VEGIS, A.: Climatic control of germination, bud break, and dormancy. Environmental Control of Plant Growth, ed. L. T. EVANS, 265—285. New York & London. 1963.

227. WEISER, C. J., BLANEY, L. T., and LI, P.: The question of boron and sugar translocation in plants. PP 17, 589—599.

228. WHITE, P. R., and RISSER, P. G.: Some basic parameters in the cultivation of spruce tissues. PP 17, 600—619.

229. WHITFIELD, F. E.: The use of proteolytic and other enzymes in the separation of slime mould grex. ECR 36, 62—72.

230. WIKLERT, P.: Studier av vissningsgränsen. En modifierad odlingsmetod. Texturell och strukturell vissningsgräns. Upptagningsgräns. Grundförbättring 17, 1—100, summary 87—95.
231. WILSON, B. W., and LEVEDAHL, B. H.: Synthetic and division rates of Euglena gracilis grown in batch cultures. ECR 35, 69—76.
232. VINCE, D., BLAKE, J., and SPENCER, R.: Some effects of wavelength of the supplementary light on the photoperiodic behaviour of the long-day plants, carnation and lettuce. PP 17, 119—125.
233. WOLLGIEHN, R., und MOTHES, K.: Über die Incorporation von ^{3}H-Thymidin in die Chloroplasten-DNS von Nicotiana rustica. ECR 35, 52—57.
234. ZACHARIAS, B.: Biological nitrogen fixation. The effect of irradiated nitrogen gas on nitrogen fixation by Azotobacter. Svensk Kem. Tidskr. 76, 87—96. Diss., Stockholm.
*235. — Detection of gas ions in ultraviolet irradiated nitrogen gas and their effect on nitrogen fixation in batch cultures of different species and strains of the genus Azotobacter. ACS 17, 1599—1603. 1963.
*236. — Detection of positive and negative gas ions in ultraviolet irradiated nitrogen gas and their effect on nitrogen fixation in continuous cultures of Azotobacter vinelandii. ACS 17, 2221—2224. 1963.
237. — Effect of nitrogen gas, irradiated with beta-ray source, on nitrogen fixation in continuous cultures of Azotobacter vinelandii. ACS 17, 2225—2229.
*238. — Effect of UV-irradiated nitrogen gas on biological nitrogen fixation in batch cultures of Azotobacter vinelandii. Biotechn. and Bioengin. 4, 87—97. 1962.
*239. — Effect of UV-irradiated nitrogen gas on biological nitrogen fixation in continuous cultures of Azotobacter vinelandii. ACS 17, 2055—2060. 1963.
240. ZETTERBERG, G.: Mutagenic effect of ultraviolet and visible light. Photophysiology 2, ed. A. C. GIESE, 247—281. New York & London.
241. ÅBERG, E.: Susceptibility: factors in the plant modifying the response of a given species to treatment. The Physiology and Biochemistry of Herbicides, ed. L. J. AUDUS, 401—422. London & New York.

Se även nr. 11, 21, 22, 244, 247, 291, 398, 411, 423, 434.

Genetik. Cytologi – Genetics. Cytology

242. ALMGÅRD, G.: Experiments with Poa II. Studies on polyhaploid Poatypes. Lantbrukshögsk. Annaler 30, 335—373.
243. BJÖRK, S.: Kromosomgeografi och kromosomekologi beträffande Phragmites communis. Chromosome geography and ecology of Phragmites communis. Skrifter utg. av Södra Sver. Fiskeriför., Årsskr. 1961—1962, 71—81. Lund.
244. BJÖRKMAN, O. E.: Metabolic differences within species and their adaptive relation to climate. TIBC, 144.
245. BLIXT, S.: Studies of induced mutations in peas. VIII. Ethyleneimine and gamma-ray treatments of the variety Wilham Wonder. AHG 22, 171—183.
246. BLIXT, S., GELIN, O., MOSSBERG, R., AHNSTRÖM, G., EHRENBERG, L., and LÖFGREN, R. A.: Studies of induced mutations in peas. IX. Induction of leaf spots in peas. AHG 22, 186—194.
247. BOOTHROYD, E. R., and LIMA-DE-FARIA, A.: DNA-synthesis and differential reactivity in the chromosomes of Trillium at low temperature. Her. 52, 122—126.

248. BÖCHER, T. W.: Chromosome connections and aberrations in the Campanula persicifolia group. SBT 58, 1—17.
249. DAHLGREN, K. V. O.: Chromosome numbers in the genus Plumbago. A review, revision and reinvestigation. SBT 58, 172—176.
*250. EHRENBERG, L.: Chemical mutagenesis: biochemical and chemical points of view on mechanisms of action. Abh. Dtsch. Akad. Wiss. Berlin Kl. Medizin 1960: 1, 124—136. 1960.
251. EHRENBERG, L., and ERIKSSON, G.: Mutation in the waxy character in barley pollen grain following ^{90}Sr-incorporation at low activities. Mutation Research 1, 139—145.
252. FRÖST, S.: Further studies of accessory chromosomes in Crepis conyzaefolia. Her. 52, 237—239.
253. FRÖST, S., and ISING, G.: Cytogenetics of fragment chromosomes in barley. Her. 52, 176—180, 1 pl.
254. GELIN, O., and BLIXT, S.: Root nodulation in peas. AHG 22, 149—159.
255. GOLDSCHMIDT, E.: Cytologische Untersuchungen an diploiden Arten und Arthybriden der Gattung Ribes L. Her. 51, 146—186, 4 pl.
256. — Cytologische Untersuchungen an tetraploiden Pflanzen der Gattung Ribes L. Her. 52, 139—150, 2 pl.
257. HAGBERG, A., and PERSSON, G.: Practical use of mutations in genetics, taxonomy and breeding. Barley Genetics I (Proc. 1. Intern. Barley Genetics Symp. Wageningen 1963), 55—67.
258. HAGMAN, M.: Incompatibility in Pinus. Her. 52, 245.
259. HALKKA, O.: A photometric study of the Luzula problem. Her. 52, 81—88.
260. HEDBERG, INGA and O.: Documented chromosome numbers of Swedish plants. SBT 58, 125—128.
261. JONSELL, B.: Chromosome numbers of Rorippa silvestris (L.) Bess. in Scandinavia. SBT 58, 204—208.
262. KIVI, E.: Relationships between seed and pollen fertility in an X- and gamma-rays treated barley. Her. 52, 244—245.
263. LAMPRECHT, H.: Der Effekt interspezifischer Gene sowie neue Ergebnisse mit der Exmutante microsurculus u.a. Zur Kenntnis der naturbedingten Spezies. AHG 22, 1—55.
264. — Die Vererbung eines neuen Typs von Marmorierung der Samen von Phaseolus vulgaris L. AHG 22, 256—271.
265. — Partielle Sterilität und Chromosomenstruktur bei Pisum. AHG 22, 56—148.
266. — Species concept and the origin of species. The two categories of genes: intra- and interspecific ones. A simplified presentation. AHG 22, 272—280.
267. — Zur Chromosomenstruktur von Hammarlunds K-Linie von Pisum. AHG 22, 227—242.
268. LANGLET, O.: Tvåhundra år genekologi. SBT 58, 273—308.
269. LEVAN, A., FREDGA, K., and SANDBERG, A. A.: Nomenclature for centromeric position on chromosomes. Her. 52, 201—220.
270. LIMA-DE-FARIA, A.: Seriation of meiotic stages and spindle orientation in Gazania. Portug. Acta Biol. Sér. A. 8, 147—153.
*271. — The evolution of the structural pattern in a rye B chromosome. Evolution 17, 289—295. 1963.

