

Drawings of Scandinavian Plants 1-2

Drawings of Scandinavian plants, with critical remarks, are planned to be presented under this title in each fascicle of Botaniska Notiser. It is our hope that they shall be of interest and service to the professional botanists as well as floristically interested persons in general. The wild and naturalized species of *Rosa* will start the series in the present volume.

Rosa L.

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There are about 13 native and 3 introduced and \pm naturalized species of *Rosa* in Scandinavia. Most of these species (10) belong to the section *Caninae* CRÉP., which is taxonomically very critical. The variation of its taxa is wide and a great number of taxa has been described. The taxa are all irregular polyploids with $2n=28, 35$, or 42 (conforming with the formula $(14+7a)$ where $a=2, 3$, or 4). The reproduction is unique. At meiosis 7 bivalents and 14, 21 or 28 univalents are formed. The univalents are eliminated in the pollen formation and the pollen grains have only 7 chromosomes derived from the bivalents. The ovules have $7+7a$ chromosomes. At fertilization the original somatic number is restored. The inheritance thus is predominantly maternal; most of the chromosomes of the offspring come from the seed forming parent. This means that the biotypes (microtaxa) in this section are relatively constant. Hybridization may produce new biotypes which may survive and become stabilized.

Literature: ALMQUIST, S. 1916. Danmarks Rosae. Bot. Tidsskr. 34. — ALMQUIST, S. 1919. Sveriges Rosae. Stockholm. — GUSTAFSSON, Å. 1944. The constitution of the *Rosa canina* complex. Hereditas 30. — HERRING, P. 1934. Danske roser. Copenhagen. — LINDMAN, C. A. M. 1918. Svensk Fanerogamflora (*Rosa* by A. A. LINDSTRÖM, p. 335). Stockholm. — NEUMAN, L. M. 1901. Sveriges Flora (*Rosa* by L. P. R. MATSON, p. 348). Lund. — PEDERSEN, A. 1965. Rosaceernes udbredelse i Danmark 1. Bot. Tidsskr. 61. — TÄCKHOLM, G. 1922. Zytologische Studien über Gattung *Rosa*. Acta Horti Berg. 7.

R. sherardii DAVIES, em. BOULENGER

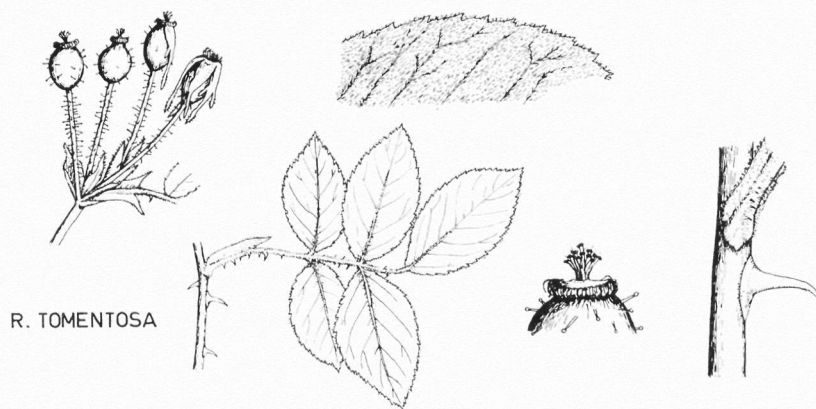
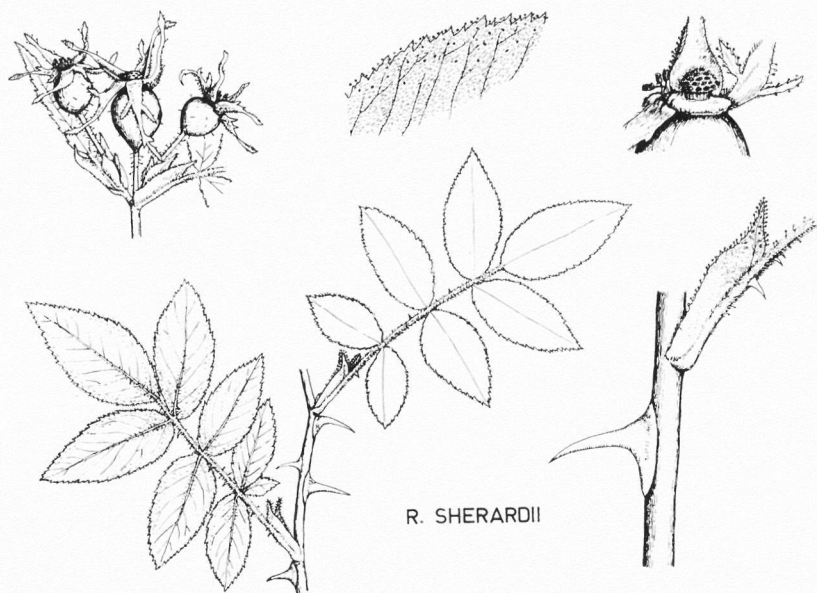
(*R. omissa* DÉSÉGL., *R. mollissima* GODET, non WILLD.)

1.5—3 m tall *shrub with flexuous stems*, young stems often pruinose. *Prickles rather stout* (up to 20 mm long), *straight or often somewhat curved* near apex, rarely hooked, widened at base; on young stems rather closely set and of variable size. *Leaflets usually 5 or 7, ovate, ovate — lanceolate* (20—45×12—25 mm), often subacute, rounded or tapering, symmetrical at base, the terminal one the largest; *tomentose* (or pubescent) on both sides (sometimes thinly tomentose but always densely tomentose along main veins of lower side), often harsh to the touch, pale, greyish or bluish green; *glandular beneath*, sometimes also above, strongly *smelling of turpentine*; simply or usually *doubly glandular-serrate*, teeth of different size and shape; stipules often narrow, *auricles acute, usually diverging*; bud-scales entire. Bracteoles broad, blunt with a point, shorter than the pedicels. *Pedicels rather long*, 2—3 cm, glandular-hispid, erect. *Flowers usually several, 2—6 together*, 4—5 cm in diam., deep pink. *Sepals patent or ascending* (sometimes erect) after flowering, *persistent until the fruit reddens*, then falling, somewhat constricted and not swollen at base, 2—3 sometimes richly and *distinctly lobed*, lobes glandular-serrate. *Styles laminate or villous*; *stigmas in a rather broad, dense, cushioned or vaulted head*; disc c. 4—5 mm, flat or concave, *orifice c. 2 mm*. Hip 1—2 cm, *erect, globose, obovoid, or pyriform*, smooth or sometimes glandular-hispid. June—July. $2n=28, 35, 42$.

Native. In scrub and open woods and on dry hills and stony shores, mainly on calcareous soils along the coast. A Central and W. European species; in Scandinavia common only in E. Denmark and in S.E. Sweden, rather rare in the rest of Sweden up to Bohuslän and Upland, in S. Norway, and SW. Finland.

In Scandinavia this species is known to form hybrids with *R. canina*, *R. dumalis*, and *R. villosa*. The hybrid with *R. canina* is morphologically very similar to *R. tomentosa*.

R. sherardii is very variable in Scandinavia. Three distinct form groups may be distinguished. These groups largely have separate distribution areas (but their distribution is imperfectly known). Regarding their distribution the groups may be treated as subspecies (here : as varieties), intermediate forms occur within the areas where the groups meet (in Scania, N. Småland, and on some of the Danish islands).



The form groups may be characterized as follow:

1. Var. *umbelliflora* (Sw.) HERRING (*R. cuspidatoides* CRÉP. in SCHEUTZ 1872; *R. umbelliflora* Sw. ex SCHEUTZ 1873, n. illeg.) — Prickles rather weak, all often slightly curved, usually sparsely spaced on young stems; young stems pruinose; leaflets ovate-lanceolate ($30-40 \times 13-18$ mm), usually densely

tomentose on both sides, *greyish or bluish green*, usually glandular above, *often simply glandular-serrate with low teeth*, *stipules narrow*; pedicels rather long (1.5—3 cm), sparsely glandular-hispid or smooth; bracteoles usually densely villose; *sepals* relatively *short*, not richly lobed, *ascending or erect*; *stigmas* in a *dense*, cushioned, *villose head*; disc 4—5 mm, orifice 2 mm; hip globose, obovoid or pyriform, smooth or sparsely glandular-hispid. (The drawing is made from this variety.)

The commonest form; with an eastern distribution in Scandinavia; in Denmark rather common on the islands, particularly on E. Sealand, Möen, Fyen, and Bornholm; in Sweden on the Baltic islands of Öland and Gotland and along the E. coast from Gladsax in Scania to Upland; in Finland on the islands of Åland.

2. Var. *venusta* (SCHEUTZ) HERRING (*R. venusta* SCHEUTZ 1872; incl. var. *scabriuscula* and var. *subglobosa*.) — Similar to no. 1 but prickles often distinctly curved, sometimes hooked, sparsely spaced on young steems; *leaflets ovate* (30—40×20—25 mm) with rounded base, usually *thinly tomentose* at least above, harsh to the touch, *greyish green*, sparsely glandular beneath, *distinctly doubly glandular-serrate*, teeth ± deltoid; *pedicels rather short* (1.0—2.0 cm); bracteoles usually smooth; *sepals long, richly lobed, ascending or deflexed*; *stigmas* in a vaulted, rather loose, *pilose head*; disc 4—5 mm, orifice 1.5—2 mm; *hip globular, usually smooth*.

This form has a western distribution in Scandinavia; in Denmark rather common in SE. Jutland, rare in N. and W. Jutland; in Sweden rather rare from the island of Ven and Mt. Kullaberg in Scania along the coast to N. Bohuslän, and in an isolated area in S. Småland; and from Oslofjord to S. Hordaland in S. Norway.

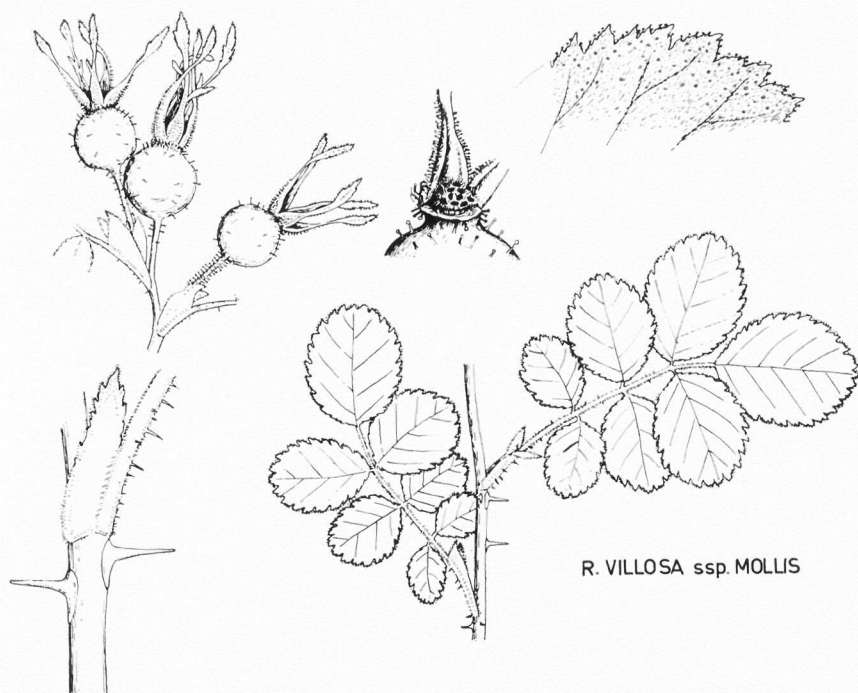
3. Var. *resinosoides* (CRÉP.) HERRING (*R. resinosoides* CRÉP.) — Similar to no. 1 but *prickles* usually straight or slightly curved near apex, *rather stout*, often densely spaced on young stems, on floriferous stems slender but rather long; young stems pale green; *leaflets ovate* (30—40×20—25 mm) with rounded base, *thinly tomentose* at least beneath, soft to the touch, *pale green*, sparsely glandular mainly along the veins beneath, *distinctly doubly glandular-serrate*, teeth ± deltoid; *stipules relatively broad*; pedicels rather long (2.5—3.5 cm), densely glandular-hispid; bracteoles almost smooth; *sepals* patent to ascending, *long, richly lobed*, and glandular-serrate; *stigmas* in a *dense* cushioned *villose head*; disc 4 mm, orifice 1.5 mm; hip pyriform or usually ellipsoid, densely glandular-hispid.

Rare, in scattered localities; in Denmark known from the island of Bornholm; in Sweden from N. Småland around Oskarshamn and Västervik, and from S. Scania in several localities around Skurup, Börringe, and Svedala.

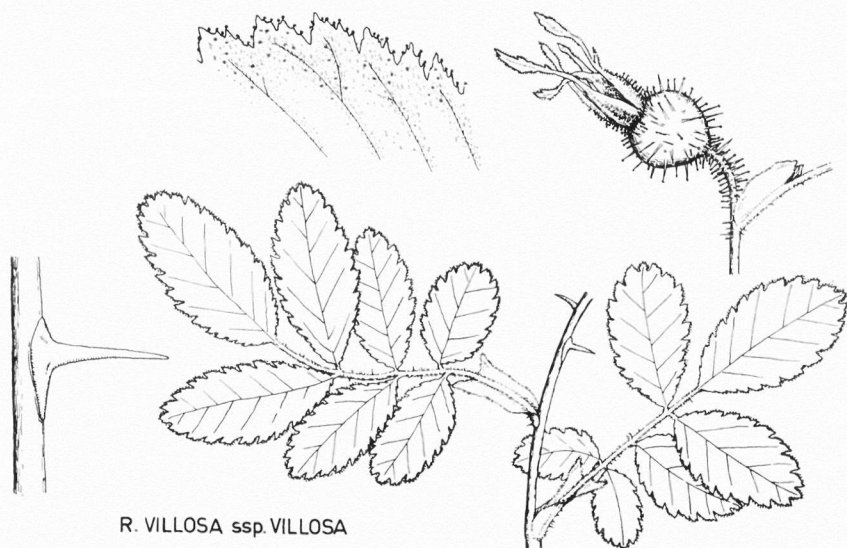
R. tomentosa Sm.

(*R. mollissima* WILLD. 1787, n. amb. rejic.)

Similar to *R. sherardii* but *stems* often *arching*, young stems and leaves pale green; prickles somewhat slender and more curved with a



R. VILLOSA ssp. *MOLLIS*



R. VILLOSA ssp. *VILLOSA*

broad base; leaflets 5—7, usually ovate-lanceolate (20—40×12—20 mm), densely tomentose on both surfaces, glandular beneath, simply or doubly glandular-serrate with low teeth, smelling of turpentine; stipules narrow with short triangular, straight or diverging auricles; bracteoles acute, tomentose, much shorter than the pedicel; *pedicels relatively long*, 2.5—3.5 cm, erect, often *densely glandular-hispid* (2—3 times as long as the fruit); flowers often several (1—4) together, 3—4 cm in diam., pink or white; *sepals patent — deflexed and soon falling after flowering*, distinctly *constricted at base*, 3 richly lobed; *styles glabrous or thinly pilose, stigmas in a loose, diffuse globose or conoidal head, disc c. 4 mm, ± conoidal, orifice 0.5—1 mm*; hip 1—1.5 cm, ovoid or sometimes globose, usually glandular-hispid but often smooth. June—July. $2n=35$.

Native. Woods and scrub. S. and C. Europe, very rare in S. Scandinavia; in Denmark with two nearby localities in E. Jutland, and two in N. Sealand; one collection from Gladsax in E. Scania, Sweden, seems to agree with the above description.

R. tomentosa seems to be rather uniform in Scandinavia. Some forms of *R. sherardii* var. *umbelliflora* are morphologically very similar to this species. They may be distinguished by the shape and direction of the sepals, the hair covering of the styles, and the relation between the disc and orifice.

Rosa villosa L. 1753, ampl. L. 1755 ssp. **mollis** (SM.) KELL. & GAMS. (*R. mollis* SM., *R. mollissima* FR., non WILLD.)

Low, 0.4—1.2 m tall *shrub, with erect stems*, branching in upper parts, *young stems usually pruinose. Prickles quite straight, rather weak*, subulate; on young stems sparse or often 0, on floriferous stems often 1—5 below each node. Leaves usually falling when the fruit reddens. *Leaflets* usually 7, oblong, *oval or sometimes roundish* (20—35×12—20 mm, often more rounded than those of related species), usually subobtuse, asymmetrical at base, the terminal pair often the largest; tomentose on both surfaces, greyish-green; glandular beneath (occasionally eglandular), scentless or smelling of resin; *markedly doubly* (often only in the middle parts) *glandular-serrate*; stipules rather broad, *auricles falcate and somewhat incurved*; bud-scales glandular-ciliate. Bracteoles broad, acute, usually somewhat shorter than the pedicel. *Pedicels short*, 0.5—1.5 cm, glandular-hispid, erect.

Flowers usually 1—3, 4—5 cm diam., deep pink (in some regions white, Dalarna and E. Scania). *Sepals* ascending or *usually erect after flowering*, *persistent until the fruit falls*, swollen but not constricted at base, few lobed (2 or 3 with 1—3 pairs), or *often all entire*, in the terminal part often widened, glandular-serrate. Styles lanate-villose; *stigmas in a dense cushioned head*; *disc c. 5 mm*, flat or concave, *orifice c. 3 mm*. Hip 1.0—1.8 cm, red, usually globose, *soft as ripe*, usually sparsely glandular-hispid, sometimes smooth, *early ripening* (in S. Scandinavia in the first half of August, about 3—4 weeks before the other species). June—July. $2n=28$.

Native. Hedges, scrub, stony shores, occasionally in open woods. Rather common in S. Scandinavia, mainly in the coastal districts, becoming less abundant in the inland and towards north. This subspecies is NW.-European; in Denmark it is particularly common in N. Jutland, Sealand, and Bornholm; it has previously been collected on the Faroes; in Norway it extends northwards to Troms and Lofoten; in Sweden northwards to Värmland and Medelpad; it also occurs in the 'Skärgård' of SW. Finland.

Ssp. mollis is rather variable, particularly in the shape and size of the leaflets ($1.2-4.2 \times 0.8-2.6$ cm), which are acute or obtuse, eglandular or densely glandular beneath, densely or sparsely tomentose; the sepals are erect or ascending, entire or lobed; the hips are globose or pyriform, stipitate-glandular or smooth.

In Scandinavia this subspecies is known to form hybrids with *R. canina*, *R. dumalis* (the commonest hybrid), *R. majalis*, *R. pimpinellifolia*, *R. rubiginosa*, and *R. sherardii*.

R. villosa* L. ssp. *villosa

(*R. villosa* L. s. str. orig.; *R. pomifera* HERRM., n. illeg.; *R. villosa* ssp. *pomifera* KELL. & GAMS)

Similar to ssp. *mollis* but *stems often up to 2 m, not pruinose*; *leaflets oblong-ovate* ($3.5-7.0 \times 1.8-3.5$ cm), obtuse and usually with parallel sides, markedly doubly glandular-serrate, with deep teeth, pubescent to tomentose, bluish-green, with densely spaced glands below, more fruit-scented; *pedicels very short*, glandular-stipitate; *flowers often solitary*, pink; hip globose — pyriform (1.5—2.5 cm), *densely glandular-stipitate*, dull red (ripening in September). July.

Introduced (from SW. and C. Europe). On the sites of old gardens, sometimes escaped and naturalized on hedge-banks and road-sides in S. Scandinavia, in Sweden extending northwards to Värmland and Up-land. In recent times rarely observed and collected.

Ssp. *villosa* seems to be rather uniform in Scandinavia and is mainly represented by var. "*typica*" CRÉP. and var. *recondita* (PUG.) CHRIST. Morphologically intermediate forms between the two subspecies of *R. villosa* (ssp. *mollis* var. *pseudopomifera* LÖNNR.) occur in several localities in S. Scandinavia.

(Scale of the drawings: leaves and hips $\times 0.5$; details nat. size.)

Studies in the Aegean Flora X
Cytologic and Morphologic Notes on *Plantago*

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ABSTRACT

Aegean material of some *Plantago* species has been cytologically investigated. The following chromosome numbers have been determined:

<i>P. major</i> L.		
ssp. <i>intermedia</i> LGE	2n=12	<i>P. albicans</i> L. 2n=30
<i>P. coronopus</i> L.		<i>P. psyllium</i> L. 2n=12
ssp. <i>coronopus</i>	2n=10	<i>P. amplexicaulis</i> CAV.
ssp. <i>commutata</i> (GUSS.) PILG.		ssp. <i>amplexicaulis</i> 2n=10
	2n=20	<i>P. lanceolata</i> L. 2n=12
<i>P. cretica</i> L.	2n=10	<i>P. lagopus</i> L. 2n=12
<i>P. bellardi</i> ALL.		
ssp. <i>deflexa</i> (PILG.) RECH.F.		
	2n=10	

The morphologic and cytologic diversity in *P. coronopus* L. and *P. albicans* L. is briefly discussed.

INTRODUCTION

In the southern and central Aegean 12 *Plantago* species have been recorded, which represent 7 out of 19 sections within the genus according to PILGER's monograph (1937). Cytologic observations on 9 species (representing 7 sections) are presented in this paper. All species dealt with have previously been cytologically investigated.

The strains studied were obtained from seeds of spontaneous material collected in the field. In most cases 4—6 individuals of each strain have been analysed. Cytologic observations were made in root-tip sections (fixation in the Svalöf modification of Navashin-Karpeschenko and staining in crystal violet).

The investigated material and in most cases also the parents obtained

in the field have been dried and are preserved in the Botanical Museum, Lund, Sweden. The names of the exact localities have been taken from the detailed sea charts of the British Admiralty (cf. also the maps in RUNEMARK et al. 1960).

SECT. POLYNEURON

***Plantago major* L. ssp. *intermedia* LGE**

$2n=12$

Cyclades. Naxos, 1 km NE of Moni, c. 600 m.s.m. 31.6 1958 (R-3472).

The name *intermedia* has been applied to different taxa within the *major*-complex. In this paper it has been used in accordance with RECHINGER in Flora Aegaea (1943) but contrary to PILGER (1937). Specimens collected by me from the Aegean (Naxos and Ikaria) belong to apparently indigenous populations along small rivers and rills in areas with siliceous bedrock.

The same chromosome number has been recorded for ssp. *intermedia* by PÓLYA (1949) from Hungary and by GRIPENBERG (in TISCHLER 1950).

SECT. CORONOPUS

Plantago coronopus* L. ssp. *coronopus

$2n=10$

Cyclades. Astipalea, Maltesana 10.5 1960 (R-3881).

***Plantago coronopus* L. ssp. *commutata* (GUSS.) PILG.**

$2n=20$

Cyclades. Sirina, Ag. Ioannis Ormos 2.5 1958 (R-3483). — Tria Nisia, the S-island 15.5 1960 (R-3882). — Astipalea, Maltesana-Vriseu Punda 11.5 1960 (R-3880). — Makares, Prasini 26.5 1958 (R-3461). — Ano Koufonisi 10.6 1960 (R-3883).

Karpathos. Saria, Ormos Armiro 4.5 1958 (R-3459).

Crete. S of the town of Ag. Nikolaos 14.5 1962 (R-3884).

Within the *coronopus*-complex three different levels of ploidy have been recorded, viz. diploids ($2n=10$), tetraploids ($2n=20$), and hexaploids ($2n=30$) — cf. LÖVE 1961.

According to BÖCHER et al. (1955) the East-Mediterranean tetraploids seem to be distinct enough in morphologic and cytologic characteristics to be treated as a separate species (*P. commutata* GUSS.). A morphologic analysis of the material collected by me (c. 50 collections) from the southern and central Aegean supports such a treatment. The material of ssp. *commutata* seems homogenous and individuals morphologically intermediate between ssp. *coronopus* and ssp. *commutata* do not occur. The single population of ssp. *coronopus* found by me (Astipalea, Maltesana) may be adventitious as well as the single record in the literature (from Mikra Delos in the Cyclades) as in both cases the material was found near harbours, rich in casuals.

However, according to GUINOCHET and GORENFLOT (1952, cf. also BÖCHER et al. 1955) and GORENFLOT (1959), both diploid and tetraploid strains of ssp. *commutata* as well as ssp. *coronopus* (as delimited by PILGER 1937) occur in North Africa. This statement is supported by the heterogeneity of herbarium material from North Africa. In the same way a study of herbarium material from the northern Aegean shows a morphologic diversity which may be an indication of the occurrence of different cytotypes.

The present knowledge of the *coronopus*-complex can be summarized as follows. In western Europe a variable, but morphologically circumscribable, diploid taxon (ssp. *coronopus*) occurs. In the mountains of Sicily and North Africa another diploid, well characterized taxon [ssp. *cupani* (GUSS.) PILG.] is found. In the southern and eastern Mediterranean a tetraploid taxon (ssp. *commutata*) occurs, which in its main area (southern Italy, southern Greece, southern Turkey, Syria, Lebanon, Israel, and Egypt) is morphologically well delimited and cytologically stabilized (cf. BÖCHER et al. 1955). The record of hexaploids (BÖCHER et al. 1953, 1955) from central Portugal cannot yet be taxonomically evaluated. However, in the West-Mediterranean and in the northern Aegean morphologically variable complexes occur, in which cytologically unbalanced strains (BÖCHER et al. 1955) and unexpected combinations of chromosome numbers and morphologic features have been found. As long as this complexity has not been treated in detail it seems best to maintain the subspecific rank for the main taxa in the *coronopus* complex.

The main differences between ssp. *commutata* and ssp. *coronopus* in the East-Mediterranean are tabulated below (most of the material of ssp. *commutata* coincides well with the figures in PILGER 1937).

	<i>Ssp. coronopus</i>	<i>Ssp. commutata</i>
Leaves	extremely variable in size and shape, but mostly with narrow segments; dwarfs with ensiform leaves not seen in the area	extremely variable in size and shape, but mostly with broad segments; dwarfs with ensiform leaves rather common
Scape	nearly always longer than the leaves, slender	shorter or rarely as long as the leaves, strongly thickened (most markedly in the upper part), especially in fruiting stage
Bracts	as long as or longer than the flowers, usually tapering into an acute point	1/2—3/4 of the length of the flowers, with a relatively short, often obtuse apex
Sepals	elliptic, carina (central coloured part) narrowly lanceolate or narrowly oblong, narrower than the colourless wings	broadly elliptic, carina (central coloured part) elliptic, broader than the colourless wings
Seeds	0.8—1.1 mm, dark brown, with a "sooty" surface	0.9—1.4 mm, light brown, \pm smooth

SECT. HYMENOPSYLLIUM

Plantago cretica L.

$2n=10$

Cyclades. Naxos, Panermo 8.6 1958 (R-3450). — Naxos, WSW of Ormos Leonis, 200 m.s.m. 21.5 1958 (R-3441). — Denousa, 2 km ESE of Akr. Aspron 25.5 1958 (R-3440). — Antimilos, c. 500 m.s.m. 15.5 1958 (R-3435). — Sifnos, Ormos Kondos 13.5 1958 (R-3457). — Sirina, Ag. Ioannis Ormos 2.5 1958 (R-3479).

Karpathos. Saria, Armiro Ormos 2.5 1958 (R-3456).

The chromosome number $2n=10$ has previously been recorded by MACCULLAGH (1934).

P. cretica is an invariable, east-mediterranean species (the Aegean to Israel). It is common in small islands in the south-eastern part of the Cyclades.

Plantago bellardi ALL. ssp. *deflexa* (PILG.) RECH.F.

$2n=10$

Euboea. Mantili Nisos 21.6 1958 (R-3454). — Petalides, Megalo Nisi 21.6 1958 (R-3438).

Ikaria. 2 km W of Praya P:t 14.7 1958 (R-1379).

The chromosome number $2n=10$ has previously been recorded for the species (most probably ssp. *bellardi*) by MACCULLAGH (1934) and RAHN (1966).

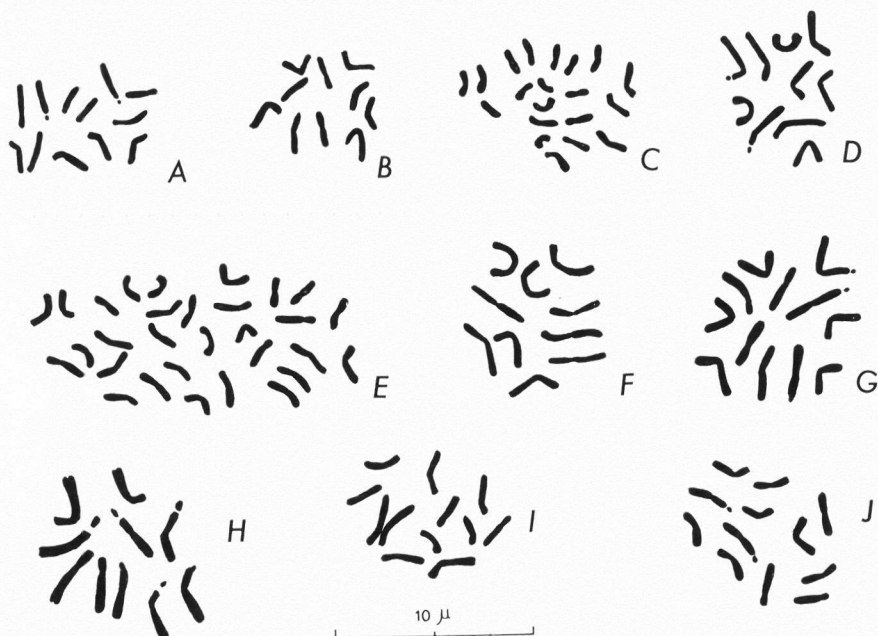


Fig. 1. Chromosomes (metaphase plates) in Aegean material of *Plantago*. — A: *P. major* ssp. *intermedia* ($2n=12$). — B: *P. coronopus* ssp. *coronopus* ($2n=10$). — C: *P. coronopus* ssp. *commutata* ($2n=20$). — D: *P. bellardi* ssp. *deflexa* ($2n=10$). — E: *P. albicans* ($2n=30$). — F: *P. cretica* ($2n=10$). — G: *P. psyllium* ($2n=12$). — H: *P. amplexicaulis* ssp. *amplexicaulis* ($2n=10$). — I: *P. lanceolata* ($2n=12$). — J: *P. lagopus* ($2n=12$).

P. bellardi is an omnimediterranean species eastwards reaching Persia. It has been subdivided by PATZAK and RECHINGER (1965) into two subspecies, ssp. *bellardi* occurring in the West-Mediterranean, eastwards reaching Turkey, and ssp. *deflexa* (characterized by thick, often deflexed scapes, shorter than the leaves) in the Orient, westwards to the Balcan peninsula. All material collected by me in the central Aegean belongs to ssp. *deflexa*.

SECT. LEUCOPHYLLUM

Plantago albicans L.

$2n=30$

Cyclades. Naxos, NE of Akr. Axapsi 30.7 1958 (R-1541). — Naxos, Ormos Kalantou 4.6 1958 (R-3488). — Naxos, Ormos Agiasou 3.6 1958 (R-3489). — Kato Koufonisi 11.6 1960 (R-3875).

The chromosome number $2n=20$ has been recorded from Spain (LORENZO-ANDREU 1951, LARSEN 1954) and southern France (RAHN 1957). HEITZ (1927) and MACCULLAGH (1934) found $2n=12$. FAHMY (1955) in material from Tunesia found 3 chromosome levels, viz. $2n=12$, $2n=24$ and $2n=30$ and some plants with abnormal numbers ($2n=10$ and $2n=32$).

Morphologically the European material is relatively homogenous. A comparison between a restricted Spanish (tetraploid?) and Aegean (hexaploid) herbarium material shows that the Aegean material has somewhat larger flowers (the size of the cells somewhat larger than in Spanish material). No differences in pollen size and stomata length were observed. The number of apertures in the pollen grains varied between 6 and 10, except in one Spanish collection, which had only 3—5 apertures.

The North-African material seems to be relatively heterogenous. Differences occur, e.g., in hairiness, shape of the leaves, pollen size, and morphology. This wide variation does not make the unexpected heterogeneity in chromosome numbers observed by FAHMY (1955) wholly improbable. It is apparent that a thorough experimental investigation of the North-African material is wanted before a taxonomic revision of the *albicans*-complex can be undertaken.

SECT. PSYLLIUM

***Plantago psyllium* L. (sensu PILGER)**

$2n=12$

Cyclades. Naxos, 2 km NNW of Kato Potamia 2.4 1958 (R-3468). — Kamila 6.5 1958 (R-3463). — Anafi, E of the monastery 8.5 1958 (R-3466). — Denousa, Ormos Rousa 23.5 1958 (R-3458). — Makares, Strongilo 5.6 1958 (R-3471).

The same chromosome number has previously been recorded by FUJIWARA (1956), REESE (1957), LARSEN (1960), and RAHN (1966). The species is omnimediterranean and also occurs in S.W. Asia (reaching N.W. India).

SECT. BAUPHULA

Plantago amplexicaulis* CAV. ssp. *amplexicaulis

$2n=10$

Cyclades. Safrania (Safora) 1.5 1958 (R-3439). — Anafi, NW of the monastery 29.5 1960 (R-3878). — Astipalea, Baia di Caminacia 13.5 1960 (R-3877).

The same chromosome number has previously been recorded for the species by MACCULLAGH (1934) and RAHN (1966). *P. amplexicaulis* occurs in the South-Mediterranean and in S.W. Asia (to N.W. India). It reaches Europe in southern Spain and southern Greece. PATZAK and RECHINGER (1965) subdivided the species into two subspecies, the mainly Mediterranean ssp. *amplexicaulis*, which is hairy on the carina of the sepals and has ovate, 3.25—3.75 mm long corolla lobes, and the Saharo-Sindian ssp. *bauphula* (EDGEW.) RECH. f. becoming glabrous on the carina of the sepals and having rather narrow, 2—2.5 mm long corolla lobes.

SECT. ARNOGLOSSUM

***Plantago lanceolata* L.**

2n=12

Cyclades. Denousa, Ormos Rousa 23.5 1958 (R-3447). — Ano Koufonisi 10.6 1960 (R-3878).

The same chromosome number has previously been recorded by numerous authors (cf. LÖVE 1961) from different parts of its area. The species, which is rather variable, is distributed all over Europe and the extra-European part of the Mediterranean as well as western and central Asia. From the central and southern Aegean I have collected material, which must be referred to v. *communis* SCHLECHT. (v. *lanceolata*), v. *mediterranea* (KERNER) PILG., and v. *dubia* (L.) WBG. according to the system of PILGER. The cytologically investigated material belongs to v. *communis*.

***Plantago lagopus* L.**

2n=12

Cyclades. Naxos, N of Ormos Kalantou 4.6 1958 (R-3434). — Naxos, N of Moutsounis 6.6 1958 (R-3437). — Keros, Plaki 10.6 1958 (R-3475). — Koufonisi, Kopria 5.6 1958 (R-3445). — Makares, Prasini 26.5 1958 (R-3476). — Amorgos, Liadi 3.7 1958 (R-3432). — Kinaros 2.7 1958 (R-3436). — Levitha, "Porto di Levitha" 1.7 1958 (R-3443, 3446). — Anafi, Makra 7.5 1958 (R-3460). — Anafi, E of the monastery 8.5 1958 (R-3474). — Siros, Ormos Kondos 13.5 1958 (R-3452).

The same chromosome number has previously been recorded by HEITZ (1927), MACCULLAGH (1934) and RAHN (1957, 1966). The species, which is not very variable, is restricted to the Mediterranean area taken in a wide sense (eastwards to Persia).

ACKNOWLEDGEMENT

The field work and the technical assistance during the cytologic work have been financed by grants from the Swedish Natural Science Research Council.

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Further Records for the Vascular Flora of the Falkland Islands

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ABSTRACT

Acaena pumila VAHL, *A. microcephala* SCHLECHT. and a newly described species, *Nastanthus falklandicus* D. M. MOORE (*Calyceraceae*), are added to the native flora of the Falkland Islands. *Chrysanthemum leucanthemum* L., *Hieracium aurantiacum* L. and *Sedum acre* L., not previously reported, are added to the list of naturalized aliens known from the archipelago. Range extensions within the islands are documented for 7 species now known to occur on East Falkland and 2 newly reported from West Falkland.

INTRODUCTION

In a recent publication by MOORE and SLADEN (1965) the opportunity was taken to summarise, from the literature and various unpublished collections, the data on the vascular plants of the Falkland Islands which have accrued since the publications of SKOTTSBERG (1913, 1929) and MARQUAND (1923). All new records up to 1961 were reported, apart from the addition to the Falkland flora of *Scutellaria nummulariifolia* HOOK. f. (EPLING 1938).

The present paper results from the collections made during my visit to the Falkland Islands in 1964 and from three small collections which I have studied recently. These latter were made by Dr. R. W. M. CORNER and Dr. R. E. LONGTON, respectively a medical officer and a botanist to the British Antarctic Survey, and by Mr. S. BOOTH of Port Stanley. Three native species, one of them new, and three naturalized aliens, are added to the Falkland flora, while some major extensions of distributions within the archipelago are documented.

