

Drawings of Scandinavian Plants 100

Chenopodium L.

By Lennart Engstrand and Mats Gustafsson¹

Department of Plant Taxonomy,
University of Lund,
Ö. Vallgatan 18—20,
S-223 61 Lund, Sweden

100. *Chenopodium album* L. 1753

Annual, 10—200 cm high, ascending to erect, rarely prostrate, simple to much-branched. Stem angular, striated, often red-tinged. Leaves alternate, green to greyish, sometimes reddish, in young stages of development farinose, later becoming glabrous to farinose. Lower leaves petiolate, length of petiole very variable, at most as long as lamina, rhombic—ovate to lanceolate, cuneate to attenuate, rarely obtuse at base, lamina length 1—10 cm, breadth 0.5—6 cm, length usually at least 1 1/2 times the breadth. Margins sinuate—dentate to entire, teeth obtuse to acute, outward- to forward-pointing, lowermost lateral teeth usually most prominent, apex obtuse to acute. Upper leaves more or less petiolate, rhombic—ovate to lanceolate, cuneate to attenuate at base, dentate to entire. Flowers situated in rounded to oblong more or less distinct glomerules, forming a more or less leafy, rather loose to compact, spicate inflorescence or a cymosely branched panicle. Flowers perfect, glabrous to farinose, 5-merous. Perianth lobes united at most up to 1/2, ovate, obtuse to acute, green to brownish in the centre, light green to whitish and membranous in the most marginal parts, more or less keeled on the back. At maturity the perianth almost entirely covers the seed. Pistil with a short style and two rather long stigmas

papillate to the base. Stamens 5, rarely 4. Seeds horizontal, black, ovoid to orbicular, 0.8—1.4 mm in diameter, margins obtuse to keeled. Pericarp rather thin, yellowish green to brownish, easily detached from the seed. Testa lustrous, smooth, rugose or with faint, radial furrows. Radicula rather short and broad, closely attached to the seed. Embryo annular.

Flowering time: June to September.

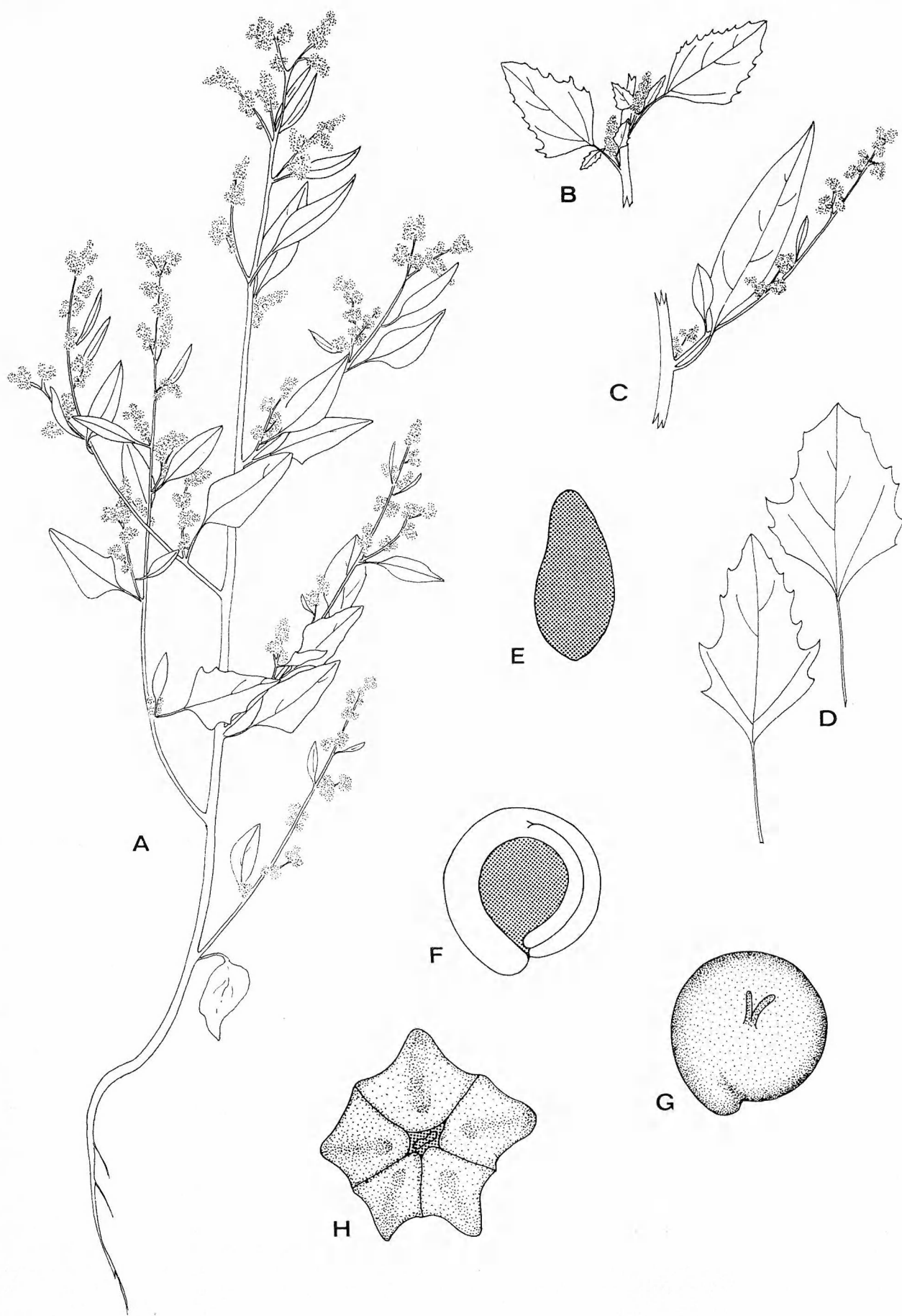
Chromosome number: $2n=18, 36, 54$.

Comments: Certain forms of *C. album* show a morphological similarity to *C. opulifolium*, *C. suecicum* and *C. strictum* respectively (cf. comments under these species and below).

Variation: *C. album* is a very polymorphic species, extremely variable in most characters. In Scandinavia *C. album* is probably represented by native forms growing on shores and on cultivated ground, as well as by foreign recently introduced forms, which have become more or less established on waste ground. The extensive polymorphism can be in part due to the effects of hybridization and introgression between different biotypes and the successful establishment of hybrid derivatives.

In the delimitation of *C. album* most attention has been paid to the features of the leaves and inflorescence. But probably, at least differences in size characters such as height and leaf-length are to a great extent due to modifications. According to AELLEN (1960) some forms keep their

¹ ENGSTRAND is responsible for the drawings and GUSTAFSSON for the text.



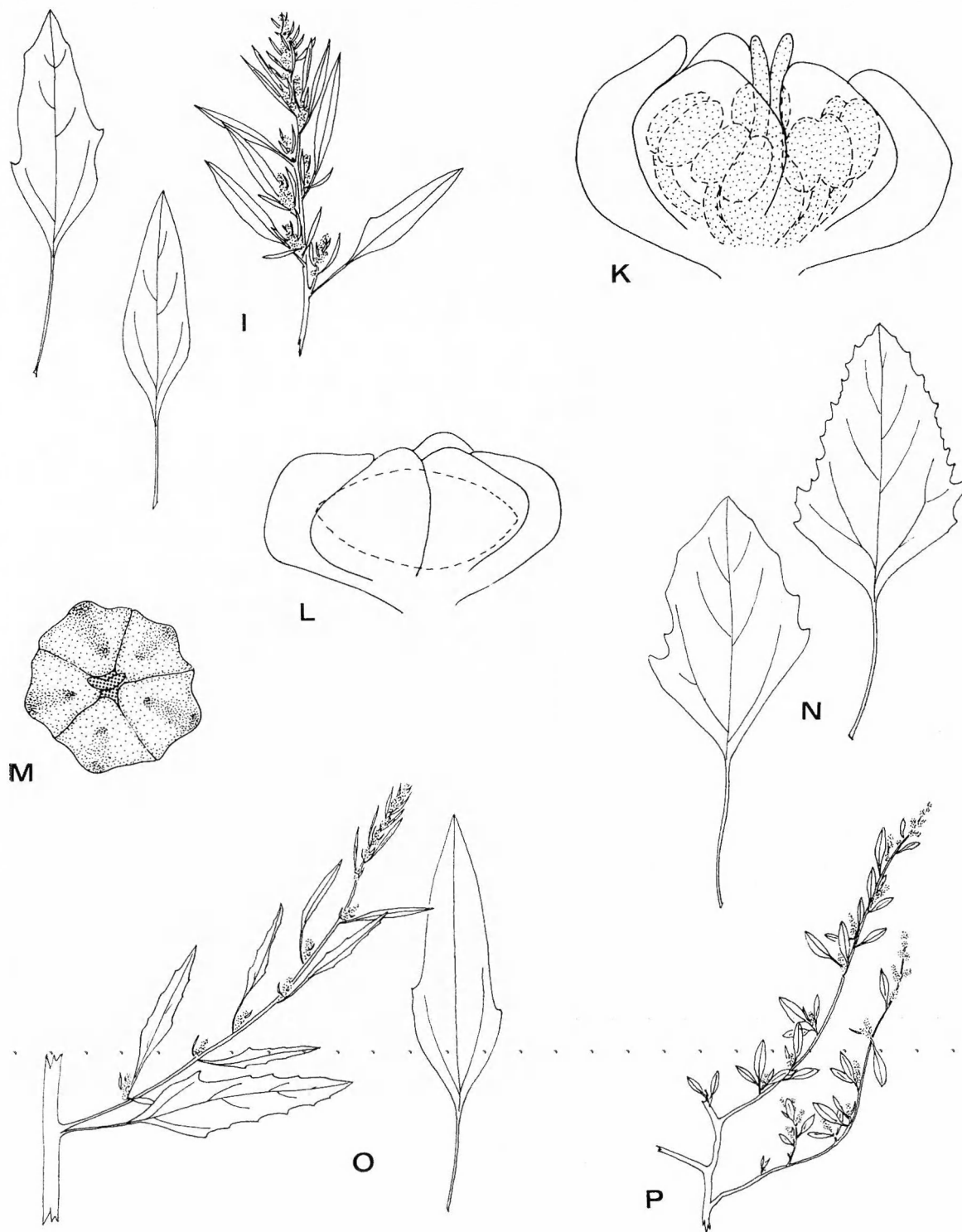


Fig 100. *Chenopodium album* L. — A—H: ssp. *album*. — A: Habit. — B—C: Branches showing the shapes of lower leaves and inflorescences of var. *album*. — D: Shape of lower leaves of var. *borbasii* (MURR.) A. LUDW. — E: Seed in transection. — F: Section through a seed showing the embryo. — G: Fruit. — H: Perianth seen from above. — I: ssp. *densifoliatum* A. LUDW. & AELL.: Shapes of leaves and inflorescence. — K, N: ssp. *fallax* AELL. — K: Hermaphrodite flower. — N: Shape of lower leaves. — L, M, O: ssp. *virgatum* (THUNB.) BLOM. — L: Horizontal fruit enclosed in the perianth. — M: Perianth seen from above. — O: A branch showing the shapes of leaves and inflorescence. — P: ssp. *microphyllum* (BOENNINGH.) STERNER: A branch showing the shapes of leaves and inflorescence. — A—D, I, N—P: $\times 0.5$. — E—G, K—L: $\times 20$. — H, M: $\times 12.5$.

characteristic features as regards leaf-form and inflorescence in cultivation experiments, while other forms are highly modificative and the features vary with the environmental conditions. Obviously, little or no correlation exists between shape of leaves and type of inflorescence on the one hand, and between morphological feature and chromosome number on the other. Thus, the intraspecific variation pattern is extremely complicated and it seems to be impossible to discern it at present. Experimental investigations are highly desirable and may solve some of the problems. The taxonomical treatment of the different forms of *C. album* is a matter of opinion and consequently the delimitation of *C. album* varies with different authors. Seven subspecies have been distinguished in Scandinavia, but transitional forms are common and it is only possible to determine typical specimens. The classification, taxonomic position and distribution of some of the subspecies is rather uncertain (ssp. *diversifolium*, ssp. *ovatum* and ssp. *fallax*).

100 a. *C. album* L. ssp. *album*

Ascending to erect, usually not more than 1 m high, more or less branched, branches usually ascending to erect. Lower leaves greenish, glabrous to farinose, ovate to rhombic, rarely lanceolate, with sinuate—dentate to entire margins, or rarely 3-lobed with two relatively large lateral lobes and a sharply dentate middle lobe. Inflorescence very variable.

Note: Ssp. *album* is very heterogeneous and a number of different forms have been distinguished (for further information see ILJIN 1936 and AELLEN 1960). Var. *borbasii* (MURR.) A. LUDW., which shows a certain morphological similarity to *C. opulifolium* SCHRAD., is characterized by a stout habit, up to 1 m high, $\pm$ 3-lobed, large, mostly more than 4 cm long lower leaves 1—1½ times as long as broad, with dentate margins, lateral lobes with two large main teeth and several others,

mid-lobe with prominent, acute forward-pointing teeth, and often moderately farinose inflorescence.

It has been suggested that var. *borbasii* is of hybrid origin, i.e. it constitutes established derivatives of *C. album* $\times$ *C. opulifolium* (for references see ASCHERSON & GRAEBNER 1919), while other authors consider it to be an exotic form of *C. album* (for references see AELLEN 1960). It is more or less distinguishable from *C. opulifolium* by a combination of the following characters: stouter habit, larger leaves, sometimes longer than broad, sharply dentate margins and often moderately farinose inflorescence.

Habit: Occurring on shores and as a weed on most cultivated and waste ground.

Distribution: Abundant in Europe and Asia, and is represented by regional forms or closely related species in North and South America, South Africa and Australia. Common in the whole of Scandinavia, except the northernmost alpine parts.

100 b. *C. album* L. ssp. *microphyllum*
(BOENNINGH.) STERNER 1938

(Syn. *C. strictum* ROTH. ssp. *microphyllum* (BOENNINGH.) P. M. JÖRG.)

All parts usually smaller than in ssp. *album*. Prostrate to erect, with a much-branched, graceful habit, basal branches rather long and slender, prostrate to ascending. Lower leaves small, mostly ovate to rhombic, cuneate at base, greenish above, greyish and farinose beneath, margins entire to sharply dentate. Upper leaves ovate to lanceolate, more or less entire. Inflorescence erect, spicate and delicate, composed of flowers situated in pearl-like glomerules. Seeds small, about 0.8 mm in diameter.

Habitat and distribution: Sandy places and shores. Distributed from W. Europe to the southern parts of the U.S.S.R., probably originating from this area. In Scandinavia commonest on the islands of Öland and Gotland, relatively rare in other parts of southernmost Scandinavia.

Note: *C. album* ssp. *microphyllum* has been transferred to *C. strictum* ROTH. by P. M. JÖRGENSEN (1974) because of a similar type of inflorescence and late flowering time. However further study is needed to confirm this point.

100 c. *C. album* L. ssp. *densifoliatum*
A. LUDW. & AELLEN 1930

Ascending to erect, up to 1 m high, usually branched, branches rather slender and densely leafy. Lower leaves greenish, elliptical—oblong to lanceolate, at least twice as long as broad, attenuate at base, usually glabrous above, farinose and often with prominent, light veins beneath, margins entire to sparsely dentate, apex acute. Upper leaves lanceolate, entire, acute. Flowers in oblong, rather farinose glomerules, forming a rather compact and conspicuously leafy panicle.

Habitat and distribution: A more or less occasional weed occurring on waste ground. Scattered localities in the southernmost parts of Scandinavia. Origin unknown.

100 d. *C. album* L. ssp. *diversifolium*
AELLEN 1928

Ascending to erect, mostly with a stout more or less branched habit, up to 50 cm high. Lower leaves greenish, often fleshy, ovate to rhombic, about 1 1/2 times as long as broad, base cuneate to attenuate, glabrous to sparsely farinose, mostly with prominent light veins beneath, margins dentate, the lowermost lateral teeth largest. Flowers in oblong, sparsely farinose glomerules forming a more or less leafy panicle.

Habitat and distribution: A more or less occasional weed occurring on waste ground usually close to harbours, factories and mills. Isolated localities in Denmark, Sweden and Norway. Origin unknown.

100 e. *C. album* L. ssp. *ovatum*
AELLEN 1928

Erect to ascending, with a stout and more or less branched habit, 1 to 1 1/2 m

high. Lower leaves greenish, often fairly large, ovate, glabrous to farinose, obtuse or cuneate at base, margins dentate—sinuate to entire. Upper leaves ovate to lanceolate, mostly entire. Flowers clustered in sparsely farinose glomerules, forming a spike-like or paniculate inflorescence.

Habitat and distribution: A more or less occasional weed on waste ground. Isolated localities in the southernmost parts of Scandinavia. Origin unknown.

100 f. *C. album* L. ssp. *fallax*
AELLEN 1928

Ascending to erect, with a stout, branched habit, usually about 1 m high, glabrous to farinose, at maturity often yellowish or reddish. Lower leaves rather large, rhombic to ovate, about 1 1/2 times as long as broad, obtuse to cuneate at base, margins sharply dentate to sinuate, the lowermost teeth largest. Upper leaves rhombic to lanceolate, dentate. Flowers in oblong, sparsely farinose glomerules, forming a rather compact, conspicuously leafy panicle.

Habitat and distribution: A more or less occasional weed on waste ground. Scattered localities in Denmark and southern parts of Sweden. Origin unknown.

100 g. *C. album* L. ssp. *virgatum*
(THUNBERG) BLOM 1938
(Syn. *C. virgatum* THUNBERG.)

Mostly erect, simple to sparsely branched, usually tall, up to 2 m high, glabrous to farinose, often reddish and when dry becoming blackish. Lower leaves oblong to lanceolate, much longer than broad, attenuate at base, entire to sparsely dentate, apex acute. Upper leaves similar. Flowers in oblong, glabrous to sparsely farinose glomerules, forming rather compact, leafy spicate inflorescences.

Habitat and distribution: A more or less occasional weed on most waste ground. Scattered localities in the southern parts of Scandinavia. Native to the eastern parts

of Asia. In Scandinavia a fairly distinct subspecies, but in Asia with morphological transitions towards *C. strictum* (AELLEN 1960).

LITERATURE CITED

- AELLEN, P. 1960. *Chenopodium*. — In HEGI, Illustrierte Flora von Mitteleuropa, 2. Aufl. III(2). — München.
- ASCHERSON, P. & GRAEBNER, P. 1919. Synopsis der Mitteleuropäischen Flora, V:I. — Leipzig.
- ILJIN, M. M. 1936. *Chenopodium*. — In KOMAROV, Flora SSSR VI. — Leningrad.
- JÖRGENSEN, P. M. 1973. The genus *Chenopodium* in Norway. — Norwegian Journ. Bot.: 303—319.

Cytology and Morphology of the Genus *Hyacinthus* L. s. str. (Liliaceae)

Bengt Bentzer, Roland von Bothmer
and Per Wendelbo

BENTZER, B., BOTHMER, R. VON & WENDELBO, P. 1974 11 28. Cytology and morphology of the genus *Hyacinthus* L. s. str. (Liliaceae). — Bot. Notiser 127: 297—301. Lund. ISSN 0006-8195.

The genus *Hyacinthus* comprises 3 species, viz. *H. orientalis* L. ($2n=16$) from SE Europe and SW Asia, *H. litwinowii* E. CZERNJAK ($2n=18$) and *H. transcaspicus* LITW. ($2n=18$), the last two from NE Iran and Turkmenistan. Compared with the two other species *H. orientalis* is a derived species adapted to myrmecochory. Its somewhat deviating karyotype may be explained by a change due to an unequal reciprocal translocation and the subsequent elimination of a resulting small chromosome.

Bengt Bentzer and Roland von Bothmer, Department of Plant Taxonomy, University of Lund, the Wallenberg Laboratory, Fack 7031, S-220 07 Lund, Sweden. Per Wendelbo, Department of Plant Geography, University of Göteborg, Carl Skottsbergs Gata 22, S-413 19 Göteborg, Sweden. (Present address: Ariamehr Botanical Garden, P.O. Box 8-6096, Tehran, Iran.)

INTRODUCTION

The genus *Hyacinthus* L. has had a somewhat complicated history. In the original sense of LINNAEUS (1753) it consisted of no less than 12 species, 11 of which are now referred to a wide range of other genera. In the standard treatment for *Natürlichen Pflanzenfamilien* (KRAUSE 1930) it was treated as a 'medium-sized' genus with 5 sections, but 4 of these, *Bellevallia*, *Hyacinthella*, *Periboea* and *Strangweya*, are now mostly treated as separate genera, and partly even further split. *Hyacinthus* in the strict sense is then left with only three species, i.e. *H. orientalis* L., the type species, found in SE Europe and SW Asia, and the two little-known species, *H. litwinowii* E. CZERNJAK and *H. transcaspicus* LITW. (syn. *H. kopetdaghi* E. CZERNJAK) both from NE Iran and Turkmenistan (for descriptions, see LOSINA-LOSINSKAJA 1935).

The chromosomes of *H. orientalis* ($2n=16$) have been studied extensively, but apparently only in material of different cul-

tivars (for references, see NAITHANI 1937, FEDOROV 1969). *H. litwinowii* ($2n=18$) has previously been studied by DYER (1963) who constructed an idiogram of the chromosomes and by GRIF (in BARANOVA 1965) who was also the first to study the cytology of *H. transcaspicus* ($2n=18$).

MATERIAL AND METHODS

Cytological observations were made on material cultivated in the Botanical Garden of Göteborg. The origin of the material is given in Table 1.

The usual squash method with Feulgen staining was used (cf. BOTHMER 1970). The root tips were pretreated in a mixture of 0.6 % colchicine and 2 mM 8-hydroxyquinoline for about 2 hours. The idiograms are based on 10 good metaphase plates. The karyological terminology follows LEVAN et al. (1965).

RESULTS

Morphologically *H. orientalis* is clearly distinguished from the two other members of the genus in having a large elaiosome

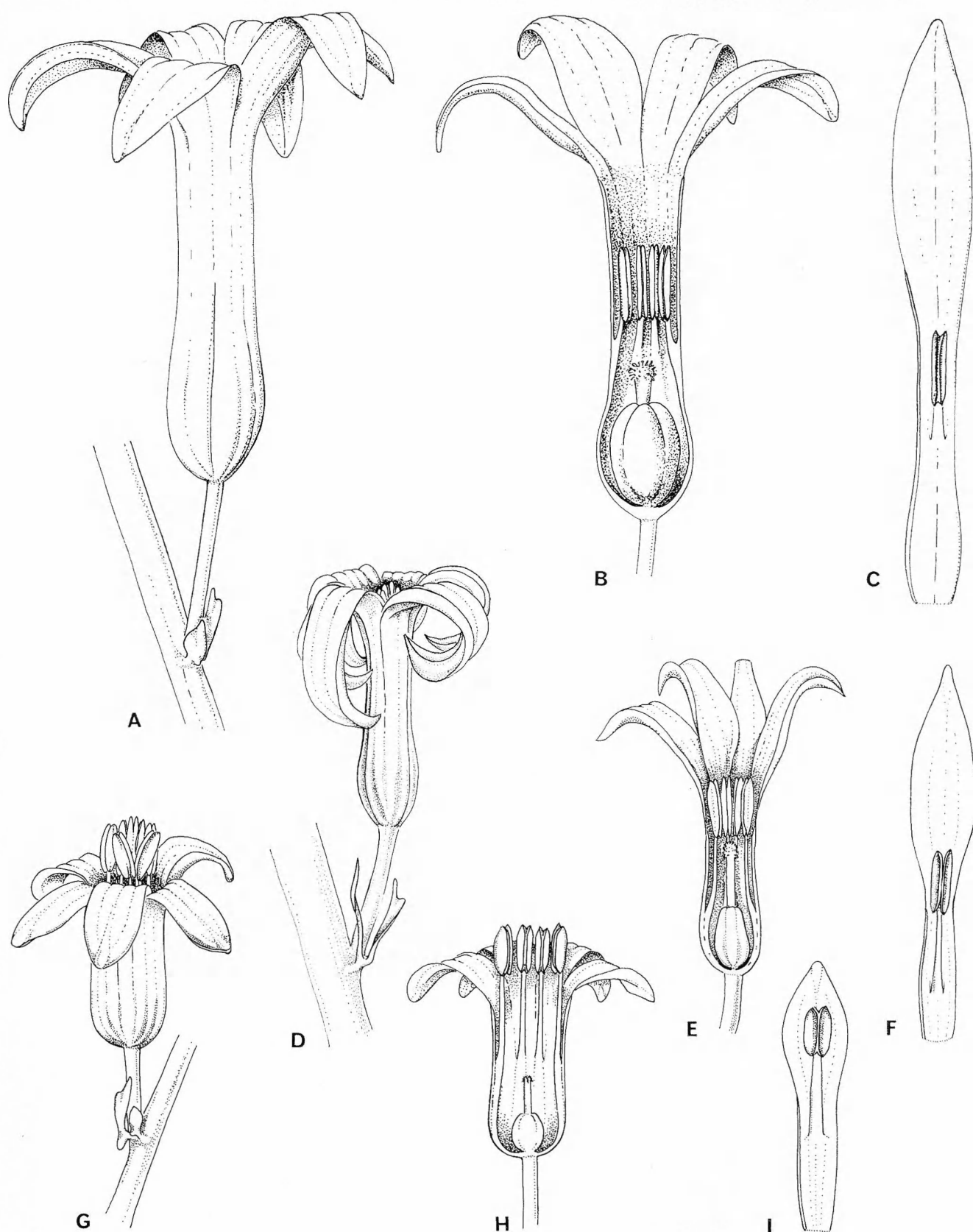


Fig. 1. Perigone with pedicel and bracts, perigone split open and segment with stamen of the three *Hyacinthus* species. — A—C: *H. orientalis*, Italy, near Venetia, FRIGO leg. (GB). — D—F: *H. litwinowii*, Iran, FURSE 7394, cult. — G—I: *H. transcaspicus*, Iran, FURSE 7179, cult. — All $\times 2.8$. ENAR SAHLIN del.

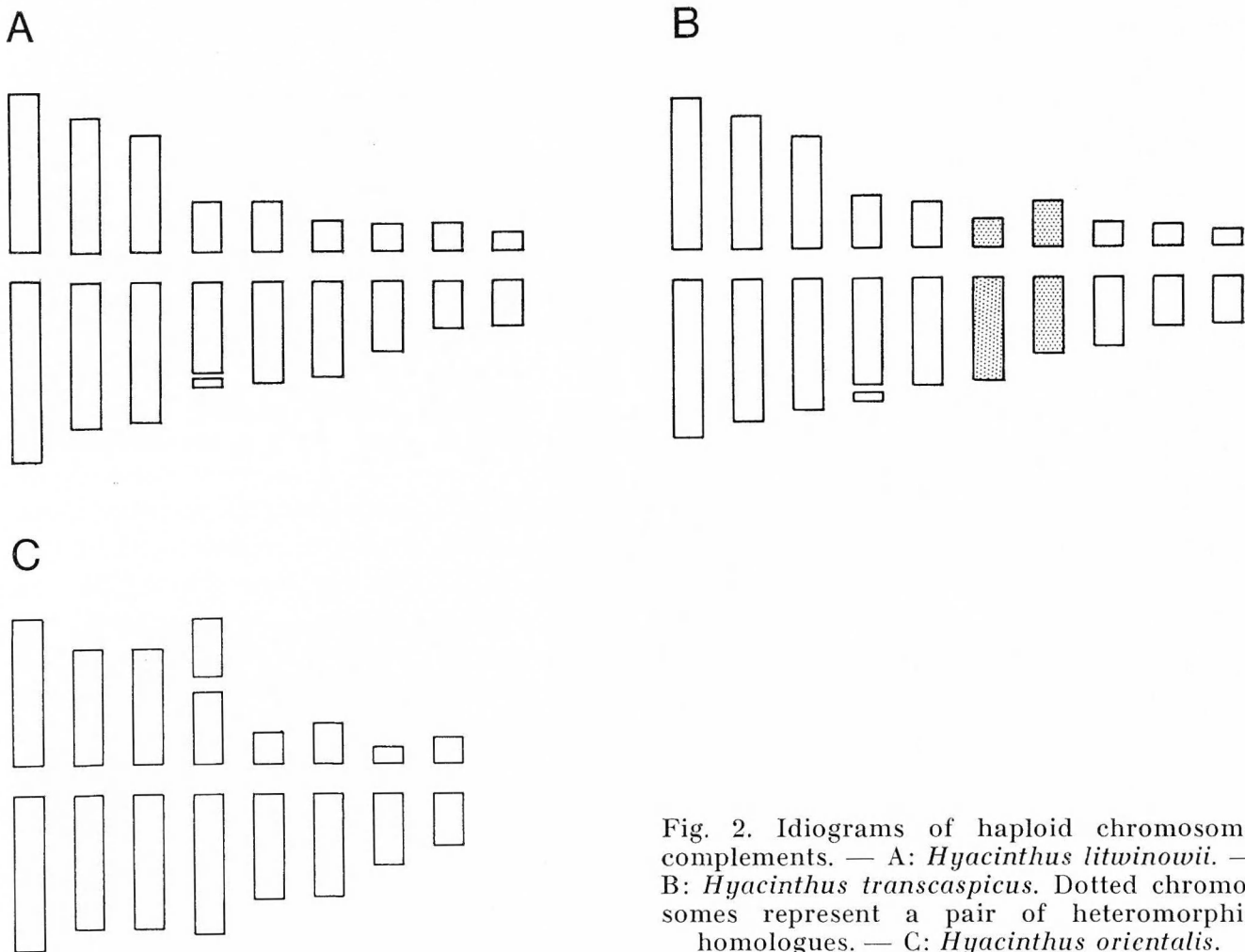


Fig. 2. Idiograms of haploid chromosome complements. — A: *Hyacinthus litwinowii*. — B: *Hyacinthus transcaspicus*. Dotted chromosomes represent a pair of heteromorphic homologues. — C: *Hyacinthus orientalis*.

developed on the seed and in the weak fruiting stem. *H. litwinowii* shares with *H. orientalis* the perigone with a more or less tubular-urceolate tube and comparatively long, recurved segments. The perigone of *H. transcaspicus* has a cylindrical

tube and patent lobes as well as exerted anthers (Fig. 1). *H. orientalis* has several linear leaves whereas the two other species have 2—3 comparatively short and broad erect leaves. All three species share the character of having a subspherical,

Table 1. Chromosome numbers and localities of investigated spontaneous material of *Hyacinthus*.

Species	2n	Collection no.	Locality
<i>H. orientalis</i>	16	Izmir no. 2	Turkey: Manesa: 21 km SW of Sinderge, 430 m.
	16	Izmir no. 166	Turkey: exact locality not known.
	16	Izmir no. 222	Turkey: exact locality not known.
<i>H. litwinowii</i>	18	PF 7394	Iran: Kopet Dagħ, E of Gulestan Forest to Bojnurd. Coll. P. FURSE.
	18	PF 7531	Iran: Eastern Elburz, S of Quchan on road to Sultanabad. Coll. P. FURSE.
<i>H. transcaspicus</i> ..	18	PF 7179	Iran: Eastern Elburz, Gorgan to Shahrud, N of the pass. Coll. P. FURSE.

Collections nos. 2, 166, 222 obtained from Dr E. KJELLQUIST, Izmir.

rather fleshy capsule similar to that found in *Scilla*, for example, and very different to that of the *Bellevalia-Muscari* complex.

The chromosome numbers for the three species are given in Table 1. The haploid complements of both *H. litwinowii* and *H. transcaspicus* consist of 3 long m chromosomes, 3 medium-sized sm-st chromosomes and 3 short sm chromosomes (Fig. 2). All the chromosome pairs can easily be distinguished on their r-value (arm index), relative length or satellite attachment. The difference in length between the long and the medium-sized chromosomes is more pronounced in *H. litwinowii* than in *H. transcaspicus*. In both species satellites are attached to one pair of the medium-sized chromosomes. The plant of *H. transcaspicus* which was used for constructing the idiogram has a structural heterozygosity in one of the medium-sized pairs (Fig. 2 B) possibly owing to a pericentric inversion or to a shift. On the whole the chromosomes of the two species are very similar.

H. orientalis has a haploid complement consisting of 4 long m chromosomes, 2 medium-sized sm-st chromosomes and 2 short sm-st chromosomes (Fig. 2 C). Satellites are lacking on the medium-sized sm-st chromosomes but secondary constrictions appear in a more or less median position on the short arm of one pair of the long m chromosomes. The chromosome complement of our spontaneous material agrees closely with that of cultivated diploid varieties.

DISCUSSION

The weak stem and the elaiosome developed on the seed of *H. orientalis* are the most typical features belonging to the syndrome of characters for myrmecochory. From a phylogenetic point of view myrmecochory within a genus must be considered a marked form of specialization. Thus *H. orientalis* must be considered a specialized and advanced species compared with the two other ballistic members of the genus.

The chromosome morphology of the three species is very similar in general appearance in spite of the difference in chromosome number. Judging from the chromosome morphology of *H. orientalis* one can theoretically explain its deviating number by assuming that a translocation has taken place. In chromosome sets like those of *H. litwinowii* and *H. transcaspicus* with $2n=18$, an unequal reciprocal translocation may have occurred in which most of the long arm of a short sm-st chromosome has changed places with a minute part of the short arm of a medium-sized sm-st chromosome. In this way the medium-sized chromosome would be transferred to the group of long chromosomes while the resulting minute chromosome may have been eliminated. Processes involving a similar decrease in basic chromosome numbers via translocations have been shown in *Crepis* (TOGBY 1943, SHERMAN 1946), for example.

In spite of cytological and morphological differences, in particular between *H. orientalis* and *H. litwinowii*—*H. transcaspicus*, the species must be considered related and should be kept within the same genus. The cytological results corroborate the conclusion drawn from the morphological comparison, i.e. that compared with the two other species *H. orientalis* is derived.

LITERATURE CITED

- BARANOVA, M. V. 1965. Giatsint. — Moskva-Leningrad. Acc. to FEDOROV (see below).
 BOTHMER, R. VON 1970. Cytological studies in *Allium* 1. Chromosome numbers and morphology in sect. *Allium* from Greece. — Bot. Notiser 123: 519—551.
 DYER, A. F. 1963. Allocyclic segments of chromosomes and the structural heterozygosity that they reveal. — Chromosoma (Berl.) 13: 545—576.
 FEDOROV, A. A. (ed.) 1969. Chromosome numbers in flowering plants. — Leningrad.
 KRAUSE, K. 1930. Hyacinthus. — In A. ENGLER (ed.): Die Natürlichen Pflanzenfamilien 15 a: 346—347.
 LEVAN, A., FREDGA, K. & SANDBERG, A. A. 1965. Nomenclature for centromeric position on chromosomes. — Hereditas 52: 201—220.

- LINNAEUS, C. 1753. *Species plantarum*, 1. — Holmiae.
- LOSINA-LOSINSKAJA, A. S. 1935. *Hyacinthus*. — In V. L. KOMAROV (ed.): *Flora of the U.S.S.R.* 4: 311—312, Israel progr. for scientific transl. Jerusalem 1968.
- NAITHANI, S. P. 1937. Chromosome studies in *Hyacinthus orientalis* L. I. The somatic chromosomes. — *Annals of Botany N.S.* 1: 129—147.
- SHERMAN, M. 1946. Karyotype evolution: a cytogenetic study of seven species and six interspecific hybrids of *Crepis*. — *Univ. Calif. Publ. Bot.*, 18: 369—408.
- TOBGY, H. A. 1943. A cytological study of *Crepis fuliginosa*, *C. neglecta*, and their F_1 hybrid, and its bearing on the mechanism of phylogenetic reduction in chromosome number. — *Journ. Genetics* 45: 67—111.

Zytotaxonomische Beiträge zur Flora von Kreta I

D. Phitos und G. Kamari

PHITOS, D. & KAMARI, G. 1974 11 28. Zytotaxonomische Beiträge zur Flora von Kreta I. — Bot. Notiser 127: 302—308. Lund. ISSN 0006-8195.

The chromosome numbers for 15 taxa are published, 11 of them from Crete. Numbers were published for the first time in *Euphorbia dimorphocaulon* ($2n=18$), *Bolanthus creutzburgii* ($2n=20$), *B. graecus* ($2n=20$), *Ebenus sibthorpii* ($2n=14$), *Veronica thymifolia* ($2n=16$), *Scabiosa sphaciotica* ($2n=18$), *Crepis sibthorpiana* ($2n=8$), *C. auriculaefolia* ($2n=10$), *Lactuca acanthifolia* ($2n=18$), and *L. eburnea* ($2n=18$). The chromosome number $2n=20$ was found for the first time in *Narcissus serotinus*. Cytotaxonomy and phylogeny of some of the taxa mentioned are briefly discussed.

D. Phitos and G. Kamari, Botanical Institute, University of Patras, Patras, Greece.

In der vorliegenden Arbeit werden die ersten zytotaxonomischen Untersuchungsergebnisse der Flora von Kreta, mit deren Studium das Botanische Institut der Universität Patras begonnen hat, vorgelegt. Während der letzten vier Jahre haben wir wiederholt auf der Insel Kreta Exkursionen durchführen können, auf denen wir reichlich Material für unsere Untersuchungen sammelten. Die vorliegenden Ergebnisse beruhen auf der Untersuchung eines Teiles des von uns gesammelten Materials.

Die untersuchten Pflanzen (Tab. 1) wurden entweder aus Samen gezogen oder in der Natur lebend gesammelt; in diesem Fall wird die betreffende Pflanze mit einer bestimmten Kulturnummer (Kult.) zitiert. In den meisten Fällen wurde zur Vorbehandlung 8-Hydroxychinolin verwendet; nur bei den Monocotyledonen haben wir eine Mischung von 8-Hydroxychinolin und 0,2 % Colchizin im Verhältnis 1:1 benutzt. Die Färbung wurde immer mit der Feulgen-Methode durchgeführt.

In all den Fällen, wo wir glauben, dass es zum Verständnis der taxonomischen bzw. phylogenetischen Probleme der untersuchten kretischen Sippen beiträgt, bringen wir auch einige Bemerkungen über verwandte

Sippen oder Pflanzen aus benachbarten Gebieten.

Herrn Prof. Dr. J. DAMBOLDT (Berlin) danken wir herzlich für seine vielfältige Hilfe. Unsere besten Dank sprechen wir auch der Nationalen Forschungsförderung für die Unterstützung dieser Studien aus.

1. *Euphorbia dimorphocaulon* P. H. DAVIS
2. *E. apios* L.

Innerhalb der Gattung *Euphorbia* bilden *E. dimorphocaulon* und *E. apios* ein Artenpaar, das besonders durch die geophytische Lebensweise (Auftreten von rübenförmigen Wurzeln) gekennzeichnet ist. In ihren spezifischen Merkmalen unterscheiden sich jedoch beide Arten sehr klar und auch ihre Verbreitungsareale sind verschieden. *E. dimorphocaulon* ist bis heute nur auf Kreta und Cypern bekannt, während *E. apios* im südöstlichen Italien, der Balkanhalbinsel, Türkei, Syrien und Libanon verbreitet ist.

Die zytologischen Verhältnisse beider Arten sind sehr interessant. Für *E. dimorphocaulon* beträgt die Chromosomenzahl, die hier das erste Mal mitgeteilt wird, $2n=18$ Chromosomen (Abb. 1 A). Die zytologischen Angaben über *E. apios* sind

Tabelle 1. Liste der zytologisch untersuchten Pflanzen. — KA=KAMARI; PH=PHITOS; Kult.=Kulturnummer.

Taxon	Herkunft	Probe- nummer	Chromo- somenzahl (2n)
<i>Euphorbia dimorphocaulon</i> P. H. DAVIS	Ins. Creta: Prov. Lasithi, supra pagum Ano Elounta, ca 600 m.	Kult 385	18
<i>E. apios</i> L.	Stereia Hellas: Prov. Attiki, mons Hymittos, in declivibus orienta- libus, ca 500 m.	Kult. 516, 517	14 14
	Peloponnisos: Prov. Achaia, mons Panachaikon, in declivibus bo- realibus, 700 m.	Kult. 137, 138	14 14
<i>Bolanthus creutzburgii</i> GREUTER ...	Ins. Creta: montes Psiloritis, 1800 m.	Kult. 360	20
<i>B. graecus</i> (SCHREBER) BARKOUDAH	Stereia Hellas: Prov. Attiki, mons Parnis, 1050 m.	PH 11461	20
<i>Ebenus cretica</i> L.	Ins. Creta: Prov. Iraklion, prope Knossos	Kult. 521	14
<i>E. sibthorpii</i> DC	Stereia Hellas: Prov. Attiki, in di- tione pagi Alepochorion	KA 151	14
<i>Veronica thymifolia</i> S. & S.	Ins. Creta: montes Psiloritis 1980 m.	Kult. 522	16
<i>Scabiosa sphaciotica</i> ROEM. & SCHULT.	Ins. Creta: montes Psiloritis, in cacumine Chalasokephala, 1970 m.	PH 12110	18
<i>Crepis sibthorpiana</i> BOISS. & HELDR.	Ins. Creta: montes Psiloritis, in cacumine Chalasokephala, 1970 m.	PH 12109	8
<i>C. auriculaefolia</i> SIEBER	Ins. Creta: Prov. Hagios Vasilios, supra pagum Asomatos, ca 400 m.	KA 260	10
<i>C. incana</i> S. & S.	Peloponnisos: Prov. Achaia, mons Panachaikon, 1600 m.	PH 12104	8
<i>Leontodon tuberosus</i> L.	Ins. Creta: Prov. Lasithi, supra pagum Ano Elounta, ca 600 m.	PH 12108	8
<i>Lactuca acanthifolia</i> (WILLD.) BOISS.	Ins. Creta: Prov. Rethymnon, prope pagum Episkopi	Kult. 448	18
<i>L. eburnea</i> RECH. FIL.	Ins. Rhodos: supra pagum Salakos	Kult. 22	18
<i>Steptorhamphus tuberosus</i> (JACQ.) GROSSH.	Ins. Creta: Prov. Chania, in fau- cibus Samaria	KA 12098	16
<i>Narcissus serotinus</i> L.	Ins. Creta: Prov. Amari; supra pagum Vryses	Kult. 271, 272	20 20
	Ins. Pyrgousa (Dodekanisos)	Kult. 520	20

davon verschieden und z.T. etwas wider-
sprüchlich. KOŽUHAROV & KUZMANOV (1964)
geben für Pflanzen aus dem Piringebirge
(Bulgarien) die Chromosomenzahl von
 $2n=12$ an. 1967 hat CESCA in einer seiner
ausführlichen Arbeiten über die Gattung
Euphorbia bei Pflanzen aus Süditalien die
Chromosomenzahl von $2n=28$ gefunden.
In dem Versuch, die abweichende Chro-
mosomenzahl von KOŽUHAROV & KUZMA-
NOV zu erklären, schliesst CESCA einerseits
einen Fehler der erwähnten Autoren nicht

aus, lässt aber andererseits die Möglichkeit
offen, dass bei *E. apios* in der Tat eine
zytologische Differenzierung vorliegt. Auf
jeden Fall ist es sehr interessant, dass die
von uns bis heute untersuchten Populatio-
nen aus verschiedenen Gebieten Griechen-
lands (siehe auch DAMBOLDT & PHITOS 1971)
einheitlich die diploide Chromosomenzahl
von $2n=14$ besitzen (Abb. 1 E). Unsere
Ergebnisse passen sehr gut zu den Befun-
den von CESCA, indem die griechischen
Pflanzen als diploid, die süditalienischen



als tetraploid zu bezeichnen sind. Ein Vergleich der Karyotypen der griechischen und der italienischen Pflanzen zeigt trotz unterschiedlicher Methodik, die Existenz aller Chromosomentypen. Weitere Untersuchungen an diploiden und tetraploiden Pflanzen sind nötig, um auf Grund möglicher vorhandener morphologischer Unterschiede zu einer neuen taxonomischen Gliederung zu kommen.

3. *Bolanthus creutzburgii* GREUTER

4. *B. graecus* (SCHREBER) BARKOUDAH

Die taxonomische Stellung der Gattung *Bolanthus* gegenüber den nahe verwandten Gattungen *Gypsophila* und *Saponaria* ist schon von BARKOUDAH (1962) aufgeklärt worden. Für die Gattung *Bolanthus* werden in dieser Arbeit zum ersten Mal Chromosomenzahlen angegeben und zwar für *B. creutzburgii* und *B. graecus*, bei denen wir je $2n=30$ Chromosomen gefunden haben (Abb. 1 D). Die Chromosomenzahlen unterstützen, unserer Ansicht nach, die Auffassung von BARKOUDAH, *Bolanthus* als eigene Gattung zu führen. Ausserdem kommt auf Grund vieler verschiedener Zählungen bei *Gypsophila* und *Saponaria* die Chromosomenzahl von $2n=28$ vor. Ausnahmen bilden allerdings bei *Gypsophila* die asiatischen Arten *G. cerastioides* mit $2n=30$ und *G. elegans* mit $2n=26$ (WENGER-RAZINE 1969). Auf jeden Fall stellen die hier angegebenen Chromosomenzahlen für die Gattung *Bolanthus* einen Beitrag zur Kenntnis und der taxonomischen Stellung dieser Gattung dar. Von den untersuchten Arten ist *B. graecus* in Griechenland weiter verbreitet und wird auch für Bulgarien als *Gypsophila thymifolia* SIBTH. & SM. (JORDANOV 1966) angegeben. Im Gegensatz dazu ist *B. creutzburgii* eine

sehr charakteristische, endemische Art der Hochgebirge Kretas.

5. *Ebenus cretica* L.

6. *E. sibthorpii* DC.

Die Gattung *Ebenus* ist in Griechenland durch die zwei Arten *E. cretica* und *E. sibthorpii* vertreten. *E. cretica* ist eine endemische, aber weitverbreitete Art auf Kreta. Die Chromosomenzahl von $2n=14$ wurden schon von FRAHM-LELIVELD (1957) und MIÈGE & GREUTER (1973) bestimmt. Wir haben bei dieser Art die gleiche Chromosomenzahl gefunden (Abb. 1 C). *E. sibthorpii* ist morphologisch aber auch geographisch, von der ersten Art sehr deutlich geschieden. Ihr Verbreitungsareal umfasst Thessalien, Sterea Hellas und die Insel Euböa. Diese Art ist hier zum ersten Mal untersucht worden; ihre Chromosomenzahl beträgt ebenfalls $2n=14$ (Abb. 1 B). Ein Vergleich der Karyotypen beider Arten zeigt, dass z.T. unterschiedliche Chromosomen vorkommen. So sind z.B. im Karyogramm von *E. cretica* zwei sehr langen Chromosomenpaare, die fast doppelt so lang wie die längsten Paare von *E. sibthorpii* sind. Demgegenüber zeigt sich eine Ähnlichkeit der Karyotypen besonders im Auftreten je eines SAT-Chromosomenpaares mit einem grossen Satelliten bei beiden Arten:

7. *Veronica thymifolia* S. & S.

Es handelt sich um eine endemische Art Griechenlands die nach „Flora Europaea“ auf der Insel Kreta und dem südlichen griechischen Festland verbreitet ist. Die Chromosomenzahl von $2n=16$ wird hier zum ersten Mal mitgeteilt (Abb. 1 G).

Abb. 1. Wurzelspitzenmitosen von: A: *Euphorbia dimorphocaulon* ($2n=18$). — B: *Ebenus sibthorpii* ($2n=14$). — C: *Ebenus cretica* ($2n=14$). — D: *Bolanthus graecus* ($2n=30$). — E: *Euphorbia apios* ($2n=14$). — F: *Scabiosa sphaciotica* ($2n=18$). — G: *Veronica thymifolia* ($2n=16$). — H: *Lactuca acanthifolia* ($2n=18$). — I: *Leontodon tuberosus* ($2n=8$). — J: *Crepis auriculaefolia* ($2n=10$). — K: *Steptorhamphus tuberosus* ($2n=16$).

8. *Scabiosa sphaciotica* ROEM. & SCHULT.

Diese auf Kreta endemische Art teilt sich nach RECHINGER (1943) in zwei geographische Sippen, von denen die subsp. *sphaciotica* auf die Lefka-ori beschränkt ist, während die subsp. *decalvans* im Psiloriti- und auch im Lassithi-Gebirge vorkommt. Unsere Pflanzen aus dem Psiloriti-Gebirge, stimmen jedoch mit den Merkmalen von subsp. *decalvans*, die nach der Beschreibung dieser Sippe als var. *decalvans* (HALÁCSY 1901) „caules glabri, folia et involucra parce adpresse hirta“ haben soll, nicht ganz überein. Wir führen unsere Pflanzen daher nur mit dem Artnamen an. Die zytologische Untersuchung ergab die Chromosomenzahl von $2n=18$. In der Abb. 1 F kann man in der abgebildeten Platte nur zwei B-Chromosomen erkennen, während in Prophasen mehrere B-Chromosomen einwandfrei beobachtet wurden. Zu erwähnen ist auch noch die Existenz eines Paares von SAT-Chromosomen mit charakteristischen, grossen Satelliten. Nach EHRENDORFER (1964) soll die Grundzahl für die Gattung *Scabiosa* $x=9$ sein, so dass unsere Pflanzen als diploid zu bezeichnen sind.

9. *Crepis sibthorpiana* BOISS. & HELDR.

10. *C. auriculaefolia* SIEBER

Crepis sibthorpiana ist eine charakteristische, leicht kenntliche Art der montanen und alpinen Stufe der Insel Kreta. Von BABCOCK (1947) ist sie zu Recht von der peloponnesischen Sippe *C. taygetica* BABCOCK unterschieden worden, während HAYEK (1927) beide Sippen als Unterarten von *C. divaricata* BOISS. & HELDR. führt. Neben den unterschiedlichen morphologischen Merkmalen zeigt die zytologische Untersuchung, dass *C. sibthorpiana* diploid mit $2n=8$ ist (Abb. 2 B). Dagegen ist *C. taygetica* nach BABCOCK (1947) „a modified octoploid with $x=5$ “.

Ein Vergleich der Karyotypen von *C. sibthorpiana* und der tetraploiden Pflan-

zen von *C. incana* S. & S. (BABCOCK 1947) zeigt, dass das ganze Chromosomenkomplement von *C. sibthorpiana* bei *C. incana* anzutreffen ist. Ausserdem besitzen die von uns untersuchten *C. incana*-Pflanzen vom Panachaikon (N. Peloponnes) einen diploiden Karyotyp ($2n=8$), der völlig mit dem von *C. sibthorpiana* übereinstimmt (Abb. 2 C). Man kann daher auch auf Grund gewisser morphologischer Ähnlichkeit annehmen, dass die tetraploide *C. incana* in einem phylogenetischen Zusammenhang mit der diploiden *C. sibthorpiana* steht. Auf jeden Fall wären weitere zytologische Untersuchungen der heute als *C. incana* bezeichneten Pflanzen, die diploide und tetraploide Populationen umfassen, wünschenswert, um vielleicht zu einer besseren taxonomischen Erfassung und Wertung der verschiedenen Zytotypen innerhalb dieser Art zu kommen.

Eine andere endemische *Crepis*-Art Kretas ist *C. auriculaefolia*. Die von uns untersuchten Pflanzen, können nach ihren morphologischen Merkmalen als typische *C. auriculaefolia* bezeichnet werden; sie haben $2n=10$ Chromosomen (Abb. 1 J). Nach RECHINGER (1943) erscheint die Trennung der *C. raulini* BOISS., die ebenfalls auf Kreta endemisch ist, von *C. auriculaefolia* problematisch. Auf jeden Fall stimmt der Karyotyp der von uns untersuchten *C. auriculaefolia*-Pflanzen mit dem von BABCOCK für *C. raulini* gegeben überein. Den einzigen Unterschied zwischen beiden Karyotypen bildet das SAT-Chromosomenpaar, das bei *C. auriculaefolia* das längste Paar ist.

11. *Leontodon tuberosus* L.

Für diese weitverbreitete Art ist hier wieder die schon bekannte Chromosomenzahl von $2n=8$ (Abb. 1 I) gefunden worden (DAMBOLDT & PHITOS 1971, FERNANDES & QUEIROS 1971). Das Karyogramm zeigt eine grosse Übereinstimmung mit dem von *L. graecus* BOISS. & HELDR. (PHITOS & DAMBOLDT 1971).

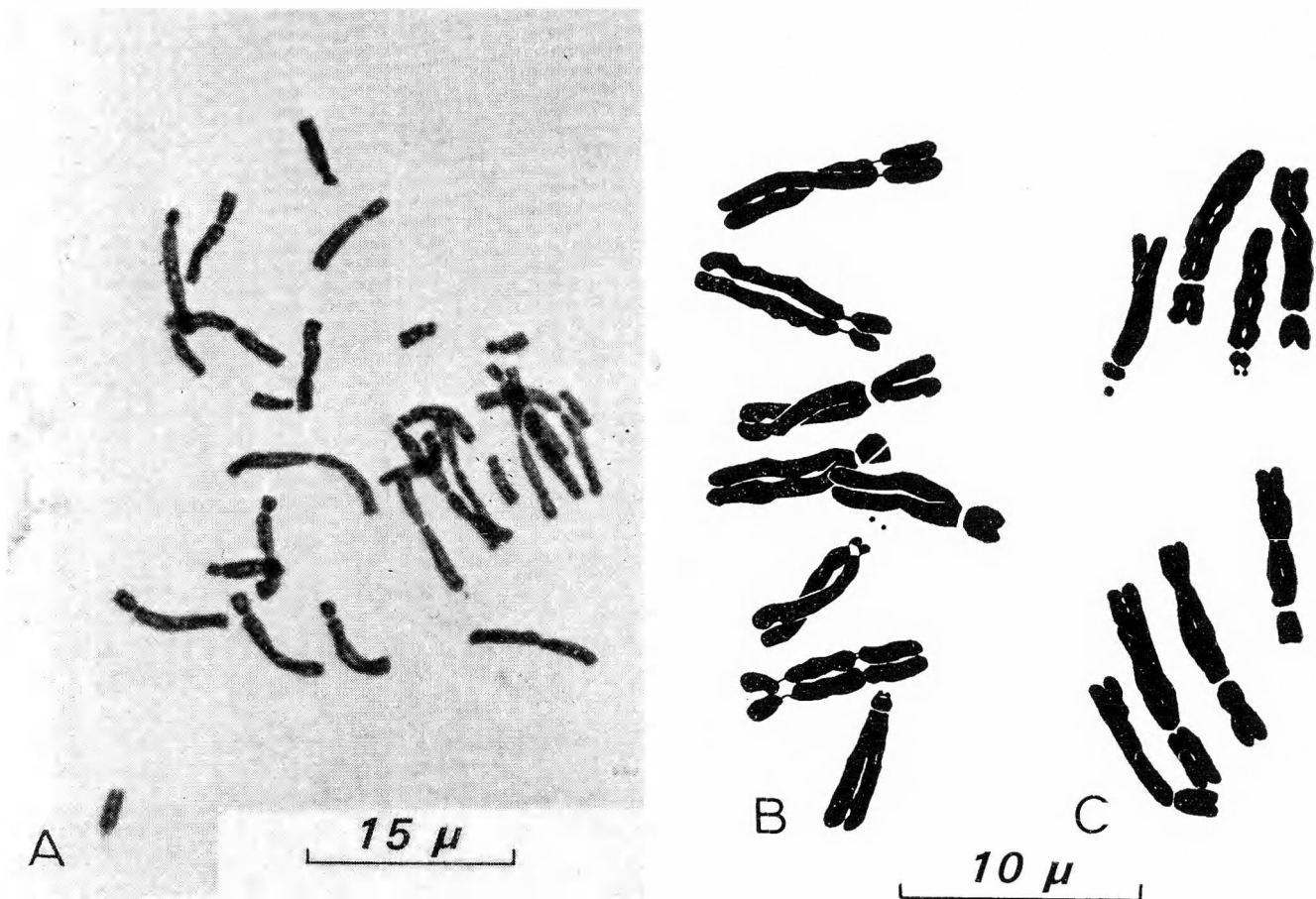


Abb. 2. Wurzelspitzenmitosen von: A: *Narcissus serotinus* ($2n=30$). — B: *Crepis sibthorpiana* ($2n=8$). — C: *Crepis incana* ($2n=8$).

12. *Lactuca acanthifolia* (WILLD.) BOISS.
13. *L. eburnea* RECH. FIL.

Diese Art ist an mehreren Stellen im südlichen Teil Kretas gefunden worden und wahrscheinlich noch weiter auf anderen ägäischen Inseln verbreitet. Die Chromosomenzahl ($2n=18$) von *L. acanthifolia* wird hier zum ersten Mal mitgeteilt (Abb. 1 H). Die Chromosomenzahlen von $2n=18$ und $2n=16$ sind die häufigsten Zahlen, die innerhalb der Gattung *Lactuca* gefunden worden sind (FEDOROV 1969, MOORE 1973). Als Basiszahl dieser Gattung können wir $x=8$ und $x=9$ betrachten. Interessant ist der Karyotyp der von uns untersuchten kretischen Pflanzen, die aus drei verschiedenen Populationen stammen. Besonders bemerkenswert ist ein Paar Chromosomen, das wesentlich grösser als die übrigen ist, die alle eine graduelle „Ver-

kleinerung“ zeigen. Anzumerken ist noch die Existenz von wenigstens 2 akzessorischen Chromosomen, die gerade in den frühen Prophasen gut zu beobachten sind. Die von uns untersuchten Pflanzen von *L. eburnea*, einer endemischen Art der Insel Rhodos, haben nicht nur die gleiche Chromosomenzahl ($2n=18$) wie *L. acanthifolia*, sondern stimmen auch im Karyotyp am meisten überein. Weitere vergleichend morphologische Untersuchungen werden sehr wahrscheinlich die Identität dieser beiden Sippen ergeben.

14. *Steptorhamphus tuberosus* (JACQ.)
GROSSH. (*Lactuca cretica* DESF.)

Für diese weitverbreitete Art können wir die schon bekannte Chromosomenzahl von $2n=16$ (Abb. 1 K) bestätigen (FEDOROV 1969).

15. *Narcissus serotinus* L.

Die zytologischen Verhältnisse dieser an den Küsten des Mediterrangebietes und der atlantischen Küste von Marokko und der iberischen Halbinsel weitverbreiteten Art, sind auf Grund einer Reihe von ausführlichen Arbeiten von FERNANDES (besonders 1943, 1969) gut bekannt. Nach diesen Arbeiten kennt man bis heute diploide ($2n=10$) und hexaploide ($2n=30$) Populationen. Die von uns untersuchten Pflanzen von den Inseln Kreta und Pyrgousa (Dodekanes) sind dagegen tetraploid mit $2n=20$ Chromosomen (Abb. 2 A). Auffällig ist im Gegensatz zu der sonst bekannten Variabilität der Karyotypen, die Ähnlichkeit im Karyogramm der von uns untersuchten Pflanzen. Die Ähnlichkeit wird besonders betont durch ein Paar akrozentrischer SAT-Chromosomen, sowie durch ein zweites SAT-Paar, bei dem die Satelliten an dem längeren Arm sitzen. Im Gegensatz dazu zeigen sich gegenüber den von FERNANDES untersuchten Pflanzen (besonders bei den diploiden) grössere Unterschiede, z.B. kommen bei den kretischen Pflanzen 4 Paare von akrozentrischen Chromosomen vor, die relativ klein sind. Zur Entstehung dieser charakteristischen Chromosomenpaare kann auch hier die Hypothese von FERNANDES (1966) herangezogen werden, dass nämlich diese Chromosomen durch Brüche des langen oder kurzen Armes von bestimmten primitiven Chromosomen entstanden sein können oder durch andere Störungen in der Meiose.

LITERATURVERZEICHNIS

- BABCOCK, E. B. 1947. The genus *Crepis*. Part two. — Univ. Calif. Publ. Bot. 22: 199—1030.
- BARKOUDAH, Y. I. 1962. A revision of *Gypsophila*, *Bolanthus*, *Ankyropetalum* and *Phryna*. — Wentia 9: 1—203.
- CESCA, G. 1967. Osservazioni citotassonomiche su *Euphorbia apios* L., *E. ceratocarpa* Ten., *E. amygdaloides* L. s.l., *E. characias* L. s.l. — Arch. Bot. Biogeogr. Ital. 43: 280—290.
- DAMBOLDT, J. & PHITOS, D. 1971. IOPB Chromosome number reports XXIV. — Taxon 20: 787.
- EHRENDORFER, F. 1964. Über stammesgeschichtliche Differenzierungsmuster bei den Dipsacaceen. — Ber. Deutsch. Bot. Ges. 77: 84—94.
- FEDOROV, A. A. (ed.) 1969. Chromosome numbers of flowering plants. — Leningrad.
- FERNANDES, A. 1943. Sur la caryo-systematique de la section *Autumnales* Gay du genre *Narcissus* L. — Bol. Soc. Brot. sér. 2, 17: 5—54.
- 1966. Nouvelles études caryologiques sur la section *Jonquilla* DC. du genre *Narcissus* L. — Bol. Soc. Brot. sér. 2, 40: 207—248.
- 1969. Contribution to the knowledge of the biosystematics of some species of genus *Narcissus* L. — Publ. Univ. Sevilla (V Simposio de Flora Europaea) 245—284.
- & QUEIROS, M. 1971. Contribution a la connaissance cytotoxinomique des Spermatophyta du Portugal. II. Compositae. — Bol. Soc. Brot. 45 (ser. 2): 5—122.
- FRAHM-LELIVELD, J. A. 1957. Observations cytologiques sur quelques Légumineuses tropicales et subtropicales. — Rev. Cyt. Biol. Vég. 18: 273—287.
- HALÁCSY, E. VON. 1901. Conspectus florae graecae 1. — Lipsiae.
- HAYEK, A. 1927. Prodrömus Florae peninsulae Balcanicae 2. Feddes Rep. Beih. 30, 2.
- JORDANOV, D. 1966. Flora Reip. Pop. Bulgariae 3. — Sofia.
- KOŽUHAROV, S. & KUZMANOV, B. 1964. Chromosome numbers of some bulgarian plant species. — Ann. Univ. Sofia 57: 103—107.
- MIÈGE, J. & GREUTER, W. 1973. Nombres chromosomiques de quelques plantes recoltés en Crète. — Ann. Mus. Goulandris 1: 105—111.
- MOORE, R. J. 1973. Index to plant chromosome numbers 1967—1971. — Regnum Vegetabile 90.
- PHITOS, D. & DAMBOLDT, J. 1971. Beiträge zur Flora Ionica III. Cytotaxonomische Bemerkungen zu einigen griechischen Compositen. — Ann. Naturhistor. Mus. Wien 75: 157—162.
- RECHINGER, K. H. 1943. Neue Beiträge zur Flora von Kreta. — Akad. Wiss. Wien Math. Naturwiss. Kl. Denkschr. 105/2/1.
- WENGER-RAZINE, M. 1969. IOPB chromosome number reports XXIII. — Taxon 18: 560—562.

Contributions to the Flora and Vegetation of the Galápagos Islands

III. Five New Floristic Records¹

Ole Hamann

HAMANN, O. 1974 11 28. Contributions to the flora and vegetation of the Galápagos Islands. III. Five new floristic records. — Bot. Notiser 127: 309—316. Lund. ISSN 0006-8195.

Ranunculus flagelliformis SMITH (Ranunculaceae), *Dioclea reflexa* HOOK. FIL. and *Canavalia dictyota* PIPER (Leguminosae), *Matisia cordata* HUMB. & BONPL. (Bombacaceae) and *Cinchona succirubra* PAVON ex KLOTZSCH (Rubiaceae) are reported as new in the Archipelago.

Ole Hamann, Institute of Systematic Botany, University of Copenhagen, 140 Gothersgade, DK-1123, Copenhagen K, Denmark.

Five new records from the Galápagos Islands are reported from collections made by my wife and myself during an 11 months' stay in the Galápagos during 1971 and 1972. The collections are deposited at the Botanical Museum of the University of Copenhagen (C). As in the earlier publication (HAMANN 1974) short descriptions of the species are given, serving as a supplement to WIGGINS & PORTER 1971.

Ranunculus flagelliformis SMITH, Fig. 1.

SMITH 1819 in REES, Cycl. 29.

Perennial. Stem elongated, glabrous, $\pm$ creeping, rooting at the nodes, up to 50 cm long, branching. Flowers solitary, opposite the cauline leaves. Basal leaves simple, glabrous, 2—6.5 cm long, 2—6.5 cm broad, crenate, deeply cordate at the base, distally rounded. Petioles up to 25 cm long, distally sparingly strigose; stipular leaf-bases broad, sheathing, about 2—3 cm long. Cauline leaves similar in shape to basal leaves, but smaller. Pedicels furrow-

ed, 0.5—1 cm long in flower, approx. 2—2.5 cm in fruit, distally strigose. Sepals 3—4, greenish, elliptic-obovate, about 2.5—3.6 mm long, 1.2—2.4 mm broad, glabrous, early deciduous. Petals 3—5, obovate, about 3.2 mm long $\times$ 1.6 mm broad, light yellow with darker veins. Nectary scale basal, small. Stamens 10, approx. 1.3—1.5 mm long. Achenes 20—40 in a subglobose head about 4—6 mm in diameter. Achene elliptic-acute, slightly compressed, about 1.7—2 mm long, 1.2—1.4 mm broad, slightly verrucose, glabrous, beak very short. Receptacle pyriform, about 1.5—1.8 mm long in fruit, glabrous.

The Galápagos specimens match typical *Ranunculus flagelliformis* in flower and fruit characters, but differ in habit, size and form of leaves, which are generally 5 $\times$ 5 cm or larger, and in the strigose petioles and pedicels.

The specimens of *Ranunculus flagelliformis* in the Copenhagen (C) and Kew (K) Herbariums have been examined. Two specimens, SPRUCE no. 5994, Aug. 1859 (C & K), and W. H. CAMP no. E. 4222, July 16, 1945 (K), both from the Province of

¹ The Charles Darwin Foundation Contribution no. 168.

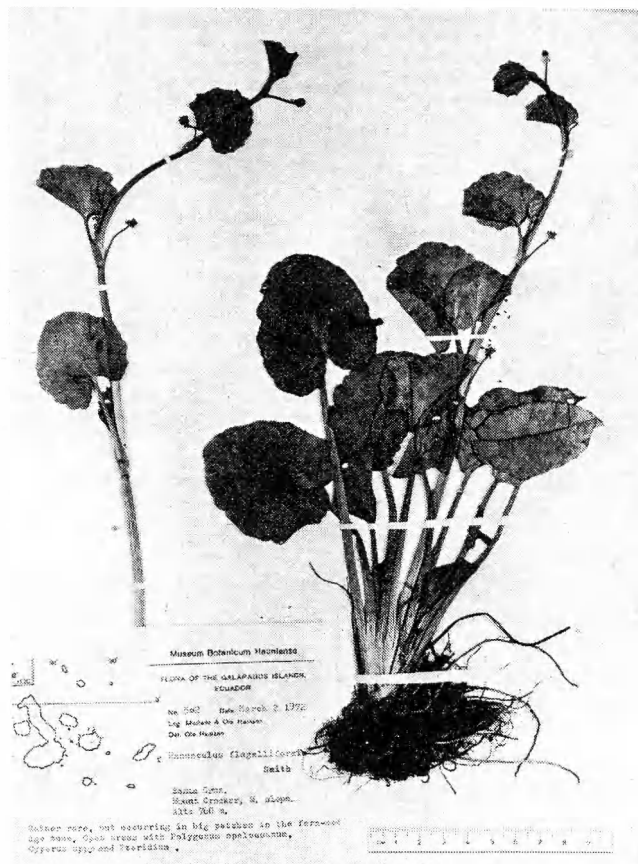


Fig. 1. *Ranunculus flagelliformis* SMITH. Flowering and fruiting specimen from Isla Santa Cruz. — Photo: F. SARUP.

Azuay, Ecuador, were found to match the collected Galápagos specimens. At the same time, no intermediate forms between these and typical *R. flagelliformis* were found. According to LOURTEIG (1956 p. 65), specimens which differ from typical *R. flagelliformis* in the size of the stems, petioles and leaves are found at high altitudes in tropical South America. She refers these forms to var. *major* EICHLER (EICHLER 1864 in MARTIUS, Fl. Bras. 13(1): 156—157, pl. 34). LOURTEIG's description fits the Galápagos and Azuay specimens, although the reference to EICHLER is somewhat doubtful, as EICHLER's illustration shows a medium-sized *R. flagelliformis* with typical leaf-form. The very distinct forms from the Galápagos and Azuay may be a special variety that has originated in the Azuay Province of Ecuador. Until more material of *R. flagelliformis* from South

America has been examined, however, the question of whether these forms merit the taxonomic rank of variety or subspecies, or whether they represent extreme modification to a certain habitat is left open. It might also be noted that they fall within the wide description of *Ranunculus flagelliformis* given by BENSON (1948 pp. 199—200).

This is the first published record of a member of the Ranunculaceae in the Galápagos. *R. flagelliformis* was found at 700 and 760 m altitude in the central highlands of Isla Santa Cruz where it was collected in open vegetation ("fern-sedge zone") in relatively wet areas, along small temporary rain pools or in damp soil. It was found growing among ferns and herbs typical of this type of vegetation within the Archipelago, such as *Pteridium aquilinum* (L.) KUHN var. *arachnoidum* (KAULF.) HERTER, *Cyperus grandifolius* ANDERSS., *Rhynchospora corymbosa* (L.) BRITT., *Polygonum opelousanum* RIDDEL ex SMALL, *Jaegeria* spp., *Drymaria monticola* HOWELL, *Ludwigia leptocarpa* (NUTT.) HARA and *Hypericum uliginosum* KUNTH var. *pratense* (CHAM. & SCHLECHT.) KELLER.

Ranunculus flagelliformis is either a recent introduction to the island, or it may be a species which has previously been overlooked.

The highlands of Isla Santa Cruz have been rather well investigated botanically during the last few decades and *R. flagelliformis* would probably have been recorded if it had been there. Furthermore, this area of the island has been influenced by introduced cattle which could have been instrumental in transporting seeds of *R. flagelliformis* to the island from the mainland of Ecuador.

On the other hand *R. flagelliformis* may be natural in the Galápagos. The species has a distribution comparable to *Calceolaria meistantha* PENNELL, for example, which was first recorded from the Galápagos by ELIASSON in 1968. The altitude of the Galápagos findings of *Calceolaria meistantha* range from about 420 m to

1,530 m (ELIASSEN 1968 and personal observation). It is found on Isla Isabela in open vegetation corresponding to the "fern-sedge" zone as described from Isla Santa Cruz. On the South American mainland it is known from Colombia, Ecuador and Peru at altitudes of from 1,200 m to 2,300 m (PENNELL 1951, p. 96).

Some of the species of the Galápagos (mostly pteridophytes), which inhabit the "fern-sedge" vegetation zone exhibit this pattern of distribution, i.e. a restricted geographic and ecological distribution in the Galápagos and a wide distribution either at high altitudes in tropical South America or in more temperate American regions.

As noted above *Ranunculus flagelliformis* is represented in the Galápagos by a form which, as far as the author can judge, only occurs in the Azuay province in continental Ecuador at altitudes of about 2,700 m to 3,400 m. *Ranunculus flagelliformis* might accordingly be another species of Andean habitats occurring naturally and probably under somewhat similar conditions in the Galápagos.

Ranunculus flagelliformis s. lat. is widespread in Central and South America, from Mexico to Argentina and Chile (BENSON 1948, LOURTEIG 1951 & 1956).

COLLECTIONS STUDIED. Santa Cruz. M. & O. HAMANN no. 502, north slope of Mount Crocker, alt. 760 m, March 2, 1972. — No. 1936, between El Puntudo and Mount Crocker, alt. 700 m, July 30, 1972.

Dioclea reflexa HOOK. FIL.

HOOKER FIL. 1849 p. 306.

A woody vine. Stems glabrate or rufous-pilose with adpressed or ascending hairs. Leaves pinnately 3-foliolate, long petiolate, stipellate. Stipules lanceolate, reflexed, about 2 cm long, rufous-pilose. Stipels subulate, about 0.6—0.8 cm long, rufous-ferruginous-tomentose. Petioles and petioles rufous-ferruginous-tomentose. Leaflets short petiolulate, ovate-elliptic-obovate, 8—15 cm long, 5—10 cm broad, very short acuminate, rounded at the base, dark lus-

trous and almost glabrous above, paler, adpressed rufous-pilose, at least on veins, or glabrate, reticulate veined beneath. Inflorescence, bracts, bractlets and calyx adpressed rufous-ferruginous-pilose to tomentose. Inflorescence when mature up to 35 cm long. Bracts lanceolate, acuminate, reflexed, about 1.5—2 cm long. Bractlets ovate, about 0.2—0.3 cm long, persistent. Flower buds straight. Pedicels about 0.3 cm long. Calyx about 1.0—1.2 cm long, the tube mostly 0.7—0.8 mm long, rufous-ferruginous within, lobes obtuse, the upper 2 united, the lateral ones smaller. Petals violet, about 1.5(—2) cm long; standard orbicular-ovate, reflexed, with inflexed auricles at the base; wings obovate, free; keel shorter than wings, incurved, obtuse. Vexillar stamen free at the base, connate at the middle with the others; 5 alternating stamens abortive. Style incurved, glabrous. Stigma terminal, truncate. Ovary 3—4(—5) ovulate, rufous-tomentose.

The Galápagos collections were not fruiting, but as described by STANDLEY & STEYERMARK (1946 p. 243) the legume is compressed, 12—20 cm long, 6—7 cm wide, rufous-tomentose at first but when mature almost glabrous, the upper suture with a broad costa on each side; seeds 2—4, the linear hilum half the circumference of the seed.

According to AMSHOFF (1939 p. 67) *Dioclea reflexa* HOOK. FIL. has been confused with *D. megacarpa* ROLFE and *D. violacea* BENTH. in several West Indian Floras and in Flora Brasiliensis. The Galápagos collections however match (even if mature fruits are lacking) *D. reflexa* sensu AMSHOFF, and the specimens of *D. reflexa* in the Kew Herbarium (part of the Kew material being the basis for AMSHOFF's critical work).

This is the first record of the genus in the Galápagos. *D. reflexa* was found growing on the upper slopes of the southern part of Isla Santa Cruz at an altitude of approx. 410 m. It was found in a small area, about 2 square km, south-west of El

Camote, climbing among shrubs and small trees. The area is situated just where the vegetation changes from *Scalesia* forest, dominating at lower altitudes, to the dense scrub of *Miconia robinsoniana* COGN. found higher up. The dominant species of the low *Scalesia* forest are *Zanthoxylum fagara* (L.) SARG., *Psidium galapageium* HOOK. FIL., a few *Scalesia pedunculata* HOOK. FIL. and in the undergrowth mainly *Psychotria rufipes* HOOK. FIL. accompanied by many species of ferns. The trees of the forest are further up replaced by *Miconia* shrubs, but the undergrowth is still dominated by *Psychotria rufipes* and ferns.

According to Mr A. KASTDALEN, farmer and resident, *D. reflexa* has been growing here for more than 20 years, the whole time covering approximately the same area as now. Mr KASTDALEN reports that no fruits of *D. reflexa* have ever been found, although it flowers each year (personal communication). *D. reflexa* apparently represents an old, and maybe natural, introduction into Isla Santa Cruz, where it has only been able to spread in a limited area.

It is known from the West Indies, tropical America, Africa and Asia (STANDLEY & STEYERMARK 1946 p. 243).

COLLECTIONS STUDIED. Santa Cruz. M. & O. HAMANN nos. 1249 & 2159, south-west of El Camote, alt. 410 m, May 22 & September 1, 1972.

Canavalia dictyota PIPER

PIPER 1925 p. 574.

Canavalia dictyota is new to the Galápagos. The collection studied agrees well with *C. dictyota* as circumscribed by SAUER (1964 pp. 147—148) and with authentic material of *C. dictyota* from South America studied in the Kew Herbarium. It is closely related to *C. maritima* (AUBL.) THOUARS, which occurs in the Archipelago, hitherto recorded from Isla Marchena only (WIGGINS & PORTER 1971 p. 611). *C. dictyota* is easily distinguished from the

oceanic *C. maritima* by the following characters (among others): The non-emarginate leaflets are lanceolate-elliptic; the lowest tooth of the calyx is slightly subulate, equalling the obtuse laterals; the pod is compressed; it is a species of inland habitats.

Canavalia dictyota was collected on Isla Isabela near the former penal settlement, Alemania, on the south-west slopes of Volcán Sierra Negra. It was found growing in dense forest, mainly dominated by *Psidium guajava* L. and *Zanthoxylum fagara*. The vegetation around Alemania still shows signs of the efforts at cultivation which took place until 1959, when the penitentiary was finally closed. *C. dictyota* is probably an introduction from this period.

Canavalia dictyota is known from continental South America, where it is sometimes planted as a cover crop (SAUER 1964 p. 148).

COLLECTION STUDIED. Isabela. M. & O. HAMANN no. 2469, near Alemania, south-west slopes of Volcán Sierra Negra, alt. 350 m, September 30, 1972.

Matisia cordata HUMB. & BONPL., Fig. 2.

HUMBOLDT & BONPLAND 1808 p. 10, Pl. 2.

A small to medium-sized tree. Lower branches almost horizontal, smooth-barked, green. Stipules small, pilose, deciduous. Leaves alternate, somewhat clustered at the tip of branches; blade 15—35 cm long, 15—30 cm broad, cordate, venation palmate with 8—10 nerves at the base, rounded or acute apically, deeply cordate at the base, membranaceous, $\pm$ glabrous, upper surface dark green, lower side paler. Petioles about 7—20 cm long, light green. Flowers 3—10 together in clusters, on the branches beneath the leaves, short pedicellate, with small bracts at the base. Calyx persistent, greenish, 5-lobed, about 1.5—2.0 cm long, white-greenish-tomentose within. Corolla slightly bilabiate, composed of 5 unequal petals; these about 2.5—3.0



Fig. 2. *Matisia cordata* HUMB. & BONPL. Isla Santa Cruz (M. & O. H. no. 2201). Note the projecting staminal tube. Flowers about 8 cm long. — Photo: O. H., September 12, 1972.

cm long, elliptic, pubescent, yellowish-cream in colour. Stamens of the same colour, staminal tube about 4 cm long; free parts of the stamens about 1.5 cm long, each with about 12 one-celled (bisporangiate), reniform anthers. Style erect, slightly shorter than stamens; stigma capitate, minutely 5-lobed. Ovary pilose, $\pm$ 5-angled.

No fruits were seen on the Galápagos specimen, but according to HUMBOLDT & BONPLAND (1808) and LITTLE & DIXON (1969 p. 389) the fruit is a berry, about 10–14 cm long, leathery, 5-loculed, each locule one-seeded. Seed dark brown, about 2.5–5 cm long.

Matisia cordata is new to the Galápagos. The specimen collected agrees well with *M. cordata* as described by HUMBOLDT & BONPLAND (the anthers are described as

“biloculaires”, which is here interpreted as “bisporangiate”) and by LITTLE & DIXON (1969). It was collected on Isla Santa Cruz near Occidente. Here a few trees about 7 m high were growing in hedges round coffee-plantations. *M. cordata* is probably a very recent introduction into the island, where it might be able to spread spontaneously.

Matisia cordata is known from Colombia, Ecuador, Peru and Brazil (Amazonas) (LITTLE & DIXON 1969).

COLLECTION STUDIED. Santa Cruz. M. & O. HAMANN no. 2201, west of Occidente, in hedge round coffee plantation, alt. 250 m, September 12, 1972.

***Cinchona succirubra* PAVON ex KLOTZSCH, Fig. 3.**

KLOTZSCH 1858 p. 60.

C. pubescens VAHL 1790 p. 19, pro parte.

Bot. Notiser, vol. 127, 1974

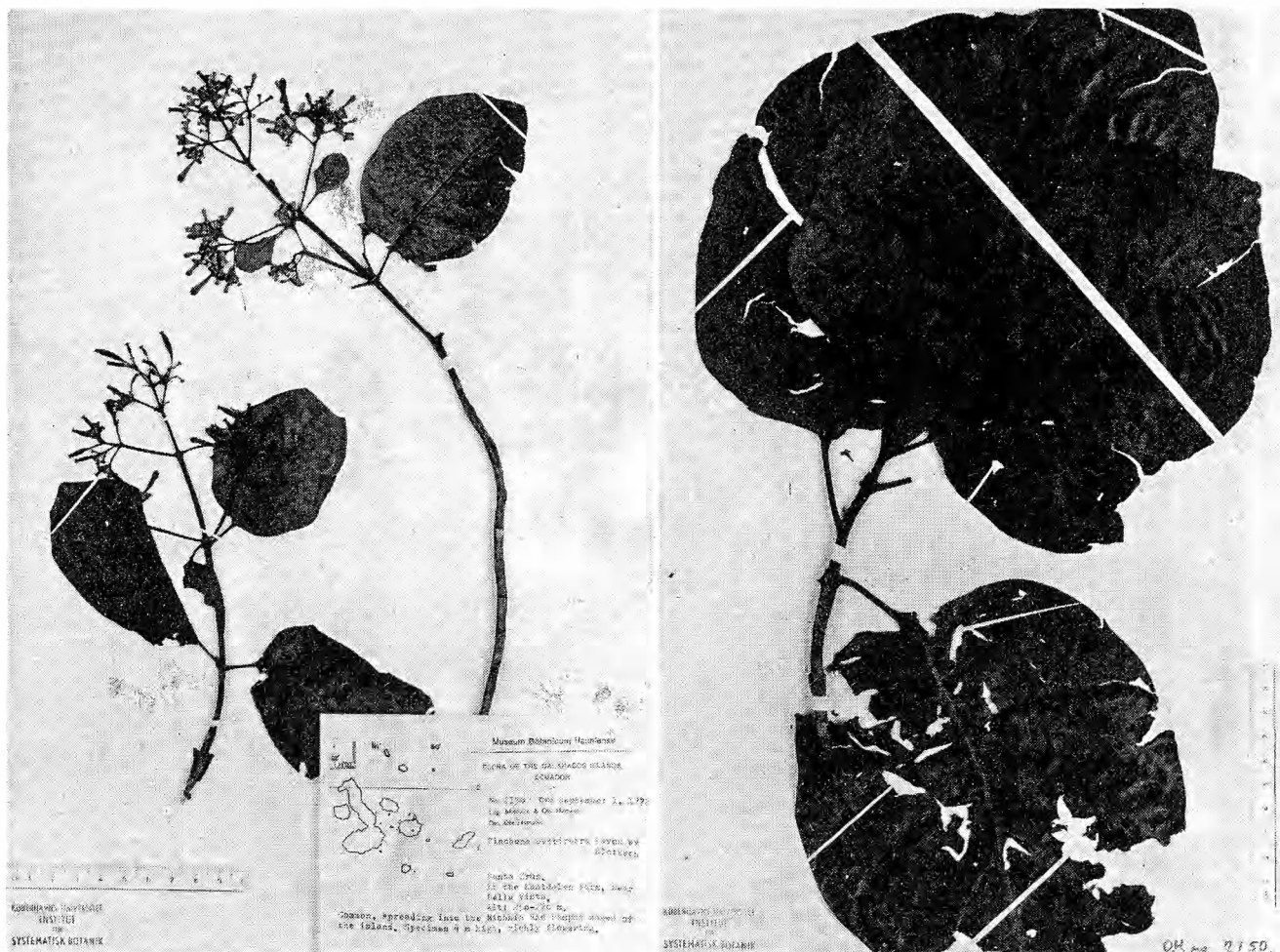


Fig. 3. *Cinchona succirubra* PAVON ex KLOTZSCH. Specimen with flowers and immature fruits, Isla Santa Cruz. — Photo: F. SARUP.

A small to medium-sized tree, about 4.5—12 m high. Branches terete, branchlets obtuse-angled, yellowish-pubescent. Stipules oblong, obtuse, keeled, $\pm$ puberulous, caducous, about 2.5—3.5 cm long. Leaves membraneous, broad ovate, $\pm$ obtuse, truncate, about 10—22.5 cm long, 6—17 cm broad, upper side deep green, short yellowish-pubescent at first, becoming $\pm$ glabrous and shiny with age, lower side paler, yellow-puberulous, pubescent on the veins. Petioles $1\frac{1}{2}$ -terete, caniculate on the upper side, puberulous, up to 3.5 cm long. Flowers in terminal, interrupted panicles, the lower part leafed, the upper part with $\pm$ persistent, oblong-linear bracts. Peduncles flattened, puberulous. Calyx turbinate, with small bracteoles at the base; the tube densely whitish-yellowish-pubescent; the

limb $\pm$ cup-shaped, with 5 reddish teeth, sparsely pubescent, the teeth shortly acute, broad, $\pm$ keeled on the back. Corolla $\pm$ pink-violet, yellow-brownish when dried, about 1.4—1.5 cm long, shortly pubescent, the tube attenuate below; limb divided into 5, the divisions ovate-acute, villous within, the hairs white-pink, turning yellow when dried. Stamens and style $\pm$ included, glabrous. Stigma bipartite. Fruit a capsule with many seeds, 2-valved, opening at the base, brown.

Many previously described *Cinchonas*, including *C. succirubra* PAVON ex KLOTZSCH, were reduced to synonyms under *C. pubescens* VAHL by STANDLEY (1930—31). This was rejected by RUSBY (1931 pp. 523—530), and HODGE also (1950 pp. 137—155)

maintained that although a great number of forms, varieties and hybrids of *Cinchona* are represented in the literature some entities, including *C. succirubra*, are very stable.