272. LIMA-DE-FARIA, A., and JAWORSKA, HALINA: Haplo-diploid chimaeras in Haplopappus gracilis. Her. 52, 119—122.
273. LUNDQVIST, A.: The nature of the two-loci incompatibility system in grasses III. Frequency of specific incompatibility alleles in a population of Festuca pratensis Huds. Her. 52, 189—196.
274. — D:o IV. Interaction between the loci in relation to pseudo-compatibility in Festuca pratensis Huds. Her. 52, 221—234.
275. LÖVE, Á., and KJELLQVIST, E.: Chromosome numbers of some Iberian Cistaceae. Portug. Acta Biol. Sér. A. 8, 69—80.
276. MILLER, J. J.: A comparison of the effects of several nutrients and inhibitors on yeast meiosis and mitosis. ECR 33, 46—49.
277. MÜNTZING, A.: Ärftlighetsforskning. En översikt av metoder och huvudresultat. 3. omarb. uppl., 400 s. Stockholm.
278. NORDENSKIÖLD, HEDDA: The effect of X-irradiation on diploid and polyploid Luzula. Her. 51, 344—374.
279. NYGREN, A.: Relationship and chromosome cytology. TIBC, 147.
*280. PERSSON, G., and HAGBERG, A.: Linkage data from studies on mutations induced in Bonus barley. Barley Newsletter 7, 39—40. 1963.
*281. — Linkage studies with the erectoides loci. Barley Newsletter 5, 46—47. 1961.
282. VON ROSEN, G.: Mutations induced by the action of metal ions in Pisum II. Further investigations on the mutagenic action of metal ions and comparison with the activity of ionizing radiation. Her. 51, 89—134.
283. SIMAK, M.: Karyotype analysis of Siberian larch (Larix sibirica Ledb. and Larix sukaczewii Dyl.). Studia Forest. Suec. 17, 15 s., sammanf. 14.
284. SJÖDIN, J.: Some unifoliata mutants in Vicia faba L. Her. 51, 279—290.
285. WALLES, B.: Macromolecular biology of lethal chloroplast mutants. Her. 52, 245—246.
286. WEIBULL, G.: Note on a possible natural polyploidizing process in Dactylis glomerata L. AHG 22, 184—185.
287. ZEILINGA, A. E.: Polyploidy in Cotoneaster. BN 117, 262—278.

Se även nr. 2, 21, 22, 28, 44, 61, 64, 67, 94, 136, 181, 182, 193, 203, 296, 307, 401, 407, 414, 416, 418, 429.

Nomenklatur. Systematik — Nomenclature. Systematics

1. Fanerogamer — Phanerogamae

288. CHRTEK, J., und JIRÁSEK, V.: Zur Erkenntnis der taxonomischen Probleme der Art Poa balfourii Parn. in Skandinavien. BN 117, 200—212.
289. DAHLGREN, R.: The correct name of the »Rooibos» tea plant. BN 117, 188—196.
290. — The genus Euchlora Eckl. & Zeyh. as distinguished from Lotononis Eckl. & Zeyh. BN 117, 371—388.
*291. ERDTMAN, H.: Some aspects of chemotaxonomy. Pure and Applied Chemistry 6, 679—708. 1963.
292. FLINCK, K. E., and HYLMÖ, B.: Cotoneaster splendens, a new species from western China. BN 117, 124—132.
293. FRÖHNER, S.: Zwei Alchemilla-Probleme aus Nordeuropa. BN 117, 33—55.
294. HEDBERG, INGA: Pubescence — a spurious taxonomic character in Anthoxanthum odoratum L. s. lat. SBT 58, 237—240, 1 pl.

295. HEDGE, I., and WENDELBO, P.: Acanthophyllum xanthoporphyranthum sp. nov. from W. Afghanistan. BN 117, 315—317.
296. HOLMEN, K.: Cytotaxonomical studies in the Arctic Alaskan flora. The genus Festuca. BN 117, 109—118.
*297. HOWARD, R. A., and NORLINDH, T.: The typification of Diospyros ebenum and Diospyros ebenaster. Journ. Arnold Arboretum 43, 94—107. 1962.
298. HULTÉN, E.: Pedicularis sudetica in Colorado. SBT 58, 435—437.
299. — The Saxifraga flagellaris complex. SBT 58, 81—104.
300. HYLANDER, N.: Alchemilla-studier. 1. Om Alchemilla oxyodonta, dess avgränsning och utbredning. SBT 58, 241—257, Zusammenf. 254—256.
301. — The taxonomic treatment of geographical and ecological races within the Scandinavian flora. TIBC, 122.
302. JANSSON, C.-A.: A new Sedum-species from Mt Victoria in Burma. Acta Horti Gotoburg. 27, 7—10, 2 pl.
303. JULIN, E.: Eine neue skandinavische Sippe des Ranunculus monophyllus. SBT 58, 486—490, 1 pl.
304. — Några ord om Sveriges majranunkelflora. SBT 58, 27—30.
305. KJELLQVIST, E.: Festuca arenaria Osb. — a misinterpreted species. BN 117, 389—396.
306. KŘÍSA, B.: Taxonomic revision of the Pyrola rotundifolia complex in Fennoscandia. BN 117, 397—417.
307. LAMPRECHT, H.: Genanalytische Studien zur Artberechtigung von Pisum transcaucasicum (Govorov) Stankov. AHG 22, 243—255.
308. LINDMAN, C. A. M.: Nordens Flora. Texten granskad och reviderad av M. FRIES, 3 vol., XXXVI+673 s., 663 pl. Stockholm.
309. MARKLUND, G.: A new Taraxacum from Australia (A.C.T.). BN 117, 197—199.
309a. — En för mellersta Norrland och den västnyländska svenskbygden gemensam majranunkel. SBT 58, 18—26, 1 pl., Zusammenf. 24—26.
310. NILSSON, A.: Något om skånska förekomster av Festuca arundinacea Schreb. var. aspera (Mutel) A. o. G., och liknande utländska typer av rödsvingel. Weibulls Grästips maj 1964, 175—185, summary 183—185.
*311. NORDENSTAM, B.: Hybrids of Euryops in Kirstenbosch. Journ. Bot. Soc. South Afr. 49, 15—16. 1963.
312. — A new species of Eriocephalus. Journ. South Afr. Bot. 30, 49—52.
313. — A new species of Othonna. Journ. South Afr. Bot. 30, 27—29.
314. — Comptonanthus, a new genus of the Compositae with notes on Lasiopogon in South Africa. Journ. South Afr. Bot. 30, 53—65.
315. — Studies in South African Liliaceae. I. New species of Wurmbea. BN 117, 173—182.
316. — D:o II. Two small species of Bulbine. BN 117, 183—187.
317. — The lost type species of Elytropappus Cass. Journ. S. Afr. Bot. 30, 45—48.
318. NORDHAGEN, R.: Om Oxytropis lapponica (Wg) Gaud. og O. deflexa (Pall.) DC. subsp. norvegica Nordh. SBT 58, 129—166, summary 159—163.
319. NORLINDH, T.: On the identity of Arctotis stoechadifolia Berg. SBT 58, 193—203.
320. RAYMOND, M.: A new Columnea of sect. Pentadenia from Ecuador. SBT 58, 184—192.
321. SKOTTSBERG, C.(†): Wikstroemiae novae hawaiienses. SBT 58, 177—183.

