Drawings of Scandinavian Plants 41–44

Rubus L. Subgen. Rubus

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Rubus hartmani GANDOGER ex SUDRE 1905

(*Rubus horridus* HARTMAN 1832)

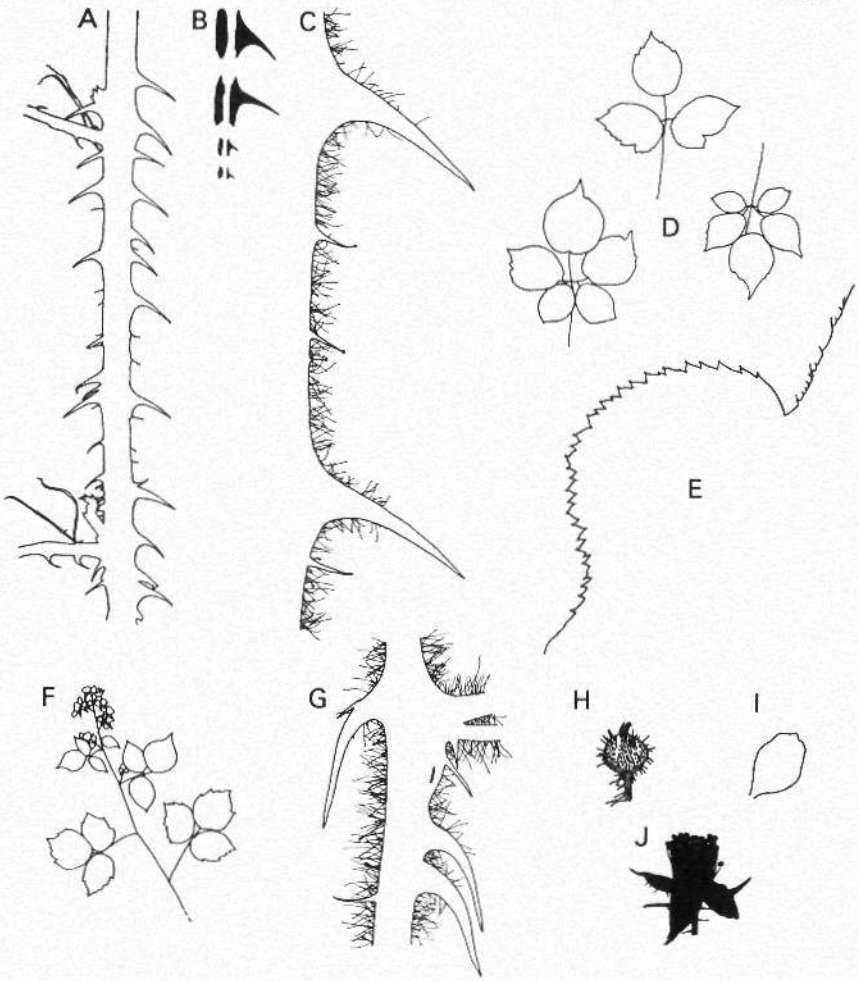
Stem arching—creeping, densely hairy, glandular; *prickles* unequal, the smaller ones bristle-like, the larger 5—8 mm long, slightly bent—falcate, with 3—8 mm long bases; *leaves* 3—5-foliolate, glabrescent above, velvety pubescent, green—grey beneath; *terminal leaflet* elliptic—orbiculate, acuminate; *inflorescence* rather long, with a dense, almost leafless apex and spreading axillary branches, prickles numerous, some of them bristle-like, others larger, recurved or hooked, with long, pale tips, glands numerous; *flowers* 1.5—2 cm across; *sepals* grey-tomentose, acuminate, prickles numerous; *petals* white—pink, broadly obovate; *filaments* about 5 mm long.

Normally, the stem is terete—angled, rather strong, purple—brown, the hairs are short; the prickles are numerous, larger ones with a rather strong, dark base and a light tip; the leaflets are coarsely and unevenly serrated; the terminal leaflet from a 5-foliolate leaf, except the tip, is less than twice as long as the petiolule, whereas the petiolules of the lower pair of leaflets are about 0.5 cm long; the branches of the inflorescence have at least three flowers; the disposition of the sepals varies from deflexed to loosely clasping the fruit. *R. hartmani* grows on rocky ground in the Östergötland archipelago on the Swedish east coast. WATSON (1958) reports the species from Bornholm.

Rubus bellardii WEIHE & NEES 1825

Stem procumbent, hairs few, glands numerous; *prickles* of two kinds, one 1—2 mm long, bristle-like, the other up to 5 mm long, retrorse,

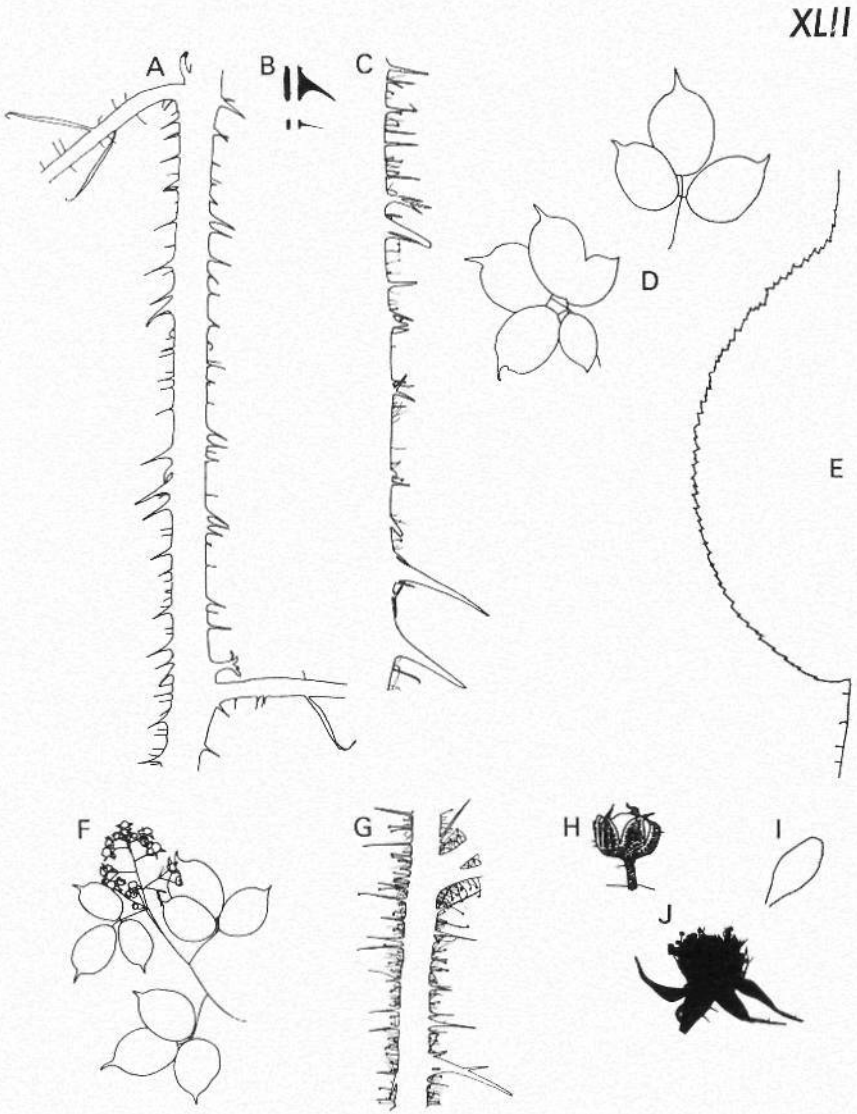
XLI



Pl. XLI. *Rubus hartmani* GANDOGER. — Remark: E refers to a 5-foliolate leaf.

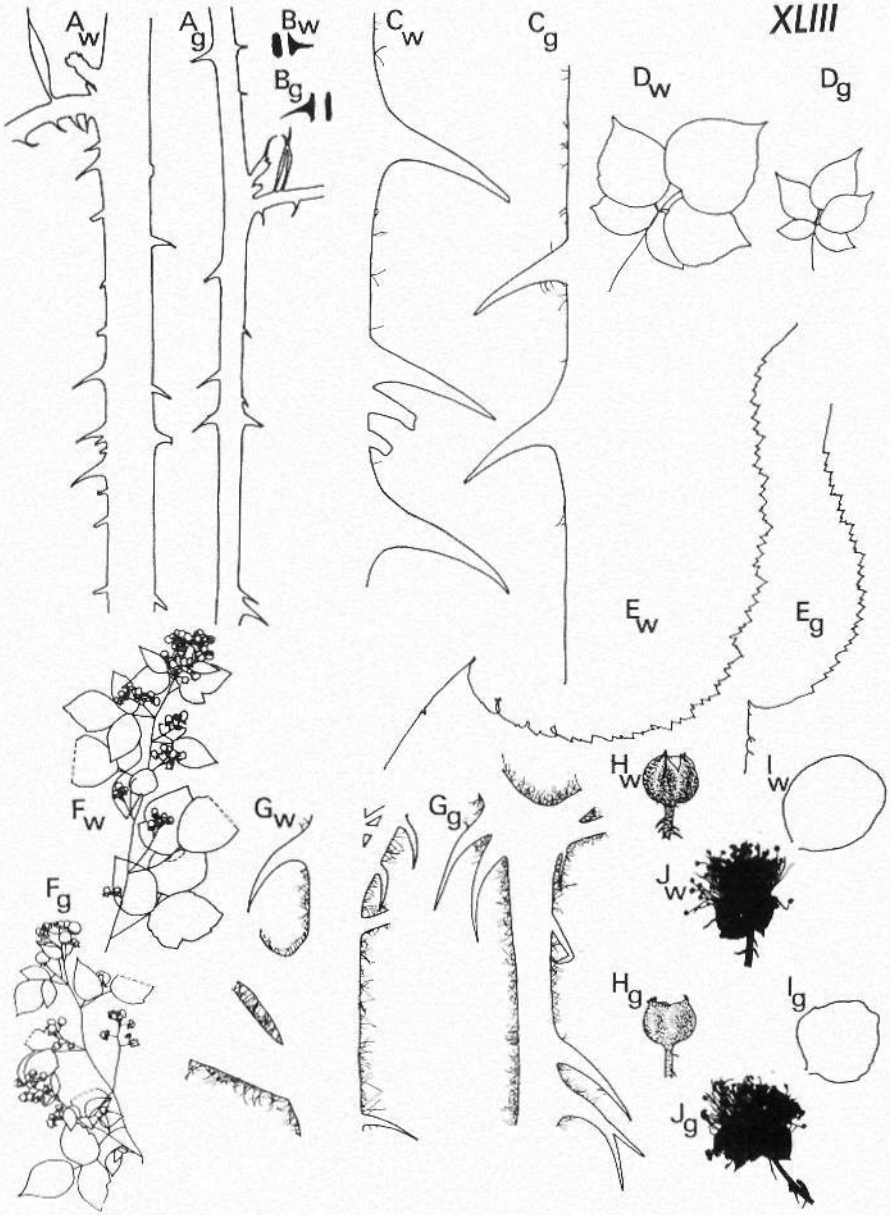
GENERAL LEGEND FOR THE PLATES

First-year growth (*primocane*): A. Stem with prickles. 1 : 1. — B. Prickles, drawn from the side and from above. 1 : 1. — C. Stem with prickles, glands, and hairs. 4 : 1. — D. Leaves (without serration and petiole diameter shown). 1 : 8. — E. Margin of a terminal leaflet with a petiolule. 1 : 2. — *Second-year growth* (*floricane*): F. Inflorescences (without prickles, serration of the leaves, and axis diameters shown). 1 : 8. — G. Rachis with prickles, glands, and hairs. 4 : 1. — H. Floral bud with prickles. 1 : 1. — I. Petal (without hairs). 1 : 1. — J. Flower (without petals, glands, and hairs). 1 : 1.

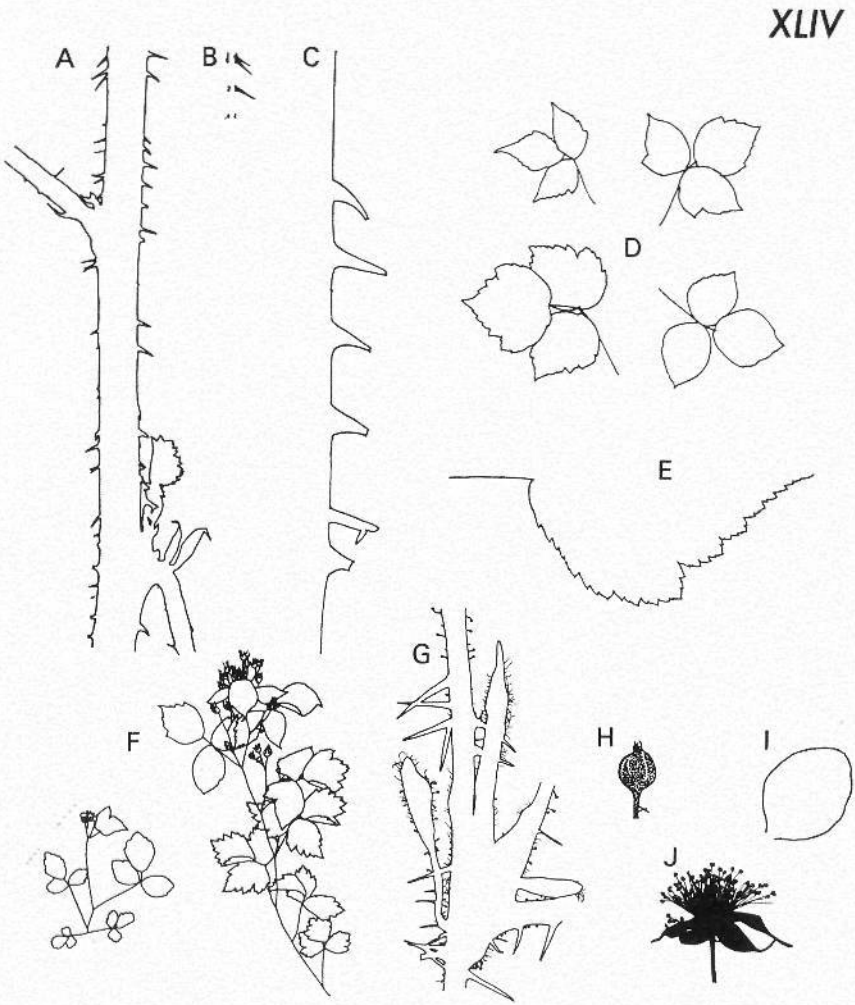


Pl. XLII. *Rubus bellardii* WEIHE & NEES. — Remark: D. 4- or 5-foliolate leaves are rare.

straight, with an up to 4 mm long, narrow base; *leaves* 3-foliolate, with scattered, rather long, stiff hairs above, and somewhat scabrous beneath; *terminal leaflet* oblong, elliptic or obovate, abruptly long-acuminate; *inflorescence* relatively short and broad, branches widely spreading,



Pl. XLIII. *Rubus corylifolius* agg. — Remarks: Referring to HYLANDER (1955), *R. gothicus* (**g**) and *R. wahlbergii* (**w**) belong to the most common species within the *R. corylifolius* agg. in Scandinavia. — F. Considerably smaller inflorescences also occur.



Pl. XLIV. *Rubus caesius* L.

pedicels rather long, glands and small, straight prickles numerous; *flowers* about 2 cm across; *sepals* greyish, triangular, acuminate, glands and small prickles numerous; *petals* white, narrowly obovate; *filaments* about 5 mm long.

Normally, the stem is terete, light brown or dark purple; the prickles are numerous and have needle-like, long, yellow tips; the leaf surfaces are large and flat, bright green above, green beneath; the leaflets are

finely serrated; the terminal leaflet, except the tip, is almost four times as long as the petiolule, whereas the petiolules of the other two leaflets are about 0.4 cm; the stipules are 1—1.5 cm long, linear, attached to the petiolule about 1 cm from the axil; the apex of the inflorescence has a few, entire leaves and 1—3-flowered branches; the sepals clasp the fruit. *R. bellardii* grows in damp woods, often covering most of the ground. In Sweden, the species occurs along the east coast (Oskarshamn —Norrköping). In Denmark, the species is known from several localities in south-eastern Jylland, but is rare on Sjælland and Fyen.

Rubus corylifolius agg.

(*Rubus* grex *Corylifolii* FOCKE 1914, *Rubus dumetorum* WEIHE 1824)

Stem low-arching or creeping, usually glabrous, glands absent (or present); *prickles* 3—6 mm long, patent or somewhat recurved, base 2—5 mm long; *leaves* 5 (3—7)-foliolate, glabrescent (—rather hairy) above, sparsely hairy, green or velvety pubescent, green—light grey-tomentose beneath; *terminal leaflet* cordate, ovate, elliptic, rhomboid or broadly obovate, with a short—rather long, broad tip; *inflorescence* small, racemose, leafless, or larger, pyramidal, leafy, compound, with a corymbose apex and relatively short axillary branches, prickles often numerous, patent—falcate, sometimes strong, glands absent or present; *flowers* 2—3 cm across, *sepals* usually grey—white felted, short-tipped; *petals* white or pink, orbiculate (—rather narrow); *filaments* about 5 mm long.

Normally, the stem is more than 2 m long, terete—angular, greenish or dark brownish red, not pruinose; the prickles are rather numerous, relatively strong; the petiolule of the terminal leaflet is 2—4 cm long, the petiolules of the upper pair of leaflets are 0.5 (—1.5) cm long, while those of the lower pair are about 1 mm long or lacking; the stipules are narrowly lanceolate, green, 1 cm long or more, and 0.1—0.3 cm broad, attached to the petiolule less than 0.5 cm from the axil; the sepals are spreading, deflexed or clasping the fruit; the fruit is dull black, consisting of relatively few, large, pulpy druplets. *R. corylifolius* agg. grows on the edge of cultivated fields, in pasturelands and open woods. The taxon occurs in Norway along the south-east coast. In Sweden, it is rather rare along the west coast; is rather common along the east coast from Norrköping and southwards, and on Öland; and is rare on Gotland and in the region between Stockholm and Göteborg. In Denmark,

it occurs over the entire country. *R. corylifolius* agg. is the only taxon of blackberry that is known from Finland, being represented on Åland.

R. corylifolius agg. has been divided into some thirty species in Scandinavia. The variation within this taxon is rather great, but my experience from both living and dried *R. corylifolius* agg. in Sweden indicates that there is no possibility to determine more than a fraction of the specimens found in nature using the existing keys.

R. corylifolius agg. is generally believed to have its origin from crossings between various blackberries and the dewberry (*R. caesius* L.). In south-eastern Sweden, except on Öland and Gotland, *R. corylifolius* agg. has a considerably wider distribution than *R. caesius*. This implies that the suggested hybrid origin can hardly be recent for most of the *R. corylifolius* agg. in this area. My own frequency mapping in southern Sweden (1959—63, unpublished) supports the assumption that *R. corylifolius* agg., in Sweden, has reached its optimal distribution. I believe that *R. corylifolius* agg., in Scandinavia, should not be recognized as a great number of species nor as dewberry hybrids, but as a single taxon.

Rubus caesius L. 1753

Stem creeping, pruinose, glabrescent; *prickles* 1—3 mm long, recurved, bristle-like, base up to 2 mm long; *leaves* 3-foliolate, sparsely hairy above, pubescent, green—greyish green beneath; *terminal leaflet* rhomboid or broadly ovate—triangular, somewhat lobate; *inflorescence* lax, leafy, compound with alternating corymbs, pedicels long, prickles bristle-like, glands present; *flowers* 2—2.5 cm across; *sepals* greyish, long-acuminate, glandular; *petals* white, broadly ovate—obovate; *filaments* 4—5 mm long.

Normally, the stem is about 1 m long, terete, 2—4 mm thick, light grey-green or dark purple; the bristle-like prickles are numerous (sometimes almost lacking); the pair of leaflets has basal lobes and 0—3 mm long petiolules; the stipules are broadly lanceolate, green; the inflorescence is long, erect; the sepals are rather large and loosely clasp the fruit; the fruit, consisting of relatively few, large druplets, is pruinose, watery, and flavorous. *R. caesius*, the dewberry, prefers calcareous ground and can be found in the open, along roads and ditches, or in damp woods. The species is rather common in Denmark. In Sweden, it is common on Öland and Gotland and in Skåne, except on the ridges, but is rather rare in the region between Stockholm and Göteborg, along the coasts, and northernmost to Gävle. In Norway, this species is known

from the south-easternmost part and a few localities in the south-west. In Finland, it occurs on Åland.

R. caesius sometimes forms hybrids with *R. idaeus* L., whereas the hybrid *R. caesius* L.×*R. saxatilis* L. is very rare.

In the next paper, I intend to terminate my current contribution to "Drawings of Scandinavian Plants" with a key of the treated taxa and a brief discussion.

LITERATURE

ARESCHOUG, F. W. C. 1879. Rubus. — In: HARTMAN, Handbok i Skandinaviens Flora. 11 uppl., pp. 279—285. — Stockholm.

BLYTT, A. 1906. Haandbog i Norges Flora. — Kristiania. 780 pp.

FOCKE, W. O. 1910, 1911, 1914. Species Ruborum I—III. — Biblioth. Bot. (Stuttgart) 72 (1—2), 83. 498 pp.

FRIDERICHSEN, K. 1914, 1922. Rubus. — In: RAUNKIÆR, Dansk ekskursionsflora. Eds. 3—4. — Kjøbenhavn.

HESLOP-HARRISON, Y. 1968. Rubus. — In: Flora Europaea 2: 7—25. — Cambridge.

HIITONEN, I. 1933. Suomen Kasvio. — Helsingissä. 771 pp.

HUBER, H. 1965. In: HEGI, Illustrierte Flora von Mitteleuropa IV (2). — München.

HULTÉN, E. 1950. Atlas över växternas utbredning i Norden. — Stockholm. 512 pp.

HYLANDER, N. 1955. Förteckning över Nordens växter. 1. Kärlväxter. — Lund. 175 pp.

LEGRAIN, J. 1958, 1959. Rubus. — In: ROBYNS, Spermatophytes. 3 (1—2). — Bruxelles. 306 pp.

LID, J. 1963. Norsk og svensk flora. — Oslo. 800 pp.

LINDMAN, C. A. M. 1926. Svensk fanerogamflora. 2 uppl. — Stockholm. 644 pp.

NEUMAN, L. M. 1901. Sveriges flora (Fanerogamerna). — Lund. 832 pp.

OREDSSON, A. 1963. Rubus. — In: H. WEIMARCK, Skånes flora, pp. 371—378. — Lund.

WATSON, W. C. R. 1958. Handbook of the Rubi of Great Britain and Ireland. — Cambridge. 274 pp.

Studies in the Aegean Flora XVII

Variation and Distribution of Atriplex recurva D'Urv. (Chenopodiaceae)

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ABSTRACT

GUSTAFSSON, M.: Studies in the Aegean Flora XVII Variation and Distribution of Atriplex recurva D'URV. (Chenopodiaceae). — Bot. Notiser 123: 371—383, Lund.

Evidence is presented for the separation of *Atriplex recurva* D'URV. (endemic in the Aegean area of Greece) from *A. tatarica* L. *A. recurva* is described in detail, including the local variation. The chromosome number (2n=18) has been determined in material from six populations. A map of the total distribution of *A. recurva* is included. The floating capacity of the bracteoles and the germinability of seeds have been investigated. The evolutionary situation within the species and the background for its present, irregular distribution are discussed.

INTRODUCTION

On the recommendation of Dr. H. RUNEMARK, Lund, a study has been made of the cytology and morphological variation in *Atriplex recurva* D'URV., a species endemic in the Aegean region of Greece.

A. recurva was described by D'URVILLE (1822), based on material collected "ad litus Atticum propè insulam Helenam" (orig. collection not seen). Later botanists have mostly treated it as a member of the polymorphic species *A. tatarica* L. [*A. tatarica* L. var. *recurva* (D'URV.) HAL., *A. tatarica* f. *recurva* (D'URV.) GÜRKE and *A. tatarica* ssp. *recurva* (D'URV.) RECH. FIL.], or rarely as a variety of *A. laciniata* L. [*A. laciniata* var. *recurva* (D'URV.) MOQ.]. In Flora Europaea (1964), AELLEN only lists it as a synonym of *A. tatarica*. RECHINGER raised it again to specific rank (1950, 1955), but without any taxonomic comments.

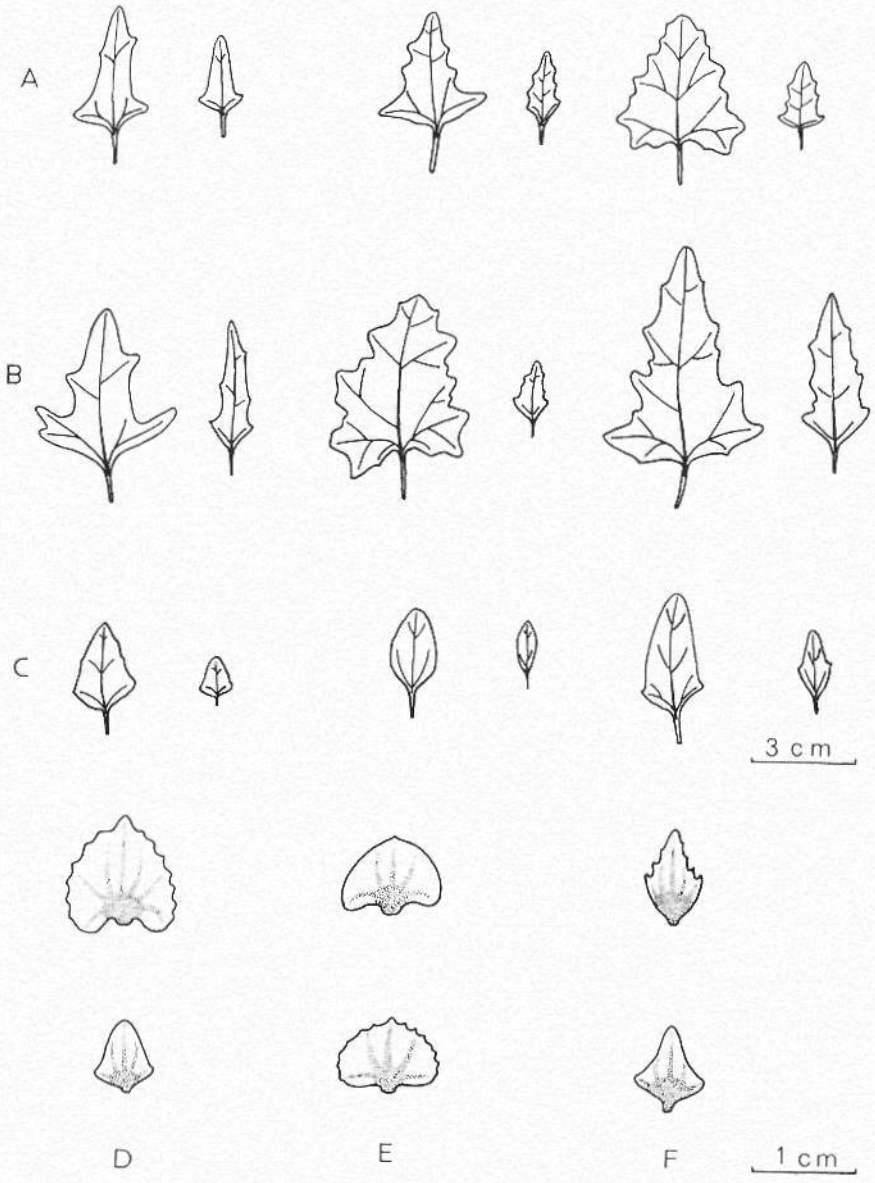

Fig. 1. The shape of the lower and upper leaves of *Atriplex recurva* (A), *A. tatarica* (B), *A. halimus* (C). — Bracteoles of *A. recurva* (D), *A. halimus* (E), *A. tatarica* (F).

