Drawings of Scandinavian Plants 7–8

Rosa L.

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Rosa pimpinellifolia L.

(*R. spinosissima* auct. mult., non L.; *R. myriacantha* SER.)

Low shrub 10—50 cm tall, occasionally up to about 1 m; stems numerous, erect; spreading by suckers and forming often large, dense patches. *Prickles abundant* and rather long (up to 1.2 cm), thin, ± straight on the main stems, sparser and shorter on the flowering branches, *interspersed with* and passing into *numerous acicles and stiff bristles. Leaflets* (5—) *7—9; small, suborbicular—broadly elliptical* (5—17×4—9 mm), obtuse and with a rounded base; dark green; simply serrate, rarely biserrate, teeth distinct, directed outwards-forwards; *glabrous* on both sides or occasionally sparsely pubescent beneath, usually eglandular but sometimes with glands along the main veins beneath; stipules narrow, auricles expanded. *Bracts usually lacking* or rarely small and scale-like. Pedicels 1.5—2.5 cm long, usually distinctly longer than the hip, eglandular or sparingly glandular-hispid. *Flowers solitary*; 2—4 cm in diam.; *cream-white,* occasionally purplish pink. *Sepals* ascending—erect in fruit, *entire*, narrow, *short,* acuminate, eglandular, persistent till the hip decays. Styles short, free, lanate; stigmas in a broad, compact, depressedly semiglobose head; disc narrow with a wide orifice; ovaries shortly stipitate. *Hip* 0.7—1.3 cm, globose—subglobose, sometimes slightly depressed, *purplish black,* rather hard. June—July. 2n=28.

Native; but also frequently introduced and cultivated, and sometimes naturalized. *R. pimpinellifolia* has a W. European distribution occurring from SW. Norway to Spain and Italy, with its main occurrences in the coastal provinces. Besides this area it also has a continuous distribution in SE. Europe and Asia, extending eastwards to N. China and Korea. According to HULTÉN (Atlas över växternas utbredning i Norden 1950) it belongs to the subatlantic group of species. This is somewhat inexact in regard to its disjunct European distribution.

The species grows in dunes, sandy heaths, and lime-stone pavements, often on calcareous soils. In particular it grows near the sea but it reaches considerable altitudes in the inland, in the Swiss Alps up to 2000 m and in the Kaukasus 2400 m.

In Denmark *R. pimpinellifolia* occurs as native in several localities along the west coast of Jutland, between Skagen and Römö, and in the Limfjord area. It also occurs in a few adjacent localities at Tilsvilde on NE. Sealand where it is probably native. In other localities in Denmark it has escaped from cultivation. In SW. Norway it is native along the coast from Hjelmeland and Karmö to Stord and perhaps also in Östlandet, from Brunlanes to W. Moland, otherwise it is an escape. As native it is in Sweden a very rare plant. Previously it occurred in Bohuslän on the island of Koön where it has been extinct for a long time. It was discovered there by L. M. NEUMAN in 1860, and was probably collected the last time by O. NORDSTEDT in 1898 (LD). Recently it was rediscovered in N. Halland, very sparsely in one locality in Ölmevalla (Ö. NILSSON, Bot. Notiser 1961). In its Scanian localities it has long been known, at Kullaberg it was collected by F. ARESCHOUG in 1862 and was seen there till 1934. It is still present at Fortuna and Ramlösa, but it probably was introduced and escaped or was planted in all present Scanian localities. As an escape it occurs northwards to Jämtland.

The introduced and escaped forms of *R. pimpinellifolia* are usually easily ditsinguished from the native ones by their taller growth, with stems often 1 m high. The native form seems to be rather uniform in Scandinavia. A form with glandular-hispid pedicels (var. *spinosissima* R. KELL.) is known from N. Jutland and Norway.

Occasionally *R. pimpinellifolia* forms hybrids with species of the section *Caninae* CRÉP. In the hybrids the influence of this species is often easily recognized, but the other parent is usually impossible to determine exactly. The most frequent hybrid is *R. pimpinellifolia*× subsect. *Vestitae* which is known from Denmark and Norway. *R. villosa* ssp. *mollis*, in the same localities as *R. pimpinellifolia*, is probably the other parent. *R. pimpinellifolia*×subsect. *Caninae* is known from Norway.

R. majalis HERRM.; MANSF.

(*R. cinnamomea* L. 1759, non L. 1753; *R. spinosissima* L. p.p.)

Shrub up to 2 m tall, but usually lower (0.5—1.5 m); stems numerous, erect, forming often large, dense patches. Cortex light reddish-brown (cinnamon-brown). *Prickles on young and towards the base of older stems often numerous*, thin, straight or slightly curved, rather long (up to 1 cm), interspersed with and passing into small bristles and acicles; *prickles on other stems* or branches slender, shorter, slightly curved, *sparsely set in pairs* just below the base of each leaf; *flowering branches often unarmed. Leaflets* (3—) 5 (—7), elliptical—obovate (15—45×15—25 mm), occasionally broadly lanceolate, acute—subacute, cuneate at base; bluish-green—green above, pale glaucescent beneath; simply serrate, teeth rather low, directed forwards, often shortly pointed, usually lacking in the basal third; glabrous—sparsely pubescent above, *pubescent beneath,* eglandular. *Bracts broad and long,* about equalling or slightly longer than the pedicel. *Pedicel* ca. 2 cm long, longer than the hip, glabrous. *Flowers solitary*; 4—5 cm in diam.; *purplish pink.* Sepals erect in fruit, usually entire, rather narrow, apically often much dilated, usually eglandular, persistent till the hip decays. Styles free, short, white-lanate; disc narrow with a wide orifice; carpels lining the inside wall and the bottom of the hip. *Hip* 0.8—1.0 cm, *globose—spheroidal,* glabrous, scarlet red. June (—July). 2n=14.

Native; but also cultivated, particularly previously and sometimes escaped and naturalized. *R. majalis* has a boreal-continental distribution, reaching westwards in C. Europe into Poland, Czechoslovakia, S. Germany, and the E. Alps. The species grows in moist and stony grounds along streams, in open woods, and along fen margins. In Norway it extends up to an altitude of 1250 m in Jotunheimen, in N. Sweden up to 700 m; it is never found above the timber line.

In Norway *R. majalis* is common in the SE. part, in Östlandet and Sörlandet, and rather common in Sogn and S. Tröndelag, and has scattered localities up to latitude 70° N. In Sweden it occurs in several localities in Götaland, but is as native rare in the southern part and probably not native in Scania and Blekinge. It is common in Svealand and Norrland, where it has a continuous distribution. It becomes rare in the westernmost parts and has very few localities north of the Arctic Circle. In Finland it is common in the S. and C. parts but becomes rare north of about the same latitude as in Sweden. In Denmark the species is probably not native, if not on the island of Bornholm, but it has become naturalized in several places.

R. majalis was previously frequently and is still cultivated in gardens for hedges and ornament. Several of the cultivated forms have *floribus plenis* [e.g., var. *foecundissima* (MÜNCH.) HYL.], and have pale pink or white flowers. As native the species is rather uniform within Scandinavia. A form with pyriform hips has been described as var. *turbinella* SW., and var. *acutifolia* ROSÉN & WG has acute, lanceolate leaflets; f. *simplicifolia* (T. VEST.) SÖDERB. with simple leaves is known from Sweden.

The hybrid *R. majalis*×*villosa* ssp. *mollis* is known from Sweden.

R. acicularis LINDL.

Similar to *R. majalis* but stems usually lower, up to ca. 1 m long; cortex rather dark brown; *prickles numerous,* thin, long (up to 1.3 cm), usually straight or slightly curved *on the main stems,* interspersed with shorter bristles and acicles, *sparser and shorter on the flowering branches*; leaflets broadly elliptical—oblong (20—55×15—30 mm), subacute, broadly cuneate or sometimes rounded at base, usually simply serrate, teeth broad, comparatively long, forwards-outwards directed, usually lacking in the basal part, often glabrous above, pubescent beneath, sparsely glandular or eglandular; *bracts rather narrow and long,* equalling or usually shorter than the pedicel; *pedicel* 2—5 cm long, (glabrous) or *glandular-hispid*; sepals glandular on the back, occasionally eglandular; *hip* 1.0—1.4 cm long, *ovoidal with a distinct neck below the sepals*, sometimes with a tapering base. June—July. 2n=56.

Native; occasionally cultivated. *R. acicularis* has a boreal-continental circumpolar distribution but has no occurrence in C. Europe and is extending southwards with scattered localities into ca. latitude 52° N. in C. and E. Russia. The species grows on moist places in woods and around fens.

In Sweden *R. acicularis* is only known from two localities. One is in Västerbotten where the species is abundant near Skellefteå and one in Ångermanland nearby Härnösand where it is sparse and recently discovered (E. MO, Ångermanland No. 8, 1962). In Finland the species is rather common in N. Karelia along the Russian border; westwards it becomes rare and occurs on scattered localities in the SE. and C. parts of the country extending northwards to the Arctic Circle and westwards to the Gulf of Bothnia; it is lacking in the southwestern and southernmost parts.

The Swedish and Finnish material of this species belongs to var. *carelica* FR. which is distinguished from the type form by glandular pedicels and sepals, and the always simply serrate leaflets.

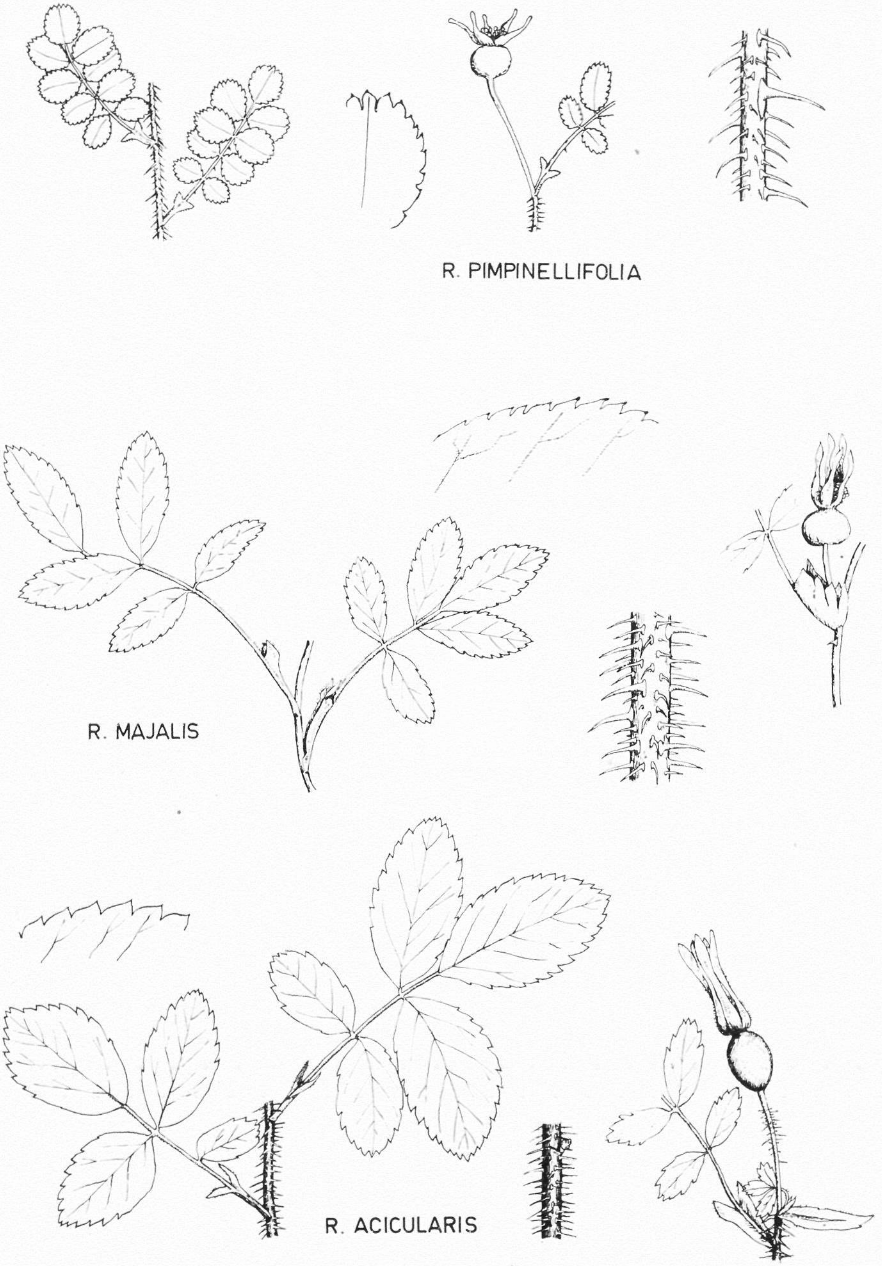

Fig. 1.

R. rugosa THUNB.

Shrub up to 2.5 m tall, but usually lower (1—2 m); forming dense, large patches within which the central stems are often dead; stems erect or sometimes arching, much branched; young stems tomentose. Cortex light yellowish-brown. *Prickles abundant,* rather long (up to ca. 1.5 cm), thin, *interspersed with closely set acicles and stiff bristles, densely tomentose* at least *on the basal half,* apical part usually glabrous. *Leaflets* (5—) *7—9,* ovate—broadly elliptical (20—55×15—30 mm), acute, with a broadly cuneate or rounded base; usually deep green and glossy above, pale yellowish green beneath; thick, *rugose* with ± involute margins; simply serrate almost all around, teeth low, forwardly directed; glabrous above, *densely tomentose beneath,* eglandular; rachis tomentose, often with sparse acicles; *stipules* pale green, *broad, serrate,* auricles acute, somewhat diverging. *Bracts broad,* acute, about equalling the pedicel in length, light green, tomentose, *serrate. Pedicels* ca. 2 cm long, of about the same length as the hip, *usually curved, tomentose* and often bristly. *Flowers 1—3 together; 6—8 cm in diam.*; bright purplish pink or sometimes white. *Sepals entire,* erect in fruit, rather broad, tapering towards the apex, tomentose, persistent till the hip decays. Disc narrow with a wide orifice. *Hips large,* 2—3 cm, *depressedly napiform, with a distinct neck below the sepals,* scarlet red. June—September. 2n=14.

Introduced; frequently cultivated for hedges, ornament, the hips, and as a stock for other roses, often escaped and naturalized. Nowadays it is naturalized and stationary in several places, in particular along the coasts of southern Scandinavia and Finland, sometimes also in the inland. *R. rugosa* is native of the northern coasts of the Pacific Ocean, extending from Alaska southwards in Asia into N. China and Japan. It was introduced into Europe during the last decades of the 18th Century.

R. rugosa thrives particularly well on sandy or gravelly soils and is very capable of resisting in exposed localities on the sea shores, where it is often expanding in large patches at the expense of the native vegetation. By its salt water resistent hips, which may be transported by the streams, it has excellent possibilities to invade new localities (K. JESSEN, Bot. Tidsskr. 1958). Its almost explosive immigration on the S. Scandinavian coasts during the last two decades is remarkable. It usually occurs on sandy or shingly shores. On sandy sea shores it is often growing within a restricted zone inside the outmost dune. In the inland it is established mainly along the sandy sides and banks of highways and railroads, where it is also often planted, however.

The first report of naturalized or escaped *R. rugosa* from Denmark dates from 1875 and is from an inland locality. Now it is naturalized along the coast of the entire country where the localities are suitable. In Norway the naturalization of this species is almost confined to the sea shores in the south. Its present distribution is, however, incompletely known. One of the first naturalized findings is from 1948, when the species was discovered at Håöja in Frogn nearby Oslo (H. RUI, Blyttia 1963). The first Swedish record of naturalized *R. rugosa* dates from 1918, and is from Lidingö, where the species occurred along a railroad bank. The first report from a sea shore locality is from S. Halland at Höka drift-sand area of 1928. Now it is rather common along the Swedish west coast from Bohuslän to Scania. It is also common on the S. and E. coasts of Scania and in Blekinge. Along the east coast the localities become scattered further northwards, but it may be locally common on the coast of, e.g., NE. Öland and between Bråviken and Slätbaken in Östergötland. It extends northwards up to about Gävle. In Finland it is known from the coastal area N. of the Finnish Gulf. However, the immigration history of this interesting and successful invader of our coasts is imperfectly known and difficult to trace because of the very scanty collections of this species.

R. camtschatica VENT. ('*R. rugosa* var. *hollandica*') is related to *R. rugosa*. It is sometimes cultivated in Scandinavia, particularly as a stock of other roses. It is also a native of the NE. Asia.

R. camtschatica differs from *R. rugosa* by the ± glabrous prickles which are less abundant, particularly on the flowering branches, on which they are often confined to a pair just below the leaves; the leaflets are narrower, ± broadly lanceolate, and sparsely pubescent beneaht, and not so distinctly rugose; the pedicels are almost glabrous and often straight; the flowers are distinctly smaller (about 4—5 cm in diam.); and the sepals are longer, equalling the tepals and very narrow. $2n=14$.

This species has escaped and has been locally naturalized in S. Sweden. It is known from Gothenburg from where it was reported in 1961. In Scania it was collected as naturalized on the island of Ven in 1956, by A. NILSSON (LD). The author has seen it in Scania at the coast in Kåseberga in 1966, in which place it is entirely established and forms large patches, and as an escape at Domsten in 1967. *R. camtschatica* grows on localities of the same type as *R. rugosa*, and seems to be hardy too.

R. rubrifolia VILL.

(*R. glauca* POURR., non VILL.; '*R. ferruginea* VILL.')

Shrub often up to 3 m tall; stems erect with somewhat arching branches. *Cortex of young stems bluish-green, pruinose,* becoming purplish brown. *Prickles few* and scattered or sometimes lacking, slightly hooked—straight, *rather small* (up to 0.7 cm long), *weak,* with a long, narrow base, all ± uniform. *Leaflets* 5—7 (—9), elliptical—ovate (20—45 × 15—25 mm), acute with a cuneate base; *purplish blue-green,* paler beneath than above; simply or occasionally irregularly biserrate, teeth long, acute; glabrous; stipules narrow with long acute, somewhat diverging auricles. Bracts narrow, distinctly shorter than the pedicels. Pedicels about 2 cm long, longer than the hip, glabrous or sometimes with scattered, stalked glands. *Flowers 1—5 together, rather small,* about 3—3.5 cm in diam.; deep purplish pink; petals narrow, shorter than the sepals. *Sepals* ascending—erect in fruit, *long, about twice the length of the hip, very narrow* also at the base, 2—3 mm wide, *usually entire* or occasionally with a few narrow, small lobes; glabrous or sometimes sparsely glandular-hispid; persistent till the hips ripen. Styles white-lanate; disc slightly concave, about twice as broad as the orifice. *Hips* 1.0—1.5 cm, globose—obovoidal, usually glabrous, *dark purplish brown.* July (—August). $2n=28$.

Introduced; cultivated for ornament, sometimes escaped and occasionally naturalized. As naturalized *R. rubrifolia* occurs on roadsides and in waste places near farms and villages. It is native of the mountainous areas of C. Europe, extending southwards to the Pyrenees, C. Italy, and Albania. In Denmark this rose is rather frequently planted, particularly along the railroads. It is rarely found as escaped. In S. Sweden, *R. rubrifolia* is often cultivated, and is naturalized in some scattered localities. It was reported by SCHEUTZ in 1871 from Kullaberg in Scania where it occurred in a wood-plantation together with, e.g., *R. pimpinellifolia*: the provenience of the tree plants was south European. The cultivation of this rose and the number of naturalized findings seem to have increased somewhat in the last years.

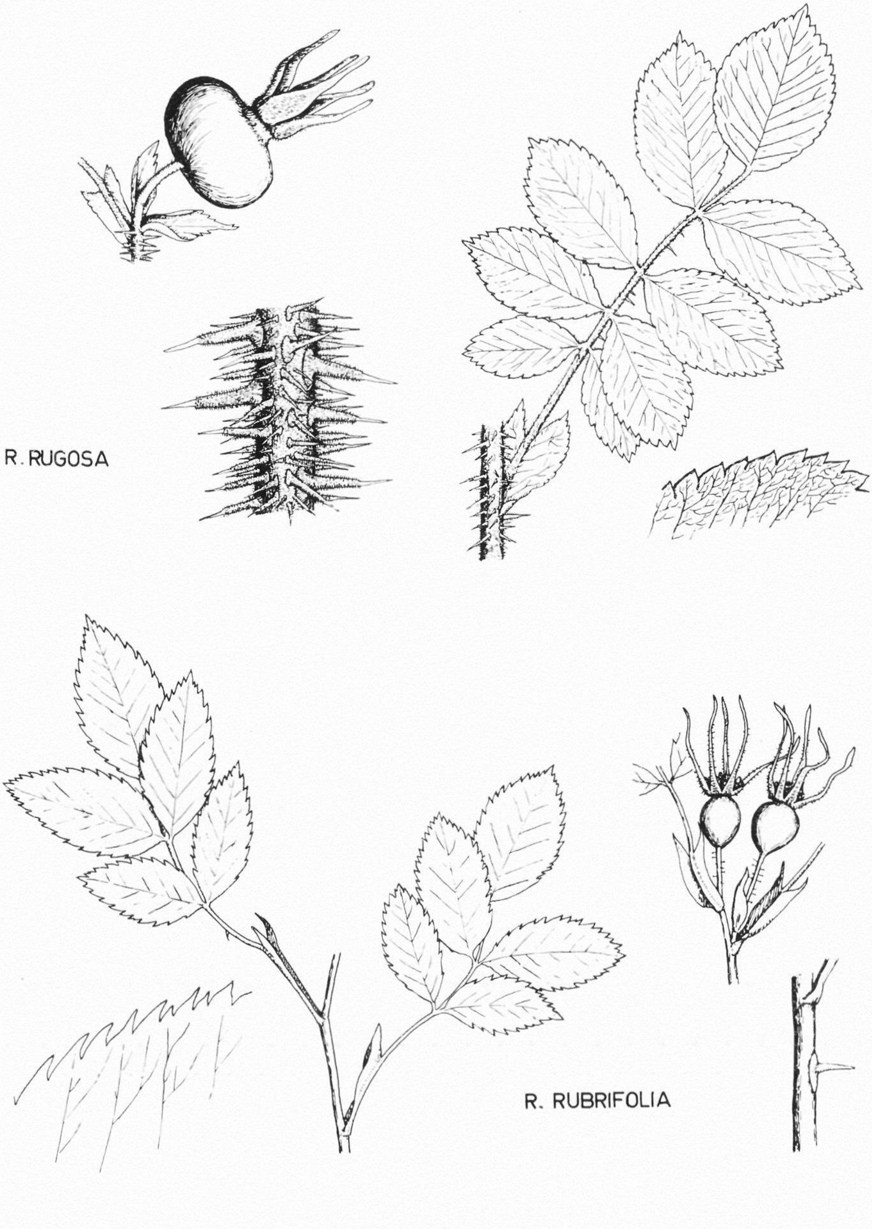

Fig. 2.

COMPLEMENTARY REMARKS

Besides *R. rubrifolia* and *R. rugosa*, which have been selected here for illustration among the introduced roses, there are several other species and cultivars which often have long been cultivated in Scandinavia, and which sometimes also occur as escaped and more occasionally as naturalized. The cultivars are often complex hybrids. Their most important ancestors are; *R. moschata* HERRM., *R. odorata* (ANDR.) SWEET, *R. chinensis* JACQ., *R. multiflora* THUNB., *R. provincialis* HERRM. (=*R. gallica* L.), *R. damascena* MILL., *R. foetida* HERRM., *R. centifolia* L., *R. wichurana* CRÉP., *R. virginiana* MILL., and the native species *R. rubiginosa, R. pimpinellifolia,* and *R. canina* (often in an unarmed form). These species are also often cultivated as 'pure' species. The species mainly originate from E. Asia, E. North America, and S. Europe. A few which rather often have escaped and become naturalized in Scandinavia are presented and briefly characterized below.

× **R. alba** L. (*R. canina* var. *dumentorum*×*provincialis*)

The white rose has been in cultivation for a long time in Europe. It was introduced in about 1590. It is still rather frequently planted in Scandinavia, and the many records of escaped shrubs around old cottages and farm gardens bear evidence of its previous popularity.

The numerous solitary flowers are not of purest white but flushed with pink towards the centre and are somewhat depressed in appearance; the shrubs are about 1—1.3 m tall and forms when escaped often large patches; the hooked prickles are often interspersed with bristles; the sepals are deflexed and deciduous after flowering, the outer three are pinnatifid; the disc is wide with a narrow orifice; the leaflets are somewhat coriaceous, ± compound-serrate, dull glaucescent-green, and ± glabrous.

R. multiflora THUNB.

In Denmark and S. Sweden the polyantha rose is often planted for hedges and may sometimes be escaped. In Scania it occurs as an escape at Hälsingborg, Mölle, and Simrishamn where the author has seen it in 1966 and 1967.

The shrubs are widely spreading, and about 1.5 m tall; the leaflets are 5—11; the numerous flowers are set in many-flowered, loose corymbs, and are white and very fragrant. *R. multiflora* is native of E. Asia.

R. pendulina L. (*R. alpina* L.; *R. cinnamomea* L. 1753, cf. HYLANDER, Studien über Nordische Gefässpflanzen, 1945)

This rose was first reported as escaped from Vanås in Scania in 1870 (Sweden). Later it has been seen in different parts of Sweden, and it seems to be very hardy, extending as far north as to Upper Torneå. This species has long been known from Eidsvold in Norway (M. BLYTT, Norges Flora 1876, p. 1152). It is still rather popular and often cultivated in gardens, often within certain districts, e.g., around Stockholm.

The shrubs are up to 2 m tall; the prickles are usually absent; the leaflets are glandular-biserrate and usually glandular on the veins beneath; the rich purplish pink flowers are solitary; the glandular-hispid pedicels are recurved-pendent in fruit; the red hips are often pyriform and glandular-hispid. It is native of the mountainous parts of C. and S. Europe.

R. virginiana MILL. (*R. lucida* ERHR.)

R. virginiana is cultivated for ornament and native of E. North America. Together with *R. rubrifolia* and *R. pimpinellifolia* this rose was found by SCHEUTZ at Kullaberg in Scania, Sweden, in 1871, in a young wood-plantation. In the same year it was collected there by WELANDER (LD), but no later collection is known from that locality. In Sweden it is known as an escape from Västergötland and Värmland, at Karlstad. In Scania and Blekinge and at Kalmar in Småland it has been seen by the present author as ± naturalized on roadsides. The first record from Denmark dates from 1842.

The shrub is up to 2 m tall; the paired prickles are slightly curved and interspersed with acicles on the young stems; the leaflets are 5—9, elliptical, acute and cuneate at base, dull green, simply serrate, and eglandular; the flowers are 2—7 together, pink or white; the pedicels are glandular-hispid; the sepals are patent and falling soon after flowering.

A great number of different forms of the native *Rosa* species has been described or reported from Scandinavia, mainly by the three Swedish rhodologists ALMQUIST, LINDSTRÖM and MATSSON in the beginning of this century. These forms have usually been omitted here. By LINDSTRÖM (in LINDMAN, Svensk Fanerogamflora 1918) the native

Swedish species (collective species) were divided into several 'micro' species, according to a peculiar system, with α-, β-, γ-, and δ-species in regard to leaf characters. At that time several hybrids were also described between the critical species of the section *Caninae*. Some of these have been considered here, but the present author is uncertain of their origin and in particular about the identification of the parents, in regard to the unique reproduction system of this group.

Besides the native species which have been presented here there are two more which have been reported to occur in Scandinavia. However, the determination of these species has often been regarded doubtful and therefore they will be only briefly discussed and characterized below for the sake of completeness.

R. marginata WALLR. (*R. jundzillii* BESS.)

A specimen which belongs to this species was found by F. CRÉPIN (Bot. Notiser 1893, p. 155) in the herbarium of E. FRIES (UPS). The specimen was collected by CORNELL on the island of St. Karlsö nearby Gotland in Sweden. The species was accepted by MATSSON in his *Rosa* revision (in L. M. NEUMAN, Sveriges Flora 1901, p. 356) with the addition of a new collection of WESTÖÖ, but the locality was wrongly altered to L. Karlsö. According to LINDSTRÖM (Bot. Notiser 1917, p. 74) CORNELL's specimen belongs to another unnamed species (det. S. ALMQUIST). The Swedish material is a particular form, var. *pendulina* (FR.) which differs a little from the main form. The species belongs to the section *Caninae* and is distributed in C. and E. Europe, extending northwards to Brandenburg in Germany. In the flora of Gotland there are several species which have a continental distribution in general and outpost localities on this island, thus the occurrence of this species on Gotland seems possible.

Shrub 1—2 m tall, erect or trailing. Cortex even, light brown-red. Prickles thin, straight or slightly curved, sometimes lacking. Leaflets 5—7, elliptical—ovate (25—40×15—27 mm), somewhat coriaceous, usually glabrous, glandular-biserrate; rachis pubescent, bristly; stipules narrow with long, acute auricles. Flowers often solitary, pale—deep purplish pink. Pedicels about 3 cm long, distinctly longer than the hip, glandular-hispid. Sepals deflexed and falling soon after flowering, glandular on the back and with long, narrow, glandular-serrate lobes. Styles often lanate. Hip 1.2 cm, globose—ovoidal, glandular-hispid or glabrous, red. $2n=42$.

The present author has seen the specimen of the original collection from St. Karlsö, and there seems to be no doubt that it belongs to *R. marginata.* The specimen was determined by ALMQUIST to *R. arvatica* BAKER, a species closely related to *R. agrestis,* of the subsection *Rubiginosae.* However, the specimen is not connected with that subsection which is easily established by means of its coriaceous leaflets which are almost eglandular beneath, the long pedicel, and the lack of prickles. *R. marginata* was growing according to the original label in '*fissuris ruprum . . . pendula*'. The occurrence is remarkable and phytogeographically very interesting, a fact already noted by CRÉPIN.

R. caryophyllacea BESS.

This species was reported as new to Scandinavia by MATSSON (Bot. Notiser 1901, p. 115) from Lyckeby in Blekinge (Sweden), and was collected by P. F. LUNDQUIST in 1877. The species is native of SE. Europe. It belongs to the subsect. *Rubiginosae*, the species of which often have a very restricted distribution. The Swedish form (*R. caryophyllacea* var. *suecica* MATSS. 1901; *R. suecica* MATSS. ex ALMQ. 1918) differs in many respects from the main form, by the leaflets which are sparsely glandular above and rather sparsely glandular beneath, and by the loss of bristles or acicles on the flowering branches and by the strongly hooked prickles. The present author has seen two specimens of the Lyckeby collection. They were both determined to *R. obtusifolia* (*R. sclerophylla*) by F. CRÉPIN. The material is rather incomplete, in particular the fructiferous parts, for a sure determination but it is in the author's opinion closely connected to *R. obtusifolia* which has been studied in Blekinge this summer and may hardly be referred to *R. caryophyllacea* s. str., although it has some similarities to it. According to LINDSTRÖM (1918) the identification is not certain, and he proposes that it may be a hybrid with *R. dumalis* and some other species. He also gives an new locality from Långholmen at Stockholm (one shrub) for the species in question. It has not been collected later. A description of *R. caryophyllacea* is given, however, because further investigation is needed.

Low shrub, up to ca. 1 m tall. Prickles stout, broad, almost straight and interspersed with bristles and acicles on the flowering branches. Leaflets 5—7, ovate—elliptical (10—30×10—20 mm), cuneate at base, densely glandular on both surfaces, occasionally sparsely so above, with scent of apples. Pedicels glabrous. Sepals glandular or eglandular, deflexed after flowering but usually persistent till the hips redden. Flowers 2—6 together, small, pale purplish pink. Styles lanate. Hip ca. 1.2 cm, subglobose—ellipsoidal, glabrous.

KEY TO THE SCANDINAVIAN TAXA OF ROSA

Deciduous shrubs of variable height (about 0.5—4 m), erect or sometimes trailing or climbing. Stems branched, usually with prickles or acicles dilated at base. Leaves alternate, pinnate with a terminal leaflet; leaflets serrate; stipules adnate with free auricles. Flowers terminal, solitary or in corymbs, hermaphrodite, 5-merous, often scenting. Sepals five, all ± equal, entire or three outer lobed and two entire. Hypanthium urceolate, becoming coloured and ± fleshy when ripe (here referred to as the hip). Stamens and pistils numerous; ovule one, pendulous. Styles ± shortly exserted through the orifice, together with the stigmas forming a ± distinct head, surrounded by a disc.

(Designations within parentheses refer to the page in Bot. Notiser 1967, vol. 120, where the species are treated. The key does not always cover the entire variation of some taxa, and does not include the species which are not illustrated. The direction of the sepals refer to the fruit stage.)

Type species: *Rosa centifolia* L. (BRITTON & BROWN, Ill. Fl. N.U.S. 1913, ed. 2 p. 282.)

Sect. *Pimpinellifoliae* DC. (*R. pimpinellifolia*)
Sect. *Cinnamomeae* CRÉP. (*R. majalis, acicularis, rugosa*)
Sect. *Caninae* CRÉP.
    subsect. *Rubrifoliae* CRÉP. (*R. rubrifolia*)
    subsect. *Vestitae* R. KELL. (*R. villosa, sherardii, tomentosa*)
    subsect. *Rubiginosa* CRÉP. (*R. rubiginosa, micrantha, agrestis, elliptica*)
    subsect. *Caninae* (*R. canina, dumalis, obtusifolia*)

1 Sepals usually entire 2
Outer three sepals distinctly pinnatifid or lobed 6
2 Young stems without or with a few scattered, weak prickles; sepals long and narrow; leaves and branches purplish .... *R. rubrifolia* (p. 400)
Young stems with ± closely set prickles often interspersed with acicles; sepals comparatively short and broad; leaves ± green 3
3 Young stems, basal part of prickles tomentose; leaflets thick, rugose, 7—9; flowers and hips large (6—8 cm and 2—3 cm in diam., respectively); pedicels curved .... *R. rugosa* (p. 398)
Young stems and prickles glabrous; leaflets even; flowers and hips smaller, solitary; pedicels straight 4

4 Leaflets 7—11, small, glabrous; bracts lacking; flowers white; hips black . . . . *R. pimpinellifolia* (p. 393)

Leaflets usually 5, larger, pubescent beneath; bracts large; flowers purplish pink; hips scarlet red 5

5 Flowering branches with closely set, small prickles and acicles; hips ovoid . . . . *R. acicularis* (p. 396)

Flowering branches usually without prickles and acicles; hips ± globose . . . . *R. majalis* (p. 394)

6 Leaflets usually eglandular beneath, simply or sometimes biserrate, teeth usually eglandular; prickles curved or hooked; pedicels and sepals eglandular or sparsely glandular 7

Leaflets ± densely viscid-glandular beneath, minutely glandular-biserrate, frequently with scent of resin or apples; prickles straight, curved or hooked; pedicels and sepals often glandular or glandular-hispid 8

7 Stigmas in a loose, globose or conoidal head; styles glabrous or sparsely villosus; disc ± conoidal, > three times wider than the orifice; leaflets glabrous or sparsely pubescent beneath; sepals patent or usually deflexed, falling soon after flowering; hips hard and ± leathery, ripening late . . . . *R. canina* (p. 137)

Stigmas in a dense, semiglobose, depressed head almost concealing the disc; styles usually densely lanate; disc flat or shallowly concave, about two times as broad as the orifice; leaflets glabrous—tomentose; sepals usually ascending, erect or patent, persistent till the hip reddens; hips rather soft, ripening early . . . . *R. dumalis* (p. 140)

A. Leaflets glabrous or sparsely pubescent and glaucescent beneath, teeth long and acute; sepals ± erect . . . . . . ssp. *dumalis* (p. 143)

B. Leaflets pubescent or glabrous above, tomentose beneath, teeth shorter, subacute; sepals usually ascending or patent . . . . ssp. *coriifolia* (p. 143)

8 Prickles straight or slightly curved; leaflets ± densely pubescent or tomentose, smelling of resin or turpentine 9

Prickles curved or hooked; leaflets ± glabrous above and sparsely pubescent and glandular beneath, scentless or with scent of apples 11

9 Prickless usually straight, weak, very sparsely set on young stems; stems comparatively low, ± straight; auricles falcate and somewhat incurved; pedicels shorter than the hips; sepals erect, few-lobed, persistent till the hip decays; hips soft, ripening early . . . . *R. villosa* (p. 6)

A. Leaflets oblong—ovate, deeply serrate; stems not pruinose; hips large (1.5—2.5 cm), globose—pyriform, densely glandular-stipitate . . . . ssp. *villosa* (p. 7)

B. Leaflets oval—suborbicular; stems pruinose; hips smaller (1.0—1.8 cm), usually globose, ± sparsely glandular-hispid or smooth . . . . ssp. *mollis* (p. 6)

Prickles straight or often slightly curved, stout, ± closely set; stems comparatively high, arching; auricles acute, straight—diverging; pedicels longer than the hips; sepals ascending, patent or deflexed, distinctly lobed; hips hard, ripening late 10

10 Stigmas in a head of *dumalis* type; styles usually densely pilose; disc flat or concave, about two—three times wider than the orifice; sepals patent or ascending, persistent till the hip reddens; pedicels relatively short .... *R. sherardii* (p. 2)

Stigmas in a head of *canina* type; styles glabrous or thinly pilose; disc ± conoidal, about four—five times wider than the orifice; sepals patent or often deflexed, falling soon after flowering; pedicels relatively long .... *R. tomentosa* (p. 4)

11 Sepals distinctly pinnatifid with broad, deeply glandular-dentate or lobate lobes, deflexed and falling soon after flowering; prickles stout, strongly hooked or falcate; leaflets usually only with glands on the main veins beneath, scentless .... *R. obtusifolia* (p. 138)

Sepals with narrow, ± entire lobes; prickles curved or hooked; leaflets with ± closely spaced viscid glands all over the lower surface, scentless or often with scent of apples 12

12 Prickles stout, on young and towards the base of older stems interspersed with setae and acicles; leaflets rounded at base, with scent of apples; corymbs many-flowered; pedicels glandular-hispid; sepals glandular on back, erect or ascending, persistent till the hip reddens; styles lanate—villous .... *R. rubiginosa* (p. 249)

Prickles not interspersed with setae and acicles 13

13 Leaflets rounded at base, with scent of apples; pedicels glandular-hispid; sepals glandular on back, deflexed, falling soon after flowering; styles ± glabrous .... *R. micrantha* (p. 253)

Leaflets cuneate at base; sepals eglandular on back 14

14 Pedicels glabrous; leaves ± scentless; sepals erect—patent, persistent till the hip reddens; styles lanate—villous .... *R. elliptica* (p. 250)

Pedicels glandular-hispid—glabrous; leaves with scent of apples; sepals deflexed, falling soon after flowering; styles glabrous .... *R. agrestis* (p. 252)

The Phytogeographic Evolution of the Genus Ginkgo L.