322. SNOGERUP, S.: Juncaceae, rush family. K. H. RECHINGER: Flora of Lowland Iraq, 140—142. Weinheim.
323. SPARRE, B.: Wikstroemiae novae hawaiienses — a supplement. SBT 58, 497.
324. WENDELBO, P.: Erodium dimorphum sp. nov., an alpine species from northern Iran. BN 117, 28—32.
325. — Two now species of Scrophularia from East Afghanistan. BN 117, 366—370.

Se även nr. 6, 17, 19, 30, 287, 361, 480.

2. Kryptogamer — Cryptogamae

326. CRUNDWELL, A. C., and NYHOLM, ELSA: Amblystegium saxatile Schimp. in Cornwall, new to the British Isles. Transact. Brit. Bryol. Soc. 4, 638—641.
327. — — The European species of the Bryum erythrocarpum complex. Transact. Brit. Bryol. Soc. 4, 597—637.
328. DIXON, P. S.: Taxonomic and nomenclatural notes on the Florideae, IV. BN 117, 56—78.
329. DIXON, P. S., and RUSSEL, G.: Miscellaneous notes on algal taxonomy and nomenclature, I. BN 117, 279—284.
330. DU RIETZ, G. E.: Sphagnum nemoreum Scop. or Sph. capillaceum (Weis) Schrank? SBT 58, 167—171.
331. ERIKSSON, O.: Nectriella laminariae n. sp. in stipes of a Laminaria. SBT 58, 233—236.
332. ETTL, H.: Trachydiscus nov. gen., eine neue Gattung der coccalen Xanthophyceen. BN 117, 213—221.
333. HOLM, L.: Études urédinologiques. SBT 58, 105—112.
334. JUNELL, LENA: The genus Spolverinia A. Massal. SBT 58, 55—61.
335. LANGE, M.: Svampflora (Svensk översättning och bearbetning av O. ANDERSSON), 239 s. Stockholm.
336. LUNDQVIST, N.: Anopodium, a new genus of coprophilous Pyrenomycetes with apically pedicellate spores. BN 117, 355—365.
337. — Fimetariella, a new genus of coprophilous Pyrenomycetes. BN 117, 238—248.
338. — The genus Trichodelitschia in Sweden. SBT 58, 267—272.
339. NILSSON, S.: Freshwater Hyphomycetes. Taxonomy, morphology, and ecology. Symb. Bot. Upsal. 18:2, 130 s.
340. — Studies on freshwater Hyphomycetes. Abstracts of Uppsala Diss. in Science 37, 13 s.
341. NORDIN, I.: Abrothallus suecicus, a common lichenicolous fungus. SBT 58, 225—232, 3 pl.
342. SKUJA, H.: Weiteres zur Kenntnis der Süsswasserrhodophyceen der Gattung Nothocladus. Revue Algol., N.S., 7, 304—314.
*343. THOMASSON, K.: Algological notes 2. An interesting Staurastrum population. Revue Algol., N.S., 7, 93—99, 1 pl. 1963.
344. — Two Surirellaceae from South America. Nova Hedwigia 8, 135—137, pl. 14—16.

Se även nr. 516, 525, 534.

Paleobotanik. Pollenanalys – Paleobotany. Pollen analysis

345. BERGLUND, B. E.: The post-glacial shore displacement in eastern Blekinge, southeastern Sweden. Sver. Geol. Unders. Ser. C, Nr. 599, 47 s., 3 pl.
346. CRANWELL, LUCY M.: Hystrichospheres as an aid to Antarctic dating with special reference to the recovery of Cordosphaeridium in erratics at McMurdo sound. GP 5, 397—405.
347. DEUNFF, M. J.: Le genre Duvernaysphaera Staplin. GP 5, 210—215.
348. ERDTMAN, G.: Sporology, palaeobotany, evolution. TIBC, 28.
349. FLORIN, R.: Barrträdens utbredning i tid och rum. Svensk Naturvetenskap 17, 243—270, summary 269—270.
350. FRIES, M.: Kvartärbotanisk undersökning av submarin torv från Laholmsbukten. SBT 58, 315—319, summary 318—319.
*351. — Pollenanalyser från Åland. Åländsk Odling 24, 102—125, summary 123—125. Mariehamn. 1963.
*352. — Pollenanalytiskt bidrag till vegetations- och odlingshistoria på Åland. Finskt Museum 68 (1961), 5—20, 1 utvikspl., Zusammenf. 19—20. Helsingfors. 1963.
353. HÖRNSTEN, Å.: Ångermanlands kustland under isavsmältningsskedet. Geol. Fören. Stockholm Förhandl. 86, 181—205, abstract 181, [vegetationsutvecklingen 195—203].
354. LUNDQVIST, G.: Interglaciala avlagringar i Sverige. Sver. Geol. Unders. Ser. C, Nr. 600, 60 s., summary 56—58.
355. MAGNUSSON, E.: Pollen-analytical investigations at Tåkern, Dagsmosse and the neolithic settlement at Alvastra, Sweden. Sver. Geol. Unders. Ser. C, Nr. 597, 47 s., 1 pl.
356. MILLER, U.: Diatom floras in the quarternary of the Göta river valley (western Sweden). Sver. Geol. Unders. Ser. Ca, Nr. 44, 67 s., 8 pl.
357. NILSSON, T.: Entwicklungsgeschichtliche Studien im Ageröds Mosse, Schonen. Lunds Univ. Årsskr. N.F. Avd. 2, 59: 8, 34 s., 4 pl.
358. — Standardpollendiagramme und C^{14}-Datierungen aus dem Ageröds Mosse im mittleren Schonen. Lunds Univ. Årsskr. N.F. Avd. 2, 59: 7, 52 s., 2 pl.
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360. TRALAU, H.: Juniperoxylon (Juniperus cf. communis L. sens. lat.) funnen i Pilgrimstads interglaciala flora. SBT 58, 496—497.
361. — The genus Nypa van Wurmb. K. Svenska Vet.-akad. Handl. 4. ser. 10: 1, 29 s., 5 pl.
362. — The genus Trapella Oliver in the Tertiary of Europe. BN 117, 119—123.
363. TSUKADA, M., and ROWLEY, J. R.: Identification of modern and fossil maize pollen. GP 5, 406—412.
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365. VENKATACHALA, B. S., and KAR, R. K.: Schizopollis Venkatachala & Kar, a new pollen genus from the Permian of North Karanpura coalfield, Bihar, India. GP 5, 413—424.