Table 1. Comparison between *A. recurva*, *A. tatarica*, and *A. halimus* in some features of morphology and ecology.

	A. recurva	*A. tatarica*	*A. halimus*
Duration	Perennial	Annual	Perennial
Stem habit	Procumbent	Erect	Erect
Leaf-type	Triangular	Triangular	Ovate—rhombic
Leaf-margin	Lobed—dentate	Lobed—dentate	Entire
Inflorescence	Without leaves	With small leaves	With leaves
Bracteoles	Rhombic—orbicular	Rhombic	Rhombic—orbicular
Ecology	Maritime	Weed and ruderal	Maritime

MATERIAL

The present investigation of *A. recurva* is based on material collected in the Aegean area by H. RUNEMARK and co-workers in 1957—1969. In addition, herbarium specimens from Vienna (W) have been studied. Seed collections from some populations were grown in the greenhouses of the Lund Botanical Garden in 1968 and 1969 (cf. p. 383). All known localities are listed at the end of this paper.

TAXONOMIC POSITION

Earlier, *A. recurva* was included in *A. tatarica*; but there are so many differences between these two species in morphology, ecology and distribution (Fig. 1 and Table 1) that they should be retained as separate species. Both of these species belong to sect. *Sclerocalymma* ASCH. together with two other European species, *A. laciniata* L. and *A. rosea* L.; two Asiatic species, *A. sphaeromorpha* ILJIN and *A. transcaspica* BORNM. et SINT.; and one Asiatic-Arabic-African species, *A. dimorphostegia* KAR. et KIR.

A. halimus L., is widely distributed in the Mediterranean region. ULBRICH (1934) placed it in sect. *Teutlioides* ULBRICH. This section is divided into two series — one consisting of *A. halimus* and species in Africa, Arabia, and India; the other is comprised of Australian species. *A. halimus* has many characters in common with *A. recurva* and *A. tatarica*, e.g., the vertical seeds with the radicle pointing upwards, the shape of the stigmas, stamens, and bracteoles. The main difference between *A. halimus* and *A. recurva*—*A. tatarica* is the entire leaves of *A. halimus* versus the dentate or lobed leaves of the other species (Fig. 1 and Table 1). These three species can hardly be referred to different sections. Probably, *A. halimus* ought to be transferred to sect. *Sclerocalymma*. Data from crossing experiments are highly desirable.

The only common species of this section in the Aegean area are *A. recurva* and *A. halimus*. *A. rosea* has been introduced around ports and villages.

MORPHOLOGY

A. recurva is a perennial species with a much branched, prostrate habit and ascending branches, 10—40 cm high. The basal stem is 0.5—2 cm in diameter. Both the stem and the lower branches are smooth and strongly lignified. The number of annual rings indicates that *A. recurva* can have a longevity of 30 years or more.

LEAVES. The lower leaves are up to 7×5 cm, but often much smaller, silvery or grey, rhombic to triangular, always dentate or lobed, the lowest lobes being largest. The young leaves are covered with glands, which disappear with age. The upper leaves are like the lower ones, but smaller. All leaves are opposite and most of them are excurved.

INFLORESCENCE AND FLOWERS (see Fig. 2). The terminal inflorescence is rather long (5—10 cm), often branched and always leafless. The flowers are of two types: *1.* male flowers, with five stamens and a five-lobed perianth. The ovate perianth lobes are membranous with a light green midrib. 2. Female flowers, with two large, persisting bracteoles surrounding the gynoecium and without a perianth. Bisexual flowers have not been observed. The two stigmas are papillate to the base; the style is very short; and the ovary contains only one ovule.

BRACTEOLES AND SEEDS. The bracteoles are grey, up to 2 cm long, with a rhomboidal to orbicular shape and with no or small appendages on the back. The bracteoles are united to the middle and become indurated below. The seeds are dimorphic. The large seeds are brown and ovoid, while the small seeds are black and spheroidal. The small seeds are rather rare. The radicle is always pointing upwards.

FLOWERING TIME AND SEED SET. In nature *A. recurva* flowers during the spring or summer and the seeds mature in the summer or autumn. In the greenhouse there is a tendency towards autumn flowering. Normally, it is wind-pollinated, but fully self-fertile. However, as female flowers are developed a few days earlier than male flowers, self-pollination is prevented to some extent. But since the terminal flowers undergo anthesis first, pollen from these may pollinate female

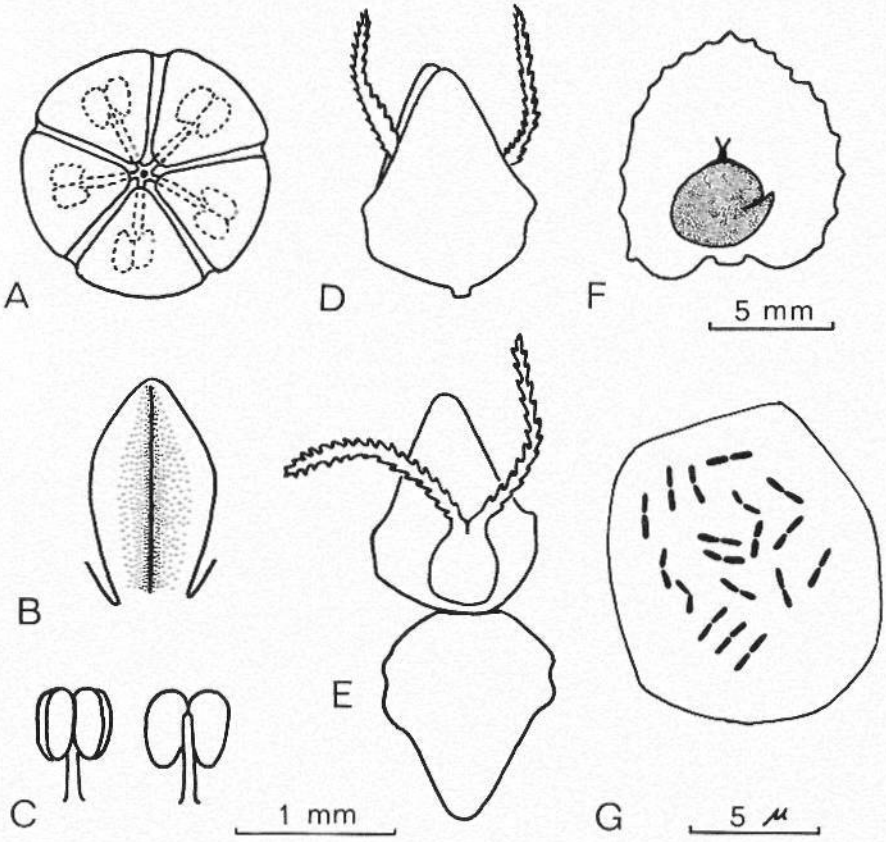

Fig. 2. *Atriplex recurva*. — A: A single male flower. — B: One perianth lobe of the male flower. — C: Stamens. — D: Bracteole at anthesis. — E: Pistil. — F: Position of the seed. — G: Somatic metaphase plate (2n=18).

flowers on a lower level. The seed set and germination are rather good both in nature and in cultivation.

VARIATION

The variation of *A. recurva* is rather small compared with the extremely variable *A. tatarica*. The shape of the leaves from populations in the Naxos—Paros area and the islands around Safora are shown in Figs. 3 and 4. There are only small differences between these populations. Normally, the populations have small and narrow, grey—silvery

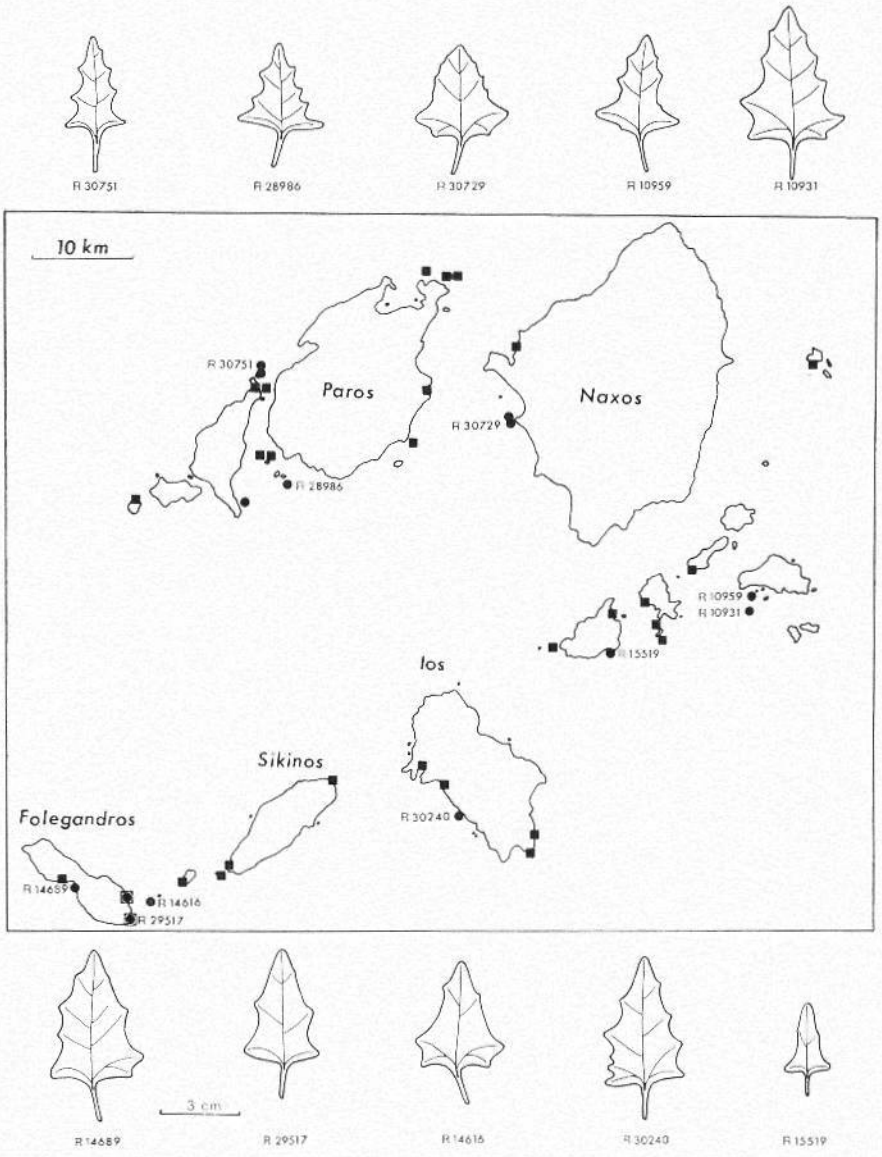

Fig. 3. Variation in the leaf-shape and distribution of some *Atriplex* populations in the Naxos area. Circles indicate populations of *A. recurva* and squares populations of *A. halimus*.

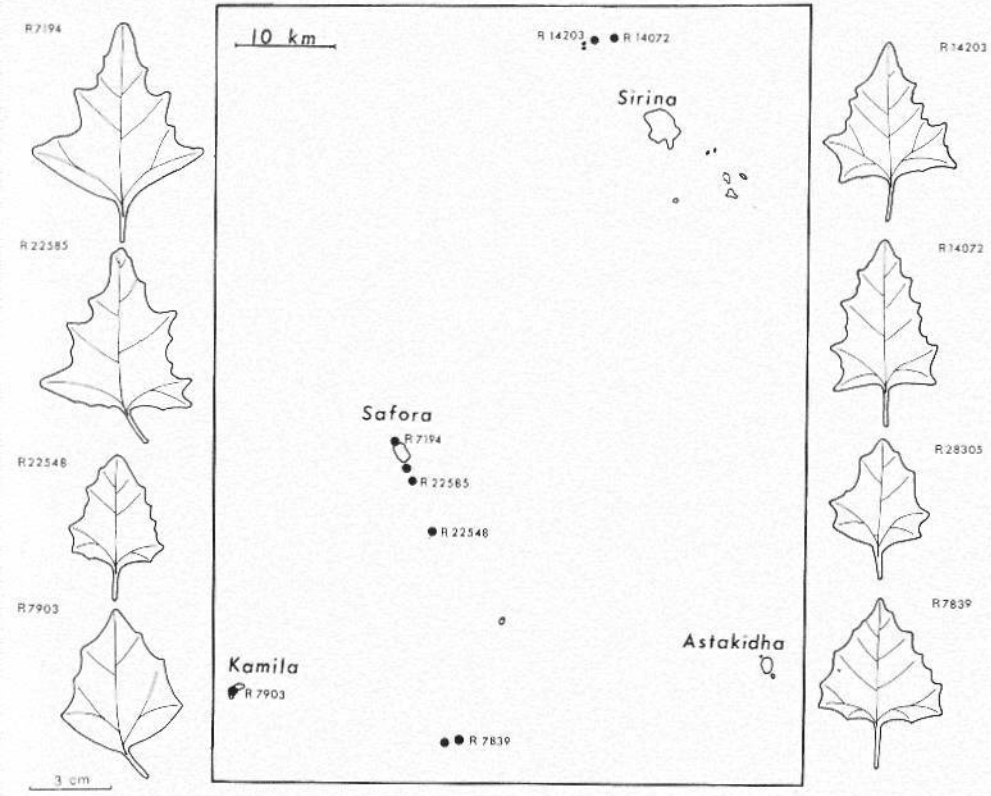

Fig. 4. Variation in the leaf-shape and distribution of *Atriplex recurva* in the islands around Safora.

leaves (up to 3×2 cm), with small lobes. The populations around Safora and Naxos have relatively large and broad leaves (up to 7× 5 cm), which are silvery—green, with large lobes. The Kamila population (R&S 7903) is somewhat different from the other populations with regard to leaf and bracteole shape. The leaves are more rhombic and the lobes are regular and rather small. The bracteoles are more rhomboidal, whereas they are generally orbicular. The island of Kamila is strongly isolated at present and may have been so for a long time.

No significant differences in habit, inflorescence, bracteoles (except the Kamila population), and seeds have been observed in the material investigated. The variation within populations is rather small, both in nature and in cultivation.

CYTOLOGY

The chromosome number of *A. recurva* (2n=18) is based on counts made from the following populations:

R&P 22548 The island of Kavari.
R&P 22585 Safora, Mikro Safora.
R&P 22595 The small island S of Safora.
R&B 27764 Serifos, the island of Serifopoula.
R&B 28345 Safora, Makri Safora.
R&B 30729 Naxos, the south islet outside Akr. Pardenos.

The average length of the chromosomes is about 2 μ and the centromere region is median to submedian (Fig. 2 G). No cytological differences have been observed in the material studied.

The chromosome number was determined from somatic metaphase plates in root tips from plants cultivated in Lund. The cytological material was prepared as follows: after cooling for about 12 hours, the root tips were fixed in the Svalöf modification of Navashin-Karpechenko, microtomed (14 μ) and stained in 1 % crystal violet.

All investigated species of sect. *Sclerocalymma* are diploid. Previously 2n=18 has been reported (cf. Löve & Löve 1961) for *A. tatarica* (Wulff 1937), *A. halimus* (Castro & Fontes 1946), and *A. rosea* (Wulff 1936).

DISTRIBUTION AND ECOLOGY

A. recurva is endemic in the Aegean islands and distributed from the Northern Sporades southwards to Crete (Fig. 5). The species is not known from the islands close to the mainland of Turkey (eastern Aegean islands); however, these islands are incompletely investigated. *A. recurva* is found in some groups of small islands, but is absent in others. In the Milos and Astipalea areas, there are many small islands but only some of them are occupied by *A. recurva*. Another example is the small islands around Paros (Runemark 1969), where *A. recurva* inhabits some small islands, but is lacking on others within a distance of 500—1000 m (Fig. 3).

A. recurva mainly grows in the sublitoral zone of very small islands (usually only a few hundred metres long) together with a few other species. Rarely, it has also been found in maritime biotopes on larger islands, as cliff crevices and screes, exposed to the sea. The populations studied contained less than 1000 individuals and most of them were much smaller. Evidently, *A. recurva* has a wide tolerance for different rock substrates, as it is found on islands consisting of granite, limestone, schist, or volcanic rocks.

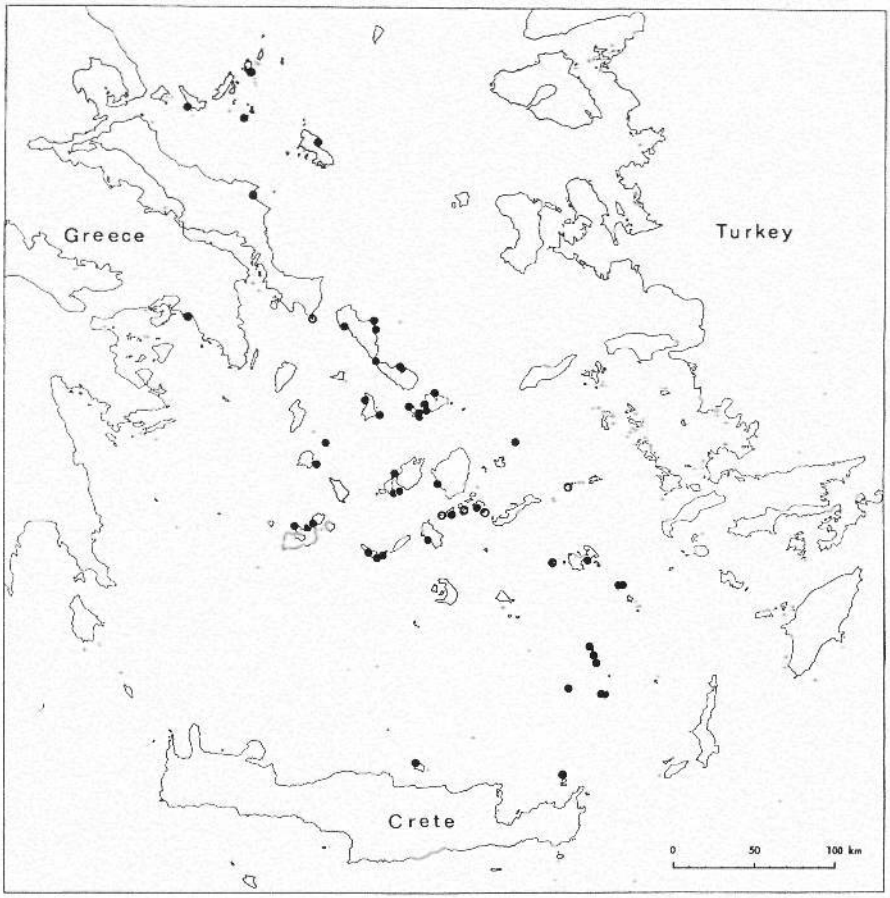

Fig. 5. The total distribution of *Atriplex recurva*. Filled circles indicate material seen by the author and open circles literature records.

FLOATING AND GERMINATION EXPERIMENTS

The dispersal range of *Atriplex* seeds is probably determined by the floating capacity of the bracteoles enclosing the seeds. To obtain some measurements of this factor, 97 bracteoles were placed in four jars containing salt water (with a salinity of 30 ‰, which is approximately equal to the salt content in the Aegean Sea). Each jar was carefully shaken twice a day. In this experiment the bracteoles were floating between 3 days and 2 weeks. Only 50 % were still floating after 4 to 5 days (Fig. 6). Under natural conditions, the bracteoles are apparently not dispersed one by one, but the whole panicle is dis-

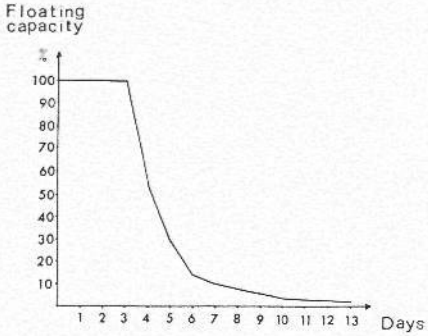

Fig. 6. *Atriplex recurva*. Floating capacity of the bracteoles (enclosing the seeds). Floating capacity (vertical axis) in relation to time (horizontal axis).

seminated, owing to the hard connection between the bracteoles and the branches. Probably the panicles have a greater floating capacity than a single bracteole. Of course, many other factors may influence dispersal, e.g., currents and winds; but the floating capacity is obviously sufficient for a dispersal over shorter distances.

Germination experiments indicate that the germinability of salt water-treated seeds and non-treated ones is the same. Ninety well-developed seeds were treated in a 34 ‰ salt-water solution for 3 weeks. About 65 % of these seeds germinated within 3 weeks, which was the same germination percentage as for non-treated seeds.

DISCUSSION

Atriplex recurva is a member of the sublitoral element (including ca 25 species) wholly or almost wholly confined to very small islands in the Aegean region discussed by RUNEMARK (1969). According to RUNEMARK, this element probably represents the last remnants of a sublitoral flora that occurred around the Sea of Crete in the late Pliocene. Most of these species are confined to the central and southern Aegean regions. Only *Elymus rechingeri* (RUN.) RUN. and *A. recurva* reach as far north as to the Northern Sporades. *A. recurva*, as almost all species belonging to this element, has a very irregular local distribution. This distribution cannot be explained by the present ecological conditions.

Only a few of the species belonging to this element are perennial shrubs — viz., *A. recurva*, *A. halimus* L., *Salsola aegaea* RECH. F., *Suaeda fruticosa* L., and *Thymelaea hirsuta* L. These shrubby species occur mainly as pseudovicariads, i.e., only exceptionally more than one

of these species is found on the small islands. In the central part of the Aegean islands (Naxos—Folegandros), *A. recurva* dominates on some small islands or groups of islands and *A. halimus* on others (Fig. 3). On larger islands (Ios and Folegandros) both species occur, but rarely in the same locality.

Dispersal plays an important role in the distribution of the sublitoral element. Dispersal over greater areas can probably be excluded within *A. recurva*, as the floating capacity of the bracteoles is restricted. But dispersal of bracteoles by the sea over shorter distances seems very plausible. The establishment of a new population from seeds dispersed to a new island, is, however, highly limited by reproductive drift (RUNEMARK 1969). The seeds will reach a new island in such a small number, compared with the number of seeds from established species, that they run a risk of being randomly eliminated. Also the survival of individual species in a small plant community, where almost all the species occur in restricted numbers, are subject to random elimination by reproductive drift. But probably competition between these pseudovicariads plays a certain role, too. Consequently, the small islands have a relatively small number of dominant species. Therefore, one island does not need to have the same combination of species as another nearby island. Reproductive drift and competition may partially be the causes of the present, irregular distribution.

The age of isolation — i.e., the time of migration of *A. recurva* from a presumed initial area around the Sea of Crete in the late Pliocene — is very difficult to estimate. It is probable that the central region of the Kikladhes (Andros—Naxos—Folegandros) has been isolated from Crete and the southern islands for at least a million years. However, groups of closely situated populations may have been isolated from oneanother for about a hundred-thousand years.

The differentiation between isolated populations is very moderate compared with several other members of the sublitoral element, e.g., *Elymus rechingeri* (HENEEN & RUNEMARK 1962) and *Anthemis scopulorum* (RUNEMARK 1970, and unpublished data). In *Elymus rechingeri* the populations are very homogeneous and composed of members with the same morphological features. On the other hand, the differences between populations are so great that one population can be distinguished from all the others. There is a great breakdown in the cytological stability through genetic drift, which results in gene differences and structural changes. In *Anthemis scopulorum* the population structures are similar to that of *Elymus rechingeri*. The dif-

ferences between populations are so great that only fruit characters unite them.

Since *A. recurva* occurs in a small-population system, there must be differential gene fixation in different populations due to genetic drift. But the morphological diversity observed is of a lower magnitude than in the above-mentioned species. The effectivity of the isolation may have been less strong within *A. recurva*. It might also be a more stable species as regards morphology and cytology than other sublitoral species — e.g., *Elymus rechingeri* and *Anthemis scopulorum*.

LITERATURE CITED

AELLEN, P. 1964. Atriplex. — In: Flora Europaea 1: 95—97. — Cambridge.

D'URVILLE, J. D. 1822. Enumeratio plantarum. — Paris.

HENEEN, W. K. & RUNEMARK, H. 1962. Chromosomal polymorphism and morphological diversity in Elymus rechingeri. — Hereditas 48: 545—564.

LÖVE, A. & LÖVE, D. 1961. Chromosome numbers of central and northwest European plant species. — Opera Bot. 5.

RECHINGER, K. H. FIL. 1943. Flora Aegaea. — Denkschr. Akad. Wiss. Math.-Nat. Kl. (Wien) 105: 1.

— 1950. Grundzüge der Pflanzenverbreitung in der Aegeis II. — Vegetatio 2: 239—308.

— 1955. Sitzung der mathematisch-naturwissenschaftlichen Klasse von 28. Jänner. — Österr. Akad. Wiss. 2: 1—7.

RUNEMARK, H. 1969. Reproductive drift, a neglected principle in reproductive biology. — Bot. Notiser 122: 90—129.

— 1970. The role of small-populations for the differentiation of plants. — Taxon 19: 196—201.