The Galápagos collection agrees in all details with *C. succirubra* as described by KLOTZSCH (1858 p. 60). The specimens of *Cinchona* in the Copenhagen and Kew Herbariums have been examined. The Galápagos material matched *C. succirubra* well, whereas both the type-specimen of *C. pubescens* VAHL (in C) and authentic specimens of this species differed: *C. succirubra* has basally truncate leaves which are densely yellowish-pubescent on the veins beneath, the lower leaves soon get a bright, reddish tinge; the leaves of *C. pubescens* VAHL s. str. are attenuate, less pubescent underneath, and do not get the same bright, reddish colour.

This is the first report to be published on the genus in the Galápagos. *Cinchona succirubra* was introduced onto Isla Santa Cruz in 1946 by a resident, Mr KARL ANGERMEYER (personal communication). In 1972, it was completely naturalized on this island.

We collected *C. succirubra* twice: On the south slope of Media Luna at an altitude of 580 m where scattered small trees are common between shrubs of *Miconia robinsoniana*, and also at an altitude of 270 m where larger trees were flowering and fruiting. Furthermore it was observed in several places in the central part of the island. Apparently *C. succirubra* is resisting the grazing cattle in the area better than *Miconia robinsoniana*; at least the extension of the *Miconia* zone on Isla Santa Cruz is decreasing due to occasional fires, grazing by cattle and invasion by *Cinchona*-trees.

Cinchona succirubra is a species of the high Andes, but as long as a modern treatment of the genus is lacking it is impossible to give the exact distribution in South America.

COLLECTIONS STUDIED. Santa Cruz. M. & O. HAMANN no. 113, south slope, near Media Luna, alt. 580 m, December 23, 1971. — No. 2150, the Kastdalen farm, north-east of Bella Vista, alt. 270 m, September 1, 1972.

ACKNOWLEDGEMENTS

I wish to thank all persons and organizations whose invaluable help and support made the field work possible.

LITERATURE CITED

- AMSHOFF, G. J. H. 1939. On South American Papilionaceae. — Mededell. Utrecht 52: 1—72.
- BENSON, L. 1948. A Treatise on the North American Ranunculi. — Am. Midland Nat. 40: 199—200.
- EICHLER, A. G. 1864. — In MARTIUS, C. F. P., Fl. Bras. 13(1): 156—157. — Monachii.
- ELIASSON, U. 1968. Studies in Galápagos Plants. V. Some New Botanical Records from the Archipelago. — Sv. Bot. Tidskr. 62: 243—248.
- HAMANN, O. 1974. Contributions to the Flora and Vegetation of the Galápagos Islands I. New floristic records from the Archipelago. — Bot. Notiser 127: 245—251.
- HODGE, W. H. 1950. Notes on Peruvian Cinchonas I. — Bot. Mus. Leaflets. Harvard Univ. 14: 137—155.
- HOOKE, J. D. 1849. — In HOOKE, W. J., Niger Flora: 306. — London.
- HUMBOLDT, A. & BONPLAND, A. 1808. Plantes Equinoxiales I: 10, Pl. 2. — Paris.
- KLOTZSCH, J. F. 1858. Über die Abstammung der im Handel Vorkommenden Rothen Chinarinde. — Abh. Akad. Berlin: 60—61.
- LITTLE, E. L. & DIXON, R. G. 1969. Arboles Comunes de la Provincia de Esmeraldas: 389—390. — Roma.
- LOURTEIG, A. 1951. Ranunculaceas de Sudamérica Templada. — Darwiniana 9: 453—457.
- 1956. Ranunculaceas de Sudamérica Tropical. — Mem. S. C. Nat. La Salle 16: 61—65.
- PENNELL, F. W. 1951. The Genus Calceolaria in Ecuador, Colombia and Venezuela. — Proc. Acad. Nat. Sci. Phil. 103.
- PIPER, C. V. 1925. The American species of Canavalia and Wenderothia. — Contr. U.S. Nat. Herb. 20: 555—588.
- RUSBY, H. H. 1931. The genus Cinchona in Bolivia. — Bull. Torrey Bot. Club. 58: 523—530.

- SAUER, J. 1964. Revision of *Canavalia*. — *Brittonia* 16: 106—181.
- SMITH, J. E. 1819. *Ranunculus* sp. no. 13. — In REES, A., *Cyclopaedia* 29. — London.
- STANDLEY, P. C. 1930—31. The Rubiaceae of Colombia, Ecuador, Bolivia and Venezuela. — *Field Mus. Nat. Hist. Bot. Ser.* 7.
- & STEYERMARK, J. A. 1946. *Flora of Guatemala* V: 242.
- VAHL, M. 1790. *Skrivt. Naturh. Selsk.* I: 19, Tab. II.
- WIGGINS, I. L. & PORTER, D. M. 1971. *Flora of the Galápagos Islands*. — Stanford.

Variation and Distribution Pattern in *Draba sibirica* (Pall.) Thell.

Tyge W. Böcher

BÖCHER, T. W. 1974 11 28. Variation and distribution pattern in *Draba sibirica* (Pall.) Thell. — Bot. Notiser 127: 317—327. Lund. ISSN 0006-8195.

Draba sibirica (PALL.) THELL. is a continental mainly Eurasian species, in the west reaching mountains in eastern Europe and even Jameson Land in East Greenland. It extends eastwards to the Ogilvie Mts in Yukon and the Mackenzie Mts in the northwest territories of Canada. If taken as a single species it is very polymorphic. Several chromosome investigations, however, have shown that a number of different strains are diploid ($2n=16$). Material from East Greenland has been cultivated along with material possibly originating from montane eastern European localities. The Greenlandic plants proved to be essentially different from the eastern European plants and are described as a new subspecies, ssp. *arctica*. The disjunctions in the area of distribution of *D. sibirica* are explained as the result of survival in non-glaciated refugia combined with restricted habitat requirements of the species.

Tyge W. Böcher, Institute of Plant Anatomy and Cytology, University of Copenhagen, Solvgade 83, DK-1301 København K, Denmark.

INTRODUCTION

Draba sibirica (PALL.) THELL. deviates from most other species in the genus in having creeping stolons. It was first given the name of *Lepidium sibiricum* PALLAS (P. S. PALLAS Nordische Reise-Bemerkungen 1772 footnote on p. 34 referring to Plate 56 fig. 2 in GMELIN Flora sibirica Vol. III 1768). Its structure appears further from drawings by GELERT (1898 Fig. 9) and BUSCH (1919 p. 322 Figs. a and e). The drawing by GELERT was also reproduced by PORSILD (1964 Fig. 2).

The species was discovered in East Greenland in 1899 by A. G. NATHORST, who found it in the innermost part of the fjord, Hurry Inlet, on August 7th in flower and with semi-mature siliques (DUSÉN 1901 pp. 23—24). Since then it has been collected by several other botanists in the same fjord, but not until recently has living material been brought to Denmark — by Messrs DAVID and RUSSELL MARRIS (1968). The plants have now been cultivated for a few

years at the experimental field at Tåstrup as well as in the Arctic Greenhouse. These cultivations unveiled a number of interesting differences between the Greenlandic plants and three strains of *D. sibirica* which had been grown in culture over a longer period of time.

CHROMOSOME NUMBER AND EXPERIMENTAL CULTIVATIONS

The chromosome number of *D. sibirica* is invariably $2n=16$. It was counted in plants originating from the Botanical Gardens in Strasbourg, Halle and Moscow (BÖCHER 1966 p. 34). The new material from Greenland was also diploid, and according to A. E. PORSILD (1967) even the plants from the Ogilvie Mts in Yukon have the diploid number (counted by G. A. MULLIGAN).

According to the experiences from the first cultivations, the plants from the three Botanical Gardens were rather uniform,

all having the same habit and dimensions. They were easy to grow in Copenhagen, and the plants that germinated in the spring flowered the same year. The plants also grew abundantly in a private rock-garden north of Copenhagen.

In 1972—73, cultures from Greifswald, Halle and Moscow were repeated and grown simultaneously with the Greenlandic plants. Uniform-sized small sections of the creeping shoots were planted in earthenware bowls at the experimental field and in the Arctic Greenhouse in order to compare growth rates and the development of the plants.

The strains from Greifswald, Halle and Moscow grew fast and produced numerous flowering peduncles as well as ascending sterile leafy stolons (Fig. 1, right). In open frames at the experimental field the number of flowers in the racemes was 7—10 and the peduncle (scape) length (including the raceme) 6—10 cm. The longest leaves were 8—12(—15) mm and the longest sterile stolon 5—9 cm. When grown in the Arctic Greenhouse the peduncles were longer (12—19 cm) with 5—6 flowers, and the largest leaves measured 11—14 mm.

The Greenlandic plants grew slowly and kept their short stolons near the surface of the soil. Plants placed in the open frames at the field developed 2—3 cm long peduncles which usually produced 1—2 flowers only (Fig. 1, left). The longest stolons were 1.5 cm and the longest leaves 4—5(—8) mm long. In the Arctic Greenhouse the peduncles attained a length of 5—9 cm and carried 2—7 flowers. The terminal leafy stolons were 2—5 cm long and the longest leaves 6—9 mm.

Apart from the conspicuous differences in size and vigour there were other important distinctions. The arctic plants flowered early and only once, while the two garden strains had two flowering periods, an early luxuriant one, and a late one (in September) with fewer flowers and shorter peduncles (plants from Moscow). The latter plants deviated further in having leaves that turned wine-coloured in the autumn.

In the arctic plants the bifurcate, malpighiaceous hairs were found almost exclusively on the leaf margins, but usually the middle nerve on the lower side of the leaves also had some hairs. The plants from the two Gardens had bifurcate as well as stellate hairs along the margins and on the surfaces.

A striking feature is the relatively great thickness of the leaves in the arctic plants. This anatomical difference can be seen in Fig. 2. The more fleshy structure concerns the entire leaf from the middle nerve (Fig. 2 C) to the margin (Fig. 2 A). The leaves of the Garden strains are thin along the margin (Fig. 2 B) and slightly thicker around the middle nerve.

The arctic material behaves like an arctic ecological race. Many of its characters seem to be adaptive, such as the low creeping adpressed habit which probably signifies an adjustment to the comparatively advantageous microclimate near the soil surface, the slow rate of growth and low production, the small and fleshy leaves and the absence of a late summer flowering.

The size and thickness of the leaves deserve comment. BLISS (1962 p. 132) states that some species from arctic and alpine "tundras" have fleshy leaves "though this probably is more characteristic of alpine species". As examples of the arctic plants we may point to species like *Draba crassifolia*, *Eutrema edwardsii*, *Braya purpurascens*, *B. thorild-wulfjii*, *Saxifraga cernua*, *S. aizoides*, *Oxyria digyna* and *Minuartia rossii*, all of which, like *Draba sibirica*, are species characteristic of mesic to wet soils.

In this context, however, the observations by TURESSON (1925) on *Myosotis silvatica* and *Melandrium rubrum* are particularly interesting. In both species the alpine race has comparatively thick leaves. The difference in thickness between leaves of mountain and lowland plants is of the same magnitude as that found in *Draba sibirica*.

The ecological advantage of fleshy leaves in arctic-alpine strains is not immediately

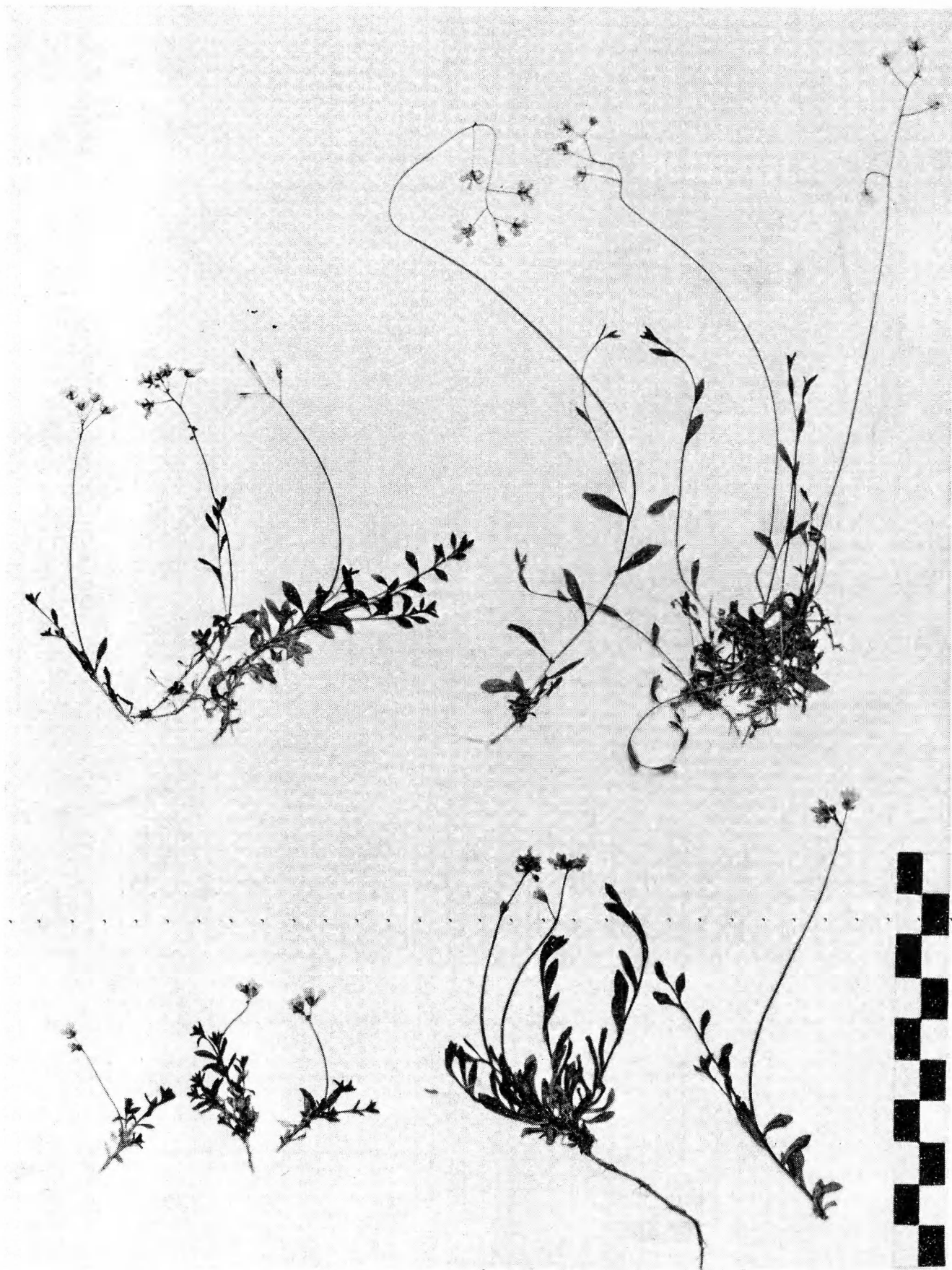


Fig. 1. Cultivated material of *Draba sibirica*. Upper row from the Arctic Greenhouse. Lower row from the experimental field at Tåstrup. Left-hand specimens are ssp. *arctica* from East Greenland, the specimens on the right are from Greifswald (upper row) and Moscow (lower row). Length of quadrangles 1 cm.

obvious. In the case of the arctic race of *Draba sibirica* accessible soil water is probably abundant during the growing season. Thick leaves may, however, be able to absorb and retain heat radiation more readily than thin ones, thereby increasing leaf temperature and photosynthetic activity.

Optimal leaf size was recently discussed by PARKHURST and LOUCHS (1972). According to these authors large leaves are an advantage only when air temperatures are high and radiation (light) is low. Small leaves in arctic or northern strains may therefore be looked upon as a response to conditions of temperature. In this connection we may also call attention to the heritably small-leaved and almost glabrous plants of *Veronica officinalis* occurring in subalpine situations in the Faroes (BÖCHER 1944).

TAXONOMICAL CONSIDERATIONS

The taxonomical position of the arctic race of *Draba sibirica* must be considered. The view advanced by TOLMACHEV (1939 p. 446), that the most substantial variation within the species seems to be due to environmental change is possibly correct for most of the Eurasian montane plants, but it is impossible to maintain this view if the arctic material is taken into consideration. Moreover, we must not forget that BUNGE according to BUSCH (1919) had cultivated *D. sibirica* (= *D. gmelinii* ADAMS) and *D. repens* M. BIEB. and found them different. Both *Draba repens* and *D. gmelinii* are generally cited as synonyms for *D. sibirica*, but may cover different ranges of its variation pattern. BUSCH expresses the variation by describing three varieties among which var. *latifolia* N. BUSCH may not be a modification only. EKMAN (1931) agrees with SCHULZ in joining *D. repens* and *sibirica*, but she is clearly in doubt and says that "*D. repens* is a form from wet places and has, therefore, longer stolons, *D. gmelinii* grows in drier stations and is more compact". The ecological remark may be based on the character of

the habitat for *D. gmelinii* given by BUSCH "in lapidosis, schistosis, glareosis etc."

The Yukon representative of *D. sibirica* deviates slightly from the Asiatic montane plants. The material collected by HULTÉN in 1964 in the Ogilvie Mts was described by HULTÉN (1966) as a new species, *D. ogilviensis*, about which he says that it is abundantly different from *D. sibirica* e.g. in having large almost glabrous leaves and large cauline leaves. *D. sibirica*, on the other hand, is scapose. The material collected later by R. T. PORSILD in 1966 from the same area alters the picture according to A. E. PORSILD (1967). The plants from higher elevations (5,500—6,500 ft., R. T. PORSILD No. 141) form soft cushions of loosely packed branches terminating in naked peduncles. In the duplicate plants in the Copenhagen Herbarium the leaves are small and the peduncles and stolons short thus approaching the arctic plants. The other collection (R. T. PORSILD No. 9 from 2,500—4,200 ft.) has one or two leaves on the peduncles, but this character is hardly constantly present in the material as a whole. The degree of hairiness also varies. In No. 141 the leaves are ciliated along the margin with simple or forked projecting hairs, while malpighiaceae hairs are absent. In No. 9 the leaves are glabrous, but the young ones have simple and forked projecting hairs, not horizontally patulate marginal hairs. As *D. sibirica* from its whole range includes specimens which differ markedly in hair density and hair types it is difficult to use hair characters, but it may perhaps be possible to delimit the Yukon plants in this way. A. E. PORSILD concludes (1967 p. 168) that HULTÉN "needlessly proposed *D. ogilviensis*". CODY and PORSILD (1968 pp. 268—269) mention two new stations in the Mackenzie Mts for *D. sibirica*, while HULTÉN (1973 p. 490) refers to the same material under the name of *D. ogilviensis*. Not having had access to the plants from the Mackenzie Mts, I am not able to pass any final judgment; it may be enough to state that it is never unnecessary to point out

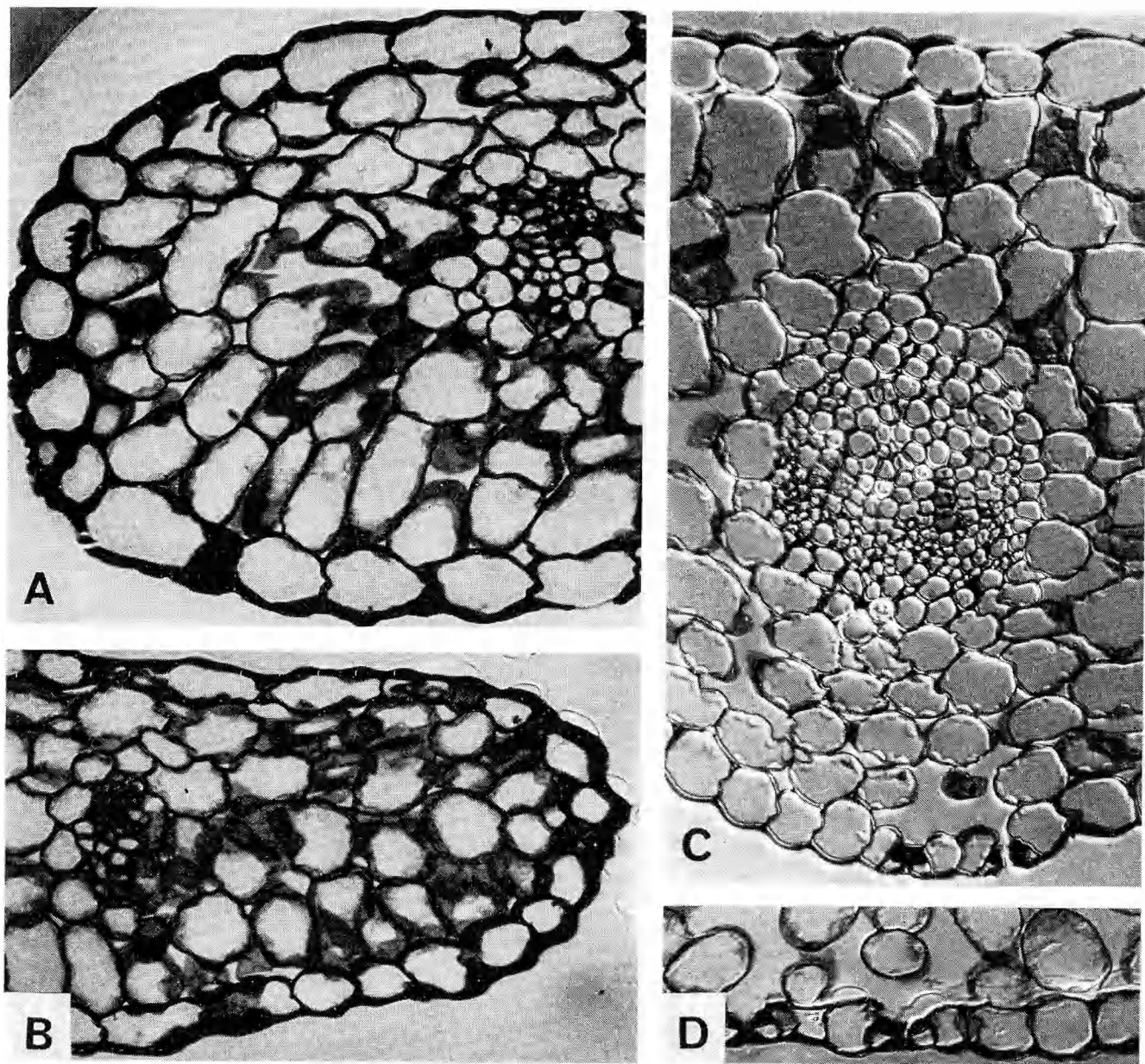


Fig. 2. *Draba sibirica*. Cross-sections of parts of leaves. — A, B: Leaf margins. A: ssp. *arctica*. B: ssp. *sibirica*. — C, D: Middle nerve area and epidermis on lower side of ssp. *arctica*. Plants cultivated in the Arctic Greenhouse. — $\times 365$.

morphological differences. In the present case, however, I would have preferred to propose a subspecies. In any case, the northwestern American material is highly interesting from an evolutionary point of view, because the plants have probably been isolated from the Asiatic main stock for lengthy periods.

Presumably the Greenlandic populations have also been isolated for a very long time. But the fact is that the material from Greenland resembles that from Novaya

Zemlya, Waigatch and the northern Ural Mts to such a degree, that I feel more inclined to discuss isolation of all the arctic plants including those from northern Ural.

On the map of the Eurasian-Greenlandic range of *D. sibirica* (HULTÉN 1958 Map 90) a gap in the distribution is shown between the arctic stations and the stations south of Moscow in the vicinity of Voronezh and those in southern Ural between Sverdlovsk and Perm. The material from the area south of Moscow may be identical with

Table 1. Measurements of characters in *Draba sibirica*. All specimens from the Botanical Museum in Copenhagen (C).

Origin of material	Longest peduncle incl. raceme, cm	Numbers of flowers in raceme	Length of largest leaf, mm	Length of longest sterile stolon, cm
<i>Ssp. sibirica</i>				
Prov. Kubañ, Teberda Valley. Caucasus.				
N. & E. BUSCH, Fig. 4	14—19	9—16	13—17	4.5—6
Guv. Tamboviensis. D. LITWINOW	15—16	11—14	11—16	3—5
Tomsk. P. KNET. 23/5 1959	20—25	6—13	15—16	7—8
Altai. LEDEBOUR	11—17	11	14—18	3—4.5
<i>Ssp. arctica</i>				
N.E. Greenland.				
Klitdal. 29/7 1971. Sv. FUNDER, Fig. 3 ..	3—6	3—9	5—8	2—3.5
Hurry Inlet. 3/8 and 7/8 1899. NATHORST & DUSÉN, Fig. 3	5—7	3—10	8	—
Ulveodde. 4/8 1900. N. HARTZ & C. KRUUSE	4	3—9	6—8	1.5
8/7 1953. P. GELTING	2.5—5	1—8	6—10	1.5—3.5
Jameson Ld. Lollandselev. 25/7 1963. P. MOORE	4—6	1—6	8	1.5
Mid Depot elev. 28/7 1963. G. HALLIDAY	6.5—8.5	8—11	8	1.5
Lower Depot elev. 1/8 1963. G. HALLIDAY	4	3—5	6	0.5
Novaya Zemlya.				
Lat 70°34'. 22/8 1882. TH. HOLM	3—4	1—6	4—5	1.5—3
Olonje. 23/8 1882. TH. HOLM	2—3.5	1—6	5—6	1.5—2
Waigatch.				
Dolgoi Bay. 29/6—8/7 1897. TH. WF ..	3—6	4—7	6—8	1—2
Cape Grebenij. 1875. KJELLMAN & LUNDSTRÖM; see Fig. 9 in GELERT (1898 p. 298)	4—5	(1) 4—7	6—7 (11)	2—3
N. Ural.				
64°—65°. 1927. V. SOZAVA	4—5.5	2—6	7—8	2—2.5
Lake Hadata. 1964. SKVORTSOV, FILIN & ISAKOVA	6—12	1—7	8—10	2—4

my culture from the Moscow Gardens, and, as mentioned, it differs widely from the Greenlandic population.

In the Herbarium it is impossible to find significant differences between the Greenlandic plants and those from Novaya Zemlya—Waigatch—Ural Mts. On the other hand these collections deviate strongly from the southern montane plants and in the same way as the cultivated plants do.

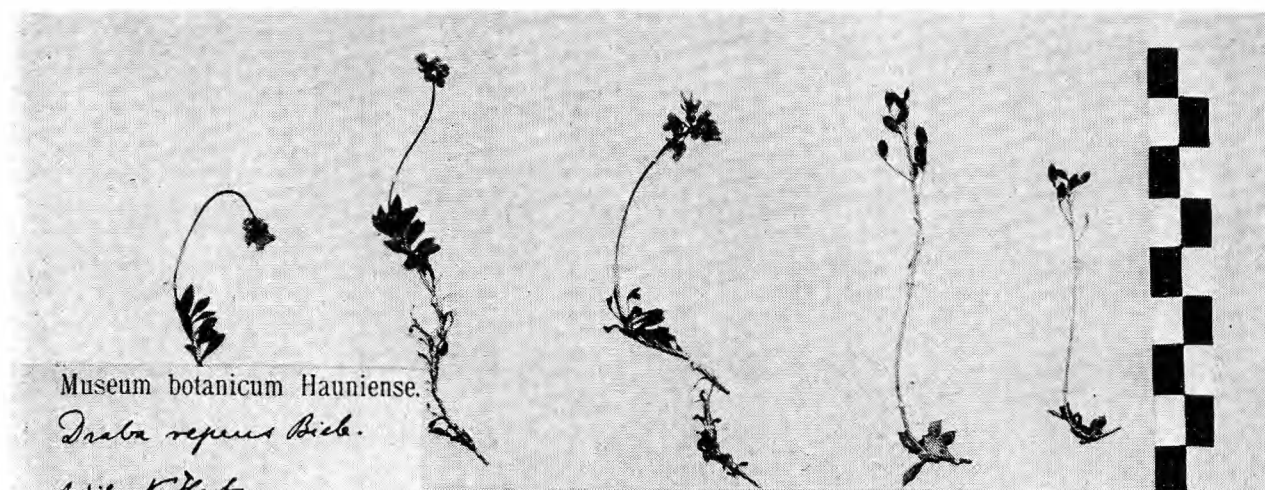
In this situation I have found it most relevant to operate with two taxa, an arc-

tic and a subarctic-montane. The arctic material is proposed here as *Draba sibirica* (PALL.) THELL. ssp. *arctica*.

Draba sibirica* (PALL.) THELL. ssp. *arctica
BÖCHER, ssp. nov.

Statura minore, stolonibus brevibus omnino prostratis, foliis minoribus crassioribus pilos bifurcatos paene ut in *Malpighia* divaricatos praesertim margine gerentibus a ssp. *sibirica* diversa. Maxima folia 5—8(—11) mm longa; stolones 2—4 cm longi; axes floriferi cum racemis 4—8(—12) cm alti, quisque 1—9(—11)

Fig. 3. *Draba sibirica* ssp. *arctica*. Top, the first collection from Greenland (NATHORST & DUSÉN 1899). Below, the material collected 1971 by Sv. FUNDER (type of ssp. *arctica*). The material corresponds to the cultivated material shown in Fig. 1. Length of quadrangles 1 cm.
Bot. Notiser, vol. 127, 1974



Museum botanicum Hauniense.

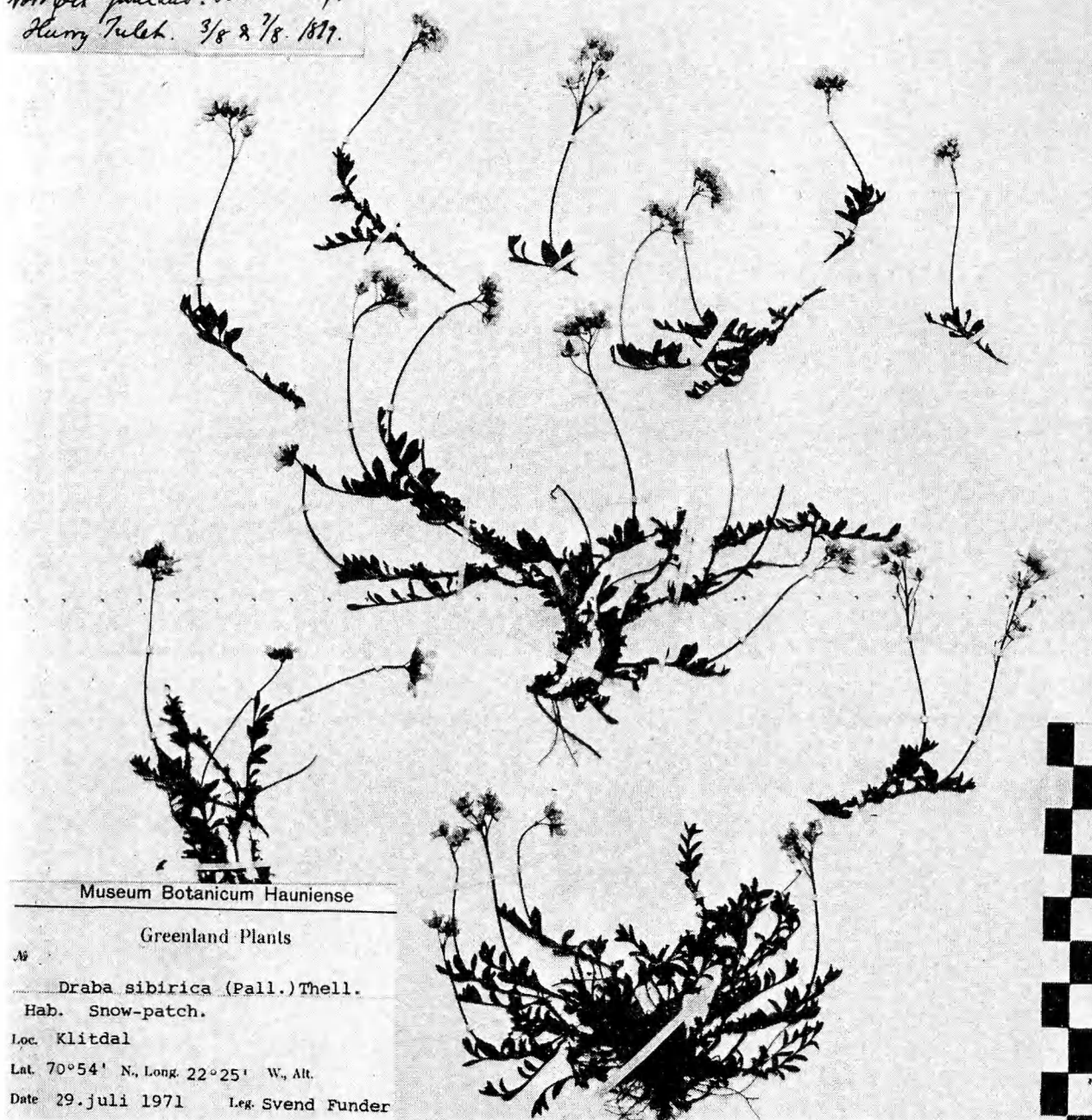
Draba repens Bieb.

det. N. Kartz.

determ: } A. G. Nathorst & P. Dusen.

legit:

Nord-Pol-Grönland. Rindens af
Humpy Tuleh. 3/8 & 7/8. 1879.



Museum Botanicum Hauniense

Greenland Plants

N.

Draba sibirica (Pall.) Thell.

Hab. Snow-patch.

Loc. Klitdal

Lat. 70°54' N., Long. 22°25' W., Alt.

Date 29. juli 1971 Leg. Svend Funder

flores gerens. Petala flava, 4—6 mm longa. Siliquae circiter 3.5—5 mm longae, stylis 0.3—0.5 mm longis terminatae.

Typus die 29 Julii anni 1971 in valle Klitdal Groenlandiae Orientalis lat. bor. 70°54' long. occ. 22°25' a SVEND FUNDER lectus, in fig. 3 hic apposita infra monstratus, in Museo Botanico Hauniensi (C) depositus.

The type of *Draba sibirica* ssp. *sibirica* is pictured in GMELIN (1768, Plate 56 Fig. 2). The length of the peduncle and the raceme on the specimen is 11.5 cm, the raceme has 9 flowers, the largest leaves are 15—18 mm long and the longest sterile stolons are 2—3 cm. The type material thus corresponds very well with the plants of ssp. *sibirica* mentioned in Table 1.

In the Flora of USSR the limits of the leaf and peduncle lengths and the number of flowers, the size of petals and siliques show that arctic and southern montane plants have been treated together. If ssp. *arctica* (arct.) is separated from a ssp. *sibirica* (sib.), we get the following dimensions: Leaf length 10—25 mm (sib.), 5—11 mm (arct.), peduncle length (including raceme) 10—25 cm (sib.), 2—12 cm (arct.), number of flowers in the raceme 6—35 (sib.), 1—11 (arct.), petal length 5—6.5 mm (sib.), 4—6 mm (arct.), length of silique 4—8.5 mm (sib.), 3.5—5 mm (arct.).

The two subspecies appear to be very distinct, if the material in Table 1 is considered. However, the material from high and low elevations in the Ogilvie Mts indicates that in these mountains clinal or continuous variation may make any clear distinction between minor taxa difficult, or even impede it. However, this is no reason for foregoing taxonomical treatment. Clines (character gradients) often seem to be bunched, and ranges of such bunched clines may be cut out as subspecies (BÖCHER 1967 p. 258).

ECOLOGY AND DISTRIBUTION

Very little is known about the ecology of *D. sibirica*. While southern populations (e.g. from Caucasus, see Fig. 4) may occur in meadows, in birch and poplar woods,

some of the Asiatic ones according to BUSCH seem to grow in gravel or sand, thus perhaps in comparatively dry situations. On the other hand the northwestern American populations are recorded from alpine meadows below snow flushes (HULTÉN 1966 p. 316) or rich calcareous herb mats (A. E. PORSILD 1964 p. 96). CODY and PORSILD (1968 pp. 268—269) found it on limestone talus slopes and banks of lakes.

The Greenlandic habitat was described by KRUSE (1905 p. 162) who says that it prefers humid tableland, the banks of half dried up pools and sandy ground. HARTZ and KRUSE (1911 p. 402) mention a locality in Klitdal on the southern side of a low gneiss knoll on a rudimentary herbaceous slope together with, for instance *Salix arctica* var. *groenlandica*, *Betula nana*, *Taraxacum croceum*, *T. phymatocarpum* and *Minuartia biflora*. FUNDER (see label on Fig. 3) refers to the habitat as a snow-patch. In any case, the Greenlandic plant grows in habitats which are protected by snow during the winter, but the snow melts early. The soils are mesic to wet, sometimes sandy and probably not calcareous, nor very acid or poor.

The very isolated occurrence of the species has created much interest in *D. sibirica* in Greenland.

DUSÉN (1901), who was the first to mention the problems, concluded that the species had probably been transported from northern Asia by drift-ice, but he admits that if this had been the case its absence from the Spitzbergen archipelago seems strange.

GELTING (1934 p. 262) advanced the opinion that the Greenlandic occurrence was the result of survival in an unglaciated area. He lists *D. sibirica* among the uni-centric and microcentric species having one small area only. In the same group he places *Potentilla stipularis*, *Polemonium boreale* and *Alchemilla wichurae*. He emphasizes that the interior of Hurry Inlet has not been exposed to drift-ice. *Draba*

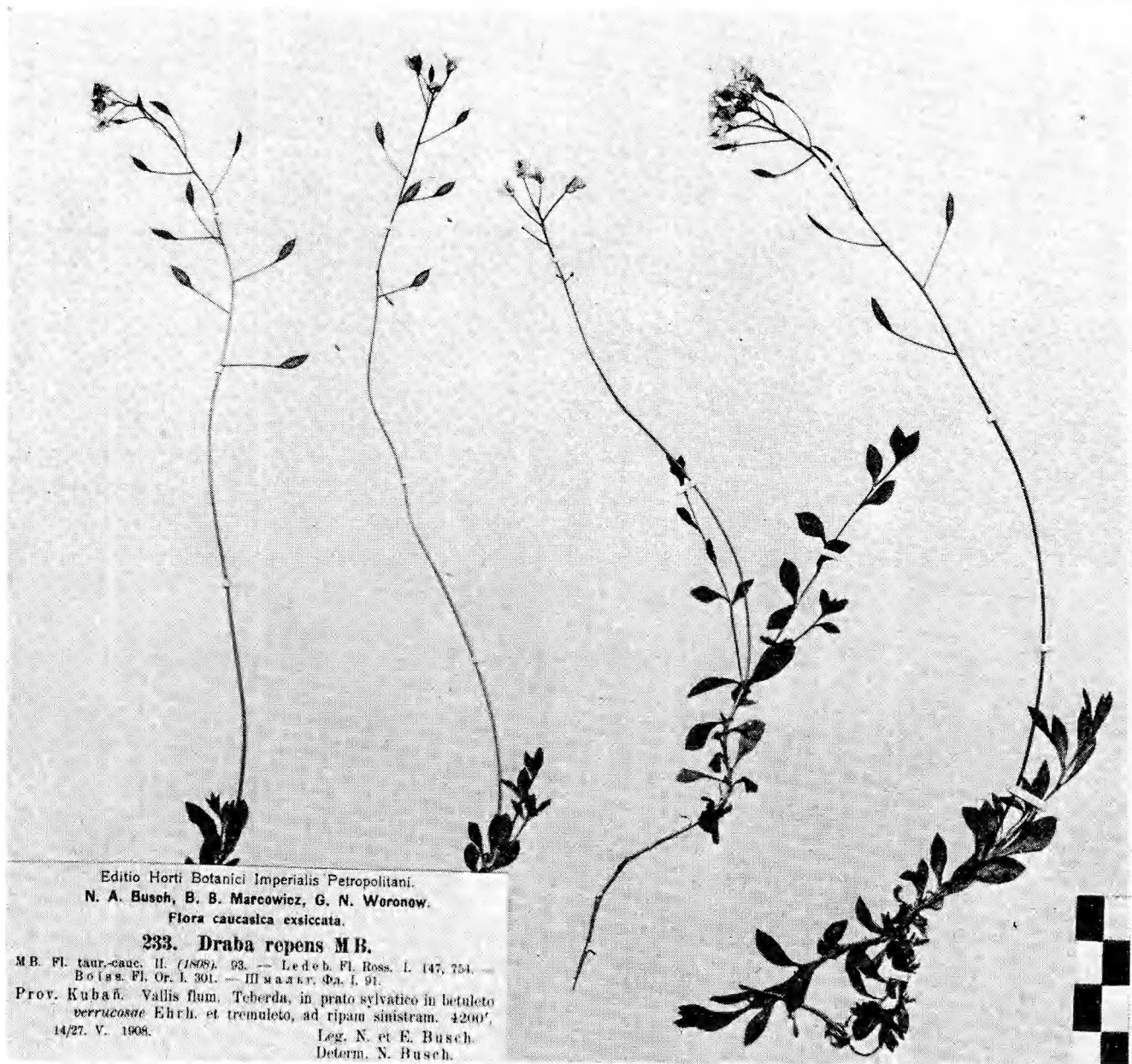


Fig. 4. *Draba sibirica*. From the exsiccate of Caucasian plants (N. A. BUSCH, B. B. MARCOWICZ & G. N. WORONOW No. 233). Length of quadrangles 1 cm.

sibirica belongs to a continental element "which seems to have immigrated under climatic conditions entirely different from those of the present day". He also thinks it unlikely that the East Greenland Polar Current should have transported seeds of these species capable of germinating. On p. 269 GELTING concludes that the centric species (the survivors) do not form an ecological unit, but represent widely different demands. This he takes as proof that the unglaciated areas were rather extensive.

The centric species are preferably lowland plants and thus "become an argument for the existence of unglaciated lowlands during the Ice-Age". In GELTING's later paper from 1941 is a map showing the total area of *D. sibirica* (based on the map in BUSCH 1919). GELTING mentions *D. sibirica* as an old, middle Pleistocene immigrant from the east (1941 p. 93).

The station, Klitdal, in Hurry Inlet is indicated on the map in HULTÉN 1958. This map now has to be supplemented, as far

as Greenland is concerned, with two stations in Jameson Land west of Hurry Inlet (Table 1).

Evidently an immigration from Asia (Novaya Zemlya) to Hurry Inlet—Jameson Land would be easier to accept if, according to the continental drift theory, Asia was closer to Greenland. However, even if the distance in late Tertiary times was shorter than now, it was still a long way, and *Draba sibirica* has no characters fitting it for long-distance dispersal.

The two additional stations in Jameson Land are placed in an area which, according to recent investigations on C^{14} ages for samples of marine bivalve shells, must have been uncovered by the inland ice for more than 40,000 years B.P. (FUNDER & HJORT 1973). These authors assume that the ice-free conditions may have resulted from reductions in the precipitation, and they find some support for this idea in the calculated models by LAMB and WOODROFFE (1970) of atmospheric circulation during the Weichselian glaciation.

A comparison of the world range of *Draba sibirica* and maps showing the distribution of glaciated regions during the Quarternary Period shows that *Draba sibirica* at the present time is almost exclusively found outside areas which were covered by ice sheets during the last glaciation. This implies that we may discuss its area of distribution by assuming reductions of an original circumpolar area rather than by speculating on recent long-distance dispersal by ice, wind or birds.

According to maps in HULTÉN (1968) and V. K. PREST (1969 Map 1257 A) the Ogilvie Mts and part of the Mackenzie Mts escaped a solid ice cover. Furthermore, there are many signs of refugial areas in southwestern Alberta and adjacent regions of British Columbia (cf. PACKER 1971 p. 143). The area of *Draba sibirica* in North America may be comparable to that of *Braya henryae* which is endemic to the northern part of the Cordilleras (CODY 1971 Map 13).

GELTING regards *D. sibirica* as a conti-

nental species. However, it is not a xerophytic steppe plant, but a species connected with herb mats and not too long persistent snow beds. It prefers local accumulations of snow in medium arctic-alpine and continental climatic regimes. Furthermore, it may have some still undiscovered edaphic demands. The combination of habitat requirements, in particular a continental climate combined with herb-mat conditions, is probably not very common. The species may be somewhat fastidious, sorting out particular habitats.

The stations for *D. sibirica* in the Ogilvie Mts and the Mackenzie Mts are located very close to a line for 300 mm annual precipitation. In East Greenland the stations for *D. sibirica* are near the town of Scoresbysund where the annual precipitation is between 300 and 400 mm. The station, Klitdal, in Hurry Inlet and the Jameson Land stations are situated in the interior of the fjord system where the annual precipitation may amount to less than 300 mm. Most Eurasian stations are also in regions with a low annual precipitation and cold winters.

In Greenland the climatic dryness increases considerably north of the Scoresbysund region. The basis for developing herb mats gradually disappears. This implies that even if survival in the area north of Scoresbysund was possible because of the existence of non-glaciated areas (e.g. Cape Mackenzie and Clavering Island), it is uncertain whether *Draba sibirica* could grow there because of its habitat demands.

ACKNOWLEDGEMENTS

The author is indebted to Messrs DAVID and RUSSELL MARRIS for the material of *D. sibirica* from East Greenland, to Mrs ELLA BUCK and Mr H. ELSTED JENSEN for valuable technical assistance and to Dr TYGE CHRISTENSEN for latinizing the diagnosis.

LITERATURE CITED

- BLISS, L. C. 1962. Adaptations of arctic and alpine plants to environmental conditions. — Arctic 15: 117—144.

- BUSCH, N. 1919. Cruciferae in Flora Sibiriae et Orientis extremi. No. 25.
- BÖCHER, T. W. 1944. The leaf size of *Veronica officinalis* in relation to genetic and environmental factors. — Dansk Bot. Arkiv 11(7): 1—20.
- 1966. Experimental and cytological studies on plant species IX. Some arctic and montane Crucifers. — Biol. Skr. Dan. Vid. Selsk. 14(7): 1—74.
- 1967. Continuous variation and taxonomy. — Taxon 16: 255—258.
- CODY, W. J. 1971. A phytogeographic study of the floras of the continental Northwest Territories and Yukon. — Naturaliste Can. 98: 145—158.
- & PORSILD, A. E. 1968. Additions to the flora of Continental Northwest Territories, Canada. — Canad. Field Naturalist 82: 263—275.
- DUSÉN, P. 1901. Zur Kenntnis der Gefäßpflanzen Ostgrönlands. — Bih. K. Svenska Vet.-Akad. Handl. 27, III(3): 1—70.
- EKMAN, E. 1931. Contribution to the *Draba* flora of Greenland III. — Svensk Bot. Tidskr. 25: 465—494.
- FUNDER, S. & HJORT, CHR. 1973. Aspects of the Weichselian chronology in central East Greenland. — Boreas 2: 69—84.
- GELERT, O. 1898. Notes on arctic plants. — Bot. Tidsskr. 21: 287—318.
- GELTING, P. 1934. Studies in the vascular plants of East Greenland between Franz Joseph Fjord and Dove Bay. — Medd. Grønland 101(2): 1—337.
- 1941. Über pleistozäne Pflanzenrefugien in Grönland. — Mitt. naturforsch. Ges. Schaffhausen 17: 74—96.
- GMELIN, D. J. 1768. Flora sibirica III.
- HARTZ, N. & KRUISE, C. 1911. The vegetation of Northeast Greenland 69°25'—75° lat. N. — Medd. Grønland 30: 335—431.
- HULTÉN, E. 1958. The amphi-atlantic plants and their phytogeographical connections. — K. Svenska Vet.-Akad. Handl. IV 7(1): 1—340.
- 1966. New species of *Arenaria* and *Draba* from Alaska and Yukon. — Bot. Notiser 119: 313—316.
- 1968. Flora of Alaska and neighboring territories. — Stanford.
- 1973. Supplement to Flora of Alaska and neighboring territories. — Bot. Notiser 126: 459—512.
- KRUISE, C. 1905. List of phanerogams and vascular cryptogams found on the coast 75°—66°20' lat. N. of East Greenland. — Medd. Grønland 30: 145—208.
- LAMB, H. H. & WOODROFFE, A. 1970. Atmospheric circulation during the last Ice Age. — Quat. Res. 1: 29—58.
- PACKER, J. G. 1971. Endemism in the flora of Western Canada. — Naturaliste Can. 98: 131—144.
- PARKHURST, D. F. & LOUCKS, O. L. 1972. Optimal leaf size in relation to environment. — Journ. Ecol. 60: 505—537.
- PORSILD, A. E. 1964. *Potentilla stipularis* and *Draba sibirica*, new to North America. — Canad. Field-naturalist 78: 92—96.
- 1967. *Draba sibirica* in North America. — Ibidem 81: 165—168.
- PREST, V. K. 1969. Retreat of Wisconsin and recent ice in North America. — Geol. Survey Canada.
- SCHULZ, O. E. 1927. *Draba*. — In Das Pflanzenreich 89 IV 105.
- TOLMATCHEV, A. N. 1939. *Draba*. — In Flora USSR Vol. VIII, p. 371.
- TURESSON, G. 1925. The plant species in relation to habitat and climate. — Hereditas 6: 147—236.

Cytology and Some Chromosome Numbers of Czechoslovak Roses II

Irena Klášterská and Ivan Klášterský

KLÁŠTERSKÁ, I. & KLÁŠTERSKÝ, I. 1974 11 28. Cytology and some chromosome numbers of Czechoslovak roses II. — Bot. Notiser. 127: 328—337. Lund. ISSN 0006-8195.

The present paper deals with the results of a cytological evaluation of the spontaneous species of the genus *Rosa* in the collection belonging to the Botanical Institute of the Czechoslovak Academy of Sciences at Průhonice near Praha. The chromosome numbers of 53 plants belonging to 20 taxa are presented. These results are compared with the complete survey of results known for each taxon until now (including the results given under other synonyms). In five species and six varieties the cytological data are published here for the first time. Each plant is provided with information on its origin.

A heptaploid plant with aberrant meiosis, taxonomically identical with hexaploid *R. jundzillii* was recorded.

Irena Klášterská, Wallenberg Laboratory, Stockholm University, S-104 05 Stockholm 50, Sweden.

Ivan Klášterský, Botanical Institute of the Czechoslovak Academy of Sciences, Průhonice near Prague, Czechoslovakia.

INTRODUCTION

The present paper continues the investigation of the living collection of natural species of the genus *Rosa* which is kept in the garden of the Botanical Institute of the Czechoslovak Academy of Sciences at Průhonice. This collection was established by Dr IVAN KLÁŠTERSKÝ during his taxonomic studies of the genus *Rosa*. For each individual the original locality and necessary taxonomical data are given. All plants have been supported by documentary vouchers both on their original localities and in their new place in the collection. The herbarium specimens (provided with their respective numbers) are deposited at the Botanical Institute of the Czechoslovak Academy of Sciences at Průhonice.

More detailed data regarding the particularities of the cytology of this genus have been published by KLÁŠTERSKÁ (1969).

Each result is also provided with all the literature data on the cytology of the respective taxon the author was able to gather (including those published under other synonyms). It must be pointed out, however, that the species are often not sharply separated from each other, and there exist many transitional forms — these data and contingent differences of chromosome numbers, should be treated very cautiously. Very often plants are probably involved which in fact are not related. The cytology of this genus has been studied predominantly by morphologists and genetists, owing to the peculiarities found in the meiosis. It is therefore probable that documentary herbarium material of the investigated individuals has not been preserved. A revision of the original determination is impossible in these cases.

METHODS

The somatic numbers (mitoses) were counted in the apical meristems of vegetative shoots. After pre-treatment with paradichlorobenzene the material was fixed in a mixture of alcohol and acetic acid (3:1). Squashes made according to MURIN's method (1960) were stained with gentian violet. For the study of meiosis, the buds were fixed in Navashin's fluid and paraffin sections were stained with crystal violet.

RESULTS

Section Cinnamomeae

Rosa pendulina L. (*R. alpina* L.)

References: as *R. pendulina* L. — TÄCKHOLM (1922) in 5 plants $2n=28$, M 14_{II}, PENLAND (1923) $2n=28$, M 14_{II}, HURST (1928, 1931/2) in 14 plants $2n=28$, M 14_{II}, FAGERLIND (1945, 1948, 1951) $2n=28$, M 14_{II}.

Data for varieties: *R. pendulina* var. *laevis* R. KELL. — KLÁŠTERSKÁ (1969), $2n=28$, M 14_{II}, as *R. pendulina* f. *balsamea* R. KELLER — FAGERLIND (1951) $2n=28$, as *R. pendulina* var. *pyrenaica* SER. — TÄCKHOLM (1922) $2n=28$, as *R. pendulina oxyodon* ROWLEY (1960) $2n=21$ and once $2n=36$.

Under syn. *R. alpina* L. var. *macrophylla* (LINDL.) BOULENG. — ERLANSON (1937) $2n=28$, $2n=42$.

1. *pendulina* (522=registration number of the shrub in the collection). $2n=28$. — Part of a shrub from Bohemia, mountains Doupovské hory, hill Štengelberg above Radošov in 1951 transplanted into the collection from the original locality.

2—4. *pendulina* (504, 507, 511). $2n=28$. — Seed-grown plants. The seeds were taken from the shrub (522) under no. 1 from the original locality and sown out in 1951; they germinated luxuriantly in 1953. These individuals represent a typical form of the species. They have usually one, rarely two straight larger prickles under each leaf insertion on floriferous twigs. The plants conform perfectly to the herbarium material taken from the parent plant on the original locality.

Rosa pendulina L. var. *pubescens* (KOCH) R. KELL.

5. *pendulina* var. *pubescens* (788 a). $2n$

=28. — The shrub was dug out from the original locality: Slovakia, region Slovenský ráj (highland Stratenská hornatina), a cleared slope (originally Fageto-Abietetum) near the ice grotto of Dobšiná (=Dobšinská Láďová jaskyňa), about 900 m altitude; it was transferred to the collection in 1965. This individual represents a typical form of the species and variety. It has no prickles at all, they are absent even on the shoots (innovations).

Section Jundzilliae

Rosa jundzillii BESS. (*R. marginata* auct. non WALLR.)

References: as *R. jundzillii* BESS. var. *typica* R. KELL. — TÄCKHOLM (1922) 5 plants $2n=42$, M 7_{II}+28_I. As *R. jundzillii* BESS. — HURST (1928) $2n=42$, M 7_{II}+28_I, FAGERLIND (1951) $2n=42$, M 7_{II}+28_I, ROWLEY (1960) $2n=42$, in the experiment in one case $2n=43$, KLÁŠTERSKÁ (1969) in three plants $2n=42$, M 7_{II}+28_I.

6. *jundzillii* (977 a). $2n=42$. — A small shrub from Bohemia, mountains České Středohoří, a steep slope below the top of the hill Richterstein above the village of Horní Týnec; it was transferred to the collection in 1967 (it originates from the same population as (84) which was transferred in 1935).

Rosa jundzillii BESS. var. *heteracantha* (CHRIST.) R. KELL.

7—8. *jundzillii* var. *heteracantha* (227 b, 935 — two separate parts of the same individual). $2n=49$. — The origin of this individual is a little more complicated: In 1935 seeds of *R. jundzillii* were collected on a locality below the top of the hill Richterstein in České Středohoří, only a few seedlings were obtained. One of them was planted into the collection under no. 84. From this shrub (which, unfortunately, died in 1960) seeds from free pollination were sown out again in 1941 and one selected seedling was planted into the collection. On the occasion of a later replanting it was divided into two individ-

uals (227 b and 935). Herbarium material exists taken both from the original parent shrub on the hill Richterstein and from the shrub (84) as well as from both the living shrubs (227 b, 935). These herbarium specimens fully conform with each other; they all are doubtless *R. jundzillii* BESS. There exists one difference only, viz. on Richterstein only low shrubs occur, whereas in the collection they are comparatively robust shrubs, 120—150 in height. — This shrub which in morphological respects is not different from the other typical representatives of this species, is cytologically aberrant. The heptaploid chromosome number was observed in apical meristems. The evaluation of meiosis, which is of the Caninae type, could not be made at diakinesis and metaphase I. At anaphase I (where the chromosomes which formed bivalents move in distinct groups some first to the poles, while the univalents remain at the equatorial plane), the following frequencies of "bivalents" was found among the 22 PMCs studied: 15(1), 16(1), 17(3), 18(1), 19(5), 20(6), 21(4), 22(1). Meiosis in individual anthers, especially in the later stages of cell division, is not synchronized. The formation of "tetrads" is much more regular than is usual in *R. jundzillii*, fewer microspores are formed (see Caninae type meiosis, KLÁŠTERSKÁ 1969). A more detailed study of meiosis in this plant is given in KLÁŠTERSKÁ and NATARAJAN (1974). Later another heptaploid plant of *R. jundzillii* was found by Dr N. KONČALOVÁ in the original habitat.

Rosa jundzillii BESS. var. *trachyphylla*
(RAU) CRÉPIN

9. *jundzillii* var. *trachyphylla* (392). $2n=42$. — A seed-grown plant from a sowing (in 1951) of seeds taken from a shrub in Bohemia above the village of Salajna (formerly Konradsgrün) near the town Cheb. The seeds germinated in 1953.

10. *jundzillii* var. *trachyphylla* (223). $2n=42$. — This shrub was dug out in 1948 in

Bohemia: Bohemian Karst (neighbourhood of Karlštejn castle), hill Velká hora near Karlštejn, a steppe meadow, about 300 m altitude. A typical example of both species and variety.

11—13. *jundzillii* var. *trachyphylla* (394, 396, 442). $2n=42$. — Seed-grown plants. The seeds taken from a shrub in Bohemia above the village of Salajna (Konradsgrün) near Cheb, were sown out in 1950. A typical form of both species and variety. They originate from the same sowing as (392) under no. 9.

Rosa jundzillii BESS. var. *nemorivaga*
(DÉS.) R. KELL.

14. *jundzillii* ± var. *nemorivaga* (329). $2n=42$. — From a sowing brought from an unknown botanical garden. (It differs from var. *trachyphylla* primarily in its pubescent leaves and a more developed glandulosity.)

Section **Caninae**

Rosa canina L.

References: As *R. canina* L. — BLACKBURN and HARRISON (1921), HURST (1928), GUSTAFSSON and HÅKANSSON (1942), GUSTAFSSON (1944), YARNELL and BLACKHURST (1941), FAGERLIND (1951, 1958), LEWIS (1958): in all cases $2n=35$, $M 7_{II}+21_I$. ROWLEY (1960) found in an experiment (sowing of seeds from free pollination) the following numbers: fifteen times 35, twice 31, four times 33, three times 34 and three times 36. As *R. canina* L. var. *lutetiana* (LÉM.) BAKER — KLÁŠTERSKÁ (1969) $2n=35$ in three plants. TÄCKHOLM (1922) and HURST (1931/1932) give the results for a series of varieties in all cases as $2n=35$, $M 7_{II}+21_I$ (on the basis of the nomenclature used there it is in most cases impossible to reconstruct which taxa — from the viewpoint of the current conception — were discussed). Furthermore, there exist a number of data regarding cultivars of *R. canina* used under various names in practical horticulture: for *R. canina* cv. *Grange Briar* ROWLEY (1960) gives from an experiment the following numbers: $2n=42$ (seven times), 39 (once), 43 (twice). For *R. canina* cv. *Jägerbataillon* RABY (1937) gives $2n=35$, for *R. canina* cv. *Kokulensky* FERGUSON (1933) gives $2n=35$, ROWLEY (1960) from

an experiment $2n=35$ (nine times), 34 (once), RABY (1937) $2n=35$; for *R. canina* cv. *Schmidt's Ideal* RABY (1937) gives $2n=35$, for *R. canina* cv. *Senff* FERGUSON (1933) gives $2n=35$, RABY (1937) $2n=34$, ROWLEY (1960) from an experiment $2n=34$ (nine times), 42 (once), for *R. canina* cv. *Polmeriana* RABY (1937) gives $2n=35$.

Rosa canina L. var. *dumalis* BAK.

15. *canina* var. *dumalis* (37 a). $2n=35$. — An individual that is not very typical. Leaflets only irregularly double serrate, eglandular. A seed-grown plant, origin unknown. The number mentioned above had already been found before (1933) by POLÍVKOVÁ (unpubl.) in the root tips of germinating seeds.

16. *canina* var. *dumalis* ($\pm$ *bicolor* R. KELL.). (846). $2n=35$. — The shrub was dug out in 1966 in Slovakia: highland Strážovská hornatina, the village of Horné Vestenice; a dry, bushy slope east of the village, dolomite, about 400 m altitude.

Rosa canina L. var. *lutetiana* (LÉM.) BAKER (*R. lutetiana* LÉM.)

17. *canina* var. *lutetiana* (83). $2n=35$. — A seed-grown plant. Seeds taken from the parent shrub in Bohemia mountains České Středohoří, on the hill Richterstein near the village of Horní Týnec, on basalt, about 500 m altitude. They were sown out in 1932 and germinated in 1935. The individual represents a typical form of both species and variety.

Rosa squarrosa (RAU) BOREAU (*R. scabrata* CRÉP.)

References: No data known up to the present.

18. *squarrosa* (673 a). $2n=35$. — The shrub was dug out in 1965, locality: Slovakia, village Hontianské Nemce (S of the town of Banská Štiavnica), pastureland named Pusté vinice above the hamlet of Pivnica. It represents a rather atypical form of the species: the glands are sparse,

beneath they occur on the main-vein only. It shows close affinity with the form group of *R. canina* L. var. *dumalis* BAK.

19. *squarrosa* (682). $2n=35$. — The shrub was dug out in 1965, locality: Slovakia, slopes above the road running along the River Hron between the towns of Zvolen and Hronská Dúbrava (Quercetum cerris with small steppe meadows). This individual represents a typical form of the species.

Rosa blondaeanae RIPART ex DÉS. (*R. nitidula* BESS.?)

References: under the synonym *R. canina* var. *blondaeanae* GUSTAFSSON (1944) and GUSTAFSSON and HÅKANSSON (1942), $2n=42$, M 7II + 28I, under the synonym (?) *R. nitidula* BESS. $2n=35$, TÄCKHOLM (1922).

20. *blondaeanae* (825). $2n=35$. — The individual was dug out in 1966, locality: Western Slovakia, southern part of the highland Strážovská hornatina, slopes E. of the village of Dolné Vestenice. It differs from the typical form of the taxon in its prickles which on the innovations are straight or very slightly bent, as well as by rather sparsely occurring glands beneath the leaflets and on the fruit peduncles.

Rosa subcanina (CHRIST) DALLA TORRE et ŠARNTH.

References: No data known up to the present.

21. *subcanina* (819). $2n=35$. — The shrub was dug out in 1966, locality: Slovakia, highland Strážovská hornatina, hill Baba above the village of Omšenie (near the spa Trenčianské Teplice). The sepals, which are typically horizontally spreading to suberect and longer persistent, corroborate the relationship with this species, whilst other characters answer to *R. canina* L.

Rosa intricata GRENIER (1864)

References: No data known up to the present.

22—25. *intricata* (540, 542, 543, 544). $2n=35$. — All four shrubs are separate parts of one shrub found on the locality: Bohemia, mountains České Středohoří, hill Boreč above Režný Újezd near the town of Lovosice, on phonolite, about 360 m altitude. They were transferred to the collection in 1963. — *R. intricata* GRENIER is an old (1864) species; it is restored by KLÁŠTERSKÝ who includes in it all taxa (varieties and forms) of *R. vosagiaca* DESP. with doubly to compound-serrate leaflets which are glandular beneath at least on the main-nerve (however, they are often glandular on the secondary nerves or even on the whole blade, too); the flower (and fruit) pedicels also bear stalked glands.

Rosa corymbifera BORKH. (*R. dumetorum* THUILL.)

References: As *R. corymbifera* BLACKBURN and HARRISON (1921) $2n=35$, under the synonym *R. canina* L. var. *dumetorum* (THUILL.) HURST (1931—1932) $2n=35$, M $7_{II}+21_I$, under the synonym *R. dumetorum* THUILL. TÄCKHOLM (1922), BLACKBURN and HARRISON (1921), PENLAND (1923) $2n=35$, M $7_{II}+21_I$, YARNELL and BLACKHURST (1941) $2n=35$.

Rosa corymbifera BORKH. var. *platyphylla* (RAU) CHRIST.

26. *corymbifera* var. *platyphylla* (757). $2n=35$. — The shrub was dug out in 1956, locality: Slovakia, on bushy slope, sunny and dry, near the village of Hontianské Nemce, on andesite, about 250 m altitude. A typical form of both species and variety.

27. *corymbifera* var. *platyphylla* (642). $2n=35$. — A seed-grown plant. The shrub was planted in 1958. A typical form of both species and variety.

28. *corymbifera* var. *platyphylla* (P 8). $2n=35$. — A shrub growing spontaneously in the park of Průhonice (rose garden, on a spot close to a wall). The pubescence is only slightly developed, only the rhachis and main-nerve of leaflets are sparsely hairy. Plants like this one occur frequently in the valley of the brook Botič in the sur-

roundings of Průhonice, and from there it was probably transferred to the park.

Rosa coriifolia FRIES (*R. caesia* SMITH)

References: As *R. coriifolia* FRIES — TÄCKHOLM (1922), BLACKBURN and HARRISON (1921), YARNELL and BLACKHURST (1941), KLÁŠTERSKÁ (1969), in all cases $2n=35$. ROWLEY (1960) gives from an experiment $2n=35$ (ten times), 34 (twice), 36 (four times), 37 (three times), 38 (once). TÄCKHOLM (1922) gives the results for a number of varieties (in all cases $2n=35$). His nomenclature, however, is no longer used, and in most cases it is impossible to reconstruct which taxa (from the present standpoint) were under discussion.

For syn. *R. caesia* SMITH var. *venosa* (SCHWARTZ), HURST (1931—1932) gives $2n=35$, M $7_{II}+21_I$.

Rosa coriifolia FRIES var. *froebelii* KOEHNE

29. *coriifolia* var. *froebelii* (591). $2n=35$. — A sample of the garden stock used at the experimental station Kostelec nad Černými Lesy, incorrectly called *Rosa laxa*. It was transferred to the collection in 1964.

30. *coriifolia* var. *froebelii* (283). $2n=35$, in meiosis $7_{II}+21_I$. — It was acquired from Mr FRANK, head of the Municipal horticultural enterprise of the town of Přeštice (Bohemia), as an example of stock. In the collection since 1956.

Rosa pycnanantha BORB. (= *R. coriifolia* FRIES f. *pycnacantha* BORB.)

References: KLÁŠTERSKÁ (1969), in four plants $2n=35$, M $7_{II}+21_I$.

31. *pycnacantha* (404, 406). $2n=35$. — Seed-grown plants. The seeds were collected from: Slovakia, Banská Štiavnica, behind the place named Červená Studňa. They were sown out in 1950 and germinated in 1952. The individuals represent a typical form of the taxon (microspecies) and conform perfectly to the parent plant.

32—33. *pycnacantha* (410, 412). $2n=35$. — Seed-grown plants. The seeds were collected from: Slovakia, Banská Belá (near

Banská Štiavnica), above the pond Kolpachský rybník. They were sown out in 1950 and germinated in 1952. The individuals represent a typical form of the taxon (microspecies) and do not show any differences from the parent plant (according to the herbarium specimens).

34—35. *pycnacantha* (246, 247). $2n=35$. — (247) is only a separate part of (246). — The shrub was dug out in 1950 on the locality: Slovakia, Banská Štiavnica, at the foot of the hill Kalvária. This individual is a typical form of the taxon (microspecies) from a place very close to locus classicus.

36—37. *pycnacantha* (404, 538). $2n=35$. — Seed-grown individuals. The seeds were collected from Slovakia, Banská Štiavnica, slope in the place named Vindšachta near the village of Sitnianska. They were sown out in 1950 and germinated in 1952. The individual represent a typical form of the taxon (microspecies) and is in perfect accordance with the herbarium specimens of the parent plant.

Rosa inodora FRIES (forma *briacensis* H. BRAUN?)

References: As *R. inodora* FRIES — TÄCKHOLM (1922) $2n=42$. HURST (1928, 1931/2) $2n=42$, M 7II+28I.

38. *inodora* f. *briacensis* (831 b). $2n=42$. — The shrub was dug out in 1966 on a slope (pasture) in Slovakia, highland Strážovská hornatina, valley of the River Váh, above the village of Dolné Hlboké nad Váhom, about 400 m altitude. It is not a wholly typical individual.

Rosa gizellae BORB. (*R. obornyana* CHRIST.)

References: No data known up to present.

39. *gizellae* (820). $2n=42$. — The shrub was dug out in 1966 in Slovakia: southern slope of the mountain Baba near the spa Trenčianské Teplice; on limestone, about 500 altitude. A not very typical form of

the species: it is densely prickly, but leaflets are less pubescent than the typical individuals. Only some peduncles with glands (which sometimes occur also beneath the hips). This form occurs rather frequently in the locality.

40. *gizellae* (?) (686). — $2n=42$. — A transitional form between *R. gizellae* BORB. and *R. agrestis* SAVI. The plant is sparsely pubescent to subglabrous, rather poorly glandular (in comparison with other Slovakian individuals), styles short and entirely glabrous. The shrub was dug out in 1965 in Slovakia: steppe meadows in an oak forest (*Quercus cerris*) on an andesite slope facing south, above the road between Hronská Dúbrava and Zvolen (valley of the River Hron).

Rosa denudata (R. KELL.) KLÁŠT. (in KLÁŠTERSKÝ 1969) (*R. agrestis* SAVI var. *denudata* R. KELL.)

References: No data known up to present.

41. *denudata* (818). $2n=42$. — The shrub was dug out in 1966, locality: Slovakia, highland Strážovská hornatina, on the hill Baba above the village of Omšenie near the spa Trenčianské Teplice, about 550 m altitude, on limestone.

42. *denudata* (826). $2n=42$. — The shrub was dug out in 1966 on the following site where more individuals of the same species occurred: Slovakia, highland Strážovská hornatina, in a small valley among the hills near the village of Dolné Vestenice, about 240 m altitude, on dolomite.

Remarks on both plants under nos. 41 and 42: This species differs strongly from all the other forms of the *agrestis* complex. It is glabrous, the leaflets beneath (and, of course, also above) bearing absolutely no glands. More or fewer glands occur on the petiole and rhachis, but they are never numerous; sometimes they are almost solitary. The serration of the leaflets and the shape and size of hip, calyx, disk and styles are nevertheless typical of the *R.*

agrestis complex. Although this taxon is not too widespread in the extensive area it occurs in many localities in Strážovská hornatina. It is conspicuous especially in one character, viz. that the sepals spread horizontally before the hip ripens (and fall soon afterwards); this character, although not mentioned in R. KELLER's original description, points to some degree of analogy with *R. indora* FRIES.

Rosa tomentosa SMITH

References: As *R. tomentosa* SMITH (1800) — HURST (1928) $2n=35$, M $7_{II}+21_I$, as *tomentosa* var. *Richardsoniana* HARRISON (1930) $2n=35$, M $7_{II}+21_I$. TÄCKHOLM (1922) mentions four varieties of *R. tomentosa*, in all cases $2n=35$, $7_{II}+21_I$.

43—46. *tomentosa* (407, 455—456). $2n=35$. — Seed-grown plants. The seeds were taken from a shrub from: Slovakia, Banská Štiavnica, next to the road running towards the village of Teplá, about 570 m altitude, on andesite. They were sown out in 1950, germinated in 1952. These individuals represent a typical form of the species and conform perfectly to the herbarium specimens of the parent shrub taken from the original locality.

47. *tomentosa* (844). $2n=35$. — The shrub was dug out in 1966, locality: Slovakia, highland Strážovská hornatina, a slope (pasture) above the village of Vrchteplá, about 560 m altitude, on dolomite. The individual represents a typical form of the species.

Rosa tomentosa SMITH var. *subglobosa* (SMITH) CARION.

48. *tomentosa* var. *subglobosa* (484). $2n=35$. — A seed-grown plant. The parent shrub was found in Bohemia, near the village of Petrov in the highland Doupovské hory. The seeds were sown out in 1951, germinated in 1953. A typical form of both species and variety.

49. *tomentosa* var. *subglobosa* (690). $2n=35$. — The shrub was dug out in 1965 in

Slovakia: Low Tatra Mountains, limestone hillocks along the road above the village of Malužiná, about 800 m altitude. A typical form of both species and variety.

Rosa sherardii DAVIES

(= *R. omissa* DÉS.)

References: as *R. sherardii* DAV. (perhaps var. *pseudomollis* W. DOD) — ROWLEY (1960), in an experiment $2n=35$ (twenty-one times). 34 (once). As *R. omissa* — BLACKBURN and HARRISON (1921) $2n=28, 35$, WULFF (1954) on the data from TISCHLER (1950): $2n=28$ ($7_{II}+14_I$), 35 ($7_{II}+21_I$), 42 ($7_{II}+28_I$). As *R. omissa* DÉS. (1864 p.p.) — HURST (1928) $2n=28$, M $7_{II}+14_I$.

50—51. *sherardii* (480, 485). $2n=35$. — Seed-grown plants. The seeds were collected from: Bohemia, highland Doupovské hory, pastureland near the village of Petrov, about 550 m altitude, on basalt. Sown out in 1951, they germinated in 1953. The individuals represent a typical form of the species.

Plants in the Collection which are Regarded as Spontaneous Hybrids

52. *Rosa gizellae* BORB. $\times$ *Rosa eglanteria* L.? (800). $2n=41$. — The shrub was dug out in 1965 in Poland: a dry slope, on almost bare Cambrian shales, hills Góry Pieprzowe in the valley of the River Vistula near the town of Sandomierz, about 180 m altitude.

It answers well to the description of *R. gizellae* BORB. with the exception of two not unimportant characters: the sepals of mature hips are perfectly, typically erect, the styles are numerous, short, forming a hairy sessile capitulum on the flat disk. These two characters on which the plant is distinctly separated from the classical form of the *R. agrestis* complex, bring it nearer to *R. inodora* FRIES. Thus, it is an analogy of this species in the group of forms with glandular peduncles. If *R. inodora* FRIES is regarded as a remnant of the hybrid swarm between *R. agrestis* SAVI

and *R. elliptica* TAUSCH, it may be assumed that this individual is perhaps an offspring of a former crossing between *R. gizellae* BORB. and *R. eglanteria* L. (which, by the way, frequently occurs in the rich local population of the Góry Pieprzowe). This opinion is also supported by the presence of comparatively numerous suprafolial glands which appear irregularly, but not rarely, on the leaves of this individual in the same way as in some individuals of *R. eglanteria* (var. *umbellata* LEERS DU MORT.). In the locality in the Góry Pieprzowe this form occurs fairly frequently.

53. *Rosa pendulina* × *Rosa vosagiaca* (*R. Maukschii* KIT. in SCHULT. Fl. austr. Č: 69 1814, nothomorpha nova. (790 d) $2n=42$).

Shrub about 130 cm high, rather dense, with numerous shoots from underground suckers. Both branches and shoots purple, mostly totally without prickles; prickles only sparse, solitary, either thin, slightly curved to almost straight with broadly elliptical bases, or, less frequently, stouter and longer, at their tips more distinctly curved, with bases long-elliptical. Floriferous twigs completely lacking prickles, ± densely leafy.

Leaves consisting of (5—)7 leaflets, glabrous, only petioles locally puberulent; petioles abundantly glandular, rhachis (sparsely glandular) and stipules purple, leaflets dark green above, on their edges frequently purple, below greyish-green. Leaflets coriaceous, broadly ovate or broadly elliptical (30×20 , 38×24 , 35×28 mm) or, more rarely, suborbicular (25×23 mm), shortly acute, less frequently subobtuse to obtuse, at bases shortly and broadly cuneate or rotundate, irregularly toothed, lower leaves bidentate with intruded simple teeth, the upper leaves predominantly simply toothed, both above and beneath totally glabrous and eglandular, or on the main-vein below sparsely glandular, very rarely with a few glands on the lateral veins, too. Stipules big, broad, their auricles big, acute or acuminate, both above and below glabrous,

eglandular, only on their edges fimbriate-glandular.

Flowers solitary or in few-flowered corymbs. Pedicels short (4—12 mm), more or less stipitate-glandular, covered with the longer and comparatively broad bracts. The almost ripened hips bottle-shaped (25×12 , 23×10 mm), below the disk contracted into a well-developed neck, sepals rather broad, 18—23 mm long, above slightly broadened, the external ones with 1—3 lateral appendages, edges partly sparsely glandular (sometimes also on the back poorly glandular), immediately after anthesis deflexed, later patent or even erect. We have not seen the petals. Disk flat, ostium rather broad. Styles form a big, ± dense capitulum. It differs from *R. pendulina* in the following characters: Stouter and ± curved prickles, dense acicles in the lower parts of shoots are lacking; leaves with at most 7 leaflets (also in the shoots), wholly glabrous; leaflets coriaceous, edges sometimes (in the upper leaves always) simply toothed; bracts long and rather broad; short, rather stout pedicels which are mostly sparsely stipitate-glandular; sepals with lateral appendages.

From *R. vosagiaca* it differs in the production of numerous underground suckers and shoots growing from them; in very sparse, thinner and only slightly curved prickles on stems; in at least some petioles slightly pubescent; in pedicels which are always ± stipitate-glandular; and in bottle-shaped hips with a well-developed neck below the disk.

From both parents the plant differs in its intensive anthocyanin coloration which causes the dark purple colour of bark, the dark green colour of leaves (above), and in the colour of the hips which are brown rather than red.

Only one individual among the parent plants has been found by VÁCLAV VĚTVIČKA in N. Slovakia (Montes Carpathi occid.), at the foot of the Liptovské Hole Mts, near the mouth of the brook Ráčkový potok, on a scrubby mountain meadow near the village of Pribylina, 900 m alti-

tude. The individual was transferred to the rosarium of the Botanical Institute of the Czechoslovak Academy of Sciences at Průhonice near Praha on September 1, 1965, and has been kept there in culture since (after dividing it into four) under no. 790 a, b, c. — The herbarium documentation material from the original locality has been deposited in the collections of the Department of Botany of the National Museum at Průhonice under no. 287092.

DISCUSSION

This paper which represents a continuation of the cytological investigation of the collection of natural taxa of the genus *Rosa*, includes further results for some species and varieties. In several cases earlier statements have been confirmed. In other cases new data only are given for the varieties, as the species have previously been elaborated cytologically. For the species *R. subcanina*, *R. squarrosa*, *R. gizellae*, *R. intricata* and *R. denudata*, the cytological data are given for the first time.

Our findings are not in accordance with the cytological data published in the literature for *R. blandaana*. GUSTAFSSON (1944) and GUSTAFSSON and HÅKANSSON (1942) give $2n=42$ for *R. canina* var. *blandaana*, whereas our individual is pentaploid.

For *Rosa sherardii* (= *omissa*) the following numbers are to be found in the literature: $2n=28$, 35 and 42 (meiosis: $7_{II} + 14_I$, $7_{II} + 28_I$). It is no longer possible to decide whether there were in fact different taxa under discussion, or whether these different numbers were found in morphologically conforming individuals (cases like this have been found in the species *R. caryophyllacea* and *R. jundzillii* in our collection). Owing to the regular formation of 7 bivalents in meiosis, it is probable that in reality different taxa were in question. Both specimens in our collection are pentaploid.

ROWLEY's (1960) studies, showing the yield of a high number of aneuploid plants

from free pollinated seed, were not confirmed.

Of great interest is the heptaploid *R. jundzillii*. The origin of the plant in the collection is complicated, but another heptaploid plant (possibly the mother plant) morphologically identical, was found in the original habitat. As on the locality only *R. canina*, *R. jundzillii* and *R. gallica* were found, the heptaploid *R. jundzillii* could possibly have originated as a cross between *R. jundzillii* (egg cell 35 chromosomes) and *R. gallica* (pollen 14 chromosomes), but the influence of the pollinator is not detectable morphologically. The question as to how this unusual chromosome number was preserved through two generations by means of such irregular meiosis (KLÁŠTERSKÁ & NATARAJAN 1974) remains unanswered.

Another case of different chromosome numbers in two taxonomically identical plants (*R. caryophyllacea*, $2n=35$ and 42) was reported in a previous paper (KLÁŠTERSKÁ 1969).

ACKNOWLEDGEMENTS

Thanks are due to Dr A. T. NATARAJAN and Professor F. FAGERLIND for their help and interest.

LITERATURE CITED

- BLACKBURN, K. B. & HARRISON, J. W. H. 1921. The status of the British Rose forms as determined by their cytological behaviour. — *Ann. Bot.* 35: 159—188.
- ERLANSON, E. W. 1937. BOULENGER, G. A., Revision des Roses d'Asie. (Review.) — *Journ. Ind. Bot. Soc., Madras*, 16: 241—244.
- FAGERLIND, F. 1945. Die Bastarde der Canina-Rosen, ihre Syndese- und Formbildungsverhältnisse. — *Acta Hort. Berg.* 14: 7—37.
- 1948. Compatibility, eu- and pseudoincompatibility in the genus *Rosa*. — *Ibid.* 15: 1—36.
- 1951. Influence of the pollen giver on the production of hips, achenes and seeds in the Canina-roses. — *Ibid.* 16: 121—168.
- 1958. Hip and seed formation in newly formed *Rosa* polyploids. — *Ibid.* 17: 229—256.

- FERGUSON, J. 1933. A botanical study of rose stocks. — Journ. Roy. Hort. Soc. 58: 344—371.
- GUSTAFSSON, Å. 1944. The constitution of the *Rosa canina* complex. — Hereditas 30: 405—428.
- & HÅKANSSON, A. 1942. Meiosis in some *Rosa* hybrids. — Bot. Notiser 331—343.
- HARRISON, J. W. 1930. New British roses from Northumberland. — Proc. Univ. Durham, Philosoph. Soc. 8: 161—167.
- HURST, C. C. 1928. Differential polyploidy in the genus *Rosa* L. — Zeitschr. Abst. Vererb. Suppl. 2: 868—906.
- 1931—1932. Embryo-sac formation in diploid and polyploid species of *Rosae*. — Proc. Roy. Soc. London, B 109: 126—148.
- KLÁŠTERSKÁ, I. 1969. Cytology and some chromosome numbers of Czechoslovak roses I. — Folia Geobot. Phytotax. 4: 175—189.
- & NATARAJAN, A. T. 1974. Studies on the cytology of the genus *Rosa* with special reference to the section *Caninae*. — Hereditas 76: 97—108.
- KLÁŠTERSKÝ, I. 1969. Komplex *Rosa agrestis* v Československu (Die Problematik des *Rosa agrestis*-Komplexes in Tschechoslowakei). — Zprávy Čs. botan. společ. 4: 179—184.
- LEWIS, W. H. 1958. The roses of Virginia and West Virginia. — Castanea 23: 77—88.
- MURÍN, A. 1960. Substitution of cellophane for glass covers to facilitate preparation of permanent squashes and smears. — Stain Technol. 35: 351—353.
- PENLAND, C. W. 1923. Cytological behaviour in *Rosa*. — Bot. Gaz. 76: 403—410.
- RABY, J. 1937. The cytology of rose stocks. — Gard. Chron. 102: 145.
- ROWLEY, G. 1960. Aneuploidy in the genus *Rosa*. — Journ. Genetics 57: 253—263.
- TÄCKHOLM, G. 1922. Zytologische Studien über die Gattung *Rosa*. — Acta Hort. Berg. 7: 97—381.
- TISCHLER, G. 1950. Die Chromosomenzahlen der Gefäßpflanzen Mitteleuropas. — Gravenhage.
- WULFF, H. D. 1954. Zytologische Untersuchungen an einem pentaploiden Rosenbastard (*Rosa* hybr. "315") und seiner Nachkommenschaft. — Planta 43: 420—439.
- YARNELL, S. H. & BLACKHURST, H. T. 1941. Rose investigations — cytological studies. — Texas Agricult. Exp. Station, 54 Ann. Rep. 53.

Notes on Central Andean Passifloraceae

L. B. Holm-Nielsen

HOLM-NIELSEN, L. B. 1974 11 28. Notes on Central Andean Passifloraceae. — Bot. Notiser 127: 338—351. Lund. ISSN 0006-8195.

Three new species of *Passifloraceae*, viz. *Passiflora harlingii*, *P. sparrei* and *P. caucaense* and a new variety of *P. mixta*, *P. mixta* var. *pilaloense*, are described. Further, new collections of 34 spp. are mentioned and short notes on their distribution are given.

L. B. Holm-Nielsen, Botanical Institute, Nordlandsvej 68,
DK-8240 Risskov, Denmark.

INTRODUCTION

This paper is a contribution to the knowledge of the central Andean distribution of the *Passifloraceae*. The study has been carried out as part of the study of the family for the "Flora of Ecuador". The main part of the material is Colombian, collected by different local botanists. The Ecuadorian material mentioned was collected by the author during an expedition to Ecuador (HOLM-NIELSEN & JEPPESEN 1968). The taxonomic arrangement and the terminology follow KILLIP (1938, 1960). Of the 38 taxa mentioned 4 are new to science, viz. *Passiflora caucaense*, *P. harlingii*, *P. sparrei*, and *P. mixta* var. *pilaloense*. *P. caucaense* was seen in the Cauca Valley, Colombia, by KILLIP but as the corona was withered he was not able to see the differences between it and *P. emarginata*, which makes it necessary to describe this new species here. The other new taxa have all been collected in the area around the little Ecuadorian village Pilalo in the Western Cordillera of the Andes, central Ecuador. This area has an extremely rich and luxurious vegetation, the mountain and fog forest above the village in particular having a concentration of species seen hardly anywhere else in the country. Large areas of this vegetation on the steep slopes of the Andes in this valley system are still unexplored.

During this study several problems have arisen, and it would be convenient to stress some of them. Firstly, though *Passiflora* is a very "ornamental" genus there are extremely small collections of almost every species, apart from the widespread species such as *P. mixta* and *P. foetida*. Secondly, it seems possible that within the group several examples of vicarious species and relatively local endemics (especially of the high Andean taxa) occur. Thirdly, the labels are badly lacking in careful notes on the coronal structure and the colours of the different floral parts, which are of great taxonomic value, and often nearly impossible to recognize when the plants have been dried, when even the rather strong coronal tissues often become badly deformed.

Further field work is obviously needed, including careful notes, photographs and collections, and besides this further experimental studies must be carried out including bio-taxonomic studies of some of the rather puzzling groups, which will almost certainly change the limits of some of the taxa.