366. WILSON, L. R.: Recycling, stratigraphic leakage, and faulty techniques in palynology. GP 5, 425—436.
367. ZEVEN, A. C.: On the origin of the oil palm (Elaeis guineensis Jacq.). GP 5, 121—123.

Se även nr. 6.

Patologi — Pathology

*368. ANDERSSON, S.: Sklerotier i klöverfrö. Svensk Frötidning 32, 172—175. 1963.
369. ANDERSSON, S., NYBERG, A.: Växtsjukdomar och skadedjur i Skåne och Halland under vegetationsperioden 1963. Växtskyddsnot. 28, 59—66.
*370. BJÖRKMAN, E., and HÆGER, G. E.: Outdoor storage of chips and damage by microorganisms. TAPPI 46, 757—766. 1963.
371. BJÖRLING, K., och MÖLLERSTRÖM, G.: Faktorer påverkande förekomster av betbladmögel i Sverige under åren 1946—1963. Socker Handl. I 20, 15—30.
372. BJÖRKMAN, E., FORSSBLAD, L.-H., MALM, E., REGESTAD, S. O., RINGSTRÖM, E., RYDHOLM, S.: The use of decayed wood from some conifers and broadleaf trees for chemical pulping purposes. Studia Forest. Suec. 21, 66 s., 2 pl.
373. HANSEN, L. R.: The reaction of clones of Bromus inermis and B. inermis × pumpellianus to Pyrenophora bromi. AAS 14, 59—64.
374. HERMANSEN, J. E.: Notes on the appearance of rusts and mildew on barley in Denmark during the years 1961—1963. AAS 14, 33—51.
375. HÜPPEL, A.: Topptorka hos bok. Skogen 51, 107—108.
376. HÜPPEL, A., och KLINGSTRÖM, A.: Några parasitsvampar i plantskolor och skogskulturer 1960—1963. Norrl. Skogsvårdsförb. Tidskr. 1964, 53—63, summary 62.
377. JOHNSSON, T.: Erfarenheter från mjöldaggförsök med äpple. Växtskyddsnot. 28, 43—52.
378. JØRGENSEN, J.: Investigations on loss in yield due to attack by Cercosporella herpotrichoides Fron in field experiments with winter wheat. AAS 14, 12—20.
379. — Some observations on the effect of temperature on the sporulation of Cercosporella herpotrichoides Fron. AAS 14, 126—128.
380. KOLK, H.: Bestämning av kärnfusarios hos stråsäd på filtrerpapper och i tegelgrus. Medd. Stat. Centr. Frökontrollanstalt 39, 55—60, summary 59.
381. — Betning av timotej- och klöverutsäde. Svensk frötidning 33, 55—58.
382. LINDSTEN, K.: Iakttagelser och synpunkter rörande dvärgskottsjukans utbredning. Växtskyddsnot. 28, 3—10.
383. MÖLLERSTRÖM, G., och AF KLINTEBERG, H. B.: Rotbrand på betor. Socker Handl. I 20, 1—13.
384. NILSSON, L.: Vit krysantemumrost i Sverige. Växtskyddsnot. 28, 99—108.
385. NYBERG, A.: Svartprickröta på gurka — iakttagelser och försök. Växtskyddsnot. 27, 76—82.
386. OLOFSSON, B.: Den nya parasitsvampen [på potatis]. Lantmannen 75, 944—945.
387. — Stjälkbakterios hos potatis. Växtskyddsnot. 27, 71—75.
388. — Undersökningar rörande förutsättningarna för bladmögelbekämpning med hjälp av varningstjänst baserad på meteorologiska data. Stat. Växtskyddsanst. Medd. 12 (: 97), 357—409, summary 403—407.

389. PANTON, C. A.: A review of some aspects of the wilt pathogen Verticillium albo-atrum, Rke. et Berth. AAS 14, 97—112, 2 pl.
390. PETTERSSON, C.-G.: Bomullsmögel på potatis. Växtskyddsnot. 27, 85—87.
391. RYDÉN, KERSTIN: Aspermi — en vanlig virussjukdom på krysantemum. Växtskyddsnot. 27, 67—70.
392. — Gurknekrossjuka — en i Sverige ny virussjukdom hos gurkor. Växtskyddsnot. 28, 53—56.
*393. RÖNDE-KRISTENSEN, H.: Virussjukdomar hos körsbärsträd. SYR Information 5: 3, 37—43, 5: 4, 27—37. 1963.
*394. — Virussjukdomar hos plommonträd. SYR Information 5: 2, 9—22, 1963.
*395. — Virussjukdomar hos päronträd. SYR Information 5: 1, 19—27. 1963.
*396. — Virussjukdomar hos äppleträd. SYR Information 4: 8, 22—35. 1962.
397. THIRINGER, J. O.: Eine für Schweden neue Knospenkrankheit auf Koniferen. Acta Horti Gotoburg. 27, 1—6, 4 pl.

Tillämpad botanik — Applied botany

1. Jordbruksbotanik — Agricultural botany

398. AGERBERG, L. A., och ROOTS, L.: Försök med bor II. Åren 1953—1961. Lantbrukshögsk. Medd. 10, 23 s., summary 21—23.
399. ALMGÅRD, G.: High content of iron in teff, Eragrostis abyssinica Link., and some other crop species from Ethiopia — a result of contamination. Lantbrukshögsk. Annaler 29, 215—220.
400. BERGMAN, B.: Förändringar i artsammansättningen vid gödsling av naturlig betesmark. Berätt. Malmöhus Skogs- och Betesvårdsför. Verksamhet 1963, 23—28. Malmö.
401. BINGEFORS, S., and ELLERSTRÖM, S.: Polyploidy breeding in red clover. The tetraploid variety Svalöf's Ulva compared with some diploid and tetraploid varieties. Zeitschr. Pflanzenzücht. 51, 315—334.
402. ESKILSSON, L.: Om frösättningen i tetraploid klöver. Nord. Jordbrugsforsk. Suppl. 8, 173—176.
403. FLORIN, B., JÓNSSON, L., och NILSSON, K. O.: Fältförsök med NP-gödselmedel i vårstråsäd på lerjordar. Lantbrukshögsk. Medd. Ser. A. 20, 21 s., summary 20—21.
404. GUMMESSON, G.: Kemisk bekämpning av flyghavre. II. Resultat från försöksverksamheten 1960—1963. Lantbrukshögsk. Medd. Ser. A. 17, 17 s.
405. JOHNSSON, E., och LINDER, H.: Markens borhalt och försök med borgödsling. Aktuellt fr. Lantbrukshögsk. 32, 12 s.
*406. JULÉN, G.: Ett långtidsförsök med gödsling av naturlig betesmark. Berätt. Malmöhus Läns Skogs- och Betesvårdsför. Verksamhet 1962, 11—23. Malmö. 1963.
*407. — The conservation of primitive cultivated forms. Genetica Agraria 17, 403—406. 1963.
408. KIVIMÄE, A., and VALDMAA, K.: Methoxyl as an index of the nutritive value of timothy. AAS 14, 165—177.
409. KÅHRE, L.: Frömognaden hos vallväxter. Växtodling 20, 102 s., summary 91—96. Diss., Uppsala.