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ABSTRACT

The oldest finds of *Ginkgo* are dating from the Lower Jurassic. From evidence outlined it seems likely that the genus was represented by at least two, but certainly not more than three natural species during Jurassic times.

During the Cretaceous increasing polymorphy in foliar remains indicates the rise of new species. During the Lower Cretaceous there also appears a type of leaf known both as *G. adiantoides* and as *G. paradiantoides*. This leaf is from the gross morphological and the anatomical point of view very similar to the Tertiary and Recent *Ginkgo* populations, making it likely that one may expect a direct ancestry between the present-day *Ginkgo* and those of the Lower Cretaceous.

By Lower Tertiary times a considerable reduction has taken place leaving only one gross morphological type of leaf, that of *G. adiantoides*. This is generally suggested to be identical with *G. biloba*. The Tertiary population of *Ginkgo* is thus assumed to represent one polymorphic species with several subspecific units, and the modern species being the result of further advanced genetical reduction. The geographical reduction runs from a circumpolar distribution during the Palaeo-Eocene, via extinction on the North American continent during the Upper Miocene, to an Eurasiatic range in Pliocene times. Although there is no positive evidence it can be assumed that the final reduction of the genus, to its present-day East Asiatic home, has taken place during the Pleistocene period.

INTRODUCTION

This paper, concerning the phytogeographic development of *Ginkgo* in the Northern Hemisphere, aims to introduce a new method of mapping phytogeographic evolution courses. Previously maps of fossil distribution did almost never consider the immense changes of sea and land levels during bygone periods. These general geographic and topographic facts, however, are doubtless of considerable importance for phytogeography. They can reasonably be expected to have influenced floral zonation, etc., in a fundamental way.

Once before, the present author made a similar attempt in mapping the Eocene occurrences of *Nypa* along the Lower Tertiary sea shore lines (Tralau 1964). The present maps include Mesozoic and Cainozoic systems and are thus expected to give a more complete picture of the geological events during these periods. In the maps the approximative maximum extension of epicontinental sea transgressions are outlined, whereas the highly theoretical assumptions regarding the former position of continents in relation to each other are omitted. Relatively long periods are covered by the present maps, which means that only approximative maximum extensions of marine transgressions could be outlined. Neither was it practicable to mark estuarine environments in the rather small maps. These circumstances lead, without doubt, to the regrettable disadvantage that fossiliferous sites situated immediately above or below a sea transgression appear to be within the marine area. Also the estuarine occurrences tend to behave in a similar manner. These facts should be noted when reading the maps.

The maps presented here have been established, with regard to the historical geological facts, by sources cited previously (Tralau 1964), to which, however, sources obtained from Termier and Termier (1952) and Vakhrameev (1964) have been added. More detailed botanical facts are obtainable from another paper of the present author (Tralau 1967).

HISTORIC PHYTOGEOGRAPHY OF GINKGO

The oldest fossils doubtless belonging to the genus *Ginkgo* date from the Lower Jurassic of Fergana in the southern Asiatic part of the Soviet Union (see Fig. 1). As a matter of fact, however, according to the evidence known to us, *Ginkgo* seems never to have been frequent during the Liassic period anywhere in the Northern Hemisphere, if it ever existed in a wider range. Thus, owing to the low frequency, or partly real absence, of fossils referable to *Ginkgo* during the Liassic it is likely that the genus actually still must have been rare in the flora of this period. On the other hand, the sudden increase in frequency and wide occurrence of *Ginkgo* in Middle Jurassic deposits all over the Northern Hemisphere is striking. But, as Lower Jurassic plant fossiliferous layers are as common as those of the Middle Jurassic and as the flora of the Lower Jurassic is not less known, it seems reasonable to suggest a restricted frequency of the genus *Ginkgo* in the flora of this earlier period.

Fig. 1. The Lower Jurassic occurrence of the genus *Ginkgo*. The hatched areas indicate the approximative maximum extension of epicontinental sea transgressions during the Lower Jurassic.

The fossil evidence known so far gives us no traces concerning the time and place of origin nor migration routes of the genus *Ginkgo* during its earliest history. It is also quite uncertain whether the genus is to be considered monophyletic or polyphyletic. The single Lower Jurassic find of *Ginkgo* in the southern part of the Soviet Union is weak evidence for the assumption of an Asiatic origin, and the related Mesozoic genera and possible predecessors do not provide reliable facts concerning this matter. We should thus plainly concede as true that we do not know when, where, and how the genus *Ginkgo* came into being, but it seems not unfair to suggest morphologically related types as *Ginkgoites* and *Ginkgoidium* as possible predecessors of *Ginkgo*.

The oldest foliar remains of this genus are described as *Ginkgo digitata* from Fergana as mentioned above. The leaf resembles in all essen-

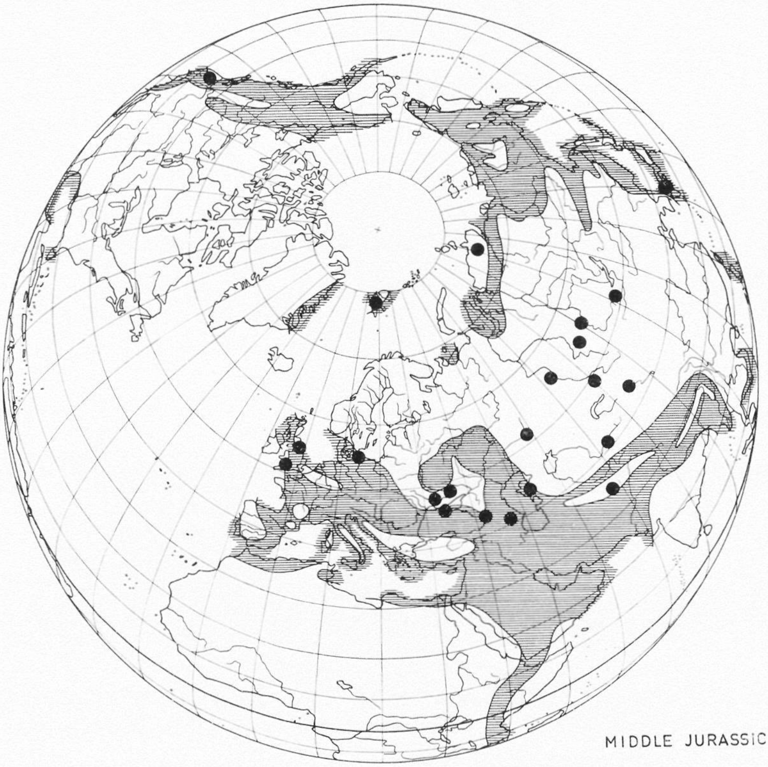


Fig. 2. The Middle Jurassic distribution of the genus *Ginkgo*. The hatched areas indicate the approximative maximum extension of epicontinental sea transgressions during the Middle Jurassic.

tial gross morphological characters the leaf of a special part of the Middle Jurassic *G.* "*digitata*" population of Asia. This leaf form is common in Eurasiatic Middle Jurassic to Lower Cretaceous sediments and is mostly referred to as *G.* "*digitata*".

In Middle Jurassic sediments the genus *Ginkgo* is represented by numerous foliar remains thus suggesting a general occurrence throughout Eurasia and North America.

Among the leaf remains of the Middle Jurassic there are, according to gross morphological features, certainly two distinct, and perhaps three, groups of leaves which also should be presumed to form the same number of natural species.

I do not agree with SHAPARENKO (1935), who referred all fossil remains of *Ginkgo* as well as the modern species *G. biloba* to *G. adiantoides*, a species

UPPER JURASSIC

Fig. 3. The Upper Jurassic distribution of the genus *Ginkgo*. The hatched areas indicate the approximative maximum extension of epicontinental sea transgressions during the Upper Jurassic.

most characteristic of the Tertiary period. There are considerable gross morphological differences in size and in anatomy among the foliar characters of the various populations confined to separate stratigraphic and geographic regions.

One species, which in its most characteristic appearance seems to have been restricted to Europe, is called *G. digitata*. The leaf of *G. digitata* s. str. has a broad lamina with a basal angle of at least 180° and with mostly about 12 shallowly divided lobes.

Taken in this original and narrow sense *G. digitata* seems to be a species typical of Europe, perhaps Western Europe only. It seems also likely that this species is even confined stratigraphically to a narrow range, that is to the Middle Jurassic. Specimens ascribed to *G. digitata* from the Lower and Upper Jurassic are distinct.

The other species is *G. huttoni*. The leaves of this species are remarkably variable in general appearance and cuticle structure and it is uncertain whether one or more natural species is involved. Deeply lobed leaves similar to those of *G. huttoni* are occasional in the Lower Jurassic, but most of them, if not all, obviously belong to the genus *Ginkgoites*. It seems for this reason likely that records concerning especially the polymorphic Lower and Middle Jurassic species of *Ginkgoites lepida* include both species of *Ginkgoites* and specimens of *Ginkgo huttoni*. *G. huttoni* becomes relatively abundant during the Middle Jurassic throughout the Northern Hemisphere and remains such until theend of the Lower Cretaceous (see Figs. 2—4).

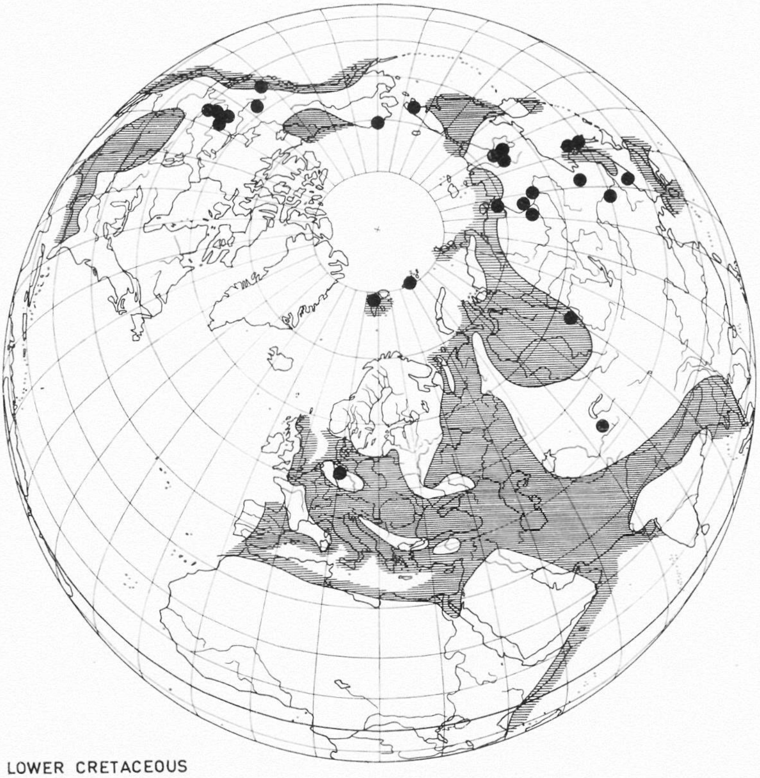
The lamina of *G. huttoni* is small with a radius of 3 to 4 cm and a basal angle of mostly ±135°. It is generally symmetrically divided into six lobes by more or less shallow notches, the central one being the deepest. Asymmetric leaves as well as leaves with four lobes are common.

From evidence outlined previously (TRALAU 1967) it seems likely that the genus *Ginkgo* during the Jurassic period was represented by at least two species, i.e. *G. digitata* from Europe, and *G. huttoni* with a north-hemispheric, circumpolar distribution. *G. huttoni* is likely to include numerous subspecific units, some of which, perhaps, are geographically separated.

There is also a south-hemispheric occurrence of *Ginkgo* during the Jurassic, which, however, is not considered here.

In Cretaceous deposits the macroscopic polymorphy of leaves belonging to the genus *Ginkgo* is striking. Consequently a great number, i.e. about 18, of palaeobotanic "species" have been described. It is quite likely, however, that a number of new natural species have arisen during the end of the Jurassic and at the very beginning of the Cretaceous. It is also likely that a part of the Jurassic *Ginkgo* population became extinct during this time, as the more deeply divided leaves of the Jurassic *G. huttoni* apparently no longer are present in the Cretaceous deposits, whereas the broad-lobed forms referred to this species are not infrequent.

Apart from a number of relatively small and rather frequently dissected leaves from chiefly Arctic regions, leaves of the modern *biloba*-type, which often are referred to *G. adiantoides,* appear in the Lower Cretaceous and became comparatively abundant especially in Upper Cretaceous time. However, it is hard to tell the real number of natural species involved in the Cretaceous *Ginkgo*-population as we have limited



LOWER CRETACEOUS

Fig. 4. The Lower Cretaceous distribution of the genus *Ginkgo*. The hatched areas indicate the approximative maximum extension of epicontinental sea transgressions during the Lower Cretaceous.

knowledge only regarding other than gross morphological characters, as for instance epidermal features, which could confirm specific discrimination. According to my experience the frequent absence of cuticle in Cretaceous specimens depends on the fact that many of the fossil remains are embedded in sand- or limestone in which all organic pattern generally is destroyed.

Among the rather well known Cretaceous species is *G. pluripartita,* which obviously is not uncommon in especially Lower Cretaceous deposits of Eurasia as well as of North America. The lamina is typical with its broad and deeply notched lobes, which mostly are six in number and which are arranged symmetrically. The lamina forms mostly less than 1/2 of a circle. The two inner, or central lobes, are as a rule, broader than the adjacent ones.

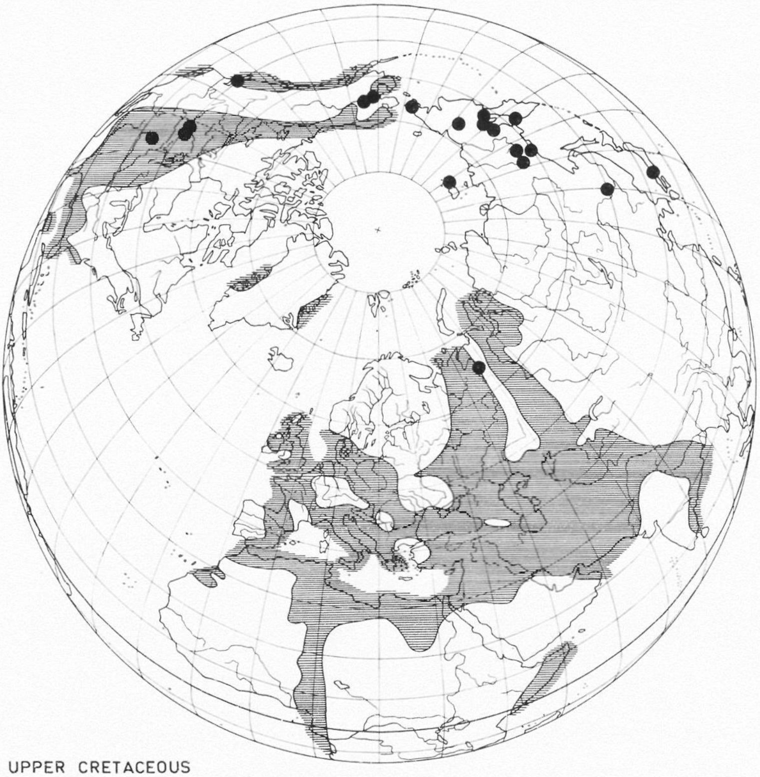


Fig. 5. The Upper Cretaceous distribution of the genus *Ginkgo*. The hatched areas indicate the approximative maximum extension of epicontinental sea transgressions during the Upper Cretaceous.

Another thoroughly known *Ginkgo* species of the Lower Cretaceous is *G. polaris,* which has been described from Franz Joseph Land. The lamina of *G. polaris* is rather small (2.5 cm in breadth, 3.5 cm in length), generally forming 1/2 or more of a circle, and has shallowly notched lobes.

Another species from the Lower Cretaceous of Franz Joseph Land is *G. coriacea.* This resembles *G. polaris* in some gross morphological features, but differs by its somewhat bigger leaves, by deeper notches, and by the fact that the lamina obviously never forms more than 1/2 of a circle.

Recently a new species, *G. paradiantoides,* has been described from Lower Cretaceous deposits of Eastern Siberia. Gross morphologically this fossil species resembles *G. adiantoides* and is consequently also close to the Recent *G. biloba*. But epidermal features, too, make it clear that this fossil should be considered close to *G. adiantoides*.

As pointed out above, *G. pluripartita* has a North-hemispheric distribution, whereas *G. polaris* and *G. coriacea* are restricted to the Arctic. The type of leaves often described as *G. adiantoides* or *G. pseudoadiantoides* from Lower Cretaceous, but preferably from Upper Cretaceous sediments of the Northern Hemisphere, is in the case of the Lower Cretaceous *G. paradiantoides* also known from the anatomical point of view, suggesting phylogenetic connection between the Recent and Cretaceous populations. The conclusion is thus that it might be reasonable to expect the direct predecessors of Tertiary and Recent *Ginkgo* in this part of the Lower Cretaceous population of *Ginkgo*.

In Tertiary deposits there is, according to gross morphological features, only one type of *Ginkgo* leaf to which the name of *G. adiantoides* has been given, and which by most of its more recent students is considered to be undistinguishable from the leaves of modern *G. biloba*. The remarkable variation of megascopic leaf features of *G. biloba* which is generally considered to be due to ontogenetic as well as environmental influence has been studied frequently and is well known. Comparison with Tertiary remains makes it likely that also this fossil population should be considered to comprise one natural species, as there can be little doubt, if any, that the variability of gross morphological leaf characters in the fossil population corresponds to that of the modern species.

However, it has been questioned whether the Tertiary *Ginkgo* population really constitutes one species only or whether it should be considered identical with or in any other way closely related to the recent *G. biloba*. Especially the older students of the genus, as for instance HEER, created a great number of different "species" of Tertiary *Ginkgo*.

The summarized evidence of gross morphological and anatomical features of the Tertiary *Ginkgo* specimens known at present makes it clear that the variability of characters does not exceed the variability of for instance Jurassic species, as *G. huttoni*. Save for some anatomical characters of the epidermis in the Eocene *G. gardneri*, all Tertiary *Ginkgo* specimens are even considerably close to the modern species. It seems therefore justifiable to suggest the presence of one polymorphic species in the Tertiary, the different fossil species described thus being of subspecific value. These conclusions are especially due to the fact that for a start we have but few, i.e. only three, Lower Tertiary speci-

Fig. 6. The Palaeo-Eocene distribution of the genus *Ginkgo*. The hatched areas indicate the approximative maximum extension of epicontinental sea transgressions during the Palaeo-Eocene.

mens in which the epidermis is known to differ in some but slight respects from Recent and Middle to Upper Tertiary specimens, and further because we do not really know whether these differences are due to the genetic constitution of the entire population, the single investigated specimen thus representing this fossil population, or whether these differences are to be considered being of subspecific or even ontogenetic and ecological origin.

During the Tertiary period the phytogeographic evolution of the genus *Ginkgo* is characterized by a number of distinctive features.

In Palaeo-Eocene sediments *Ginkgo* occurs chiefly, and sometimes abundantly, in northern regions, at present arctic, the southernmost finds being situated around latitude 45°N in North America and above

Fig. 7. The Oligocene distribution of the genus *Ginkgo*. The hatched areas indicate the approximative maximum extension of epicontinental sea transgressions during the Oligocene.

50° N in Asia (see Fig. 6). It seems likely that the genus was absent from the flora of more southern regions, which was tropical at those times. For instance, the exceedingly rich and well-known Eocene London clay flora, which predominently consists of tropical and subtropical elements, is lacking in remains of *Ginkgo*. Neither is *Ginkgo* known from any other region, which judging from its floral or faunal remains must be considered as having been tropical during Palaeocene-Eocene times.

During the Oligocene and Miocene a considerable lowering of temperature took place in the Northern Hemisphere, a fact that generally is realized by biogeographers, giving rise to a more southerly distribution

MIOCENE

Fig. 8. The Miocene distribution of the genus *Ginkgo*. The hatched areas indicate the approximative maximum extension of epicontinental sea transgressions during the Miocene.

and causing the extinction of *Ginkgo* in its northern habitat. No middle-Tertiary occurrences are known north of latitude 55°N, the main distribution of *Ginkgo* being between 38°N and 53°N (see Fig. 7, 8). Other wise it seems perfectly clear that the genus retained its circum-polar distribution even during middle-Tertiary times, being known throughout Eurasia and Northern America, or at least, western North America. Whether *Ginkgo* ever existed in the eastern parts of the North American continent during the Oligocene and Miocene is uncertain, unless fossil evidence can be supplied.

At the end of the Miocene *Ginkgo* appears to have become extinct in North America. At least, after being rather numerous in several Miocene deposits in western parts of this continent, the genus is absent

Fig. 9. The Pliocene distribution of the genus *Ginkgo*. The hatched areas indicate the approximative maximum extension of epicontinental sea transgressions during the Pliocene.

from Pliocene sites of America. During the Pliocene the genus seems to be confined to Eurasia, covering mainly its pre-Pliocene area of distribution (see Fig. 9). Furthermore, there is no reason to assume any noteworthy reduction of its frequency in Europe. The fact that numerous finds of fossil *Ginkgo* are known throughout Europe, i.e. in regions in which Pliocene sediments are to be found, does not suggest any important reduction of this genus in the European Pliocene flora.

The most striking geographic and, certainly also genetic reduction of *Gingko,* from its wide Eurasiatic habitat to its most restricted present-day occurrence in China, has taken place between the Upper Pliocene and modern times. It is not known whether this reduction came about suddenly during the uppermost Tertiary or whether it happened slowly during the Lower Quaternary. At present there is no fossil evidence for Quaternary survival of *Ginkgo* in Europe, and nothing is known concerning the Quaternary history of *Ginkgo* in Asia either. To add to the unsolved problems regarding *Ginkgo*, it has often been doubted whether even the exact recent authochtonous area of distribution of this genus is in fact known.

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Two New Species of Pyrola from the Himalayan Region of Asia

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ABSTRACT

Two new species of *Pyrola* — *P. karakoramica* KŘÍSA and *P. andresii* KŘÍSA belonging to the nominatic section *Pyrola* are described from the montane regions of the Himalayas and adjacent mountain massifs, the mountain range Hindukush, Karakoram in the west and, in the east, the Chinese Burmese frontier region, and the province of Sechuan. The specific values of both taxa, the distribution of which is limited, was supported by the analysis of morphological features and by mutual comparison of these values with related species.

TAXONOMY AND CHOROLOGY

In the Himalayan montane region there are disjunctive populations of the genus *Pyrola* with, in the majority of cases, a local endemic character. ANDRES 1914 a presumes two centres of evolution in Asia: *a.* the central-Asiatic localised in the vast region reaching from Karakoram to the Chinese province of Yünnan, including the river regions of Mekong, and *b.* the Manchurian-Japanese centre with an expressed inclination to the small Pacific island area. Regarding the complicated florogenesis of the Asiatic sub-continent, it is impossible to accept this global division without seeing the different evolutionary tendencies (including the variability of the feature complex) of the individual taxonomic groups (series, subseries). In the area of the Indo-Malayan archipelago the species penetrate deeply in the palaeotropic florographic region (cf. ANDRES 1936 a) approaching taxonomically more distinctly the Asiatic Pacific insular area than the continental central-Asiatic mountain system. The locality in north Sumatra: Atjeh Gjalanden, G. Losir, 2,700—2,880 m s.m., leg. VAN STEENIS 1937, SING No 26317 is, according to the present knowledge, the southernmost extremity (approx. 4°80′ north latitude) of the taxa of the genus *Pyrola* in the northern hemisphere.

The florogenesis of the centres of evolution of the Asiatic species of *Pyrola* starts from an ancestral group of archtypes originating approximately in the Pliocene and in the interglacial periods of the Pleistocene glaciation of Siberia with a subsequent progressive evolution in the Post-Glacial. Probably, by a divergent evolution originated several more or less independent phyletic groups in which there occurred a successive feature differentiation together with a long-term spatial migration. The individual phyletic groups in the Altai-Himalayan region including the adjacent areas occupied similar geographically-biotic surroundings. The basis of the differentiation of the Quaternary taxa in the Pleistocene was most probably the Arcto-Tertiary flora which infiltrated from the northern regions of Siberia southwards. It is just from the Oligocene that there are proofs of existence of the vast barren lands in the central-Asiatic area on which the main stream of the infiltration of the Arcto-Tertiary floral elements was directed into the montane positions where the climate was moister, and by far not so cold as the one after the glacial Quaternary catastrophy. Orogenetic processes in the Tertiary in some regions either supported or excluded the penetration of the flora to the Altai-Himalayan area. An important role in the southeastern part of the Asiatic sub-continent played the existence of the Tethys Sea, its southeastern margin reaching to those parts and which attained its maximum in the lower Oligocene. The progressive disappearance of the Tethys at the end of Palaeogene affected substantially the infiltration of the floral elements from the north to the south.

The local endemism in the Himalayan area can be explained by a progressive differentiation of the above-mentioned phyletic groups which, from the taxonomic point of view, represent series or subseries in the range of the Eurasiatic nominatic section. From the original macro-endemic basis, which was represented by the species *P. rotundifolia* s.lat., *P. incarnata* s.lat. and the *P. japonica* complex, started a progressive geographical differentiation in Asia. I believe that the original progressive area trend at the end of the Pliocene lost its activity during the Pleistocene glaciation, and became stabilized in the form of local oreoendemites in the whole Altai-Himalayan massif. These are the micro-endemic populations the formation of which was completed in the Pleistocene, probably at an allochtoneous area, regarding the Arcto-Tertiary flora in the north and the Indo-Malayan relict flora in the south. According to the character of the feature complex these are all distinct species with an area of a rigid character.

When studying the feature complex of the nearctic taxa of the series *Asarifoliae* KŘÍSA sect. *Pyrola,* the evident relations to the east-Asiatic populations were manifested (cf. KŘÍSA 1966). A common basis is not excluded, particularly considering the existence of an ancient north-pacific connection — Palaeoberingia. Remarkable is the phenomenon of continental endemism, especially in those species, the area of which penetrates far into the joining region, insular or continental, between Asia and North America. Of the nearctic part, these are the areas of the following species: *P. californica* KŘÍSA (the pacific part of the Alaska, and all the Aleutian Islands), *P. asarifolia* MICHX. ssp. *asarifolia* (Western Pacific Coast Distr. of Alaska). From the palaearctic part the species *P. incarnata* FISCH. ex DC. ssp. *incarnata* (Kamchatka, Kurile) and *P. japonica* SIEB. (Hokkaido, south Kurile). The feature barriers caused by spatial isolation are typical in both directions and are the result of separate florogenetic processes on both continents. I believe that the above-mentioned continental differentiation started from a common Arcto-Tertiary base in all the holarctic region and this assumption can be, to a certain extent, confirmed in the sense of the taxonomical-chorological study.

The newly-described species belong to the nominatic section which is divided in two series in the Asiatic area. The species *P. karakoramica* sp. nov. belongs to the series *Incarnatae* KŘÍSA (1965) and, according to the type of morphological features it stands most closely to *P. incarnata* ssp. *dahurica* comb. nov. (cf. KŘÍSA 1967). This population has, likewise, an oreophytic character of distribution and grows in all the Altai-Sayan-Transbaikal region. Together with the nominatic population of *P. incarnata* its area approaches to the mountain system of central Asia to which it does not reach, however. The species *P. karakoramica* is a local endemic population in the montane region of Kashmir with the adjacent mountain massifs. The species *P. andresii* sp. nov. belongs to the series *Japonicae* KŘÍSA which is distributed from the east-Himalayan area (including the region of Nepal, Sikkim, Bhutan) right to the Japanese Islands. This species represents an endemic montane population in the region of SE Tibet with the adjacent regions and its features resemble *P. japonica* SIEB. and *P. alba* H. ANDR. The species *P. rotundifolia* s. str. into which all Asiatic populations were included, does not occur in the area of central Asia. East of Ural it reaches to the West Siberian lowlands, furthermost to the river-basin of the upper and middle course of the Yenisei where it forms transitory populations with the species *P. incarnata* s.lat. ANDRES (1936 b) has described two new species from the area of Sechuan: *P. rugosa* and *P. mattfeldiana* which, according to the type of the feature complex, belong to the series *Sororiae* KŘÍSA and approximate more the species *P. media* Sw.

The submitted diagrams (Fig. 1) show the variability of some diacritical morphological features and the mutual comparison between the related species. Altogether 65 specimens were analysed of the species *P. karakoramica*, 94 specimens of the species *P. andresii*. The measured values of the investigated morphological features represented always more than 500 of each feature in the range of individual species.

DESCRIPTIONS OF SPECIES

Pyrola karakoramica KŘÍSA, sp. nov.

Planta perennis, intermedia, rarius magna, (raro 12) 16 usque ad 25(—30) cm alta. Caules plerumque atropurpureo colorati, sulcati, in superiore parte tertia inconspicue alati. Squamae numerosae, usque 10 mm longae, 5—6 mm latae. Folia satis tenuia, glauco-viridia, rotundata; laminae 2—4 cm latae, (1.5—)2.0—3.5(—4.5) cm longae, rete nervorum eminenter artum, eximie in foliis siccatis nervi gravissimi perspicui; petioli (1.0—)1.5—3.0(—4.0) cm longi, sulcati. Flores nutantes, albi, raro rosei, breviter lateque campanulati; pedicelli graciles; bracteae plane amplexicaules, 4—8 mm longae, pedicello aequilongae vel paullum longiores. Petala alba vel rosea, late obovata. Sepala longiora quam lata, viridia, lanceolata usque ad 2 mm lata, (3.8—)3.9—4.2(—4.3) mm longa, apice contracta. Antherae (2.5—)2.6—2.9(—3.0) mm longae, luteae. Stylus roseus, 6.5—8.0 mm longus, curvus, apice patelliformis. Capsulae rubrae, globularae.

Typus: Kashmir: Gumber Nullah, Zoji La; on rock amongst grass, alt. 12,000 ft., (ca. 3,600 m s.m.), 25.8.1940, F. LUDLOW et G. SHERRIFF, 8005. Holotypus in herbario Musei Britannici Londinensis (BM) et isotypus in herb. Horti botanici regalis Edinensis (E) conservatur.

Positio in systemate generis: in serie *Incarnatae* KŘÍSA sectionis subgenerisque *Pyrola* positum.

Etymologia: secundum montes Karakoram dictam denominatur.

Habitat: plantae in pratis alpinis in Montes Hindukush, regio Chitral, Montes Karakoram et Montes Himalayaenses (pars occidentalis in regio Indica) distributae.

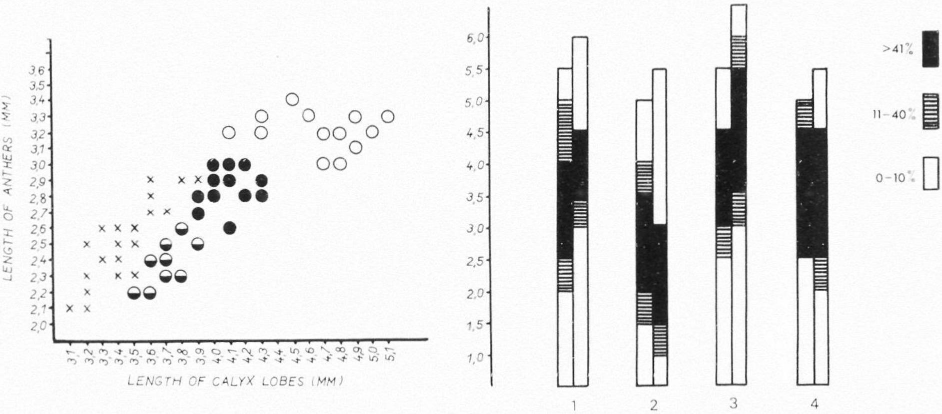

Fig. 1. To the left: Scatter diagram showing the relation of anther length to calyx lobe length in the four taxa: × *P. incarnata* s. lat., ◒ *P. rotundifolia* s. str., ● *P. karakoramica*, ○ *P. andresii*. — To the right: Histograms showing the mean lengths of blades and petioles in percentages in the four taxa. The left column represents the lengths of blades (cm), the right column the lengths of petioles (cm). 1. *P. andresii*, 2. *P. karakoramica*, 3. *P. rotundifolia* s. str., 4. *P. incarnata* s. lat.

SPECIMINA EXAMINATA: West Pakistan: Chitral: Rosh Gol, N.E. of Tirich Mir, 12,000 ft., beneath birches, at edge of stream 7.7.1958, J. D. A. STAINTON 2832 (BM, E). — Chitral: Yarkhun Ondine, between 36°30′ N. 72°40′ E. and 36°48′ N. 73°5′ E., shade moist well drained position among willows, 11,000 ft., 21.6.1958, BOWES LYON 976 (BM, E). — Kashmir: Gumber Nullah, Zoji La; on rock amongst grass, 12,000 ft., 25.8.1940, F. LUDLOW, et G. SHERRIFF 8005 (BM, E). — Gilgit, Naltar Lakes, 17,000 ft., 19.7. 1954, R. R. STEWART 26311 (BM); Gilgit, Babusan Village, 13,000 ft., 12.7. 1964, E. NASIR 2732 (RAW); Gilgit, 1886, G. M. GILES 201 (CAL). — Sonamarg, lat. 34°20′ N., long. 75°20′ E., 10,500 ft., 5.8.1965, J. D. A. STAINTON 5034 (BM); 12,000 ft., 22.4.1924, R. R. STEWART 6618 (K). — Karakoram: Sokha Glacier, left bank, moist slope, 13,000 ft., 23.8.1939, R. S. RUSSELL 1675 (BM, UPS). — Astor-rama, 23.7.1946, R. R. STEWART et E. NASIR 21878 (RAW); Astor Valley, 10,000 ft., 14.8.1892, J. F. DUTHIE 12452 (BM); Astor: Gudhai Valley, under *Pinus excelsa*, 11,000 ft., 22.7.1892, J. F. DUTHIE 12224 (K); Astor, 1847, WINTERBOTTOM 640 (K); Astor: forest above Doyen in Astor Valley, 10—12,000 ft., 14.8.1892, J. F. DUTHIE 12452 (E, W). — Haramosh Range: Mani Basin, on old moraine ridge, Silver birch woodland, approx. 36° N., 75° E., 12.8.1957, R. C. CULBERT (BM). — Nagar State, Minapin Glacier, ridge to west of glacier, rock with shallow soil, 12,500 ft., 22.8.1961, LLOYD et MEGUN 131 (BM); Minapin Glacier, 11,500 ft., 9.8.1961, LLOYD et MEGUN 86 (BM). — Baltal, 10,000 ft., 28.9.1848, THOMSON (K). — India: Western Himalaya, Bibyáli, 22.7.1899, sine coll., 269710 (CAL). — Chama State, Pangi. 10,000 ft., 3.9.1897, J. H. LACE 1686 (E).