Passiflora L., Sp. Pl. 955. 1753.

Subg. **Plectostemma** MAST., Trans. Linn. Soc. 27: 626. 1871.

Passiflora coriacea JUSS., Ann. Mus. Hist. Nat. 6: 109. 1803.

Colombia: Dept. Magdalena, vicinity of San Andrés, alt. 100—1,300 m. Mar. 24. 1959. R. ROMERO-C. 7607 (AAU).

Distribution. - Mexico—northern South America to Peru and Bolivia.

Passiflora auriculata HBK., Nov. Gen. et Sp. 2: 131. 1817.

Colombia: Dept. Narino, 22 km E of Espriella, in Tumacu district. July 8. 1952. R. ROMERO-C. 3187 (AAU).

Distribution. Central America to northern South America and the Amazon basin to Bolivia.

Passiflora alnifolia HBK., Nov. Gen. et Sp. 2: 136. 1817.

Colombia: Dept. Magdalena, vicinity of San Andrés, alt. 1,300 m. Jan. 17. 1959. R. ROMERO-C. 6939 (AAU). Occidental slopes of Sierra Nevada, San Andrés, alt. 400—1,300 m. Mar. 25. 1959. R. ROMERO-C. 7623 (AAU).

Both collections almost certainly belong to this taxon, but extend the area of distribution as far north as to the Sierra Nevada, the northernmost mountains of South America.

Distribution. The Andes of Colombia, normally from 1,500—3,000 m.

Passiflora bogotensis BENTH., Pl. Hartw. 184. 1845.

Colombia: Dept. Cundinamarca, La Mesa district, by the road SE of La Mesa, alt. 1,100—1,300 m. May 26. 1954. L. E. MORA 669 (AAU).

Distribution. Eastern Cordillera of the Colombian Andes and the Santa Marta Mountains.

Passiflora cuneata WILLD., Enum. Hort. Bercl. 696. 1809.

Colombia: Dept. Cundinamarca, Bojacá district, the path to San Antonio; "La Merced", close to the Mosquera—Tena road, alt. 2,500—2,700 m. Oct. 6. 1964. G. LORENZO-C. and H. TORRES-R. 148 (AAU).

Distribution. Eastern Cordillera of the Colombian Andes, the Santa Marta Mountains and the central Venezuelan mountains.

Passiflora biflora LAM., Encycl. 3: 36. 1789.

Colombia: Dept. Magdalena, Santa Marta region, Tucurínca. Mar. 1. 1950. R. ROMERO-C. 2136 (AAU). Dept. Cundinamarca: vicinity of the bridge over Rio Choco, between Fusagasuga and Tibacuy, alt. 1,550 m. Jun. 21. 1961. M. T. MURILLO and R. JARAMILLO-M. 177 (AAU), Villeta district, path from Center to Rio Dulce, alt. 800—900 m. Dec. 19. 1964. G. LOZANO-C. and H. TORRES-R. 217 (AAU).

Distribution. Caribbean area, Mexico to northern South America, Bahamas.

Passiflora capsularis L., Sp. Pl. 957. 1753.

Colombia: Dept. Guajira, Chingolita, 17 km E of Carraipia, alt. 300 m. Nov. 24. 1953. R. ROMERO-C. 4404 (AAU).

Distribution. Caribbean area, Greater Antilles, Central America to Colombia and central Brazil to Paraguay, lowlands.

Passiflora pulchella HBK., Nov. Gen. et Sp. 2: 134. 1817.

Colombia: Dept. Bolivar, between Juan Arias and Magangué, by the road Sept. 9. 1963. R. ROMERO-C. 9819 (AAU).

Distribution. Mexico through Central America to the northern coast of Colombia and Venezuela, lowlands.

Passiflora hahnii (FOURN.) MAST in MART. Fl. Bras. 13, pt. 1: 569. 1872.

Colombia: Dept. Magdalena, lowlands by Rio Menguaca, alt. 100 m. Mar. 28. 1959. R. ROMERO-C. (AAU).

Distribution. Mexico through Central America to central Colombia, lowlands to 1,300 m.

Subg. **Rathea** (KARST.) KILLIP, Field Mus. Nat. Hist. Bot. 19: 28. 1938.

Passiflora harlingii sp. nov.

Herba scandens, praeter flores et superficies nervorum foliorum glabra. Caulis sub-

Bot. Notiser, vol. 127, 1974

quinguangulus. Stipulae lineari-lanceolate, 8—10 mm longae, circiter 2 mm latae, glandulis serratae, deciduae; petiolus 1.5—2 cm longus, 2—6 glandulis minutis instructus; folium subcoriaceum, ad minus quam 1 cm supra basim trilobum, lobis anguste lanceolatis, 5—7 cm longis, 1—1.5 cm latis, acutis, serrulatis, marginibus reflexis, apicibus loborum lateralium 5—8 cm distantibus, angulis inter lobos formati 45° patentibus, rotundatis vel subcuneatis. Pedunculus 10—12 cm longus, teres; bracteae, 2—3, ovate-deltoides, apice acuminatae, basi cordatae, 1.5—2 cm longae, 1.5—2 cm latae, usque ad basim liberae, serrulatae; tubus calycis cylindricus vel cylindrico-infundi-buliformis, 13—15 cm longus, ad fauces 2—4 cm latus, 10-nervis, glaber aurantiacus, apice flavus; sepala oblonga, tertiam vel quartam partem longitudinis tubi attinentia, circiter 1.5 cm lata, obtusa, quidque sub ipso apice arista minus quam 1.5 mm longa extra armatum; petala oblonga vel obovato-oblonga, 5—7 cm longa, 1.2—1.7 cm lata, obtusa, in medio tubi calycis vel paulo supra inserta; corona circiter 1.5 cm supra basim tubi sita, e filamentis formata in duas series dispositis, exterioribus (superioribus) ad 1.5—2.5 mm longis, deflexis, interioribus (inferioribus) minus quam 0.5 mm longis, erectis; operculum circiter 0.5 cm supra basim tubi situm, deflexum, margine denticulato, recurvo, limen membranaceum, poculiforme, basim gynophori cingens; ovarium ellipsoide, tomento fusco denso curto villosa vestitum, supra stamina longe stipitatum, in stylos attenuatum. Fructus maturus non visus.

Herbaceous vine, plant glabrous throughout, except flowers and upper surface veins of the leaves. Stem subquingular. Stipules linear-lanceolate, 8—10 mm long, about 2 mm wide, glandular serrulate, deciduous; petioles 1.5—2 cm long, minutely 2—6 glandular. Leaves 3-lobed to within 1 cm from the base, (lobes narrowly lanceolate, 5—7 cm long, 1—1.5 cm wide, acute, serrulate margin reflexed), 5—8 cm between apices of lateral lobes, angle between lobes 45 degrees, base rounded or subcuneate, subcoriaceous. Peduncle 10—12 cm long, terete; bracts ovate-deltoid, 2—3, apices acuminate, base cordate, 1.5—2 cm long, 1.5—2 cm wide, free to base, serrulate; calyx tube cylindrical or cylindrical—funnel-shaped, 13—15 cm long, 2—4 cm wide at throat, 10-ribbed, glabrous, orange, yellow distally; sepals oblong, one-

third to one-quarter as long as the tube, about 1.5 cm wide, obtuse, aristulate on outside just below apex, awn less than 1.5 mm; petals oblong to obovate-oblong, 5—7 cm long, 1.2—1.7 cm wide, obtuse, inserted at or slightly above middle of the tube; corona about 0.5 cm from the base of tube, filamentous, the filaments in two series, the outer (upper) up to 1.5—2.5 mm long, deflexed, the inner (lower) less than 0.5 mm, erect; operculum about 0.5 cm above base of tube, deflexed, margin denticulate, recurved, limen membranous, cup-shaped, surrounding the base of the gynophore; ovary elliptic, densely short-villous—tomentose, tomentum brown, long-stipitate above the stamens, tapering to the styles, styles distinct. Mature fruits not seen.

Holotype. HOLM-NIELSEN and JEPPESEN 1542 (AAU).

Type locality. Ecuador: Prov. Cotopaxi, area around Pilalo, 72°2'W, 0°57'S, alt. 2,400 m. Jul. 9. 1968.

Other collections. Ecuador: Prov. Cotopaxi, road Quevedo-Latacunga, above Pilalo, alt. 2,900 m. May, 3. 1968. HARLING, STORM & STRÖM 8992 (AAU, GB).

The species epithet is in honour of the Swedish botanist, Professor GUNNAR HARLING, Göteborg, who has shared his expertise with many young botanists on expeditions in Ecuador, and now as one of the leaders of the Flora of Ecuador project is continuing his work of many years by increasing our knowledge of South American plants.

The new species is remarkable because it belongs to the very distinct (sub)genus *Rathea* (KARST.) KILLIP which possesses one other species only, *Passiflora andina* KILLIP, distributed only in the northern Ecuadorian Andes. *P. harlingii* differs from *P. andina* in several respects, most strikingly in the shape of bracts, the latter having oblong-lanceolate bracts. But also in having a double-ranked corona *P. harlingii* is unique (*P. andina* having none or a very weak single-ranked corona of low teeth). After examination of these plants and other "Tacsonias" I must agree with KILLIP's suggestions for the generic relationship, and it seems evident that further investiga-

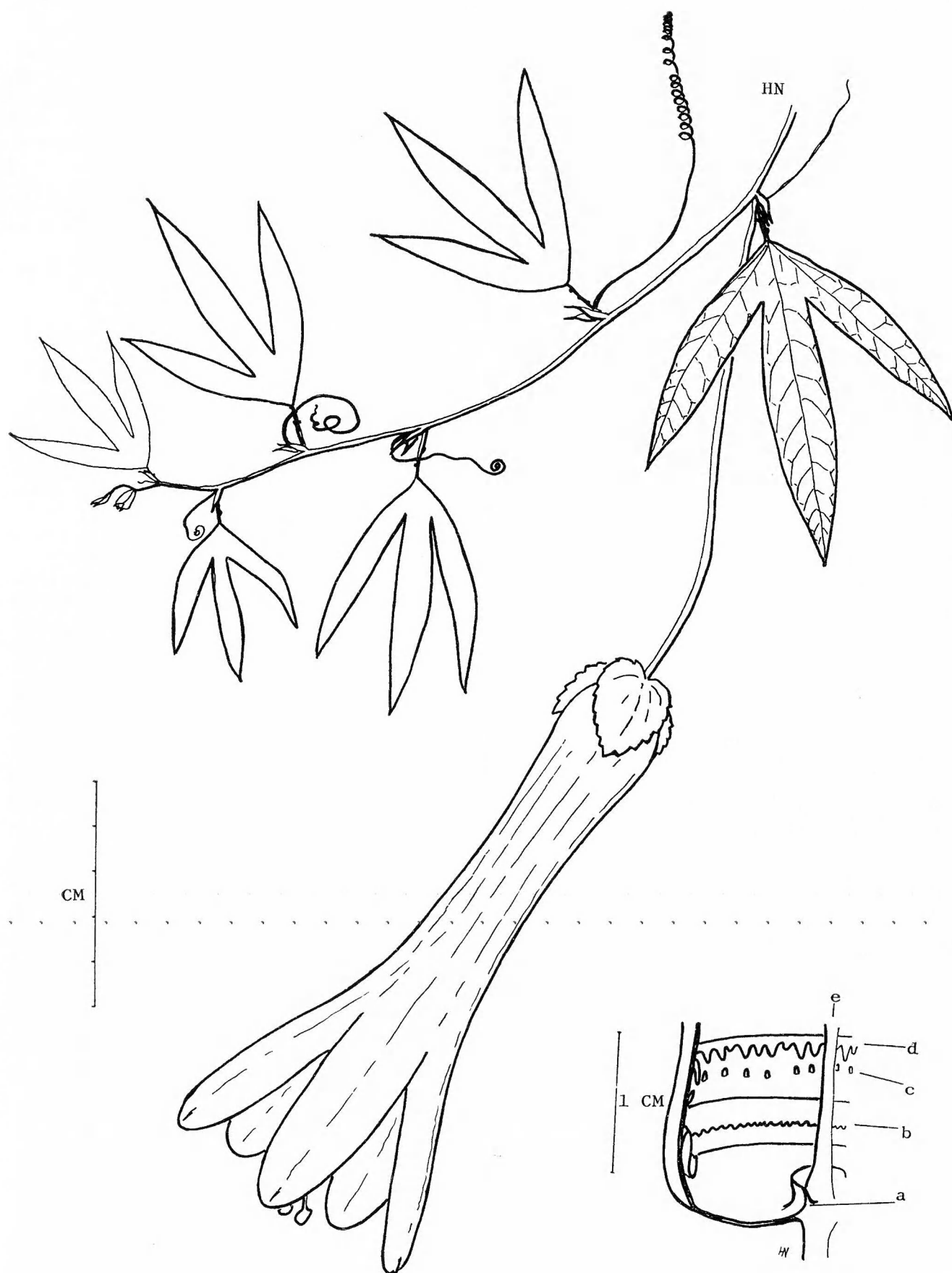


Fig. 1. *Passiflora harlingii* sp. nov. — Bottom right: transection of base of calyx tube; a: limen. b: operculum. c—d: corona. e: androgynophore.

tions will prove this taxon as sufficiently distinct to maintain the genus *Rathea* KARSTEN.

Subg. **Tacsonia** (JUSS.) TR. & PL., Ann. Sci. Nat. V. Bot. 17: 126. 1873.

Passiflora eriocaula HARMS, Repert, Sp. Nov. 18: 295. 1922.

Colombia: Dept. Cundinamarca, Junin a Gama, Rio Rucio, alt. 2,200—2,600 m. Sept. 18.—19. 1962. H. GARCIA-B. 17518 (AAU).

The collection is remarkable as it is the first time the species has been recorded so far south, and furthermore at an altitude 800 m lower than previous records, presumably under very different conditions. This specimen does not differ strikingly in morphological details, but some small differences in the venation of the leaves and bracts are seen, for example, thus it is a *P. eriocaula* though atypical.

Distribution. Eastern Cordillera of the Colombian Andes, dept. Santander and Cundinamarca, very few collections.

Passiflora mixta L. FIL., Suppl. 408. 1781.

Colombia: Dept. Cundinamarca, Cordillera Oriental, western slopes, La Pena, alt. 2,700 m. Dec. 1933. H. GARCIA-B. 68 (AAU).

The type of pubescence in this collection can be referred to the second according to KILLIP's classification. Leaves glabrous, calyx tube and ovary pubescent.

Distribution. The Andes from central Venezuela to Bolivia, alt. 2,400—2,600 m.

Passiflora mixta L. var. *eriantha* (BENTH.) KILLIP, Field Mus. Nat. Hist. 19: 298. 1938.

Ecuador: Prov. Tungurahua, Montana Agoyan, 10 km E of Banos, 78°22'W, 1°23'S. May 2. 1968. HOLM-NIELSEN and JEPPESEN 259 (AAU).

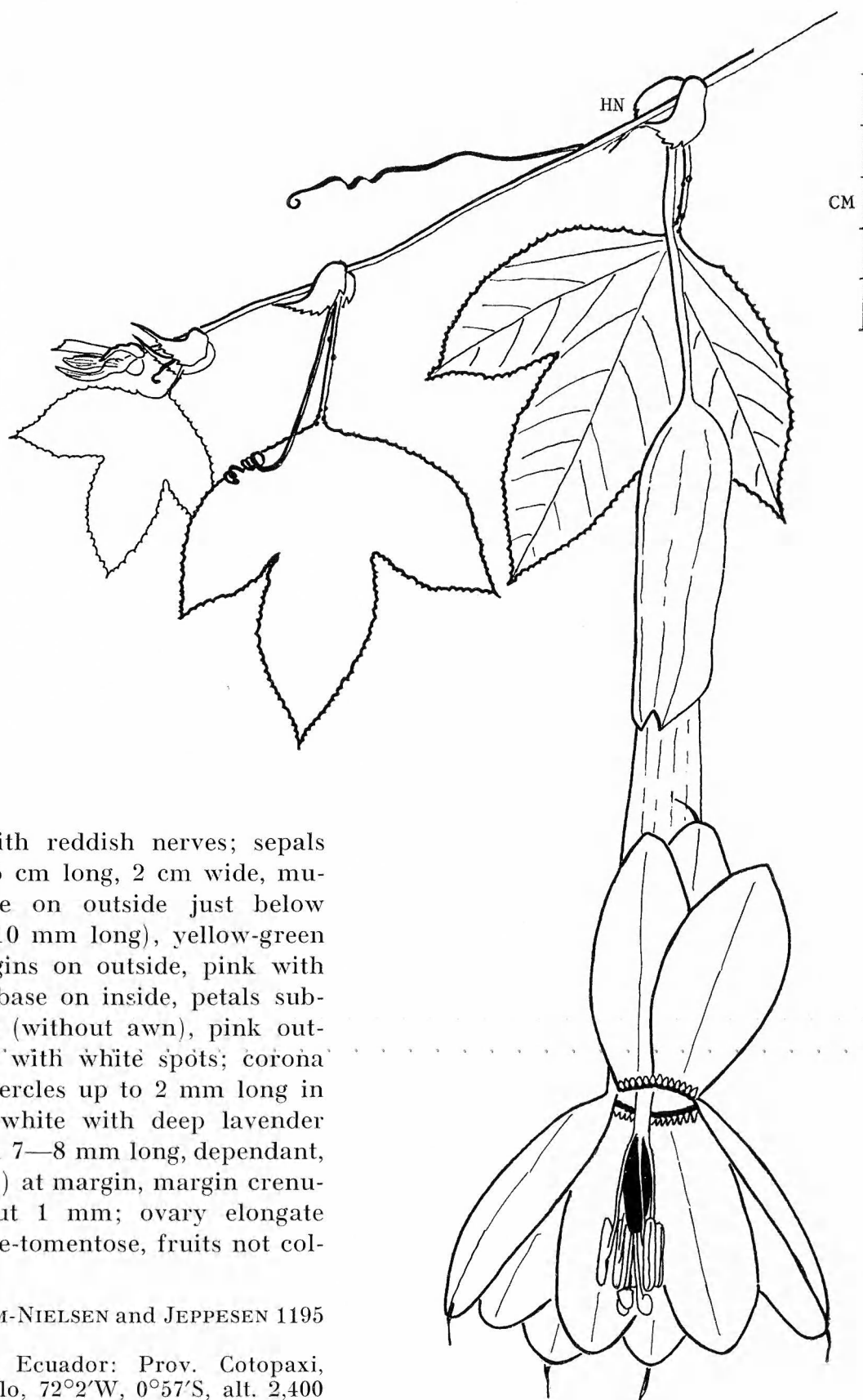
Distribution. Ecuadorian highlands, 2—3,000 m alt.

Passiflora mixta L. var. *pilaloensis* var. nov.

Herba scandens. Caulis angulatus, flavido-

pubescens. Stipulae subreniformes, 2—3 cm longae, 0.5—1 cm latae, cuspidatae, callososerratae, dentibus inaequalibus; petiolus 2.5—3 cm longus, 4—8 glandulis stipitatis vel subsessilibus instructus; folium 6—8 cm longum, 8—10 cm latum, coriaceum, supra glabrum nervis impressis, subtus laxe cinereo-tomentosum, ad infra medium trilobum, lobis ovato-oblongis, 3 cm latis, acuminatis, truncatis, serratis, inter se 45° divergentibus. Pedunculus validus, 5—6.5 cm longus; bractae per plus quam tres partes quartas in involucrum tubuliforme subcylindricum 6—7 cm longum connatae, partibus liberis ovato-lanceolatis, acute acuminatis, integerrimis, una fissura plerumque reliquis multo profundiore, nervis rubentibus, totis bracteis ut pedunculo flavido-pubescentibus; tubus calycis cylindricus, 13—14 cm longus, circiter 1.5 cm latus, ad fauces paulum dilatatus, glaber, flavido-viridis nervis rubentibus; sepala oblonga, 4.5—5.5 cm longa, 2 cm lata, mucronata, extra flavovirentia marginibus roseis, intra rosea basi albo-maculata, quidque sub ipso apice arista 7—10 mm longa extra armatum; petala sepalis subaequilonga aristis non inclusis, extra rosea, intra rosea basi albo-maculata, corona tuberculata, tubercula ad 2 mm longa in unam seriem disposita, dentes albi, basi saturate lavandulacei, operculum 7—8 mm longum, dependulum, margine per 2 mm recurvum, crenulis circiter 1 mm longis limbatum; ovarium elongate ellipsoideum, albotomentosum. Fructus non lectus.

Herbaceous vine. Stem angulate, yellowish-pubescent. Stipules subreniform, 2—3 cm long, 0.5—1 cm wide, cuspidate, callos-serrate, the teeth unequal; petioles 2.5—3 cm long, 4—8 glandular, the glands stipitate or subsessile; leaves 6—8 cm long, 8—10 cm wide, 3-lobed below middle, lobes ovate-oblong 3 cm wide, acuminate, (lateral lobes divaricate, 45 degrees from the midlobe), truncate, serrate, coriaceous, glabrous and impressed-nerved above, greyish-pubescent, tomentose, beneath. Peduncles stout, 5—6.5 cm long; bracts united more than three-quarters of their length into a tubulate, nearly cylindrical involucre 6—7 cm long, free parts ovate-lanceolate, acute-acuminate, entire, one fissure usually much deeper than the others, nerves reddish; peduncles and bracts yellowish-pubescent; calyx tube cylindrical 13—14 cm long, about 1.5 cm wide, slightly enlarged at throat, glabrous,



yellow-green with reddish nerves; sepals oblong, 4.5—5.5 cm long, 2 cm wide, mucronate, aristate on outside just below apex (awn 7—10 mm long), yellow-green with pink margins on outside, pink with white spots at base on inside, petals subequal to sepals (without awn), pink outside and inside with white spots; corona tuberculate, tubercles up to 2 mm long in 1 series, teeth white with deep lavender base, operculum 7—8 mm long, dependant, recurved (2 mm) at margin, margin crenulate, teeth about 1 mm; ovary elongate ellipsoidal, white-tomentose, fruits not collected.

Holotype. HOLM-NIELSEN and JEPPESEN 1195 (AAU).

Type locality. Ecuador: Prov. Cotopaxi, area around Pilalo, 72°2'W, 0°57'S, alt. 2,400 m. Jul. 6. 1968.

The variety epithet refers to the area around the village Pilalo in an erosion valley in Cordillera Occidental where this plant was found, and has been given under the impression of the richness of the flora in this area.

Fig. 2. *Passiflora mixta* L. var. *pilaloensis* var. nov.

Bot. Notiser, vol. 127, 1974

This variety is very outstanding, because almost all details are enlarged compared with the typical *P. mixta* material. For example, the operculum is about 3 times as long, the awn is twice as long and the calyx tube 3 cm longer than in the largest cited *P. mixta*. The pubescence could be referred to the fourth type (KILLIP 1960): lower surface of leaves pubescent, calyx tube glabrous, ovary pubescent. Only two further collections has this type of pubescence: Ecuador: Prov. Canar, Tipococha, alt. 3,200 m, PENDLAND and SUMMERS 1006 (US). Prov. Canar, Tipococha, along the Pan American Highway, quebrada vegetation, alt. 3,400 m, 16 sept. 1967, SPARRE 18539 (S), but these collections differ in other respects.

Passiflora sparrei sp. nov.

Herba scandens. Caulis angulatus, partibus junioribus dense tomentosus. Stipulae, subreniformes, 1.5 cm longae, serratae vel fimbriato-dentatae, dentibus circiter 2 mm longis, nullis glandulis terminatis; petiolus 2—2.5 cm longus, ad apicem 2 glandulis 1—2 mm longis munitus; folium 5—8 cm longum, 7—12 cm latum, trilobum, lobis convexe triangulis, 3—5 cm latis, apice rotundatis, plus quam 90° inter se divergentibus, basi truncatum, trinerve, nervis ut venis lateralibus supra paulum impressis, glandulis serrulatum, coriaceum, supra glabrum, infra fusco-tomentosum. Pedunculus ad 10 cm longus, tomentosus; bracteae circiter 3 cm longae, per tres partes quartas connatae, una fissura tamen reliquis multo profundiore, partes liberae acuminatae, utrinque subpuberulae; flores violacei; tubus calycis cylindricus, 7—8 cm longus; sepala oblonge elliptica, 5—6 cm longa, 2 cm lata, acuta vel obtusa, quidque sub ipso apice arista 1.5 mm longa armatum; petala sepalis subaequilonga, obtusa; corona minute tuberculato-dentata, uniserialis, filamentis 1 mm longis; operculum pendulum, 6 mm longum, margine dentato per 1 mm recurvo; gynophorum tenue, non exsertum; ovarium obovoides, puberulum. Fructus maturus non visus.

Herbaceous vine. Stem angular, younger parts densely tomentose. Stipules subreniform 1.5 cm, serrate to fimbriate-dentate, teeth about 2 mm, without glands; petioles 2—2.5 cm, terminally bearing 2 glands, 1—2 mm; leaves 5—8 cm long, 7—12 cm

wide, 3-lobed (lobes convex-triangular, 3—5 cm wide, rounded at apex, angle at sinus between middle and lateral lobes more than 90 degrees), truncate at base, 3-nerved glandular-serrulate, coriaceous, glabrous above, brown tomentose beneath, nerves and veins weakly impressed above. Peduncle up to 10 cm long, tomentose; bracts about 3 cm long, united three-quarters of their length, one fissure much deeper than the others, free parts acuminate, weakly puberulent on both sides; flowers violet; calyx tube cylindrical, 7—8 cm long; sepals oblong-elliptic, 5—6 cm long, 2 cm wide, acute-obtuse, awned just below apex, awn 1.5 mm; petals subequal to the sepals, obtuse; corona minutely tuberculate-dentate, uniseriate, filaments 1 mm long; operculum dependant, the margin recurved, dentate, 6 mm long, recurved margin 1 mm; gynophore slender, not exserted; ovary obovoid, puberulent. Mature fruits not seen.

Holotype. HOLM-NIELSEN and JEPPESEN 1543 (AAU).

Type locality. Ecuador: Prov. Cotopaxi, area around Pilalo, 72°2'W, 0°57'S, alt. 2,400 m. Jul. 9. 1968.

The species epithet is in honour of the Swedish botanist, BENKT SPARRE, Stockholm, who has spent most of his time adding to our knowledge of South American botany and plant geography. He is now one of the leaders of the Flora of Ecuador project and Curator of the Regnellian Herbarium, Riksmuseet, Stockholm (S).

This new *Tacsonia* is remarkable in its relationships to the Ecuadorian species *P. roseorum* KILLIP, which KILLIP suggests as a possible hybrid between *P. jamesonii* (MAST.) BAILEY and *P. cumbalensis* (KARST.) HARMS. Nevertheless *P. sparrei* differs strikingly from *P. roseorum* in many respects, such as shape of stipules (subreniform), petioles with two well-developed glands, and larger leaves. The sepals are at least two-thirds of the length of calyx tube (in *P. roseorum* the sepals are between one-third and half the length of the calyx tube). In other respects, however, there is parallelism, e.g. the dense

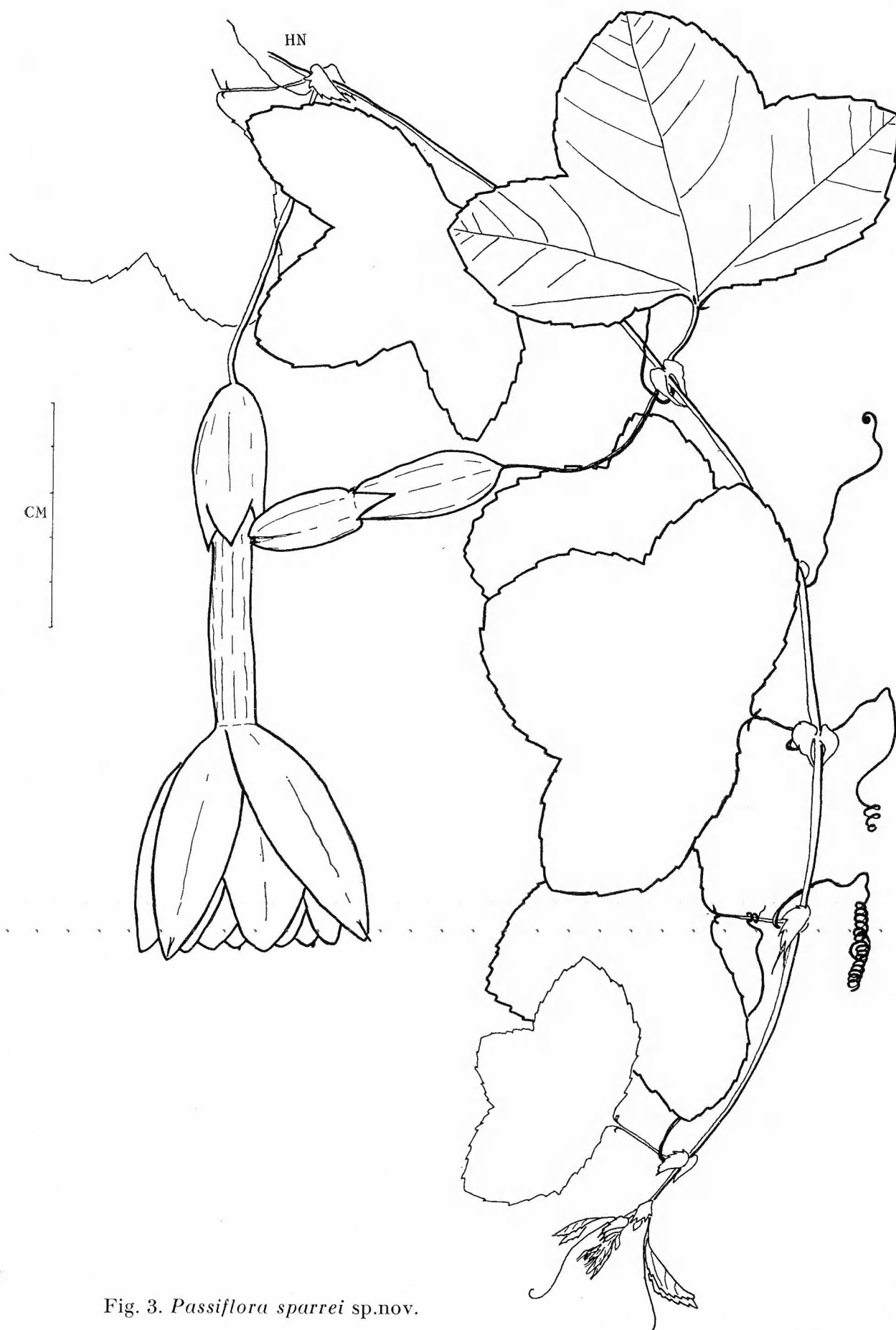


Fig. 3. *Passiflora sparrei* sp. nov.

brown tomentum beneath the leaves. Future investigations may fill in the details of the puzzle.

Passiflora cumbalensis (KARST.) HARMS, Bot. Jahr. 18: Beibl. 46: 13. 1894.

Colombia: Dept. Cundinamarca, Cerros by San Miquel, SE, on the sabana near Bogota. Alt. 2,800 m. Jul. 8. 1954. URIBE-U., IDROBO and FERNANDEZ 2593 (AAU).

As a supplement to the description we need to mention that the corona tubercles are short (less than 1 mm) white teeth.

Distribution. The central Andean highlands of Colombia and Ecuador alt. 2,500—3,000 m.

Passiflora lanata (JUSS.) POIR., Lam. Encycl. Suppl. 2: 843. 1811.

Colombia: Dept. Cundinamarca, Choconta, El Sisga, alt. 2,700—2,800 m. Febr. 21. 1962. H. GARCIA-B. 17415 (AAU).

The specimen varying from the description in displaying leaf dimorphism, the younger leaves ovate to ovate-lanceolate, acute, the older three-lobed, lobes ovate, acute.

Distribution. Eastern Cordillera of central Colombia, 2,500—3,000 m.

Passiflora pinnatistipula CAV., Icon. Pl. 5: 16 pl. 428. 1799.

Colombia: Dept. Cundinamarca, Guasca, alt. 2,700 m. Sept. 1954. L. URIBE-U. 2638 (AAU).

Distribution. The Andes 2,500—3,800 m from eastern Colombia to Chile.

Passiflora schlimiana TR. & PL., Ann. Sci. Nat. V. Bot. 17: 130. 1873.

Colombia: Dept. Magdalena, Serrania de Perija, Sabana Rubia, small shrub in the paramo, alt. 2,470 m. Mar. 5. 1959. R. ROMERO-C. 7407 (AAU). Region de Santa Marta, western slopes of the Sierra Nevada, alt. 2,800 m. R. ROMERO-C. 4588 (AAU).

Distribution. Endemic to Santa Marta Mountains NE Colombia.

Bot. Notiser, vol. 127, 1974

Subg. **Granadillastrum** (TR. & PL.) KILLIP, Field Mus. Nat. Hist. Bot. 19: 28. 1938.

Passiflora manicata (JUSS.) PERS., Syn. Pl. 2: 221. 1807.

Colombia: Dept. Cauca, El Tambo, Cordillera Occidental, eastern slopes, La Paz and neighbourhood, alt. 1,400—1,700 m, Las Juntas. Aug. 29. 1949. J. M. IDROBO 286 (AAU).

Distribution. Andes from Venezuela to northern Peru.

Subg. **Distephana** (JUSS.) KILLIP, Field Mus. Nat. Hist. Bot. 19: 29. 1938.

Passiflora glandulosa CAV., Diss. 10: 453. pl. 281. 1790.

Colombia: Dept. Vaupes, Yavarate. Nov. 21. 1952. R. ROMERO-C. 3668 (AAU).

First collection reported from Colombia, although the species is known from the adjacent areas of Guiana.

Distribution. Guiana to the Amazon basin and eastern Brazil.

Passiflora vitifolia HBK., Nov. Gen. et Sp. 2: 138. 1817.

Ecuador: Prov. Napo-Pastaza, Shell-Mera rain forest, 2 km N of Shell-Mera, alt. 1,050 m, 78°3'W, 1°29'S. Jun. 6. 1968. HOLM-NIELSEN and JEPPESEN 379 (AAU). At Rio Payamino 60 km along Rio Payamino W of Coca, alt. 350 m, 77°12'W, 0°29'S. Jun. 18. 1968. HOLM-NIELSEN and JEPPESEN 789 (AAU). At Rio Suno, 3 km W of Rio Napo 77°10'W, 0°42'S, alt. 400 m. Jun. 22. 1968. HOLM-NIELSEN and JEPPESEN 869 (AAU).

Colombia: Dept. Caqueta, Arbolitos, close to Rio Cagnan, alt. 400 m. Apr. 12. 1953. R. ROMERO-C. 3957 (AAU).

This widespread species has only been recorded once before in Ecuador.

Distribution. Central America to Venezuela and the eastern slopes of the Andes, Amazon basin to northern Peru.

Subg. **Granadilla** (MEDIC.) MAST., Trans. Linn. Soc. 27: 635. 1871.

Passiflora quadrangularis L., Syst. ed. 10. 1248. 1759.

Colombia: Dept. Cauca, El Tambo, Hoyo del Patia, Corregimiento de Mosquera, Aguacera, alt. 1,100 m. Aug. 13—19. 1949. IDROBO and FERNANDEZ 173 (AAU). Dept. Antioquia, vicinity of San Luis de Cocorna, 3 km S of confluence of the Rio Cocorna and the Magdalena, on the eastern banks. Nov. 19. 1963. R. ROMERO-C. 10105 (AAU).

Distribution. Cultivated throughout Tropical America.

Passiflora serrato-digitata L., Sp. Pl. 960. 1753.

Colombia: Dept. Choco, Rio Sucio district, Tilupo. Jun. 16. 1957. R. ROMERO-C. 6264 (AAU).

Distribution. Caribbean area, Guiana and the Amazon area to southern Bolivia and Peru.

Passiflora tilliaefolia L., Sp. Pl. 956. 1753.

Colombia: Dept. Narino, 86 km by railroad from Tumaco to Divisio. Jul. 27. 1952. R. ROMERO-C. 3326 (AAU).

Distribution. Western Andes of Colombia and Peru 1,500—2,000 m.

Passiflora maliformis L., Sp. Pl. 956. 1753.

Colombia: Dept. Cundinamarca, La Mesa district, by the road SE of La Mesa, alt. 1,100—1,300 m, May 26. 1954. L. E. MORA 674 (AAU), dept. Huila, San Augustin, in the archaeological park, alt. 1,600—1,700 m, Nov. 25. 1957. R. ROMERO-C. 6533 (AAU).

Distribution. Caribbean area and northern South America to Ecuador, alt. less than 1,700 m.

Passiflora riparia MART., MAST. in MART. Fl. Bras. 13, 1: 599. 1872.

Ecuador: Prov. Napo-Pastaza, 2 km W of Archidona, 77°48'W, 0°54'S, alt. 600 m. Jun. 6. 1968. HOLM-NIELSEN and JEPPESEN 1040 (AAU).

First report from Ecuador.

Distribution. Amazon basin (Brasil, Guiana, Colombia, Peru).

Passiflora nitida HBK., Nov. Gen. et Sp. 2: 130. 1817.

Colombia: Dept. Vaupes, de Monfort by Santa Maria, Rio Papuri. Dec. 2—4. 1952. R. ROMERO-C. 3870 (AAU). Dept. Narino, Rio Sequion, vicinity Iscuande, alt. 200 m. Nov. 17. 1955. R. ROMERO-C. 5472 (AAU).

Distribution. Northern South America and east of the Andes to Peru, lowlands.

Passiflora lehmanni MAST., Journ. Bot. Brit. For. 23: 115. 1885.

Colombia: Dept. Huila, San Augustin, in the archaeological park. Dec. 7. 1957. R. ROMERO-C. (AAU).

This specimen has been collected a few hundred km south of the area of distribution, which thus does not seem to be as restricted as earlier expected.

Distribution. Eastern Cordillera of Colombia (very few collections).

Passiflora smithii KILLIP, Journ. Wash. Acad. Sci. 20: 378. 1930.

Colombia: Dept. Cundinamarca, vicinity La Mesa, by the road SE of La Mesa, alt. 1,100—1,300 m. May 26. 1954. L. E. MORA 669-A (AAU). Dept. Magdalena, San Andrés district, alt. 1,300 m. Jan. 15. 1959. R. ROMERO-C. 6901 (AAU).

Distribution. Eastern Cordillera of Colombia (very few collections).

Passiflora oerstedii MAST., MART. Fl. Bras. 13. pt. 1: 562. 1872.

Colombia: Dept. Narino, 86 km of railroad from Tumaco to El Divisio, alt. 1,800 m. Jul. 27—29. 1952. R. ROMERO-C. 3323, 3342 (AAU).

This collection from dept. Narino extends the area of distribution from central Colombia as far south as to the Ecuadorian border.

Distribution. Caribbean area from Mexico to Venezuela and southern Colombia.

Passiflora subpeltata ORTEGA, Nov. Rar. Pl. Hort. Matrit. 6: 78. 1798.

Colombia: Dept. Bolivar, vicinity of Sincé. Sept. 6. 1963. R. ROMERO-C. 9766 (AAU).

Distribution. Caribbean area, Mexico to northern South America.

Subg. **Dysosmia** (DC.) KILLIP, Field Mus. Nat. Hist. Bot. 19: 30. 1938.

Passiflora foetida L., Sp. Pl. 959. 1753.

Colombia: Dept. Magdalena, between Tasa-jero and Los Cocos [Isla de Salamanca. En Duna, alt. 10 m. Mar. 22. 1959. R. ROMERO-C. 7576 (AAU)]. Cienaga, by El Arsenal. Feb. 17. 1950. R. ROMERO-C. 1968 (AAU).

Distribution. Widely dist. in tropical America, weed in other tropics.

Subg. **Astropheia** (DC.) MAST., Trans. Linn. Soc. 27: 629. 1871.

Passiflora phaeocaula KILLIP, Journ. Wash. Acad. Sci. 17: 430. 1927.

Brasil: Yutica, orilla izguierda del Rio Vaupes, subxerophytia. Nov. 15. 1952. R. ROMERO-C. 3502 (AAU).

This collection is only the second record of *P. phaeocaula* and is remarkable because R. ROMERO-CASTENADA (without knowing of the first collection) has made the collection in exactly the same part of the Amazon area, the upper Rio Negro. It would be very interesting to see further collections.

Distribution. Amazon basin, endemic to the upper Rio Negro?

Passiflora caucaense sp. nov.

Arbor circiter 6 m alta; truncus 0.40 m diam.; cortex rugosus, atro-cinereus; rami erecti, vetustiores teretes, juniores subangulati, rufo-hirtelli. Petiolus minus quam 2 cm longus, rufohirtellus; folium ellipticum vel obovato-oblongum, 10—20 cm longum, 4—12 cm latum, apice obtusum, saepe retusum, basi truncatum vel subcuneatum, penninerve, nervo medio prope basim folii subtus 2 glandulis nigris paene 2 mm diam. munito, lateralibus utrinque 12—18, parallelis, rectis vel

apice subarcuatis, prominentibus, folio obscurioribus, coriaceum vel subcoriaceum, supra obscure viride, glabrum, infra pallidius, in nervo medio parce pubescens. Pedunculus ad 10 cm longus, 1—2 furcatus, parte principali ramis subaequilonga vel duplo longiore, parce pubescens; bracteae lineari-subulatae, circiter 3 mm longae; calycis tubus campanulatus, 5—7 mm longus, circiter 6 mm latus; sepala oblonga, 2—3 cm longa, circiter 6 mm lata, obtusa, alba; petala lineari-spatulata, 2 cm longa, alba; corona filamenta compressa, in duas series disposita, exterioribus subdolabriliformibus, 1—1.2 cm longis, apice flavis basi albis, interioribus perbreviter lineari-falcatis, dilatatis, 1.5—2 mm longis, albis; operculum 2—3 mm infra coronam oriens, membranaceum, 1 mm altum; ovarium subglobulare, dense tomentosum. Fructus secundum collectorem sphaericus, rubellus, ferrugineo-tomentosus, ab auctore non visus.

Small tree 6 m high; stem 0.40 m in diameter; cortex rugose, dark grey; branches erect, terete, the younger ones subangular, rufo-hirtellous. Petioles less than 2 cm long, rufo-hirtellous; leaves elliptic to obovate-oblong 10—20 cm long, 4—12 cm wide, apex obtuse and often retuse, truncate or subcuneate at base, penninerved (midnerve biglandular on lower side near base, the glands black, nearly 2 mm in diameter, lateral nerves 12—18 on each side, parallel, straight or slightly arcuate near ends, prominent, darker than the blade), coriaceous or subcoriaceous, dark green and glabrous above, paler beneath, only sparsely pubescent on the midnerve. Peduncles up to 10 cm long, 1—2-furcate, main portion subequal to or twice as long as branches, only sparsely pubescent; bracts linear subulate, about 3 mm long; calyx tube campanulate, 5—7 mm long, about 6 mm wide; sepals oblong 2—3 cm long, about 6 mm wide, obtuse, white; petals linear-spatulate, 2 cm long, white; corona filaments laterally compressed, in 2 series, the outermost subdolabriliform, 1—1.2 cm long, yellow in the upper half, white in the lower, the filaments of the innermost series very shortly linear-falcate, dilated, 1.5—2 mm long, white; operculum arising 2—3 mm below the corona, membranous, 1 mm high; ovary subglo-

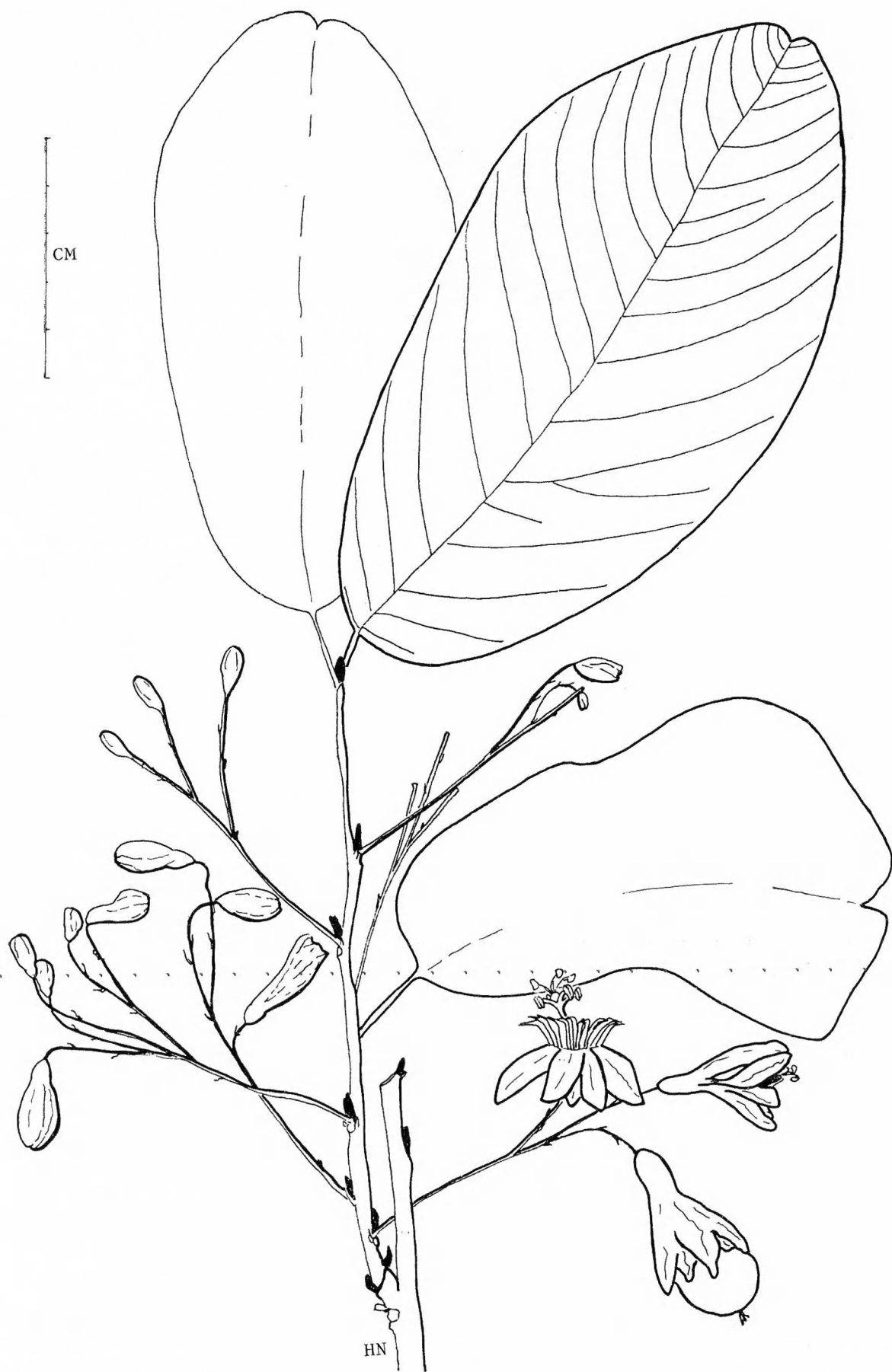


Fig. 4. *Passiflora caucaense* sp. nov.

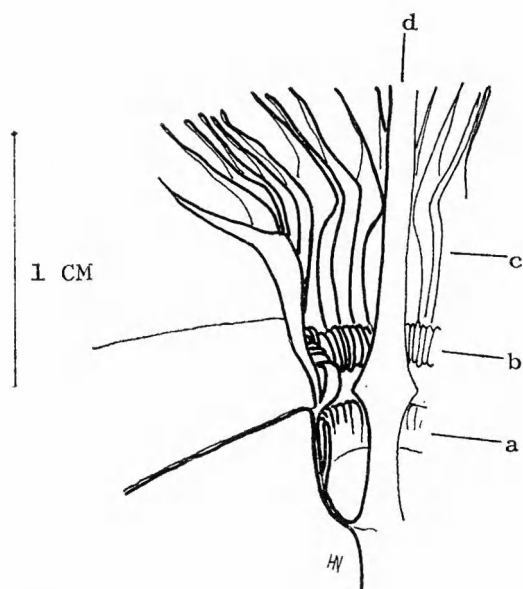


Fig. 5. *Passiflora caucaense*, transection of flower. a: operculum. b—c: corona. d: androgynophore.

bose, densely tomentose. Fruit spherical, ferruginous-tomentose, reddish. (Mature fruit and seeds not seen, the description of the fruit based on notes of the collector).

Holotype. H. GARCIA-BARRIGA 17596 (AAU).

Type locality. Dept. Valle del Cauca, Cordillera Occidental, Yanacónas al Silencio, montana de la Victoria, alt. 1,700—2,000 m.

The species epithet refers to the landscape, the Cauca Valley, where KILLIP has seen the plant and from where, through the collection of GARCIA-BARRIGA, it has been possible to describe the new species.

The species is found in the Western Cordillera near Yanacónas al Silencio, Victoria Mountain, Cauca Valley. From the same area is the *P. emarginata* HUMB. & BONPL. known as an endemic. The two species are very close to each other, but KILLIP as early as 1938 noticed some differences in the pubescence of some plants collected by Dr ANTONIO GARCIA west of Popayan, Cauca Valley. But KILLIP had not seen flowers: "unfortunately the flowers had withered badly, and it was impossible to make satisfactory notes on the coronal structure." The collection of H. GARCIA-BARRIGA (17596, AAU), shows all the coronal structures in good condition

and these structures differ from those of *P. emarginata* in one very distinct way, in having only two series of corona filaments. For this reason, and because of other differences in the pubescence we must describe this new species.

Passiflora spinosa (POEPP. & ENDL.) MAST., Trans. Linn. Soc. 27: 630. 1871.

Colombia: Dept. Santander, 30 km NE of La Gomez. Oct. 11. 1960. R. ROMERO-C. 8481 (AAU).

Distribution. Amazon basin of Colombia and Brasil to Peru.

Dilkea MAST., Trans. Linn. Soc. 27: 627. 1871.

Dilkea wallisii MAST., MART. Fl. Bras. 13 pt. 1: 622. 1872.

Colombia: Vaupes, Yavarate. Nov. 22. 1952. R. ROMERO-C. 3684 (AAU).

Distribution. Amazon basin of Peru, Brasil and Venezuela to Colombia, (very few collections reported).

Dilkea retusa MAST., Trans. Linn. Soc. 27: 628. 1871.

Ecuador: Prov. Napo-Pastaza, Tena rain forest, 6 km W of Tena along Rio Pano, alt. 600 m. Jun. 12. 1968. HOLM-NIELSEN and JEPPESEN 673 (AAU).

The collection contains only stems and flowers (liana, flowers at a height of 2 m, leaves in the tops of the trees), but differs in no respects strikingly from the description of *D. retusa*, although future investigations including collections of the whole plant may prove the identity of this very rare plant.

Distribution. Amazon basin, only two reports before from Peru and Brasil.

ACKNOWLEDGEMENTS

The field work in Ecuador has been made possible through a grant from the Danish shipowner, Mr J. LAURITZEN (Expedition to Ecuador, HOLM-NIELSEN and JEPPESEN 1968).

I wish to express my gratitude to Mr K. LAURITZEN for his helpfulness. Further, to the Danish botanist Dr TROELS MYNDEL PEDERSEN, Corrientes Argentine and the University of Aarhus I hereby gratefully acknowledge financial support. Special thanks are due to Dr JOSÉ CUATRECASAS, the Smithsonian Institution, Washington, for personal information, Dr SARA J. LAMLEIN, Field Museum, Chicago for help with the determination, and Dr TYGE CHRISTENSEN, Institute of Thallophytic Botany, University of Copenhagen for writing the Latin diagnosis.

LITERATURE CITED

- AYENSU, E. S. & STERN, W. L. 1964. Systematic anatomy and ontogeny of the stem in Passifloraceae. — *Bull. US. Nat. Mus.* 34: 43—72.
- BENTHAM, G. & HOOKER, J. D. 1867. Passifloraceae. — In *Genera Plantarum* 1: 807—816.
- BRIZICKY, G. K. 1961. The genera of Turneraceae and Passifloraceae in the Southeastern United States. — *Journ. Arnold Arb.* 42: 204—218.
- HARMS, H. 1894. *Plantae Lehmannianae in Colombia et Ecuador*. — *Bot. Jahrb.* 18, Beibl. 46: 1—14.
- 1922. Neue Arten der Gattung *Passiflora* L. — *Repert. Sp. Nov.* 18: 294—299.
- 1923. Beiträge zur Kenntnis der amerikanischen Passifloraceae I. — *Repert. Sp. Nov.* 19: 25—32, II. *ibid.* 56—60.
- 1925. Passifloraceae. — In ENGLER & PRANTL, *Die natürlichen Pflanzenfamilien* 21: 470—507.
- 1929. Passifloraceae americanae novae. — *Notizbl. Bot. Gart. Berlin* 10: 808—816.
- HOLM-NIELSEN, L. B. & JEPPESEN, S. 1968. Preliminary report on the Expedition to Ecuador 1968: 1—16. — Botanical Institute, University of Aarhus.
- KILLIP, E. P. 1938. The American species of Passifloraceae. — *Publ. Field. Mus. Nat. Hist. Bot.* 19: 1—613.
- 1941. Passifloraceae. — In MACBRIDE, *Flora of Peru* 13,4: 90—132.
- 1960. Supplemental notes on the American species of Passifloraceae with descriptions of new species. — *Contr. US. Nat. Herb.* 35: 1—23.
- MASTERS, M. T. 1871. Contributions to the natural history of the Passifloraceae. — *Trans. Linn. Soc. London* 27: 593—645.
- 1872. Passifloraceae. — In Mart. *Fl. Bras.* 13(1): 531—627.
- 1883. On the Passifloraceae collected by M. Edouard André in Ecuador and New Granada. — *Journ. Linn. Soc.* 20: 25—44.
- 1883. New Passifloraceae. — *Journ. Bot. Brit. & For.* 21: 33—36.
- 1885. Notes on certain Passifloraceae from western tropical America. — *Journ. Bot. Brit. & For.* 23: 113—116.
- 1887. *Plantae Lehmannianae, Passifloraceae*. — *Bot. Jahr.* 8: 216—220.
- SODIRO, A. 1970. *Tacsonias Ecuatorianas*. — *Anal. Univ. Quito* 18: 333—348, 407—417.
- SOUKUP, J. 1970. Las Passifloraceas del Perú, sus generos y lista de especies. — *Biota* 8: 106—110.
- TRIANA, J. J. and PLANCHON, J. E. 1873. *Prodromus Florae Novo-Granatensis*. — *Ann. Sci. Nat. V Bot.* 17: 121—186.
- URIBE-URIBE, L. 1956. Passifloraceae. — In MUTIS, *Flora de la Real Expedition Bot. de Nuevo de Granada* 27.
- WOODSON, R. E. and SCHERY, R. W. 1958. Passifloraceae. — In *Flora of Panama* 7: 1—22.

Leaf Anatomy and Ultrastructure of Chloroplasts in *Salsola kali* L. as Related to the C₄-pathway of Photosynthesis

Peter Olesen

OLESEN, P. 1974 11 28. Leaf anatomy and ultrastructure of chloroplasts in *Salsola kali* L. as related to the C₄-pathway of photosynthesis. — Bot. Notiser 127: 352—363. Lund. ISSN 0006-8195.

An investigation of leaf anatomy, ultrastructure of chloroplasts, and their capacity to reduce tetranitro blue tetrazolium dye confirms that *Salsola kali* L. belongs to the group of higher plants which utilize the C₄-pathway of photosynthesis. The anatomical features of the chlorenchyma deviate from the general picture seen in C₄-pathway plants: in the cylindrical leaves typical bundle sheaths are lacking, but the chlorenchyma is differentiated into a palisade and a chlorenchymatous sheath. The chloroplasts of the chlorenchymatous sheath clearly have a reduced development of grana relative to the palisade chloroplasts, indicating a minor degree of reducing power in photosynthetic light reactions. Nevertheless, these chloroplasts show a greater capacity for reducing tetrazolium dye than do the palisade chloroplasts.

SEM studies of sectioned and freeze-dried leaf tissue provide convincing additional evidence of the internal morphology of the cells in the chlorenchyma, especially of the wall between the sheath cells and the palisade cells. The centripetal location of the sheath chloroplasts in *Salsola* does not seem to fit the concept of a correlation between the location of sheath chloroplasts and primary photosynthetic products in C₄-pathway plants.

Peter Olesen, Institute of Plant Anatomy and Cytology, University of Copenhagen, DK-1307 Copenhagen K, Denmark.

INTRODUCTION

Salsola kali has been reported as a C₄-pathway plant from measurements of low values of CO₂ compensation point (TREGUNNA & DOWNTON 1967) and biochemical assays (OSMOND 1970). Anatomically, *Salsola kali* is different from other C₄-pathway plants in having cylindrical leaves without a typical bundle sheath as noted by WELKIE & CALDWELL (1970). However, the chlorenchyma is specialized into two different strata each one cell deep. Ecologically, *Salsola* is noticeable among temperate plants in being both a succulent and a C₄-pathway plant; it is a member of the open strand community with xeric conditions and high light intensities.

Recently a concept has been developed according to which plants with the C₄-pathway of photosynthesis can be divided into two distinct groups (cf. DOWNTON 1970 and BROWN & GRACEN 1972). *Zea*, *Saccharum* and *Gomphrena* among others have the sheath chloroplasts arranged adjacent to the mesophyll layer (the centrifugal type), the major initial photosynthetic product is malate (referred to as malate-formers), and these plants also have more or less reduced grana in the sheath chloroplasts. Another group comprising some *Atriplex* and *Amaranthus* species and several grasses (BROWN & GRACEN 1972) have a centripetal location of the sheath chloroplasts, aspartate as primary product, and well-developed grana. From

these statements it would seem natural to expect *Salsola kali* to belong to the latter group because of the centripetal location of the sheath chloroplasts (GREENFIELD 1913, Figs. 27 and 30). Nevertheless, OS-MOND (1970) reported *Salsola kali* as a malate-former on biochemical data. This apparent paradox between anatomical and biochemical characteristics raises a problem of particular interest.

MATERIAL AND METHODS

In this study mature leaves of *Salsola kali*, *Zea mays* and *Saccharum officinarum* were used. *Salsola* was collected in nature or germinated and grown in soil without any addition of salt in a controlled environment chamber at 16°/13° (day/night) with a 17 h day at 16,000 lux. *Zea* and *Saccharum* were taken from a greenhouse. For transmission electron microscopy (TEM) leaf tissue was fixed in cold 2 % glutaraldehyde in 0.1 M phosphate buffer (pH 6.8) and post-fixed in 2 % OsO₄ in cold buffer. Following dehydration in ethanol, the tissue was embedded in Spurr's epoxy resin (SPURR 1969) and sectioned with an LKB ultratome using glass knives. The sections were post-stained in uranyl acetate and lead citrate and finally viewed with a JEM T-7 electron microscope.

For scanning electron microscopy (SEM) tissue was fixed following the procedure for EM, with or without post-fixing in osmium. Dehydration was completed through water-ethanol and ethanol-benzene and finally freeze-dried in benzene with an EDWARDS tissue drier. The specimens were coated with carbon and gold and viewed with a Cambridge Stereoscan 600.

In the histochemical investigations tetranitro blue tetrazolium chloride (TNBT) and 3-(3,4-dichlorophenyl)-1,1-dimethylurea (DCMU) were used as described by DYAR (1953) and DOWNTON et al. (1970). In contrast to the method used by DOWNTON et al. the leaf tissue was vacuum-infiltrated in the test solutions in order to achieve better penetration of the reagents as indicated by SCHÖCH & KRAMER (1971). Starch accumulation was determined with a 3 % solution of J-KJ.

RESULTS

Anatomy

The leaves of *Salsola kali* show a pronounced succulence with the mesophyll differentiated into a peripheral chloren-

chyma and central water-storage tissue (cf. MCNICOLL 1929 and SHIELDS 1951). The chlorenchyma is placed like a cylinder surface between the epidermis and the water-storage tissue and is differentiated into two, individually distinct, single-cell layers. The outer layer is a palisade with intercellular spaces and thin-walled, cylindrical cells with elongated, flattened chloroplasts along the side walls. Between the palisade and the water-storage tissue there is a compact band of cells with thicker walls and without any intercellular spaces. The cells of this chlorenchymatous sheath contain many chloroplasts with a deeper green colour than those found in the palisade cells. The sheath chloroplasts have rounded profiles and are concentrated along the inner tangential wall (centripetal location). The short sheath cells with a high chlorophyll content have been referred to as a starch sheath by WARMING (1897) and GREENFIELD (1913), while others rarely have found starch here (MCNICOLL 1929). VOLKENS (1887) describes the chlorenchymatous sheath as "ein Mantel chlorophyllreicher Sammelzellen".

The vascular tissue in the leaves consists of a central bundle and two lateral bundles. The lateral bundles give off branch systems that anastomose from opposite sides. The midrib contributes to this system only at its apical termination. The anastomosing branch systems constitute a vascular network connecting the chlorenchymatous sheath and the water-storage tissue. Furthermore, as noted by WARMING (1897), the xylem in the small veins is placed on the outside in close proximity to the green sheath (a feature common to several plants with succulent leaves). This architecture could be regarded as a possible specialization ensuring the rapid translocation of photosynthetic products or facilitating water exchange between the water-storage tissue and the chlorenchyma.

Ultrastructure

The two types of cells in the chlorenchyma clearly have very different chloro-

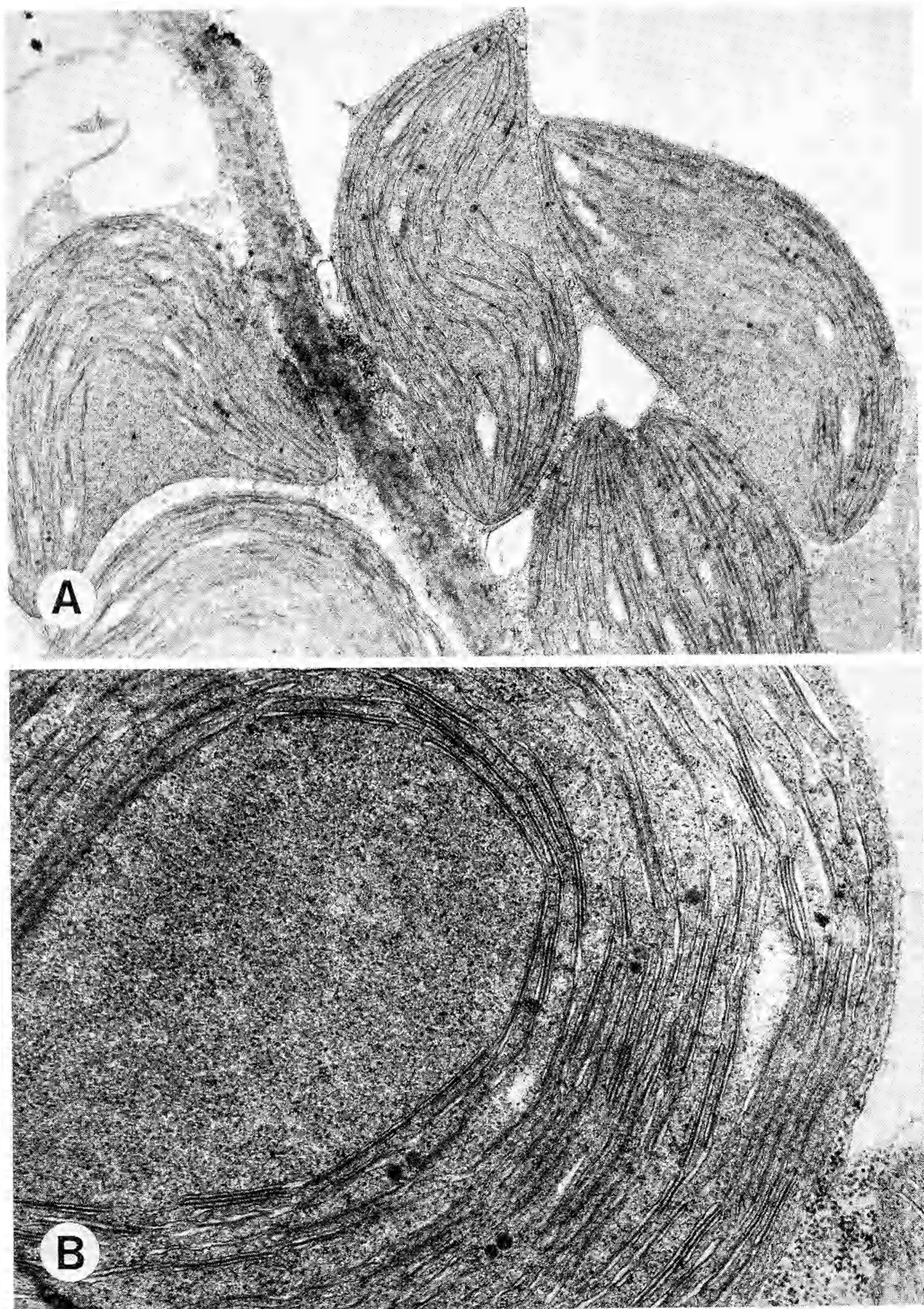


Fig. 1.

Table 1. Analysis of thylakoid configuration in the two types of chloroplasts in *Salsola kali*. A, B, C, and D are totals of eight chloroplasts. For further explanation, see text.

	A No. of analysed grana	B No. of parti- tions	C Total partition length (μ)	D Chloro- plast area (μ^2)	B/A No. of par- titions per granum	C/E Total par- tition length per unit area of chloroplast
Palisade chloroplasts .	408	1,077	282	29.5	2.7 ± 0.4	10.1 ± 1.3
Sheath chloroplasts ..	516	650	278	61.4	1.3 ± 0.2	4.9 ± 1.9

plasts. The palisade cells have normal chloroplasts with well-developed grana (Fig. 3 B). The chlorenchymatous sheath has chloroplasts of a deviating structure showing reduced development of grana with relatively few lamellae in each granum. Regions of two or three appressed thylakoids are the most common granal configuration observed (Fig. 1), but also single thylakoids are numerous (Fig. 2 C). A structure resembling a horseshoe is frequently seen in sections of these chloroplasts: the thylakoids are placed around a central homogeneous stroma (Fig. 1 B), which reaches the chloroplast envelope in the opening of the horseshoe-like structure. In each sheath cell there are intermediates between this structure and chloroplasts with evenly distributed lamellar systems (Fig. 1 A).

In order to achieve a more accurate documentation of the thylakoid configuration, the two types of chloroplasts were analysed using a statistical approach (cf. Woo et al. 1971). Eight distinct electron micrographs were selected for each type of chloroplast and the following parameters were determined (Table 1): number of grana per chloroplast (A), number of partitions per chloroplast (B), partition length per chloroplast (C), and chloroplast area (D). A partition is here defined as the electron-dense line between two appressed thylakoids in a granum.

Table 1 reveals a significant difference in thylakoid configuration: the total partition length per unit area of chloroplast in the sheath cells only amounts to half of the value found in palisade cells.

In general there is a considerably greater concentration of organelles in sheath cells than in palisade cells (cf. BLACK & MOLLENHAUER 1971). In *Salsola*, microbodies (Fig. 2 A) are often seen in the sheath cells but very seldom in the palisade cells (cf. HILLIARD et al. 1971). The peripheral reticulum, which has been the subject of intensive discussion (LAETSCH 1971), is observed in both types of chloroplasts (Figs. 2 B and 3 B). Prominent and abundant plasmodesmata are seen in the wall between the palisade and the sheath cells; they are concentrated in thin wall areas (pit fields, Fig. 3 A).

The TEM investigations showed very little starch in the chloroplasts. In fact, conspicuous starch grains were only seen in guard cells and sheath chloroplasts from plants harvested in the growth chamber after a period of 6—8 hours with continuous bright light. Starch was not observed in plants collected in nature.

The SEM studies provide additional evidence for a morphological and ultrastructural difference between the chloroplasts in the palisade and sheath cells, respectively (Figs. 4 and 5). Some of the sheath chloroplasts show a concave de-

Fig. 1. *Salsola kali*. — A: Chloroplasts from two chlorenchymatous sheath cells with different distributions of the lamellar system. $\times 11,000$. — B: Sheath chloroplast with the thylakoids situated around a central part of the stroma in a structural formation resembling a horse shoe. $\times 30,000$.

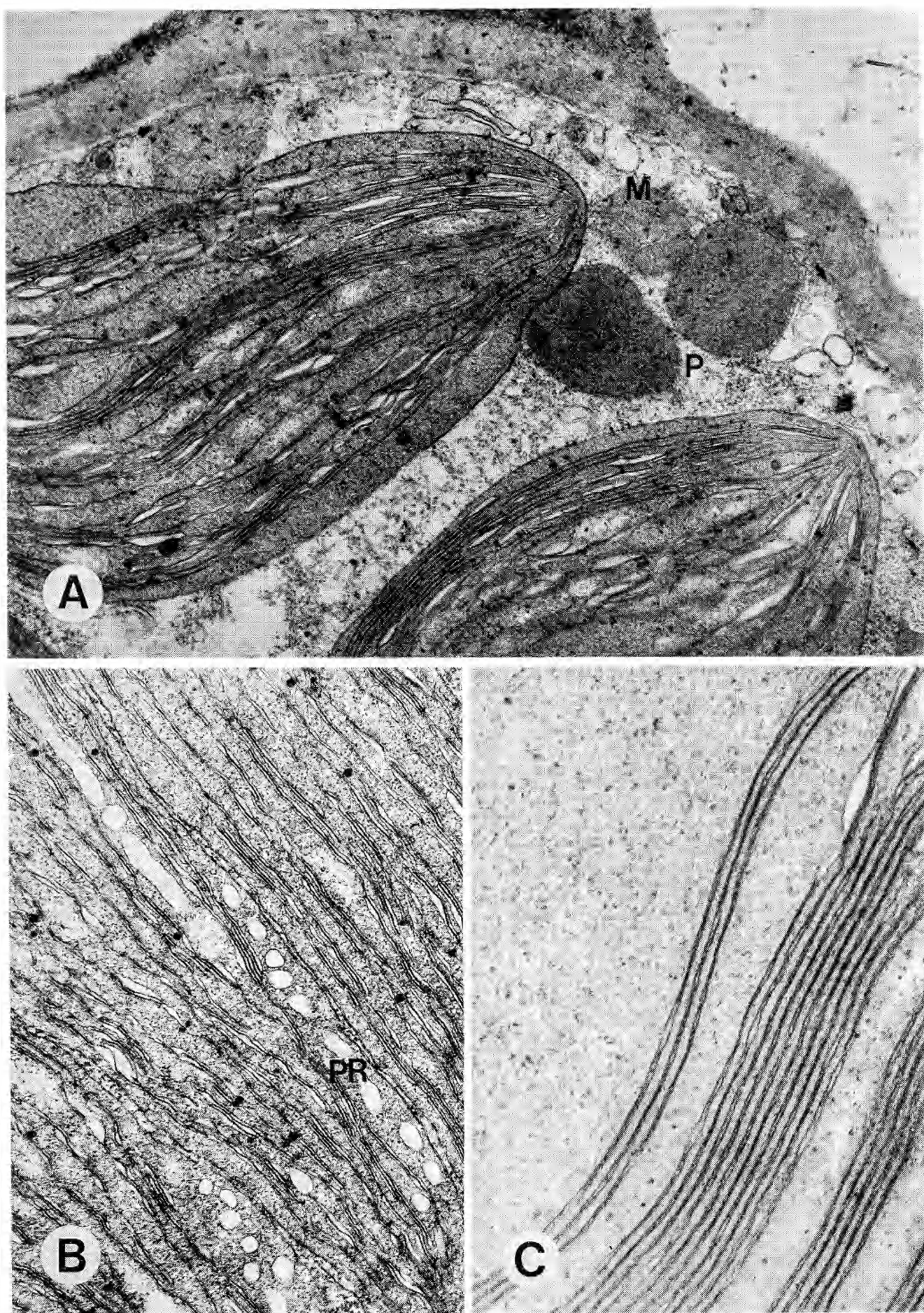


Fig. 2.

Table 2. TNBT reduction in leaf sections of various C₄-pathway plants. For further explanation, see text. — +++=very strong, ++=strong, +=weak, and —=negative reaction.

	<i>Salsola kali</i>		<i>Zea mays</i>		<i>Saccharum officinale</i>	
	sheath	palisade	sheath	mesophyll	sheath	mesophyll
TNBT+light	+++	++	(+)	+++	(+)	++
TNBT+dark	—	—	—	—	—	—
TNBT+DCMU+light	—	—	—	—	—	(+)

pression or invagination (Fig. 4 A), probably corresponding to the opening in the horseshoe-like two-dimensional structure observed in TEM. Furthermore, the SEM confirms the existence of conspicuous pit fields with abundant plasmodesmata between the two types of chlorenchyma cells (Fig. 5 A). The many small protrusions seen in the pit fields are here interpreted as remains of the plasmodesmatal connections (i.e. the areas of close contact between the plasmodesmata themselves and the plasmalemma). Some of the wall areas connecting the pit fields have distinct cross-striations, which seem to be rather deep furrows in the wall. At present it seems impossible to assign these furrows to any previously described structure.

Histochemistry

Iodine solution applied to fresh sections produced conspicuous spots in the sheath chloroplasts and a weak, evenly distributed colouring of the palisade chloroplasts. However, the colour of the starch reaction was not dark blue but brownish as mentioned by BÖCHER (1972) for *Sporobolus rigens*, another C₄-pathway plant.

The photochemical activities of the chloroplasts were studied according to DOWNTON et al. (1970). As control plants *Zea mays* and *Saccharum officinarum* were chosen because of the well-known photo-

chemical activities of their dimorphic chloroplasts. The results obtained with the use of TNBT and DCMU as a test for the Hill reaction are summarized in Table 2.

In *Zea* and *Saccharum* the reduction of TNBT is practically confined to the mesophyll chloroplasts in agreement with the results of DOWNTON et al. (1970). The dark control and the DCMU blockage indicate that the reaction is a photochemical process. *Salsola kali* clearly shows the most intensive reduction in the sheath cells. The light-dependant reduction of the colourless TNBT to opaque diformazan in the sheath chloroplasts could be followed under the light microscope: the reaction mostly begins with concentric bands or elongated areas following the profile of the chloroplast. Frequently a light area without any reaction remains in the centre of the chloroplast (Fig. 1 B). In the palisade chloroplasts the reduced TNBT is localized in small dots comparable to the grana seen in TEM (cf. Fig. 3 B).

DISCUSSION AND CONCLUSION

The chloroplast ultrastructure showing reduced grana in the sheath chloroplasts presents an interesting problem because these chloroplasts also have a fairly great capacity for reducing TNBT (Table 2). The reduction of this tetrazolium dye with

Fig. 2. *Salsola kali*. — A: Part of sheath cell with mitochondria (M) and peroxisomes (P). $\times 11,000$. — B: Sheath chloroplast with well-developed peripheral reticulum (PR). $\times 20,000$. — C: Part of sheath chloroplast showing only stroma lamellae, no grana are present. $\times 38,000$.

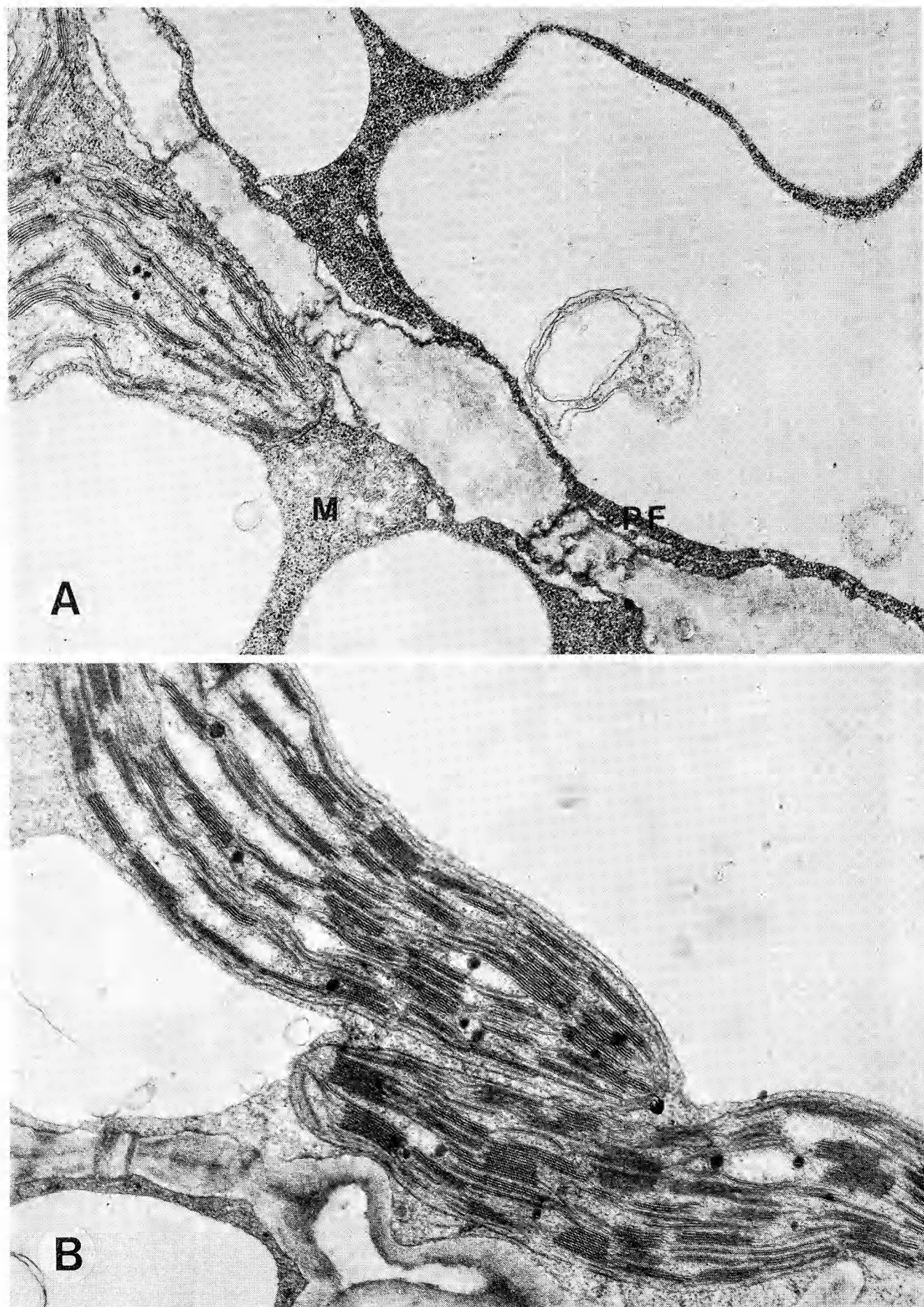


Fig. 3.

appropriate control (e.g. DCMU, an inhibitor of photosystem II) has been considered to provide evidence of the activity of photosystem II (DOWNTON et al. 1970). The activity of photosystem II apparently depends on the granal structure in chloroplasts: it seems to be located in the partitions between thylakoids in the granum (WOO et al. 1970).

The ultrastructural analysis of granal configuration in *Salsola kali* clearly shows a reduced development of grana in the sheath chloroplasts relative to the palisade chloroplasts expressed as total partition length per unit area of chloroplast (Table 1). On the other hand, the reduction of TNBT is more intense in the sheath chloroplasts than in the palisade chloroplasts (Table 2). In the control plants (*Zea* and *Saccharum*) there is a fairly good correlation between the reduction of TNBT and granal development (cf. DOWNTON et al. 1970). For *Salsola* it must be concluded that the much greater concentration of chloroplasts in the sheath cells compared with the palisade cells can account for a more intense reduction of TNBT seen under the light microscope. Probably it would be possible to obtain a better correlation between the reduction of TNBT and the granal development if isolated chloroplasts were used.

Because of the discrepancy between ultrastructural and histochemical investigations of the starch accumulation in *Salsola* it seems appropriate to await further investigations, under controlled and

uniform conditions, of the distribution of starch in the two types of chloroplasts. It is tempting to speculate on a possible relationship between the starch distribution and the regulation of osmotic pressures in the cells of a halophytic species such as *Salsola kali*. This assumption would agree with the fact that starch grains were only observed in sheath chloroplasts from plants grown under non-saline conditions.

As mentioned above one could expect *Salsola kali* to be an aspartate-former (DOWNTON 1970) on the basis of the centripetal location of the sheath chloroplasts. However, the biochemical assays (OSMOND 1970) and the reduced development of grana in the sheath chloroplasts reported in the present paper make it fairly evident that *Salsola kali* can be characterized as a malate-former. Therefore it must be argued that the concept of a close association between primary products of carbon dioxide fixation and anatomical location of the sheath chloroplasts does not apply to all plants with the C_4 -dicarboxylic acid pathway in photosynthesis. *Salsola* seems to be an exception as are two species of *Panicum* (Gramineae) according to BROWN and GRACEN (1972).

It seems clear that *Salsola kali* has all the characteristics constituting the C_4 -syndrome (SCHÖCH & KRAMER 1971) or Kranz syndrome according to SMITH and BROWN (1973) except the typical bundle sheaths (cf. MOSER 1934). The anatomical specialization, which provide the basis for the functional aspects of the syndrome, is

Fig. 3. *Salsola kali*. — A: Wall between palisade cell (left) and sheath cell (right) with plasmodesmata located in pit fields (PF). Two mitochondria (M) are seen in the palisade cell near the wall. $\times 16,000$. — B: Two chloroplasts from palisade cell, note the well-developed grana. $\times 13,000$.

Fig. 4. *Salsola kali*. SEM micrographs of leaf tissue sectioned obliquely. — A: Water-storage tissue (W), cells in the chlorenchymatous sheath (S) and palisade cells (P). Note depression in some of the sheath chloroplasts. $\times 1,000$. — B: Sheath cell with chloroplasts. $\times 10,000$.

Fig. 5. *Salsola kali*. SEM micrographs of leaf tissue sectioned obliquely. — A: Palisade cells (P) standing on inner wall of epidermis (W), note stomatal cavity (S). $\times 1,000$. — B: Part of the cell wall between the chlorenchymatous sheath and the palisade seen from a sheath cell: conspicuous pit fields with remains of plasmodesmatal connections. $\times 20,000$.

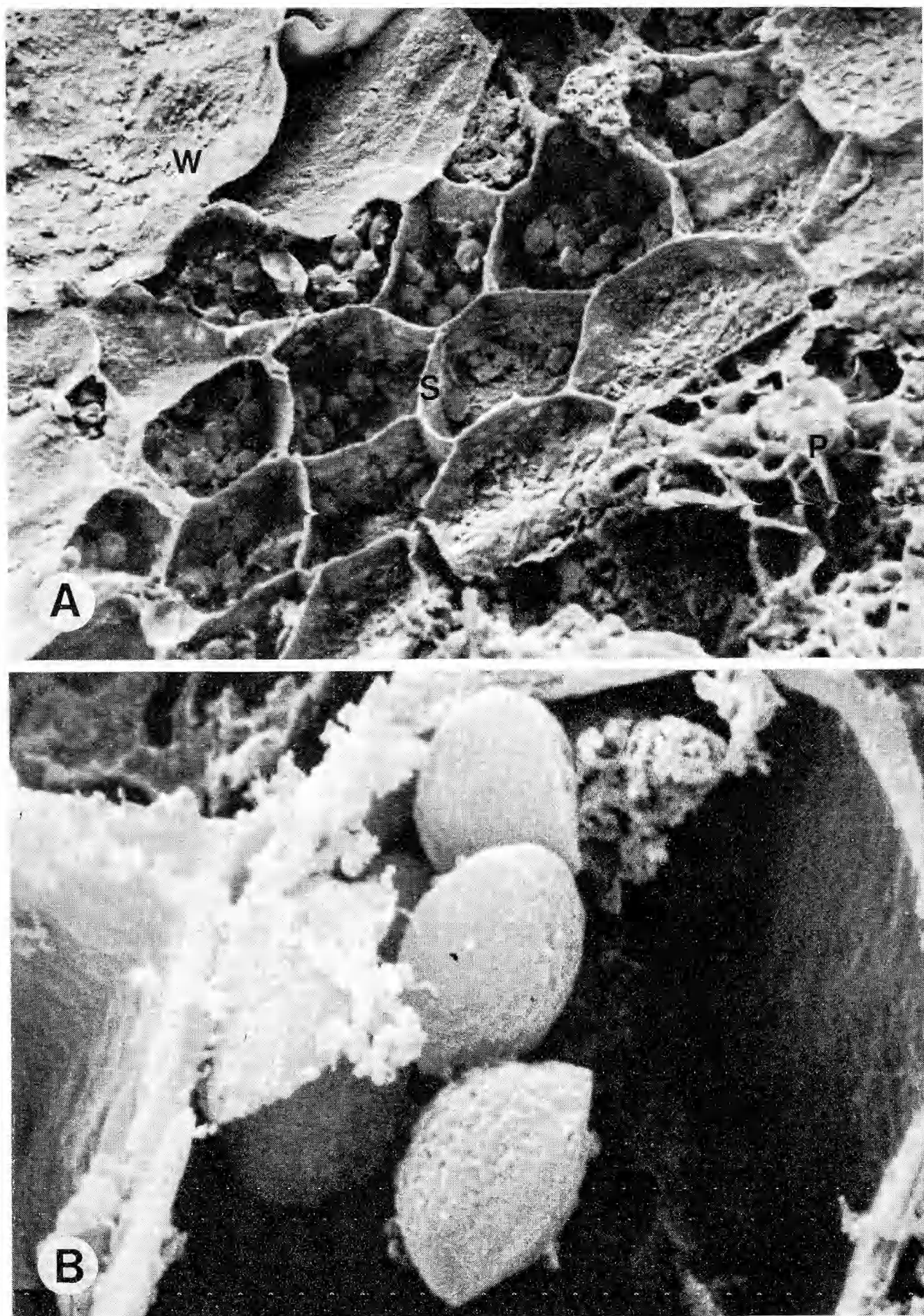


Fig. 4. Legend on p. 359.