410. LINDBERG, P., BINGEFORS, S., LANNEK, N., and TANHUANPÄÄ, E.: The fatty acid composition of Swedish varieties of wheat, barley, oats, and rye. AAS 14, 2—11.
411. LINDBERG, P., TANHUANPÄÄ, E., NILSSON, GERDA, and WASS, L.: The fatty-acid composition of ripening grain. AAS 14, 297—306.
412. LORENZO-ANDREU, A., BACH, E., and FRANDSEN, K. J.: Studies on the variation in content and production of nitrogen and some essential amino acids in forage plants III. Determinations of lysine, histidine and arginine in plant material. AAS 14, 77—86.
413. LÖÖF, B., and APPELQVIST, L.-Å.: Breeding work in rape, turnip rape and white mustard in connection with research on the composition of the fatty acids in their seeds. Zeitschr. Pflanzenzücht. 52, 113—126.
*414. MAC KEY, J.: Methods of utilizing induced mutation in crop improvement. Nat. Acad. Sc. Nat. Res. Council Publ. 891 (Symp. on Mutation and Plant Breed., Cornell Univ., 1960), 336—361. 1961.
415. NILSSON, B., och ÅBERG, E.: Olika typer av flyghavre och bekämpningsåtgärdernas beroende av detta. Nord. Jordbrugsforsk. Suppl. 8, 161—163.
*416. NYBOM, N.: The use of induced mutations for the improvement of vegetatively propagated plants. Nat. Acad. Sc. Nat. Res. Council. Public. 891 (Symp. on Mutation and Plant Breed., Cornell Univ., 1960), 252—294. 1961.
417. OLOFSSON, S.: Magnesium, kalcium och kalium i betesgräs. Lantbrukshögsk. Medd. Ser. A. 9, 40 s., summary 35—38.
418. OLSSON, G.: Auto- och allopolyploidi inom släktet Brassica. Nord. Jordbrugsforsk. Suppl. 8, 168—171.
419. SORTEBERG, A., and DEV, G.: Effect of liming peat soils on the availability of applied phosphate to plants. AAS 14, 307—314.
420. STÅHLBERG, S.: Studies on the Release of Bases from Minerals and Soils, 7 s. Örebro. Diss., Uppsala.
421. UMÆRUS, MAGNHILD, och ÅKERBERG, E.: Dagslängdsproblemet i nordisk växtodling. Nord. Jordbrugsforskn. Suppl. 8, 229—233.
422. WIKLERT, P.: Studier av Samspelet Mark-Vatten-Växt med Särskild Hänsyn till Vissningsgränsen, 14 s. Diss., Uppsala.
423. ÅBERG, B.: Herbicidernas fysiologiska verkningssätt. Aktuellt fr. Lantbrukshögsk. 28, 22 s.

Se även nr. 207, 254, 378.

2. Skogsbotanik — Forest botany

424. BJÖRKMAN, E.: Breeding for resistance to disease in forest trees. Unasylva 18, 71—81.
425. HAGNER, M.: Frövärdet hos tall- och grankott insamlingssäsongen 1964—65. Skogen 51, 467.
426. HUSS, E.: Tall- och granfröets grobarhet 1963. Skogen 51, 46.
427. — Tall- och granfröets grobarhet 1964. Skogen 51, 468—469.
428. JAKABFFY, E.: Kottillgången 1964—1965. Skogen 51, 465.
429. JOHNSSON, H.: Forest tree breeding by selection. Clonal seed orchads — seedling seed orchards, progeny test. Silvae Genetica 13, 41—49.
430. LJUNGER, Å.: Granens blomning 1964. Skogen 51, 231, 242.

431. MALMSTRÖM, C.: Forest draining in northern Sweden. Festskrift Tillägnad Carl Kempe 80 år 1884—1964, 693—712, sammanf. 707—709. Uppsala.
432. NEANDER, A.: Lind med luftrötter — unikt träd i Älmeboda. Älmeboda sockens Hembygdsskrifter 6 (Älmebodaboken), 53—57. Växjö.
433. NILSSON, B.: Studier av avkommor efter korsning mellan gran av svensk och mellaneuropeisk proveniens. Fören. Skogsträdsförädling Årsbok 1963, 23 s.
*434. OKSBJERG, E. B.: The behaviour of Norway spruce (Picea abies (L.) Karst) In Central Jutland, Denmark, in the summer of 1955. The Water Relations of Plants (A Symp. of the Brit. Ecol. Soc. London 1961), ed. A. J. RUTTER and F. H. WHITEHEAD, 142—152. London. 1963.

Se även nr. 93, 135, 370, 475, 536.

3. Hortikulturell botanik — Horticultural botany

435. GUSTAVSSON, A.: Dendrologiska anteckningar från Gävle. Lustgården 44, 85—109.
436. HYLANDER, N.: Scilla Rosenii C. Kock, en odlingsvärd kaukasisk art. Lustgården 44, 120—124, summary 124.
437. JOHNSON, M.: Skador på trädplanteringar i Göteborg och dessas orsaker. Lustgården 44, 61—74, 1 pl., summary 72—73.
438. NILSSON, A.: Om vegetationen på torrmurar. En inventering av floran på låga stenmurar vid Svegs och Ekshärads kyrkogårdar. Weibulls Grästips maj 1964, 191—194, summary 194.
439. — Varieties originating from interspecific hybrids in annual Chrysanthemum. AHG 22, 160—170.
440. NORDIN, I.: Mycket att se i parkerna i Västerås. Särtr. ur Vestmanlands Läns Tidnings Julnummer 1964, 8 s. Västerås.
441. — Sällskapet D. B. V:s Botaniska Trädgård i Visby, 67 s. Visby.
442. SANTESSON, R.: En resa genom sekler. Föreningens för dendrologi och parkvård vårexkursion till Nord-Italien 1962. Lustgården 44, 5—53.
*443. SYLVÉN, N., och TEDIN, O.: Hjalmar Nilssons Park, 63 s., 2 kartor. Hässleholm. 1961.
444. WALLSÉN, E.: Parker och planteringar i Gävle. Lustgården 44, 75—84.

Växtgeografi. Ekologi — Plant geography and ecology

445. ALMBORN, O.: Some types of distribution in the lichen flora of southern Africa. TIBC, 104.
*446. ALMESTRAND, ASTA: Ein Beitrag zur Verbreitung von Ceratium carolinianum in Schweden. Advancing Frontiers of Plant Sciences 4, 193—208, 1 tabell. 1963.
447. ALMQUIST, E.: Berula erecta, Carex pediformis m.fl. novitier i Upplands flora. SBT 58, 491—495.
448. — Är misteln inhemsk i Sverige? SBT 58, 320—336.
449. ANDERSSON, S.: Glimtar från nordvästra Värend. Sydsmåländsk Natur, 139—145. Växjö.