HARTMANN (1966 p. 334) records this species as "*P. rotundifolia* L. s.str.", from the mountain range Karakoram in some places in the region Mongo westward from the glacier Biafo at altitudes ranging between 3.500 and 4.000 m above the sea level. The dominant phytocoenoses are alpine *Salix*-bushes with several typical accompanying species: *Carex tristis, Festuca alatavica, Doronicum falconeri* and *Aconitum rotundifolium.* Above the 4,000 m altitude line there appear bushy stands with *Salix karelinii* which pass in alpine meadows, and these finish the vegetation cover reaching right to the snow line at the altitude of approx. 5,000 m. From the central Asiatic montane region was reported only the species "*P. rotundifolia* L." (cf. HOOKER 1882 pp. 475—476) and this wrong interpretation has been observed in some works right up to the present. In the Himalayan area this wide complex was evaluated, for the first time, by ANDRES 1914 b, whose evaluation to sub-specific taxa does not fully express the taxonomical-chorological problems in the range of nominatic section. The species *P. karakoramica* belongs, according to the type of distribution, to the montane species of the Sino-Japanese region, the same as a number of other species (cf. WENDELBO 1952) with a probable absence in the Pamir, Tian-Shan and Altai, and with the eastern limit in NW Himalayas (see the map).

Pyrola andresii KŘÍSA, sp. nov.

Syn.: *P. rotundifolia* L. ssp. *tibetana* H. ANDR., Oesterr. bot. Zeitschr., 64: 50, 1914, p.p.
P. rotundifolia L. ssp. *indica* (C. B. CLARKE pro var.) H. ANDR., Oesterr. bot. Zeitschr. 64: 232—233, 1914, p.p.
P. rotundifolia L. ssp. *grandis* H. ANDR., in sched.
P. rotundifolia L. sensu auct. fl. asiat.

Planta perennis, robusta et valida, intermedia vel magna, (15—)20 ad 30 (raro 35) cm alta. Caules fuscopurpureo vel atropurpureo colorati, crassi, validi, sulcati. Squamae integrae, paullum carinatae, attenuatae. Folia robusta et fere coriacea et glauco-viridia, late oblonga usque fere late elliptica, margine remote dentata et in apice acuminata; laminae 2—4 cm latae, (2.0—)2.5—4.0(—5.0) cm longae, rete nervorum artum et robustum et in foliis vetustioribus subtus paulo eminens perspicuumque; petioli (3.0—)3.5—4.5(—5.5) cm longi, sulcati. Flores campanulati, dilute rubri vel carnei, raro albi; pedicelli teneri, sulcati; bracteae plus minusve amplexicaules, ovato-lanceolatae, 5—10 mm longae, pedicello plerumque longiores. Petala elliptica usque ovata. Sepala lanceolata, viridia, margine pallidiora, in superiore parte tertia

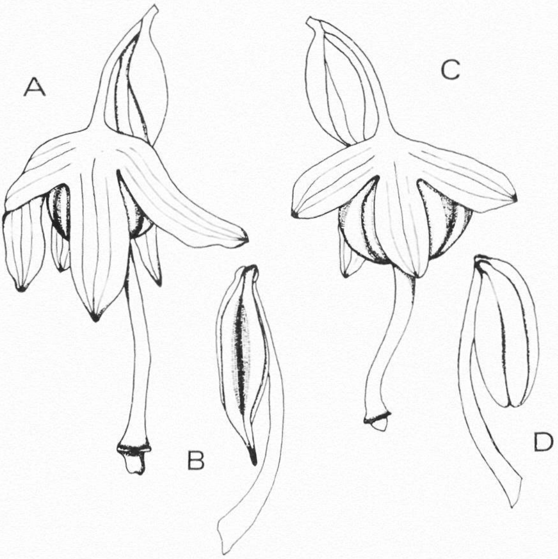

Fig. 2. A—B: *P. andresii,* floret after florescence, ×10; anther, ×20. C—D. *P. karakoramica,* floret after florescence, ×10; anther, ×20.

subito contracta, obtusa, (4.0—)4.2—4.9(—5.1) mm longa. Antherae (2.9—)3.0—3.4(—3.5) mm longae, luteae, ad finem tertiae partis acuminatae. Stylus roseus, 6.0—9.0 mm longus, tenuis paullum arcuatus, apicem versus sensim inucrassatus; stigmate immerso, carnoso. Capsulae depresso-globularae.

Typus: China: Kongbo province: Pro La, lat. N. 29°30′, long. E 95°00′, in *Pinus* forest, alt. 11,500 ft., (ca. 3,500 m s.m.), 8.7.1938, F. LUDLOW, G. SHERRIFF et G. TAYLOR 5173 a. Holotypus in herbario Musei Britannici Londinensis (BM) et isotypus in herb. Horti botanici regalis Edinensis (E) conservatur.

Positio in systemate generis: in serie *Japonicae* KŘÍSA sectionis subgenerisque *Pyrola* positum.

Etymologia: speciem novam nomine cl. doctoris HEINRICH ANDRES, botanistae germanici meriti appellavimus.

Habitat: plantae imprimis in altitudines alpinas crescentes. In China: Tibet austro-orientalis (Montes Himalayenses adjacentiorumque), provincia Sechuan occidentalis.

SPECIMINA EXAMINATA: Bhutan: Monyul, Trimo, lat. N. 27°55′, long. E. 91°53′, on steep ravine side, 9,800 ft., 31.10.1938, F. LUDLOW, G. SHERRIFF et G. TAYLOR 6425 (BM, E). — China: Kongbo province, Pero La, lat. N. 29°30′, long. E. 95°00′, in *Pinus* forest, alt. 11,500 ft., 8.7.1938, F. LUD-

LOW, G. SHERRIFF et G. TAYLOR 5173 a (BM, E), 5173 (BM). — Tsanang La, lat. N. 29°16′, long. E. 94°26′, growing in moss under *Abies* forest, alt. 11,000 ft., 23.9.1938, F. LUDLOW, G. SHERRIFF et G. TAYLOR 6529 (BM, E); near Paka, lat. N. 29°14′, long. E. 94°23′, 11,000 ft., 16.7.1938, F. LUDLOW, G. SHERRIFF et G. TAYLOR 5840 (BM, E). — Ba La, Pasum Chu, on mossy boulders, 13,000 ft., 21.6.1947, F. LUDLOW, G. SHERRIFF et G. TAYLOR 13958 (BM, E). — Ata, Zayul, in temperate mixed forest on the shady side of the river, 8,000 ft., 30.5.1933, F. KINGDON-WARD 10444 (BM). — Vicinity of Tité, Upper Taron Valley, 28°30′ N., 97°50′ E., 10,000 ft., 13.9. 1931. F. KINGDON-WARD 10079 (BM). — Karutra, Chayul Chu, in dense damp forest, alt. 12,000 ft., 12.7.1936, F. LUDLOW et G. SHERRIFF 2343 (BM, E). — Takpo province: Tsangpo Valley, Valley above Tse, lat. N. 29°23′, long. E. 94°22′, on mossy floor of *Picea* forest, 10,500 ft., 1.6.1938, F. LUDLOW, G. SHERRIFF et G. TAYLOR 4624 a (BM, E), 4624 (BM). — Western China, Mt. Omi, sine dato, E. H. WILSON 5136 (BM). — Tha Chu Valley: in mixed forest, conifer and broad leafed, open rocky places, 6,000—8,000 ft., 1.7.1950, F. KINGDON-WARD 19552 (BM, E). — West Sechuan, chiefly near Tachienlu, 9,000—13,000 ft., A. E. PRATT, 1890, 827 (E sub *P. rotundifolia* L. ssp. *grandis* H. ANDR.), (BM, K, CAL), 764 (BM, K). — Sikang, Kangting (Tachienlu) distr.: Chungo Valley, versus Yara, in silva mixta, ca. 3,900 m s.m. 5.10.1934, H. SMITH 12733 (UPS). — Chungo Valley, Yara, in alpinetis muscosis, 3,990—4,000 m s.m., 18.8.1934, H. SMITH 11159 (UPS); mont. orient., in prato fruticoso, ca. 3,200 m s.m. 11.7.1934, H. SMITH 10487 (UPS); mont. occident., in prato fruticoso-muscoso, ca. 3,300 m s.m., 15.7.1934, H. SMITH 10474, 12958 (UPS). — Taipaishan, 2,600 m s.m., 27.9.1937, T. N. LIOU et P. C. TSOONG 1256 (PE). — Sechuan province: Pao-hsing-hsien, alt. 2,850 m s.m., 7.8.1936, K. L. CHU, 3452 (E), 3189 (E); Tien-chuan-hsien, alt. 2,600 m s.m., 11.6.1936, K. L. CHU 2152, 2662 (E); Tatsienlu, 1938, MCLAVEN (E); baurong to Tachienlu, via Hadjaha, alt. 9,000—15,000 ft., 1929, H. STEVENS 143 (W).

This species grows in the east-Himalayan area in a wide transitory vegetation zone between the mild zone of forests with *Abies spectabilis, Picea spinulosa, Pinus griffithii, Larix griffithii* and alpine forests with bushy stands: *Abies webbiana, A. densa,* and numerous species of *Rhododendron.* The altitude of the timber line in this region is somewhat higher as compared with the western Himalayas, approximately 3,800 to 4,000 m above sea level.

ACKNOWLEDGEMENTS

I wish to express my sincere thanks to the officials at the following Botanical Institutes for lending herbarium material of the *Pyrola* species: Department of Botany, British Museum (Natural History), London (BM); Royal Botanic Gardens, Kew (K); Royal Botanic Garden, Edinburgh (E); Muséum National d'Histoire Naturelle, Paris (P); Institute of Systematic Botany of the

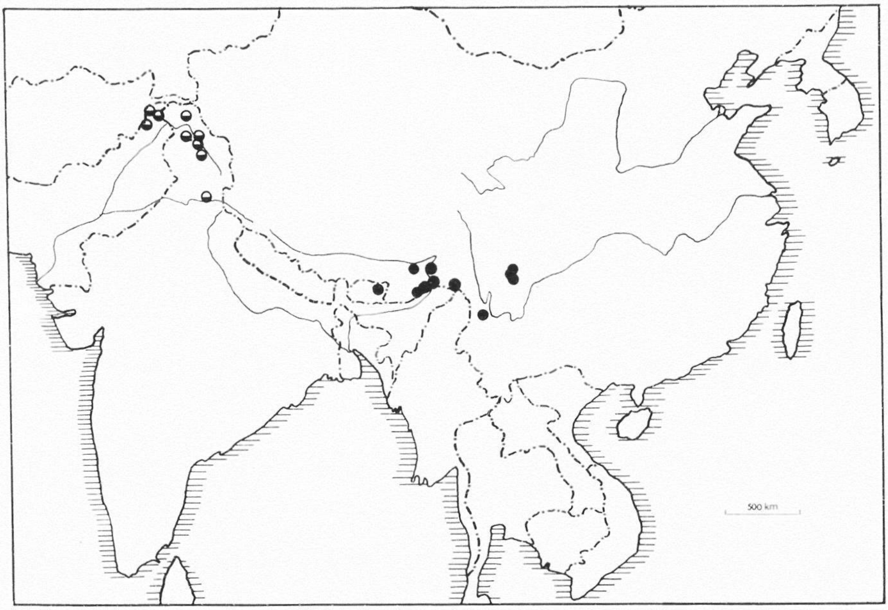

Fig. 3. Distribution map of investigated material of *P. karakoramica* (◒) and of *P. andresii* (●) in Asia.

University, Uppsala (UPS); Botanische Abteilung Naturhistorisches Museum, Wien (W); Botany Dept. Gordon College, Rawalpindi, West Pakistan (RAW); Botanical Survey of India, Calcutta (CAL); Botanical Institute Academy of Science, Peking (PE).

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On the Effect of Phosphorus and Nitrogen, Supplied to Baltic Shore-Meadow Vegetation

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ABSTRACT

Measured amounts of NaH_2PO_4, $NaNO_3$ and NH_4Cl were supplied to uniform *Juncus gerardi*-vegetation on a sea-shore meadow in the Baltic archipelago of S:t Anna, about 125 km SSW Stockholm. The effects of the single compounds, as well as of phosphate and nitrate combined, on production and mineral uptake were studied during one season in selected sets of sample squares. A supply of 0.5 mol P as $H_2PO_4^-$ or 2.5 mol N as NH_4^+ per square metre brought about an average increase in the production of the field layer, amounting to c. 30 %, whereas 2.5 mol N as NO_3^- per square metre had little effect. The uptake of phosphorus by the vegetation, calculated per unit area, was dubbled when 0.5 mol $H_2PO_4^-$ was supplied per square metre. As a whole, the uptake of major metal cations kept step with the increase in production.

The mineral uptake of *Juncus gerardi* and *Plantago maritima,* two species belonging to different life-forms, were studied separately, and the considerable differences between them are discussed. Attention is payed to how important a thorough knowledge of the quantitative and qualitative composition of the plant cover may be for the understanding of differences in its mineral uptake.

INTRODUCTION

The present paper is a part of a more comprehensive regional study concerning the importance of mineral nutrition for the sea-shore meadows along the east coast of Central Sweden. So far, hardly any information is available as to the production and mineral uptake of the Baltic sea-shore meadows. Since plant ecology to-day to an increasingly great extent has become concentrated on the analysis of production and mineral circulation in the ecosystems, the data presented in this paper will also be of a more general interest as a contribution to the knowledge of a rather unknown ecosystem.

The purpose of this study was to receive some primary information about several questions concerning production ecology. Briefly, they might be summarized in the following points:

1. Is the flowering and fruiting of the species, as well as the physiognomy of the plant cover, affected by the nutrient supply?

2. Does the supply of measured amounts of pure phosphorus and nitrogen compounds produce any measurable increase in the production of the plant cover? Furthermore, how large is the influence on the uptake of phosphorus and nitrogen by the plant cover, calculated per unit area and dry matter, and how large amounts of phosphorus and nitrogen compounds are required, before any measurable increase in production or mineral uptake no longer is received?

3. How much of the nutrition, supplied with the methods described below, is actually consumed by the plant cover?

4. Are the contents of metal ions, calculated per unit dried plant matter, influenced by the supply of phosphorus and nitrogen?

5. How important is the floristic composition of the plant cover to the uptake of different minerals per unit area? A comparison between *Juncus gerardi* and *Plantago maritima* may elucidate this problem.

GENERAL DESCRIPTION

The experiment was carried out in 1966 on a sea-shore meadow at Älskär, situated on the island chain Yxnö—N. Finnö in the archipelago of S:t Anna (58°23′N, 16°50′E), c. 125 km SSW Stockholm. As a whole the district has been affected by depopulation during the last decades, and this sea-shore meadow has not been grazed by cattle for at least five years. The adjacent terrestrial meadows have been planted with pine in their upper parts, but on the sea-shore meadow proper the floristic composition as well as the physiognomy and zonation are quite the normal to the area.

The experiment was localized to the *Juncus gerardi*-community, here developed as a continuous belt on the upper half of the shore-meadow. Six sampling points were chosen along the central part of the belt. On each of these points one set of five sample squares was localized.

The floristic composition of these 30 sample squares was analyzed, when they were harvested on the 6th and 7th of August, 1966. At the analyses the degrees of cover for the separate species were expressed conventionally according to the scale of HULT-SERNANDER-DU RIETZ (DU RIETZ 1921). Cf. Table 1. The qualitative as well as the quantitative composition of the plant cover is very uniform; only the sample

Table 1. The floristic composition of the sample squares. Base figure: number of squares with the species represented. Exponent: degree of cover according to HULT-SERNANDER-DU RIETZ.

Set	A	B	C	D	E	F
Plantago maritima	5^{4}	5^{4-5}	5^{4}	5^{4-5}	5^{4-5}	5^{3-4}
Juncus gerardi	5^{4-5}	5^{4-5}	5^{4-5}	5^{4-5}	5^{4}	5^{2-3}
Festuca rubra	5^{2}	5^{2-3}	5^{2-3}	5^{2-3}	5^{3-4}	5^{2-3}
Glaux maritima	5^{2-3}	5^{2}	5^{1-2}	5^{2-3}	5^{2-3}	3^{1}
Leontodon autumnalis	5^{1}	5^{1}	5^{1}	5^{1}	5^{1}	5^{1-2}
Agrostis stolonifera	5^{1}	3^{1}	4^{1}	5^{1-2}	5^{1}	5^{2-3}
Eleocharis uniglumis	4^{1}	5^{1}	4^{1}	5^{1}	5^{1}	5^{1}
Carex nigra	5^{1}	3^{1}	5^{1}	4^{1}	5^{1}	5^{1-2}
Triglochin maritimum	5^{1}	5^{1}	5^{1}	5^{1}	5^{1}	—
Poa pratensis ssp. *irr.*	5^{1}	3^{1}	4^{1}	2^{1}	5^{1}	—
Galium palustre	—	1^{1}	3^{1}	5^{1}	1^{1}	—
Potentilla anserina	3^{1}	2^{1}	1^{1}	—	1^{1}	—
Trifolium fragiferum	3^{1}	—	—	—	—	—
Trifolium repens	—	1^{1}	—	—	2^{1}	—
Triglochin palustre	1^{1}	—	1^{1}	1^{1}	—	—

Additional comments. A thin layer of *Campylium polygamum* present in all sample squares. Single records of 8 more vascular plants not included in the table.

squares of set F show certain divergences, as several quantitatively less important species are lacking. The most prominent species are *Plantago maritima, Juncus gerardi* and *Festuca rubra,* to a certain extent also *Glaux maritima.* A loose and thin bottom layer of *Campylium polygamum* should be added to be list of species in all sample squares.

The sea-shore meadow at Älskär is developed on a substrate of clay, as is the case with the majority of unexposed shore-meadows along the Baltic coast. No analyses of the mineral constituents in the soil have been carried out on samples from 1966, but in 1965 three samples were taken on the depth of 10—20 cm in the *Juncus gerardi*-community. The amounts of major metallic cations, extractable with 1 M NH_4Ac and calculated per dm^3 intact soil, were:

Na^{+}	40—50	mmol/dm^3
K^{+}	10—12	,,
Ca^{2+}	20—25	,,
Mg^{2+}	25—30	,,

These figures are insignificantly different from corresponding figures for soils from the same plant community on other sea-shore meadows in this district.

The weather conditions during the growing season must be assigned a certain importance. Information of precipitation and temperature on Harstena, c. 17 km SE Älskär, is compiled in the following table. Values for 1966 have been obtained from Sveriges Meteorologiska och Hydrologiska Institut. Figures in brackets design normal values for 1931—1960.

	April	May	June	July	August
Mean monthly temperature, °C	0.3	7.4	14.8	17.0	12.9
	(3.6)	(8.4)	(13.6)	(17.1)	(16.7)
Precipitation, mm	70	51	53	43	15
	(32)	(41)	(46)	(59)	(73)

The deviations from the normal values for the period May—July as a whole are very small: the precipitation sum 147 (146) mm and the mean temperature 13.1 (13.0) °C. It seems improbable that the low temperatures during early spring had a lowering effect on the production of plant matter during the growing season. The aberrant values for August are of little interest in this context, as the experiment was finished on the 7th of August.

FIELD METHODS

The experiment started on the 2nd of May, 1966. Six sampling points were distributed along the central part of the *Juncus gerardi*-community. On each of these sampling points (called A-F) a row of five sample squares with the size of 1 square metre was distributed. These sets of sample squares were orientated parallelly to the shore. The squares were marked out with wooden sticks in all corners and between them an area, 50 cm wide, was left free. Remaining plant litter from the year before was removed to simplify the harvest later on.

As fertilizers purum qualities of $NaNO_3$, NH_4Cl and NaH_2PO_4 were used. These compounds dissolved in 5 litres of sea-water, very diluted at this time of the year, were supplied to the sample squares. The chemical composition of the solvent was:

Na^+	6.6	mmol/l
K^+	0.22	,,
Mg^{2+}	0.67	,,
Ca^{2+}	0.35	,,
Cl^-	7.1	,,
SO_4^{2-}	0.6	,,
P_{tot}	1.2	µmol/l

In each of the sets A, B and C one sample square was supplied with 2.5 mol N as $NaNO_3$, a second with 2.5 mol N as NH_4Cl and a third with 0.5 mol P as NaH_2PO_4. A fourth square was supplied with both 2.5 mol $NaNO_3$ and 0.5 mol NaH_2PO_4. The remaining square was watered only with the solvent to serve as a control.

The squares of set D were supplied with varying amounts of P as NaH_2PO_4 (0, 0.1, 0.2, 0.5 and 1.0 mol, resp.), set E with N as NH_4Cl (0, 0.5, 1.0, 2.5, and 5.0 mol, resp.) and set F with N as $NaNO_3$ (0, 0.5, 1.0, 2.5 and 5.0 mol, resp.). The controls were watered with the solvent. The relative order between the squares, treated in those different ways, was varied randomly.

The solutions were supplied with an ordinary watering-can, equipped with a fine strainer and evenly distributed over the sample square. Warm and dry weather prevailed as well as the following day. The water level of the sea was low, as it usually is in spring and early summer.

Three months later, on the 6th and 7th of August, all sample squares were harvested. The plant cover of the squares, in the following as dried called standing crop, was cut at the level of the ground. The thin bottom layer of *Campylium polygamum* was collected separately. *Juncus gerardi* and *Plantago maritima* were partly sorted out for separate analysis. All plant material was dried at about 37°C for 3 weeks, whereupon its dry weight was determined. In the calculations on standing crop the outsorted fractions of *Juncus* and *Plantago* have been integrated. The weight of the bottom layer ranged from 3 to 12 g per square metre. However, this bottom layer has not been subjected to any further analysis and is not included in the tables.

LABORATORY METHODS

The dried plant material was ground on a plant mill and dried again at 37°C for one day. 1 g sample was digested and evaporated with $HClO_4$ and HNO_3 (1 : 4), according to the methods commonly used (cf. MALMER & SJÖRS 1955). Two different extracts were prepared from each sample. On these extracts metal cations and total phosphorus were determined.

Sodium and potassium were determined flame photometrically (EEL Flame Photometer Mark II, gasole-air burner).

Calcium, magnesium, manganese and iron were determined through atomic absorption (Perkin-Elmer Atomic Absorption

Spectrophotometer Mod. 303, acetylene-air burner), calcium with 1 % $LaCl_3$ in sample and standard solutions for masking of phosphorus.

Phosphorus was determined colorimetrically (Unicam Sp. 600 Spectrophotometer) by two different methods.

a) The "Molybdate" method (modification of method described by JACKSON 1958). 2 ml sample solution (equivalent to 20 mg plant matter) was evaporated with 3 ml HNO_3 and 5 drops of H_2SO_4 to almost dryness, and the residue transferred to a measuring flask (50 ml). The pH was adjusted to c. 4 with 10 % Na_2CO_3-solution, using 2,4-dinitrophenol in saturated solution as indicator. After acidification with 5 ml 0.5 M H_2SO_4, 5 ml 8 % $NaHSO_3$-solution was added and the flask shaken for a few seconds. 1 hour later, 5 ml MoO_3-reagent (containing 0.4 % MoO_3, in 2.5 M H_2SO_4) was added and 1 hour later 5 ml $SnCl_2$-solution (containing 0.08 % $SnCl_2$ and 1 % arabic gum in aquous solution). Finally the flask was filled with deionized water and the contents thoroughly mixed. Standard solutions containing 1—20 µmol P/l and at least one blank were treated in the same way and at the same time as the samples. The colorimetration was carried out with the beginning 2 hours after the addition of $SnCl_2$. During all waits the extracts were protected against direct light.

b) The "Vanadate" method (KITSON & MELLON 1944, RAUTERBERG 1951). 15 or 20 ml sample solution (equivalent to 150 or 200 mg plant matter) was transferred to a measuring flask (100 ml). 10 ml vanadate-reagent (composed of 0.85 g NH_4VO_3, 16.7 g $(NH_4)_6Mo_7O_{24} \cdot 4\,H_2O$ and 340 ml HNO_3 per litre) was added and the flask filled up with deionized water. Blanks and standard solutions (10—200 µmol P/l) were treated in the same way. The colorimetration was carried out c. 2 hours after the addition of vanadate-reagent, but could with the same result have been done immediately, as the colour was fully developed in a few minutes.

The vanadate method has many advantages over the molybdate method. The yellowish colour of the complex is very stable and not light-sensitive. The reduced, blue phosphorus-molybdenum-complex, produced with the molybdate method, ought to be colorimetrated within 5—6 hours, as it then begins to fade, at least exposed to day-light. Another important advantage of the vanadate method is its character of a semi-macro method, which allows ten times as much sample to be used at with the molybdate method, resulting in a smaller risk of pollution. Most important of all is, that the vanadate method is very time-saving.

But there are also certain disadvantages. As is evident from the calculation of analytical errors (below), the mean difference between the duplicates is larger than with the molybdate method. However, this is probably explained by the fact, that the separate treatment with acids also is excluded. Both methods require that all phosphorus acid is present in the orto-form, and this is probably not always true after the first treatment with acids, connected with the digestion. In single cases, one of the duplicates gave a lower value than the corresponding values with the molybdate methods, and re-determination did not change this aberration. For the direct vanadate method a very effective primary evaporation is necessary to give a sufficiently reliable result in all cases. Calculation of all samples gave a mean of 36.3 μmol P/g dry plant matter with the vanadate method, corresponding to 37.0 μmol with the molybdate method.

Nitrogen was determined with a semi-micro Kjeldahl method. 250 mg ground plant material, dried at 37°C, was digested in a Kjeldahl flask (50 ml) with 3 ml H_2SO_4 and 1 g catalyst ($K_2SO_4 + CuSO_4 + HgSO_4$). Destillation was performed during 7 minutes with 20 ml 30 % NaOH, containing 5 % $Na_2S_2O_3$, to a receiving flask with 10 ml 0.050 M HCl. Remaining acid was back-titrated with 0.050 M NaOH. Duplicates were always taken.

CALCULATION OF ANALYTICAL ERRORS

As two determinations in separate extracts of the same sample have been carried out throughout, the present data make it possible to calculate the total analytical error involved in laboratory work. However, possible chemical interferences are not included, since they will influence both values uniformly. With the methods used these interferences will not be large.

The analytical errors, calculated from the differences between the duplicates, may be expressed in three different terms, viz.:

(A) Mean differences between duplicates.
(B) Mean differences as a percentage of the mean.
(C) Standard deviation (S.D.) of the mean difference.

Expressed in formulas:

$$\frac{\Sigma(a - b)}{n} \quad (A); \qquad \frac{\Sigma(a - b)\ 100}{\frac{\Sigma(a + b)}{2}} \quad (B); \qquad \sqrt{\frac{\Sigma(X - M)^2}{n}} \quad (C)$$

Number of analyses 2×90 ($n = 90$).
a, b = measuring values of duplicates ($a \geq b$).
$X = a - b$; $M = (A)$.

	(A) µmol/g	(B) °/o	(C) µmol/g
Macro elements:			
sodium	12.1	1.8	16.3
potassium	6.3	1.5	8.1
calcium	3.8	2.0	5.2
magnesium	3.2	1.8	4.9
phosphorus (Mo) . .	1.0	2.8	1.4
,, (V) . . .	1.8	5.0	2.7
nitrogen	8.6	1.1	10.7
Micro elements:			
manganese	0.11	4	0.14
iron	0.40	11	0.55

The large relative error for iron is probably partly due to pollutions at the handling of the samples, partly to insensibility of the iron determination.

RESULTS

1. Effects of the mineral supply, clearly visible already in the field, have only been registrated on the heavily manured sample squares. The vegetation of the sample square, manured with 5.0 mol NH_4^+, was considerably darker green than the surrounding plant cover, and through its colour the position of this sample square was recognizable already at a distance. A couple of the squares supplied with 2.5 mol NH_4^+ also seemed somewhat darker green than the surroundings.

In set D the sample square most strongly manured with phosphorus seemed somewhat lighter green than the surroundings, but the difference was little distinct. Any effect of the nitrate supply, discernable in the field, has not been established.

The lengths of the floral shoots of *Juncus gerardi* and *Plantago maritima* have been measured on part of the material from all sample squares. Only for *Juncus* did the supply of mineral compounds have any measurable influence on the shoot-length. An average increase of the straw-length by 2—4 cm has been measured in sets A—C, irrespective of kind of mineral supply. On the most strongly manured squares in sets D—F, the straws of *Juncus* were even 7—9 cm (30—40 °/o) longer than on the controls.

Table 2. Production of the sample squares, measured as dry matter in g/m² and contents of phosphorus and nitrogen in standing crop and in the shoots of *Juncus gerardi* and *Plantago maritima*, measured as µmol/g dry matter.

Set	Supply of mineral nutrition (mol/m²)	Production g/m²	Contents of phosphorus and nitrogen µmol/g dry matter					
			Standing crop		*Juncus gerardi*		*Plantago maritima*	
			P	N	P	N	P	N
A	(0)	253	43	780	43	790	39	650
	P (0.5)	321	60	790	46	670	58	685
	P (0.5) + NO_3 (2.5)	362	53	845	50	770	48	745
	NO_3 (2.5)	336	39	830	36	700	38	735
	NH_4 (2.5)	376	38	890	35	880	37	790
B	(0)	288	34	790	34	770	31	645
	P (0.5)	391	53	810	47	770	46	750
	P (0.5) + NO_3 (2.5)	349	50	790	40	790	51	670
	NO_3 (2.5)	331	37	845	37	840	35	795
	NH_4 (2.5)	427	33	870	30	860	32	690
C	(0)	312	28	805	30	810	26	635
	P (0.5)	434	45	920	38	850	46	805
	P (0.5) + NO_3 (2.5)	457	47	860	39	820	50	700
	NO_3 (2.5)	251	28	850	30	840	31	775
	NH_4 (2.5)	323	28	900	28	900	29	760
D	(0)	471	30	1030	30	940	31	840
	P (0.1)	548	33	880	28	930	35	755
	,, (0.2)	449	36	940	30	820	42	790
	,, (0.5)	525	46	925	41	910	50	715
	,, (1.0)	494	42	925	40	910	40	750
E	(0)	390	33	755	26	660	35	650
	NH_4 (0.5)	367	27	760	22	700	31	690
	,, (1.0)	396	28	810	24	760	32	685
	,, (2.5)	493	31	885	25	770	31	770
	,, (5.0)	442	31	955	27	880	32	725
F	(0)	252	51	875	33	710	45	730
	NO_3 (0.5)	365	45	830	26	680	48	740
	,, (1.0)	344	42	870	31	700	44	780
	,, (2.5)	316	35	760	32	750	41	780
	,, (5.0)	394	36	910	29	840	43	785

Abbreviations. $P = NaH_2PO_4$
$NO_3 = NaNO_3$
$NH_4 = NH_4Cl$

In both *Juncus gerardi* and *Plantago maritima* there is in the material a rather weak tendency to poorer development of the inflorescences, connected with the addition of both phosphorus and nitrogen. That the vegetative development is favoured by manuring is hardly a new experience.

Table 3. Relative production of the sample squares. Percentage of control square. Supply of mineral nutrition (mol/m^2)

Set	P (0.5)	P (0.5) + NO_3 (2.5)	NO_3 (2.5)	NH_4 (2.5)
A	126	143	133	148
B	136	121	115	148
C	139	146	81	104
D, F, E	112	—	126	126
M (S.D)	128 (10)	137 (11)	114 (20)	132 (18)

Explanations. M = mean.
S.D. = standard deviation of M.
Mineral compounds abbreviated as in table 2.

2. One of the chief tasks of the present study was to decide, whether a supply of phosphorus and nitrogen compounds to vegetation on sea-shore meadows may bring about an increase in the plant material produced during the growing season. Such an increase in the production of the field layer was to be expected, when the usually positive effect in manuring terrestrial pastures and mowing-grounds with mineral salts was taken into account (cf., e.g., JESSEN 1950). From tables 2 and 3 it is evident, that in the studied shore-meadow vegetation the manured sample squares with only few exceptions did produce more than the corresponding controls.

The average increase in dry weight of standing crop, when 0.5 mol P as $H_2PO_4^-$ or 2.5 mol N as NH_4^+ per square metre was supplied, amounted to 90—100 g/m^2 or c. 30 %, compared with the production of the controls. The effect of N supplied as NO_3^- with 2.5 mol/m^2 was less, only about 30 g/m^2 and barely statistically significant. $H_2PO_4^-$ and NO_3^- combined gave a somewhat better effect than $H_2PO_4^-$ alone, but a real difference in production is not fully proved on the basis of the present data.

The uptake of phosphorus increased notably with the supply of phosphorus as is shown in tables 2 and 4. The contents of phosphorus in standing crop, calculated on dry weight, increased with about 50 %, and the uptake per unit area was dubbled with the supply of 0.5 mol $H_2PO_4^-$ per square metre. This large relative increase in the uptake of phosphorus was made possible through the low initial contents (only 30—40 µmol P/g dry matter or about 1/25 of N). The uptake of phosphorus per unit area in the squares supplied only with nitrogen (cf. table 4), however, did not keep step with the increase in production. This might indicate a scantiness in the reserves of available phosphorus.

Table 4. Relative contents of phosphorus and nitrogen in standing crop. Percentage of control square. Left figure: calculated per unit dry matter. Right figure: calculated per unit area. Abbreviations as in table 2. and 3.

Supply of mineral nutrition (mol/m^2)

	P (0.5)	P (0.5) + NO_3 (2.5)	NO_3 (2.5)	NH_4 (2.5)
I. Phosphorus				
set A	140/179	123/179	91/121	88/131
B	156/213	147/179	109/126	97/145
C	161/223	168/245	100/82	100/103
D, F, E	153/171		69/88	94/118
M (S.D.)	153(8)/197(22)	146(18)/201(31)	93(15)/104(15)	95(4)/124(16)
II. Nitrogen				
set A	101/128	108/155	108/141	114/169
B	103/139	100/120	107/122	110/163
C	114/159	107/157	106/85	112/116
D, F, E	90/100		87/109	117/148
M (S.D.)	102(8)/132(21)	105(4)/144(17)	102(9)/114(21)	113(3)/149(20)

An increase in the contents of nitrogen per unit dry matter is clearly demonstrable only when NH_4^+ is supplied (cf. table 4). It amounts in the sample squares, manured with 2.5 mol/m^2, to 10—15 %. In the squares, supplied with 2.5 mol NO_3^-/m^2, the increase in nitrogen uptake is only equivalent to the small increase in production.

The production of the sample squares, supplied with only phosphorus, is larger than the production of the squares, supplied with NO_3^-. Since the contents of nitrogen, calculated per g dried plant matter, are just about the same in both cases, the somewhat unexpected consequence is revealed, that the supply of phosphate proved somewhat more effective than the supply of nitrate to bring about an increase in the uptake of nitrogen per unit area. It seems probable, that addition of phosphorus mobilized latent nitrogen reserves, whereas the vegetation at the addition of nitrogen could not take up appreciably more phosphorus from the substrate per unit area (cf. table 4). This might indicate, that the scantiness of phosphorus is larger than that of nitrogen for this shore-meadow vegetation.

The disposition of the experiment also intended to approximately show to what limit an increase in the supply of phosphorus and nitrogen compounds is balanced by an increase in production and mineral uptake. Three of the sets, D, E and F, were primarily intended to this gradation experiment. In the phosphorus set (D) a supply of 0.5 mol

$H_2PO_4^-/m^2$ resulted in a much larger uptake of phosphorus per unit area than with 0.0, 0.1 and 0.2 mol/m^2. In the ammonium set (E) 2.5 mol and 5.0 mol NH_4^+/m^2 gave a considerably larger uptake of nitrogen per unit area than 0.0, 0.5 and 1.0 mol/m^2. In the nitrate set there is no significant increase with increasing N-supply.