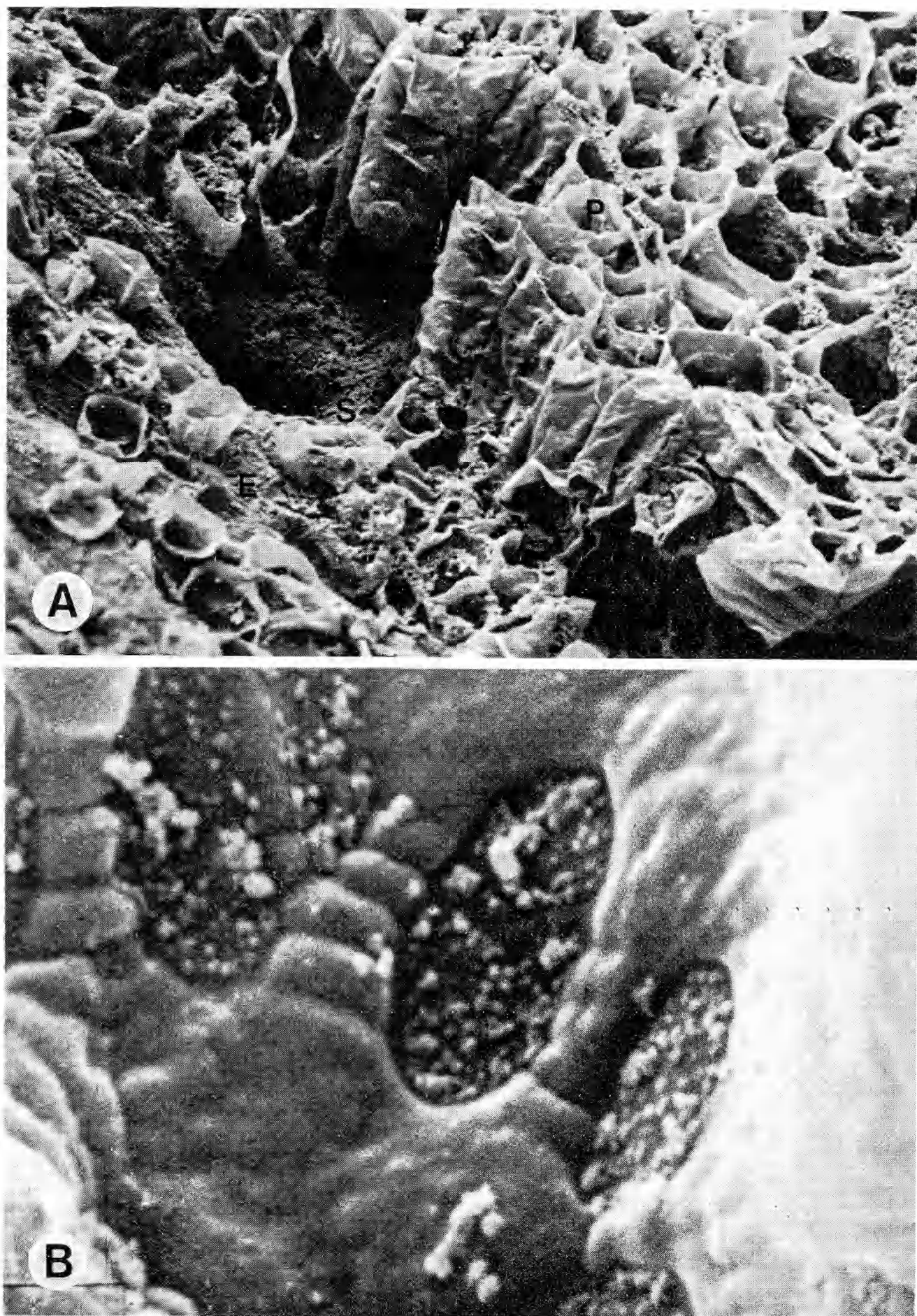


Fig. 5. Legend on p. 359.

here differentiated into a chlorenchymatous sheath surrounding the central structures in the leaf like the endodermis in root and stem. Functionally, this sheath equals the typical bundle sheaths seen in certain other members of the Chenopodiaceae and many grasses (WARMING 1897 p. 358). Probably the anatomy of the chlorenchyma in *Salsola* is a further development of the structure seen in *Bassia muricata* (VOLKENS 1887) with the chlorenchyma confined to the outer side of the bundles.

Of special interest in *Salsola* is the pronounced succulence, and there is reason to hope that measurements of photosynthetic gaseous exchange will detect any relationship with CAM-photosynthesis known from many succulents as indicated by LAETSCH (1968 and 1971).

ACKNOWLEDGEMENTS

The author is greatly indebted to TYGE W. BÖCHER for valuable discussions and helpful advice in preparing the manuscript. I also wish to thank BENT W. RASMUSSEN for the skilful operation of the scanning electron microscope at the Zoological Museum, Copenhagen.

LITERATURE CITED

- BLACK, C. C. Jr. & MOLLENHAUER, H. M. 1971. Structure and distribution of chloroplasts and other organelles in leaves with various rates of photosynthesis. — *Plant Physiol.* 47: 15—23.
- BROWN, R. H. & GRACEN, V. E. 1972. Distribution of the postillumination CO₂ burst among grasses. — *Crop Sci.* 12: 30—33.
- BÖCHER, T. W. 1972. Leaf anatomy in *Sporobolus rigens* (Tr.) Desv. (Graminae). — *Bot. Notiser* 125: 344—360.
- DOWNTON, W. J. S. 1970. Preferential C₄-dicarboxylic acid synthesis, the postillumination CO₂ outburst, carboxyl transfer step, and grana configuration in plants with C₄-photosynthesis. — *Can. J. Bot.* 48: 1795—1800.
- BERRY, A. J. & TREGUNNA, E. B. 1970. C₄-photosynthesis: non-cyclic electron flow and grana development in bundle sheath chloroplasts. — *Z. Pflanzenphysiol.* 63: 194—198.
- DYAR, M. T. 1953. Studies on the reduction of a tetrazolium salt by green plant tissue. — *Amer. J. Bot.* 40: 20—25.
- GRACEN, V. E., HILLIARD, J. H., BROWN, R. H. & WEST, S. H. 1972. Peripheral reticulum in chloroplasts of plants differing in CO₂ fixation pathways and photorespiration. — *Planta (Berl.)* 107: 189—204.
- GREENFIELD, M. 1913. Histology of *Salsola kali* L. var. *tenuifolia* G. F. W. May. — *Kansas Univ. Sci. Bull.* 7: 263—273.
- HILLIARD, J. H., GRACEN, V. E. & WEST, S. H. 1971. Leaf microbodies (peroxisomes) and catalase localization in plants differing in their photosynthetic carbon pathways. — *Planta (Berl.)* 97: 93—105.
- LAETSCH, W. M. 1968. Chloroplast specialization in dicotyledons possessing the C₄-dicarboxylic acid pathway of photosynthetic CO₂ fixation. — *Amer. J. Bot.* 55: 875—883.
- 1971. Chloroplast structural relationships in leaves of C₄-plants. — In HATCH, M. D. et al. (eds.): *Photosynthesis and Photorespiration*, pp. 323—349. New York.
- McNICOLL, I. S. 1929. Notes on strand plants — III. *Salsola kali* L. — *Trans. Bot. Soc. Edinb.* XXX, II: 147—156.
- MOSER, H. 1934. Untersuchungen über die Blattstruktur von *Atriplex*. — *Beih. Bot. Zbl.* 52: 378—388.
- OSMOND, C. B. 1970. Photosynthesis in the Chenopodiaceae. — *Z. Pflanzenphysiol.* 62: 129—132.
- SCHÖCH, E. & KRAMER, D. 1971. Korrelation von Merkmalen der C₄-Photosynthese bei Vertretern verschiedener Ordnungen der Angiospermen. — *Planta (Berl.)* 101: 51—66.
- SHIELDS, L. M. 1951. Leaf xeromorphy in dicotyledon species from a gypsum sand deposit. — *Amer. J. Bot.* 38: 175—190.
- SMITH, B. N. & BROWN, W. V. 1973. The Kranz syndrome in the Graminae as indicated by carbon isotope ratios. — *Amer. J. Bot.* 60: 505—513.
- SPURR, A. S. 1969. A low-viscosity epoxy resin embedding medium for electron microscopy. — *J. Ultrastruct. Res.* 26: 31—43.
- TREGUNNA, E. B. & DOWNTON, W. J. S. 1967. Carbon dioxide compensation in members of the Amaranthaceae and some related families. — *Can. J. Bot.* 45: 2385—2387.
- WARMING, E. 1897. Halofytstudier. — *K. Danske Vid. Selsk. Skr.* 6, VIII, 4: 172—272.
- WELKIE, G. W. & CALDWELL, M. 1970. Leaf anatomy of species in some dicotyledon families as related to the C₃ and C₄ pathways of carbon fixation. — *Can. J. Bot.* 48: 2135—2146.

- VOLKENS, G. 1887. Die Flora der ägyptisch-arabischen Wüste auf Grundlage anatomisch-physiologischer Forschungen. — Berlin.
- WOO, K. C., ANDERSON, J. M., BOARDMAN, N. K., DOWNTON, W. J. S., OSMOND, C. B. & THORNE, S. W. 1970. Deficient photosystem II in agranal bundle sheath chloroplasts of C_4 plants. — Proc. Nat. Acad. U.S.A. 67: 18—25.
- PYLIOTIS, N. A. & DOWNTON, W. J. S. 1971. Thylakoid aggregation and chlorophyll a/chlorophyll b ratio in C_4 plants. — Z. Pflanzenphysiol. 64: 400—413.

Studies in the Aegean Flora

XXII. The Flora of the Island of Skantzoura

Mats Gustafsson and Sven Snogerup

GUSTAFSSON, M. & SNOGERUP, S. 1974 11 28. Studies in the Aegean Flora. XXII. The flora of the island of Skantzoura. — Bot. Notiser 127: 364—372. Lund. ISSN 0006-8195.

The island of Skantzoura has a rather isolated position in the central Aegean, SE of the other islands of the Northern Sporades. The main island is surrounded by 8 islets of varying size. The present vegetation on the main island consists to a great extent of a phrygana community dominated by *Juniperus phoenicea* L. In all, 272 species have been observed and are listed below.

Mats Gustafsson and Sven Snogerup, Department of Plant Taxonomy, The Wallenberg Laboratory, University of Lund, Fack 7031, S-220 07 Lund 7, Sweden.

The islands of Skantzoura has a rather isolated position in the central Aegean, SE of the other islands of the Northern Sporades (Fig. 1). It is surrounded, at distances of 0.5—2 km, by eight islets of varying size.

Skantzoura has received little attention from botanists, probably because of its lack of mountains and spectacular cliffs. RECHINGER (1943) gave no records at all from the island. PHITOS (1967) mentions in his list *Juniperus phoenicea* L., *Pulicaria odora* (L.) REICHENB., *Anthemis auriculata* BOISS. and *Ptilostemon chamaepeuce* (L.) LESS. In his introductory discussions he also mentions *Coridothymus capitatus* (L.) REICHENB. FIL., *Anthyllis hermanniae* L., *Cistus creticus* L. and *C. salviifolius* PAMP. as occurring on Skantzoura. RUNEMARK and NORDENSTAM visited some of the small islets in 1960. The present investigation was performed during the period 1—3 of May 1972, and on the first day we were accompanied by R. VON BOTHMER, Lund, Sweden. In all, 272 species were noted from Skantzoura.

GEOLOGY, FLORA AND VEGETATION

The bedrock consists of hard limestone which in most parts is, however, covered by a more or less thick layer of schist. Exposed limestone is mainly found on the smallest islets and in parts of the shores of the main island and the larger islets.

The cliffs are rather small and are all directly exposed to the sea. The two specialized chasmophytes present, viz. *Campanula sporadum* FEER and *Centaurea rechingeri* PHITOS, are also found on the other islands of the Northern Sporades.

No water courses are present on the island, and the water-supply for settlements and grazing animals had to be taken from wells of varying depth. The vegetation on almost the whole of the main island is at present a phrygana community dominated by *Juniperus phoenicea* L. Several of the most common phrygana shrubs of the area, are, however, lacking whereas species also occurring in the undergrowth of woods, such as *Cistus* species, are rather common. Thus the phrygana is probably

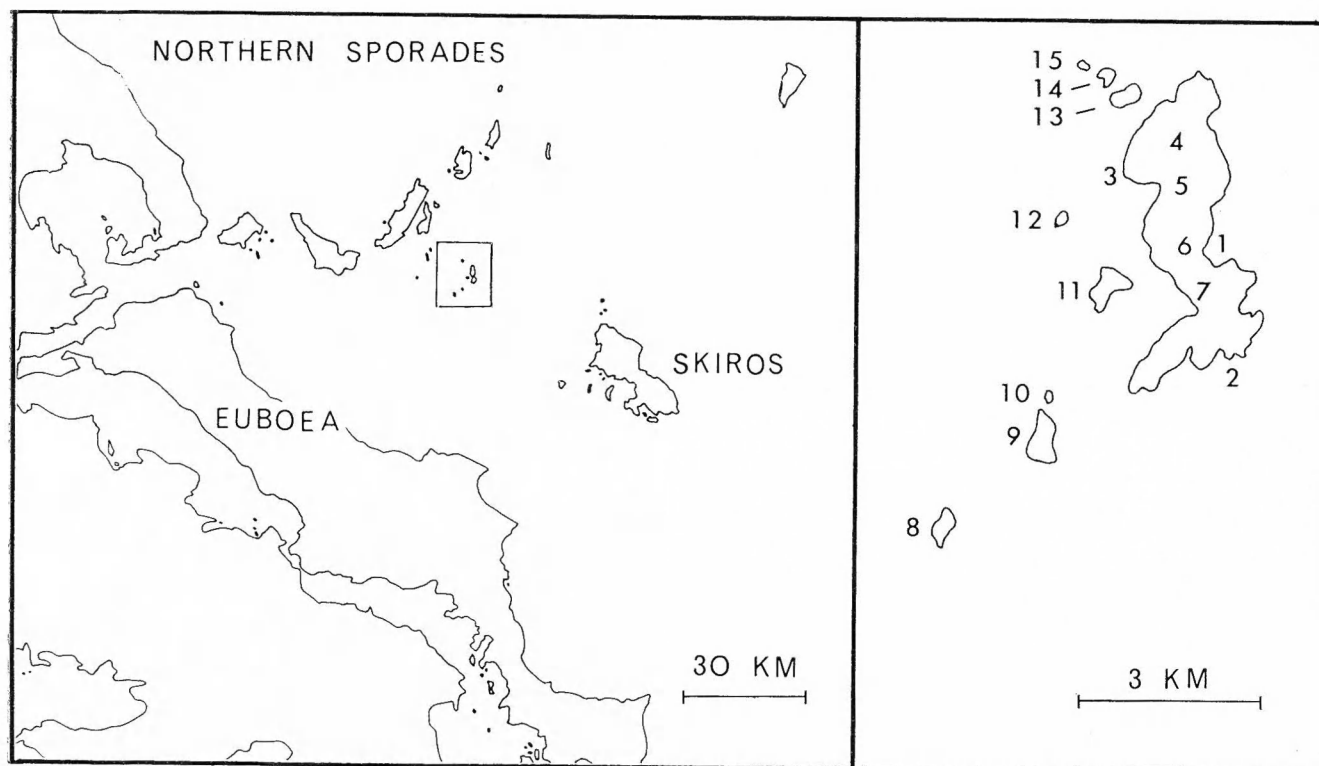


Fig. 1. The geographical position of Skantzoura (the framed area on the map to the left) and detailed map of Skantzoura (right) showing the localities listed on page 366.

a secondary type of vegetation. The natural vegetation was probably forest which has been destroyed by cutting and heavy grazing. Several forest-forming species of trees were observed, and as the future development of the vegetation will be worth following they were noted in detail.

Pinus halepensis MILL. occurs in two places. Two very old pines, which have previously been tapped for resin, are situated on the low ridge N of the landing place and W of the former monastery. Both had produced a large number of cones, but only one young tree, about 4 m tall, was observed. Further, a solitary old pine was found growing about 1 km S of the monastery on the highest part of the island, but no younger trees were observed close to it.

Quercus ilex L. is represented by at least two trees on rocky slopes about 0.5 km N of the monastery. One of them with a thick trunk was about 10 m high and was obviously very old.

Quercus coccifera L. is represented by a single tree about 0.5 km N of the landing

place. This tree had originally produced a trunk approximately 40 cm in diameter, which has been cut down. Later 13 stout shoots grew up from the stump 10 of which were in their turn cut down a few years ago. The remaining 3 stems are now 15–20 cm in diameter.

A number of small, shrubby specimens of *Philyrea latifolia* L. occur in the dense macchia-like vegetation less than 0.5 km N of the monastery. If left undisturbed this species also grows into fairly large trees.

The few trees observed probably form the relicts of a former natural forest, although the pines may have been planted. Now they run considerable risk of being cut down by visiting fishermen because of the scarcity of wood in the area. But as all human settlement on the island has now been abandoned there is also a fair chance that the trees will be able to reproduce again so that the forest vegetation can again prevail.

The smallest islets (localities nos. 8–15) are inhabited by a rather special composition of species, several of which are not

at all present on the main island or only in small numbers. The most striking examples are: *Atriplex recurva* D'URV., *Halmione portulacoides* (L.) AELLEN, *Silene fabaria* SIBTH. & SM., *Brassica cretica* LAM., *Medicago arborea* L. and *Convolvulus oleifolius* DESF. The species of this small-islet element are partly the same as those observed on the southern Aegean Islets (cf. RUNEMARK 1969).

TAXONOMICAL REMARKS

Campanula sporadum FEER s. lat. which comprises a number of closely related species, has recently been revised by PHITOS (1966). He stated, when he examined the material from Skantzoura, that this material cannot be referred to any of the species occurring in the Northern Sporades, but he also declared that further descriptions should be avoided as these and other recent collections complicate the variation pattern. The *C. sporadum* aggregate is no doubt in need of experimental revision.

The material here called *Anthemis* cf. *flexicaulis* RECH. FIL. displays great morphological variation between populations of different islets, even in characters used in the delimitation of species in the group. In the Skantzoura area, populations occurring within a distance of only some kilometres vary greatly, e.g. in growth habit, size of capitulum, leaf form and size of the auricle of the achenes. RECHINGER, who examined the material, stated that it is at least very closely related to populations of *A. flexicaulis* from Euboea. The whole complex of related maritime *Anthemis* species in the Aegean area displays the same extreme interpopulational variation, which makes recognition of species rather difficult.

Most of the material of *Hedypnois cretica* (L.) DUM. from Skantzoura can be referred to any of the subspecies. However, specimens from the islet of Skantilion (S., B. & G. 43890) seem to be intermediate be-

tween ssp. *cretica* and ssp. *monspeliensis* MURB.

The plants listed below as *Papaver rhoeas* L. also include specimens that agree more closely with the description of *P. strigosum* (BÖNNINGH.) SCHUR, but we found it impossible to distinguish between these taxa.

LIST OF SPECIES

In the table below, the localities are indicated by numbers according to the following code:

1. The main island, 1 km SSE of the monastery, maritime cliffs.
2. The main island, 3 km SSE of the monastery, maritime cliffs.
3. The main island, 1 km W of the monastery, the landing place.
4. The main island, 0.5—1.5 km N of the monastery.
5. The main island, the monastery.
6. The main island, 1 km S of the monastery.
7. The main island, 2 km S of the monastery.
8. The islet of Korakas.
9. The islet of Skantilion.
10. The small islet N of Skantilion.
11. The islet of Prasson.
12. The islet of Strongylo.
13. Lagophytionisia, the inner SE islet.
14. Lagophytionisia, the middle islet.
15. Lagophytionisia, the outer NW islet.

Records marked H indicate our own collections, R those of RUNEMARK and NORDENSTAM 1960, and × field notes. All the voucher specimens are preserved at LD.

LITERATURE CITED

- PHITOS, D. 1966. Die quinqueloculären *Campanula*-arten. — Österr. Bot. Zeitschr. 112: 449—498.
- 1967. *Florula Sporadum*. — *Phyton* 12: 102—149.
- RECHINGER, K. H. FIL. 1943. *Flora Aegaea*. — Denkschr. Akad. Wiss. Wien, Math.-Nat. Kl. 105(1).
- RUNEMARK, H. 1969. Reproductive drift, a neglected principle in reproductive biology. — Bot. Notiser 122: 90—129.

Species	Main island							Islets												
	Locality							Locality												
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15					
<i>Selaginella denticulata</i> (L.) LINK	.	.	.	x	.	.	x	.	.	.	.	.	.	.	.					
<i>Cheilanthes pteridioides</i> (REICH.) C. CHR.	.	.	x	.	.	.	.	.	.	.	x	.	.	.	.					
<i>Ceterach officinarum</i> DC.	.	.	H	.	.	.	x	.	.	.	.	.	.	x	.					
<i>Juniperus phoenicea</i> L.	.	.	H	x	x	x	x	.	.	.	.	.	.	.	.					
<i>Pinus halepensis</i> MILL.	.	.	x	.	.	.	x	.	.	.	.	.	.	.	.					
<i>Quercus coccifera</i> L.	.	.	x	.	.	.	.	.	.	.	.	.	.	.	.					
<i>Q. ilex</i> L.	.	.	.	H	.	.	.	.	.	.	.	.	.	.	.					
<i>Urtica dubia</i> FORSKÅL	.	.	.	.	.	.	x	.	.	.	.	.	.	.	.					
<i>U. urens</i> L.	.	.	.	.	x	.	.	.	.	.	.	.	.	.	.					
<i>Parietaria cretica</i> L.	.	.	x	.	.	.	.	H	x	.	x	x	x	x	.					
<i>P. punctata</i> WILLD. (syn. <i>P. diffusa</i> MERT. & KOCH in RÖHLING)	.	.	.	x	.	.	.	x	x	.	.	x	.	.	.					
<i>Rumex pulcher</i> L.	.	.	.	x	x	.	.	.	.	.	.	.	.	.	.					
<i>Mercurialis annua</i> L.	.	.	.	x	.	.	x	x	.	.	.	x	.	x	.					
<i>Euphorbia acanthothamnus</i> HELDR. & SART.	.	.	.	.	.	.	.	x	x	.	.	.	x	x	.					
<i>E. exigua</i> L.	.	.	.	H	.	H	.	.	.	.	x	.	H	.	.					
<i>E. helioscopia</i> L.	.	.	.	H	.	.	.	.	.	.	.	.	.	.	.					
<i>E. peplus</i> L.	.	.	.	H	.	H	.	H	H	.	H	H	.	H	.					
<i>Chenopodium murale</i> L.	.	.	.	.	x	.	.	x	.	.	.	.	.	.	.					
<i>Atriplex recurva</i> D'URV.	.	.	.	.	.	.	.	.	.	.	.	H	.	.	.					
<i>Halimione portulacoides</i> (L.) AELLEN	.	.	.	.	.	.	.	.	H	x	.	.	x	.	.					
<i>Theligonum cynocrambe</i> L.	.	.	.	x	.	x	.	x	x	.	.	.	x	.	.					
<i>Carpobrotus acinaciformis</i> (L.) L. BOLUS	.	.	.	.	x	.	.	.	.	.	.	.	.	.	.					
<i>Arenaria leptoclados</i> (REICHENB.) GUSS. ..	.	.	.	.	.	.	x	.	.	.	x	.	.	.	.					
<i>Stellaria media</i> (L.) VILL.	.	.	.	.	x	.	.	.	.	.	.	.	.	.	.					
<i>Holosteum umbellatum</i> L.	.	.	.	.	.	x	.	.	.	.	.	.	.	.	.					
<i>Sagina ciliata</i> FRIES	.	.	.	.	.	.	H	.	H	.	.	.	.	.	.					
<i>S. maritima</i> G. DON FIL.	.	.	H	.	.	.	.	.	.	.	.	.	.	.	.					
<i>Herniaria hirsuta</i> L.	.	.	.	.	.	.	.	x	x	.	.	.	.	.	.					
<i>Polycarpon tetraphyllum</i> (L.) L.	.	.	.	x	x	.	.	x	x	.	.	.	.	x	.					
<i>Spergularia bocconeii</i> (SCHEELE) ASCH. & GRAEBN.	.	.	.	.	.	H	.	.	.	.	.	.	.	.	.					
<i>Silene vulgaris</i> (MOENCH) GARCKE	.	.	.	.	x	.	.	.	.	.	.	.	.	.	.					
<i>S. fabaria</i> (L.) SIBTH. & SM.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	H					
<i>S. gallica</i> L.	x	.	x	.	.	.	.	x	x	.	.	.	.	.	.					
<i>S. sedoides</i> POIRET	x	.	x	.	.	.	.	x	x	.	x	.	x	x	.					
<i>Petrorhagia velutina</i> (GUSS.) P. W. BALL & HEYWOOD	.	.	.	H	.	.	.	.	.	.	.	.	.	.	.					
<i>Cytinus hypocistis</i> (L.) L.	.	.	.	x	.	.	x	.	.	.	.	.	.	.	.					
<i>Nigella arvensis</i> L. ssp. <i>aristata</i> (SIBTH. & SM.) NYM.	.	.	.	.	.	.	.	.	H	.	.	.	H	.	.					
<i>Clematis cirrhosa</i> L.	.	.	.	x	.	.	x	.	x	.	x	.	.	.	.					
<i>Adonis annua</i> L.	.	.	.	H	.	.	.	.	.	.	H	.	.	.	.					
<i>Papaver apulum</i> TEN.	.	.	.	.	x	.	.	.	.	.	.	.	.	.	.					
<i>P. dubium</i> L.	.	.	x	.	x	.	x	.	.	.	.	.	.	x	.					
<i>P. rhoeas</i> L.	.	.	.	H	.	.	x	.	.	.	.	.	.	.	.					
<i>Fumaria capreolata</i> L.	.	.	.	.	.	.	x	.	.	.	.	.	.	.	.					
<i>F. judaica</i> BOISS.	.	.	.	.	.	.	H	H	.	.	.	H	.	H	.					
<i>F. officinalis</i> L. ssp. <i>wirtgenii</i> (KOCH) ARC- ANGELI	.	.	.	H	.	.	.	.	.	.	.	.	.	.	.					
<i>Capparis spinosa</i> L. ssp. <i>rupestris</i> (SIBTH. & SM.) NYM.	.	.	.	.	.	.	.	x	x	x	.	x	.	x	x					
<i>Sisymbrium officinale</i> (L.) SCOP.	.	.	.	x	.	.	x	.	.	.	.	.	.	.	.					
<i>S. orientale</i> L.	.	.	.	.	x	.	.	.	.	.	.	.	.	.	.					
<i>Arabidopsis thaliana</i> (L.) HEYNH.	.	.	.	.	.	.	x	.	.	.	.	.	.	.	.					

Species	Main island							Islets							
	Locality							Locality							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
<i>Malcolmia flexuosa</i> (SIBTH. & SM.) SIBTH. & SM., ssp. <i>naxensis</i> (RECH. FIL.) A. L. STORK	×	.	.	.	.	.	.	H	H	.	.	H	.	H	H
<i>Clypeola jonthlaspi</i> L.	.	.	.	.	.	.	×	.	.	.	.	.	×	.	.
<i>Brassica cretica</i> LAM.	.	.	.	.	.	.	.	H	H	.	.	.	.	H	H
<i>Hirschfeldia incana</i> (L.) LAGRÈZE-FOSSAT	.	.	.	.	×	.	.	.	.	.	.	.	.	.	.
<i>Rapistrum rugosum</i> (L.) BERGERET ssp. <i>orientale</i> (L.) ARCANGELI	.	.	.	.	.	.	.	H	.	.	.	.	.	.	.
<i>Biscutella didyma</i> L.	.	.	.	×	.	.	.	.	×	.	.	.	×	.	.
<i>Capsella rubella</i> REUT.	.	.	.	×	.	.	×	.	.	.	.	.	.	.	.
<i>Cistus incanus</i> L. ssp. <i>creticus</i> (L.) HEYWOOD	.	.	.	×	.	.	H	.	.	.	×	.	×	.	.
<i>C. monspeliensis</i> L.	.	.	.	.	.	.	H	.	.	.	.	.	.	.	.
<i>C. salviifolius</i> L.	.	.	.	×	.	.	H	.	.	.	.	.	.	.	.
<i>Tuberaria guttata</i> (L.) FOURR.	.	.	.	×	.	.	×	.	.	.	×	.	.	.	.
<i>Helianthemum salicifolium</i> (L.) MILLER	.	.	.	.	.	.	.	.	×	.	.	.	.	.	.
<i>Fumana arabica</i> (L.) SPACH	.	.	.	.	.	.	×	.	.	.	×	.	×	.	.
<i>F. thymifolia</i> (L.) VERLOT	.	.	.	.	.	.	.	.	.	.	H	.	H	.	.
<i>Viola kitaibeliana</i> ROEM. & SCHULT.	.	.	.	.	.	.	H	.	.	.	.	.	.	.	.
<i>Frankenia hirsuta</i> L.	.	.	×	.	.	.	.	.	H	×	.	.	×	.	.
<i>Malva cretica</i> CAV.	.	.	.	×	.	.	×	×	×	.	H	.	.	.	.
<i>M. pusilla</i> SM. in SOWERBY	.	.	.	.	.	.	×	.	.	.	.	.	.	.	.
<i>M. sylvestris</i> L.	.	.	.	×	×	.	.	.	.	.	.	.	.	.	.
<i>Lavatera arborea</i> L.	.	.	.	.	.	.	.	×	.	.	.	H	.	.	×
<i>Linum strictum</i> L.	.	.	.	×	.	.	×	×	×	.	×	.	×	.	.
<i>L. trigynum</i> L.	.	.	.	×	.	.	×	.	×	.	×	.	×	.	.
<i>Geranium robertianum</i> L. ssp. <i>purpureum</i> (VILL.) NYM.	.	.	.	×	.	.	×	.	.	.	×	.	.	.	.
<i>G. rotundifolium</i> L.	.	.	.	×	.	.	×	.	.	.	×	.	.	.	.
<i>Erodium cicutarium</i> (L.) L'HÉR.	.	.	.	H	.	.	.	.	.	.	.	.	.	.	.
<i>E. malacoides</i> (L.) L'HÉR.	.	.	.	.	.	.	H	×	H	.	.	H	H	H	.
<i>Ruta chalepensis</i> L.	.	.	.	.	.	.	.	×	.	.	.	.	.	.	.
<i>Sedum litoreum</i> GUSS.	.	.	.	.	.	.	.	×	×	.	×	.	×	×	.
<i>S. rubens</i> L.	.	.	.	.	.	.	.	.	H	.	.	.	H	.	.
<i>Pistacia lentiscus</i> L.	.	.	.	×	.	.	.	×	×	.	×	.	×	.	.
<i>Tillaea muscosa</i> L.	.	.	.	×	.	.	.	.	.	.	.	.	.	.	.
<i>Aphanes microcarpa</i> (BOISS. & REUT.) ROTHM.	.	.	.	×	.	.	H	.	.	.	.	.	.	.	.
<i>Sarcopoterium spinosum</i> (L.) SPACH	.	.	.	×	.	.	×	.	.	.	×	.	.	.	.
<i>Astragalus hamosus</i> L.	.	.	.	H	.	.	×	.	.	.	.	.	.	.	.
<i>Biserrula pelecinus</i> L.	.	.	.	×	.	.	×	.	.	.	.	.	.	.	.
<i>Vicia cretica</i> BOISS. & HELDR. var. <i>spruneri</i> (BOISS.) BOISS.	.	.	H	.	.	.	.	.	.	.	.	.	.	.	.
<i>V. cuspidata</i> BOISS.	.	.	H	.	.	.	.	.	.	.	H	.	.	.	.
<i>V. dasycarpa</i> TEN.	.	.	.	×	.	.	×	×	×	.	×	.	.	.	.
<i>V. hybrida</i> L.	.	.	.	×	.	.	.	.	.	.	.	.	.	.	.
<i>V. lathyroides</i> L.	.	.	H	.	.	.	.	.	.	.	.	.	.	.	.
<i>V. microphylla</i> D'URV.	.	.	.	.	.	.	H	.	.	.	.	.	.	.	.
<i>Ononis ornithopodioides</i> L.	.	.	.	.	.	.	.	.	.	.	.	.	H	.	.
<i>O. reclinata</i> L.	.	.	.	.	.	.	H	.	.	.	H	.	×	.	.
<i>Trigonella monspeliaca</i> L.	.	.	H	.	.	.	.	.	H	.	.	.	H	.	.
<i>Medicago arborea</i> L.	.	.	.	.	.	.	.	×	.	.	.	×	.	×	.
<i>M. coronata</i> (L.) BART.	.	.	.	.	.	.	×	.	.	.	.	.	×	.	.
<i>M. disciformis</i> DC.	.	.	.	.	.	.	.	H	.	.	.	.	.	.	.
<i>M. orbicularis</i> (L.) BART.	.	.	.	.	.	×	.	.	.	.	.	.	.	.	.
<i>M. praecox</i> DC.	.	.	.	.	.	.	.	.	.	.	.	.	H	H	.

Species	Main island							Islets							
	Locality							Locality							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
<i>M. tuberculata</i> (RETZ.) WILLD.	.	.	.	H	.	.	.	.	.	.	.	.	.	.	.
<i>M. truncatula</i> GAERTN.	.	.	.	H	.	.	.	.	H	.	.	.	.	.	.
<i>Trifolium angustifolium</i> L.	.	.	.	x	.	.	x	.	.	.	.	.	.	.	.
<i>T. campestre</i> SCHREB.	.	.	.	H	.	.	H	H	H	.	H	.	H	.	.
<i>T. scabrum</i> L.	.	.	.	x	.	.	.	x	x	.	x	.	x	x	.
<i>T. stellatum</i> L.	.	.	.	x	.	.	x	.	x	.	.	.	x	.	.
<i>T. subterraneum</i> L.	.	.	.	x	.	.	x	.	.	.	.	.	.	.	.
<i>T. suffocatum</i> L.	.	.	.	.	.	H	.	.	.	.	.	.	.	.	.
<i>T. tomentosum</i> L.	.	.	.	x	.	.	x	.	.	.	.	.	.	.	.
<i>T. uniflorum</i> L.	.	.	.	x	.	.	x	.	x	.	.	.	.	.	.
<i>Dorycnium hirsutum</i> (L.) SÉR.	.	.	x	x	.	.	x	.	x	.	x	.	.	.	.
<i>Lotus angustissimus</i> L.	.	.	.	H	.	H	.	.	.	.	.	.	.	.	.
<i>L. coimbrensis</i> BRÖT.	.	.	.	.	.	H	.	.	.	.	.	.	.	.	.
<i>L. cytisoides</i> L.	.	.	.	.	.	.	.	H	H	x	.	x	.	x	.
<i>L. edulis</i> L.	.	.	x	.	.	.	.	x	x	.	.	.	x	x	.
<i>L. ornithopodioides</i> L.	.	.	.	H	.	.	.	.	.	.	H	.	H	.	.
<i>Tetragonolobus purpureus</i> MOENCH	.	.	.	x	.	.	.	x	.	.	x	.	x	.	.
<i>Hymenocarpus circinnatus</i> (L.) SAVI.	.	.	.	x	.	.	x	.	x	.	.	.	.	.	.
<i>Anthyllis hermanniae</i> L.	.	.	.	x	.	.	x	.	.	.	x	.	x	.	.
<i>A. spruneri</i> (BOISS.) G. BECK	.	.	.	x	.	.	.	.	.	.	.	.	x	.	.
<i>Physanthyllis tetraphylla</i> (L.) BOISS.	.	.	.	.	.	.	x	.	.	.	.	.	.	.	.
<i>Hippocrepis ciliata</i> WILLD.	.	.	.	.	.	.	.	.	.	.	.	.	H	.	.
<i>Scorpiurus subvillosus</i> L.	.	.	.	.	.	x	.	x	x	.	x	.	x	.	.
<i>Eryngium campestre</i> L.	.	.	.	.	.	.	.	x	x	.	.	.	.	.	.
<i>Lagoecia cuminoides</i> L.	.	.	.	x	.	.	x	x	x	.	x	.	x	.	.
<i>Bupleurum gracile</i> D'URV.	.	.	.	.	.	.	H	.	.	.	.	.	x	.	.
<i>B. trichopodium</i> BOISS. & SPRUNER	.	.	H	.	.	.	.	.	x	.	.	.	.	.	.
<i>Crithmum maritimum</i> L.	x	.	.	.	.	.	.	x	x	x	.	.	x	x	x
<i>Ferula communis</i> L.	.	.	.	.	.	.	.	.	H	.	H	.	.	.	.
ssp. <i>glauca</i> (L.) ROUY & CAM.	.	.	.	.	.	.	.	.	H	.	H	.	.	.	.
<i>Tordylium apulum</i> L.	.	.	.	x	.	.	x	x	x	.	x	.	x	.	.
<i>Daucus guttatus</i> SIBTH. & SM.	.	.	.	.	.	.	.	H	x	.	.	.	.	.	.
<i>D. involucratus</i> SIBTH. & SM.	.	.	.	x	.	.	.	.	.	.	x	.	x	.	.
<i>Orlaya daucoides</i> (L.) GREUTER	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
(syn. <i>O. Kochii</i> HEYWOOD)	.	.	x	.	.	.	.	.	.	.	.	.	.	.	.
<i>Torilis arvensis</i> (HUDS.) LINK	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
ssp. <i>elongata</i> (HOFFM. & LINK) CANNON	.	.	H	.	.	.	.	.	.	.	.	.	.	.	.
<i>T. leptophylla</i> (L.) REICHENB. FIL.	.	.	x	.	.	.	.	.	.	.	.	.	.	.	.
<i>T. nodosa</i> (L.) GAERTN.	.	.	.	x	.	.	x	x	x	.	.	.	x	x	.
<i>Scandix australis</i> L.	.	.	.	x	.	.	x	.	.	.	.	.	.	.	.
<i>S. pecten-veneris</i> L.	.	.	.	x	.	.	.	.	x	.	.	.	.	.	.
<i>Bifora testiculata</i> (L.) ROTH	.	.	.	H	.	.	x	.	.	.	.	.	.	.	.
<i>Limonium gmelini</i> (WILLD.) O. KUNTZE ..	x	x	.	.	.	.	.	.	.	.	.	.	x	H	.
<i>Arbutus unedo</i> L.	.	.	.	x	.	.	x	.	.	.	.	.	.	.	.
<i>Erica manipulifera</i> SALISB.	.	.	.	.	.	.	x	.	.	.	.	.	.	.	.
<i>Asterolinon linum-stellatum</i> (L.) DUBY ...	.	.	x	.	.	.	H	.	.	.	x	.	x	.	.
<i>Anagallis arvensis</i> L.	.	.	.	x	.	.	x	x	x	.	x	x	x	x	.
<i>Convolvulus althaeoides</i> L.	.	.	.	.	.	x	.	.	.	.	.	.	.	.	.
<i>C. arvensis</i> L.	.	.	x	.	.	x	.	.	.	.	.	.	.	.	.
<i>C. oleifolius</i> DESR.	.	.	.	.	.	.	.	x	x	.	.	x	x	x	.
<i>Cuscuta palaestina</i> BOISS.	.	.	.	.	.	.	.	.	H	.	.	.	.	H	.
<i>Heliotropium europaeum</i> L.	.	.	.	.	.	.	.	.	.	.	.	.	R	.	.
<i>H. hirsutissimum</i> GRAUER	.	.	.	.	.	.	.	R	.	.	.	.	.	.	.
<i>Myosotis incrassata</i> GUSS.	.	.	.	.	.	H	.	.	.	.	.	.	.	.	.
<i>Lithospermum apulum</i> (L.) VAHL	.	.	.	x	.	.	x	.	x	.	.	.	x	.	.

Species	Main island							Islets							
	Locality							Locality							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
<i>Echium lycopsis</i> L. (syn. <i>E. plantagineum</i> L.)	.	.	.	x	x	.	.	.	.	.	.	.	.	.	.
<i>Hyoscyamus albus</i> L.	.	.	.	.	x	.	.	R	.	.	.	.	.	.	.
<i>Antirrhinum orontium</i> L.	.	.	.	x	.	.	H	.	.	.	x	.	x	.	.
<i>Linaria pelisseriana</i> (L.) MILLER <i>L. simplex</i> (WILLD.) DC. (syn. <i>L. parviflora</i> (JACQ.) HAL.)	.	.	.	x	.	.	x	x	x	.	x	.	.	.	.
<i>Scrophularia peregrina</i> L.	.	.	.	x	x	.	x	.	.	.	.	.	.	.	.
<i>Veronica arvensis</i> L.	.	.	.	x	.	.	.	.	.	.	.	.	.	.	.
<i>V. cymbalaria</i> BODARD	.	.	.	.	.	.	x	.	.	.	.	.	.	.	.
<i>Parentucellia latifolia</i> (L.) CAR.	.	.	.	x	.	x	.	.	.	.	.	.	.	.	.
<i>Orobanche minor</i> SM.	.	.	.	.	.	.	.	H	H	.	.	.	.	.	.
<i>Teucrium divaricatum</i> SIEBER ex HELDR.	.	.	x	.	.	.	.	.	.	.	x	.	x	.	.
<i>T. polium</i> L.	.	.	.	x	.	.	.	.	x	.	.	.	.	.	.
<i>Prasium majus</i> L.	.	.	.	x	.	.	x	x	x	.	.	.	.	.	.
<i>Sideritis curvidens</i> STAPF	.	.	.	H	.	.	x	.	x	.	.	.	x	.	.
<i>Lamium amplexicaule</i> L.	.	.	.	x	.	.	x	.	.	.	x	.	.	.	.
<i>Salvia triloba</i> L.	.	.	.	.	.	.	.	.	.	.	x	.	.	.	.
<i>S. verbenaca</i> L.	.	.	.	x	.	.	x	.	.	.	.	.	.	.	.
<i>Micromeria graeca</i> (L.) BENTH.	.	.	.	x	.	.	x	.	.	.	.	.	.	.	.
<i>M. nervosa</i> (DESF.) BENTH.	.	.	x	.	.	.	.	.	.	.	.	.	.	.	.
<i>Coridothymus capitatus</i> (L.) REICHENB. FIL.	.	.	.	.	.	.	.	.	x	.	x	.	x	.	.
<i>Mentha pulegium</i> L.	.	.	.	.	.	.	x	.	.	.	.	.	.	.	.
<i>Plantago afra</i> L. (syn. <i>P. psyllium</i> L.)	.	.	.	x	.	.	x	.	x	.	x	.	x	.	.
<i>P. bellardii</i> ALL.	.	.	.	H	.	.	.	.	H	.	.	.	.	.	.
<i>P. coronopus</i> L.	.	.	x	x	.	.	.	x	x	.	.	.	x	x	.
<i>P. lagopus</i> L.	.	.	.	x	.	.	.	.	.	.	.	.	.	.	.
<i>P. lanceolata</i> L.	.	.	.	x	.	.	x	.	x	.	.	.	.	.	.
<i>Centaureum pulchellum</i> (SW.) DRUCE	.	.	H	.	.	.	.	.	.	.	.	.	H	.	.
<i>Blackstonia perfoliata</i> (L.) HUDS.	.	.	.	.	.	.	x	.	.	.	.	.	.	.	.
<i>Phillyrea latifolia</i> L.	.	.	.	x	.	.	.	.	.	.	.	.	.	.	.
<i>Olea europaea</i> L. ssp. <i>sylvestris</i> (MILLER) ROUY	.	.	.	.	.	.	.	.	x	.	x	.	x	.	.
<i>Sherardia arvensis</i> L.	.	.	.	x	.	.	x	x	.	.	x	.	.	.	.
<i>Crucianella latifolia</i> L.	.	.	x	x	.	.	x	.	.	.	.	.	.	.	.
<i>Galium aparine</i> L.	.	.	.	x	.	.	x	x	.	.	x	.	x	.	.
<i>G. murale</i> (L.) ALL.	.	.	.	x	x	.	.	x	.	.	x	.	x	.	.
<i>Valantia hispida</i> L.	.	.	.	x	.	.	x	.	.	.	.	.	x	.	.
<i>V. muralis</i> L.	.	.	.	.	.	.	.	x	x	.	x	.	x	x	.
<i>Rubia olivieri</i> RICH.	.	.	.	.	.	.	H	.	.	.	.	.	.	.	.
<i>Valerianella coronata</i> (L.) DC.	.	.	.	.	.	.	H	.	.	.	.	.	.	.	.
<i>V. dentata</i> (L.) POLL.	.	.	.	H	.	.	.	.	.	.	H	.	.	.	.
<i>V. discoidea</i> (L.) LOIS.	.	.	.	H	.	.	H	.	.	.	H	.	H	.	.
<i>Campanula erinus</i> L.	.	.	.	x	.	.	x	.	.	.	x	.	.	.	.
<i>C. sporadum</i> FEER s. lat.	x	x	.	.	.	.	.	.	.	.	.	.	.	x	.
<i>Legousia falcata</i> (TEN.) FRITSCH	.	.	.	.	.	.	H	.	.	.	.	.	.	.	.
<i>Bellis annua</i> L.	.	.	.	.	.	.	.	.	x	.	.	.	.	.	.
<i>Bellium minutum</i> (L.) L.	.	.	.	.	.	.	.	.	H	.	.	.	.	.	.
<i>Filago cretensis</i> GANDOG. ssp. <i>cretensis</i>	.	.	.	.	.	.	.	.	H	.	.	.	.	.	.
<i>F. eriocephala</i> GUSS.	.	.	.	H	.	.	.	H	H	.	H	.	.	.	.
<i>F. gallica</i> L.	.	.	.	H	.	.	x	.	.	.	x	.	.	.	.
<i>F. germanica</i> (L.) HUDS.	.	.	.	.	.	.	H	.	.	.	.	.	.	.	.
<i>F. pyramidata</i> L.	.	.	.	H	.	.	x	.	.	.	.	.	.	.	.
<i>Evax pygmaea</i> (L.) BROT.	.	.	.	.	.	.	H	H	H	.	H	.	H	.	.
<i>Phagnalon graecum</i> BOISS. & HELDR.	.	.	.	.	.	.	.	.	x	.	.	.	x	.	.
<i>Inula viscosa</i> (L.) AITON	.	.	.	.	.	.	x	.	.	.	.	.	.	.	.

Species	Main island							Islets							
	Locality							Locality							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
<i>Pallenis spinosa</i> (L.) CASS.	.	.	.	.	.	.	.	×	.	.	.	.	.	.	.
<i>Anthemis arvensis</i> L.	.	.	.	×	.	.	.	.	.	.	.	.	.	.	.
<i>A. cf. flexicaulis</i> RECH. FIL.	.	.	.	.	.	.	.	H	H	H	.	.	H	H	.
<i>Chrysanthemum coronarium</i> L.	.	.	.	.	×	.	.	.	.	.	.	.	.	.	.
<i>C. segetum</i> L.	.	.	.	×	.	.	.	.	×	.	.	.	.	.	.
<i>Matricaria recutita</i> L.	.	.	.	.	×	.	.	.	.	.	.	.	.	.	.
<i>Senecio vulgaris</i> L.	.	.	.	×	.	.	×	×	×	.	×	×	.	×	.
<i>Calendula arvensis</i> L.	.	.	×	×	.	.	.	×	×	.	.	.	×	×	.
<i>Carlina corymbosa</i> L.	.	.	.	×	.	.	×	.	.	.	.	.	.	.	.
<i>C. lanata</i> L.	.	.	.	.	.	.	.	×	.	.	.	.	×	.	.
<i>Atractylis cancellata</i> L.	.	.	.	×	.	.	×	.	.	.	.	.	×	.	.
<i>Carduus macrocephalus</i> DESF. ssp. <i>inconstrictus</i> (O. SCHW.) KAZMI ...	.	.	.	H	.	.	.	.	.	.	.	.	.	.	.
<i>C. pycnocephalus</i> L.	.	.	.	.	×	.	.	.	×	.	.	.	×	×	.
<i>Crupina crupinastrum</i> (MORIS) VIS.	.	.	.	.	.	.	×	.	.	.	.	.	×	.	.
<i>Centaurea rechingeri</i> PHITOS	.	×	.	.	.	.	.	.	H	.	.	.	.	.	.
<i>Tolpis umbellata</i> BERT.	.	.	.	.	.	.	H	.	.	.	.	.	.	.	.
<i>Hyoseris scabra</i> L.	.	.	.	H	.	.	.	.	.	.	.	.	.	.	.
<i>Rhagadiolus stellatus</i> (L.) GAERTN.	.	.	.	×	.	.	.	.	.	.	.	.	.	.	.
<i>Hedypnois cretica</i> (L.) DUM. ssp. <i>cretica</i> ..	.	.	.	H	.	.	H	H	.	.	.	.	H	.	.
ssp. <i>monspeliensis</i> MURB.	.	.	.	.	.	.	.	.	.	.	H	.	.	.	.
ssp. <i>tubaeformis</i> (TEN.) NYM.	.	.	.	.	.	.	H	.	.	.	.	.	.	.	.
<i>Hypochaeris achyrophorus</i> L.	.	.	.	×	.	.	.	H	.	.	×	.	×	×	.
<i>Urospermum picroides</i> (L.) SCOP. ex F. W. SCHMIDT	.	.	.	×	.	.	.	×	×	.	×	.	×	×	.
<i>Chondrilla juncea</i> L.	.	.	.	.	.	.	×	.	.	.	.	.	.	.	.
<i>Reichardia picroides</i> (L.) ROTH	.	.	.	.	.	.	×	×	×	.	.	.	×	.	.
<i>Sonchus oleraceus</i> L.	.	.	.	×	.	.	×	.	.	.	.	.	.	.	.
<i>S. tenerrimus</i> L.	.	.	.	.	.	.	.	.	.	.	.	.	H	H	.
<i>Aetheorhiza bulbosa</i> (L.) CASS.	.	.	.	×	.	.	×	×	×	.	×	.	×	×	.
<i>Crepis multiflora</i> SIBTH. & SM.	.	.	.	.	.	.	.	.	.	.	.	.	H	.	.
<i>C. neglecta</i> L.	.	.	.	.	.	.	.	H	H	.	H	.	.	.	.
<i>C. zacintha</i> (L.) BABC.	.	.	.	H	.	.	.	.	.	.	.	.	.	.	.
<i>Asphodelus microcarpus</i> VIV.	.	.	.	.	.	.	.	.	.	.	×	.	.	.	.
<i>Lloydia graeca</i> (L.) ENDL. ex KUNTH	.	.	.	×	.	.	×	.	.	.	.	.	.	.	.
<i>Urginea maritima</i> (L.) BAKER.	.	.	.	×	.	.	.	.	.	.	.	.	.	.	.
<i>Leopoldia weissii</i> (FREYN) FREYN ex HELDR.	.	.	.	.	.	.	.	.	H	.	.	.	H	H	.
<i>Iris germanica</i> L.	.	.	.	.	×	.	.	.	.	.	.	.	.	.	.
<i>Bromus fasciculatus</i> C. PRESL	.	.	H	.	.	.	H	.	.	.	.	.	H	.	.
<i>B. intermedius</i> GUSS.	.	.	.	.	.	.	H	.	.	.	.	.	H	.	.
<i>B. madritensis</i> L.	.	.	H	.	.	.	.	.	H	.	.	.	.	H	.
<i>B. scoparius</i> L.	.	.	.	H	.	.	H	.	.	.	.	.	.	.	.
<i>B. sterilis</i> L.	.	.	.	×	.	.	.	.	.	.	.	.	.	.	.
<i>Trachynia distachya</i> (L.) LINK	.	.	.	×	.	.	×	.	×	.	.	.	×	.	.
<i>Triticum macrochaetum</i> (R. J. SHUTTLEW & HUET) RICHTER (syn. <i>Aegilops biun-</i> <i>cialis</i> VIS.)	.	.	.	H	.	.	.	H	.	.	.	.	.	.	.
<i>T. vagans</i> (JORDAN & FOURR.) GREUTER (syn. <i>Aegilops ovata</i> L.)	.	.	.	H	.	.	.	H	H	.	.	.	.	.	.
<i>Hordeum murinum</i> L.	.	.	×	×	.	.	×	×	×	.	.	.	×	×	.
<i>Melica ciliata</i> L. ssp. <i>nebrodensis</i> (PARL.) COSS.	.	.	.	.	.	.	.	H	.	.	.	.	.	.	.
<i>M. minuta</i> L.	.	.	×	×	.	.	.	.	.	.	.	.	.	.	.
<i>Briza maxima</i> L.	.	.	.	H	.	.	×	.	×	.	×	.	×	.	.
<i>Dactylis glomerata</i> L. ssp. <i>hispanica</i> (ROTH) NYM.	.	.	.	H	.	.	.	×	×	.	×	.	×	×	.

Species	Main island							Islets							
	Locality							Locality							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
<i>Cynosurus echinatus</i> L.	.	.	.	×	.	.	.	.	.	.	.	.	.	.	.
<i>Lamarckia aurea</i> (L.) MCH.	.	.	.	×	.	.	×	.	.	.	.	.	.	.	.
<i>Poa bulbosa</i> L.	.	.	.	×	.	×	.	.	.	.	.	.	.	.	.
<i>P. exilis</i> MURB.	.	.	.	.	.	×	.	.	.	.	.	.	.	.	.
<i>Vulpia bromoides</i> (L.) S. F. GRAY	.	.	.	H	.	.	H	.	.	.	.	.	.	.	.
<i>Catapodium marinum</i> (L.) HUBBARD	.	.	.	.	.	.	.	×	×	.	.	×	.	×	.
<i>C. rigidum</i> (L.) HUBBARD	.	.	×	H	.	.	H	×	×	.	×	.	×	.	.
<i>Lolium rigidum</i> GAUDIN	.	.	×	×	.	.	×	H	H	.	.	.	.	.	.
<i>Parapholis incurva</i> (L.) HUBBARD	.	.	H	.	.	.	.	.	.	.	.	.	H	×	.
<i>Psilurus incurvus</i> (GOUAN) SCHINZ & THELL	.	.	.	×	.	.	×	.	.	.	×	.	.	.	.
<i>Lophochloa cristata</i> (L.) HYL.															
(syn. <i>Koeleria phleoides</i> (VILL.) PERS.)	.	.	×	×	.	.	.	×	×	.	×	×	.	×	.
<i>Avena barbata</i> POTT ex LINK	.	.	.	×	.	.	×	×	×	.	.	.	×	×	.
<i>Aira elegantissima</i> SCHUR	.	.	.	×	.	.	×	.	.	.	×	.	.	.	.
<i>Lagurus ovatus</i> L.	.	.	.	.	.	.	.	×	×	.	.	.	×	×	.
<i>Stipa bromoides</i> (L.) BRAND	.	.	×	×	.	.	.	.	.	.	.	.	.	.	.
<i>S. lagascae</i> ROEM. & SCHULT.	.	.	.	.	.	.	.	.	×	.	.	.	.	.	.
<i>S. tortilis</i> DESF.	.	.	.	×	.	.	×	.	×	.	.	.	×	.	.
<i>Oryzopsis coerulescens</i> (DESF.) HACKEL ..	.	.	.	.	.	.	.	.	.	.	.	.	×	.	.
<i>O. miliacea</i> (L.) ASCH. & SCHWEINF.	.	.	.	.	.	.	.	×	.	.	.	.	.	.	.
<i>Ophrys scolopax</i> CAV.															
ssp. <i>cornuta</i> (STEVEN) CAMUS	.	.	.	.	.	.	.	.	.	.	.	.	H	.	.
<i>Anacamptis pyramidalis</i> (L.) L. C. M.															
RICHARD	.	.	.	.	.	.	.	.	.	.	×	.	.	.	.
<i>Arisarum vulgare</i> O. TARG.-TOZZ.	.	.	.	.	.	.	×	×	.	.	.	×	×	×	.

Achnanthes pseudobiceps nov. spec., eine neue Achnanthes-Art aus dem Barsebäcksmosse (Südschweden)

Hannelore Håkansson

HÅKANSSON, H. 1974 11 28. *Achnanthes pseudobiceps* nov. spec., eine neue Achnanthes-Art aus dem Barsebäcksmosse (Südschweden). — Bot. Notiser 127: 373—375. Lund. ISSN 0006-8195.

Achnanthes pseudobiceps nov. spec. is described from brackish water sediments in the Barsebäck area. Its closest ally seems to be *A. biceps* HUST.

Hannelore Håkansson, Quartärbiologisches Laboratorium, Tornavägen 13, S-223 63 Lund, Schweden.

Achnanthes pseudobiceps HÅKANSSON nov. spec.

Achnanthes bicipiti peraffinis sed differt structura distincte radiali, area centrali rapho-valvae bene evoluta, striis singulatim brevioribus insertis.

TYPUS: Barsebäck Nr 180x, 1971, Quartärbiologisches Laboratorium, Tornavägen 13, Lund.

Achnanthes pseudobiceps HÅKANSSON nov. spec. Die Schalen sind stark hyalin, im Umriss linear-elliptisch mit in der Mitte nahezu parallelen Seiten und ziemlich breit und kurz ausgezogenen, kopfigen Enden. 8—14 μ lang, 4.5—6.5 μ breit. Raphenlose Schale mit einer grossen, linear-elliptischen Pseudoraphe von annähernd halber Schalenbreite. Transapikalstreifen ziemlich kurz, randstehend, deutlich radial, 20—22 in 10 μ , gegen die Pole enger werdend, ca 30 in 10 μ . Raphenschale mit gerader, fadenförmiger Raphe. Axialarea sehr eng, linear, in der Mitte zu einer kleinen, runden Zentralarea erweitert. Transapikalstreifen dichter stehend als auf der raphenlosen Schale, 26—30 in 10 μ , in der Mitte deutlich radial, an den

Enden parallel bis schwach konvergent. In der Mitte oft einzelne, verkürzte Streifen eingeschoben. Auf den Elektronenmikroskop-Bildern der Raphenschale ist ausserdem eine deutliche Kieselrippe sichtbar, die parallel mit der Schalenkante läuft.

Diese Art steht der *Achnanthes biceps* HUST. (HUSTEDT 1959, S. 41, Taf. 1, Fig. 22—23) sehr nahe. Sie unterscheidet sich jedoch durch die deutlich radiale Struktur, die stark markierte Zentralarea, auf der Raphenschale, sowie die einzeln eingeschobenen, verkürzten Streifen.

Achnanthes pseudobiceps nov. spec. kommt im Sediment des Barsebäcksmosse (NILSSON 1935, DIGERFELDT 1972 und Manuskript) mehr oder weniger reichlich vor. Da diese Art u.a. in Gesellschaft von *Achnanthes Hauckiana*, *Cocconeis scutellum*, *Diploneis interrupta*, *Hyalodiscus scoticus*, *Mastogloia smithii* var. *smithii* und var. *amphicephala*, *Navicula digitoradiata*, *N. halophila*, *Synedra cristallina*, *S. pulchella* vorkommt, muss es sich um eine Brackwasserart handeln.

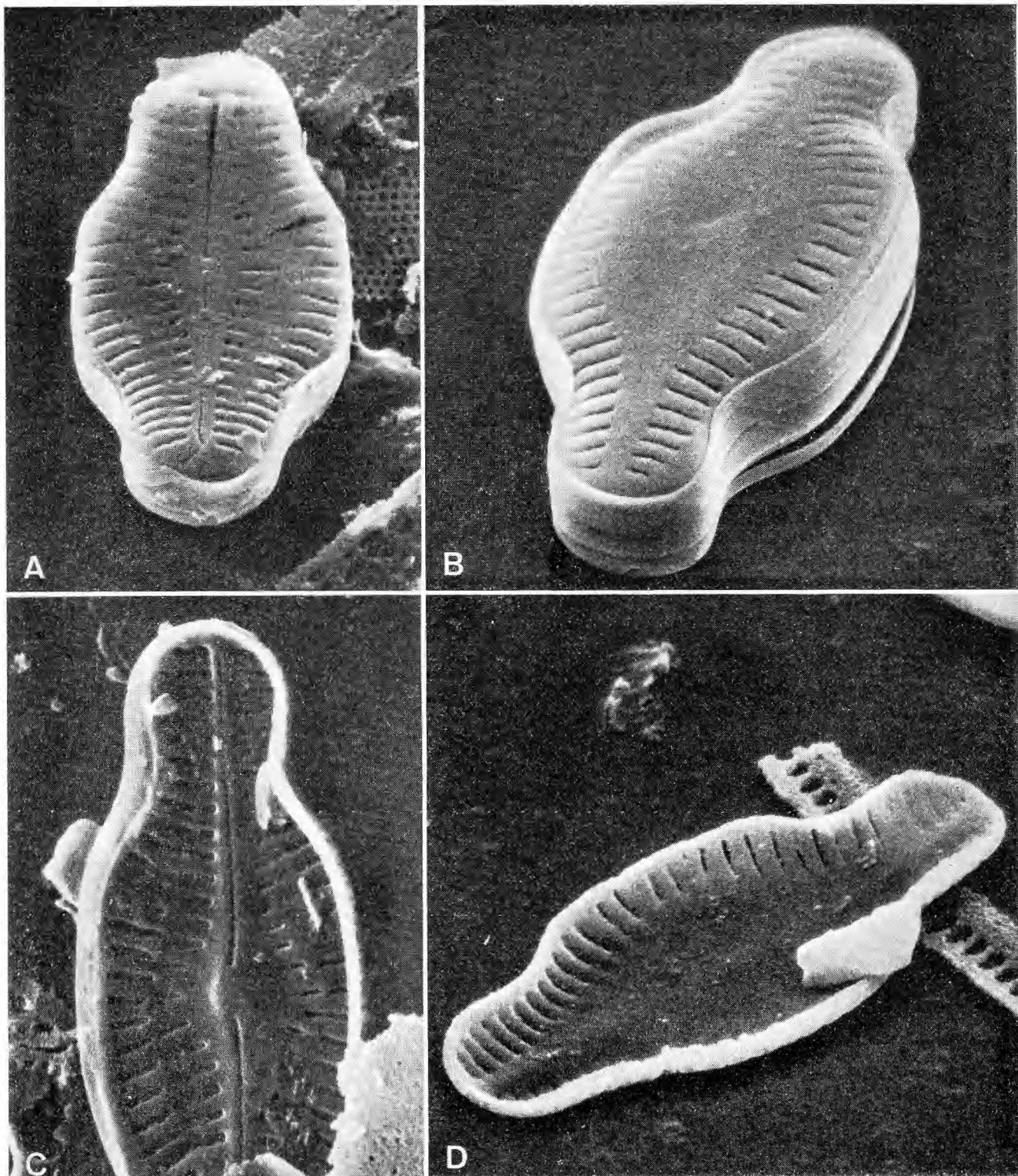
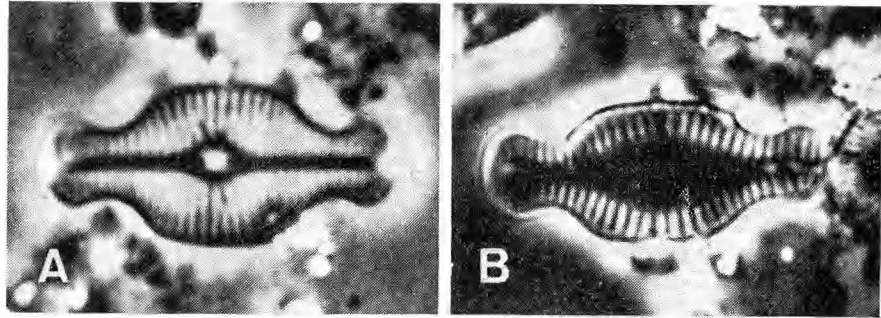


Abb. 1. *Achnanthes pseudobiceps* n.sp. — A: Eine Zelle mit der Raphenschale sichtbar (obs., die Kieselrippe). REM 8750 $\times$. — B: Eine Zelle mit der raphenlosen Schale sichtbar. REM 8750 $\times$. — C: Die Raphenschale von innen gesehen. REM 8750 $\times$. — D: Die raphenlose Schale von innen gesehen. REM 8750 $\times$. — Photo: Elektronenmikroskoplaboratorium, Zoologisches Institut, Lund. Prep.: Hannelore Håkansson.

Abb. 2. *Achnanthes pseudobiceps* n.sp. — A: Eine Raphenschale. Lichtmikroskop. Anoptral-Fasekontrast 2500 $\times$. — B: Eine raphenlose Schale. Lichtmikroskop. Anoptral-Fasekontrast 2500 $\times$. — Photo: Max Möller, Odense, Dänemark.



LITERATURVERZEICHNIS

DIGERFELDT, G. 1972. A preliminary report of an investigation of Littorina transgressions in the Barsebäck area, Western Skåne. — Geol. Fören. Förhandl. 94: 4.
— 1974. Manuskript.

HUSTEDT, F. 1959. Die Diatomeenflora der Unterweser von der Lesummündung bis

Bremerhaven mit Berücksichtigung des Unterlaufs der Hunte und Geeste. — Veröffentl. Inst. Meeresforsch. in Bremerhaven VI.

NILSSON, T. 1935. Die pollenanalytische Zonengliederung der spät- und postglazialen Bildungen Schonens. — Geol. Fören. Förhandl. 57: 3.

Studies in Gasteromycetes

II. Notes on the Morphology and Intraspecific Variation in *Geastrum umbilicatum* Fr.

By *Stellan Sunhede*

SUNHEDE, S. 1974 11 28. Studies in Gasteromycetes. II. Notes on the morphology and intraspecific variation in *Geastrum umbilicatum* Fr. — Bot. Notiser 127: 376—391. Lund. ISSN 0006-8195.

Swedish material of *Geastrum umbilicatum* Fr. (ut *Geaster*) has been studied in the field and in the laboratory. Notes are given on the morphology and the intraspecific variation of mature or nearly mature fruiting bodies of this species. Photographs and drawings represent an important part of the paper. SEM-pictures show spores, capillitial threads and surfaces of endoperidia. The choice of the name *G. umbilicatum* Fr. instead of *G. badium* PERS. is explained.

Stellan Sunhede, Department of Systematic Botany, University of Göteborg, Carl Skottsbergs Gata 22, S-413 19 Göteborg, Sweden.

INTRODUCTION

FRIES' name *Geastrum umbilicatum* Fr. (ut *Geaster*) will be used throughout this paper. There seems to be no Friesian material left, and the choice of this name is based on his description (FRIES 1829). The reason why the name *Geastrum badium* PERS. is omitted will be given in the discussion. *Geastrum elegans* VITT. (ut *Geaster*) appears to be synonymous with *G. umbilicatum*. It has hitherto not come to my knowledge if there exist any Vittadian specimens of *G. elegans*. However,

the detailed description and figure given by VITTADINI (1842) seem to be well in accordance with specimens regularly included in the intraspecific variation of *G. umbilicatum*.

There is often a great variation in different characteristics of mature fruiting bodies within the species of the genus *Geastrum*. In certain species the variation is moderate while in others it is so great that without knowing the intermediary forms one would be inclined to exclude

Fig. 1. *Geastrum umbilicatum* Fr. Fully expanded fruiting bodies with the rays recurved under the exoperidial discs. — A—E: Fresh specimens with an intact whitish fleshy layer. — F: Older fruiting body with a brown and somewhat shrunken fleshy layer. — A, B: Non-saccate with arched exoperidia. — C—F: Exoperidia more or less saccate. — A: The pits in the fleshy layer (arrows) have been made by an invertebrate mycophage. — B: Note the low plicate peristome and compare it with those of the others (A, C—F). — C: Exoperidium split to more than the half. — D: Exoperidium split to about the middle. Note the cracks in the pseudoparenchymatic layer of the rays. — E: Exoperidium split to less than the middle except at one place where it has split nearly to the centre. One of the rays not recurved under the exoperidial disc. (p) part of the fleshy layer that has peeled off. — All endoperidia except the right one in (D) are covered with a layer of hyphae and crystalline matter. Figs. A—F of different scales. Diameters of fruiting bodies varying from 15 mm (B) to 35 mm (E). Photo: STELLAN SUNHEDE. — A, F: In the autumn of 1970. — B—E: 29.IX.1972.

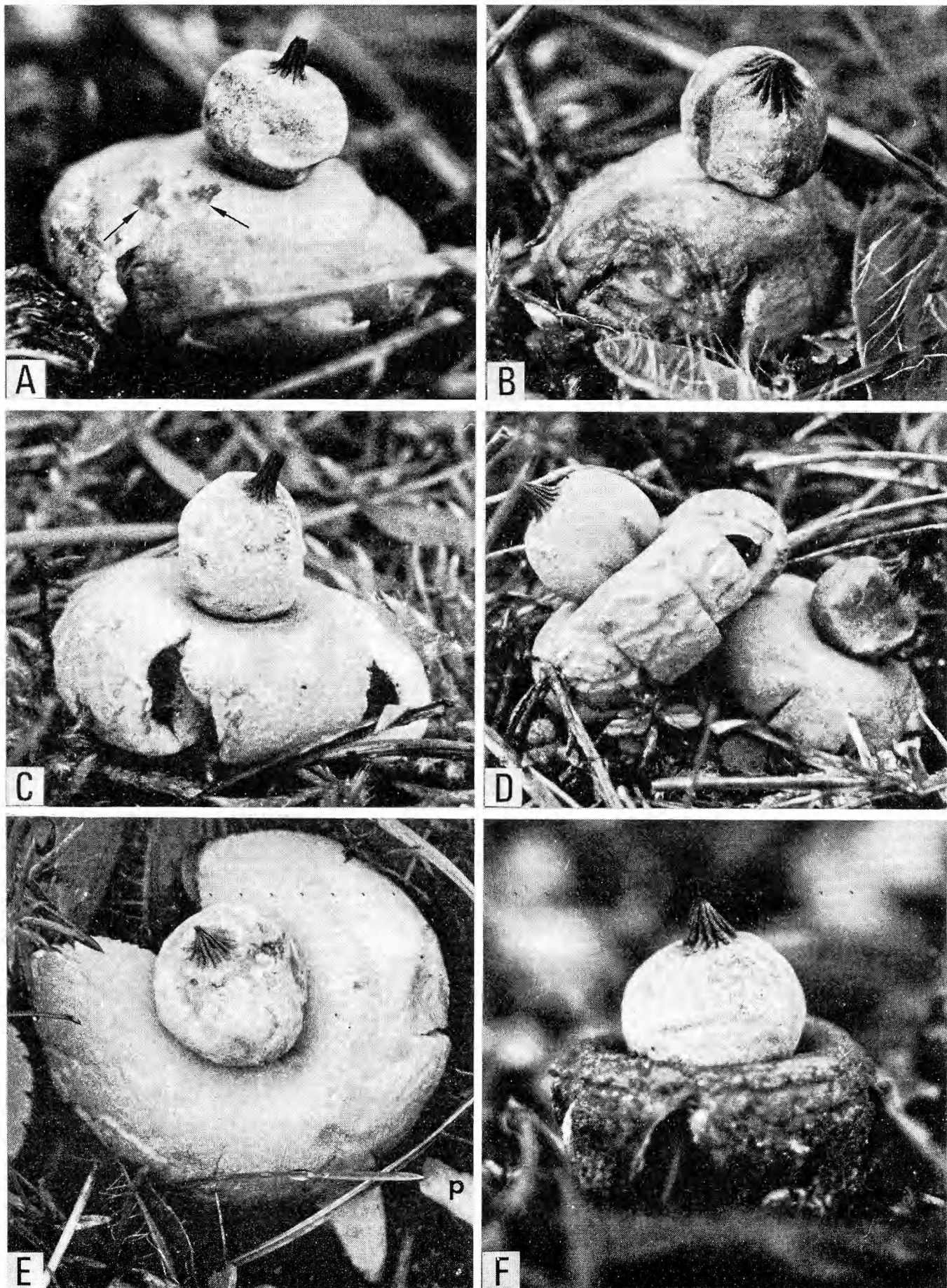


Fig. 1.

specimens from their true taxonomic position.

In understanding the intraspecific variation in *Geastrum* it is an advantage and sometimes a necessity that the knowledge of species be based not only on existing herbarium material but also on experience and collecting in the field. Fruiting bodies may persist in the field for one year or more depending on species and environmental factors. It is therefore also of interest to collect specimens during different seasons to study the change in the fruiting bodies with age.

This paper is intended to be the first in a series discussing the morphology and intraspecific variation in Swedish material of *Geastrum*. Photographs, drawings and their legends represent an important part of the paper.

MATERIAL AND METHODS

The Swedish members of the genus *Geastrum* PERS. have been studied by the author in southern Sweden, especially on the islands of Öland, Gotland and Gotska Sandön during the last five years. More than 400 days have been spent in the field in collecting fruiting bodies and studying the biology of these fungi. Field observations have been made during all four seasons but mainly from September to December.

Here notes will be given on the morphology and intraspecific variation in *Geastrum*

umbilicatum. The investigation is based on field observations and a study of 329 fruiting bodies collected by the author on Öland and Gotland. If nothing else is mentioned all measurements herein refer to dried specimens.

Microscopic characteristics have been examined in 2 % KOH, Melzer's reagent and Cotton blue in an optical microscope (in ordinary light as well as in phase contrast). These characteristics (except the spore processes) are measured to the nearest 0.5 μ .

Spores, capillitial threads and endoperidial surfaces have also been examined in a Jeol JSM-1 Scanning Electron Microscope. The investigated matter has been mounted on a specimen holder covered with a thin layer of Casco RX glue and after drying coated with first a thin layer of carbon and then with a thin layer of gold-palladium. The material has been examined under a beam voltage of 10 kV and a tilt angle of 45°. Ilford FP4 film and an exposure time of 100 sec. have been used. For macrophotos in the field and in the laboratory Kodak TRI-X Pan and Kodak Panatomic-X films have been used.

OBSERVATIONS

Exoperidium, Macroscopic Characteristics

The fruiting body is found immediately under the ground level just prior to opening. Approximately twenty fruiting bodies seen in this state have been more or less pointed or onion-shaped (Fig. 3 C: f and

Fig. 2. Dry fruiting bodies of *Geastrum umbilicatum* FR. — A: Variation in size of fruiting bodies (dried when rather fresh). All specimens except (e) seen from above and with the rays recurved under the exoperidial discs. (a—d, g—i) with normal peristomes, (e, f) with only a hole at the top of the endoperidium. (e) side view of a fruiting body, not quite opened, with an empty endoperidium. This extremely small fruiting body was incorporated in the mycelial layer of a larger one. (i) the arrow points to the light margin of an exoperidial ray. — B, C: The same specimen (dried when fresh) with not fully expanded rays and with the mycelial layer partly peeled off. — B: Top view. The endoperidial wall as well as the peristome are covered with a layer of thin-walled hyphae. (p) inner surface of the pseudoparenchymatic layer. (f) the outer side of the fibrous stratum. (m) the inner surface of the mycelial layer. The arrow points to a light border where the fleshy layer is thinner. — C: Side view. Note the glossy surface (reflecting light) of the fibrous layer (f). (m) inner side of the mycelial stratum. The arrow points to the outer side of the mycelial layer with adherent humus and debris. — D: Specimen where the fleshy layer has been gelatinized and got dried, stiff and dark. The exoperidium bulges up into a small papilla that makes the endoperidium look shortly stalked (arrow). The endoperidium is partly covered with a thin whitish layer of hyphae and crystalline matter. — E: Old specimen with only greyish remnants of the fleshy stratum on the white fibrous layer of the exoperidium. Endoperidium without covering hyphae or crystalline matter. Photo: STELLAN SUNHEDE.

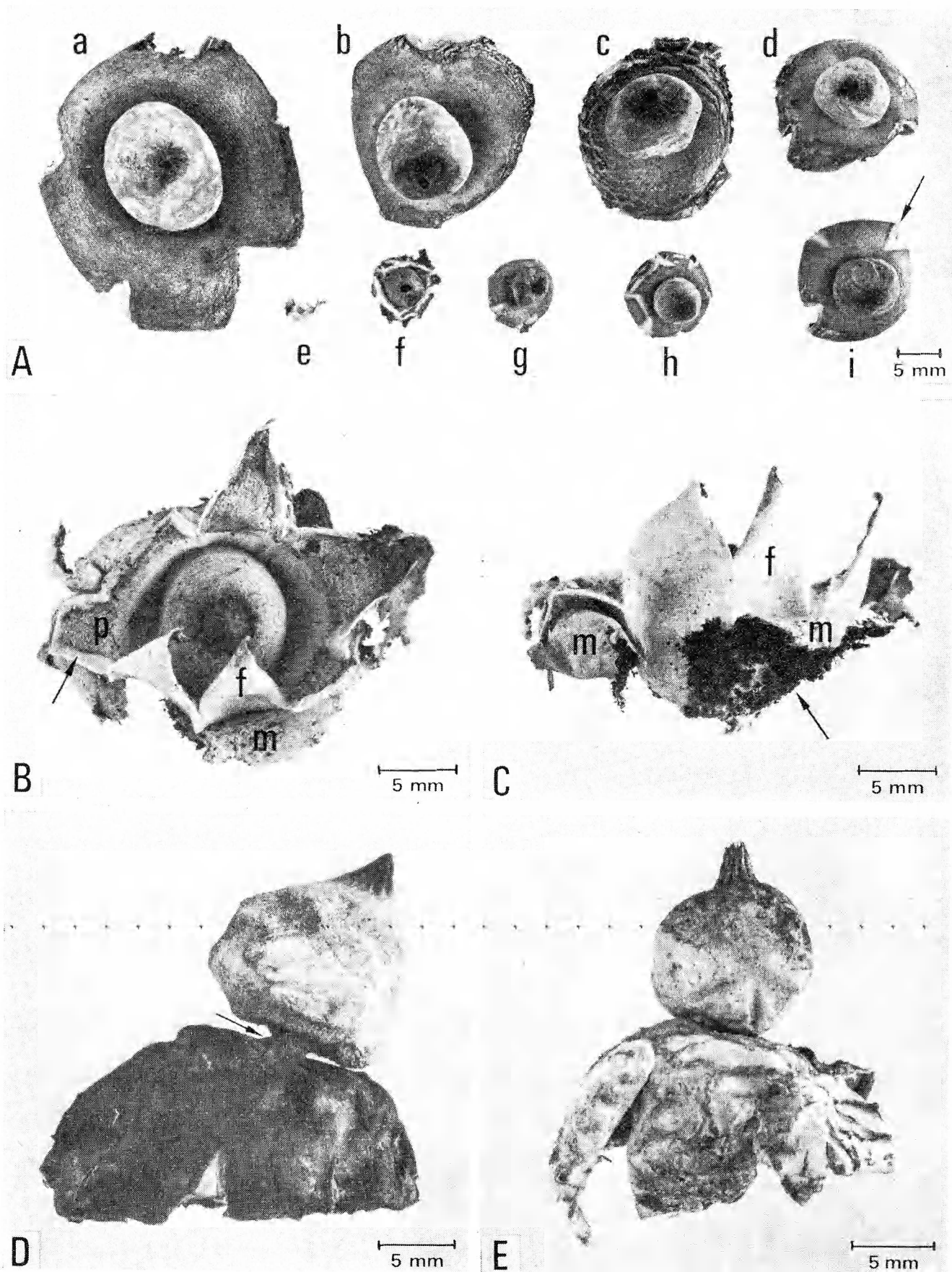


Fig. 2.

to some extent g and A: j). Exoperidium splitting occurs from the apex (Fig. 3 C: g, h) and downwards into 4—10 stellate rays often in a regular manner (Fig. 3 B: e, g, h) but sometimes irregularly (Fig. 3 B: d, f, i). The shape of the rays varies (Fig. 3 B: a—j). Most specimens have six or seven rays (Fig. 6 B). The exoperidium may split to about the middle, or less or more (Figs. 1 A—E; 2 B, C, E; 3 B: a—k, C: d, e; 4 C: c). The rays often recurve under the disc of the exoperidium (the unsplit part of the exoperidium) (Figs. 1 A, C—E; 2 A: a—d, f—i, D; 3 A: a—e, B: k, C: a—e; 4 C: a, b) but also take up other positions (Figs. 2 B, C; 3 A: f—o).

The exoperidium is often more or less saccate (Figs. 1 C—F; 2 A: a—d, f—i; 3 A: a—c, C: a—e; 4 C: a, b). 84 % of 286 expanded and intact specimens have been saccate. The diameter of the expanded fruiting body varies (cf. Fig. 2 A) from (4.5—)8.6—35 mm but most of the specimens have a diameter between 10 and 25 mm (Fig. 6 B). When the rays are forced out into a stellate configuration, as shown in Figs. 3 B: a—j; 4 C: c, the maximal diameter noted is 62 mm. Exoperidial rays are often non-hygroscopic (Fig. 4 C: a, b) but hygroscopic specimens occur (Fig. 4 A: a—c, B: a—c, C: c, d). In fruiting bodies dried when fresh there is often a light border at the margins of the exo-

peridial rays, where the pseudoparenchymatic tissue is thinner (Fig. 2 A: i, B).

The pseudoparenchymatic layer (the fleshy layer) in a fresh young and just opened fruiting body is whitish and about 1 mm or more thick (Fig. 1 A—E). The colour changes with age from white to ochraceous or reddish tints to brown of different shades. The fleshy layer may sometimes split in a way reminiscent of the cracking of *Geastrum triplex* JUNGH. (Fig. 3 C: a—c). It may also crack into fissures (Figs. 1 D, E; 2 A: c; 3 C: e; 4 B: a) or into a chequered pattern (Fig. 3 C: d) or peel off (Fig. 1 E: p). Under wet conditions it seems gradually to gelatinize. At last it disappears and the whitish fibrous layer of the exoperidium is exposed (Fig. 2 E).

In herbarium specimens the colour and structure of the fleshy layer thus depend on the age and state of the fruiting bodies when they were collected. When dried the colour often changes to some degree. The colour of the fleshy layer of dried specimens varies from whitish-beige to different tints of ochre, greyish brown and blackish brown.

The middle layer of the exoperidium, the fibrous layer, is whitish and when the mycelial layer has peeled off, its outer side often appears glossy (Fig. 2 B: f, C: f). A scar is often seen at the centre of the outer

Fig. 3. *Geastrum umbilicatum* FR. Fruiting bodies. — A: Vertical sections through the middle of fruiting bodies showing the curvature of the exoperidium and the position of and to some extent the shape of the endoperidium (dotted area). Simplified drawings of dried specimens. (a, b) prominently saccate, (c) somewhat saccate, (e, g) exoperidial disc plane or nearly so, (d, f, h) exoperidium arched, (i) old specimen with only the paper-like fibrous layer of the exoperidium left, (j—m) young opening fruiting bodies and (n, o) older specimens with some rays only partly opened. — B: (a—j) simplified drawings from above of specimens where the exoperidia under wet conditions have been forced into one plane. The position of the endoperidia dotted. Note the regular (e, g, h) and irregular (d, f) splitting of the exoperidium, the depth to which it has been cleft and the shape of the rays. (k) specimen seen from below. The mycelial layer has peeled off and a scar (arrow) in the fibrous layer can be seen. Note the rays that have recurved under the exoperidial disc. — C: The pseudoparenchymatic layer has cracked in a way similar to that often seen in *Geastrum triplex* JUNGH. (a) and (b) same specimen from different views. (d) fruiting body where the fleshy layer is cracked in a chequered pattern and dried. (e) dry specimen with cracks in the pseudoparenchymatic layer. (f—h) young fruiting bodies with humus and debris attached to the mycelial layer. (f) unexpanded and (g, h) just opened specimens.

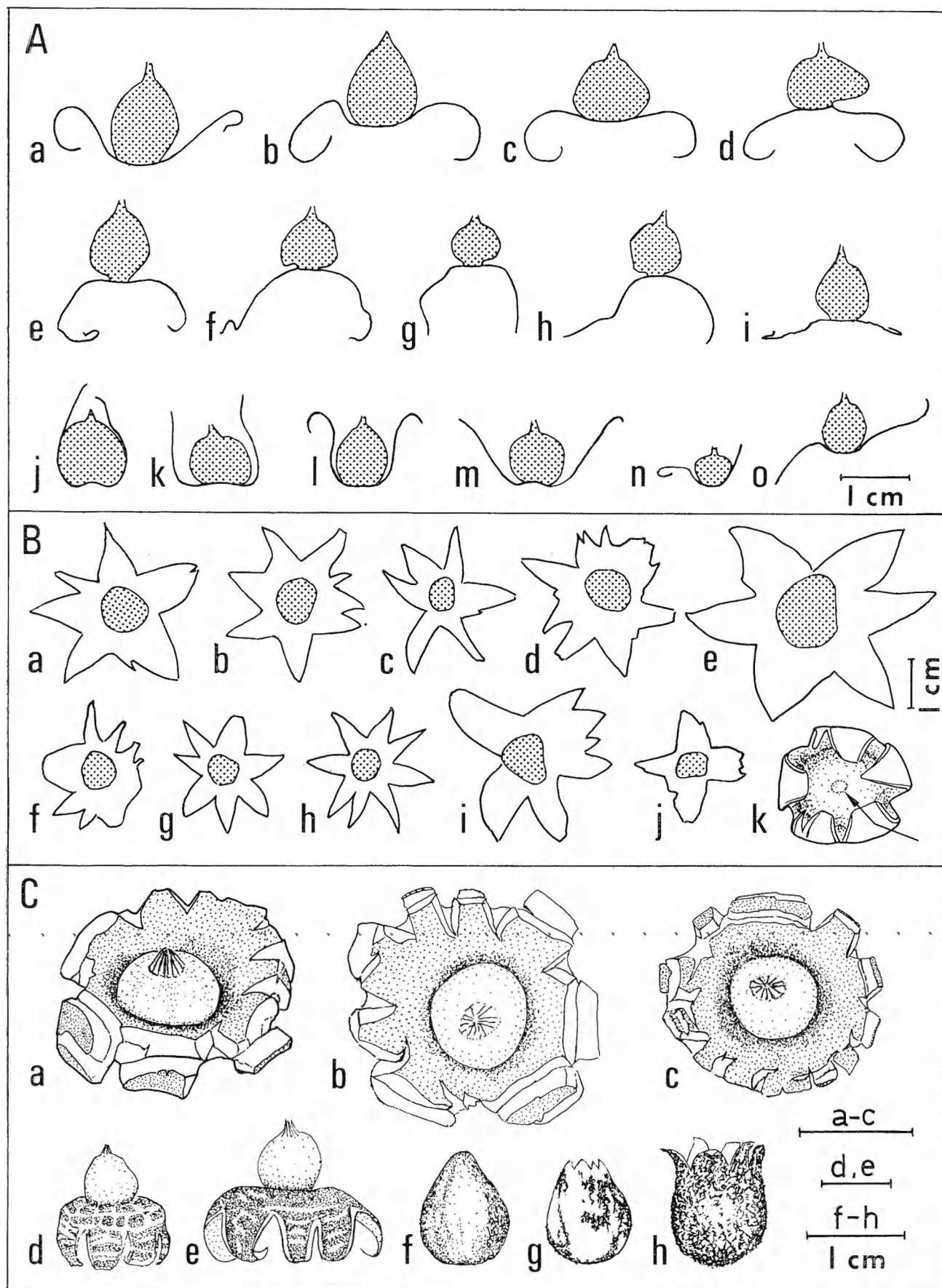


Fig. 3.

side of the fibrous layer (Fig. 3 B: k) just below the attachment of the exoperidium (cf. PALMER 1956 p. 63 and DISSING & LANGE 1961 p. 11). The dry fleshy and fibrous layers give a texture to the exoperidium like that of parchment. The margins of the exoperidial rays are often bordered with a fimbriate down of hyphae from the fibrous layer. This results from the splitting of the exoperidium and is best seen in fruiting bodies that have been dried when fresh. When both the pseudoparenchymatic and the mycelial layers have peeled off, the remaining fibrous layer has a paper-like structure.