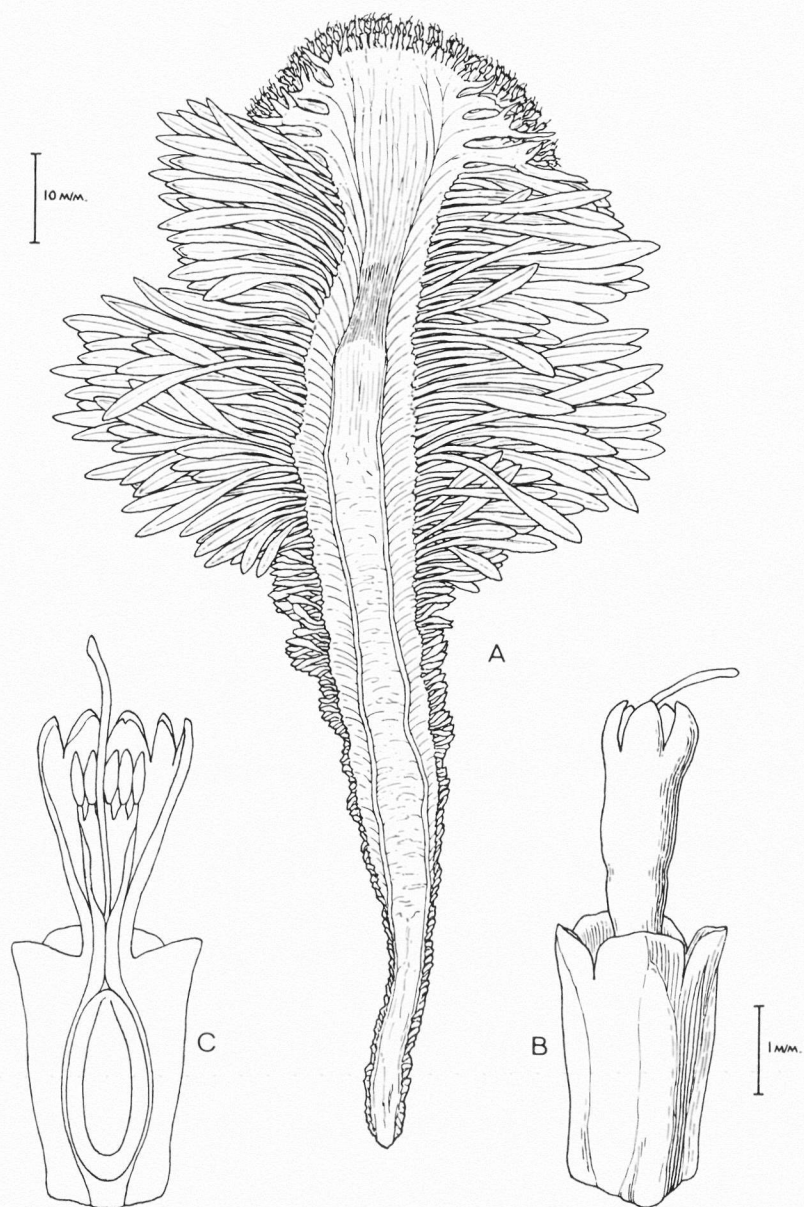
Additions to the flora

NATIVE SPECIES

***Nastanthus falklandicus* D. M. MOORE sp. nov. (Figs. 1—2)**

Herba perennis, glabra, caespitosa. *Caules* 20—70 mm longis, 5—18 mm latis, carnosus, crassis, latissimis in parte extreme, inflorescentia ad apicem ferens, densis foliorum verticillis qui ei externa videntur, foliis carens ad basem, ubi fuscus et foliorum cicatricibus asper. *Folia* 12—40 mm longa, 2—4 mm lata, dense imbricata, oblonga vel oblanceolata vel subspatulata, coartata in dimidio basali, subcarnosa; apex acutus vel rotundatus; margo integer. *Pedunculi* usque ad 20 mm longi, foliis breviores, inferiores liberi et simplices vel semel ramosi, in capitulo unico terminati; pedunculi breviores et coniuncti ad apicem caulis fiunt; capitula terminalia et sessilia. Bractea peduncularis unica, folio similis. *Capitulum* 4—8 mm diametro, hemisphaerum. *Bracteae involucales* 3, 3—4 mm longae, 2—3 mm latae, ovatae vel ovatae-triangulares, virides, integrae, acutae, connatae in base ad dimidiam longitudinem. *Bracteae receptaculares* 6—10, 1.5—3 mm longae, c. 0.5 mm latae, angusto-ellipticae vel oblanceolatae, membro fastigato vel tenui, etiam filiformi ungue. *Calyx* viridis, cum ovario iuncta per maiorem partem longitudinis; lobis c. 1 mm longis et latis, obtusis vel rotundatis; ala prominens lata carnosae linea media lobae cuiusque oritur et secundum longitudinem receptaculi iungitur. *Corolla* c. 3 mm longa, tubulata, alba; membro diviso ad medios ferme antheras; lobis c. 0.8 mm longis, apice acuto et cucullato. *Stamina* in petalis inserta ad medium ferme corollae membrum, ubi grandes parvae cum eis alternant; filamentis in dimidio inferiore coniunctis, quae tubulum ad corollam coniunctum efficiunt; antheris c. 0.6 mm, in base connatis. *Stylus* filiformis, exsertus c. 1 mm; stigmate simplici. *Achena* immatura c. 2.5 mm longa, quae in lobis calycis perstantibus fastigatur; alis 5, prominentibus. Achenae maturae non visae. Protogynosa. Flores nectare graviter olent.

Perennial herb, glabrous, caespitose. *Stem* 20—70 mm long, 5—18 mm wide, fleshy, stout, broadest distally and tapering to an underground, \pm horizontal, sometimes divided stock, bearing inflorescences towards apex, with dense whorls of leaves below appearing external to them, leafless towards base where brown and rough with leaf-scars. *Leaves* 12—40 mm long, 2—4 mm wide, densely imbricate, oblong to oblanceolate or subspathulate, narrowing in basal half to resemble winged petiole; rather fleshy with median longitudinal groove on upper surface; apex acute or rounded; margin entire. *Peduncles* to 20 mm long, shorter than leaves, the lower free and simple or once-branched, terminating in a single capitulum; peduncles becoming shorter and connate towards stem apex; terminal capitula sessile. *Peduncular bract* 1, leaflike, borne well below capitulum on lower peduncles, on more



D.E.

FFig. 1. *Nastanthus falklandicus* D. M. MOORE. — A. Section of plant; B. Flower; C. Corolla-tube opened to show stamens, and ovary in vertical section.

distal peduncles resembles, though exceeds, the involucre bracts with which it is in close contact. *Capitulum* 4—8 mm in diameter, hemispherical. *Involucre* of 3 ovate-triangular, green bracts; bracts 3—4 mm long, 2—3 mm wide, acute, entire, connate basally to 1/2 their length. *Receptacular bracts* 6—10, 1.5—3 mm long, c. 0.5 mm wide, narrow-elliptical to oblanceolate, limb narrowing to slender, even filiform, claw. *Calyx* green, adnate to ovary for most of length; lobes c. 0.5 mm long and wide, obtuse to rounded; prominent broad fleshy wing arising from midline of each lobe and adnate along length of receptacle. *Corolla* c. 3 mm long, tubular, white; limb divided to about the middle of the anthers; lobes c. 0.8 mm long, with acute cucullate apex. *Stamens* inserted on petals about middle of corolla-limb where small glands alternate with them; filaments united in lower half forming tube fused to corolla, free above; anthers c. 0.6 mm, connate at base. *Style* filiform, exerted c. 1 mm; stigma simple. Immature *achene* c. 2.5 mm long, terminating in persistent calyx-lobes, with 5 prominent wings. Mature achenes not seen. Protogynous. Flowers smell strongly of nectar.

CHROMOSOME NUMBER. — $n=20-21$.

TYPUS. FALKLAND ISLANDS. West Falkland: Port Stephens: Ten Shilling Bay Peninsula, west coast c. 3 miles SE Stephens Peak, c. 90 m, "in gravel and sand between loose rock slabs near cliff top, also on bare cliff ledges", 28.i.1964, MOORE 707 (holotype K; isotypes LP, LTR, GH).

Table 1. Principal characters distinguishing *Nastanthus falklandicus* and those species most resembling it. Data for *chubutensis* and *spathulatus* from Pontiroli (1963) and for *compactus* from type material.

	<i>falk-</i> <i>landicus</i>	<i>com-</i> <i>pactus</i>	<i>chubu-</i> <i>tensis</i>	<i>spathu-</i> <i>latus</i>
Leaf margin	entire	entire	crenate- dentate	dentate, rarely entire
No. of involucre bracts	3	c. 5	5—7	5—7
No. of receptacular bracts	6—10	0	many	few
Corolla length (mm)	c. 3	c. 8	c. 6	7—8
Corolla tube length (mm)	1	6	4.0	?
Corolla lobes, length (mm)	0.8	0.8	2.0	?
Anther length (mm)	0.6	1.0	1.0	2.5
Glands at base of filaments	small	absent	absent	large
Distribution	Falkland Is.	Andes of C. Chile	Argen- tinian Andes 38—44° S.	Andes of C. Chile and Argentina to S. Patagonia

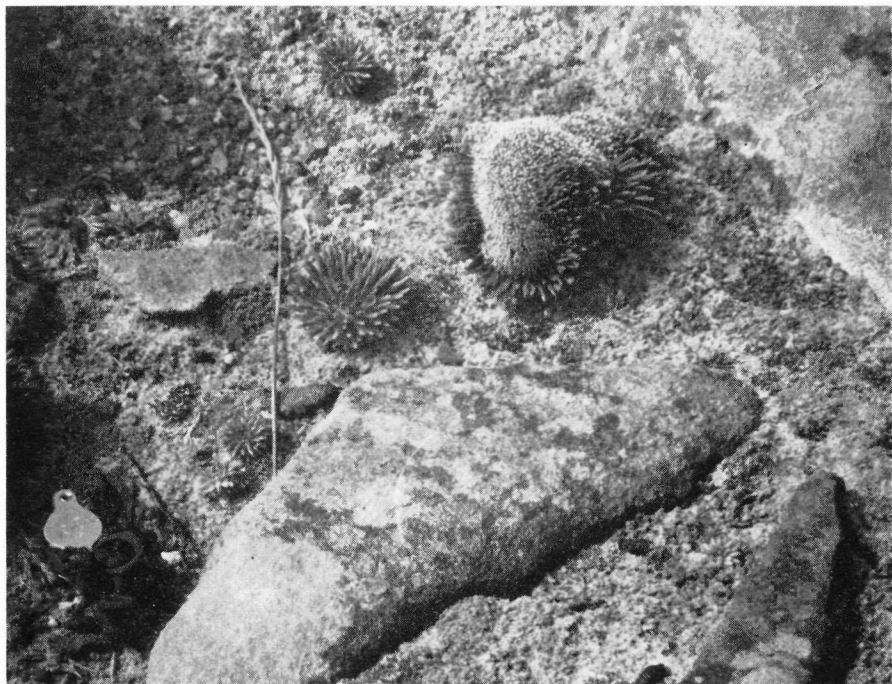


Fig. 2. Above. Photograph of *Nastanthus falklandicus*, flowering and non-flowering plants *in situ*. — Below. Habitat, showing scattered cushions of *Valeriana sedifolia* D'URV. (lighter colour) and *Bolax gummifera* (LAM.) SPRENG.

OTHER MATERIAL. Falkland Islands, sin. loc., 1839?, Lieut. ROBINSON s.n. (K).

N. falklandicus most closely resembles *N. chubutensis* SPEG., *N. spathulatus* (PHIL.) MIERS and *N. compactus* (PHIL.) MIERS; the characters distinguishing the four species are summarized in Table 1.

This species is endemic to the Falkland Islands and appears to be restricted to the SW coast of West Falkland (Fig. 3). However, it seems to be extremely susceptible to grazing by sheep, occurring almost entirely in areas to which they cannot find access, and it is possible that the unlocalized fragment collected by Lieut. ROBINSON in 1839 may indicate a wider occurrence formerly.

***Acaena pumila* VAHL**

This species occurs in Fuegia, southern Andean and West Patagonia and in an isolated locality in the Cordillera Pelada, Prov. Valdivia, S. Chile (c. 40° S.). It was reported from the Falkland Islands by DUSE (1905) on the basis of a HOOKER specimen in the WEBB herbarium at Firenze, but SKOTTSERG (1913) followed BITTER (1911 p. 40) in denying its presence in the archipelago. In his recent monograph, GRONDÓNA (1964) included the Falkland Islands in the distribution of this species but no voucher material was cited.

East Falkland: Mt. Usborne; N. side on wet peaty ledges, c. 2100 ft. (646 m.), fl., 13.xi. 1963, CORNER 352 (LTR).

***Acaena microcephala* SCHLECHT.**

This species, which is rather closely related to *A. ovalifolia* RUIZ & PAVÓN, occurs along the Andes from c. 40° S. to Tierra del Fuego and Isla de los Estados. In the Falkland Islands it seems to be restricted to the highest summits, like *A. pumila*, but is recorded from both the main islands.

East Falkland: Mt. Usborne; N side on wet peaty ledge, c. 2100 ft. (646 m.), fl., 13.xi.1963, CORNER 353 (LTB); N side on peaty soil beside tarn, c. 2000 ft., (615 m.), fl., 18.i.1964, MOORE 600 (K, LP, LTR).

West Falkland: Mt. Adam; "among moss at edge of waterfall near summit", c. 2000 ft. (615 m.), 1909—11, VALLENTIN s.n. (K).

ALIEN SPECIES

Eightynine introduced species have been recorded from the Falkland Islands (MOORE & SLADEN 1965). Three further species are now known to be locally naturalized and their occurrence is documented here.

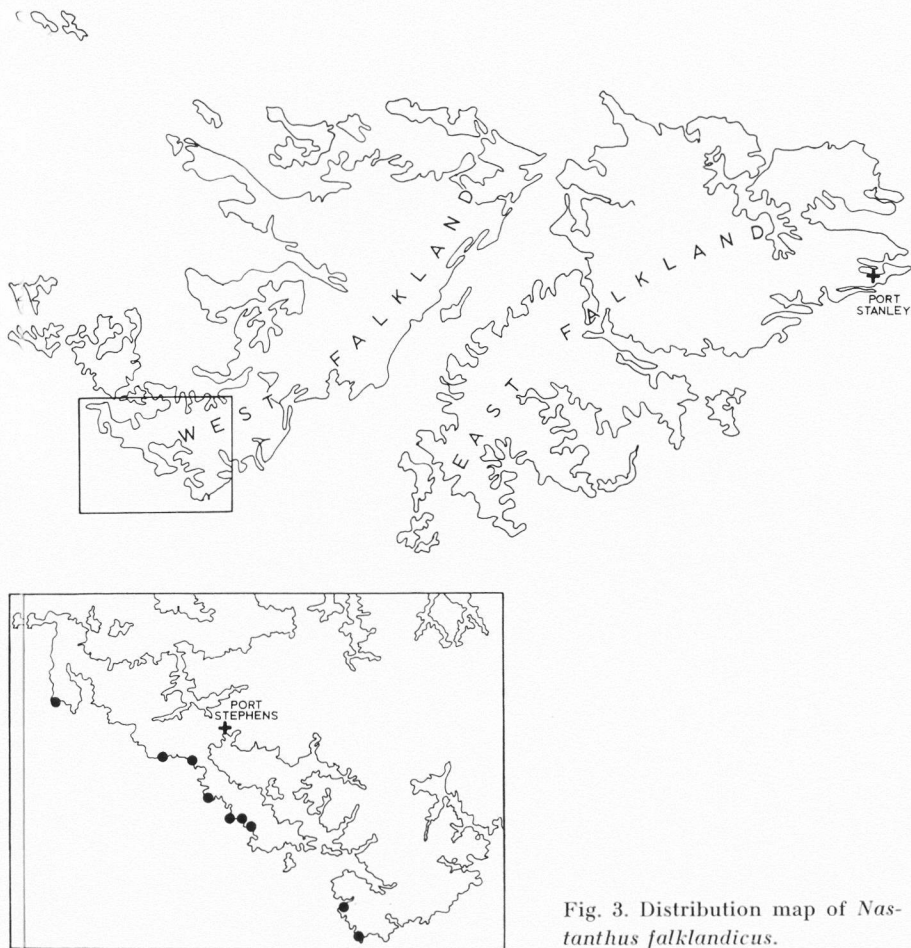


Fig. 3. Distribution map of *Nastanthus falklandicus*.

Chrysanthemum leucanthemum L. — West Falkland: Port Howard; Paddocks of the Plains, fl., 10.i.1964, BOOTH 75 (LTR). Mr. BOOTH also saw this species on the banks of the River Warrah in the same area and he thinks that it was introduced many years ago with grass seed used for a pasture improvement programme.

Hieracium aurantiacum L. — East Falkland: Port Stanley; in sward along edge of harbour, fl., 12.i.1964, MOORE 538 (BIRM, GH, K, LP, LTR, US). This ornamental C. European species is commonly encountered as a naturalized garden-escape in Britain and is apparently repeating the pattern in disturbed habitats in and around Port Stanley.

Sedum acre L. — East Falkland: Port Stanley; in rocky heath near radio station, fl., 12.i.1965, LONGTON 1047 (BIRM, LTR). This species is almost certainly a garden-escape in this area, perhaps as a result of dumping garden or building rubbish.

Range extensions

SKOTTSBERG (1913) drew attention to the differences between the lists of species present on East and West Falkland. He suggested that they may result from climatic or historical factors but noted at the same time that alterations would undoubtedly be necessary with increased botanical exploration of the archipelago. MOORE & SLADEN (1965) provided certain modifications to these lists and the collections now being considered necessitate further changes. Seven species previously recorded only from West Falkland are now known from East Falkland and two species are here reported for the first time from West Falkland.

NEW RECORDS FOR EAST FALKLAND

Asplenium dareoides DESV. — Mt. Usborne; S side at Cerritos Rocks, c. 1500 ft. (461 m.), 7.xi.1963, CORNER 334 (LTR).

Cystopteris fragilis (L.) BERNH. — Darwin; head of harbour at mouth of Burnside Creek, coastal cliffs, 21.i.1964, MOORE 639 (K, LP, LTR).

Polygonum maritimum L. — San Carlos; Black Rincon, top of pebbly beach, fl., 25.i.1964, MOORE 662 (LTR); mouth of Head of Bay Creek, base of cliffs, fl., 26.i.1964, MOORE 665 (K, LP, LTR).

Ranunculus acaulis BANKS & SOL. — San Carlos; White Rincon, sandy beach above highwater mark, fl., 24.i.1964, MOORE 650 (C, CHR, GH, K, LP, LTR, S, US).

Cotula scariosa (CASS.) FRANCH. — Moody Valley, W of Port Stanley, bank of stream, fl., .xii.1961, BOOTH 43 (LTR).

Carex aemathorrhyncha DESV. — San Carlos; Head of the Bay Creek, wet area by stream, 26.i.1964, MOORE 667 a (CHR, GH, K, LP, LTR, S).

Deschampsia parvula (HOOK. f.) DESV. Mt. Usborne; summit area, among *Bolax* and *Azorella selago* cushions, c. 2300 ft. (708 m.), fl., 18.i.1964, MOORE 608 b (K, LTR).

NEW RECORDS FOR WEST FALKLAND

Carex caduca BOOTT. — Mt. Adam; N side on wet ledges, c. 1900 ft. (585 m.), 15.ii.1964, MOORE 882 (CHR, GH, K, LP, LTR, S); Hill Cove; base of French Peaks, wet *Cortaderia* grassland, c. 500 ft. (154 m.), 14.ii.1964, MOORE 874 (C, K, LTR, P, UC, US); Port Stephens; Carew Harbour, wet *Cortaderia* grassland, 10.ii.1964, MOORE 815 (BIRM, GH, K, LP, LTR, S).

Carex microglochin WAHLENB. ssp. *oligantha* (BOOTT.) KUCK. — Hill Cove; base of French Peaks, wet *Cortaderia* grassland, c. 500 ft. (154 m.), 14.ii.1964, MOORE 873 (BIRM, CHR, GH, K, LP, LTR, S).

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The award of a Royal Society and Nuffield Foundation Commonwealth Bursary made possible my visit to the Falkland Islands, which was facilitated by the help and continuing interest of the British Antarctic Survey and its Director, Sir VIVIAN FUCHS. The interest of Sir EDWIN ARROWSMITH, Governor of the Falkland Islands, and of my many friends there who provided hospitality and transport assured the success of my collecting. I am extremely grateful to Drs. R. W. M. CORNER and R. E. LONGTON, and to Mr. S. BOOTH for placing their collections at my disposal, to Dr. CARLOS MUÑOZ of the Museo Nacional de Historia Natural in Santiago de Chile for providing photographs and information on the type of *Nastanthus compactus*, and to Dra. A. PONTIROLI of the Museo de La Plata in Argentina for comparing the new *Nastanthus* with Argentinian species. Subsequent herbarium work has been aided by a grant from the Research Board of Leicester University. The drawing of *Nastanthus falklandicus* was prepared by Mrs. D. ERASMUS and my colleague Mr. E. RUSHWORTH assisted with the Latin diagnosis.

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Some New and Rediscovered Species of *Aspalathus* (Leguminosae)

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ABSTRACT

Three new species of *Aspalathus* are described, viz. *A. rycroftii* R. DAHLGR., *A. taylorii* R. DAHLGR., and *A. barbiger*a R. DAHLGR. Complementary notes are given on *Aspalathus macrocarpa* ECKL. & ZEYH., *A. prostrata* ECKL. & ZEYH., and *A. pallescens* ECKL. & ZEYH., which previously were incompletely known with regard to distribution and various details. The chromosome number of *A. pallescens* and *barbiger*a is $2n=18$, and the latter of these species has a caryotype similar to those of the morphologically similar *A. cephalotes* THUNB. and *A. nigra* L.

INTRODUCTION

A revision of the genus *Aspalathus* is continuously being published in *Opera Botanica*, and a comprehensive account of the genus has been given in vol. 9:1 (DAHLGREN 1963 A) of this series. During a second period of field work in South Africa lasting between July 1965 and March 1966 I had the opportunity of broadening the knowledge of the variation and distribution (and also ecology and cytology) of most species of the genus. A great advantage in the work was the offer of the Director and staff of the National Botanic Gardens, Kirstenbosch, to take care of the living plants (in the case of *Aspalathus* the seedlings) collected. After some time in culture the plants had developed fresh root tips which were fixed in Navashin-Karpechenko fixative and later (in Lund) stained in crystal violet (with aniline). Material raised from seed collected are at present kept in greenhouse cultivation in Lund.

Some new species were discovered during the studies in the field. Two of these are described here. A third new species, *A. taylorii*, was collected by Mr. H. C. TAYLOR near Riversonderend in 1962. Besides, notes are given here on three species previously with unknown or little known occurrence and in some cases with incompletely known shape of flower or fruit. — Dr. O. ALMBORN has kindly read the manuscript.

Aspalathus taylorii R. DAHLGR. sp. nov. (Fig. 1)

Original collection: Caledon Div.: Tygerhoek; 150—240 m. 19/12 1962, H. C. TAYLOR no. 4484 (holotype STE; isotype PRE).

Fruticulus decumbens, ramis ad c. 45 cm longis, gracilibus; ramuli graciles, in parte exteriore rubelli, breviter villosi; internodia exteriora ad > 4 cm longa. *Folia* sessilia, trifoliolata; foliola subplana, linearia—angustissime oblanceolata, plerumque 6—11 mm longa et 0.4—1 mm lata, acuminata, in parte basali breviter villosa, aliter sparse ciliata, supra canaliculata, subtus prominenter unicastata. *Flores* 1—5 in apicibus ramulorum sedentes. *Bracteae* subfiliformes vel subulati, 0.5—1.5 mm longae, sparse pilosae. *Pedicelli* 3.5—4.5 mm longi, teretes, rubentes, breviter villosi. *Bracteolae* minutissimae. *Tubus calycis* infundibuliformis, breviter villosus. Lobi lineares vel filiformes, c. 1.2—1.3 mm longi, flexiles, sparse pilosi. *Petala* lutea—flava. *Lamina vexilli* elliptica, c. 4.5—5 mm longa et c. 2.9—3.4 mm lata, dorso breviter pilosa. *Laminae alarum* c. 4—4.5 mm longae et 1.1—1.4 mm latae, glabrae. *Laminae carinae* lunatae, c. 3.5 mm longae et c. 1.7 mm latae, breviter sericeae. *Ovarium* in parte superiore sericeum.

Decumbent shrublet with 25—45 cm long, slender branches with longitudinally splitting bark. Branchlets slender, with sometimes up to more than 4 cm long internodes, reddish-brown, but covered with white villous variously dense pubescence. — *Leaves* sessile, trifoliolate, mainly alternate, but opposite at the branchlet apices. Leaflets partly flat, linear or very narrowly oblanceolate, usually 6—11 mm long and 0.4—1 mm broad, broadest a few mm from apex, subcarnose, acuminate, puberulous or short villous on basal third, otherwise with sparse spreading rather long wavy hairs except on the upper surface; lower side with prominent midrib, making the leaflet almost keeled, upper surface canaliculate. — *Flowers* solitary or up to 4 or 5 together at the apex of the branchlets (surrounded by the upper leaves), but often superseded by a branchlet developed in the axil of some of the uppermost leaves. — *Bract* filiform, very narrow, up to c. 0.5—1.5 mm long, reddish, with sparse hairs. — *Pedicel* 3.5—4.5 mm long, but only c. 0.2 mm thick, terete, reddish, densely puberulous. — *Bracteoles* sometimes visible as small tufts of hairs on the sides of the middle part of the pedicel. — *Calyx* tube almost infundibular, c. 1.2—1.3 mm long (between the base and the sinuses), puberulous or short villous, at least the five veins purplish but often pale yellowish white inbetween. Lobes filiform, about 3—3.5 mm long, less than 0.2 mm broad almost to the base, weak, partly or entirely purplish, sparsely hairy. — *Petals* pale to bright yellow. — *Vexillum* with elliptic, c. 4.5—5 × c. 2.9—3.4 mm large blade shortly pubescent on the back, glabrous

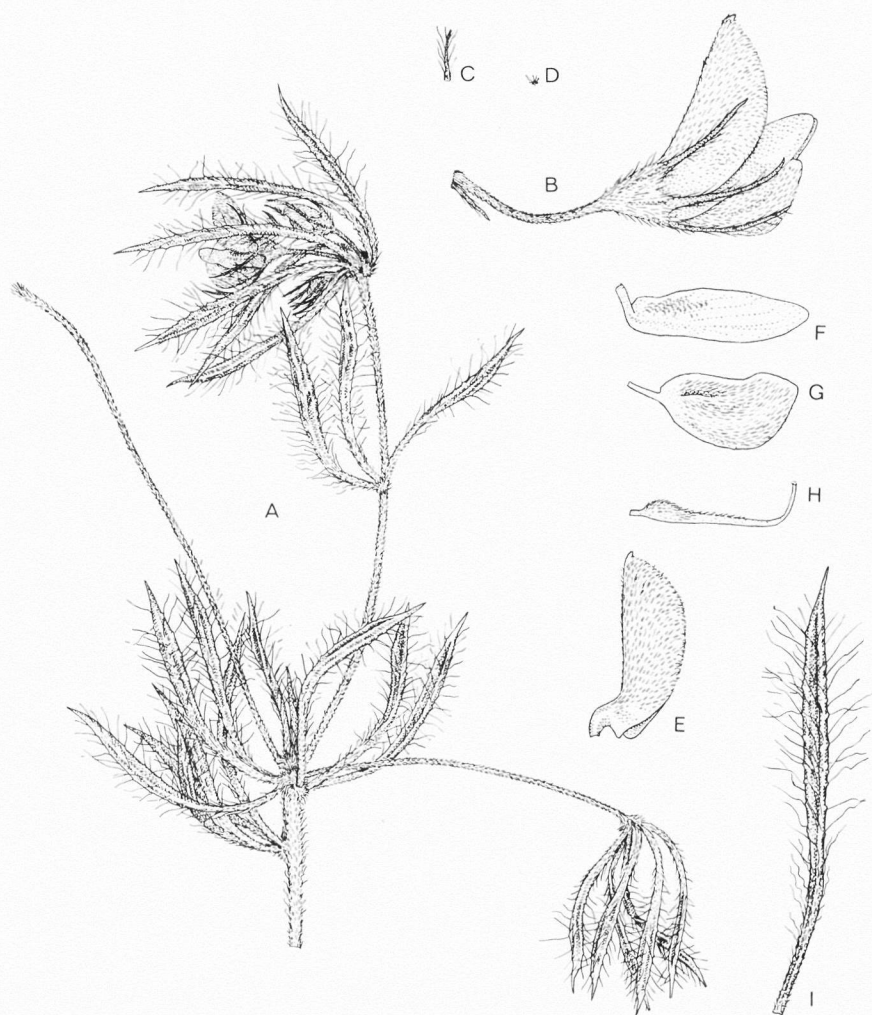


Fig. 1. *Aspalathus taylorii*; TAYLOR no. 4484. — A: Branch end with floriferous branchlet; notice the subopposite position of the leaves on the branchlet ends. — B: Flower. — C: Bract. — D: Bracteole. — E: Vexillum, side view. — F: Ala petal. — G: Carina petal. — H: Pistil. — I: Leaflet of vegetative leaf. — (A $\times 2.5$; B–I $\times 5$.)

on the front, apex with a short tip. Claw only c. 0.4–0.6 mm long. — *Ala* blades c. $4\text{--}4.5 \times 1.1\text{--}1.4$ mm large, glabrous, with c. 4–5 rows of distinct small pockets on the basal parts of the outer side. Claws only c. 0.7 mm long. — *Carina* blades lunate, c. 3.5×1.7 mm large (see

Fig. 2 G), densely puberulous on most parts of the outer side. Claws c. 0.7—0.8 mm long. — *Pistil* shortly stipitate, pubescent on the upper parts. Style upcurved, ciliated on the upper side of the basal half. Ovary 2. (Pods not seen.)

The species is very distinct. Perhaps it is most similar morphologically to *Aspalathus stenophylla* ECKL. & ZEYH. (cf. DAHLGREN 1960 p. 120 et seqq.), but it differs from this species in its much smaller flowers with much longer pedicels and in its glabrous ala blades.

Tygerhoek is an experimental farm near Riviersonderend. The species was found on the lower slopes of Spitzkop, a tributary of Riviersonderend, beyond a stream at an altitude of about 200 m. It was growing in coarse sand of the Table Mountain Series (on a ground reminiscent of that on the Red Hill plateau on the Cape Peninsula). All this according to the information kindly given by Mr. H. C. TAYLOR, to whom I am most indebted.

***Aspalathus barbiger* R. DAHLGR. sp. nov. (Fig. 2 A—G)**

Original collection. Bredasdorp Div.: Small hill c. 2 miles E. of Kaathoek. 16/11 1965, DAHLGREN & STRID no. 4182 (holotype NBG; isotypes BCOL, LD, PRE, S).

Frutex erectus ad > 1 m altus, dense ramosus, ramis ascendentibus, pallide cinereis vel albescentibus. Ramuli villosi foliosi. Foliola linearia, plerumque 7—11 mm longa, flexilia, depressa, acuta—acuminata, sordide viridia, sparse villosa. Flores (3—)6—15 in spica elongata sedentes. Pedicellus 0. Bractee pro parte maxima trifoliolata, in apice inflorescentiae simplices, foliola linearia, (6—)8—11 \times 0.6—0.8 mm, depressa, foliolis vegetativis similes. Bracteolae simplices, foliolis bractearum similes. Tubus calycis laevis, sparse et longe sericeus; lobi calycis subulati, flexiles, 5—6 mm longi, marginibus praesentim in partibus basalibus densissime et longe ciliatis. Lamina vexilli oblongo-elliptica, 8—8.5 \times 3.5—3.8 mm, dorso dense villosa-sericea, ungue 2.3—3.0 mm longo. Laminae alarum lineares, c. 6.5—7.0 \times 2.0—2.2 mm, in partibus inferioribus et apicalibus densissime albo-lanatae. Laminae carinae c. 4.3—4.8 \times 2.5—2.9 mm, in partibus inferioribus densissime albo-lanatae. Petala alba vel pallide violacea. Ovarium in parte apicali longe sericeum.

Shrub erect, up to > 1 m tall, rather densely branched, with ascending, rather slender but rigid branches white or light grey in colour. Last year's branchlets brownish, slender, villous, and leafy. — *Leaflets* 3 or more together, linear, flexible, dull green; those of the base of the branchlets short and glabrous or subglabrous, the others usually 7—11 mm long, slightly depressed, acute or acuminate, often slightly

incurved, with irregular surface and sparse spreading curly hairs. — *Inflorescence* a usually \pm elongate spike, 1.5—3.5 mm long, with (3—) 6—15 flowers. — *Pedicel* lacking. — *Bracts* of most flowers trifoliolate, leaflike, with short base and 3 depressed or almost flat, usually (6—) 8—11 \times 0.6—0.8 mm large leaflets glabrous on upper side, with short spreading hairs on lower side and margins. Uppermost bracts simple, shorter than leaflets of trifoliolate bracts. — *Bracteoles* simple, linear, similar to the leaflets of the bracts, usually 4—7 mm long. — *Calyx* tube 2.5—3 mm long, campanulate, smooth, with sparse but long hairs. Calyx lobes subulate, weak, \pm flat, 5—6 mm long, dull green, often slightly recurved, acuminate, densely long- and white-villous on the margins especially on the basal parts, sparsely long-hairy on the basal parts of the outer side. — *Petals* almost white or very pale violet (but the carina distinctly purple). — *Vexillum* blade oblong-elliptic, about 8—8.5 \times 3.5—3.8 mm large, very densely white-woolly on the back side, and somewhat hairy also on the marginal parts of the front side, the base pubescent on each side of the claw. Claw broad, 2.3—3.0 mm long, \cap -shaped in cross-section, glabrous on the back, pubescent within. — *Ala* blades linear-oblong, about 6.5—7 \times 2.0—2.2 mm large, with very marked irregularly curved folds reaching almost to the upper margin on the basal part, very densely long-woolly on the lower, middle, and apical parts of the outer side. Claws slender, 3.0—3.5 mm long. — *Carina* blades lunate, about 4.3—4.8 \times 2.5—2.9 mm large, purplish on apical parts, densely woolly on the lower and lower-apical parts. Claws slender, c. 3.5 mm long or more. — *Stamens*: four anthers basifixed and c. 0.9 mm long, six (incl. the lowest median) ones dorsifixed and about 0.5 mm long. — *Pistil* shortly stipitate, with small 2-ovulate ovary with long, forwardly directed, straight hairs on the apical parts; style slender, glabrous; stigma small, regular. (Pods not seen.)

DISTRIBUTION. The species has been found only on a little hill near Kathoek, west of the Potberg, in the Bredasdorp Division, where it grows on the southern side in a community with a certain amount of *Elytropappus*, and also together with erect more than one metre high *Sutherlandia frutescens*. The ground is clayey and rather dry.

COLLECTIONS

Bredasdorp Div.: S. side nr. top of a small dry hill c. 2 miles E. of Kathoek along rd. to Malagas. Oct. 1965, DAHLGREN & STRID no. 3629 (LD). — Same place. Nov. 1965, D. & S. no. 4182 (BOL, LD, NBG, PRE, S).

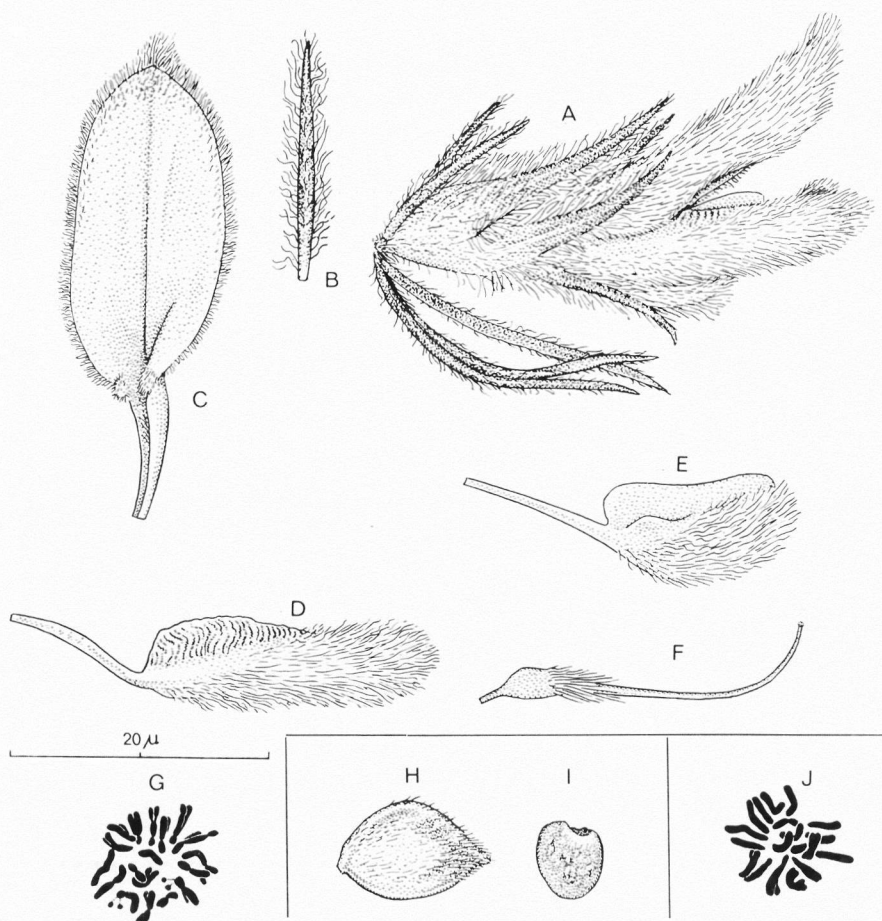


Fig. 2. *Aspalathus barbigerata* (A—G), *A. prostrata* (H—I), and *A. pallescens* (J). — A—G: DAHLGREN & STRID no. 4182; H—I: D. & S. no. 4198; J: D. & S. no. 4188. — A: Flower. — B: Bracteole. — C: Vexillum, front side. — D: Ala petal. — E: Carina petal. — F: Pistil. — G and J: Metaphase plate of root tip (the scale is the same in both cases). — H: Pod. — I: Seed. (A—F and H—I $\times 5$.)

MORPHOLOGICAL AFFINITY. *A. barbigerata* agrees in all respects with the species of the *A. nigra* group (see DAHLGREN 1961), where it should be placed. Among the other species in this group it is probably most similar morphologically to *A. cephalotes* THUNB. It differs from this in the densely woolly petals, the vexillum of which is rather narrow in relation to its length. From each of the three subspecies distin-

guished in *A. cephalotes* it also differs in other respect. The different appearance would be expected, as the population is small and isolated by a considerable geographic interval from the similar forms.

Seedlings were collected in the original locality and cultivated in the Kirstenbosch Botanic Gardens. The somatic chromosome number is 18, and the caryotype is similar to those in the previously investigated *A. cephalotes* (ssp. *violacea*) and *A. nigra* L. (DAHLGREN 1963 A Fig. 74 A—C on p. 232). One pair of chromosomes has distinct satellites and one rather long pair has a distinct secondary constriction on one of the arms (Fig. 2 G).

***Aspalathus rycroftii* R. DAHLGR. sp. nov. (Fig. 4)**

Original collection. Malmesbury Div.: 2 miles SW. of Malmesbury. 20/2 1966, DAHLGREN & STRID no. 4973 (holotype NBG; isotypes BOL, LD, PRE, STE). — Named after Prof. H. B. RYCROFT, Director at Kirstenbosch.

Fruticulus decumbens, ramis ad > 60 cm longis, ramulis et extremis ramorum rigidis rectis apicibus plerumque defoliatis desiccatisque. *Folia* primaria et folia brachyblastorum basi in processu calcariformi vel spiniformi, glabro, aurantiaco, 0.5—2.5 mm longo exerta. *Foliola* oviformia—linearia, plerumque 1—3.5 mm longa, subteretia, glabra, acuta. *Flores* solitarii in apicibus ramulorum brevissimorum sedentes. *Bracteae* et *bracteolae* subulatae. *Pedicellus* c. 2 mm longus, breviter sericeus. *Tubus calycis* sparse puberulus, lobi anguste triangulares, 2.3—3.5 mm longi, ad marginem incrassati et virides. *Petala* flava, plerumque \pm purpurascentia. *Lamina vexilli* elliptica, 11—12.3 \times 8.0—9.5 mm, acuta vel apiculata, dorso \pm dense sericea, ungue 0.5—0.8 mm longo. *Laminae alarum* oblongae (—obovatae), 7.0—8.7 \times 3.0—4.2 mm, glabrae. *Laminae carinae* rostriformes, sursum curvatae, 9.2—10 mm longae, 3.2—4.0 mm latae, pallide flavae, glabrae. *Ovarium* sericeum, 6—8-ovulatum. Stylus gracilis, curvatus. Stigma elongatum, 0.5—0.7 mm longum, prorsum spectans. *Legumen* anguste ovoideum, c. 11—13 \times 4—5 mm, subteres.