3. How large part of the phosphorus and nitrogen supplied is actually incorporated in the standing crop? The difference in uptake of phosphorus between the sample squares, manured with 0.5 mol $H_2PO_4^-/m^2$ and the corresponding controls averages about 10 $mmol/m^2$:

set	A	B	C	D
$mmol/m^2$	8.5	11.0	10.7	10.0

An amount of phosphorus, equivalent to 2 % of the amount supplied has consequently been consumed by the vegetation of the field layer. The corresponding value for nitrogen with 2.5 mol NH_4^+ supplied per square metre amounts to about 5 %, but with 2.5 mol NO_3^- only to about 1 %. It is to be observed, however, that merely addition of phosphorus resulted in an increase in the nitrogen uptake per unit area, equivalent to about 3 % of 2.5 mol N/m^2.

4. The uptake of metal cations, calculated per unit dry matter, was usually not influenced by the supply of phosphorus and nitrogen. The relative uptake of calcium, magnesium and manganese per unit dry matter in the sample squares, manured with $H_2PO_4^-$, NH_4^+ and NO_3^- resp., is for standing crop as a whole as well as for *Juncus gerardi* and *Plantago maritima* remarkably well centered around averages between 96 and 106 % of the control. This is also true for sodium, though the range in this case is somewhat larger. When phosphorus and nitrogen is supplied to this kind of vegetation, the uptake of these cations per unit area is increased only to the same extent as the production.

The exception from this rule is potassium. The uptake of potassium per unit dry weight in *Plantago maritima* shows a marked deviation. The potassium contents in the shoots of this species increased with about 20 % when phosphorus and nitrogen compounds were supplied. In *Juncus gerardi* no additional uptake of potassium has been established (cf. table 5). *Plantago maritima* is characterized by a low potassium consumption, especially in comparison with *Juncus gerardi* (cf. table 6). To judge from the present results, an increase in the consumption of phosphorus and nitrogen makes an increase in the uptake of potassium per unit dry matter possible. From an ecological point of

Table 5. Relative contents of potassium in *Juncus gerardi*, *Plantago maritima* and standing crop. Percentage of control squares. Average figures, as K/unit dry matter. Abbreviations as in table 2.

Supply of mineral nutrion (mol/m^2)

	P (0.5)	P (0.5) + NO_3 (2.5)	NO_3 (2.5)	NH_4 (2.5)
Juncus gerardi	103	103	97	106
Plantago maritima	126	116	120	126
standing crop	113	112	104	119

Table 6. Metal ion contents of *Juncus gerardi* and *Plantago maritima*. µmol/g dry weight, median values. Left figure: *Juncus gerardi*. Right figure: *Plantago maritima*.

Set	Na	K	Ca	Mg	Fe	Mn	Σ
A	225/1180	510/250	62/260	97/310	2.0/3.6	2.8/0.9	890/2010
B	115/1150	520/360	94/350	96/290	2.2/2.4	3.6/0.7	860/2050
C	185/1260	480/270	84/370	100/270	1.9/4.2	3.3/1.0	850/2240
D	185/1430	520/360	76/350	91/260	1.5/2.1	2.5/0.8	880/2410
E	205/1230	510/320	67/330	96/300	1.7/2.3	2.8/0.9	890/2230
F	210/1670	510/390	66/235	81/270	1.7/2.4	4.3/1.2	900/2570
A—F	195/1270	510/340	72/340	96/280	1.9/2.5	3.2/0.9	890/2250
% Σ	22/57	58/15	8/15	11/12			

view it is interesting to demonstrate, that there is evidently no lack of potassium for this shore-meadow vegetation.

5. All measurements of the mineral uptake by the vegetation per unit area is very depending on the floristic composition of the sample area. What a change in the proportions between the species may import to the mineral contents of standing crop is demonstrated by the comparison between the contents of metal ions in *Juncus gerardi* and *Plantago maritima*, which is presented in table 6. These specially examined species are representatives of the two most important life-forms in the vegetation of the sea-shore meadows. *Juncus gerardi* is a gramineous plant with hard and stiff shoots and rather low water-contents, *Plantago maritima*, on the other hand, a herbaceous succulent with fleshy leaves, rich in water. It is shown in table 6, that the average molar sum of metal cations in *Juncus* on the sample squares amounted to 0.89 mmol and in *Plantago* to 2.25 mmol/g dried plant matter. This difference corresponds approximately to the difference in water contents between the species, according to some preliminary measurements. The part of the osmotic value that depends on mineral electrolytes will therefore be about the same in both species on the same sample area.

More interesting than the absolute values are in this context the remarkably large differences in the proportions between the cations. The succulent *Plantago* consumes large quantities of sodium; 58 % of the molar sum of metal cations was sodium, compared with only 22 % of this sum in *Juncus*. With potassium the proportions are just the contrary. The consumption of potassium by *Plantago* is very moderate; only 15 % of the ionic sum, compared with 58 % in *Juncus*. Calcium, again, takes in *Plantago* a relatively larger part than in *Juncus*, but this is hardly remarkable, since the calcium consumption of herbs usually is larger than that of gramineous plants.

The two specially examined species do not behave identically as far as the uptake of phosphorus and nitrogen per unit dry weight is concerned (cf. table 2). With the supply of 0.5 mol P as $H_2PO_4^-$ per square metre, *Juncus* increases its phosphorus contents by about 25 %. The corresponding values for *Plantago* are about 60 %. Moreover, *Plantago* reacts on both NO_3^- and NH_4^+ with an increase in the nitrogen contents of the shoot, amounting to about 15 %, *Juncus* only on NH_4^+.

Among the minor elements there are also obvious differences in the uptake. The consumption of manganese is three to four times larger in *Juncus* than in *Plantago*.

The mineral circulation of the plant cover or the ecosystem as a whole ought to be studied together with the floristic composition of the vegetation and the proportions between its species. Information on the mineral uptake by the plant cover is of limited value, if the composition of this plant cover is insufficiently known.

CONCLUDING REMARKS

This experiment reveals, that the supply of phosphorus and nitrogen as NaH_2PO_4 and NH_4Cl to the sea-shore vegetation resulted both in an increase in the production and an increase in the contents of phosphorus and nitrogen, respectively, of the shoots. The reason why the supply of $NaNO_3$ had such a weak effect might be, that clayey soils have a lower capacity for nitrate than for ammonium ions. The clay colloids serve primarily as acidoids, adsorbing or releasing cations.

However, other explanations are not quite impossible. In the substrate of sea-shore meadows considerable redox-processes take place, and periodically an essential part of the plant-available nitrogen might be present in reduced form as ammonium. The vegetation of sea-shore meadows might be adapted to NH_4^+ rather than to NO_3^-. It is further possible, though unlikely, that nitrates are stored in the plants without being converted into organic compounds. In the determination of nitrogen according to KJELDAHL, nitrates are not included. That the two specially studied species reacted differently on the addition of $NaNO_3$ might indicate, that the inadequate effectiveness of the nitrate ought to be given a plant physiological rather than a colloidal explanation.

The increase in the production, following the supply of phosphorus and nitrogen, must indicate, that these elements are deficient, at least for certain of the more important species of the sea-shore meadow. However, the relative scantiness of phosphorus seems to be larger than that of nitrogen. The uptake of phosphorus per unit area, when NH_4^+ was supplied, did not keep step with the increase in the production, whereas the uptake of nitrogen, when phosphorus was supplied, was proportional to this increase.

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Apomixis in Hierochloë monticola (Gramineae)

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ABSTRACT

Hierochloë monticola (BIGELOW) LÖVE & LÖVE (9x) from New Hampshire develops eight-nucleate embryo sacs from aposporous initials, often more than one in the same nucellus. A megaspore mother cell can be present but divides irregularly or not at all. Diplospory may presumably also occur. Abnormal or degenerating embryo sacs are frequent. One antipodal cell in some cases has an egg-like appearance. — Embryo sacs occur frequently in some anthers. Pollen formation is irregular. — Comparisons with *H. australis* and *H. odorata* are made.

INTRODUCTION

Diploid *Hierochloë australis* samples from Germany and Finland have been found to be facultative apomicts (WEIMARCK 1967). In *Hierochloë odorata,* tetraploid plants studied from Connecticut and from Sweden produce seed from reduced embryo sacs. On the other hand, hexaploids from Sweden and octoploids from Michigan as well as from Sweden are completely or almost completely apomictic (NORSTOG 1957, 1963; WEIMARCK 1967). Apomixis has been found also in *Hierochloë alpina* (WEIMARCK unpubl.).

LÖVE & LÖVE (1965; in LÖVE & SOLBRIG 1964) have stated that SØRENSEN (1954) unintentionally redescribed from Greenland BIGELOW's (1816 p. 334) *Holcus monticola* from New Hampshire under the name *Hierochloë orthantha.* The correct name thus should be *Hierochloë monticola* (BIGELOW) LÖVE & LÖVE. SØRENSEN (loc. cit. p. 8) presumed the taxon to be apomictic because of its morphologically irregular pollen and its somatic chromosome number 63 ($x=7$), as did also JØRGENSEN, SØRENSEN & WESTERGAARD (1958 pp. 12, 13).

AIMS AND METHODS

The aim of this work was to investigate the embryo sac formation of *Hierochloë monticola.* The plants studied originate from caryopses from New Hampshire, Mount Washington, Alpine Garden (coll. Á. LÖVE, D. LÖVE, E. KJELLQVIST; locality A K D) and were cultivated in open air in the experimental garden in Lund. Voucher specimens have been preserved at the institute.

The somatic chromosome number 63 was determined in root tip sections. The roots were fixed in Müntzing's modification of Navashin-Karpechenko fluid (MÜNTZING 1933 p. 131) and stained in gentian violet. Series of panicles were fixed in 1964 and 1965 in the manner described by WEIMARCK (1967 p. 210). C. 225 well-stained and well-orientated spikelets could be used.

The drawings were made with Abbe camera lucida and the photomicrograph with Leica camera, both on Leitz microscope.

OBSERVATIONS

The structure of the spikelet and the ovule is in general the same as in *Hierochloë australis* and *H. odorata* (cf. WEIMARCK 1967 p. 211).

One megaspore mother cell (MMC) was found in 14 of 63 young nucelli investigated (22 %; Fig. 1 *A*). Ten of them were accompanied by unreduced embryo sac initials (EI). Anaphase I was observed in two cases. At the same time, other nucelli in the panicle contained up to eight-nucleate embryo sacs (ES). Both divisions were irregular with some chromosomes outside the spindle (Fig. 1 *B*).

No sure instances of young tetrads or triads have been found. However, in three cases (one of them illustrated in Fig. 1 *C*), a reduced ES may possibly have developed and reached the four-nucleate stage. The supposition is based upon the presence of probable megaspore remnants and the fact that the ES have characteristically rounded nuclei with one nucleolus (or exceptionally two); cf. below and similar observations made in octoploid *Hierochloë odorata* (WEIMARCK 1967 p. 226) where, however, the material did not permit any certain conclusions either.

The MMC degenerates as a rule at late stages, still remaining in prophase. In most such instances, one or few EI have already developed into ES (Fig. 1 *F*).

In a few cases, a single EI evidently occupies the place of an MMC (Fig. 1 *D*) and is probably homologous with a such one, something which implies diplospory in the sense of STEBBINS (1950 p. 384). Mostly, however, in the absence of an MMC a group of EI (up to c. 10 in number) is found, one or a few of which develop into ES (Fig. 1 *E*, *F*, and *G*). These unreduced ES have flattened nuclei with many nucleoli in contrast to the presumably reduced ES mentioned above. The two synergids and the three antipodals usually degenerate early.

The eight-nucleate stage is rapidly reached, in the fixation series from 1965 on the same day as the first male meiosis observed and one week before the fixation including the female meioses mentioned above.

The endosperm normally performs a few divisions previous to the division of the egg (Fig. 1 *H*). The reverse condition has been found in a few ES (Fig. 1 *I*). In a few ES, one antipodal has not degenerated but has an egg-like appearance (Fig. 1 *I*). In no case has a development of an embryo from such an antipodal been observed, but the number of nucelli studied at this stage is small.

At stages corresponding to the development from binucleate to mature ES, 52 nucelli out of 124 studied (42 %) only contained degenerating or quite abnormal ES or merely degenerative traces. This was the case with 13 nucelli of 36 (36 %) at stages corresponding to young embryos. The values lie within the range of those found in *Hierochloë australis* and *H. odorata* (WEIMARCK 1967 p. 229). — The germinability has not been tested.

Beside anthers showing male meiosis going on or completed, although with frequent formation of micronuclei, many other anthers have degenerating contents and failing pollen formation. In some spikelets from three panicles of the plant A K D 2, ES of the type found in hexaploid and octoploid *Hierochloë odorata* (WEIMARCK 1967 pp. 221—224, 227) are abundant in the anthers (Fig. 2 *A*). In some instances, the development has proceeded beyond the uninucleate stage (Fig. 2 *B* and *C*).

DISCUSSION

The embryo sac formation in *Hierochloë monticola* has many features in common with that in *H. australis* and in hexa- and octoploid *H. odorata* (cf. WEIMARCK 1967). Apospory is the rule, but diplospory may presumably also occur. The function of reduced ES cannot be excluded

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Fig. 1. — *A:* MMC, prophase. — *B:* MMC, anaphase I, disturbed. — *C:* Four-nucleate ES, presumably reduced. — *D:* 1 EI. — *E:* 8 EI; 1 uninucleate ES. — *F:* MMC, prophase, degenerating; 2 binucleate ES. — *G:* 1 four-nucleate ES; 2 eight-nucleate ES. — *H:* ES with undivided egg, degenerating synergids and antipodals and four-nucleate endosperm. — *I:* ES with embryo, secondary nucleus and one egg-like antipodal.

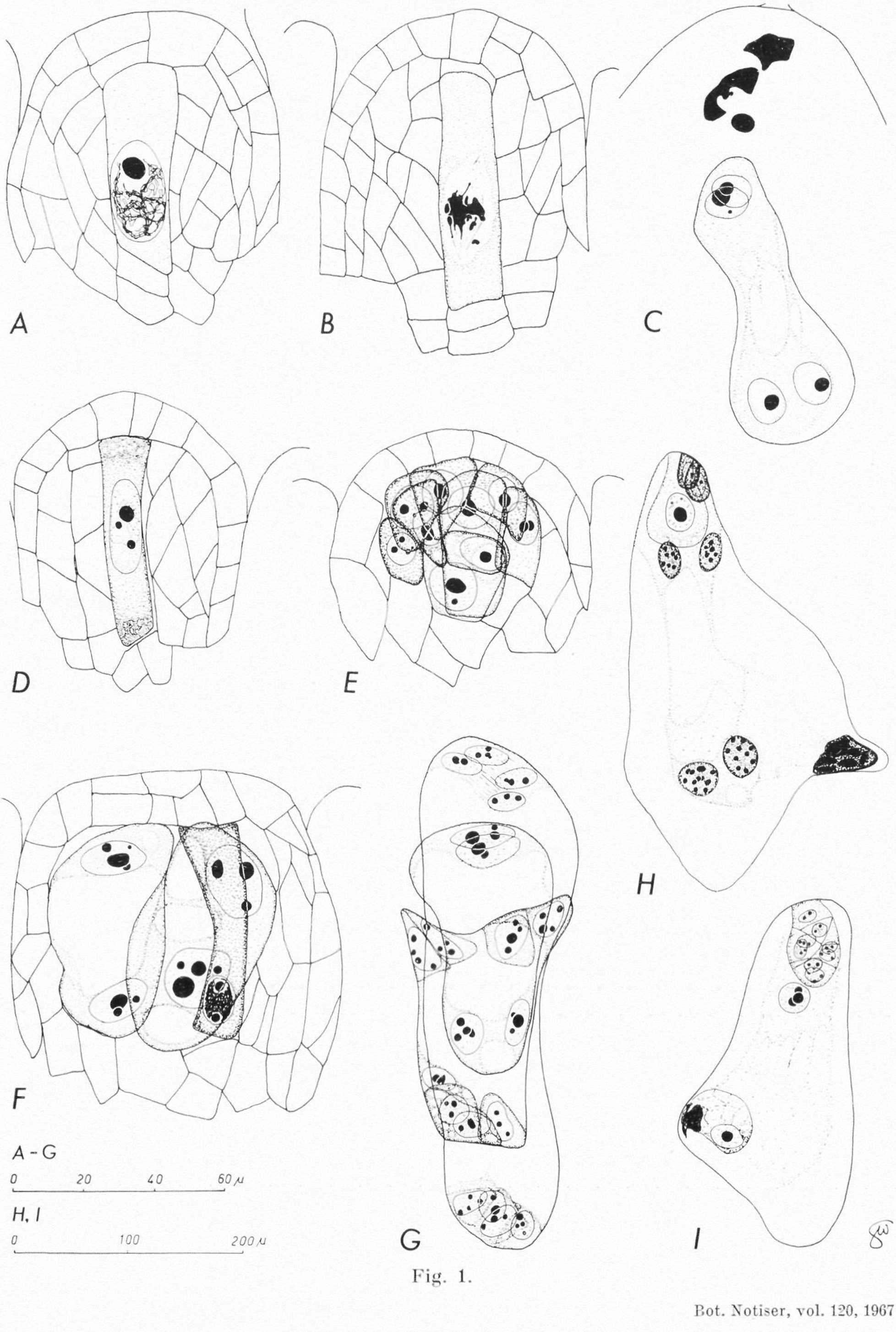

Fig. 1.

but seems improbable. The uneven somatic number makes a normal meiosis impossible, and a combination of gametes would be expected to bring about a certain frequency of plants with deviating chromosome numbers. In the limited number of plants — from only two or three localities — hitherto studied by SØRENSEN (1954; JØRGENSEN, SØRENSEN & WESTERGAARD 1958), LÖVE & LÖVE (in LÖVE & SOLBRIG 1964) and myself no variation in chromosome number is reported. *H. monticola* thus appears pronouncedly apomictic as do *H. australis* and *H. odorata* according to NORSTOG (1963 p. 820) and WEIMARCK (1967 pp. 230, 231).

In no case has more than one MMC or a derivative thereof been found. The number of EI is, on the other hand, variable and sometimes fairly high. At least some of the reproductive disturbances can be ascribed to competition between EI.

The possibility of embryo formation from an antipodal cannot be rejected and ought to be checked in the future. Antipodals functioning as egg cells are reported in a number of cases, e.g. in apomictic *Allium nutans* (HÅKANSSON 1951 pp. 164, 165), *A. odorum* (TRETJAKOW 1895; HEGELMAIER 1897 pp. 135—136; HABERLANDT 1922 pp. 394, 396—397, 400; MODILEWSKI 1925 pp. 10, 12—15, 1931 pp. 29—32, HÅKANSSON 1951 pp. 168—169), *Elatostema sinuatum* (FAGERLIND 1945 p. 42), *Sedum fabaria* (MAURITZON 1933 pp. 59—60), *Ulmus americana* (SHATTUCK 1905 pp. 214—215), and *Ulmus glabra* (EKDAHL 1941 pp. 148—151). In other species, however, egg-like antipodal cells have been observed without any sign of antipodal embryos, e.g. in sexual *Allium nutans* (HÅKANSSON 1951 pp. 146—149), *A. paradoxum* (WEBER 1929 pp. 33, 34), *A. schoenoprasum* (MESSERI 1931 p. 424), *A. senescens* (HÅKANSSON 1951 p. 176), *A. subhirsutum* (MESSERI 1931 p. 420), *Arctotis stoechadifolia* (DAHLGREN 1924 pp. 184, 185), *Cistus laurifolius* (CHIARUGI 1925 p. 232), *Nothoscordum fragrans* (STENAR 1932 p. 34), *Plumbagella micrantha* (DAHLGREN 1916 p. 53), *Plumbago zeylanica* (loc. cit.), *Rudbeckia bicolor* (MAHESHWARI & SRINIVASAN 1944 pp. 139—141), and *Ulmus hollandica* var. *belgica* (LELIVELD 1935 p. 559).

The antipodals are known to have the somatic chromosome number in apomictic *Allium nutans* (HÅKANSSON 1951 pp. 152—156), *A. odorum* (due to endo-duplicational meiosis; HÅKANSSON & LEVAN 1957), *Elatostema sinuatum* (due to apospory; FAGERLIND loc. cit.), and (at a low frequency and due to pseudomixis) in *Ulmus glabra* (HJELMQVIST & GRAZI 1965 pp. 350—351). In *Rudbeckia bicolor*, the antipodals are

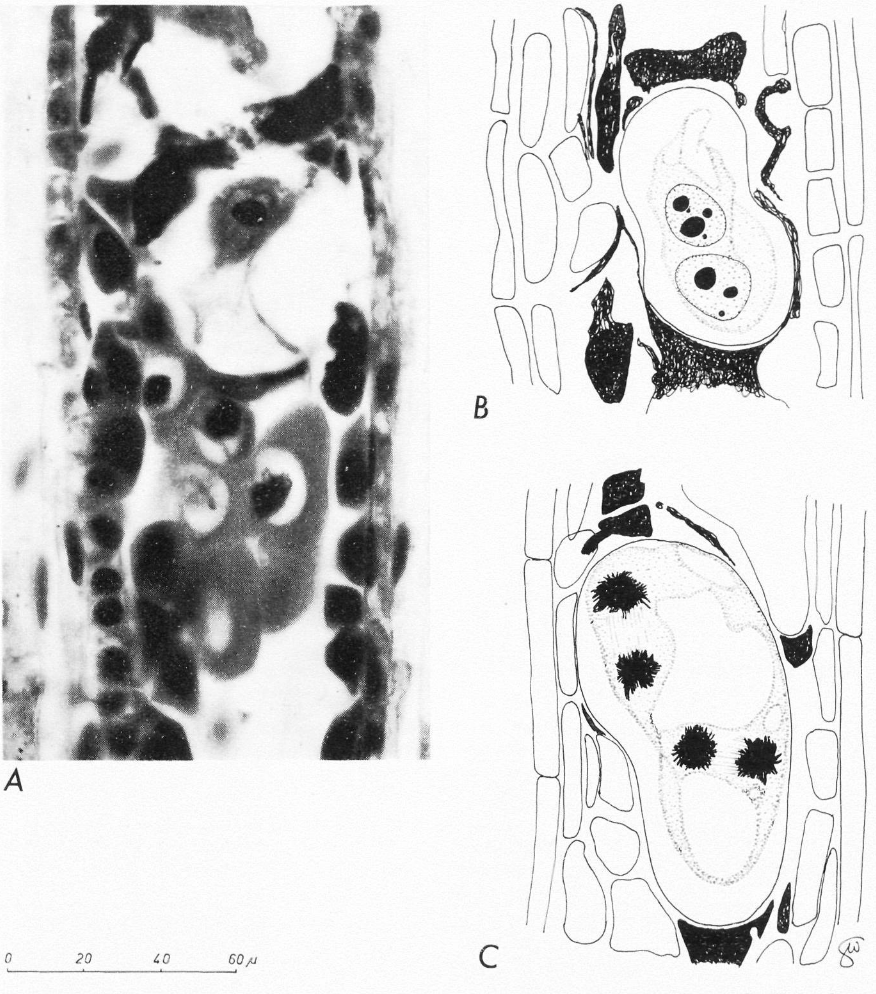

Fig. 2. ES in anthers. — *A:* Uninucleate ES. — *B:* Binucleate ES. — *C:* Telophase leading to four-nucleate ES.

triploid (MAHESHWARI & SRINIVASAN 1944 p. 137), as is the single antipodal in *Plumbagella micrantha* (FAGERLIND 1937 pp. 3—5).

A development of ES in anthers has been observed also in some aposporic species and hybrids within *Rubus* (BERGER 1953 pp. 255—257). In this genus BERGER found no sexual and diplosporous species developing such ES. — The reverse change of sex, with microsporangia developing within the ovary, is reported in *Salix* already by CHAMBERLAIN (1897 p. 173).

The apomictic ES formation shortens the time of development (as defined by WEIMARCK 1967 p. 216) as is the case also with *Hierochloë australis* and with hexaploid and octoploid *H. odorata* (WEIMARCK 1967 pp. 231, 232). In the subarctic-alpine *H. monticola*, this shortening apparently implies a selective advantage.

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Sonchus friesii, a New African Species of Compositæ

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ABSTRACT

The new species *Sonchus friesii* BOULUS is described, which is known from Zambia, Rhodesia and Moçambique. It is most related to *S. integrifolius* HARV. Together with *S. wilmsii* R. E. FRIES and *S. dregeanus* DC. (=*S. ecklonianus* DC.) these species form one section of subgenus *Origosonchus* BOULUS. A key is provided to separate the four species.

FRIES (1925) described some African species of *Sonchus* L., related to subgenus *Origosonchus* BOULOS, such as *Sonchus wilmsii* R. E. FRIES, *S. stenophyllus* R. E. FRIES, *S. afromontanus* R. E. FRIES, etc.

Further studies on this group (BOULOS 1963) showed that quite a number of specimens among the collections from Zambia (North Rhodesia), Rhodesia (South Rhodesia) and Moçambique seem to belong to none of the known species of that group. These collections (see distribution), typified by the specimen number 4656 collected by T. NORLINDH and H. WEIMARCK from Rhodesia, constitute a new species of the subgenus *Origosonchus*.

It is proposed to name this species *Sonchus friesii,* homage to ROBERT E. FRIES (1876—1966) who contributed to our knowledge on the African *Sonchus* (FRIES 1925).

Sonchus friesii BOULOS sp. nov.

Herba perennis erecta, 30—90 cm alta; folia ariculata glabra, integra—pinnatifida; capitula alba, basi tomentosa. Folia basalia 3—8×1—2 cm, oblanceolata—anguste elliptica; folia caulina 5—15×1.5—3.5 cm, anguste elliptica vel oblanceolata vel anguste ovata. Caulis herbaceus glaber. Pedunculus 0.2—7 cm longus. Capitula ±15×8 mm; flores 55—85 in capitulo. Involucri squamae ±25, imbricatae. Corolla 12.5—17 mm longa; tubus corollae 8—11

Fig. 1. *Sonchus friesii,* sp. nov. — Rhodesia austr.: Inyanga Down, the highest part. 29.1.1931. collected by TYCHO NORLINDH and HENNING WEIMARCK, No. 4656 (LD!). Holotypus. (Courtesy of The Botanical Museum, Lund.)

Holotypus, Boulos 1964

Sonchus friesii Boulos sp.nov.
det. L. Boulos 1962

Exped. Suecica in Africam austr. et. Rhodesiam austr. 1930—31.

4656 Sonchus

Rhodesia austr.: Inyanga, Inyanga Down, the highest part.

29 1 1931. legg. *Tycho Norlindh et Henning Weimarck.*

mm longus. Achenium 4—5.5×1 mm bruneolum rugosum anguste ellipsodeum. Pappus ±12 mm longus, persistens. Pollinis grana parva (28—35 μ diam.).

Holotypus: Rhodesia austr.: Inyanga Down, the highest part, 29.1.1931, NORLINDH et WEIMARCK 4656 (LD!).

EXTENDED DESCRIPTION

General habit: Erect perennial (with rhizome) herb, 30—90 cm high; leaves glabrous, auricled; heads white tomentose at the base. *Rhizome* 3—8 mm in diameter, solid. *Roots* 0.1—1.5 mm in diameter. *Caudex* simple or rarely branched, woody, 4—10 mm in diameter. *Caudical leaves* 3—8 cm long, 1—2 cm broad, oblanceolate to narrowly elliptic, entire to pinnatifid, margin irregularly dentate, base with small auricles, apex acute. *Cauline leaves* 5—15 cm long (rarely longer), 1.5—3.5 cm broad, narrowly elliptic, oblanceolate or narrowly ovate, entire to pinnatifid; lobes ± triangular, recurved; margins denticulate or irregularly dentate; apex acute; base auriculate, auricles ± triangular, acute; midrib 2—3 mm broad at the clasping leaf-base. *Stem* herbaceous, glabrous, unbranched or rarely branched at the base, ± cylindrical, hollow, 3—12 mm in diameter, narrowly grooved. *Peduncle* 0.2—7 cm long (4—20 mm), ± cylindrical, hollow, slightly white-tomentose below the capitule, in the axil of a triangular bract. *Heads* few, subumbelled, white tomentose at the base, ±15 mm long, ±8 mm in diameter, larger during the anthesis; number of flowers 55—85 per head. *Involucre* of ±25 imbricated scales, distinguished into ±9 outer narrowly triangular ones, 5—10 mm long, 1.5—3 mm broad, with thick base and occasionally hairy midrib towards the apex, margins slightly scarious, apex obtuse, ciliate; ±8 intermediate narrowly rectangular ones, slightly thick at the base, midrib occasionally hairy towards the apex, margins scarious, apex obtuse, ciliate; ±8 inner narrowly rectangular ones, scarious, apex obtuse, ciliate. *Corolla* yellow, outer florets pale purple on the lower side, 12.5—17 mm long, ligule 4.5—6 mm long, 1.5 mm broad, with 5 obtuse teeth; corolla tube 8—11 mm long, hairy towards the ligule; staminal tube ±3 mm long; style branches ±2 mm long. *Achene* 4—5.25 mm long, ±1 mm broad, brownish, wrinkled, narrowly-ellipsoid, slightly compressed, with thick margins and on each face with ±5 ribs of which the median is thickest. *Pappus* ±12 mm long, persistent. *Pollen* 28.6—35.7 μ in diameter.

DISTRIBUTION

Zambia (North Rhodesia), Rhodesia (South Rhodesia) and Moçambique.

Zambia: Broken Hill 4000 feet, Rogers 8645 (K!).

Rhodesia: Pungwe Waterfalls, Norlindh & Weimarck 3753 (LD!); 6000 feet, Chase 5909 (BM!). — Inyanga, Norlindh & Weimarck 3487 (LD!); Norlindh & Weimarck 4656 (Holotypus and Isotypus, LD!). — Mt. Nuza, 5700—5800 feet, Gilliland 450 (K!). — Melsetter distr., Swynnerton s.n. (BM!).

Moçambique: Chirinda, 3800 feet, Swynnerton 487 (BM! K!); Swynnerton 190 (BM!).

Sonchus friesii grows as a weed in cultivated fields and in the steppes at an altitude of 1100—2100 m. Flowering and fruiting seasons are principally from October to January, occasionally from May to June.

The most closely related species to *Sonchus friesii* is *S. integrifolius* Harv., known from Rhodesia, Moçambique and mainly from South Africa. The two species could be separated as follows:

	S. friesii	*S. integrifolius*
leaves	thin	coriaceous
heads	white tomentose at the base	glabrous
involucral scales ...	±25 with obtuse apex	±34 with acuminate apex

Sonchus friesii and 3 other species viz. *S. dregeanus* DC. (Syn. *S. ecklonianus* DC.), *S. integrifolius* Harv. and *S. wilmsii* R. E. Fries, form together one section of the subgenus *Origosonchus* Boulos. They could be separated as follows:

1 A. Heads glabrous .... *S. integrifolius*
1 B. Heads white tomentose
    2 A. Stem ± leafless, richly branched at the base; leaves narrow, rosetted .... *S. dregeanus*
    2 B. Stem leafy, not or rarely branched at the base; leaves broad
        3 A. Leaves deeply dissected, heads ±20×12 mm ...... *S. wilmsii*
        3 B. Leaves not or slightly dissected, heads ±15×8 mm .. *S. friesii*

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Studies on the Nutlet Structure of South Scandinavian Species of Carex

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ABSTRACT

The nutlet structure of the *Carex* species occurring in South Scandinavia (about 70 species) has been investigated and a key has been worked out to facilitate a determination of subfossil and recent material. Some contributions to the taxonomy of the genus have also been obtained.

INTRODUCTION

In subfossil material often nutlets of various *Carex* species are present the utricles of which have been destroyed so that only the nutlet proper remains. Such finds have generally been left undetermined as to the species, since the characters of the nutlet have been considered insufficient for a specific determination. As a matter of fact, there are however certain differences in the nutlet characters between different *Carex* species that in the great majority of cases make a determination possible, even though the utricle is absent. In the following we have made an attempt to work out a key for determination of the *Carex* species occurring in southern Scandinavia, which irrespective of its practical purpose also may give some contributions to the taxonomy of the genus. The taxa that have been treated are those that occur in the Swedish provinces Skåne, Halland, Småland and Blekinge and in Denmark, thus the same districts that are represented in the flora of WEIMARCK (1963). Occasionally occurring species have also been included, if they belong to an adjacent flora district and thus may be thought to have occurred within the district in older time, but not such species (e.g., *C. tribuloides* WG) which belong to quite alien flora districts.

In the nomenclature we follow as a rule the flora of HYLANDER (1966), and the geographical districts have also the same designations as in this work. As to the terminology it should be noted that the term "beak" means the basal persistent part of the style that structurally agrees with the fruit wall; sometimes this part is only present as a low callus at the style base and in these cases it is not regarded as a true beak. In those species that have flattened, bicarpellate nutlets the "inner" side means the side turned to the axis, the "outer" side the other; when there is a more distinct difference between them, both are figured in the illustrations. When the nutlet surface is designated as "verrucose", it means that the epidermis cells have the whole outer wall convex, when it is called "papillate", there is a smaller or bigger process from the centre of the outer cell wall. The terminology follows in other respects STEARN (1966).

In order to get an idea of the variation of the species some collections from different localities both within and outside South Scandinavia have been studied. The size figures are founded on some fruits from each of these collections and are only intended to give an approximative conception of the dimensions. The length figures of the nutlet do not include the beak.

Since the key is especially intended to be used in determination of older finds, it should perhaps be pointed out that free nutlets of some species can scarcely be expected to occur in older contexts, because their utricles in later stages are so thickened and hardened that they are very resistent. This is true about the species belonging to sections *Montanae* and *Paniculatae,* and further of *C. chordorrhiza* EHRH.

It may be pointed out that the statements given refer to quite ripe nutlets. In the immature nutlets the colour is paler and greener, the faces are often concave instead of convex, and the shape may be altered by shrinkage.

The work has been divided between the authors insofar as the tricarpellate species with three stigmas and trigonous nutlet have been treated by Ö. NILSSON, the bicarpellate and distigmatic with flattened nutlet by H. HJELMQVIST, of course under the mutual cooperation of the authors. The drawings have been made by the authors.

KEY

(The designation within parentheses following the species name refers to the illustrations.)

1. Nutlet tricarpellate, ± trigonous with three distinct angles and faces . . 2
   Nutlet bicarpellate, ± compressed with two distinct edges and faces . . 46

2. Nutlet ± terete; faces narrowly oblong, 2.3—2.7 mm long, ca. 0.8 mm broad, very convex, smooth; beak 0.4—0.5 mm long, thin, erect; light brown, angle lines distinct, narrow . . . . **C. pauciflora** LIGHTF. (1 *A*)
   Nutlet ± distinctly trigonous; faces of other shape 3

3. Nutlet ± distinctly stipitate 4
Nutlet without stipe or indistinctly stipitate 16

4. Stipe curved; beak 0 or very short; faces smooth 5
Stipe straight; beak 0, very short or longer 6

5. Stipe 0.5—0.7 mm long, ca. 0.4 mm thick; faces oblong—narrowly obovate, 2.2—2.6 mm long; olivaceous .... **C. digitata** L. (2 *E*)
Stipe 0.9—1.0 mm long, ca. 0.2 mm thick; faces broadly oval—ovate, 1.7—2.1 mm long; dark brown .... **C. ornithopoda** WILLD. (2 *F*)

6. Beak very short (< 0.1 mm) or 0 7
Beak longer (> 0.2 mm) 8

7. Faces obovate, 1.8—2.0 mm long with minute, pointed papillae; beak thin; olivaceous with distinct angle lines .... **C. pallescens** L. (1 *L*)
Faces broadly oval, 1.6—1.8 mm long, verrucose; beak rather thick; dark grey-brown, angle lines indistinct .... **C. globularis** L. (1 *M*)

8. Faces narrowly ovate with tapering ends, 2.1—2.4 mm long, concave; angles sharp; beak 0.3—0.5 mm long, straight; stipe 0.6—0.8 mm long, ca. 0.4 mm thick; chestnut-brown, angle lines distinct, narrow .... **C. montana** L. (2 *A*)
Faces of other shape; stipe comparatively thin; beak curved or straight 9

9. Beak long (> 0.4 mm), curved and often twisted 10
Beak short (< 0.4 mm), straight, erect or bent at the base 13

10. Faces concave, broadly oblong, 2.4—2.6 mm long, tapering towards the base with distinct pointed papillae in the upper half; beak 0.5—0.7 mm long; stipe 0.4—0.5 mm long; light yellowish brown, without angle lines .... **C. riparia** CURT. (3 *J*)
Faces ± convex or flat, oblong—obovate; stipe shorter 11

11. Beak ca. 0.8—1.0 mm long, thin; angles blunt often with one shallow depression on either side; stipe ca. 0.2 mm long (often indistinct); dark yellowish brown .... **C. vesicaria** L. (3 *H*)
Beak ca. 0.5 mm long, rather thick; angles ± sharp; faces pointedly papillose all over; light yellowish brown 12

Fig. 1. Nutlets of **A:** *Carex pauciflora*, Sk, Tjörnarp, J. ERICSON 1951. — **B:** *C. obtusata*, Öl, Räpplinge, Ö. NILSSON 1967. — **C:** *C. hartmanii*, Sk, Äsphult, T. PERSSON 1964. — **D:** *C. buxbaumii* ssp. *buxbaumii*, Nrk, Svennevad, G. KJELLMERT 1943. — **E:** *C. flacca*, Sk, Ö. Sönnarslöv, T. HULTHÉN 1924. — **F:** *C. vaginata*, Vg, S. Säm, Ö. NILSSON 1967. — **G:** *C. panicea*, Ög, Åby, Ö. NILSSON 1967. — **H:** *C. livida*, Sm, Nydala, Ö. NILSSON 1959. — **I:** *C. magellanica*, Ång, Nora, E. EVERS 1957. — **J:** *C. limosa*, Sm, Aneboda, N. BLOMGREN 1924. — **K:** *C. pendula*, Sk, Tofthög, H. HOLMGREN 1900. — **L:** *C. pallescens*, Sk, Vomb, J. LINDERS 1943. — **M:** *C. globularis*, Gstr, Hille, J. A. NANNFELDT 1963. — **N:** *C. tomentosa*, Sk, Klagshamn, H. RICKMAN 1963. — ×10.

