Botaniska Notiser 1962 · Vol. 115 · Fasc. 3 · Lund

Taxonomic and Nomenclatural Notes on the Florideae, III

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The present notes are concerned with problems of nomenclature and taxonomy which have been discovered during the preliminary work for the preparation of the volume on *Rhodophyta* for the proposed '*Flora of British Marine Algae*'. Two papers in this series have been published previously in this journal (Dixon, 1959 a, 1960).

Helminthocladia agardhiana nom. nov.

It has been accepted generally that the alga known currently as *Helminthocladia hudsoni*[1] was described originally by C. Agardh (1824, p. 50) under the name *Mesogloia hudsoni*. The original description is extremely brief: —

> "*M.* [esogloia] *hudsoni, fronde virgata ramis omnibus divaricatis.*
> *Ulva rubra, Huds. — E.B. t. 1627.*
> *In mari Britannico.*"

A search of the Agardh herbarium at Lund showed that at the present time there were no British specimens preserved therein which could have served as the basis for this description. In addition, from a consideration of the abbreviated method of citation used by C. Agardh in this publication it is obvious that the description quoted above can be interpreted only in one way, viz., that it is based, not upon a specimen or a previous description but upon the illustration of '*Ulva rubra* Hud-

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[1] By Article 73 of the *International Code of Botanical Nomenclature* (Lanjouw, 1956), the epithet '*hudsoni*' should be regarded as orthographic error and corrected to '*hudsonii*'. This has not been done in the present paper to avoid confusion.

son' given by Smith (1806) in '*English Botany*'. According to Smith (1806, pl. 1627), this figure was taken from "a fine specimen in the possession of Mr. Edward Forster, which was bought at the sale of the late Mr. Hudson". The circumstances relating to the acquisition by Forster of certain Hudson specimens have been discussed in detail previously (Dixon, 1959 b). From the studies of specimens originating from Hudson, which have been carried out during the past five years, it was known that the relevant specimen was now preserved in the Herbarium of the British Museum (Natural History). This specimen (Fig. 1), filed in the Herbarium under *Halarachnion ligulatum,* is annotated as having been obtained from the Forster collection and it is associated with two labels, "Hudson Sale", and "*Ulva rubra Halymenia ligulata.*". Examination showed that the specimen had been placed in its correct taxonomic position in the Herbarium. A comparison of the specimen and the figure published in '*English Botany*', referred to above, indicated that, although the illustration is not a perfect representation of the specimen, it is obviously based upon it. This specimen is therefore the type of *Mesogloia hudsoni* C. Agardh. The binomial *Mesogloia hudsoni* must be regarded therefore as a synonym of the alga described originally as *Ulva ligulata* Woodward (1797) and known currently as *Halarachnion ligulatum* (Woodw.) Kütz.

The description of *Mesogloia hudsoni* given by C. Agardh is so bad that it is not surprising that there was some confusion as to the application of the binomial. However, if subsequent phycologists had realised fully the implications of the citation of the illustration from '*English Botany*', and dismissed *M. hudsoni* C. Ag. as a synonym of *Ulva ligulata* Woodw., as did Greville (1830), the chaos which ensued could have been avoided. Harvey (1833) for instance, although referring *Ulva rubra* Huds. to *Halymenia ligulata* [=*Halarachnion ligulatum*], retained *Mesogloia hudsoni* as a separate entity, but applied the binomial to the alga known today as *Helminthora divaricata,* an error continued by many British phycologists. The crucial error was, in fact, made by the Agardhs. Firstly, C. Agardh attributed to *M. hudsoni* certain North African specimens of a species of *Helminthocladia* received from P. K. A. Schousboe, whilst J. G. Agardh (1841, 1851 b) continued to apply the epithet *hudsoni* to the Schousboe specimens misidentified by his father, even after accepting the general opinion that the '*English Botany*' illustration referred to the alga now known as *Halarachnion ligulatum.* That this error had occurred is obvious from his comments "vera *Mesogloia hudsoni* Ag. est planta bene distincta, quoad habitum