Shrublet with decumbent branches up to > 60 cm long and up to > 5 mm thick, with grey longitudinally splitting bark, and radiating from a common centre. Branchlets and branch ends rather rigid, shortly sericeous, often ending as dry tips. — *Leaf bases* platelike, woody, and extended into an up to > 2 mm long, rigid, glabrous, and orange-coloured spur or spine. — *Leaflets* bright green, glabrous, subterete or angular, acute, from < 1 to c. 3 mm long and c. 0.5 mm thick. Leaves on the long shoots with rather long leafbase spines but with relatively short leaflets, leaves of the brachyblasts with short leafbase spines (or spurs) but usually with longer leaflets (Fig. 4 B and C resp.). — *Flowers* solitary on very short lateral branchlets. — *Bracts* and

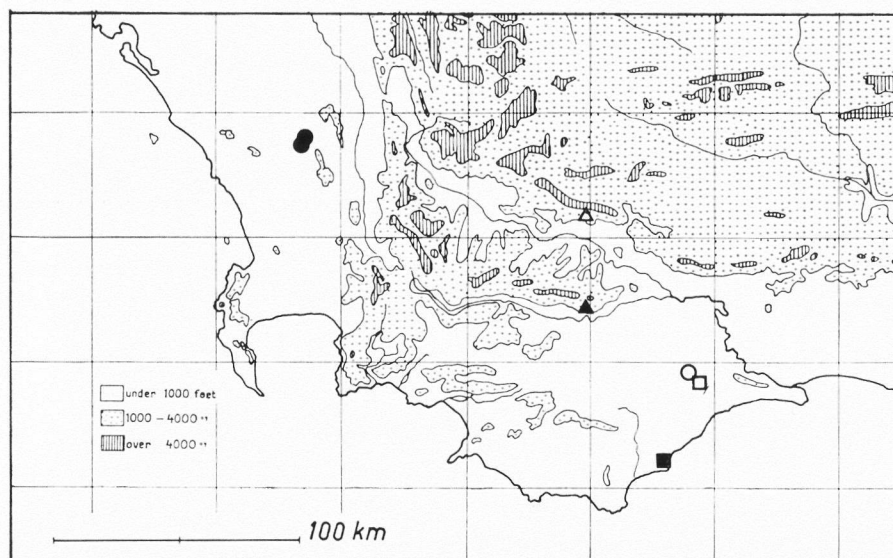


Fig. 3. Map to show the known localities of *A. taylorii* (▲), *barbigeri* (○), *rycroftii* (●), *macrocarpa* (Δ), *prostrata* (■), and *pallescens* (□).

bracteoles oblong or linear-subulate, (0.6—)1.2—2.5 mm long, short pubescent on the inner side. — *Pedice*l about 1.5—2.5 mm long, short sericeous. — *Calyx* tube infundibular—campanulate, about 3.5 mm long, pale, sparsely puberulous; calyx lobes narrowly triangular, about 2.3—3.5 mm long, acute, with green, glabrous, carnos margins. — *Petals* yellow but often partly or entirely turning purplish. — *Vexillum* blade bright yellow, elliptic, about 11—12.3×8.0—9.5 mm large, with an acute, slightly incurved and often greenish apex, sericeous on the back side, glabrous on the front side, carnos but without appendages at the base. Claw only c. 0.5—0.8 mm long. — *Ala* blades oblong (—obovate), 7.0—8.7×3.0—4.2 mm large, rounded at apex, glabrous, with 5—6 rows of distinct minute folds at the base. Claws c. 1.5—2.1 mm long. — *Carina* blades beaklike, curved upwards, rigid, pale yellow, 9.2—10.2 mm long (straightly measured from base to apex) and 3.2—4.0 mm broad at the middle, without distinct lateral bulges. Claws about 2.0—2.4 mm long. — Four *anthers* basifixed and 1.5—2 mm long, 5 anthers dorsifixed and only c. 0.6 mm long; the lowest median anther about 1.0—1.2 mm long. — *Pistil* shortly stipitate; ovary sericeous; ovules 6—8; style slender, glabrous; stigma elongate, forwardly

directed. — *Pod* narrowly elliptic—ovoid, about 11—13 mm long and 4—5 mm broad, subterete, brown when ripe, sparsely puberulous on most parts.

DISTRIBUTION. As far as we know *A. rycroftii* is limited to the renos-terbos-fynbos hills around the town of Malmesbury, where it grows on clayey substrate of the "Malmesbury Beds" (Malmesbury Series). It has been found on cleared road banks inhabited by a sparse community with species from the surrounding veld. *Aspalathus arida* E. MEY. (ssp. *procumbens*) and low-growing forms of *A. acuminata* LAM. coll. are associated with the species in the places studied.

COLLECTIONS

Malmesbury Div.: C. 2 miles SW. of Malmesbury, clay on cleared road bank on hill overlooking Abbotsdale c. 1 mile N. of this village. 20/2 1966, DAHLGREN & STRID no. 4973 (BOL, LD, NBG, PRE, STE). — Same area. 8/3 1966, D. & S. no. 5005 (LD, NBG). — C. 1/2—1 mile NW. of Malmesbury, road bank along the Cape Town—Piketberg rd. 8/3 1966, D. & S. no. 5006 (LD, NBG).

MORPHOLOGICAL AFFINITY. In spite of the different growth this species is most similar to *Aspalathus uniflora* L., *A. pinea* THUNB., and *macrocarpa* ECKL. & ZEYH., especially in the extended spinelike leaf-bases, the carnose beaklike carina without lateral bulges, the ala shape, and the forwardly directed elongate stigma. See below.

***Aspalathus macrocarpa* ECKL. & ZEYH. (Fig. 5)**

ECKLON & ZEYHER 1836 p. 203; BENTHAM 1848 p. 630; HARVEY 1962 p. 123; DAHLGREN 1965 p. 96.

The find of this species was of particular interest and importance as it had previously only been collected once and at that time in fruit stage. The original collection was made "in subalpinis prope Wagenmakersbosch (Swellendam)" by MUNDT (ECKLON & ZEYHER no. 1827), a place which I have not been able to identify.

A. macrocarpa was rediscovered in a kloof of the Langeberg Mountains a couple of miles northeast of Robertson:

Robertson Div.: Slopes just NW. and N. of the uppermost farm of "De Hoop"; alt. 400 m. 3/10 1965. DAHLGREN & STRID no. 3462 (BOL, LD, NBG, PRE, S, STE). — Same area. 5/12 1965, D. & S. no. 4402 (LD, NBG).

The species was found in clayey soil (shaley ground of the Bokkeveld Series) on rather steep slopes. The shrubs raised considerably

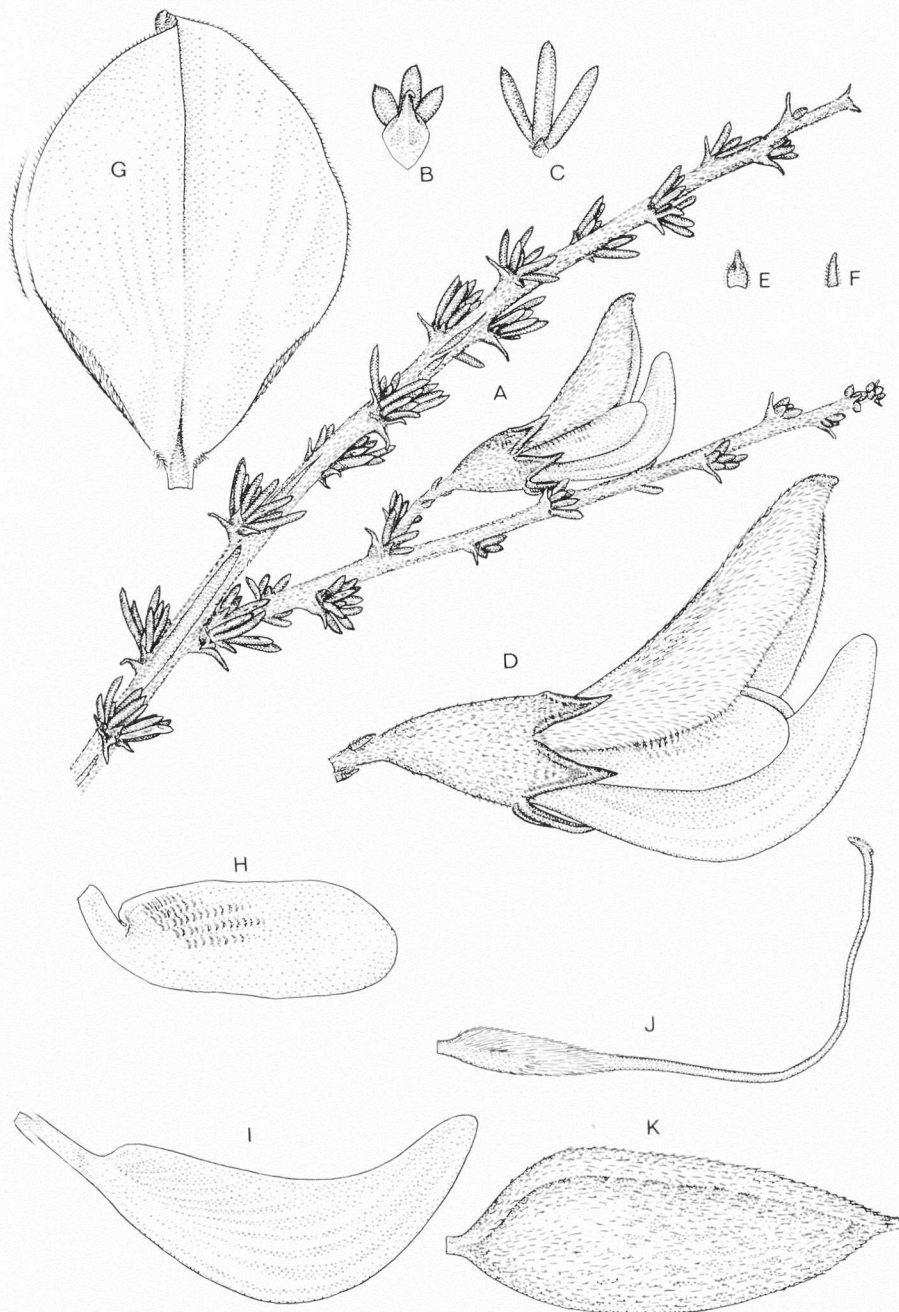


Fig. 4. *Aspalathus rycroftii*; DAHLGREN & STRID no. 5005. — A: Branch end with flower. — B: Leaf of long shoot. — C: Leaf of brachyblast in the axil of B. — D: Flower. — E: Bract. — F: Bracteole. — G: Vexillum, front view. — H: Ala petal. — I: Carina petal. — J: Pistil. — K: Pod. (A $\times 2.5$; B—K $\times 5$.)

above the rather low fynbos community with, e.g., species of *Leuca-dendron* and *Athanasia*. It was accompanied by *Aspalathus submissa* R. DAHLGR. which is typical of shaley ground. On a steep slope previously burnt *A. macrocarpa* regenerated richly and young specimens of varying size (also seedlings later transplanted) were found.

As the flowers were not known previously (cf. DAHLGREN 1965 p. 96) a description of the species seems adequate.

Shrubs erect, lanky, usually 1—2 m tall, sparingly branched, with long rodlike stem and a few (seldom numerous) not or little branched laterals. Bark on the older branches grey, longitudinally striated. Young branches long-woolly—sericeous. — *Leaflets* in fascicles, especially on the main branches in great numbers in the axillary brachyblasts developed. Leaves of long shoots subtended by a woody, yellowish, obtuse, glabrous, and usually 1—2 mm long leafbase spur. Leaflets linear, 5—12(—16) mm long, 0.4—0.5 mm thick, slender, weak, bright green, acute—mucronulate, glabrous or usually with very sparse spreading hairs. — *Flowers* usually solitary on lateral brachyblasts, distributed along long stretches of the branches. — *Bract* linear or subulate, from < 2 to > 4.5 mm long, about 0.4 mm broad, weak, sericeous at least on the upper side. — *Pedicel* usually 2.3—3 mm long, rather slender, densely white-sericeous. — *Bracteoles* similar to the bract, (2—)2.3—4.5 mm long, on the outer half of the pedicel. — *Calyx* tube c. 3.5 mm long, campanulate but with infundibular sulcate base, sparsely sericeous. Lobes narrowly triangular, subulate, the upper 1.5—2.7 and the lowest 1.8—3.3 mm long, acuminate, weak, green, sparsely sericeous. — *Petals* mainly yellow. — *Vexillum* blade elliptic, 12—14×8—11 mm large, sericeous on the back, glabrous on the front side, yellow or partly dark purplish on the back side, with acute—acuminate incurved apex, carinose at base (but without disclike structures as in *A. uniflora*). Claw 1.6—2 mm long. — *Ala* blades oblong or elliptic-oblong, 9.5—10.5×3.2—4.8 mm large, bright yellow, glabrous, with 5 or more rows of distinct lunulate folds on middle and basal parts. Claws rel. broad, 2.0—3.2 mm long. — *Carina* blades beaklike, curved upwards, 10.2—12.7 mm long (measured straightly from base to apex), 5—5.5 mm broad at broadest part, pale yellow, glabrous, without or with indistinct lateral bulge; blades mutually connate along lower margins (except at base) and also along part of upper margins somewhat below the apex. Claws 2.3—3.5 mm long. — *Stamens*: 5 anthers basifixed and 2.0—3.0 (the lowest median 2 mm, the others longer)

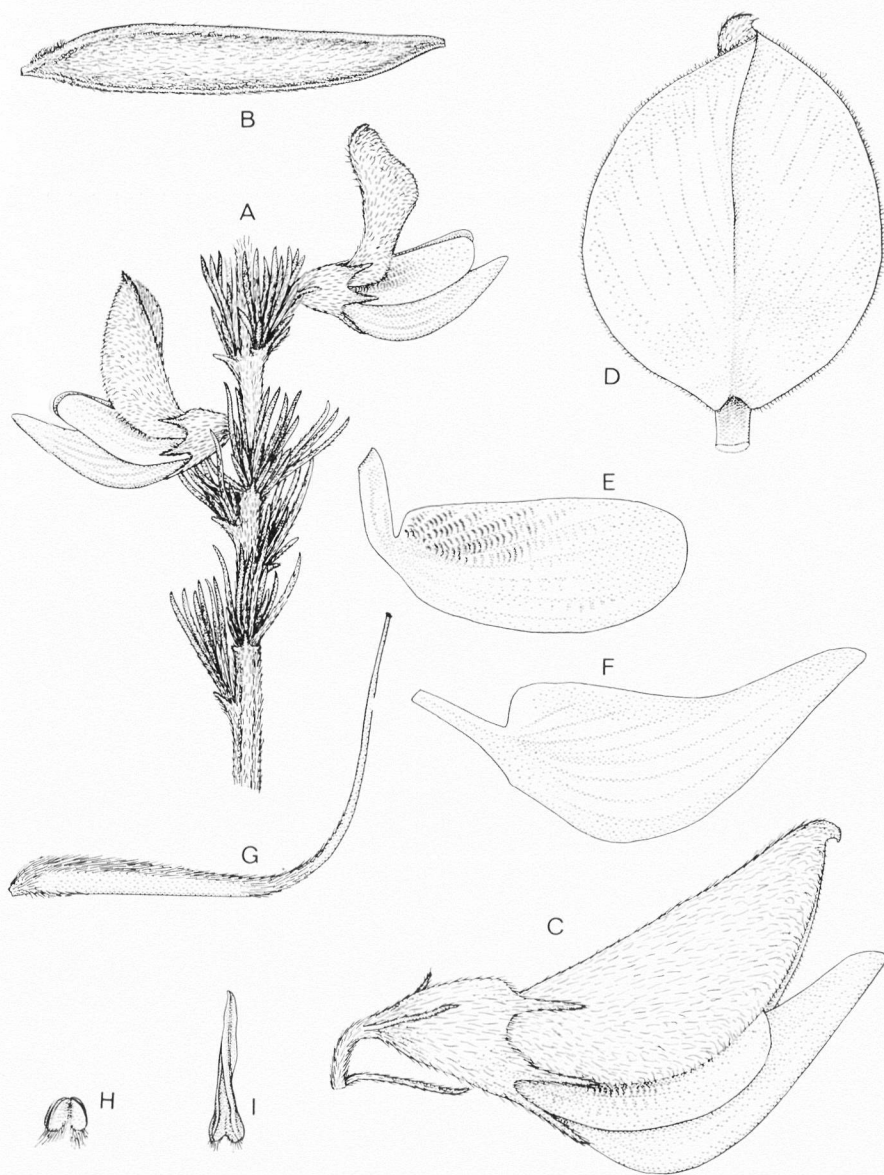


Fig. 5. *Aspalathus macrocarpa*; DAHLGREN & STRID no. 3462. — A: Part of branch with floriferous brachyblast. — B: Pod. — C: Flower. — D: Vexillum, front view. — E: Ala petal. — F: Carina petal. — G: Pistil. — H—I: Short and long anther respectively; notice the pubescence at their base. (A—B $\times 2$; C—G $\times 4$; H—I $\times 8$.)

long, 5 anthers dorsifixed and only c. 0.5—0.7 mm long; all anthers, especially the shorter, with basewardly directed pubescence on the base (Fig. 5 H—I). — *Pistil* almost sessile; ovary linear, long-sericeous on upper parts and apex; ovules 14—16; style slender, sericeous on basal upper parts; stigma short, only slightly directed forwards. — *Pod* linear, tapering gradually towards apex, $22-33 \times 4.3-5.0$ mm large when ripe, sparsely and rather long sericeous, often with 4 good seeds.

OBSERVATIONS. The size of bracts, calyx lobes and petals is variable between as well as within the individuals, in the latter case (beside on stage) depending on the parts of the branches where the flowers are situated, the upper ones being usually smaller.

The carina apex (see the description above) has the form of a compressed tube, and the pubescence on the base of the short anthers (which have long filaments and reach high above the long anthers) contribute in keeping the pollen mass as a plug in the apical carina cylinder.

MORPHOLOGICAL AFFINITY. The lack of disclike callosities on the vexillum base, the shape of the carina with the blades partly connate on the upper apical side, the presence of pubescence on the anthers, of which the basifixed ones are exceptionally long and pointed, and the stigma shape are all in accordance with the condition in *A. rostrata* BENTH., which, however, is less pubescent on the anthers. From the vegetative appearance this was not expected, as the habit, like the pod shape, is conspicuously similar to that of *A. pinea* THUNB. But like *A. uniflora* L. this has the mentioned disclike bodies on the vexillum base, its carina blades are mutually free on the upper side, its anthers are glabrous, and its stigma is elongate and directed forwards.

A. rycroftii (see above) lacks the basal vexillum discs, but agrees with *A. uniflora* and *pinea* in the other characters mentioned. — Also *A. macrantha* and *A. filicaulis* has glabrous anthers and carina blades free on the upper side.

The consequence of these conditions found will cause the following redivision of the groups (cf. DAHLGREN 1963 A pp. 123—130; 1965 pp. 76—107):

The *A. pinea* group: *A. rycroftii*, *A. uniflora*, and *A. pinea*.

The *A. rostrata* group: *A. macrocarpa* and *A. rostrata*.

***Aspalathus prostrata* ECKL. & ZEYH. (Fig. 2 H—I)**

ECKLON & ZEYHER 1836 p. 206; BENTHAM 1848 p. 613; HARVEY 1862 p. 113; DAHLGREN 1963 B p. 148.

Previously this species had been collected only by MUNDT "in montibus prope Swellendam".

It was rediscovered in:

Bredasdorp Div.: Flat limestone rock with low fynbos vegetation about 1 mile NW. of Arniston. 16/11 1965, DAHLGREN & STRID no. 4198 (BOL, LD, NBG, PRE, S, STE).

Here it grew together with the rather similar *Aspalathus salteri* L. BOL. Other typical calcicolous *Aspalathus* species occurring in the same place were *A. calcarea* R. DAHLGR., *A. crassisejala* R. DAHLGR., and *A. incurvifolia* WALP.

Only one specimen was seen of *A. prostrata*, a dense mat c. 80 cm across. In this place it is rather dissimilar in habit to *A. salteri*, which is decumbent or procumbent but does not form mats (as it does on the Cape Peninsula). Other differences from *A. salteri* are the flat, short and broad bracts, bracteoles, and calyx lobes, and also the flowering period, as *A. prostrata* was in postfloral stage when found, but *A. salteri* in full blossom.

The pods of *A. prostrata*, not previously described, are about 4×2.5 mm large, rhombic-ovate, pale-brown when ripe, and rather pubescent at least on the apical parts (Fig. 2 H—I). The fact that the plant set seeds indicates that it is probably not of hybrid origin as might be expected from its solitary occurrence and proliferous habit.

***Aspalathus pallescens* ECKL. & ZEYH.**

ECKLON & ZEYHER 1836 p. 218; BENTHAM 1848 p. 639; HARVEY 1862 p. 130; DAHLGREN 1963 B p. 155 (fig. 56).

Like *A. prostrata*, this species was first collected by MUNDT. It was recorded from "ad montium latera prope Plettenbergsbay". — Plettenberg Bay of today is far to the east of the presently known distribution of the species. In 1957 it was discovered by W. F. BARKER "on flats, De Hoop Provincial Farm" in the Bredasdorp Division.

The species was collected by me in the same region as by Miss BARKER, viz. in:

Bredasdorp Div.: E.-facing slopes of rocky limestone hills c. 2 miles SW. of Ouplaas (=Wydgelegen). 13/10 1965, DAHLGREN & STRID no. 3649 (BOL, LD, NBG, PRE, S). — Same area. 16/11 1965, D. & S. no. 4188 (LD, NBG).

The species grows in fissures of partly bare limestone rock at an altitude of c. 200 m above sea level. The shrublets are erect, usually 50—170 cm tall, and rather densely branched. In the same community but at a slightly lower level (c. 170 m alt.) were found, among other species, *Adenandra rotundifolia* ECKL. & ZEYH., *Aspalathus calcarea* R. DAHLGR., *Euryops linearis* HARV. and *Lebeckia sessiliflora* (ECKL. & ZEYH.) BENTH.

The shrubs of *A. pallescens* were in fruit stage when found and seeds as well as seedlings were collected. The former were brought into cultivation in the Kirstenbosch Botanic Gardens. The species is at present in greenhouse culture at Lund. The somatic chromosome number (Fig. 2 J) is $2n=18$.

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The Status of the Genus *Notosceptrum* Benth. (Liliaceae)

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ABSTRACT

The genera *Notosceptrum* and *Kniphofia* are compared, and it is shown that the former genus must be included in *Kniphofia*. The two new species *Kniphofia reflexa* HUTCH. ex CODD and *K. reynoldsii* CODD are described.

BENTHAM erected the genus *Notosceptrum* in BENTH. & HOOK. f., Gen. Plant. 3: 775 (1883), basing it on two Angolan species, *N. benguelense* (BAK.) BENTH. and *N. andongense* (BAK.) BENTH. (sphalm: "*angolense*"), both of which had previously been described by BAKER in the genus *Kniphofia*. In the same work, BENTHAM added a third species, *N. alooides* (BOL.) BENTH. (basionym: *Urginea alooides* BOL.), described by BOLUS from an inflorescence only, which was collected by MCLEA in the eastern Transvaal. An examination of this inflorescence has shown that it was from an *Aloë*, and the combination *Aloë alooides* (BOL.) VAN DRUTEN (with *A. recurvifolia* GROENEWALD placed as a synonym) was made in Botahlia 6: 544 (1956).

The characters used by BENTHAM to distinguish *Notosceptrum* from *Kniphofia* are, mainly, the very long, slender inflorescences bearing numerous ascending or patent flowers, and the short, subcampanulate perianth which is relatively deeply lobed.

Three species have since been added to *Notosceptrum*, two of which are South African, namely, *N. natalense* BAK. (1896) and *N. brachystachyum* A. ZAHLBR. (1900), while one is from West Tropical Africa, *N. reflexum* HUTCH. (1936). The last-named has an elongate inflorescence with numerous short, ascending flowers and may be regarded as a true *Notosceptrum*. The two South African species, however, do not naturally belong in *Notosceptrum* for several reasons. For instance, the inflorescences are not markedly elongate and the perianths, although short (4.5—6.5 mm long in *N. natalense* and 4—5 mm long in *N. brachystachyum*), are not deeply lobed. If these two species are included

in *Notosceptrum*, there would be equally good grounds for placing *Kniphofia buehneri* (perianth 4—5.5 mm long) in *Notosceptrum* also, which is a step no author has taken.

A further, and decisive, reason for excluding the two South African species from *Notosceptrum* is provided by a recently discovered species in Swaziland, obviously closely related to *N. natalense* but with a cylindrical perianth 8—9 mm long, while the flowers, although spreading in the bud stage, are eventually pendulous. These three species, *N. natalense*, *N. brachystachyum* and the Swaziland species (*Kniphofia umbrina* CODD in *Bothalia* Vol. 9, Part 1, in press), form a relatively homogeneous group with flowers that are yellow-brown to chocolate-brown and possess the somewhat unusual character of being faintly scented. These three species are regarded as forming a section of the genus *Kniphofia* and the two South African species previously included in *Notosceptrum* have been transferred to *Kniphofia* in *Flowering Plants of Africa* t. 1424 (1964), as follows: *K. typhoides* CODD (*N. natalense* BAK., non *K. natalensis* BAK.) and *K. brachystachyum* (A. ZAHLBR.) CODD.

All the South African species previously placed in *Notosceptrum* have thus been removed from that genus, leaving only the tropical species with slender, elongate inflorescences, campanulate perianth tubes which are deeply lobed, and the flowers which are ascending or patent, namely, *N. benquellense*, *N. andongense* and *N. reflexum*.

I had the opportunity of discussing the status of *Notosceptrum* with Dr. JOHN HUTCHINSON at Kew in 1961 and he expressed the opinion that the genus should be kept up. However, at that stage, the South African species *K. multiflora* WOOD & EVANS had not been taken into consideration. This species possesses two of the three characters used to distinguish *Notosceptrum*, namely, an extremely elongate, slender inflorescence, and ascending flowers. It differs, however, in a very important respect from the tropical species remaining in *Notosceptrum* in having a longer perianth which is cylindrical, not campanulate, while the perianth lobes are much shorter than the tube (perianth 7—12 mm long, lobed to a depth of 1.5 mm). Even in the West African species described as *N. reflexum* by Dr. HUTCHINSON, the perianth lobes are distinctly shorter than the tube (perianth tube 5—6 mm long, lobes 2.5—3 mm long), while the flowers, when open, are not ascending but spread at right-angles to the rhachis.

From the foregoing it is evident that the floral characters used to distinguish *Notosceptrum* from *Kniphofia* break down when all the



Fig. 1. *Kniphofia reynoldsii* CODD: the type plant, REYNOLDS 8625, in cultivation at Mbabane, Swaziland.

known species are taken into consideration. One is left with only one character, the striking facies of certain species retained, until now, in *Notosceptrum* (and exhibited also by *Kniphofia multiflora*). Even this character is not a reliable distinction; the two Angolan species *N. benguellense* and *N. andongense* (on which the genus *Notosceptrum* is based) are somewhat intermediate in having less markedly elongate inflorescences than *N. reflexa*, *K. multiflora* and the species now described below as *K. reynoldsii*.

For the above reasons it is concluded that the genus *Notosceptrum* cannot be upheld and *Kniphofia benguellense* BAK. and *K. andongense*

BAK. are reinstated in the genus *Kniphofia*. *N. reflexum* HUTCH. was published in Fl. West Trop. Afr. (1936) without a Latin diagnosis or description. The name is, therefore, illegitimate and so, on transferring it to *Kniphofia*, the requirements are now complied with. In addition, a new species from Malawi and Tanzania, related to *K. reflexa*, is described under the name *K. reynoldsii*.

***Kniphofia reflexa* HUTCH. ex CODD, sp. nov., *K. benquellensi* Bak.** affinis sed corollae tubo longiore, lobis brevioribus, bracteis longioribus cymbiformibus differt.

Notosceptrum reflexum HUTCH. in Fl. West Trop. Afr. 2,2: 342 (1936), nom. illegit.

Planta 60—70 cm alta. *Folia* linearia, nervata, 60—120 cm longa, 1.4—1.6 cm lata, subtus carinata, supra canaliculata, marginibus minute scabridis. *Pedunculus* 25—35 cm longus, crassus, 1—1.2 cm diam. *Inflorescentia* angusta, elongata, 30—45 cm longa, 2.5 cm lata, subdensa. *Bracteae* oblongae, cymbiformes, acutae, 5—6 mm longae, basi 2—4 mm latae, mox reflexae; marginibus scabridis. *Flores* flavi, patentes, subsessile, pedicellis 0.5 mm longis. *Perianthium* 7—9 mm longum, lobatum; tubus campanulatus, 5—6 mm longus, lobis ovatis obtusis 2.5—3.5 mm longis, erectis vel subpatulis, uninervatis. *Stamina* vix exserta, filamentis angustis, 4—7 mm longis; antheris oblongis, 3—4 mm longis. *Ovarium* ovoideum, 3—4 mm longum, stylo 4—5 mm longo. *Fructus* non visus.

TYPE: S. Nigeria, Cameroons, Maitland 1624 (K, holotype).

Known only from the above gathering; the species is described as being plentiful on grassy slopes at altitudes of about 6,000 ft.

***Kniphofia reynoldsii* CODD, sp. nov., *K. reflexae* HUTCH. ex CODD** affinis sed plantis robustioribus, foliis latioribus, corollae lobis longioribus.

Planta 2.2—3 m alta. *Folia* linearia, nervata, 80—120 cm longa, 4—5 cm lata, subtus carinata supra canaliculata, marginibus levibus. *Pedunculus* 1.5—2.5 m longus, crassus, 1.2—1.5 cm diam. *Inflorescentia* angusta, elongata, 50—70 cm longa, 2.5—3 cm lata, subdensa. *Bracteae* oblongo-ovatae, cymbiformes, obtusae, 4—5 mm longae, 3—4 mm latae, mox reflexae, apice cucullato, marginibus levibus. *Flores* saepe aurantii, patentes, pedicellis 0.5—1 mm longis. *Perianthium* 7.5—10 mm longum, lobatum; tubus campanulatus, 4—5 mm longus, 4 mm latus, lobis oblongo-lanceolatis, 5—5.5 mm longis, 2 mm latis, primum patentibus demum reflexis, uninervatis. *Stamina* exserta, patula, filamentis 9—10 mm longis, antheris oblongo-falcatis, fuscis, 3.5 mm longis. *Ovarium* ovoideum, triquetrum, 4—5 mm longum, stylo subcrasso, 4—5 mm longo. *Fructus* non visus.

TYPE: Malawi, Central Province, Vipya Plateau, 15 miles south of Mzuzu, alt. 4,700 ft., plants collected 16/6/58 and cultivated at Mba-

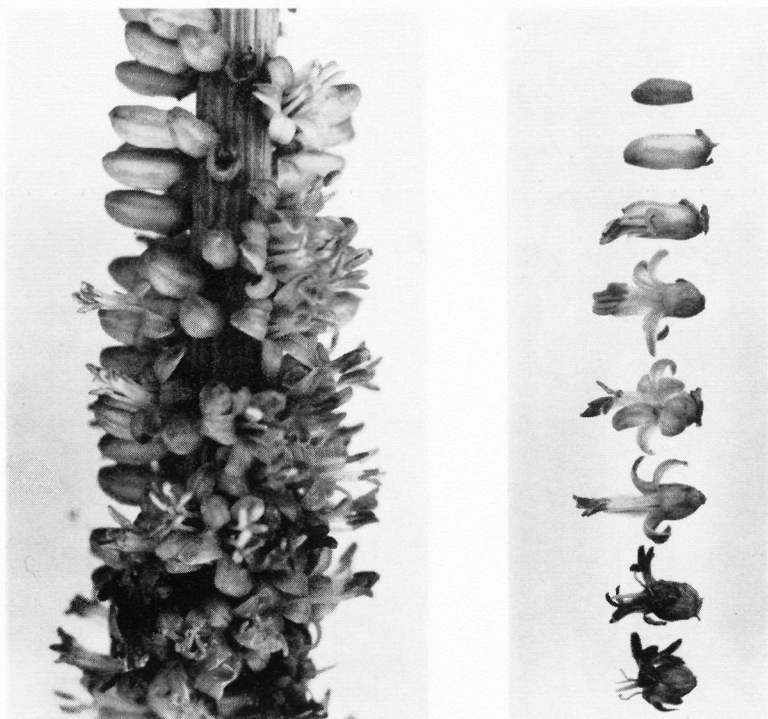


Fig. 2. Left: *Kniphofia reynoldsii* COBB: portion of inflorescence, life size. — Right: flowers of various ages from the bud stage.

bane, Swaziland, flowered 5/4/64, REYNOLDS 8625 (PRE, holotype; K, SRGH).

This striking species, growing up to 3 m tall, is found at altitudes of 4,500 to 6,500 ft. in Malawi and southern Tanzania, and is often locally common on grassy hillsides.

MALAWI. — Central Province, Vipya Plateau, 15 miles south of Mzuzu, 4,700 ft., cult. Mbabane, Swaziland, REYNOLDS 8625; Vipya Plateau, between Luwawa and Chicomgawa, 5,500—6,000 ft., CHAPMAN 1633 (K, PRE, SRGH).

TANZANIA. — Southern Highlands Province, 20 miles north of Mbeya, 6,500 ft., photograph only, REYNOLDS 8668.

It is a pleasure to name this species in honour of Dr. G. W. REYNOLDS who collected it while studying the *Aloë* species of Central Africa and whose book on the Aloës of Tropical Africa and Madagascar has been published recently.

Revision of the Genus *Vicia* Linn. from West Pakistan

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ABSTRACT

Thirteen species of *Vicia* LINN. are known to occur in W. Pakistan, of which one species, *V. bakeri* ALI, is described here for the first time. A new name, *V. benthamiana* ALI, is given to one of the species. A key for identification of various species is given alongwith critical information about typification and distribution of taxa.

The genus *Vicia* LINN., possibly from *vincio*, in reference to the clinging tendrils of many species (JOHNSON & SMITH 1958), consists of about hundred and fifty species (WHYTE et al. 1953). A number of species of *Vicia* Linn. are commonly cultivated in view of their appreciable economic importance. *Vicia sativa* LINN., *V. villosa* ROTH, *V. faba* LINN., *V. articulata* HORNEM., *V. angustifolia* LINN., *V. atropurpurea* DESF. and *V. narbonensis* LINN., are cultivated for fodder (WHYTE et al. 1953). Some species, e.g. *V. sativa* LINN., *V. villosa* ROTH, *V. angustifolia* LINN. and *V. narbonensis* LINN. are known to provide green manure. The seeds of *V. faba* LINN. and *V. articulata* HORNEM. are used for human consumption (WHYTE et al. 1953). *V. cracca* LINN., *V. gerardii* ALL. and *V. fulgens* BATT. are grown as ornamental plants (RICKER 1950).

There exists no single work which could be used for this genus from W. Pakistan. The classical works of BAKER (1876) and BOISSIER (1872; referable to Baluchistan) are still indispensable. Later COOKE (1902) has given the account of the genus from Sind, but no such work exists for rest of W. Pakistan.

The following subdivisions of the area have been recognised: Sind, Baluchistan, N.W.F. Province, Punjab, and Kashmir.

The information about the flowering period of the taxa is referable to plants from W. Pakistan and may not be applicable to plants of other regions.

Vicia LINN. Sp. Pl.: 734. 1753; Gen. Pl. ed. 5: 327. 1754. Type: *V. sativa* LINN. (HUTCHINSON 1964).

KEY TO THE SPECIES

1. Style conspicuously bearded on the lower side of the tip. 2
 Style finely downy all round near the tip. 7
2. Penduncle 7 mm or more 3
 Penduncle less than 7 mm 4
3. Stipule bi- or trifid or dentate. 1. *V. monantha*
 Stipule with 6 or more teeth. 2. *V. bithynica*
4. Pod glabrous when mature. 5
 Pod pilose. 6
5. Inflorescence 1—2 flowered, calyx cup c. 2—< 3 mm broad, (in pressed condition), leaflets generally more than 5 times as long as broad; all calyx teeth reach almost the same level 3. *V. sativa*
 Inflorescence 2—6 flowered, calyx cup c. > 3—4 mm broad (in pressed condition), leaflets generally less than 5 times as long as broad, all calyx teeth do not reach the same level 4. *V. sepium*
6. Leaflets entire, glabrous, pod densely pilose, hairs not spreading. 12. *V. faba*
 Leaflets minutely dentate, pilose at the margin, pod with spreading hairs 5. *V. narbonensis*
7. Pod pilose 8
 Pod glabrous 10
8. Pod c. 1 cm long, (calyx almost as long as the keel.). 6. *V. hirsuta*
 Pod > 1 cm long 9
9. Flower less than 2 cm (c. 1.2 cm), pod less than 2.5 cm (c. 2.3 cm).
 13. *V. villosa*
 Flower more than 2 cm (2.3—2.5 cm), pod more than 2.5 cm (c. 3—4 cm) long. 7. *V. benthamiana*
10. Inflorescence 1—3 flowered 11
 Inflorescence more than 3 flowered 12
11. Flowers c. 12—15 mm long. 1. *V. monantha*
 Flowers c. 7—8 mm long. 8. *V. tetrasperma*
12. Leaflets lanceolate, linear; c. 10 times or more as long as broad. 13
 Leaflets elliptical, oblong (not lanceolate); c. 5 times as long as broad. 14
13. Lower 1 or 2 leaflets invariably arising very near stipule. 9. *V. tenuifolia*
 Lower 1 or 2 leaflets not arising near stipule. 13. *V. villosa*
14. Lower teeth of the calyx c. 4—5 mm; corolla pale lilac. 10. *V. bakeri*
 Lower teeth of the calyx 2 mm; corolla reddish. 11. *V. rigidula*

1. ***Vicia monantha* RETZ.** Obs. Bot. 3:39. 1783. — Type: In Herb. Stockholm.

No country of origin was given by RETZIUS. For further discussion see BURTT & LEWIS (1949).

SYNONYMY: 1. *V. cinerea* M. BIEB. Fl. Taur. Cauc. 3:470. 1819. — 2. *V. monantha* ssp. *cinerea* (M. BIEB.) MAIRE in Bull. Soc. d'Hist. Nat. Afr. Nord. 31:17 no. 3141. 1940. — 3. *V. griffithii* BAKER in HOOK f. Fl. Brit. Ind. 2:178. 1876. — For a detailed list of synonymy reference may be made to BURTT & LEWIS (1949).

REPRESENTATIVE SPECIMENS:

N.W.F. Province: Chitral, Drosh fields, 4500 ft., March—April 1908, S. M. TOPPIN 76 (K); Waziristan, Perei Kesai, flower purple, 16.4.27, BLATTER & FERNANDEZ 830 (K); Waziristan, Razani, in cult. fields, 19.4.27, BLATTER & FERNANDEZ 2835 (K). Punjab: Rawalpindi, 1700 ft., 8.3.1922, R. R. STEWART 6947 $\frac{1}{2}$ (K); Hasan Abdal, field weed, 28.3.1928, R. R. STEWART 9533 (K); Jhelum Dt., Haripur, 1.5.1937, K. L. MALHOTRA 15843 (K); Rawalpindi, 27.2.1872, J. E. T. AITCHISON 1045 (K). Baluchistan: near Sultan, Maslokh range, 5000 ft., desert, 2—10.5.1957, R. R. STEWART 28009 (K); Quetta, 5500 ft., garden weed, 2—10.5.1957, R. R. STEWART 27999 (K).

DISTRIBUTION: W. Pakistan, N.W.F. Province, Punjab, Baluchistan, Kashmir; Afghanistan; Persia; Arabia; Iraq; Caucasus; Cyprus; Morocco.

Our plants conform to *V. monantha* ssp. *monantha* [*V. monantha* ssp. *cinerea* (M. BIEB.) MAIRE], whose distribution is given above. *V. monantha* ssp. *triflora* (TEN.) BURTT & LEWIS occurs in Spain, Algeria and Egypt.

FLOWERING PERIOD: February—April.

2. ***Vicia bithynica*** (L.) LINN. Syst. ed. 10(2):1166. 1759. — Type: Herb. Linn. 906/19 (LINN).

The specimen bears "*Vicia* 9 *bithynica*" in the writing of LINNAEUS. The number corresponds to its position under *Lathyrus*, where LINNAEUS originally published this epithet.

SYNONYMY: 1. *Lathyrus bithynicus* LINN. Sp. Pl.: 731. 1753.

REPRESENTATIVE SPECIMENS:

N.W.F. Province: Peshawar, 24.3.1940, M. NATH (RAW); Chitral, Drosh, 4500 ft., April, 1908, S. M. TOPPIN 77 (K). Punjab: Kangra, Thakor, 9.3.1885, DRUMMOND 1686 (RAW); Dalhausie Road, c. 2000 ft., 16.2.1917, R. R. STEWART 1202 (K; RAW).