The third and outer layer, the mycelial stratum, is thin. Attached to its outer side are humus, debris of needles and sandgrains (Figs. 2 C; 3 C: f—h), depending on the habitat of the fungus. The inner side is a web of hyphae with an ochraceous colour, sometimes with a reddish tint (Fig. 2 B: m, C: m). The mycelial layer may peel off rather soon (Fig. 2 B, C) or remain attached wholly or partly to the fibrous layer for a long time.

Endoperidium, Macroscopic Characteristics

The shape of the endoperidium is often more or less globose, ovoid, obovoid, ellipsoid or a variation of these. Also other forms occur. Even the size, shape and position of the peristome contribute to the

general picture of the endoperidium. Examples of the variation of shape and size of the endoperidium are given especially in Figs. 5; 3 A, B but also in Figs. 1; 2 A, B, D, E; 4 A—C. The base of the endoperidium is sometimes furrowed (Fig. 5 A: b, j) and an indication of an apophysis may occur (Fig. 5 A: i, l, n). The maximal diameter of the endoperidium varies between (3—)4.1—15 mm and most of the specimens have a diameter between 5 and 10 mm (Fig. 6 B). The height of the endoperidium (peristome included) varies from (2.5—)3.1—17.8 mm.

The peristome is mostly plicate and conical. It may have a more or less depressed peristome field (Fig. 5 A: b, B: a) or the folds may merge into the endoperidium (Fig. 5 A: a, B: b). The mouth may also be a simple hole (Figs. 2 A: f; 5 A: s, B: e) or intermediate between a hole and a plicate peristome (Fig. 5 B: c). Besides the true mouth there are sometimes one or more holes in the endoperidial wall (Fig. 5 A: m). Such holes may be made by mycophagous invertebrates (SUNHEDE 1974 p. 338). In young fruiting bodies the peristome is often covered by a layer of hyphae (Fig. 5 B: d). The height of the peristome varies from less than 0.5 mm to 4 mm (Fig. 6 B) and its width at the base from 1.9 to 6.8 mm. Examples of the shape, height and position of the peristome are given especially in the Figs. 1 and 5.

The folds of the peristome are often simple but may split or fuse in different

Fig. 4. A—C: *Geastrum umbilicatum* Fr. — A: Hygroscopic movements of the exoperidial rays in a specimen that probably has never been fully expanded. (a, c) dry and (b) wetted specimen. — B: Hygroscopicity in some of the rays in a fully expanded fruiting body. The two rays marked with arrows in (a) are recurved under the exoperidial disc and nonhygroscopic. (a, c) dry and (b) wetted specimen. Note the fissures in the fleshy layer exposing the lighter fibrous layer of the exoperidium (a, c). When wet the exoperidium has swollen (b). — C: The same specimen under different conditions. Top views. (a) dry, saccate. (b) wet, saccate and swollen fruiting body. (c) the rays and the disc have been forced out into a horizontal plane. From this position the rays have incurved to and over the endoperidium when drying (d). — D, E: The specimen No. 910, 261—765 in Herb. Lugduno-Balavorum that PALMER formally designated as a type of *Geastrum badium* PERS. — D: Diam. of the fruiting body about 5 cm. — E: Detail of the fruiting body shown in D. The dry pressed endoperidium has been wetted and fixed in a suitable position. It appears to be pedicellate (p) and to have a characteristic collar ring at the base of the endoperidium (arrow). End=endoperidium. Ex=exoperidium. Photo: STELLAN SUNHEDE.

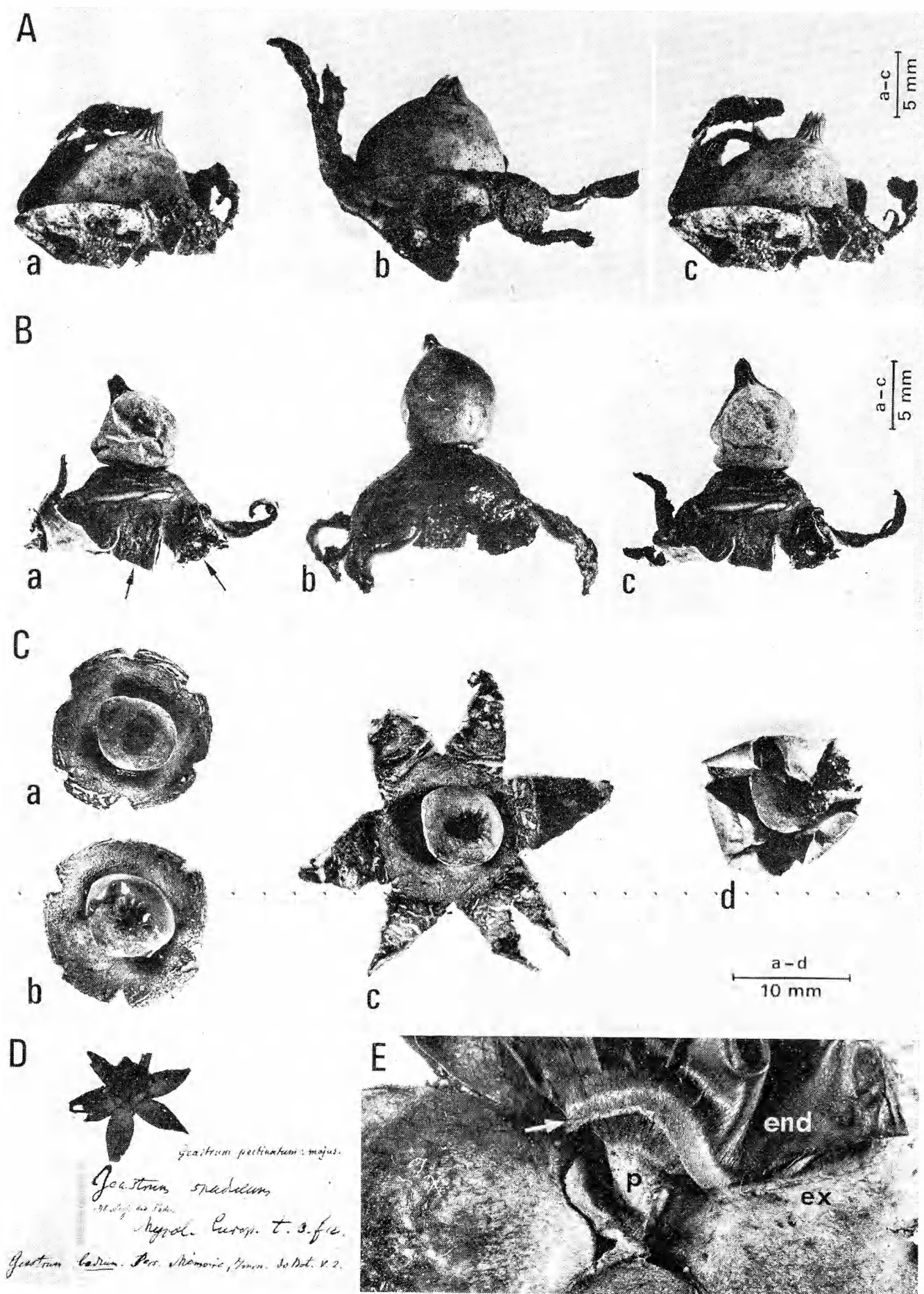


Fig. 4.

ways. They often continue from the base to the top of the peristome. Sometimes the folds reach only half way up the length of the peristome starting either from the base or from the top. At the mouth the peristome is often fimbriate. The number of folds normally varies between 10 to 20 (—26). In one specimen with an abnormal peristome 33 folds were observed.

In young fruiting bodies the endoperidium seems to be covered with a layer of hyphae with crystalline matter (Figs. 7 B; 1 A—F). The hyphae gradually disappear and in somewhat older specimens a layer of crystalline matter dominates (Fig. 7 A, C). Rain may denude the endoperidium, and there is often no crystalline matter seen on the endoperidial wall of old specimens (Figs. 2 E; 7 D).

The colour of the endoperidium is lighter or darker brown often with an ochraceous tint and at last fading into a pale cinereous or even argillaceous shade. The young endoperidium covered with a layer of sparse hyphae has a light ochraceous colour. The layer of crystals forming a thin pruina gives a whitish or bluish colour to

the endoperidium surface. The peristome is often brownish in colour and darker than the endoperidium. In old faded specimens it may be cinereous or even whitish.

The endoperidium is most often sessile (Figs. 3 A; 5 A: a—k, m—o). Sometimes when the pseudoparenchymatic layer has disappeared it may have a very short "stalk" (Fig. 5 A: l). At the junction of the endoperidium there may be a small bulge in the exoperidium that makes the endoperidium appear stalked (Fig. 5 B: f, g). The area and shape of the junction varies. Capillitial threads from the inner side of the endoperidial wall radiate toward a central capillitial mass emerging from an often more or less club-shaped pseudocolumella (Fig. 5 B: f—h).

The total height of the mature fruiting bodies with expanded rays varies from 5.7 to 26 mm.

Microscopic Characteristics

Spores. Observations under optical microscope: The spores are normally globose

Fig. 5. *Gastrum umbilicatum* FR. — A: The variation in the shape and size of the endoperidium and the peristome is shown in side views (a—o) and top views (p—y). (d) and (e) are different views of the same endoperidium and (p) is the same as (o) seen from above. The line at the base of the endoperidia (a—o) indicates the limit of the inner surface of the exoperidium. (b) and (j) are specimens with furrows at the base of the endoperidium. All endoperidia are sessile except (l) which is shortly stalked. Indication of apophysis can be seen in (i, l, n). The black spot in (m) is a hole in the endoperidial wall. This regular opening has probably been made by an invertebrate mycophage. In (i) and (s) the mouth is a simple hole. The specimen (b) has a well defined and depressed field around the deeply plicate peristome, while in i.a. (a) and (c) the folds of the peristome merge into the adjoining endoperidium. — B: (a—e) details of different types of peristomes. (a) plicate peristome with a slightly depressed but well-defined peristome field. (b) plicate peristome without a peristome field. (c) a type intermediate between (b) and a simple hole. In (d) the peristome is of the same type as in (a) but is covered with a layer of thin-walled hyphae. (e) endoperidium from above. The mouth is a simple hole in the endoperidium surrounded by a field of thin-walled hyphae. (f—h) principal outlines of one and the same specimen. Sections through endoperidia and in (g, h) also through exoperidial layers. Capillitial threads from the inner side of the endoperidial wall radiate towards a central capillitial mass emerging from a pseudocolumella. The outer side of the endoperidium is dotted. (f) the central capillitial mass not sectioned. Note the stalk-like junction between the endoperidium and the exoperidium. The blackish tint of the exoperidium, represents an old, dark, dried and shrunk pseudoparenchymatic layer. (g) dry specimen, section showing a club-shaped pseudocolumella with radiating capillitial threads. Note the bulge of the fibrous layer of the exoperidium (arrow) that makes the endoperidium appear stalked. (h) wetted specimen, note the swelled pseudoparenchymatic layer (black) adjoined to the fibrous one which has also swelled to some extent. The mycelial layer has disappeared.

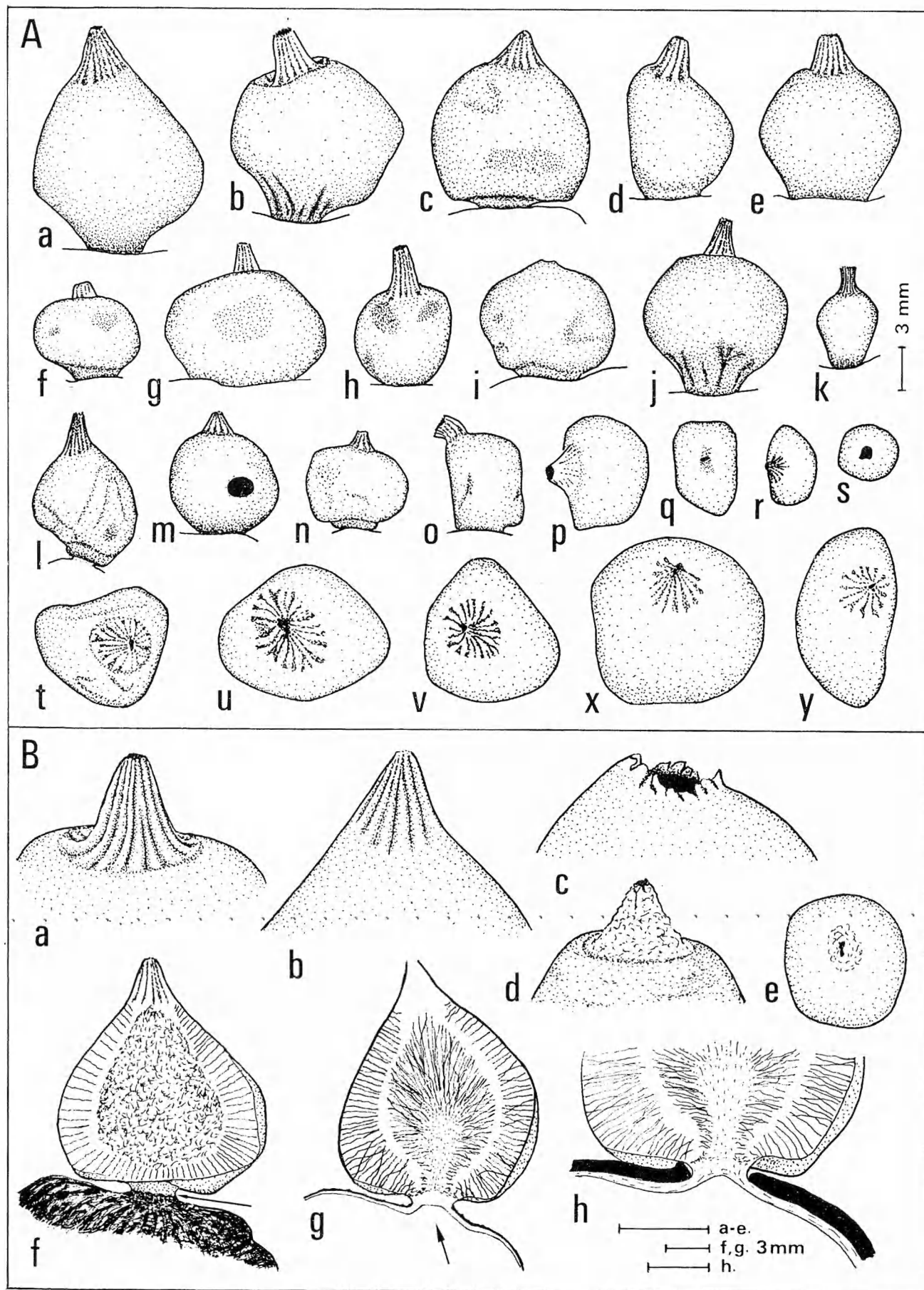


Fig. 5.

and, including the processes, the diameter (observed in cotton blue or KOH) varies between (4.5—)5—6(—7) μ . Smaller spores have been observed but these do not seem to be fully developed and many of them are not globose. The processes vary in shape and size, often wart-shaped or echinulate but even ridge-like (sometimes s- or bow-shaped) and with a height up to 0.75 μ . Sometimes ridge-like processes radiate from the apiculus. The processes and to some extent the spore wall are stained with cotton blue. Melzer's reagent appears to be negative. The colour of the spore wall in KOH is yellow-brown. The processes have a darker tint. There are often one or more oil-like droplets in the spores (Fig. 6 A: u—y). — Observations under the SEM: The grouping, size and shape of the processes are shown in Fig. 8 A—C. Root-like ridges are observed at the base of the processes (Fig. 8 A).

The diameter of the more or less thick-walled capillitial threads varies from 1.5 to 6(—8) μ (Fig. 6 A: a—i). They may be smooth or nearly so (Figs. 6 A: b, e, h, i; 8 E) or have a cyanophilous cover of warts (Figs. 6 A: a, f; 8 C) or debris of different shapes (Figs. 6 A: c, d, g; 8 D). The walls are more or less cyanophilous. Melzer's reagent appears to be negative. The colour of the capillitial threads in KOH and ordinary light is yellow-brown.

In a section of an endoperidium the hyphae of the pseudocolumella are lighter than the capillitial threads but there is no distinct border between them (Fig. 5 B: g).

These hyphae are much of the same kind as the capillitial ones.

The hyphae of the endoperidial wall (Fig. 7 D) are thick-walled, cyanophilous and have a diameter of 2—6(—7) μ . The cover of sparse hyphae seen in young fruiting bodies on the endoperidium (Fig. 1 A—F) consists of thin-walled embryonic hyphae with clamps, and a crystalline matter (Figs. 6 A: r, s; 7 B). Diameter of the hyphae 1.5—3 μ .

The same kind of thin-walled hyphae and crystalline matter may be seen as a thin layer on the surface of the pseudoparenchymatic stratum in young fruiting bodies. Here are also observed swelling embryonic hyphae differentiating into pseudoparenchymatic tissue (cf. Fig. 6 A: sequence l, o, m, k, n) which when fully developed consists of cell-like vesicles (Fig. 6 A: p).

The fibrous layer of the exoperidium is built up of thick-walled hyphae with a diameter of 1—4 μ . The diameter of the thick-walled hyphae of the mycelial layer varies between 1 and 3 μ . The hyphae of both layers are cyanophilous.

The generative hyphae with a diameter of 1.5—3 μ and provided with clamps are to some degree found everywhere in the fruiting body.

DISCUSSION

PALMER (1956) studied type material of *Gastrum badium* PERS. and wrote (p. 61):

Fig. 6. *Gastrum umbilicatum* FR. — A: Microscopic characteristics. (a—i) parts of capillitial threads. (b, c, e, h, i) are optical sections illustrating the thickness of the wall. (c) with a narrow lumen and (i) with a broad one. Note the variation in surface structure (a—i). Branches (d) are seldom seen. (e) with a bulge in the wall. (g—i) tips of capillitial hyphae. (i) crystalline matter from the sparse layer of hyphae covering the endoperidium and the fleshy layer in a young fruiting body. (k—o) hyphae from the surface of the fleshy layer illustrating how pseudoparenchymatic tissue may be differentiated from embryonic hyphae with clamps (sequence: l, o, m, k, n). (p) section through the fleshy layer of a fresh specimen showing the cell-shaped hyphae. (q—t) generative hyphae with clamps. (u—y) optical sections through spores with one or more oil-like droplets. — B: Diagrams showing the variation of different characteristics in the fruiting body. The analyzed characteristics are: number of exoperidial rays, largest diameter of exoperidium, shape of exoperidium (see below), largest diameter of endoperidium and height of peristome. s=saccate, [s]=somewhat saccate, p=plane and a=arched.

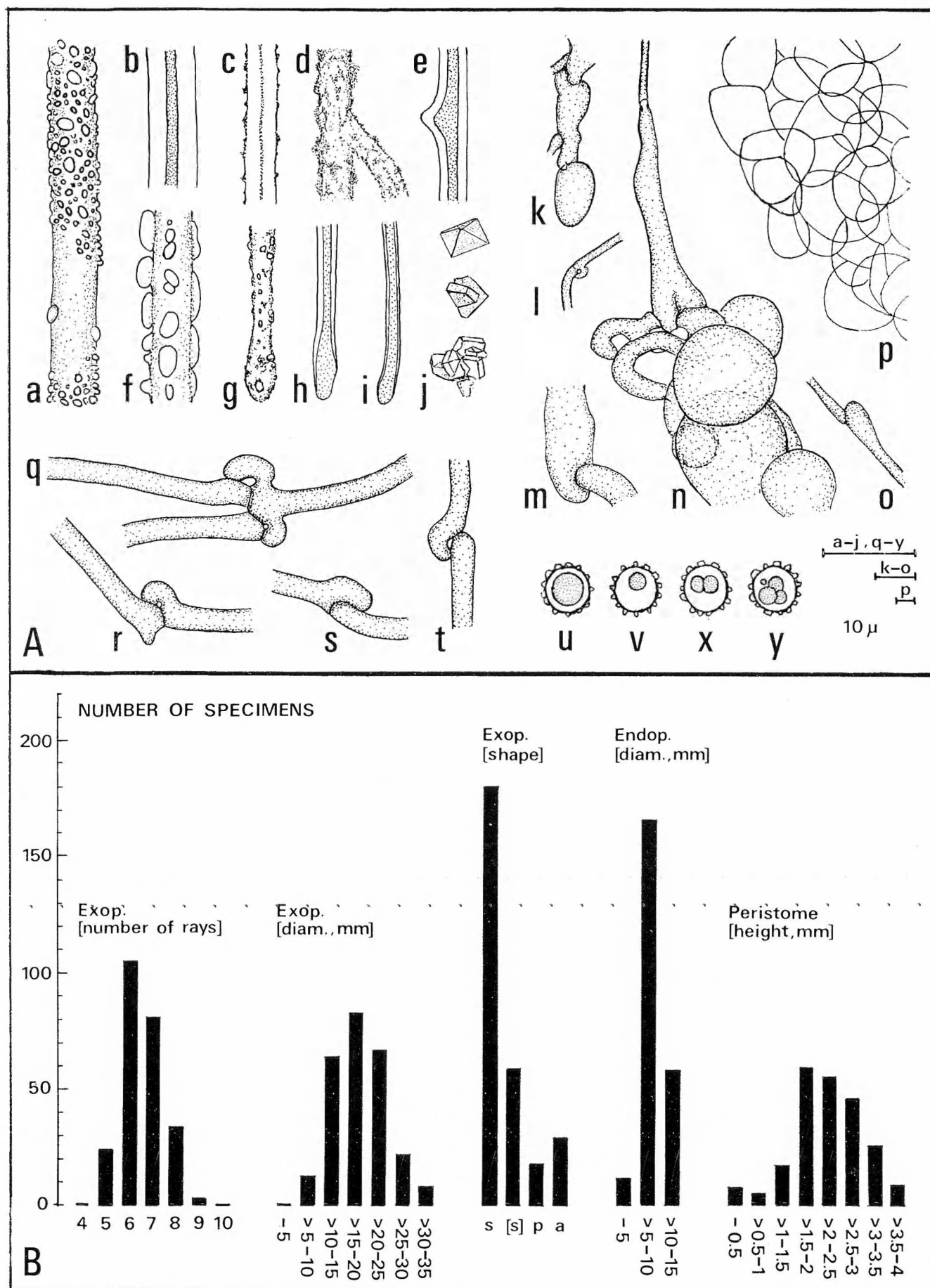


Fig. 6.

"The authentic specimen in the Herb. Persoon, Leiden, is described and designated as Type." He further noted: "In his herbarium in the Rijksherbarium there is a single specimen (L 910, 261—756) annotated in Persoon's handwriting: '*Geastrum badium* PERS. Memoire Journ. de Bot. v. 2.' as well as '*Geastrum spadiceum* Hb. Pers. ded. Tode, Mycol. Europ. t.3. f.2.'. The legend '*Geastrum pectinatum: majus*' is in another hand, and according to a label dated Dec., 1924, KITS VAN WAVEREN determined it as *G. pectinatum* . . . From the evidence available, this specimen is what PERSOON called *G. badium* in 1809 but, like many of the old botanists, it seems that he later decided to call it *G. spadiceum*. However, *G. spadiceum* appears to have been only an herbarium name and not validly published. Consequently, *Geastrum badium* PERS. is the legitimate name for this species and specimen No 910, 261—756 in the Herbarium Lugduno-Batavorum is formally designated as the Type."

I have seen the actual fruiting body (Fig. 4 D) and examined the fungus. It is a single specimen, pressed and glued to a sheet of paper. In this state the endoperidium seems to be really sessile. But when the fruiting body is wetted the endoperidium appears to be prominently stalked and there is a characteristic collar ring around the base of the endoperidium immediately above the pedicel (Fig. 4 E). According to the nomenclature of STANĚK (1958) this is a typical specimen of *Geastrum striatum* DC. (*G. bryantii* BERK.). The colour and habitus of the old denuded fruiting body also speak for *G. striatum*, even when the stalk (pedicel) is not seen. However, it can be said in defence of PALMER that the endoperidium of the pressed fruiting body covered the stalk and that endoperidial hyphae seemed to have stuck together with exoperidial ones so the fruiting body really seemed to be sessile. A stalked endoperidium is not in accordance with PERSOON's diagnosis

where he states that the endoperidium is sessile (PERSOON 1809 p. 27).

A question arises: Has PERSOON seen the actual specimen only in a pressed state and not observed that it is stalked or has there been another specimen at his disposal that agrees with his description? The diagnosis of *Geastrum badium* is not detailed enough and HOLLÓS (1904 p. 61) wrote: "aber dessen Diagnose ist so unvollständig, dass ich Persoons benennung nicht beizubehalten wage." HOLLÓS used FRIES' name *Geastrum umbilicatum* and considered *G. elegans* VITT. as a synonym.

If the Leiden specimen is what PERSOON really called *Geastrum badium* the epithet "*badium*" would have to be given to the species which is today generally called *G. striatum* (*G. bryantii*) and would thus cause confusion.

Without taking a definite stand as to the correct name of the actual species I have decided to use the name *Geastrum umbilicatum* FR. (ut *Geaster*) and hope to be able to return to the question.

Swedish specimens of *G. umbilicatum* may sometimes be somewhat hygroscopic. HOLLÓS (1904 p. 51) and STANĚK (1958 p. 783) stated non-hygroscopic. HENNIG (1960 p. 131) wrote that the points of the dry rays are hygroscopic. PALMER (1956 p. 64) notes: "All geasters are hygroscopic to some extent, but the hard, woody rays with the persistent, horny Fleshy Layer of the hygroscopic series are unmistakable." *G. umbilicatum* does not belong to this series and when the pseudoparenchymatic layer has disappeared, the remaining fibrous part of the exoperidium will be flaccid when wet.

STANĚK (1958) and DISSING & LANGE (1961) observed no apophysis in their material of fruiting bodies. In a few specimens of the Swedish material there has been observed an indication to apophysis.

For further information concerning *G. umbilicatum* is referred to the literature cited in this paper.

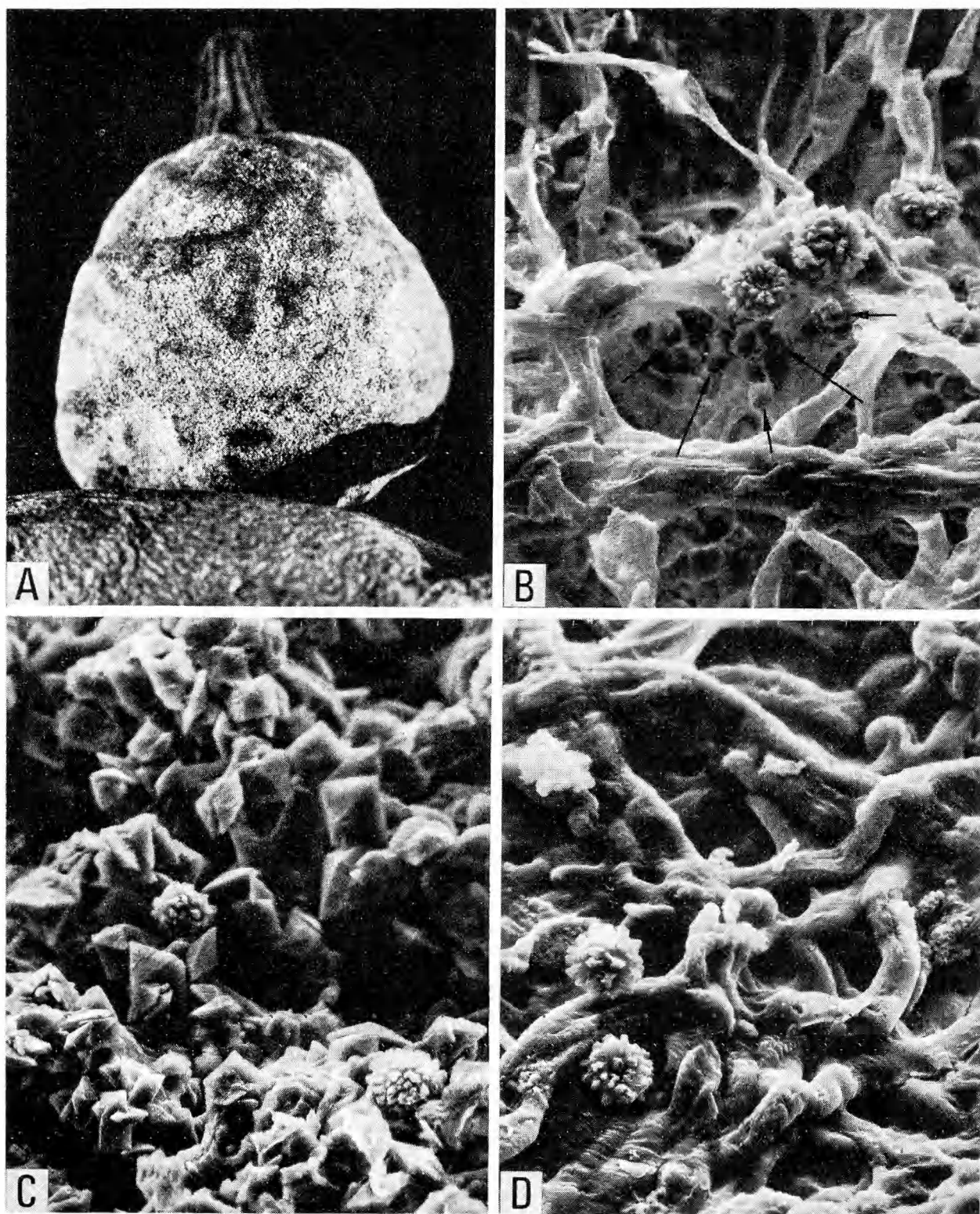


Fig. 7. *Geastrum umbilicatum* FR. — A: Endoperidium nearly covered with a whitish crystalline matter. A crack in the endoperidial wall down to the right exposes the dark mass of spores and capillitium. The less dark pattern on the endoperidial surface designates areas with very few or no crystals. — B—D: SEM photos of endoperidial surfaces. — B: Part of a young endoperidium covered with a thin layer of hyphae mixed with crystalline matter. The thin-walled hyphae have collapsed. The arrows point to the crystalline matter. Three spores are seen in the middle of the picture. — C: Part of the endoperidial wall with crystals and two spores. — D: Endoperidial surface from an old fruiting body where the layer of thin-walled hyphae and crystalline matter has disappeared. Note the thick-walled non-collapsed hyphae. Two spores are also seen. — A: Endoperidium 7 mm in diam. — B—D: 2,000 $\times$. Photo: STELLAN SUNHEDE.

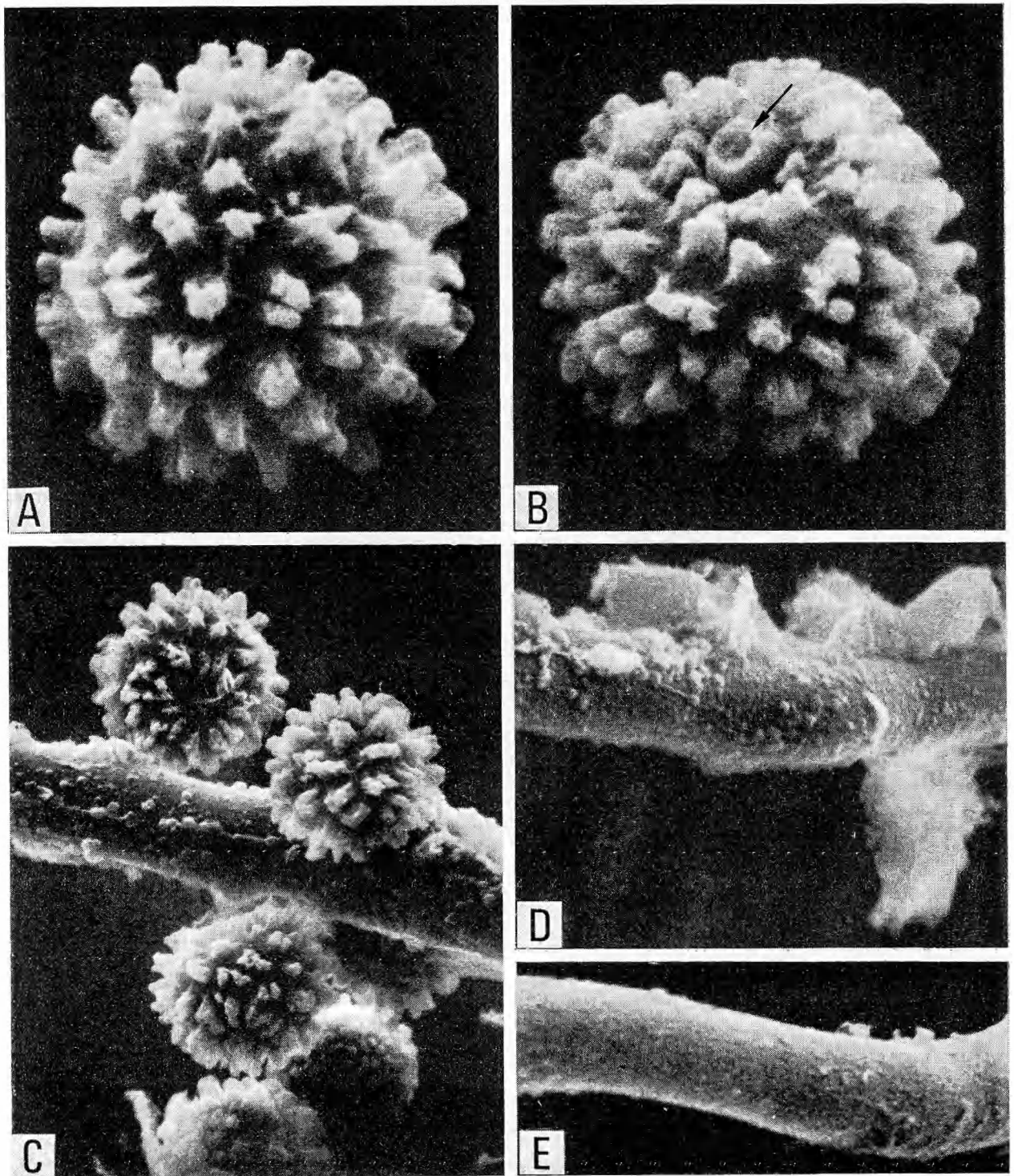


Fig. 8. *Geastrum umbilicatum* FR. SEM photos of spores and capillitial threads. — A: Note the root-like ridges at the base of the processes. — B: The arrow points to the apiculus of the spore. — C: Six spores. Note the variation in shape and grouping of the processes. The capillitial thread has a surface coat of cyanophilous matter. — D: Part of a capillitial thread with remainders of debris of some kind. — E: Nearly smooth capillitial thread. — A, B: 11,000 $\times$. — C: 4,000 $\times$. — D, E: 6,500 $\times$. Photo: STELLAN SUNHEDE.

ACKNOWLEDGEMENTS

I am very grateful to my parents VERA and SUNE SUNHEDE, Värnamo, and to INGRID and BERTIL LÖWGREN and their son DANIEL, Fårösund. Their help and understanding have highly facilitated my field work. I am also much indebted to Drs JOHN ERIKSSON and BO PETERSON, Göteborg, for valuable discussions. Mr WESLEY SYKES kindly checked the English.

LITERATURE CITED

- DISSING, H. & LANGE, M. 1961. The genus *Geastrum* in Denmark. — *Bot. Tidsskr.* 57: 1—27.
- FRIES, E. M. 1829. *Systema mycologicum* III sect. I. — *Gryphiswaldae*. Reprint New York 1952.
- HENNIG, B. 1960. *Handbuch für Pilzfreunde* II. — Jena.
- HOLLÓS, L. 1904. *Die Gasteromyceten Ungarns*. — Leipzig.
- PALMER, J. T. 1956. Observations on Gasteromycetes 4. Studies on type material No. 2: *Geastrum badium* Pers. — *Fungus* 26: 61—64.
- PERSOON, C. H. 1809. *Mémoire sur les Vesse-Loups ou Lycoperdon*. — *J. Bot.* 2: 5—31.
- STANĚK, V. J. 1958. *Geastrum*. In PILÁT et al. (eds.), *Flora ČSR B-1. Gasteromycetes*. — Praha.
- SUNHEDE, S. 1974. Studies in Gasteromycetes I. Notes on spore liberation and spore dispersal in *Geastrum*. — *Sv. Bot. Tidskr.* 68: 329—343.
- VITTADINI, C. 1842. *Monographia Lycoperdineorum*. — *Mem. Accad. Sci. Torino Ser.* 2, 5: 145—237.

Correction

In my previous paper (SUNHEDE 1974) 'BULMER' was erroneously spelt 'BLUMER' (pp. 342, 343).

Scanning Electron Microscopy of the Seed-Coat Surface in *Epilobium* Species

A. K. Skvortsov and I. I. Rusanovitch

SKVORTSOV, A. K. & RUSANOVITCH, I. I. 1974 11 28. Scanning electron microscopy of the seed-coat surface in *Epilobium* species. — Bot. Notiser 127: 392—401. Lund. ISSN 0006-8195.

Seeds of 41 plants belonging to 19 species of *Epilobium* s.str. (chiefly from the flora of the European part of the USSR) have been investigated and photographed under magnifications of 100, 600, 1,200, 2,000, and 4,000. In all species of *Epilobium* s.str. the surface structures have been determined at cell level, the pattern of the whole surface consisting of numerous repetitions of uniform elements represented by single cells. Due to shrinkage in the cells of the spermoderm as the seed dries either on the plant itself or when being pressed (and probably also during vacuum treatment), secondary deformations may appear. This should be taken into consideration in morphological or taxonomic evaluations of scanning microscope data. Three very distinct basic types of surface structures of the seed-coat have been revealed in *Epilobium* s.str. In at least one of these types there are several variations. Some phylogenetic and taxonomic implications of the data obtained are considered. We believe that further investigations of seed-coat structures in *Epilobium* would be of considerable value chiefly at supra-specific level. Seeds of *Chamaenerion latifolium* have a surface structure entirely different from all the *Epilobium* species investigated.

A. K. Skvortsov and I. I. Rusanovitch, Main Botanic Garden, Academy of Sciences of the USSR, 127276 Moscow, USSR.

INTRODUCTION

Species of genus *Epilobium* L. s.str. are fairly uniform both ecologically and in external appearance; they are not at all rich in diagnostic characters. Therefore in his classic monograph of the genus HAUSSKNECHT (1884) even there made an attempt to utilize seed morphology as well for diagnostic purposes. However he succeeded in producing only very approximate descriptions of *Epilobium* seeds, and still more approximate drawings. The imperfections of light microscopy, the only available technique, obviously provide the explanation of why subsequent authors, too, added little to what had been achieved by HAUSSKNECHT. Even in the very careful treatment of the genus *Epilobium* in the Kola Peninsula by SCHLJAKOV (1959) drawings of some seeds (e.g. of *E. horne-*

mannii and *E. davuricum*) are rather indistinct and not very convincing.

On the presumption that electron microscopy would open up new vistas, we investigated under the scanning electron microscope 41 specimens of mature seeds of 19 *Epilobium* species, chiefly from the flora of the European part of the USSR.

MATERIAL AND METHODS

The seeds were taken from the following herbarium specimens, all at the herbarium of the Main Botanic Garden, Moscow (MHA). (Inasmuch as no satisfactory natural system of the genus exists as yet, the species are enumerated here simply in an order convenient for subsequent discussion):

Epilobium paniculatum NUTT. ex TORR. et GRAY. — USA, California, Nevada County, Donner Lake, P. RAVEN 20667.

E. hirsutum L. — USSR, Moscow region, Kashira district, near Baskatchi, 17 Sept.

1969, A. SKVORTSOV. — USSR, Krym, Cape Martyan, 29 July 1968, V. SIPLIVINSKI.

E. parviflorum SCHREB. — USSR, Kaluga region, near Maloyaroslavets, 17 Sept. 1969, A. SKVORTSOV. — USSR, Krym, upper course of the Salghir River, 27. July 1969, A. SKVORTSOV.

E. lanceolatum SEB. et MAURI. — USSR, Krym, Kosma-Damian Monastery, 7 July 1893, O. and B. FEDTCHENKO. — Krym, near Mount Kastell, 29 June 1969, A. SKVORTSOV.

E. collinum GMEL. — USSR, Smolensk region, Znamenka district, near Zholobovo, 30 July 1958, A. SKVORTSOV. — USSR, Estonia, Abja, 2 Sept. 1970, M. AASAMAA. — USSR, Sverdlovsk region, near Berezovski, 25 July 1962, CHECHELEVA.

E. tetragonum L. — USSR, Kaluga region, near Dugna, 4 Sept. 1971, V. MAKAROV et A. SKVORTSOV.

E. obscurum SCHREB. — England, West Norfolk, King's Lynn, 16 Aug. 1962, E. SWANN.

E. roseum SCHREB. — USSR, Leningrad region, park of the town of Lomonosov, 5 Oct. 1969, A. SKVORTSOV. — Kiev region, Belaya Tserkov, 23 July 1966, A. SKVORTSOV.

E. nervosum BOISS. et BUHSE. — USSR, Moscow region, Kashira district, near Bas-katchi, 22 July 1969, A. SKVORTSOV. — Tula region, Alexin district, near Krasnoye, 3 Sept. 1971, A. SKVORTSOV.

E. minutiflorum HAUSSKN. — USSR, Kirghizia, middle course of the Chichkan River, 14 Aug. 1970, A. SKVORTSOV (two plants from different habitats). — USSR, Tadzhikistan, Pendzhikent region, upper course of the Shing River, 22 July 1970, I. RUSANOVITCH.

E. palustre L. — USSR, Tula region, Alexin district, near village Krasnoye, 3 Sept. 1971, A. SKVORTSOV. — USSR, Kirghizia, middle course of the Chichkan River, 14 Aug. 1970, A. SKVORTSOV. — England, West Norfolk, Cranberry Rough, 12 Aug. 1962, E. SWANN.

E. davuricum FISCH. ex HORNEB. — USSR, Anadyr River Basin, at the Komarinaya River, 28 July 1968, A. KATENIN and V. PETROVSKI. — Canada, Yukon, Canol Road, Nisutlin River, 23 July 1944, PORSILD and BREITUNG 10832.

E. nutans SCHMIDT. — USSR, Transcarpathia region, Mount Bliznitsa, 22–23 July 1968, A. SKVORTSOV.

E. anagallidifolium LAM. — USSR, Kola Peninsula, Hibiny Mountains, 10 Aug. 1966, A. SKVORTSOV. — Transcarpathia region, Mount Bliznitsa, 22–23 July 1968, A. SKVORTSOV.

E. hornemannii RCHB. — USSR, Kola Peninsula, Hibiny Mountains, 12 Aug. 1966, A. SKVORTSOV. — Arctic Urals, Paipudyna River, 18 Aug. 1964, A. SKVORTSOV, V. FILIND and Z. ISAKOVA.

E. alsinifolium VILL. — USSR, Auton Republic of Komi, Ust-Tsylma district, Pizhma-Petchorskaya River, 22 July 1961, A. LASTCHENKOVA. — Transcarpathian region, Mount Pop Ivan, 17 July 1968, A. SKVORTSOV.

E. adenocaulon HAUSSKN. — USSR, Moscow, Park of Izmailovo, 4 Aug. 1969, A. SKVORTSOV. — Moscow, Ostankino, 11 Aug. 1969, A. SKVORTSOV. — Moscow region, Kashira district, near Bolshoye Kropotovo, 23 Aug. 1969, A. SKVORTSOV. — Kiev region, city of Belaya Tserkov, 20 July 1966, A. SKVORTSOV. — Leningrad region, Karelian Isthmus, Repino, July 1971, T. RETINA.

E. rubescens auctt. europ. — USSR, Moscow, forest of Lossiny Ostrov, 4 Aug. 1969, A. SKVORTSOV. — Moscow, Ostankino, 28 July 1969, A. SKVORTSOV. — Moscow region, Odintsovo district, village Matreikovo, 18 Aug. 1969, A. SKVORTSOV. — Karelian Isthmus, Repino, July 1971, T. RETINA.

E. exaltatum DREW. — USA, California, Nevada County, Donner Lake, 1 Sept. 1965, P. RAVEN 20657.

Besides *Epilobium* species, two specimens of *Chamaenerion latifolium* (L.) TH. FR. et LANGE have been investigated: Yakutia, Aldan district, at the Bolshoi Nimnyr River, 5 Sept. 1967, A. SKVORTSOV. — Alaska, Talkeetna, 11 Aug. 1941, P. ANDERSON N7716.

In naming the two American specimens collected by Dr P. H. RAVEN we rely upon Dr RAVEN himself. For determinations of all other specimens the responsibility is ours. As to the problem of how to delimit and reliably determine the *Epilobium* species of the European part of the USSR, writings of SCHLJAKOV (1959), SKVORTSOV (1964, and in press), and KYTÖVUORI (1969, 1972) should be referred to.

All *Epilobium* seeds have been investigated and photographed from the convex ("dorsal") side at magnifications of 100, 600, 1,200, 2,000, and 4,000. The flattened ("ventral") side of the seeds has less pronounced surface structures and is thus of less interest. For large-scale photographs we chose parts near the centre of the dorsal side of the seed where the surface structures have the most characteristic and most constant appearance. The clearest and most significant pictures have been obtained at magnifications of 600 and 1,200. This is due to the fact that the structures of the spermoderm surface in *Epilobia* are determined at cellular level: the surface pattern of the whole seed is nothing but a multiple repetition of the structures found in single cells. Quantitative parameters, such as cell dimensions or the height of external protuberances may vary to some extent in different parts of the seed surface, but the basic

structural type of the epidermal cells is constant in any given seed.

In all, we have obtained about 200 photographs, but to save space only a selection necessary to illustrate the main facts and the conclusions we arrived at while considering the entire material will be presented here.

In addition to the basic species, we have also investigated seeds of a few natural interspecific *Epilobium* hybrids. The results of this investigation are published elsewhere (SKVORTSOV & RUSANOVITCH 1973).

RESULTS AND DISCUSSION

Problem of Adequacy of Observed Pictures

Before attempting taxonomic or phylogenetic interpretations of our observations, it will be necessary to consider the following two important general problems.

(1) To what extent are the stereoscan pictures adequate and reliable — have they become obscure or distorted due to secondary intervening causes? Indeed, surface microstructures may change as the seed dries — whether on the plant itself or while being pressed; deformations may perhaps also be produced by the vacuum required for scanning microscopy. Nor can the possibility of a gradual disintegration of microstructures with the course of time be ruled out unreservedly in the case of long-term storage of specimens.

(2) What is the extent of the intraspecific variability of seed-surface microstructures — with or without allowing for possible artifacts?

A comparison of Fig. 1 H and I showing the seed surface of samples of *Epilobium lanceolatum* collected in 1893 and 1969 respectively makes it clear that spontaneous destruction caused merely by long-

term storage is negligible, if any — both figures show a striking similarity.

But with regard to other possible circumstances that might influence what is seen under the microscope, the situation appears to vary in different species groups. All specimens of *E. adenocaulon* and *E. rubescens* investigated are practically identical under the microscope; interindividual differences do not seem to be greater than the intraindividual ones observed in different parts of the surface of any one seed (Fig. 2 L—N). In these species too, the surface structures are rather simple and after some experience can, in general, also be understood with the help of a compound microscope. The virtual image seen under a light microscope agrees perfectly with the stereoscan images. Thus in the case of the *E. adenocaulon* group there is practically no reason to suspect the occurrence of artifacts.

E. palustre presents a different case. In spite of the fact that this species is very constant and uniform in its gross morphology throughout a huge, almost holarctic area, the seed surface of the three samples investigated by us vary considerably (Fig. 2 D—F). In the specimen from Kirghizia (Fig. 2 D) the whole external surface of the cells is moderately convex with some slight radial wrinkles. In the plant from the Tula district we can still see this convexity, but at the same time the whole external cell wall is impressed, so that cells look like half-collapsed blisters; the radial wrinkles are more prominent (Fig. 2 E). Finally, in the English specimen radial wrinkles are fairly indistinct, but in the middle of the convexity of the external cell wall there is an im-

Fig. 1. A: *Epilobium paniculatum* NUTT. ex TORR. et GRAY, $\times 40$. — B: *E. paniculatum*, $\times 480$. — C: *E. hirsutum* L. Moscow region, $\times 240$. — D: Same as C, $\times 1,600$. — E: *E. hirsutum*. Crimea, $\times 240$. F: Same as E, $\times 1,600$. — G: *E. parviflorum* SCHREB. Crimea, $\times 240$. — H: *E. lanceolatum* SEB. & MAURI. Crimea, year 1893, $\times 240$. — I: *E. lanceolatum*. Crimea, year 1969, $\times 240$. — J: *E. collinum* GMEL. Sverdlovsk region, $\times 40$. — K: Same as fig. 10, $\times 480$. — L: *E. collinum*. Smolensk region, $\times 480$. — M: Same as L, $\times 1,600$. — N: *E. collinum*. Estonia, $\times 480$. — O: Same as N, $\times 1,600$. — P: *E. nervosum* BOISS. & BUHSE. Moscow region, $\times 480$.

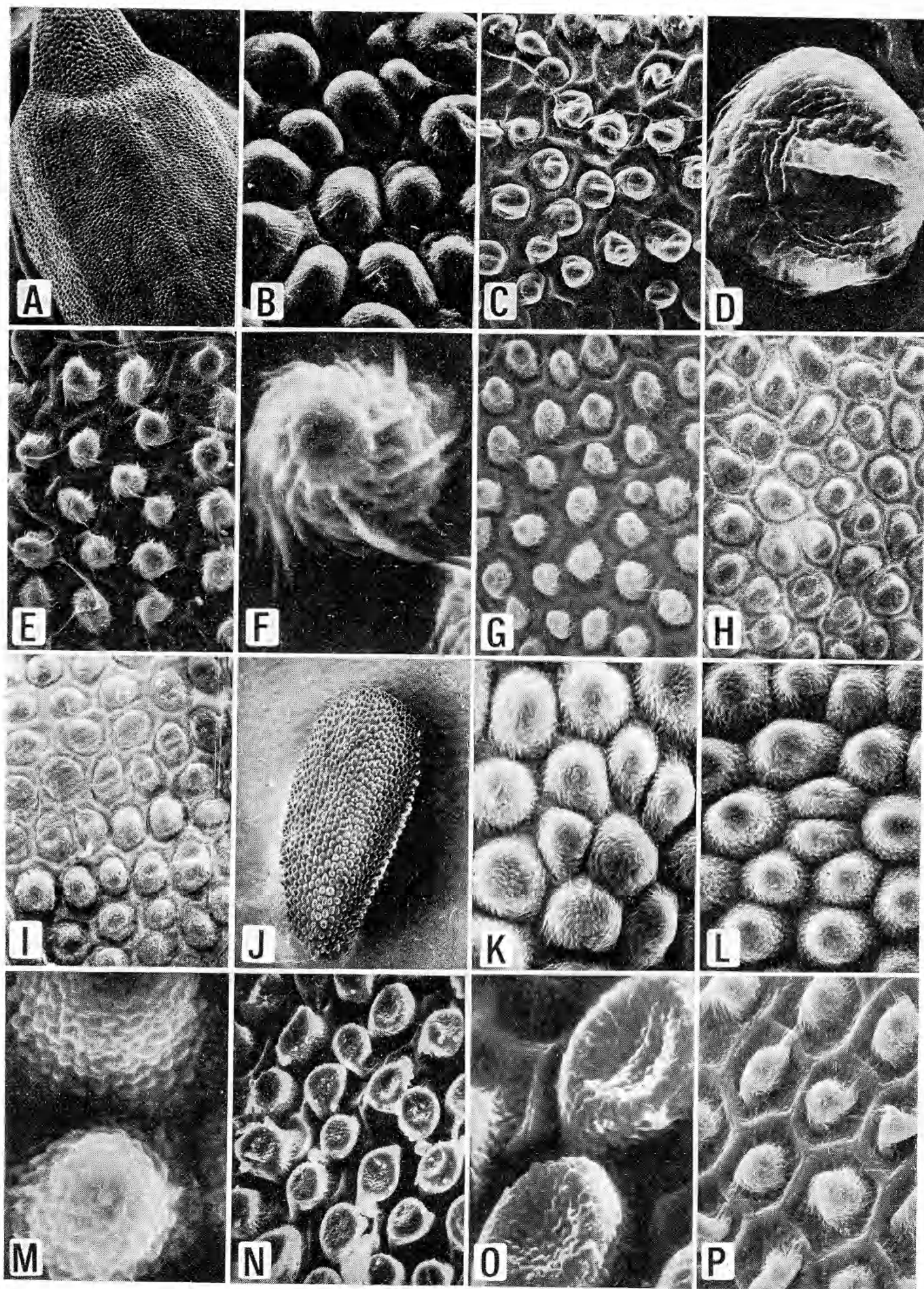


Fig. 1.

pression not seen in the two previous specimens (Fig. 2 F). Evidently, in the case of *E. palustre* we are concerned with secondary deformations — while drying, thin cell walls collapse and shrink — in varying ways. Fig. 2 D presumably represents the least deformed, virtually primary structure.

Epilobium hirsutum seems to represent an analogous case. Here the convexity is much more pronounced than in *E. palustre* and the outer cell wall forms a kind of hemispheric tubercle. Here, too, secondary deformations were observed, either representing the bilateral collapse of the wall (Fig. 1 C, D), or as centripetal shrinkage accompanied by the formation of numerous fine creases and wrinkles (Fig. 1 E). As distinguished from *E. palustre*, the wrinkles in *E. hirsutum* are not radial but somewhat spiral.

It is difficult to believe that Fig. 1 K and L (*E. collinum*) refer to different plants, so great is their similarity. And yet the one plant originates from the Smolensk region, and the other coming from Sverdlovsk. Evidently secondary deformation is either entirely absent here or is minimal. However, in the third specimen of the same species there is clearly some secondary deformation (Fig. 1 N, O).

All three specimens of *E. minutiflorum* investigated represent identical seed-surface structures. Had we confined all our investigation of *Epilobium* seeds to these particular specimens, the existence of secondary deformations would scarcely have been suspected. But from experience with other species, as mentioned above, the occurrence of secondary deformations must also be admitted in *E. minutiflorum*.

Thus we arrive at the important conclusion that in investigations of spermoderm structures we should always keep in mind the possibility of secondary deformation. This applies almost without doubt to seeds of other genera as well. For instance some of the stereoscan pictures of the nutlet epidermis of Cyperaceae that have recently appeared in botanical literature (e.g. SCHUYLER 1971) closely resemble what we have observed in *Epilobium minutiflorum*, for example, and may also well have been influenced by secondary shrinkage. Unfortunately there is no constant coefficient of deformation. On the contrary there is a wide scale of gradation ranging from complete rigidity of structure in the *E. adenocaulon* group to a great variety of types of deformation in *E. palustre*. Perhaps some constant coefficient does actually exist in some species (e.g., *E. minutiflorum*), but to make a definite statement to this effect requires the investigation of a far greater number of samples than we have been able to carry out.

As regards individual variability (i.e. genotypic variability, not that caused by secondary deformation), our material is not sufficiently extensive to allow us to draw any final conclusions. Still, the perfect conformity of structure in different individuals, sometimes widely disjunct in space or time, makes us believe that the real individual genotypic variability of the seed-surface structures in *Epilobium* is very small (for instance, the samples of *E. adenocaulon* and *E. rubescens*, or the above-mentioned cases of old and new collections of *E. lanceolatum*, or *E. collinum* from the West and from the extreme East of the European part of the USSR). This

Fig. 2. A: *E. roseum* SCHREB. Kiev region, $\times 480$. — B: *E. minutiflorum* HAUSSKN. Kirghizia, $\times 800$. — C: *E. minutiflorum*. Tadzhikistan, $\times 800$. — D: *E. palustre* L. Kirghizia, $\times 480$. — E: *E. palustre*. Tula region, $\times 480$. — F: *E. palustre*. England, $\times 480$. — G: *E. davuricum* FISCH. Yukon, $\times 480$. — H: *E. hornemannii* RCHR. Arctic Urals, $\times 40$. — I: *E. anagallidifolium* LAM. Kola Peninsula, $\times 240$. — J: *E. alsinifolium* VILL. Komi, $\times 480$. — K: Same as J, $\times 1,600$. "Second-order" structures clearly visible. — L: *E. adenocaulon* HAUSSKN. Moscow-Ostankino, $\times 40$. — M: *E. adenocaulon*. Moscow-Izmailovo, $\times 480$. — N: *E. rubescens* auctt. europ. Moscow region, $\times 240$. — O: *Chamaenerion latifolium* (L.) TH. FR. et LANGE. Aldan district, $\times 240$.

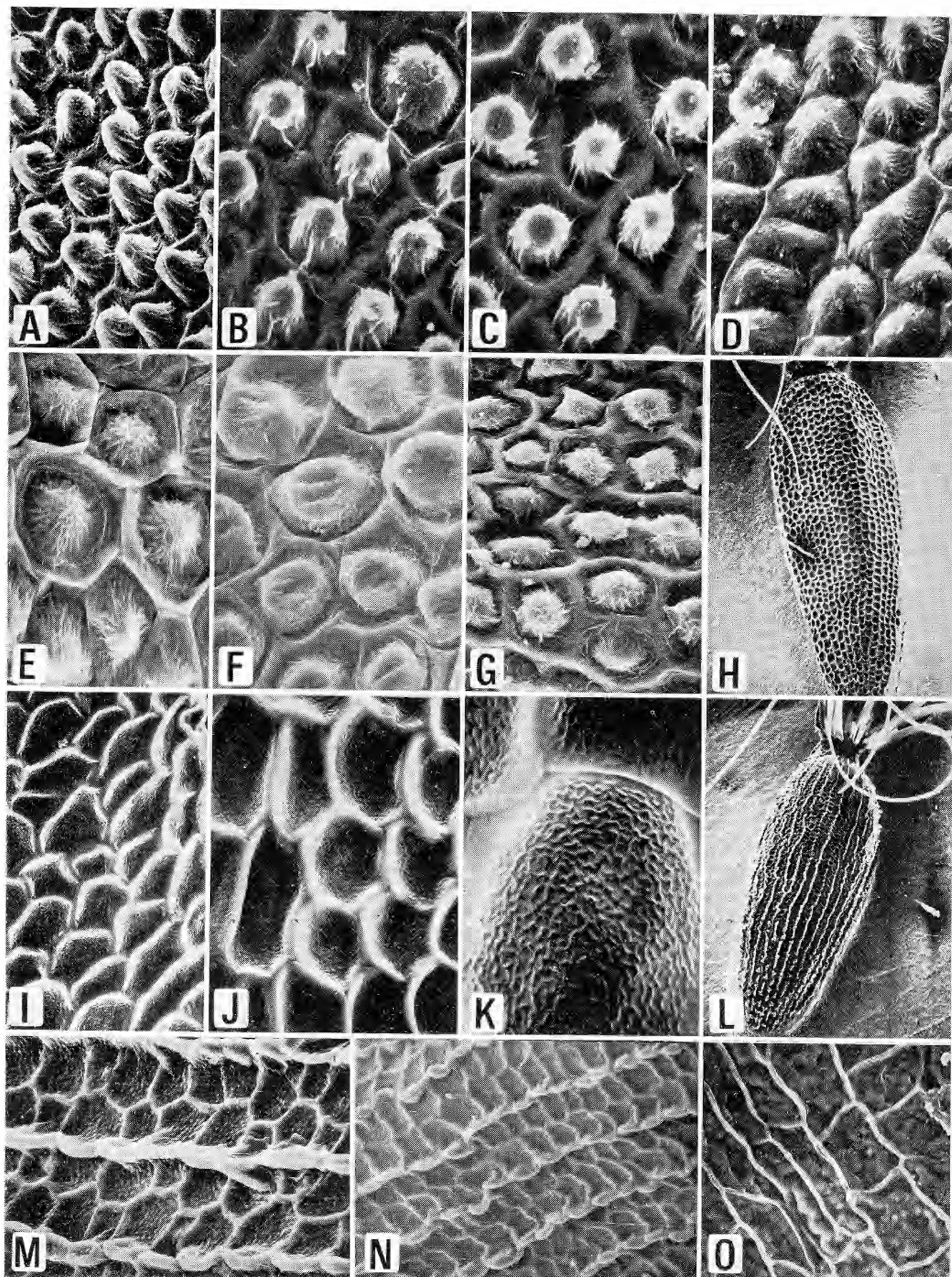


Fig. 2.

agrees well with the remarkable stability (at least as regards the species of the European part of the USSR) of other structural features in the species of this genus.

Types of Structures Found

Keeping in mind the above introductory remarks and limitations of the method, we may now examine the seed-coat structures of *Epilobia* from the point of view of the main aim of the present investigation, viz. to see if any taxonomic and/or phylogenetic implications exist.

All the surface structures we have observed in species of *Epilobium* s.str. can be easily divided into three very distinct basic types.

In type I, epidermal cells are regularly polygonal in outline, but are nevertheless arranged comparatively at random, not in regular rows. Cell boundaries are moderately distinct (at times only weakly so), the external cell surface is either completely and evenly convex or has a kind of protuberance in its centre (presumably due to secondary shrinkage) (Figs. 1, 2 A—G). To this type belong the majority of the species investigated, viz. *E. paniculatum*, *E. hirsutum*, *E. parviflorum*, *E. lanceolatum*, *E. collinum*, *E. tetragonum*, *E. obscurum*, *E. nervosum*, *E. roseum*, *E. minutiflorum*, *E. palustre* and *E. davuricum*. It is not difficult to see that these species do not comprise a uniform taxonomic group. Whichever system of the genus is proposed, it is evidently impossible to lump together in one section, say, *E. hirsutum* and *E. minutiflorum* or *E. roseum*. However, a closer inquiry shows that within this type there is a further differentiation into subtypes. Thus *E. palustre* and *E. davuricum* seem to have in common moderately convex and very thin outer cell walls. When the cells collapse or shrink, the resulting wrinkles and creases form a reticulate or more or less irregular radial pattern, not a spiral one.

Another group within type I is formed by *E. paniculatum*, *E. lanceolatum* and *E. collinum*. Here the epidermal cell walls are evidently much more rigid, much less liable to have secondary deformations. There is usually some kind of distinct "second-order" micellary or minutely tuberculate structure (see in particular Fig. 1 M). Cell boundaries are themselves indistinct, and the contour of the cell is indicated not so much by the lateral cell walls as by the convexity of the external wall. Within this small group the structures observed in *E. paniculatum* again differ from those observed in the other two species: in *E. paniculatum* the micellary structures of the second order are rather obscure, and wrinkling, if at all discernable, is radial, while in *E. collinum* and *E. lanceolatum* wrinkling is concentric or somewhat spiral (the latter feature can be clearly seen in Fig. 1 K).

A further division of type I into smaller groups is hardly warranted. In all the remaining species (*E. hirsutum*, *E. tetragonum*, *E. obscurum*, *E. nervosum*, *E. roseum* and *E. minutiflorum*) the seed-surface structure is fairly uniform — the cell contours are fairly well defined, the outer cell walls more or less impressed with a very prominent tubercle in the centre, this tubercle usually being spirally wrinkled. (In all these species the wrinkles all follow the same direction — as if the tubercles formed a clockwise spiral; as the microscope we used produces a mirror image, this is actually anti-clockwise.) Although further division seems to be unwarranted, still it is worth while noting that *E. roseum* (Fig. 2 A) has especially small cells with particularly prominent central tubercles, and in this way differs from *E. nervosum* (Fig. 1 P). The latter also differs in gross morphology, ecology and distribution. Thus we may confidently conclude that to lower *E. nervosum* to subspecific rank subordinating it to *E. roseum* (RAVEN 1968) is not warranted. *E. minutiflorum*, too, is characterized by small spermoderm cells (Fig. 2 B, C).

Type II of the seed-surface structure is represented by *E. nutans*, *E. anagallidifolium*, *E. hornemannii* and *E. alsinifolium*. Here the cell contours are very well defined and are irregularly polygonal or sometimes approaching the form of a square. There is often a tendency towards a regular linear orientation of cells. The external cell walls always appear to be definitely impressed (concave) which seems to contradict the data presented by KYTÖVUORI (1972). According to this author, in transverse sections of seed epidermides in the "*Alpinae*" group the outer cell walls are slightly convex. We can probably assume that the original convexity has changed to concavity due to the drying up of the cell contents and the resulting retraction of the thin cell walls. After some experience with the compound microscope one also gets the definite impression that the cell wall is concave. Thus it would appear warranted to speak of the cell surface in this species group as being concave.

Finally, type III of the seed-surface structure may be observed in *E. adenocaulon*, *E. rubescens* and *E. exaltatum* (Fig. 2 L—N). These species belong to a predominantly (and originally, perhaps, exclusively) North American, taxonomically extremely intricate conglomeration of related races. Two of them, *E. adenocaulon* and *E. rubescens*, are not uncommon as adventitious plants in the European part of the USSR; they have very stable (though rather subtle) diagnostic characters and can always be reliably distinguished (SKVORTSOV 1973). But in North America where the number of microspecies of this group mounts presumably to dozens, to our knowledge nobody ever attempted to delineate and to distinguish them all; recent American specialists on the genus P. MUNZ (1965) and P. H. RAVEN (as we may judge by his herbarium determinations known to us), apply a rather broad and generalized treatment to this group. In the hope of finding some new supporting points for the discrimination

of the microspecies of this group in the seed-surface sculpture we investigated more specimens of these species than of any others, viz. five specimens of *E. adenocaulon* and four of *E. rubescens*. But we failed to find any interspecific differences that were stabler and more significant than the differences that might be observed between different samples of the same species, or even between parts of the surface of one and the same seed. The only specimen of *E. exaltatum* investigated has also revealed the same structure.

Type III is characterized by rectangular, often nearly square cells arranged in longitudinal rows parallel to the longitudinal axis of the seed, with clearly defined cell boundaries (Fig. 2 L—N). At greater magnifications second-order micellary structures are usually clearly visible. The external cell surface is concave, but along the central axis is a strong longitudinal crest, fusing with the similar structures of the neighbouring cells. Thus the whole seed surface appears to be longitudinally striped (Fig. 2 L).

Some Phylogenetic and Taxonomic Implications

We believe that some phylogenetic and taxonomic interpretations could be given to the structures described. Structural type I can be met with in species of very diverse taxonomic position, including those with a primitive cruciform stigma (the *Schizostigma* group of HAUSSKNECHT: *E. hirsutum*, *E. parviflorum*, *E. lanceolatum* and *E. collinum*). Hence it is probably necessary to consider type I as the most primitive and least specialized. From this type evolution has proceeded either towards thinner outer cell walls and the loss of tuberculate convexity in the arcto-alpine species group (*E. alsinifolium*, *E. anagallidifolium*, *E. hornemannii* and *E. nutans*) — or towards the transformation of tuberculiform convexities into rigid flat crests (the *E. adenocaulon* group).

Clearly the thin-walled variety of type I, as seen in *E. palustre*, somewhat approaches type II and may be considered a kind of transition form between type I and type II. On the other hand, among the species belonging to type II, *E. nutans* has less pronounced features, and in a way its seed-coat structures approximate those of *E. palustre* (in its gross morphology *E. nutans*, too, is a kind of intermediate between *E. palustre* and *E. anagallidifolium*). It looks as if seed-coat structures may justify a certain taxonomic isolation of the *E. palustre* - *E. davuricum* group with sectional or at least subsectional rank.

Within the *Schizostigma* group, the moderate- and small-sized species devoid of long patent hairs (*E. lanceolatum*, *E. collinum*) on the basis of gross morphology alone certainly need to be taxonomically separated from the large-sized patently pubescent species such as *E. hirsutum* and *E. parviflorum*, at least at sectional level. The seed-coat structure gives full corroboration to this conclusion. *E. paniculatum*, however distinct its external habit, is evidently more closely related to the *E. lanceolatum* - *E. collinum* group than to any other we have investigated. But taking into consideration the unusual shape and dimensions of its seeds (Fig. 1 A) and the glabrous outer-cell-wall convexities, it should be kept taxonomically apart as a representative of a group of its own.

The *E. adenocaulon* group which is usually not given taxonomic recognition, in our opinion should be recognized at least as a subsection. The individual speciation pattern in this group resulting in the formation of an abundance of scarcely distinguishable microspecies, supplemented by an extremely individual seed-coat structure, provides a sufficient basis for such recognition.

Seeds of *Chamaenerion latifolium* have shown such an individual and striking surface structure that so far we have not ventured to interpret it nor to compare it with the structures observed in the species

of *Epilobium sensu proprio*. In any case, this is a sound additional argument in favour of recognizing *Chamaenerion* as a valid separate genus.

Concluding, we may state that our results fully confirm the significance of seed-coat structures for *Epilobium* taxonomy. At the same time, it should be clearly pointed out that seed-coat structures do not provide a universally applicable key. Also, they can be helpful, like any other character used in taxonomy, in resolving only some of the taxonomic problems within the genus. Seed-coat morphology works best at the supraspecific level, and it should not be expected, except perhaps in a few cases such as in the above-mentioned case of *E. roseum*/*E. nervosum* — to be of very much help in species delimitation. Investigations of seeds of further groups not yet involved in the present study are desirable.

ACKNOWLEDGEMENTS

The present study was carried out while the authors were on the staff of the Botanic Garden of the University of Moscow. Facilities were provided by the Electron Microscopy Laboratory, the Biological Faculty of the University. The authors wish to express their sincere thanks to the Head of the Laboratory, Mr G. N. DAVIDOVITCH and to his assistants. To Dr P. H. RAVEN, Missouri Botanical Garden, USA, the authors are greatly indebted for sending in exchange considerable herbarium material of *Epilobium*.

LITERATURE CITED

- HAUSSKNECHT, C. 1884. Monographie der Gattung *Epilobium*. — Jena.
- KYTÖVUORI, J. 1969. *Epilobium davuricum* Fisch. in Eastern Fennoscandia compared with *E. palustre* L. — Ann. Bot. Fenn. 6, 1: 35—58.
- 1972. The Alpinae group of the genus *Epilobium* in northernmost Fennoscandia. A morphological, taxonomical and ecological study. — Ibid. 9, N4: 163—203.
- MUNZ, P. A. 1965. Onagraceae. — North American Flora, publ. by the New York Bot. Garden, ser. II: 5.

- RAVEN, P. H. 1968. *Epilobium*. — *Flora Europaea* 3: 308—311.
- SCHUYLER, A. E. 1971. Scanning electron microscopy of achene epidermis in species of *Scirpus*. — *Proc. Acad. Natur. Sci. Philad.* 123: 29—52.
- SCHLJAKOV, R. N. 1959. *Onagraceae*. — *Flora Murmanskoi oblasti* (Flora of the Murmansk Province) 4: 211—225. — Moscow-Leningrad. (In Russian.)
- SKVORTSOV, A. K. 1964. *Onagraceae*. — In MAJEVSKI, P. F. (ed.): *Flora Srednei Polosy Evropeiskoi chasti SSSR* (Flora of the central region of the European part of the USSR) ed. 9. — Moscow-Leningrad. (In Russian.)
- 1973. *Novye dannye ob adventivnoi flore Moskovskoi oblasti. II.* (New data on adventive flora of the Moscow Province.) — *Bull. Glavnogo botanicheskogo Sada* (Bull. Main Botanic Garden) 88: 30—35. (In Russian.)
- (in press). *Onagraceae*. — *Flora Evropeiskoi chasti SSSR* (Flora of the European part of the USSR, publ. by the Komarov Botanical Institute, Leningrad. (In Russian.)
- & RUSANOVITCH, I. I. 1973. Hybrid cell structures of the seed coat of *Epilobia*. — *Priroda* (Moscow) 12: 89—93.

Révision systématique du genre *Sonchus* L. s.l.

VI. Sous-genre 3. *Origosonchus*. Genres *Embergeria*, *Babcockia* et *Taeckholmia*.

Species exclusae et dubiae. Index

Loutfy Boulos

BOULOS, L. 1974 11 28. Révision systématique du genre *Sonchus* L. s.l. VI. Sous-genre 3. *Origosonchus*. Genres *Embergeria*, *Babcockia* et *Taeckholmia*. Species exclusae et dubiae. Index. — Bot. Notiser 127: 402—451. Lund. ISSN 0006-8195.

Fourteen species and two varieties of subgenus *Origosonchus*, two species of *Embergeria*, one species of *Babcockia* and seven species of *Taeckholmia* are discussed. For each taxon is given: nomenclature; vernacular names in different languages where known; uses where known; detailed description; distribution with localities; ecological and biological characters; chromosome numbers where known; palynological particulars if any. For each taxon relationships with other taxa are discussed as well as any characteristics calling for special emphasis. 27 distribution maps, including a map showing the general distribution of *Sonchus* L. s.l., and 24 illustrations are included. Subgenus *Origosonchus* is endemic to Africa south of the Sahara, and to Madagascar. *Embergeria* is endemic to Australia, New Zealand and the Chatham Islands. *Babcockia* and *Embergeria* are endemic to the Canary Islands. The chromosome numbers of nine species are given: $2n=18$ for three species of *Origosonchus* as well as the monotypic *Babcockia* and three species of *Taeckholmia*; $n=9$ for *Babcockia*; $2n=36$ for both species of *Embergeria*. Appendix 1 includes a list of 164 excluded species previously described under *Sonchus*, and here referred to corresponding genera. Appendix 2 includes a list of 29 doubtful species. An index of taxa treated in all parts of this monographic study is given in Appendix 3.

Loutfy Boulos, Département de Biologie, Faculté des Sciences, Université de Jordanie, Amman, Jordanie.

41. *Sonchus schweinfurthii*

OLIV. et HIERN

OLIVER et HIERN, in OLIVER, Fl. Trop. Afr. 3: 458, 1877. — Holotype: Congo, Monbuttu-Land, bei Munsa, in der Steppe, SCHWEINFURTH 3460 (K!).

Sonchus bipontini ASCHERS. var. *pinnatifidus* sensu MENDOÇA, in Contr. Conhec. Fl. Angola 1 Compos. 1: 151, 1943; non OLIV. et HIERN.

S. schweinfurthii OLIV. et HIERN 1877 var. *violaceus* HIERN, in Cat. Welwitsch's Afr. Pl. 1: 623, 1898.

NOMS VERNACULAIRES. Au Congo: Akaziralugumwe, Atchak, Babua, Ikinyamata, Lurira, Muhenehene, Muryamlene, Zelelo. — En Rwanda et Burundi: Uruniamata. — Au

Bot. Notiser, vol. 127, 1974

Kénya: Lihóli, Ibunabuni, Munanyangd. — En Uganda: Luwomerambuzi, Mangele.

USAGES. En principe, la plante n'est pas consommée par le bétail; toutefois, elle est occasionnellement broutée par les chèvres à l'état jeune.

Plante vivace, 70—200 cm de hauteur, herbacée, richement ramifiée, à rhizome ligneux; capitules généralement nombreux à tomentum dense, de couleur chair à leur base. Rhizome vertical, devenant quelquefois rampant (probablement chez les vieilles plantes), 4—25 mm diam., ligneux, $\pm$ cylindrique, portant des racines fibreuses,



Fig. 1. *Sonchus schweinfurthii*. MILNE-RED-HEAD et TAYLOR 10999 (K!). (Distribution, Fig. 2 A.)

quelquefois ligneuses, 0,2—3 mm diam. Collet ramifié, ligneux, plein, $\pm$ cylindrique, 6—20 mm diam. Tige 3—12 mm diam., cylindrique, creuse, souvent pourpre dans la partie basale, verdâtre vers le sommet, glabre, lisse ou à cannelures fines. Feuilles du collet presque de la même forme comme les caulinaires, mais moins longues et moins séquées. Feuilles caulinaires 8—35 $\times$ 1—10 cm, glabres, $\pm$ coriaces, à marges finement serrées, dentées ou denticulées; à formes variées: entières, donc étroitement elliptiques, $\pm$ linéaires, étroitement triangulaires, ou pinnatifides à pinnatiséquées, à lobes étroitement triangulaires ou triangulaires, souvent fléchi vers la base, sommet acuminé, rare-

ment aigu ou obtus; bases engainantes à oreillettes aiguës ou acuminées. Pédoncule 0,3—8 (0,3—2) cm, densément tomenteux dans la partie supérieure, entièrement tomenteux chez les pédoncules courts, tomentum des pédoncules et capitules d'une couleur chair, donnant un aspect caractéristique à la plante. Capitules 13—18 $\times$ 8—12 mm lorsqu'ils sont fermés, plus larges pendant l'anthèse. Nombre de fleurs 160—220 par capitule. Écailles de l'involucre $\pm$ 34, à sommet obtus et cilié; les externes 11, 4—12 $\times$ 1,5—3 mm à base densément tomenteuse et nervure médiane quelquefois poilue; les intermédiaires 10, 13—17 $\times$ 2 mm; les internes 13, 13—17 $\times$ 1,5 mm. Corolle jaune pâle ou jaune-orangé, fleurs externes pourpres ou rougeâtres sur la face extérieure, 12—15 mm. Ligule 4—5 $\times$ 1,5 mm. Tube de la corolle 8—10 mm. Anthères 2,5 mm. Akènes 2,8—3,8 $\times$ $\pm$ 1 mm, crèmes-jaunâtres, brunâtres ou ardoises, comprimés, étroitement elliptiques, marges épaisses, à une côte médiane principale et $\pm$ 4 côtes moins importantes sur chaque face; légèrement rugeux. Aigrette $\pm$ 10 mm, persistante.

DISTRIBUTION. Nigéria, Cameroun, Sudan, Éthiopie, Rio Muni, Zaïre, Rwanda, Burundi, Uganda, Kénia, Tanzanie, Angola, Zambie, Malawi, Mozambique et Rhodésie.

Nigéria: Mambila Plateau, HEPPER 1656 (K!).

Cameroun: Bamenda, 5000 ft, MIGEOD 366 (BM!); UJOR s.n. (K!); HEPPER 1988 (K!); DARAMOLA FHI 40572 (K!).

Sudan: Yambio, VON RAMM 236 (K!) — Kagelu, Prov. Equator., ANDREWS 1093 (K!).

Éthiopie: Jimma, Jimma Agric. Tech. School s.n. (K!).

Rio Muni: Bebai, TESSMANN 345 (K!).

Zaïre: Stanleyville (Kisangani), MICHOTTE 2 (BM! BR!) — Kisantu, GILLET s.n. (BR!); VANDERYST 1218 (BR!) — Riv. Benga, VANDERYST 14932 (BR!) — Sumbi, terr. Seke Banza, FLAMINGI 10223 (BR!) — Beni, BEQUAERT 3359 et 3366 (BR!) — Leversville, VANDERYST 6198 et 6260 (BR!) — Kikwit, VANDERYST 2905 (BR!) — Bas-Uele, DE WULF 171 (BR!); Haut-Uele, BLOMMAERT 197 (BR!) — Rutshuru, c. 1290 m, LEBRUN 8907 (BR!);

Bot. Notiser, vol. 127, 1974

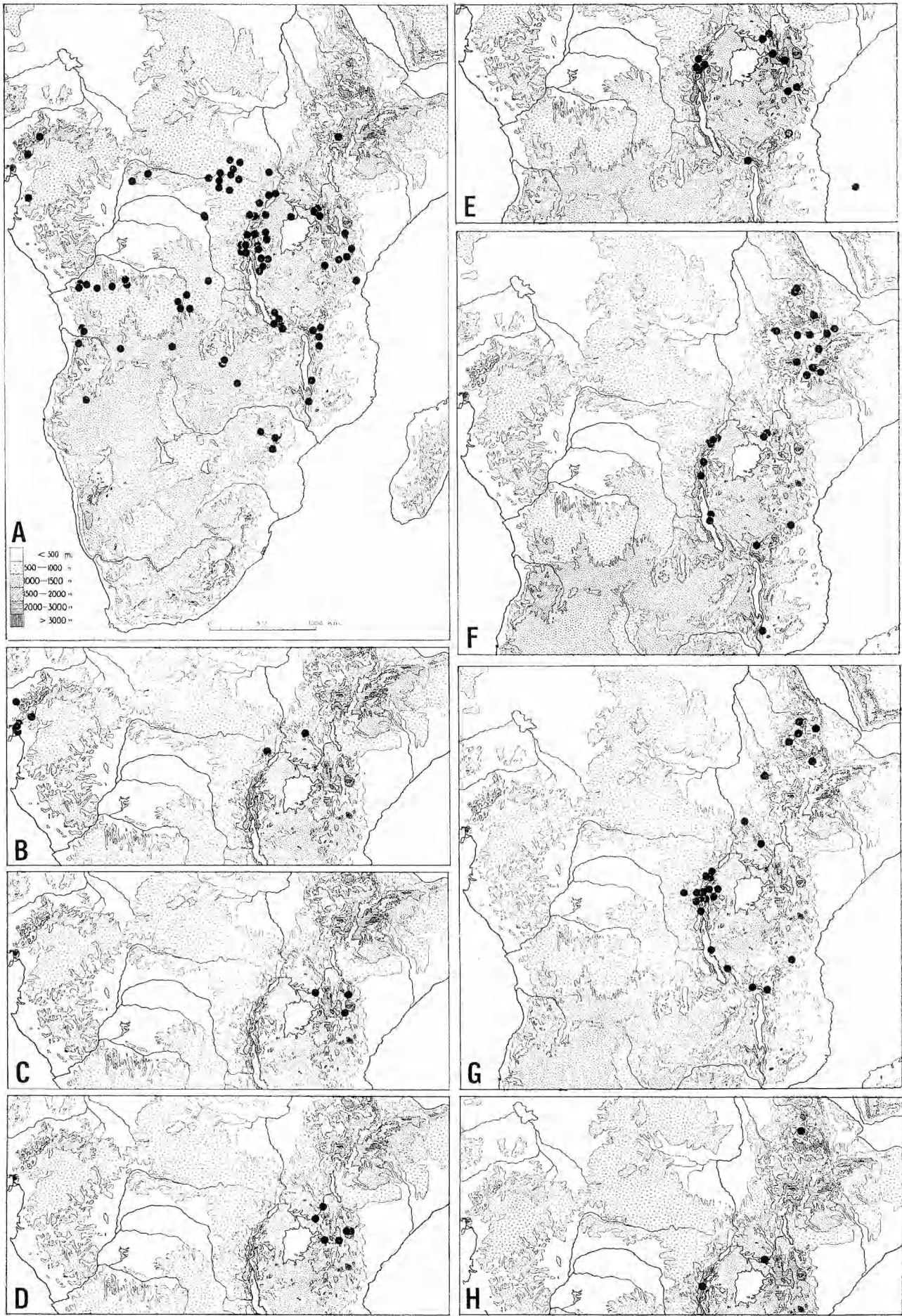


Fig. 2.