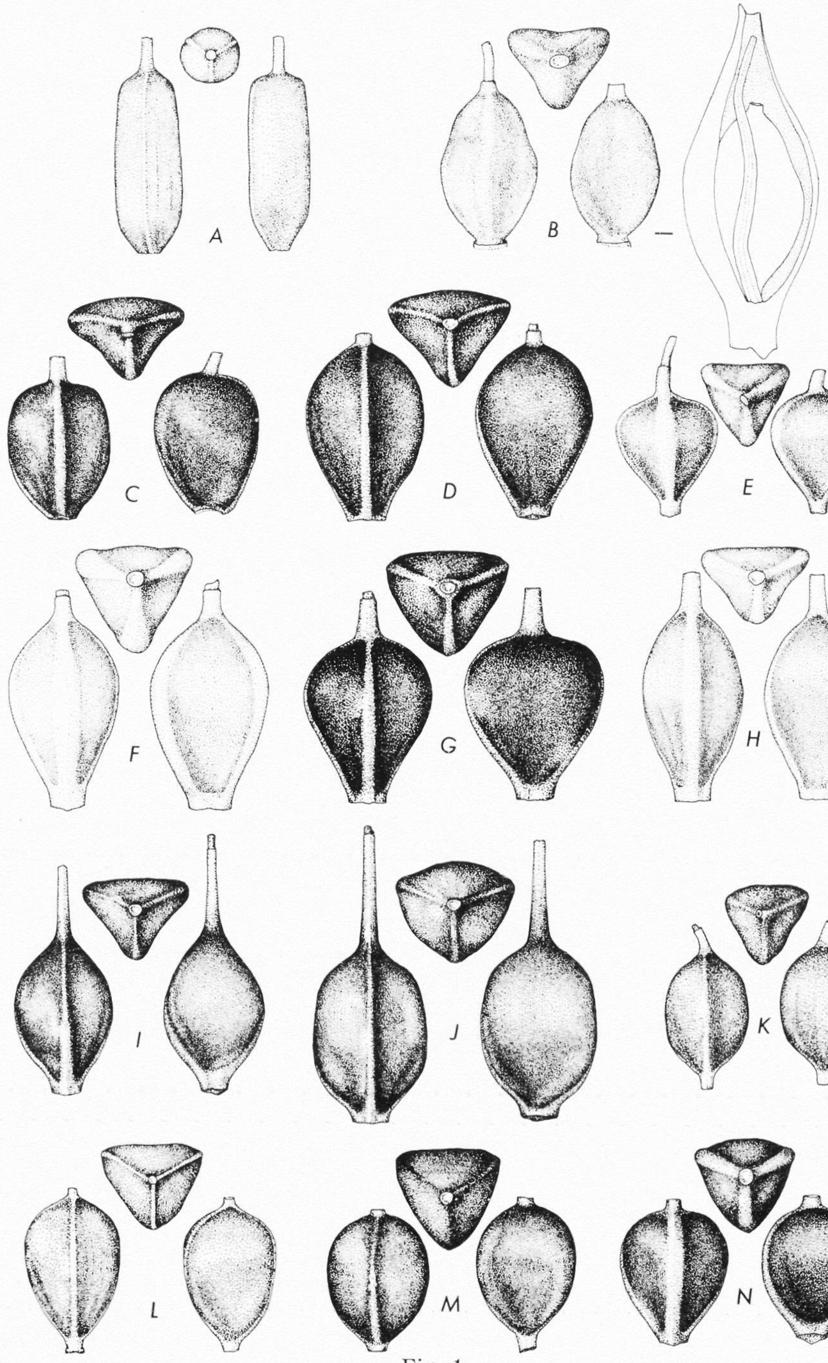

Fig. 1.

12. Faces broadly oblong—obovate, with ± parallel margins, tapering towards the base, 1.9—2.2 mm long; stipe 0.2—0.3 mm long; angle lines usually indistinct, narrow .... **C. lasiocarpa** Ehrh. (3 *E*)
Faces obovate with curved margins, tapering towards the base, 2.0—2.2 mm long; stipe 0.5—0.6 mm long; without marked angle lines .... **C. hirta** L. (3 *F*)

13. Faces cuneiform or obovate; stipe rather thick 14
Faces oblong; stipe thin, distinct 15

14. Faces broadly cuneiform, 1.5—1.7 mm long, 1.2—1.3 mm broad, ± flat with minute, pointed papillae; angles blunt; beak 0.2—0.3 mm long, often slightly bent at the base; stipe ca. 0.2 mm long (often indistinct); grey-brown, angle lines distinct, broad .... **C. flacca** Schreb. (1 *E*)
Faces narrowly cuneiform—obovate, tapering towards the base, 1.4—1.6 mm long, 1.0—1.1 mm broad, slightly convex with minute, pointed papillae; angles sharp, often with a shallow depression on either side; beak about 0.3 mm long, erect; stipe short (often indistinct); dark olivaceous, angle lines indistinct, narrow .... **C. lepidocarpa** Tausch (2 *K*)

15. Faces broadly oblong, 1.5—1.6 mm long, 1.0—1.2 mm broad, slightly convex with minute, pointed papillae; angles blunt; beak about 0.3 mm long, thin, often bent at the base, whitish; stipe ca. 0.2 mm long; dark chestnut brown, angle lines narrow, indistinct, becoming distinct towards the base .... **C. pendula** Huds. (1 *K*)
Faces oblong, 1.4—1.6 mm long, 0.8—0.9 mm broad, flat or slightly concave with small, pointed papillae; angles rather sharp; beak ca. 0.2 mm long, whitish; stipe 0.2—0.3 mm long; light brown, angle lines distinct, narrow .... **C. strigosa** Huds. (2 *I*)

16. Beak 0 or very short (usually < 0.1 mm long) 17
Beak longer (> 0.2 mm long) 29

17. Faces ± flat or slightly concave 18
Faces distinctly convex 24

18. Faces ± broadly lanceolate or oval, tapering towards the ends, with ± curved margins 19
Faces of other shape 21

Fig. 2. Nutlets of **A:** *Carex montana*, Sk, Härslöv, A. Nilsson 1953. — **B:** *C. pilulifera*, Gbg, Härryda, H. Fries 1942. — **C:** *C. caryophyllea*, Sk, Ö. Broby, E. Nyholm 1943. — **D:** *C. ericetorum*, Hl, Ölmevalla, Ö. Nilsson 1962. — **E:** *C. digitata*, Ång, Edsele, K. Holm 1953. — **F:** *C. ornithopoda*, Öl. Mörbylånga, C. M. Norrman 1950. — **G:** *C. capillaris*, Sk, Trolle-Ljungby, Ö. Nilsson 1967. — **H:** *C. silvatica*, Sk, Hörröd, T. Hulthén 1947. — **I:** *C. strigosa*, D Jl, Vejle, T. Schilz 1886. — **J:** *C. flava*, Vg, Ulricehamn, Ö. Nilsson 1961. — **K:** *C. lepidocarpa*, Sk, Smedstorp, H. Weimarck 1943. — **L:** *C. tumidicarpa*, Ög, Krokek, Ö. Nilsson 1967. — **M:** *C. oederi* ssp. *oederi*, Hl, Ölmevalla, Ö. Nilsson 1966. — **N:** *C. oederi* ssp. *pulchella*, Hl, Ölmevalla, Ö. Nilsson 1966. — ×10.

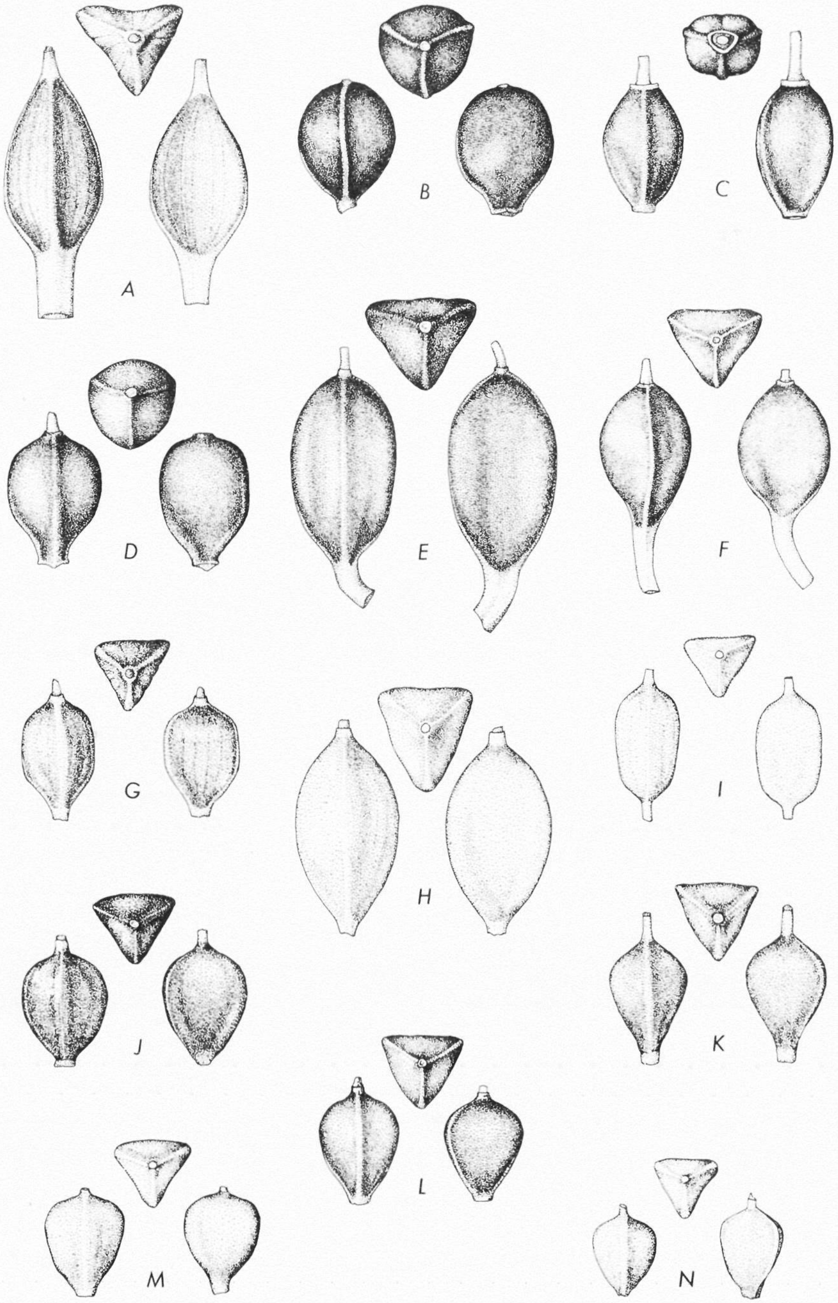

Fig. 2.

19. Beak about 0.1 mm long; faces oval, 2.6—2.7 mm long, two broader than the third, with minute, pointed papillae; stipe indistinct (or very short); light grey-brown, angle lines narrow, rather distinct, towards the centre broader and more diffuse .... **C. silvatica** HUDS. (2 *H*)
Beak 0 or < 0.1 mm long; darker with broad, distinct angle lines 20

20. Olivaceous; faces broadly lanceolate, 2.0—2.3 mm long, 1.3—1.5 mm broad, almost smooth; angles rather sharp .... **C. extensa** GOOD. (3 *D*)
Chestnut-brown; faces oval, 2.1—2.4 mm long, 1.5—1.6 mm broad, with minute, pointed papillae; angles blunt; stipe indistinct .... **C. distans** L. (3 *A*)

21. Faces shortly and broadly oblong, tapering towards the base, 1.5—1.6 mm long, 1.0—1.1 mm broad, two broader than the third, often ± distinctly furrowed, ± smooth; angles sharp; beak 0.1 mm long, whitish; stipe indistinct (or very short); dark olivaceous, angle lines rather broad, distinct .... **C. capillaris** L. (2 *G*)
Faces cuneiform—broadly obovate; angle lines narrow 22

22. Faces almost smooth, cuneiform, 1.3—1.5 mm long, 1.0—1.1 mm broad; angles rather sharp; beak ca. 0.1 mm long; dark olivaceous, angle lines rather distinct, narrow .... **C. tumidicarpa** ANDS. (2 *L*)
Faces with small, distinct, pointed papillae; light olivaceous, angle lines rather indistinct 23

23. Nutlet 1.2—1.5 mm long, 0.9—1.0 mm broad; faces cuneiform—broadly obovate, ± flat; angles rather sharp; stipe indistinct .... **C. oederi** RETZ. ssp. **oederi** (2 *M*)
Nutlet 1.0—1.2 mm long, about 0.8 mm broad .... **C. oederi** RETZ. ssp. **pulchella** LÖNNR. (2 *N*)

24. Faces obovate, convex but flat in centre; angles blunt and ± distinctly keeled; beak thin; olivaceous .... **C. pallescens** L. (1 *L*)
Faces broadly obovate or oval; dark or black-brown 25

25. Style base surrounded by a white, low collar; faces narrowly oval, 1.6—1.8 mm long, 1.0—1.1 mm broad, very convex, one often with one or two shallow furrows, smooth; angles blunt, distinctly keeled; dark brown, angle lines indistinct .... **C. caryophyllea** LATOURR. (2 *C*)
Style base without such collar; faces broadly obovate or roundedly oval 26

26. Faces very convex; beak 0; angles blunt, narrowly keeled 27
Faces slightly convex or convex but flat in centre; angles blunt 28

27. Faces flat or slightly convex towards the base, broadly oval, 1.6—1.7 mm long, 1.2—1.3 mm broad with minute, pointed papillae; stipe indistinct (or very short); dark brown-black, dull with narrow, distinct, towards the base somewhat broader angle lines .... **C. pilulifera** L. (2 *B*)
Faces concave towards the base, broadly oblong with a tapering base, 1.6—1.8 mm long, 1.1—1.3 mm broad, ± smooth; stipe indistinct; dark brown, rather shining, angle lines very narrow only distinct towards the base .... **C. ericetorum** POLL. (2 *D*)

28\. Angle lines very narrow, only distinct towards the base; faces broadly oval, 1.6—1.8 mm long, convex but flat in centre; beak very short (0.05—0.1 mm long) or 0; stipe indistinct or sometimes ca. 0.1 mm long; dark grey-brown . . . . **C. globularis** L. (1 *M*)
Angle lines broad, distinct; faces broadly obovate, 1.6—1.7 mm long, slightly convex, almost smooth; angles often with a shallow depression on either side; beak distinct but very short (ca. 0.1 mm long); stipe indistinct; dark brown . . . . **C. tomentosa** L. (1 *N*)

29\. Beak > 0.8 mm long, straight or curved and twisted 30
Beak < 0.5 mm long, usually straight 34

30\. Beak straight; faces ± smooth 31
Beak usually curved and twisted, ca. 0.8—1.0 mm long, rather thin, about 0.15 mm thick; dark yellowish brown; faces ± broadly obovate, tapering towards the base 33

31\. Faces narrowly oval, 1.5—1.7 mm long, 0.8—1.0 mm broad, flat; angles sharp; beak very long, about 1.4—1.8 mm, often slightly bent at the base, thin (ca. 0.1 mm thick); light yellowish brown, angle lines very narrow, rather indistinct, with a central, white streak . . . . **C. pseudocyperus** L. (3 *G*)
Faces ovate—ovately oblong, convex or concave; beak erect, thicker; angles blunt; nutlet larger 32

32\. Faces ovate—broadly oval, 1.9—2.1 mm long, 1.2—1.4 mm broad, one face slightly convex, broader than the two shallowly concave ones; beak ca. 0.8—1.0 mm long; dark red-brown with rather distinct, narrow, towards the base broader angle lines . . . . **C. magellanica** LAM. (1 *I*)
Faces ovately oblong, 2.1—2.4 mm long, 1.4—1.6 mm broad, one face more convex than the other two; beak ca. 1.3—1.6 mm long; brown with indistinct, very narrow, towards the base slightly broader angle lines . . . . **C. limosa** L. (1 *J*)

33\. Faces with small, pointed papillae in the apical half, 1.9—2.2 mm long, 1.3—1.6 mm broad, slightly convex, often delicately furrowed; angles blunt often with a shallow depression on either side; indistinctly stipitate or with an up to about 0.2 mm long stipe; angle lines indistinct, disappearing towards the top . . . . **C. vesicaria** L. (3 *H*)
Faces verrucose, 1.7—2.0 mm long, 1.1—1.5 mm broad, ± flat; angles almost sharp; angle lines near the base distinct, broad, towards the top narrower and less distinct, with a central, white streak . . . . **C. rostrata** STOKES ap. WITH. (3 *I*)

34\. Faces ovate often with a slight contraction near the top, 2.0—2.3 mm long, 1.2—1.4 mm broad, concave, smooth and shining; angles blunt; beak ca. 0.2 mm long; light olivaceous, angle lines indistinct, rather broad (rachilla thin, triquetrous, somewhat longer than the nutlet but not exserting the utricle) . . . . **C. obtusata** LILJEBL. (1 *B*)
Faces of other shape, ± flat or convex 35

35\. Faces broadly lanceolate—oval 36
Faces cuneiform or broadly obovate 40

36\. Beak ca. 0.2 mm long; nutlet with a narrow base 37
Beak 0.2—0.5 mm long, erect; nutlet with a broad base 38

37\. Faces oval, 2.6—2.7 mm long, 1.4—1.5 mm broad; light grey-brown .... **C. silvatica** Huds. (2 *H*)
Faces broadly oval, 1.6—1.8 mm long, 1.2—1.4 mm broad, ± flat, almost smooth, angles ± blunt; stipe indistinct; dark chestnut-brown, somewhat glossy with narrow angle lines, visible towards the ends .... **C. punctata** Gaud. (3 *C*)

38\. Angles sharp; faces often furrowed, broadly lanceolate—oval, 2.0—2.2 mm long, 1.1—1.3 mm broad, ± flat with minute, pointed papillae; beak 0.4—0.5 mm long, light yellow; dark chestnut-brown, very dark at the base, angle lines distinct, rather narrow, towards the base broader .... **C. acutiformis** Ehrh. (3 *K*)
Angles ± blunt; angle lines distinct, broad; brown—light olivaceous. 39

39\. Faces ovally obovate—oval, ± flat or slightly convex, 2.5—2.8 mm long, 1.4—1.6 mm broad, all ± equally broad with very minute, ± pointed papillae; angles often with a shallow depression on either side; beak 0.2—0.3 mm long; stipe indistinct; light olivaceous with light brown angle lines tapering towards the ends .... **C. vaginata** Tausch (1 *F*)
Faces oval, one broader and ± flat, two narrower and shallowly concave, 1.9—2.1 mm long, the broader 1.2—1.4 mm broad, ± smooth; beak 0.4—0.5 mm long, whitish; stipe 0 or indistinct; brown with green-white angle lines .... **C. livida** (Wg) Willd. (1 *H*)

40\. Faces broadly obovate, distinctly verrucose; nut ± compressed; angles blunt 41
Faces cuneiform; nutlet not compressed 42

41\. Faces oblongly obovate, roundedly truncate at the top, 1.6—2.0 mm long, the broader 1.2—1.5 mm broad, one distinctly broader and convex, the two other narrower and concave; beak 0.3—0.4 mm long, erect or often slightly bent at the base, whitish; brown-black, angle lines distinct, rather broad .... **C. hartmanii** A. Caj. (1 *C*)
Faces obovate, 2.0—2.3 mm long, 1.3—1.6 mm broad, obtuse, one somewhat broader and convex, the two other narrower and slightly concave; beak 0.1—0.2 mm long, ± erect; brown-black, angle lines very

Fig. 3. Nutlets of **A:** *Carex distans,* Hl, Fjärås, Ö. Nilsson 1959. — **B:** *C. hostiana,* Hl, Ölmevalla, Ö. Nilsson 1966. — **C:** *C. punctata,* N Ö. Agd, Dypvåg, D. Danielsson 1955. — **D:** *C. extensa,* Bl, Nättraby, B. Holmgren 1920. — **E:** *C. lasiocarpa,* Ång, Nora, E. Evers 1957. — **F:** *C. hirta,* Sk, Vomb, J. Linders 1946. — **G:** *C. pseudocyperus,* Sk, Genarp, Ö. Nilsson 1954. — **H:** *C. vesicaria,* Hl, Ölmevalla, Ö. Nilsson 1963. — **I:** *C. rostrata,* Vg, Limmared, Ö. Nilsson 1963. — **J:** *C. riparia,* Sk, Börringe, Ö. Nilsson 1967. — **K:** *C. acutiformis,* Sk, Äsphult, T. Håkansson 1944. — ×10.

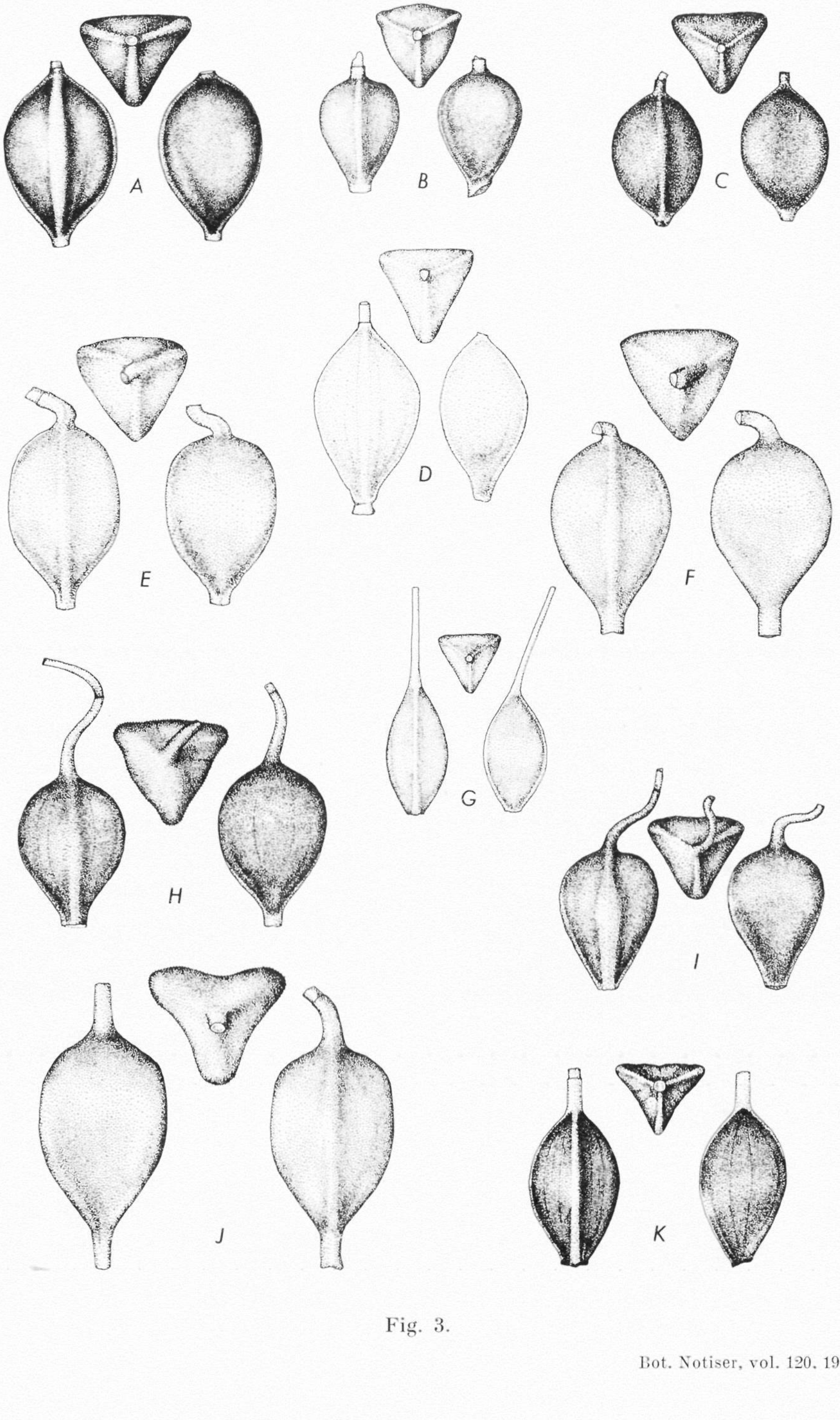

Fig. 3.

distinct, narrow, tapering towards the top .... **C. buxbaumii** Wg ssp. **buxbaumii** (1 *D*)

42\. Faces broadly cuneiform; angle lines distinct, broad 43
Faces cuneiform—cuneiformly obovate; angle lines ± distinct, narrow 44

43\. Faces 1.6—1.7 mm long, 1.2—1.3 mm broad, ± flat; angles ± blunt; beak often bent at the base, 0.2—0.3 mm long; base narrow, nutlet indistinctly stipitate .... **C. flacca** Schreb. (1 *E*)
Faces 2.0—2.4 mm long, 1.5—1.8 mm broad, convex but flat in centre, almost smooth; angles rather sharp; beak erect, 0.5—0.7 mm long, yellowish white; base broad, stipe 0; dark brown .... **C. panicea** L. (1 *G*)

44\. Faces narrowly cuneiform, with minute pointed papillae; beak ca. 0.3 mm long; nutlet often indistinctly stipitate .... **C. lepidocarpa** Tausch (2 *K*)
Faces cuneiform—cuneiformly obovate, verrucose; beak ca. 0.2 mm long 45

45\. Angles sharp; faces cuneiformly obovate, 1.3—1.5 mm long, 1.1—1.2 mm broad, almost flat; dark chestnut-brown, rather dull, angle lines very narrow .... **C. flava** L. (2 *J*)
Angles bluntly keeled; faces cuneiform, 1.5—1.6 mm long, 1.1—1.2 mm broad, slightly convex; stipe indistinct or 0; dark chestnut-brown, somewhat glossy, angle lines rather narrow .... **C. hostiana** DC. (3 *B*)

46\. Nutlet with a transverse fold and an oblique beak; dark brown 47
Nutlet without transverse fold 48

47\. Faces of the nutlet irregularly obovate with narrow base; surface somewhat lustrous, without papillae; length 1.3—2.5 mm .... **C. paleacea** Wg (4 *A*)
Faces broader in relation to length, 1.3—2.0 mm long, with broad base; surface ± papillate, dull .... **C. vacillans** Drej. ap. Hartm. (4 *B*)

48\. Nutlet short and broad, length not much greater then breadth, with broad base; beak distinct, thin 49
Nutlet with narrow base or with indistinct, very small or lacking beak, of varying shape 52

49\. Faces of the nutlet shortly obovate; edges rounded; surface with comparatively large papillae or verrucae 50
Faces almost orbicular, length equal to breadth or a little greater; edges sharp 51

50\. Nutlet rather big (1.7—2.2 mm long, 1.3—1.8 mm broad); surface with very large verrucae; edges rounded; black brown .... **C. trinervis** Degl. ap. Lois. (4 *H*)
Nutlet smaller (1.4—1.8 mm long, 1.2—1.5 mm broad), thinner; edges thinner, though somewhat rounded; surface papillate, with broad and low papillae; olivaceous .... **C. acuta** L. (4 *F*)

51. Nutlet almost as broad as long, broadest at or a little above the middle, with broad base and sharp edges; surface with broad and low papillae; grey-brown; length 1.4—1.8 mm .... **C. nigra** (L.) Reich. (4 *G*)
Nutlet of similar shape or sometimes somewhat square at apex, but the base less broad; surface finely dotted with small papillae; light olivaceous; length 1.6—2.5 mm .... **C. elata** All. (4 *D*)

52. Nutlet oblong (margins ± parallel), 2.4—3.0 mm long, 1.0—1.5 mm broad, with distinct beak and especially the outer face strongly convex; surface papillate, dull, dark grey-brown .... **C. pulicaris** L. (5 *A*)
Margins of the nutlet not parallel, ± curved, or if the margins are partly parallel, nutlet broader in relation to length or with strongly lustrous surface 53

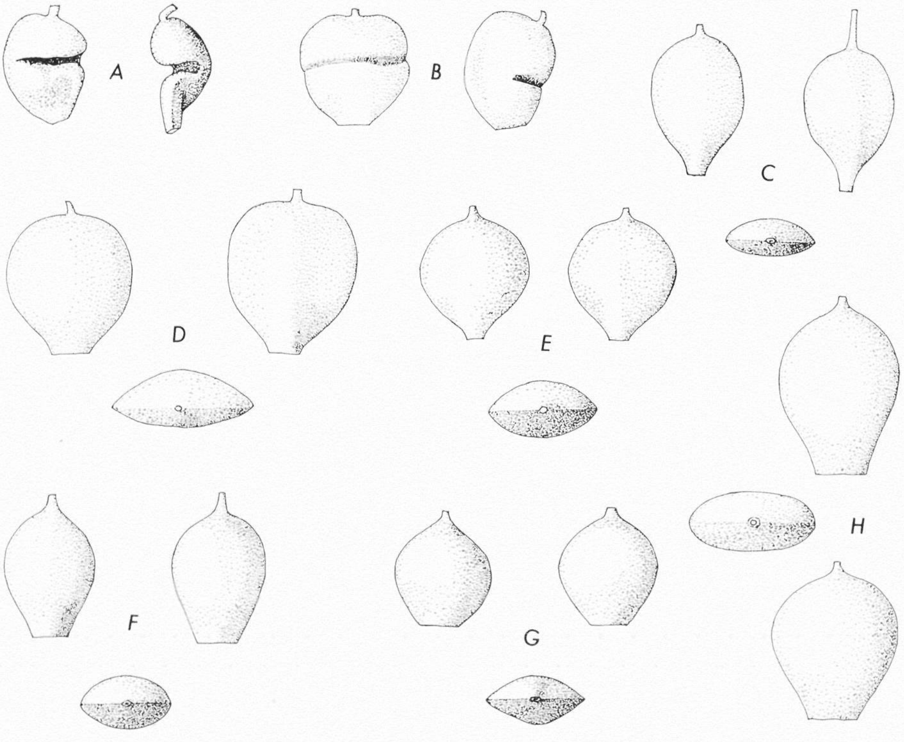

Fig. 4. Nutlets of **A:** *Carex paleacea*, N Akh, Bærum, P. Sunding & L. Køgel 1966. — **B:** *C. vacillans*, Bh, Strömstad, K. Bökman 1956. — **C:** *C. aquatilis*, Sthm, N. Djurgården, T. Erdmann 1917. — **D:** *C. elata*, Sk, Bökeberg, Th. Brandt 1929. — **E:** *C. caespitosa*, Nrk, Lillkyrka, Ekeberg, N. Sylvén 1932. — **F:** *C. acuta*, Sm, Nydala, H. Hjelmqvist 1952. — **G:** *C. nigra*, Sm, Nydala, H. Hjelmqvist 1946. — **H:** *C. trinervis*, Germany, Borkum, Wilms 1864. — ×10.

53. Nutlet, irrespective of the possibly occurring short stipe, with almost orbicular faces 54
Nutlet more elongate, of other shape 56

54. Nutlet quite small, about 1.5 (1.4—1.8) mm long, without distinct stipe but with a thin beak; surface with very small papillae, olivaceous . . . . **C. caespitosa** L. (4 *E*)
Nutlet bigger, 1.7—2.3 mm long; beak at least at the base coarse; surface with comparatively large verrucae 55

55. Nutlet strongly convex, especially at the outer side, ca. 0.8 mm thick; beak quite short, strongly tapering upwards; stipe indistinct; surface brown, somewhat lustrous; length 1.7—2.0 mm. **C. maritima** GUNN. (5 *C*)
Nutlet with moderately convex faces, about 0.5—0.6 mm thick; stipe short but distinct; beak thick and blunt; light brown, 1.9—2.3 mm long . . . . **C. otrubae** PODP. (6 *E*)

56. Nutlet pyriform or turbinate, about as thick as broad; beak very small or absent 57
Nutlet more or less flattened, of other shape 58

57. Nutlet pyriform, with thin stipe and rounded apex; the inner side strongly convex in the upper part but without a sharp recess at the base; surface papillate, dark red-brown; length 1.3—1.7 mm . . . . **C. diandra** SCHRANK (5 *M*)
Nutlet turbinate, broadest about at the middle; the inner side with a basal depression and a sac-like widened upper part; surface small-verrucose, dark brown; length 1.0—1.6 mm. **C. appropinquata** SCHUM. (5 *N*)

58. Nutlet obcordate or obovate, usually with a square or emarginate apex, rather thick; beak short and thick, often somewhat oblique; surface with pointed verrucae, dark olivaceous; length 1.7—2.1 mm . . . . **C. chordorrhiza** L. FIL. (5 *B*)
Nutlet with rounded or somewhat square apex, never emarginate, usually thin 59

59. Nutlet dull or slightly lustrous, ± verrucose or papillate 60
Nutlet strongly lustrous, smooth or almost so 75

Fig. 5. Nutlets of **A:** *Carex pulicaris*, N Östf, Hvaler, Herföl, P. WENDELBO 1966. — **B:** *C. chordorrhiza*, Sm, Nydala, H. HJELMQVIST 1946. — **C:** *C. maritima*, N Nrd, Elvegaard, Ö. NILSSON 1962. — **D:** *C. dioica*, Sm, Nydala, H. HJELMQVIST 1946. — **E:** *C. davalliana*, D Sj, Søndersøen pr. Jonstrup, S. MURBECK 1888. — **F:** *C. mackenziei*, N Nrd, Elvegaard, Ö. NILSSON 1962. — **G:** *C. canescens*, Sm, Nydala, H. HJELMQVIST 1942. — **H:** *C. brunnescens* ssp. *brunnescens*, Sm, Nydala, H. HJELMQVIST 1940. — **I:** *C. disperma*, Dlr, Falun, ZETTERSTRÖM 1887. — **J:** *C. loliacea*, TL, Abisko, Ö. NILSSON 1962. — **K:** *C. remota*, Sk, Riseberga, T. HÅKANSSON 1942. — **L:** *C. elongata*, Sm, Nydala, H. HJELMQVIST 1945. — **M:** *C. diandra*, N Hdm, Stange, Ottestad, P. SUNDING 1965. — **N:** *C. appropinquata*, Sk, Ugerup, P. TUFVESSON 1914. **O:** *C. paniculata*, Sk, Svaneholm, P. BOURNONVILLE 1901. — ×10.