DISTRIBUTION: W. Pakistan, N.W.F. Province, Punjab; Russia, European part, Caucasus (B. Fedtschenko, 1948); Afghanistan; Asia Minor; Southern and Western Europe.

FLOWERING PERIOD: February—March.

3. ***Vicia sativa*** LINN. Sp. Pl.: 736. 1753. — Type: Herb. LINN. 906/20 (LINN).

As LINNAEUS has given a description apart from citing references, the specimen (Herb. LINN. 906/20) bearing '*sativa* 10' in the writing of LINNAEUS, should be accepted as the Type.

SYNONYMY: 1. *Vicia cordata* WULFEN in STURM, Deutsch. Fl. Heft.: 32. 1812. — 2. *V. incisa* M. BIEB. Fl. Taur. — Cauc. 3:471. 1819.

REPRESENTATIVE SPECIMENS:

N.W.F. Province: Abbotabad, c. 4000 ft., April 1927, R. R. STEWART 9065 (RAW); Peshawar, military grass farm, 24.3.1940, BALDEV RAJ 19387 (RAW); Chitral, 26.6.50, I. I. CHAUDHRI 117 (RAW); Brimbret, 5000 ft., 29.7.1954, A. RAHMAN (RAW). — Kashmir: Ladakh, Nuna, 10,000 ft., in wheat field, fls. rich, standard paler, with a still paler spot in centre, 26.8.1931, W. KOELZ 2699 (RAW); Baltistan, Skardu, 23.6.1955, E. NASIR & G. L. WEBSTER 5741 (RAW); Kotli to Mirpur, c. 3000 ft., 24.4.1954, R. R. STEWART (RAW); Domel, Jhelum valley, 2500 ft., April 1931, R. R. STEWART 12069 (RAW); Poonch, Palandri, 3500 ft., April, 1931, R. R. STEWART 12055 (RAW); Domel, 2000 ft., May 1926, R. R. STEWART 11092 (RAW); Nakial, 5000 ft., 20.4.1954, A. RASHID, E. NASIR & R. R. STEWART (RAW). — Punjab: Rawalpindi, Saidpur, 1800 ft., 3.4.1930, R. R. STEWART 13251 (RAW); Pathankot, Feb. 1917, R. R. STEWART 987 (RAW); Topi park, 13.4.34, MOHINDAR NATH 129 (RAW); Murree Hills, Ghora Gali, c. 6000 ft., 30.4.1928, R. R. STEWART 13253 (RAW); Attock, 3.3. 1940, E. NASIR 19323 (RAW). — Baluchistan: Near Hanna c. 6000 ft., 15.7. 1957, E. NASIR 28424 (RAW); Pathankote near Loralai, 18.4.43, MOHINDAR NATH 6100 (RAW).

DISTRIBUTION: W. Pakistan, N.W.F. Province, Punjab, Baluchistan, Kashmir; Russia European part, Caucasus, Western Siberia, Far east, Central Asia (B. FEDTSCHENKO 1948); Central and Southern Europe; Oriens (BAKER 1876).

FLOWERING PERIOD: February—April.

4. ***Vicia sepium*** LINN. Sp. Pl.: 737. 1753. — Type: Herb. LINN. 906/31 (LINN).

As LINNAEUS has given a description in addition to citing other references including Hort. Cliff. 362, the specimen in Herb. LINN. 906/31 (LINN) bearing '*sepium* 15' in the writing of LINNAEUS, should be accepted as the Type.

REPRESENTATIVE SPECIMENS:

N.W.F. Province: Swat, Utrot, c. 8000 ft., purple, 21.7.1953, R. R. STEWART & A. RAHMAN 25272 (RAW). — Kashmir: To Bantara gali, c. 8000 ft., 4.7.1952, R. R. STEWART & E. NASIR 24104 (RAW); Taubat region, c. 7000 ft., 24—25.7.1939, R. R. & I. D. STEWART 17922 A (RAW); Sharda to Khel, c. 6000—6500 ft., 22.7.1939, R. R. & I. D. STEWART 17787 (RAW); Pahlgam, c. 9000 ft., blue purple, 24.7.1920, R. R. STEWART 5415 (RAW); Aru, c. 9000 ft., 5.7.1902, J. R. DRUMMOND 14114 (K).

DISTRIBUTION: W. Pakistan, N.W.F. Province, Kashmir: Oriens; throughout Europe (BAKER 1876); Russia, European part, Caucasus, Western Siberia, Eastern Siberia, Far East, Central Asia, (B. FEDT-SHENKO 1948).

FLOWERING PERIOD: July—August.

5. ***Vicia narbonensis*** LINN. Sp. Pl.: 737. 1753. — Type: Untraceable.

Though LINNAEUS (1753) has attributed the phrase name '*Vicia leguminibus subsessilibus solitariis erectis, foliolis fenis subovatis; stipulis denticulatis*' to 'Hort Ups. 218', but there is considerable difference in the phrase name originally published there, i.e. '*Vicia leguminibus erectis subsessilibus, foliolis subovatis; stipulis dentatis*'. Thus it is obvious that LINNAEUS's description has been drawn from an actual specimen. There is a specimen in the Linnaean Herbarium bearing '*narbonensis* 16 H.V. (Herb. LINN. 906/33). But this specimen is not the type of *Vicia narbonensis* L. because in Species Plantarum, LINNAEUS describes it as '*Vicia leguminibus subsessilibus solitariis erectis, foliolis fenis subovatis, stipulis denticulatis*.' Hort. Ups. 218 Sauv. monsp. 234. and in this specimen 3 flowers are present in each axil and fruit is not present. In view of this discrepancy between the specimen and the Linnaean description, it is concluded that the Type is presently untraceable.

REPRESENTATIVE SPECIMENS:

N.W.F. Province: Swat, Kanjoo, 3500 ft., 30.4.1954, A. RAHMAN 25903 (RAW); Lower Swat, cult., 4—8.4.1956, R. R. STEWART 27471 (RAW); Abbotabad, 30.3.1934, MOHINDAR NATH 106 (RAW). Kashmir: Kotli, c. 3500 ft., 9.4.1954, RASHID KHAN 27371 (RAW). Punjab: Attock Distr., HASAN ABDAL, 16.3.1929, R. R. STEWART 10138 (RAW); Rawalpindi, near Dairy Farm, 22.4. 1934, MOHINDAR NATH 168 (RAW); Rawalpindi Distr., Saidpur, c. 1800 ft., March 1929, R. R. STEWART 13250 (RAW).

DISTRIBUTION: W. Pakistan, N.W.F. Province, Punjab; Kashmir; Russia, European part, Caucasus, Central Asia, (B. FEDTSCHENKO 1948); Europe; Oriens (BAKER 1876).

FLOWERING PERIOD: March.

6. ***Vicia hirsuta*** (LINN.) S. F. GREY, Syst. Arr. Brit. Pl. 2: 614. 1821. — Type: Herb. LINN. 907/5 (LINN).

SYNONYMY: 1. *Ervum hirsutum* LINN. Sp. Pl.: 738. 1753. — 2. *E. filiforme* ROXB. in WALL. Cat. 5955. nom. nudum.

REPRESENTATIVE SPECIMENS:

N.W.F. Province: Abbotabad, 5000 ft., 8—11.4.1927, R. R. STEWART (RAW); Swat, Madian, c. 4000 ft., 17.8.1952, R. R. STEWART 24512 (RAW); Lower

Swat, Manglaur 3000 ft., 6.4. 1956, R. R. STEWART 27490 (RAW). — Kashmir: Domel, Jhelum Valley Road, 2000 ft., May 1926, R. R. STEWART 11094, 12053 (RAW); Poonch, Trarkhel, c. 6000 ft., weed in plantation, 25.4.1953, A. RASHID, E. NASIR, R. R. STEWART 25544 (RAW); Bagh, 17.4.52, R. R. STEWART & E. NASIR (RAW); Azad Kashmir, Kotli, c. 3500 ft., 9.4.1954, RASHID KHAN 27392 (RAW). — Punjab: Pathankot, 5.2.1917, R. R. & I. D. STEWART 1034 (RAW); Murree Hills, 1956, ASGHAR ALI (RAW).

DISTRIBUTION: W. Pakistan, N.W.F. Province, Punjab; Kashmir, India, E. Punjab, Kumaon Nilghiris; Nepal; Orient; Europe (BAKER 1876); Russia, Caucasus Western & Eastern Siberia, Far East, Central Asia, (B. FEDTSCHENKO, 1948).

FLOWERING PERIOD: February—August.

7. ***Vicia benthamiana*** ALI nom. nov. — *V. mollis* BENTH. ex BAKER in HOOK. f. Fl. Brit. Ind. 2: 177. 1876, non BOISS. et HAUSSK. 1872. — Holotype: Valley of Kishenganga, 1852, WINTERBOTTOM (K).

REPRESENTATIVE SPECIMENS:

N.W.F. Province: Chitral, Faban Pass, 11,000 ft., July, 1909; Parith Gol, July, 1908, S. M. TOPPIN 455 (K); Chitral, Ziarat, 9000 ft., 14.6.1895, S. A. HARRISS 16067 (K). Kashmir: Minimarg, c. 9000—10,000 ft., 29—30.8.1939, R. R. & I. D. STEWART 19177 (RAW); Below Burzil Chowki, c. 9000—10,000 ft., 26.7.1940, R. R. STEWART 19772 (RAW); Upper Astor Valley, 10,000 ft., 18.8.1939, R. R. STEWART 18703 (RAW); Burzil Pass, c. 11,000 ft., 27—28.8. 1939, R. R. & I. D. STEWART (RAW); Lower Kamri, above Kalapani, c. 10,000 ft., 18.8.1939, R. R. & I. D. STEWART 18703 (RAW).

DISTRIBUTION: Kashmir; Chitral.

FLOWERING PERIOD: August.

8. ***Vicia tetrasperma*** (L.) SCHREBER, Spicil. Fl. Lips.: 26. 1771. — Type: Herb. LINN. 907/3 (LINN).

The specimen in the Linnaean Herbarium bears '*tetrasperma* 2 M' in the writing of LINNAEUS, hence it may be accepted as the Type.

SYNONYMY: *Ervum tetrasperma* LINN. Sp. Pl.: 738. 1753.

REPRESENTATIVE SPECIMENS:

Punjab: in region Siwalica, in pago Parla prope Pathankot dit. Gurdaspur, March, 1885, J. R. DRUMMOND 1684 (K).

DISTRIBUTION: W. Pakistan, Punjab; India, Punjab, Kumaon; Russia, European part, Caucasus, Western and Eastern Siberia, Central Asia (B. FEDTSCHENKO 1948); Japan; Throughout Europe; Persia.

FLOWERING PERIOD: March.

9. ***Vicia tenuifolia*** ROTH, Tent. Fl. Germ. 1: 309. 1788. — Type: 'Habitat in collibus et campis arenosis Ducatus Bremensis saxoniae prope Berlinum, ROTH (B — not seen).

REPRESENTATIVE SPECIMENS:

Punjab: Kagan, 17.8.96, J. F. DUTHIE 19325 (K); Bimbal, Kagan, 21.8.97, J. F. DUTHIE 21270 (K). — N.W.F. Province: Utrot, c. 8000—9000 ft., blue, 21.7.1953, R. R. STEWART & A. RAHMAN 25273 (RAW); Hazara Dist., Saiful Maluk, July 1954, blue, Ch. SHAUKA ALI (RAW); Kalam, c. 8000 ft., 23.8.1952, R. R. STEWART 24745 (RAW); Chitral, Aug. 1949, HASSAN DIN 279 (RAW). — Kashmir: Ladakh, Kharbu, July 1912, R. R. STEWART (RAW); Rattu above Astor, c. 9000 ft., Aug. 21, 1939, R. R. & I. D. STEWART 18827 (RAW); Kishenganga Valley, below Rajdhiangan Pass, c. 8000 ft., 27.7.1939, R. R. & I. D. STEWART 17960 (RAW). Kel to Taubat, 6500—7500 ft., 24—25.7.1939, R. R. & I. D. STEWART 17855 (RAW); Tragbol Pass 9000 ft., 19.7.1940, R. R. STEWART 19494 (RAW); Gurez to Chorwan, 8000—8500 ft., 27.7.1940, R. R. STEWART 19634 (RAW); Kishenganga Valley to Rajdhiangan Pass, c. 8000 ft., 27.7.1939, R. R. & I. D. STEWART 17960 (RAW); Gilgit Agency, Chilam to Gudai, 8.8.1955, blue purple, E. NASIR & G. L. WESBSTER 6416 (RAW); Kaghan Valley, 3.7.1952, blue, M. A. SIDDIQI 24212 (RAW).

DISTRIBUTION: W. Pakistan: N.W.F. Province, Punjab, Kashmir; India, Chamba; Russia, European part, Caucasus, Western and Eastern Siberia, Central Asia (B. FEDTSCHENKO 1948); Asia minor; Persia; Afghanistan; widely distributed in Europe.

FLOWERING PERIOD: July—August.

10. ***Vicia bakeri*** ALI sp. nov. — *V. pallida* auct. non TURCZ.: BAKER in HOOK. f. Fl. Brit. Ind. 2: 178. 1876; *V. himalayensis* BENTH. Herb. Sched. Kew (nomen nudum). Fig. 1.

Herba annua. Caulis costatus, pilosus. *Folia* stipulis lateralibus simplicibus vel dividiuus, c. 7—15 mm longis; rhachide c. 6—12 cm longa. Foliola 14—23, opposita, subopposita vel alterna; oblonga-lanceolata, c. 7—25 mm longa, c. 4—9 mm lata, supra glabra vel subglabra, infra pilosa, margine integra apice mucronato. *Inflorescentia* racemosa, pedunclo c. 5—15 cm longo. *Flores* pedicellis c. 1.5—3 mm longis. *Calyx* c. 7 mm longus, dentibus superioribus c. 1 mm, lateralibus c. 3 mm, inferioribus (uno) c. 5 mm longis. *Vexillum* c. 12 mm longum, c. 6 mm latum; *alis* c. 12 mm longis, c. 3.5 mm latis, *clave* c. 6 mm

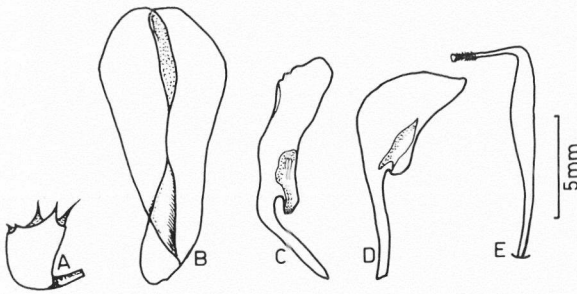


Fig. 1. Floral parts of *V. bakeri* ALI. — A: Calyx. — B: Vexillum. — C: Wing. — D: Keel. — E: Ovary. (MOHINDAR NATH 4268, RAW).

longa, auricula c. 1.5 mm longa; *carina* c. 10 mm longa, c. 4 mm lata, clavo c. 7 mm longo. *Stamina* mono vel diadelfia, 9+1, filamentis c. 12 mm longis. *Ovarium* stipitatum (stipite c. 3—3.5 mm longo, glabro), c. 6 mm longum, c. 15 mm latum, stylo c. 4.5 mm ab apice angulo recto superne flexo apicem versus piloso, stigmatibus simplicibus. *Fructus* stipite c. 4—5 mm longo, legumine c. 40—42 mm longo, c. 8—8.5 mm lato, glabro.

HOLOTYPE: Kumaon, Jallet 6500 ft., R. STRACHEY and J. E. WINTERBOTTOM 2 (K). Fig. 2.

REPRESENTATIVE SPECIMENS:

Kashmir: Alibad, 10,000 ft., 9.7.1876, purple blue, C. B. CLARKE 28691 A (K); Kashmir, Ex Herb. FALCONER 427 (K); Apharwat above Gulmarg, 15.8.1958, purple blue, R. R. STEWART 10469 (RAW); Ferozpur nallah, 3.7.1935, pinky purple with some blue on wings, R. R. STEWART (RAW). — N.W.F. Province: Changla to Dunga Road, fl. mauve-white, E. M. SAUNDERS (K). — W. Punjab: Murree, c. 8000 ft., sm. Sept. 1885, Ex Herb. DRUMMOND 1755 (K). — E. Punjab: Simla, Nag Kanda, 9000 ft., 30.9.76, J. S. GAMBLE 1482 B (K); 1482 A (K); Between Tisa and Alivas, 5000—7000 ft., 28.8.1896, G. A. GAMMIE 18275 (K); Satlaj Valley, 6000—7000 ft., 1852, THOMSON (K); Simla-Siwaliks, 1885, J. R. DRUMMOND 22408 (K); Simla, 1887, J. R. DRUMMOND 20836 (K); in dumetis c. 8000 ft., sm., in regus Kumharsen in vicinitate Simla, 4.9.1884, J. R. DRUMMOND 1520 (K); in sylvestribus c. 7000 ft. sm. prope Simla, 1884, J. R. DRUMMOND 1523 (K); Simla, 1887, J. R. DRUMMOND 20834 (K); Mattiana, 5 August, J. R. DRUMMOND 21902 (K); Madkote, Gori Valley, 25.8.1900, leg. J. F. DUTHIE 24352 (K); Lahul, Manali, 6500 ft., a herbaceous cirrhose herb with purplish flowers, 5.8.41, N. L. BOR 15597 (K); in sepibus etc. c. 8000 ft., sm., prope Nagkanda, in vicinitate Simla, 1884, J. R. DRUMMOND 1521 (K); Mattiana, 21.9.1917, H. H. RICH 735 (K); Shali nr. Simla, 8000 ft., 12.9.1886, H. COLLETT (K); Patarnalar, 8000 ft., Oct. 1885, H. COLLETT (K). — Kumaon: Kumaon, 5000—7000 ft., common in open weeds, STRACHEY & WINTERBOTTOM (K); Nainital, 7000 ft., July 1875, lilac flower, DAVIDSON (K).

DISTRIBUTION: W. Pakistan, N.W.F. Province, Punjab, Kashmir; India, Punjab, Kumaon.

FLOWERING PERIOD: July—September.

Previously, this species has been confused with *V. pallida* TURCZ. (BAKER 1876; COLLET 1902) from which it differs in the shape of leaflets (ovato-oblong in *V. pallida*), the structure of calyx and the size of fruits. In *V. pallida* TURCZ. the calyx teeth are deltoid c. and or < 1 mm; in *V. bakeri* ALI, the lateral and lower calyx teeth are linear and c. 3—5 mm. In *V. pallida* TURCZ. the fruit is c. 2 cm. long (excluding the stipe); in *V. bakeri* ALI, on the other hand, it varies in length from 4—4.2 cm.

The resemblance between *V. bakeri* ALI and *V. megalotropis* LEDEB. is more pronounced. However, they differ in the shape and size of leaflets (which are more elongated in *V. megalotropis* LEDEB.) and the ratio between calyx cup and lower calyx tooth. In *V. megalotropis* LEDEB., the calyx cup is c. 3.5 mm and the lower calyx tooth c. 5 mm long.

11. ***Vicia rigidula*** ROYLE, Ill. Bot. Him. Mount.: 200. 1835. — Type: 'Hab. Rogee in Kunawar, ROYLE, untraceable. ROYLE's Herbarium has been discovered at Liverpool (STANSFIELD 1953) and there are large number of duplicates at Kew. However at both these places, the type specimen referred to above is not present.

SYNONYMY: 1. *Lathyrus himalensis* CAMB. in JACQ. Voy. Ind. Bot. 1: 44. t. 53. 1843. — 2. *Vicia pseudocassubica* RECH. f. in Symb. Afgh.: 203. t. 242, 243. 1957.

REPRESENTATIVE SPECIMENS:

Punjab: Kagan Valley, 7000 ft., 1.6.96, leg. J. F. DUTHIE 19323 (K). — N.W.F. Province: Swat, Sho nala, 8000—9000 ft., 23.8.1955, A. RAHMAN 191 (RAW); Swat, Kalam, 13.8.1956, M. A. KAZMI 1606 (RAW); Swat, Mingora, 19.8.1956, M. A. KAZMI 1650 (RAW); Above Utrot, c. 9000 ft., 21.7.1953, yellow, R. R. STEWART & A. RAHMAN 25275 (RAW). — Kashmir: Sonamarg, 9000—10,000 ft., 26.7.1921, whitish cream turning orange as grows older like *L. luteus*, R. R. STEWART 6441 (RAW); Sonamarg-Baltal, 9000 ft., 20.8.1928, canary yellow, R. R. STEWART 9809, 9919 (RAW); Pahlgam c. 9000 ft., 18.8. 1920, R. R. & I. D. STEWART 9242, 5729 (RAW); Kashang valley, 12.7.1940, MOHINDAR NATH 2865 (RAW).

DISTRIBUTION: W. Pakistan, N.W.F. Province, Kashmir; India, Punjab, Kumaon.

FLOWERING PERIOD: July—August.

KIEW NEGATIVE
No. 7851
1 MAR 1966



Fig. 2. Holotype of *V. bakeri* ALL.

12. **V. faba** LINN. Sp. Pl.: 737. 1753.

Commonly cultivated during winter. The garden or broad bean. Varn.: *Bakla*. Widely cultivated in Europe and other places.

According to P. W. BALL (ined.) the origin of this species is not known. Some authorities consider it to have originated in S.W. Asia and others in N. Africa, but undoubtedly wild plants are not known from these areas. An alternative theory is that it has been developed from *V. narbonensis* L., which it closely resembles in many characters.

13. **Vicia villosa** ROTH, Tent. Germ. 2(2):182. 1789.

Introduced in Baluchistan (Mastung, S. C. P.) from Europe where it is widely distributed.

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Studies on Penaeaceae III

The Genus *Glischrocolla*

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ABSTRACT

The monotypic genus *Glischrocolla* is studied with special regard to nomenclature, morphology, and distribution. The species was first described under the name *Penaea formosa* THUNB. in 1800. The new combination *Glischrocolla formosa* (THUNB.) R. DAHLGR. is established.

The species is apparently endemic in the northern part of the Hottentots Holland Mountains (SW. Cape Province), where it grows on shelves in steep precipices of the Somerset Sneeuwkop and Landdrostkop Peaks at altitudes of 1200—1500 m. The inflorescence is principally a headlike determinate racemule, the flowers are bibracteolate, and the anthers not incurved in bud. In the ovary each of the ovules has two pendulous and two ascending ovules like *Endonema*. The pollen grains are 5-colporate and square in equatorial view.

INTRODUCTION

Accounts on *Stylapterus*, *Brachysiphon*, *Sondera*, and *Saltera* in *Penaeaceae*, are given in *Opera Botanica* during 1967 (in press).

The genus *Glischrocolla* (ENDL.) A. DC. is distinctly demarcated in morphological and other characters from the other genera of *Penaeaceae*. Of these *Endonema* is the most similar.

The single species is *Glischrocolla formosa* (THUNB.) R. DAHLGR., usually known as *G. lessertiana* (A. JUSS.) A. DC. It was collected by MASSON about 1790 in what he stated to be the mountains near French Hoek, but was then not recorded until 1932, when found by T. P. STOKOE at high altitude on the Landdrostkop Peak in the northern parts of the Hottentots Holland Mountains. It exerted a great power of attraction on the mountaineer-collector STOKOE, who returned many years in search for it. In a letter dated May 1937, he explained to Miss E. L. STEPHENS (who treated *Penaeaceae* for *Flora Capensis* in 1925) the details of buds and early flowers and he also added drawings of inflorescences. Later he also supplied a photograph of the plant in its

natural habitat (Fig. 4) and made a sketch map of the localities on Landdrostkop and Somerset Sneeuwkop. Though botanizing in these mountains I have not refound the species.

Herbarium specimens from the following herbaria (abbreviated according to LANJOUW & STAFLEU 1964) have been studied: BM, BOL, G, NBG, PRE, SAM, UPS(-THUNB).

HISTORICAL NOTES

The species was first mentioned by THUNBERG in an appendix of his *Prodromus plantarum Capensium* 2 (1800 p. 187) with the phrase name "*Penaea floribus terminalibus, foliis ovatis glabris*". Later, in 1807 (p. 122), the species was given the following rather detailed description by THUNBERG.

"3. *P. formosa*. — *Prodrom. Pl. capens. Append. p. 187*. — *Crescit in montibus pone Fransche hoek*. — *Frutex* totus glaber, erectus, parum ramosus. *Rami* alterni, erecti. *Folia* decussata, sessilia, ovata, obtusiuscula, integra, margine pallido, glabra, imbricata, semipollicaria. *Flores* in ramis terminales, aggregati, rufescentes uti et bracteae. *Corolla* pollicares. *Bracteae* oblongae, sanguineae."

It is surprising that with this description the species was so consequently misunderstood by the subsequent botanists. The name *formosa* was combined under *Sarcocolla* by JUSSIEU in 1846. By most — if not all — writing about "*Sarcocolla formosa*" this name was used for forms, notably such with solitary terminal flowers, of the species at present called *Saltera sarcocolla*.

THUNBERG's *Penaea formosa* was described from a branch collected by MASSON (a French botanist and fellow traveller of THUNBERG on some of his journeys in South Africa), but this was not mentioned in print by THUNBERG. Also JUSSIEU's *Sarcocolla lessertiana* was described from a MASSON specimen, and there is little doubt that the two names were based, independently, on different specimens of the same collection. The species *S. lessertiana* was soon distinguished as a separate section, *Glischrocolla*, under *Sarcocolla* by ENDLICHER (1847 p. 74), and by DE CANDOLLE (1857 p. 490) *Glischrocolla* was elevated to genus. However, by some botanists, e.g. BAILLON (1877 p. 99) and BENTHAM & HOOKER (1880 p. 202), *Glischrocolla* was not considered generically distinct from *Endonema*, although the species was never combined nomenclaturally under the latter genus. BAILLON (l.c.) distinguished between those members of *Endonema* which have valvate aestivation ("*Euendonema*") and those with reduplicate aestivation ("*Glyschrocolla*", sic!).

GILG (1894, pp. 210—212) treated *Glischrocolla* as a separate genus and also supplied an illustration (l.c., Fig. 73 H—K). STEPHENS (1925 p. 96) gave a rather detailed description of the species for Flora Capensis, where she also cited as a synonym "*Penaea formosa*, Thunb. Fl. Cap. ed. Schult. 149 (from description and original material in THUNBERG's herbarium)." Following the Kew rules of nomenclature and current practice she did not make the recombination necessary under the present Code, but SALTER in 1940 (p. 42) was aware of this necessity and wrote: "Since the exact identities of . . . and

Penaea formosa Th. (? *Glischrocolla lessertiana* A. D.C.) are doubtful, it is left to those who have access to the type specimens to make new combinations if necessary."

The anatomical conditions of *Glischrocolla* and the other genera of *Penaeaceae* were studied by VAN TIEGHEM already in 1893. Beside other characteristics in common to all the *Penaeaceae* he observed that in *Glischrocolla* there are stomata only on the lower side of the leaves and that the mesophyll is developed as a palisade layer only on the upper side of the leaves, and is loose and lacunous in the middle and on the lower side. All the sclereid-idioblasts are of one kind, viz. with annular or spiral and slightly lignified walls, and these sclereids are limited to the lower loose layer of the mesophyll, occasionally ramifying and creeping along the lower epidermis. In *Endonema* VAN TIEGHEM found, in addition, other sclereid cells with a stellate shape and with thicker and more or less smooth walls.

NOMENCLATURE

***Glischrocolla formosa* (THUNB.) R. DAHLGR. comb. nov.**

Penaea formosa THUNB., THUNBERG 1800, p. 187; 1807, p. 122; 1823, p. 149. — *Sarcocolla formosa* (THUNB.) A. JUSS.; DE JUSSIEU 1846, p. 25 [probably wrongly used in this and the following works for *Saltera sarcocolla* (L.) BULLOCK]; ENDLICHER 1847, p. 73; DE CANDOLLE 1857, p. 489; GILG 1894, p. 212; STEPHENS 1909, p. 363; 1925, p. 95; SALTER 1940, p. 42; etc. — See also in the historical notes above.

ORIGINAL COLLECTION. "*Penaea formosa*. e Cap. b. spei. MASSON" in THUNBERG's herbarium (UPS, lectotypus). It was not mentioned in THUNBERG's publications that his *Penaea formosa* was based on a collection of MASSON. However, THUNBERG (1807, p. 122, and 1823, p. 149) remarked that the plant grew "in montibus prope Franschhoek". See also the comments on the type of *Sarcocolla lessertiana* below.

Sarcocolla lessertiana A. JUSS.; DE JUSSIEU 1846, p. 26. — *Sarcocolla* (sect. *Glischrocolla* ENDL.) *lessertiana* A. JUSS.; ENDLICHER 1847, p. 74. — *Glischrocolla lessertiana* (A. JUSS.) A. D.C.; DE CANDOLLE 1857, p. 490; VAN TIEGHEM 1893, p. 283; GILG 1894, p. 210; STEPHENS 1925, p. 96; SALTER 1940, p. 42.

ORIGINAL COLLECTION. "Promont. Bonae Spei, Fr. MASSON" in Herbarium DELESSERT (G, holotype). It should be noted that this specimen was collected by MASSON, and as the species is quite rare it is doubtless the same collection as the type of THUNBERG's *Penaea formosa* (!), although it is at present in a poorer condition. Another specimen, probably also of the same collection, is in BM; on this is written "Africa australis: montibus prope Franschhoek. Fr. MASSON."

MORPHOLOGY

The plant is an about 35—50 cm tall, erect or ascending shrub with rather coarse branches. Each branch ends as an inflorescence with an axis usually 1—3 cm long. In the axils of the uppermost leaf pair

below each old inflorescence lateral branches develop. After some seasons the result is a more or less regular sympodial branch system, which in the old branchings has a "dichotomous" appearance, as the old inflorescence axes have been dropped. This is seen in Fig. 1.

The young branches have a smooth or faintly striated surface. On each internode, above each of the two opposite leaves, there are two low ridges. These are sharply demarcated on the inner side above the leaves, but have a diffuse demarcation on the peripheral sides, such as seen in Fig. 3 K. The ridges each end as a shortly conical tip, one on each side of the leaf bases on the upper node delimiting each internode.

The outer sculptured layer splits up longitudinally and transversely into rectangular or square portions on the second-year branches, and is finally shed. The older branches are more or less terete.

The *leaves* are flat or slightly keeled, rhombic-ovate or rhombic-elliptic, usually $1.5\text{--}2.4 \times 0.7\text{--}1.4$ cm large, with cuneate base and obtuse or sometimes subacute apex. The margins are markedly pale, almost white, consisting of thick-walled cells without chloroplasts. The upper side of the leaves is smooth and rather dark green with a very distinct middle groove reaching from the base to $1.5\text{--}2.5$ mm from the apex. The lower side is pale-green and smooth or slightly rugose. It has a quite prominent and rather pale midvein but no distinct lateral veins.

On each side of the median line, in the leaf axils, there are a number of up to about 0.6 mm long, stout, multicellular trichomes which soon become brown or black. These are sometimes interpreted as stipule homologues.

The *inflorescence* is principally a compact raceme, but as the internodes of the inflorescence axis are short and as the flowers are long and tubular and more or less erect the inflorescence has a headlike appearance. The inflorescence apex generally bears a terminal flower, but this may drop in early stage. In the inflorescence there are usually 5 or more pairs of purplish leaves below the terminal flower, the upper ones narrowly oblanceolate—linear and quite thin, the others successively broader, thicker, and more like the uppermost vegetative leaves. Lateral flowers are usually developed in the axils of the 2—4 lowest of these pairs of leaves, which are then to be classified as bracts.

The uppermost pair of *bracteoles* of the terminal flower are quite narrow, about 2.5 mm broad or less, and about 15 mm long. The next pair of bracteolate leaves is longer and especially broader and rather



Fig. 1. *Glischrocolla formosa*; branch of STOKOE, SAM no. 56518, from Somerset Sneeuwkop (approx. $\times 0.6$). The sympodial branching system is clearly visible.

convex. They merge into the pairs of *bracts* of the lateral flowers. These bracts vary between 6 and 17 mm in breadth and between 22 and 30 mm in length. The lowest bracts are usually broader than the upper vegetative leaves and are sometimes green and coriaceous like these. Most bracts and bracteoles are intensely purple or carmine at least on the apical half.

The pedicel of the lateral flowers is about 5—6 mm long. One pair of bracteoles are borne on the middle of the pedicel. They are narrowly oblanceolate or linear, about $15-25 \times 1-3$ mm large, carmine, and rather thin.

The *perianth* tube is cylindrical, although tapering towards the base and also slightly towards the throat. It is about 27—30 mm long and 5—6 mm wide in flowering stage. Especially in bud stage it is markedly quadrangular in cross-section. Four very prominent elevated veins run to the sinuses. Between them there are four less distinct veins which run into the lobes. The perianth tube is, according to notes on one of STOKOE's herbarium sheets, "yellow flushed with carmine in bud, changing to carmine in old flowers."

The lobes are narrowly ovate, $7-8.5 \times 4-5$ mm large, acute, and rather carnose, and are spreading or reflexed in flowering stage. The inner side has a rather prominent middle ridge. The apical and lateral parts of adjoining lobes are closely connivent in the bud stage, and the aestivation may be classified as reduplicate-valvate. The lobes are (according to STOKOE) "deep cream to yellow", but more or less carmine at least at the base of the outer side.

The main parts of the *filaments* take part in the flower tube or hypanthium (here — accordingly somewhat improperly — called the "perianth tube"). The apical free part of each filament emerges on the inner side of the tube at its edge, at the bottom of or slightly below the sinuses between the reflexed perianth lobes (the bases of which form an annular rather thick and carnose structure). The free parts of the filaments are about 0.7—1 (in postfloral stage up to 1.5) mm long and about 0.6—0.8 mm broad at the base tapering slightly towards their apex.

The *connective* is narrowly ovate, usually 3.6—4.0 mm long and 2.0—2.4 mm broad at the base, with rounded-obtuse apex and cordate base. The back side has a prominent middle ridge with a groove on each side. The connective surface is covered with relatively large papillae inflated in late stage. The pollen sacs, on the inner side of the connective, are almost as long as the connective, about 3.2—3.7 mm long. The anthers are erect in bud as well as flowering stage.



Fig. 2. *Glischrocolla formosa*; STOKOE, PRE no. 29713, flower and branchlet ($\times 2$). The map shows the Landdrostkop and Somerset-Sneeuwkop area, where the species has been found (black dot).

The *pistil* in flowering stage is of about the same length as the perianth tube or slightly longer. The stipe is almost as thick as the ovary, and these together form a stout basal cylinder tapering into a long and slender style, which ends as a capitate quadrangular or slightly quadrilobate stigma (Fig. 3 F—H). The epidermis of the ovary

and style is smooth (i.e. not papillate) or the surface of the ovary may be somewhat rugose longitudinally. Each of the four locules has four ovules, two ascending and two pendulous, which emerge on the middle part of the inner (axial) side, just as in *Endonema*.

The *capsule* is about 13—15 mm long (excl. the variably long persistent style base). The valves are about 3.5 mm broad or more (in early fruit stage). The outer walls are rugose longitudinally and dark-brown—black. When the capsule ripens the sides of the valves recurve until the outer walls of the valves are almost entirely enclosed as seen in Fig. 3 I. The capsules remain within the (more or less broken and dry) perianth tubes, and when the latter have disintegrated, after about a year, the old reflexed capsule walls can still be seen on the shrubs (Fig. 1).

The *pollen grains* (see p. 81) are very characteristic and easily distinguishable from those of the other genera in the family. They are 5-colporate (in *Endonema* they are 3-colporate), and almost square in equatorial view, with somewhat thickened margins round the colpi. In polar view they have a decalobate shape with 5 distinct grooves alternating with the colpi.

DISTRIBUTION

The species has a limited distribution in the northern part of the Hottentots Holland Mountains, where it has been found on the peaks of Landdrostkop and Somerset Sneeuwkop and in the steep rocky kloof between these peaks. MASSON's record "mountains near French Hoek" is probably also from this area. It seems likely that the species occurs also on similar rocky precipices in, e.g., the even more inaccessible mountains of Dwarsberg and Victoria Peak.

COLLECTIONS

Somerset West — Caledon Div. border: "Mts. nr. French Hoek." MASSON (BM, G, UPS). — E. side of Landdrostkop. 1932, STOKOE (no. 9603) (BOL). — E. slopes of Landdrostkop; 1200—1500 m. 1933, THORNE, SAM no. 51544 (SAM). — Top of Landdrostkop, E. side. 1936, STOKOE no. 7980 (BOL). — Nr. cave, Landdrostkop. 1938, STOKOE no. 7976 (BOL). — E. slopes of Somerset Sneeuwkop Mt. nr. top of Landdrost Kloof; 1350 m. 1934, STOKOE no. 2834 (PRE). — Between Somerset Sneeuwkop and Landdrostkop. 1938, STOKOE, SAM no. 53966 (SAM). — Nr nek between Landdrostkop and Somerset Sneeuwkop; c. 1200 m. 1943, STOKOE (NBG). — Between Landdrostkop and Somerset Sneeuwkop. 1955, MAC PHERSON (NBG); WOODS, SAM no. 67540

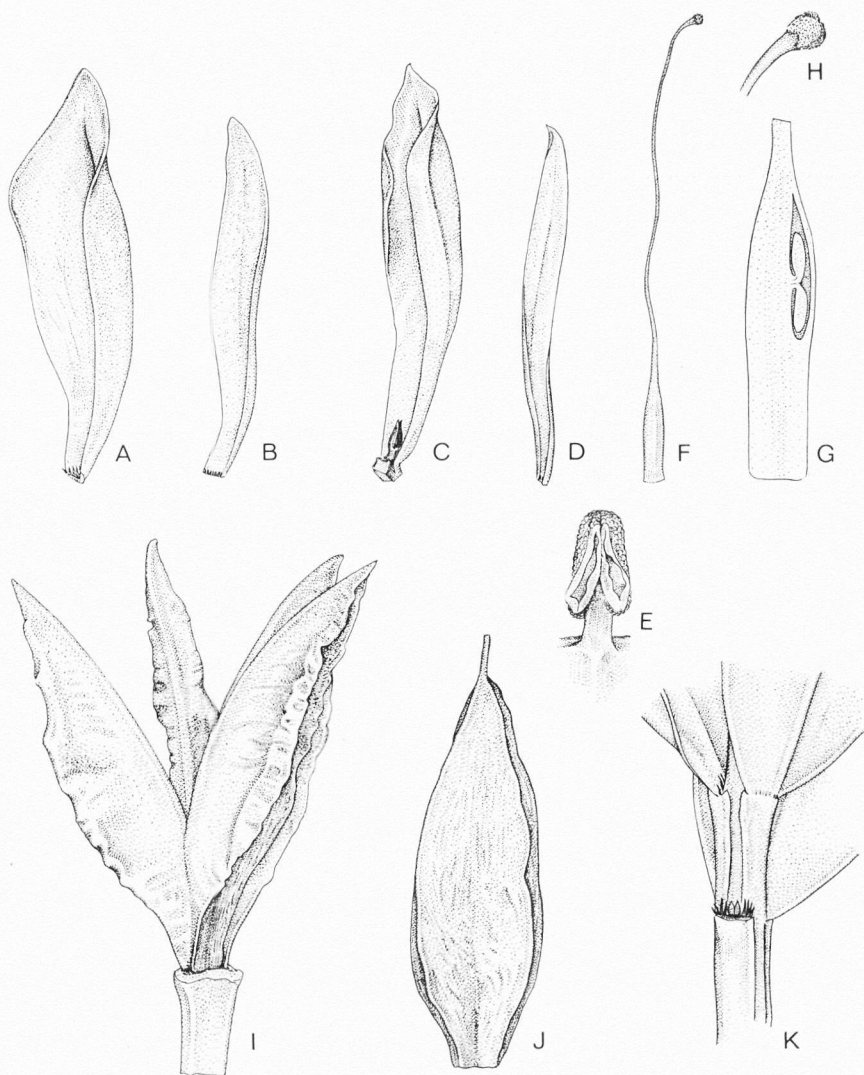


Fig. 3. *Glischrocolla formosa*; A—I: STOKOE, PRE no. 29713; J: ESTERHUYSEN no. 3640; K: STOKOE, SAM no. 56518. — A and B: Bract and bracteole respectively of flower from the middle part of an inflorescence ($\times 2$). — C and D: Bract and bracteole respectively from the inner (=uppermost) part of an inflorescence ($\times 2$). — E: Stamen ($\times 4$). — F: Pistil ($\times 2$). — G: Stigma ($\times 8$). — H: Ovary in longitudinal section ($\times 8$). — I: Old capsule, opened ($\times 4$). — J: Capsule, unripe ($\times 4$). — K: Part of branchlet (one leaf removed) to show ridges and axillary trichomes ($\times 4$).