ULBRICH, E. 1934. Chenopodiaceae. — In ENGLER, A. & PRANTL, K. Die natürlichen Pflanzenfamilien. Ed. 2. 16 C: 510—519. — Leipzig.

APPENDIX

The study is based on material collected by H. RUNEMARK (R), B. NORDENSTAM (N), J. PERSSON (P), B. BENTZER (B), L. ENGSTRAND (E), S. SNOGERUP (S), and R. VON BOTHMER (Bo) during field-work in the Aegean area in 1957—1969. This material is preserved in the Botanical Museum Lund, Sweden. In addition, material from the Naturhistorisches Museum, Vienna, Austria (W), was studied and all known literature records are given. Material observed by K. H. RECHINGER FIL., according to Flora Aegaea, is marked RECH. obs.

Northern Sporades. Pelagonisi: Cliffs at Melissi, 1896, LEONIS (W); Small island NW Skanzoura, 1960, R&N 16859; Skopelos: The island of Plero, 1960, R&N 16877.

Skiros. Kastro, 1908, TUNTAS (W).

Euboea. Kymi, Platana, 1966, RECHINGER (W); The island of Mantili, RECHINGER (not seen).

Attica. Phaleri, 1894, HELDREICH (W); Propè insulam Helenam, D'URVILLE (not seen).

Kikladhes. Andros: Stakala Vrakhos, S of Akra Gria, 1968 S&Bo 33170; The island Plati S of Gavrion, 1968, S&Bo 31300; 1 km ESE Gavrion, 1968, S&Bo 32952; The island Gaidharos S of Gavrion, 1968, R&Bo 31245; The island between Andros and Tinos, 1960, R&N 16799. — Tinos: The island of Dragonisi, 1968, R&E 36917; Prassonisia, the N-island, 1968, R&E 36924. — Siros: The islet of Varvarousa, 1881, HELDREICH (W), and 1968, S&E 33664; The island of Aspronisos, 1968, S&E 33454. — Mikinos: Dilos, the islands of Prassonisi, 1906, HELDREICH (W); The main island of Prassonisi, 1968, R&E 35712; The W-island of Prassonisi, 1968, R&E 35716; The island of Reumatiari, 1968, R&E 36105; The small island N of Rinia, 1968, R&E 35978; The island of Marmaronisi, 1968, R&E 36167; Ormos Ornos, 1960, R&N 16076; Hagios Georgios, 1900, HELDREICH (W). — Serifos: The island of Serifopoula, 1967, R&P 27764; Vous, 1967, R&B 27913. — Antiparos: The N-island north of Kavouras (Spirodionisi), 1954, WETTSTEIN (W) and 1967, R&B 30751; The S-island north of Kavouras, 1967, R&B 30747; Petalidha, 1967, R&B 28986. — Naxos: The islands outside Akr. Pardenos, 1934, RECHINGER 4773 (W), and 1967, R&B 30729, R&B 30735; Voidonisos (Ktenia), 1954, WETTSTEIN (W), and 1958, R&S 11025. — Milos: The island of Kaloyeros, 1967, R&B 29910; Akradia, the E-island, 1967, R&B 26806. — Kimolos: Small island on the S-part of the W-side, 1967, R&B 29931. — Folegandros: 2 km W Pelagia, 1967, R&B 29517; Cliffs on the SE-part, 1960, R&N 14689; The island SE of the harbour, 1967, R&B 25599; The islands of Adelfia Petra, the W-island, 1960, R&N 14616. — Ios: Prasos, 1967, R&B 30240. — Iraklia: the SE-point, 1960, R&N 15519; Small island W of Iraklia, RECH. obs. — Skhoinousa: Small island, RECH. obs. — Keros: The island of Plaki, 1958, R&S 10931; Small island SW of Keros, 1958, R&N 10959; Andreas, 1934, RECHINGER 5128 (W). — Antikeros, RECH. obs. — Kinaros, RECH. obs. — Ofidousa, RECH. obs. — Astipalea: Khondro Nisi, 1960, RUNEMARK obs. — Sirina: Dio Adelfi, RECH. obs.; Dio Adelfi, the E-island, 1960, R&N 14072; Dio Adelfi, the W-island, 1966, R&P 22290. — Safora: Safora, 1935, RECHINGER 7655 (W), and 1967, R&B 28245; The N-part of Safora, 1958, R&S 7194; Small island S of Safora, 1966, R&P 22595; Mikro Safora, 1966, R&P 22585; The island of Karavi, 1935, RECHINGER 7693 (W), and 1966, R&P 22548; Kamila, 1958, R&S 7903; Ounia Nisia, the E-island, 1967, R&B 28249; Ounia Nisia, the W-island, 1967, R&B 28305.

Crete. The island of Dhia: The islet of Petalidha, 1899, BALDACCI (W); The small island of Glaronisi, 1960, R&N 16463. — Sitia: The island of Paximadi, RECHINGER 12891 (not seen).

Populations cultivated in the Botanical Garden of Lund, Sweden

Northern Sporades. The small island NW Skanzoura, R&N 16859.

Kikladhes. Naxos: The S-island outside Akr. Pardenos, R&B 30729. — Antiparos: The S-island north of Kavouras, R&B 30747. — Serifos: The island of Serifopoula, R&B 27764. — Sirina: Dio Adelfi, the W-island, R&P 22290. — Safora: The small island S of Safora, R&P 22595; The island of Makri Safora, R&B 28245; The island of Mikro Safora, R&P 22585; The island of Karavi, R&P 22548; Ounia Nisia, the E-island, R&B 28249.

Studies in the Aegean Flora XVIII

Notes and Chromosome Numbers in Aegean Umbelliferae

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ABSTRACT

ENGSTRAND, L.: Studies in the Aegean Flora XVIII. Notes and Chromosome Numbers in Aegean Umbelliferae. — Bot. Notiser 123: 384—393, Lund.

Somatic chromosome numbers of 22 taxa of *Umbelliferae* from the Aegean region are reported. As far as the author is informed, 12 of these have not previously been cytologically investigated. One number deviates from an earlier report.

New records are: *Artedia squamata* L. 2n=16, *Carum multiflorum* (SIBTH. & SM.) BOISS. ssp. *multiflorum* 2n=20, *Daucus carota* L. ssp. *drepanensis* (ARCHANGELI) HEYWOOD 2n=18, *Daucus guttatus* SIBTH. & SM. ssp. *guttatus* 2n=22, *Daucus involucratus* SIBTH. & SM. 2n=22, *Ferula chiliantha* RECH. F. 2n=22, *Malabaila involucrata* BOISS. & SPRUNER 2n=22, *Microsciadum minutum* (D'URV.) BRIQ. 2n=12, *Scaligeria cretica* (MILLER) BOISS. 2n=20, *Scaligeria halophila* (RECH. F.) RECH. F. 2n=20, *Scandix australis* L. ssp. *australis* 2n=12, *Smyrnium rotundifolium* MILLER 2n=22, *Torilis nodosa* (L.) GAERTNER 2n=24.

In some cases notes on variation and distribution are presented.

MATERIAL AND METHODS

The main part of the material studied was collected by RUNEMARK and co-workers between 1958 and 1967. Some material was collected by the author in 1968.

Plants were cultivated in the greenhouses in the Botanical Garden, Lund. After pretreatment for c. 12 hours at 2—4°C, root tips were fixed in the Svalöv modification of Navashin-Karpechenko and stained in crystal violet. The drawings were made with the aid of a camera lucida.

The R-series refers to the collection numbers of RUNEMARK and colleagues, and the X-series to the cultivation numbers of the author. Voucher specimens are preserved in the Botanical Museum, Lund (LD).

The following abbreviations of the collectors' names are used: BE=B. BENTZER, B=R. VON BOTHMER, N=B. NORDENSTAM, P=J. PERSSON, R=H. RUNEMARK, S=S. SNOGERUP, ST=A. STRID.

As far as possible the nomenclature follows that of Flora Europaea (TUTIN et al. 1968). N. Cyclades, N. Samos etc. in the list of collections refer to the Departments (Nomos) of Greece.

RESULTS

Ammi majus L. 2n=22

Greece. N. Cyclades. Paros, seashore NE of Drios (R & S 30954).
— — Naxos, S of the town (R & S 11890).

This number has previously been recorded several times, e.g., by HÅKANSSON (1953) and SCHULZ-GAEBEL (1930).

Ammi majus is distributed around the Mediterranean, in the Canary Islands, and in the Orient. It is not uncommon as a weed in central and northern Europe.

Anthriscus caucalis BIEB. 2n=14

Greece. N. Samos. Samos, E-promontory of mt. Kerki, 900 m s.m. (X 16).

Apium graveolens L. 2n=22

Greece. N. Cyclades. Amorgos, SE of Chora Amorgos (R & S 12298).

This number has previously been recorded by WANSCHER (1931).

Artedia squamata L. 2n=16

Turkey. Aydin. Kusadasi (X 14).

No earlier records are known to the author.

Artedia squamata is distributed in Asia Minor and the Middle East, westwards to the Aegean Sea. The chromosomes are too long to get a good drawing with the used method.

Carum multiflorum (SIBTH. & SM.) BOISS. ssp. **multiflorum** 2n=20 (Fig. 1 L)

Greece. N. Arcadia. Vertical rock facing NW 3 km ENE of the village of Agiorgitika, 820—860 m s.m. (St 23389).

No previous records are known to the author. WANSCHER (1931) reported the number 2n=20 for *Carum carvi* and SCHULZ-GAEBEL (1930), 2n=22 for the same species. *Carum verticillatum* was reported to have 2n=20 by GARDÉ & MALHEIROS-GARDÉ (1949).

Especially in the Cyclades *C. multiflorum* is variable in the shape of the leaves, bracts, and braclets, as well as in fruit size. Stout plants from Zafora, Dodecanesos (R & Be 28088, R & P 22536) have 5 mm long fruits.

Daucus carota L. ssp. **drepanensis** (Archangeli) Heywood 2n=18 (Fig. 1 C)

Greece. N. Cyclades. Mikonos, the small island of Prasonisi (R & N 16785). — N. Dodecanesos. Tria Nisia, the E-island (R & N 14402).

There are no previous counts for this subspecies (sensu Heywood 1968), but the number is in accordance with that of other subspecies of *D. carota* (cf. Löve & Löve 1961).

It is very difficult to determine the different subspecies of *Daucus carota* recognized by Heywood in Flora Europaea. The cytologically investigated collections belong to the complex of *D. gingidium* L. This form was referred to *D. gingidium* ssp. *polygamus* var. *russeus* (syn. *D. russeus* Held.) by Rechinger (1943) in Flora Aegaea. It is a perennial and flowers in the first year. The stem is short (5—10 cm), but at least in cultivation it can grow up to 30 cm. This form belongs to the group of small-island species discussed by Runemark (1969).

With the extreme variation within the complex of *D. carota—gingidium* it seems impossible to distinguish this form as a separate taxon.

Daucus guttatus Sibth. & Sm. ssp. **guttatus** 2n=22 (Fig. 1 B)

Greece. N. Cyclades. Amorgos, the bay of Langada (R & Be 30679).
— — Andiparos, Dhiplo (R & Be 30786).
— — — the island of Kavouras (R & Be 30828).
— N. Samos. Ikaria, 2—4 km WNW of Orm. Praia (R & S 11368).
— — — the pass of Orm. Praia (R & S 11470).
— N. Euboea. N of Ag. Dimitrio (R & S 11790).
— — 3 km WSW of Akr. Kafirevs (R & S 11701).
— — Petalides, Prasonisi (R & S 11583).
— N. Attica. Mt. Hymettos, 400 m s.m. (X 4).
— N. Rethymni (Crete). Ag. Vasilis, Paximadia island (S, St & B 20929).

No earlier records are known to the author.

Daucus guttatus is distributed in the eastern Mediterranean, from Italy to Asia Minor, Syria, and Egypt. It is very common in the Aegean islands.

Most forms of *D. guttatus* are distinct from *D. broteri*. The two collections from Andiparos, however, have the short, stout bracts of *D. broteri*, but the fruits are similar to those of *D. guttatus*.

Daucus involucratus SIBTH. & SM. 2n=22 (Fig. 1 A)

Greece. N. Kavala. Thasos, the mountain N of Theologos, 450 m s.m. (X 11). — N. Samos. Ikaria, the pass N of Orm. Praia, 450 m s.m. (R & S 11470).

No earlier records are known to the author.

Daucus involucratus is distributed in the Aegean region, Crete, and Cyprus; always in dry, stony places.

The species is easily recognized by means of its long, almost leaf-like bracts. The rays are few and short and the flowers small (c. 1 mm). The peduncles are long and slender. *D. involucratus* is rather uniform throughout the distribution area.

Ferula chiliantha RECH. F. 2n=22 (Fig. 1 E)

Greece. N. Cyclades. Kimolos, the W-side of the S part, the small island (R & BE 29930).
— — Ios, the island of Prasos (R & BE 30239).
— — — Varvaronisi, the small island (R & BE 30223).
— — Thira, Prof. Elias, S-exposed cliffs and sands at the sea (R & BE 30401).
— N. Dodecanesos. Levitha, the small island at the inlet of the harbour, cliffs near the sea (R & S 10695).
— — Rhodos, the island N of Cape Foca, calcareous rock (R & N 16727).

No earlier records are known to the author.

Ferula chiliantha is distributed in the southern part of the Aegean. It was described from Samos and was later found on Rhodos, and recently on Crete and several of the Cycladian islands. It is recognized by the rounded umbels with 25—40 rays and the large inflated sheaths of the upper leaves. *F. chiliantha* is found in cliffs, often calcareous, towards the sea, while *F. communis* seems to occur more frequently on cultivated ground. The fruit shape is highly variable in *F. chiliantha* (Fig. 1 N—P).

Ferula communis L. 2n=22

Greece. N. Cyclades. Naxos, precipice 4 km W of Psiliamos Ormos, 260 m s.m. (R & S 10695).

The same number was reported by GARDÉ & MALHEIROS-GARDÉ (1949).

Lagoecia cuminoides L. 2n=16

Greece. N. Cyclades. Skhoinousa (R & S 4423).
— — Iraklia, S of the harbour (R & S 4283).
— — Makares, Ag. Nikolaos (R & S 10457).

The same number was reported by TAMAMSCHJAN (1933).

Lagoecia cuminoides is a Mediterranean species, extending eastwards to Persia.

Malabaila involucrata BOISS. & SPRUNER 2n=22 (Fig. 1 I)

Greece. N. Samos. Ikaria, 1—2 km W of Ormos Leona, 200 m s.m. (R & S 9141).

No earlier records are known to the author.

Malabaila involucrata is restricted to the Balkan peninsula and the Aegean region. It is distinguished from *M. aurea* by the involucre with more than five bracts.

Microsciadum minutum (D'URV.) BRIQ. 2n=12 (Fig. 1 D)

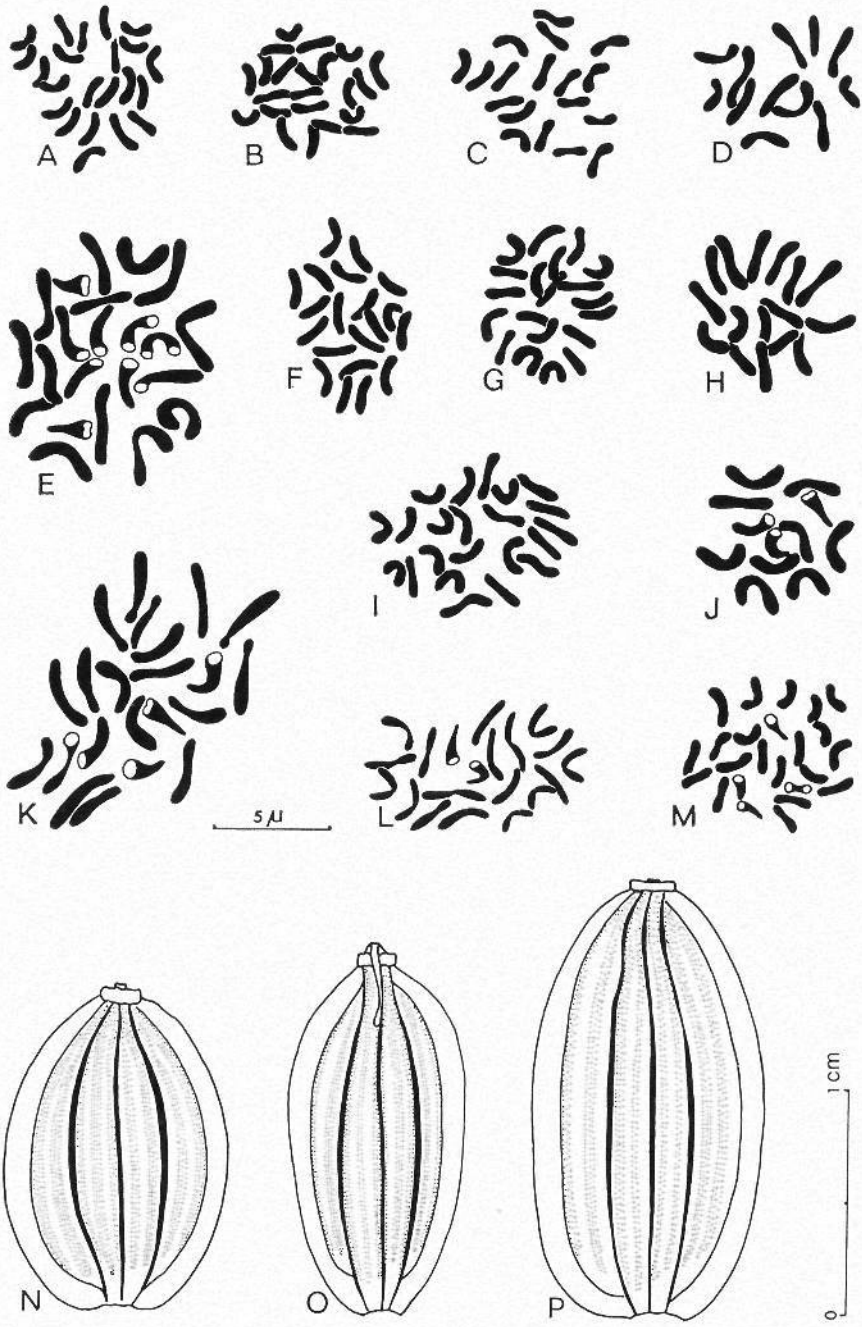
Greece. N. Samos. Samos, E-promontory of mt. Kerki, c. 800 m s.m. (X 6).
— — — SW-precipitous of mt. Kerki, c. 800 m. s.m. (R & S 19693).

No earlier records are known to the author.

Microsciadum minutum is distributed in western Turkey around Izmir and Söke and on the eastern Aegean islands (Mytilene, Chios, Samos, Kalymnos and Kos). It does not occur west of the phytogeographical border line between the Cyclades and the eastern Aegean islands (cf. RECHINGER 1949).

Microsciadum is a monotypic genus. *M. minutum* is a slender annual, 2—15 cm high. The unequal rays and pedicels are clavate. The fruits are c. 2 mm long.

Fig. 1. A—M. Somatic metaphases in sections of root tips. — A: *Daucus involucratus*, 2n=22. Ikaria. — B: *Daucus guttatus* ssp. *guttatus*, 2n=22. Hymettos. — C: *Daucus carota* ssp. *drepanensis*, 2n=18. Mikonos. — D: *Microsciadum minutum*, 2n=12. Samos. — E: *Ferula chiliantha*, 2n=22. Thira. — F: *Scaligeria halophila*, 2n=20. Zafora. — G: *Scaligeria cretica*, 2n=20. Rhodos. — H: *Scandix australis* ssp. *australis*, 2n=16. Hymettos. — I: *Malabaila involucrata*, 2n=22. Ikaria. — J: *Torilis leptophylla*, 2n=12. Hymettos. — K: *Smyrnium rotundifolium*, 2n=22. Naxos. — L: *Carum multiflorum* ssp. *multiflorum*, 2n=20. Agiorgitika. — M: *Torilis nodosa*, 2n=24. Pelagos. — N—P. *Ferula chiliantha* RECH. F., dorsal view of mericarps. — N: Ios, the island of Prasos. — O: Thira, Prof. Elias. — P: Rhodos, the island of Akr. Archangelo.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Orlaya kochii HEYWOOD 2n=16

Greece. N. Phocis. The mountain of Giona, on a cliff at the village of Sthromi, 850 m s.m. (X 20).
— N. Lasithion (Crete). Sitia, N part of mt. Spathi, 300—500 m s.m. (R & S 18414).
Turkey. Izmir, the mountain S of Pinarbaschi, 200 m s.m. (X 22).

LARSEN (1956) reported the number 2n=16 and discussed the number 2n=18 reported by TAMAMSCHJAN (1933).

Pimpinella peregrina L. 2n=18

Greece. N. Samos. Ikaria, Faros (R & S 12507).
— — — 1 km W of Orm. Kerame (R & S 12534).
— N. Cyclades. Amorgos, Katapola, the E valley up to Chora Amorgos, 0—100 m s.m. (R & S 12298).
— N. Euboea, N of Akr. Merouti (R & S 11876).

The number 2n=18 was reported by SCHULZ-GAEBEL (1930).

Pimpinella peregrina is distributed from Spain to Turkey and in the Middle East.

Pseudorlaya pumila (L.) GRANDE 2n=16

Greece. N. Cyclades. Tinos, Johannisbukt (X 1).
— — Sifnos, Orm. Kondos, the beach (R & S 8477).
— — Dhenousa, Orm. Chendro, sandy shore (R & S 9575).

The same number has been reported several times, e.g., by BJÖRKQVIST et al. (1969).

This Pan-Mediterranean species is common in maritime sands in the Aegean region. A form with short spines on the fruit, var. *breviaculeata* (BOISS.) HEYWOOD, is sometimes found, e.g., on Siros (R & B 37714), Andiparos, the island of Despotico (R & BE 28632). There seems to be a gradual transition from almost spineless forms to those with normal spines.

Scaligeria cretica (MILLER) BOISS. 2n=20 (Fig. 1 G)

[Correct name *S. napiformis* (SPRENGEL) GRANDE, cf. GREUTER & RECHINGER 1967].

Greece. N. Euboea. N of Ag. Dimitriou (R & S 11818).
— N. Cyclades. Naxos, N of the W-peak of Koronos Oros, 200 m s.m. (R & S 10026).

— — — Fanari Oros, NE of Moni, 600 m s.m. (R & S 11930).
— N. Samos. Samos, Tigani, 0—50 m s.m. (R & S 19941).
— N. Dodecanesos. Rhodos, mt. Prof. Elias, 400 m s.m. (X 2).

No earlier records are known to the author.

Scaligeria halophila (RECH. F.) RECH. F. 2n=20 (Fig. 1 F)

Greece. N. Dodecanesos. Zafora, the island of Makro Zafora (R & BE 28236).
— N. Cyclades. Makares, Strongilo (R & S 10384).

No earlier records.

Scaligeria halophila was originally described as a subspecies of *S. cretica*. It was given the status of species by RECHINGER (1965). *S. halophila* is probably very closely related to *S. cretica*, but it is morphologically distinct by its fleshy leaves; the fruits are big (length c. 2 mm; Fig. 2). *S. halophila* is restricted to the spray-zone or cliffs of small islands. It is irregularly distributed in the southern Aegean.

S. cretica and *S. halophila* have pseudomonocotyly. The cotyledon of *S. halophila* is similar to that of *S. cretica*, which was described by IRMISCH (1858). This description was cited by WEISSE (1930), who gives *Butinia cretica* BOISS. as a synonym. However, *Butinia cretica* is a synonym of *Huetia cretica* (BOISS. & HELD.) P. W. BALL, which might have pseudomonocotyly like the rest of the genus *Huetia* (ENGSTRAND unpubl.).

Scandix australis L. ssp. **australis** 2n=16 (Fig. 1 H)

Greece. N Attica, the top of mt. Hymettos (X 5).

No earlier records are known to the author. The same number was reported for *Scandix pecten-veneris* by WANSCHER (1931).

Smyrnium rotundifolium MILLER 2n=22 (Fig. 1 K)

Greece. N. Cyclades. Naxos, NE of Moni (R & S 11921).

No earlier records known to the author.

Torilis leptophylla (L.) REICHENB. F. 2n=12 (Fig. 1 J)

Greece. N. Cyclades. Naxos, slope N of Orm. Kalando, 50 m s.m. (R & S 10214).
— N. Attica, mt. Hymettos, 400 m s.m. (X 12).

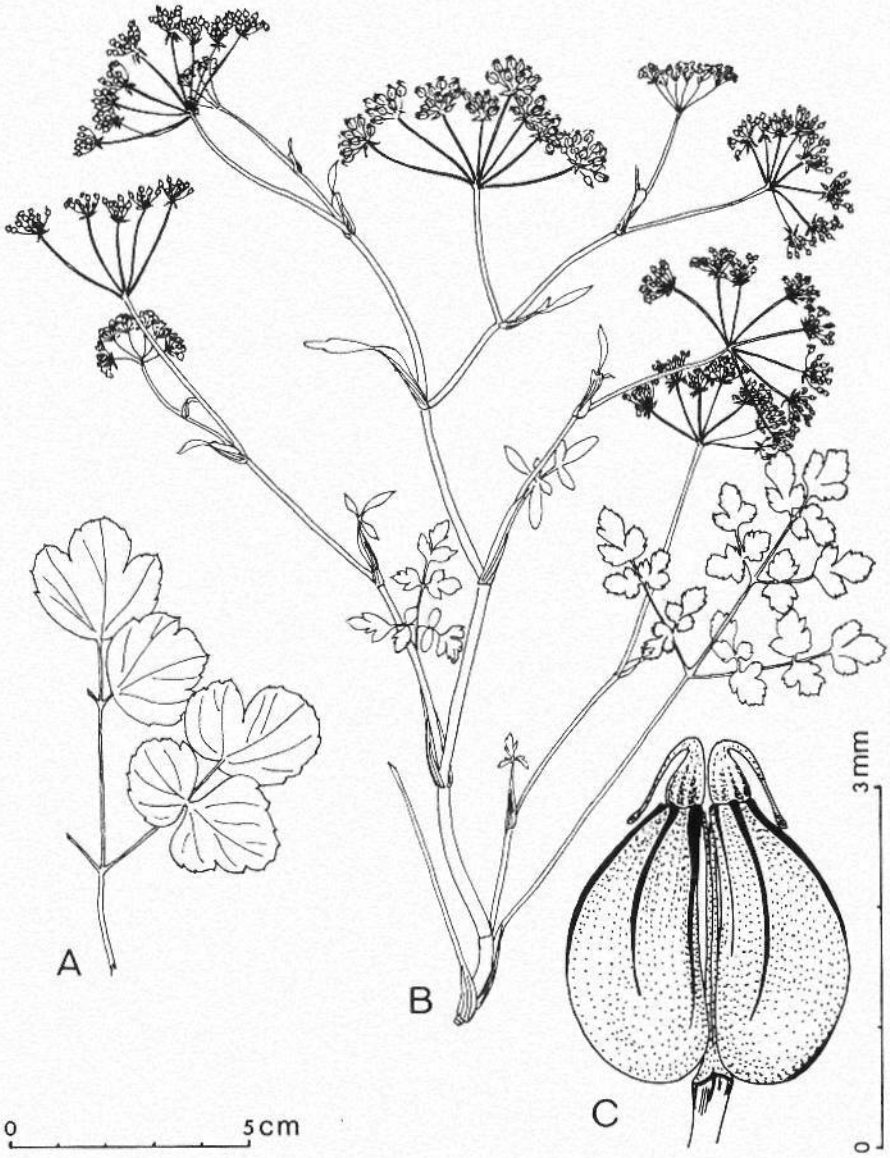

Fig. 2. *Scaligeria halophila* (RECH. F.) RECH. F. from Stakida (Dodecanesos). — A: Basal leaf. — B: Habit. — C: Lateral view of fruit.