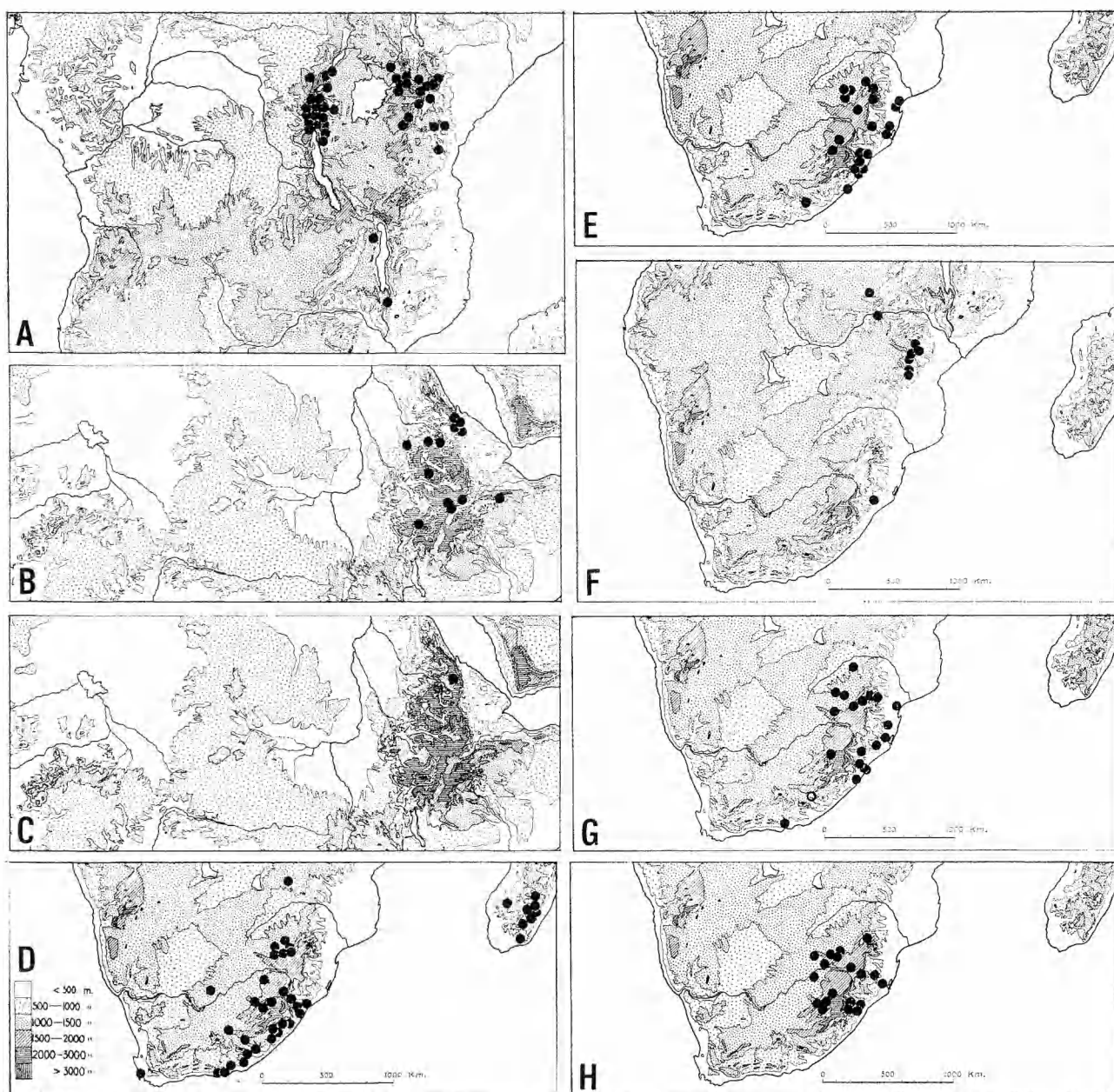


Fig. 3. Distribution de: A: *Sonchus luxurians*. — B: *S. melanolepis*. — C: *S. obtusilobus*. — D: *S. dregeanus*. — E: *S. integrifolius*. — F: *S. friesii*. — G: *S. wilmsii*. — H: *S. nanus*. — ○: in litt.

1270 m, LEBRUN 9104 (BR!) — Mt. Katale, Rutshuru, 1500—1700 m, LEBRUN 9181 (BR! K!) — Mt. W Lac Kivu, 2000 m, HUMBERT 7740 (BR! P!) — Entre Isiro et Mt. Mambunga, LOUIS 1730 (BR!) — Lukumi, QUARRÉ 5328 (BR!) — Doruma, DE GRAER 541 (BR!) — Munama, QUARRÉ 1257 (BR!) — Bwito, Kihondo, 1650 m, DERU 80 (BR!) — Nya-Gezi, 1700—1900 m, BOUTAKOFF 38 (BR!) —

Keyberg, 1280 m, QUARRÉ 4797 (BR!) — Entre Libenge et Gemena, LEBRUN 1786 (BR!) — Bambesa, BREDO 667 et 1027 (BR!); STEYAERT 170 (BR!); GERARD 4496 (BR!) — Entre Riv. Suronga et Niangara, SERET 444 (BR!) — Mvuazi, 480 m, R. DELHAYE 181 (BR!) — Nioka, 1800 m, TATON 588 (BR!); c. 1700 m, FROMENT 70 (BR!); WILBAUX 113 (BR!) — Niarembe, LATHOUWERS III/29 (BR!) —

Fig. 2. Distribution de: A: *Sonchus schweinfurthii*. — B: *S. angustissimus*. — C: *S. stenophyllus*. — D: *S. camporum*. — E: *S. afromontanus*. — F: *S. bipontini* var. *bipontini*. — G: *S. bipontini* var. *glanduligerus*. — H: *S. bipontini* var. *louisii*. — ○: in litt.

Irumu, BEQUAERT 2721 et 2955 (BR!) — Bodangabo, EVRARD 1011 (BR!) — Kaniama, 900 m, MULLENDERS 377 (BR!) — Mutwanga, HAUMAN 291 (BR!) — Katanda, 950 m, LEBRUN 7529 (BR!) — Tukpwo, GERARD 1401, 1441 et 1718 (BR!) — Mwene-Ditu, LIBEN 3969 (BR!) — Katuba, QUARRÉ 4193 (BR! K!); QUARRÉ 3225 (BR!) — Kitwabaluzi, terr. Kabare, J. F. LAURENT 396 (BR!) — Elisabethville (Lubumbashi), 4800 ft, ROGERS 10075 (K!); DE GIORGI s.n. (BR!); QUARRÉ 4686 et 6223 (BR!) — Dilolo, VIN 87 (BR!) — Thielen, VANDERYST 21627 (BR!) — Monbuttu-Land, Munsa, SCHWEINFURTH 3460 (Holotype K!) — Lwiro, 1700 m, CHRISTIAENSEN 2325 (BR!) — Lushadu, 1478 m, HENDRICKX 7538 (BR!) — Mvuazi, DEVRED 446 (BR!) — Nala, BOONE 168 (BR!).

Rwanda: Gabiro, 1500 m, GERMAIN 2961 (BR!) — Entre Nyanza et Gitwe, 1800 m, ROBYNS 2439 (BR! K!) — Gasagara, Cheff. Buliza, Kigali, 1800 m, BECQUET 212 (BR!) — Kakitumba, 1400 m, CHRISTIAENSEN 811 (BR!).

Burundi: Kininya, Mosso, MICHEL 3367 (BR!); Mosso, 1500—1600 m, STANER 2115 (BR!) — Nyabitare, MICHEL et REED 725 bis (BR!) — Kiofi, MICHEL et REED 1443 (BR!) — Rusengo, Buyogoma, MICHEL 4294 (BR!).

Uganda: Kipayo, 4000 ft, DÜMMER 466 (BM!) — Badiri Bughishu, 4360 ft, CHANDLER 477 (K!) — Yoro, Fort Portal, HAZEL 200 (K!).

Kénya: Mt. Elgon, LUGARD 195 (K!) — Chyulu, 5000 ft, BALLY 8140 (K!) — Kipkarren, HILL 159 (K!) — Doondu, 5400 ft, STARZENSKI 49 (BR!).

Tanzanie: Dindira, W Usambara, Koroogwe Distr., 4500 ft, FAULKNER 2040 (BR! K!) — Mt. Merou (Meru) 9500 ft, COOPER 52 (BM!) — Msinga, 800 ft, EMSON 278 (K!) — Njombe, LYNES V.49h (K!); Njombe Distr., MILNE-REDHEAD et TAYLOR 10999 (BR! K!) — Marangu, 1550 m, Kilimanjaro, VOLKENS 1462 (BM! BR! E! G! LE!) — Lupembe Hill, Songea Distr., 1800 m, MILNE-REDHEAD et TAYLOR 8212 (BR! K!); Songea Distr., TAYLOR 9263 (K!) — Piganyonga's, 1260 m, TAYLOR 10938 (K!) — Mbulumbul, 5500 ft, Mbulu Distr., GREENWAY 7767 (K!) — Ufipa Distr., Mbesi forest, 2550 m, RICHARDS 6940 (BR! K!).

Angola: Golungo, WELWITSCH 3645 et 3648 (BM! K!); WELWITSCH 3646 et 3647 (BM!) — Cazengo, 750 m, GOSSWEILLER 4375 (BM! COI! K!) — Capir, 900 m, EXELL et MENDONÇA 3154 (CGE!) — Xassengue, c. 1200 m, EXELL et MENDONÇA 416 (BM! COI!); YOUNG 1009 et 1120 (BM!) — Huila, 3800—5500 ft, WELWITSCH 3649 (BM!); MORENO 39 (COI!).

Zambie: Abercorn, 5000 ft, RICHARDS 452 (K!); Abercorn Distr., 6000 ft, RICHARDS 1245

(K!); Abercorn-Mpui Rd., 1800 m, RICHARDS 6845 (K!) — Walamba Distr., FANSHAW 1222 (BR! K!) — Saisi River, 500 ft, RICHARDS 2105 (K!) — Woodland above Mukoma, 3100 ft, RICHARDS 4899 (K!).

Malawi: Shire Highlands, BUCHANAN 423 (K!).

Mozambique: Vila Cabral, Niassa Distr. TORRE 132 (COI!).

Rhodésie: Inyanga, WILD 14479 (K!). — Salisbury, WILD 44317 (LD!) — Chirinda, 3800 ft, SWYNNERTON 1886 (BM! K!).

CARACTÈRES ÉCOLOGIQUES ET BIOLOGIQUES. *Sonchus schweinfurthii* est une espèce tropicale et subtropicale; elle croît dans les savanes herbeuses, par exemple à *Imperata*, dans les prairies, au bord des routes, dans les champs cultivés, sur les bords des canaux, des fleuves et des fossés. La plante se trouve à une altitude de 200 à 4000 m, mais généralement à 1000—2000 m. Floraison et fructification toute l'année.

DISCUSSION. D'après SAAD (1961), la morphologie des pollens montre qu'il est très probable que *Sonchus schweinfurthii* forme la liason entre les deux sous-genres *Origosonchus* et *Dendrosonchus*.

D'après PONS et BOULOS (1972), cette opinion est fondée.

42. *Sonchus angustissimus* HOOK. FIL.

HOOKE, in J. Linn. Soc. Bot. 7: 203, 1864; non *S. angustissimus* H. LINDB. Itin. Mediterr., Act. Soc. Sci. Fenn. n.s. B, 1(2): 169, 1932. — Lectotype: Cameroun, Mt. Cameroon, G. MANN 1919 (K!); isolectotype (W!).

NOMS VERNACULAIRES. Au Congo: Atchak, Zape.

Plante vivace, herbacée, 0,8—3 m de hauteur, ramifiée, écailles externes de l'involucre à poils dorés très caractéristiques. Collet ligneux, ramifié, ± 8 mm diam. Tige cylindrique, creuse, glabre, 3—12 mm diam., à cannelures étroites, portant les bases des feuilles après leur chute. Feuilles caulinaires 5—25 $\times$ 0,2—1,5 cm (à l'exclusion des lobes), glabres, assez épaisses, à base engainante; auriculées, à oreillettes



Fig. 4. *Sonchus angustissimus*. SAVORY et KEAY FHI 25261 (K!). (Distribution, Fig. 2 B.)

triangulaires, acuminées ou aigues; marges denticulées ou serrées; feuilles supérieures non séchées, $\pm$ linéaires, ou triangulaires-linéaires; feuilles basales pinnatiséquées, à $\pm$ 2 paires de lobes, $0,5-3 \times 0,2-0,5$ cm, étroitement triangulaires, acuminés. Pédoncule 2—20 (2—5) mm, entièrement couvert par un tomentum dense chez les pédoncules courts, tomenteux dans la partie supérieure seulement chez les longs. Capitules 15—18 $\times$ 12 mm lorsqu'ils sont fermés, plus larges pendant l'anthèse. Nombre de fleurs 180—220 par capitule. Écailles de l'involucre $\pm$ 35; les externes 13, 4—11 $\times$ 2,25 mm, base et nervure médiane densément couvertes par des poils dorés; les intermédiaires 12, 13—15 $\times$ 2 mm, base et nervure médiane légèrement couvertes par des poils dorés; les internes

10, 13—15 $\times$ 1,5 mm. Corolle jaune-orangé, 12—17 mm. Ligule 4—6 mm. Tube de la corolle 8—11 mm. Anthères 3 mm. Akènes 3—3,5 $\times$ $\pm$ 1 mm, brunâtres à brun-noirâtres, comprimés, $\pm$ lisses à légèrement rugueux, étroitement elliptiques, à marges assez épaisses et une côte principale et 4 côtes moins importantes sur chaque face. Aigrette $\pm$ 8 mm, caduque.

DISTRIBUTION. Nigéria, Cameroun, Zaïre et Uganda.

Nigéria: Sonkwala, Obudu, 5200 ft, SAVORY et KEAY FHI 25261 (K!).

Cameroun: Mt. Cameroon, 2850 m, BRETELER, DE WILDE, LEEUWENBERG et LETOUZEY MC 23 (K! P!); above Musake, 6500 ft, HUTCHINSON et METCALFE 24 (K!); 1800 m, ANNET 98 (P!); 7000—9500 ft, IRVINE 1474 (E!); 2000 m, JUNGER 153 (UPS!); MANN 1919 (Lectotype K!, isolectotype W!); Victoria Distr., 7800 ft, KEAY 28637 (K!); Ekondetewe, c. 2560 m, BRENNAN 9390A (K! P!); Mann's Spring, 2130 m, BRENNAN et ONOCHIE 9390 (K!); Buea, DALZIEL 616 (K! LE!); Buea, 2800 m, MILDBREAD 10843 (K!); 5000 ft, MAITLAND 260 (K!); 6000 ft, MAITLAND 682 (K!); 6000 ft, BATES 832 (BM!); above Buea, HAMBLER 173 (K!) — Above Bamenda, 7000 et 8000 ft, MIGEOD 491 et 342 (BM! K!); 6000 ft, MAITLAND 1750 (K!).

Zaïre: Nioka, 1800 m, TATON 114 (BR!).

Uganda: Imatong Mts., Loyaro, 6300 ft, A. S. THOMAS 1773 (BM! K!).

CARACTÈRES ÉCOLOGIQUES ET BIOLOGIQUES. *Sonchus angustissimus* est une espèce typique des près tropicaux et subtropicaux, croissant à hautes altitudes de 1800—2800 m. Floraison et fructification ont lieu presque toute l'année, mais principalement de novembre à mars.

DISCUSSION. *Sonchus angustissimus* est une espèce voisine de *S. schweinfurthii*. Il semble que les barrières génétiques entre les deux espèces ne sont pas suffisantes pour empêcher l'hybridation. Des spécimens examinés possédant des caractères morphologiques intermédiaires, sont en faveur de cette hypothèse.

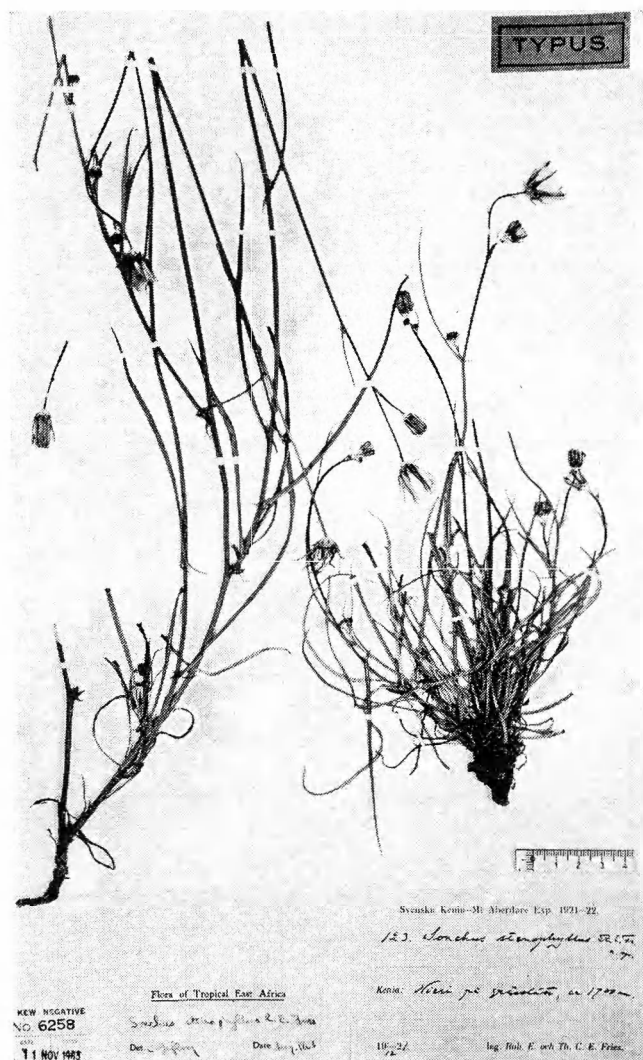


Fig. 5. *Sonchus stenophyllus*. Holotype, R. E. et TH. FRIES 123 (UPS!). (Distribution, Fig. 2 C.)

43. *Sonchus stenophyllus* R. E. FRIES

FRIES, in Act. Hort. Berg. 8: 106, t. 1, 1925. — Holotype: Kenya, Nyeri (Nieri), c. 1700 m, R. E. et TH. FRIES 123 (Holotype UPS!, isotype K!).

NOMS VERNACULAIRES: Au Kénya: La-kulet (Sanb).

Plante vivace, herbacée, 12—60 cm de hauteur, richement ramifiée à la base, feuilles linéaires. Collet ramifié, 8—20 mm diam., ligneux, plein. Tige herbacée dans la partie supérieure, ligneuse et pleine dans la partie basale, cylindrique, glabre. Feuilles du collet 5—12×0,2 cm, linéaires, légèrement pubescentes, bases engainantes,

Bot. Notiser, vol. 127, 1974

auriculées, à oreillettes acuminées; marges entières, sommet acuminé, nervure médiane proéminente. Feuilles caulinaires de la même forme que les précédentes, mais plus larges (2—5 mm), à oreillettes plus longues (10 mm), glabres sauf aux aisselles. Pédoncule 1—10 cm, blanc-tomenteux au-dessous du capitule, à ± 2 bractées étroitement triangulaires. Capitules peu nombreux, 16×8 mm, plus larges pendant l'anthèse, blanc tomenteux à la base. Nombre de fleurs ± 100 par capitule. Écailles de l'involucre ± 26 ; les externes 11, 4—8×1,5—2 mm, densément velues à la base; les intermédiaires 7, 15×2—2,5 mm; les internes 8, 16×2 mm. Corolle jaune, les fleurs externes pourpres sur la face extérieure, 12—14 mm. Ligule 3,5—4,5 mm. Tube de la corolle 8,5—9,5 mm. Anthères 2,5 mm. Akènes 3,5×1 mm, brunâtres, oblancéolés, rugueux, comprimés, à marges épaisses et une côte médiane principale et ± 4 côtes moins importantes sur chaque face. Aigrette ± 8 mm, persistante.

DISTRIBUTION. Kénya, endémique.

Kénya: Nyeri (Nieri), c. 1700 m, Grasboden, R. E. et TH. FRIES 123 (Holotype UPS!, isotype K!) — Uaraguess, 6500 ft, NEWBOULD 3110 (K!) — Mt. Elgon, 11,000 ft, DUMMER 3547 (K!).

CARACTÈRES ÉCOLOGIQUES ET BIOLOGIQUES. *Sonchus stenophyllus* croît dans les prés du Kénya à une altitude de 1700—3300 m. Floraison et fructification, principalement de décembre à janvier.

DISCUSSION. *Sonchus stenophyllus* est une espèce peu connue étant donné sa rareté. Nous avons examiné trois échantillons seulement appartenant à cette espèce: le type et deux autres déterminées *Sonchus schweinfurthii*.

Il est facile de reconnaître *S. angustifolius* grâce à ses feuilles typiquement non divisées et linéaires; ses capitules blanc-tomenteux à la base.

44. *Sonchus camporum* (R. E. FRIES)

BOULOS ex C. JEFFREY

JEFFREY, in Kew Bull. 18:478, 1966. — Holotype: Mt. Kenya, R. E. et TH. FRIES 513 b (UPS!), isotype (S!).

Sonchus schweinfurthii OLIV. et HIERN 1877, var. *camporum* R. E. FRIES, in Act. Hort. Berg. 8: 100, t. 2, 1925.

NOMS VERNACULAIRES. Au Kénya: Chabara.

Plante vivace, herbacée, 15—70 cm de hauteur, feuilles légèrement séchées, capitules blancs-tomenteux à la base. *Rhizome* vertical, $\pm$ cylindrique, $\pm$ 8 mm diam., ligneux, plein, portant des racines fibreuses fines. *Collet* ligneux, plein, ramifié. *Tige* cylindrique, glabre, ligneuse, pleine dans la partie basale, herbacée et creuse dans la partie supérieure. *Feuilles du collet* 4—8 $\times$ 0,8—1,2 cm, glabres, étroitement elliptiques, à bases engainantes, entières ou très légèrement séchées; lobes 3 $\times$ 2 mm, marges irrégulièrement dentées. *Feuilles caulinaires* 5—20 $\times$ 1—2 cm (à l'exclusion des lobes), glabres, étroitement elliptiques ou lancéolées, entières ou pinnatifides, lobes $\pm$ triangulaires, 8 $\times$ 3 mm, marges entières ou dentées, bases engainantes, auriculées, oreillettes $\pm$ triangulaires et aigues. *Pédoncule* 0,2—7 cm, blanc-tomenteux dans la partie supérieure, entièrement tomenteux chez les pédoncules courts. *Capitules* peu nombreux, 18 $\times$ 7 mm; plus larges pendant l'anthèse. Nombre de fleurs $\pm$ 65 par capitule. *Écailles de l'involucre* $\pm$ 24; les externes 9, 5—12 $\times$ 2—2,5 mm, blanches-tomenteuses à la base; les intermédiaires 8, 13—15 $\times$ 2,5 mm; les internes 7, 14—16 $\times$ 2 mm. *Corolle* jaune, fleurs externes pourpres sur la face extérieure, 13—17 mm. *Ligule* 4—6 mm. *Tube de la corolle* 9—11 mm. *Anthères* $\pm$ 2,75 mm. *Akènes* 4,5 $\times$ 1 mm, brunâtres, étroitement obovales, fortement comprimés, marges étroites et assez épaisses, à $\pm$ 5 côtes sur chaque face, la médiane est la plus épaisse. *Aigrette* $\pm$ 10 mm, persistante.

DISTRIBUTION. Kénya, endémique.

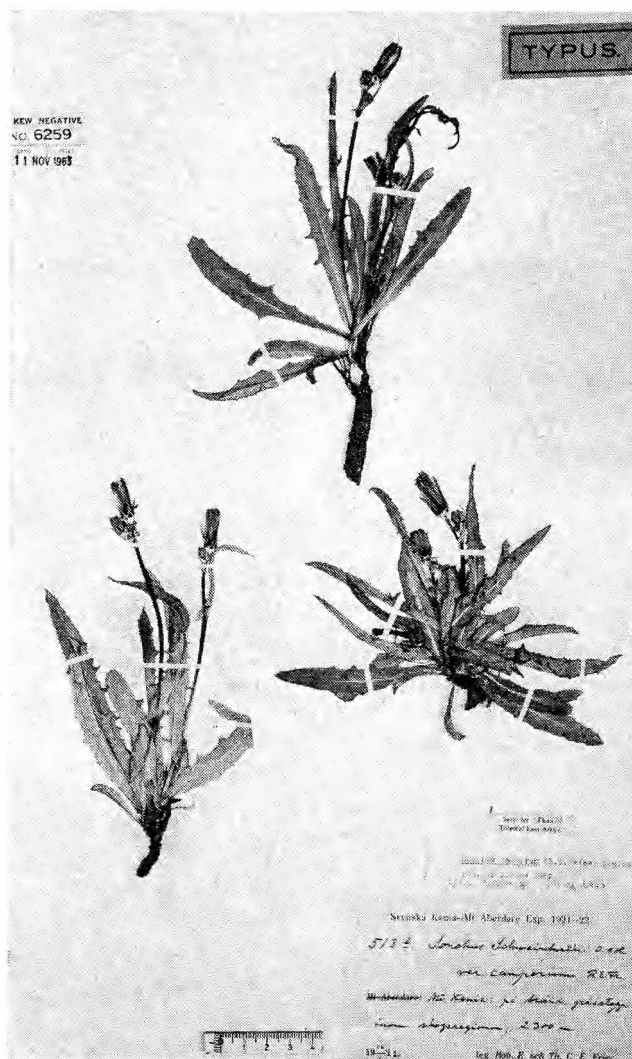


Fig. 6. *Sonchus camporum*. Holotype, R. E. et TH. FRIES 513 b (UPS!). (Distribution, Fig. 2 D.)

Kénya: Mt. Kenya, Forest Station; 2300 m, R. E. et TH. FRIES 513 (S! UPS!); 2300 m, R. E. et TH. FRIES 513 a (UPS!); 2300 m, R. E. et TH. FRIES 513 b (Holotype UPS!; isotype S!); Marania Riv., R. E. et TH. FRIES 1458 a (S! UPS!); Kinangop, R. E. et TH. FRIES 2875 (UPS!) — Mt. Elgon, 6700 ft, E. J. et C. LUGARD 546 (K!); Suam Riv., 6000 ft, TRAIL s.n. (BM!) — Kapsiliat, 7500 ft, STARZEŃSKI s.n. (BR!).

CARACTÈRES ÉCOLOGIQUES ET BIOLOGIQUES. *Sonchus camporum* croît dans les prés de Kénya à une altitude de 2000 à 2300 m. Floraison et fructification de décembre à avril.

DISCUSSION. *Sonchus camporum* a été considéré par FRIES (1925) comme une

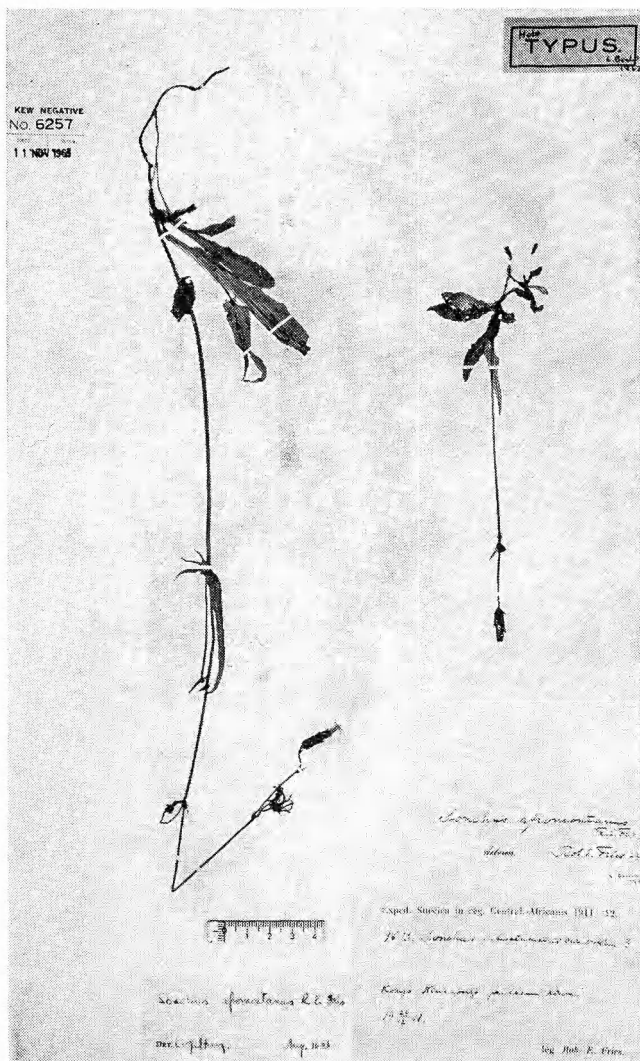


Fig. 7. *Sonchus afromontanus*. Holotype, R. E. FRIES 1673 (UPS!). (Distribution, Fig. 2 E.)

variété de *S. schweinfurthii*. Nous avons étudié en détail les caractères morphologiques du premier taxon, et nous constatons qu'il se rattache davantage à *S. stenophyllus* qu'à *S. schweinfurthii*. D'ailleurs, *S. camporum* mérite le rang d'une espèce pour ses caractères morphologiques bien distingués des autres espèces voisines.

45. *Sonchus afromontanus* R. E. FRIES

FRIES, in Act. Hort. Berg. 8: 103, t. 1, 1925. — Holotype: Ninagongo, c. 2500 m, près du lac Kivu, Congo, R. E. FRIES 1673 (UPS!).

Plante vivace, herbacée, 15—45 cm de hauteur, ramifiée, feuilles basales en rosette; tiges tendres, presque nues; capitules

Bot. Notiser, vol. 127, 1974

peu nombreux. *Rhizome* rampant, cylindrique, 1—7 mm diam., plein, ligneux, portant des racines fibreuses ramifiées, 0,1—0,3 mm diam. *Collet* ramifié, ligneux. *Tige* herbacée, cylindrique, creuse, tendre, 1—3 mm diam., non ramifiée, nue ou avec un petit nombre de feuilles très espacées. *Feuilles du collet* 2—7 × 0,5—1,2 cm, en rosette, oblancéolées, entières ou très légèrement séquées; lobes triangulaires, 2—3 × 2 mm. *Feuilles caulinaires* 3—10 × 0,5—1,2 cm, très espacées, oblancéolées ou étroitement elliptiques, marges dentées, base engainante à oreillettes triangulaires et aigues. *Pédoncule* 0,2—3 cm. *Capitules* 13 × 4—5 mm, plus larges pendant l'anthèse, légèrement tomenteux à la base. Nombre de fleurs ± 45 par capitule. *Écailles de l'involucre* ± 19; les externes 8, 3—7 × 1,5—2 mm, à nervure médiane proéminente et noirâtre très caractéristique; les intermédiaires 6, 10—12 × 2 mm; les internes 5, 12 × 1,5 mm. *Corolle* ± 12,5 mm, jaune, fleurs externes pourpres sur la face extérieure. *Ligule* ± 4,5 mm. *Tube de la corolle* ± 8 mm. *Anthères* 2 mm. *Akènes* 3—3,75 × 1 mm, noirâtres ou brun-foncés, étroitement obovales à étroitement elliptiques, comprimés, à une côte médiane et ± 6 côtes moins importantes sur chaque face. *Aigrette* ± 7 mm, persistante.

DISTRIBUTION. Zaïre, Kenya, Tanzanie et Comores.

Zaïre: Ninagongo, c. 2500 m, R. E. FRIES 1673 (Holotype UPS!) — Parc National Albert, Shaheru, 2700 m, LEBRUN 9336 (BM! BR! K! P!) — Karisimbi, 2400 m, DE WITTE 1293 (BR!) — Muhavura, c. 3500 m, DE WITTE 1923 (BR!).

Kenya: Mt. Aberdare, Kinangop, c. 3200 m, R. E. FRIES et TH. FRIES 2689 (UPS!); R. E. FRIES et TH. FRIES 2718 (S! UPS!); 9200 ft, TAYLOR 1273 (BM!); 10,200 ft, TAYLOR 1290 (BM! S!) — Mau Forest, Endabarra, 7300 ft, BALLY 4998A (K!) — NE Elgon, 10,000 ft, TWEEDIC 2550 (K!); Mt. Elgon, 11,000 ft, TWEEDIC 25 (K!).

Tanzanie: Mt. Kilimanjaro, c. 8000 ft, HAARER 680 a (K!); 2800—2900 m, E Lemosho Glades, BREMER 24 (K! UPS!); 3700 m, HEDBERG 1305 (S!) — Mt. Meru, 3350 m, HEDBERG 2391 (K! S!); N slope of Rungwe Mt.,

Tukuyu Distr., 2500 m, RICHARDS 14319 (K!) — Uluguru Berge, Lukwangulo, 2500 m, STUHLMANN 9150 (in litt., R. E. FRIES, 1925).

Comores: Plateau de la grande Comore, BOIVIN s.n. (P!).

CARACTÈRES ÉCOLOGIQUES ET BIOLOGIQUES. *Sonchus afromontanus* est une espèce des hautes montagnes de l'Afrique Centrale, d'où l'épithète "afromontanus"; elle croît à une altitude de 2200—3500 m en Afrique. La plante est connue aussi dans l'île de Comore. Floraison et fructification d'octobre à avril.

DISCUSSION. *Sonchus afromontanus* est caractérisé par ses capitules peu nombreux, longs et étroits, le faible nombre des écailles d'involucre (± 19) et de fleurs (± 45) par capitule. Les écailles externes de l'involucre sont caractérisées par les nervures médianes proéminentes et noirâtres.

46. *Sonchus bipontini* ASCHERS.

ASCHERSON in SCHWEINF. Beitr. Flora Aethiop. 160, 1867. — Holotype: Abyssinia, prope Dschenausam in dumetis, SCHIMPER 1299 (P!); isotypes (G! K! L! W!).

Sonchus lactucoïdes SCH. BIP. ex A. RICH., Tent. Fl. Abyss. 1: 467, 1848, non *S. lactucoïdes* BUNGE, in Mém. Sav. Etr. Pétersb. 2: 114, 1835; nom. illegit.

NOMS VERNACULAIRES. En Rwanda: Nyabahima. — En Tanzanie: Sungu.

USAGES. WALLANCE in schedule écrit: "leaves used as vegetable"; le specimen est récolté en Tanzanie.

Plante vivace, dressée ou grimpante par les spinules des marges des feuilles caulinaires (HALL, in schedule), 0,6—3 m de hauteur, richement ramifiée, feuilles non séchées, capitules blanc-tomenteux à la base. Rhizome cylindrique, ligneux, ± 4 mm diam., portant des racines fibreuses, ramifiées, très fines. Collet ligneux, volumineux chez les vieilles plantes, ramifié. Tige ligneuse et pleine dans la partie basale, ailleurs herbacée et creuse; ramifiée,



Fig. 8. *Sonchus bipontini* var. *bipontini*. (Distribution, Fig. 2 F.)

cylindrique, glabre. Feuilles du collet plus courtes et denses que les caulinaires. Feuilles caulinaires 4—15 $\times$ 0,2—0,8 cm, glabres, s'espacant beaucoup vers le sommet, plus densément insérées vers la base, linéaires, étroitement elliptiques ou étroitement oblancéolées, non séchées; marges entières, denticulées ou épineuses; bases auriculées à oreillettes $\pm$ triangulaires, aigues ou acuminées, sommet aigu; nervure médiane proéminente. Pédoncule 2—60 mm (généralement 2—5 mm), pédoncules courts entièrement blanc-tomenteux, le long de la partie supérieure. Capitules densément groupés aux sommets des tiges en 5—10 capitules, rarement solitaires, 12 $\times$ 4 mm lorsqu'ils sont fermés.

Nombre de fleurs ± 40 par capitule. *Écailles de l'involucre* ± 18 ; les externes 5, 2,5—5 $\times$ 1,5 mm; les intermédiaires 6, 10—12 $\times$ 1,5 mm; les internes 7, 11—12 $\times$ 1,25 mm. *Corolle* jaune, $\pm 10,5$ mm. *Ligule* ± 4 mm. *Tube de la corolle* $\pm 6,5$ mm. *Anthères* 2 mm. *Akènes* 2,5—3 $\times$ 1 mm, crèmes-jaunâtres à brun-foncés, comprimés, $\pm$ étroitement elliptiques, ridés, à une côte principale et ± 4 côtes moins importantes sur chaque face, marges épaisses. *Aigrette* ± 5 mm, caduque.

DISTRIBUTION. Éthiopie, Zaïre, Rwanda, Uganda, Kénya, Tanzanie et Malawi.

Éthiopie: Dessie, 2600 m, HALL 47 (BM!) — Addis Ababa, 8000 ft, MOONEY 5009 (K!); SENNI 1161 (FI!); Managasha, 25 miles W Addis Ababa, 7800 ft, MOONEY 6372 (K!) — Iecama, Harrar Distr., Dire Dawa, GETAHUN A-74 (K!); Ahmar Mts., près Cobo, 75 km W Dire Dawa, BURGER 1189 (K!) — Dschenausa, SCHIMPER 833 (G!); SCHIMPER 1299 (Holotype P!, isotypes G! K! L! W!) — Heelsoha, SCHIMPER 355 (BM! K!) — Agheremarian (Alghe), 6300 ft, GILLET 14685 (K!) — Shuka, SW Bale, MOONEY 8484 (K! BM!) — 4 km W Baroda, Hararge Prov., 8000 ft, PERDUE JR. 6366 (K!) — Jem Jem forest, 8000 ft, MOONEY 6395 (K!) — Ghimbie, Wollega Prov. 1850 m, MEYER 8158 (K!) — Aselle, Arussi Prov., 8000 ft, MOONEY 5243 (K!) — Galla Pass, 7600 ft, GILLET 5199 (K!) — Alamaya, Imp. Coll. Agric. A-74 (K!) — Amhara, Semien (Simien), CHIOVENDA 984 (FI!).

Zaïre: Between Mushumangabo Crater and Rulenga, 6500 ft, BURTT 3116 (K!) — Kalonge, Ruwenzori, c. 2000 m, HUMBERT 8859 (BR!).

Rwanda: Uwinka, terr. Shangugu, TROUPIN 10456 (BR!).

Uganda: Mt. Ruwenzori, 7000—9000 ft, SCOTT ELLIOT 1009 (BM!); 5000—6000 ft, SCOTT ELLIOT 6460 (BM!); 6000 ft, SCOTT ELLIOT 7723 (BM!); SCOTT ELLIOT 9009 (K!); 8400 ft, PURSEGLOVE 338 (K!) — Bulambuli, 9000 ft, SANDY et HANCOCK s.n. (K!); 9000 ft, THOMAS 557 (K!).

Kénya: Mt. Elgon, 3000 m, HOLM 78 (S!); 2550 m, HEDBERG 66 (S!); 9000 ft, TWEEDIE s.n. (K!).

Tanzanie: S Highlands Prov., GEILINGER s.n. (K!); 1900 m, GARLINGS 2168 (K!) — Morogoro Distr., 3000 ft, WALLACE s.n. (K!) — Selimweguru, 6800 ft, NEWBOULD et HARLEY 4650 (M!) — Mapananda Distr., below Kungwe Mt., 5700 ft, HARLEY 9526 (M!).

Malawi: Mt. Milange, WHYTE s.n. (BM!).

CARACTÈRES ÉCOLOGIQUES ET BIOLOGIQUES. *Sonchus bipontini* est une plante souvent grimpante, croissant dans les bosquets d'arbrisseaux, à une altitude de 1800—3000 m (rarement à 1000 m). Floraison et fructification d'août à avril.

CARACTÈRES CARYOLOGIQUES. $2n = 18$ (STEBBINS et al. 1953).

PARTICULARITÉS PALYNOLOGIQUES. La calotte polaire possède des lacunes relativement importantes qui tendent à s'étaler autour des épines polaires nombreuses (convergence avec les espèces du genre *Taackholmia*?). D'autre part, on trouve une brèche porale assez large.

DISCUSSION. *Sonchus bipontini* possède des feuilles $\pm$ linéaires et des capitules en groupes denses à tomentum blanc très caractéristiques.

46 a. *Sonchus bipontini* ASCHERS. 1867 var. *glanduligerus* (R. E. FRIES) ROBYNS

ROBYNS, in Fl. Spermat. Parc Nat. Albert 2: 596, 1947. — Holotype: Congo, in montibus, prope lac Kivu, R. E. FRIES 1487 a (UPS!).

Sonchus bipontini ASCHERS. 1867 f. *glanduligerus* R. E. FRIES, in Act. Hort. Berg. 8: 101, 1925.

S. bequaerti DE WILD. Pl. Bequaert. 5: 461, 1932.

NOMS VERNACULAIRES. *Au Congo:* Kanyamata, Mulyambene, Uruvunanka. — *Au Rwanda:* Nyabahima.

USAGES. Au Congo, la plante est brou-tée spécialement par chèvres.

DISTRIBUTION. Éthiopie, Zaïre, Rwanda, Uganda et Tanzanie.

Sudan: Imatong Mts., JOHNSTON 1423 (K!).

Éthiopie: Lake Tana Region, CHEESMAN s.n. (BM!) — Kundi, 10,000 ft, MOONEY 6428 (K!) — Anfilo, near Dembidollo, 6300 ft, MOONEY 6865 (K!) — Mai Chow, 10,000 ft, GREATHEAD 115 (BM!) — Dschenausa, SCHIMPER 833 (BM!) — Entotto Mt., Shoa Prov., 2800 m, MEYER 7549 (K!) — Amhara, Dembià, CHIOVENDA 1887 (FI!).

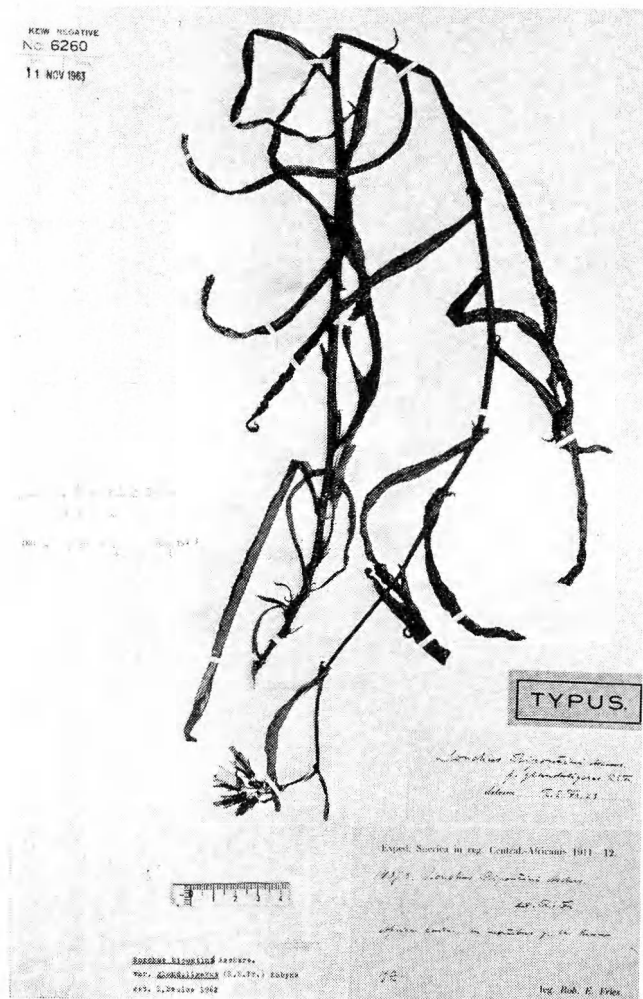


Fig. 9. *Sonchus bipontini* var. *glanduligerus*. Holotype, R. E. FRIES 1487 a (UPS!). (Distribution, Fig. 2 G.)

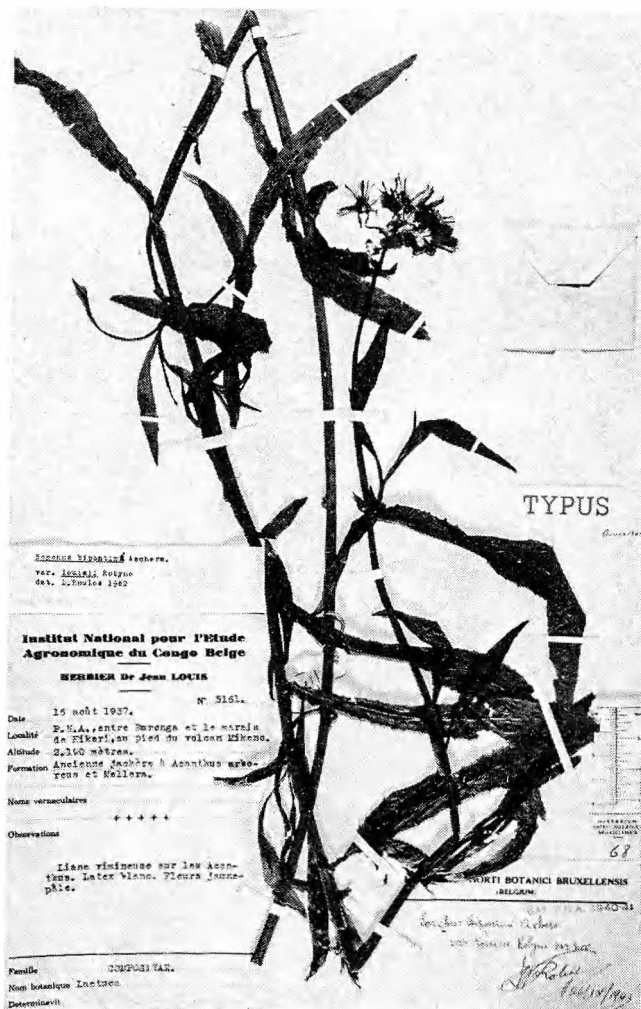


Fig. 10. *Sonchus bipontini* var. *louisii*. Holotype, LOUIS 5161 (BR!). (Distribution, Fig. 2 H.)

Zaïre: Mt. du Lac Kivu, c. 2000 m, R. E. FRIES 1487 a (Holotype UPS!) — Mushari, 2300 m, SPITAELS 44 (BR!) — Mukohwa, terr. Masisi, 1350 m, GUTZWILLER 3581 (BR!) — Manyema, terr. Walikale, 1300 m, GUTZWILLER 2963 (BR!) — Lanuri, c. 1900 m, BEQUAERT 4476 (BR!) — Kalonge, 2200 m, HAUMAN 258 (BR!) — Butagu, 1600—1800 m, BEQUAERT 3546 (BR!); c. 2300 m, BEQUAERT 3696 (BR!) — Rumoka, DE WITTE 1359 (BR!) — Muhavura, c. 2700 m, DE WITTE 1952 (BR!).

Rwanda: Uwinka, terr. Shangugu, 2300 m, TROUPIN 11292 (BR!).

Uganda: Near Kalapata, Karamoja Distr., 5000 ft, WILSON 903 (K!) — Buhungi, 7500 ft, GODMAN 248 (BM!) — Ibanda Hill, 5000 ft, MAITLAND 937 (K!) — Imatong Mts., 9000 ft, PURSEGLOVE 1406 (K!) — Bukimbiri, 6500 ft, PURSEGLOVE 3364 (K!) — Virunga Mts., Kigezi Distr., TAYLOR 2138 (S!); c. 3000 m, STAUFFER 844 (BR! K! M!).

Tanzanie: Mahali Mts., NEWBOULD et JEFFORD 1781 (K!) — Morogoro Distr., 3000 ft, WALLACE 159 (K!) — Sumbawanga, 7000 ft, RICHARDS 3442 (K!) — Njombe, 1860 m, MILNE-REDHEAD et TAYLOR 10965 (BR! K!) — Ngozi, Poroto Mts., 2100 m, RICHARDS 6540 (K!).

CARACTÈRES ÉCOLOGIQUES ET BIOLOGIQUES. La variété *glanduligerus* de *Sonchus bipontini* croît dans les champs abandonnés, dans les savanes herbeuses, exemple à *Pennisetum*, et comme la variété typique, dans les bosquets d'arbrisseaux, etc., à une altitude de 1350—3000 m. Floraison et fructification ont lieu toute l'année.

DISCUSSION. La variété *glanduligerus* de *S. bipontini* se distingue de la variété

typique, principalement, par la présence des poils glanduleux sur les bases des capitules et sur les pédoncules.

46 b. *Sonchus bipontini* ASCHERS. 1867
var. *louisii* ROBYNS

ROBYNS in Bull. Jard. Bot. État Brux. 17: 105, 1943. — Holotype: Congo (Zaïre), entre Burunga et le marais de Kikeri, pied du Mikeno, 2190 m, LOUIS 5161 (BR!).

DISTRIBUTION. Éthiopie, Zaïre et Uganda.

Éthiopie: Gattaz, 8200 ft, SCHIMPER 69 (G! P!); SCHIMPER 1239 (BM! E! K!).

Zaïre: Entre Burunga et le marais de Kikeri, LOUIS 5161 (Holotype BR!).

Uganda: Near Sasa stream, Mtale Distr., Mt. Elgon, 10,500 ft, WOOD 140 (K!).

CARACTÈRES ÉCOLOGIQUES ET BIOLOGIQUES. D'après ROBYNS (1947), *Sonchus bipontini* var. *louisii* croît comme liane sur les *Acanthus*. La plante se trouve à une altitude de 1500 à 3150 m. Floraison et fructification de juillet à mars.

DISCUSSION. *Sonchus bipontini* var. *louisii* diffère de la variété typique par ses feuilles minces et plus grandes (2—20 mm), à marges serrées, et par ses capitules plus longs et plus larges.

47. *Sonchus luxurians* (R. E. FRIES)
C. JEFFREY

JEFFREY in Kew Bull. 18: 480, 1966. — Holotype: Tanzanie, Mt. Kilimanjaro, Marangu, 1500 m, VOLKENS 753 (B†, lectotype BM!, isolectotype G!).

Sonchus bipontini ASCHERS. 1867, var. *pinnatifidus* sensu R. E. FRIES, in Act. Hort. Berg. 8: 102, 1925; non OLIV. et HIERN 1877.

S. bipontini ASCHERS. 1867, var. *pinnatifidus* OLIV. et HIERN 1877, f. *luxurians* R. E. FRIES, in Act. Hort. Berg. 8: 102, 1925.

S. oliveri-hiernii BOULOS, 1962 var. *luxurians* (R. E. FRIES) BOULOS, in Bull. Jard. Bot. État Brux. 32: 105, 1962.

S. oliveri-hiernii BOULOS, in Bull. Jard. Bot. État Brux. 32: 106, 1962; pro parte excl. syn. *S. bipontini* var. *pinnatifidus* OLIV. et HIERN.

NOMS VERNACULAIRES. Au Congo: Kachumo-chumo, Kanyamata, Kanyaruhima, Bot. Notiser, vol. 127, 1974



Fig. 11. *Sonchus luxurians*. HOLM 79 (S!).
(Distribution, Fig. 3 A.)

Kattaruguma, Kizilangoma, Munyamarcha
(Qui donne du lait), Murukia.

USAGES. D'après ROBYNS, in schedule, au Congo "latex remède contre les plaies".

Plante vivace, herbacée, 0,6—2 m de hauteur, richement ramifiée, à feuilles pinnatiséquées, capitules en groupes denses, subsessiles, blancs-tomenteux à la base. Rhizome 5—12 mm diam., ligneux, plein, cylindrique, portant des racines fibreuses, ramifiées, 0,2—2,5 mm diam. Collet ligneux, volumineux chez le vieux specimens richement ramifié. Tige ramifiée, herbacée sauf à la base chez les vieilles plantes, ± cylindrique, creuse, lisse ou à canellures fines. Feuilles caulinaires glabres, 5—20 × 2—9 cm, à contour elliptique (triangulaire chez les supérieures), pinnatiséquées; lobes

triangulaires, rarement elliptiques, marges dentées, denticulées, rarement entières; bases auriculées, oreillettes largement elliptiques ou $\pm$ circulaires, à bases aiguës ou acuminées; nervure médiane proéminente sur la face inférieure. *Péduncule* 1—20 mm, à tomentum blanc et dense. *Capitules* en groupes denses très caractéristiques, blanc-tomenteux à la base, 12—15×5—7 mm, plus larges pendant l'anthèse. Nombre de fleurs 50—70 par capitule. *Écailles de l'involucre* $\pm$ 25; les externes 9, 3—8×2 mm; les intermédiaires 8, 12—15×2 mm; les internes 8, 12—15×1,5 mm. *Corolle* jaune, 12—18 mm. *Ligule* 4—6 mm. *Tube de la corolle* 8—12 mm. *Anthères* 2,5 mm. *Akènes* 3,25—3,75×1—1,35 mm, crèmes-jaunâtres, comprimés, étroitement elliptiques, transversalement ridés, marges épaisses, à une côte médiane principale et $\pm$ 4 côtes moins importantes sur chaque face. *Aigrette* $\pm$ 10 mm, caduque.

DISTRIBUTION. Zaïre, Rwanda, Burundi, Uganda, Kénia, Tanzanie et Malawi.

Zaïre: Mushumangabo, 2075 m, LEBRUN 7108 (BR!) — Nya Kaziba, J. F. LAURENT 525 (BR!) — Kikoma, terr. Masisi, 1650 m, PIERLOT 1941 (BR!) — Bohenda, terr. Masisi, 1700 m, GUTZWILLER 907 (BR!) — Mt. Bukulumiza, 2150 m, PIERLOT 321 (BR!) — Mt. Muhi, 3000 m, HENDRICKX 5399 (BR!) — Bugobe, terr. Kabare, 1985 m, GUTZWILLER 657 (BR!) — Mt. Ruwenzori, c. 2000 m, BEQUAERT 4303 (BR!) — Lacs Mokoto, GHESQUIÈRE 5039 (BR!) — Mushari, 1800—2000 m, TRAMASURE 501 (BR!) — Kibati, DE WITTE 1258 (BR!) — Niamlagyra, 1700—1900 m, GERMAIN 1232 (BR!) — Mt. à l'ouest du lac Kivu, c. 2000 m, HUMBERT 7741 (BR!) — Mt. Ludwe, entre Lubero et Butembo, 2300 m, CHRISTIANSEN 2206 (BR!) — Lulenga, VAN DEN HOUDT 87 (BR!) — Busenene, Mushari Est, 2080 m, VAN ISACKER 29 (BR!) — Tshibinda, HENDRICKX 4444 (BR!).

Rwanda: Runaba, 2200 m, A. LEBRUN 14 (BR!) — Uwinka, 2390 m, TROUPIN 9723 (BR!); 2100 m, TROUPIN 10384 (BR!).

Burundi: Kisozi, LEJEUNE 2 (BR! G! K!) — Entre Isare et Muramvya, 1800 m, ROBYNS 2283 (BR!) — Muruketchu, terr. Ngozi, 1700 m, BECQUET 866 (BR!) — Rwegura, 2200 m, LEWALLE 3627 (BR! K!).

Uganda: Mt. Ruwenzori, 6000 ft, WOLLASTON s.n. (BM!) — Kinaba gap, Kigezi, 7820 ft, CHANDLER et HANCOCK 2569 (BR! K!);

Kachwekano, Kigezi, 7200 ft, PURSEGLOVE 2742 (K!) — Kisoro, GHESQUIÈRE 5709 (BR!) — Rubiza, BAGSHAW 458 (BM!) — Virunga, Muhavura-Mgahinga, c. 3000 m. STAUFFER 845 (BR! K!).

Kénia: Nguaso Nyiro River, Sotik country, 1800—2100 m, EDGAR 419 (BM!) — Mt. Elgon, LINDBLOM s.n. (S!); HOLM 79 (S!); 2500 m, GRANVIK 273 (LD! S!); 7600 ft, TWEEDIE s.n. (K!) — Meru, HANCOCK 29 (K!) — Mt. Kénia, 8600 ft, MEINERTZHAGEN s.n. (BM!); 2300 m, R. E. FRIES et TH. FRIES 579 (BR! S! UPS!); 8500 ft, VAN SOMEREN s.n. (K!); versant ouest, 2400 m, ALLUAUD 246 (P!) — Mau Forest, 8300 ft, BALLY 4743 (K!); SW Mau Forest, Farm 1645, 8000 ft, WHITTALL 3 (K!) — Wamuhu, S Kinangop Forest, 8500 ft, KERFOOT s.n. (K!) — Londiani, 7800 ft, ROGERS 508 (BR! K! S!) — Eldoma (Eldama), WHYTE s.n. (K!) — Ngong Hill Ridge, 7000 ft, BALLY 1147 (G! K!) — Kisumu, 7000 ft, DÜMMER 1731 (BM!); 5450 ft, DÜMMER 1924 (BM!) — Nairobi, 5500 ft, DOWSON 360 (K!); KERFOOT 498 (K!) — Mt. Aberdare, JAMES s.n. (K!) — Nieri (Nyeri), c. 1700 m, R. E. FRIES et TH. FRIES 71 et 262 (BR! S! UPS!) — Kiandongoro, Nyeri Distr., MATHEGE 207 (K!) — River Thiba, Embu Distr., 6100 ft, BALLY 426 (K!).

Tanzanie: Mt. Kilimanjaro, Marangu, 1500 m, VOLKENS 753 (Lectotype BM! Isolectotype G!); VOLKENS 667 (BM! G! K!); 1600 m, SCHLIEBEN 4717 (BM! BR! G! S!); 2000—3000 m, JANSSENS s.n. (BR!) — Ran Rombo, E Kilimanjaro, c. 4000 ft, HAARER 412 (K!) — Olomoti Volcano, Oldonyowass, 8300 ft, BURTT 4379 (K!) — Lushoto, 1700 m, DRUMMOND et HEMSLEY 2399 (BR! K!) — Ngorongoro, Mbulu Distr., North Prov., GEILINGER 3618 (K!); 5000 ft, BALLY 2257 (K!); 6500 ft, TANNER 3268 (K!) — Crater Highlands, Nainokanoka, 8500 ft, NEWBOULD 6247 (K!).

Malawi: Nyika plateau, 2300 m, BRASS 17173 (BM! BR! K!) — Mt. Mlange, 6400 ft, NEWMANN et WHITMORE 207 et 518 (BM!).

CARACTÈRES ÉCOLOGIQUES ET BIOLOGIQUES. *Sonchus luxurians* croît au bord des routes, dans les savanes herbeuses, dans les champs cultivés, etc., à une altitude de 1300—3000 m. Floraison et fructification toute l'année.

PARTICULARITÉS PALYNOLOGIQUES. Calotte polaire ressemble fort à celle de *Sonchus bipontini* et de plus on peut observer entre les épines polaires une réticulation de l'exine qui est toujours ab-

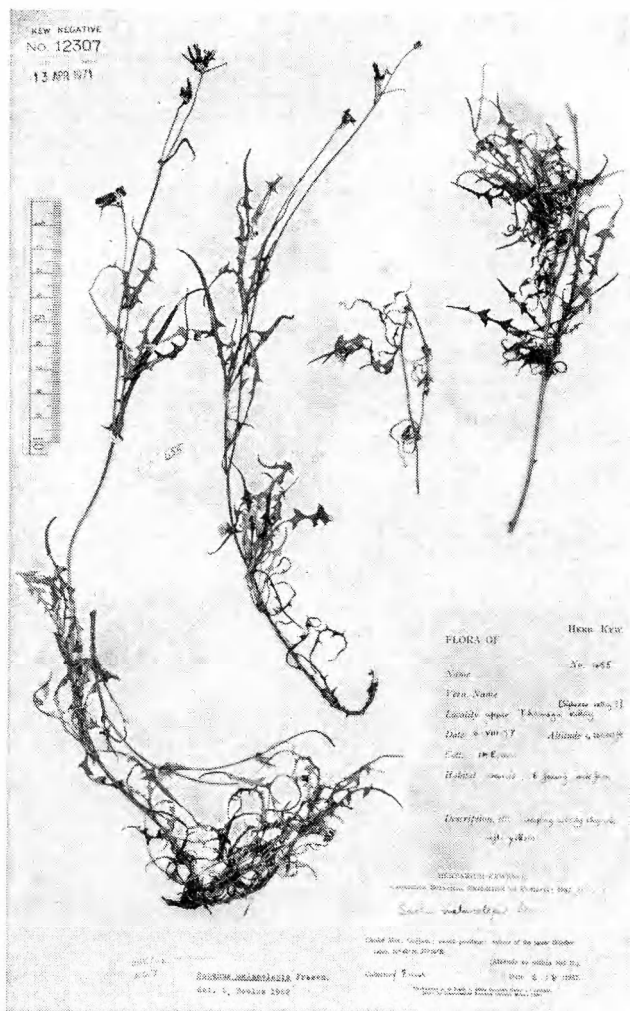


Fig. 12. *Sonchus melanolepis*. (Distribution, Fig. 3 B.)

sente dans les véritables lacunes; ce fait tend à montrer la nature particulière des "lacunes polaires" sensu SAAD (1961).

DISCUSSION. *Sonchus luxurians* est une espèce caractérisée par ses feuilles pinnatiséquées à grandes oreillettes; ses capitules nombreux, subsessiles, blanchotomenteux à la base, en groupes denses. Les akènes sont transversalement ridés à marges et côtes médianes épaisses.

48. *Sonchus melanolepis* FRESEN.

FRESENIUS, in Mus. Senckenb. 3: 76, 1839. — Type: Abyssinie, Semien, RÜPPELL; non vide.

Sonchus melanolepis FRESEN. 1839, f. str.— Bot. Notiser, vol. 127, 1974

mineus R. E. FRIES, in Act. Hort. Berg. 8: 104, 1925.

S. melanolepis FRESEN, 1839, var. *linearis* R. E. FRIES, in Act. Hort. Berg. 8: 105, 1925.

Plante vivace, ligneuse à la base, richement ramifiée, 15—40 cm de hauteur. *Rhizome* rampant, ligneux, 3—6 mm diam., portant des racines fibreuses fines, ramifiées, rarement ligneuses, 0,2—1 mm diam. *Collet* ligneux, ramifié, assez volumineux chez les vieilles plantes. *Tige* glabre, $\pm$ cylindrique, 1,5—3 mm diam., plus épaisse vers le collet, ligneuse, feuillée et pleine dans la partie basale; presque nue, herbacée et creuse vers le sommet. *Feuilles du collet* en rosette, glabres, $3-12 \times 0,8-3$ cm, oblancéolées, pinnatiséquées; lobes latéraux $\pm$ réniformes, fléchi vers la base, lobe terminal $\pm$ triangulaire, marges irrégulièrement denticulées; nervure médiane proéminente sur la face inférieure. *Feuilles caulinaires* glabres, $2-10 \times 0,5-2$ cm, pinnatiséquées; lobes latéraux $\pm$ triangulaires ou étroitement rectangulaires, lobe terminal $\pm$ linéaire, étroitement triangulaire ou rarement triangulaire, marges entières ou irrégulièrement dentées. *Pédoncule* 0,2—5 cm, blanchotomenteux vers le capitule, à 1—3 bractées, ± 2 mm. *Capitules* peu nombreux, 10×5 mm, plus larges pendant l'anthesis, à tomentum blanc-rosâtre sur la partie basale. Nombre de fleurs 60—90 par capitule. *Écailles de l'involucre* ± 27 ; les externes 11, $2,5-7 \times 1,5$ mm, à nervures médianes saillantes et poilus-glanduleuses; les intermédiaires 7, $9-10 \times 1,5$ mm; les internes 9, $9-10 \times 1,5$ mm. *Corolle* jaune, $10-12,5$ mm. *Ligule* 4—5,5 mm. *Tube de la corolle* 6—7 mm. *Anthères* 2 mm. *Akènes* $2,5 \times 0,8$ mm, brunâtres, comprimés, légèrement rugueux, étroitement obovales à étroitement elliptiques, à une côte médiane principale (quelquefois peu développée) et ± 5 côtes moins importantes sur chaque face. *Aigrette* ± 6 mm, persistante.

DISTRIBUTION. Éthiopie, endémique.

Éthiopie: Addis Ababa 8100 ft, MOONEY 6495 (K!); 2600 m, SENNI 367, 1737, 2181

(FI!); NEGRI 192 (FI) — Entre Addis Ababa et Entotto, BUSCALIONI 708 (FI!) — Entre Fra Meta' et Auletta, Scioa (Shoa), BUSCALIONI 1570, 1597 (FI!) — Mensa, Mt. Ira, 2400 m, TERRACCIANO et PAPPI 1437 (FI!) — Asniara, Eritrea-Haniasen, CHIOVENDA 26 (FI!) — Entre Asmara et Belesa, Amasen, TERRACCIANO et PAPPI 2551 (FI!) — Entre Asmara et Bet Ghiorghis Hamasen (Amasen) CHIOVENDA 193 (FI!); BALDRATI 3044 (FI!) — Soïra, 2900 m, DAINELLI et MARINELLI 181 (FI!) — Harar, BUSCALIONI 659 (FI!) — Halai, 2600 m, SCHWEINFURTH 679 (MPU! Z!) — Demérqui, 11,000 ft, SCHIMPER 834 (BR!); SCHIMPER s.n. (G! K! LE! MPU! P!); prope Demerki in Monte Bachit, SCHIMPER 1242 (BR! L!) — Hedschagipfel, 3000 m, SCHIMPER 355 (BR! S!) — Semien, CHIOVENDA 856, 3088 bis (FI!) — Dembia', CHIOVENDA 1059, 1093, 1565, 2490 (FI!) — El Ejan, 2700 m, SCHWEINFURTH 1676 (C! G! LE! P!) — Uossil, 1400 m, SCHWEINFURTH 1316 (BR! G! K! P!) — Tchamoga Valley, Choké Mts., c. 10,000 ft, EVANS 455 (K).

CARACTÈRES ÉCOLOGIQUES ET BIOLOGIQUES. *Sonchus melanolepis* croît dans les fentes des rochers à une altitude de 1400—3500 m. Floraison et fructification d'août à avril.

DISCUSSION. FRIES (1925) a décrit deux taxons infraspécifiques: f. *stramineus* et var. *linearis* de *Sonchus melanolepis*. Il semble que les différences morphologiques sur lesquelles l'auteur a basé ses taxons sont d'origine purement stationnelles. Nous avons remarqué, par exemple, que parmi les specimens examinés, ceux récoltés à une altitude d'environ 1400 m, possédaient des feuilles beaucoup plus larges que ceux croissant à une altitude de 2600—3500 m. Les specimens des basses altitudes méritent donc un rang infraspécifique "sensu FRIES".

Nous proposons, en conséquence que la forme et la variété de FRIES devaient être considérées comme synonymes de l'espèce-type.

49. *Sonchus obtusilobus* R. E. FRIES

FRIES, in Act. Hort. Berg. 8: 105, 1925. — Holotype: Berg Erareta, 3200 m, Abyssinie, SCHIMPER 614 (Holotype B†, lectotype BM!, isoelectotypes E! K!).

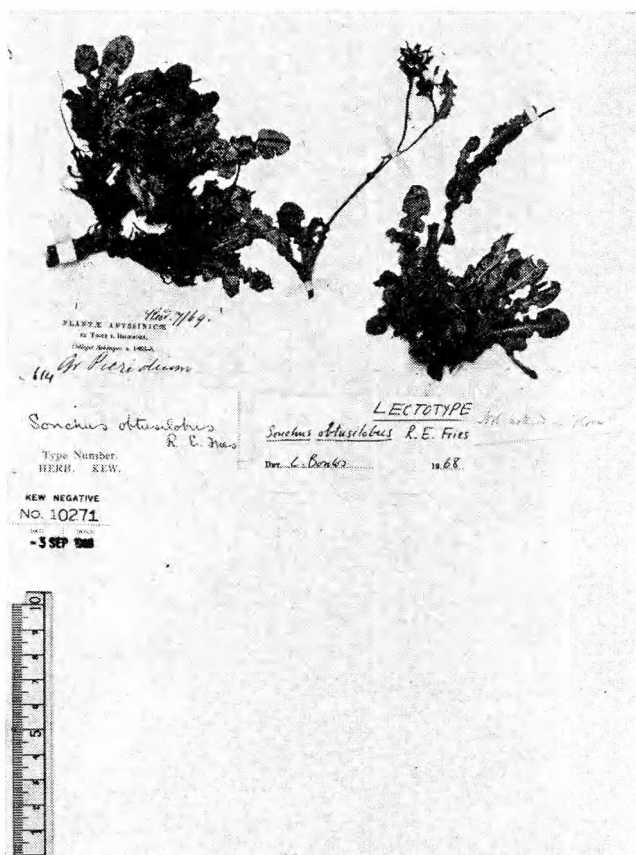


Fig. 13. *Sonchus obtusilobus*. Isoelectotype, SCHIMPER 614 (K!). (Distribution, Fig. 3 C.)

Plante vivace, 15—30 cm de hauteur, tiges ligneuses à la base, feuilles en touffes denses, inflorescence presque nue, portant un petit nombre de capitules, écailles externes de l'involucre à zone médiane couverte de poils dorés caractéristiques. Rhizome "rhizome ramoso crasso (ramis 0,5—1 cm diam.)", d'après FRIES (1925). Collet ligneux, ramifié. Tige ligneuse, 3—15 mm diam., couverte par les bases des feuilles persistantes. Feuilles glabres, densément insérées à la base, 3—6×0,8—1,8 cm, lyrées, pinnipartites à pinnatiséquées, lobes ovales, marges dentées, sommet obtus. Pédoncule 1—4 cm. Capitules 11×6,5 mm, plus larges lorsqu'ils sont ouverts, à tomentum de couleur chair à la base. Écailles de l'involucre à sommet obtus, les externes à poils dorés denses sur la partie médiane. Akènes et Aigrette, d'après FRIES (1925): "Achaenia lanceolata, applanata,

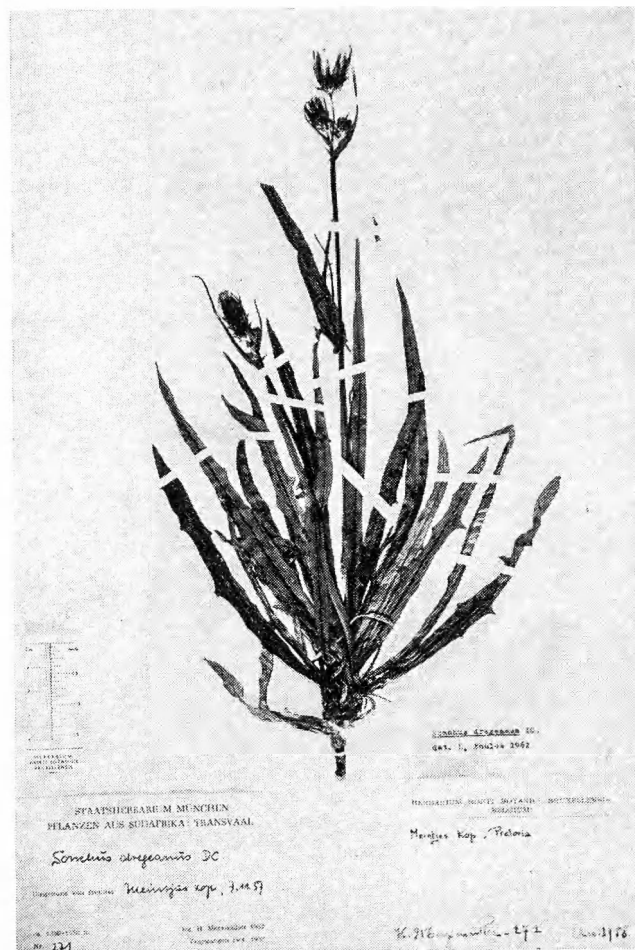


Fig. 14. *Sonchus dregeanus*. MERXMÜLLER 271 (BR!). (Distribution, Fig. 3.D.)

paucistriata, ceterum laevia et nitida, fusca, 3,5 mm longa, pappo 3—5 mm longo candido coronata.”

DISTRIBUTION. Éthiopie, endémique.

Éthiopie: Berg Erareta, 3200 m, SCHIMPER 614 (Lectotype BM!, isolectotypes E! K!).

DISCUSSION. *Sonchus obtusilobus* est une plante d'aspect très particulier, par son feuillage très dense, ses tiges courtes et ligneuses. Les poils dorés sur la zone médiane des écailles externes de l'involucre caractérisent les capitules.

50. *Sonchus dregeanus* DC.

DE CANDOLLE, Prodr. 7: 184, 1838. — Lectotype: Zwarkop Riv., Zwarte-Storm et Willbergen, DRÈGE 6177 (G-DC!).

Bot. Notiser, vol. 127, 1974

Sonchus ecklonianus DC. Prodr. 7: 184, 1838.

Plante vivace, herbacée, 12—90 cm de hauteur, ramifiée surtout à la base, feuilles $\pm$ en rosette. Rhizome cylindrique, ligneux, plein, 3—12 mm diam., portant des racines fibreuses fines. Collet ligneux, ramifié. Tige cylindrique, herbacée, creuse, 2—6 mm diam., glabre, lisse ou à cannelures fines. Feuilles du collet glabres, en rosette, 4—18 $\times$ 0,3—1 cm (à l'exclusion des lobes), oblancéolées, étroitement elliptiques ou linéaires; entières, pinnatifides ou pennipartites; lobes triangulaires ou étroitement triangulaires, 3—10 $\times$ 2—5 mm, marges entières ou légèrement denticulées, bases légèrement engainantes, sommet aigu ou acuminé. Feuilles caulinaires largement espacées surtout vers le sommet, étroitement elliptiques à étroitement rectangulaires, moins séquées que celles du collet, bases engainantes, auriculées, oreillettes triangulaires, aiguës, sommet acuminé, marges entières ou légèrement denticulées. Pédoncule 0,2—8 cm, à 1—3 bractées triangulaires. Capitules 16 $\times$ 5—15 mm, base à tomentum blanc, rarement poilus. Nombre de fleurs 70—200 par capitule. Écailles de l'involucre $\pm$ 33, à sommet cilié; les externes 14, 3—10 $\times$ 1,5—3 mm, à base blanche-tomenteuse, nervure médiane saillante et quelquefois poilue; les intermédiaires 10, 13—16 $\times$ 2—3 mm, nervure médiane saillante et rarement poilue sur la partie supérieure; les internes 9, 14—16 $\times$ 2 mm. Corolle jaune, les fleurs externes pourpres sur la face extérieure, 12—17,5 mm. Ligule 4—5,5 mm. Tube de la corolle 8—12 mm. Anthères 2,25 mm. Akènes 4,25—5,75 $\times$ $\pm$ 1 mm, étroitement elliptiques, comprimés, légèrement ridés, marges étroites et assez épaisses, à une côte médiane principale et $\pm$ 4 côtes moins importantes sur chaque face. Aigrette $\pm$ 12 mm, persistante.

DISTRIBUTION. Rhodésie, République Sud-Africaine, Lésoto et Madagascar.

Rhodésie: Matobo Distr., WEST 2565 (LD!).

Republique Sud-Africaine: Transvaal: Pienaars Riv., MERXMÜLLER 170 (BR!) — Meintjies Kop, Pretoria, SMITH 106 (PRE!); 1350—1550 m, MERXMÜLLER 271 et 272 (BR! M!) — Johannesburg, MOSS 15659 et 15922 (BM!) — Heidelberg, 4980 ft, ACOCKS 20826 (K! M!) — Bruttholm, BURTT DAVY 17649 (CGE!) — Fountains Valley, VERDOORN 631 (K!) — Goedgedacht, 5000 ft, Ventersdorp Distr., SUTTON 592 (PRE!) — Horns Nek, Magaliesberg, c. 1450 m, SCHLIEBEN 7833 (BR! G!) — Queenswood, MEEUSE 10289 (K! LD!) — État Libre d'Orange: Kroonstad Distr., 4500 ft, PONT 445 (PRE!) — Witzies Hoek, JUNOD 17399 (PRE!) — Thaba Nchu, 6700 ft, ROBERTS 2351 (PRE!) — Natal: Isipingo Flats, Pietermaritzburg, WARD 6307, 6308, 6311 (NU!) — Foxhill, Pietermaritzburg Distr., GORDON GRAY 6255, 6256 (NU!) — Reunion Rocks, Pietermaritzburg Distr., WARD 6825 (NU!) — King Edward Avenue, Pietermaritzburg, HILLIARD 4869 (NU!) — Mtunzini Distr., VENTER 3232 (PRE!) — Durban, R. E. et TH. FRIES 3104 (UPS!) — Oliviershoek Pass, Bergville Distr., HILLIARD 4919 (NU!) — s. loc., WILLIAMS s.n. (K!) — Province du Cap: Wildschutsberg, 4000 ft, DRÉGE s.n. (S!) — Kei Riv., KAVAGAN 1813 (UPS!) — Uitenhage, MAC OWAN 531 (BM!) — Devils Peak, WOLLEY DOD 2665 (K!) — Dohne Research Station, ACOCKS 9730 (M!) — Dohne, Stutterheim Distr., ACOCKS 9254 (PRE!); Stutterheim, ACOCKS 9028 (K!) — Grahamstown, BREYER 16893 (PRE!); MELVILL s.n. (MANCH!); MAC OWAN s.n. (MANCH!); 1800 ft, MAC OWAN 531 (K!) — Alexandria, MARAIS 190 (K!) — Port Elizabeth, PATERSON 749 (MANCH!) — Eerste Riv., Humansdorp, FOURCADE 1964 (BM! PRE!) — Baziya, Um-tata Distr., 2000—2500 ft, BAUR 303 (K!) — 4 miles W Kokstad, ACOCKS 21996 (M! PRE!) — Kentani, PEGLER 2914 (PRE!) — Idutywa, WATT et BRANDWYK 1162 (PRE!) — 2 miles E Rosmead, 4000 ft, Middelburg Distr., ACOCKS 16327 (PRE!) — Griqua Town, Griqualand West, BURCHELL s.n. (K!).

Lésotho: Lérivé, DIETERLEN 571 (MPU! P!) — Likhuèla, DIETERLEN 1184 (P!) — Near Roma Riv., Maseru, SCHMITZ 195 (PRE!).

Madagascar: Environs Ambalavao, PERRIER 14319 (P!) — Massif Andringitra, HUMBERT 3667 (G! K! P!) — Environs Ivohibe, PERRIER 3451 (P!); DECARY 5385 (P!) — Chaîne de l'Ambinda, W. Ivohibe, DECARY 5648 (BM! P!) — Mt. Kalambatittra, HUMBERT 11822 (P!) — Massif Ivakoany, HUMBERT 7027 (P!) — Haute Vallée du Mandrare, HUMBERT 6484 (P!) — Forêt d'Analavelona, bassin Fiherenana, HUMBERT 19792 (P!).

CARACTÈRES ÉCOLOGIQUES ET BIOLOGIQUES. *Sonchus dregeanus* croît

dans les prairies, sur les bords des chemins, des cours d'eau et des rivières, ou à l'ombre de rochers, etc., à une altitude de 600—2000 m. Floraison et fructification principalement d'octobre à février.

CARACTÈRES CARYOLOGIQUES. $2n = 18$ (MARCHANT 1970).

DISCUSSION. *Sonchus dregeanus* est une espèce intéressante, ayant une répartition géographique en Afrique du Sud et à Madagascar.

Après avoir examiné les deux types de *S. dregeanus* et *S. ecklonianus* dans l'herbier G-DC, et plusieurs autres échantillons, nous avons considéré le dernier comme un synonyme du premier. Il est très difficile de séparer l'un de l'autre d'après les caractères morphologiques; même les deux échantillons de DE CANDOLLE, sur lesquels les descriptions sont basées, sont presque identiques.

51. *Sonchus integrifolius* HARV.

HARVEY, in HARV. et SOND. Fl. Cap. 3: 528, 1865. — Syntypes: Natal, T. WILLIAMSON, J. SANDERSON, Durban, GERRARD et MC KEN 315; non vide.

Sonchus delagoeensis THELLUNG, in Vierteljahrsschr. Nat. Ges. Zürich 66: 252, 1921.

S. integrifolius HARV., 1865 f. *lobatus* R. E. FRIES, in Act. Hort. Berg. 8: 108, 1925.

S. integrifolius HARV. var. *schlechteri* R. E. FRIES, in Act. Hort. Berg. 8: 109, 1925.

Plante vivace, herbacée, glabre, feuilles peu séchées; capitules volumineux, peu nombreux, souvent solitaires à pédoncules très longs (jusqu'à 16 cm). *Rhizome* vertical, cylindrique, 4—15 mm diam., ligneux, plein, portant des racines fibreuses fines. *Collet* simple ou ramifié, 5—15 mm diam., ligneux. *Tige* herbacée, creuse, 3—8 mm diam. *Feuilles du collet* glabres, coriaces, assez denses, 5—15 × 0,5—2,5 cm, étroitement rectangulaires, étroitement elliptiques ou oblancéolées, entières ou rarement peu séchées, marges légèrement denticulées, bases engainantes, sommet obtus.

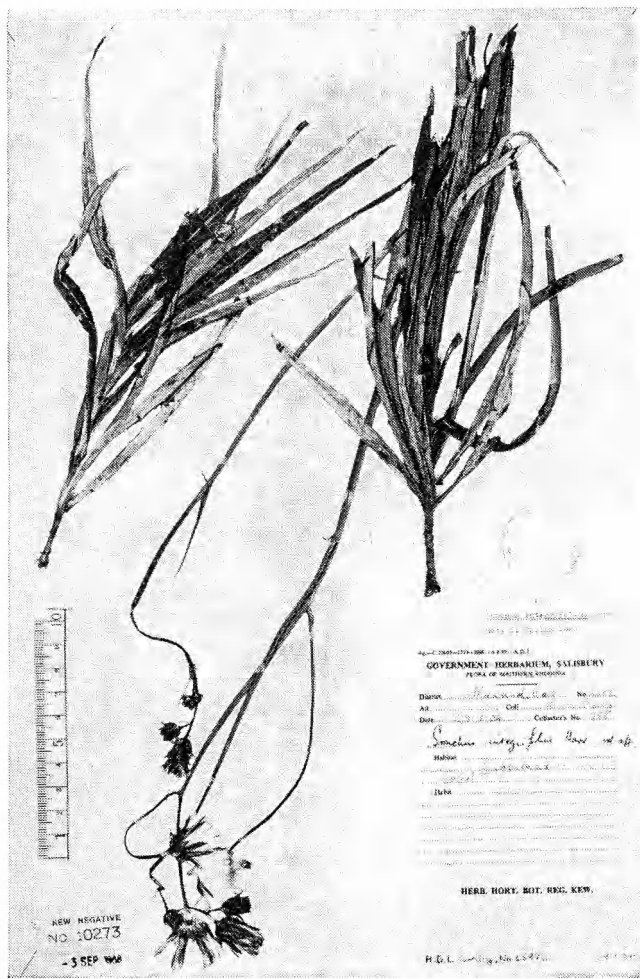


Fig. 15. *Sonchus integrifolius*. CORBY 788 (K!).
(Distribution, Fig. 3 E.)

Feuilles caulinaires glabres, coriaces, 8—20×0,5—2,5 cm (à l'exclusion de lobes), entières ou rarement pinnatifides à pennipartites; lobes étroitement rectangulaires ou triangulaires, sommet obtus, rarement aigu; bases engainantes, quelquefois auriculées à oreillettes triangulaires et aigues. *Pédoncule* 2—16 cm, à ± 2 bractées triangulaires, 2—6 mm. *Capitules* solitaires ou peu nombreux, $\pm 20 \times 10$ mm, volumineux après la maturité. Nombre de fleurs ± 110 . *Écailles de l'involucre* ± 34 ; sommet acuminé; les externes 12, coriaces, 7—15×2—3,75 mm; les intermédiaires 9, 17—20×3,5 mm; les internes 13, 18—20×2—3 mm. *Corolle* jaune, les fleurs extérieures pourpres, 13—20 mm. *Ligule* 5—6 mm. *Tube de la corolle* 8—14 mm. *Anthères* 2,75 mm. *Akènes* 4—6,5×1,2 mm,

Bot. Notiser, vol. 127, 1974

brunâtres, comprimés, étroitement elliptiques, marges relativement épaisses, à ± 6 côtes sur chaque face. *Aigrette* ± 13 mm, persistante.

DISTRIBUTION. Rhodésie, Mozambique, République Sud-Africaine et Lésoto.

Rhodésie: Marandellas, CORBY 788 (K!).

Mozambique: Delagoa Bay, SCHLECHTER 11971 (BM!) — Lourenço Marquez, JUNOD 174 (BR! G!).

Republique Sud-Africaine: Transvaal: Haenertsburg, 5500 ft, Pietersburg Distr., MURRAY T2 (PRE!); POTT 13298 (PRE!) — Lydenburg, WILMS 635 (BM!); ROGERS 14629 (K!) — Pienaars Riv., Silverton, c. 1350—1550 m, MERXMÜLLER 179 (BR! M!) — Pretoria, 1350—1550 m, MERXMÜLLER 407 (BR! M!); 4700 ft, SCHLECHTER 12121 (PRE!); Meintjies Kop, Pretoria, MERXMÜLLER 95, 272 (M!); Queenswood, Pretoria, MEEUSE 10289 (M!) — Johannesburg, RAND 975 (BM!); Moss 13745 (BM!) — NW Standerton, 5200 ft, ACOCKS 21948 (M! PRE!) — Mauchsberg, Sabie, Pilgrims Rest Distr., SMUTS et GILLET 2331 (PRE!) — Burttholm, BURTT DAVY, 15079, 17755, 18958 (CGE!) — Geduld Dam, MURRAY 578 (PRE!) — État Libre d'Orange: Near Bethlehem, 5000 ft, FLANAGAN 1997 (PRE!) — Natal: Mt. Ngwibi, Vryheid Distr., HILLIARD et BURTT 5914 (E! NU!); Mt. Nyati, Vryheid Distr., HILLIARD et BURTT 5893 (E! NU!) — Estcourt, 4000 ft, WEST 351 (PRE!); Kamberg Mt., Estcourt Distr., HILLIARD et BURTT 5733 (E! NU!); Kamberg Mt., 6200 ft, HILLIARD et BURTT 5734 (E! NU!) — Pietermaritzburg, Isipingo Flats, WARD 6307, 6310 (E! NU!); WILMS 2027 (K!) — Clairwood, Durban Distr., R. E. et TH. FRIES 3103 (UPS!); SE Lamontville Station, Durban Distr., WARD 5875, 5876 (PRE!); Pathside near Racecourse, Durban Distr., EVANS s.n. (E!) — Port Natal, HARVEY 1840 (K!) — Zululand, GERRARD 441 (BM! K!) — Bazwana, Ubombo Distr., STREY 5113 (PRE!) — Cato Ridge, Camperdown Distr. KEYTEL 37 (PRE!) — New Hanover Distr., Noodsberg, HILLIARD 2083 (NU!) — Kelsey Beach, Umzinto Distr., STREY 7296 (K! M! PRE!) — Province du Cap: Grahamstown, 1800 ft, MAC OWAN (K!) — Port St. Johns, SWINNY et BAKER 14140 (PRE!).

Lésoto: Lérivé, DIETERLEN 155 (MPU! P!).