(SAM) and PRE no. 29714 (PRE). — Somerset Sneeuwkop; 1300 m. 1937, STOKOE no. 5026 (BOL) and STOKOE, SAM no. 52240 (SAM). — Somerset Sneeuwkop. 1938, STOKOE no. 7095 (BOL, NBG). — Somerset Sneeuwkop, SE. side, on a cliff; 1200 m. 1939, ESTERHUYSEN no. 3640 (BOL). — Somerset Sneeuwkop. 1940, STOKOE, SAM no. 56518 (SAM). — Hottentots Holland Mts., between Sugar Loaf and Somerset Sneeuwkop, E. side. 1943, STOKOE no. 8947 (BOL).

Dubious locality: Somerset West Div.: Sir Lowry's Pass. 1943, STOKOE, PRE no. 29713 (PRE).

ECOLOGY

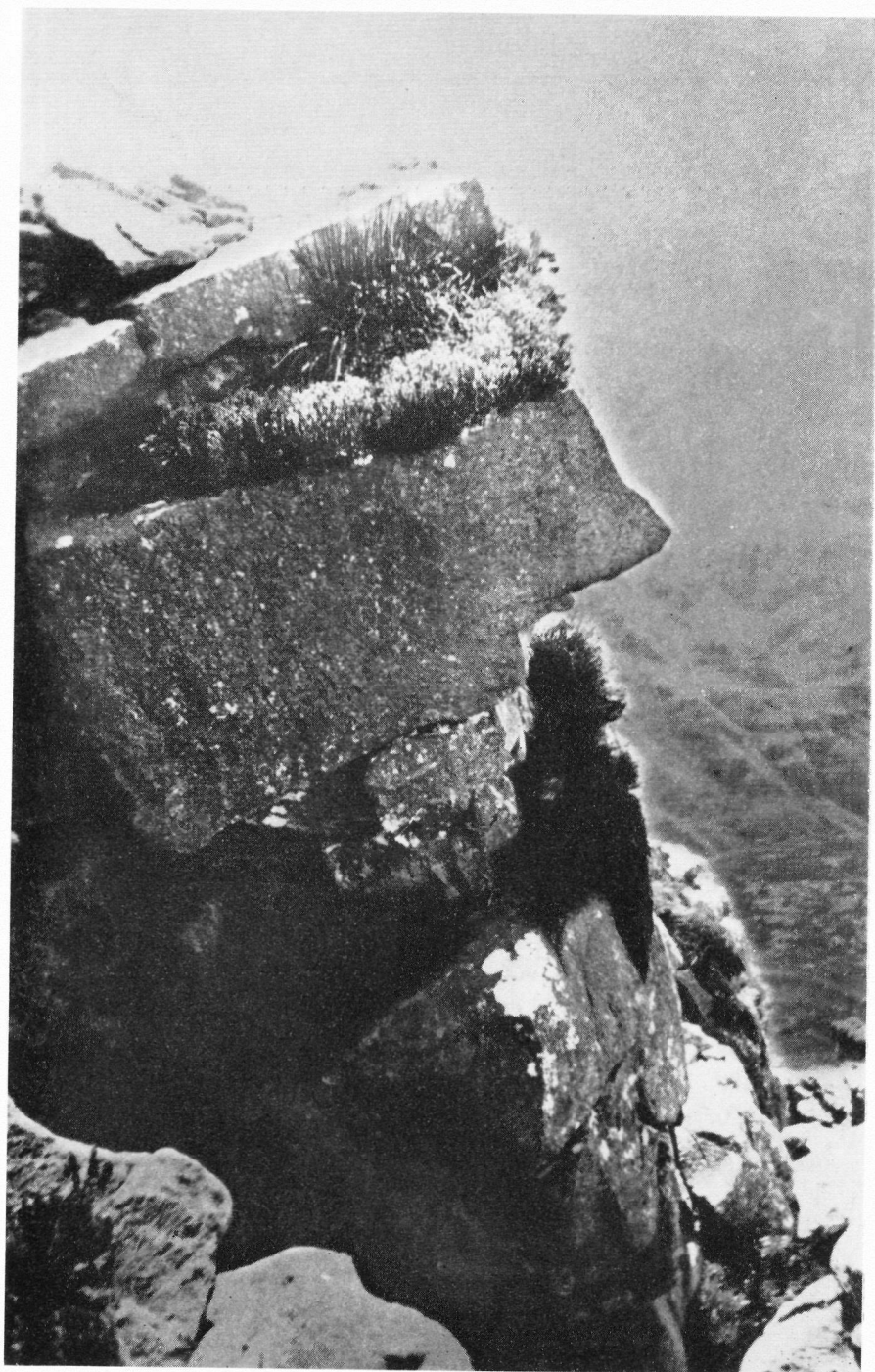
The species grows on ledges or narrow plateaus of steep precipices of sandstone rock (Table Mountain Series) at altitudes of 1200—1350 (—1500?) m., apparently (cf. Fig. 4) in a very shallow layer of soil.

The photograph of Fig. 4 and the ecological information derive from STOKOE (see the introduction), who recorded from the same ledge as *Glischrocolla* also *Erica banksia* ANDR. and species of *Stilbe* and *Tittmannia*.

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Fig. 4. *Glischrocolla formosa*, photograph taken by T. P. STOKOE in 1932 on the eastern side of Landdrostkop below the beacon. The plant is seen on the ledge in the upper part of the figure. — Published with the permission of the Bolus Herbarium, Cape Town.



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Studies on Penaeaceae IV

The Genus *Endonema*

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ABSTRACT

The two species of *Endonema* (*Penaeaceae*), *E. lateriflora* (L. fil.) GILG and *E. retzioides* SOND., are examined from nomenclatural, morphological, and distributional points of view. *Endonema* differs clearly from the monotypic genus *Glischrocolla*, e.g. in the stamens incurved in the bud stage in *Endonema*, erect in *Glischrocolla*. The "flowers" are lateral in *Endonema* and may be interpreted as unifloral lateral inflorescences with only the terminal flower developed. In *Glischrocolla* the inflorescence is terminal, often with one terminal and few or several lateral bibracteolate flowers. In *Endonema* the leaves possess thick- and smooth-walled idioblast sclereids, a cell type lacking in *Glischrocolla*. The pollen grains in both species of *Endonema* are tricolporate and ellipsoidal in equatorial view, but in *Glischrocolla* pentacolporate and almost square in the same view. It is also shown that the two species of *Endonema* differ in a number of conspicuous characters, such as the leaf shape, the number of bracteolate leaves supporting the flowers, and the colour of the perianth lobes. There are differences also in details, such as the cuticle structure of the leaves.

INTRODUCTION

The family *Penaeaceae* comprises 7 genera, *Endonema*, *Glischrocolla*, *Saltera*, *Sondera*, *Brachysiphon*, *Stylapterus*, and *Penaea*. The first two of these genera have in common large cylindrical perianth tubes with carnose bright-coloured lobes and ovaries with 4-ovulate locules, 2 ovules being pendulous and 2 ascending. Especially the latter character was important for the distinction of the two genera as a separate tribe, *Endonemae*, by, e.g. DE CANDOLLE (1857).

The two species of *Endonema* A. JUSS. both have large brilliant flowers. Their distributions are mainly concentrated to the Riversonderend Mountains in the southwestern part of the Cape Province. The flowers have the typical appearance of being ornithophilous, but no botanist

seems to have published any observation of bird visits (although damages on the flowers strongly indicate them).

The present study is based largely on herbarium material in the following herbaria (abbreviated according to LANJOUW & STAFLEU 1964): BM, BOL, C, G, K, L, LD, M, NBG, PRE, S, SAM, SBT, STE, UPS, W, WU.

HISTORICAL NOTES

Endonema was described by A. DE JUSSIEU in 1846 (p. 26) in his treatment on the family *Penaeaceae*. It was recognized as distinct from the other genera in, for example, the simply valvate aestivation, the filaments being incurved in bud stage but erect in the flower, the 4 ovules in each locule of the ovary, 2 ascending and 2 pendulous, and the long tubular perianth.

The single species known at that time was *Endonema thunbergii*, based on *Penaea lateriflora*, which was described already in 1781 by LINNÉ filius (p. 121) possibly with the assistance of THUNBERG, who had collected the plant in South Africa. The original description of *P. lateriflora* is somewhat inaccurate in details (. . . "*flores sessiles*, . . . *flores* . . . *longitudine foliorum*, . . . *filamenta nulla*") but there are no doubts about the identity. Adequate type material is present in the Linnean Society (LINN) as well as in THUNBERG's and other herbaria (UPS, LD, SBT).

The species was also mentioned in THUNBERG 1794 (p. 30), 1807 (p. 124) and 1823 (p. 150), and later botanists often cited THUNBERG as the original author. In THUNBERG 1807 the species was supplied with an illustration (l.c. Fig. 3) and the information "*crescit in montibus prope Zoetemelcks valley juxta sylvam*", although there are no locality records on the type sheets.

In KUNTH 1830 (p. 678) *P. lateriflora* was regarded as dubious species under the genus *Geissoloma* (but the nomenclatural combination with this genus was not made).

After the establishment of *Endonema* by DE JUSSIEU in 1846, where the species was illustrated (l.c. Plate 3) the genus has been accepted although with a slightly variable circumscription. SONDER in 1850 (pp. 103—104) described a second species, *E. retzioides*, superficially similar to *Retzia*. *E. retzioides* was based on an ECKLON & ZEYHER collection (with the manuscript name "*Sarcocolla retzioides* ECKL. & ZEYH.") from the eastern parts of the Riversonderend Mountains. SONDER also recorded a find of *E. "thunbergii"* (= *lateriflora*) from Genadendal by the same collectors.

DE CANDOLLE in 1857 (p. 490) by the side of *Endonema* placed the new genus *Glischrocolla*. These genera formed his tribe *Endonemae*, distinguished especially by the 2 ascending and 2 pendulous ovules in each locule, and also by the 2—4 bracteoles (which is in fact not true for *E. lateriflora*). BAILLON (1877 p. 96) treated *Glischrocolla* ("*Glyschrocolla*") as a section under *Endonema* and also BENTHAM & HOOKER (1880 p. 202) included *Glischrocolla* in *Endonema*.

VAN TIEGHEM in 1893 studied the anatomical conditions in *Penaeaceae*. In *Endonema* he found in each corner of the quadrangular branchlets a narrow cortical meristele which is lacking in the other genera of the family. On the leaves stomata occur on the lower side only, and a palisade parenchyma is developed only on the upper side. In the mesophyll of the leaves were found sclereid idioblasts with relatively thin and spiral or annular wall structures as well as others with smooth and thicker walls. His statement that the latter cell type has thicker walls in *E. lateriflora* than in *E. retzioides* has not been verified by me. The thick- and smooth-walled kind of sclereids were not observed in *Glischrocolla* by VAN TIEGHEM (or by me) and affords a difference between the genera. Further studies on the anatomy of *Penaeaceae* were performed by SUPPRIAN (1894).

GILG in 1894 b (p. 210) according to the present principle combined the specific name *lateriflora* with *Endonema*, but he wrongly ascribed the specific name to THUNBERG instead of LINNÉ filius.

In 1925 the genera *Endonema* and *Glischrocolla* were examined by STEPHENS for Flora Capensis. The *Endonema* species, *retzioides* and "*thunbergii*", were described and notes on the distributions were given. In the same year MARLOTH mentioned the two species in his Flora of South Africa. A record of *E. lateriflora* from "near Van Stadens", doubtless based on a mislabelled specimen (in W), appears for the first time in these works. The brilliant colour of the perianth lobes in *E. retzioides* was examined in detail by MARLOTH and according to him depends on the combination of the "papillate form of the cells of the upper epidermis, the red sap of these cells, the layer of yellow chromatophores in the lower part of each cell, and the numerous air-spaces in the internal tissue, caused by the stellate shape of these cells".

In PHILLIPS 1926 (p. 426) the distribution of the genus was said to extend "from Caledon to the Uitenhage district" (cf. above). In the second edition of the same work (1951) "*E. latiflora*" (= *E. lateriflora*) was selected the type species of the genus.

ERDTMAN (1952 p. 317) illustrated and described the pollen grains in *E. retzioides*. They are 3-colporate and rounded hexangular in polar view because of 3 colpoid grooves alternating with the colpi. This, I have found, is the case in both species, whereas the pollen grains of *Glischrocolla* are 5-colporate (Fig. 4).

MORPHOLOGY

The species are little or rather much branched shrubs or shrublets, sometimes rather low and ascending, sometimes up to 130 cm tall and erect. The stems and branches are rather rigid and stiff, and in *E. lateriflora* quite coarse. The young branches have a smooth or longitudinally striated cortex and the more or less compressed internodes have 4 ridges, much more prominent in the relatively slender-branched *E. retzioides* than in *E. lateriflora*. These ridges do not end as a distinct tip, wart, or process, but have an abrupt truncate or obtuse end on level with the

leafbases. Below each leafbase, median in position, there is a sometimes rather prominent ridge in *E. retzioides*. The sculptured cortical layer flakes off after some year(s) and the older greyish-brown branches are terete.

The *branching* is mainly sympodial. In *E. retzioides* the branching is sometimes almost regularly pseudo-dichotomous, two opposite branches developing at some distance below each degenerating branch tip, which finally gets dry and dead and remains with one or more internodes for some time. The flowers (may be regarded as uniflorous inflorescences) are lateral and in this species usually situated only one or two (—5) on each branchlet. If the floriferous branchlets bear lateral new branchlets these are formed in the leaf axils above or below those where the flowers are situated, or in some cases even in a leaf axil opposite one with a flower.

In *E. lateriflora* the flowers are distributed on long stretches of the banches in a spikelike fashion. Although the growth in young specimens seems to be monopodial it apparently shifts to sympodial where inflorescences are formed. Lateral branchlets are usually developed in leaf axils above (or in) the floriferous part of the branch ends, and as the main branch end dies off its tip is left. One to five branches are formed below each branch end.

The *leaves* are sessile, coriaceous, and rather closely set (in *E. lateriflora* imbricated) on the younger branches. They are very dissimilar between the two species. In *E. lateriflora* they are ovate or elliptic, in *E. retzioides* linear. They have a prominent midvein on the lower side. The margins are strongly recurved in *E. retzioides* but not or only slightly recurved in *E. lateriflora*. The surface is smooth or in *E. retzioides* slightly roughened by the bulging epidermis cells. The young leaves (and also the bracteoles) have a quite minute brownish apical point or wart, which in the older leaves takes the shape of a brown dot.

Cross-sections of the leaves from the upper parts of the branches are seen in Fig. 3. The two species differ in the shape of the epidermis, which is especially marked on the upper side. In *E. retzioides* the cuticle of each cell is convex—subpapilliform, but has a smooth surface. In *E. lateriflora* it is only slightly convex and has a finely denticulate, rough surface. The palisade cells are longer in *E. retzioides* than in *E. lateriflora*. The sclereid cells in both species are of two kinds as described above. — It may be pointed out that the cuticle of the *Glischrocolla* leaf is rather similar to that of *E. lateriflora* (both also have broad

leaves), but that, e.g., the thick- and smooth-walled idioblast sclereids are lacking.

In each leaf axil there are two lateral groups of brownish subulate hairs (sometimes merging into one row); the longest hairs are up to 0.8 mm long, the shorter much less.

The *flowers* are distributed on the young branches, in *E. lateriflora* on long stretches, in *E. retzioides* only in a number of 1—3(—5), on each branch and branchlet respectively. The flowers are relatively large and tubular, and have a distinct stalk (which in part may be regarded an inflorescence axis). This in *E. lateriflora* bears 3, in *E. retzioides* 2, pairs of leaves, “bracteoles”. As indicated, the “flower” may be regarded as a uniflorous inflorescence, as suppressed buds are sometimes found in the axils of the lowest pair of “bracteoles”. In fact, STEPHENS (1925 p. 97) reported for *E. lateriflora* that this bud “(very exceptionally) may grow out into another short peduncle, bearing a terminal flower and furnished with 2, 1 or no pairs of bracts, according to whether it was borne in the axil of the first, second or third pair on the original peduncle.” This condition I have not noticed in any of the material studied. (In one case I found a bud in the axil of one of the lowest bracteoles, but this bud only had one pair of bracteoles.)

The *bracteolate leaves* are thinner than the vegetative ones, and the margins are almost hyaline. They are narrowly elliptic and pale yellow in *E. lateriflora*, shorter, rotund, and yellow or pale brownish in *E. retzioides*, where they are also usually shed in early flowering stage. In their axils the bracteolate leaves bear short stout trichomes as do the vegetative leaves.

The *perianth tube* is long and cylindrical, often slightly tapering in the basal and upper part. The veins are rather distinct in *E. lateriflora*, more indistinct in *E. retzioides*, and never as prominent as in *Glischrocolla*. The colour of the flower tube is yellow in both species, perhaps most brightly so in *E. lateriflora*. The perianth lobes are narrowly triangular, valvate in aestivation, and very carnosae. They have a prominent ridge on the apical half of the upper (inner) side making the bud apex compact. In flower the perianth lobes spread open but they are not reflexed as in *Saltera*. The colour of the perianth lobes is yellow (sometimes said to have a reddish tinge) in *E. lateriflora*, brilliant red in *E. retzioides* (see also the remarks in MARLOTH 1925 mentioned in the historical note above).

The *filaments* are partly incorporated in the flower tube. The free apical parts emerge on the inner side of the tube in the sinuses between

the lobes of the perianth. They have a flattened subulate-linear shape and are considerably broader at the base than at the apex. In bud stage the filaments are incurved near the middle with the anthers turned over with the back side towards the centre (Fig. 3 D), which is a peculiar characteristic of the genus within the family. In early anthesis they straighten up and the pollen sacs become introrse as in the other genera.

The *anthers* are medifixed. The elongate connective body is usually broadest in the basal part which is more or less recurved in anthesis. The back side of the connective is prominently ridged and rugose or wrinkled. A longitudinal groove continues from the attachment point of the filament to the apex on the inner side. The pollen sacs are narrow and linear. They reach from the connective apex to some distance from its base, and they form a narrow angle with each other being more apart in the basal part. The margins of dehiscence have rather shortly papillose cells.

The pollen grains are similar in the two species, 3-colporate, ellipsoidal, hexalobate in polar view because of 3 intracolpate longitudinal grooves (see also ERDTMAN 1952). In the pollen shape *Endonema* differs markedly from *Glischrocolla* which has 5-colporate grains square in equatorial view (see Fig. 4).

The *pistil* is smooth. The ovary has a broad base, but the style is long and slender reaching in anthesis to about the same height as the erect anthers. The style apex is relatively broad and rather quadrangular-sulcate just below the quadrangularly capitate or shortly quadri-lobate papillate stigma.

The 4 ovules are situated on the middle part of the inner or central side of each of the four locules in the ovary. The two upper ovules are ascending and the two lower pendulous. The raphe is extrorse in all of them.

The *capsule* is similar to those of the other genera but relatively large. It is smooth-walled or longitudinally somewhat rugose, dark-brown—black when ripe, and is considerably larger in *E. retzioides* than in *E. lateriflora*.

Fig. 1. *Endonema lateriflora*; A—J: STOKOE no. 2148 from Oudebos, Riversonderend Mountains; K: ZEYHER no. 17. — A: Branch end with unifloral lateral inflorescences. — B: Unifloral inflorescence ("flower"). — C—D: Leaf of lower, middle, and upper pair in B. — F—H: Stamen in back, side, and front views respectively. — I: Capsule. — J: Pistil. — K: Seed. — (A—E and I $\times 2$; F—H and J—K $\times 4$.)



Fig. 1.

1. *Endonema lateriflora* (L. FIL.) GILG

GILG 1894 b p. 210 [as "*Endonema lateriflora* (THUNB.) GILG"]; MARLOTH 1825 p. 210; PHILLIPS 1951 p. 524 (as "*E. latiflora*"). — *Penaea lateriflora* L. fil. ("THUNB." sometimes cited as the author); LINNÉ filius 1781 p. 122; THUNBERG 1794 p. 30; 1807 p. 124; 1823 p. 150; POIRET 1804 p. 540; KUNTH 1830 p. 678 (under *Geissoloma* as a synonym); DE JUSSIEU 1846 p. 27 (as a synonym of *Endonema Thunbergii*); SAVAGE 1945 pp. 25, 210. — [*Geissoloma lateriflorum* (L. fil.) A. DC.; DE CANDOLLE 1857 p. 491 as a synonym of *E. Thunbergii*; this combination was not made by KUNTH 1830.] — *Endonema Thunbergii* A. JUSS.; DE JUSSIEU 1846 p. 27; ENDLICHER 1847 p. 74; SONDER 1850 p. 104; DE CANDOLLE 1857 p. 491; VAN TIEGHEM 1893 pp. 280 and 283—285; SUPPRIAN 1894 pp. 328—329; GILG 1894 b p. 210 (as a synonym of *E. lateriflora*); STEPHENS 1925 p. 97.

ORIGINAL COLLECTION. *P. "lateriflora"* (THUNBERG leg.) (*Penaea* sheet no. 7) in LINN (lectotype); isotypes in S and UPS.

ILLUSTRATIONS. Figs. 1 and 3 F and H. — THUNBERG 1807 Plate 3: 2; DE JUSSIEU 1846 Plate 3.

Erect, rigid shrub usually 90—140 cm tall, with strong, straight, terete stem rather smooth and brownish grey on the older parts, up to > 1.5 cm thick at base. Upper (and sometimes middle) parts of the shrubs densely and imbricately leafy, the branches compressed, greyish, slightly striated on the younger parts, the cortex with 4 rather low ridges ending bluntly on the sides of the leafbases at the nodes. The sculptured cortex flaking off in rectangular pieces at the age of about 2 years. — *Leaves* imbricated, suberect, sessile, flat, coriaceous, ovate or elliptic or circular, usually 10—27×7—16 mm in size, those at the end of each branch generation smaller than those in the lower parts, obtuse(—subacute), rounded-obtuse at base, entire, with minute apical dot, rather light-green below, bright green above, ± smooth, with distinct light midvein, in the axils with a row of short subulate setae (the lateral being the longest). — *Flowers* (may be interpreted as uniflorous inflorescences) in the axils of the leaves of the last branch generation, distributed in often considerable number along a considerable distance, somewhat longer than the leaves, subtended by 3 pairs of bracteoles on the end of a c. 2.5—3.5 mm long, quadrangular, ± compressed stalk. — *Bracteoles* elongate, thick and subcarnose in the middle and basal parts and gradually thinner towards the subhyaline margins, light—bright yellow, with a ± distinct minute apical point, and in the axils with a ± continuous row of short subulate trichomes c. 0.2—0.7 mm long. Lowest pair narrowly ovate, elliptic or obovate, keeled below, usually 8—11×2.7—4.8 mm large, acute or apiculate.



Fig. 2. *Endonema retzioides*; HOHENACKER (without no.). — A: Part of branchlet with 2 unifloral inflorescences ("flowers"). — B and C: Leaf of lower and upper pair subtending the flower. — D: Stamens in bud stage (notice the incurved filament); cf. fig. 3 A. — E: Pistil. — F: Stigma. (A $\times 2$; B—E $\times 4$; F $\times 8$.)

Middle pair lanceolate or narrowly oblong-elliptic, acute, usually 13—18×5.8—8.0 mm large. Upper pair linear-oblong or narrowly oblong-elliptic, usually 15—19×4.5—6.3 mm large. Flower buds occasionally developed in the axils of the bracteoles. — *Perianth* tube cylindrical, usually 19.8—21 mm long (in flower) and c. 3.5(—4) mm wide, rather bright yellow, smooth but with 8 distinct longitudinal veins, tapering-obtuse at base. Perianth lobes narrowly triangular-lanceolate, usually 6.5—8.5×3.3—3.8 mm large, bright yellow, almost flat and smooth on outer (lower) side, inner side strongly carnosely and keeled on the apical half, concave on the basal half. — *Stamens*: filaments (free parts) linear-subulate, c. 2.9—3.2 mm long in anthesis, 0.7—1.1 mm broad at base, slightly depressed, incurved near the anther in bud. Connective elongate, about 3.1—4×1.5—2 mm large (depending largely on stage), broadest at base, obtuse—retuse at apex, obtuse at base, strongly recurved after anthesis, with rugose or folded surface, the back side with a prominent ± irregular (and sometimes double) ridge, the inner side with a deep groove between the two linear, 2—3 mm long pollen sacs. — *Pistil* as described in the morphological notes above; stigma shortly 4-lobate, about 0.9 mm across. — *Capsule* as seen in Fig. 1 I, valves about 12—13×4 mm large. — *Seeds* (those seen probably not quite ripe) longitudinally striated, about 3.5 mm long excl. funicle (see Fig. 1 K).

DISTRIBUTION AND ECOLOGY. *E. lateriflora* is limited to the River-sonderend Mountains where it is recorded between the mountains above Genadendal in the west and those above Riversonderend in the east.

It grows in moist and semishaded places on rocky sandstone slopes mainly facing south. — Where I have seen it (Kanonkop above Genadendal) it grew in connection with, mainly below and on the sides of, a stream spread out on vertical rocks. It was accompanied by, e.g., *Pteridium aquilinum* and species of *Leucadendron* and *Elegia*.

COLLECTIONS

Caledon Div.: (Mts. nr.) Genadendal. ZEYHER (S, W); 1909, BRUNN-THALER no. 597 (WU). — Slopes above Genadendal; about 1000 m. 1855, H. BOLUS no. 5396 (BOL, SAM); 1897, SCHLECHTER no. 10305 (BM, BOL, K). — S. slope of Kanonkop, above Genadendal, wet slope nr. stream side. 1964, ROURKE no. 8 (BOL, NBG); 1966, DAHLGREN & STRID no. 4979 (LD, NBG). — Baviaanskloof Mts. nr. Genadendal. 1815, BURCHELL no. 7782 (K, L, M, PRE, W); NIVEN no. 105 (BM). — Schilpad Kop, upper S. slopes. 1941, ESTERHUYSEN no. 5064 (BOL, NBG, PRE). — Schilpad Kop, steep S. slopes; 1000 m. 1953,

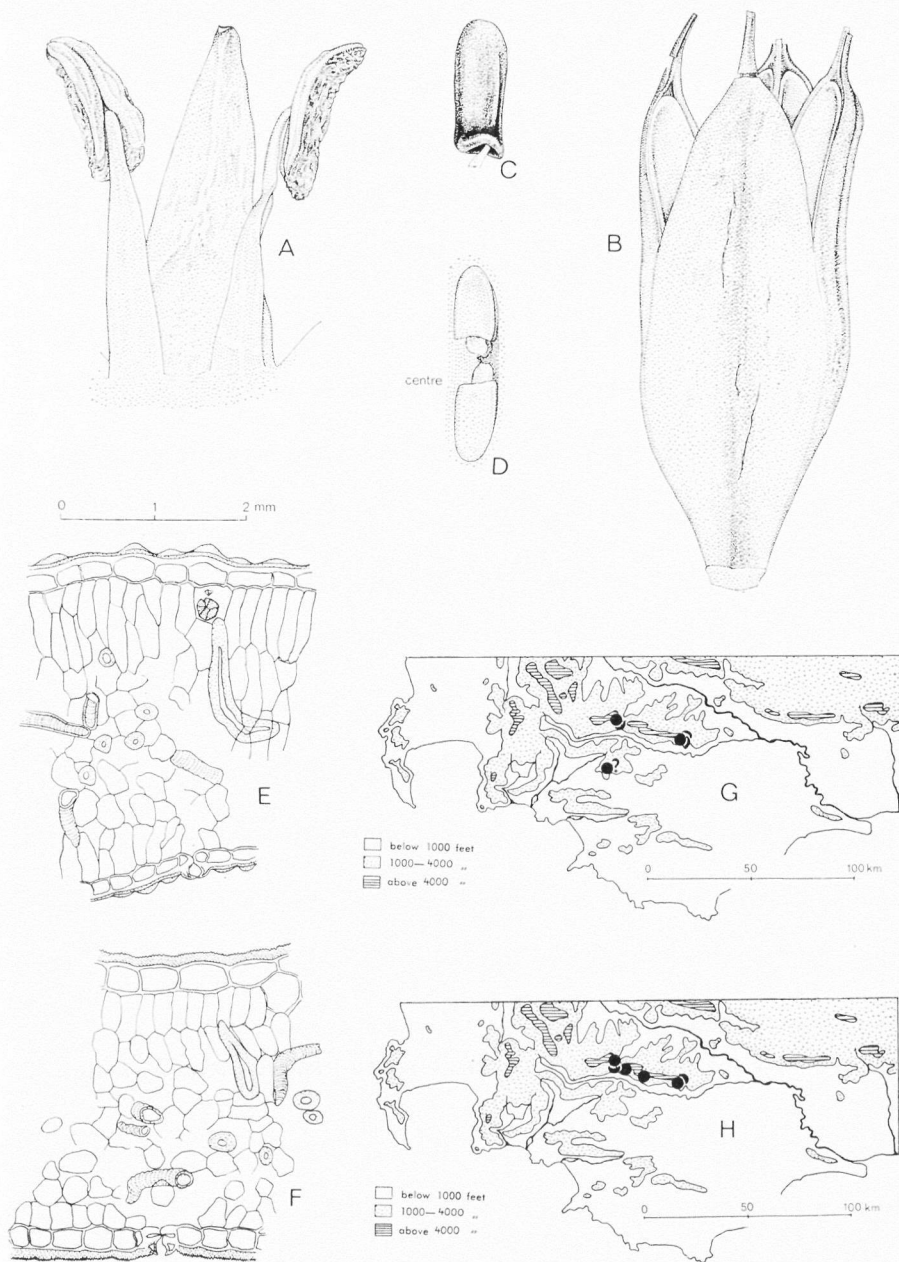


Fig. 3. *Endonema retzioides* (A—E) and *E. lateriflora* (F). — A: Stamens in anthesis; HOHENACKER ($\times 4$). — B—C: Capsule and seed; ZEYHER no. 3724 ($\times 4$). — D: Longitudinal section through ovary; VIGNE ($\times 16$). — E—F: Part of cross-section of leaf of DAHLGREN & STRID no. 4231 and no. 4979 respectively; same scale. Notice the different structure of the cuticle. — G—H: Distribution maps of *E. retzioides* and *lateriflora* respectively.

ESTERHUYSEN no. 21053 (BOL). — Grootwadersbosch. ZEYHER, SAM no. 19964 (SAM). — Oudebos, Sonderend Mts. 1930, STOKOE no. 2148 (PRE). — River-sonderend Mts. (River Sonder Einde). 1930, STOKOE nos. 2148 and 6294 (BOL). — Deep kloofs facing S., Riversonderend Mts. 1930, STOKOE, SAM no. 48623 (SAM).

Very dubious record: Stony places in "Vanstadesberg". ECKLON & ZEYHER (W).

2. *Endonema retzioides* SOND.

SONDER 1850 p. 104; DE CANDOLLE 1857 p. 491; VAN TIEGHEM 1893 pp. 280, 283—285; SUPPRIAN 1894 pp. 327—328; GILG 1894 b p. 210; MARLOTH 1825 pp. 210—211; STEPHENS 1825 p. 98; ERDTMAN 1952 p. 317. — [*Sarcocolla retzioides* ECKL. & ZEYH. ex SOND. (cited as a herbarium synonym of *E. retzioides* in SONDER 1850 p. 104.)]

ORIGINAL COLLECTION. "15. *Sarcocolla retzioides* E. Z. 90. 2." in SONDER's herbarium (S, lectotype). Also often marked ZEYHER no. 3724. Isotypes in G, K, M, PRE, SAM, UPS.

ILLUSTRATIONS. Figs. 2, 3 A—E, and 4 A—C. — GILG 1894 a Fig. 10 A—G and GILG 1894 b Fig. 73 A—G; MARLOTH 1925 Plate 71 D and Fig. 135 B; Protected wild flowers of the Cape Province, 2, (1953) Plate 84; ERDTMAN 1952 Fig. 184 (pollen grain).

An ascending or erect shrub or shrublet 35—100 cm tall, sympodially (often pseudodichotomously) branched at least in the upper parts of the branches. — *Branches* smooth, compressed, with 4 or 6 prominent ridges arranged 2—3+2—3 on the shorter sides of the branchlets. Ridges truncate or very shortly and obtusely toothlike at the distal nodes. — *Leaves* (in adult stage) linear, (12—)16—35×1.5—2.4(—3) mm large, subacute (although the very apex blunt—truncate and with a brown dot), light or yellowish green, subcoriaceous, slightly rugose below, upper side with a marked middle groove running from base to apex and with subpapillate epidermis; lower side with a prominent keel-like midrib, margins recurved. Leaf axil with short brown trichomes. — *Flowers* (may be interpreted as uniflorous inflorescences) in leaf axils on the outer branchlets, few on each branchlet, with two pairs of bracteoles and a quadrangular pedicel about 3—3.5 mm long. — *Outer bracteoles* circular, ovate or obovate, usually 3.2—5×3.5—4.8 mm large, brown or yellowish, rather thick in the middle part, with thin, ± irregular margins, and with acute(—acuminate) apex. Inner bracteoles usually transversely elliptic or very broadly obovate, usually 4.5—7.5×7.0—8.8 mm large, generally retuse but with a ± distinct and often acute apical point, otherwise similar to the outer bracteoles although

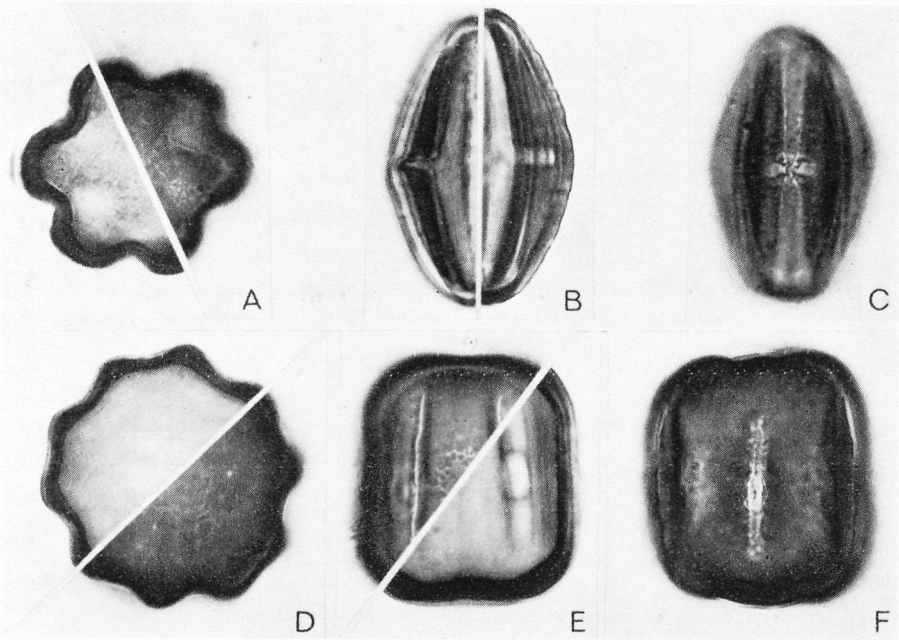


Fig. 4. Pollen grains of *Endonema retzioides* (STOKOE no. 2093) in the upper row, and *Glischrocolla formosa* (WOODS, Hottentots Holland Mts., 1955) in the lower row. — A: Lower left half in optical section, upper right half in polar view. — B: Optical sections, differently focused. — C: Equatorial view. — D: Upper left half in optical section, lower right half in polar view. — E: Upper left half in equatorial view, lower right half in optical section. — F: Equatorial view focused to show colpus and ora. (Same scale; \times about 720.) Pollen slides made by the Palynological Laboratory, Solna. Photo K. E. SAMUELSSON.

often with more irregular margins with sparse papillose cells. — *Flower* tube \pm cylindrical, generally 27–33 mm long and about 6 mm wide, tapering towards the base and also slightly in the upper part, yellow, lustreless. Lobes narrowly ovate-triangular or broadly lanceolate, $9.5-12.3 \times 4.0-5.3$ mm large, with obtuse and incurved apices, bright red, smooth and rather flat on the outer side, inner (upper) side concave on the basal parts with marginal ridges meeting at the middle of the lobe to form a very prominent ridge running from the middle to the apex, the apical part being thick and filled up with fungous tissue (cf. MARLOTH 1925 cited above). *Æstivation* valvate, the apical parts of the lobes forming a compact body in bud. — *Filaments* incurved near the anther in bud, elongating and straightening up in early an-

thesis, becoming 7 mm long or more, \pm depressed, and subulate in outline. Anther turned over, with the pollen sacs extrorsely directed in bud stage, straightened by the filament in anthesis to introrse position (Fig. 3 A). Anther attached to the filament slightly below the middle of the inner side, with the elongate connective broadest below the middle, somewhat folded in bud stage, in late anthesis deeply folded and rather strongly recurved, about $4.6-5.5 \times 2.0-2.6$ mm large (depending largely on stage), with a deep groove between the pollen sacs on the inner side. Pollen sacs linear, 3.5—4.5 mm long (varying with stage), reaching from the connective apex to some distance from the connective base. — *Pistil* as described for the genus; stigma shortly 4-lobate, about 0.7—1.0 mm across. — *Capsule* of the shape seen in Fig. 3 B; valves $13-17 \times 4.8-6.0$ mm large, reddish-brown—black, very hard. — *Seeds* oblong, subterete or slightly compressed, about $4.2-4.7 \times c. 1.7$ mm large (excluding funicle), with slightly prolonged raphe side, blackish-brown, \pm glossy. Funicle white, \pm fungous, but relatively narrow for the family.

DISTRIBUTION. *E. retzioides* occurs on the Riversonderend Mountains in about the same regions as *E. lateriflora*. There are also two records from "Caledon", but these may refer only to the division. The VIGNE collection from "Zwarteberg near Tygerhoek" probably also actually derives from the Riversonderend Mountains, as there is a farm with that name near Riversonderend (see below *Aspalathus taylorii* on p. 29 in this fascicle), but none with that name known to me from the Zwarteberg.

The species grows on rocky slopes and probably always in connection with some watercourse, especially where the ground is rocky and shelving and the scrub vegetation sparse.