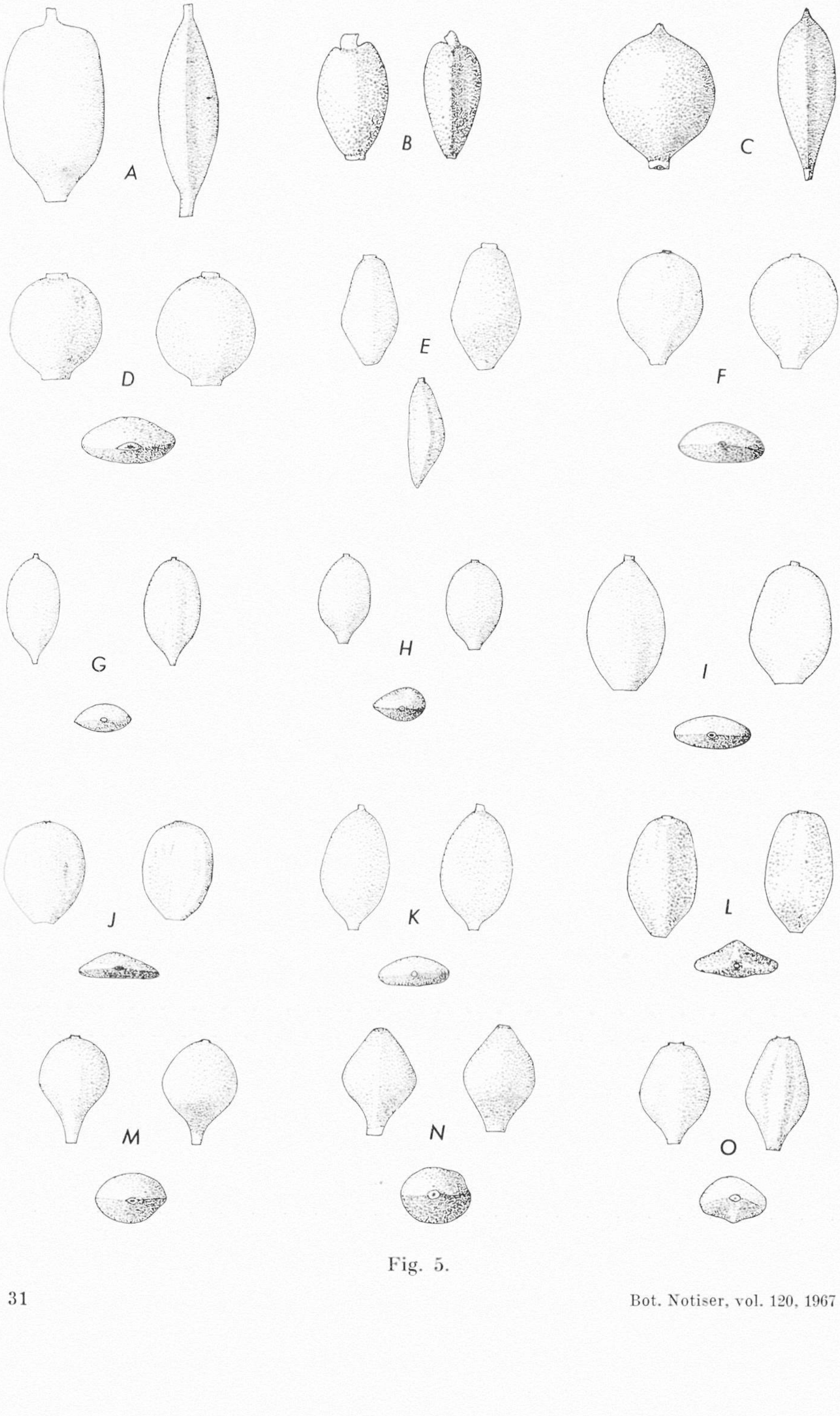

Fig. 5.

60\. Margins of the nutlet equally curved and faces evenly convex or flattened 61
Margins of the nut somewhat angular, the outline being slightly rhombic-ovate or oblong-ovate; the inner face often cut off at the base . . . 67

61\. Faces of the nutlet short and broad, not much longer than broad, briefly ovate, elliptic or obovate to almost orbicular 62
Faces of the nutlet distinctly longer than broad, ovate or elliptic 63

62\. Faces shortly ovate to elliptic or obovate, tapering towards the base, subacute above; true beak lacking; surface verrucose, slightly lustrous, light grey-brown; length 1.6—2.0 mm .... **C. mackenziei** V. Krecz. (5 *F*)
Faces almost orbicular or very shortly ovate-obovate, with a short or indistinct stipe and rounded apex; beak very short but broad; surface papillate, light olivaceous; length 1.4—1.7 mm ...... **C. dioica** L. (5 *D*)

63\. Nutlet broadest below the middle, with a short stipe and tapering towards the top into a short but distinct beak; surface small-papillate, light red-brown; length 1.3—1.8 mm .... **C. remota** L. (5 *K*)
Nutlet broadest at or a little above the middle 64

64\. Beak distinct, thick; stipe lacking; faces elliptic with distinct edge lines and indistinct longitudinal furrows; surface very small-papillate, dark chestnut-brown; length 1.9—2.3 mm .... **C. acutiformis** Ehrh., distigmatic type (6 *F*).
Beak very short or indiscernible 65

65\. Faces equally elliptic, broadly rounded above, with almost equally rounded base; stipe lacking; surface slightly verrucose, almost smooth, slightly lustrous, light yellowish brown; length 1.5—1.7 mm .... **C. loliacea** L. (5 *J*)
Nutlet with a short stipe-like base, above this the faces ovate, tapering towards the top 66

66\. Nutlet ca. 1.5 (1.3—1.6) mm long, 0.8—1.0 mm broad, with a narrow and short stipe and comparatively sharp edges; a very short beak may be present; surface finely papillate, red-brown .... **C. canescens** L. (5 *G*)
Nutlet more short and broad, 1.2—1.6 mm long, 0.8—1.2 mm broad; stipe broader and less distinct; edges somewhat rounded; beak only represented by a low callus; surface low-verruculose to almost smooth, brown, somewhat lustrous .... **C. brunnescens** (Pers.) Poir. (5 *H*)

67\. Nutlet of small or middle size, generally 1.5—2 mm long, 0.8—1.4 mm broad, with the inner side cut off at the base 68
Nutlet rather large, length generally about 2—2.5 mm, breadth 1.3—2.3 mm; both faces convex, without basal depression, large-verrucose . . . 72

68\. Faces of the nutlet rhombic-ovate or rhombic-elliptic, with a distinct basal depression at the inner side 69
Faces less distinctly rhombic-ovate or somewhat oblong-ovate; nutlet rather thin with less distinct depression at the inner side 70

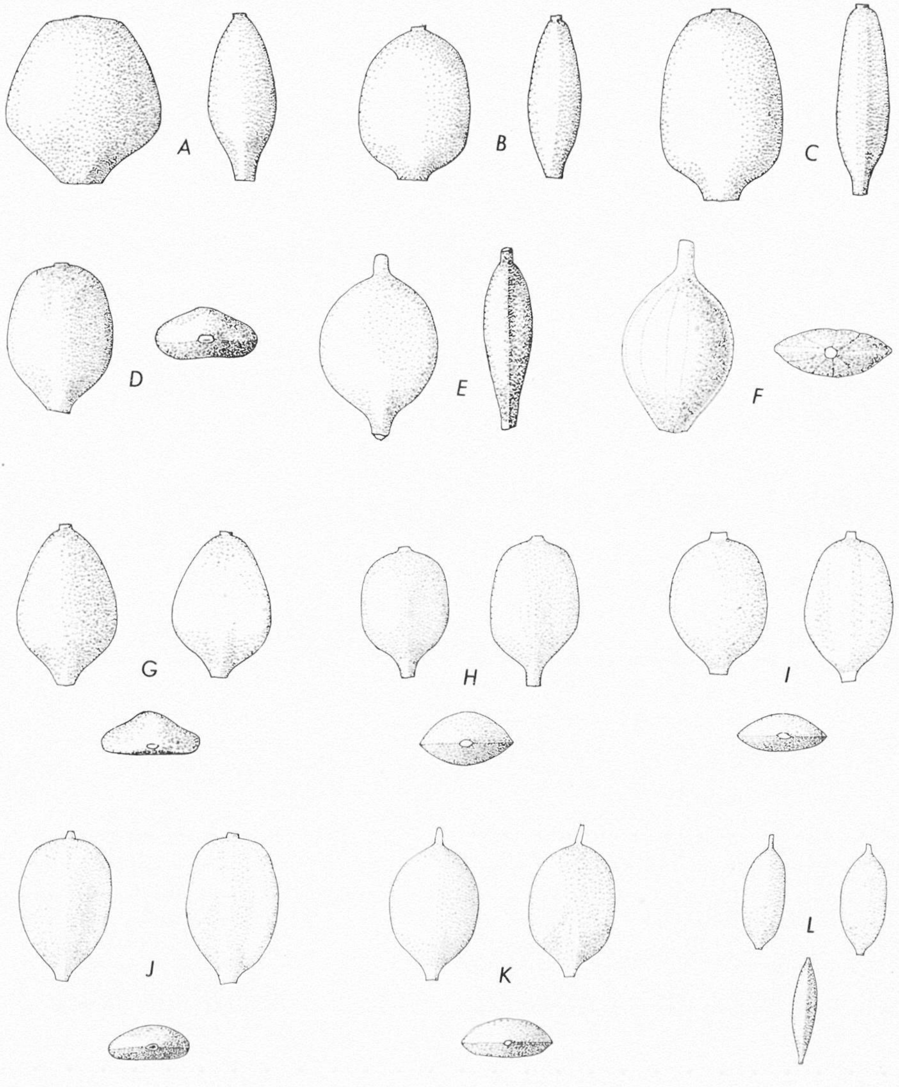

Fig. 6. Nutlets of **A:** *C. spicata*, Sm, Nydala, H. Hjelmqvist 1941. — **B:** *C. pairaei*, Sm, Nydala, H. Hjelmqvist 1941. — **C:** *C. divulsa*, Sk, Lomma, C. Blom 1932. — **D:** *C. vulpina*, Öl, Köping, C. Sandberg 1931. — **E:** *C. otrubae*, Öl, Vickleby, O. Köhler 1923. — **F:** *C. acutiformis*, distigmatic form, Sk, Vitaby, Ö. Nilsson 1963. — **G:** *C. echinata*, Sk, Lomma, G. Norrman 1935. — **H:** *C. arenaria*, Sk, Lund, H. Hjelmqvist 1967. — **I:** *C. ligerica*, Öl, Ventlinge, Parboäng, I. Lagercrantz 1890. — **J:** *C. disticha*, Sk, Krageholm, Tullberg & Sjödahl 1868. — **K:** *C. leporina*, Sk, Rynge, C. Kurck 1900. — **L:** *C. bohemica*, Czecho-Slovakia, Bohemia, Jindřichův Hradec, Chrtek & Kŕísa 1964. — ×10.

69. Stipe indistinct or lacking; a short but very broad beak structure at the top; the inner side sharply cut off at the base; surface with broad and low papillae, light brown; length 1.5—1.8 mm. **C. davalliana** SM. (5 *E*)
Nutlet broadest at or a little below the middle, tapering downwards into a stipe; the inner face with a basal depression and a strongly convex upper part; apex square but narrow; the inner side sometimes ridged; surface papillate, dark brown; length 1.5—1.7 mm. **C. paniculata** L. (5 *O*)

70. Outline broadly ovate—rhombic-ovate, margins strongly convergent towards the rounded apex; the inner side somewhat flattened, cut off at the base; nutlet short-stipitate; surface finely papillate, brown-olivaceous, somewhat lustrous; length 1.4—2.1 mm. **C. echinata** MURR. (6 *G*)
Faces indistinctly rhombic-ovate to oblong-ovate with a rather broad apex 71

71. Faces rather narrow in the lower part, with a square apex; stipe indistinct; surface small-verruculose, olivaceous, dull; length 1.5—1.7 mm . . . . **C. elongata** L. (5 *L*)
Faces with somewhat more rounded margins; stipe short but generally distinct; the inner side only little bent; surface rather large-verrucose, orange-brown, somewhat lustrous; length 1.6—2.3 mm . . . . **C. ligerica** J. GAY (6 *I*)

72. Nutlet of moderate size, 1.3—1.5 mm broad, 1.6—2.3 mm long; beak very short or lacking; surface light olivaceous-brown with large verrucae, distinctly oblong in transverse section . . . . **C. vulpina** L. (6 *D*)
Nutlet big and broad, (1.4—) 1.5—2.3 mm broad, dark olivaceous-brown; surface with large, pointed verrucae, in transverse section orbiculate 73

73. Faces roundedly rhombic or rather pentagonous, the apex being square and broad; stipe indistinct and beak only present as a low callus; length 2.0—2.5, breadth 1.7—2.3 mm . . . . **C. spicata** HUDS. (6 *A*)
Outline of the faces more rounded, not distinctly rhombic 74

74. Nutlet more short and broad, 1.7—2.5 mm long and (1.4—) 1.5—2.0 mm broad; a very short stipe present; a low callus at the top of the nutlet . . . . **C. pairaei** F. SCHULTZ (6 *B*)
Nutlet longer and of more elongate shape, 2.4—2.8 mm long and 1.8—2.2 mm broad; beak sometimes undeveloped, sometimes forming a low point; stipe short or indistinct . . . . **C. divulsa** STOKES ap. WITH. ssp. **leersii** (A. & G.) W. KOCH (6 *C*)

75. Nutlet with a distinct beak and generally a short stipe 76
Beak very short or lacking, not longer than broad 78

76. Nutlet generally with a short stipe, above the stipe with regularly curved margins; beak longer or shorter; faces elliptic to obovate; black brown; length 1.3—1.7 mm . . . . **C. aquatilis** WG (4 *C*)
Nutlet ± oblong, reddish brown 77

77. Faces elliptic-oblong to ovate-oblong; orange-brown; length 1.6—1.8 mm, breadth 1.0—1.3 mm .... **C. leporina** L. (6 *K*)
Faces oblong; dark red-brown; length 1.3—1.4 mm, breadth 0.5—0.6 mm .... **C. bohemica** SCHREB. (6 *L*)

78. Faces ovate, with equally curved margins; apex rounded; stipe lacking; surface brown; length 1.6—2.0 mm .... **C. disperma** DEW. (5 *I*)
Nutlet with a short, ± distinct stipe, broad apex and the margins less curved in the middle part 79

79. Margins rather distinctly angular, slightly convergent towards the broad and square apex; both faces strongly convex; stipe rather distinct; brown—brown-black; length 1.5—2.0 mm .... **C. arenaria** L. (6 *H*)
Similar to the preceding but usually with somewhat more rounded margins and apex; the inner side somewhat flattened; stipe less distinct; surface dark brown, often longitudinally furrowed; length (1.5—)1.8—2.2 mm .... **C. disticha** HUDS. (6 *J*)

DISCUSSION

The nutlet provides several useful characters for the taxonomy of the species in this genus. The shape, size, colour, and other characters of the nutlet have proved to be rather stable even in otherwise variable species. However, there are a few species which have a considerable variation of the nutlet. This variation is often most pronounced in species which have a wide ecological and geographical differentiation within Scandinavia. The most variable character is usually the size and beak length while the shape, colour and surface texture are more stable.

It has been possible to distinguish definitely the nutlets of most of the species investigated. In a few cases such great similarities occur and the differences are so subtle between the nutlets that a certain determination of the species may be difficult.

It is also evident that the nutlet characters may be valuable in the taxonomical treatment of the sections or some groups of species, in and between which the relationship is uncertain. In most sections the species have usually a certain nutlet type in common. But especially in the large sections there may be some species which diverge from the others in nutlet type.

Tristigmatic Species

In the group of 'tristigmatic' *Carices* with ± trigonous nutlets 38 species have been examined. HYLANDER (1966) arranged these species into fourteen sections and his arrangement is followed here. The sections are not always related and thus the species sequence followed is often arbitrary. Some of the large sections seem to be artificial.

Two species belong to the subgenus *Primocarex* KÜKENTH., viz., *C. obtusata* and *pauciflora*. The remainder belongs to the subgenus *Carex* (*Eucarex*). Four sections contain more than two species.

In this group of *Carices* the nutlet usually does not fill up the utricle entirely. An exception constitute the sections *Montanae* and *Digitatae* where the 'resistent' utricle firmly encloses the nutlet. This difference may have an ecological and biological reason in regard to diverging types of dispersal of the entire fruit. The beak is in some species long and thin and thus it can be easily broken at different points and become somewhat shorter than it was originally. The limit between the beak and the style-continuation is usually sharp and there the breakage regularly occurs. The 'soft style part' is usually green-brown, papillate and shrinks when the fruit is ripe, while the beak forms an extension of the apical part of the nut.

Usually the 'tristigmatic' *Carice*s have trigonous nutlets, but in most species occasionally some tetragonous nutlets occur together with the trigonous ones. Very occasionally biconvex nutlets have been found, only in *C. riparia, vesicaria* and *acutiformis*. In the two first-mentioned it is an occasional occurrence but in *C. acutiformis* all nutlets of certain collections (from, e.g., E. Scania) have this shape.

In the section *Paniceae* CAREY the four species have several nutlet characters in common; e.g., a rather short, stout, and distinct beak and usually distinct, broad angle lines. *C. vaginata* and *livida* have oval—narrowly obovate nutlets with a light colour. *C. panicea* and *flacca* have broader nutlets and the colour is darker. The nutlets of the three first-mentioned species have almost smooth faces while they are pointedly papillose in *C. flacca*. In this species the beak is slightly bent at the base and the nutlet is often ± distinctly stipitate. *C. flacca* has often been separated from the other species and referred to the section *Trachychlaenae* DREJER.

Regarding the nutlet characters the section *Montanae* FR. is heterogeneous. Apart from the dark colour most of the species have no character in common. The two most divergent species are *C. caryophyllea* and *montana*.

C. globularis and *tomentosa* form a group of their own with similar nutlets. The nutlet faces are only slightly convex and smooth, and the beak is usually distinct. By KÜKENTHAL (1909) they were treated in a particular section, *Pachystylae* KÜKENTH., together with *C. pallescens*. The nutlet of the last species has the same shape and a similar beak as the preceding group but the faces are pointedly papillose and the colour lighter.

C. ericetorum and *pilulifera* constitute another group with similar nutlets, characterized by broadly obovate and very convex faces. The angles are keeled and the beak is lacking. Sometimes it may be difficult to distinguish the nutlets of the two species, but the nutlet of *C. pilulifera* has always distinct angle lines and the faces are pointedly papillose. Somewhat connected with these two is perhaps *C. caryophyllea* by the very convex nut faces and the keeled angles. However, it differs much in the nutlet shape and in the peculiar white collar surrounding the style base. It was placed in a separate section, *Mitratae* KÜKENTH., by KÜKENTHAL.

The most obvious differences in the nutlet are found in *C. montana*. It was placed in the same section, *Montanae* s. str., as *C. ericetorum* and *pilulifera* by the last-mentioned author. This treatment is not supported by the nutlet characters. The nutlet is provided with a long, coarse, spongy stipe and a rather long beak. The faces are ovate and concave. Regarding the stipe *C. montana* shows some similarities with the two species of the section *Digitatae* FR. In these the stipe is always curved and the beak is diminutive, however.

The eight species of the section *Extensae* FR. form a rather uniform group concerning the nutlet. Two extreme nutlet types may be distinguished. One may be represented by *C. lepidocarpa*. It is distinguished by small, dark nutlets with usually cuneiform, slightly convex faces, a short but distinct beak, and narrow angle lines. The second is found in *C. extensa*. It is characterized by larger, pale nutlets with oval, almost flat or slightly concave faces, a lacking beak, and broad, distinct angle lines.

Nutlets of the first type occur in *C. lepidocarpa, oederi, tumidicarpa,* and *flava,* and to some degree also in *C. hostiana*. Rather similar to the *C. extensa* type are the nutlets of *C. distans,* especially in shape and size, the very short beak, and the broad angle lines. The nutlet is broader and much darker, however. An almost intermediate position is occupied by the nutlet of *C. punctata*. In shape it is similar to that of *C. extensa* but by the presence of a short beak, smaller size, darker colour, and narrow, indistinct angle lines it resembles, e.g., *C. hostiana*. In taxonomical treatments *C. extensa* is often connected with the first group of species while *C. distans, punctata*, and *hostiana* are regarded as related.

The section *Paludosae* FR. was interpreted by HYLANDER in a broad sense. It was divided by KÜKENTHAL into four sections; *Pseudo-cyperae* TUCKERM. (*C. pseudocyperus*), *Physocarpae* DREJER (*C. vesicaria, rostrata*), *Paludosae* s. str. (*C. riparia, acutiformis*) and *Hirtae* TUCKERM. (*C. hirta, lasiocarpa*). In regard to the nutlets the section *Paludosae* s. lat. is heterogeneous, but some of the species may be grouped after nutlet similarity. The nutlets of *C. hirta* and *lasiocarpa* are alike. Both have large, pale, distinctly stipitate nutlets with obovate, slightly convex, papillose faces. The angle lines are lacking or very indistinct. The nutlets are provided with a rather short, coarse, curved, and somewhat twisted beak. Closely similar are the nutlets of *C. riparia.* They are also large and pale, without angle lines, and distinctly stipitate, and have a similar beak. However, they are somewhat different in shape and in having concave faces.

C. rostrata and *vesicaria* have a curved and twisted beak in common with the three preceding species. However, they form a distinct group characterized by smaller and darker, never distinctly stipitate nutlets with broadly obovate—cuneiform almost flat faces. The beak is long and slender. It is often difficult to distinguish the nutlets of the two species. The nutlet faces of *C. vesicaria* are pointedly papillose and the angle lines always indistinct and sometimes there is a short but usually indistinct stipe.

C. acutiformis has often been regarded as closely related to *C. riparia* but the nutlets do not support this assumption. The nutlet is very different from that of *C. riparia,* and also from the other species of the section. It is sharply trigonous with concave, furrowed, oval faces, and dark with distinct angle lines. Two important differences are the lacking stipe and the erect, straight beak.

Evidently distinguished from the other species in the section is also the nutlet of *C. pseudocyperus.* It is comparatively small and light with marked angle lines, and almost flat, oval faces. The nutlet lacks a stipe and has a very long, thin, straight beak, often slightly bent at the base. In shape the nutlet resembles somewhat that of *C. acutiformis,* and the beak has some similarities to that of *C. vesicaria* and *rostrata.*

The division of the section *Paludosae* s. lat. that was proposed by KÜKENTHAL does not either seem to be entirely satisfactory if the nutlet differences of the species are regarded. The obvious divergences between *C. riparia* and *acutiformis* and the similarities between *C. riparia* and *C. hirta* and *lasiocarpa* have to be considered. The two last-mentioned species (sect. *Hirtae*) were separated by CLAPHAM *et al.* (1952) from the other species and placed in a near connection to the section *Montanae*. However, there are no similarities in the nutlets of these two sections, and thus this taxonomic transposition is not supported by the nutlet characters.

Of the small sections, *Digitatae* has been mentioned previously because of the similarities in the stipe to *C. montana*. The two species *C. digitata* and *ornithopoda* have similar nutlets, which are easily distinguished by their shape and size and by the length of the stipe.

C. limosa and *magellanica,* section *Limosae* CAREY, have a particular nutlet type, easily recognized by a long, straight beak. The two species can be distinguished by the shape and the size of the nutlets. These are slightly compressed and in this character they resemble *C. hartmanii* and *buxbaumii,* section *Atratae* CAREY. But in these species the beak is very short and the nutlet is very dark with distinct angle lines. *C. hartmanii* can be distinguished from *C. buxbaumii* by the smaller nutlets with ± parallel face margins and a longer beak, often somewhat bent at the base; a character in common with *C. flacca.* This section shows some other nutlet characters which also are in common with the section *Paniceae.*

The two species *C. pendula* and *strigosa* have rather similar nutlets. They are in both distinctly stipitate and have a rather short beak and almost the same shape. *C. strigosa* is distinguished by the somewhat narrower and lighter and densely papillose nutlet faces.

The similarities in the size, shape and colour of the nutlets of *C. extensa* and *silvatica* may also be mentioned. The last species has indistinct very narrow angle lines and a distinct but short beak which makes the distinction between the species easy.

Distigmatic Species

Within the section *Carex* (=*Acutae* FR.) two species, *C. paleacea* and *C. vacillans,* are sharply distinguished from all other species by the occurrence of a transverse fold on the nutlet and an oblique beak. Also the other species have, however, on the whole a particular nutlet type: a comparatively short and broad nutlet with rounded margins, shortly obovate or orbicular faces, and a distinct thin beak that shows a gradual transition to the nutlet, giving it a bottle-like appearance. Sometimes, however, the nutlet may be more square at the top, as observed in some cases in *C. aquatilis* and *C. elata* (Fig. 4 *D,* to the right). Most of the species are also characterized by a very broad nutlet base. Between the different species of the section the distinguishing features are however often small. Besides the two species with transversely folded nutlet there is only one, *C. aquatilis*, that shows a more marked difference form the others, having a smooth, strongly lustrous nutlet without papillae. In this it shows a resemblance to *C. paleacea* and other species of the subsection *Cryptocarpae* TUCKERM., in the same way as it in some other characters shows similarities to this group (HJELMQVIST & NYHOLM, 1947). On the other hand, *C. vacillans* has a ± papillate nutlet, which is in agreement with the theory that it is a hybridogenous species arisen through hybridization between *C. paleacea* and *C. nigra.*

The five remaining species of section *Carex* show rather great similarities in nutlet structure, but a good help for their distinction is obtained from the characters of the nutlet surface. *C. caespitosa* and *C. elata* have finely papillate nutlets, especially the first-mentioned, whereas in *C. acuta* and *C. nigra* the nutlet wall has broad and rounded papillae, about half as broad as the epidermis cell. *C. trinervis* finally has very broad verrucae on the surface, which are formed by the entire convex outer wall of the epidermis cells, thus obviously differing from the other species. *C. caespitosa* and *C. elata* are sometimes of similar nutlet shape, but may distinguished by the narrower nutlet base of *C. caespitosa. C. acuta,* on the other hand, is often similar to *C. nigra* when it has more short and rounded nutlets; in general there is, however, the difference that the nutlet of the former is somewhat more obovate and has more rounded edges.

……

The two closely related species *C. canescens* and *C. brunnescens* show great similarities as regards the nutlet, but that of *C. brunnescens* is shorter and broader and has an indistinct stipe part. A clear difference is present in the surface structure: in *C. canescens* the nutlet is finely papillate and dull, in *C. brunnescens* the papillae are lacking and the surface is slightly verrucose to almost smooth, somewhat lustrous and also more purely brown in colour when the nutlet is ripe. The two subspecies of *C. brunnescens,* ssp. *brunnescens* and ssp. *vitilis* (FR. em. BL.) KALELA, show a certain difference in the shape of the nutlet, as has already been indicated by KALELA (1965). Judging from material from different parts of Sweden, the nutlet of ssp. *brunnescens* is on the whole somewhat shorter and broader in relation to the length and the stipe is more indistinct, whereas in ssp. *vitilis* the nutlet is somewhat longer and the stipe a little more distinct. The differences between the subspecies are however small, and both show a certain variation; measurements of some twenty samples gave a length of 1.2—1.5 mm for ssp. *brunnescens* and 1.3—1.6 mm for ssp. *vitilis*. It is of interest that ssp. *vitilis* in the shape of the nutlet approaches *C. canescens* a little; however, in the somewhat lustrous, purely brown surface without papillae it is clearly different from this species.

The species *C. paniculata, C. diandra,* and *C. appropinquata,* belonging to sect. *Paniculatae* (KUNTH) CAREY have a special nutlet type, ± turbinate or pyriform, almost orbicular in transverse section, with a depression at the base of the inner side, corresponding to a thickening of the utricle wall. In *C. paniculata* the faces of the nutlet are somewhat flattened, but also here the thickness is considerable and the similarity to the two other species is evident. However, the differences between the species are also clear, as is seen from the key and the illustrations. Also in the surface structure there are obvious divergences between the species: *C. diandra* has a finely papillose nutlet, with thin and pointed papillae, *C. paniculata* has low and obtuse papillae, and in *C. appropinquata* the nutlet is verrucose.

The three species that belong to sect. *Muehlenbergianae* TUCKERM., *C. spicata, pairaei,* and *divulsa,* are also of a special type as to the nutlet structure: the large and broad, at either side equally developed nutlet with short or lacking beak and verrucose surface distinguishes them from other species. In their typical form the species may be distinguished by the shape of the nutlet, as was already shown to some extent from the illustrations of SAMUELSSON (1933): *C. spicata* has a more angular nut face, broadly rhombic-ovate or almost pentangular, whereas it is more rounded in outline in the two other species and in *C. divulsa* longer and more elongate than in *C. pairaei*. However, the differences between the species are not great and, as a certain variation also occurs within each of them, a distinction may sometimes be difficult. There are no differences in the surface structure either: all species have pointed verrucae, and the colour is the same.

SAMUELSSON (l.c. 1933) distinguishes between two geographical races of *C. pairaei*, which by HYLANDER (1966) are regarded as subspecies, ssp. *pairaei* and ssp. *borealis* HYL. These agree on the whole in the nutlet characters, only the nutlet in ssp. *borealis* is in general apparently a little bigger than in ssp. *pairaei*, in some investigated specimens 2.2—2.5 mm long, compared to 1.7—2.2 in ssp. *pairaei*.

The two related species *C. vulpina* and *C. otrubae* show clear differences in the nutlet structure. On one hand the nutlet of *C. otrubae* has a well-developed stipe and is, when the stipe is disregarded, almost orbicular in shape, whereas in *C. vulpina* the nutlet face is ovate, with indistinct stipe and short of lacking beak. On the other hand the surface is in *C. otrubae* verrucose with low, conical verrucae, whereas *C. vulpina* has verrucae which are distinctly oblong in cross section. Besides the differences in surface structure of the utricle first shown by SAMUELSSON (1922), there are thus also clear differences in the shape and surface texture of the nutlet.

The four species *C. arenaria, C. disticha, C. leporina,* and *C. bohemica,* which belong to three different sections but no doubt are somewhat related to one another, show great agreements in the nut characters. All have strongly lustrous nutlets with ± smooth surface (when ripe), and also in the nutlet shape there is a considerable similarity between the species. They all have a certain tendency to oblong nutlet shape, i.e., the margins are not equally curved but tend to be ± parallel in the middle of the nutlet. Especially *C. arenaria* and *C. disticha* have a very similar nutlet shape; *C. disticha* has only a less distinct stipe and a little more curved margins, also a more flattened nutlet. *C. leporina* has also a similar shape, only still more rounded, but differs in the distinct beak. The latter is moreover true of *C. bohemica,* which is also distinguished by the small size of the nutlet and the more pronounced oblong shape.

C. ligerica, which is closely related to *C. arenaria,* differs from this and the other species just mentioned by the duller surface of the nutlet, which is verrucose and only slightly lustrous. In the nutlet shape it agrees very closely with *C. arenaria,* the only difference being that the nutlet is not quite as broad at the apex and the margins are consequently a little more convergent and rounded in their upper part.

CONCLUSIONS

The taxonomical value of the nutlet characters should not be overemphasized. They must be considered in relation to all other characters available. However, as has been shown above, the nutlets can give some taxonomical intimations worth considering. The obvious divergences between the species in the sections *Montanae* and *Paludosae* s. lat. and the similarities between the species in *Paniceae, Atratae, Limosae, Paniculatae,* and *Muehlenbergianae* are notable. The nutlet characters also give support to the affinity between the species in the *C. flava* group and also its relationship to the *C. hostiana* group, and between *C. hirta* and *lasiocarpa* (possibly also *C. riparia*) as well as between *C. rostrata* and *vesicaria*. Furthermore, it is of interest to notice the similarities in nutlet structure between the sections *Arenariae, Ovales,* and *Cyperoideae*. On the other hand, the differences between the nutlets of *C. aquatilis* and those of *C. nigra* and related species give support to the view that *C. aquatilis* is not so closely related to this group. It must, however, also be kept in mind that there are similarities in nutlet structure between, e.g., *C. silvatica* and *C. extensa*, two species that are not considered to be very closely related. Thus the nut structure — as all other morphological characters — must of course not be used as a sole deciding factor, but considered in relation to the total morphology of the species it may give some contributions of importance.

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Brief Articles and Reports

Addendum to "Studies in the Aegean Flora XII"

In "Studies in the Aegean Flora XII. Cytologic and Morphologic Investigations in Centaurea" (Bot. Notiser 1967 p. 161—176), the new combination *Centaurea raphanina* S. & S. ssp. *mixta* (DC.) RUN. was published. In the reference to the basionym the page of the original publication was unfortunately omitted. In order to validate the combination full reference is given below.

Centaurea raphanina SIBTHORP & SMITH (Florae graecae prodromus II p. 205. — Londini 1813) ssp. *mixta* (DC.) comb. nov.
Basionym: *Centaurea mixta* A. P. DE CANDOLLE, Prodromus systematis naturalis regni vegetabilis VI p. 594. — Parisiis 1837.
The author of *Centaurea raphanina* is deliberately cited as SIBTHORP & SMITH.

In Taxon (1967 p. 168—178) STEARN makes a very valuable and thorough analysis of Prodromus florae graecae and Flora graeca by SIBTHORP and SMITH. He clearly shows that the Prodromus was prepared entirely by SMITH. In Flora graeca SMITH (vol. 1 — vol. 7 part 1) and LINDLEY (vol. 7 part 2 — vol. 10) were wholly responsible for the text and the new names. As a consequence STEARN declares that the new names should not be attributed to SIBTHORP & SMITH but to SMITH and LINDLEY, respectively.

In my opinion the citation of authors names is solely justified as a means for technical precision. Thus the authors' names are necessary (1) to make it possible to separate homonyms and (2) to give at least some indication of the original publication.

In the actual cases the citation of SIBTHORP & SMITH is much to prefer compared to SMITH or LINDLEY, as it clearly shows that the taxon was described either in Prodromus florae graecae or in Flora graeca. A botanist must have a comparatively good knowledge of the literature to realise that, e.g., *Centaurea raphanina* "SM." and *Amygdalus graeca* "LINDLEY" were described in the Prodromus and Flora graeca, respectively. The titlepage of both these publications give the authors SIBTHORP & SMITH, which are also cited as authors in bibliographies and in Index kewensis.

HANS RUNEMARK

Astragalus arenarius L. (Leguminosae), 2n = 16

Astragalus arenarius L. occurs in several places between Simrishamn and Åhus in the E. parts of the province of Scania in S. Sweden, but it is not stationary in other provinces of Sweden or in Denmark. It grows on sandy, but relatively rich, substrate and usually near the sea. In the place where the investigated material was collected, halfway between Vitemölla and Kivik, it is relatively common, especially in a transitional zone between the sand hills [dominated by *Thymus serpyllum* L., *Dianthus arenarius* L., *Festuca polesica* Zapal., *Koeleria glauca* (Schrad.) DC., etc.] and the stony shore. It grows together with, e.g., *Vicia cracca* L. and *Trifolium striatum* L.

Seeds were collected and the resulting seedlings are kept in greenhouse cultivation in Lund. Root-tip fixation was made with Navashin-Karpechenko and the staining made with crystal violet with aniline.

Fig. 1.

The chromosome number 2n=16, of *Astragalus arenarius* (Fig. 1) does not seem to be recorded previously. The somatic diploid number of 16 is known from many other species of the genus, like *A. glycyphyllus* L., *frigidus* (L.) A. Gray, and *danicus* Retz., whereas *A. alpinus* L. may be diploid as well as tetraploid. (See Löve & Löve 1961, Chromosome numbers of Central and NW. European species, p. 230.) Also hexa- and octoploid species are known in the genus.

Rolf Dahlgren

Seseli libanotis (L.) Koch (Umbelliferae) Refound in Scania (South Sweden)

Seseli libanotis (L.) Koch was found this summer at Dalaled in the parish of Örsjö in the province of Scania. The locality is situated in the immediate vincinity of a gravel pit. The vegetation may be described as a dry meadow. Several of the species observed on the place are such which often seem to occur on waste places influenced by culture. Only one single individual was observed although the surroundings were carefully searched through. Possibly the original locality is destroyed by digging in connection with the pit or it may be an occasional occurrence.

The species has been regarded as probably extinct in Scania (cf. H. Weimarck, Skånes Flora, 1963). Previously it has occurred in two localities in this province, viz., in the parishes of Öved and S. Sandby. It was collected the last time at Linnebjer (S. Sandby) in 1880 by N. Hj. Nilsson (LD). The closest localities for this species outside Scania are found on Sealand in Denmark, and within SE. Sweden in N. Småland and on Öland, where it is rather common.

Örjan Nilsson

Ett fynd av Orobanche minor Sm. i Skåne

(Orobanche minor Sm. Discovered in the Province of Scania, South Sweden)

ABSTRACT. — *Orobanche minor* Sm., not known from Sweden previously, was discovered by L. Jeppsson on a clover field in the parish of Håslöv, Scania, South Sweden. Within Scandinavia the species is also known from Møen and S. Sealand, Denmark.