— N. Kavala. Thasos, at Theologos, 300 m s.m. (X 7).
Turkey. Izmir, the mountain S of Pinarbaschi (X 3).

The same number was published by WANSCHER (1932).

Torilis nodosa (L.) GAERTNER 2n=24 (Fig. 1 M)

Greece. N. Magnisia. Pelagos (X 13).
— N. Cyclades. Naxos, 4 km E of Orm. Psiliamo, 260 m s.m. (R & S 10707).
— — Andreas (R & S 10919).
— N. Dodecanesos. Levitha, Porto di Levitha (R & S 12023).
Turkey. Izmir, the mountain S of Pinarbaschi (X 21).

GARDÉ & MALHEIROS-GARDÉ (1949) reported the chromosome number 2n=22 for *Torilis nodosa*.

LITERATURE CITED

BJÖRKQVIST, I., BOTHMER, R. VON, NILSSON, Ö. & NORDENSTAM, B. 1969. Chromosome numbers in Iberian angiosperms. — Bot. Notiser 122: 271—283.

GARDÉ, A. & MALHEIROS-GARDÉ, N. 1949. Contribuicão para o estudo cariológico da familia Umbelliferae. I. — Agron. Lusit. 11: 91—140.

GREUTER, W. & RECHINGER, K. H. 1967. Flora der Insel kythera — Boissiera 13: 94—95.

HÅKANSSON, A. 1953. Some chromosome numbers in Umbelliferae. — Bot. Notiser 1953: 301—307.

HEYWOOD, V. H. 1968. Daucus L. — In: Flora Europaea 2: 373—375. — Cambridge.

IRMISCH, T. 1858. Botanische Mitteilungen. — Flora 41: 33—42.

LARSEN, K. 1956. Chromosome studies in some Mediterranean and South European flowering plants. — Bot. Notiser 109: 293—307.

LÖVE, A. & LÖVE, D. 1961. Chromosome numbers of central and northwest European plant species. — Opera Bot. 5.

RECHINGER, K. H. 1943. Flora Aegaea. — Denkschr. Akad. Wiss. Math.-Nat. Kl. (Wien) 105: 1.

— 1949. Grundzüge der Pflanzenverbreitung in der Aegäis I—III. — Vegetatio 2: 55—119, 239—308, 365—386.

— 1965. Zwei neue Arten aus der griechischen Flora. — Österr. Bot. Zeitschr. 112: 186—187.

RUNEMARK, H. 1969. Reproductive drift, a neglected principle in reproductive biology. — Bot. Notiser 122: 90—129.

SCHULZ-GAEBEL, H.-H. 1930. Entwicklungsgeschichtlich-zytologische Studien an der Umbelliferen-Unterfamilie der Apioideen. — Beitr. Biol. Pflanzen 18: 345—398.

TAMAMSCHJAN, S. 1933. Materialen zur Caryosystematik der kultivierten und wilden Umbelliferen. — Bull. Appl. Bot. Pl.-Breed. (Leningrad) (2): 137—164.

TUTIN, T. G., HEYWOOD, V. H., BURGES, N. A., VALENTIN, D. H., WALTERS, S. M. & WEBB, D. A. 1968. Flora Europaea 2. — Cambridge.

WANSCHER, J. H. 1931. Studies on the chromosome numbers of the Umbelliferae. — Hereditas 15: 179—184.

— 1932. Studies on the chromosome numbers of the Umbelliferae II. — Bot. Tidsskr. 42: 49—58.

WEISSE, A. 1930. Blattstellungstudien an Sämlingen abnorm keimender Dikotylen. — Beitr. Biol. Pflanzen 18: 17—80.

A Revision of the Genus Parolinia Webb (Cruciferae) in the Canary Islands

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ABSTRACT

BRAMWELL, D.: A Revision of the Genus Parolinia Webb (Cruciferae) in the Canary Islands. — Bot. Notiser 123: 394—400, Lund.

In a taxonomic revision of the genus *Parolinia* WEBB in the Canary Islands three species are distinguished: *P. ornata* WEBB, *P. schyzogynoides* SVENT. and *P. intermedia* SVENT. & BRAMWELL, sp. nov. Descriptions, ecological and geographical data and a key to species are given.

INTRODUCTION

The genus *Parolinia*, which occurs only in the Canary Islands, was first described by WEBB (1840) from the island of Gran Canaria. Until recently it was considered to be monotypic, containing only the type species *P. ornata* WEBB, but in 1956 a second species was found on the island of La Gomera and was described as *P. schyzogynoides* SVENTENIUS (1960).

In April 1969 the author and Dr. E. R. SVENTENIUS discovered a third species on Tenerife which is described below as *P. intermedia*.

Parolinia belongs to a series of woody, endemic genera — e.g. *Bencomia, Marcetella* (*Rosaceae*), *Gonospermum, Vieraea, Sventenia* (*Compositae*) — which occur in the Macaronesian region and in the Canary Islands in particular. All three species of *Parolinia* are of very restricted distribution (Fig. 1) and have closely similar ecological requirements, occurring on dry, sunny slopes, generally on basalt or phonolite base-rock between 100 and 500 m. They inhabit xerophytic communities belonging to the association *Rubio-Euphorbetum canariense* RIVAS & ESTEVE (1964) and in all the localities visited they occur in association with *Neochamaelea* (*Cneorum*) *pulverulenta* (VENT.) ERTM.

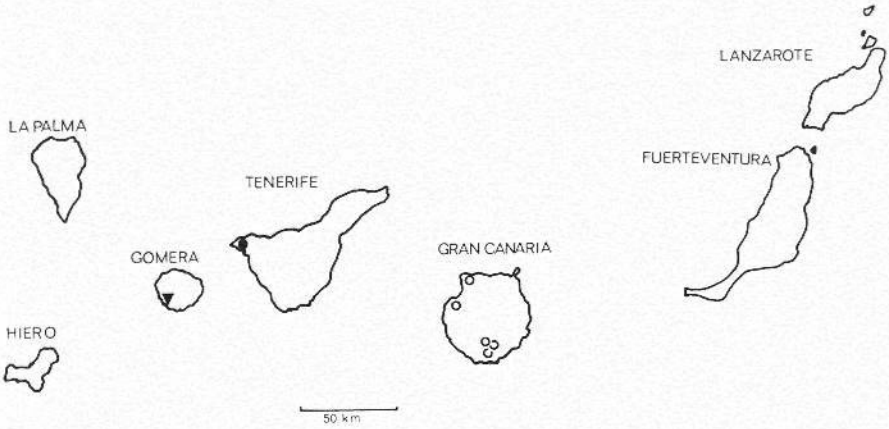

Fig. 1. Map showing the distribution of *Parolinia* in the Canary Islands. ○ = *P. ornata*; ▼ = *P. schyzogynoides*; ● = *P. intermedia*

Parolinia WEBB, Ann. Sci. Nat. Bot., sér. 2, 13: 133 (1840).

Erect shrubs; stems and leaves covered with fine, grey, stellate pubescence. Leaves linear, entire. Inflorescence racemose. Flowers shortly pedicellate. Sepals erect, equal. Petals lanceolate to spathulate, clawed, pink or white. Anthers sagittate. Style ± fleshy; stigma divaricate, shortly decurrent. Fruit an elongate, curved, latiseptate siliqua; valves with 2—9 transverse septa, the apices prolonged into two pronounced bifid appendages. Seeds brown, compressed, narrowly winged. Type species: *P. ornata* WEBB.

Key to the Species of Parolinia

Siliqua-appendages shortly bifid or trifid; siliqua 2—3-seeded ..... 2. *P. schyzogynoides*

Siliqua-appendages deeply bifid; siliqua 4—8-seeded.

Siliqua, including appendages, rarely exceeding 1.8 cm in length, 4 (—5)-seeded ..... 3. *P. intermedia*

Siliqua, including appendages, 2—2.5 cm in length, 5—8 (—9)-seeded ..... 1. *P. ornata*

1. **Parolinia ornata** WEBB, Ann. Sci. Nat. Bot., sér. 2, 13: 133 (1840).

1—1.5 m, erect, greyish; stems leafy. *Leaves* linear—lanceolate, up to 10 cm long, 2 mm broad, channelled. *Racemes* 10—30-flowered. *Sepals*

erect, 5—6 mm long. *Petals* lanceolate, c. 8 mm long, 1—1.5 mm broad, clawed, pinkish. *Siliqua*, including appendages, 2—2.5 cm long, straight or curved, 5—8 (—9)-septate. *Appendages* ± equalling valves, deeply bifid at apex. *Seeds* 5—8, oval.

Holotype: In petrosis aridissimis Canariae, Herb. Webb (FI) n.v.

Other specimens — Gran Canaria, Barranco Arguinegúin, 1.4. 1969, BRAMWELL 1219 (RNG, LTR, SEV, LAG); Ibid. KUNKEL Exsicc. Select. Fl. Canariensis 42, 1969 (Herb. Ku.); Barranco de Fataga, 28.3. 1969, BRAMWELL 2230 (RNG, SEV).

P. ornata has been recorded from Gran Canaria, Lanzarote and Fuerteventura but it has not been found on the latter two islands since the original collections (HARTUNG,[1] BOLLE, in sched.).

The species is abundant on Gran Canaria, particularly in dry barrancos of the south and west. Its distribution is discussed by SVENTENIUS (1948 p. 7) and KUNKEL (1969 pp. 1—4).

2. **Parolinia schyzogynoides** SVENT. Addit. Fl. Canar. 1: 11 (1960).

50—80 cm, compact, greyish-yellow; cauline leaves crowded towards apex. *Leaves* linear, somewhat fleshy, 3 cm long, 2 mm broad, channelled. *Racemes* up to 20-flowered. *Sepals* erect, 3 mm long. *Petals* narrowly spathulate, 6 mm long, 2 mm broad, white, turning pink in older flowers. *Siliqua*, including appendages, 0.8—1.3 cm long, usually curved, 2—3 (—4)-septate. *Appendages* shorter than or equalling valves, shallowly bifid or trifid at apex. *Seeds* 2—3, round.

Holotype: Junonia Minor (Insula Gomera); in regione austro-occidentale, Argaga a 150 m ad 300 m supra mare, 10 Octobris 1956, E. R. SVENTENIUS (ORT).

Other specimens — Gomera, Barranco de Argaga, 1.7. 1969, BRAMWELL 2046 (RNG, SEV, LTR).

This species occurs only in the south-west region of the island of La Gomera in the Barranco de Argaga between 150 and 300 m. It is fairly common in this, apparently its only, locality.

The plants form dense, compact bushes and the species is easily distinguished by its very short, few-seeded siliquae.

[1] The record for Lanzarote is apparently substantiated by a specimen cited by CHRIST (1888 p. 89) "Leg. Hartung teste specimene optimo fructifero in Herb. Helvet. Turicensi servato", but efforts to trace this specimen in the Zürich Herbarium have not been successful.

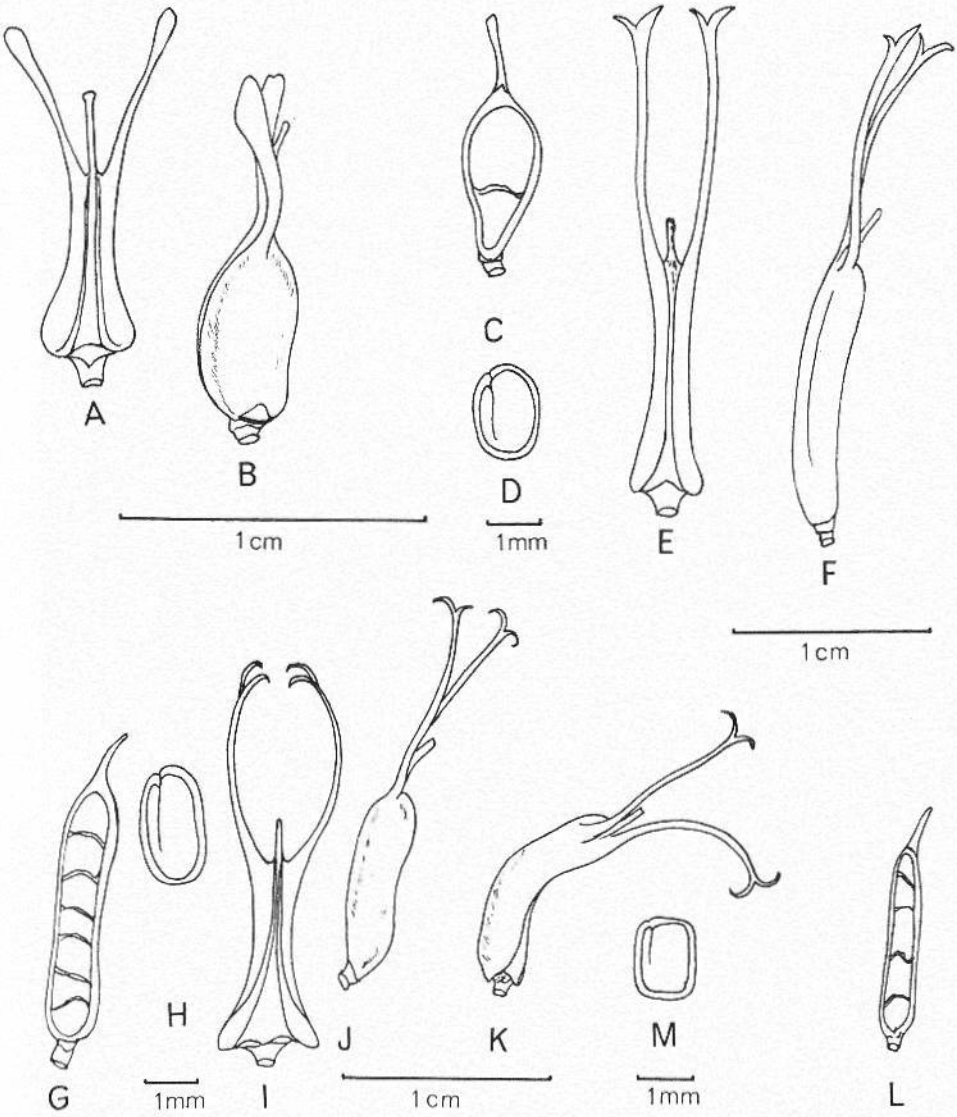

Fig. 2. A—D: *Parolinia schyzogynoides* SVENT. (BRAMWELL 2046 Gomera). — E—H: *P. ornata* WEBB (BRAMWELL 1219 Gran Canaria). — I—M: *P. intermedia* SVENT. & BRAMWELL (BRAMWELL 1453 Tenerife). — A, E, I: Dorsal view of siliqua. — B, F, J, K: Lateral view of siliqua. — C, G, L: Siliqua with valves removed showing septae. — D, H, M: Seed.

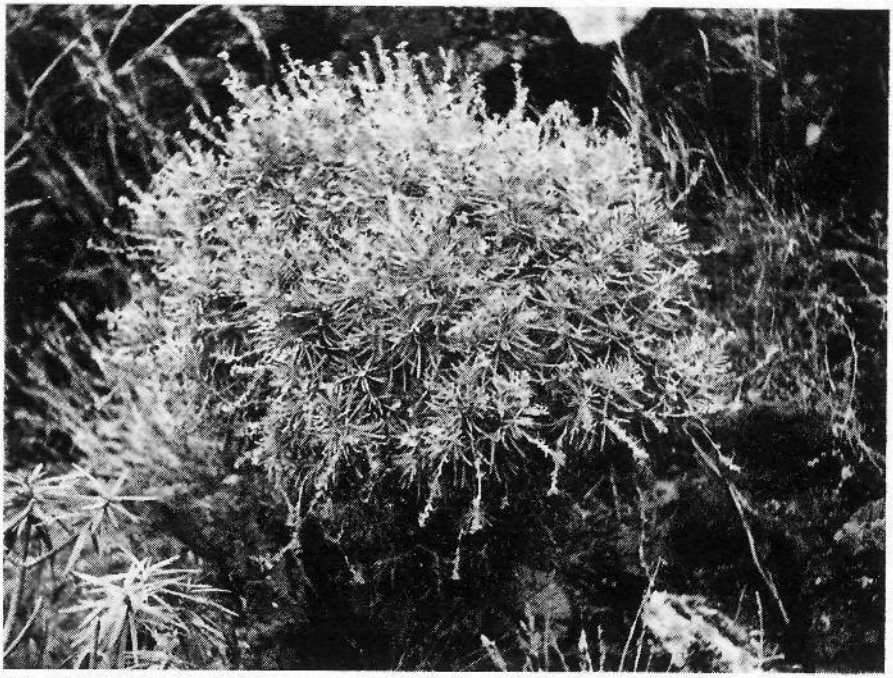

Fig. 3. *Parolinia intermedia* SVENT. & BRAMWELL, sp. nov. Punta de Teno, Tenerife (Loc. class.). Habit. — Photo: D. BRAMWELL.

3. **Parolinia intermedia** SVENT. & BRAMWELL, sp. nov.

Species haec a *P. ornata* WEBB et *P. schyzogynoides* SVENT. differt petalis late spathulatis; siliquis 2 cm longis, quadriseminalis; seminibus subquadratis.

Frutex ramosissimus ad 130 (—200) cm altus. Rami erecti. Cortex cinerascens, dense albo-pannosus praesertim in ramis juvenilibus. *Folia* alterna, linearia, crassiuscula, 3—6 cm longa et 2 mm lata, dense stellato-pannosa ad basin attenuata, apice obtusa; folia juvenilia canaliculata. *Inflorescentiae* racemosae, simplicia, erectae, 8—15 cm longa. *Sepala* lanceolata c. 3 mm longa et 1 mm lata, albopannosa, apice obtusa. *Petala* late spathulata, plerumque rosea raro alba, 7—8 mm longa et c. 2—2.5 mm lata, apice obtusiuscula. Filamenta 2—3 mm longa versus apicem angustata. Antherae 1.5 mm longae, triangulares obtusae ad basin cordatae. Stigma capitatum, subplanum. Ovarium 1.5 mm longum, gracile. *Siliquae* c. 1.8 cm longae (appendicibus inclusis), re-

curvatae, albo-tomentosae; valvae versus basin gibbosae, seminalibus 4—5. *Appendices* longitudinem valvarum aequantes, plerumque leviter curvatae, ad apicem profunde bifurcatae. *Semina* subquadrata, castanea, marginibus alato-scariosis. Floret Martio-Maio; fructificat aestate.

Holotypus: Insula Nivaria (Tenerife) regione septentrio-occidentali inter saxa rupesque, Punta de Teno, 24 Aprilus 1969, BRAMWELL & SVENTENIUS 1453, in Herb. Univ. Radingensis (RNG) servatus.

Other specimens — isotypes are conserved in the following herbaria: ORT, K, SEV, RNG, LTR, Fac. Cienc. Biol. La Laguna Tenerife (LAG); also Tenerife, Chio, 200 m, SVENTENIUS 1945 (ORT).

P. intermedia is morphologically more or less intermediate between the two other species of the genus. It is, however, considered to be a distinct species because of its angular, almost square seeds (Fig. 2), its robust habit and its curved, broad-based, 4—5-seeded siliquae.

The species occurs on the western promontory of Tenerife on dry, rocky slopes with a north-west facing aspect where the base-rock consists of Tertiary Basalt with a covering of more recent volcanic debris. It is abundant between 50 and 200 m in association with *Euphorbia canariensis* L., *Rubia fruticosa* AIT., *Neochamaelea pulverulenta* (VENT.) ERTM. and *Convolvulus scoparius* L. FIL.

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I am also very grateful to Professor V. H. HEYWOOD of the University of Reading for fostering my Canarian studies over a number of years and to Dr. D. MOORE, also of Reading, for help and advice during the preparation of the manuscript.

Special thanks are due to Dr. ERIC R. SVENTENIUS of Tenerife for his help, advice and hospitality during my stay in the Canary Islands from October 1968 to August 1969.

LITERATURE CITED

CHRIST, H. 1888. Spicilegium Canariense. — Bot. Jahrb. 9: 86—172.

KUNKEL, G. 1969. Sobre la distribución de Parolinia ornata (Cruciferae) en Gran Canaria. — Cuad. Bot. (Canary) 7: 1—4.

Rivas Goday, S. & Esteve Chueca, F. 1964. Ensayo fitosociológico de la Crassi-Euphorbieta macaronesica y estudio de los tabaibales y cardonales de Gran Canaria. — Anal. Inst. Bot. Cavanilles 22: 221—339.

Sventenius, E. R. S. 1948. Plantas nuevas o poco conocidas de Tenerife 1. — Bol. Inst. Nac. Invest. Agron. 18: 1—19.

— 1960. Additamentum ad Floram Canariensem. 1. — Madrid.

Webb, P. B. 1840. Notice sur le Parolinia, nouveau genre Cruciferae. — Ann. Sci. Nat. Bot., sér. 2, 13: 133—140.

Beech Forest Vegetation in Sweden – a Survey

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ABSTRACT

LINDGREN, L.: Beech Forest Vegetation in Sweden — a Survey. — Bot. Notiser 123: 401—424, Lund.

The vegetation of Swedish beech forests is described on the basis of the author's own investigations.

Four types of beech forest vegetation are distinguished, viz. the Deschampsia flexuosa type, the Oxalis acetosella type, the Lamium galeobdolon type and the Mercurialis perennis type.

Moreover, the regional distribution of beech forest types in Sweden is presented and related to forest regions and soil conditions.

INTRODUCTION

The main investigations on Swedish beech (*Fagus silvatica*) forests have been performed by LINDQUIST (1931, 1932, 1959), who studied the distribution of the beech and the vegetation types as well as habitat conditions. HJELMQVIST (1940) concentrated particularly on the problem of temperature as a limiting factor for the distribution of trees, mainly beech.

The results of the present investigation have appeared partly in connection with studies on ecological conditions in Swedish beech forests, and partly in connection with an inventory survey for nature conservancy. This latter extensive material includes about 500 investigated localities, and is presented here as a regional survey of the main beech forest types and their distribution in South Sweden.

DISTRIBUTION OF BEECH IN SWEDEN

The beech reached Sweden during the later part of the Sub-Boreal time about 1500 B.C. (FRIES 1965). During the beginning of the Sub-Atlantic time it extended further to the north than at present. Then

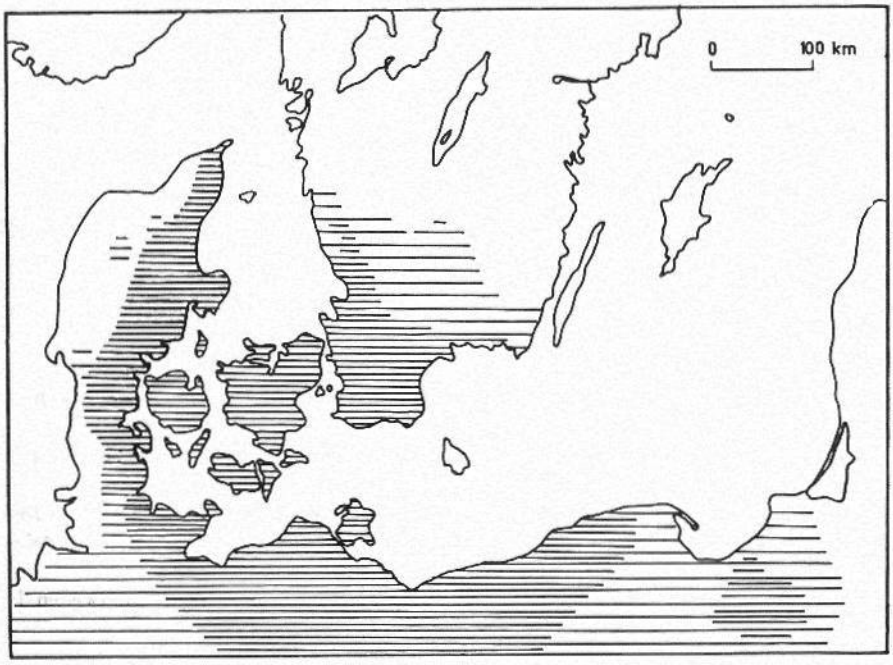

Fig. 1. The distribution of beech (*Fagus silvatica*) in Northern Europe. After HJELMQVIST (1940 Fig. 9) and LINDQUIST (1959).

the beech was forced back again to the south and west at the same time as the spruce spread rapidly southwards and man's influence on the landscape increased. The beech forests in southernmost Sweden reached a maximum about 1500 A.D. (NILSSON 1964). Today the total beech forest area in Sweden is 63.000 ha or 0.3 % of the whole Swedish forest area. Afforestation with spruce on old beech areas for economic reasons is a severe threat to the future of the beech.