COLLECTIONS

Caledon Div.: Among rocks on top of Zwarteberg (=Riversonderend ?) Mts. nr. Tygershoek; c. 700 m. 1896, VIGNE, Herb. MAC OWAN no. 1646 (BOL, G, SAM, UPS, W). — Caledon. 1895, GUTHRIE no. 3910 (NBG). — Mts. nr. Caledon. 1905, SAMPSON, BOL no. 10032 (BOL). — Genadendal Mts. nr. Caledon. 1932, WEDER, STE no. 17654 (STE). — Mt. slopes, Genadendal. 1847, TYSON, SAM no. 19981 (SAM); PAPPE (BOL, K); ROSER (K). — Baviaansberg, Genadendal. PAPPE (S). — Tops of mts. of Genadendal. 1815, BURCHELL no. 7712 (K, L, M, PRE, W). — Riversonderend Mts. above Appelskraal. ZEYHER no. 3724 (C, G, K, M, PRE, S, SAM, UPS, W, WU). — Oudebos, Riversonderend Mts. 1930, STOKOE no. 2093 (PRE). — Riversonderend Mts., lower slopes of Pilaarkop above farm Esperance; 480 m. 1965, DAHLGREN & STRID no. 4231 (LD, NBG). — Riversonderend Mts.; c. 700 m. 1945, STOKOE, SAM no. 57739

(SAM); 1928, WHITE, MARLOTH no. 13535 (PRE). — Riversonderend Mts. 1949, STOKOE, SAM no. 63585 (SAM). — [Riversonderend Mts.] Nr. Riversonderend [village]. 1930, STOKOE no. 6293 (BOL); 1933, LANGSCHMIDT (BOL); 1949, WILMAN no. 473 (BOL, PRE); 1949, NEETHLING, STE no. 26728 (STE). — Riversonderend, on high mt. plateau. 1950, MIDDLEMOST no. 1510 (NBG).

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Studies in the Aegean Flora XI

Procopiana (Boraginaceae) Included into Symphytum

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ABSTRACT

The inclusion of *Procopiana* into *Symphytum* is based on morphologic, palynologic, and cytologic investigations. The similarities between *Procopiana cretica* (WILLD.) GUŞUL., which is divided into two species in the present paper, and *Symphytum anatolicum* BOISS. are stressed in particular. *Procopiana euboica* RUN. has to be placed in the vicinity of *Symphytum ottomanum* FRIV. — A new species, *Symphytum circinale* RUN., is described. The new combinations *Symphytum creticum* (WILLD.) RUN. and *Symphytum euboicum* (RUN.) RUN. are made. — The chromosome numbers $2n=28$ for *Symphytum creticum* and *circinale* and $2n=30$ for *Symphytum anatolicum* are given. — The distribution areas of *Symphytum creticum* and *circinale* are discussed.

INTRODUCTION

GUŞULEAC (1928, 1931) divided the genus *Trachystemon* G. DON (= *Psilostemon* DC.) into two monotypic genera, *Trachystemon* s.str. and *Procopiana* gen.nov. This division is based mainly on the shape of the fornicis and the presence or absence of bracts in the inflorescence.

Procopiana was placed together with *Trachystemon* in the neighbourhood of *Borago* L. Like these genera *Procopiana* has a deeply lobed corolla. However, it differs from both genera in the shape of the fornicis, and besides from *Borago* in the form of the connective of the anthers.

Procopiana was regarded as monotypic by GUŞULEAC, with the species *P. cretica* (WILLD.) GUŞUL., restricted to southern Greece. RUNEMARK in RECHINGER (1961) described a new species, *P. euboica*, from the island of Euboea in the Aegean.

MORPHOLOGY

The fornicis in *Procopiana* are very similar to those of *Symphytum*. Also other similarities exist between the genera. Thus *Symphytum*

anatolicum BOISS. (a west-Anatolian and Aegean species) only with difficulty can be distinguished from *Procopiana cretica* s.lat. (except in the shape of the corolla), as they are very similar in habit, leaves, inflorescence, styles, anthers, fornicies, and mericarps. Even the differences in the shape of the corolla are relatively small. Thus if the apical part of the corolla tube in *Symphytum anatolicum* was split into 5 linear lobes, it would correspond to a *Procopiana* corolla. In the same way *Procopiana euboica* RUN. differs from *Symphytum ottomanum* FRIV. only in minor characteristics of the flower. In habit, shape of the leaves, and inflorescence the last mentioned species are both very similar to *Procopiana cretica* and *Symphytum anatolicum*.

PALYNOLOGY

Pollen grains have been taken from herbarium material. They have been lightly boiled and kept in a medium of glycerine and gelatine.

In *Procopiana cretica* s.lat. (= *Symphytum creticum* and *circinale*, Fig. 1 A, B) the pollen grains are ellipsoid, colporate, c. $24 \times 20 \mu$, with 9 (—10) colpi. The exine is thin with an obscure stratification.

Symphytum anatolicum (Fig. 1 C) also has ellipsoid, colporate pollen grains, c. $27 \times 23 \mu$, with 9 (—10) colpi. The exine is thin with an obscure stratification. All other species of *Symphytum* seem to have pollen grains, which are \pm rectangular in equatorial view. A tendency towards subisopolar pollen grains has also been observed (distinctly subisopolar pollen grains occur, e.g., in *Onosma* and *Echium*). They also have \pm confluent ora forming a continuous equatorial zone.

Trachystemon orientale (Fig. 1 D) has subglobose, colporate pollen grains, c. $22 \times 21 \mu$, with (6—) 7 colpi. The exine is thin with an obscure stratification.

Borago officinalis (Fig. 1 E) has globose, colporate pollen grains, c. $32 \times 32 \mu$, with (9—) 10 colpi. The ora are much longer and narrower than in other genera investigated. The exine is very thick with a distinct stratification.

DISCUSSION. From what is mentioned above and from the drawings (Fig. 1 A—E) it is evident that the pollen grains of *Procopiana cretica* s.lat. are closely similar to those of *Symphytum anatolicum*, while they are very different from those of other *Symphytum* species. The pollen grains of *Trachystemon* show a certain resemblance to those of *Procopiana*, but are smaller, subglobose and have only (6—) 7 colpi. The pollen grains of *Borago* are very dissimilar to those of *Procopiana*, e.g. in outline, the shape of the ora, and the development of the exine.

CYTOLOGY

Chromosome numbers have been determined in root-tips of material cultivated in the greenhouses of the Botanical Garden, Lund. The material was fixed in the Svalöf modification of Navashin-Karpeschenko and stained in crystal-violet. For a list of investigated material see Appendix.

Procopiana cretica s.lat. (= *Symphytum creticum* and *circinale*, Fig. 1 F, G) has the somatic number $2n=28$. In *Symphytum anatolicum* (Fig. 1 H) $2n=30$ was found.

No chromosome counts have previously been made in *Procopiana*. The number found in *Symphytum anatolicum*, $2n=30$ (and a presumed basic number $n=15$), has not previously been found in the 11 species cytologically investigated in the genus. The numbers known are $2n=18, 36, 40, 62, 63$, and 72 (cf. DARLINGTON & WYLIE 1955 and LÖVE 1961).

Procopiana cretica s.lat. and *Symphytum anatolicum* are very similar in chromosome size and shape (Fig. 1 F—H). The difference in number ($2n=28$ and $2n=30$, respectively) seems to be of restricted value from generic point of view, as aneuploid series occur in many genera of *Boraginaceae*.

The chromosomes in many genera of *Boraginaceae* show a rather conspicuous stickiness, making accurate chromosome counts arduous. *Symphytum* seems to be the most difficult genus in this respect, as the chromosome ends very often adhere to each other (cf. STREY 1931 and BRITTON 1951). The same phenomenon was met with in *Symphytum anatolicum* and *Procopiana cretica* s.lat., which made it necessary to analyse a very large number of metaphase plates to get reliable counts.

The chromosome numbers known from *Borago* are $2n=16$ and $2n=32$ (cf. LÖVE 1961). According to the drawing in STREY (1931) the chromosomes are distinctly larger than those of *Procopiana*.

TAXONOMIC TREATMENT OF PROCOPIANA

Morphologic, palynologic, and cytologic data do not support the close relationship between *Procopiana* and *Borago* generally presumed. Instead, *Procopiana* shows affinities to *Symphytum*.

Procopiana euboica is morphologically very similar to *Symphytum ottomanum* and has to be transferred to *Symphytum*.

Procopiana cretica s.lat. and *Symphytum anatolicum* show great similarities in morphologic features, in the structure of the pollen

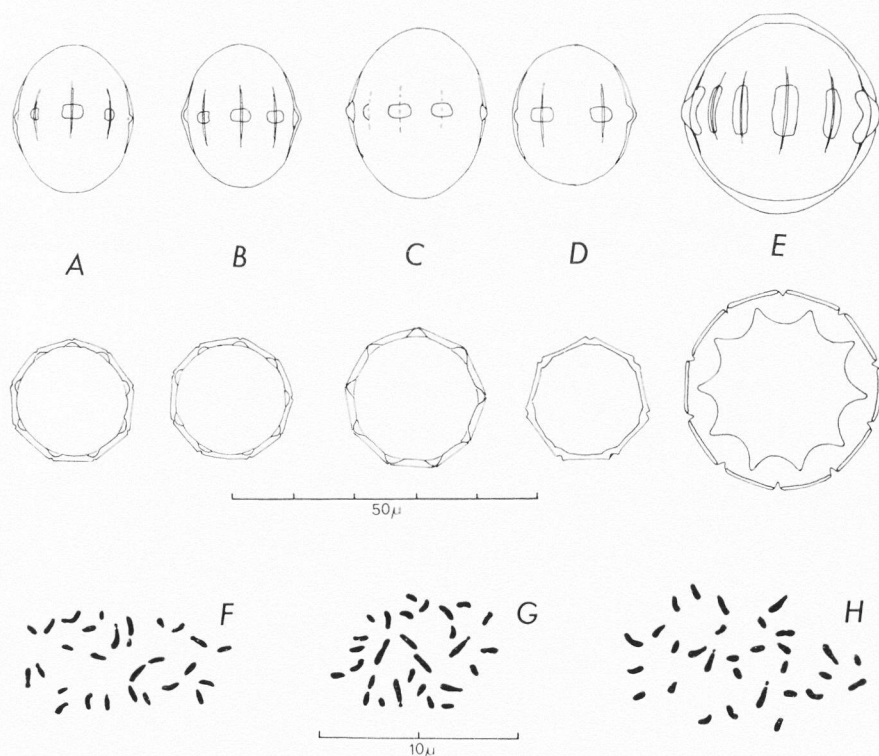


Fig. 1. Pollen grains in equatorial and polar view. A: *Symphytum creticum*, B: *Symphytum circinale*, C: *Symphytum anatolicum*, D: *Trachystemon orientale*, E: *Borago officinalis*. — Somatic metaphase plates. F: *Symphytum creticum*, G: *Symphytum circinale*, H: *Symphytum anatolicum*.

grains, and in the size and shape of the chromosomes. As they are apparently closely related, it seems inappropriate to refer them to different genera. Two ways of treatment are possible:

1. *Symphytum anatolicum* could be transferred to *Procopiana*. The enlarged genus *Procopiana* would be distinguished from *Symphytum* mainly by differences in pollen structure.

2. *Procopiana cretica* s.lat. could be included in *Symphytum*. Such a treatment is supported by similarities in vegetative characteristics, e.g., between *Procopiana cretica* and *Symphytum ottomanum* and similarities in the behaviour of the chromosomes in metaphase plates (adhering of chromosomes ends). However, the genus would be palynologically

heterogeneous, with two distinctly dissimilar pollen types.

The choice between the two possibilities must be rather subjective. I have chosen the second alternative, i.e. the inclusion of *Procopiana* in *Symphytum*, as a generic division based on palynologic characteristics seems rather impracticable. This treatment will lead to the following new combinations:

Symphytum creticum (WILLD.) RUN. comb.nov. — Basionym: *Borago cretica* WILLDENOW 1797.

Symphytum euboicum (RUN.) RUN. comb.nov. — Basionym: *Procopiana euboica* RUNEMARK in RECHINGER 1961.

SYMPHYTUM (PROCOPIANA) CRETICUM AND CIRCINALE

GUŞULEAC (1928) in his treatment of *Procopiana cretica* stated that the flowers are either white or bluish violet. HALACSY (1902) and HAYEK (1928) reported white flowers only. During investigations in the Aegean I have found bluish violet as well as white flowers. In herbarium material the flowers turn brownish making it difficult to trace the original colour.

The material can be divided into two vicarious taxa. In the east-Aegean islands (Samos and Ikaria to Rhodos) the flowers are constantly white and have the corolla lobes coiled backwards into a spiral (Fig. 2 C, D). Specimens from the Cyclades, Karpathos, Crete, Peloponnisos, and Zacynthos have bluish violet flowers and corolla lobes, which are only slightly recurved (Fig. 2 A, B). I have seen a single white-flowering population from this area (Crete, Sphakia), which, however, in all other respects coincides with normal, blue-flowering material.

Plants with different corolla types have been cultivated, which has made possible a comparative study of the delicate flowers (they are badly damaged in herbarium material). Several crossings have been made between east-Aegean and Cycladian material. These crossings were easily performed as the material was self-sterile. The crossings resultated only in 3 seeds, which, however, did not germinate.

One specimen has been collected on Ikaria, which in morphologic characteristics was suspected to be a hybrid with *Symphytum anatolicum*. The percentage of morphologically well developed pollen was c. 60. However, experimental crossings with *Symphytum anatolicum* have been unsuccessful.

As the two taxa are morphologically well characterized and do not seem to be interfertile, they have been treated as different species [*Symphytum creticum* (WILLD.) RUN. and *Symphytum circinale* sp.nov.].

Characteristics Common to the Two Species

Perennial, \pm hairy herbs, with a relatively short and thick, often branched rhizome, ending in \pm dense leaf-rosettes. Leaves ovate to elliptic, basal ones \pm gradually attenuated into the petiole, uppermost ones sessile. Flowers white or bluish violet, ebracteate, in \pm dense cincinnes. Calyx infundibuliform, 5-partite, calyx lobes at least as long as the tube. Corolla tube broadest near the base and gradually contracted towards the apex, corolla lobes longer than the tube, linear, revolute, and \pm keeled. Alternating with the stamens one row of linear, flattened fornicies having the margins densely covered by one-celled teeth. Stamens glabrous, extending long outside the corolla tube. Anthers greyish yellow, oblong, introrse, forming a narrow tube, through which the style extends. Pollen grains ellipsoid, c. $24 \times 20 \mu$, with 9—10 colpi. Style slightly longer than the stamens, reddish. Stigma small, capitate, papillose. Mericarps 3—4 mm, brownish black, obovate, erect, surface reticulate. — Self-sterile. — Basic chromosome number $x=14$.

Key to the Species

1. Corolla bluish violet (rarely white), lobes in the basal half usually with the lateral parts folded together, uppermost part slightly recurved. Fornices at the base narrower than the filaments. Each filament with 2 minute, lateral, hairy projections at the base. Hairs of leaves, stems and calyces straight or hooked. *S. creticum*
2. Corolla white, the upper half of the linear lobes coiled backwards into a spiral. Fornices at the base broader than the filaments. Each filament with a minute, basal cuff with minute marginal hairs. Hairs of leaves, stems and calyces straight. *S. circinale*

Symphytum creticum (WILLD.) RUN. comb.nov.

Borago cretica WILLDENOW 1797 — *Trachystemon creticum* G. DON 1838 — *Psilostemon creticum* DE CANDOLLE 1846 — *Procopiana cretica* GUŞULEAC 1928.

ORIG. COLL. Greece. Crete 1700 TOURNEFORT (P, not seen).

A green perennial, 10—40 cm high, with \pm branched stem. The whole plant, including peduncles and calyces covered with often hooked hairs (rarely almost glabrous). Basal leaves elliptic, 2—8 cm long, with 1—5 cm long petioles. Uppermost leaves smaller, elliptic to broadly lanceolate. Calyx during flowering 6—8 mm, calyx lobes acuminate. Corolla bluish violet or rarely white, tube c. 3 mm long, the slightly recurved

lobes c. 10 mm long, directed at $45\text{--}75^\circ$ angle to the stamens. Fornices c. 5 mm long, at the base narrower than the filaments, usually straight. Stamens 9—10 mm long, filaments basally with 2 minute, hairy lateral projections. Anthers 1.5—2 mm. — Chromosome number $2n=28$.

VARIABILITY. There is little variation in floral characteristics in the material studied. The density of pubescence as well as the type of hairs vary considerably. Material from Peloponnisos is less hairy than material from the Aegean. Specimens having a low unbranched stem, and many large, basal leaves have been observed from Karpathos. Such deviating specimens have incorrectly been referred to *Trachystemon orientale* by BARBEY in STEFANI et al. (1895).

ECOLOGY. In shady rock crevices, mainly in steep limestone cliffs near the sea.

DISTRIBUTION. The Cyclades, Karpathos, Crete, Kythera, Peloponnisos, Zacinthos.

***Symphytum circinale* RUN. sp.nov.**

ORIG. COLL. Greece. Ikaria, westernmost part, Ag. Nikolaos, along a small stream, c. 25 m s.m. 20.4 1958 RUNEMARK and SNOGERUP (6092). Holotype in Herb. Bot. Lund.

DIAGNOSIS. *Symphyto cretico* simile, sed corolla laciniis circinalibus, et stamina quam fornices angustiora. — Holotypus: Graeca. Ikaria, Ag. Nikolaos, 20.4 1958 RUNEMARK et SNOGERUP 6092 (Herb. Bot. Mus. Lund).

A dark green perennial, 25—40 cm high, with branched stem. The whole plant, including the peduncles and calyces, covered with strictly erect, 1—3 mm long hairs. Basal leaves ovate, 4—10 cm long, with 3—6 cm long petioles. Upper leaves small \pm sessile, ovate to elliptic. Calyx during flowering 6—8 mm, calyx lobes lanceolate to narrowly elliptic. Corolla white, tube 4—5 mm, corolla lobes c. 6 mm, directed at 45° angle to the stamens, upper half coiled backwards into a spiral. Fornices c. 7 mm long, slightly recurved towards the apex, at the base broader than the filaments. Stamens 11—13 mm long, filaments basally with a minute hair cuff. Anthers 1.5—2 mm. — Chromosome number $2n=28$.

VARIABILITY. *Symphytum circinale* is a “rigid” species showing little variation.

ECOLOGY. In shady rock crevices and along small streams.

DISTRIBUTION. The east-Aegean islands along the Anatolian west-coast: Samos, Ikaria, Kalimnos, Chalki, Rhodos.

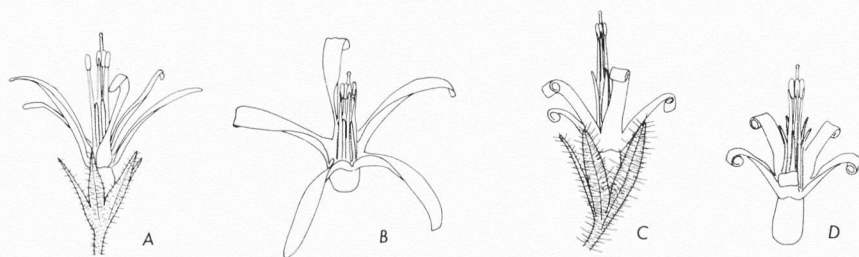
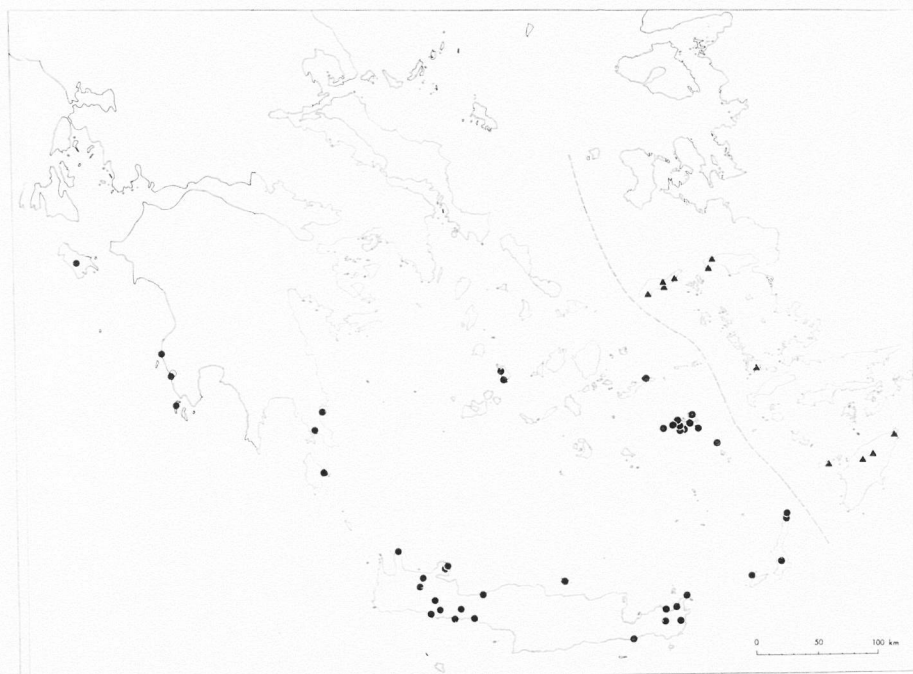


Fig. 2. The distribution of *Symphytum creticum* (black dots) and *Symphytum circinale* (triangles). — The broken line indicates the plants geographic border between the Anatolian and Greek flora. — Flowers and calyces. A—B: *Symphytum creticum*, C—D: *Symphytum circinale*.

Distribution Areas

Phytogeographically and ecologically *Symphytum creticum* belongs to the interesting south-Aegean relic element inhabiting calcareous cliffs mainly close to the sea. For maps of species belonging to this element cf. RUNEMARK et. al. (1960, maps 6, 7, 10, 11). *Symphytum creticum* extends further to the west than most of these species. Its distribution

area, however, coincides almost exactly with that of *Dianthus arboreus* (cf. DAVIS 1953, Fig. 2).

Phytogeographically *Symphytum circinale* belongs to the small east-Aegean endemic element (cf. RECHINGER 1950). Most of the endemics in this area are quite local, but a few species occupy larger areas in the Aegean. Thus *Centaurea exscapa* URV. has a distribution similar to that of *Symphytum circinale*.

Most of the east-Aegean islands were connected with the mainland at the beginning of the Quaternary. Even during Quaternary glacial periods such connections have existed, due to regressions of the sea (cf. PFANNENSTIEL 1951, 1954). This has resulted in a flora very similar to that of West-Anatolia. It is therefore probable that *Symphytum circinale* will be found also on the Anatolian mainland, when the coastal areas have been more extensively explored.

The distribution areas of the two species of *Symphytum* are an excellent illustration of the border line between the European and Turkish flora in the Aegean stressed by RECHINGER (1950).

APPENDIX

List of Localities

Only localities found by me and my collaborators (1958—1966) are given, as previous records have been summarized in HALACSY (1902) and RECHINGER (1943 a, 1943 b). However, the record of *Procopiana cretica* from Euboea in HALACSY and RECHINGER has to be transferred to *Symphytum euboicum*.

The names of the localities have been taken from the detailed sea charts of the British Admiralty (cf. also the maps in RUNEMARK et al. 1960). The following abbreviations have been used for the names of the collectors: B, ROLAND VON BOTHMER; N, BERTIL NORDENSTAM; P, JIMMY PERSSON; R, HANS RUNEMARK; S, SVEN SNOGERUP.

Symphytum circinale

Ikaria: 1.5 km E of Mesaria, 250 m (R & S 6840), Ag. Nikolaos, 50 m (R & S 6092), the W-part of Peranora Vouno, 600—700 m (R & N 16398).

Symphytum creticum

Cyclades. Sifnos: Ormos Kondos, 0—20 m (R & S 8380), E of C. Khondropo, 5—50 m (R & S 8584 a), S of Ormos Kamares, 300—350 m (R & S 8839). — Amorgos, 1 km NNE of the peak of mt. Krikelas, 350—500 m (S 20265). — Astipalea: Panormos (R & P 22760), E of Panormos (R & N 15054), E of S. Giovani, 200 m (R & N 14057), mt. Cutella, 300—400 m (R & N 15290), between Baia di Zofiri and Punta Tripiti (R & N 15195, 15218), the island of Glinonisi (R & P 22709), the island of Pontikoutha (R & N 13912), the island of Ofidousa (R & N 13698), the island of Kounoupia (R & P 22631). — Sirina, Dio Adelfi, the W-island (R & P 22321).

Karpathos area. Saria: E of Armiro Ormos, 50—270 m (R & S 7624), W of Palatia (R & N 16698). — Kasos, Plato Nisia, the W-island (B 23199).

Crete. Sitia: Zakro (R & S 17889), the valley of Maronia, 300—350 m (R & S 18129). — Sfakia. N of the village of Sfakia, 400 m (R & S 17014).

Kythera. Ravine W of Diakostis, 50 m (R & S 20828), 2 km SE of Diakostis, 300 m (R & S 20848).

Peloponnisos. Lakonia: Neapolis, narrow valley NNW of Kampos (R & S 20787), Monemvassia, cliffs around the castle, 20—50 m (R & S 20750).

Cytologically Investigated Material

Symphytum circinale. Ikaria, Ag. Nikolaos (R-1908).

Symphytum creticum. Sifnos: Ormos Kondos (R-1911), E of C. Khondropo (R-1910). — Astipalea: between Baia di Zofiri and Punta Tripiti (R-3837), the island of Ofidousa (R-3852).

Symphytum anatolicum. Sikinos, W of Kara (R-3728, 3849).

ACKNOWLEDGEMENTS

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Taeckholmia, a New Genus of Compositae from Canary Islands

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ABSTRACT

The new genus *Taeckholmia* BOULOS, related to *Sonchus*, is described. It consists of seven species divided upon two subgenera, *Taeckholmia* and *Pseudodendrosonchus* BOULOS. The genus is endemic to the Canary Islands. Several of the species have previously been included in *Sonchus*, from which *Taeckholmia* differs in the frutescent habit, the not auricled leaves crowded at the ends of the vegetative branches, the small capitula with few flowers, the few involucre scales of the capitula, the small achenes, and the different pollen grains. — New species and combinations: *Taeckholmia pinnata* (L. f.) BOULOS, *T. capillaris* (SVENT.) BOULOS, *T. canariensis* BOULOS, *T. microcarpa* BOULOS, *T. heterophylla* BOULOS, *T. regis-jubae* (PITARD) BOULOS, and *T. arborea* (DC.) BOULOS.

Two new genera, distinguished from the genus *Sonchus* L., were described: *Embergeria* from Chatham Islands (New Zealand) and Australia (BOULOS 1965 a), and *Babcockia* from Canary Islands (BOULOS 1965 b). The present paper reports on a third new genus related to *Sonchus* from Canary Islands as well as on the relationships between these new genera and the genus *Sonchus*.

DAVID DON (1829) described the genus *Atalanthus* with two species segregated from *Prenanthes* L., viz. *Prenanthes pinnata* L.f. and *P. spinosa* VAHL. In his generic description, DON gave a number of characters which partly fit *Prenanthes pinnata* and partly fit *P. spinosa*. Later on, the authors considered the latter as a *Launaea* species (e.g. MURBECK 1923 and AMIN 1957) and the former as a *Sonchus* species (e.g. SCHULTZ BIPONTINUS 1849—1850, PITARD & PROUST 1908, and BOULOS 1960). POMEL (1874) included 7 other species within the genus *Atalanthus*, which again should be classified under the genus *Launaea* CASS. This confirms the writer's idea that the major characters given to *Atalanthus* in DON's diagnosis refer to *Launaea* rather than to

Sonchus. However, some authors erroneously consider *Atalanthus* as a synonym of *Sonchus*, e.g. HOOKER & JACKSON (1895); others classify *Atalanthus* as subgenus or section of *Sonchus*, e.g. DE CANDOLLE (1838). AMIN (1957) in her classification of the genus *Launaea*, correctly lists the genus *Atalanthus* D. DON among the synonyms of subgenus *Acanthosonchus* (SCH. BIP.) O. HOFFM. of *Launaea*. *Atalanthus* should consequently be treated as a synonym of *Launaea*, with *Atalanthus spinosus* as its type species. The genus *Atalanthus* was also typified by *A. spinosus* (FORSK.) POMEL (KIRPICZNIKOV 1964).

The revisional study of the genus *Sonchus* (BOULOS 1963) shows that *Sonchus leptcephalus* CASS. [= *Prenanthes pinnata* L.f., *Atalanthus pinnatus* (L.f.) D. DON] and some allied species, which form together a group of endemic plants in the Canary Islands, are different in many respects from the rest of *Sonchus* species. The main differences between these plants that characterize them from *Sonchus* are as follows:

1. The frutescent habit of the plants, with solid often stick-like branches.
2. Leaves not auricled, \pm in dense groups at the summits of vegetative branches or at the base of flowering shoots, deeply dissected into narrow lobes.
3. Small size of the capitulum which is usually 3—7 mm long and 2—3 mm broad (in one species 10—12 mm long and 3—4 mm broad).
4. The low number of flowers per capitulum (12—29). In *Sonchus* the lowest number is about 40, while in most of its species the number ranges from about 100 to 400.
5. The low number (10—20) of involucre scales per capitulum (in one species 27—30). The ratio between the number of flowers and the number of involucre scales is about 1:1; this ratio is much higher (2—8:1) in *Sonchus*.
6. The small size of achenes (1.7—2.5 mm long, and about 0.6 mm broad) which are attenuated towards both ends and are of variable shape within the same capitulum. The achenes are provided at their upper end with a protuberance surrounded by a white disc.
7. The morphology of the pollen grains shows a characteristic type with basic differences from all *Sonchus* species (PONS & BOULOS, in press).

This group of plants, typified by *Sonchus leptcephalus* CASS., should therefore have a new generic name since *Atalanthus* could not be used any more as a legitimate generic epithet.

It is proposed to name this new genus *Taeckholmia* in honour of Dr. VIVI TÄCKHOLM, Professor of Systematic Botany, Faculty of Science, Cairo University, who inspired and encouraged the writer to study this group of plants.

Taeckholmia BOULOS gen. nov.

Frutex erectus ad 2 m altus, praesertim ad basim ramosus. *Folia* ad apicem rami sterili vel basim rami floriferi dense fasciculata, glabra vel ad basim juvenalia raro puberula, non auriculata, in lobis angustissimis profunde dissecta. *Capitula* parva, numerosa, pauciflora; corolla flava, ligula tubo longiora. *Bractae* involucri non vel vix imbricatae. *Achenium* parvum, rugosum, compressum, utrinque plus minusve 4-costatum, apice et basin versus attenuatior; forma achenia in eadem capitulum variabilis. *Pappus* deciduus, disco albo cum protuberatio centrali insidens; setae scabrosae formae diversae. *Pollinis* granulae typi speciali characteristici. $n=9$, $2n=18$.

Frutescent erect plants, 50—200 cm high, branching mainly at the base, branches solid, often stick-like; *leaves* \pm densely grouped at the summits of vegetative branches or at the base of flowering shoots, glabrous or rarely pubescent at the base of the juvenile ones, not auricled, 2—20 cm long, deeply dissected into narrow lobes 0.2—2 mm broad (rarely up to 6 mm broad); *peduncle* 3—30 mm long, \pm 1 mm diameter, cylindrical, hollow, with \pm 4 bracts; *heads* numerous, 3—7 mm long, rarely longer, 2—4 mm in diameter before anthesis, longer and broader during anthesis; *flowers* 12—29, yellow, ligule longer than corolla tube; *involucral scales* 10—30, not or slightly imbricated, the outer scales 1—4 mm long (rarely longer), \pm triangular, with thick base, the inner ones 5—9 mm long, narrowly rectangular, thin, with 4 intermediate ones in the species with imbricated scales; *achene* 1.7—2.5 mm long, \pm 0.6 mm broad, attenuated towards both ends, rugose, compressed, with \pm 4 ribs on each side, of variable shape within the same capitulum, thus narrowly oblanceolate, \pm narrowly elliptic, \pm narrowly rectangular, erect or curved; *pappus* deciduous, 3.5—6 mm long, inserted on a white disc with a central protuberance, composed of different types of scabrous hairs; pollen grains of a special characteristic type; $n=9$, $2n=18$.

TYPE SPECIES: *Taeckholmia pinnata* (L.f.) BOULOS comb. nov.

BASIONYM: *Prenanthes pinnata* L.f. Suppl. Plant. 1781: 347.

Two subgenera are recognized:

I. Subgenus **Taeckholmia**

Frutescens. *Folia* in lobis 0.2—1 mm latis dissecta. *Capitulum* 3—7 mm longum, 1.2—3 mm latum. *Flores* flavi, 12—19 in capitulo. *Ligula* corollae tubo duplo vel plus longiora. *Bractae involucri* 10—15, interiorae et exteriorae dissimiles. *Achenium* 1.7—2.5 mm longum. *Pappus* 2.5—2.75 mm longus, deciduus.

TYPE SPECIES: *Taeckholmia pinnata* (L.f.) BOULOS.

Frutescent: leaves dissected into lobes 0.2—1 mm broad; *capitulum* 3—7 mm long, 1.2—3 mm broad; *flowers* yellow, 12—19 per head; *ligule* double or more the length of corolla tube; *involucral scales* 10—15, distinguished into outer and inner scales; *achenes* 1.7—2.5 mm long; *pappus* 2.5—2.75 mm long, deciduous.

II. Subgenus **Pseudodendrosonchus** BOULOS subgen. nov.

Frutescens. *Folia* in lobis 1—6 mm latis dissecta. *Capitulum* 6—12 mm longum, 3—4 mm latum. *Flores* flavi, 15—29 in capitulo. *Ligula* corollae tubo (sed minus duplo) longiora. *Bractae involucri* 19—30, interiorae, intermediae et exteriorae dissimiles. *Achenium* plus minusve 2.5 mm longum. *Pappus* 4—6 mm longus, deciduus.

TYPE SPECIES: *Taeckholmia heterophylla* BOULOS sp. nov.

Frutescent, *leaves* dissected into lobes 1—6 mm broad; *capitulum* 6—12 mm long, 3—4 mm broad; *flowers* yellow, 15—29 per head; *ligule* longer than (but less than double) the corolla tube; *involucral scales* 19—30, distinguished into outer, intermediate and inner scales; *achene* \pm 2.5 mm long; *pappus* 4—6 mm long, deciduous.

KEY TO THE SUBGENERA

- 1 A. Leaf lobes 0.2—1 mm broad, ligule double or more the length of corolla tube *Taeckholmia*
- 1 B. Leaf lobes 1—6 mm broad, ligule less than double the length of corolla tube *Pseudodendrosonchus*

KEY TO THE SPECIES

Subgenus *Taeckholmia*

- 1 A. Leaf lobes flat, 0.5—1 mm broad, head over 4 mm long
 - 2 A. Flower 7.5—9 mm long, pappus 3.5—5.75 mm long .. *T. pinnata* 1.
 - 2 B. Flower 7 mm long, pappus 2.5—3 mm long *T. canariensis* 3.



Fig. 1. *Taeckholmia pinnata* (L. f.) BOULOS. — Aspect of the plant in nature: Monte Coello, Gran Canaria, Canary Islands. Photo L. BOULOS, May 1961.

- 1 B. Leaf lobes \pm capillary, less than 0.5 mm broad, head 3—4 mm long
- 3 A. Peduncle up to 3 mm long, achene 2—2.2 mm long *T. capillaris* 2.
- 3 B. Peduncle up to 1.5 cm long, achene 1.7—1.8 mm *T. microcarpa* 4.

Subgenus *Pseudodendrosonchus*

- 1 A. Number of flowers inferior to 20 per head, leaves of diverse forms on the same plant *T. heterophylla* 5.
- 1 B. Number of flowers superior to 20, leaves more or less of the same form
- 2 A. Leaf lobes broadly spaced, 1.5—2 mm broad *T. regis-jubae* 6.
- 2 B. Leaf lobes narrowly spaced, up to 4 mm broad *T. arborea* 7.

1. *Taeckholmia pinnata* (L.f.) BOULOS

Prenanthes pinnata L.f. Suppl. Plant. 347, 1781; non *Sonchus pinnatus* AIT. Hort. Kew. (ed. 1) 3: 116, 1789.

Chondrilla pinnata LAM. Dict. 2: 79, 1786.

Sonchus leptcephalus CASS. in Dict. Sc. Nat. 43: 281, 1826.

Atalanthus pinnatus D. DON, Edinb. New Phil. J. 6: 311, 1829.

DISTRIBUTION: Gran Canaria and Tenerife, Canary Islands.

CHROMOSOME NUMBER: $n=9$, $2n=18$ (ROUX et BOULOS).

2. ***Taeckholmia capillaris*** (SVENT.) BOULOS comb. nov.

Sonchus capillaris SVENT. Addit. Fl. Canar. 1: 85, t. 35, 1960.

DISTRIBUTION: Tenerife, Canary Islands.

3. ***Taeckholmia canariensis*** BOULOS sp. nov.

Sonchus filifolius SVENT. Addit. Fl. Canar. 1: 83, t. 34, 1960; nom. illegit., art. 37, Code Montreal 1961.

Frutescens, robustus, 0.5—1 m altus, praesertim ad basim ramosus. *Rami* veterum lignosi solidi, cortice nigris. *Folia* dense fasciculata, praeter ad basim glabra, 10—15 cm longa, in lobis angustis, 6—12-jugis, plus minusve oppositis dissecta; folia ad basim inflorescentiae minori. *Pedunculus* 4—20 mm longus, 2—4-bracteatus. *Flores* 12—16 in capitulo, flavi. *Bractae involucri* 10—13. *Achenium* 2—2.5 mm longum, forma diversa. *Pappus* 2.5—3 mm longus, deciduus, setae scabrosae, formae diversae.

Frutescent robust 0.5—1 m high, branched especially at the base, old branches solid, dense, with dark coarse bark, young branches thin, cylindrical. *Leaves* glabrous except at the base, forming dense tufts at the top of old branches or at the base of young shoots, 10—15 cm long, dissected into 6—12 pairs of linear, \pm opposite, 2—3 cm long, 0.5—1 mm broad lobes; leaf base triangular, not auricled, slightly white-tomentose; leaves smaller towards the inflorescence and at the base of young shoots. *Peduncle* 2—20 mm long, with 2—4 bracts. *Head* 4—5 mm long, 2—2.5 mm broad before anthesis, 5—7 mm long and \pm 8 mm broad during anthesis; number of flowers 12—16. *Involucre* of 10—13 scales, 3—5 triangular outer ones, 1—2.5 mm long, and 7—8 linear inner ones, 5—6 mm long, with membranous margins and obtuse ciliated apex. *Corolla* yellow, 7 mm long; ligule 4.5—5 mm long, 1—1.5 mm broad, with $5 \pm$ acute teeth; corolla tube 2—2.5 mm long, hairy and broadest at its junction with the ligule; staminal tube 2.5—2.8 mm long; style branches \pm 1.5 mm long, brownish, densely hairy. *Achene* 2—2.5 mm long, 0.5 mm broad, of variable shape: linear-elliptic, straight or curved, with the broadest part at the middle or towards either end, compressed, wrinkled, with 3—5 irregular longitudinal ribs,



Fig. 2. *Taeckholmia capillaris* (SVENT.) BOULOS. — Barranco de Tejina, Tenerife, 18.10.1957, leg. E. SVENTENIUS (Typus, CAI!).

upper end provided with a small white protuberance situated over a white disc on which the pappus is inserted. *Pappus* deciduous, 2.5—3 mm long, formed of different types of scabrous hairs; major type long, with multicellular base, provided with lateral curved spines, attenuate into a uni-, bi-, or tri-cellular apex; minor type shorter, thinner, with well developed lateral spines and an apex of anchor-like recurved cells; intermediate types of hairs also occur notably by their size and length.