Fyra arter av *Orobanche* är sedan länge kända från Sverige. *O. reticulata* (tistelsnyltrot) växer i Västergötland, *O. alba* (timjansnyltrot) förekommer på Öland och Gotland, medan *O. purpurea* (rölliksnyltrot) har sina enda svenska förekomster på Öland. *O. major* (klintsnyltrot) finns på flera lokaler i västra och sydvästra Skåne. I början av förra seklet växte *O. picridis* på Hallands Väderö men har senare inte återfunnits där.

Hösten 1962 påträffade jag ett vissnat exemplar av *Orobanche* på en vägren i Håslöv. Den växte tillsammans med bl.a. *Centaurea scabiosa, O. majors* värdväxt. Exemplaret avvek inte till det yttre från *O. major*. Eftersom den sistnämnda arten är fridlyst, kunde jag inte undersöka det påträffade exemplaret närmare, och beläggmaterial samlades givetvis inte heller. Därefter har jag varje år bevakat lokalen för att se, om det endast var fråga om en tillfällig förekomst.

I somras upptäckte jag, att ute på fältet, där man i år odlade klöver, på andra sidan av ovannämnda vägren, växte tusentals exemplar av en *Orobanche*-art, vilken senare identifierades med *O. minor*, som är parasit på *Trifolium*-arter.

De flesta exemplaren av arten på fyndplatsen var större och grövre än vad beskrivningarna lämnar besked om. Förklaringen är förmodligen att den kraftigt gödslade klövern erbjöd bättre betingelser än dem som arten normalt lever under. Markägaren berättade, att klöver odlats på samma fält även sommaren 1962, och att arten också då förekommit tillsammans med klöver men bara på ett område av fältet intill vägrenen några hundra meter från den plats, där jag på hösten samma år fann ett exemplar av *Orobanche*. Arten växte i år tätast på detta område och glesare längre bort på fältet. Enstaka exemplar förekom 500 m från nämnda område. Markägaren uppgav att arten inte vållade någon märkbar skada på klövern, vilken odlades för fröets skull.

Närmaste fynd av *O. minor* härstammar från Syd-Själland och Møen. Därifrån har arten sannolikt spridits till Håslöv senast sedan 1960. Avståndet mellan den svenska lokalen och lokalerna på den danska sidan är inte mer än åtta mil. Fröna är talrika och stoftfina och den nyligen upptäckta lokalen ligger i den förhärskande vindriktningen, faktorer som underlättar en spridning. Från vägrenen har den spritt sig ut på fältet att döma av artens starka koncentration mot den delen av fältet, en koncentration som var ännu större 1962. Att arten skulle ha medföljt utsädet anser jag vara mindre sannolikt.

Vägrenen utgörs av en vägskärning på ungefär en halv meter samt ett grunt dike. Floran på vägrenen är relativt artrik, och i somras växte där fyra à fem exemplar av *O. minor*. Arten återkommer kanske med enstaka exemplar där, men massförekomst är endast att vänta de år då klöver odlas på fältet.

Åtgärder för fridlysning har inte vidtagits ännu. Min förhoppning är, att dylika inte skall behöva vidtagas.

LENNART JEPPSSON

Carex appropinquata × otrubae funnen i Skåne

(Carex appropinquata Schum. × C. otrubae Podp. Found in Scania, South Sweden)

ABSTRACT. — Two tufts of *Carex appropinquata* SCHUM.×*C. otrubae* PODP. are reported from Klagshamn, S. of Malmö in the province of Scania, South Sweden.

I våtängsmarkerna omedelbart norr om gamla cementfabriken i Klagshamn står *Carex otrubae*-tuvorna ställvis mycket tätt. I den västligaste och våtaste delen av området finns täta vassar av *Phragmites communis, Scirpus maritimus* och *Schoenoplectus tabernaemontani*. Mellan den västliga *Scirpus-Phragmites*-vassen och det östliga *Carex otrubae*-beståndet finns ett lågstarrområde med stora, från varandra tydligt urskiljbara kloner av *C. nigra*, av vilka vissa är tuvbildande.

Bland *C. otrubae*-tuvorna i den nordöstra och torrare delen av ängen finns några stora tuvor *C. spicata*. Dessa bli här mycket långstråiga och har långt utdragna axsamlingar. På torrmarkerna öster om ängen och bort emot kalkbrottssjön växer *Inula salicina* i stora bestånd. Väster om denna sjö blommar i början av juli tiotusentals *Dactylorhiza incarnata*. Det var här som HELGE RICKMAN 1963 hittade *Carex tomentosa* (Bot. Notiser 1963, häfte 4). Han nämner dessutom *C. hartmanii, hirta* och *hostiana*.

I min anteckningsbok från juni 1966 har jag antecknat följande *Carex*-arter från området: *appropinquata, caryophyllea, distans, extensa, flacca, hirta, hostiana, nigra, otrubae, panicea, pilulifera, spicata* och *tomentosa*.

I det östliga *C. otrubae*-området hittar man enstaka *C. appropinquata*-tuvor. De äro lättast att se före midsommar, innan *C. otrubae* hunnit bli så hög. Före midsommar 1966 fann jag två tuvor som i utseende avvek från den förhärskande *C. otrubae*. Vid en undersökning av lågbladsslidorna, visade de många karaktärer gemensamma med *C. appropinquata*. Strånas höjd och grovlek och bladens bredd var tydligt intermediära mellan *C. appropinquata* och *C. otrubae*. Axsamlingen var hos den ena tuvan tät och klubblik som hos *C. otrubae,* hos den andra tuvan var axsamlingen mer utdragen och glesare. Hos båda tuvorna var fruktgömmena tomma, vilket tyder på fullständig sterilitet. Avståndet mellan tuvorna är minst 10 m, varför de sannolikt representerar skilda individ. Detta styrks också av deras olika utseende.

På grund av att området ständigt varit mer eler mindre under omvandling sedan sekelskiftet, kan man ungefärligen rekonstruera vad som har hänt vegetationen på platsen.

I våtängen finns ett par diken, som är mer eller mindre igenvuxna med *C. otrubae* och *Scirpus maritimus*. Dessa diken äro ungefär lika stora och har samma sträckning som dikena på de »orörda» strandängarna norr om utfyllnaden. Då dessa diken dessutom, så vitt jag kan se, inte har någon funktion numera, tror jag de är kvar efter ett större sammanhängande dikat strandängsområde.

När driften vid cementfabriken intensifierades i början av seklet, lade man ut fyllningsmassor till såväl vägbanken som järnvägen ut till hamnen. Mellan dessa båda vallar och den utfyllda landtungan i väster och kalkbrottet i öster, blev en liten isolerad ängsbit kvar. Den blev efter hand försumpad genom att dikena inte längre hade något avlopp. *C. otrubae* fanns troligen i dikena före utfyllnaden, liksom den ännu gör på ängarna norr om utfyllnaden, och kunde ganska snart börja invadera området. Då någon egentlig betesgång inte bedrivits på ängen de senaste femtio åren, har en igenväxning av ovan beskrivna arter kunnat fortskrida obehindrat. *Phragmites-, Scirpus maritimus-* och *Schoenoplectus tabernaemontani*-vassen i väster är troligen också en rest av den gamla strandvegetationen. Norr om utfyllnaden har strandvassarna samma artsammansättning.

Belägg av de båda hybriderna finns på Botaniska Muséet i Lund. Dessutom finns levande plantor i Lunds botaniska trädgård, samt vid parkdammen vid Fredriksbergs gård, Malmö.

(Nomenklatur enligt HYLANDER, Nordisk kärlväxtflora 1966, och WEIMARCK, Skånes flora 1963.)

JOHN KRAFT

Nytt fynd av Coeloglossum viride (L.) Hartm. i Skåne

(A New Record of Coeloglossum viride (L.) Hartm. from Scania, South Sweden)

ABSTRACT. — *Coeloglossum viride* (L.) HARTM. (*Orchidaceae*) is reported from near Björka, in the parish of Glostorp, Scania, South Sweden.

Då jag den 24 juni 1967 letade efter *Orchis ustulata* på den lilla kullen som ligger 600 m s.ö. Björka i Glostorps socken (kullen kallas av ortsbefolkningen för Lilla Smörstack) i Skåne, hittade jag fem exemplar av *Coeloglos-*

sum viride på en yta av knappt en kvm. *Orchis ustulata* hittades av LENNART JEPPSSON på kullens NÖ brant, när han 1962 inventerade området. Sedan jag funnit *Coeloglossum* sökte jag intensivt utan att kunna finna några fler exemplar. Då kullen ännu inte börjat betas, var vegetationen ganska hög, varför små, oansenliga växter var svåra att se.

Under sökandet återfann jag däremot *Orchis ustulata* på samma plats där JEPPSSON hittade den 1962, samt 20 m V därom ytterligare två exemplar, samtliga i begynnande blom.

På kullen finns enligt JEPPSSON över 100 arter, varav må nämnas *Trifolium montanum* och *striatum, Helianthemum chamaecistus* ssp. *hirsutum, Primula veris, Anemone pulsatilla* och *Armeria maritima*.

Då man för några år sedan ville utvidga grustäkten i Björkabackarna till att även omfatta Lilla Smörstack, lyckades jag tack vare förståelse från Oxie kommuns sida få länsstyrelsen att avstyrka denna ansökan. Området är så artrikt, och även ur estetisk synpunkt så tilltalande, att en fridlysning vore på sin plats.

Av andra intressanta växter i grannskapet må nämnas *Dactylorhiza maculata* ssp. *fuchsii,* som växer i ett dike intill en av körvägarna inne i grustaget 450 m OSO om Björka. Även denna hittades av JEPPSSON 1962.

På sandstensbanan (=industrispår mellan den sedan många år nerlagda sandstensfabriken och Oxie stn.), vilken numera fungerar som mindre körväg, hittade jag den 4 juli 1964 ett bestånd *Falcaria vulgaris*. Platsen är belägen i Törringe socken strax NV om Lilla Smörstack.

Beträffande *Coeloglossum* så har jag i sommar varit i tillfälle se den på ytterligare två platser, dels vid Kalkstad på Öland och dels på Hardangervidda i Norge. Jag nämner dessa iakttagelser därför att *Coeloglossum* på Lilla Smörstack avviker genom att vara både spensligare och blekare än på Öland och i Norge.

JOHN KRAFT

Ceratophyllum submersum L. på en ny Skånelokal

(Ceratophyllum submersum L. Discovered in a New Locality in Scania, South Sweden)

ABSTRACT. — *Ceratophyllum submersum* L. is reported from near Valleberga in the Ystad region, Scania, South Sweden.

Ceratophyllum submersum L. är tidigare känd från ett område öster om Landskrona, i Örja och Tofta (H. WEIMARCK, Skånes Flora 1963 sid. 297).

Under min inventering i Ystadstrakten fann jag arten sommaren 1966, 1 km SO Valleberga kyrka. Lokalen kallas av ortsbefolkningen Kallsmossen. I den del av Kallsmossen, där *Ceratophyllum submersum* förekommer, tyder den övriga floran och faunan på att vattnet är näringsrikt. *Trapa natans* sågs där för omkring 60 år sedan. I den västra kanten av mossen bröts det torv 1917.

Som följeväxter i vattnet noterades: *Alisma plantago-aquatica, Epilobium parviflorum, Equisetum fluviatile, Galium palustre, Glyceria fluitans, Lemna minor, L. trisulca, Menyanthes trifoliata, Schoenoplectus lacustris, Sium latifolium, Sparganium erectum* ssp. *microcarpum* och *Typha latifolia*. På kanterna sågs: *Carex acuta, C. paniculata, C. rostrata, Dactylorchis incarnata, Epilobium palustre, Lysimachia vulgaris, Ranunculus sceleratus* och *Stellaria palustris*. (Nomenklatur enligt H. WEIMARCK 1963.)

Utanför Sverige är arten i Skandinavien känd från Danmark, där den har spridda förekomster både på öarna och i Jylland.

BIRGITH JÖNSSON

Nordisk Förening för Taxonomisk Botanik

Protokoll fört vid föreningens andra ordinarie sammanträde i Åbo den 4—8 juli 1967

(Nordic Association for Taxonomic Botany Proceedings of the Second Ordinary Meeting Held in Åbo on July 4—8, 1967)

Den 4 juli. *Sammanträde kl. 11.15* i Åbo Universitets (Turun Yliopisto) Botaniska institution, där även övriga sammanträden hölls. Ordet leddes av föreningens ordförande professor HANS LUTHER, med dess sekreterare, biträdande professor ARNE ROUSI vid protokollet. Närvarande 47 personer.

§ 1. Ordföranden öppnade sammanträdet med en översikt av tidigare samlingssträvanden bland Nordens botanister, samt redogjorde för de viktigaste ändamålen med föreningens verksamhet. Han framhöll speciellt att föreningen avser att vara en förenande länk mellan alla växttaxonomer i Norden, även kryptogamforskare som specialiserat sig på någon grupp. Sådana specialister är välkomna att inom föreningen bilda egna sektioner.

§ 2. Sekreteraren föredrog kassarapporten för verksamhetsperioden 1965—1966.

§ 3. Professor TYCHO NORLINDH uppläste revisionsberättelsen.

§ 4. Styrelsen tillerkändes ansvarsfrihet.

§ 5. Professor KAI LARSEN inbjöd föreningen att hålla sitt nästa sammanträde i Århus, men framhöll att under det stadgeenliga mötesåret 1969 den XI internationella botaniska kongressen kommer att äga rum i Seattle och att föreningens nästa möte därför borde uppskjutas till år 1970. Inbjudan till Århus mottogs med tacksamhet, men frågan om mötets tidpunkt konstaterades förutsätta en ändring av stadgarna och uppsköts därför till mötet den 6.7.

§ 6. Upplästes ett brev från styrelseledamoten för Norge, fil. dr. GUNVOR KNABEN, i vilket meddelades att prof. KNUT FÆGRI preliminärt utfärdat en inbjudan till möte i Bergen år 1971. Inbjudan annoterades tacksamt, men mötet konstaterade att tidpunkten måste bli beroende av det avgörande som fattas i fråga om året för mötet i Århus.

§ 7. Professor KAI LARSEN valdes enhälligt till föreningens ordförande. Den avgående ordföranden och sekreteraren skulle dock fungera till det pågående ordinarie sammanträdets slut (8.7.).

§ 8. Lektor SIMON LAEGAARD från Århus valdes enhälligt till föreningens sekreterare.

§ 9. Lektor KNUD JACOBSEN från Köpenhamn valdes likaledes enhälligt till suppleant för sekreteraren.

§ 10. Diskuterades frågan om publicering av det pågående mötets förhandlingar. Mötet var enigt om att det var önskvärt att mötenas förhandlingar såvitt möjligt fortlöpande skulle publiceras i samma tidskrift. Då det första mötets förhandlingar publicerats i Botaniska Notiser beslöts att föreningen hos Lunds Botaniska Förening skulle förfråga sig om möjligheten att även i fortsättningen få utnyttja detta forum.

§ 11. Prof. LUTHER föreslog att suppleanterna för de nationella styrelseledamöterna skulle fungera som nationella sekreterare. Förslaget godkändes.

§ 12. Mötets deltagare samlades nationsvis i var sitt rum för att enligt § 4 i stadgarna välja var sin nationella styrelseledamot och en suppleant för denna (tillika nationell sekreterare). Resultaten av dessa val skulle meddelas vid mötet den 6.7.

Lunch intogs i Åbo Universitets Studentkårs restaurant.

Sammanträde kl. 14.15. Professor ANTERO VAARAMA fungerade som ordförande med sekreteraren vid protokollet.

§ 1. Prof. VAARAMA hälsade som ordförande för organisationskommittén deltagarna välkomna till sammanträdet i Åbo. Han redogjorde därefter för den botaniska forskningens historia i Åbo samt för verksamheten vid Åbo Universitets (Turun Yliopisto) Botaniska institution. Institutionen demonstrerades under pausen.

§ 2. På inbjudan höll docent ROLF SANTESSON (Uppsala) ett föredrag: »Det systematiska och biologiska sambandet mellan lavar och icke-licheniserade svampar». I diskussionen efter föredraget deltog professor JOHN AXEL NANNFELDT, docent OVE ALMBORN och professor ANDERS MUNK samt föredragshållaren.

§ 3. Professor ANDERS MUNK (København) föredrog om »Akvatiske Pyrenomyceter». Professor KAI LARSEN, docent ROLF SANTESSON, professor HANS LUTHER samt föredragshållaren deltog i diskussionen.

§ 4. Föredrag av docent ILKKA KUKKONEN (Åbo): »Om variationen i *Diphasium* (*Lycopodium*) *complanatum*-komplexet i Finland». I diskussionen efter föredraget deltog docent YRJÖ MÄKINEN samt föredragshållaren.

§ 5. Föredrag av docent YRJÖ MÄKINEN (Åbo): »Variation of *Calamagrostis lapponica* in N. Fennoscandia». Professor JOHN AXEL NANNFELDT yttrade sig efter föredraget.

Den 5 juli. Exkursion under ledning av fil. mag. UNTO LAINE till Laitila (Letala) rapakiviområde, till Bottenhavets havsstrand i Pyhäranta och till diabasområdet i Sorkka by i Raumo.

På rapakivi-hällmarken i Untamala fanns bl.a. *Allium schoenoprasum, Spergula vernalis, Sedum annuum, Thymus serpyllum* ssp. *angustifolius* och *Viola tricolor*, och på vittringsgrus var *Arctostaphylos uva-ursi* karakteristisk.

Något norrut besöktes ett hassel-måbärs-lundfragment som står kvar mitt bland åkrarna, mellan stora rapakiviblock. I lund- och örtbacksvegetationen noterades bl.a. *Lonicera xylosteum, Actaea spicata, Filipendula vulgaris, Hypochoeris maculata* och *Viola mirabilis*. På rapakiviblocken väckte speciellt den rikligt kapselbärande *Amphidium lapponicum* intresse.

På Rihtniemi uddes nordspets i Pyhäranta beundrades de vidsträckta *Hippophaë*-bestånden, vid vilka bitr. prof. Arne Rousi demonstrerade kvistar av andra provenienser av havtorn (odlade vid Trädgårdsforskningsanstalten i Pikis). I strandvegetationen observerades ytterst mot vattnet *Deschampsia bottnica*, något längre in hybriden *D. bottnica×caespitosa*, i övrigt t.ex. *Carex glareosa* och *C. mackenziei, Isatis tinctoria, Myosotis laxa* och *Valeriana salina*, av mossor den bredbladiga havsstrandsrasen av *Drepanocladus aduncus* samt på strandstenarna *Schistidium maritimum*.

Lunch intogs på restaurang Raumanlinna i Raumo.

På olivindiabasen i Sorkka besöktes en lund, en örtbacke och en bergsbrant med ovanför liggande hällmark. Av speciellt intresse var *Galium triandrum*, som här har sin enda kända förekomst på Finlands fastland.

Den 6 juli. Sammanträde kl. 9.15. Professor Kai Larsen fungerade som ordförande med sekreteraren vid protokollet.

§ 1. På inbjudan höll docent Sven-Olov Strandhede (Lund) ett föredrag: »Några biologiska och växtgeografiska problemställningar inom *Eleocharis palustris*-komplexet». I diskussionen deltog biträdande professor Arne Rousi, professor John Axel Nannfeldt, professor Kai Larsen, professor Anders Munk, professor Tycho Norlindh, professor Hans Luther, docent Henrik Skult samt föredragshållaren.

§ 2. Föredrag av fil. mag. Jan Tengnér (Stockholm): »Anatomi och taxonomi inom *Podocarpaceae*».

§ 3. Föredrag av fil. lic. Juha Suominen (Helsingfors): »The Committee for Mapping the Flora of Europe».

§ 4. Föredrag av fil. kand. Karl-Gustav Widén (Helsingfors): »Om typifieringen av släktet *Agrostis* L.». I diskussionen deltog docent Rolf Santesson, professor John Axel Nannfeldt, docent Sven-Olov Strandhede och föredragshållaren.

§ 5. Meddelades resultaten av det nationsvis företagna valet av styrelseledamöter och nationssekreterare=suppleanter (nämnda i denna ordning):

Danmark:	Professor Anders Munk (Köpenhamn); amanuensis Alfred Hansen (Köpenhamn)
Finland:	Professor Antero Vaarama (Åbo); fil. kand. Karl-Gustav Widén (Helsingfors)
Norge:	Fil. dr. Gunvor Knaben (Oslo); stipendiat Arnfinn Skogen (Trondheim)
Sverige:	Professor Gunnar Harling (Göteborg); fil. lic. Bertil Nordenstam (Lund).

Meddelades, att föreningens medlemmar på Island i brev hade ombetts sinsemellan utse en styrelsemedlem och en suppleant. Besked om detta val hade ej ingått till mötet, men mötet beslöt att det oaktat detta val skall anses gälla.

§ 6. Beslöts att § 3 i stadgarna skall få följande tillägg: »Om speciella skäl föreligger, kan mötet uppskjutas med ett år».

§ 7. I anledning av den internationella botaniska kongressen i Seattle år 1969 beslöts att föreningens nästa möte skall hållas i Århus år 1970.

Lunch intogs i Åbo Universitets Studentkårs restaurang.

Under eftermiddagen anordnades ett besök till Åbo Akademis samlingar, med docent HENRIK SKULT som ciceron, samt en utflykt till Åbo Universitets (Turun Yliopisto) Botaniska Trädgård i Runsala, med bitr. prof. ARNE ROUSI och fil. dr. REINO ALAVA som ciceroner.

På kvällen anordnades en supé på Åbo Slott.

Den 7 juli. Exkursion under ledning av fil. lic. LAURI KÄRENLAMPI med vattenbuss till Skärgårdshavets Forskningsstation (tillhör Åbo Universitet) på Själö i Nagu och dess omnejd.

På Stora Träskö studerades stenstränder och tallskogshällmark. Här påträffades bl.a. *Scutellaria hastifolia.*

På ett litet klippgrund (Väärämaanruskia) söder om Rimito Väärämaa demonstrerade exkursionsledaren speciellt lavzonationen. Den undre geolitoralen karakteriserades av *Verrucaria maura,* den mellersta geolitoralen av *Caloplaca marina* samt *Lecanora helicopis* och den övre geolitoralen bl.a. av de nitrofila arterna *Xanthoria parietina* och *Physcia caesia.*

På Själö beundrades kring det forna sjukhuset speciellt den praktfullt blommande *Melampyrum arvense,* på strandängen i söder studerades vegetationszonerna.

Lunch serverades i Forskningsstationens kosthåll.

Den 8 juli. Exkursion till myrområdet Torronsuo i Tammela. Myren demonstrerades av fil. lic. KIMMO TOLONEN (Helsingfors). I utkanterna finns en smal lagg av rikkärr, i övrigt är myren en högmosse med en del minerotrofa fönster i centrum. Av arter som ägnades intresse kan *Drepanocladus procerus, D. revolvens, Sphagnum lindbergii, Cetraria delisei* och *Icmadophila ericetorum* nämnas. Strävandena att få naturskydd för myren eller åtminstone representativa delar av den har ännu ej krönts med framgång.

Under ett kort besök på Kaukola ås demonstrerades bl.a. *Hierochloë australis.*

Lunch serverades i Lounais-Hämeen Pirtti. Återfärden gick förbi Mustiala lantbruksinstitut, där mykologen PETTER ADOLF KARSTEN varit verksam.

Sammanträdet avslutades med kaffe i Honkapirtti på Runsala, där Åbo stad stod för värdskapet.

Den 9—13 juli anordnades en exkursion till Åbo Universitets (Turun Yliopisto) subarktiska forskningsstation Kevo i Utsjoki.

Autoreferat av föredrag hållna vid andra ordinarie sammanträdet av Nordisk Förening för Taxonomisk Botanik den 4—8 juli 1967

(Reports of Lectures Held at the Second Ordinary Meeting of the Nordic Association for Taxonomic Botany on July 4—8, 1967)

On Taxonomical and Biological Relations between Lichens and Non-Lichenized Fungi

Many authors still accept and use for lichens Latin names of "subclasses", "series", etc., which are only biologically characterized fractions of taxa of non-lichenized fungi. However, names like *Ascolichenes, Basidiolichenes, Pyrenolichenes, Clavariolichenes,* etc., are clearly misleading as giving a false impression of real taxonomic groups. No argument justifies the usage of such pseudotaxonomic names.

Scientific work in lichen taxonomy as well as in lichen biology should be carried out in due connection with mycology in general, a fact often completely disregarded. The occurrence of numerous types of more or less weak lichenisation render the definition of the concept lichen very difficult. No sharp boundary-line exists between lichens and non-lichenized fungi. There are several examples of fungi which are lichenized or non-lichenized at different age or under different habitat conditions.

Primitive types of lichenisation are found in many parts of the system of fungi, but only in a limited number of groups there are advanced stages resulting in a great number of genera and species of lichens. Thus the bulk of the lichens can be referred to rather few families and very few orders. Of these orders *Lecanorales* is completely dominated by the lichens.

The lichens originate from various types of saprophytic or parasitic, non-lichenized fungi. There are all steps from very simple types of lichenisation to the highest organized lichens. At many of these steps a retrogression towards more or less complete delichenisation may occur. A number of corticolous, lignicolous and muscicolous species of non-lichenized fungi seems to originate from ancestral lichens.

Among the lichenicolous fungi and lichens there are many groups of more or less closely related species, and within these groups there are species representing different biological types. Lichens with a well developed thallus not seldom grow upon the thallus of other lichens, in some cases epiphytically and without causing much injury to their hosts, in other cases, however, they are true parasites, in spite of their own thallus. Some lichens are only occasionally lichenicolous, others are fully specialized for this habitat. A great number of parasymbiotic fungi are found growing on lichen thalli. The parasymbionts utilize the alga of the host lichen as their own phycobiont apparently without injuring their host.

Similar to the endophloeodal lichens with their thallus hidden in the substratum (the cortex) the parasymbionts have their thallus completely hidden within the thallus of the host lichen. The boundary-line between lichenicolous lichens with an "own thallus" and the parasymbionts is very vague. Lichenicolous lichens "without a thallus" but with lecanorine apothecia are always without question accepted as lichens, whereas corresponding species with lecideine apothecia are referred to the parasymbionts. Also the boundary-line between the parasymbionts and the lichenicolous parasites is somewhat indistinct. The latter group does not exhibit the symbiosis or "balanced parasitism" typical of lichenisation, but includes true parasites causing distinct injury to the host, resulting in the killing of the whole thallus or part of it. In some cases the attacking fungus is able to proceed as a saprophyte. Some saprophytes, totally non-lichenized in all stages, are apparently fungi, delichenized in this way.

In the table below some examples are given of the taxonomical (horizontal columns) and biological (vertical columns) relations between lichenized and non-lichenized fungi. The upper part of the table demonstrates some cases of a probable evolution from lichenized to non-lichenized fungi. The lower part of the table demonstrates an evolution which has proceeded in the reverse direction. Sometimes an individuum of a species during its lifetime passes over from one of the indicated biological groups to another.

An evolution from a non-lichenized fungus to a lichen, or vice versa, via lichenocolous stages is, of course, a rather special case. However, it is strongly suggested by the occurrence of numerous intermediate stages. It indicates *one* of the possible ways of lichenisation or delichenisation.

Corticolous, etc. lichens	Lichenicolous			Saprophytic, etc. fungi
	lichens	parasymbionts	parasites	
Diploschistes bryophilus				
Candelariella spp.	*Candelariella superdistans*			
Lecidea spp.	*Lecidea furvella*	*Lecidea (Nesolechia) vitellinaria*		
Catillaria spp.	*Catillaria epiblastematica*	*Catillaria (Scutula) miliaria*	*Catillaria (Scutula) aggregata*	
Buellia spp.	*Buellia scabrosa*	*Buellia (Karschia) bayrhofferi*	*Buellia (Karschia) destructans*	*Buellia (Karschia) lignyota*
		Microthyrium peltigerae	*Microthyrium maculans*	*Microthyrium* spp.
			Nectria (Lasionectria) lecanodes	*Nectria (Lasionectria)* spp.
			Athelia (Corticium) bispora	

Rolf Santesson

Aquatic Pyrenomycetes

Pyrenomycetes from freshwater have been collected and described, i.a. by the Finnish mycologist P. A. KARSTEN, but collections have been few and casual. It appears that no mycologist has collected systematically in freshwater. This can be concluded from the writer's experience: After a couple of years' collection it has appeared that the limnic flora is rich in species, in eutrophic lakes at least, and that the majority of these species are undescribed.

So far I have never found a species on wood in water known to me from the terrestrial flora, so it seems that these fungi are truly aquatic. Both ascohymenial and ascolocular forms occur, in about equal number as they do in the terrestrial flora.

The marine flora of wood-inhabiting Pyrenomycetes is fairly well known now. Even the most cautious extrapolation from my findings gives as result that the specific limnic flora is much richer in species than the marine flora. — I have only found very few members of taxa known from marine habitats in freshwater (*Halosphaeriaceae, Lulworthia* sp.). They do not seem to be conspecific with any species found in the sea.

The majority of marine Pyrenomycetes have appendages, "anchors", etc., to their spores, probably an adaptation for sticking to the driftwood in spite of the perpetual movements of the waves. Only one freshwater species found so far has a tuft of thread-like appendages on one end of the spores; it grows on periderm of submerged branches, a very smooth and slippery habitat indeed.

A conspicuously large number of species — of both *Ascohymeniales* and *Ascoloculares* — secrete pigments into the substrate: crimson red (*Pleospora*-like species); chromium yellow (a *Trichosphaeria*-like species); olive greenish (the whole large genus *Ceratosphaeria*, a distinctive dominant of the limnic flora). The spores of *Ceratosphaeria* have a different colour: a beautiful pure blood red. This pigment seems to be in the contents of the spore.

This flora of freshwater Pyrenomycetes puts the scientist back into the very first pioneer phase of taxonomy. A solid majority of the species are undescribed; many species certainly belong in genera which comprise only aquatic species and hence are undescribed; furthermore, several of these genera cannot be readily placed in any known family. — It may be of theoretical interest as well to analyze this situation of research, otherwise it is difficult today to find such a virgin field in taxonomy from which can be derived first hand experience on pioneer taxonomy.

This group of Pyrenomycetes, characterized by their ecology, is probably the only flora element of Pyrenomycetes of really great ecological and economical importance. In all probability they are the main cause of "soft rot", a special process of wood destruction which has attracted much attention during recent years.

It appears from above that an urgent need for basic taxonomic research in this group is going to be felt very soon. Also, and not least, by non-taxonomists.

ANDERS MUNK

Studies on the Variability of the Diphasium (Lycopodium) complanatum Complex in Finland

The study was undertaken in order to describe the morphological variation within the complex and, later, to find the possible causes of the existence of certain intermediates between *Diphasium complanatum* (L.) ROTHM. ssp. *complanatum* and ssp. *chamaecyparissus* (A. BRAUN) KUKKONEN (see e.g. LINDQUIST 1929, ROUY 1913). Results are based on population studies in the field and in the laboratory, and on a study of herbarium material.

The vegetation of the *Diphasium* sites was analysed in sample plots chosen chiefly in some localities in SW. Finland, but also in scattered places up to Kuusamo in the north. Specimens were taken from each of these localities, and observations were made of the mode of the growth, e.g. whether the rhizome was truly subterranean or not. In several places some strobili were also fixed for cytological studies.

The main part of the study is, however, based on herbarium material. All the specimens of the following Finnish herbaria were studied: Helsinki (H, HFR), Oulu (OULU), Turku (TUR, TURA) and Kuopio (KUO). In addition, the author was able to see herbarium material in Berlin (B), Copenhagen (C) and Stockholm (S). The specimens in Stockholm were also studied by WILCE (WILCE 1965). In the present investigation fifteen characters were studied more closely, viz.: height of the plant; distance between aerial shoots; number of peduncles per aerial shoot; peduncle length; pedicel length; number of strobili; length of strobili; width of lateral branchlet; distance between two vertically adjacent lateral leaves; free length of the upper leaf of the lateral branchlet; free length of the lower leaf of the lateral branchlet; length of spores; width of spores; spore abortion; and the angle between the arms of dichotomy. These were studied in more than 1000 sheets consisting mainly of Finnish specimens, but specimens from Central Europe, U.S.S.R. and North America were also included. The results were analysed using the method first applied by ANDERSON (ANDERSON 1953).

The morphological studies showed that the characters studied may occur in all possible combinations, and that no sharp dividing line can be drawn between ssp. *complanatum* and ssp. *chamaecyparissus*. This can be best explained as a result of introgressive hybridization, an explanation which is supported by cytological observations and findings concerning spore abortion (see also WAGNER & CHEN 1965).

Two minor taxa were represented, viz. *Diphasium complanatum* ssp. *complanatum* var. *polystachyum* (LINDBERG) emend. KUKKONEN, and var. *montellii* KUKKONEN, the last mentioned being a low, compact plant occurring in the mountains.

ILKKA KUKKONEN

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A Variety of Calamagrostis lapponica in Finnish Lapland

Calamagrostis lapponica (WG) HARTM. is a northern incompletely circumpolar species, which is closely related to *C. neglecta* through morphologically intermediate species and races (NYGREN 1946 p. 251). Its continuous distribution area includes Asia eastwards from the Urals to Alaska and northern Canada. In N. America it is represented by var. *nearctica* PORSILD, in Greenland by var. *groenlandica* SCHRANK. It has not been found in Iceland or in the Faroes, and it is also absent from the Atlantic coast in Norway. The Fennoscandian area is somewhat isolated, and the species becomes more common only east of Ural Mountains. The southernmost localities are in Norway Sel in Oppland (BERG 1965), in Sweden Stöde in W. Medelpad (HYLANDER 1953 p. 317), and in Finland Virrat in N. Häme (Suominen in H and TUR).

The chromosome number of *C. lapponica* varies between very wide limits. NYGREN (1946 p. 216) mentions 2n=42, 49, ±91, ±98, ±105 and ±112, the last two and especially ±112 being the most common numbers. BOWDEN (1960) gives 2n=28, 32, 42, ±91, ±98 and ±140. The basic number is thus seven. Var. *groenlandica* seems to have uniformly 2n=28 (several reports, see LÖVE and LÖVE 1961 p. 67). Races with low chromosome numbers generally much resemble *C. neglecta,* which has 2n=28 (NYGREN 1946 p. 216).

Several other varieties have been described. Some of them seem to be only minor habitat modifications; others might deserve a specific status. One of the varieties described in Fennoscandia is var. *opima* HARTM., which was described as follows: "Hela gräset större och gröfre; vippan af 1—2 tum långa utstående grenar". This race has commonly been regarded as a minor modification, and modern floras do not mention it.

In 1961, our attention was fixed on two populations of *C. lapponica,* growing side by side in the courtyard of the Kevo Subarctic Research Station in Utsjoki (Finnish Lapland). One race was very typical *C. lapponica*; the other (which we at that time called "giant race") was much taller, more rigid, and in every respect more robust; otherwise it looked like the common race. No habitat modification could be involved; in fact, the two races occurred somewhat mixed with each other. Subsequently, the giant race was found in several additional localities. With one exception (a stand on an old ant-hill), it always occurred on ground strongly modified by man, or on riverside sands, usually on sandy and gravelly roadsides. E.g., it spread very rapidly on the roadsides from Utsjoki ferry to Laevvajokka in Norway, forming in some places large and continuous stands. Because this giant race well corresponds to the de-

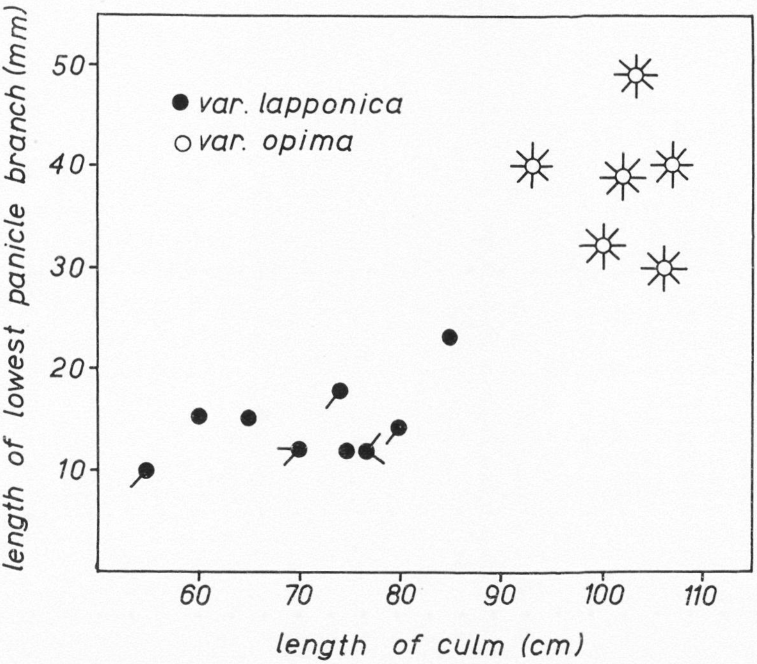

Fig. 1. Scatter diagram of the two populations of *Calamagrostis lapponica* growing at the Kevo Subarctic Station.

scription of var. *opima* HARTM., I shall temporarily place it under this name. According to the specimens in TUR, it has been collected from the following localities: Finland: PP (Ii, Lumijoki); Ks (Kuusamo); InL (Inari, Utsjoki). Norway: Finnmark (Polmak). Most of the collections have been made during the last ten years. Apparently var. *opima* is at present strongly extending its range; this seems to be in connection with the present fast rate of building new roads and highways. The subterranean stolons of var. *opima* are very strong and much thicker than in var. *lapponica,* and extend for several decimeters during one growing season.