A continuation of the Swedish distribution of beech appears around the southwestern part of the Baltic and the Danish islands (Fig. 1). In Sweden the main distribution of beech forest is found in Scania, about 85 % of the total Swedish beech forest area. Further to the north the occurrence of beech forests decreases rapidly. Moreover, the distribution has a distinct western tendency. Within the main distribution area in Scania there is a distinct concentration of beech to certain areas (Fig. 2) especially on the horsts (Söderåsen, Linderödsåsen, Hallands-

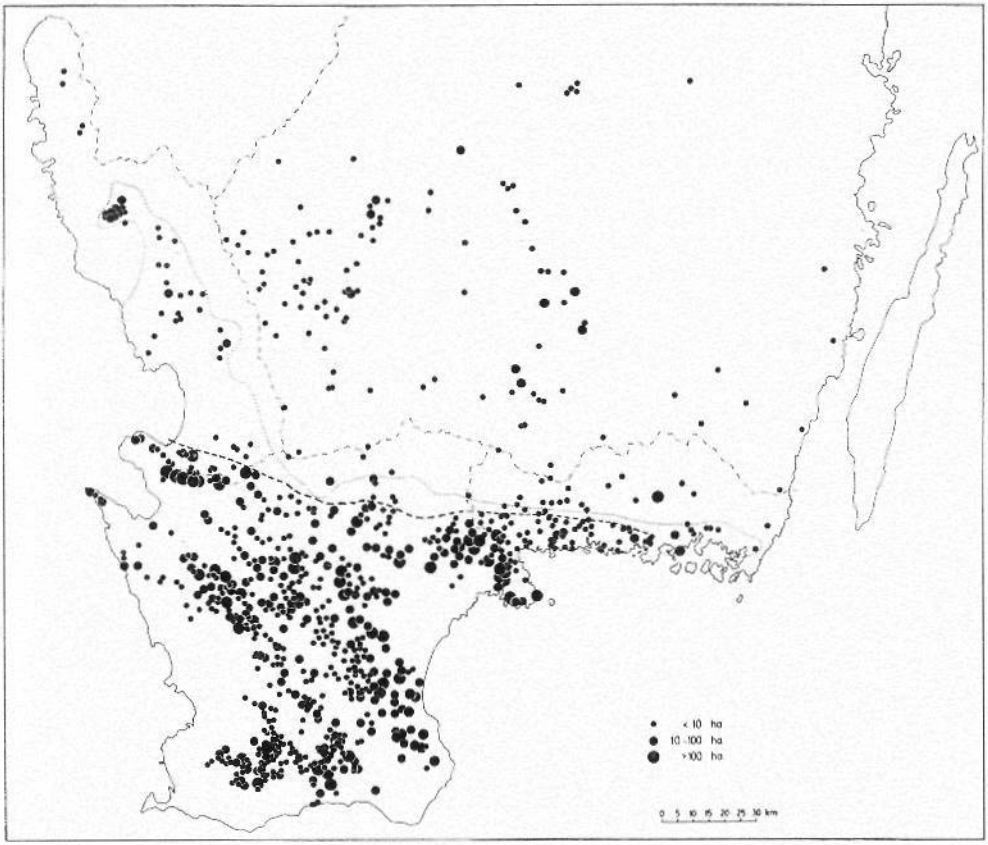

Fig. 2. The actual distribution of beech forest in Sweden. — Preliminary map (Sept. 1969) from an inventory carried out by the National Board of Forestry 1967—68. Here somewhat generalized.

The boundary between the beech forest area (proper) and the outpost beech forest area described in text is marked: ------. The South Swedish beech forest area (LINDQUIST 1959) is marked: ·····.

åsen and Ryssberget) and also around the lakes in the southernmost part.

Several authors — NILSSON (1901), ANDERSSON (1903), HESSELMAN (1915), LINDQUIST (1931, 1959), VON POST (1933), HJELMQVIST (1940) — have discussed the regional differentiation of the beech area in Sweden. LINDQUIST (1959) distinguished a beech-dominated forest region, the south Swedish beech forest area, which comprises Scania, southernmost Blekinge and Halland northwards to the

latitude of Varberg. North of this area he distinguished the beech-spruce area, limited to the north by a boundary from Kungsbacka in the west to about Kalmar in the east. In this area the beech occurs scattered in small forests or as single trees in a forest vegetation characterized by spruce. In the outpost area of beech further to the north the beech is very rare.

The beech forest area along the Swedish west coast has been regarded as potential beech forest area by LINDQUIST (1959). According to the distribution of beech forests today and the distribution of the different beech forest types it seems more convenient to exclude Halland and also Blekinge east of Ronneby from the beech forest area (proper) and regard all the rest as a part of the outpost beech forest area (Fig. 2). The beech areas in the central parts of Halland are today isolated from the main distribution of the beech forest. The occurrence of a few large beech forests just east of such a border in Blekinge can be accounted for by special conditions. With reference to the late postglacial period NILSSON (1935) has distinguished two types of pollen diagrams in Scania, viz. the main Scanian type and a north-eastern variant. Among other criteria the north-eastern variant is characterized by lower frequencies of *Fagus silvatica* and a higher frequency of *Pinus* and *Betula* during the late Sub-Atlantic period (SA II). OLAUSSON (1957) has found the last mentioned type in southern Halland and BERGLUND (1966) in eastern Blekinge. This supports the opinion that these two areas ought to be excluded from the beech forest area proper. An analysis of the large pollenanalytic material from the last decades in southern Sweden would provide further data to establish the maximum area for the beech forest in Sweden.

VEGETATION TYPES OF THE BEECH FORESTS

Methods

Beech forest in this context signifies a forest with at least 80 % cover of beech in the tree-layer. This investigation of the beech forest vegetation has been carried out in two ways:

1. During summer 1965 small square analyses were performed within homogeneous stands. The degree of cover was estimated with the HULT—SERNANDER—DU RIETZ 5-degree scale (DU RIETZ 1921).

The minimum area of the small squares (ELLENBERG 1956) was found to be between 8 and 16 m². In each locality investigated, 10 squares of 16 m² were analysed within an area of 0.1—1 ha. The results are presented in Table 1.

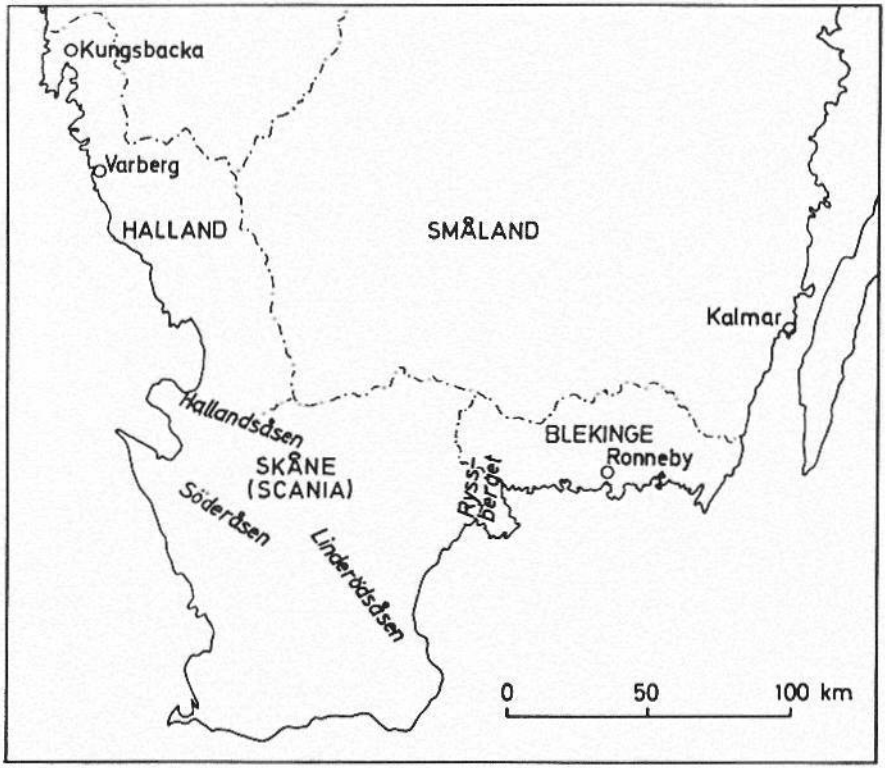

Fig. 3. Map of South Sweden showing the situation of places mentioned in text.

2. During the summers 1966—1969 a more extensive regional investigation was carried out all over South Sweden. The investigated sites were as large as possible with regard to the demand of a homogeneous vegetation. In each site the degree of cover has been estimated with a 3-degree scale.

Intensive investigation		Extensive investigation
Part of the square covered	Degree of cover	Degree of cover
<1/16	1	1
1/16—1/8	2	2
1/8 —1/4	3	
1/4 —1/2	4	
>1/2	5	3

The results are presented in Table 2.

Species of the spring aspect — e.g. *Anemone*, *Gagea* and *Corydalis* species — are excluded from the vegetation tables as the investigations were performed

even in August and September when the spring flora had disappeared. However, these species have very little significance for the classification of beech forest vegetation (cf. LINDQUIST 1931).

Information about the tree layer is not given here but can be found in LINDGREN (1967, 1968 a, b, 1969 a, b, c). Shrubs are of no importance in Swedish beech forest and, along with the bottom layer, have been excluded from the tables. Most of the bryophytes are situated on stones or other deviating substrate, where beech leaves do not settle. Moreover, leaf litter is too compact and prevents growth of bryophytes.

Nomenclature of vascular plants follows HYLANDER (1955). *Stellaria nemorum* in the following means *Stellaria nemorum* ssp. *glochidosperma*. *Viola riviniana* and *V. reichenbachiana* are treated as *V. riviniana* due to the frequent hybridization.

In all there are 315 investigated sites. The whole material of vegetation analyses has been grouped in four types and eight variants (Tables 1 and 2). The types are selected qualitatively with reference to certain characteristic species. The variants are distinguished within the types with reference to the dominance of certain species.

In some localities the vegetation type was identified without complete analysis. Therefore the maps presented (Figs. 8—14) contain more "dots" than number of localities in the tables.

The material in Table 1 is included in Table 2. The vegetation analyses which have been carried out with the two different methods — one intensive and one extensive — have given very similar results. In a vegetation such as beech forest vegetation with its well-defined and distinct types it is easy e.g. to carry out and inventory for nature conservancy once the vegetation types are characterized.

The Vegetation Types

I. THE DESCHAMPSIA FLEXUOSA TYPE

This type is poor in species. The field layer is often fragmentary or sometimes lacking. Herbs are few. *Vaccinium myrtillus* and *Trientalis europaea* are restricted to this type, while *Carex pilulifera, Deschampsia flexuosa* and *Luzula pilosa* have their main occurrence here.

This type includes a Deschampsia flexuosa variant (1) where *Deschampsia flexuosa* is dominating and *Oxalis acetosella* has a low cover even if the presence is high. Further, there is a Deschampsia flexuosa — Oxalis acetosella variant (2), where *Deschampsia flexuosa* and *Oxalis acetosella* are co-dominating. The former variant is most fully developed in sites with good light conditions, e.g. in clearings or after thinnings in older forests.

There are some further variants which not are represented in the tables. Beech forest with little or no field layer is very common, espe-

cially in the northern parts of the region. This variant seems to be very stable in middleaged and old beech forests. It may also be found in the other types, though in young forests with bad light conditions. A variant with *Vaccinium myrtillus* (Table 1) as the dominating species can sometimes be found, but often only in very limited areas. This variant is hardly a true beech forest vegetation because it is mostly found under oak, birch or other species interspersed with beech, which give deviating light conditions.

Some variants can be dominated by *Convallaria majalis* or *Majanthemum bifolium*. A special variant is the bryophyte-dominated forests. This variant can sometimes be found in particularly wind-influenced forests where the leaf litter is blown away.

See further LINDQUIST (1931 pp. 220—226).

II. THE OXALIS ACETOSELLA TYPE

Oxalis acetosella is the dominating species. Species with a high presence in the Deschampsia flexuosa type, e.g. *Luzula pilosa* and *Carex pilulifera* are less well represented. Many species, mainly herbs, appear in this type, species which are in common with the following types, e.g. *Viola riviniana, Lastrea dryopteris* (often dominating in large patches), *Dryopteris spinulosa* and *Cardamine bulbifera*. On the whole, however, this type is often fairly poor in species. This type seems to be stable provided that no severe thinnings are made. See further LINDQUIST (1931 pp. 273—278).

Some stands are dominated by *Poa nemoralis*, which is a secondary feature. This species is dominating in windexposed forest edges, especially in Scania, where it forms a zone of varying width along the edges of the forests. Sometimes *Deschampsia flexuosa* can be found as a co-dominant where the soil degeneration has been more pronounced. See further LINDQUIST (1931 pp. 251—253).

In other stands *Cardamine bulbifera* or *Lastrea dryopteris* dominates, though often in limited areas.

Within the Oxalis acetosella type there is a regional differentiation. In the outpost beech forest area *Lastrea dryopteris* is much more common than in the beech forest area and the same will be valid for *Cardamine bulbifera*. From Table 2 it is also seen that a lot of species are lacking in the outpost beech forest area. In Scania *Cardamine bulbifera* is most common in the Melica uniflora and the Allium ursinum variants, i.e. distinctly deviating vegetation types.

Table 1. Small square analysis of the field layer in beech forests. Size of small squares, 16 m². The figures give the small square frequencies and (as exponent) the characteristic degree of cover (MALMER 1962). Species with a frequency less than 10 % are excluded from the table. The species are grouped according to PASSARGE and HOFMAN (1964). Investigated sites: Parts of South and Middle Scania (1965). Vegetation types: I: the Deschampsia flexuosa type, II: the Oxalis acetosella type, III: the Lamium galeobdolon type, IV: the Mercurialis perennis type. — As to the variants see the text.

Type	I			II	III				IV	
Variant		1	2		1	2	3	4	1	2
Large squares	5	6	5	5	1	5	6	3	3	3
Small squares	50	60	50	50	10	50	60	30	30	30
Vaccinium myrtillus	100^5	10^1	·	·	·	·	·	·	·	·
Deschampsia flexuosa ..	82^2	100^4	98^4	12^1	·	·	·	·	·	·
Carex pilulifera	8^1	57^1	41^1	34^1	·	·	·	·	·	·
Luzula pilosa	4^1	10^1	25^1	14^1	30^1	·	8^1	·	·	·
Majanthemum bifolium	·	10^1	8^1	4^1	20^1	14^1	47^1	14^1	·	·
Dryopteris spinulosa ...	·	·	6^1	4^1	50^1	8^1	5^1	·	·	·
Oxalis acetosella	10^1	18^1	98^2	100^4	100^5	100^3	82^3	77^3	37^3	37^1
Milium effusum	·	·	12^1	·	·	88^1	22^1	50^1	·	·
Stellaria holostea	·	·	·	·	·	4^1	45^1	4^1	3^1	·
Dryopteris filix-mas	·	·	·	2^1	·	18^1	2^1	·	·	·
Deschampsia caespitosa	2^1	·	12^1	24^1	30^1	14^1	17^1	10^1	3^1	3^1
Carex silvatica	·	·	·	14^1	·	·	7^1	13^1	7^1	30^1
Viola riviniana	·	·	2^1	38^1	70^1	36^1	90^1	68^1	10^1	40^1
Poa nemoralis	·	·	·	20^1	·	8^1	38^1	14^1	·	·
Lamium galeobdolon ...	·	·	·	4^1	100^5	100^3	62^3	100^3	43^1	23^1
Stellaria nemorum	·	·	·	·	·	100^4	35^2	70^1	47^1	40^1
Dactylis aschersoniana ..	·	·	·	·	·	4^1	17^1	17^1	·	·
Galium odoratum	·	·	·	·	·	42^2	100^4	14^3	27^1	20^1
Melica uniflora	·	·	·	·	·	50^2	27^2	100^4	37^1	10^1
Mercurialis perennis ...	·	·	·	·	·	12^1	12^1	43^1	100^5	100^5
Hordelymus europaeus ..	·	·	·	·	·	4^1	10^1	·	7^1	5^1
Aegopodium podagraria	·	·	·	·	·	·	·	7^1	17^1	3^1
Primula elatior	·	·	·	·	·	·	·	·	·	13^1
Bromus asper	·	·	·	·	·	·	·	·	3^1	40^1
Urtica dioeca	·	·	·	2^1	·	4^1	3^1	47^1	30^1	3^1
Geranium robertianum ..	·	·	·	6^1	·	·	2^1	3^1	17^1	3^1
Allium ursinum	·	·	·	·	·	·	·	·	30^1	100^4
Rubus idaeus	2^1	·	8^1	20^1	·	26^1	2^1	30^1	30^1	30^1
Fagus silvatica juv.	68^1	57^1	72^1	32^1	·	22^1	33^1	57^1	33^1	37^1
Sorbus aucuparia juv. ..	10^1	20^1	10^1	2^1	·	·	10^1	7^1	·	·
Quercus robur juv.	14^1	3^1	6^1	8^1	·	3^1	·	·	·	·
Ulmus glabra juv.	·	·	·	·	·	·	·	40^1	·	·
Fraxinus excelsior juv. ..	·	·	·	4^1	·	6^1	7^1	43^1	27^1	73^2

III. THE LAMIUM GALEOBDOLON TYPE

In this type many of the species which characterize the Deschampsia flexuosa type are lacking or uncommon. e.g. *Deschampsia flexuosa, Luzula pilosa, Majanthemum bifolium, Vaccinium myrtillus, Trientalis europaea,* and *Carex pilulifera.* However, many species, which are lacking both in the Deschampsia and the Oxalis type occur, particularly *Lamium galeobdolon, Stellaria nemorum, Galium odoratum,* and *Melica uniflora.*

This type can be divided into four rather common and often distinct variants. In the Lamium galeobdolon variant (1), this species dominates, often together with *Oxalis acetosella.* In comparison with the other variants, this variant is poor in species. The high presence of *Lamium galeobdolon* and the relatively high presence of *Stellaria nemorum* and *Melica uniflora* distinguish it from the Oxalis type and shows that it is a Lamium type. *Lamium galeobdolon* itself is a very common species in Scanian beech forests. It is often a sub-dominant where other species dominate, probably due to the fact that *Lamium galeobdolon* has an extremely effective vegetative propagation. The site conditions may be very different but this variant is often found in moist conditions. See further LINDQUIST (1931 pp. 269—273).

In the Stellaria nemorum variant (2) *Stellaria nemorum* dominates, often together with *Oxalis acetosella* and *Lamium galeobdolon.* Two other species may be mentioned, *Milium effusum* and *Rubus idaeus,* often colonizing the forest after severe thinnings of the tree-layer. See further LINDQUIST (1931 pp. 256—257).

Occasional species.

I: *Betula pubescens, Galium saxatile, Lycopodium selago, Vaccinium vitis-idaea.*

I: 1 *Betula pubescens, Calluna vulgaris, Carex cargophyllea, Galium saxatile, Picea abies, Rhamnus frangula, Trientalis europaea.*

I: 2 *Agrostis tenuis, Calamagrostis arundinacea, Galium saxatile, Picea abies, Trientalis europaea, Veronica officinalis.*

II: *Agrostis tenuis, Circaea lutetiana, Dryopteris filix-mas, Galeopsis ladanum, Moehringia trinervia, Prunus avium, Rhamnus frangula, Rubus fruticosus.*

III: 1 *Galeopsis tetrahit, Geum urbanum.*

III: 2 *Acer platanoides, Athyrium filix-femina, Carpinus betulus, Convallaria majalis, Moehringia trinervia, Lastrea dryopteris, Polygonatum verticillatum, Pulmonaria officinalis, Stachys silvatica.*

III: 3 *Acer platanoides, Cardamine bulbifera, Galeopsis ladanum, Geum rivale, Polygonatum multiflorum, Pulmonaria officinalis.*

III: 4 *Avena pubescens, Convallaria majalis, Festuca gigantea, Galium aparine, Fragaria vesca, Melandrium rubrum, Moehringia trinervia, Poa trivialis, Pulmonaria officinalis, Sambucus nigra, Solidago virgaurea, Tilia cordata, Vicia sepium.*

IV: 1 *Athyrium filix-femina, Crataegus* sp., *Galium aparine, Lactuca muralis, Poa trivialis, Scrophularia nodosa.*

IV: 2 *Agropyron caninum, Alliaria officinalis, Crataegus* sp., *Epilobium montanum, Galium odoratum, Pulmonaria officinalis, Sanicula europaea, Stachys silvatica, Viola mirabilis.*

Table 2. Survey of the Swedish beech forest vegetation. Size of sample area, 0.1—1 ha. The figures give the presence in % and (as exponent) the degree of cover (3-degree scale). Species with a presence less than 20 % are excluded. Remaining species can be found in LINDGREN (1967, 1968 a, b, 1969 a, b, c). Investigations made 1965—1969.

	Beech forest area										Cutpost beech forest area			
Type	I		II	III				IV			I		II	
Variant	1	2		1	2	3	4	1	2		1	2		
Vaccinium myrtillus	31^1	10^1	3^1	·	·	2^1	·	·	·		32^1	23^1	12^1	
Trientalis europaea	24^1	31^1	·	·	·	·	·	·	·		32^1	23^1	4^1	
Carex pilulifera	80^1	79^1	35^1	14^1	·	7^1	·	·	·		59^1	77^1	47^1	
Convallaria majalis	27^1	21^1	15^1	28^1	13^1	10^1	18^1	·	·		37^1	54^1	19^1	
Deschampsia flexuosa	100^2	100^2	56^1	24^1	·	35^1	19^1	·	·		100^2	100^2	60^1	
Luzula pilosa	77^1	84^1	50^1	38^1	7^1	48^1	7^1	·	·		83^1	100^1	68^1	
Majanthemum bifolium	55^1	63^1	47^1	57^1	27^1	43^1	45^1	·	·		68^1	62^1	44^1	
Lastrea dryopteris	4^1	16^1	32^1	24^1	20^1	10^1	11^1	·	·		46^1	38^1	84^1	
Oxalis acetosella	72^1	100^2	100^3	100^3	100^2	88^2	96^2	60^1	60^1		73^1	100^2	100^2	
Poa nemoralis	7^1	21^1	26^1	29^1	40^1	60^1	37^1	20^1	·		10^1	·	29^1	
Dryopteris spinulosa	7^1	21^1	41^1	43^1	20^1	10^1	19^1	·	·		·	23^1	19^1	
Milium effusum	1^1	10^1	29^1	48^1	73^1	58^1	70^1	40^1	·		·	·	16^1	
Dryopteris filix-mas	3^1	·	18^1	24^1	42^1	28^1	30^1	60^1	20^1		·	·	10^1	
Carex silvatica	·	5^1	18^1	14^1	13^1	13^1	19^1	40^1	60^1		·	·	·	
Deschampsia caespitosa	3^1	16^1	38^1	62^1	42^1	33^1	19^1	40^1	20^1		2^1	·	·	
Viola riviniana	12^1	31^1	62^1	57^1	53^1	78^1	78^1	40^1	60^1		12^1	31^1	61^1	
Urtica dioeca	1^1	·	21^1	10^1	60^1	30^1	30^1	80^1	80^1		·	·	·	
Dactylis aschersoniana	·	·	6^1	5^1	13^1	23^1	15^1	20^1	·		·	·	·	
Stellaria holostea	8^1	21^1	18^1	57^1	33^1	40^1	41^1	20^1	·		·	·	10^1	
Lamium galeobdolon	·	5^1	12^1	100^3	87^2	65^2	78^2	40^1	80^1		·	·	·	
Stellaria nemorum	·	·	6^1	24^1	100^3	40^2	33^1	40^1	100^1		·	·	·	
Galium odoratum	·	5^1	3^1	10^1	73^1	100^3	37^2	·	·		·	·	·	
Melica uniflora	·	·	6^1	43^1	87^1	55^2	100^3	40^1	40^1		·	·	·	
Mercurialis perennis	·	·	3^1	10^1	53^1	23^1	56^1	100^3	100^3		·	·	·	
Cardamine bulbifera	·	·	6^1	5^1	·	8^1	11^1	·	40^1		·	·	33^2	
Circaea lutetiana	·	·	6^1	5^1	40^1	18^1	7^1	40^1	20^1		·	·	·	
Aegopodium podagraria	·	·	·	·	·	10^1	26^1	40^1	20^1		·	·	·	
Agropyron caninum	·	·	·	·	·	·	7^1	·	20^1		·	·	·	
Allium ursinum	·	·	·	·	·	5^1	4^1	20^1	100^3		·	·	·	
Rubus idaeus	8^1	31^1	56^1	33^1	87^1	33^1	52^1	60^1	40^1		7^1	23^1	25^1	
Fagus silvatica juv.	69^1	79^1	68^1	57^1	40^1	73^1	67^1	40^1	40^1		66^1	77^1	92^1	
Sorbus aucuparia juv.	43^1	53^1	32^1	29^1	13^1	35^1	19^1	·	·		42^1	54^1	20^1	
Quercus robur juv.	12^1	16^1	21^1	5^1	7^1	3^1	4^1	·	·		17^1	15^1	8^1	
Fraxinus excelsior juv.	1^1	5^1	21^1	38^1	40^1	28^1	48^1	40^1	80^2		2^1	·	8^1	
Ulmus glabra juv.	·	·	·	5^1	13^1	5^1	26^1	40^1	40^1		·	·	·	
Number of investigated sites	74	19	34	21	15	40	27	5	5	Σ 240	41	13	21	Σ 75

Fig. 4. Beech forest in the outpost beech forest area. The Deschampsia flexuosa type. Öströ, central part of Halland. — Photo: Author, August 1969.

In the Galium odoratum variant (3) *Galium odoratum* is the dominating species. *Oxalis acetosella, Lamium galeobdolon,* and *Viola riviniana* are also frequent species. This variant seems to prefer good light conditions and often a sandy soil. LINDQUIST (1931 pp. 265—269) suggested that this variant (socion) would not be stable in the southern part of Scania. However, this conclusion appears doubtful as the Galium variant seems to be stable in the whole area.

In the Melica uniflora variant (4) *Melica uniflora* dominates. Other frequent species are *Oxalis acetosella, Lamium galeobdolon, Viola riviniana,* and sometimes *Milium effusum*. This variant seems to be well developed in windexposed forests with good light conditions, and with clayey soils. See further LINDQUIST (1931 pp. 244—249).

In some localities *Galium odoratum* and *Melica uniflora* dominate together. The tables show that these two variants are more similar than the other two.

Fig. 5. Beech forest in the beech forest area (proper). The Lamium galeobdolon type, here with flowering *Stellaria nemorum*. Sjöbo Ora, Scania. — Photo: Author, June 1967.