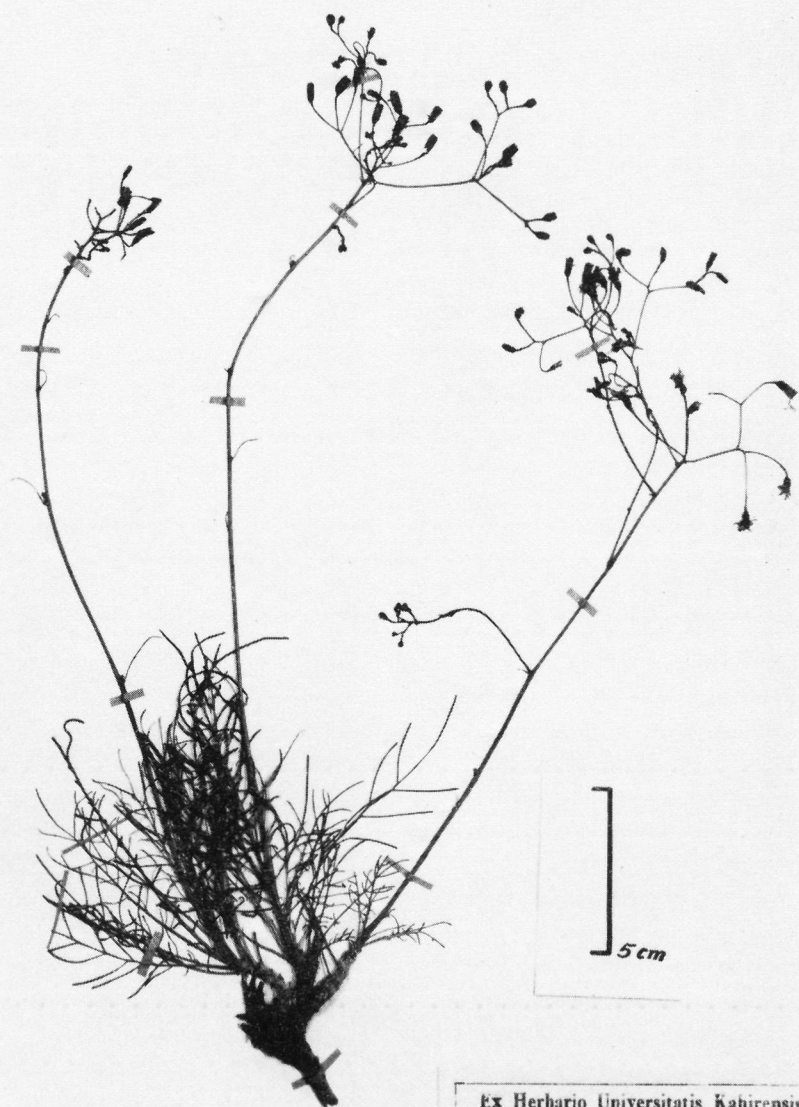
HOLOTYPE: Valle Gran Rey, Gomera, Canary Islands, 25.7.1962, BOULOS (CAI!).

DISTRIBUTION: Gomera, Canary Islands.

4. *Taeckholmia microcarpa* BOULOS sp. nov.

Frutescens, robustus, 0.5—1 m altus, praesertim ad basim ramosus. *Rami* veterum lignosi solidi. *Folia* dense fasciculata, glabrata, 8—20 cm longa, in lobis angustis, 3—6-jugis, distantibus dissecta; folia ad basim inflorescentiae minori. *Pedunculus* 3—15 mm longus, 2—4-bracteatus. *Capitula* parvi numerosi in inflorescentiam copiose ramosum corymbosam disposita. *Flores* 12—14 in capitulo. *Bractae* involucri 12—13. *Achenium* 1.7—1.8 mm longum. *Pappus* 3.5—3.75 mm longus, deciduus, setae scabrosae formae diversae. $2n=18$.

Frutescent robust, 0.5—1 m high, mainly branched at the base, old branches solid. *Leaves* glabrous, forming dense tufts at the upper part of the plant, thus mainly towards the top of old branches and at the base of flowering shoots, 8—20 cm long, dissected into 3—6 pairs of lobes; lobes linear, widely spaced, irregularly arranged, 2—8 cm long, 0.2—0.4 mm broad, terminal lobe longer; leaf base triangular, not auricled; leaves smaller towards the inflorescence. *Peduncle* 3—15 mm long, ± 0.3 mm broad, hollow, with 2—4 bracts. *Heads* numerous, in a richly branched corymbose inflorescence, before anthesis ± 4 mm long, ± 1.2 mm broad, during anthesis up to 6 mm long; number of flowers 12—14. *Involucre* of 12—13 scales, outer ones 4—5, triangular, 1—1.5 mm long, inner ones 8—9, linear-lanceolate, 5—6 mm long. *Corolla* yellow, 7 mm long; ligule 5 mm long, 1.5 mm broad, with 5 acute hairy teeth; corolla tube 2 mm long, hairy and broadest at its junction with the ligule; staminal tube 3 mm long; style branches 1.2 mm long, densely hairy. *Achene* brownish, 1.7—1.8 mm long, 0.5 mm broad, attenuated towards both ends and of variable shape in the same capitulum, slightly compressed, with 3—5 longitudinal ribs. *Pappus* 3.5—3.75 mm long, deciduous, formed of different types of scabrous hairs comparable to those of *T. canariensis*. $2n=18$.



Ex Herbario Universitatis Kahirensis	
FLORA CANARIENSIS	
Tacckholmia canariensis Boulos	
	HOLOTYPE
Valle Gran Rey, Ile de Gomera	
25.7.1962	
Leg. et det. L. BOULOS	
Cult. Univ. Press, 1981-1987, 0.000 ex.	

Fig. 3. *Tacckholmia canariensis* BOULOS. — Valle Gran Rey, Gomera, Canary Islands, 25.7.1962, leg. L. BOULOS (Typus, CAI!).

HOLOTYPE: Güimar, Tenerife, Canary Islands, 8.6.1961, BOULOS (CAI!).

DISTRIBUTION: Tenerife, Canary Islands.

CHROMOSOME NUMBER: $2n=18$ (ROUX & BOULOS).

5. *Taeckholmia heteropylla* BOULOS sp. nov.

Frutescens, 30—80 cm altus, rami veterum basium crassi. *Folia* multiforma, glabrata, 8—20 cm longa, in lobis linearis vel anguste-oblongis, integris, subalternantibus, plus minusve 7-jugae dissecta. Lobi 1—4 cm longi, 1—6 mm lati. Apex loborum latum obtusus, loborum angustum acutus. *Pedunculus* 1—2 cm longus, plus minusve 5-bracteatus. *Flores* flavi plus minusve 15 in capitulo. *Bractae involucri* plus minusve 20, imbricatae. *Achenium* brunneolum, plus minusve 2.4 mm longum, formae variabilis. *Pappus* plus minusve 4 mm longus, deciduus, setae scabrosae formae diversae. $2n=18$.

Frutescent erect, 50—80 cm high, old basal branches solid, voluminous, young branches hollow, thin. *Leaves* glabrous, multiform, in groups at the summit of vegetative branches or at the base of inflorescence, 8—20 cm long, dissected into ± 7 pairs of lobes, these entire, subalternate, linear or narrow-oblong, 1—4 cm long, 1—6 mm broad, the broad lobes with obtuse, the narrow ones with acute apex. *Peduncle* 1—2 cm long, 0.5—1 mm in diameter, hollow, with ± 5 bracts. *Head* ± 6 mm long, ± 3 mm broad when closed, number of flowers ± 15 . *Involucre* of ± 20 imbricated scales, distinguished into: 7—8 outer triangular ones, 2—5 mm long, ± 1 mm broad, with thick base and obtuse ciliated apex; 6—7 intermediate linear ones, 8—9 mm long, ± 1 mm broad, with scarious margins and obtuse ciliated apex; 6—7 inner ones, ± 8 mm long, ± 0.8 mm broad, thin scarious with obtuse ciliated apex. *Corolla* yellow, ± 8 mm long; ligule ± 5 mm long, 1.2 mm broad, with 5 obtuse teeth; corolla tube ± 3 mm long, hairy at its junction with the ligule; staminal tube 3 mm long; style branches ± 1 mm long, densely hairy. *Achene* brownish, ± 2.4 mm long, ± 0.75 mm broad, of variable shape in the same head, wrinkled, compressed, with ± 2 principal ribs on each side. *Pappus* deciduous, ± 4 mm long, formed of different scabrous hairs comparable to those of *T. canariensis*. $2n=18$.

HOLOTYPE: Agulo, Gomera, Canary Islands, 23.7.1962, BOULOS (CAI!).

DISTRIBUTION: Gomera, Canary Islands.

CHROMOSOME NUMBER: $2n=18$ (ROUX & BOULOS).

6. *Taeckholmia regis-jubae* (PITARD) BOULOS comb. nov.

Sonchus regis-jubae PITARD, in PITARD & PROUST, Iles Canar. Fl. Archipel 262, 1908.

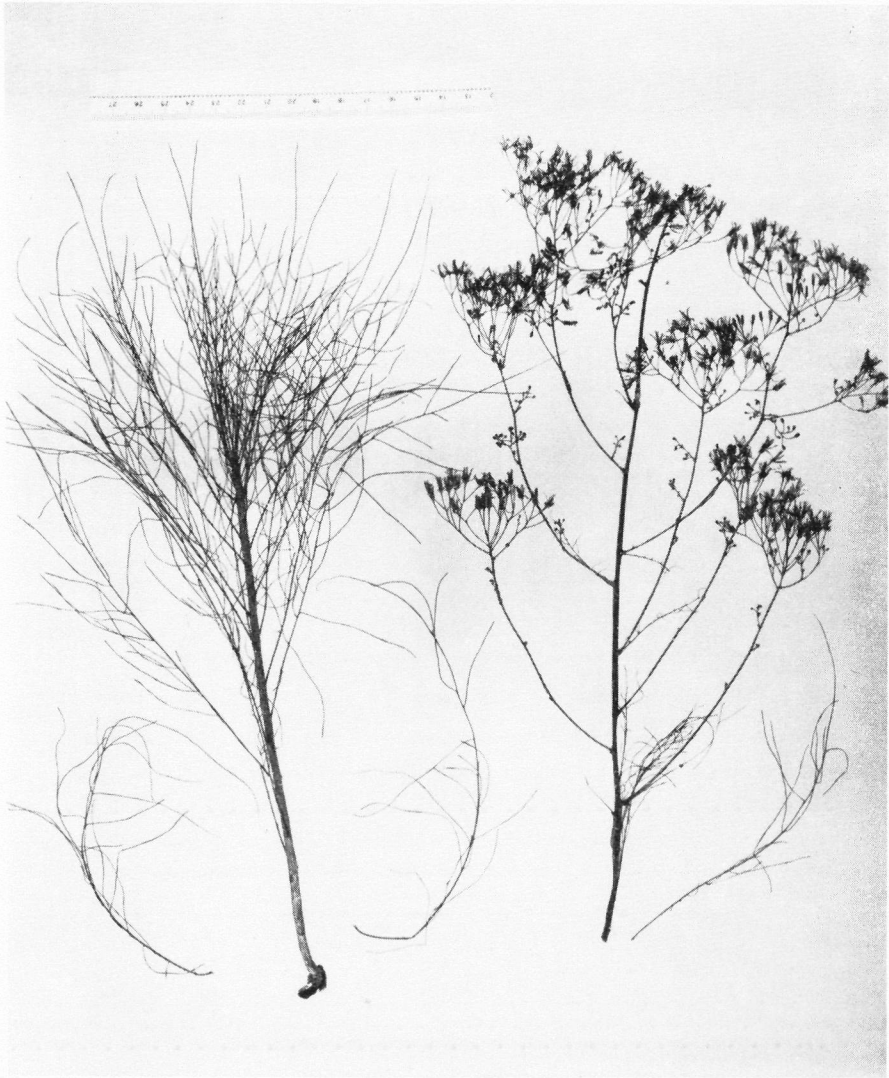


Fig. 4. *Taeckholmia microcarpa* BOULOS. — Güimar, Tenerife, Canary Islands, 8.6. 1961, leg. L. BOULOS (Typus, CAI!).

LECTOTYPE: PITARD, Canaries, Gomera: Roque de Valle Hormoso, 600 m (P!).

DISTRIBUTION: Gomera and La Palma, Canary Islands.

The plant was known only from the collection of the type. The writer collected it from the above locality in Gomera as well as from Las Nives, La Palma, Canary Islands.

7. ***Taeckholmia arborea*** (DC.) BOULOS comb. nov.

Sonchus arboreus DC. Prodr. 7: 189, 1838.

Prenanthes arborea BROUSSONET, Elench. plant. horti bot. Monsp. 47, 1805 (nom. nud.).

LECTOTYPE: *Prenanthes arborea* BROUSS., Tenerife, 1801 (G—DC!).

DISTRIBUTION: Tenerife, Canary Islands.

RELATIONSHIPS BETWEEN TAECKHOLMIA AND ALLIED GENERA

The following diagram may report on the supposed evolutionary relationships between *Launaea*, *Sonchus* (with its three subgenera: *Origosonchus* Boulos, *Dendrosonchus* Webb ex Sch. Bip. and *Sonchus*) and the segregated genera *Embergeria*, *Babcockia* and *Taeckholmia*.

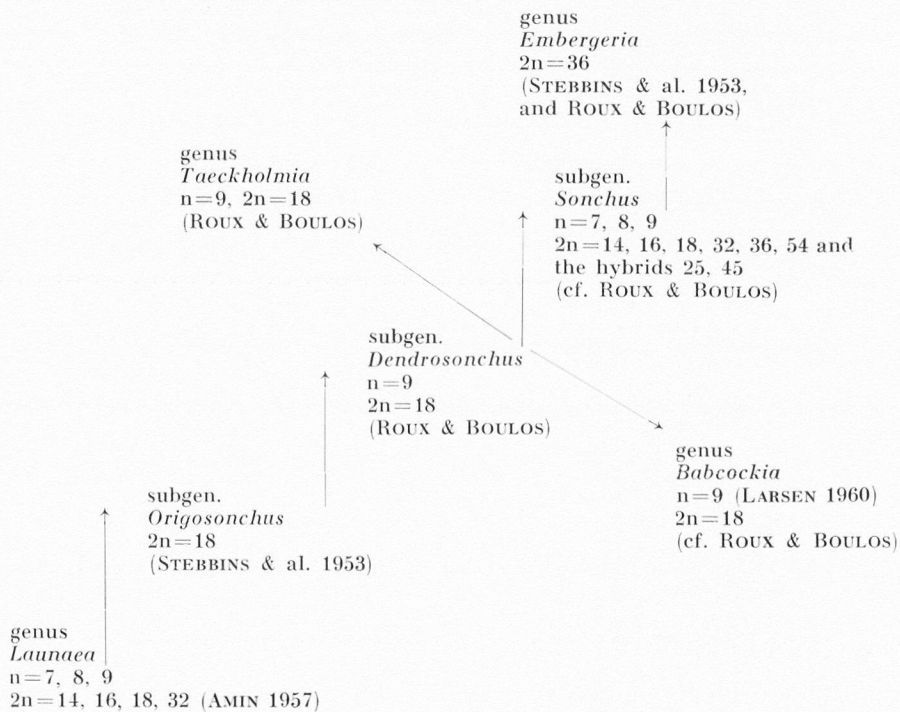




Fig. 5. *Taeckholmia heterophylla* BOULOS. — Agulo, Gomera, Canary Islands, 23.7. 1962, leg. L. BOULOS (Typus, CAI!).

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Embryological Studies in the *Sanguisorba minor* Complex (Rosaceae)

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ABSTRACT

In the *Sanguisorba minor* complex several cells of the archesporium usually develop into megaspore mother cells. Only one of these after meiosis gives rise to a fully developed embryo sac. However, also the others may undergo meiosis and reach to 1-nucleate or rarely 2—4-nucleate embryo sacs before degenerating. The divisions up to an organized embryo sac follow the normal type.

The embryo development agrees with the typical *Rosaceae* pattern. The endosperm formation is of the nuclear type.

Parallel to the sexual development there is a tendency of apospory. Only in hybrids has apospory been proved to give rise to embryos, however: in tetraploids, involving pseudogamy, and in hexaploids, where it is sometimes combined with sexual reproduction resulting in octoploids.

INTRODUCTION

This paper forms part of my experimental studies on the genus *Sanguisorba* section *Poterium*. The aim of the embryological investigation in the first place was to analyse whether or not apomixis, here used in the sense of agamospermy (TÄCKHOLM 1922), occurs in the *S. minor* complex. The complex constitutes the main part of the section *Poterium* and includes the following polymorphic taxa: *Sanguisorba minor* SCOP., with ssp. *minor*, ssp. *lasiocarpa* (BOISS. et HAUSKN. in BOISS.) NORDB., ssp. *magnoli* (SPACH) NORDB., ssp. *muricata* (SPACH) NORDB., and ssp. *rupicola* (BOISS. et REUT.) NORDB., *S. cretica* HAYEK, and *S. lateriflora* (COSS.) A. BR. et BOUCHÉ.

Apomixis could be suspected owing to the uniformity found within most local populations and the differences between separated populations. Furthermore, the progeny of certain crossings between ssp. *minor*

and ssp. *muricata* and also between the latter one and ssp. *magnolii* indicated that apomixis probably occurred in them.

The material studied embryologically originates mainly from *S. minor*. No differences were observed between the subspecies, and the species has been treated as one unit in the following discussion.

Buds at different stages were fixed in the Mützing modification of Navashin-Karpechenko fluid (MÜNTZING 1933) after pre-fixation for 15 minutes in glacial acetic acid and absolute alcohol (1:3). The material was sectioned at 14 μ and stained in Haidenhain's hematoxylin. It was practically impossible to get proper longitudinal sections through the ovary region when cutting the whole inflorescence. Single flowers had to be cut longitudinally, but there was a great risk of damaging the ovary region of young buds when they were detached from the inflorescence axis. The risk was reduced by not removing the flowers from the head until they had been transferred into paraffin.

ANATOMY AND MORPHOLOGY OF THE GYNOECEUM

The anatomy and morphology of the gynoeceum have previously been treated by PAYER (1857), JUEL (1918), and SCHAEPPi and STEINDL (1950). The embryology has been described by FISCHER (1880), PECHOUTRE (1902), JACOBSSON—STIASNY (1914), and PHELOUZAT (1962, 1963 and 1965).

The urceolate receptacle tapers downwards. In the upper margin it thickens considerably giving the urn a narrow mouth. The two pistils (rarely one or three) emerge at its basis, and the ovary region is completely surrounded by the receptacle. The carpels are of the peltate type (TROLL 1935). Each of them bears an anatropic ovule (Fig. 1 A). There can be a short difference of stage in the development of the two ovaries, and the first achene developed usually becomes somewhat larger. Occasionally only this one is mature and contains germinative seeds.

Ordinarily there is only one pistil in *S. cretica*, *S. minor* ssp. *rupicola*, the *multicaulis* form series of *S. minor* ssp. *muricata*, and the *spachiana* form series of *S. minor* ssp. *magnolii*. This has also been observed in *S. minor* ssp. *lasiocarpa*. *S. minor* ssp. *magnolii*, the *spachiana* series excluded, usually has three pistils. Three or sometimes two of the ovaries give viable fruits. Seemingly, the ovule of *Sanguisorba* is unitegmic, but the integument is formed through accretion of two. The two sides are fused and entirely surround the nucellus, and a micropyle is lacking. The nucellus belongs to the crassinucellate

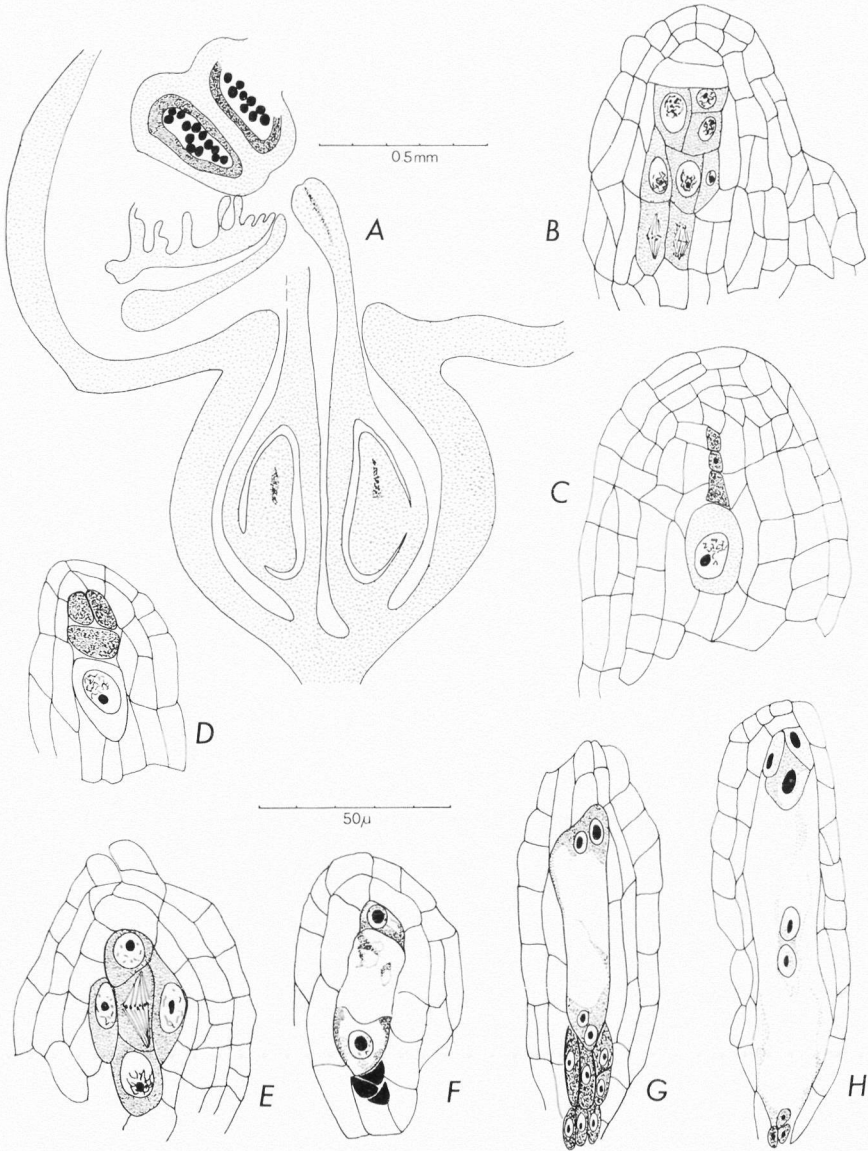


Fig. 1. A. Longitudinal cut section through the ovary region of *S. minor*. B. Archegonium with several MMC. Normally 1 primary and 3—6 secondary ones are formed. C. Linear tetrad. D. T-shaped tetrad. E—H. 1-, 2-, 4- and 8-nucleate ES respectively, G. with aposporic degenerating 1-nucleate ES in the chalazal part.

type, agreeing principally with the *Rosaceae* type, e.g. with many-layered epidermis, well-developed parietal tissue from so-called sporogenous rows, and with a multicellular archesporium in the centre.

DEVELOPMENT OF THE ARCHESPORIUM

Several cells of the archesporium develop into megaspore mother cells (MMC). Normally a central, primary MMC is formed at first, and then 3—6 secondary MMC (Fig. 1 B). Other potential MMC can be observed in the vicinity of them. There is some variation in the development, however. The central cell is not always the primary one, but all MMC may be formed at the same time, or in rare cases only one will be developed. The condition with several MMC was also observed in sect. *Sanguisorba*, where *S. officinalis* had up to 10 MMC (NORDBORG 1963).

The formation of the embryo sac (ES) follows the normal, monosporic type, the *Polygonum* type (MAHESHWARI 1963). Thus the MMC, one or several, undergoes the normal meiosis. The first division results in a dyad, the second in a tetrad. The chalazal megaspore functions and gives rise to the ES, while the remaining three megaspores degenerate. The megaspore cell nearest to the functioning one usually lies close to this, and is somewhat rounded upwards. The two upper megaspores lie either in the same row, forming a linear tetrad, or beside each other, forming a T-shaped tetrad (Fig. 1 C—D).

The functioning megaspore grows, vacuolizes, and gives rise to a 1-nucleate ES. Through three mitotic divisions a 2-nucleate, a 4-nucleate and an 8-nucleate ES, respectively, are formed. At these stages the vacuoles have been united to a central vacuole, separating the two nuclei or nucleus groups (Fig. 1 B—H). The 1-nucleate ES grows rapidly, and at the 2-nucleate stage other cells are forced aside. Therefore the degenerated megaspores can usually be observed only in the 1-nucleate stage.

Generally only one MMC, although not always the central one, gives rise to an 8-nucleate ES. Occasionally two or even three 8-nucleate ES are found in one nucellus. One of them dominates, and probably only this ES develops. Twin embryos have never been observed. Two or several MMC often divide meiotically, however, and megaspores from different tetrads develop into 2- or 4-nucleate ES before one of them becomes dominant and the others degenerate (Fig. 2 A—B). Most MMC reach the 1-nucleate ES stage before degenerating.

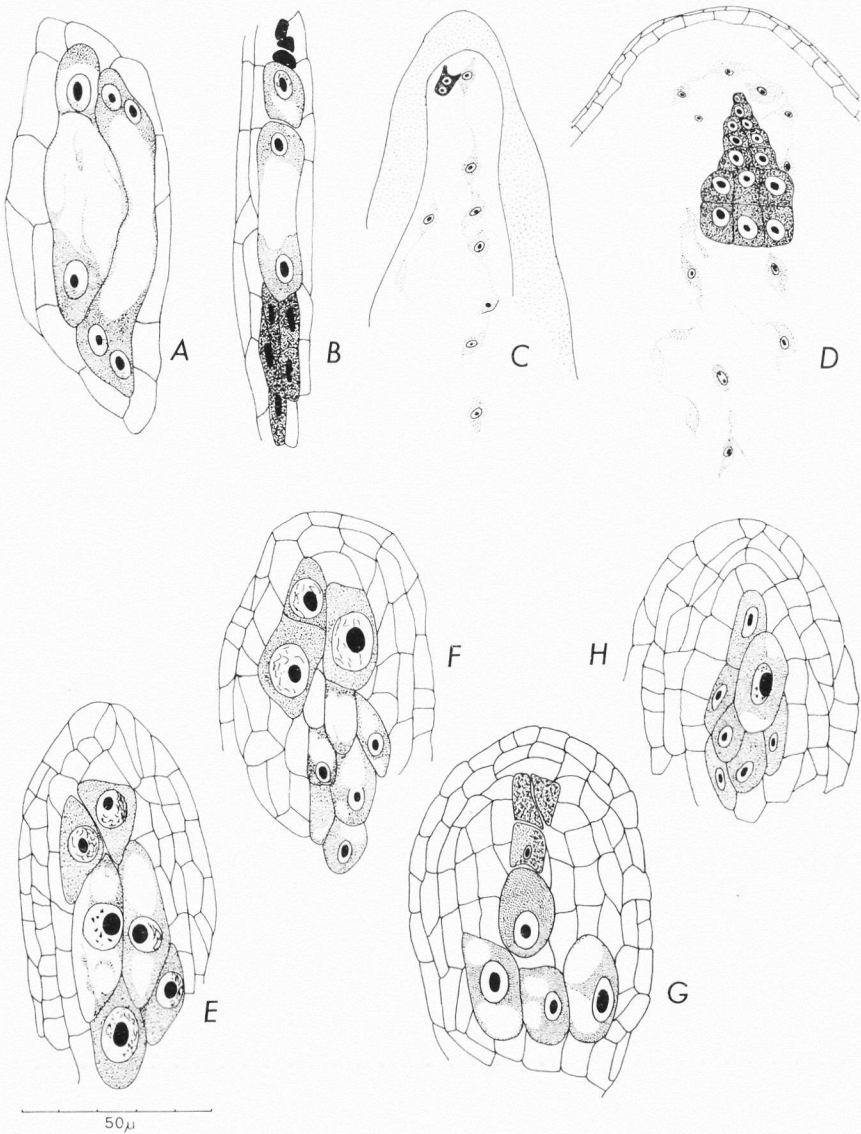


Fig. 2. A. 2- and 4-nucleate ES developed from megaspores of different tetrads. B. 1-nucleate reduced ES with degenerating megaspores, 2-nucleate reduced and 1-nucleate aposporic degenerating ES. C—D. Embryo and nuclear endosperm at different stages of development. The endosperm formation begins before the first divisions of the fertilized egg cell. E—H. 1-nucleate aposporic vacuolized ES with big nucleolus, in E together with supposed becoming MMC, in F—G together with 1-nucleate reduced ES. In H an aposporic ES is developed without any MMC or reduced ES found parallelly.

In the 8-nucleate ES organization of the nuclei and cell formation takes place. The mature ES is elongated. The egg apparatus consists of a large and diffuse egg cell and two synergids, often partially concealed by the egg cell. The three antipodal cells are small and degenerate at an early stage. They are rarely seen at the time of fertilization.

EMBRYO AND ENDOSPERM

The embryo develops from the fertilized egg cell in the normal way. It is provided with a suspensor. The development follows the typical scheme of the family *Rosaceae* (Fig. 2 C—D).

The endosperm formation begins before the first divisions of the egg cell. It belongs to the nuclear type. When completed it usually consists of only one cell layer and free nuclei.

APOSPORIC EMBRYO SACS

Parallel to the normal sexual development described above there is in most slides studied of both tetraploids and octoploids, a tendency for the development of aposporic, unreduced ES. I have used the term apospory although it is sometimes uncertain whether apospory or transitional forms to diplospory occur (STEBBINS 1950), as is the case with other genera of *Rosaceae* (GUSTAFSSON 1946). Beside or below the MMC, cells with a dense cytoplasm and big nucleoli appear. Without meiosis they give 1-nucleate ES. At this stage they can be distinguished from the reduced ones through their strong vacuolization (Fig. 2 E—H). In Fig. 2 G there is visible competition between the reduced ES with degenerating megaspores and the three vacuolized aposporic ones, the former of which usually dominates. At later stages it is impossible to see whether the existing ES has been formed in the sexual way or whether it is aposporic.

In one slide only out of about 2000 studied of this stage, an aposporic ES was found without any MMC or reduced ES existing at the same time (Fig. 2 H). The aposporic ES would probably function in that case.

Close to the antipodal region of the sexual 8-nucleate ES several 1-nucleate aposporic ES can be found, but they have often degenerated at an earlier stage, or will do so. However, they always show little tendency to develop (Figs. 1 G and 2 B).

THE APOMIXIS PROBLEM

A conclusion of the results presented is that amphimixis is the normal case in the *Sanguisorba minor* complex, but a strong tendency to apospory is found. In spontaneous material apospory has never been established. It might possibly come to expression under special circumstances such as unfavourable meteorological conditions, late autumn, mechanical incitement (i.e. at castrating), etc. In order to study these hypotheses the following experiments were made.

1. Buds were fixed from plants which had been growing *a.* in shadow, *b.* in extremely dry, and *c.* in extremely moist soil during the whole period of their development.

2. Buds were fixed after single nights of frost, in the end of October.

3. Flowers were castrated, isolated and then fixed after 3 days, and after 1, 2, 3 and 4 weeks respectively.

No embryological differences were observed in the material grown under extreme conditions. In the castrated flowers a degeneration of the egg apparatus could be found after only 3 days and at later stages the whole ES was degenerated.

Finally, as most crossings made in the *S. minor* complex gave hybrids, this supports the opinion that sexual reproduction dominates.

THE EMBRYOLOGY OF THE HYBRIDS

A subdivision into three groups must be made: spontaneous tetraploid hybrids, experimentally produced tetraploid hybrids and experimentally produced hexaploid hybrids. *S. minor* ssp. *minor* $2n=28$, ssp. *muricata* $2n=56$ and ssp. *magnolii* $2n=28$ were used in the actual crossings.

SPONTANEOUS TETRAPLOID HYBRIDS

Intermediate populations classified as hybrids as well as populations which can be referred to a certain taxon (although with some degree of introgression) have been found in nature beside the distinct taxa. No embryological differences were observed between these categories, which all followed the pattern described above.

EXPERIMENTALLY PRODUCED TETRAPLOID HYBRIDS

A large part followed the normal development pattern, but at later stages a tendency to degeneration of the ES was found in many of the

studied slides. The aposporic cells in the chalazal end were somewhat more vigorous, and in these cases the functioning ES probably came from one of them (Fig. 3 A).

Buds of the same size were investigated from the hybrids and the parental generation. A comparison of corresponding sections showed that the development had often scarcely begun in the former, while the ES had reached the 8-nucleate stage in the latter ones. This also calls attention to the fact that the MMC may degenerate and functioning aposporic ES are formed in their place in the actual cases.

The progeny of these hybrids was studied carefully. The results will be reported in the separate paper on experimental studies and taxonomy in section *Poterium*. From an embryological point of view it can be established:

1. that a reduced ES was functioning in most of the cases studied, giving a heterogenous progeny with features from both parents.

2. that an aposporic ES probably was functioning in the progeny of some hybrids as this was constant and quite similar to the mother individual. It was observed that the egg in such diploid ES produced an embryo but that the endosperm could be developed only after pollination. Thus this type of aposporic development in the *Sanguisorba minor* complex must involve pseudogamy.

EXPERIMENTALLY PRODUCED HEXAPLOID HYBRIDS

At an early stage a tendency to degenerate was observed. The ES became extremely long and shrank. The divisions of the nuclei ceased at the 1- or 2-nucleate stage (Fig. 3 B—D), and only in some cases was an organized reduced ES observed. The hexaploids cannot survive owing to an incapacity or at least a strongly reduced ability to reproduce. This must be ascribed mainly to the pollen as achenes were formed after pollination with morphologically good pollen from tetraploids or octoploids. These fruits produced pentaploid and heptaploid plants, respectively. Thus the egg cell in the reduced ES was capable of functioning.

The hexaploid material was small and inflorescence deviations common. In order to obtain receptacles and to study the progeny most developed flowers were pollinated and isolated until fruit setting. The few buds fixed for embryological studies, did not result in later stages than those found in Fig. 3 B—D. Undoubtedly aposporic ES must function in the hexaploids, however, as plants with $2n=42$, 56 and 70 were

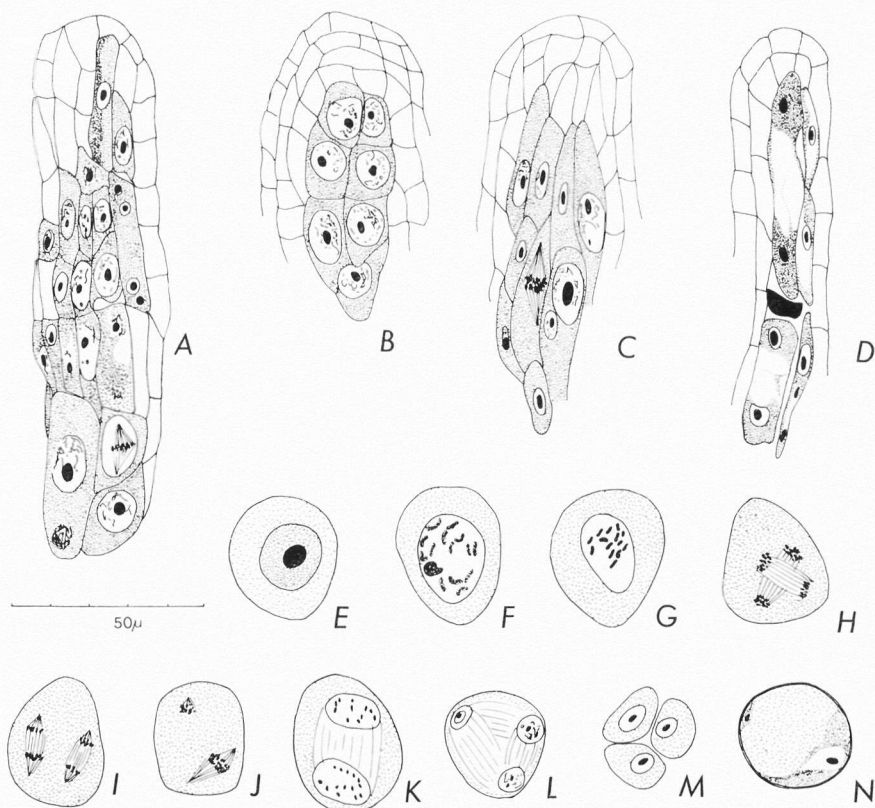


Fig. 3. A. Degenerating reduced ES and vigorous chalazal aposporic cells in experimentally produced hexaploids. The divisions of the nuclei cease at 1- or 2-nucleate stage. E—N. Meiotic divisions in pollen.

also formed after the pollination with pollen from the parents. The only likely explanation for the origin of these octoploids is that a combination of apospory and sexual reproduction must have occurred. An unreduced egg cell with 42 chromosomes probably produced the octoploid plants after fertilization with reduced pollen, $n=14$. These octoploids were fertile and stabilized.

To summarize, both tetraploid and hexaploid hybrids showed a tendency to form unreduced ES. This has previously been observed mainly in composites: *Leontodon*, *Picris*, *Antennaria dioica* and *Centaurea cyanus* (BERGMAN 1935). The egg cell, if differentiated, did not develop into an embryo, in those cases. The apomictic embryo forma-

tion in *Sanguisorba* followed two lines, i.e. unreduced egg cells developed parthenogenetically or after fertilization.

Only the hybrids produced embryos by facultative apospory. As to apomixis in hybrids GUSTAFSSON (1946) wrote "in no case it is proved that hybridization itself has been able to produce apomixis. On the contrary, it is certain that the apomictic method of reproduction has in many cases arisen within a species population". He wrote further that if STRASBURGER's (1905) studies in *Alchemilla* are accurate "agamospermy would be able to arise as an F_1 phenomenon in *Alchemilla*". The hybrids would "combine special factors for apomixis, latent in sexual parents".

Parallel examples to that in *Sanguisorba* of partial apospory followed by parthenogenesis have been reported in other species of *Rosaceae*, viz. in *Malus*, *Alchemilla* and *Crataegus* (GUSTAFSSON l.c.) and in *Aphanes* (HJELMQVIST 1959).

POLLEN DEVELOPMENT

Pollen formation and pollen development occur normally. The pollen formation is simultaneous. In Fig. 3 E—N some drawings of the first and the second meiotic divisions can be studied. The pollen grains lie free within the theca. They are loosened from the tetrad immediately after the completed meiosis. At the dispersal stage they are 2-nucleate.

ACKNOWLEDGEMENTS

I wish to thank Dr H. HJELMQVIST for valuable help during the course of this study.

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Från Lunds Botaniska Förenings förhandlingar 1966

11 MARS. Professor H. K. RECHINGER, Wien, höll föredrag över "Eine botanische Reise nach West-Pakistan und Ost-Afghanistan". — Föredraget, som utgjorde en översikt av dessa områdens natur, folk och flora, handlade huvudsakligen om en botanisk expedition företagen 1965. Som exempel kan nämnas en detalj från resan till Makran i sydvästra Pakistan. Till de karaktäristiska inslagen i den ofta mycket sparsamma vegetationen i detta torra område hör dvärgpalmen *Nannorrhops Ritchieana*. Denna palm utnyttjas såsom råvara för tillverkning av skor, remmar, mattor m.m.

31 MARS. Professor HENNING WEIMARCK redovisade det aktuella läget för inventeringen av Skånes flora. Vidare presenterade han en serie nyligen färdigställda kartor över ett dussintal skånska växters utbredning i landskapet.

Fil. lic. TORE MÖRNSJÖ höll föredrag om »Nuvarande och tidigare vegetation i Skoggårdsängarna i Genarps socken». — Skoggårdsängarna, som ligger strax väster om Häckebergasjön i Skåne, är för närvarande till stor del täckta av högvuxen starrvegetation med *Carex elata*, *rostrata* och *lasiocarpa* såsom dominerande arter. Inom en mindre del av området, som tidigare varit högmosse, företer vegetationstäcket en mosaikartad anblick. För att kunna förklara detta mönster med olika kärrtyper hade föredragshållaren företagit borrhningar och studier av växtrester i områdets torvlager. På grundval av dessa studier kunde föredragshållaren ge en skildring av områdets vegetationsutveckling från postglacial tid till nu. Särskilt intresse har hans undersökningar av de sekundära vegetationssuccessioner, som förekommit efter mänskliga ingrepp, dels vid igenväxningen av gamla torvgravar av olika ålder (jfr MÖRNSJÖ 1965), dels de förändringar, som inträtt på de gamla slåttermarkerna, efter det att området blivit satt under vatten genom dämning för ett tiotal år sedan.