*450. BAGER, B.: Botaniska strövtåg. Stenkvista, en Socken i Sörmland, 71—100. Uppsala. 1963.
451. BRINGER, K.-G.: Något om kärlväxtfloran inom en del av det till nationalpark föreslagna området av Anarisfjällen. SBT 58, 62—72, summary 71—72.
452. CHRISTOFFERSSON, I.: Målaskogstraktens natur. Sydsmåländsk Natur, 112—121. Växjö.
453. DAHLSKOG, S.: Kvikkjokks delta. Fältbiologen 17, 3—9.
454. DEGELIUS, G.: Biological studies of the epiphytic vegetation on twigs of Fraxinus excelsior. Acta Horti Gotoburg. 27, 11—55, 1 utvikstab., 2 pl.
455. — Cerinthe minor L. som adventivväxt i Västergötland. BN 117, 418—419.
456. — Ny fyndort för Botrychium matricariifolium (Retz.) A. Br. på Jylland. BN 117, 420.
*457. VON DELWIG, C.: Botaniska strövtåg i Amnehärad och Södra Råda. E. H. CEDERBOM: Amnehärad och Södra Råda, 321—333. Kinna. 1963.
*458. DOMEIJ, Å.: Växtvärlden. En Bok om Mönsterås, 29—78. Oskarshamn. 1963.
459. DU RIETZ, G. E.: Nordsvenska vegetationsregioner. Festskrift Tillägnad Carl Kempe 80 år 1884—1964, 309—324, summary 321—324. Uppsala.
460. ELIASSON, U.: Kärlväxtfloran i Töllsjö socken i södra Västergötland. SBT 58, 513—527, summary 526.
461. ERICSSON, L.-Å.: Rödsyssla i Uppland. Fältbiologen 17, 27.
462. ERIKSSON, J.: Botanical notes from the Somali plateu in South Ethiopia I. Some general observations on flora and vegetation. BN 117, 1—9.
*463. ERIKSSON, P. A.: Öjsberget — en florans lustgård i Malung. Skinnarebygd 14—15, 53—67. Malung. 1963.
464. FORSBERG, C.: The vegetation changes in Lake Tåkern. SBT 58, 44—54.
465. FRIDÉN, A.: Faunistiska och floristiska intryck från Jugoslavien. Fauna och Flora 59, 198—203.
466. GILLNER, V.: Sedum anglicum Huds. inplanterad på Christiansö. BN 117, 222—224.
467. GRANBERG, A.: Om Käymäjärvitraktens flora. Norrbottens Natur 20, 31—35.
468. HAKELIER, N.: Bidrag till Sveriges svampflora II. Geoglossacéer. SBT 58, 337—343.
469. — D:o III. Bovistella echinella funnen i Närke och Västmanland. SBT 58, 437—438.
470. HARLING, G.: Galapagos-öarna — ett botaniskt isolat. Botanica Gothoburg. 2, 20 s., 8 pl.
471. HEDBERG, O.: Etudes écologiques de la flore afroalpine. Bull. Soc. Roy. Bot. Belg. 97, 5—18.
472. — Features of afroalpine plant ecology. Acta Phytogeogr. Suec. 49, 144 s., 1 pl.
473. HJELMQVIST, H.: Potentilla micrantha som trädgårdsflykting. BN 117, 97.
474. HOLMEN, H.: Forest ecological studies on drained peat land in the province of Uppland, Sweden. Parts I—III. Studia Forest. Suec. 16, 236 s., sammanf. 232—236. Diss., Uppsala.
475. HULTÉN, E.: Remarkable range extension for Minuartia groenlandica (Retz.) Ostenf. SBT 58, 432—435.
476. — Salix glauca subsp. callicarpaea in Spitzbergen. SBT 58, 350.

*477. — The distributional conditions of the flora of Beringia. Pacific Basin Biogeography, A Symposium, ed. J. L. GRESSITT, 7—22. Honolulu. 1963.

478. HYLANDER, N.: Carex stylosa i Norge. Blyttia 22, 100—106, 2 pl., summary 105—106.

*479. — Floristic treatment of cultivated, escaped and adventive plants. With examples mainly from the Scandinavian flora. Feddes Repert. 63, 218—222. 1961.

480. — Om några adventiva Polygonum-arter av gruppen avicularia. BN 117, 231—237.

481. JULIN, E., und NORDENSTAM, S.: Über die Hieracien im nordöstlichen Norrbotten (Nordschweden). BN 117, 15—27.

482. KARVIK, N.-G.: Cryptogramma crispa funnen i Dalsland. SBT 58, 347—349.

483. — Vegetation. The terrestrial vertebrates of Dalsland in southwestern Sweden, Acta Vertebratica 3: 1, 33—47. Uppsala.

484. KONRADSSON, S.: Slåtterängar i Långasjö. Sydsmåländsk Natur, 127—138. Växjö.

485. VON KRUSENSTJERNA, E.: Några mossamhällen från Järvafältet. SBT 58, 258—266.

486. — Stockholmstraktens bladmossor, 129 s. Stockholm.

487. LOHAMMAR, G.: Observations on the changes of the vegetation of open rocky slopes in Central Sweden. TIBC, 291.

488. LUNDMARK, J.-E.: Bokskogarna i Växjötrakten. Sydsmåländsk Natur, 100—111. Växjö.

489. LÖNNQVIST, O.: Floran i Övertorneåtrakten i Norrbotten. SBT 58, 371—408.

480. MALMER, N.: Mossar och kärr i Kronobergs län. Sydsmåländsk Natur, 36—46. Växjö.

491. — On the circulation of elementary constituents in the Sphagnum mires of S.W. Sweden. TIBC, 246—247.

492. — Traneröds mosse — ett vildmarkselement. Skånes Natur, Kontakt med Skånes Naturskyddsför. 51, 37—40.

*493. MELLKVIST, C.: Växtligheten. Nor Socken, en Lokalhistorisk Studie och Hembygdsbok, 32—47. Karlstad. 1963.

494. NILSSON, A.: Landskronatraktens adventiv- och ruderatflora II. Anteckningar om Landskronatraktens flora VI. BN 117, 420—424.

495. NILSSON, S.: Venezuela — ett land med en rik och säregen flora. SBT 58, 209—224.

*496. NORDENSTAM, S.: Floran. Bygdeå Sockens Historia, 20—38. Umeå. 1963.

497. NORDIN, I.: Om käppgranar och andra extrema ormgranstyper. Lustgården 44, 110—114, summary 113.

498. OLSSON, O.: Mark och naturlig vegetation i Göteborgs Botaniska Trädgårds skyddsområde (arboretet). Acta Horti Gotoburg. 27, 57—155, summary 129—132.

499. OREDSSON, A.: Epilobium adenocaulon, E. adenocaulon×obscurum och E. rubescens i Matteröds socken. BN 117, 425—426.

500. OTTOSSON, I.: Viltskador och skogsåterväxt inom Blå Jungfruns nationalpark. K. Svenska Vet.-akad. Skrifter i Naturskyddsärenden 52, 30 s., Zusammenf. 28.