IV. THE MERCURIALIS PERENNIS TYPE

In this type, the species which characterized the Deschampsia type are absent. Species with a high presence and cover in the Lamium type such as *Oxalis acetosella, Lamium galeobdolon, Stellaria nemorum, Galium odoratum* and *Melica uniflora* are not so frequent in this type. *Galium odoratum* is almost lacking. Instead the dominance of *Mercurialis perennis* and *Allium ursinum* are characteristic. This type is restricted to calcareous clayey soils in Scania.

In the Mercurialis perennis variant (1) this species is the only dominant, and *Allium ursinum* is present only in small numbers.

In the Allium ursinum variant (2) *Allium ursinum* dominates together

Fig. 6. Typical combination of species in the Mercurialis perennis type. *Mercurialis perennis*, *Allium ursinum* and *Anemone ranunculoides*. Övedskloster, Scania. — Photo: BJÖRN ANDERSSON, April 1968.

with *Mercurialis perennis*. This variant is poor in species. In some places there are pure Allium areas with very few other species, but these areas are often restricted to some hundred square metres.

See further LINDQUIST (1931 pp. 280—283 and 285—290).

REGENERATION OF BEECH

The occurrence of beech seedlings (Tables 1 and 2) shows that beech regenerates well in the Deschampsia flexuosa type, the Oxalis acetosella type, and in the Lamium galeobdolon type with one exception, the Stellaria nemorum variant, a fact which LINDQUIST (1931 p. 256) also noticed. It is a well-known fact that a regeneration can sometimes be very difficult in the Deschampsia type on the Archaean moraines and in localities with unsuitable climatic conditions further to the north. But this is not always the rule.

The most suitable possibilities for regeneration seem to be in the Galium odoratum variant.

In the Mercurialis perennis type, especially the Allium variant, there is weak regeneration of beech. Instead a regeneration of *Fraxinus excelsior* can be very important.

LINDQUIST (1931 p. 327) has found a close correlation between regeneration and pH and that a high pH favours the regeneration.

GENERAL REMARKS

Between the Deschampsia flexuosa type and the other types there is a main limit in the vegetation. According to the common Swedish terminology on vegetation (NILSSON 1902, SJÖRS 1967) the Deschampsia flexuosa type belongs to the heath series (heath beech forest) and the other three types to the meadow series (meadow beech forest).

The beech forest vegetation in Sweden has here been presented in a simple system founded only on the present material. According to the commonly accepted classification of the Central European forest vegetation most of the Swedish beech forest vegetation belongs to the units Fagetalia silvaticae and Fagion silvaticae (cf. OBERDORFER 1967). The Deschampsia flexuosa type is closely related to similar communities within Luzulo-Fagion (OBERDORFER 1967) in northern Germany (cf. especially TÜXEN 1955, ELLENBERG 1963).

The Oxalis acetosella type seems to have no correspondence in the beech forest vegetation of Central Europe. Oxalis beech forests occur in northern Central Europe only where beech and introduced spruce are codominating (personal communication from Dr. H. PASSARGE, DDR). Therefore a new association Oxalo-Fagetum within Asperulo-Fagion may be set up and described according to these Swedish investigations.

The Lamium galeobdolon type also is a community of Asperulo-Fagion. It seems to be closely related to similar vegetation types common in Central Europe and often described in the literature as Melico-Fagetum (cf. TÜXEN 1955, SCAMONI 1956, PASSARGE 1959, 1960, 1965, ELLENBERG 1963).

The position of the Mercurialis perennis type in this system is somewhat doubtful. Strictly with reference to OBERDORFER (1967) it is most closely comparable with Querco-Ulmetum minoris (Fraxino-Ulmetum, TÜXEN) in Alno-Padion (Alno-Ulmion, TÜXEN). In ELLENBERG (1963) it is regarded as a subass. (Melico-Fagetum circaetosum) of Melico-Fagetum. PASSARGE (1959) treats it as a separate unit (Fraxino-Fagetum). This name is very suitable, bearing in mind the good regeneration of *Fraxinus excelsior* (cf. Tables 1 and 2).

Sweden is an outpost area for beech forest in Europe (Fig. 1). The number of species in the field layer is to some extent reduced in Sweden compared with that of the areas south of the Baltic. The mean number of species on the localities is low (Table 2). This is one of the problems which arise when comparing Swedish beech forest vegetation with that of Central Europe. The Lamium galeobdolon type, except the Stellaria variant, contains the largest number of species, viz. 14—15. In the Mercurialis perennis type the number is lower, and in the Deschampsia flexuosa type the number is less than 10. There do not seem to be any differences in the mean number of species between the beech forest area and the outpost beech forest area.

DISTRIBUTION OF BEECH FOREST VEGETATION

The Deschampsia flexuosa type (Fig. 8) has its main distribution in the northern parts of the beech area in Sweden, especially on the Archaean moraines. In Scania it occurs in the north and on the horsts — Söderåsen, Hallandsåsen and Linderödsåsen. In Halland, Småland and Blekinge this is the dominating beech forest type.

The Oxalis acetosella type (Fig. 9) shows a very scattered occurrence but is found within the whole beech area in Sweden. In Scania it is especially common on the slopes of the horsts. The best example of this type is in Maglehems Ora in the eastern part of Scania. The special "variants" with *Cardamine bulbifera* and *Lastrea dryopteris* are rather uncommon in the southern part of the beech area, but in the northern part — Småland and Halland — they appear on some localities with a high water table.

Table 3. The distribution of the beech forest types in Sweden. Percentage of the total number of investigated sites in each forest region.

Beech forest type	I	II	III	IV
The beech forest area	51 %	11 %	32 %	6 %
The outpost beech forest area	80 %	17 %	3 %	0 %

The Lamium galeobdolon type is restricted to the beech forest area. For the Lamium galeobdolon variant (Fig. 10) the natural distribution of *Lamium galeobdolon* in Sweden explains the fact that this variant is restricted to Scania. In this province it is spread over a vast area, but it often occurs on the slopes of the horsts. The Stellaria nemorum variant (Fig. 11) is not so common and is restricted to the southwestern half of Scania. Kongalund near the horst Söderåsen is one of the best examples of this variant. The distribution of the Galium odoratum variant (Fig. 12) is concentrated to the southern and eastern parts of Scania. In Halland it is found in some localities on the slopes of the horst Hallandsåsen, and in Blekinge it occurs along the coast. The Melica uniflora variant (Fig. 13) has a distribution similar to that of the Galium variant.

The Mercurialis perennis type (Fig. 14) is strictly limited to the southern part of Scania, mainly on slopes in Fyledalen and north of Vombsjön.

Within the southern parts of the beech forest area the whole range of beech forest vegetation is found (Table 3). The types are often very distinct and apparently in a stable state. But further to the north and northeast in this area a change in the composition of the field layer may be observed. This will be valid especially for the Lamium galeobdolon type which is poor in species compared with the type southwards. It is not unusual to find *Galium odoratum* or *Melica uniflora* growing together with *Deschampsia flexuosa*.

In the outpost beech forest area the beech forest vegeta-

Fig. 7. Altitude and soil with different Ca-content.
Soils with different Ca-content according to EKSTRÖM (1950) and MAGNUSSON et al. (1957 p. 319).

Figs. 8—14 The distribution of beech forest vegetation in Sweden. Soils with different Ca-content marked according to Fig. 7.

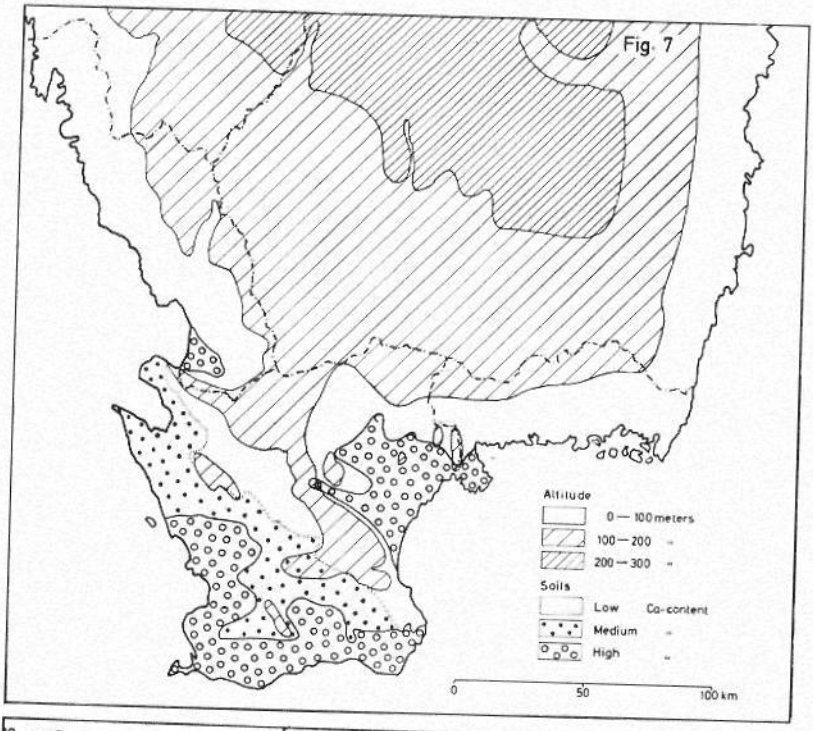
Fig. 7
Altitude
0 — 100 meters
100 — 200 "
200 — 300 "
Soils
Low Ca-content
Medium "
High "
0
50
100 km

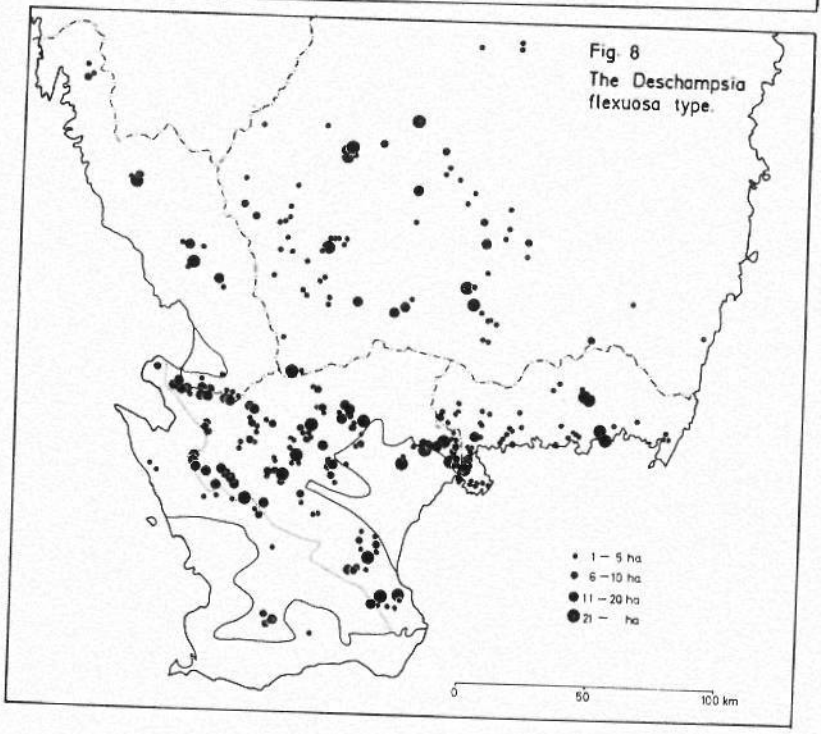
Fig. 8
The Deschampsia flexuosa type.
1 — 5 ha
6 — 10 ha
11 — 20 ha
21 — ha
0
50
100 km

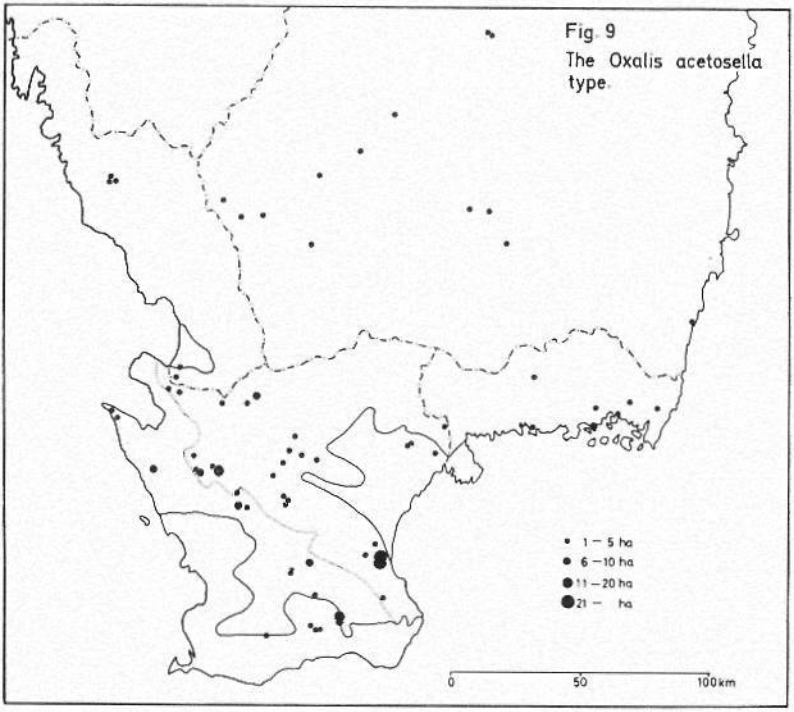

Fig. 9
The Oxalis acetosella type.

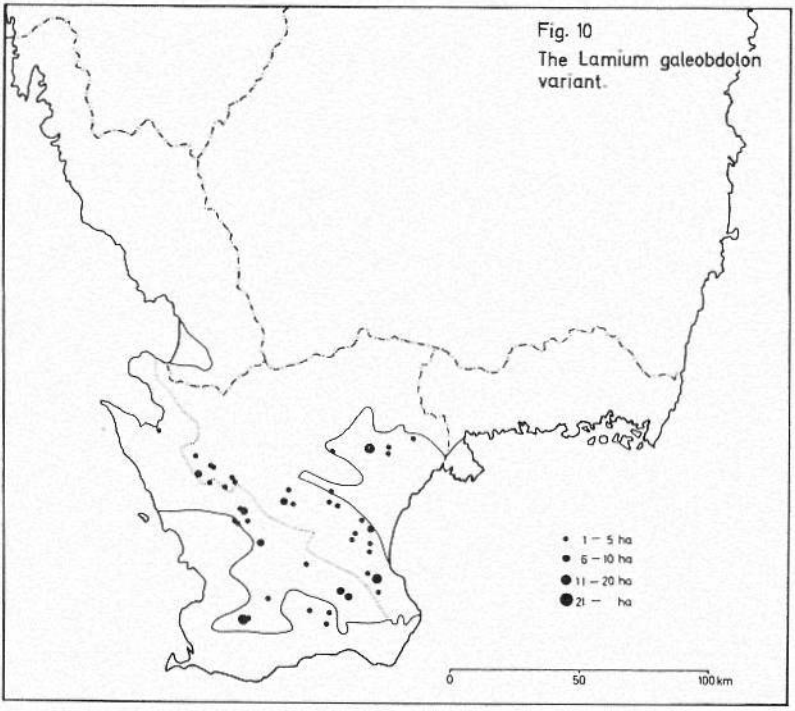

Fig. 10
The Lamium galeobdolon variant.

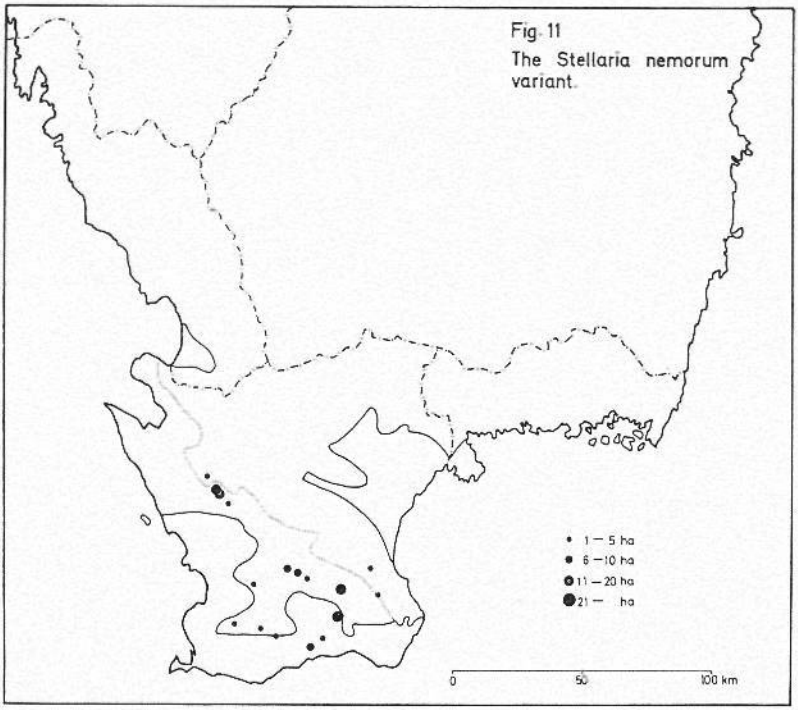

Fig. 11
The Stellaria nemorum variant.

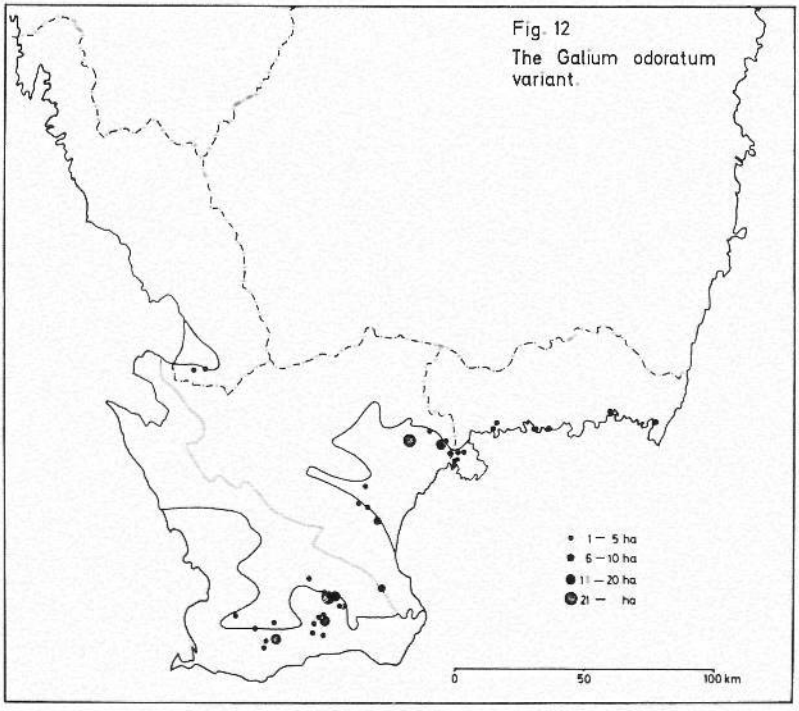

Fig. 12
The Galium odoratum variant.

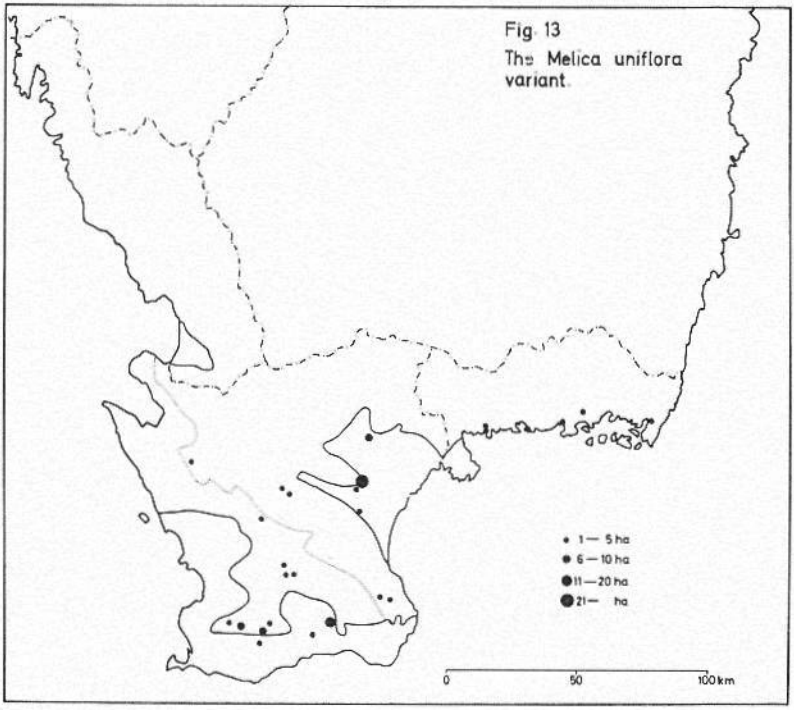

Fig. 13
The Melica uniflora variant.

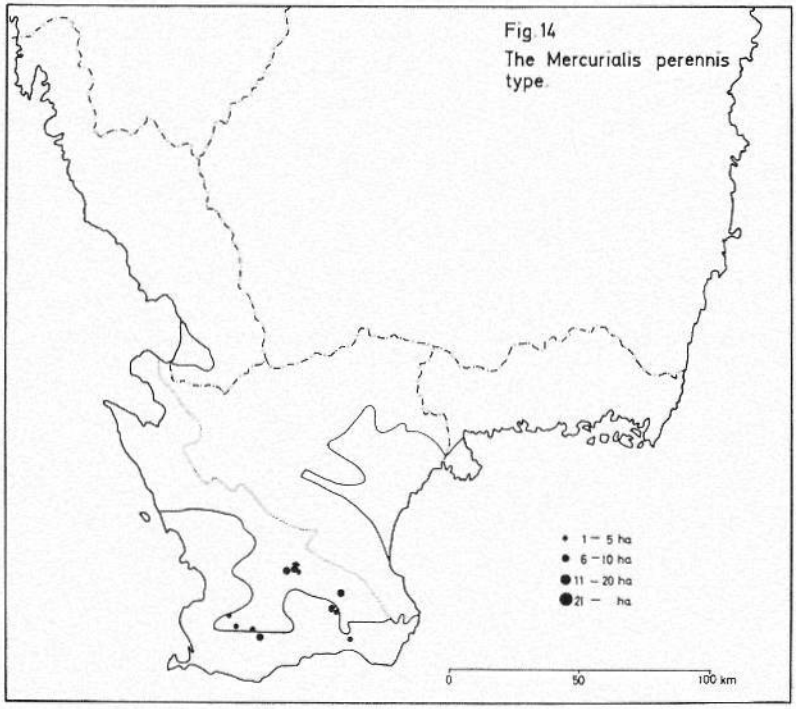

Fig. 14
The Mercurialis perennis type.

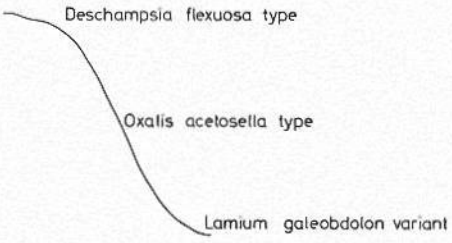

Fig. 15. Zonation on the beech-dominated slopes of the horst Söderåsen. Difference in altitude about 100 meters.

tion is considerably poorer. Only the Deschampsia flexuosa type and the Oxalis acetosella type are found. Beech forest without any field layer are more common than in the southern parts. In the Oxalis type *Cardamine bulbifera* and *Lastrea dryopteris* are more common in the outpost beech forest area. Similar vegetation seems to occur in small beech areas in Norway, where *Oxalis acetosella* and/or *Cardamine bulbifera* can be found locally as dominants (personal communication from Dr. J. KJELLAND-LUND).

VEGETATION AND SOIL

There is a close relationship between the distribution of the vegetation types of the beech forests and soil conditions (Figs. 7—14). Also the altitude (Fig. 7) is of interest as the Scanian horsts, like the South Swedish upland, have a less calcareous substrate than the surrounding lowland areas. A geological survey can be found in Atlas över Sverige (1953 Bl. 7—8).

The Deschampsia flexuosa type (Fig. 8) is restricted to areas with Archaean moraine with low lime-content in the northern part of the region and on the horsts in Scania. The soil type is mostly a podsoloid (LINNERMARK 1960), a podsolized brown forest soil. Well developed podsols with mor are rare.

The Oxalis acetosella type (Fig. 9) has more scattered occurrences, but its main distribution is on the Archaean moraine. This is the only meadow beech forest type which occurs in the northern part of the region. The soil in this and the following types is always a brown forest soil with a mull layer of varying depth.

The Lamium galeobdolon type (Figs. 10—13) is found mainly in areas with a high or medium lime-content of the moraine. The only exception is the distribution of the Lamium galeobdolon variant which sometimes may occur even on Archaean moraine (cf. Fig. 10), mainly

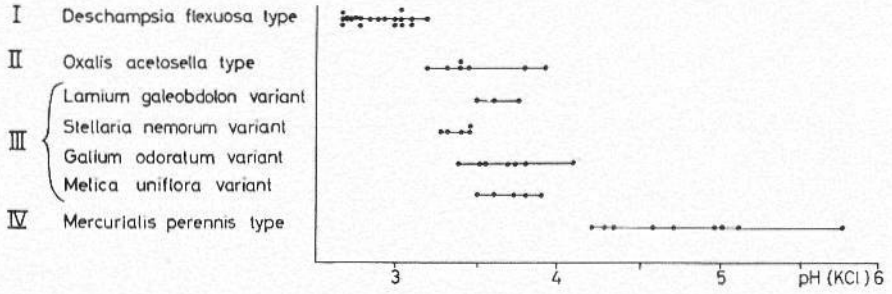

Fig. 16. pH variation in beech forests in Scania. Samples taken according to vegetation investigations 1965 from the level 0—10 cm. A volume ratio soil/suspension 1 : 2 was used and pH was determined electrometrically in extract of 0.2 M KCl.

on slopes, e.g. along the horsts in Scania. The characteristic zonation is illustrated in Figure 15. On such slopes there are often deviating local conditions such a high water table and flushwater, probably resulting in a larger supply of nutrients.

The Stellaria nemorum variant (Fig. 11) is more restricted to the calcareous soils than the Lamium variant. The Stellaria variant, however, seems to occur even on rather acid soils compared with the other meadow beech forests (cf. Fig. 16), but the humus layer is always a mull.