CARACTÈRES ÉCOLOGIQUES ET BIOLOGIQUES. *Sonchus integrifolius* croît dans les prairies et sur les bords des ri-

vières, etc., à une altitude de 550—2000 m. Floraison et fructification principalement de novembre à février.

DISCUSSION. *Sonchus integrifolius* est caractérisé par ses feuilles coriaces, ses capitules volumineux, surtout après l'anthèse, ses pédoncules longs, atteignant 16 cm, et ses écailles d'involucre coriaces à sommet acuminé.

Nous considérons les taxons infraspécifiques qui ont été décrites par FRIES (1925) comme synonymes de l'espèce-type. Les différences morphologiques peu importantes entre ces taxons et l'espèce-type sont très probablement le résultat des différences dans l'habitat.

52. *Sonchus friesii* BOULOS

BOULOS, in Bot. Not. 120: 456, fig. 1, 1967. — Holotype: Rhodesia, Inyanga Down, the highest part, NORLINDH et WEIMARCK 4656 (LD!); isotype (LD!).

Plante vivace, herbacée, 30—90 cm de hauteur, rarement ramifiée à la base, feuilles larges et engainantes, capitules blanc-tomenteux à la base. *Rhizome* 3—8 mm diam., ligneux, plein, portant des racines ramifiées, 0,1—1,5 mm diam. *Collet* simple, rarement ramifié, ligneux, 4—10 mm diam. *Tige* herbacée, glabre, simple, cylindrique, creuse, 3—12 mm diam., à cannelures fines. *Feuilles du collet* glabres, 3—8 × 1—2 cm, oblancéolées ou étroitement elliptiques, entières ou pinnatifides, marges irrégulièrement dentées, bases légèrement engainantes, sommet aigu. *Feuilles caulinaires* glabres, 5—15 × 1,5—3,5 cm, étroitement elliptiques, oblancéolées ou étroitement ovales, entières ou pinnatifides à lobes ± triangulaires fléchi vers la base, marges denticulées ou irrégulièrement dentées, sommet aigu, base fortement engainante, auriculée, à oreillettes ± triangulaires, aiguës; nervure médiane proéminente sur la face inférieure, 2—3 mm diam. à la base. *Pédoncule* 0,2—7 cm (généralement 4—20 mm), légèrement



Fig. 16. *Sonchus friesii*. Holotype, NORLINDH et WEIMARCK 4656 (LD!). (Distribution, Fig. 3 F.)

blanc-tomenteux au-dessous du capitule, à une bractée triangulaire. *Capitules* peu nombreux, densément blanc tomenteux à la base, ± 15 × 8 mm, plus larges pendant l'anthèse. Nombre de fleurs 55—85 par capitule. *Écailles de l'involucre* ± 25, à sommet obtus et cilié; les externes 9, 5—10 × 1,5—3 mm; les intermédiaires 8, 11—14 × 2—3 mm; les internes 8, 13—15 × 1,5—2,5 mm. *Corolle* jaune, les fleurs extérieures pourpres-pâles sur la face extérieure, 12,5—17 mm. *Ligule* 4,5—6 mm. *Tube de la corolle* 8—11 mm. *Anthères* 3 mm. *Akènes* 4—5,25 × ± 1 mm, brunâtres, étroitement elliptiques, comprimés, ridés, à ± 5 côtes sur chaque face, la médiane épaisse, marges assez épaisses. *Aigrette* ± 12 mm, persistante.

DISTRIBUTION. Zambie, Rhodésie et République Sud-Africaine.

Zambie: Broken Hill, 4000 ft, ROGERS 8645 (K!).

Rhodésie: Pugwe Waterfalls, NORLINDH et WEIMARCK 3753 (LD!); 6000 ft, CHASE 5909 (BM!) — Inyanga, NORLINDH et WEIMARCK 3487 (LD!); NORLINDH et WEIMARCK 4656 (Holotype et isotype, LD!) — Mt. Nuza, 5700—5800 ft, GILLILAND 450 (BM! K!) — Mt. Chirinda, 3800 ft, SWYNNERTON 487 (BM! K!); 3500 ft, SWYNNERTON s.n. (BM!) — Butler North, Tsetsera Mts., 4900 ft, CHASE 6766 (K) — Gungunyana Forest Reserve, Melsetter Distr., c. 3500 ft, GOLDSMITH 81/61 (K! M!); Melsetter Distr., SWYNNERTON s.n. (BM!).

République Sud-Africaine: Natal: Nkandla Distr., Eshowe to Nkandla, HILLIARD et BURTT 5643 (E! NU!).

CARACTÈRES ÉCOLOGIQUES ET BIOLOGIQUES: *Sonchus friesii* croît dans les champs cultivés et dans les régions steppiques à une altitude de 1100—1900 m. Floraison et fructification d'octobre à janvier, rarement de mai à juin.

DISCUSSION. *Sonchus friesii* est facile à distinguer de *S. integrifolius*, l'espèce la plus voisine, par les différences suivantes:

	<i>S. friesii</i>	<i>S. integrifolius</i>
feuilles	minces	coriaces
capitules	blancs-tomenteux	glabres
écailles de l'involucre	± 25 à sommet obtus	± 34 à sommet acuminé

53. *Sonchus wilmsii* R. E. FRIES

FRIES, in Act. Hort. Berg. 8: 107, t. 2, 1925. — Type: Lydenburg, Transvaal, WILMS 636 (Holotype B†, lectotype E!).

Plante vivace, herbacée, 30—75 cm de hauteur, glabre sauf à la base de capitules, capitules volumineux surtout après leur maturité. Collet ligneux, simple, ± 5 mm diam., plein. Tige herbacée, cylindrique, simple, creuse, 3—8 mm diam., glabre, à cannelures étroites. Feuilles du collet 4—7×2—3 cm, ± elliptiques, pennipartites, lobes ± triangulaires, marges denticulées, sommet aigu, base engainante. Feuilles du collet 5—15×2,5—8 cm, ovales, elliptiques

ou ± triangulaires, pennipartites à pinnatiséquées; lobes ± triangulaires à étroitement rectangulaires, 1—4×0,5—1,2 cm, lobe terminal souvent plus long et plus large, sommet aigu ou rarement obtus, marges denticulées, assez piquantes, base engainante et auriculée à oreillettes ± triangulaires et aiguës; nervure médiane prédominante sur la face inférieure. Pédoncule 2—20 mm, légèrement tomenteux vers le capitule, à ± 2 bractées étroitement triangulaires, 3—5×1,5 mm. Capitules ± 20×12 mm avant l'anthèse, volumineux après la maturité (± 30 mm diam.), blanchotomenteux à la base. Nombre de fleurs ± 140 par capitule. Écailles de l'involucre ± 40 à sommet obtus et cilié; les externes 16, coriaces, 6—13×2—4 mm; les intermédiaires 13, coriaces, 16—20×2,5—3,5 mm; les internes 11, 17—20×2 mm. Corolle jaune, 14—17 mm. Ligule 4—6 mm. Tube de la corolle 9—12 mm. Anthères 2,25 mm. Akènes 4,5—5,5× ± 1 mm, crèmes-brunâtres à brunâtres, comprimés, étroitement elliptiques à étroitement obovales, légèrement ridés, à 5 côtes sur chaque face, la médiane la plus épaisse, marges étroites, assez épaisses. Aigrette ± 12 mm, persistante.

DISTRIBUTION. République Sud-Africaine, Lésoto et Mozambique.

Republique Sud-Africaine: Transvaal: Près Middelburg, WILMS 636 (Lectotype E!, Holotype B† cité Lydenburg par FRIES, 1925) — Lydenburg, WILMS 633 (BM!); WILMS 637 (K!); YOUNG A 444 (PRE!) — Fountains Valley, Pretoria, MOGG 17227 (PRE!) — 21 miles S Sabie, HILLIARD et BURTT 5957 (E! NU!) — Modderfontein, 4500 ft, NATION 18 (K!) — Pienaars Riv., Silverton, 1350—1550 m, MERXMÜLLER 182 (M!) — Witpoortjie Kloof, Moss 8697 (BM!) — Brummeria, 1350—1550 m. MERXMÜLLER 364 (M!) — Blaauwberg, first plateau, 5000—5500 ft, MEEUSE 10341 (M!) — Natal: Pietermaritzburg, Durban Distr., WARD 6306 (E!) — Foxhill, Pietermaritzburg Distr., GORDON GRAY 6257 (NU!) — Town Hill, Pietermaritzburg Distr., RAM s.n. (NU!) — Shalley Beach, Port Shepstone Distr., STREY 7656 (PRE!); Port Shepstone, Mgayi, c. 1350 ft, WARD 6350 (NU!) — Hlabisa, c. 450 m, WARD 2421 (K!) — Lebombo Mts., Ingwavuma Distr., HIL-



Fig. 17. *Sonchus nanus*. WILMS 631 (M!). (Distribution, Fig. 3 H.)

LIARD et BURTT 3234 (E!) — Greytown, WYLIE s.n. (PRE!) — Pinetown Distr., Eskotene, HILLIARD 4889 (NU!) — Hluhluwe Game Reserve, WARD 2421 (PRE!) — SE Lamontville Station, 25 ft, WARD 5874 (E! M! NU!) — s. loc., GUEINZIUS s.n. (G! P!) — Province du Cap: Walmer, PATERSON 25766 (PRE!) — Queenstown Mts., 4000 ft, GALPIN 2256 (in litt., FRIES, 1925).

Lésotho: Lérivé, DIETERLEN 673 (in litt., FRIES, 1925).

Mozambique: Lourenço Marques, BALSINHAS 1110 (COI!).

CARACTÈRES ÉCOLOGIQUES ET BIOLOGIQUES. *Sonchus wilmsii* croît dans les pelouses, sur les bords des canaux, etc., à une altitude de 10 à 1400 m. Floraison et fructification principalement d'août à novembre.

CARACTÈRES CARYOLOGIQUES. $2n = 18$ (MARCHANT 1970).

DISCUSSION. *Sonchus wilmsii* est caractérisé par ses feuilles minces et séchées, à marges denticulées et par ses capitules volumineux, blancs-tomenteux à la base et par le nombre assez élevé d'écaillés d'involucre (± 40).

54. *Sonchus nanus* SOND. ex HARV.

HARVEY, in Harv. et Sond. Fl. Cap. 3: 528, 1865; non *S. nanus* HOFFM. in Engl. Pflanzenwelt Ostaf. C: 421, 1895. — Type: Cap, Afrique du Sud, ECKLON et ZEYHER, non vide.

Plante vivace, chétive, $\pm$ acaule, 3—12 cm de hauteur, glabre, ramifiée à la base, collet relativement volumineux. Rhizome ligneux, 4—15 mm diam., plein, portant des racines fibreuses ramifiées, $\pm 0,2$ mm diam. Collet ligneux, ramifiée. Tige très courte ou presque nulle. Feuilles du collet en rosette dense, $2-5 \times 1-1,5$ cm, pinnatifides à pinnatiséquées, rarement entières, $\pm$ elliptiques ou oblancéolés, lobes triangulaires, marges dentées ou ondulées, bases engainantes, sommet aigu. Feuilles caulinaires généralement absentes, la tige étant très courte ou nulle, ou peu nombreuses et ressemblant alors à celles du collet. Pédoncule 1—20 mm, rarement plus long. Capitules solitaires ou en groupes de 2—4, densément serrés entre les feuilles, 15×8 mm, plus larges pendant l'anthèse et après la maturité. Nombre de fleurs ± 80 par capitule. Écaillés de l'involucre lâchement imbriquées, ± 27 , som-

met obtus et cilié; les externes 10, 5—10×2—3 mm; les intermédiaires 8, 12—15×2—3 mm; les internes 9, 12—14×2—3 mm. *Corolle* jaune, fleurs externes pourpres sur la face extérieure, 14—17 mm. *Ligule* 4—5 mm. *Tube de la corolle* 10—12 mm. *Anthères* 2 mm. *Akènes* $\pm 4 \times 1,35$ mm, brunâtres, étroitement elliptiques, comprimés, faiblement ridés, à 5 côtes sur chaque face, la médiane épaisse, marges étroites et assez épaisses. *Aigrette* 8—10 mm, persistante.

DISTRIBUTION. République Sud-Africaine et Lésoto.

Republique Sud-Africaine: Transvaal: Woodbush, Pietersburg Distr., HOFFMANN 9 (PRE!) — Lydenburg, WILMS 631 (E! G! K! L! M! P!) — Pretoria, 4200 ft, MOGG 14776 (PRE!); SCHLECHTER 3706 (PRE!); MOGG 15203 (PRE!) — Johannesburg, LEENDERTZ 6571 (PRE!) — Hakhoslaagte, Lichtenburg Distr., KINGES 1804 (M! PRE!) — Standerton, LEENDERTZ 11088 (PRE!) — Modderfontein, CONRATH 545 (K!) — Potchefstroom, GOOSSENS 1671 (PRE!) — Wakkerstroom, 6400—6800 ft, DEVENISH 714 (K!) — État Libre d'Orange: Clarence (Clarens), VAN HOEPEN 18179 (PRE!) — Grasveld bei Station Marseille, 122 km E Bloemfontein, 1760 m. HUBER-PESTALOZZI s.n. (ZT!) — Kroonstad, PONT 682 (PRE!) — Natal: Mt. Ngwibi, Vryheid Distr., HILLIARD et BURTT 5915 (E! NU!) — Mt. Kamberg, Estcourt Distr., HILLIARD et BURTT 5732 (E! NU!); Estcourt Research Station, 4000 ft, O. WEST 344 (M! PRE!) — Zululand, Melmoth, MEEBOLD 14036 (M!) — Zwartkop Location, Lions Riv. Distr., 4500 ft, MOLL 1121 (E! NU! PRE!) — Karkloof, Lions Riv. Distr., GORDON GRAY 6173 (NU!); Near Karkloof, 3000—4000 ft, WOOD 4454 (K!) — Balgowan, MOGG 5581 (P!) — Table Mt., New Hanover Distr., c. 3000 ft, HILLIARD 3985 (E! NU!).

Lésoto: Lérivé, DIETERLEN 34 (P!) — Maseru, 5500 ft, RUCH 2295 (PRE!).

CARACTÈRES ÉCOLOGIQUES ET BIOLOGIQUES. *Sonchus nanus* croît dans les pelouses à une altitude de 900—2200 m. Floraison et fructification principalement de juillet à novembre.

PARTICULARITÉS PALYNOLOGIQUES. Calotte polaire très massive, sans

aucune trace de "lacune polaire", et avec un grand nombre d'épines polaires.

Palynologiquement, cette espèce semble la plus proche du genre *Launaea*.

DISCUSSION. Les différences entre les écailles intermédiaires et les internes de l'involucre ne sont pas très nettes, ce qui rapproche *Sonchus nanus* du genre *Launaea*.

Nous considérons *S. nanus* l'espèce la plus primitive du sous-genre *Origosonchus*, donc de toutes les espèces du genre *Sonchus*. Il est très probable qu'elle représente une forme de liason intermédiaire entre les genres *Launaea* et *Sonchus*.

2. Genre *Embergeria* BOULOS

1. *Embergeria grandifolia*

(T. KIRK) BOULOS

BOULOS, in EICHLER, Suppl. Black's Fl. S. Australia 332, 1965. — Holotype: Chatham Islands, T. KIRK s.n. (BM!).

Sonchus grandifolius T. KIRK, in Trans. N. Zeal. Inst. 26: 266, 1894; T. KIRK, in J. Bot. 32: 184, 1894.

Plante vivace, succulente, en touffes denses, 60—150 cm de hauteur, à rhizome succulent et rampant, feuilles du collet coriaces, jusqu'à 60 cm de longueur et 10—18 cm de largeur. *Rhizome* succulent, rampant, jusqu'à 5 cm diam. *Collet* cylindrique, non ramifié. *Tige* herbacée, cylindrique, creuse, à cannelures étroites. *Feuilles du collet* en rosette, coriaces, glabres, 30—60×6—14 cm, à pétiole 10—25×0,7—2 cm; ovoïdes, pinnatifides à pinnatiséquées; lobes latéraux 2—3 paires, 4—8×3—7 cm, obovoïdes, $\pm$ oblongues ou triangulaires, entières ou faiblement séquées à marges irrégulièrement dentées et piquantes, sommet pointu. *Feuilles cauli-*

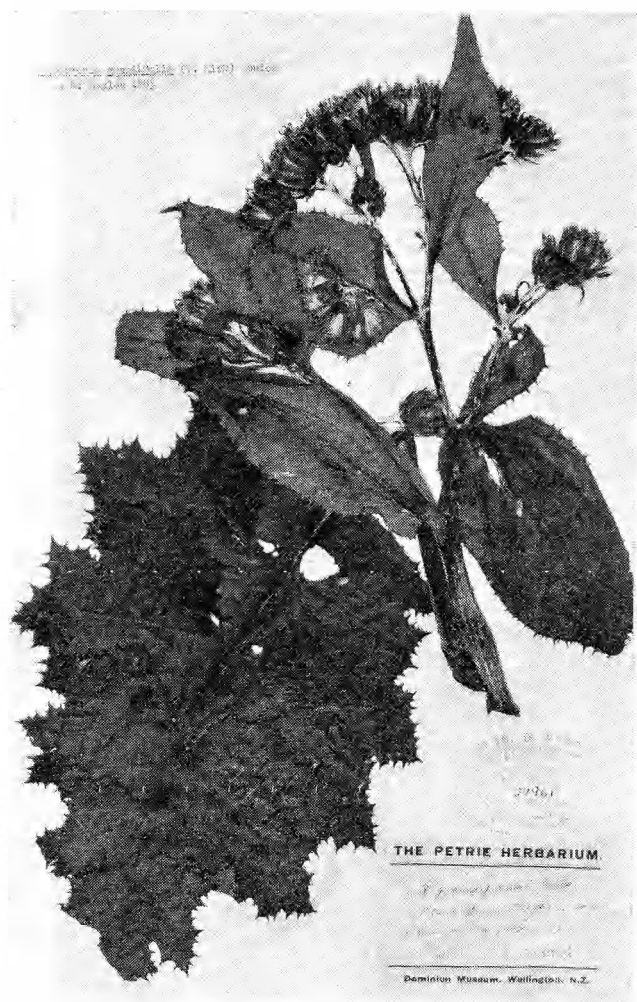


Fig. 18. *Embergeria grandifolia*. Photo: T. R. ULYATT (WELT).

naïres coriaces, glabres, à marges irrégulièrement dentées et piquantes; les inférieures $\pm 30 \times 12$ cm, pinnatifides à pinnatiséquées, à lobes $\pm$ triangulaires; les supérieures sessiles, entières, à marges dentées et piquantes. *Péduncule* 3—25 mm, densément blanc-tomenteux, à ± 3 bractées triangulaires. *Capitules* nombreux, $\pm 2 \times 2,5$ —4 cm lorsqu'ils sont ouverts. Nombre de fleurs ± 100 par capitule. *Écailles de l'involucre* ± 26 , à sommet obtus et cilié; les externes 10, 8 — 15×3 —6 mm, à base épaisse et nervure médiane pourvue de petites protubérances triangulaires et aplaties; les intermédiaires 8, 14 — 17×3 —5 mm; les internes 8, 13 — 17×3 —4 mm. *Corolle* 18—22 mm, d'après CHEESEMAN (1914): "The florets in the

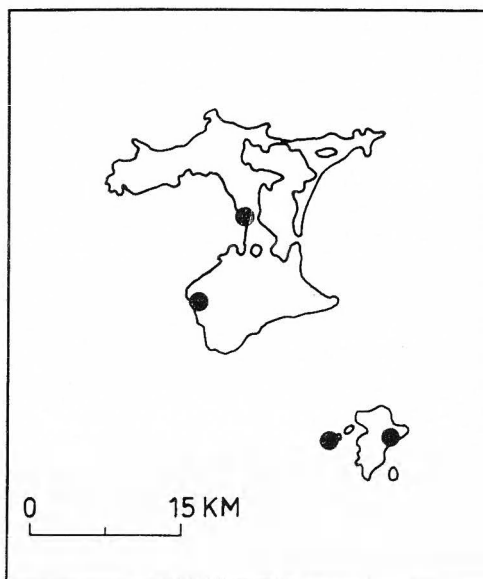


Fig. 19. *Embergeria grandifolia*. Distribution.

centre of the heads are pale yellow, but those towards the outside pale purple." *Ligule* 7—8 mm. *Tube de la corolle* 11—14 mm. *Anthères* 3 mm. *Akènes* 5—5,5 $\times$ 2,5—3 mm, crèmes-brunâtres à bruns-clairs, oblong-elliptiques, atténués davantage vers l'apex, lisses, à ailes larges et ± 5 côtes médianes sur chaque face; la partie externe (ovarienne) qui forme les deux ailes et qui renferme la graine est facile à détacher, 4×1 mm, oblancéolée, jaune-brunâtre et riche en huile. *Aigrette* 12—15 mm, persistante.

DISTRIBUTION. Îles de Chatham, Nouvelle Zélande; endémique.

Îles de Chatham: Little Mangere Island, TURBOTT s.n. (CHR!) — Pitt Island, HAMLIN 671 (UPS! WELT!) — Awatotara Creek mouth, Chatham Island, FINDLAY s.n. (CHR!) — Red Bluff, Chatham Island, OLIVER 9581 (WELT!) — s.loc., TRAVERS 1871 (CHR! K!); T. KIRK s.n. (Holotype BM!); T. KIRK s.n. (CHR!).

CARACTÈRES ÉCOLOGIQUES ET BIOLOGIQUES. D'après CHEESEMAN (1914), *Embergeria grandifolia* croît en souches sur les terrasses des rochers maritimes couvertes de sable. Il se trouve

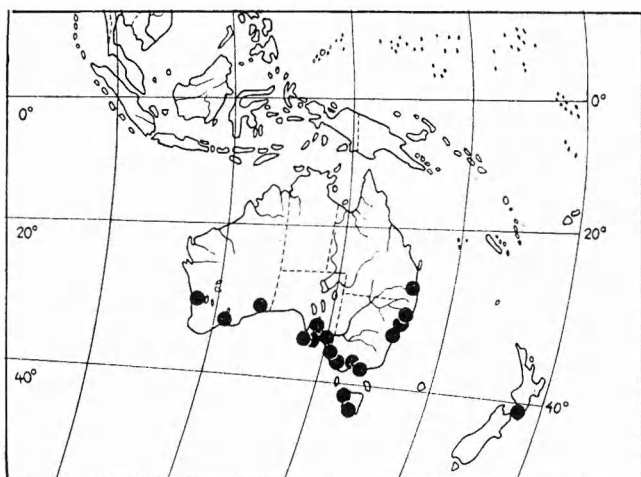


Fig. 20. *Embergeria megalocarpa*. Distribution.

mélangé avec *Apium australe*, *Samolus repens*, *Salicornia australis* et *Agropyrum coxii*. Floraison et fructification d'octobre à avril.

CARACTÈRES CARYOLOGIQUES. $2n = 36$ (STEBBINS et al. 1953).

PARTICULARITÉS PALYNOLOGIQUES. Palynologiquement *Embergeria grandifolia* ne ressemble à aucune autre espèce du genre *Sonchus* s.l.: dans l'exine, d'une épaisseur de $3,4 \mu$, on distingue une endexine relativement importante ($1,5 \mu$) et une ectexine d'épaisseur très régulière, et de structure très simple; les épines sont au contraire très importantes, d'une hauteur de $7,2 \mu$; enfin on peut seulement distinguer 6 petites lacunes abporales.

Le pollen semble se rapprocher du type *Catananche lutea* (WODEHOUSE 1959 p. 464, fig. 114 et Pl. XI, 3).

DISCUSSION. *Embergeria grandifolia*, l'espèce type du genre, représente le sous-genre monotypique *Embergeria*.

C'est une plante très caractéristique, distinguée par ses parties végétatives et sa forme très particulière. La plante croît en touffes denses, à feuilles coriaces et longues (jusqu'à 60 cm). Le rhizome succulent et rampant mesure jusqu'à 5 cm diam. Les feuilles du collet possèdent des pétio-

les longs (10—25 cm). Les feuilles caulinaires supérieures sont sessiles et larges. Les pédoncules et les bases des capitules sont couverts par un tomentum dense et blanc. Les fleurs mesurent 18—22 mm de longueur. Les grains du pollen présentent un type différent de celui de toutes les espèces du genre *Sonchus* (voir les particularités palynologiques).

2. *Embergeria megalocarpa*

(HOOK. FIL.) BOULOS

BOULOS, in EICHLER, Suppl. Black's Fl. S. Australia 333, 1965. — Lectotype: Tasmania, HOOKER FIL. s.n. (K!).

Sonchus asper (L.) HILL 1769, var. β *megalocarpus* HOOK. FIL., Fl. Tasm. 1: 227, 1856.

S. megalocarpus (HOOK. FIL.) BLACK, Fl. S. Australia 661, 1929.

NOM VERNACULAIRE. *En anglais*: Dune Thistle.

Plante vivace, 15—70 cm de hauteur, à rhizome rampant, feuilles coriaces, capitules volumineux. Rhizome ligneux, 3—15 mm diam. portant des racines fibreuses, 0,1—2 mm diam. Collet ligneux, 3—12 mm diam., rarement ramifié. Tige ligneuse et pleine à la base, autrement herbacée et creuse, peu ou non ramifiée, glabre, 3—15 mm diam., à cannelures étroites. Feuilles du collet 5—10 × 1,5—3,5 cm, coriaces, glabres, oblongues-elliptiques à oblongues-oblancoélées, entières à légèrement séquées, marges dentées, piquantes, sommet pointu. Feuilles caulinaires coriaces, glabres 8—25 × 2—7 cm, plus courtes au-dessous de l'inflorescence, polymorphes: oblongues-elliptiques, elliptiques, oblongues-lancéolées, étroitement lancéolées ou triangulaires; pinnatifides à pennipartites; base engainante, à oreillettes arrondies; lobes triangulaires à ovoïdes, parfois fléchi vers la base, marges dentées, piquantes, sommet aigu; nervure médiane 3 mm diam. à la base. Pédoncule 1—10 × 0,1—0,3 cm, la partie la plus large au-dessous du capitule, glabre, à 1—5 bractées triangulaires, 2—20 mm, aigues ou acumi-

nées. *Capitules* 1—2×2—5 cm, lorsqu'ils sont ouverts. Nombre de fleurs 80—220 par capitule. *Écailles de l'involucre* ± 36, à sommet obtus et cilié; les externes 13, 5—12×2,5—5,5 mm; les intermédiaires 11, 13—18×3—4 mm; les internes 12, 13—16×2—3,5 mm. *Corolle* jaune, 17—19 mm. *Ligule* 7—8 mm. *Tube de la corolle* 10—11 mm. *Anthères* 3 mm. *Akènes* 5—7×2—3 mm, crèmes-jaunâtres, moins fréquemment brunâtres, elliptiques, lisses, à ailes larges et ± 3 côtes médianes sur chaque face; la partie externe (ovarienne) qui forme les deux ailes et qui renferme la graine est facile à détacher, 4×1 mm, oblancéolée, ardoise ou brunâtre et riche en huile. *Aigrette* ± 10 mm, persistante.

DISTRIBUTION. Australie, Tasmanie et Nouvelle Zélande.

Australie: Australie Occidentale: Condingup, near Esperance, DANIELL s.n. (K!) — Swan Riv. to Cape Riche, DRUMMOND 368 (BM! CGE! K! P!) — Australie Méridionale: Near Beachport, between SW margin of Lake George and the sea, WILSON 1158 (K!) — Red Banks, ADCOCK s.n. (AD!) — Adelaide, ISING s.n. (AD!); HILTON 18720 (ADW!) — Wilson's Bluff, TATE s.n. (AD!) — Glenely, BLACK s.n. (K!); EARDLEY 2185 (ADW!) — Port Elliot, CLELAND s.n. (AD!) — Encounter Bay, CLELAND s.n. (AD!) — Beachport, BLACK 6 (K!); ISING s.n. (AD!) — Goolwa Barrage, CLELAND s.n. (AD!); SYMON 11325 (ADW!); HILTON 978 (ADW!) — Rivilo Bay, CLELAND s.n. (AD! K!) — Bevilacqua Ford, CLELAND s.n. (AD!) — Sandhills, between Victor Harbour and Port Elliot, CLELAND s.n. (AD!) — Cape Banks, CLELAND s.n. (AD!) — Younghusband Peninsula, CLELAND s.n. (AD!) — Victoria: Portland, ROBERTSON 42 (K!) — Wilsons Promontory, MEEBOLD 2409 (M!) — Bridgewater Bay, MELVILLE 1498 (K!) — Sorrento, Mornington Peninsula, WILLIS s.n. (K!) — Nouvelle Galles du Sud (New South Wales): Sydney, MOORE s.n. (K!); LLOTSKY s.n. (CGE!) — Port Macquaire, GUNN s.n. (K!) — Bush Island, RODWAY 2292 (K!) — South Head and Botany Bay, BROWN 2220 (BM!) — Wollomboola Lake, RODWAY 403 (K!) — Riv. Shoalhaven mouth, RODWAY 2162 (K!) — Bowen Island, RODWAY 1372 (K!) — Tabourie Island, RODWAY 3056 b (P!) — Newcastle, CUNNINGHAM s.n. (K!) — Windang Island,

RODWAY 2695 (K!) — QUEENSLAND: Noosa Heads, LONGMAN s.n. (K!) — Traser Island, HUBBARD 4449 (K!) — Ile Kangaroo: Cliffs mouth of South West Riv., CLELAND s.n. (AD! K!) — Limestone Riv., CLELAND s.n. (AD! K!) — Limestone cliffs South West Riv., CLELAND s.n. (AD!) — Vivonne Bay, CLELAND s.n. (AD!) — Pennington Bay, SYMON 10560 (ADW!).

Tasmanie: Cape Bay, COMBER 2281 (K!) — S Pieman Riv., COMBER 2132 (K!) — s. loc., GUNN 845 (CGE! K! P!); HOOKER FIL. s.n. (K! P!); ARCHER s.n. (P!).

Nouvelle Zélande: Cape Terawhiti, KIRK 1402 (K!).

CARACTÈRES ÉCOLOGIQUES ET BIOLOGIQUES. *Embergeria megalocarpa* croît principalement dans les sables maritimes. La floraison et la fructification ont lieu toute l'année, mai principalement de novembre à mars.

CARACTÈRES CARYOLOGIQUES. $2n = 36$ (ROUX et BOULOS 1972).

PARTICULARITÉS PALYNOLOGIQUES. La calotte polaire est extrêmement réduite du fait du développement des lacune paraporaes et abporales comme c'est le cas chez le groupe de *Sonchus asper*; cependant, à la différence de ces dernières, on trouve un nombre d'épines polaires beaucoup plus variable (de 0 à 7).

DISCUSSION. *Embergeria megalocarpa* représente le sous-genre monotypique *Megalocarpace*. Certains caractères morphologiques et palynologiques de cette espèce sont assez voisins de ceux des espèces de la section *Asperi*, c'est ce qui nous a amené à penser que le genre *Embergeria* dérive du genre *Sonchus*, et très probablement de la section *Asperi*.

En outre, il est facile de distinguer *Embergeria megalocarpa* des autres espèces du genre *Sonchus* grâce à son aspect très particulier et ses akènes lisses, 5—7×2—3 mm.



Fig. 21. *Babcockia platylepis*.
BOURGEAU 396 (BM!).

3. Genre *Babcockia* BOULOS

1. *Babcockia platylepis* (WEBB) BOULOS

BOULOS, in Bull. Jard. Bot. État Bruxelles 35: 64, 1965. — Lectotype: Vueltas de Taydia Cumbre, BOURGEAU 396 (Lectotype G!); isolectotypes CGE! FI! G! K! W!.

Sonchus platylepis WEBB, in WEBB et BERTH. Hist. Nat. Iles Canar. 3(2): 433, t. 131, 1849—1850.

NOM VERNACULAIRE. *En espagnol*: Cer-rájón.

Plante vivace, 30—80 cm de hauteur, à tige ligneuse, peu ou non ramifiée, capitules peu nombreux, volumineux, pédoncule jusqu'à 18 cm, pourvu des bractées jusqu'à 3 cm. *Racine* pivotante, 30—70 × 1—3 cm, renflée dans la partie supérieure, souvent nue à cause de l'érosion, contre laquelle elle est très résistante. *Collet* ligneux, peu ou non ramifié, 2—5 cm

Bot. Notiser, vol. 127, 1974

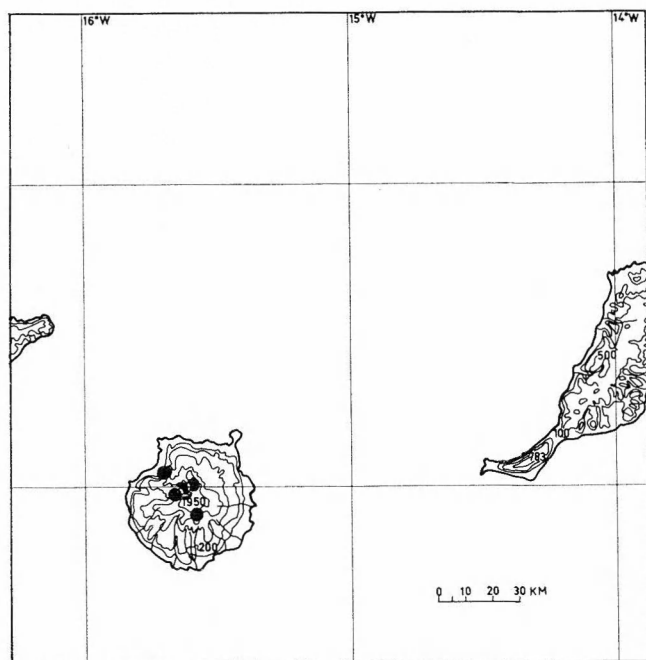


Fig. 22. *Babcockia platylepis*. Distribution.

diam. *Tige* ligneuse, pleine, brunâtre, 5—15 × 1—3 cm, portant les bases des feuilles après leur chute; tiges florifères 10—50 cm, lisses et creuses. *Feuilles du collet* 4—12 × 2—5 cm, les juvéniles couvertes d'un tomentum blanc et facile à détacher; ovales ou elliptiques, pennipartites; lobes ± triangulaires, aigus, irrégulièrement dentés; nervure médiane 2,5 mm diam. *Feuilles caulinaires* groupées à la base des tiges florifères, ± elliptiques, 10—30 × 2—8 cm, la partie la plus large étant au milieu; pinnatifides à pennipartites; lobes triangulaires, à marges entières, rarement dentées, sommet acuminé, lobe terminal nettement plus long que les latéraux; feuilles s'épaçant vers le sommet où elles diminuent de taille et sont moins séchées; feuilles à la base de l'inflorescence entières, ± triangulaires, pourvues d'un tomentum blanc et dense. *Pédoncule* 4—18 × 0,2—0,5 cm, la partie la plus large au-dessous du capitule, à 5—15 bractées distribuées le long du pédoncule, mais plus densément disposées dans la partie supérieure, 0,5—3 cm, ± triangulaires, acuminées ou aigues. *Capitules* 2,5—3 × 3—6 cm lorsqu'ils sont ouverts. Nombre de fleurs ± 550 par ca-

pitule. *Écailles de l'involucre* ± 98 ; les externes 21, légèrement ondulées, denticulées, $8-18 \times 6-9$ mm; les intermédiaires ± 47 , de deux catégories: les inférieures $18, 16-22 \times 4,5-8$ mm, les supérieures $28, 22-25 \times 3-4$ mm; les internes 30, $18-23 \times 1,5-3$ mm. *Corolle* jaune-orangée, $20-28$ mm. *Ligule* $11,5-15 \times 2,5$ mm. *Tube de la corolle* $8,5-13$ mm. *Anthères* 5 mm. *Akènes* $\pm 5,5 \times 1$ mm, légèrement atténués aux deux extrémités, souvent légèrement courbés, $\pm$ oblongs ou étroitement elliptiques, très faiblement comprimés, donc $\pm$ cylindriques, à ± 4 cannelures, côtes absentes. Les akènes d'un même capitule sont nettement dimorphes: les externes brunâtres, rugueux; les internes crèmes-jaunâtres, lisses. *Aigrette* $9-12$ mm, la majorité étant caduque. $9-12$ mm; la minorité persistante, ± 4 mm, minces et cotonneuses.

DISTRIBUTION. Gran Canaria, Îles Canaries; endémique.

Gran Canaria: Cruz Tejada, c. 1800 m, ASPLUND 1405 (G!); BOULOS s.n. (B! BM! CAI! G! MPU!) — Bco Tejada, 880 m, LID s.n. (O!) — La Culata, 2 km S Cruz Tejada, 1650 m, LID s.n. (O!) — Timagán, S Tejada, 1340 m, SUNDING (O!) — Caldera de Tejada, 1000—1300 m, BURCHARD 298 (O! ZT!) — Entre Cruz Tejada et Las Lagunetas, BOULOS s.n. (B! BR! CAI! K! LD! O! P!) — Las Lagunetas, 1450 m, LID s.n. (O!); ASPLUND 1406 (S! UPS!); BOULOS s.n. (CAI!) — c. 1 km NW Casa Forestal, Tamadaba, 1200 m, SUNDING s.n. (O!) — Entre Ufica et San Isidro, (Photo, BOULOS!) — Bco San Bartolomé, 960 m, LID s.n. (O!) — Vueltas de Taydia Cumbre, BOURGEOU 396 (Lectotype G!, isoelectotypes CGE! G! K! W!) — Cumbre, 1700 m, BORNMÜLLER 899 (P!), BORNMÜLLER 900 (B!) — ?Tunte, 900—1000 m, BURCHARD 351 (CGE! G!) — Hautes montagnes, s. loc., DESPRÉAUX s.n. (G!).

CARACTÈRES ÉCOLOGIQUES ET BIOLOGIQUES. *Babcockia platylepis* croît à une altitude de 800—1800 m; c'est une espèce de montagne assez abondante au centre de l'île de Gran Canaria, sur les rochers aux pentes érodées; moins fréquente dans des stations non rocheuses. Souvent on rencontre cette espèce avec *Aeonium caespitosum* (CHR. SM) WEBB et

BERTH. Floraison et fructification principalement d'avril à juin.

CARACTÈRES CARYOLOGIQUES. $n=9$ (LARSEN 1960); $2n=18$ (ROUX et BOULOS in BOULOS 1965).

PARTICULARITÉS PALYNOLOGIQUES. Pollen remarquable par l'épaisseur des crêtes ($5-6,5 \mu$, souvent 6μ), et par le fait que, malgré la présence de "lacunes polaires" (type d'épaississement polaire 2—3), on trouve un grand nombre d'épines polaires (environ 20).

DISCUSSION. *Babcockia platylepis* se distingue par les caractères suivants, qui n'existent chez aucune espèce du genre *Sonchus*.

1. La longueur extraordinaire du pédoncule (jusqu'à 18 cm).
2. La présence d'un grand nombre de bractées (jusqu'à 15) sur le pédoncule, ces bractées sont longues et acuminées.
3. Le nombre très élevé d'écailles d'involucre (± 98), différencient en quatre catégories.
4. Le nombre élevé des fleurs par capitule (± 550).
5. La forme des akènes (non comprimés, $\pm$ cylindrique) et l'absence des côtes.
6. La morphologie des graines de pollen présente des différences importantes avec toutes les espèces du genre *Sonchus*.

4. Genre *Taeckholmia* BOULOS

1. *Taeckholmia pinnata*

(L. FIL.) BOULOS

BOULOS, in Bot. Not. 120: 99, fig. 1, 1967. — Type: non vide.

Prenanthes pinnata L. FIL. 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. Sci. Nat. 43: 281, 1826.

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

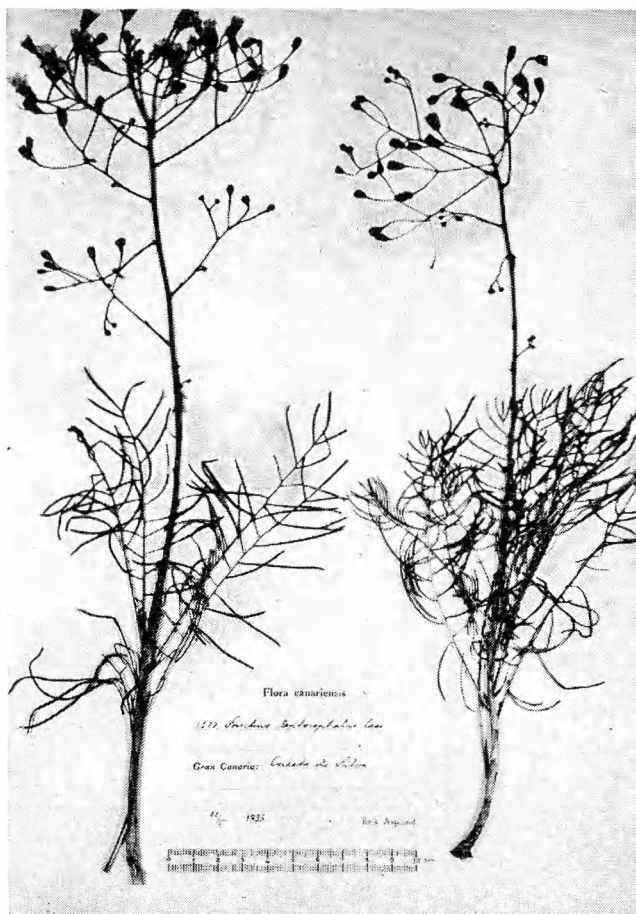


Fig. 23. *Taeckholmia pinnata*.
ASPLUND 1377 (S!).

Plante vivace, ligneuse, 0,5—1,2 m de hauteur, ramifiée; vieilles plantes à rameaux denses et enchevêtrés, nus vers la base et feuillés vers le sommet. Collet ligneux, court, ramifié chez les vieilles plantes. Tige 3—15 mm diam., brun-foncé ou gris-foncé vers le sommet, crème-jaunâtre ou blanchâtre vers la base, cylindrique; ramifications basales ligneuses et pleines, à traces de feuilles plus denses vers les noeuds, jeunes tiges ramifiées, lisses. Feuilles du collet plus courtes et moins développées que les caulinaires, présentes chez les jeunes sujets seulement. Feuilles caulinaires en touffes denses au sommet des tiges végétatives et à la base des tiges florifères, quelquefois très denses simulant ainsi une couronne de palmier et laissant les tiges nues à la base, 7—20 cm, glabres, pinnatiséquées; lobes 6—12 paires, alternes ou opposés, 10—60×0,5—1 mm (lobe

Bot. Notiser, vol. 127, 1974

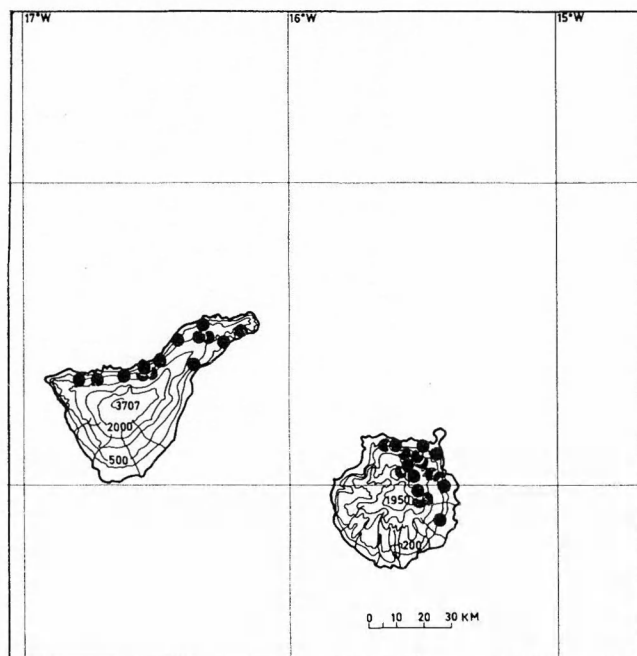


Fig. 24. *Taeckholmia pinnata*. Distribution.

terminal plus long), linéaires, sommet aigu, nervure médiane proéminente; pétiole à base triangulaire, non auriculée. Pédoncule 3—28×0,5 mm, plus large vers le capitule, à 2—4 petites bractées. Capitules 5—7×2—3 mm lorsqu'ils sont fermés, les ouverts 12 mm diam. Nombre de fleurs 13—19 par capitule. Écailles de l'involucre 12—14, à sommet cilié; les externes 3—5, 1,5—2,5×1 mm; les internes 8—9, 6,5—8×1 mm. Corolle jaune d'or, 7,5—9 mm. Ligule 5—5,5×1—1,5 mm. Tube de la corolle 2,2—2,5 mm. Anthères 3 mm. Akènes 1,85—2,25×0,5—0,65 mm, jaunes-brunâtres à bruns, linéaires-elliptiques, comprimés, à 3—4 stries principales tuberculées et ± 5 stries secondaires sur chaque face. Aigrette 3,5—3,75 mm, caduque.

DISTRIBUTION. Tenerife et Gran Canaria, Îles Canaries; endémique.

Tenerife: Hoya Meleque, DAHLSTEDT s.n. (UPS!) — W Icod, RØSTAD s.n. (O!) — Orotava, Bco del Pino, BOURGEAU 560 (BM! C! CGE! K! W!) — Orotava, 450 m, BURCHARD 59 (CGE! G! S!); RODRIGUEZ s.n. (BC! MA!) — Près Orotava, MASFERRER s.n. (BC!) — Puerto Orotava, MURRAY s.n. (BM!) — Puerto Orotava, près Hôtel Taoro, SPRAGUE et HUTCHINSON 118 (K!) — Puerto Orotava, BUR-

CHARD 100 (O!); BØRGESSEN 134 (C!) — c. 10 km S Orotava, BOULOS s.n. (CAI!) — Tacoronte, ASPLUND 1155 (G! S! UPS!) — Bajamar, 100 m, BORNMÜLLER 2547 (G! P! W!) — Tegueste, c. 400 m, BORNMÜLLER 2548 (LD! G! P! W!); LID s.n. (O!); BOULOS s.n. (B! BM! BR! CAI! G! K! LD! MPU! O!) — Bco Guadio, 380 m, Tegueste, LID s.n. (O!) — Bco Pedro Alvares, 570 m, LID s.n. (O!) — Igueste de Candelaria, Bco Martin, 480 m, LID s.n. (O!) — Santa Ursula, WAHLSTRÖM s.n. (S!) — Près Santa Ursula La Quinta, WAHLSTRÖM s.n. (S!) — Santa Ursula Quinta Roja, 230 m, LID s.n. (O!) — La Mesa, 580 m, N Santa Cruz, LID s.n. (O!) — San Andrés, 20 m, LID s.n. (O!) — Cortadura, 300 m, PITARD s.n. (P!) — Los Silos, BOURGEAU 874 (BM! K!); BOURGEAU s.n. (MA! G! K! W!) — Région infér. mérid., PARRANDIÈRE s.n. (G!) — s. loc., BOURGEAU s.n. (MPU!); CARTER s.n. (CGE!); VENTENANT s.n. (G!); DESPARÉAUX 152 (G!); DESPARÉAUX s.n. (CGE!); CAVANILLES s.n. (MA!).

Gran Canaria: Bco de Tenoya, SOBRADO s.n. (MA!) — Telde, KUNTZE s.n. (K!) — 2 km N Telde, LID s.n. (O!) — Cuesta de Silva, ASPLUND 1377 (S!) — Valsequillo, BOULOS s.n. (B! CAI! S!) — Entre Valsequillo et Tenteniguada, BOULOS s.n. (CAI!) — San Mateo, MURRAY s.n. (C!); SOBRADO s.n. (BC! MA!); BOULOS s.n. (BM! CAI! MPU! O! P!) — Entre San Mateo et Tenteniguada, BOULOS s.n. (B! CAI! K!) — Santa Birgida, BOULOS s.n. (CAI!) — Entre Utiaca et San Isidro, BOULOS s.n. (CAI!) — Valleseco, BOULOS s.n. (CAI!) — Teror, 600 m, LID s.n. (O!); BOULOS s.n. (B! BM! CAI! G! K!) — 1 km S Arucas, sur la route de Teror, BOULOS s.n. (CAI!) — Firgas, BØRGESSEN 764 (C!) — Entre Guia et El Pagador, BOULOS s.n. (CAI!) — Tafira, BOULOS s.n. (CAI! G!) — Caldera de Bandama, near Tafira, 500 m, LEMS 2128 (L!) — Monte Coello, BOULOS s.n. (B! BM! CAI! G! K! MPU!) — Las Palmas, THRETHEWY s.n. (BM!) — Bco Guiniguada, just W Tafira Alta, SUNDING s.n. (O!); Bco Guiniguada, GELERT s.n. (C!); Bco Guiniguada, près Hôtel Santa Birgida, BØRGESSEN 737 (C!) — Bco Guayadique, 450 m, LID s.n. (O!) — Bco Bavadero, 50 m, LID s.n. (O!) — Mt. San Gregorio, 385 m, LID s.n. (O!) — Bco Moya, 180 m, KUNKEL 14643 (S!).

CARACTÈRES ÉCOLOGIQUES ET BIOLOGIQUES. *Taeckholmia pinnata* est une espèce assez commune au bord des champs cultivés, sur les murs, et sur les pentes des collines, entre 0 et 600 m d'altitude. Floraison et fructification principalement de mars à novembre.

CARACTÈRES CARYOLOGIQUES. $n=9$, $2n=18$ (ROUX et BOULOS in BOULOS 1967).

PARTICULARITÉS PALYNOLOGIQUES. Pollen très hétéromorphe; taille, épaissement polaire et nombre d'épines polaires très variables.

DISCUSSION. *Taeckholmia pinnata* est une espèce polymorphe, commune dans les îles de Tenerife et Gran Canaria, îles Canaries.

La morphologie de cette espèce, ainsi que celle des espèces voisines est différente de *Sonchus*. Le nombre de fleurs par capitule (13—19), est beaucoup plus faible que chez les *Sonchus* (minimum de 36—48 par capitule chez *S. palmensis*). Les tiges et les feuilles sont différentes de celles chez *Sonchus*.

D'après LINDINGER (1926), cette espèce se trouve aux îles de Gran Canaria, Tenerife, Fuerteventura, Lanzarote et Hierro. Nous doutons de sa présence dans les trois dernières îles.

2. *Taeckholmia capillaris* (SVENT.) BOULOS

BOULOS, in Bot. Not. 120: 100, fig. 2, 1967. — Isotype: Tenerife, in anfractu vulgo dicto "Barranco de Tejina", 600 m. Inter rupes apricas et siccas, SVENTENIUS s.n. (CAI!).
Sonchus capillaris SVENT. Addit. Fl. Canar. 1: 85, t. 35, 1960.

Plante vivace, 1—2 m de hauteur, ramifiée; vieilles ramifications rugueuses, à écorce grisâtre vers la base et jaunâtre vers le sommet; feuilles en groupes denses. Collet ligneux, épais. Tige: ramifications vieilles basales ligneuses, solides, pleines, grisâtres, devenant crèmes-jaunâtres vers le sommet, à une écorce ornée des traces de feuilles triangulaires, brunâtres et proéminentes; traces des feuilles largement écartées sur les entrenœuds et deviennent denses sur les noeuds; entrenœuds longs, bien développés, d'où la grande taille de la plante; jeunes rameaux feuillés, 10—20×

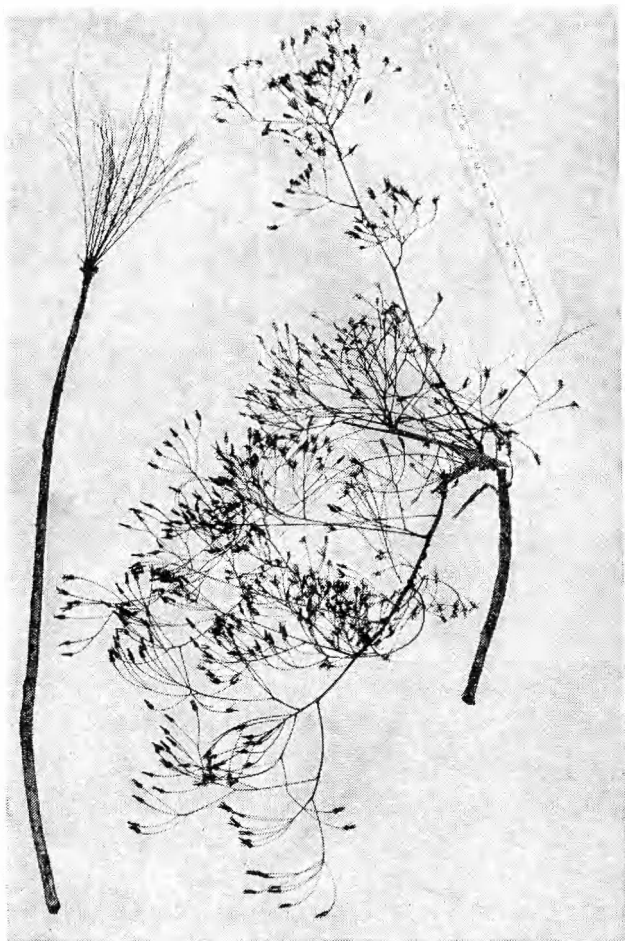


Fig. 25. *Taeckholmia capillaris*. Isotype, SVENTENIUS s.n. (CAI!).

1—2 mm, cylindriques, pleins, rigides, glabres sauf à la base, où ils sont légèrement tomenteux, brunâtres, faiblement cortifères. Feuilles caulinaires forment des touffes denses au sommet des vieilles tiges, moins denses à la base de ramifications florifères; feuilles au sommet des rameaux végétatifs pinnatiséquées, non auriculées, 8—20×4—16 cm, à 5—9 paires de lobes alternés, 2—8×0,2 mm, linéaires, filiformes, aigus; nervure médiane proéminente, 0,6—0,8 mm diam., atténuée vers le sommet. Feuilles à la base des rameaux florifères moins longues, à un petit nombre de lobes courts, devenant de plus en plus petites vers le sommet, où elle sont réduites à petites bractées axillant les branches de l'inflorescence. Pédoncule 3—30×±0,4 mm, plus large au-dessous du capitule, courbé après l'anthèse, rigide, à 2—4 brac-

Bot. Notiser, vol. 127, 1974

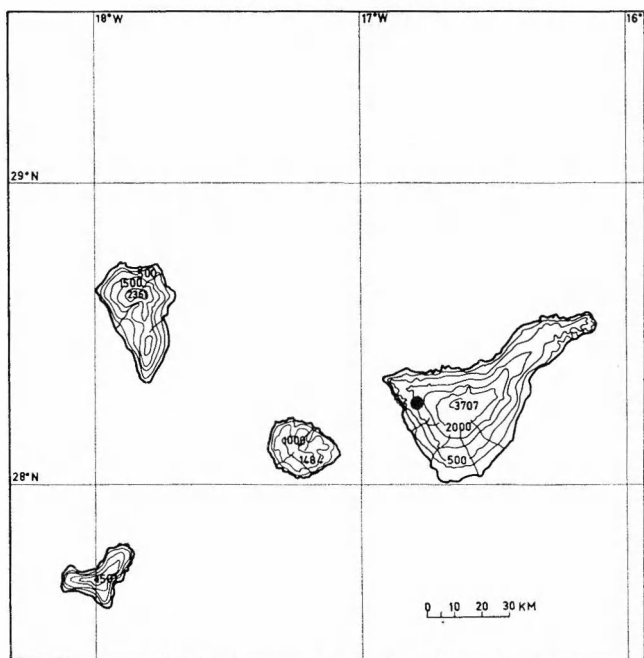


Fig. 26. *Taeckholmia capillaris*. Distribution.

tées. Capitules nombreux, 3×2 mm lorsqu'ils sont fermés, 7×7—9 mm lorsqu'ils sont ouverts, devenant moins larges après l'anthèse. Nombre de fleurs 12—15 par capitule. Écailles de l'involucre non imbriquées, 13—15; les externes 4—5, 1—2,5×1 mm, triangulaires, épaisses à la base et devenant rigides après la maturité des capitules; les internes 9—10, 5—6×1 mm, linéaires-lancéolées, à sommet obtus et cilié. Corolle jaune, 6,5 mm. Ligule 5×1,25 mm. Tube de la corolle 1,5—2 mm. Anthères 2,75—3 mm. Akènes 2—2,2×0,6—0,7 mm, linéaires-elliptiques, à 3—5 nervures principales, fortement rugueux vers les deux extrémités et légèrement rugueux au milieu. Aigrette 3 mm, caduque.

DISTRIBUTION. Tenerife, Îles Canaries; endémique.

Tenerife: Bco de Tejina, 600 m, Masca, SVENTENIUS s.n. (Isotype, CAI!).

CARACTÈRES ÉCOLOGIQUES ET BIOLOGIQUES. *Taeckholmia capillaris* est une espèce xérophile, sans feuilles pendant la majeure partie de l'année, croissant dans les milieux chauds et rocheux au

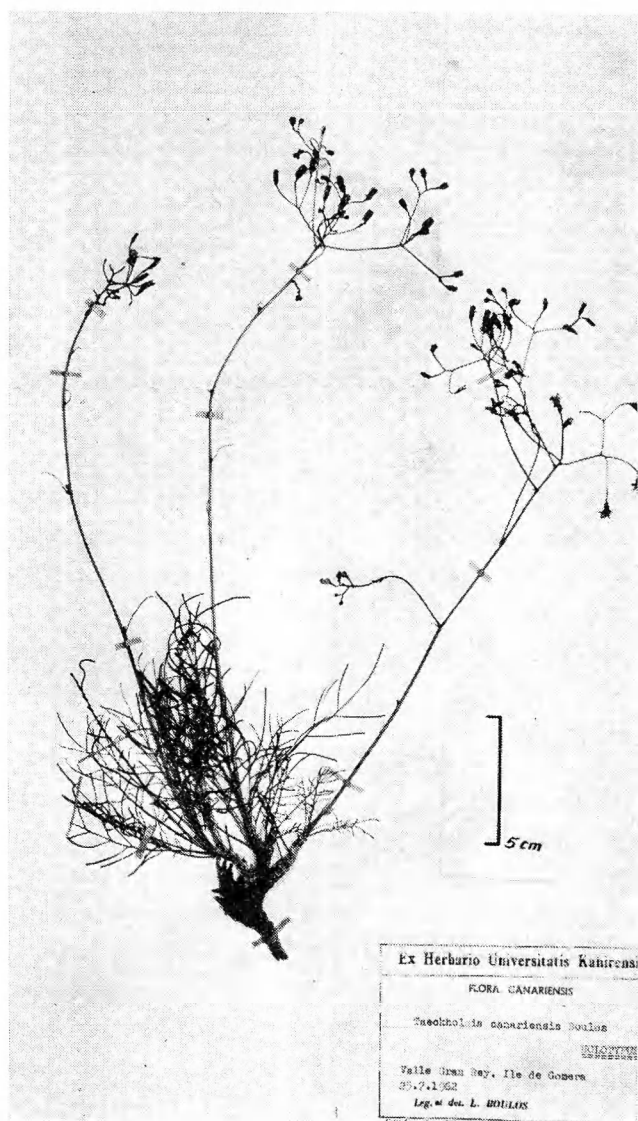


Fig. 27. *Taeckholmia canariensis*. Holotype, BOULOS s.n. (CAI!).

sud de l'île de Tenerife. Floraison et fructification de septembre à novembre.

DISCUSSION. *Taeckholmia capillaris* est l'espèce la plus voisine de *T. canariensis*, mais elle s'en distingue par sa grande taille (1—2 m), sa ramification inflorescentielle dense, richement divisée avec de nombreux capitules. Les pédoncules atteignant pour la plupart des capitules 1,5—2,5 cm, courbés après l'anthèse; ainsi que par son écorce crème-jaunâtre ou grisâtre.

3. *Taeckholmia canariensis* BOULOS

BOULOS, in Bot. Not. 120: 100, fig. 3, 1967. — Holotype: Valle Gran Rey, île de Gomera,

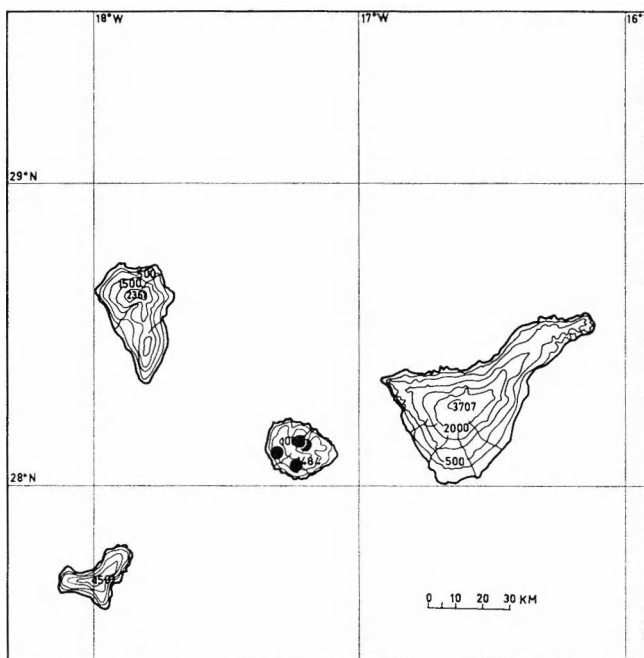


Fig. 28. *Taeckholmia canariensis*. Distribution.

BOULOS s.n. (CAI!); isotypes (B! G!).

Sonchus filifolius SVENT. Addit. Fl. Canar. 1: 83, t. 34, 1960; nom. illegit.

NOM VERNACULAIRE. En espagnol: Babillo.

Plante vivace, ligneuse, 0,5—1 m de hauteur, ramifiée principalement à la base; vieilles tiges denses, enchevêtrées, pleines, à écorce noirâtre et rugueuse, portant des cicatrices foliaires proéminentes; jeunes tiges cylindriques, tendres, feuillés à la base et terminés par inflorescences lâches. Collet, ligneux, épais. Tige: ramifications vieilles de la base, ligneuses, robustes, pleines, grisâtres à noirâtres, rugueuses, à traces des feuilles denses, entrenœuds courts, d'où le nanisme de la plante; jeune tiges fragiles à l'état sec, brunâtres, 20—30 cm. Feuilles caulinaires formant des touffes denses, principalement au sommet des vieilles tiges et à la base des jeunes, elles deviennent plus petites vers l'inflorescence; feuilles juvéniles blanches-tomenteuses; feuilles du sommet des vieilles tiges bien développées, 10—15×4—6 cm, glabres sauf à la base, pinnatiséquées; lobes 6—12 paires, linéaires, ± opposés, aigus, 20—30×0,5—1 mm; base triangulaire, non auriculée, légèrement blanche-tomenteuse;

feuilles de la base de des jeunes tiges plus petites, moins nombreuses, $3-5 \times 0,6-2$ cm; lobes 5—8 paires, $\pm$ opposés, $3-10 \times 0,1-0,25$ mm, filiformes, aiguës; ces feuilles deviennent plus petites vers le sommet de la tige où elles sont réduites à petites bractées axillant les rameaux de l'inflorescence. *Pédoncule* 0,4—2 cm, à 2—4 bractées. *Capitules* $4-5 \times 2-2,5$ mm lorsqu'ils sont fermés, $5-7 \times 8$ mm lorsqu'ils sont ouverts. Nombre de fleurs 12—16 par capitule. *Écailles de l'involucre* non imbriquées, 10—13; les externes 3—5, $1-2,5 \times 0,5$ mm, acuminées; les internes 7—8, $5-6 \times 1$ mm, à sommet obtus et cilié. *Corolle* jaune, 7 mm. *Ligule* $4,5-5 \times 1-1,5$ mm. *Tube de la corolle* 2—2,5 mm. *Anthères* 2,5—2,8 mm. *Akènes* $2-2,5 \times 0,5$ mm, brunâtres, comprimés, souvent courbés, à 3—5 nervures principales sur chaque face, rugueux transversalement; pourvus au sommet d'un disque blanc à protubérance centrale. *Aigrette* 2,5—3 mm, caduque.

DISTRIBUTION. Gomera, Îles Canaries; endémique.

Gomera: Valle Gran Rey, BOULOS s.n. (Holotype CAI!, isotypes B! G!); Valle Gran Rey, près de Roque de Guada, 600 m, SVENTENIUS 1959 (CAI!) — 9 km W San Sebastian, BOULOS s.n. (CAI!) — Près d'Alajeró, BOULOS s.n. (BM! CAI! G! O!) — Agua Jilvá, BOULOS s.n. (CAI!) — Marandon, 600 m, SVENTENIUS (in litt.). — Argaga, 150 m, SVENTENIUS (in litt.).

CARACTÈRES ÉCOLOGIQUES ET BIOLOGIQUES. *Taeckholmia canariensis* est une plante abondante dans la région du Sud, Sud Ouest et Nord Est de l'île de Gomera, dans les milieux rocheux jusqu'à 1000 m d'altitude et sur les falaises près de l'océan. Floraison de juillet à octobre et fructification de juillet à novembre.

PARTICULARITÉS PALYNOLOGIQUES. Bases des épines très évasées, et absence de mucrons bien individualisés.

DISCUSSION. *Taeckholmia canariensis* est une espèce voisine de *T. capillaris*; voir la discussion sous *T. capillaris*.

Bot. Notiser, vol. 127, 1974

4. *Taeckholmia microcarpa* BOULOS

BOULOS, in Bot. Not. 120: 102, fig. 4, 1967. — Holotype: Güimar, Tenerife, BOULOS s.n. (CAI!), isotypes B! BM! BR! G! K! LD! MPU! O! P! S!.

NOM VERNACULAIRE. En espagnol: Bailló.

Plante vivace, ligneuse, 0,5—1 m de hauteur, ramifiée à la base, capitules petits et nombreux. *Collet* ligneux, épais. *Tige* ligneuse, pleine, 2—15 mm diam., jaune-brunâtre à brunâtre, longitudinalement rugueuse, à traces des feuilles proéminentes et triangulaires. *Feuilles caulinaires* formant des touffes sur les sommets des tiges végétatives et sur les bases des ramifications florifères, $8-20 \times 4-16$ cm, pinnatiséquées; lobes 3—6 paires, irrégulièrement disposés, très espacés, capilliformes, $20-80 \times 0,2-0,4$ mm, lobe terminal plus long; base non auriculée. Feuilles des ramifications florifères moins développées et devenant de moins et moins longues vers le sommet. *Pédoncule* $3-15 \times 0,3$ mm, plus large au-dessous du capitule, à 2—4 bractées. *Capitules* nombreux, $4 \times 1,2$ mm lorsqu'ils sont fermés, atteignant 6×4 mm pendant l'anthèse. Nombre de fleurs 12—14 par capitule. *Écailles de l'involucre* non imbriquées, 12—13; les externes 4—5, $1-1,5 \times 1$ mm; les internes 8—9, $5-6 \times 1$ mm. *Corolle* jaune, 7 mm. *Ligule* $5 \times 1,5$ m. *Tube de la corolle* 2 mm. *Anthères* 3 mm. *Akènes* $1,7-1,8 \times 0,5$ mm, brunâtres, $\pm$ elliptiques, légèrement comprimés, à 3—5 nervures principales sur chaque face. *Aigrette* 3,5—3,75 mm, caduque.

DISTRIBUTION. Tenerife, Îles Canaries; endémique.

Tenerife: Güimar, BOULOS s.n. (Holotype CAI!, isotypes B! BM! BR! G! K! LD! MPU! O! P! S!) — Bco Chinico, Güimar, 580 m, LID s.n. (O!); KNOCH 330 (MPU!) — Granadilla, BOULOS s.n. (CAI! G! K!) — Bco del Infierno NORDENSTAM s.n. (S!) — Santa Cruz, THRETHEWY 5 (K!) — s. loc., WEBB s.n. (P!); LEDRU s.n. (P!).

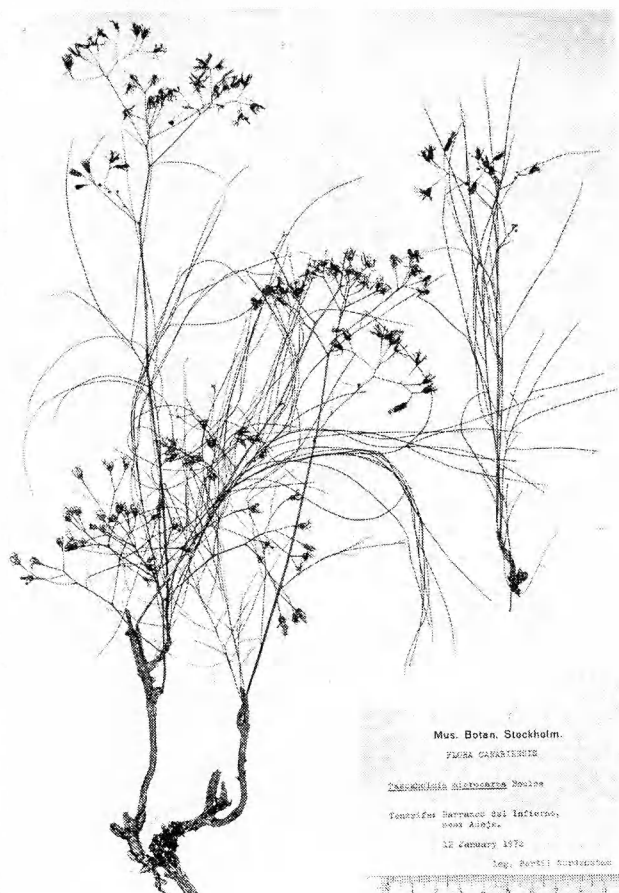


Fig. 29. *Taeckholmia microcarpa*.
NORDENSTAM s.n. (S!).

CARACTÈRES ÉCOLOGIQUES ET BIOLOGIQUES. *Taeckholmia microcarpa* croît sur les rochers volcaniques et dans des stations sèches ouvertes et ensoleillées. Floraison et fructification de mai à juillet.

CARACTÈRES CARYOLOGIQUES. $2n = 18$ (ROUX et BOULOS in BOULOS 1967).

DISCUSSION. *Taeckholmia microcarpa* forme avec les trois espèces *T. canariensis*, *T. capillaris* et *T. pinnata* le sous-genre *Taeckholmia*. Parmi ces espèces, *T. microcarpa* est caractérisé par ses capitules petits et denses sur des axes très ramifiés; akènes petits, $1,7-1,8 \times 0,5$ mm, le plus petit du groupe; feuilles à petit nombre de lobes (3-6 paires), largement espacés avec un lobe terminal très long.

29

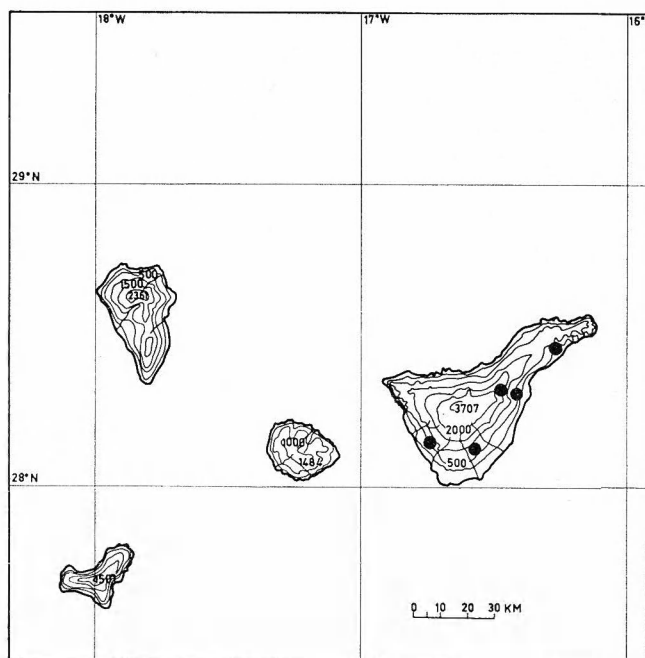


Fig. 30. *Taeckholmia microcarpa*. Distribution.

5. *Taeckholmia heterophylla* BOULOS

BOULOS, in Bot. Not. 120: 104, fig. 5, 1967.
— Holotype: Agulo, Gomera, BOULOS s.n. (CAI!), isotypes G! K!

Sonchus webbii SCH. BIP. in WEBB et BERTH. Hist. Nat. Îles Canar. 3(2): 444, t. 136, 1849-1850.

Lactucosonchus webbii (SCH. BIP.) SVENT. Ind. Sem., Agronom. Invest. Nat. Hispan. Inst. 1968.

Plante vivace, 30-80 cm de hauteur, ligneuse, ramifiée, à tiges volumineuses à la base; feuilles glabres, polymorphes. Racine ligneuse, pivotante. Collet ligneux, simple ou peu ramifié, 2-5 cm diam. Tige ligneuse, pleine, 3-15 mm, ridée, grisâtre, à traces des feuilles; jeune tiges florissantes lisses, creuses, pourvues de petites feuilles. Feuilles caulinaires en groupes denses au sommet des tiges végétatives, ou à la base de l'inflorescence, $8-20 \times 2-8$ cm, pinnatiséquées; lobes ± 7 paires, subalternés, linéaires ou étroitement oblongs, entiers, $10-40 \times 1-6$ mm, sommet obtus à aigu. Pédoncule $10-20 \times 0,5-1$ mm, la partie la plus large au-dessous du capitule, à ± 5 bractées espacées le long du pédoncule. Capitules $\pm 6 \times 3$ mm, plus longs et larges pendant l'anthèse. Nombre de fleurs ± 15 par capitule. Écailles de l'involucre légèrement



Fig. 31. *Taeckholmia heterophylla*. Holotype, BOULOS s.n. (CAI!).

imbriquées, ± 20 , à sommet obtus et cilié; les externes 7—8, 2—5 $\times$ 1 mm; les intermédiaires 5—6, 8—9 $\times$ 1 mm; les internes 6—7, 8 $\times$ 0,8 mm. Corolle jaune, ± 8 mm. Ligule 5 $\times$ 1,2 mm. Tube de la corolle 3 mm. Anthères 3 mm. Akènes 2,4 $\times$ 0,75 mm, brunâtres, oblancéolés à elliptiques, comprimés, rugueux, à ± 2 côtes principales sur chaque face. Aigrette ± 4 mm, caduque.

DISTRIBUTION. Gomera, Gran Canaria et La Palma, Îles Canaries; endémique.

Gomera: Agulo, BOULOS s.n. (Holotype CAI! isotypes G! K!) — 9—11 km de San Sebastian, sur la route principale du nord de l'île, BOULOS s.n. (CAI!).

Bot. Notiser, vol. 127, 1974

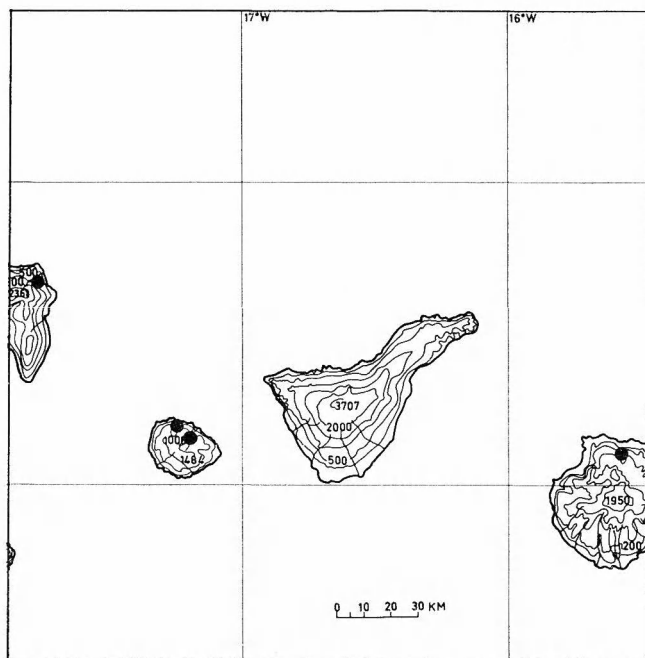


Fig. 32. *Taeckholmia heterophylla*. Distribution.

Gran Canaria: Bco Moya, 250 m, KUNKEL 14651 (S!).

La Palma: Bco de la Herradura, Los Sauces, BOURGEAU 28 (FI!), (Type de *Sonchus webbii* SCH. Bip.).

CARACTÈRES ÉCOLOGIQUES ET BIOLOGIQUES. *Taeckholmia heterophylla* croît entre les fissures des rochers, dans des stations sèches, au nord de l'île de Gomera. Floraison et fructification de juin à août.

CARACTÈRES CARYOLOGIQUES. $2n = 18$ (ROUX et BOULOS in BOULOS 1967).

DISCUSSION. *Taeckholmia heterophylla* est une espèce caractérisée par ses feuilles polymorphes, donc à lobes variés du point de vue taille, largeur et forme. La plante est caractérisée aussi par le faible nombre de fleurs par capitule (± 15), par ses fleurs courtes (± 8 mm) et par le faible nombre d'écailles d'involucre (± 20). Ces caractères peuvent être utiles pour séparer cette espèce de *T. regis-jubae*, ayant un nombre plus élevé de fleurs et des écailles d'involucre, ainsi par ses fleurs longues.

En cas d'absence de capitules, on peut



Fig. 33. *Taeckholmia regis-jubae*. Lectotype, PITARD s.n. (P!).

baser la séparation sur les caractères des feuilles; chez *T. regis-jubae*, les lobes des feuilles sont plus longs et plus espacés que chez *T. heterophylla*.

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

BOULOS, in Bot. Not. 120:104, 1967. — Lectotype: Canaries, Gomera: Roque de Valle Hormoso, 600 m, PITARD s.n. (P!).

Sonchus regis-jubae PITARD, in PITARD et PROUST, Îles Canar. Fl. Archipel 262, 1908.

NOM VERNACULAIRE. En espagnol: Babillo.

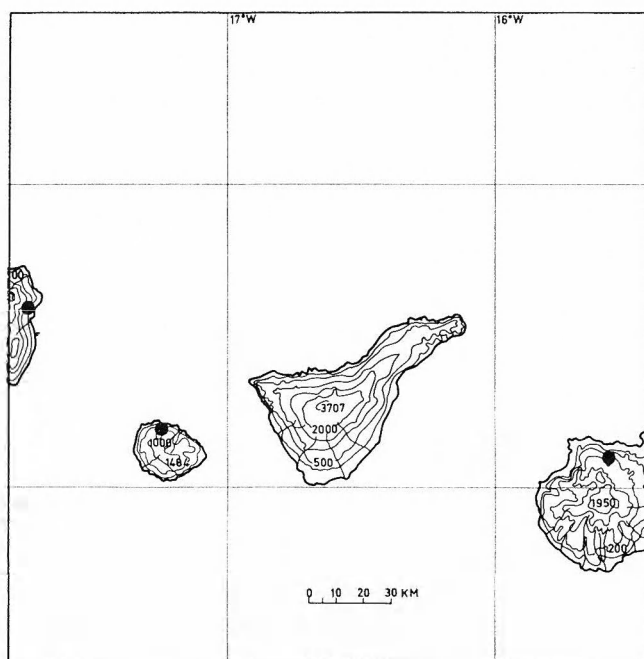


Fig. 34. *Taeckholmia regis-jubae*. Distribution.

Plante ligneuse, à tige assez robuste, 60—110 cm de hauteur, ramifiée. Racine pivotante, ligneuse vers le collet. Collet ligneux, ramifié, quelquefois simple chez les jeunes sujets. Tige ligneuse, solide, rugueuse, portant des traces de feuilles; tige florifère nue. Feuilles caulinaires 15—20 × 6—16 cm, groupées à l'extrémité des rameaux, tomenteuses à l'état juvéniles, autrement glabres, minces, pinnatiséquées; lobes 8—12 lobes, irrégulièrement arrangés, linéaires, acuminés, 30—80 × 1,5—2 mm; nervure médiane proéminente, 1,5—2 mm diam., atténuée vers le sommet. Pédoncule 12—20 × 0,5—1,5 mm, à 1—4 bractées. Capitules 10—12 × 3—4 mm. Nombre de fleurs ± 25 par capitule. Écailles de l'involucre légèrement imbriquées, 27—30, à sommet cilié; les externes 10, 2—5 × 1—1,5 mm; les intermédiaires 9, 7—8 × 1,25—1,5 mm; les internes 8—11, 8—9 × 1—1,25 mm. Corolle jaune, 11—12 mm. Ligule 6,5—7 mm. Tube de la corolle 4,5—5 mm. Anthères 3—3,5 mm. Aigrette ± 6 mm, caduque.

DISTRIBUTION. La Palma, Gran Canaria et Gomera, Îles Canaries; endémique.

La Palma: Las Nieves, BOULOS s.n. (B! BM! CAI! G! K! MPU!).

Gran Canaria: Bco Moya, 180 m, KUNDEL 14648 (S!).

Gomera: Roque de Vallehermoso, 600 m, PITARD s.n. (Lectotype P!); BOULOS s.n. (CAI! G! K!); 520 m, LID s.n. (O!).

CARACTÈRES ÉCOLOGIQUES ET BIOLOGIQUES. *Taeckholmia regis-jubae* est une plante rare, poussant sur les falaises rocheuses très ensoleillées et sèches de la zone maritime supérieure à 500—600 m d'altitude. Floraison de mars à avril.

PARTICULARITÉS PALYNOLOGIQUES. Bases des épines très évasées, absence des mucrons bien individualisés.

DISCUSSION. Il nous paraît que *Taeckholmia regis-jubae* est l'espèce la plus évoluée parmi les espèces du genre *Taeckholmia*. C'est donc l'espèce la plus proche du sous-genre *Dendrosonchus*, plus spécialement de *Sonchus gandogerii* et *S. palmensis*.

La location géographique de cette espèce dans les deux îles occidentales de l'archipel des îles Canaries, Gomera et La Palma, celle de *S. gandogerii* à Hierro et *S. palmensis* à La Palma, les caractères morphologiques et palynologiques assez voisins de ces trois espèces, sont en faveur de notre hypothèse.

7. *Taeckholmia arborea* (DC.) BOULOS

BOULOS, in Bot. Not. 120: 106, 1967. — Lectotype: *Prenanthes arborea* BROUSS., Tenerife, BROUSSONET s.n. (G-DC!); isolectotypes K! MPU!.

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

Prenanthes arborea BROUSSONET, Elench. Plant. Hort. Bot. Monsp. 47, 1805; nom. nud.

Arbrisseau, ligneux, 1—1,5 m de hauteur, ramifié principalement à la base, inflorescence dense, à plusieurs capitules. ramifiée, ligneuse, pleine, brunâtre, à zones ramifié, ligneuse, pleine, brunâtre, à zones denses de traces des feuilles. Feuilles caulinaires en touffes denses au sommet des

Bot. Notiser, vol. 127, 1974



Fig. 35. *Taeckholmia arborea*.

rameaux végétatifs et à la base des ramifications florifères, glabres, 10—20×4—10 cm; lobes 5—12 paires, ± opposés, linéaires-lancéolés, atténués et devenant aigus vers le sommet, 20—50×1—4 mm, lobe terminal plus long, base triangulaire, non auriculée. Pédoncule 1—2,5 cm, à 2—3 petites bractées. Capitules ± 7×4 mm, plus longs et larges pendant l'anthèse. Nombre de fleurs 22—29 par capitule. Écailles de l'involucre légèrement imbriquées, 19—22; les externes 7—8, 1—2,5×1 mm; les internes 12—14, 6—7×1 mm. Corolle jaune, 8—10 mm. Ligule 5 mm. Tube de la corolle 4 mm. Anthères 3 mm. Akènes 2,5×0,5—0,7 mm, brunâtres, ± el-

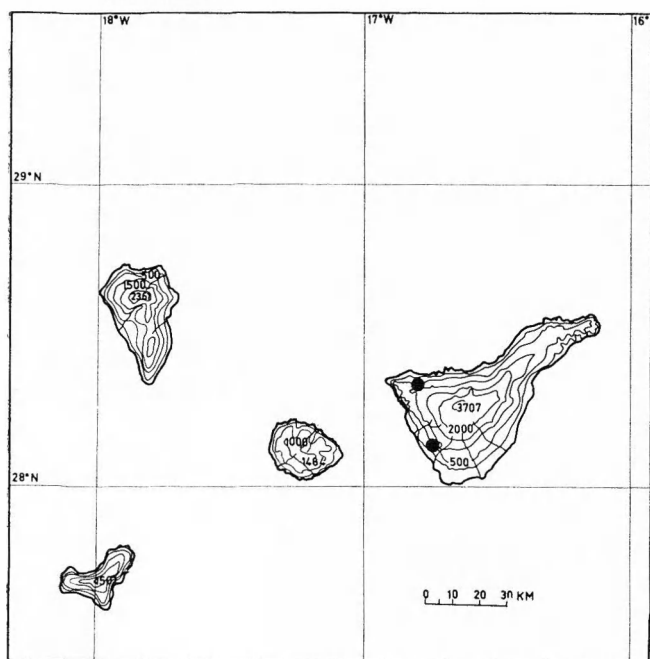


Fig. 36. *Taeckholmia arborea*. Distribution.

liptiques, comprimés, à 3—4 nervures principales rugueuses sur chaque face. *Aigrette* 4,5—5 mm, caduque.

DISTRIBUTION. Tenerife, Îles Canaries; endémique.

Tenerife: Bco del Infierno, au-dessus d'Adexe (Adeje), PITARD (in litt.) — Los Silos, Cuevas Negras, BOURGEAU (in litt.) — s. loc., BROUSSONET s.n. (Lectotype G-DC!, isotypes K! MPU!); LEDRU s.n. (P!).

CARACTÈRES ÉCOLOGIQUES ET BIOLOGIQUES. *Taeckholmia arborea* croît sur les falaises rocheuses, arides et ensoleillées de la zone maritime (PITARD et PROUST 1908). Floraison et fructification d'avril à mai.