The populations at the Kevo Station actually constitute a good culture experiment, because the habitat effects have been eliminated. Ten analyzed characters yielded the pattern presented in Fig. 1. The remaining eight characters, indicated by short bars, include (beginning clockwise from the topmost bar): 1) Width of culm (ranges 1.50—2.75 mm for no bar, and 2.76—4.00 mm for a bar; 2) Width of leaf (2.00—3.75—5.50 mm); 3) Number of leaf veins in a distance of 2 mm (5.2—7.4—9.6); 4) Length of panicle (5.0—9.0—13.0 cm); 5) Length of outer glume (3.95—4.68—5.40 mm); 6) Length of stomata (45.5—53.7—61.9 μ); 7) Length of ligule (1.50—2.75—4.00 mm); 8) Length of marginal prickles in the leaf (63.2—83.6—104.0 μ). There can be no question about the fact that the populations differ very markedly in all the characters studied.

The general habit of var. *opima* often resembles *C. epigeios,* or the hybrid *C. epigeios*×*neglecta.* A comparison of the floral parts shows, however, that especially the long awn and the long and narrow glumes in the hybrid *epigeios*×*neglecta* distinguish it from var. *opima,* which closely resembles var. *lapponica,* except for the size. Apparently var. *opima* is a highly polyploid race, but until its chromosome number is known, nothing certain can be said about its origin (counts made from var. *lapponica* at the Kevo Station yielded 2n= ±112). It can be questioned whether a taxon, regarded only as a giant race, deserves a varietal status. This is a very relative matter, and should be examined by further ecological and distributional studies.

Yrjö Mäkinen

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Comments on Some Phytogeographical and Biological Problems in the Complex of Eleocharis palustris

The lecture was based on maps of the European material of *Eleocharis,* subser. *Eleocharis* [syn. *Palustres* (C. B. Clarke) Svens.] studied (Strandhede 1966). The maps are still under preparation and will later be presented in a more complete form in Botaniska Notiser.

Special attention was drawn to the ecology and the distribution of the two subspecies of *E. mamillata* Lindb. f., out of which ssp. *austriaca* (Hayek) Strandh, was not reported from Scandinavia until 1961. This subspecies is now known from several localities in Norway, from Nordland in the north to Sör-Tröndelag in the south.

The distribution and the ecology of *E. palustris* (L.) R. & S. ssp. *palustris* and ssp. *vulgaris* Walt. were discussed in detail. Ssp. *palustris* is represented by three different races in Scandinavia, one of which is morphologically and ecologically so distinct that it is treated as a taxon of its own, var. *lindbergii* Strandh. The other two are mainly distinguished on immigration historical and ecological grounds.

The European distribution of *E. palustris* ssp. *palustris* is similar to that of "Euro-asiatic" taxa, and the distribution of ssp. *vulgaris* is similar to that of "Euro-atlantic" taxa (cf. Hultén 1950). In Scandinavia the northern limit of ssp. *vulgaris* mainly follows that of *Quercus,* and from the most south-western part of the Finnish mainland, this subspecies reaches the Baltic

Soviet Republics and Poland. Southwards, it does not occur in the proper Mediterranean areas, but reaches the western parts of the Iberian Peninsula via France.

A short presentation was given of the more or less local and regional races of *E. uniglumis* (LINK) SCHULT. in Europe. It was emphasized that samples of *E. uniglumis* from Central Europe very often have somewhat higher chromosome numbers than samples originating from Northern Europe. Thus 2n=49—51 are common in samples from South Germany, Austria, and Switzerland, instead of 2n=46, which is the common chromosome number in Northern Europe (cf. STRANDHEDE 1965).

The compatibility of different strains and taxa was discussed. Two of the taxa are highly self-incompatible: *E. palustris* ssp. *palustris* and *E. uniglumis* ssp. *uniglumis*. *E. palustris* ssp. *vulgaris* and the two subspecies of *E. mamillata* are self-compatible and *E. uniglumis* ssp. *sterneri* STRANDH. takes an intermediate position in this character.

During the discussion that followed the lecture, further comments were made on the flowering-times of Scandinavian material in culture; there is a good correlation between the flowering-times and the latitude of origin.

Comments were also made on germination experiments in progress since 1957. The results, which reveal a strong periodicity of the germination, will later be presented in a separate paper.

SVEN-OLOV STRANDHEDE

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Anatomy and Taxonomy in the Podocarpaceae

Anatomic investigations in the conifer genus *Dacrydium* of the *Podocarpaceae* have given results of a distinct taxonomic value (cf. TENGNÉR 1965). A rich material of secondary wood as well as fixed vegetative (and reproductive) material, received from various parts of the world at the request of the late professor R. FLORIN, has made it possible to extend the investigations to comprise the whole family.

In all about 90 species, representing almost all genera and sections, have been studied in detail and checked against earlier investigations (cf. especially KAEISER 1954 regarding wood anatomy in *Podocarpus*, a series of papers by BUCHHOLZ and GRAY 1948—62 regarding leaf anatomy in the same genus, and GREGUSS 1955).

The same anatomic characters as in the case of *Dacrydium* (TENGNÉR 1965) were especially studied, and the results have been compared with pollen types found and with chromosome conditions as described by HAIR and BEUZENBERG (1958) and HAIR (1963, 1966).

Table 1. Summary of Certain Anatomic Characters in *Podocarpaceae* Compared with Pollen Morphology and

Podocarpaceae		Number of species		Secondary xylem				Axis	Adult leaves			Pollen		Chromosomes acc. to Hair & Beuzenberg		
						Cross field pits										
Genera	Sections or Groups	Total	Investigated	Annual ring boundary	Wood parenchyma	Type	Number	Phloem fibres	Hypodermis	Vascular fibres	Resin ducts	Type	Well delimited air bladders	2n	Types (V+I)	"Sum" of chromosome arms
Dacrydium	I. A.	4	3	—	+	T	0—2	+	+	—	+	A	—	(20)	(10+0)	(20)
	B. 1. a	4	3	—	+	T	0—2	+	+	+	+	B	—	20	10+0	20
	1. b	1	1	—	+	T	0—4	+	+	+	+	C	—	20	10+0	20
	2	8	8	—	+	T	0—3	+	+	+	+	D	—	(20)	(10+0)	(20)
	3	1	1	—	+	C	0—2	+	+	+	+	E?	—	20	10+0	20
Dacrydium	II. (C.) 1. a	2	2	+	—	C	1—8	+	—	—	—	F	+	30	5+10	20
	1. b	1	1	+	—	C	2—5	—	—	—	—	F?	+			
	2	1	1	+	—	F	1(—2)	+	—	—	—	F	+	20	10+0	20
	3	1	1	+	−(+)	F	1(—2)	+	—	—	—	G	+	30	5+10	20
	4	3	3	+	—	F	1—2	—	—	—	—	F	+	24 22 18	4+8 5+6 7+2	16
Dacrycarpus *Polycarpus*	(1.)	10	4	−(+)	+	C T	0—3	+	+	+	+	H	+3*	(20)	(10+0)	(20)
	2. *Microcarpus*	1	1	—	—	T	0—2	(+)	—	—	+			36	2+16	20
	3. *Nageia* A.	4	3	—	+	T	0—2		+	+	+			(20)	(10+0)	(20)
	„ B.	3	1	+	+	(C)	0—2							(26)	(7+6)	(20)
	4. *Afrocarpus*	5	4	—	+	C T	0—2	—	+	+	+			(24)	(8+4)	(20)
	5. *Polypodiopsis*	5	5	−(+)	+	T	0—3	—	+		+			20	10+0	20
	6. *Sundacarpus*	1	1	—	(—)	T	0—2	—	—	—	+			38	1+18	20
	7. *Stachycarpus* A.	7	4	−(+)	−(+)	C T	0—2	—	—		+	F	+	36 38	2+16 1+18	(20)
	„ B.	3	1	—	—	(T)	0—2									
	8. *Podocarpus* A.	7	5	—	+	T	0—3	—	+		+			20 22	10+0 9+2	(20)
	„ B.	c. 30	12	+(−)	+	C T	0—2	—	+		+					
	„ C.	c. 30	7	−(+)	+	C T	0—2	—	+		+			(40)	(0+20)	(20)
	„ D.	7	6	+	+	C T	0—2(4)	—	+		+	F	+	34 38	3+14 1+18	(20)
	„ E.	1	—	—	—											
	„ F.	3	3	−(+)	+	C T	0—2	—	+		+					
Acmopyle		3	2	(+)	+	T	1—2	+	+		+	F	+	20	10+0	20
Microcachrys		1	1	+	—	F	1—3	—	+		+	H	+3*	30	5+10	20
Microstrobos (*Pherosphaera*)		2	2	+	+	F	1—2	—	+		+	H	+3*	26	7+6	20
Saxegothaea		1	1	+	+	T	1—3	—	+		+	I	0**	24	8+4	20
Phyllocladus		7	6	+(−)	—	F(T)	0—2	+	—	+	+	K	+	(18)	(9+0)	(18)

Cross field pits:
C = cupressoid T = taxodioid F = fenestriform

* Pollen with 3 well delimited air bladders.
** Without air bladders.

In Table 1, where the findings are summarized, the two first columns give the total number (approx.) of species described and the number of species investigated in one or more respects. Signs between brackets denote obscure or rare conditions. Chromosome numbers are given between brackets in case they are not known for all species of the group in question.

The sections of *Podocarpus* are according to BUCHHOLZ and GRAY. Section *Dacrycarpus* has been placed apart from the rest of *Podocarpus* to emphasize its deviating character.

It should be noted that the genus *Microstrobos* (*Pherosphaera*), which by several authors has been given an isolated position in the family, fits in quite well with the other genera as far as wood and leaf anatomy (and chromosome conditions) is concerned (cf. TENGNÉR 1966). The genera *Saxegothaea* and *Phyllocladus,* on the other hand, stand somewhat apart, especially as regards pollen structure.

Further comments on the contents of the table will be made elsewhere.

JAN TENGNÉR

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. . . .

"The Committee for Mapping the Flora of Europe"

Kommittén grundades i augusti år 1965 i Aarhus i samband med Flora Europaea-mötet, vid vilket Dr. F. H. PERRING presenterade det första experimentella skedet som berörde kartläggningen av 10 arter.

Förutom de egentliga medlemmarna och rådgivarna representerades varje land i Europa av en regional collaborator. Men erbjöd sekretariatet åt Finland. Bitr. prof. JAAKKO JALAS är ordförande och JUHA SUOMINEN tjänstgör som sekreterare.

Det andra experimentella skedet innehöll 20 arter, vilka bl.a. var mycket svåra att kartlägga. Dessa 20 arter diskuterades mycket ingående, och på basen av de erhållna uppgifterna uppställdes kartor, vilka utgjorde grunden för den slutliga kartläggningsmetodiken och de allmänna riktlinjer, som fastställdes vid kommitténs Krakova-möte i september 1966. Kartläggningsmetodiken etc. beskrivs i en engelsk publikation som utges detta år i Memoranda Societetis pro Fauna et Flora Fennica-serien. Här må dock i korthet nämnas några av de mest centrala tekniska detaljerna.

Kartläggningsområdet, artbeståndet och nomenklaturen följer Flora Europaea. Kartläggningsenheten är en ruta, 50×50 km, i en s.k. UTM-karta. Med hjälp av grundkartan (där varje ruta har en blå ring), som uppritats enkom för detta ändamål i skalan 1 : 10 miljoner, kartläggs de uppsamlade uppgifterna om växterna i de olika länderna. Dessa kartor skickas sedan till sekretariatet, som samlar ihop uppgifterna, konformerar, bearbetar, granskar och publicerar dem.

Preliminärt har man uppställt en 10-års plan, olika orsaker kan dock komplicera det hela. I detta nu kartläggs *Pteridophyta* och *Gymnospermae*.

Rutans format kan synas stor. Europa betäcks dock av 4400 rutor. Svårigheter uppstår dock även med dessa rutor i vissa trakter. Uppgifterna som uppsamlats i Finland är även rätt ojämna. Kartläggningens uppgift är ju dock att beskriva växternas utbredning i Europa, och icke allenast deras utbredning i ett enda land. Kartläggningen bör icke heller betraktas som någon slutförd komplett uppgift, utan som en metod att inrikta och stimulera forskningen.

I detta skede bör det speciellt betonas att det icke finns anledning (på bekostnad av en märkbart förlängd arbetstid) att sträva till en ytterlig noggrannhet, utan att i stället snabbt få helhetsbilden publicerad, framför allt kartverkets första del. Detta tvingar såväl de enskilda europeiska länderna, som sekretariatet i sista hand att göra kompromisser.

Växtkartläggningen är mycket enkel i princip: På kartan ritas en symbol av den taxonomiska enheten på dess ort. Vid rutkartläggningen förenklas orten avsevärt, varvid endast den taxonomiska enheten kommer att kvarstå. Med detta sammanhänger ett av kartläggningens huvudproblem, ty det är ingen idé att kartlägga ouppklarade uppgifter.

I princip strävar man till att kartlägga Flora Europaeas arter och underarter. Många av dessa arter är s.k. sensu stricto - arter, varför det i praktiken är nödvändigt att kartlägga dem *kollektivt* (åtminstone nu i början), t.ex. ett helt undersläkte, en sektion, en grupp närbesläktade arter eller en arts underarter tillsammans.

Man kan dock erhålla noggranna uppgifter om en del av ett sådant kollektivtaxons område, detta gäller dock icke alla områden. Likaledes kan endast en del av alla länders uppgifter determineras till underarterna etc., medan den enda uppgiften i flera rutor är kollektiv (t.ex. en litteraturuppgift). Härvid kan man på den kollektiva kartan (eller på en skild karta) rita de kända noggrannare uppgifterna med olika beteckningar, eller uppge dem med gränslinjer, eller i samband med texten. Geografiskt isolerade närbesläktade arter, underarter etc. är givetvis lättare att kartlägga.

Det är att hoppas att även den taxonomiska forskningen kan dra nytta av dylika kartor, vilka uppritas även med tanke på taxonomin. Dessa skulle kunna ge en helhetsbild, samt underlätta forskningens planering och orientering. Kartläggningen är alltså icke ett självändamål, utan ett medel för botaniken (för den rena floristiken, för taxonomin) som i sin tur utgör ett värdefullt stöd vid kartläggningen.

JUHA SUOMINEN

Om typifieringen av släktet Agrostis L.

Enligt de internationella nomenklaturreglerna bör släkten som upptas i LINNÉs Species Plantarum (1753) associeras med släktdiagnosen i Genera Plantarum (1754). De för typifieringen viktigaste punkterna i LINNÉs släktdiagnos för *Agrostis* är följande: Småaxen är enblommiga, med två tomfjäll. Av de två blomfjällen, som är något kortare än tomfjällen, är det större borstförsett.

I senare upplagor av Genera Plantarum och Systema Naturae ändrade LINNÉ sin beskrivning, så att den bättre motsvarade vad som nu avses med *Agrostis*, men beskrivningen från år 1754 har dock ohjälpligt prioritet, och typifieringen måste ske enligt denna.

I Species Plantarum (1753) beskriver LINNÉ 12 arter av släktet *Agrostis* fördelade på *Aristatae* och *Muticae*. *Aristatae* omfattar arterna *A. spica-venti, A. miliacea, A. arundinacea, A. rubra, A. canina* och *A. paradoxa* och *Muticae* arterna *A. stolonifera, A. capillaris, A. alba, A. minima, A. virginica* och *A. indica.* Enligt nomenklaturreglerna är alla dessa arter att betrakta som syntyper för släktet *Agrostis,* och någon av dessa arter, i allt väsentligt överensstämmande med LINNÉs släktdiagnos, bör väljas till lektotyp för släktet *Agrostis* L. Enligt reglerna gäller den första lektotypifieringen, såvida lektotypvalet inte baserats på en misstolkning av originalbeskrivningen.

Den första mig bekanta typifieringen av släktet *Agrostis* gjordes måhända redan år 1763 av ADANSON i Familles des plantes genom citering av »Scheuz. 57.» Denna typifiering måste dock förkastas emedan någon av LINNÉs syntyper måste väljas till lektotyp. Enligt HITCHCOCK (1905) är »Scheuz. 57» *Sacharum.*

Nästa typifiering utfördes av HITCHCOCK (1905) som valde *A. alba* L. till typart, vilket accepterades av BRITTON et BROWN (1913). *A. alba* är dock ett *nomen ambiguum* som ej tillfredställande kunnat typifieras tillsvidare. LINNÉs citat i Species Plantarum leder till *Poa nemoralis* (vilken art ej alls överensstämmer med LINNÉs släktbeskrivning), och av LINNÉ före år 1753 bestämt typmaterial har ej påvisats. Ytterligare må framhållas att LINNÉ förde *A. alba* till *Muticae,* d.v.s. de borstlösa arterna, varigenom arten ej helt överensstämmer med släktdiagnosen då LINNÉ framhåller att det större blomfjället är borstförsett. Sålunda synes det som om *A. alba* L. ej kunde accepteras som typart för släktet *Agrostis* L.

Följande typval gjordes år 1920, återigen av HITCHOCK. Nu meddelar han att *A alba* ej kan anses vara typart för *Agrostis* L. då *A. alba* är ett *nomen ambiguum.* I stället föreslår han att *A. stolonifera* skall väljas till typart med motivering att det är fråga om en ekonomiskt viktig art. Detta typval har accepterats av flertalet auktorer (t.ex. HITCHCOCK et GREEN 1929, appendix till nomenklaturreglerna 1935, PHILLIPS 1951, MANSFELD 1959 m.fl.). Också *A. stolonifera* fördes av LINNÉ till *Muticae.* Av betydelse är naturligtvis också typifieringen av *A. stolonifera.* Den första mig bekanta lektotypifieringen har utförts år 1904 av HITCHCOCK. Härvid valdes till lektotyp ett exemplar i LINNÉs herbarium i London som bestämts av LINNÉ uppenbarligen redan före år 1753 (detta enligt PHILIPSON 1937). Detta exemplar representerar dock *Polypogon semiverticillatus* (FORSK.) HYL. (=*Agrostis verticillata* VILL.). Då

LINNÉs beskrivning i Species Plantarum ej utesluter *Polypogon semiverticillatus*, och LINNÉs citat åtminstone delvis synes hänföra sig till detta taxon, kan HITCHCOCKs typifiering knappast förkastas i stöd av gällande regler, ehuru HITCHCOCK år 1920 själv ändrade åsikt. Härmed blir *Agrostis stolonifera* det äldsta artnamnet för *Polypogon semiverticillatus*. Om *A. stolonifera* trots att LINNÉ förde arten till *Muticae* i alla fall accepteras som typart för släktet *Agrostis* LINNÉ 1753 bleve *Polypogon* DESF. en yngre synonym till *Agrostis* L. Följande tillgängliga namn för *Agrostis* i gängse bemärkelse vore då troligen *Vilfa* ADANSON 1763 baserat på »Gramen canin. supin. C.B. Theat. 12.» och i index »Gramen canin. supin. minus C.B.» Om däremot punkt e i nomenklaturreglernas Guide to the determination of types följes är *A. stolonifera* ej det element som bäst motsvarar protologen.

År 1937 framhåller PHILIPSON med rätta att typarten för släktet *Agrostis* L. 1753 bör vara en borstförsedd art och väljer *A. canina* till lektotyp. PHILIPSON tycks dock ej ha noterat att LINNÉ beskriver corolla såsom bivalvis, d.v.s. två med lupp synliga blomfjäll bör finnas. *A. canina* utmärks dock av endast ett blomfjäll. Härmed avviker *A. canina* från LINNÉs släktdiagnos ungefär lika mycket som *A. stolonifera*, och *A. canina* kan då ej godtas som typart då lektotypifiering med *A. stolonifera* skett tidigare.

Om den av LINNÉs arter i Species Plantarum 1753 som bäst motsvarar originalbeskrivningen bör bli typart, måste det vara en art inom *Aristatae*. Av LINNÉs arter inom *Aristatae* kan *A. canina* ej väljas till typart (se ovan), *A. rubra* är ett *nomen ambiguum* (se HITCHCOCK 1904), medan däremot *A. spica-venti*, *A. miliacea*, *A. arundinacea* och *A. paradoxa* är överensstämmande med LINNÉs diagnos av släktet *Agrostis* L. Tyvärr har dock ingen av dessa arter på senare tid förts till släktet *Agrostis*, utan *A. spica-venti* till *Apera* ADANS., *A. arundinacea* till *Calamagrostis* ADANS. och *A. miliacea* och *A. paradoxa* till *Oryzopsis* MICHX. Oberoende av vilken av dessa arter som väljs till typart skulle följden således bli mycket besvärliga förändringar i rådande namnskick. Detta synes också gälla för eventuell typifiering med *A. stolonifera* såsom redan framhållits.

En möjlighet att undvika alla de besvärliga namnförändringar, vilka skulle åtfölja en korrekt typifiering av släktet *Agrostis*, ger konservering av en yngre *Agrostis*-diagnos, vilken kan typifieras med någon *Agrostis*-art enligt nuvarande namnskick, gentemot LINNÉs *Agrostis* i Species och Genera Plantarum av år 1753 och 1754, med t.ex. *A. spica-venti* som lektotyp. En sådan diagnos finns redan från år 1753, nämligen i LINNÉs Indelning i Örtriket. Detta arbete är anmält den 19 juli 1753 i Lärda Tidningar, medan Species Plantarum I anmälts den 24 maj 1753 (utgivningsdatum enligt reglerna den 1 maj 1753). LINNÉ ger i Indelning i Örtriket följande diagnos: »65. Agrostis. Har en krona i hvart blomfoder. Har en 2:delter eller 2:halfvig snärp: märkena äro långsefter sträfva.» Detta är en översättning av beskrivningen i Systema Naturae 1748 (snärp här=»calyx»). Således avser 2:delt snärp här tomfjällen. Utgående från denna diagnos vore det möjligt att till typart välja *A. canina* L. 1753 vilket namn i sin tur lektotypifierats på ett tillfredsställande sätt med ett exemplar i LINNÉs herbarium i London (PHILIPSON 1937).

KARL-GUSTAV WIDÉN

Bot. Notiser, vol. 120, 1967

Citerad litteratur

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Meddelanden

Utmärkelse

Professor Gunnar Erdtman, Palynologiska Laboratoriet, Solna, utsågs den 24 januari till hedersledamot i The Royal Society of Arts and Sciences of Mauritius.

Disputationer

I Lund

18.11 1967: Sten-Bertil Vide: »Studier över sydsvenska växtnamn».

I Uppsala

2.12 1967: Lena Jonsell: »Studies on Erysiphaceae with special regard to the Swedish species».

18.12 1967: Olle Björkman: »Comparative studies on photosynthetic properties of species and races of higher plants from ecologically diverse habitats.»

Stipendier ur Lunds Botaniska Förenings fonder 1967

Ur Svante Murbecks fond: Fil. kand. Karin Nilsson, 967 kr, för insamling av *Artemisia* på de Nordfriesiska Öarna.

Ur Jubileumsfonden: Fil. lic. Birger Ingelsten, 450 kr, för deltagande i Nordisk kongress för växtfysiologi i Bergen, Norge, och fil. mag. Lars Påhlsson, 450 kr, för deltagande i ett sympoisum över ekologiska mätmetoder i England.

Tryckningsbidrag till Botaniska Notiser

Statens Naturvetenskapliga Forskningsråd har tilldelat Lunds Botaniska Förening ett bidrag på kr 28.000 för tryckning av Botaniska Notiser under 1968.

Botanisk Litteratur (Botanical Literature)

Knapp, R.: Experimentelle Soziologie und gegenseitige Beeinflussung der Pflanzen. — Verlag Eugen Ulmer, Stuttgart, 1967. 2nd edition, 266 pages, 151 figures and 62 tables.

The present volume is a second edition of the supplement to the author's series "Einführung in die Pflanzensoziologie". The contents of the book is best given by quoting the subtitle "Verhalten höherer Pflanzen in Beständen auf Äckern, in Wäldern, Rasen und weiteren Gesellschaften. Wettbewerb (Competition), Allelopathie, Parasitismus und andere Wirkungen".

Its scope is wide and the representation refers more to results than theoretic and hypothetic views. In times with a tremendously increasing flood of plant ecological literature this book is valuable as it reviews aut- and synecological investigations from German-speaking as well as English-speaking countries. The bibliography contains app. 350 literature references before and app. 1000 after 1954, the publication year of the first edition.

Folke Andersson

Karling, John S.: Synchytrium. — Academic Press, New York and London. 1964. XVIII+470 pp. 13 plates. Price $ 17.50.

This is a monograph on the parasitic genus *Synchytrium* (Class *Chytridimycetidae*). It is the largest genus within the class and is reported to include almost 200 species. They have been found parasitic in more than 1350 mainly terrestrial host species representing 773 genera and 168 plant families. Only few species are economically important, such as *S. endobioticum*, which causes the destructive wart disease of potatoes.

There exist already good compilations of our knowledge of aquatic chytrids, but there has been a serious lack of similar compilations of terrestrial genera. Karling's monograph on the genus *Synchytrium* fills such a gap.

Although the book is directed primarily to mycologists, the discussions of host and cellular reactions to infections, host range and host specificity appeal especially to parasitologists and phytopathologists. Illustrations of the macroscopic, visible host reactions of the most frequently found species are, however, missing; figures similar to that of *Synchytrium endobioticum* on the front page of the folder. The index where the hosts are arranged systematically, and the extensive list of references will, however, be of great value for phytopathologists. A separate bibliography on *Synchytrium endobioticum* and wart disease of potato containing more than 800 titles, followed by an authors index and a subject index, complete the indices.

The evaluation of taxonomic criteria is discussed in great detail followed by a review of different systems of classification. The differences in morphology, life cycles, and development between the six subgenera accepted by KARLING are illustrated with several instructive figures. The descriptions of species are penetrating and detailed. Information is given on type specimens, exsiccata, specimens studied, and important collections, followed by critical comments by the author.

The chapter on cytology is of a certain historical interest as the genus has been cytologically studied very early. The cytological literature on *Synchytrium* is extensive, and KARLING gives a short but complete review of it illustrated by figures.

The distribution presented must necessarily be regarded as fragmentary as material has not yet been sufficiently collected and studied. For instance, 106 species are known from North America, but only 4 from Central America and 24 from South America.

As a whole, KARLING has succeeded in summarizing a lot of valuable data and information relevant to the identification, classification and phylogeny of this interesting genus. It is also easy to find the information wanted in the book because of the complete indices.

SVEN-OLOV STRANDHEDE

HUGO SJÖRS: Nordisk växtgeografi. — Andra upplagan. — Scandinavian University Books (Svenska Bokförlaget, Bonniers) Stockholm 1967. 240 sid. Pris kr 38: —.

Den student, som för femton år sedan ville skaffa sig en översikt över växtgeografiska och växtekologiska förhållanden i Norden och Sverige var i stort sett enbart hänvisad till digra framställningar i doktorsavhandlingar eller specialiserade och ofta svåråtkomliga tidskriftsuppsatser. Detta gjorde att det var besvärligt att få en samlad överblick av problemen. Läget är numera avsevärt bättre. 1956 utkom första upplagan av SJÖRS' »Nordisk växtgeografi» och 1960 STÅLFELTS »Växtekologi», båda utomordentliga och numera standardläroböcker i universitetsundervisningen. Dessa kompletteras på väsentliga punkter av SELANDERS »Det levande landskapet i Sverige» och festskriften vid G. EINAR DU RIETZ' 70-årsdag »Plant cover of Sweden». Tillkomsten av sådana översiktliga arbeten betyder oerhört mycket inte bara för undervisningen utan också för den vetenskapliga utvecklingen.

Drygt tio år efter det att första upplagan utkom har nu SJÖRS' lärobok utkommit i en andra upplaga. En översikt av bokens innehåll gavs redan i rec. av första upplagan i denna tidskrift (Bot. Notiser 110 pp. 406—407). Som författaren själv framhåller i förordet, är omarbetningarna i andra upplagan obetydliga. Antalet textsidor har ökat från 203 till 211, närmast beroende på vissa förändringar i typografin. Den viktigaste utvidgningen har skett i samband med behandlingen av ekosystembegreppet, där ett mycket värdefullt avsnitt om primärproduktionen och hur den utnyttjas och omvandlas i olika ekosystemtyper har inskjutits.

Samtidigt har avsnittet om Nordens indelning i floraområden och -provinser uteslutits. Detta innebär utan tvivel ur pedagogisk synpunkt en förenkling, eftersom begreppen inte är nödvändiga och erfarenhetsmässigt många studerande haft svårt att undvika sammanblandning med indelningen i vegetationsregioner. Det är emellertid samtidigt beklagligt, eftersom dessa frågor varit föremål för omfattande och långvarig växtgeografisk debatt i Norden.

Fem nya figurer har tillkommit och två har utbytts. De kompletterar det redan tidigare goda illustrationsmaterialet. Dock borde kanske beteckningarna »fattiga» och »rika» bergarter i fig. 35 utbytas mot mera adekvata benämningar. Det hade också varit önskvärt att i detta sammanhang utbyta den schematiserade kartbilden över Europas vegetation under den senaste nedisningen (fig. 39). Samma bild i exempelvis WALTERS »Arealkunde» ger en betydligt mera nyanserad bild av förhållandena.

Från åtskilliga håll har i olika sammanhang framförts önskemål om tillägg eller omarbetning av denna lärobok. Det är alltid lätt att framlägga sådana förslag men man måste då också troligen ta bort något av det som redan finns. Redan nu är boken förhållandevis omfångsrik och samtidigt alltigenom mycket koncentrerat skriven. Vad man kanske helst skulle önska sig vore en lärobok som i sig — gärna med utgångspunkt från ekosystembegreppet — på ett enhetligt sätt behandlade det stoff som nu tillsammans inryms i SJÖRS' och STÅLFELTS läroböcker. Svårigheten är i ett sådant fall att bokens omfång lätt skulle bli för stort och dispositionen av materialet kanske svåröverskådlig. Det är emellertid uppenbart, att det är en sådan helhetssyn på den ekologiska botaniken, som man bör sträva efter och komma fram till i undervisningen.

NILS MALMER

Natur i Lappland I och II. Redaktör KAI CURRY-LINDAHL. — Bokförlaget Svensk Natur. 1963. 1046 sidor, ett stort antal fotografiska illustrationer och kartor. Pris per del 100: — kronor.

Natur i Lappland har nu funnits tillgänglig i bokhandeln en tid, varför dessa rader blir en påminnelse om dess existens snarare än en anmälan. Verket omfattar de två sista banden i förlagets värdefulla landskapsserie och bildar sannerligen kronan på verket. Många olika synpunkter skulle kunna läggas på detta verk, som i ord och bild skildrar Lapplands natur i mitten på 1900-talet. Utan tvekan kommer det att bli ett viktigt dokument för framtiden. Emellertid kan »Natur i Lappland» också njutas som ren förströelseläsning, vilket gör, att man kan förvänta sig, att en bredare publik kommer att läsa verket. Med all säkerhet kommer »Natur i Lappland» att bidraga till ett ökat, positivt intresse och ökad förståelse för den särpräglade natur vi möter i denna del av Europa.

I hela verket ligger dock en underton av oro inför Lapplands framtid. Landskapet utsättes i detta århundrade för en våldsam exploatering, eller, för att använda ISRAEL RUONGS ord, »skändning», som endast har sin motsvarighet i kolonialmakters utnyttjande av kolonier. I sin allmänbiologiska överblick av vattenregleringarnas effekt, konstaterar också T. ROS avslutningsvis: »Ur biologisk synpunkt måste man således tyvärr säga, att det utbyggda vattendraget närmast kommer att kvarstå som en ruin i svensk natur».

»Natur i Lappland» omfattar dels en allmän del, där huvudrubrikerna är »Det forna Lappland» och »Lappland av idag». Därefter följer en regional del, där Lappmarkernas natur, fauna och flora presenteras av en rad förnämliga lapplandskännare. De välgjorda och mycket ingående sakregistren i slutet på andra delen bidrager i stor utsträckning till att göra »Natur i Lappland» till en högst användbar bok för såväl vetenskapsmän som amatörer och turister. Jag begränsar i det följande mina kommentarer till de rent botaniska kapitlen.

F. EBELING ger en intressant orientering om Lapplands skogar, deras skötsel samt målsättningen för denna. I en annan, bara alltför kort, uppsats presenteras lappländska urskogsreservat av C. OLDERTZ. Myrspecialisten framför andra, H. SJÖRS, ger en initierad orientering om Lapplands mångskiftande myrkomplex, vilka täcker stora delar av landskapet öster om fjällkedjan.

Den flitigaste botaniska författaren i verket är O. RUNE, som till stor del redovisar sina egna floristiska undersökningar inom området. Han inleder med ett allmänt kapitel i del I om Lapplands flora och återkommer sedan i en presentation av den ur såväl botanisk som zoologisk synpunkt märkliga Kultsjön, så som denna existerade före vattenregleringarnas tid. RUNE skriver också om Vilhelminafjällen, där de karga, delvis serpentiniserade Marsfjällen och de rika Lasterfjäll och Vardofjäll bjuder på växtgeografiska sensationer.

Bland Tärnafjällen, som behandlas i en följande uppsats av samme författare, bör kanske ur floristisk synpunkt främst nämnas Mieskattjåkko inom de märkliga Artfjällmassiven. I ytterligare en uppsats skildrar RUNE hur *Arenaria humifusa* återupptäcktes i Skandinavien. Han framkastar också tanken, att *Arenaria humifusa* och *Potentilla hyparctica* kanske tillhör de organismer, vilka hypotetiskt har överlevt sista istiden på isfria refugier i Skandinavien. RUNE och S. SELANDER (†) skildrar i var sin uppsats, hur *Potentilla hyparctica* påträffas under en expedition till Jeknaffo.

Till samma del av fjällvärlden för oss G. EDIN i en trevlig uppsats om det ur botanisk synpunkt klassiska Vuoggatjålme och den rika floran på Tjittjak, och K. CURRY-LINDAHLs arbete om Tarradalen behandlar en annan av fjällvärldens »veritabla lustgårdar». I sitt kapitel om Kebnekaise kommer G. BORENIUS kortfattat in på floran i dessa massiv, och floran i den genom vattenregleringar allvarligt amputerade Stora Sjöfallets Nationalpark behandlas av G. BJÖRKMAN.

Torneträsk och omkringliggande områden skildras i en hel serie arbeten. Abisko-områdets kännare framför andra, G. SANDBERG, bidrar med en allsidig och väl genomarbetad uppsats om växtvärlden i Abisko Nationalpark. Han lämnar också en bara alltför kort presentation av den i vidare kretsar föga kända Vadvetjåkkos Nationalpark nordväst om Torneträsk.

G. LOHAMMAR ger en initierad skildring av såväl det högre som det lägre växtlivet i Torneträsk och omkringliggande sjöar. En intressant uppsats om bl.a. sydbrantsfloran i fjällen norr om Torneträsk har skrivits av K.-G. BRINGER, och hans förslag till fridlysning av detta område bör snarast uppmärksammas av Statens Naturvårdsverk. I all synnerhet som dolomitförekomsterna kan leda till en icke önskvärd exploatering i detta stycke unik fjällnatur. De botaniska uppsatserna i »Natur i Lappland» avslutas så med en kort uppsats av O. HEDBERG om »Sveriges nordligaste hörn».

Avslutningsvis måste en uppriktig gratulation framföras till såväl redaktören KAI CURRY-LINDAHL som till förlaget för ett väl genomfört verk om Svensk Natur!

SVEN-OLOV STRANDHEDE

Lunds Botaniska Förening 1967

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