The Galium odoratum variant (Fig. 12) is nearly always developed on calcareous soil. In southern Scania this type seems to prefer a sandy substrate. It is more common in the eastern than in the western parts of the area. This may be due to the fact that sandy soils are more widespread in eastern Scania. In the northeastern part of the distribution area it often occurs on the slopes of the horsts.

The Melica uniflora variant (Fig. 13) is also developed mainly on calcareous soil. In southern Scania it is often well developed on clayey soils. In the province of Blekinge this type is common near the coast where there are plains with high clay content.

The Mercurialis perennis type (Fig. 14) is limited to a substrate with a high or medium lime-content and usually a high water table.

The close relationship between the vegetation type and the soil can also be shown by the pH-range (Fig. 16). The same trend has been demonstrated by LINDQUIST (1931 p. 328). In his more extensive material the pH of the soil in the Deschampsia flexuosa type is distinctly more acid than in the other types. Within the latter group only minor differences can be demonstrated, except in the Mercurialis perennis type where the pH of the soil is considerably higher.

ACKNOWLEDGEMENTS

The investigations have been carried out at the Department of Plant Ecology, University of Lund. The Department is directed by Ass. Professor NILS MALMER and to him, his assistants and many colleagues who have given valuable help, I want to express my thanks. The investigations were financed by grants from the Royal Swedish Academy of Agriculture and Forestry and the National (Swedish) Environment Protection Board, for which I am very grateful.

LITERATURE CITED

ANDERSSON, G. 1903. Några drag ur de svenska skogarnas historia. — Skogsvårdsför. Tidskr. 1: 3—22.

Atlas över Sverige. 1953. Bl. 7—8.

BERGLUND, B. 1966. Late-quarternary vegetation in eastern Blekinge, southeastern Sweden. A pollen-analytical study. II. Postglacial time. — Opera Bot. 12 (2).

DU RIETZ, G. E. 1921. Zur methodologischen Grundlage der modernen Pflanzensoziologie. — Uppsala.

EKSTRÖM, G. 1950. Skånes åkerjordsområden. — Svenska Sockerfabriks Aktiebolagets Skrifter 6. — Malmö.

ELLENBERG, H. 1956. Aufgaben und Methoden der Vegetationskunde. —In H. WALTER (ed.), Einführung in die Phytologie IV. — Stuttgart.

— 1963. Vegetation Mitteleuropas mit den Alpen. — In H. WALTER (ed.), Einführung in die Phytologie IV (2). — Stuttgart.

FRIES, M. 1965. The late-quartenary vegetation of Sweden. — Acta Phytogeogr. Suec. 50: 269—280.

HESSELMAN, H. 1915. Växtgeografi. — In GUINCHARD, Sveriges land och folk, 1: 51—67. — Stockholm.

HJELMQVIST, H. 1940. Die Abhängigkeit der Baumgrenzen von den Temperaturverhältnissen. — Lund.

HYLANDER, N. 1955. Förteckning över Nordens växter. 1. Kärlväxter. — Lund.

LINDGREN, L. 1967. Växtekologisk inventering av bokskogar i Malmöhus län. — Lund (Mimeograph).

— 1968 a. Växtekologisk inventering av bokskogar i Hallands län. — Lund (Mimeograph).

— 1968 b. Växtekologisk inventering av bokskogar i Blekinge län. — Lund (Mimeograph).

— 1969 a. Växtekologisk inventering av bokskogar i Kristianstads län. — Lund (Mimeograph).

— 1969 b. Växtekologisk inventering av bokskogar i Kronobergs län. — Lund (Mimeograph).

— 1969 c. Växtekologisk inventering av bokskogar i Jönköpings län. — Lund (Mimeograph).

LINDQUIST, B. 1931. Den skandinaviska bokskogens biologi. — Sv. Skogsvårdsför. Tidskr. 29.

LINDQUIST, B. 1932. The beech forest of Sweden. — In RÜBEL, Die Buchenwälder Europas. — Veröff. Geobot. Inst. Rübel. 8: 282—293.

— 1959. Forest vegetation belts in southern Scandinavia. — Acta Horti Gotoburg. 22 (5).

LINNERMARK, N. 1960. Podsol och brunjord. En studie av vegetation och jordmånsbildning inom östra Skånes ås- och skogsområden. — Lund.

MAGNUSSON, N. H., LUNDQVIST, G. & GRANLUND, E. 1957. Sveriges geologi. — Stockholm.

MALMER, N. 1962. Studies on mire vegetation in the Archaean area of southwestern Götaland (South Sweden). I. Vegetation and habitat conditions on the Åkhult mire. — Opera Bot. 7 (1).

NILSSON, A. 1901. Växtgeografi. — In SUNDBÄRG, Sveriges land och folk. 1: 48—57. — Stockholm.

— 1902. Svenska växtsamhällen. — Tidskr. Skogshushållning 30: 127—147.

NILSSON, T. 1935. Die pollenanalytische Zonengliederung der spät- und postglazialen Bildungen Schonens. — Geol. För. Stockholm Förhandl. 57.

— 1964. Standardpollendiagramme und C^{14}-Datierungen aus dem Ageröds mosse im mittleren Schonen. — Lunds Univ. Årsskr. N. F. Ser. 2. 44.

OBERDORFER, E. et al. 1967. Systematische Übersicht der westdeutschen Phanerogamen- und Gefässkryptogamen-Gesellschaften. Ein Diskussionsentwurf. — Schriftenreihe Vegetationskunde 2: 7—62.

OLAUSSON, E. 1957. Das Moor Roshultsmyren. — Lunds Univ. Årsskr. N. F. Ser. 2. 53.

PASSARGE, H. 1959. Vegetationskundliche Untersuchungen in den Wäldern der Jungmoränenlandschaft um Dargun/Ostmecklenburg. — Archiv Forstwesen 8 (1): 1—74.

— 1960. Waldgesellschaften NW-Mecklenburgs. — Ibid. 9 (6): 499—541.

— 1965. Beobachtungen über die soziologische Gliederung baltischer Buchenwälder in S-Schweden. — Ibid. 14 (10): 1133—1148.

— & HOFMAN, G. 1964. Soziologische Artengruppen mitteleuropäischer Wälder. — Ibid. 13 (9): 913—937.

POST, L. VON 1933. Den svenska skogen efter istiden. — Studentför. Verdandis Småskr. 357.

SCAMONI, A. 1956. Das Melico-Fagetum im baltischen Buchenmischwald. — Forstarchiv 27: 55—59.

SJÖRS, H. 1967. Nordisk växtgeografi. Ed. 2. — Stockholm.

TÜXEN, R. 1955. Das System der nordwestdeutschen Pflanzengesellschaften. — Mitt. Florist.-Soziol. Arbeitsgemeinschaft N. F. 5.

Studies in the Genus Juncus IV

The Typification of Juncus conglomeratus L.

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ABSTRACT

SNOGERUP, S.: Studies in the Genus Juncus IV. The Typification of Juncus conglomeratus L. — Bot. Notiser 123: 425—429, Lund.

Juncus conglomeratus L. (1753) is formally typified with a sheet of Herb. Royen at Rijksherbarium, Leiden. The traditional use of the name is preserved. The distinction between *J. conglomeratus* L. and *J. effusus* L. is discussed.

THE TYPE MATERIAL

The question of the identity of the name *Juncus conglomeratus* L. (1753) was recently discussed by DANDY (1969). He arrived at the conclusion that the material of the Royen Herbarium should be used for typification of the name, because LINNAEUS' nomen specificum, *Juncus culmo nudo stricto capitulo laterale*, was taken unchanged from ROYEN (1740). I must agree with him at that point, though the wording "obligate lectotype" has no status under the present code. DANDY did not, however, have access to the entire Royen material, because for my work on the genus *Juncus* in some floras I had most of it on loan.

There are two different collections of the Royen herbarium named *Juncus culmo nudo stricto capitulo laterale*. One of them, the one available to DANDY ("sheet 1"), is a young inflorescence of *J. effusus* L. (1753) in the usual sense of that name. It is mounted together with another specimen of *J. effusus* wearing the name *Juncus culmo nudo paniculo laterali* overtaken by LINNAEUS for his *J. effusus*. The second specimen ("sheet 2") is typical *J. conglomeratus* in the usual sense of the name. It is mounted on a sheet of its own, with the ribbons typical for the Royen herbarium. It has a full inscription in the handwriting typical

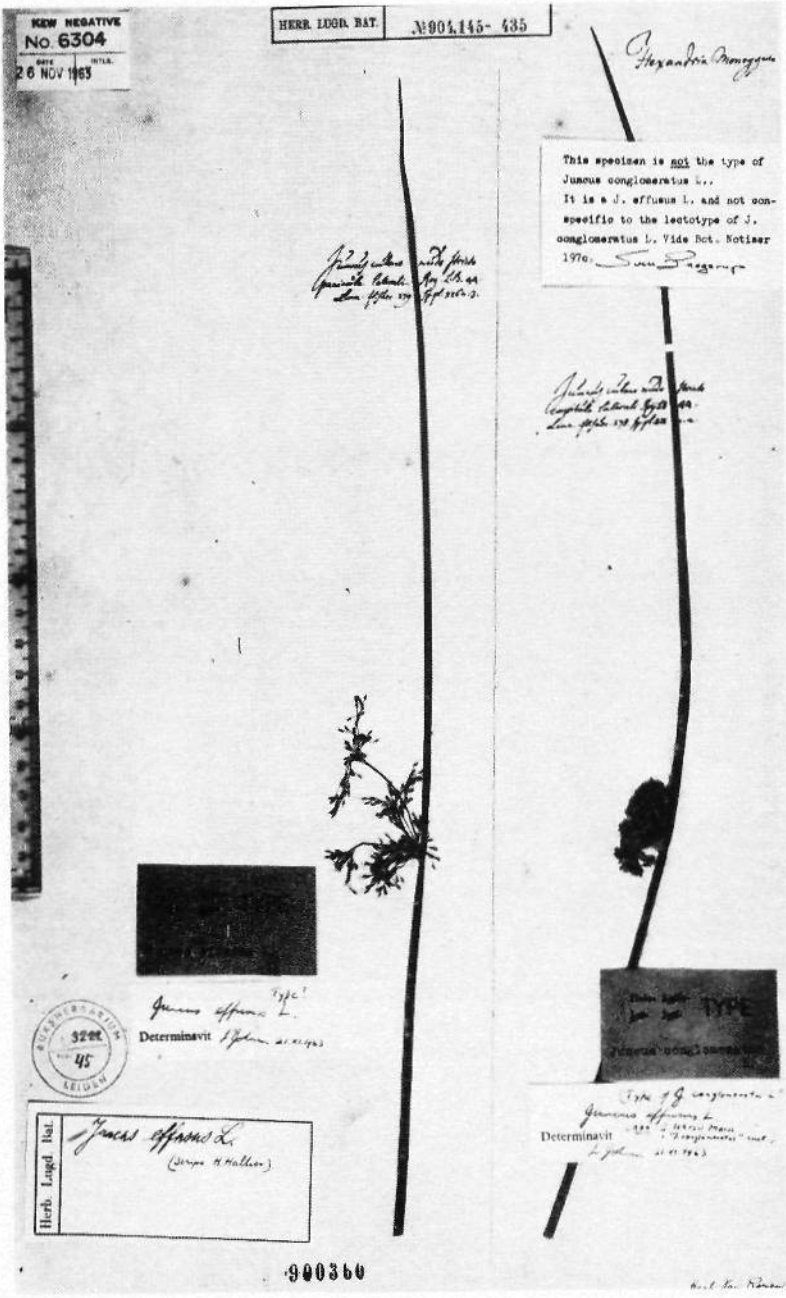

Fig. 1. One of the herbarium specimens discussed, referred to as "sheet 1".

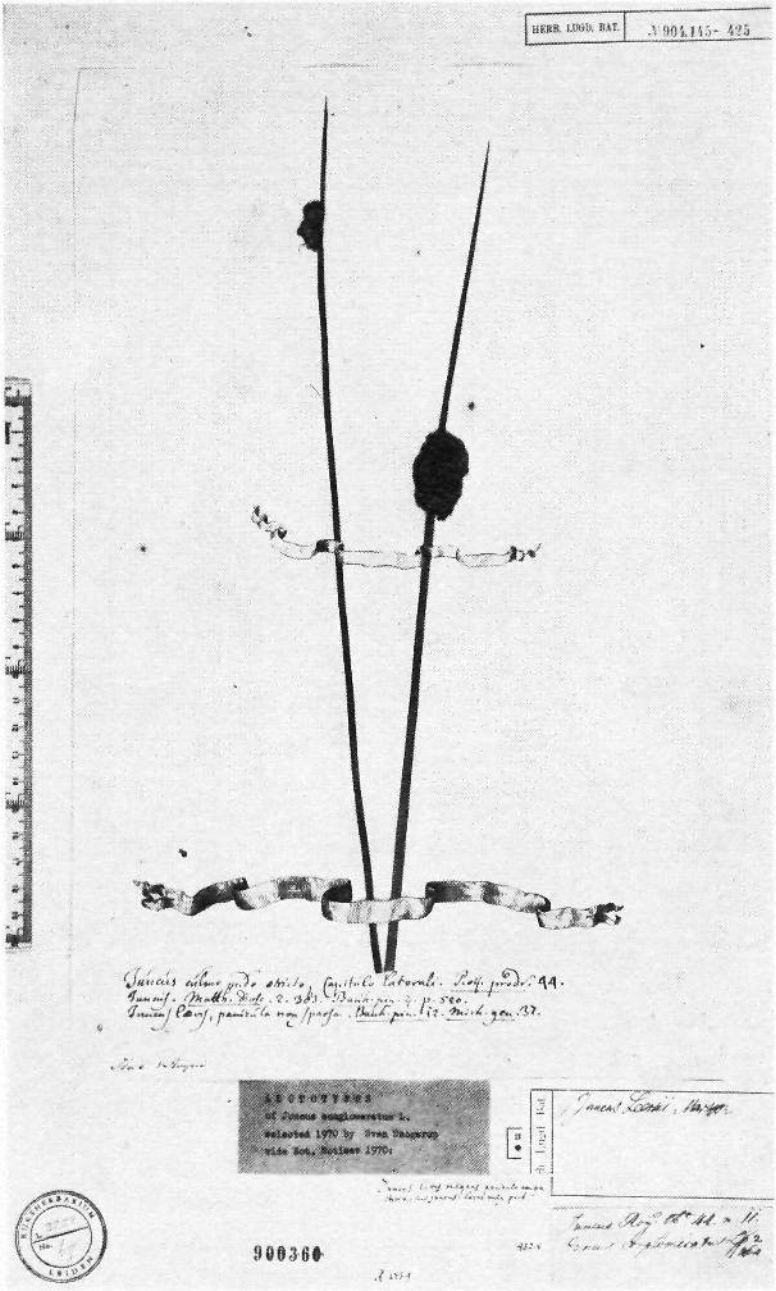

Fig. 2. The other of the herbarium specimens discussed. The selected type of *Juncus conglomeratus* L., referred to as "sheet 2".

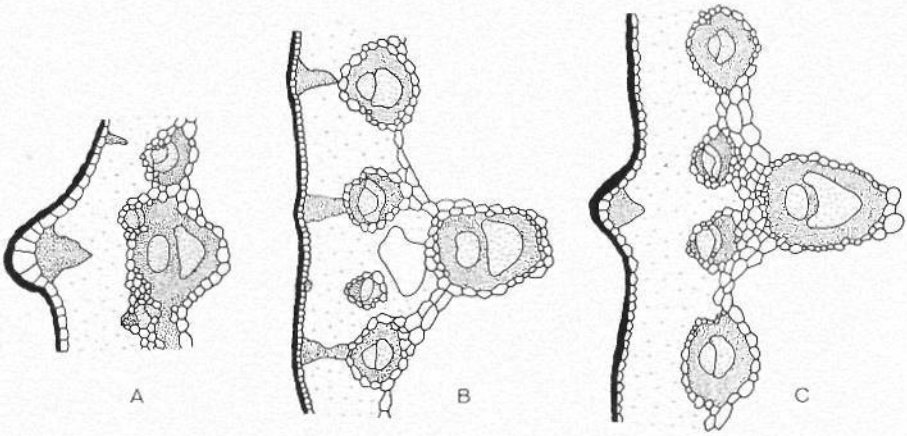

Fig 3. Corresponding parts of stems in transect, illustrating the nature of the longitudinal ridges. The epidermis to the left, the aerenchyma of the stem center not drawn, sclerenchyma densely dotted. — A: *Juncus conglomeratus* L. — B: *J. effusus* L. — C: *J. conglomeratus* × *effusus*. — All material from S. Sweden, kept at LD. — ×100.

for this herbarium, probably ROYEN's own. The text to the specimen of sheet 1 is in the same handwriting, but apparently written much later as it cites Species Plantarum.

As the Royen material of *Juncus culmo nudo stricto capitulo laterali* is thus composed of two discordant elements, I find it necessary to select one of them. Therefore, the one above called sheet 2 is herewith selected as lectotype of the name *Juncus conglomeratus* L. (1753). It has been marked by a label indicating this choise. Sheet 1, as well as its photography at the Kew Herbarium will be provided with notes indicating that it is not the type. To sheet 1 a note indicating that it should be the holotype of *J. conglomeratus* L. was attached by JOHNSSON (of Botanic Gardens, Sydney) 1953. Apparently he did not know, either, about the existence of sheet 2, which was found among the indeterminates of the Leiden herbarium. To avoid future misunderstandings, photographs of the two sheets discussed are presented in Figs. 1 and 2.

The other specimen of sheet 1 might perhaps serve for the typification of *J. effusus* L., but as it is perhaps collected and named at some later date, I will avoid making any choice to that effect at present.

TAXONOMICAL REMARKS

By the above lectotype choice, the name *Juncus conglomeratus* L. may be kept in its traditional sense. Obviously LINNAEUS and his contemporaries did not distinguish between true *J. conglomeratus* and forms of *J. effusus* with condensed inflorescences. The two species are, according to my experience, well separated, and the best distinguishing character is found in the stem anatomy (Fig. 3). In *J. effusus* the large vascular bundles are not connected to the subepidermal sclerenchyma strands, and the stem is only inconspicuously striate. In *J. conglomeratus* the strong subepidermal sclerenchyma strands are situated above the largest vascular bundles. They form prominent ridges, which are further stressed by enlarged epidermis cells with a thickened cuticle.

AGNEW (1968) describes fertile transitional, hybridogenous forms from Britain. KRISA (1962) stated that the two species were united by intermediates to such a degree that only extreme specimens can be determined to species. I have not observed any such fertile intermediates. The only hybrids found in southern Sweden are quite seed sterile, though they form empty capsules.

LITERATURE CITED

AGNEW, A. D. Q. 1968. The interspecific relationships of Juncus effusus and J. conglomeratus in Britain. — Watsonia 6: 377—388.

DANDY, J. E. 1969. Nomenclatural changes in the list of British vascular plants. — Watsonia 7: 157—178.

KRISA, B. 1962. Relations of the ecologico-phenological observations to the taxonomy of the species Juncus effusus L. s. l. — Preslia 34: 114—126.

LINNAEUS, C. 1753. Species Plantarum II. — Holmiae.

ROYEN, A. VAN. 1740. Florae Leydensis Prodromus. — Lugdunum Batavorum.

Studies in African Cyperaceae I

A New Species of Scirpus (Cyperaceae) From Mt. Elgon

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ABSTRACT

LYE, K. A. & HAINES, R. W.: Studies in African Cyperaceae I. Species of Scirpus (Cyperaceae) From Mt. Elgon. — Bot. Notiser 123: 430—432, Lund.

A new species, *Scirpus graminoides* R. HAINES & K. LYE, is described from the Kenyan side of Mt. Elgon at an altitude of 3500 m. This species appears to have no close relatives in East Africa or even in Africa as a whole. The plant is very small and grass-like and is very easily overlooked even when flowering.

In December 1969 a remarkable new grass-like species of the genus *Scirpus* was found on the eastern slope of Mt. Elgon. This species is totally different from all other East African species of the genus.

Scirpus graminoides R. HAINES & K. LYE, sp. nov.

Herbae perennes glabrescentiae minutae. *Culmus* 2—3 cm altus et 1 mm latus. *Folia* culmi 1.5—3.5 cm longa et 0.5—0.6 mm lata, erecta; vaginae longae pallidae. *Inflorescentia* 3—4 spiculae. *Spiculae* 5—7 mm longae et 1.5—2.0 mm latae, lanceolatae, virides, multiflorae. *Squamae* dense imbricatae oblongo-lanceolatae, 2.0—2.5 mm longae, virides; apice rotundae. *Perigonium* nullum. *Stamina* 2. *Stylus* longus, stigmatae 2. *Nux* oblonga vel obovato-oblonga biconvexa.

Typus speciei: HAMILTON n. 1418, 15.XII. 1969. Kenya, Sirikwa K 3, Mt. Elgon, E-slope, grid ref. XS 8226, 3500 m (Holotype MHU; isotypes EA and K).

Scirpus graminoides R. HAINES & K. LYE is a glabrous mat-forming perennial with thickened somewhat bulbous base surrounded by fibrous remains of old leaf-sheaths. *Stems* 2—3 cm long and about 1 mm thick when including the leaf-sheaths. *Leaves* 1.5—3.5 cm long and 0.5—0.6

Fig. 1. *Scirpus graminoides* R. HAINES & K. LYE. Drawn from the holotype (HAMILTON 1118.) Original.

mm wide, flat and linear, spreading as a tuft from the stem-apex, rarely with 1—2 leaves lower down the stem. Leaf-sheaths greyish-white to pale brown, some nearly as long as the stem; ligule absent. *Inflorescence* consisting of 3—4 shortly stalked (rarely on a peduncle to 8 mm long) green spikelets, usually almost hidden among the leaf-bases; each spikelet with a foliage-leaf springing in succession from the prophyll of the preceeding. *Spikelets* 5—7 mm long and 1.5—2.0 mm wide, lanceolate, green; at the base of the peduncle a thin flattened transparent prophyll (larger than the glumes) with 2 brown nerves and several whitish ribs; each spikelet with numerous bisexual flowers. *Glumes* 2.0—2.5 mm long, concave, soft, green with wide transparent margin; midrib only slightly more prominent than the lateral ridges; apex rounded. *Perianth*-segments absent. *Stamens* 2; filaments often persistent on the ripe nut. *Style* with 2 long style-branches. Nut about 1 mm long and 0.7 mm wide, flattened, obovate in outline, as young whitish, as mature dark grey with the surface forming a minute reticulum.

On peat-mat on top of rocks in open rocky place, 3500 m. Associated species: *Bulbostylis glaberrima* KÜKENTH., *Crassula granvikii* MILDBR., the alpine dwarf-form of *Cyanotis barbata* D. DON., *Haplocarpha rueppellii* (SCH. BIP.) BEAUVERD. and *Senecio jacksonii* S. MOORE. Only known from the type-collection from the Kenyan side of Mt. Elgon.

Notes on South African Iridaceae: Lapeirousia and Babiana

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ABSTRACT

NORDENSTAM, B.: Notes on South African Iridaceae: Lapeirousia and Babiana. — Bot. Notiser 123: 433—443, Lund.

The new species *Lapeirousia lewisiana* B. NORD. and *Babiana lewisiana* B. NORD. are described, both from quartzite areas in Vanrhynsdorp Division, Cape Province. A second and somewhat deviating population of *Babiana horizontalis* LEWIS is reported from L. Namaqualand Division.

Some names used by G. J. LEWIS in her revision of *Babiana* in 1959 are shown to be incorrect. *B. pulchra* (SALISB.) LEWIS is substituted by *B. angustifolia* SWEET. *B. nana* (ANDR.) SPRENG. var. *angustifolia* (ECKL.) LEWIS is changed to var. *maculata* (KLATT) B. NORD., comb. nov.

The importance of herbarium KLATT in Stockholm (S) is pointed out. *Babiana multiflora* KLATT is typified and shown to be a member of *Haemodoraceae*, viz. *Wachendorfia paniculata* L. *B. parviflora* BREHM. ex KLATT is typified and regarded as a synonym of *B. lineolata* KLATT.

INTRODUCTION

The untimely death in 1967 of Dr. G. JOYCE LEWIS, Cape Town, put an end to a fine line of research on South African *Iridaceae*. Her *magnum opus* was to be a revision of *Gladiolus* in South Africa. This work was far advanced at the time of her death and is now being completed by other workers. Miss LEWIS's revisions of *Babiana* (1959) and *Ixia* (1962) are well known and given time she would no doubt have made major contributions to our knowledge of several other genera, including *Lapeirousia*. I find it very appropriate to name the new species of *Babiana* and *Lapeirousia* described in this paper in her honour.

Some nomenclatural changes in *Babiana* will be proposed below. Comments on a few KLATT specimens will also be included. It may not be generally known that F. W. KLATT's herbarium is preserved in the

Museum of Natural History, Stockholm (S). This important herbarium contains, *inter alia,* a number of holotypes, mainly of South African *Iridaceae.* However, KLATT founded many of his new species on material in the herbaria of Lübeck and Berlin. Most of these types were destroyed during World War II, but isotypes — from small fragments to complete specimens — are often found in KLATT's own herbarium. In other cases KLATT's notes and drawings are the only remains of the original material, and these may be very helpful in the interpretation of his species. KLATT's herbarium abounds in skilfully executed drawings, many of them beautifully coloured.

Lapeirousia lewisiana B. NORD., sp. nov.

Orig. coll.: NORDENSTAM 965, Cape Province, Vanrhynsdorp Div., Komkans, at the river, quartzite kopje W. of the road, 11.VIII.1962 (S holotype, NBG).

Illustr.: Fig. 1.

Cormus late ovoideus—conicus, tunicis rigidis atrofuscis plicatis et reticulatis basi in dentes subulatos patentes acuminatos productis. Caulis erectus simplex glaber. Folium basale anguste lineare attenuatum striatum subtus parce hirsutum. Folia superiora reducta 1—3 bracteis similia amplexicaulia ovato-acuminata subacuta multinervia glabra. Spica simplex subdisticha subdense pluriflora. Bractea ovata c. 2 cm longa integerrima multinervia anguste membranacco-marginata. Bracteola ovata obtusa 7—8 mm longa membranacea binervis. Perigonium violaceum, tubo anguste cylindrico bractea duplo longiore apicem versus paulo ampliato, segmentis obovato-spathulatis apice rotundatis, dorsali maximo. Stamina exserta, antheris 3.5—4 mm longis. Stylus antheras excedens, ramis profunde bifurcatis. Ovarium oblongum glabrum.