501. PERBY, ASTRID: Upptäcktsresa till Falsterbonäset. Sveriges Natur, Svenska Naturskyddsför. Tidskr. 55, 116—121.
*502. PERSSON, H., and GJÆREVOLL, O.: New records of Alaskan bryophytes. Det Kgl. Norske Vidensk. Selsk. Skrifter 1961: 2, 26 s. 1961 (1963).
503. PERSSON, K.: Förteckning över Luleåtraktens kärlväxter. Norrbottens Natur 20, 41—51.
504. PERSSON, P. E.: Några nya växtlokaler från urkalkområdet i Viker. BN 117, 96.
505. PERSSON, Å.: The vegetation at the margin of the receding glacier Skaftafellsjökull, southeastern Iceland. BN 117, 323—354.
506. PETTERSSON, B.: Notes on the ecology of Tolypella glomerata (Desv.) Leonh. BN 117, 133—140.
507. PICHI-SERMOLLI, R. E. G.: Botanical notes from the Somali plateau in South Ethiopia II. List of the Pteridophyta collected in the Somali plateau by J. Eriksson in 1958. BN 117, 10—14.
508. PÅHLSSON, L.: Knivsås. Om vegetationen på en skånsk rullstensås. Skånes Natur, Kontakt med Skånes Naturskyddsför. 51, 20—24.
*509. RODHE, W.: Die Dynamik des limnischen Stoff- und Energiehaushaltes. Verh. Intern. Verein. Limnol. 14, 300—315. 1961.
510. — Effects of impoundment on water chemistry and plankton in Lake Ransaren (Swedish Lappland). Verh. Intern. Verein. Limnol. 15, 437—443, 4 pl.
511. ROMELL, L.-G.: Skog och odling i svensk »natur». Sveriges Natur 55, 110—124.
512. VON ROSEN, B.: Jättekaprifol i Stockholms län. Fauna och Flora 59, 268—269.
513. — Mattgran och bordsgran. Fauna och Flora 59, 204—216.
514. RUNGBY, S.: A contribution to the bryophytic flora of Spain, especially the environs of Hellín. BN 117, 167—172.
515. RYDÉN, M.: Järnvägsfloristiska notiser från sydvästra Östergötland. SBT 58, 343—347.
516. SANTESSON, R.: Swedish Myxomycetes. SBT 58, 113—124.
517. SJÖBECK, M.: Skottskog och grässvål. Sveriges Natur 55, 27—52.
518. SJÖGREN, E.: Epilitische und epigäische Moosvegetation in Laubwäldern der Insel Öland (Schweden). Acta Phytogeogr. Suec. 48, 184 s., 1 pl., summary 165—173.
519. SJÖRS, H.: A comparison between Boreal peatland vegetation in Ontario and Fennoscandia. TIBC, 289.
*520. — Bogs and fens on Attawapiskat River, northern Ontario. Nat. Mus. Canada Bull. 186, 45—133. 1963.
521. — Ecological aspects of peat accumulation and its abscence. TIBC, 256.
522. — [Svenska Botaniska] Föreningens vårutfärd till Uppsala-trakten 1963. SBT 58, 460—464.
523. SJÖSTEDT, B.: Bidrag till Skånes Flora 55. Flora och vegetation i Lövestads socken. BN 117, 79—91, summary 91.
524. SKOTTSBERG, C. J. F.: Antarctic phycology. Biologie Antarctique (Premier Symp. organisé par le S.C.A.R. Paris 1962 Comptes Rendus), 147—154. Paris.
525. SKUJA, H.: Grundzüge der Algenflora und Algenvegetation der Fjällgegenden um Abisko. Nova Acta Reg. Soc. Scient. Upsal. Ser. IV. 18: 3, 468 s., 69 pl.
526. SKYE, E.: Epifytfloran och luftföroreningarna. Svensk Naturvetenskap 17, 327—332, summary 332.

*527. STÅLFELT, M. G.: On the distribution of the precipitation in a spruce stand. An attempted analysis. The Water Relations of Plants (A Symp. of Brit. Ecol. Soc. London 1961), ed. A. J. RUTTER and F. H. WHITEHEAD, 115—126. London. 1963.

528. SUNDIN, T.: Utbredningsföreteelser bland Epilobium-hybrider särskilt inom Nynäshamnstrakten. SBT 58, 438—439.

*529. SVEDBERG, T.: Draba gredinii E. Ekman in Spetsbergen. Blyttia 19, 158—159. 1961.

530. SÖDERBERG, I., JOHANNESSON, J., and ÖSTERLIND, F. O.: Om mossfloran på Smålands Taberg. SBT 58, 465—485, Zusammenf. 483—485.

531. TAMM, C. O.: Growth of Hylocomium splendens in relation to tree canopy. TIBC, 262—263.

532. — Growth of Hylocomium splendens in relation to tree canopy. The Bryologist 67, 423—426.

533. — Survival of individual perennial herbs, with some remarks on the role of plant persistence in vegetation dynamics. TIBC, 271—272.

534. THOMASSON, K.: Algae from lakes in northern Colorado. SBT 58, 73—80.

535. — Plankton and environment of North Patagonian lakes. Abstracts of Uppsala Diss. in Science 34, 9—28.

536. TROEDSSON, T.: Barrskogens framryckning i Vombsänkan. Ett markvårdsproblem. Skånes Natur 51, 98—106.

537. TURESSON, G.: Sedum anglicum Huds. på Christiansö. BN 117, 426—427, summary 427.

538. WÆRN, M.: En algbevuxen torvbotten i Laholmsbukten. SBT 58, 309—314.

539. WISTRAND, G., och LUNDQVIST, J.: Kärlväxtflora på och kring stränder inom mellersta Piteälvens vattensystem. K. Svenska Vet.-akad. Skr. i Naturskyddsärenden 51, 72 s., Zusammenf. 66—70.

540. ÅBERG, S.: Botaniska strövtåg i Sjösås socken. Sydsmåländsk Natur, 122—126. Växjö.

Se även nr. 230, 243, 304, 306, 310, 326, 340, 343, 349, 422, 434, 438, 550.

Årsberättelser. Historia. Personalia — Annual reports. Botanical and personal history