DISCUSSION. *Taeckholmia arborea* est une espèce rare; on ne connaît à ce jour, que le type et un très petit nombre d'autres spécimens. Nous n'avons pas vu d'autres exemplaires que ceux récoltés en 1801 par BROUSSONET (type).

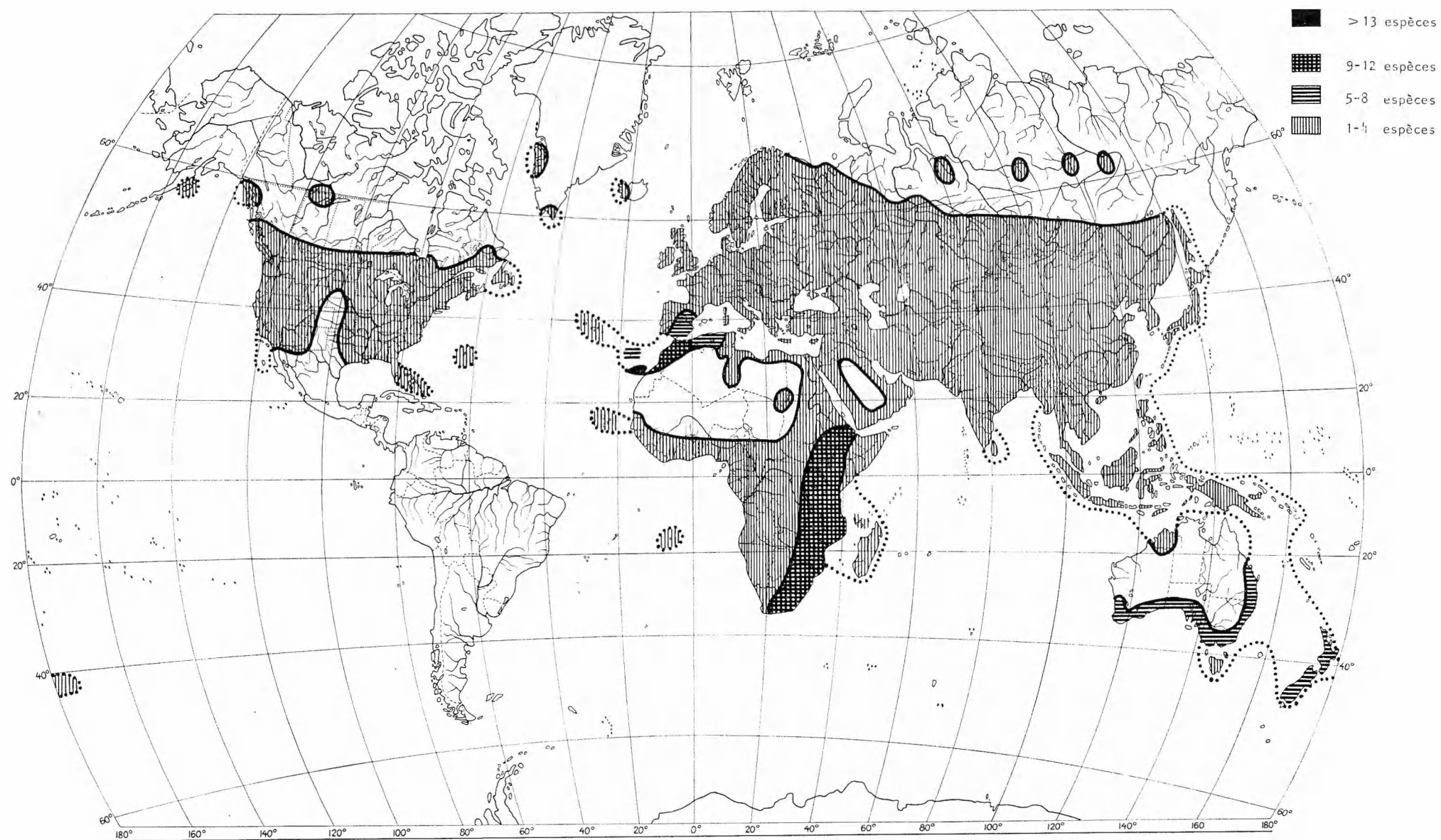
D'après LINDINGER (1926), *T. arborea* est connue de Lanzarote, Fuerteventura et Tenerife. Cependant, sa présence dans les deux premières îles n'était pas confirmée,

et nous considérons ces localités comme douteuses.

T. arborea forme avec *T. regis-jubae* et *T. heterophylla* le sous-genre *Pseudodendrosonchus*. Ces trois espèces sont les plus proches du *Sonchus palmensis* et *S. gandogerii*, deux espèces du sous-genre *Dendrosonchus*.

REMERCIEMENTS

Notre profonde gratitude va vers Messieurs les Directeurs et membres du personnel des Institutions suivantes: State Herbarium of South Australia, Adelaide; Waite Agricultural Research Institute, Adelaide; Botanisches Museum, Berlin-Dahlem; Instituto Botánico de Barcelona; Post Herbarium, American University at Beirut; Blatter Herbarium, St. Xavier's College, Bombay; British Museum (Natural History), London; Jardin Botanique National de Belgique, Bruxelles; Botanical Museum and Herbarium, Copenhagen; Department of Botany, Cairo University; The Agricultural Museum, Cairo; Botany School, Cambridge; Botany Division, Department of Scientific and Industrial research, Christchurch; Botanical Institute of the University of Coimbra; Royal Botanic Garden, Edinburgh; Istituto Botanico, Firenze; Conservatoire et Jardin Botaniques, Genève; Göteborgs Botaniska Trädgård; The Herbarium, Royal Botanic Gardens, Kew; Rijksherbarium, Leiden; Botanical Museum and Herbarium, Lund; Herbarium of the Department of Systematics and Plant Geography of the Botanical Institute of the Academy of Sciences of the U.S.S.R., Leningrad; The Linnean Society of London; Department of Botany of the University, Leicester; Botanische Staatssammlung, München; Instituto Botánico "Antonio José Cavanilles", Madrid; The Manchester Museum, The University of Manchester; Institut de Botanique, Université de Montpellier; Botany Department, University of Natal, Pietermaritzburg; Botanisk Museum, Oslo; Muséum National d'Histoire Naturelle, Laboratoire de Phanérogamie, Paris; Botanical Research Institute, National Herbarium, Pretoria; Institut Scientifique Chérifien, Rabat; Department of Botany, University of Reading; Sektionen för Botanik, Naturhistoriska Riksmuseet, Stockholm; Institute of Systematic Botany, University of Uppsala; Naturhistorisches Museum, Wien; The Dominion Museum, Wellington; Botanischer Garten und Institut für Systematische Botanik der Universität Zürich; Institut für Spezielle Botanik der Eidgenössische Technische Hochschule, Zürich.

Fig. 37. Distribution du genre *Sonchus* L. s.l.

Nous adressons aussi nos vifs remerciements à nos amis et collègues pour le dévouement avec lequel ils ont collaboré avec nous, tout particulièrement: G. et M. AYMONIN, O. ALMBORN, P. BAMPs, R. BAVAZZANO, G. BOQUET, A. L. BONNET, D. BRAMWELL, J. P. M. BRENAN, B. L. BURTT, A. L. CABRERA, J. F. M. CANNON, R. DAHLGREN, J. E. DANDY, H. J. EICHLER, V. FERÁKOVÁ, A. FERNANDES, I. FUJIWARA, W. GREUTER, B. G. HAMLIN, O. HEDBERG, F. N. HEPPER, V. H. HEYWOOD, C. JEFFREY, TH. KARLSSON, M. KASSAS, D. J. B. KILLICK, M. KIRPICZNIKOV, G. KUNKEL, K. LARSEN, O. A. LEISTNER, G. LONG, Á. et D. LÖVE, B. H. MACMILLAN, H. MERXMÜLLER, G. MOGGI, I. NAHAL, YASMIN NESARGI, B. NORDENSTAM, T. NORLINDH, A. PONS, K. H. RECHINGER, J. ROUX, H. RUNEMARK, H. SAID, CH. SAUVAGE, W. T. STEARN, C. G. G. J. VAN STEENIS, H. STEINBERG, P. SUNDING, S. SUNNA, S. K. WAGH, S. M. WALTERS et G. WEIMARCK.

À notre ami et collègue HANS TRALAU nous voudrions exprimer notre reconnaissance pour l'aide qu'il a apporté pour la réalisation des cartes de distribution.

LITTÉRATURE CITÉE

- ALLAN, H. H. 1961. Flora of New Zealand 1. — Wellington.
- AMIN, A. 1957. Taxonomic studies in the genus *Launaea*. — M. Sc. Thesis, Fac. Sci. Cairo Univ., Cairo [non publié].
- BABCOCK, E. B. 1947. The genus *Crepis*. — Univ. Calif. Publ. Bot. 21, 22.
- BOULOS, L. 1962. Cytotaxonomic studies in the genus *Sonchus*. 4. The generic status of some species earlier treated as *Sonchus*. — Bot. Notiser 115: 58—60.
- 1965. *Babcockia*, un nouveau genre de Composées des îles Canaries. — Bull. Jard. Bot. État. Bruxelles 35: 63—66.
- 1967. *Taeckholmia*, a new genus of Compositae from Canary Islands. — Bot. Notiser 120: 95—108.
- CHEESEMAN, T. F. 1914. Illustrations of the New Zealand flora. — Wellington.
- CUFODONTIS, G. 1967. Enumeratio plantarum Aethiopiae Spermatophyta. — Bull. Jard. Bot. Nat. Belg. 37, suppl.
- DANDY, J. E. 1958. List of British vascular plants. — London.
- FRIES, R. E. 1925. Die *Sonchus*-Arten des tropischen und südlichen Afrika. — Acta Horti Berg. 8: 89—121.
- HEDBERG, O. 1957. Afroalpine vascular plants, a taxonomic revision. — Symb. Bot. Ups. 15(1).
- JEFFREY, C. 1966. Notes on Compositae: I. The Cichorieae in East Tropical Africa. — Kew Bull. 18: 427—486.
- KIRPICZNIKOV, M. E. 1964. *Sonchus*. — In KOMAROV (Ed.), Flora of U.S.S.R. 29: 244—260.
- LARSEN, K. 1960. Cytological and experimental studies on the flowering plants of the Canary Islands. — Biol. Skr. Dan. Vid. Selsk. 11(3).
- LINDINGER, L. 1926. Beiträge zur Kenntnis von Vegetation und Flora der Kanarischen Inseln. — Abh. aus d. Gebiet d. Auslandskunde, Hamburg Univ., 21, Reihe C, 8.
- MARCHANT, C. J. 1970. IOPB chromosome number reports XXV. — Taxon 19: 102.
- PITARD, J. & PROUST, L. 1908. Les îles Canaries. Flore de l'Archipel. — Paris.
- PONS, A. & BOULOS, L. 1972. Révision systématique du genre *Sonchus* L. s.l. III. Étude palynologique. — Bot. Notiser 125: 310—319.
- ROBYNS, W. 1947. Flore des spermatophytes du Parc National Albert. 2. — Bruxelles.
- ROUX, J. & BOULOS, L. Révision systématique du genre *Sonchus* L. s.l. II. Étude caryologique. — Bot. Notiser 125: 306—309.
- SAAD, S. I. 1961. Pollen morphology in the genus *Sonchus*. — Pollen et Spores 3: 247—260.
- STEBBINS, G. L. JR., JENKINS, J. A. & WALTERS, M. S. 1953. Chromosomes and phylogeny in the Compositae, tribe Cichorieae. — Univ. Calif. Publ. Bot. 26: 401—430.
- SVENTENIUS, E. R. 1948. Plantas nuevas o poco conocidas de Tenerife. — Bol. Inst. Nacion. Investig. Agronom. 18: 285—291.
- 1960. Additamentum ad floram Canariensem I. — Matriti.
- TÄCKHOLM, V. 1956. Students' flora of Egypt. — Cairo.
- WODEHOUSE, R. P. 1959. Pollen grains. Ed. 2. — New York.

APPENDICE 1. SPECIES EXCLUSAE

- Sonchus acanthifolius* CLAIRV. = *Lactuca plumieri* GREN et GODR.
- S. acanthoides* STEUD. = *Lactuca plumieri* GREN. et GODR.
- S. acuminatus* BIGEL = *Cicerbita alpina* (L.) WALLR.

- S. acuminatus* WILLD. = *Lactuca canadensis* L.
- S. adscendens* BOJ. ex DC. = *Emilia adscendens* DC.
- S. agrestis* SWARTZ = *Erechtites agrestis* (SWARTZ) STANDL. et STEYERM.
- S. albanus* STEV. = *Cicerbita racemosa* (WILLD.) BEAUV., fide KIRPICZNIKOV (1964).

- S. alpestris* CLAIRV. = *Cicerbita alpina* (L.) WALLR.
S. alpinus L. = *Cicerbita alpina* (L.) WALLR., fide DANDY (1958).
S. amboinensis HORT. ex STEUD. = *Emilia flammea* CASS.
S. amplexicaulis GUELLENST., nom. nud.
S. angustifolius DESF. = *Launaea angustifolia* (DESF.) MUSCHL., fide AMIN (1957).
S. asper WULF. ex DC. = *Picris hieracioides* L.
S. australis HORT. ex COLLA, nom. nud.
S. azureus LEDEB. = *Cicerbita azurea* (LEDEB.) BEAUV., fide KIRPICZNIKOV (1964).
S. biennis MOENCH = *Lactuca biennis* (MOENCH) FERN.
S. bocconi JAN. ex DC. = *Picridium vulgare* DESF.
S. brasiliensis MEYEN et WALP. = *Erechtites praealta* RAFIN.
S. brunneri (WEBB) OLIV. et HIERN. = *Launaea brunneri* (WEBB) AMIN ex BOULOS, fide BOULOS (1962).
S. cacaliaefolius M. BIEB. = *Prenanthes cacaliifolia* (M. BIEB.) BEAUV., fide KIRPICZNIKOV (1964).
S. caeruleus SM. = *Cicerbita alpina* (L.) WALLR.
S. californicus HOOK. et ARN. = *Malacothrix saxatilis* TORR. et GRAY
S. calyculatus ROXB. = *Lactuca heyneana* DC., nom. illegit. = *Launaea intybacea* (JACQ.) BEAUV., fide JEFFREY (1966).
S. canadensis FROEL. = *Cicerbita macrophylla* (WILLD.) A. GRAY
S. canadensis L. = *Cicerbita alpina* (L.) WALLR.
S. candolleanus JAUB. et SPACH = *Launaea mucronata* (FORSSK.) MUSCHL., fide TÄCKHOLM (1956).
S. capitatus SPRENGEL = *Launaea capitata* (SPRENGEL) DANDY in ANDREWS
S. cassinianus JAUB. et SPACH = *Launaea cassiniana* (JAUB. et SPACH) KUNTZE, fide TÄCKHOLM (1956).
S. caucasicus BIEHLER = *Crepis sibirica* L., fide BABCOCK (1947).
S. caucasicus SPRENG. = *Crepis sibirica* L.
S. cavanillesianus FONT QUER et SVENT., nom. nud., fide SVENTENIUS (1948).
S. cervicornis (BOISS.) NYMAN = *Launaea cervicornis* (BOISS.) FONT QUER et ROTHM., fide AMIN (1957).
S. charmelii SENNEN et MAURICIO, nom. nud.
S. chevalieri (HOFFM. et MUSCHL.) DANDY = *Launaea chevalieri* HOFFM. et MUSCHL.
S. chondrilloides DESF. = *Launaea resedifolia* (L. em. COSS.) O. KUNTZE
S. chondrilloides SIBTH. et SM. = *Picridium vulgare* DESF.
S. cichoraceus MOENCH = *Lactuca plumieri* GREN. et GODR.
S. ciliatus PERR. ex DC. = *Launaea goreënsis* (LAM.) O. HOFFM. = *Launaea intybacea* (JACQ.) BEAUV., fide JEFFREY (1966).
S. coeruleus SMITH = *Cicerbita alpina* (L.) WALLR., fide KIRPICZNIKOV (1964).
S. cordifolius DESF. = *Cicerbita macrophylla* (WILLD.) WALLR.
S. cornutus HOCHST. ex OLIV. et HIERN. = *Launaea cornuta* (HOCHST. ex OLIV. et HIERN) C. JEFFREY, fide JEFFREY (1966).
S. cristatus SCH. BIP. = ?*Embergeria grandifolia* (T. KIRK) BOULOS
S. cubangensis S. MOORE = *Lactuca cubangensis* (S. MOORE) C. JEFFREY, fide JEFFREY (1966).
S. cyaneus D. DON = *Lactuca hastata* DC.
S. dentatus LEDEB. = *Prenanthes angustifolia* BOULOS, fide BOULOS (1962).
S. dianthoseris CHIOV. = *Nannoseris schimperii* (SCH. BIP.) HEDB., HEDBERG (1957).
S. dichotomus (VAHL) WILLD. = *Launaea nudicaulis* (L.) HOOK. FIL., fide CUFODONTIS (1967).
S. dichotomus SAVI = *Launaea nudicaulis* (L.) HOOK. FIL.
S. divaricatus SAVI = *Launaea nudicaulis* (L.) HOOK. FIL.
S. divaricatus BUCH = *Launaea* sp.
S. divaricatus DESF. = *Launaea nudicaulis* (L.) HOOK. FIL., fide CUFODONTIS (1967).
S. divaricatus SIEBER ex STEUD. = *Picridium dichotomum* FISCH. et MEY. ex DC.
S. dulosus FISCH. et MEY. ex SWEET, nom. nud.
S. elliotianus HIERN = *Launaea nana* (BAK.) CHIOV., fide C. JEFFREY (1966).
S. erythraeae SCHWEINF. ex PENZIG, nom. nud.
S. erythropappus MEYEN et WALP. = *Erechtites valerianaefolia* DC.
S. exauriculatus (OLIV. et HIERN) O. HOFFM. = *Launaea cornuta* (HOCHST. ex OLIV. et HIERN) C. JEFFREY, fide JEFFREY (1966).
S. fischeri O. HOFFM. = *Launaea rarifolia* (OLIV. et HIERN) BOULOS, fide JEFFREY (1966).
S. flexuosus LEDEB. = *Crepis sibirica* L., fide BABCOCK (1947).
S. floridanus AIT. = *Cicerbita alpina* (L.) WALLR.
S. floridanus L. = *Lactuca floridana* (L.) GAERTN.
S. floridanus LOUR. = *Lactuca brevirostris* CHAMP. ex BENTH.
S. floridanus MICHX. = *Lactuca acuminata* SPRENG.
S. freynianus HUTER, PORTA et RIGO ex HUTER = *Launaea arborescens* (BATT.) MURB., fide JEFFREY (1966).
S. fruticosus NORONHA = *Centratherum frutescens* BENTH. ex C. B. CLARKE
S. glutinosus LAM. = *Hieracium glutinosum* L. = *Crepis pulchra* L.

- S. goreënsis* LAM. = *Launaea intybacea* (JACQ.) BEAUV., fide JEFFREY (1966) et CUFODONTIS (1967).
S. goreënsis LESS. ex STEUD. = *Prenanthes alata* D. DIETR.
S. gracilis SENNEN in SENNEN et MAURICIO, nom. nud. = *Launaea* sp.
S. gramineus BOJ. ex DC. = *Emilia graminea* DC.
S. hastatus LESS. = *Prenanthes alata* (HOOK.) DIETR., fide KIRPICZNIKOV (1964).
S. hastatus WALL. = *Lactuca hastata* DC.
S. hispanicus JACQ. = *Picridium tingitanum* DESF.
S. hispidulus BOVÉ ex DC. = *Picridium tingitanum* DESF.
S. hispidus LEDEB. = *Cicerbita uralensis* (ROUY) BEAUV., fide KIRPICZNIKOV (1964).
S. hochstetteri SCH. BIP., nom. nud. = *Launaea intybacea* (JACQ.) BEAUV., fide CUFODONTIS (1967).
S. intermedius JAN ex DC. = *Picridium intermedium* SCH. BIP. in WEBB et BERTH.
S. jacottetianus THELLUNG = *Launaea* sp.
S. javanicus (BURM. FIL.) SPRENG. = *Hieracium javanicum* BURM. FIL. = *Prenanthes javanica* WILLD.
S. kabarensis DE WILD. = *Launaea cornuta* (HOCHST. ex OLIV. et HIERN) C. JEFFREY, fide JEFFREY (1966).
S. lactucoides BUNGE = *Lactuca tatarica* (L.) C. A. MEY.
S. laevis GARSALT, nom. illegit.
S. lampsanoides LAM. = *Crepis lampsanoides* FROEL.
S. lanifer DINTER = *Launaea rarifolia* (OLIV. et HIERN) BOULOS, fide JEFFREY (1966).
S. lapponicus FROEL. = ? *Lactuca floridana* GAERTN.
S. lasiorhizus O. HOFFM. = *Lactuca lasiorhiza* (O. HOFFM.) C. JEFFREY, fide JEFFREY (1966).
S. ledermannii R. E. FRIES = *Lactuca lasiorhiza* (O. HOFFM.) C. JEFFREY, fide JEFFREY (1966).
S. leucodon FISCH. et MEY. = *Launaea nudicaulis* (L.) HOOK. FIL.
S. leucophaeus WILLD. = *Cicerbita alpina* (L.) WALLR.
S. libycus SPACH ex BOISS. = *Launaea angustifolia* (DESF.) MUSCHL.
S. longifolius COLLA, nom. nud.
S. lowei HEER ex BOLLE, nom. nud.
S. ludovicianus NUTT. = *Lactuca ludoviciana* RIDDELL
S. luxurians SCHARD. in STEUD., nom. invalid. = *Cicerbita macrophylla* (WILLD.) WALLR.
S. macer S. MOORE = *Launaea rarifolia* (OLIV. et HIERN) BOULOS, fide JEFFREY (1966).
S. macrophyllus WILLD. = *Cicerbita macrophylla* (WILLD.) WALLR., fide DANDY (1958) et KIRPICZNIKOV (1964).
S. mareoticus DEL. ex BARBEY = *Launaea capitata* (SPRENG.) DANDY
S. maritimus PALL. ex LEDEB. = *Lactuca sibirica* (L.) BENTH. ex MAXIM., fide KIRPICZNIKOV (1964).
S. massaviensis (FRES.) SCH. BIP. = *Launaea massauensis* (FRES.) O. KUNTZE, fide CUFODONTIS (1967).
S. metzianus SCH. BIP. = *Launaea acaulis* (ROXB.) BABC., fide BABCOCK (1947).
S. montanus LAM. = *Cicerbita alpina* (L.) WALLR., fide KIRPICZNIKOV (1964).
S. multiflorus DESF. = *Cicerbita alpina* (L.) WALLR.
S. nanellus R. E. FRIES = *Launaea nana* (BAK.) CHIOV., fide JEFFREY (1966).
S. nanus O. HOFFM. = *Launaea nana* (BAK.) CHIOV. fide JEFFREY (1966).
S. novae-zelandiae (HOOK. FIL.) BENTH. ex JAKS. = *Kirkianella novae-zelandiae* (HOOK. FIL.) ALLAN, fide ALLAN (1961).
S. nudicaulis (L.) SCH. BIP. = *Launaea nudicaulis* (L.) HOOK. FIL., fide CUFODONTIS (1967).
S. occidentalis SPRENG. = *Erechtites praealta* RAFIN.
S. octophyllus SCH. BIP. in SCHWEINF. et ASCHERS., nom. nud. = *Launaea intybacea* (JACQ.) BEAUV., fide CUFODONTIS (1947).
S. oliveri-hiernii BOULOS, pro parte quoad syn. *S. bipontini* var. *pinnatifidus* OLIV. et HIERN = *Launaea cornuta* (HOCHST. ex OLIV. et HIERN) C. JEFFREY, fide JEFFREY (1966).
S. pallidus TORR. = *Cicerbita alpina* (L.) WALLR.
S. pallidus WILLD. = *Lactuca canadensis* L.
S. pauciflorus BAKER = *Launaea rarifolia* (OLIV. et HIERN) BOULOS, fide JEFFREY (1966).
S. pendulus WEBB ex SCH. BIP. = *Prenanthes pendula* SCH. BIP.
S. pensylvanicus SPRENG. ex STEUD., nom. nud.
S. pentaphyllus (SCH. BIP.) SCH. BIP. in SCHWEINF., nom. nud. = *Launaea taraxacifolia* (WILLD.) AMIN ex JEFFREY, fide JEFFREY (1966).
S. perfoliatus GUELLENST. ex LEDEB., nom. nud.
S. picroides LAM. = *Reichardia picroides* (L.) ROTH
S. picroides SIBTH. et SM. = *Reichardia picroides* (L.) ROTH, fide QUEZEL et SANTA (1964).
S. pinnatifidus LAG. ex DC. = *Reichardia tingitana* (L.) ROTH
S. plumerianus ST. LAG. = *Lactuca plumeri* GREN. et GODR.
S. plumerii ST. LAG. = *Lactuca plumeri* GREN. et GODR.
S. plumeri L. = *Lactuca plumeri* GREN. et GODR.

- S. plumieri* PANČ. ex VIS. = *Mulgedium pancicii* VIS.
S. prenanthoides M. BIEB. = *Cicerbita prenanthoides* (M. BIEB.) BEAUV., fide KIRPICZNIKOV (1964).
S. prenanthoides OLIV. et HIERN = *Launaea chevalieri* O. HOFFM. et MUSCHL.
S. pulchellus PURSH = *Lactuca pulchella* DC. = *Lactuca tatarica* (L.) C. A. MEY. subsp. *pulchella* (PURSH) STEBBINS
S. pycnocephalus R. E. FRIES = *Launaea rogersii* (HUMB.) HUMB. et BOULOS in HUMBERT, fide JEFFREY (1966).
S. quercifolius DESF. = *Launaea quercifolia* (DESF.) PAMP.
S. quercifolius PHILLIPSON = *Lactuca lasiorhiza* (O. HOFFM.) C. JEFFREY, fide JEFFREY (1966).
S. racemosus LAM. = *Cicerbita alpina* (L.) WALLR.
S. rarifolius OLIV. et HIERN = *Launaea rarifolia* (OLIV. et HIERN) BOULOS, fide BOULOS (1962).
S. reflexus LAG. = *Launaea nudicaulis* (L.) HOOK. FIL.
S. robustus WALL. = *Lactuca hastata* DC.
S. rueppellii (FRES. ex SCH. BIP.) R. E. FRIES = *Launaea rueppellii* (FRES. ex SCH. BIP.) AMIN ex BOULOS, fide CUFODONTIS (1967).
S. scapiformis THELLUNG = *Lactuca tysonii* (PHILLIPS) C. JEFFREY, fide JEFFREY (1966).
S. scorzoneraeformis LAG. = *Launaea pumila* (CAV.) KUNTZE
S. serratus PERR. ex DC. = *Lactuca taraxacifolia* SCHUM. et THONN.
S. setosus EHRENB. ex SWEET, nom. nud.
S. sibiricus M. BIEB. = *Cicerbita racemosa* (WILLD.) BEAUV., fide KIRPICZNIKOV (1964).
S. sibiricus L. = *Lactuca sibirica* (L.) BENTH. ex MAXIM., fide KIRPICZNIKOV (1964).
S. sibiricus RICHARDS = *Lactuca pulchella* DC. = *Lactuca tatarica* (L.) C. A. MEY. subsp. *pulchella* (PURSH) STEBBINS
S. spachii SCHWEINF., nom. nud. = *Launaea* sp.
S. spicatus LAM. = *Cicerbita alpina* (L.) WALLR.
S. spinosus DC. = *Launaea spinosa* (FORSSK. em. VAHL) SCH. BIP., fide AMIN (1957).
S. spinosus MARÈS = *Launaea cervicornis* (BOISS.) FONT QUER et ROTHM., fide AMIN (1957).
S. squamosus LAM. = *Picridium vulgare* DESF.
S. strictus PAU = *Prenanthes stricta* GREENE
S. subacaulis DUM.-COURS. ex STEUD., nom. nud.
S. suberosus ZOHARY et DAVIS = *Prenanthes suberosa* (ZOHARY et DAVIS) BOULOS, fide BOULOS (1962).
S. taraxacifolius WILLD. sensu SPRENG. = *Launaea intybacea* (JACQ.) BEAUV.
S. taraxacifolius WILLD. = *Launaea taraxacifolia* (WILLD.) AMIN ex JEFFREY, fide JEFFREY (1966).
S. tataricus L. = *Lactuca tatarica* (L.) C. A. MEY., fide KIRPICZNIKOV (1964).
S. tenax FISCH. ex SWEET, nom. nud.
S. tingitanus (L.) LAM. = *Reichardia tingitana* (L.) ROTH, fide JEFFREY (1966).
S. tomentosus PALAU ex WILLK. et LANGE = *Crepis albida* VILL.
S. tuberosus MURR. = ?*Steptorhamphus tuberosus* (JACQ.) GROSSH., fide KIRPICZNIKOV (1964).
S. tysonii PHILLIPS = *Lactuca tysonii* (PHILLIPS) C. JEFFREY, fide JEFFREY (1966).
S. vaginatus HORT, ERF. ex STEUD., nom. nud.
S. verdickii (DE WILD.) R. E. FRIES = *Launaea rarifolia* (OLIV. et HIERN) BOULOS, fide JEFFREY (1966).
S. violaceus O. HOFFM. = *Launaea nana* (BAK.) CHIOV., fide JEFFREY (1966).
S. virgatus DESF. ex STEUD. = *Prenanthes virgata* MICHX.
S. volhynicus BESS. ex NYM. = *Lactuca tatarica* (L.) C. A. MEY.
S. welwitschii (SCOTT ELLIOT) CHIOV. ex S. MOORE = *Launaea rarifolia* (OLIV. et HIERN) BOULOS, fide JEFFREY (1966).
S. zollikoferioides ROUY = *Launaea* sp.

APPENDICE 2. SPECIES DUBIAE

- Sonchus angulatus* SESSÉ et MOC.
S. bupleurifolius BOISS. et KOTSCHY
S. capensis SCHLECHT.
S. cavanillesii CABALLERO
S. cervicornis WILLK.
S. crepioides SM.
S. crispus POIR.
S. elongatus KUNZE ex SCHLECHT.
S. engleri MUSCHL.
S. eriopus ROYLE
S. gibbosus SAVI = *S. torulosus* SAVI
S. gorgadensis BOLLE = *S. bolei* SCH. BIP.
S. haussknechtii BRUEGG.
S. hotha C. B. CLARKE
S. hypochaeroides SCHLECHT.
S. intermedius KRÖCK.
× *S. jaquiniocephalus* SVENT.
S. laciniatus T. MOORE
S. maculigerus H. LINDB.
S. mairei LÉVEILLÉ, 1913
S. mairei LÉVEILLÉ, 1915, non praec.
S. maynari SVENT.
S. montanus KOIDZ.
S. nigricans TAUSCH
S. paniculatus MOC. et SESSÉ
S. pensylvanicus MOLIN ex COLLA
S. prudhommei BOUCHARD
S. tectifolius SVENT.
S. tigrinus RUPR.

APPENDICE 3. INDEX TAXONOMIQUE

Les noms corrects des taxons appartenant aux genres *Babcockia*, *Embergeria*, *Sonchus* et *Taeckholmia* sont imprimés en **caractères gras** comme c'est aussi le cas pour les références (volume, page) lorsque le taxon est traité en détail (généralement avec une carte et une photo). Les synonymes des taxons acceptés dans ces genres sont imprimés en *italique*. Les noms des autres taxons sont imprimés en caractères ordinaires.

<i>Acanthus</i>	127:414
<i>Aeonium caespitosum</i> (CHR. SM.)	
WEBB et BERTH.	127:429
<i>Agropyrum coxii</i>	127:426
<i>Ambrosiae</i>	125: 317 318
<i>Apium australe</i>	127:426
<i>Atalanthus pinnatus</i> D. DON	127:429
Babcockia BOULOS	125: 293 302
306 309 316 317 318;	127:428
platylepis (WEBB) BOULOS	
125: 302 309 316 317;	127: 428
<i>Catananche</i> L.	125: 317 318
<i>lutea</i>	127:426
<i>Centratherum frutescens</i> BENTH. ex	
C. B. CLARKE	127:442
<i>Chondrilla pinnata</i> LAM.	127:429
<i>Cicerbita</i>	125:289
<i>alpina</i> (L.) WALLR. ..	127:441 442 443 444
<i>azurea</i> (LEDEB.) BEAUV.	127:442
<i>macrophylla</i> (WILLD.) WALLR.	
127: 442 443	
<i>macrophyta</i> (WILLD.) A. GRAY ...	127:442
<i>prenanthoides</i> (M. BIEB.) BEAUV.	127:444
<i>racemosa</i> (WILLD.) BEAUV. ..	127: 441 444
<i>uralensis</i> (ROUY) BEAUV.	127:443
<i>Cichorieae</i>	125: 312 317
<i>Crepis</i>	125:287 289 311 318
<i>albida</i> VILL.	127:444
<i>lampsanoides</i> FROEL.	127:443
<i>pulchra</i> L.	127:442
<i>sibirica</i> L.	127:442
<i>Cyperus laevigatus</i>	126:175
<i>Dianthoseris</i>	125:293
Embergeria BOULOS	125: 293
301 306 308 316 317 318;	127:424
sous-genre Embergeria ..	125: 301
316;	127:426
sous-genre Megalocarpa BOULOS ..	
125: 301 302 316;	127:427
grandifolia (T. KIRK) BOULOS	
125: 301 302 308 316 317;	127: 424 442
megalocarpa (HOOK. FIL.) BOULOS	
125: 302 309 316 317 318;	127: 426
<i>Emilia adscendens</i> DC.	127:441
<i>flammea</i> CASS.	127:442
<i>graminea</i> DC.	127:443
<i>Erechtites agrestis</i> (SWARTZ) STANDL.	
et STEYERM.	127:441
<i>praealta</i> RAFIN.	127: 442 443
<i>valerianaefolia</i> DC.	127:442

<i>Erica arborea</i> L.	127: 18
<i>Hieracium</i>	125:287
<i>arvense</i> SCOPOLI	126:180
<i>glutinosum</i> L.	127:442
<i>javanicum</i> BURM. FIL.	127:443
<i>Imperata</i>	127:406
<i>Juncus</i>	126:175
<i>Juniperus cedrus</i> WEBB et BERTH. ..	127: 18
<i>Kirkianella novae-zelandiae</i> (HOOK.	
FIL.) ALLAN	127:443
<i>Lactuca</i>	125:287 289 293 311 318
<i>acuminata</i> SPRENG.	127:442
<i>biennis</i> (MOENCH) FERN.	127:442
<i>brevirostris</i> CHAMP. ex BENTH. ...	127:442
<i>canadensis</i> L.	127: 441 443
<i>cubangensis</i> (S. MOORE) C. JEFFREY	127:442
<i>floridana</i> (L.) GAERTN.	127: 442 443
<i>hastata</i> DC.	127:442 443 444
<i>heyneana</i> DC.	127:442
<i>intybacea</i> (JACQ.) BEAUV.	127:442
<i>lasiorhiza</i> (O. HOFFM.) C. JEFFREY	
127: 443 444	
<i>ludoviciana</i> RIDDEL	127:443
<i>plumieri</i> GREN. et GODR.	127:441 442 443
<i>pulchella</i> DC.	127:444
<i>serriola</i>	126: 174 185
<i>sibirica</i> (L.) BENTH. ex MAXIM. ...	
127: 443 444	
<i>taraxacifolia</i> SCHUM. et THONN. ...	127:444
<i>tatarica</i> (L.) C. A. MEY.	127: 443 444
subsp. <i>pulchella</i> (PURSH) STEB-	
BINS	127:444
<i>tysonii</i> (PHILLIPS) C. JEFFREY ...	127:444
<i>Lactucosonchus webbia</i> (SCH. BIP.)	
SVENT.	127:435
<i>Launaea</i>	125:287 293 311 313
318; 126:192;	127:424
sp.	127:442 443 444
<i>acaulis</i> (ROXB.) BABC.	127:443
<i>angustifolia</i> (DESF.) MUSCHL.	
127: 442 443	
<i>arborescens</i> (BATT.) MURB.	127:442
<i>brunneri</i> (WEBB) AMIN ex BOULOS	127:442
<i>capitata</i> (SPRENGEL) DANDY in AN-	
DREWS	127: 442 443
<i>cassiniana</i> (JAUB. et SPACH) KUNTZE	127:442
<i>cervicornis</i> (BOISS.) FONT QUER et	
ROTHM.	127: 442 444
<i>chevalieri</i> HOFFM. et MUSCHL.	127: 442 444
<i>cornuta</i> (HOCHST. ex OLIV. et	
HIERN) C. JEFFREY	127: 442 443
<i>goreënsis</i> (LAM.) O. HOFFM.	127:442
<i>intybacea</i> (JACQ.) BEAUV.	127:442 443 444
<i>massauensis</i> (FRES.) O. KUNTZE ..	127:443
<i>mucronata</i> (FORSSK.) MUSCHL. ...	127:442
<i>nana</i> (BAK.) CHIOV.	127:442 443 444
<i>nudicaulis</i> (L.) HOOK. FIL.	127:442 443 444
<i>pumila</i> (CAV.) KUNTZE	127:444
<i>quercifolia</i> (DESF.) PAMP.	127:444
<i>rarifolia</i> (OLIV. et HIERN) BOULOS	
127:442 443 444	
<i>resedifolia</i> (L. em. COSS.) O. KUNTZE	127:442

- rogersii (HUMB.) HUMB. et BOULOS 127:444
 rueppellii (FRES. ex SCH. BIP.) AMIN
 ex BOULOS 127:444
 spinosa (FORSSK. em. VAHL) SCH.
 BIP. 127:444
 taraxacifolia (WILLD.) AMIN ex
 JEFFREY 127: 443 444
 Lomatolepis 125:293
 Malacothrix saxatilis TORR. et GRAY 127:442
 Microrhynchus 125:293
 Mulgedium pancicii Vis. 127:444
 Nannoseris schimperii (SCH. BIP.)
 HEDB. 127:442
 Pennisetum 127:413
 Picridium dichotomum FISCH. et MEY.
 ex DC. 127:442
 intermedium SCH. BIP. in WEBB et
 BERTH. 127:443
 tingitanum DESF. 127:443
 vulgare DESF. 127: 442 444
 Picris hieracioides L. 127:442
 Prenanthes 125:287
 alata (HOOK.) DIETR. 127:443
 angustifolia BOULOS 127:442
 arborea BROUSS. 127:438
 cacaliifolia (M. BIEB.) BEAUV. 127:442
 javanica WILLD. 127:443
 pendula SCH. BIP. 127:443
 pinnata L. FIL. 127:429
 stricta GREENE 127:444
 suberosa (ZOHARY et DAVIS) BOULOS 127:444
 virgata MICHX 127:444
 Reichardia picroides (L.) ROTH 127:443
 tingitana (L.) ROTH 127: 443 444
 Rhabdotheca 125:293
 Salicornia australis 127:426
 Samolus repens 127:426
 Sonchi genuini W. KOCH 125:294
 Sonchidium POMEL 125:293
 maritimum POMEL 126:174
 palustre POMEL 126:177
 Sonchos ST. LAG. 125:293
 trachus 125:289
 Sonchoseris FOURR. 125:293
 arvensis FOURR. 126:180
 decora FOURR. 126:180
 maritima FOURR. 126: 174 177
Sonchus L. **125: 287 288 289**
 290 291 292 **293** 306 307 310 311
 312 314 317 318; 127:426 429 431
 sect. **Arvenses** (KIRP.) BOULOS ...
 125: 295 296 314
 ser. *Arvenses* SCHCHIAN ex KIRP. ... 125:297
 sect. **Asperi** BOULOS **125: 294**
 296 314 317 318; 127:427
 sect. **Brachylobi** BOULOS
 125: 298 299 315
 sect. **Dendrosonchus** **125: 298 299 315**
 sous-genre **Dendrosonchus** SCH.
 BIP. ex BOULOS .. **125: 290 294**
 297 306 307 308 311 312 313 315;
 126:163; 127: 7 9 14 24 406 438 439
 sect. **Dregeani** BOULOS .. **125: 300 312 316**
 sect. *Eusonchus* DC. 125:294
 sect. **Maritimi** (KIRP.) BOULOS ...
 125: 295 296 314
 ser. *Maritimi* KIRP. 125:296
 sect. **Nani** BOULOS **125: 300 301 316**
 ser. *Oleracei* KIRP. 125: 294 296
 sect. **Origosonchus** **125: 300 313 315**
 sous-genre **Origosonchus** BOULOS
 125: 290 294 299 306 307 308 311
 312 313 315 318; 126:163; 127:406
 ser. *Palustres* SCHCHIAN ex KIRP. 125:296
 sect. **Pinnati** BOULOS ... **125: 298**
 299 315; 127: 29
 sect. **Pustulati** BOULOS .. **125: 295**
 296 314; 126:192
 sect. **Sonchus** **125: 295 296 314 317**
 sous-genre **Sonchus** **125: 290**
 294 306 307 311 312 313 314;
 126:155 158 163 175
 sect. **Tuberiferi** BOULOS **125: 295 296 315**
 abbreviatus LINK 125:308; 127:7 9
 acanthifolius CLAIRV. 127:441
 acanthoides STEUD. 127:441
 acaulis DUM.-COURS. 125:298
 299 308 313 315; **127: 9**
 var. *abbreviatus* SCH. BIP. 127: 11
 var. *elongata* SCH. BIP. 127: 11
 var. *palmensis* SCH. BIP. 127: 11
 acidus SCHOUSB. ex WILLD. 127: 22
 acuminatus BIGEL 127:441
 acuminatus WILLD. 127:441
 adscendens BOJ. ex DC. 127:441
 aemulus MERINO 126:164
 afromontanus R. E. FRIES 125:300
 315; **127: 410**
 agrestis SWARTZ 127:441
 albanus STEV. 127:441
 alpestris CLAIRV. 127:442
 alpinus L. 125:289; 127:442
 altissimus VAHL ex SCH. BIP. 127: 9
 amboinensis HORT. ex STEUD. 127:442
 amplexicaulis GULDENST. 127:442
 angulatus SESSÉ et MOC. 127:444
 angustifolius DESF. 127:442
 angustifolius NECK. 126:174
 angustissimus H. LINDB. 126:156; 127:406
 angustissimus HOOK. FIL. 125:300
 315; 126:156; **127: 406**
 aquatilis POURR. 126:174
 arborescens SALZM. ex BALL 126:158
 arboreus DC. 127:438
 arvensis L. 125:289 292 295
 297 307; **126: 180 184 185 188**
 subsp. *arvensis* .. 125:295 314;
 126: 182 185
 f. *brachyotus* (DC.) KIRP. 126:182
 subsp. *brachyotus* (DC.) KITA-
 MURA 126:182
 β *glabrescens* GUENTH., GRAB. et
 WIMM. 126:182

- Bot. Notiser, vol. 127, 1974

- crepioides* SM. 127:444
crispus POIR. 127:444
cristatus SCH. BIP. 127:442
crocifolius HORT. ex SCH. BIP. ... 126:164
cubangensis S. MOORE 127:442
cumbulus BUCH.-HAM. ex WALL. .. 126:188
cuspidatus BLUME 126:164
cyaneus D. DON 127:442
daltonii WEBB 125:298 299 315; **127: 13**
decipiens ZENARI 126:164
decorus CAST. 126:180
delagoeensis THELLUNG 127:419
dentatus BANKS ex LOWE 127: 20
dentatus LEDEB. 127: 20 442
dianae LACAITA ex WILLK. 126:158
dianthoseris CHIOV. 127:442
dichotomus SAVI 127:442
dichotomus (VAHL) WILLD. 127:442
divaricatus BUCH. 127:442
divaricatus DESF. 127:442
divaricatus SAVI 127:442
divaricatus SIEBER ex STEUD. 127:442
dregeanus DC. 125:300 301
308 316; **127: 418**
dulosus FISCH. et MEY. ex SWEET .. 127:442
ecklonianus DC. 127: 418 419
elliottianus HIERN 127:442
elongatus KUNZE ex SCHLECHT. ... 127:444
engleri MUSCHL. 127:444
eriopus ROYLE 127:444
eryngiifolius SOSN. 126:164
eryngioides DC. 126:164
erythraeae SCHWEINF. ex PENZIG 127:442
erythropappus MEYEN et WALP. .. 127:442
exaltatus WALLR. 126:180
exauriculatus (OLIV. et HIERN) O.
HOFFM. 127:442
fabrae SENNEN 126:156
fallax WALLR. 126:164
fauces-orci KNOCHÉ 125:298
299 315; **127: 22 24**
fauriei LÉVEILLÉ et VANOT .. 126: 182 184
ferox WALL. 126:164
filifolius SVENT. 127:433
fischeri O. HOFFM. 127:442
flexuosus LEDEB. 127:442
floridanus AIT. 127:442
floridanus L. 125:289; 127:442
floridanus LOUR. 127:442
floridanus MICHX. 127:442
fragilis BALL ... 125:295 297 311
314 318; **126: 192 193**
freynianus HUTER, PORTA et RIGO
ex HUTER 127:442
friesii BOULOS 125:300 301 316; **127: 421**
fruticosus JACQ. 127: 7 31
fruticosus L. FIL. ... 125:298 299
308 315; **127: 7 31**
fruticosus NORONHA 127:7 31 442
gandogerii PITARD ... 125:292 298
299 308 315; **127: 33 36 438 439**
gibbosus SAVI 127:444
giganteus SHUTTLEW. ex ROUY ... 126:165
gigas BOULOS ex HUMBERT
125:294 296 307 314; **126: 169 170**
glaber GILIB. 126:155
glaber SCHULT. 126:182
glaber THUNB. 126:164
glandulosus SCHUR 126:180
glaucescens JORD. 126:165
glaucus THUNB. 127: 22
glutinosus LAM. 127:442
gomerensis BOULOS 125:298
299 308 311 315; **127: 17**
gonzalezpadroni SVENT. 127: 17
goreënsis LAM. 127:443
goreënsis LESS. ex STEUD. 127:443
gorgadensis BOLLE 127:444
gracilis PHIL. 126:156
gracilis SENNEN in SENNEN et MAU-
RICIO 127:443
graecus REUT. ex WEISS 126:165
gramineus BOJ. ex DC. 127:443
grandifolius T. KIRK 125:308; 127:424
gummifer LINK 125:298 299
308 315; **127: 19**
hantoniensis SWEET 126:180
hastatus LESS. 127:443
hastatus WALL. 127:443
haussknechtii BRUEGG. 127:444
hieracioides WILLK. 126:174
hierrensis (PITARD) BOULOS
125:298 299 308 313 315 318; **127: 11**
hispanicus JACQ. 127:443
hispidulus BOVÉ ex DC. 127:443
hispidus GILIB. 126:180
hispidus LEDEB. 127:443
hochstetteri SCH. BIP. 127:443
hotha C. B. CLARKE 127:444
humilis ORLOVA 126:180
hydrophilus BOULOS 125:295
296 314; **126: 172**
hyoseridifolius HORNEM. 127: 26
hypochaeroides SCHLECHT. 127:444
imbricatus SVENT. 126:163
infestus POEPP. ex DC. 126:164
integrifolius HARV. 125:300
301 311 316; **127: 419 422**
f. lobatus R. E. FRIES 127:419
var. *schlechteri* R. E. FRIES ... 127:419
intermedium KROCH. 127:444
intermedius JAN ex DC. 127:443
intermedius KOCH 126:180
inundatus M. POP. 126:177
italicus SPRENG. 126:158
jacottetianus THELLUNG 127:443
jacquini DC. 125:308; 127:7 9 13
β *congestus* DC. 127: 9
var. *hierrensis* PITARD 127: 11
jacquini SPR. 127: 7 9
× *jaquinioccephalus* SVENT. 127:444
javanicus (BURM. FIL.) SPRENG. .. 127:443
javanicus JUNGH. 126:189

- javanicus* SPRENG. 125: 307;
 126: 189 190
kabarensis DE WILD. 127: 443
ketzkhovellii SCHCHIAN 126: 182
kralikii ROUY 126: 165
lacerus WILLD. 126: 155
lachnocephalus RECH. FIL. 126: 188
laciniatus T. MOORE 127: 444
lactuoides BUNGE 127: 411 443
lactuoides SCH. BIP. ex A. RICH. .. 127: 411
laevigatus WILLD. 127: 31
laevis GARSALT 127: 443
laevis VILL. 126: 155
laevissimus SCHUR 126: 180
lampsanoides LAM. 127: 443
lanifer DINTER 127: 443
lapponicus FROEL. 127: 443
lasiorhizus O. HOFFM. 127: 443
ledermannii R. E. FRIES 127: 443
leptocephalus CASS. 127: 429
leucodon FISCH. et MEY. 127: 443
leucophaeus WILLD. 127: 443
libycus SPACH ex BOISS. 127: 443
lidii BOULOS ... 125: 292 298 299
 308 315; **127: 33 36**
littoralis (T. KIRK) ALLAN
 125: 294 296 314; **126: 166 174**
littoralis (T. KIRK) COCKAYNE ... 126: 174
longifolius COLLA 127: 443
longifolius TREV. 126: 155 164 188
longifolius WALL. 126: 188
loscosii WILLK. 126: 174
lowei HEER ex BOLLE 127: 443
ladovicianus NUTT. 127: 443
luxurians (R. E. FRIES) C. JEFFREY
 125: 300 311 312 313 316 318; **127: 414**
luxurians SCHARD. in STEUD. 127: 443
lyratus WILLD. 127: 31
macer S. MOORE 127: 443
macranthus POIR. 127: 7
macrocarpus BOULOS et C. JEFF-
 REY 125: 287 294 296 307
 313 314; **126: 169 172**
macrophyllus WILLD. 127: 443
macrotus FENZL 126: 155
maculigerus H. LINDB. 127: 444
mairei LÉVEILLÉ 127: 444
malaianus MIQ. 125: 295 296
 307 314 317; **126: 189**
mareoticus DEL. ex BARBEY 127: 443
maritimus ECHEAND. ex LOSC. et
 PARD. 126: 177
maritimus L. ... 125: 295 296 307
 314; **126: 174 177 182 185**
 var. *malaianus* (MIQ.) HOCHR. .. 126: 189
maritimus PALL. ex LEDEB. 127: 443
maritimus TURCZ. 126: 182
masguindalii PAU et FONT QUER
 125: 295 297 314 315; **126: 192 193 195**
massaviensis (FRES.) SCH. BIP. .. 127: 443
mauritanicus BOISS. et REUT.
 125: 294 296 312 314 317; **126: 165 168 181**
maynari SVENT. 127: 444
megalocarpus (HOOK. FIL.) BLACK 127: 426
melanolepis FRESSEN. 125: 300
 316; **127: 416**
 var. *linearis* R. E. FRIES .. 127: 416 417
 f. *stramineus* R. E. FRIES .. 127: 416 417
metzianus SCH. BIP. 127: 443
montanus KOIDZ. 127: 444
montanus LAM. 127: 443
multiflorus DESF. 127: 443
nanellus R. E. FRIES 127: 443
nanus O. HOFFM. 127: 423 443
nanus SOND. ex HARV. et SOND.
 125: 300 301 316; **127: 423**
nigricans TAUSCH 127: 444
nitidus VILL. 126: 180
novae-zelandiae (HOOK. FIL.)
 BENTH. ex JAKS. 127: 443
nudicaulis (L.) SCH. BIP. 127: 443
nymanii TIN. et GUSS. 126: 165
obtusilobus R. E. FRIES .. 125: 300
 316; **127: 417**
occidentalis SPRENG. 127: 443
octophyllus SCH. BIP. in SCHWEINF.
 et ASCHERS. 127: 443
oleraceus L. 125: 287 289 291
 292 293 294 295 296 306 307 313
 314; **126: 154 161 164 165 169 177 181**
 γ et δ *asper* L. 126: 164
oleraceus WALL. 126: 164
oliveri-hiernii BOULOS 127: 414 443
 var. *luxurians* (R. E. FRIES)
 BOULOS 127: 414
oreophilus MIQ. 126: 189
orixensis ROXB. 126: 185
ortunoi SVENT. 127: 11
otaviensis DINTER 126: 174
pallescens PANČ. 126: 156
pallidus TORR. 127: 443
pallidus WILLD. 127: 443
palmensis (SCH. BIP.) BOULOS
 125: 298 299 308 315; **127: 11 28**
 431 438 439
paludosus GÜLDENST. ex LEDEB. .. 126: 177
palustris L. 125: 289 295 296
 307 311 312 314; **126: 177**
 subsp. *palustris* 125: 295; 126: 179
 subsp. *sosnowskyi* (SCHCHIAN)
 BOULOS 125: 295 296; **126: 177**
paniculatus MOC. et SESSÉ 127: 444
parviflorus LEJ. ex REICHENB. 126: 155
pauciflorus BAKER 127: 443
pectinatus DC. 126: 158
pendulus WEBB ex SCH. BIP. 127: 443
pensylvanicus MOLIN ex COLLA .. 127: 444
pensylvanicus SPRENG. ex STEUD. 127: 443
pentaphyllus (SCH. BIP.) SCH. BIP.
 in SCHWEINF. 127: 443
perennis (LANGE) H. LINDB. 126: 158
perfoliatus GÜLDENST. ex LEDEB. 127: 443
picris LÉVEILLÉ et VANOT 126: 185

- picroides* LAM. 127:443
picroides SIBTH. et SM. 127:443
pinnatifidus CAV. ... 125:288 298
 299 308 312 313 315; **127: 22**
pinnatifidus LAG. ex DC. ... 127: 22 443
pinnatus AIT. .. 125:299 308 315;
 127: 26 29 429
 var. *angustiloba* LOWE ... 127: 27 28
 var. *canariensis* SCH. BIP. 127: 30 33
 var. *latiloba* LOWE 127: 26 28
 var. *palmensis* SCH. BIP. .. 127: 28 29
pitardii BOULOS 125:292 299
 308 313 315; **127: 35**
platylepis WEBB 125:309; 127:428
plumerianus ST. LAG. 127:443
plumerii ST. LAG. 127:443
plumieri L. 127:443
plumieri PANČ. ex VIS. 127:444
polyodon WEBB et BERTH. 127: 9
pratensis SCHUR 126:180
prenanthoides M. BIEB. 126:157; 127:444
prenanthoides OLIV. et HIERN 127:444
prudhommei BOUCHARD 127:444
pulchellus PURSH 127:444
pustulatus WILLK. .. 125:295 297
 308 314; **126: 191** 192 194
pycnocephalus R. E. FRIES 127:444
quercifolius DESF. 127:444
quercifolius PHILLIPSON 127:444
racemosus LAM. 127:444
radicatus AIT. 125:298 299
 308 311 315; **127: 16** 19 20
radicatus LINK 127: 16
rarifolius OLIV. et HIERN 127:444
regis-jubae PITARD 127:437
reflexus LAG. 127:444
repens BUB. 126:180
reversus E. MEY. ex DC. 126:155
rivularis PHIL. 126:156
robustus WALL. 127:444
roseus BESS. ex SPRENG. 126:155
royleanus DC. 126:155
rueppellii (FRES. ex SCH. BIP.)
 R. E. FRIES 127:444
runcinatus (FIORI) ZENARI
 126:156; 127: 22
runcinatus VENT. ex SCH. BIP.
 126:156; 127: 22
sagittatus MOENCH 126:177
scapiformis THELLUNG 127:444
schimperii A. BRAUN et BOUCHÉ .. 126:155
schmidianus C. KOCH 126:155
schweinfurthii OLIV. et HIERN ...
 125:299 300 313 315; **127: 402** 407 408 410
 var. *camporum* R. E. FRIES 127:409
 var. *violaceus* HIERN 127:402
scorzoneraeformis LAG. 127:444
septensis GANDOGER 126:158
serratus PERR. ex DC. 127:444
setosus EHRENB. ex SWEET 127:444
sexpedalis GILIB. 126:177
shzucinianus TURCZ. ex HERD. 126:182
sibiricus L. 125:289; 127:444
sibiricus M. BIEB. 127:444
sibiricus RICHARDS 127:444
simplicissimus LAG. 126:179
sosnowskyi SCHCHIAN 126:177
spachii SCHWEINF. 127:444
spicatus LAM. 127:444
spinosus DC. 127:444
spinosus LAM. 126:164
spinosus MARÈS 127:444
spinulifolius SENNEN et MAURICIO 126:156
spinulosus BIGEL. 126:164
squamosus LAM. 127:444
squarrosus DC. 127: 31
stenophyllus R. E. FRIES
 125:300 315; **127: 408**
strictus PAU 127:444
subacaulis DUM.-COURS. ex STEUD. 127:444
subbipinnatifidus (GUSS.) ZENARI 126:156
suberosus ZOHARY et DAVIS 127:444
sulphureus BOISS. 126:164
sundaicus BLUME 126:155
taquetii LÉVEILLÉ 126:182
taraxacifolius WILLD. 127:444
taraxacifolius WILLD. sensu
 SPRENG. 127:444
tataricus L. 127:444
tectifolius SVENT. 127:444
tenax FISCH. et SWEET 127:444
tener SALISB. 126:158
tenerrimus L. 125:289 295
 296 307 311 313 314; **126: 156**
 157 **158** 163 165
 var. *tuberculatus* BALL ... 126: 161 162
tenerrimus SCHUR 126:156
tenuifolius NUTT. 126:158
tibesticus QUÉZEL 126:164
tigridus RUPR. 127:444
tingitanus (L.) LAM. 127:444
tomentosus PALAU ex WILLK. et
 LANGE 127:444
torulosus SAVI 127:444
transcaspicus NEVSKI 126:174
tuberifer SVENT. 125:295 297
 308 315; **126: 163 194**
 var. *latisecta* SVENT. 126:194
tuberosus MURR. 127:444
tysonii PHILLIPS 127:444
uliginosus M. BIEB. 125:292; 126:182
umbellatus E. MEY ex DC. 126:164
umbellifer THUNB. 126: 155 164
ustulatus LOWE 125:298 299
 315; **127: 17 20**
 var. *angustifolia* LOWE 127: 22
 var. *imbricata* LOWE 127: 22
 var. *latifolia* LOWE 127: 22
vaginatus HORT., ERF. ex STEUD. 127:444
verdickii (DE WILD.) R. E. FRIES 127:444
violaceus O. HOFFM. 127:444
virgatus DESF. ex STEUD. 127:444
viridis ZENARI 126:164
volhynicus BESS. ex NYM. 127:444

- vulgaris* ROUY 126: 174 180
wallichianus DC. 126: 188
webbii SCH. BIP. in WEBB et
 BERTH. 127: 435 436 444
welwitschii (SCOTT ELLIOT) CHIOV.
 ex S. MOORE 127: 444
wightianus DC. 125: 295 297
 307; **126: 181 184 185**
 subsp. *wallichianus* (DC.) BOU-
 LOS 125: 296 297; **126: 185 188**
 subsp. *wightianus* 125: 295 314
wilmsii R. E. FRIES 125: 300
 301 308 316; **127: 422**
zacinthoides DC. 126: 155
zollikoferioides ROUY 127: 444
Steptorhamphus tuberosus (JACQ.)
 GROSSH. 127: 444
Taeckholmia BOULOS **125: 293**
 302 306 309 312 313 316 317 318;
 127: 412 429 438
 sous-genre **Pseudodendrosonchus**
 BOULOS **125: 303 316; 127: 439**
- sous-genre **Taeckholmia**
125: 303 316; 127: 435
arborea (DC.) BOULOS ... 125: 303
 311 316; **127: 438**
canariensis BOULOS 125: 303
 316 317; **127: 433 435**
capillaris (SVEN.) BOULOS
 125: 303 316; **127: 431 434 435**
heterophylla BOULOS 125: 303
 309 316; **127: 435 439**
microcarpa BOULOS 125: 303
 309 316; **127: 434**
pinnata (L. FIL.) BOULOS
 125: 302 303 306 309 316; **127: 429**
regis-jubae (PITARD) BOULOS
 125: 303 316 317; **127: 436 437 439**
Taraxacum 125: 287
dens-leonis 126: 156 164 177 181
Trachodes D. DON 125: 293
Typha 126: 175

Botanical Literature

WINTERL, J. J.: *Index Horti Botanici Universitatis Hungaricae, que Pestini est.* 1788. — Facsimile edition, published by the Publishing House of the Hungarian Academy of Sciences. Price \$7.80.

By the end of the 18th century most European countries had made basic investigations of their flora. However, due to the disadvantages of history, great parts of Hungary still remained unexplored. This was true of the Hungarian Great Plain and the Central Mountains in particular, the flora of which differs greatly from that of other parts of central Europe.

In 1770 JAKOB JOSEPH WINTERL was appointed Professor of Chemistry and Botany at the Nagyszombat University. Starting in 1771 he organized a Botanical Garden, which in 1784 was moved to Pest. WINTERL went on innumerable botanical excursions and collected material for cultivation. In this way the *Index Horti Botanici* became more than just a list of plants cultivated in the Botanical Garden of Pest. In actual fact it was the first major contribution to the knowledge of the Hungarian flora. WINTERL's *Index* formed a solid base for the more detailed work on Hungarian plants carried out by his student and successor PÁL KITAIBEL.

The *Index* comprises 1652 taxa, some just mentioned by name, others with a Latin description. WINTERL considered 46 species to be new. Most of these were later validly published by EHRHART and WALDSTEIN & KITAIBEL. Unfortunately WINTERL just mentioned them as "nova", however with a Latin diagnosis.

The facsimile edition is accompanied by a postscript by SZ. PRISZTER. Among other information about WINTERL and his *Index* there are indexes showing WINTERL's plant names and the corresponding names

valid today. Surely it must have entailed a tremendous amount of work to identify all names, all species mentioned as "nova", and the 25 copperplate engravings which are appended to the *Index*.

The original *Index Horti Botanici* is extremely rare. At most there are 100 copies in existence. In Hungary only six complete copies have been found. The facsimile is very beautiful and will certainly find buyers among bibliophiles. Of course it will also be of value to all those who are interested in floristic research history.

LENNART ENGSTRAND

DREBES, G.: *Marines Phytoplankton. Eine Auswahl der Helgoländer Planktonalgen (Diatomeen, Peridineen).* Georg Thieme Verlag, Stuttgart 1974. 186 pp. Price DM 14.80.

With this small book a need has been met. A photo-flora dealing with the most common species of marine phytoplankton has long been wanted, and the fact that "Marines Phytoplankton" deals with a restricted area is no disadvantage as the area in question is the North Sea where true oceanic species quite often occur among the indigenous neritic species.

Much can be said in praise of this book: the splendid micrographs, the handy size, the price 14.80 DM and in particular the fact that it deals with diatoms, dinoflagellates, chrysophyceans and even some plankton parasites — generally one has to use as many floras as there are algal groups, and this applies even to students making a first contact with marine phytoplankton.

The micrographs are all of living material and many species are shown in more than one view, which is an excellent idea. However, the value of the book would

have been considerably increased if the cleaned frustles of certain species that are difficult to determine when alive had also been represented. This of course would have entailed a lot of extra work for the author, as the inclusion of a scale on each micrograph would have been, instead of merely indicating the magnitude of the enlargement.

Description, size, distribution and season are given for each species in the well-balanced text. In addition to this flora section there is another section dealing with methods of investigation. This section gives several methods for cleaning frustles, discusses the North Sea as a biotope and includes a discussion of the annual cycles of phytoplankton and the reproductive mechanisms of the algae concerned. A valuable glossary is found at the end of the book.

To summarize, the book is an excellent contribution to marine phytoplanktonology, with descriptions and illustrations of about 170 species of North Sea phytoplankton, and it will certainly attain a wider distribution than along the coasts of the North Sea.

LARS EDLER

BAEUMER, K.: *Allgemeiner Pflanzenbau*. UTB 18. Verlag Eugen Ulmer, Stuttgart 1971. 264 pp. Price DM 15.80 (cloth).

This book is number 18 in a pocket-book series (Uni-Taschenbücher, UTB, GmbH Stuttgart) published by a union of fourteen publishers. It deals with the fundamentals of and general methods of plant-growing primarily within agriculture, under different climatic conditions. Previous volumes have dealt with vegetation zones and climates (14), plant physiology (15), plant diseases and plant protection (16, 17), etc.

Among the factors described in the work are yield-supporting and yield-limiting processes (assimilation, transpiration; nutri-

ment consumption and production of solid constituents; distribution of roots in soil; growth and yield; weather conditions, climate and yield); interference in plant habit due to farming (cultivation, manuring, plant protection, watering); different methods of soil exploitation (biological factors for different successions of crops; problems of specialized agriculture); yield regulation (competition within plant stock; the combatting of weeds by mechanical and chemical means; sowing techniques and problems of harvesting).

According to the foreword the book is primarily intended for students of agriculture and science at university or college level. The volume has numerous drawings, which in a very informative manner describe different relations. Besides the usual histograms and linear functions there are 'three-dimensional', visual curves. A reader lacking a knowledge of chemistry, mathematics or biology at advanced school or college level would have difficulty in understanding many of these illustrations. However, the actual text is very easy to read and is a rich source of information.

Intensive agriculture has long been the practise. Maximum economic profit has been the main directive. It is evident from the contents cited above that the book aims at giving a theoretical background and a brief outline of what our possibilities are of carrying on intensive farming. The author is well aware of the disadvantages of monocultivation. He draws attention to the consequences resulting from the unplanned and uncontrolled use of chemical pesticides and herbicides. Different plans of action for avoiding or restricting the use of these poisons are reported on, but there are no examples of purely biological control such as are already in use in greenhouse cultivation and experimental field work.

In a concluding chapter man's chance of surviving the population explosion is described from a global point of view. Based on the assumption that eleven per cent only

of the surface of the earth is under cultivation, a maximum of 35 milliard people could live without starvation and that there would be sufficient room for them during working hours and during their leisure. These calculations are based on fact. The problems of population expansion are more likely to be problems of a political nature. A just distribution of the world's food resources appears to be an essential condition for a future world at peace, which implies that a new category of people need to read KORD BAEUMER's *Allgemeiner Pflanzenbau*: the politicians belonging to all parties.

ULF OLSSON

HEGNAUER, R.: *Chemotaxonomie der Pflanzen*. Eine Übersicht über die systematische Bedeutung der Pflanzenstoffe. Band 6. Dicotyledonae: Rafflesiaceae—Zygophyllaceae. Birkhäuser Verlag, Basel and Stuttgart 1973. ISBN 3-7643-0667-X. 882 pp. Price S.Fr. 178.00.

The sixth volume of HEGNAUER's valuable survey of plant constituents deals with the families Rafflesiaceae to Zygophyllaceae in alphabetical order including such important families as Ranunculaceae, Rosaceae, Rubiaceae, Rutaceae, Scrophulariaceae, Solanaceae and Umbelliferae. Leguminosae has not yet been dealt with and has been reserved for the seventh and last volume. According to the introduction the information in volume six is correct to November 1972.

Volume five was reviewed in *Bot. Notiser* 123: 203—204 (1970), and the same positive criticism and general statements that appear there apply to volume six. HEGNAUER's ability to integrate the data derived from classical taxonomical botany and phytochemistry is undisputed.

In volume six it is of especially great interest to read his critical comparison of the major systems according to CRONQUIST and TAKHTAJAN as regards the tubiflorous families as seen in the new light of chemo-

taxonomical data. Thus, contrary to the botanists mentioned, HEGNAUER concludes that Solanaceae and Convolvulaceae constitute a natural independent group within the tubiflorous plants. I am convinced that these and other plant systematic conclusions based upon chemical data will influence and facilitate the future revision of plant groups at any level.

It seems superfluous to mention the tremendous importance of the work for disciplines such as pharmacognosy, biochemistry, plant physiology and genetics.

ULF OLSSON

DODGE, CARROLL W.: *Lichen Flora of the Antarctic Continent and Adjacent Islands*. Phoenix Publishing, Canaan, New Hampshire. 1973. 22+399 pp. No illustrations. Price \$40.00 (boards).

For almost half a century Dr C. W. DODGE (University of Vermont, Burlington, Vermont, U.S.A.) has been one of the most productive authors in lichen taxonomy. His major works include "Some Lichens of Tropical Africa" 1—5 (1953—71), reviewed in *Bot. Notiser* 118 (1965) p. 131 and 126 (1973) p. 270, and several papers on lichens from Central and South America and Antarctica. He has worked up a considerable amount of lichen material from various Antarctic expeditions, for instance the second Byrd Expedition (with GLADYS E. BAKER, 1938) and the British-Australian-New Zealand Expedition (1948). These large volumes were followed by a series of minor papers "Lichenological Notes on the Flora of the Antarctic Continent and the Subantarctic Islands" 1—11 (1955—70).

As lichens play a predominant part in the vegetation of Antarctica a great deal of information on them has been accumulated since the early 1820's. Many new species have been described, in several cases based on very scanty material. A cri-

tical revision of all these data would have been highly appreciated. The reviewer regrets to state that the present volume does not in any way come up to these expectations.

The first impression of this Lichen Flora is good: a clear lay-out and handsome binding. Brief introductory chapters contain information on morphological adaptation to severe climates, geographical distribution and origin of the lichen flora, etc. The main part of this work (382 pp.) is a taxonomic account of lichens known from Antarctica, in general following ZAHLBRUCKNER's system. 27 families, 86 genera (one new: *Redonia*) and 424 species have been treated. There are numerous new combinations (several of which, however, have been made earlier by other authors), but only a few new species. Contrary to recommendation 37 B of the International Code of Botanical Nomenclature we find no information on where the type specimens are preserved.

It is evident, however, that Dr DODGE's Lichen Flora is much more a compilation from literature than the result of a critical revision of the material available, including a study of the type specimens. We often find vague information about type material studied, but there is much evidence that the author has seen fairly few types, at least from European Herbaria, and probably none during the last two decades. In the introduction he says that he has not seen the material of the two French CHARCOT expeditions (lichens published by HUE, many new species) which is available in Paris. "The descriptions are so complete that one is never in doubt as to whether the specimen before one is the same species as that described by Hue or not." Every lichenologist acquainted with HUE's longish descriptions knows that they are often vague and do not conform to the type specimens.

One of the author's strange ideas is that a species recorded from Antarctica must be endemic there or at least restricted to

the southernmost parts of the Southern Hemisphere. Some examples among many: *Verrucaria mucosa*, recorded by LAMB (1948), a very reliable lichenologist, from West Graham Land ("quite typical"), is quoted by DODGE (without seeing any types) as *V. microspora*, as the latter species was described from Chile. *Dermatocarpon intestiniforme*, reported by LAMB (l.c.) from East Graham Land, is quoted as *D. antarcticum* DODGE, "endemic" to Antarctica. *Alectoria pubescens* (an interesting bipolar lichen), recorded by LAMB (1964) from several districts in Antarctica, is quoted by DODGE as *A. nigerrima* HUE, also "endemic" to Antarctica. LAMB has seen HUE's type, which DODGE has not, and declares that it is identical with the well-known *A. pubescens* ("typical"). No kind of phytogeography can be founded on the material presented by DODGE.

Even regarded as a compilation this work has shortcomings. Some records of interesting Antarctic species have been overlooked, e.g. *Alectoria chalybeiformis*, *A. nigricans* (bipolar), *Cornicularia aculeata* (also bipolar) and *C. epiphorella* (LAMB, British Antarctic Survey, 1964).

As in his previous work the author has paid too little attention to formal detail. A few examples (among hundreds): Subgen. *Euverrucaria* (for Subgen. *Verrucaria*), Sect. *Euramalina* (for Sect. *Ramalinà*), 'Collèmàceàe' (for 'Collèmataceàe'), *Omphalodiscus Bakeri* (for *bakerae*), *Caloplaca Mawsoni* (for *mawsonii*).

The reviewer knows that the great majority of his colleagues agree with him in this criticism. From a letter written by one of the leading lichenologists of today, otherwise known for his moderate judgement, may be quoted: "This author has caused untold damage to taxonomic lichenology. His publications unfortunately cannot be simply ignored. Future serious lichenologists will have to spend much time and trouble in evaluating and identifying all his mainly worthless taxa."

OVE ALMBORN

Bot. Notiser, vol. 127, 1974

HALE, M. E.: *The Biology of Lichens*, 2nd Edition. Contemporary Biology. London (Edward Arnold Ltd.) 1974. 181 pp., 16 plates (black-and-white) and numerous figures in text. Price £5.50 (boards), £2.75 (paperback).

This textbook by Dr M. E. HALE, Smithsonian Institution, Washington D.C., U.S.A. was first published in 1967. Cf. review in Bot. Notiser 1968 p. 136. The present new edition follows its predecessor in all essentials. It is written in a clear and concise style, and the illustrations are of first-class quality.

Some chapters have been slightly changed or extended in order to bring information on recent progress in certain fields of lichenology up to date. Under "Chemistry of Lichens" the new techniques of thin-layer chromatography and mass spectrometry are mentioned briefly. The chapter "Effects of Atmospheric Pollution" has been slightly remodelled and reflects part of the vivid discussion on this topic during the last decade.

The scanning electron microscope came into general use in the study of lichens in 1968. It has greatly improved our knowledge of their surface structures. It is highly probable that some of these results will open up new pathways in lichen taxonomy.

The role of the "chemical strains" in the classification of lichens is discussed, and the various ways of treating their nomenclature are presented in a fairly neutral manner. "Most lichenologists are still far from convinced that chemical characters are valid specific or infraspecific criteria."

Part of the chapter on ecology has been rewritten to reflect the European methods of lichen phytosociology more fully than in the previous edition.

The reviewer does not hesitate to repeat his opinion from 1968: "Seldom has a student who wants to tackle the various fields of lichen science got so brilliant a survey of principles and problems as in this condensed little volume."

OVE ALMBORN

OPERA BOTANICA

Vol. 1. N. HYLANDER, I. JØRSTAD and J. A. NANNFELDT: Enumeratio Uredinearum Scandinavicarum. 1953. 102 pp. — H. HORN AF RANTZIEN: Middle Triassic Charophyta of South Sweden. 1954. 83 pp. — H. HJELMQVIST: Die älteste Geschichte der Kulturpflanzen in Schweden. 1955. 186 pp. — Price Sw. Kr. 30 (15).

Vol. 2. H. RUNEMARK: Studies in Rhizocarpon. I. Taxonomy of the Yellow Species in Europe. 1956. 152 pp. — H. RUNEMARK: Studies in Rhizocarpon. II. Distribution and Ecology of the Yellow Species in Europe. 1956. 150 pp. — G. KNABEN: On the Evolution of the Radicatum-Group of the Scapiflora Papavers as Studied in 70 and 56 Chromosome Species. A. Cytotaxonomical Aspects. 1959. 76 pp. — Price Sw. Kr. 30 (15).

Vol. 3. A. GUSTAVSSON: Studies on Nordic Peronosporas. I. Taxonomic Revision. 1959. 271 pp. — A. GUSTAVSSON: Studies on Nordic Peronosporas. II. General Account. 1959. 61 pp. — G. KNABEN: On the Evolution of the Radicatum-Group of the Scapiflora Papavers as Studied in 70 and 56 Chromosome Species. B. Experimental Studies. 1959. 96 pp. — Price Sw. Kr. 30 (15).

Vol. 4. R. DAHLGREN: Revision of the Genus Aspalathus. I. The Species with Flat Leaflets. 1960. 393 pp. — Price Sw. Kr. 30 (15).

Vol. 5. Å. LÖVE and D. LÖVE: Chromosome Numbers of Central and Northwest European Plant Species. 1961. 581 pp. — Price Sw. Kr. 40 (20), bound Sw. Kr. 48 (28).

Vol. 6. Å. PERSSON: Mire and Spring Vegetation in an Area North of Lake Törneträsk, Torne Lappmark, Sweden. I. Description of the Vegetation. 1961. 187 pp. — R. DAHLGREN: Revision of the Genus Aspalathus. II. The Species with Ericoid and Pinoid Leaflets. 1—2. 1961. 120 pp. — Å. PERSSON: Mire and Spring Vegetation in an Area North of Lake Törneträsk, Torne Lappmark, Sweden. II. Habitat Conditions. 1962. 100 pp. — Price Sw. Kr. 40 (20).

Vol. 7. N. MALMER: Studies on Mire Vegetation in the Archaean Area of Southwestern Götaland (South Sweden). I. Vegetation and Habitat Conditions on the Åkhult Mire. 1962. 322 pp. — II. Distribution and Seasonal Variation in Elementary Constituents on Some Mire Sites. 1962. 67 pp. — Price Sw. Kr. 40 (20).

Vol. 8. R. DAHLGREN: Revision of the Genus Aspalathus. II. The Species with Ericoid and

Pinoid Leaflets. 3. 1963. 183 pp. — N. SYLVÉN: Det skandinaviska floraområdets Carices Distigmaticae. The Carices Distigmaticae of the Scandinavian Flora District. 1963. 161 pp. — C. BLIDING: A Critical Survey of European Taxa in Ulvales. I. Capsosiphon, Percursaria, Blidingia, Enteromorpha. 1963. 160 pp. — Price Sw. Kr. 40 (20).

Vol. 9. R. DAHLGREN: Studies on Aspalathus and Some Related Genera in South Africa. 1963. 301 pp. — S. O. STRANDHEDE: Chromosome Studies in Eleocharis, subser. Palustres. III. Observations on Western European Taxa. 1965. 86 pp. — Price Sw. Kr. 40 (20).

Vol. 10. R. DAHLGREN: Revision of the Genus Aspalathus. II. The Species with Ericoid and Pinoid Leaflets. 4. 1965. 231 pp. — S. O. STRANDHEDE: Morphologic Variation and Taxonomy in European Eleocharis, subser. Palustres. 1966. 187 pp. — Price Sw. Kr. 40 (20).

Vol. 11. R. DAHLGREN: Revision of the Genus Aspalathus. II. The Species with Ericoid and Pinoid Leaflets. 5. 1966. 266 pp. — G. NORDBORG: Sanguisorba L., Sarcopoterium Spach, and Bencomia Webb et Berth. Delimitation and Subdivision of the Genera. 1966. 103 pp. — Price Sw. Kr. 50 (30).

Vol. 12. B. E. BERGLUND: Late-Quaternary Vegetation in Eastern Blekinge, Southeastern Sweden. A Pollen-analytical Study. I. Late-Glacial Time. 1966. 180 pp. — II. Post-Glacial Time. 1966. 190 pp. — Price Sw. Kr. 70 (42).

No. 13. S. SNOGERUP: Studies in the Aegean Flora. VIII. Erysimum Sect. Cheiranthus. A. Taxonomy. 1967. 70 pp. — Price Sw. Kr. 15 (9).

No. 14. S. SNOGERUP: Studies in the Aegean Flora. IX. Erysimum Sect. Cheiranthus. B. Variation and Evolution in the Small-Population System. 1967. 86 pp. — Price Sw. Kr. 16 (9.40).

No. 15. R. DAHLGREN: Studies on Penaeaceae. I. Systematics and Gross Morphology of the Genus Stylapterus A. Juss. 1967. 40 pp. — Price Sw. Kr. 8 (4.80).

No. 16. G. NORDBORG: The Genus Sanguisorba Section Poterium. Experimental Studies and Taxonomy. 1967. 166 pp. — Price Sw. Kr. 27 (16.20).

No. 17. I. BJÖRKQVIST: Studies in Alisma L. I. Distribution, Variation and Germination. 1967. 128 pp. — Price Sw. Kr. 25 (15).

No. 18. R. DAHLGREN: Studies on Penaeaceae. II. The Genera Brachysiphon, Sonderotham-

nus and Saltera. 1968. 72 pp. — Price Sw. Kr. 13 (7.80).

No. 19. I. BJÖRQVIST: Studies in *Alisma* L. II. Chromosome Studies, Crossing Experiments and Taxonomy. 1968. 138 pp. — Price Sw. Kr. 25 (15).

No. 20. B. NORDENSTAM: The Genus *Euryops*. I. Taxonomy. 1968. 409 pp. — Price Sw. Kr. 55 (33).

No. 21. R. DAHLGREN: Revision of the Genus *Aspalathus*. II. The Species with Ericoid and Pinoid Leaflets. 6. 1968. 309 pp. — Price Sw. Kr. 75 (45).

No. 22. R. DAHLGREN: Revision of the Genus *Aspalathus*. III. The Species with Flat and Simple Leaves. 1968. 126 pp. — Price Sw. Kr. 30 (18).

No. 23. B. NORDENSTAM: Phytogeography of the Genus *Euryops* (Compositae). A Contribution to the Phytogeography of Southern Africa. 1969. 77 pp. — Price Sw. Kr. 20 (12).

No. 24. T. MÖRNSJÖ: Studies on Vegetation and Development of a Peatland in Scania, South Sweden. 1969. 187 pp. — Price Sw. Kr. 50 (30).

No. 25. G. TYLER: Studies in the Ecology of Baltic Sea-Shore Meadows. II. Flora and Vegetation. 1969. 101 pp. — Price Sw. Kr. 25 (15).

No. 26. M. SONESSON: Studies on Mire Vegetation in the Torneträsk Area, Northern Sweden. III. Communities of the Poor Mires. 1970. 120 pp. — Price Sw. Kr. 30 (18).

No. 27. F. ANDERSSON: Ecological Studies in a Scanian Woodland and Meadow Area, Southern Sweden. I. Vegetational and Environmental structure. 1970. 190 pp. — Price Sw. Kr. 50 (30).

No. 28. A. STRID: Studies in the Aegean Flora. XVI. Biosystematics of the *Nigella arvensis* Complex. With Special Reference to the Problem of Non-adaptive Radiation. 1970. 169 pp. — Price Sw. Kr. 50 (30).

No. 29. R. DAHLGREN: Studies on Penaeaceae. VI. The Genus *Penaea*. 1971. 58 pp. — Price Sw. Kr. 30 (18).

No. 30. A. STRID (ed.): Evolution in the Aegean. Proceedings of a Symposium held at the Department of Plant Taxonomy, Lund, Sweden on January 22–24, 1971. 1971. 83 pp. — Price Sw. Kr. 35 (21).

No. 31. J. LUNDGREN: Revision of the Genus *Anaxeton* Gaertn. (Compositae). 1972. 59 pp. — Price Sw. Kr. 25 (15).

No. 32. A. K. STRID: Revision of the Genus *Adenandra* (Rutaceae). 1972. 112 pp. — Price Sw. Kr. 40 (24).

No. 33. A. L. STORCK: Studies in the Aegean Flora. XX. Biosystematics of the *Malcolmia maritima* Complex. 1972. 118 pp. — Price Sw. Kr. 50 (30).

No. 34. R. VON BOTHMER: Studies in the Aegean Flora. XXI. Biosystematic Studies in the *Allium ampeloprasum* Complex. 1974. 104 pp. — Price Sw. Kr. 55 (33).

No. 35. K. PERSSON: Biosystematic Studies in the *Artemisia maritima* Complex in Europe. 1974. 188 pp. — Price Sw. Kr. 100 (60).

No. 36. U. ELIASSON: Studies in Galápagos Plants. XIV. The Genus *Scalesia* Arn. 1974. 117 pp. — Price Sw. Kr. 60 (36).

No. 37. A. K. STRID: A Taxonomic Revision of *Bobartia* L. (Iridaceae). 1974. 45 pp. — Price Sw. Kr. 30 (18).

OPERA BOTANICA SER. B: FLORA OF ECUADOR

No. 1. G. HARLING: 216. *Cyclanthaceae*. 1973. 48 pp. — Price Sw. Kr. 35 (21).

No. 2. B. SPARRE: 89. *Tropaeolaceae*. 1973. 31 pp. — Price Sw. Kr. 25 (15).

No. 3. PH. A. MUNZ: 141. *Onagraceae*. 1974. 46 pp. — Price Sw. Kr. 35 (21).

Volumes in preparation. MILDRED MATHIAS and L. CONSTANCE: 145. *Umbelliferae*. — K. RAHN: 184. *Plantaginaceae*.

BOTANISKA NOTISER SUPPLEMENT

Vol. 1. S. WALDHEIM: *Kleinmoosgesellschaften und Bodenverhältnisse in Schonen*. 1947. 203 pp. — O. ALMBORN: *Distribution and Ecology of some South Scandinavian Lichens*. 1948. 254 pp. — Price Sw. Kr. 15 (10).

Vol. 2. H. HJELMQVIST: *Studies on the Floral Morphology and Phylogeny of the Amentiferae*. 1948. 171 pp. — O. ANDERSSON: *Larger Fungi on Sandy Grass Heaths and Sand Dunes in Scandinavia*. 1950. 89 pp. — A. ALME-

STRAND and A. LUNDH: Studies on the Vegetation and Hydrochemistry of Scanian Lakes. I—II. 1951. 174 pp. — Price Sw. Kr. 15 (10).

Vol. 3. A. LUNDH: Studies on the Vegetation and Hydrochemistry of Scanian Lakes. III. 1951. 138 pp. — O. HEDBERG, O. MÅRTENSSON, and S. RUDBERG: Botanical Investigations in the Pältsa Region of Northernmost Sweden. 1952. 209 pp. — K. H. RECHINGER FIL.: Monograph of the Genus *Rumex* in Africa. 1954. 114 pp. — Price Sw. Kr. 15 (10).

Opera Botanica (except Ser. B) is published by the Lund Botanical Society in cooperation with the Department of Plant Taxonomy, University of Lund. It consists of comprehensive papers issued at indefinite times.

Opera Botanica Ser. B, Flora of Ecuador, is published by the Department of Systematic Botany, University of Göteborg and the Section of Botany, Riksmuseum, Stockholm. This series is also issued at indefinite times.

All parts of Opera Botanica and its predecessor Botaniska Notiser Supplement are still available.

Booksellers and non-members should apply to C.W.K. Gleerup Bokförlag, Öresundsvägen 1, S-222 38 Lund, Sweden. Prices given are approximate. Members of the Lund Botanical Society receive all the three series at a reduced rate (bracketed prices). Members should apply direct to Opera Botanica, Botanical Museum, Ö. Vallgatan 18, S-223 61 Lund, Sweden.

UNIVERSITETSBIBLIOTEKET

05. DEC. 1974

LUND