5 MAJ. Fil. lic. SVEN SNOGERUP föredrog revisionsberättelser. Dessa godkändes av föreningen, som också beviljade tacksam ansvarsfrihet.

Fil. lic. FOLKE ANDERSSON höll föredrag om »Vegetation och ståndortsförhållanden i domänreservatet Linnebjerg». — Linnebjergsreservatet, som omfattar c. 23 hektar, ligger c. 1 mil nordost från Lund. Föredragshållaren gav en

allmän översikt av vegetationen inom reservatet, men uppehöll sig särskilt vid ett av Linnebjersreservatets ängsområden med kringliggande skog, som utvalts för ekologiska specialstudier. Från detta specialområde skildrades vegetation och flora samt dess ståndortsförhållanden (jfr F. ANDERSSON 1966 b).

Fil. mag. LARS PÅHLSSON höll föredrag om »Vegetation och klimat på Knivsås». — Föredragshållaren beskrev vegetationen på denna ås, som ligger i Hällestads socken i Skåne, med särskild hänsyn till de skillnader, som förefinnes mellan åsens sydexponerade sluttning och dess nordexponerade. I anslutning till dessa vegetationsbeskrivningar redovisade föredragshållaren sina studier av ståndortsförhållandena på åsens olika sidor. Främst berördes därvid mikroklimatiska mätningar över ljusintensiteten och över temperaturen i luften och i marken (jfr PÅHLSSON 1966).

Dessa två föredrag utgjorde en introduktion till exkursionen den 15 maj.

15 MAJ. Under ledning av fil. lic. FOLKE ANDERSSON och fil. mag. LARS PÅHLSSON företogs en exkursion i Lundatrakten. Route: Lund—Linnebjer—Hardeberga—Tygelsjö—Dalby—Bonderup—Jävan—Björnstorp—Björnstorps stn—Knivsås—Dalby—Lund.

Under FOLKE ANDERSSONS ledning gjordes en rundvandring inom Linnebjersreservatet. På vägen genom ekskogen, där fältskiktet av vitsippor var heltäckande, diskuterades Linnebjerskogens kulturhistoriska bakgrund. Vegetationen i Linnebjer finns översiktligt beskriven av FOLKE ANDERSSON (1966 a), varför det kan vara onödigt att här presentera några artlistor från exkursionstillfället.

Inom sitt specialstuderade försöksområde demonstrerade exkursionsledaren en bandprofil, som sträckte sig från skogen ut i ängen (Fig. 1). Här diskuterades sambandet mellan vegetationens differentiering utmed bandprofilen och de ståndortsförhållanden över vilka mätningar företagits. Speciellt uppehöll sig hr ANDERSSON vid markens vattenförhållanden och hur dessa kunde tänkas påverka syrgasförhållandena och näringsomsättningen i marken.

Nästföljande anhalt var Jävan på Romeleåsen, där Lunds universitets nya astronomiska observatorium höll på att färdigställas. I anslutning till utsikten härifrån över landskapet demonstrerade LARS PÅHLSSON kartor (hämtade från SAHLIN 1930) över Romeleåsens fäladsmarker och de förändringar, som dessa genomgått.

Från Jävan for deltagarna vidare till Knivsås, där man till en början ägnade sitt intresse åt den skogklädda delen av åsen, som ligger i Dalby socken. Markprofiler studerades på de plana områdena nedanför åsen. I bokskogen söder om åsen var marken närmast av brunjordstyp med ett tydligt mullager. Fältskiktet i denna bokskog innehöll bl.a. *Adoxa moschatellina*, *Anemone nemorosa* och *ranunculoides*, *Corydalis fabacea*, *Gagea lutea*, *Impatiens parviflora*, *Lamium galeobdolon* och *Ranunculus ficaria*. Norr om Knivsås i en planterad c. 40-årig granskog kunde en tydlig podsoleringsstendens iaktas i marken. Podsoleringen kan förmodas ha inträtt efter det att området planterades med gran. Härefter demonstrerades skillnaderna i vegetationens sammansättning på den bokskogsklädda delen av Knivsås. De mikroklimatiska förhållandena här i skogen och deras betydelse för markens och vegetationens

differentiering diskuterades, varefter man förpassade sig ut på den »öppna» delen av Knivsås, som ligger i Hällestads socken. LARS PÅHLSSON visade här skillnaderna i växttäcket mellan nord- och sydsida och redogjorde för sina mikroklimatiska mätningar, som avser att ge ett underlag för en diskussion om de ståndortsskillnader, vilka ger ett så påtagligt utslag i vegetationen.

5 SEPTEMBER. Dr E. A. SCHELPE, Bolus Herbarium, Cape Town, höll föredrag om »The montane and subalpine flora of the Natal Drakensberg». — Områdets geologi och klimat skildrades som inledning, varefter föredragshållaren med hjälp av diabilder i färg belyste floran. Han hade ägnat speciellt intresse åt orkidéerna och bland dem, som demonstrerades var *Satyrrium*-arterna *neglectum* och *parviflorum*, samt arter av släktena *Disperis* och *Habenaria*.

11 SEPTEMBER. Exkursion företogs med buss till södra Skåne under ledning av fil. kand. ÖRJAN NILSSON. Route: Lund—Dalby—Genarp—Häckeberga—Skönabeck—Brodda—Svaneholm; Svaneholm—Havgård—N. Grönby—Gabeljung—Kullatorp (i Gärdslövs sn)—Hjortholmshuset—Bygdegården (i Börringe sn)—Stjärneholm—Svaneholm; Svaneholm—Lund.

I Gärdslövs sn besöktes ett område med äldre bokskog (c. 200 m nordväst om Kullatorp), som var utbildad som ängsskog med ett rikt fältskikt i synnerhet i närheten av skogsbrynet. Av arterna i fältskiktet kan nämnas *Campanula trachelium*, *Galium odoratum*, *Lactuca muralis*, *Lamium galeobdolon*, *Polygonatum multiflorum*, *Brachypodium sylvaticum*, *Bromus Benekenii* och *ramosus*, *Carex sylvatica*, *Dactylis Aschersoniana*, *Festuca gigantea* och *Melica uniflora*. Vid en mindre skogsväg kunde man också påträffa *Geum urbanum*, *Rumex sanguineus* och *Veronica montana*. Litet längre in från landsvägen (c. 300 m nordväst från Kullatorp) i en björkskog på fuktigare mark fanns ovanligt många exemplar av *Daphne mezereum*. Därifrån kunde också noteras bl.a. *Betula pubescens*, *Acer pseudoplatanus*, *Prunus padus*, *Rubus idaeus*, *Athyrium filix-femina*, *Mercurialis perennis*, *Pulmonaria officinalis* ssp. *obscura*, *Scrophularia nodosa*, *Stachys sylvatica*, *Brachypodium sylvaticum*, *Festuca gigantea* och *Phalaris arundinacea*.

Färden gick vidare till Börringe socken, och botaniserandet startade på nytt på en backe c. 600 m ostsydost från Lemmeströtorp. Här demonstrerade ÖRJAN NILSSON olika *Rosa*-arter, *canina*, *dumalis*, *rubiginosa* och *Sherardii*. Vegetationen på backen var huvudsakligen av s.k. torrängstyp, d.v.s. en gräs- och örtrik betesmark. Bland förekommande arter antecknades bl.a.: *Calluna vulgaris* (fåtalig), *Achillea millefolium*, *Astragalus glycyphyllos*, *Campanula rotundifolia*, *Cirsium acaule*, *Chrysanthemum leucanthemum*, *Daucus carota*, *Dianthus deltoides*, *Euphrasia brevipila*, *Galium verum*, *Hieracium pilosella*, *Hypericum perforatum*, *Knautia arvensis*, *Lotus corniculatus*, *Ononis repens*, *Pimpinella saxifraga*, *Plantago lanceolata*, *Senecio jacobaea*, *Stellaria graminea*, *Trifolium medium*, *Viola canina*, *Agrostis canina* ssp. *montana*, *Agrostis tenuis*, *Carex hirta*, *Dactylis glomerata* och *Festuca rubra*.

Vid en åkerkant blommade *Centaurea cyanus* och *Chrysanthemum segetum*.

Det stora kärrområdet c. 5,7 km ostsydost om Börringe kyrka gav prov på flera olika vegetationstyper, stundom med en till synes ganska heterogen karaktär. Denna rika omväxling kan hänföras, dels till de naturliga förutsättningarna, dels till olika igenväxningsstadier efter mänskliga ingrepp (såsom



Fig. 1. Exkursion till Linnebjerg den 15 maj 1966. F. ANDERSSON demonstrerar bandprofil i ängsområdet. Från vänster L. PÅHLSSON, H. WEIMARCK, F. ANDERSSON, T. FLENSBURG.

torvtäkt). Mineraljorden är starkt lerhaltig och kan helt säkert stundom vara kalkrik; ovanpå mineraljorden ligger ett torvlager av skiftande mäktighet.

Vissa delar av kärret är skuggade av uppväxande albuskar. Från ett dylikt avsnitt, där vegetationen dominerades av *Carex rostrata*, antecknades bl.a. *Alnus glutinosa*, *Lastrea thelypteris*, *Menyanthes trifoliata*, *Peucedanum palustre*, *Potentilla palustris*, *Equisetum fluviatile*, *Carex echinata*, *rostrata* och *Molinia caerulea*. Inom ett mera öppet avsnitt fanns *Hammarbya paludosa*, som växte uppe i stora *Sphagnum*-tuvor, som höjde sig något över den övriga kärrytan.

Inom »torrare» delar av området fanns också vegetation av fukthedsliknande utseende, där särskilt *Gentiana pneumonanthe* var en fröjd för ögat.

För övrigt sågs här bl.a. *Andromeda polifolia*, *Calluna vulgaris*, *Vaccinium uliginosum*, *Oxycoccus palustris*, *Pedicularis sylvatica*, *Potentilla erecta*, *Succisa pratensis*, *Viola palustris*, *Eriophorum vaginatum* och *Molinia caerulea* samt i bottenskiktet *Sphagnum*-arter.

I den västra delen av kärrområdet hade vegetationen i de igenväxta torvgravarna en stundom märklig blandning av arter, såsom *Drosera rotundifolia*, *Pinguicula vulgaris*, *Primula farinosa*, *Rhynchospora alba*, *Trichophorum alpinum*, *Eriophorum angustifolium* samt i bottenskiktet på sina ställen *Camphylidium stellatum* och *Scorpidium scorpioides*.

På backarna c. 500 m ostsydost från klockarbostället blommade ännu *Dianthus superbus* i något exemplar. Av backens flora kunde för övrigt bl.a. följande arter antecknas: *Ononis repens*, *Achillea millefolium*, *Alchemilla glaucescens*, *Anemone pulsatilla*, *Armeria maritima*, *Campanula rotundifolia*, *Cirsium acaule*, *Galium verum*, *Helianthemum chamaecistus* ssp. *hirsutum*, *Hypericum maculatum*, *Lathyrus montanus*, *Pimpinella saxifraga*, *Plantago lanceolata*, *Thymus serpyllum*, *Trifolium repens*, *Agrostis tenuis*, *Festuca ovina* och *Poa pratensis*.

Såsom avslutning på dagens botaniska studier besöktes Lillesjö vid Stjärneholm i Skurups sn, där ett rikt bestånd av *Cladium mariscus* beskådades.

13 OKTOBER. Docent BJÖRN E. BERGLUND höll föredrag om »Florans invandring till Sydsverige under sen- och postglacial tid». — Med utgångspunkt från LENNART VON POSTS banbrytande insatser skisserade föredragshållaren pollenanalysens utveckling och tillämpning såsom ett väsentligt medel vid vegetationshistorisk forskning.

Sedan följde en översikt över de sen- och postglaciala perioderna sedda ur vegetationshistorisk synvinkel. På grundval av sina studier i östra Blekinge hade föredragshållaren för sen- och postglacial tid urskilt olika »invandringsvågor» med hänsyn till förändringarna i floran. En invandringsvåg utmärkes av att nytillskottet av arter är tydligt större än under övriga perioder. Framförallt tre perioder har dylika invandringsvågor nämligen senglacial, boreal och subatlantisk tid. Föredragshållaren karakteriserade och diskuterade utförligt dessa invandringsvågor i Sydsverige.

25 NOVEMBER. Föreningen behandlade ett styrelseförslag om höjd medlemsavgift. Efter en utförlig diskussion fastställde föreningen den nya avgiften att fr.o.m. 1967 vara 40 kr pr år. För studerande (utan akademisk examen) sattes avgiften till 30 kr.

Förrättades val av styrelse för 1967. Valda blev: Professor HENNING WEIMARCK, ordf.; docent ROLF DAHLGREN, vice ordf.; fil. mag. JAN ERICSON, sekr.; fil. kand. GÖRAN MATTIASSON, vice sekr.; övriga ledamöter i styrelsen: fil. lic. FOLKE ANDERSSON, docent STIG OLOF FALK, laborator BÖRJE LÖVKVIST, docent HANS RUNEMARK, och docent SVEN-OLOF STRANDHEDE. — Docent SUNE PETTERSSON och fil. lic. SVEN SNOGERUP valdes till revisorer, och fil. lic. LARS-OLOF BJÖRN och fil. mag. LARS PÅHLSSON valdes till revisorssuppleanter.

Laborator BÖRJE LÖVKVIST höll föredrag över »Differentieringen inom några *Stellaria*- och *Limonium*-arter». — Föredragshållaren uppehöll sig först

vid arterna *palustris*, *graminea* och *longifolia* inom släktet *Stellaria*, där han redovisade egna undersökningar och gjorde jämförelser med tidigare utförda. Han övergick sedan till sina undersökningar över *Limonium*-arter. Dessa studier berörde framförallt skånska typer, som demonstrerades med hjälp av krusat levande material.

15 DECEMBER. Fil. kand. ROLAND VON BOTHMER och fil. stud. HANNES MELLQUIST höll föredrag om »Botaniska strövtåg i Hellas och Levanten». — Föredraget, som illustrerades med ögonfägnande diabilder i färg, handlade om folkliv, åsnor och flora på det grekiska fastlandet, i någon mån i Turkiet men framförallt på olika grekiska öar.

LITTERATUR

- ANDERSSON, FOLKE. 1966 a. Klenoder i Skånes natur IX: Linnebjer. — Skånes Natur 53, (Kontakt med Skånes Naturskyddsförening) (1): 12—16. Lund.
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 MÖRNSJÖ, TORE. 1965. Agens växtplatser och historia i Skåne. — Skånes Natur 52: 184—199. Malmö.
 PÄHLSSON, LARS. 1966. Vegetation and Microclimate along a Belt Transect from the Esker Knivsås. — Bot. Notiser 119: 401—418. Lund.
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Jan Ericson

Meddelanden

Forskningsbidrag

Ur HIERTA-RETZIUS forskningsfond har tilldelats: Docent OVE ALMBORN, Lund, kr. 2.000 för studieresa till Tenerifa, fil. lic. KARIN BRUNSBURG, Lund, kr. 2.000 för forskning rörande *Lathyrus pratensis*-gruppen i Europa, fil. lic. KERSTIN GEZELIUS, Uppsala, kr. 2.000 för undersökning av differentiering hos de cellulära slemsvamparna, fil. lic. JIM LUNDQVIST, Uppsala, kr. 1.000 för växtbiologiska fältstudier i Pite Lappmark, fil. lic. SVANTE PEKKARI, Uppsala, kr. 2.000 för vattenväxtundersökningar i Bottniska Viken, docent ERIK SJÖGREN, Uppsala, kr. 2.000 för studier av mossvegetationens ekologi och sociologi på Öland, Bornholm och det norska Vestlandet, och docent KUNO THOMASSON, Uppsala, kr. 4.000 i bidrag till algologisk forskningsresa till södra Australien.

Ur VETENSKAPSAKADEMIENS RESEUNDERSTÖD har utdelats kr. 650 till fil. lic. KARIN BRUNSBURG för en botanisk inventering i Jämsjö socken, Blekinge.

Nytt utseende på Botaniska Notiser och Opera Botanica

Tiden har ansetts mogen att ge Botaniska Notiser ett nytt ansikte. Omslag och artikelrubriker har förnyats. En enhetligare utformning av artiklarna har genomförts, med t.ex. kort sammanfattning i början och enhetlig form på litteraturförteckningarna enligt internationellt mönster. Tidskriften har dessutom skurits. (Dock finns ett begränsat antal oskurna exemplar tillgängliga för dem som ovillkorligen så önskar. Hänvändelse till fil. mag. JAN ERICSON, avdeln. f. ekologisk botanik, Ö. Vallgatan 14, Lund.)

Denna modernisering har varit möjlig tack vare stort tillmötesgående från C. W. K. Gleerups Förlag, Lund, där jag särskilt vill tacka direktör W. EKSTRAND, fru I. SCHAAR, och bokkonstnär H. KUMLIEN, vilken ritat omslagen och gjort förslag till nya rubrikhuvuden. Lika stort stöd har givits oss av boktryckare CARL BLOM, som med största intresse och sakkunskap realiserat och utformat våra önskningar. Jag vill rikta mitt varmaste tack till de nämnda och också till kollegor som bidragit med tankvärda synpunkter.

Den nya utformningen av Botaniska Notiser har medfört en måttlig kostnadsstegring. Den nyligen höjda medlemsavgiften har dock ingenting med moderniseringen att göra, utan beror på allmänna kostnadsökningar och på Naturvetenskapliga Forskningsrådets anvisningar om riktpriiser och tillåtna rabatter.

Opera Botanica har fått ett utseende likt Botaniska Notisers, men med blått omslag.

Redaktören

Botanisk litteratur (Botanical Literature)

THREE BOOKS ON CHLOROPHYLLS AND CHLOROPLASTS

The Chlorophylls. Physical, Chemical, and Biological Properties. Ed. LEO P. VERNON & GILBERT R. SEELY. Academic Press, New York. 1966. 679 pp. Price \$ 25.

Biochemistry of Chloroplasts. Ed. T. W. GOODWIN. Proceedings of a NATO advanced study institute held at Aberystwyth, August 1965. Academic Press, London. Vol. I. 1966. 476 pp. Price 115 s. Vol. II. 1967. 776 pp. Price 160 s.

Le Chloroplaste. Ed. C. SIRONVAL. Masson, Paris (in press).

It is often heard to-day that the branches of science are becoming more and more specialized, at the same time as the boundaries between them are vanishing. One of the clearest examples of this is the research on chloroplasts and photosynthesis. Especially when dealing with the chlorophylls and their functions, botany merges with biochemistry, organic chemistry, photochemistry, atomic physics and steady state physics. It is difficult for a plant physiologist or anyone else to acquire a wide enough basic knowledge to understand all that is being written in this field. It is natural that the three books dealt with here do not have one author each, but, taken together, about two hundred.

"The chlorophylls" has four main sections: Isolation and chemistry; Physical properties in solution and in aggregates; State of the chlorophylls in the cell; Photochemistry and photophysics.

In the first section the chapter of most general interest is probably the one on extraction and assay. One learns that no extraction procedure is universally applicable to all plants, and that a suitable solvent must be empirically determined in each case. It is pointed out that the chlorophylls are easily altered during extraction. Faulty extraction methods are responsible for the now untenable view that many marine algae contain as much chlorophyll c as chlorophyll a.

Another chapter in the first section describes the attempts to synthesize chlorophyll a in the laboratory, crowned with success by Nobel laureate R. B. WOODWARD. To completely digest this chapter requires an organic chemist, but it is nevertheless interesting to see how different this reaction

sequence is from that employed by the plant (the biosynthesis is described in a later chapter).

In the section on physical properties the most interesting novelty is the measurements of NMR (nuclear magnetic resonance). NMR is a method of analysis by which it is possible to determine how hydrogen atoms (and certain other atoms) are bonded in a molecule by determining magnetic properties of the atoms. This method has now, among other things, provided a clearcut affirmative answer to the old question whether the chlorophyll molecule has any "loose" hydrogen atoms which can exchange with the environment. This may, of course, be of importance for the role of chlorophyll in photosynthetic reduction processes.

The third section describes the organization of chloroplasts and the corresponding structures in bacteria and blue-green algae on the electron microscopical and molecular levels. It further deals with the natural physical state and the protein complexes of chlorophylls, with their biosynthesis and their distribution in the plant kingdom. One of the new methods for investigation of the natural state of chlorophyll is measurement of optical rotary dispersion, i.e. measurement of how the oscillation plane of plane polarized light is influenced in different spectral regions. The refined equipment now available makes possible measurements which were earlier hampered by the strong light absorption of chlorophyll. It seems as if theory lags somewhat behind experimental technique in this field, and there is some uncertainty about what conclusions that can be drawn from the measurements of rotary dispersion.

It is here impossible to penetrate into the last section, dealing with photochemistry and photophysics of chlorophylls. At the bottom of most contemporary theories of the role of the chlorophylls in the photosynthesis of green plants lies the idea that they mediate not only one, but two primary photochemical processes.

No objections can be raised against the factual contents of the book. The authors are among the leading scientists in their respective fields. Due to the large number of contributors to the volume (twenty-two), some iterations have been unavoidable. E.g., Figure 6 of Chapter 13 I is identical to Figure 12 of Chapter 14. Such cases are rare, however, even when the three books considered here are taken together.

If, after having consumed the 679 pages of "The chlorophylls", the reader feels that a tiny chloroplast has no room for anything but all this pigment, the may turn to "Biochemistry of chloroplasts". The two volumes of this book deal not only with the pigments and the photochemical processes connected with them. They also extensively treat the nature, structural organization and biosynthesis of lipids, proteins, and nucleic acids. The biosynthetic mechanisms are also put in relation to morphogenesis.

The last book to be mentioned here, "Le chloroplaste", is a result of a symposium held at Gorsem, Belgium, in 1965. The reviewer has as yet only taken part of preliminary manuscripts. The main theme is "growth and aging of chloroplasts". There are contributions about structure and development, proteins, nucleic acids, and pigments of chloroplasts.

LARS OLOF BJÖRN

M. J. PURVIS, D. C. COLLIER, and D. WALLS: *Laboratory Techniques in Botany*. Butterworths, London. 1966. 439 pp. Price 57 s. 6 d.

Judging from the title of this book one might assume that it is a kind of handbook for scientists and technicians working in laboratories where plants are being examined. Most of the book has this character. However, there are also long sections describing elementary and educational experiments in plant physiology, e.g. respiring peas in a thermos bottle and photosynthesizing *Elodea* under a water-filled, inverted test tube. It is the reviewers belief that the mixing of two such really different subjects in one volume is not very fortunate.

The above criticism of the basic plan of the book does not imply that it is without value. The reader is shown how good cotton plugs for culture flasks and organ sections for microscopy are prepared, how a warburg apparatus and even ordinary pipettes are used. Many useful formulas for culture media and solutions for histological work are included. One drawback is that although many references are listed, it is often impossible to trace the source of a particular formula.

LARS OLOF BJÖRN

EDWARD GURR: *The Rational Use of Dyes in Biology*. Leonard Hill, London. 1965. XII+422 pp. Price 105 s.

This book deals with staining methods in disciplines like general cytology, botany, haematology, and protobiology, and is a companion volume to the work *Staining — Animal Tissues* (1962). Together with *Encyclopaedia of Microscopic Stains*, also published by GURR, these books represent an extensive manual of biological staining.

Microscopists in natural science have been working with mostly empirical staining methods for almost 300 years. They have not been rational in the sense of having known chemical reactions between dyes and tissue components. Dr GURR who is an experienced chemist has made a successful attempt to present, in concise form, a comparative anatomy of dye molecules classified after their chemical and physical properties.

The book contains four parts. The first one is 'a guide to the rational use of dyes in biology' with for example a theoretical discussion about interaction of dye molecules. For the experimentally working histologist or cytologist, who actually wishes to test the new ideas of GURR, the book has many tables and diagrams of dye properties. Especially important and informative are the absorption curves of synthetic dyes. In connection with notes on colligators (a new term coined by GURR), i.e. a kind of functional groups or auxochromes of atom groups which will modify the colour of an unsaturated organic compound, these curves will help the scientist to choose reagents acting upon the dye component in wanted direction.

The second part presents empirical and rational staining methods alphabetically ordered. Each method recipe is followed by notes on technique and results from different organs used. In polarizing microscopy one can study optically anisotropic structures. The special technique of plane-polarized light will cause visible almost 50 % of birefringent elements. The use of stains

does not remarkably improve this method. GURR, however, in collaboration with MACCONAILL has prepared a better method with elliptically polarized light and a new dyestuff technique, which merits a greater attention.

In the last two parts are given a list of recipes and structural formulas, absorption maxima, solubility, etc., of biological stains. Here one also can find an alphabetical catalogue of chemical qualitative analyse methods with colour reactions. A thorough general index, an authors index, and a quite large bibliography complete the book and contribute in making it an excellent guide to staining theory and practise.

ULF OLSSON

Algae and Man. Ed. D. F. JACKSON. X+434 pp. Plenum Press, New York. 1964. Price \$ 14.50.

The book represents the proceedings of the Advanced Study Institute *Algae and Man*, held in July 22—August 11, 1962, at the University of Louisville, Kentucky, sponsored by the Scientific Affairs Division of NATO. The institute was held with the purpose of examining current concepts concerning the biology of algae and of discussing the effects of algae, beneficial and detrimental, on the human organism.

The papers, written by phycologists from NATO nations, report recent advances in taxonomy, cytogenetics, culturing, physiology, and ecology. Topics concerning toxic algae, water supplies, pollution, waterblooms, and algae as gas exchangers are treated. New techniques and instrumentation for conducting research and for applying existing knowledge to practical requirements are described. Some contributions are selected for brief comments below.

G. W. PRESCOTT: Contributions of Current Research to Algal Systematics. — The great importance of systematics in all branches of biological research is stressed and the author gives a review of the position of phycological systematics and singles out some taxonomic problems much in need for investigation. A few fields of research in relation to systematics are selected for brief consideration.

T. CHRISTENSEN: The Gross Classification of Algae. — The author accepts 15 classes of which he has introduced two: *Haptophyceae* and *Loxophyceae*. The delimitation of the divisions *Chrysophyta* and *Chlorophyta* is still uncertain as is the arrangement of the classes *Cryptophyceae*, *Dinophyceae*, *Rhaphidophyceae*, *Xanthophyceae*, and *Euglenophyceae*.

MARGARET ROBERTS: The Cytology of the Phaeophyta — A Review of Recent Developments, Current Problems, and Techniques. — Details of nuclear and chromosome structure, chromocentres and "chromophilous sphaerule", and the centromeric activity are briefly considered.

G. E. FOGG: Environmental Conditions and the Pattern of Metabolism in Algae. — Environmental conditions may change the pattern of metabolism in drastic ways. It is also changed by altering the proportions of nutrients and the amount of extra cellular metabolites in the medium and by adaptive enzymes formed by the algae.

CLYDE EYSTER: Micronutrient Requirements for Green Plants, Especially

Algae. — The need of the following micronutrients is demonstrated: manganese, iron, chlorine, vanadium, zinc, calcium, boron, molybdenum, cobalt, copper, silicon, and sodium.

A. G. WURTZ: Some Problems Remaining in Algae Culturing. — Different methods of evaluating the growth and the yield of algae in cultures are shown as methods of purification in order to obtain bacteria-free algae cultures. The author also demonstrates how cultures of algae are used for ecological purposes, for purifying industrial wastes and sewage, and for estimating water quality and biologic production. They also give information on how algae are linked in the food chains in nature.

RUTH PATRICK: A Discussion of Natural and Abnormal Diatom Communities. — When characterizing a water, the number of species present is often of greater practical interest than the taxonomic composition of the flora, as the number of species changes only little in a water during the year. The size of the populations of most of the species composing a community is more similar when there is a great number of species as in undisturbed water bodies. In dystrophic streams, but often also in certain natural waters, a few species are represented by a great many specimens. A similar structure of the diatom populations is also found in water bodies with pollution present. The dominant species change, however, during the year.

J. B. LACKEY: The Ecology of Plankton Algae. — From his own experience, the author discusses the direct and indirect human effects on algae and algal effects on Man.

J. VERDUIN: Principles of Primary Productivity: Photosynthesis under Completely Natural Conditions. — A comparison of photosynthesis and respiration in two small ponds is given. A limiting-factor equation is presented and levels of photosynthetic yield in aquatic environments are analyzed. By applying the Lambert-Beer's law to aquatic environments, the author has found an equation from which a coefficient relating light penetration to suspensoid concentration can be evaluated.

C. M. PALMER: Algae in Water Supplies of the United States. — The algae referred to most frequently in water supply problems comprise 27 genera, seven of which are diatoms. Rivers, as well as lakes and reservoirs, are subject to occasional sudden algal blooms, causing great crises for communities using the water. The epidemic blooms of algae are often caused by enriching the water bodies by pollution. Examples of more or less successful treatments are given. The definite answer to occurring problems is probably a systematized biologic control.

O. M. SKULBERG: Algal Problems Related to the Eutrophication of European Water Supplies, and a Bio-Assay Method to Assess Fertilizing Influence of Pollution on Inland Waters. — Regional investigations of phytoplankton in the lakes of Europe show that important species of algae, active as interference organisms in water supply practice, occur all over the continent. Two examples from Norway of seasonal changes of standing stock of phytoplankton in temperate lakes show that the algae respond quickly to changes in environmental factors, the culmination of their growth coinciding with the circulation periods of the water masses, and the replacement of species is then rapid. The results of physical and chemical analysis are difficult to inter-

pret with respect to what they indicate about the biologic conditions of the recipient. The use of a bio-assay method is recommended and demonstrated.

P. R. GORHAM: Toxic Algae. — Three main problems are discussed: (1) Are algae or bacteria responsible for the toxicity observed in certain waterblooms? (2) Is more than one toxin involved? (3) Why do waterblooms vary in toxicity? Laboratory studies have provided at least partial answers to the questions. Strains of two blue-green algae, *Microcystis aeruginosa* and *Anabena flos-aquae*, have been found to produce toxins responsible for lethal poisonings of various animals. The death factors in the algae are not identical.

M. LEFÈVRE: Extracellular Products of Algae. — Almost all algae are probably producing extracellular products. Some of the products have antibiotic properties, others are toxic to animals and man, still others are growth stimulating to animal and plant tissues. Waterblooms are often an effect of inhibition of the growth of other algae and the waterblooms themselves disappear as a result of autoinhibition caused by their own extracellular products.

D. SCHWIMMER & M. SCHWIMMER: Algae and Medicine. — There is a clear parallelism between the animal and the human intoxications associated with blooms of blue-green algae. The clinic manifestations are gastrointestinal, hepatic, neuromuscular, respiratory, and cardiovascular. Another group of algae causing respiratory and dermatogenic diseases are marine *Gymnodinium* species. Gastrointestinal disorders caused by *Chlorella* and *Scenedesmus* have also been reported when these algae have been tested experimentally as food. A series of indirect intoxications caused by ingestion of certain fishes, shellfishes, mussels, etc., eating algae have regionally been known during long times. The rôle of algae in certain bacteriologic disease syndromes, as botulism, hepatitis, cholera, polio, and others, is discussed. The paper is followed by 235 references on the subject.

R. J. BENOIT: Mass Culture of Microalgae for Photosynthetic Gas Exchange. — The author gives an account of experimentally estimated possibilities of using *Chlorella* strains as oxygen and food producers for a complete recycling of biological elements in space ships and submarines.

S. O. STRANDHEDE

RECHINGER, K. H.: *Flora Iranica*. — Fasc. 1—15. Graz (Akademische Druck- u. Verlagsanstalt). 1963—65. 305 pp. 90 plates (incl. 6 colour photos).

Already as a young botanist K. H. RECHINGER got the idea to produce a modern counterpart of BOISSIER's 'Flora Orientalis'. His contributions to the floras of the Far and Middle East and the Mediterranean are numerous, and with the publication of the first parts of 'Flora Iranica' that old dream of his is beginning to come true.

The area covered by the flora is shown on a coloured map on the front page of each fascicle. It includes Persia, Afghanistan, parts of West Pakistan, Northern Iraq, Azerbaidjan, and Turkmenistan. Something like 9000 species of flowering plants inhabit the area. Thus the 'Flora Iranica' project is an enormous task, which only Prof. RECHINGER could undertake and be expected to carry through.

The work is published in fascicles, each comprising one family. They are

published independently without any special sequence being followed. Among the families hitherto treated are *Convolvulaceae*, *Euphorbiaceae*, *Primulaceae*, *Campanulaceae*, and *Plantaginaceae*. Fortunately, RECHINGER has managed to get collaborators saving him from some pieces of the heavy load of work. So far, these authors are H. SCHIMAN-CZEIKA, H. RIEDL, P. H. RAVEN, T. G. YUNCKER (†), and especially P. WENDELBO. The latter is himself a specialist on, i.a., the flora of Afghanistan and he has considerable field experience from the area.

Keys to genera and species, descriptions and distributional data are written in Latin. Comments besides the standard text are in German, however. Species descriptions were not given in the first six fascicles but later included, a most welcome addition.

One is pleased to find that the approach is that of a modern critical flora. Type specimens and synonyms are cited, and there is complete citation of collections, all thoroughly checked and confirmed. Even the total distribution of the species is given.

A very useful feature is the often exhaustive taxonomic discussions, giving valuable information on the present state of knowledge and indicating suitable fields for further research.

The flora is richly illustrated, another point of great value. Both drawings and photographs (of dried specimens) are included, sometimes a combination of both. Even colour plates occur, viz. six beautiful photographs (by P. WENDELBO) of *Primulas* and *Dionysias* in their natural habitats.

The area of 'Flora Iranica' is one of great phytogeographical interest, a fact reflected, e.g., by the comparatively high degree of endemism. In this respect there is naturally a great variation between different taxonomic groups. Often almost half the number of species of a genus are endemic within the area. E.g., of the 10 species of *Ephedra* 5 are endemic, and the corresponding figures are for *Convolvulus* 57: 27, for *Tamarix* 35: 12, for *Euphorbia* 98: 40, and for *Campanula* 57: 20. Quite another pattern is shown by some other large and widespread genera. Thus of the 29 species of *Epilobium* only 2 are endemic, and similar figures are obtained for *Cuscuta*, viz. 24: 5, and *Plantago*, viz. 28: 5. A third characteristic group consists of genera with a pronounced centre within the area, including, of course, the endemic genera. An instructive case is *Dionysia*, a genus well known through WENDELBO's monographic study. 34 species are known altogether, and no less than 30 species occur in the 'Flora Iranica' area. They are with one exception endemic there!

Every new part of the flora will bring similar interesting facts to light. Let us hope that RECHINGER will in due time also contribute a phytogeographical essay on the area.

We congratulate Prof. RECHINGER to the parts of 'Flora Iranica' already published and wish him success in completing the work. No doubt it will rank among the foremost contributions to Botany of this century.

BERTIL NORDENSTAM

RECHINGER, K. H.: *Flora of Lowland Iraq*. — Weinheim (J. Cramer) 1964. 746 pp. Price DM. 120: —.

This one-volume flora resulted from the author's stay in 1956 as Visiting Professor in Baghdad. The achievement of this work is another proof of RECHINGER's outstanding ability to undertake a difficult task and complete it within a limited time. In this case he had to produce a useful flora of a practically unknown country as a synthesis of his own field research and the very scattered information available in literature and herbaria.

Lowland Iraq as delimited in the flora comprises areas with a mean annual rainfall of less than 300 mm. Altogether about 80 % of the total area of Iraq is covered. The flora of the area is phytogeographically a mixture of the Saharo-Sindian element, which is dominant, and the Iranian element, which is most evident in the northern and eastern parts.

About 1200 species are treated, and in addition some species are included, which are likely to occur within the area but which have not yet been found (e.g. *Elyonurus royleanus* NEES and *Aristida adscensionis* L.). The largest genera are *Astragalus* (31 spp.), *Euphorbia* (25), *Centaurea* (16), *Allium* (15), and *Cyperus* (14). There are full species descriptions and distributional data with citation of collections. It should be pointed out, that this flora does not claim to be equally critical in approach as 'Flora Iranica'. Type specimens are not cited, and literature references are used without having been checked. However, the author's own collections are thoroughly determined and checked against authentic material.

Keys to genera and species are given and even a key to the families, a feature which considerably increases the usefulness of the book, esp. for beginners. The same may be said about the glossary at the end of the flora.

BERTIL NORDENSTAM

MERXMÜLLER, H.: *Prodromus einer Flora von Südwestafrika*. — J. Cramer, Lehre. Fasc. 1—8, 1966. Fasc. 9—16, 1967. Subscription price DM. 3.50 per 16 pp., complete work ca. DM. 450: —. Post-publication price ca. DM. 660: —.

The old German plans to produce a flora of South West Africa were taken up in 1950 by Prof. SUESSENGUTH in Munich and since 1955 continued by Prof. MERXMÜLLER. The work was delayed from time to time due to various difficulties involved in a pioneer work of this kind. Now the first parts have appeared, and one notices with great satisfaction that the whole work is intended to be published within three years.

Behind the flora lies a time-consuming taxonomic research, carried out by MERXMÜLLER and his team of eight long-time collaborators in Munich. There has also been fruitful cooperation with the herbaria in Pretoria and Windhoek as well as with specialists in other parts of the world.

The shape of the work is that of a 'Prodromus'. It was judged too ambitious and also premature to attempt producing an elaborate complete flora like e.g. 'Flora Zambesiaca' or 'Flora of Southern Africa'. It should be remembered, that parts of South West Africa are still insufficiently known, in spite of a

considerable field activity during the last ten years. Some areas are rather inaccessible for climatic, topographical or political reasons.

Though lacking detailed species descriptions and illustrations the 'Prodromus' serves as a most useful flora, containing the essential information. Condensed species descriptions are included in the keys, which are nevertheless easily handled through latinization of the important characters. There are descriptions of families and genera. Type specimens are cited when from the area, otherwise only their geographical origin is indicated. Synonyms quoted are wisely restricted to names that have been used for South West African plants. The distribution is given through enumeration of the districts (of which there are 22) where the species has been found. Selected collections, seen by the author, are cited. Sometimes critical remarks are given, a most valuable feature.

The 'Prodromus' is published in fascicles, comprising one or several families. They appear independently until the whole work is finished. The last fascicle will contain a key to families and an index.

Among the families published in 1966 are *Molluginaceae*, *Amaranthaceae*, *Capparaceae*, *Brassicaceae*, *Oxalidaceae*, *Geraniaceae*, *Zygophyllaceae*, *Combretaceae*, *Rubiaceae*, *Campanulaceae*, and the families of 'Helobiae'. In 1967 have hitherto appeared, i.e., *Convolvulaceae*, *Mimosaceae*, *Caesalpiniaceae*, *Portulacaceae*, *Chenopodiaceae*, *Scrophulariaceae* (27 genera), and *Cyperaceae* (17 genera).

We eagerly await the continuation and completion of the 'Prodromus'. Its rapid publication (which should encourage to subscription!) will make it, in a way, a 'Prodromus' also to the elaborate longtime floras under preparation of adjacent areas. To workers on the botany of South and Tropical Africa it will be indispensable.

BERTIL NORDENSTAM

OPERA BOTANICA

is edited by the Lund Botanical Society in co-operation with the Institute of Systematic Botany, University of Lund. It consists of larger treatises issued at indefinite times. After vol. 12 the series is published in separate numbers, each with an individual price. The reduced prices for members of the Lund Botanical Society are indicated.

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