541. Algologföreningen i Uppsala (Sammankomster år 1963). SBT 58, 452—453.

542. ALMBORN, O.: In memoriam. Adolf Hugo Magnusson 1/3 1885—14/7 1964. BN 117, 428—438.

543. ALMQUIST, E.: Anton Hamrin. 17/10 1893—13/4 1961. SBT 58, 510—512.

544. Association pour l'étude taxonomique de la flore d'Afrique Tropicale (A.E.T.F.A.T.) Bulletin No. 15, 64 s. Uppsala.

545. Botaniska Föreningen i Göteborg (Sammankomster år 1963). SBT 58, 453—454.

546. Botaniska Sektionen av Naturvetenskapliga Studentsällskapet i Uppsala (Sammankomster år 1963). SBT 58, 454—455.

547. Botaniska Sällskapet i Stockholm (Sammankomster år 1963). SBT 58, 455—456.

548. ERICSON, J.: Från Lunds Botaniska Förenings förhandlingar 1963. BN 117, 92—95.

549. HOLMQVIST, A. H.: Svensk Botanisk Litteratur 1963. Swedish Botanical Bibliography 1963. BN 117, 439—464.
550. LUNDQVIST, Å.: Före Sterner och efter. Kring Ölands botaniska kartläggning. Åkerbo Hembygdsför. Årsbok Öländsk Bygd Åkerbo Härad, 34—49.
551. MALMESTRÖM, E.: Carl von Linné. Geniets kamp för klarhet, 389 s., 12 pl. Stockholm.
552. NANNFELDT, J. A., och FRIES, N.: Botanik. Svensk Naturvetenskap 17, 399—410.
553. PETERSON, B.: Carl Skottsberg 1880—1963. Taxon 13, 1—7.
554. SJÖRS, H.: Vad är växtbiologi? Festskrift Tillägnad Carl Kempe 80 år 1884—1964, 813—818, summary 818. Uppsala.
555. Societas pro Fauna et Flora Fennica (Sammankomster år 1963). SBT 58, 456—458.
556. Svenska Botaniska Föreningen [1963]. SBT 58, 459—464.
557. Svenska Växtgeografiska Sällskapet (Sammankomster år 1963). SBT 58, 458.
*558. THOMASSON, K.: Prof. Dr. Hugo Kaho on his 75th birthday. Annales Soc. Tartuensis ad Res Naturae Investigandas Constitutae. Ser. Nova in Exsilio Condita 3, 169—172. Lund. 1963.
*559. VIDE, S.-B.: Kring några växtnamn i Nils Liljas Skånska Flora. Onsjöbygden 10, 48—60. Lund. 1963.

Se även nr. 268, 442, 522.

ARNE H. HOLMQVIST
Botaniska Museet, Lund

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Litteratur

VOISIN, ANDRÉ: Ueber die Verbindung der Gesundheit des modernen Menschen mit der Gesundheit des Bodens. — Arbeitsgem. f. Forschung des Landes Nordrhein-Westfalen. Heft 108. 1962. 51 sid. (hela häftet 98 sid.) Pris DM. 8.25.

Publikationen är ett av de mera välunderbyggda försöken att upplysa om nu rådande brukningsmetoders avigsidor och vänder sig lika mycket till växtfysiologen, växtodlaren och marklärefackmannen som till läkaren, födoämnesspecialisten och den dietetiskt engagerade. I centrum för utredningen står åkermarken och dess grödor med avseende på deras inverkan på kreaturens och människans hälsa. Dessutom ägnas dricksvattnet viss uppmärksamhet. För att eliminera misstankar skall framhållas, att det inte rör sig om en biodynamisk kampskrift, men VOISIN tar på ett sakligt sätt givetvis ställning även till detta ämne.

Vår moderna tid har i motsats till gångna perioder möjligheter att förebygga jordtrötthet betingad av växtnäringsämnesbrist, främst då spårämnesbrist. På grund av kvävets starkt produktionsmängdökande verkan uppstår i åkerjorden ett större behov av spårnäringsämnen, som i många jordar inte kan tillfredsställas utan gödsling med mikroelement.

Kapitlet om kräftsjukdomar (i synnerhet deras frekvenskartor) verkar inte lika klart och lättförståeligt som t.ex. avsnittet struma, dels därför att man efterlyser en jämförelse med jordartskartor och dels därför att uppgifter om odlingstekniken i resp. områden saknas. Av speciellt intresse är att märgstamkål under vissa förhållanden kan innehålla en strumaframkallande faktor som övergår i mjölken, att kalk är ett antagonistämne till jod på så sätt att ökad kalknärvaro leder till sköldkörteluppsvällning efter jodfattig utfodring och slutligen att den kväveform fodret är odlat på påverkar jodhalten i sköldkörteln: nitratkväve sänker den relativa jodhalten, medan ammoniakkväve ej har någon jodsänkande effekt.

Likaså finns en antagonism mellan kväve och koppar såtillvida att ökad eller långvarig hög kvävegödsling medför kopparbrist hos betesdjuren, vilken kompenseras med 7 kg/hektar kopparsulfat (=1 ppm per 20 cm matjordsdjup).

Med nu rådande gödslingsnormer tillför vi för mycket NPK och kalk i förhållande till magnesium. Som följder utpekas betestetani, trombos och phlebitits (undertecknads anmärkning: även för tidig bladfällning hos fruktträd vållas oftast av magnesiumbrist). Påståendena ledsagas av försöksresultat och illustrationsmaterial.

Förf. framhåller övertygande dels nödvändigheten av en förbättrad lantbruksgödsling, där även spårämnesbehovet fullt tillgodoses, och dels betydelsen av biologisk kvalitetsundersökning av födoämnena. Uppnående av biologisk kvalitet behöver inte innebära nedsatt kvantitativ avkastning, ifall vi går in för en mera vetenskapligt än industriellt grundad gödsling.

Skriften vore värd att översättas till svenska.

HELLMUT MERKER

Notiser

Doktorsdisputation. Fil. lic. VOLKMAR STOY försvarade den 30 okt. 1965 vid Lunds Universitet avhandlingen »Photosynthesis, Respiration, and Carbohydrate Accumulation in Spring Wheat in Relation to Yield».

Forskningsanslag. Jordbrukets forskningsråd har vid sammanträde den 27 okt. 1965 utdelat bl.a. följande anslag: till hortonom T. JOHNSSON, Alnarp, 9.000 kr. för studier över sambandet mellan kväveupptagningen och blomknoppsbildningen samt fruktutvecklingen hos päronträd; till docent A. KYLIN, Stockholm, 12.000 kr. för isolering och karaktärisering av Na^+-aktiverade ATP-aser i betor; till docent A. NILSSON, Uppsala, 5.700 kr. för studier rörande de växtöstrogena ämnenas metabolism vid C.S.I.R.O.:s laboratorium i Perth, Australien, samt till laborator H. ZECH, Uppsala, 10.304 kr. för undersökningar över reproduktionsprocessen hos växtvirus.

Insamlingar i Ecuador. Intendent BENKT SPARRE, Riksmuseets bot. avd., Stockholm 50, meddelar: Begagnande mig av det nu utdelade Regnellska resestipendiet ämnar jag under 1966, troligtvis i september, avresa till Ecuador. Uppehållet där kommer att omfatta ca. ett år och såväl regnskogs- som högfjällsområdet kommer att besökas. Om det utan men för mitt eget program visar sig möjligt, är jag gärna villig att åtaga mig diverse specialinsamlingar inom begränsad grupp — fixeringar, fröinsamling, anatomiprover, pollen, mindre vattenprover, o.d. Någon större extra utrustning för detta insamlingsarbete kan tyvärr ej medtagas. Förslag och förfrågningar mottagas t.o.m. april månads utgång. Endast undantagsvis kan jag senare ta upp beställningar, då planeringen då måste vara i det närmaste slutförd.

Nordisk förening för taxonomisk botanik. Anmälan om medlemskap kan göras till föreningens svenska ombud, prof. H. WEIMARCK, Institutionen för systematisk botanik, Lund. Årsavgiften (10 kr.) kan insättas å föreningens postgirokonto 53 12 88.

Utmärkelse. Prof. HENNING WEIMARCK, Lund, har av Fysiografiska Sällskapet i Lund tilldelats Linnépriset i botanik för sin år 1963 utgivna »Skånes flora».

Professors namn. Professors namn har tillagts universitetslektorn vid Göteborgs universitet, docent GUNNAR DEGELIUS, avd. föreståndaren vid Sveriges Utsädesförening i Svalöv, docent ARNE HAGBERG, samt föreståndaren för institutet för växtförädling av frukt och bär i Balsgård, docent NILS NYBOM.

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