Corm broadly ovoid—conical, 1.2—2 cm in diam. Tunics hard, blackish brown, basally produced into spreading subulate teeth up to 5 mm long, in the lower half plicate, towards the apex reticulate, apically produced into short bristles and a whitish submembranous neck 1—3 cm long. Produced *basal leaf* 1, suberect to spreading and curved, narrowly linear, 10—15 cm long, 1.5—2 mm wide about the middle, flat, striate, sparsely hirsute on the adaxial side. *Stem* 10—20 cm long incl. the inflorescence, erect, gently flexuous, subterete, glabrous, with 1—3 reduced *leaves;* these bract-like, amplexicaul, glabrous, ± ovate-acuminate, 1.5—2.5 cm long, c. 1 cm broad (when expanded), many-veined, subacute. *Spike* spiral, subdistichous, up to 15-flowered. *Bract* ovate, c. 2 (1.5—2.5) cm long, 1—1.5 cm wide (when expanded), entire, somewhat conduplicate and navicular—cucullate at the apex, many-

Fig. 1. *Lapeirousia lewisiana* B. NORD. (NORDENSTAM 965). — A: Habit. ×1. — B: Bracteole, ×2. — C: Flower (bract and bracteole removed), ×1. — D: Stamens, ×5. — E: Style apex, ×5. — Del. auct.

veined, narrowly membrane-edged, obtuse or nearly so. *Bracteoles* united, ovate, obtuse, 7—8 mm long, 4 mm wide, glabrous, membranous and hyaline, with 2 green veins. *Perigon* violet (drying blue). Tube ± erect, straight or slightly curved, narrowly cylindric, gradually widening above, 3.5—4 cm long, 1 mm wide basally, 2—2.5 mm wide near the apex. Dorsal perigon segment obovate-spathulate, rounded at the apex, 11—12 mm long and c. 7 mm wide; other segments spathulate, 10—12 mm long, 4—5.5 mm wide. *Filaments* exserted, reaching c. 5 mm above the perigon throat. *Anthers* narrowly lanceolate, 3.5—4 mm long, 0.8—1 mm wide, narrowly sagittate basally. *Style* overtopping the anthers, reaching c. 9 mm above the throat; style branches c. 2 mm long, deeply bifurcate with curved lobes 1.5—1.8 mm long; stigmas crenulate. *Ovary* oblong, c. 2.5 mm long, glabrous.

Flowering time: August.

Distribution: Only known to me from the type collection (NORDENSTAM 965, see above). Some collections from Calvinia and neighbouring Divisions (MIDDLEMOST 1605 and 1619 in NBG, LEWIS 2345 and 2346 in SAM) come close in general habit, corm shape, etc., but probably represent another undescribed species.

Affinities: *L. lewisiana* belongs to subgenus *Ovieda* BAKER, or subgenus *Lapeirousia* to be correct, and is apparently related to *L. fissifolia* (JACQ.) KER. The corm is differently shaped, however, with longer basal teeth and more sculptured tunics. Furthermore, the basal leaf of *L. lewisiana* is narrower, the stem is not flattened, and the bracts are larger.

Babiana lewisiana B. NORD., sp. nov.

Orig. coll.: NORDENSTAM 787, Cape Province, Vanrhynsdorp Div., 4 miles N. of Holriver bridge, quartzite area, 28.VII.1962 (S holotype, M, NBG).

Illustr.: Fig. 2.

B. salteri LEWIS affinis, sed foliis fere glabris, bracteolis connatis, staminibus longioribus, stylo multo longiore, ovario glabro, et aliter differt.

Cormus ovoideus, basi subtruncatus, tunicis e fibris brunneis sat robustis concretis, in collum compactum badium 6—10 cm longum productis. Caulis supraterraneus erectus 5—13 cm altus, basi glaber, superne parce pilosus, simplex vel ramo unico brevissimo. Folia 6—7 disticha, laminis e petiolis suberectis abrupte patentibus oblique oblongis glabris vel marginibus et

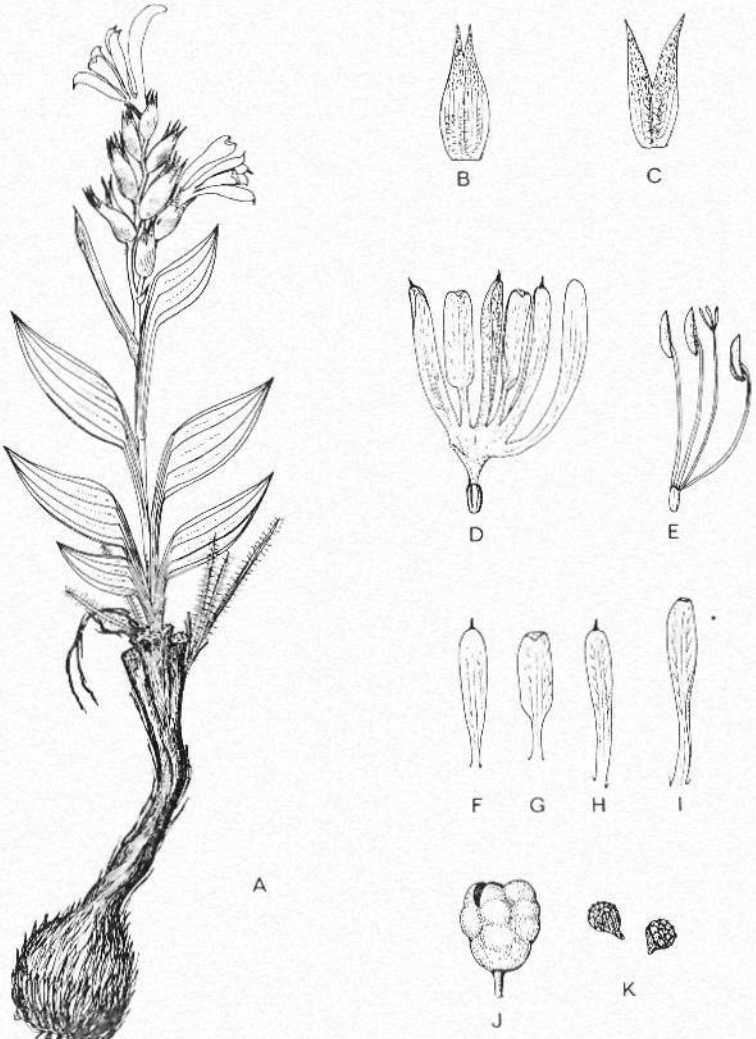


Fig. 2. *Babiana lewisiana* B. Nord. (A—I: Nordenstam 787; J—K: Nordenstam 2931). — A: Habit, ×0.5. — B: Bract, ×1. — C: Bracteole, ×1. — D: Perianth, laid out, with dorsal segment to the right, ×1. — E: Gynoecium and stamens, ×1. — F—I: Perianth lobes (F ventral, G lower lateral, H upper lateral, I dorsal segment), ×1. — J: Capsule (bract and bracteoles removed), ×2. — K: Seeds, ×2. — Del. auct.

interdum nervis puberulis, ad 5 cm longis et 1.5 cm latis, nervis prominentibus stramineis leviter curvatis, apicibus acuminatis ascendentibus. Spica disticha (1—) 3—8-flora. Bractea oblongo-ovata 1.5—2 cm longa herbacea viridis saepe fusco-maculata, parce villosa vel subglabra, apice bifida scariosa ferruginea. Bracteolae ad medium connatae, bracteae aequilongae, lanceolatae acuminatae fusco-maculatae, apice scariosae ferrugineae. Flores zygomorphi magentei, segmentis inferioribus lateralibus flavovirentibus; perianthii tubus leviter curvatus, anguste infundibuliformis, c. 1 cm longus; segmenta plus minusve anguste oblonga, exteriora fusco-mucronata, dorsale distincte separatum arcuatum ceteris longius, duo lateralia inferiora unguiculata. Stamina arcuata, filamentis c. 2 cm longis, antherisque 5—6 mm longis. Ovarium oblongum, 3 mm longum, glabrum; stylus staminibus aequilongus, ramis oblanceolatis conduplicatis 2.5 mm longis. Capsula oblonga—subglobosa, glabra, straminea et fusco-maculata. Semina subtriquetra 2 mm lata atrofusca nitentia.

Corm ovoid with flattish base, 2—3.5 cm in diam.; tunics of brown, fairly coarse matted fibres; neck firm, 6—10 cm long, reddish brown. *Stem* erect, 5—13 cm high (aerial portion), glabrous near the base, sparsely pilose above, simple or with one very short branch. *Leaves* 6—7, distichous, the petioles suberect, the blades arising at almost right angles and spreading horizontally or nearly so, obliquely oblong, (1—)2—5 cm long, (0.5—)1—1.5 cm wide, acuminate with somewhat upwardly curved tips, glabrous or minutely pubescent along the edges (and occasionally along parts of the veins), prominently veined with 4—6 stramineous slightly curved ribs on each side, not or only slightly plicate basally. Young leaves lanceolate to narrowly linear or almost filiform, up to 12 cm long, pilose. *Spike* distichous, (1—)3—8-flowered, the flowers overtopping the leaves. *Bract* oblong-ovate, 1.5—2 cm long, herbaceous, green or somewhat brown-speckled, striate, sparsely villous or subglabrous; apex acuminate, bifid, scarious and ferruginous. *Bracteoles* connate to about the middle, as long as the bract, lanceolate, c. 1.8 cm long, acuminate, greenish and brown-speckled, with hyaline margins and scarious, ferruginous tips. *Flowers* zygomorphic, magenta, with lower lateral lobes greenish yellow. Perianth tube somewhat curved, narrowly infundibuliform, c. 1 cm long; dorsal lobe arcuate and separated from the others, narrowly oblong-oblanceolate, 2.5 cm long, 3—5 mm wide, rounded at the apex. Upper lateral lobes slightly curved, narrowly oblong, c. 2 cm long and 3 mm wide, distinctly mucronate with a brown, c. 1 mm long mucro; lower lateral lobes unguiculate, c. 1.7 cm long, claw linear, 5—6 mm long and 1.5 mm wide, blade narrowly oblong, 1—1.2 cm long and 3—4 mm wide, apically cucullate and acute; lowest lobe subunguiculate, 1.9 cm long, 2.5—3 mm wide,

distinctly mucronate with a brown, c. 1 mm long mucro. *Stamens* arcuate; filaments 2 cm long; anthers 5—6 mm long, c. 1 mm wide, minutely apiculate in both ends. *Ovary* oblong, 3 mm long, 1 mm broad, glabrous; *style* equalling the stamens in length; style branches oblanceolate, conduplicate, 2.5 mm long, with small stigmas. *Capsule* oblong—subglobose, 5—9 mm long, 5—8 mm wide, glabrous, straw-coloured and dotted with brown. *Seeds* subtriquetrous, c. 2 mm broad, shiny dark brown, outer surface convex and reticulate, inner surface flattish and striate.

Flowering time: July—August.

Distribution: Only known from the type locality (see above). Fruiting specimens were collected in Sept. 1963 (NORDENSTAM 2931 in herb. S). The species is probably endemic in quartzite areas of Vanrhynsdorp Division ('The Vanrhynsdorp Centre' in NORDENSTAM 1969).

Affinities: This new species was by Miss LEWIS (oral communication in 1962) regarded as closely related to *B. salteri* LEWIS. The latter species was by its author referred to sect. *Babiana* (LEWIS 1959 p. 74), although she commented upon the similarity in flower shape to members of sect. *Exohebeoides* LEWIS.

B. lewisiana differs from *B. salteri, inter alia,* by the united bracteoles and the glabrous ovary, two characters, pointing to sect. *Exohebeoides* rather than sect. *Babiana*. Other differences from *B. salteri* are the almost glabrous leaves, the larger flowers, the longer stamens, and the much longer style about equalling the stamens in length.

It is possible that a more natural arrangement is achieved, if *B. salteri* is removed from sect. *Babiana* and together with *B. lewisiana* placed in sect. *Exohebeoides* in the vicinity of *B. stenomera* SCHLTR. The latter species in flower shape comes fairly close to *B. lewisiana*, but lacks the horizontally directed leaf-blades, which are so characteristic of *B. salteri* and *B. lewisiana*. A third species with similar leaves, but probably more distantly related is *B. horizontalis* LEWIS of sect. *Babiana* (cf. below).

In conclusion it may be stated that the sections *Babiana* and *Exohebeoides* are not sharply separated, a connecting link being formed by the species group, *B. salteri, lewisiana* and *stenomera*.

Babiana horizontalis LEWIS (LEWIS 1959, p. 90)

This little-known species was described on a single incomplete herbarium specimen. The species is characterized, *inter alia*, by its short

stem and by the completely glabrous, horizontally directed leaf-blades, recalling those of *B. lewisiana* B. NORD. and its allies (cf. above). In 1962 I found a population of a similar plant, which although deviating in certain characters is probably best referred to *B. horizontalis*. The new locality (Cape Province, L. Namaqualand Div., c. 20 miles E. of Port Nolloth, granite kopje c. 3 miles N. of the road, in crevices, 18.VII. 1962, NORDENSTAM 656 in herb. S and NBG) is situated about 30 miles west of the original locality (Anenous Pass).

My plants deviate in having uniformly dirty yellow coloured flowers, up to four-flowered spikes, longer anthers, and in some other respects, which may be summarized as follows.

Corm 1—1.5 cm in diam.; neck up to 10 cm long. Leaves 3—5; the blade horizontal or nearly so, quite glabrous, narrowly oblong, acute and mucronate, 2.5—4.5 cm long, 0.3—1.2 cm wide. Juvenile leaves linear, acuminate, glabrous. Spike 1—4-flowered, secund or subdistichous. Bract 2—3 cm long. Perianth tube 2—2.2 cm long, slightly curved, widening above, puberulous on the inside. Perianth lobes all dirty yellow, ± oblanceolate; dorsal lobe 3.2 cm long, 7 mm wide, shortly aristate; upper lateral lobes c. 3 cm long, 4—5 mm wide, shortly united with the three lower ones; lower lateral lobes c. 2.5 cm long, 4—5 mm wide, acute. Filaments 1.5 cm long. Anthers 8—10 mm long. Ovary oblong, glabrous, 6 mm long.

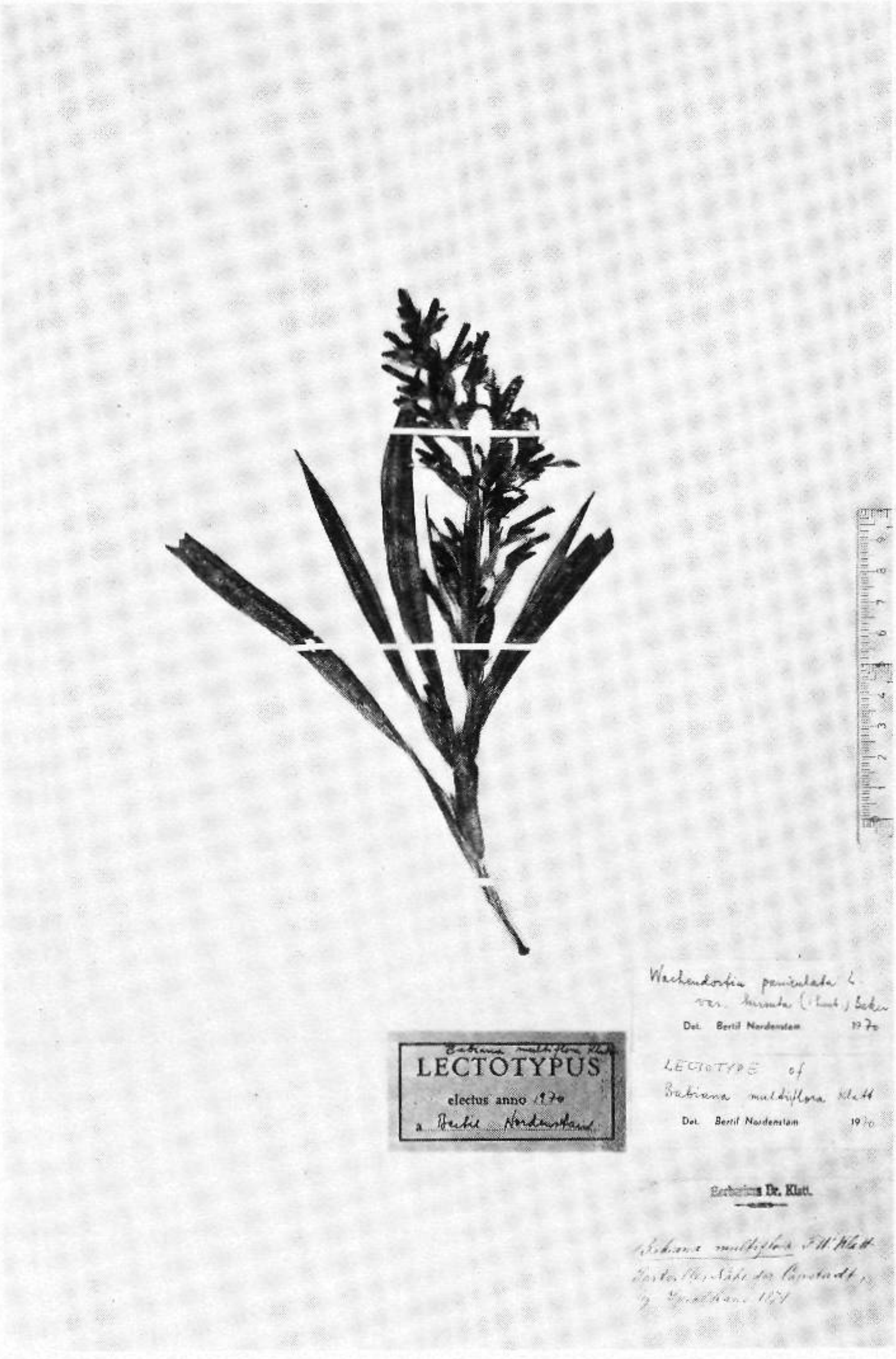
Babiana "sect. Acaste (SALISB.) BENTH. & HOOK." (LEWIS 1959, p. 28)

The genus *Acaste* SALISB. was not validly published, since it appeared without a description (SALISBURY 1812, p. 322). The section *Acaste* of *Babiana* must be ascribed to BENTHAM & HOOKER alone.

Babiana "pulchra (SALISB.) LEWIS" (LEWIS 1959, p. 48)

The basionym, *Acaste pulchra* SALISB., was not validly published, since it was subordinate to a genus not validly published (cf. above and Art. 43 of the Code). The earliest legitimate epithet appears to be *angustifolia*, published as *Babiana angustifolia* SWEET (1827, p. 396). (ECKLON's *B. angustifolia* was published later in 1827 and is a nomen nudum. Cf. below!) SWEET's name was published without a description but with reference to Curtis's Bot. Mag. t. 637. This illustration

Fig. 3. Lectotype in herb. KLATT (S) of *Babiana multiflora* KLATT, a synonym of *Wachendorfia paniculata* L. (*Haemodoraceae*). — Photo Y. SAHLBERG.


LECTOTYPUS
electus anno 1970
Det. Bertil Nordenstam
LECTOTYPE of
Babiana multiflora Klatt
Det. Bertil Nordenstam
Herbarium Dr. Klatt.

was also the base of SALISBURY's "*Acaste pulchra*". Thus the plate remains the type of this species, but the name has to be changed to *B. angustifolia* SWEET.

Babiana nana (ANDR.) SPRENG. "var. **angustifolia** (ECKL.) LEWIS" (LEWIS 1959, p. 80)

The basionym of this combination, viz. *B. angustifolia* ECKL., is a *nomen nudum* and as such not validly published. It is also antedated by *B. angustifolia* SWEET, published earlier in the same year (cf. above under *B.* "*pulchra*").

KLATT realized the invalidity of ECKLON's name and introduced *B. maculata* KLATT, typified by ECKLON & ZEYHER no. 124 in herb. Berlin and Lübeck (lectotype in B, see LEWIS 1959, p. 80). The epithet *maculata* was used in the varietal position already by BAKER (1892, p. 183, and 1896, p. 112) in the combination, *B. plicata* BAKER [non KER] var. *maculata* (KLATT) BAKER. LEWIS ought to have adopted the varietal epithet *maculata* instead of *angustifolia*, which is inadmissible for several reasons, as shown above. The following new combination is necessitated:

Babiana nana (ANDR.) SPRENG. var. **maculata** (KLATT) B. NORD., comb. nov.

Basionym: *Babiana maculata* KLATT; KLATT 1882, p. 349. — *B. plicata* BAKER [non KER] var. *maculata* (KLATT) BAKER; BAKER 1892, p. 183; 1896, p. 112. — Orig. coll.: ECKLON & ZEYHER no. 124 (B lectotype, cf. LEWIS 1959, p. 80; isotype in herb. KLATT, S).

Synonym: *B. nana* (ANDR.) SPRENG. "var. *angustifolia* (ECKL.) LEWIS", LEWIS l.c., nom. illeg.

Babiana multiflora KLATT (KLATT 1882, p. 351)

In establishing this species KLATT made an unusual mistake, which has given rise to some confusion. The original material in herb. Lübeck is evidently destroyed (cf. LEWIS 1959, p. 137), and subsequent authors have not realized its true identity. BAKER (1896, p. 113) included the species in *B. stricta* (AIT.) KER, and LEWIS (l.c.) thought it might possibly be *B. secunda* (THUNB.) KER. It is quite obvious that none of these authorities saw any authentic material. In herb. KLATT in Stockholm

(S) there is a good isotype, and I select this specimen as lectotype of *B. multiflora* KLATT (Fig. 3). The label in KLATT's handwriting runs, "*Babiana multiflora* F. W. KLATT. Porterville, Nähe der Capstadt, leg. SPIELHAUS". Remarkably, the specimen is no *Babiana*, not even a member of *Iridaceae*. In my opinion it belongs to a polymorphic member of *Haemodoraceae*, viz. *Wachendorfia paniculata* L., and it comes closest to var. *hirsuta* (THUNB.) BAKER.

Babiana parviflora BREHM. ex KLATT (KLATT 1882, p. 350)

This species was likewise founded on a now destroyed specimen in herb. Lübeck, viz. DRÈGE no. 1825 ex parte. KLATT placed the species in his subgenus *Acaste*, and BAKER (1896, p. 113) included it in *B. stricta* (AIT.) KER. Having seen no original material, LEWIS (1959, p. 137) placed the species under the heading "Species excluded", because of the insufficient knowledge concerning its identity.

An isotype in herb. KLATT (S) makes a suitable lectotype. The specimen is poor and difficult to interpret, but I believe it can be referred to *B. lineolata* KLATT of sect. *Babiana*. These two species were published simultaneously, and I suggest that *B. parviflora* BREHM. ex KLATT is regarded as a synonym of *B. lineolata* KLATT.

LITERATURE CITED

BAKER, J. G. 1892. Handbook of the Irideae. — London.
— 1896. Irideae. — In THISELTON-DYER, Flora capensis 6: 7—171. London.
ECKLON, C. F. 1827. Topographisches Verzeichniss der Pflanzensammlung von C. F. Ecklon. — Esslingen.
KLATT, F. W. 1882. Ergänzungen und Berichtigungen zu Baker's Systema Iridacearum. — Abh. Naturf. Ges. Halle 15: 335—404.
LEWIS, G. J. 1959. The genus Babiana. — Journ. S. Afr. Bot. Suppl. Vol. 3.
— 1962. South African Iridaceae. The genus Ixia. — Journ. S. Afr. Bot. 28: 45—195.
NORDENSTAM, B. 1969. Phytogeography of the genus Euryops. A contribution to the phytogeography of Southern Africa. — Opera Bot. 23.
SALISBURY, R. A. 1812. On the cultivation of rare plants. — Trans. Hort. Soc. 1: 261—366.
SWEET, R. 1827. Sweet's Hortus britannicus. Ed. 1. — London.

Botanical Literature

Botanisk litteratur

COLE, A. J. (ed.). Numerical Taxonomy. — Academic Press, London and New York 1969. XV+324 pp. Price 65 shillings.

Numerical aids have been used for taxonomical purposes during a very long time but have greatly increased in importance for the last decade, and the application has shifted to some extent. Not only are numerical methods employed when treating vast amounts of information otherwise difficult to handle, they are also often used to give various kinds of indices, based upon many characters taken together and presumed to illustrate affinities between taxonomic entities. The latter use, which has been named "numerical taxonomy", is often claimed to be objective. It is looked upon with great scepticism by many taxonomists.

Very valuable contributions to the current lively debate on "numerical taxonomy" are given in this book, containing the proceedings of a colloquium held in 1968 at St. Andrews, Scotland.

The first paper, "Mapping Diversity: A Comparative Study of Some Numerical Methods", by A. J. BOYCE, deals with a central problem. It attacks the question of whether numerically obtained results are truly objective or not. The effects of a number of methods are clarified. The material chosen, hominid skulls, seems very illustrative and presents no difficulties to a non-zoologist, since the method rather than the material is stressed. Due to characteristic differences in their reaction upon the given material any of the tested methods gave a different grouping, although some basic pattern was common. None of the methods can be claimed to be mathematically better than any other; the choice depends upon whether a formula more sensitive to the size component, the shape component, etc., is wanted. Thus the final result is highly dependent upon subjective evaluations. The choice of characters for the measurements may still more diminish the objectivity. Such groupings give, however, much valuable information, provided one is aware of the type of similarity stressed by the method used when evaluating dendrograms and other diagrams.

Among the other papers some should be briefly mentioned in this context. In "Group Forming and Discrimination with Homogeneity Functions", A. V. HALL analyzes some possible methods. He prefers the expression "numerical aids to taxonomy" (and I fully agree). He joins the ones rejecting the widely

used "taxonomic distance" (p. 59) because of its over-emphasis of larger differences. Papers such as "The Phenetic Relationships between Species of Ononis", by R. B. IVIMEY-COOK, and "A Taximetric Approach to the Classification of the Spiny-fruited Members (tribe Caucalideae) of the Flowering-Plant Family Umbelliferae", by J. MCNEILL, P. F. PARKER and V. H. HEYWOOD, do offer much of interest on principle to the phytotaxonomist. The papers by D. M. JACKSON, I. C. LERMAN, L. ORLOCI, and M. ROUX, being more centred around mathematics, contain information which is very valuable but not especially easily accessible to a biologist.

The book also includes an account of suitable computer programmes. It is to be highly recommended as a stimulating source for discussion on this topic.

GUNNAR WEIMARCK