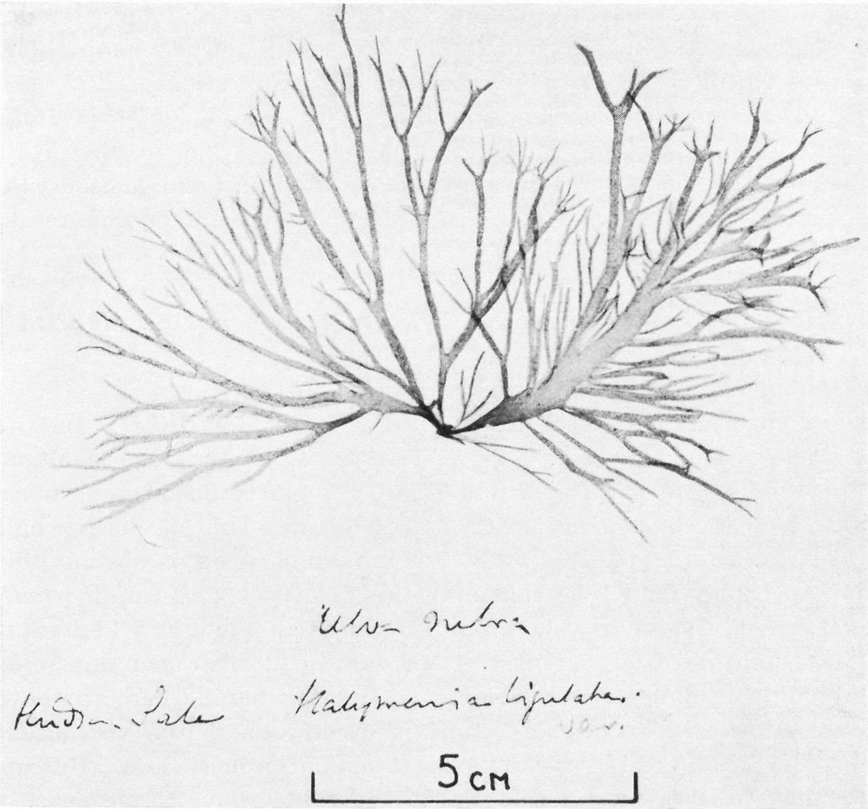

Fig. 1. The specimen of *Halarachnion ligulatum,* now preserved in the British Museum (Natural History), used as the basis for the plate of *Ulva rubra* in Smith's '*English Botany*'. From the citation given by C. Agardh, this specimen in the type of *Mesogloia hudsoni* C. Ag. Slightly reduced.

non male in fig. 1627 Engl. Botany quadrans, cujus e mari hispanico plura specimina habeo. Synonyma vero allata Hudsoni et Engl. Botany, observante Cel. Arnott, non ad hanc plantam sed ad formam *Halymeniae ligulatae* referenda dicuntur" (J. G. Agardh, 1841). Finally, J. G. Agardh (1851 b, p. 412) created a new genus *Helminthocladia* [non *Helminthocladia* Harvey (1838)], to which he referred *Mesogloia hudsoni* C. Ag., at the same time, by his citation "*Mesogloia hudsoni* Ag. l.c. (Excl. syn.)", excluding the type of that taxon which he cited in the same publication (J. G. Agardh, 1851 a, p. 202) as a synonym of *Halymenia ligulata* [=*Halarachnion ligulatum*]. That J. G. Agardh had changed the circumscription of the taxon, and in so doing, excluded the type was clearly understood by Hamel (1930) and Feldmann (1939) but without their realizing the nomenclatural implications.

As the epithet *hudsoni* must be interpreted as a synonym of *Halarachnion ligulatum,* and as there appears to be no other epithet available for the alga known currently as '*Helminthocladia hudsoni*' the taxon is without a name. It is proposed that the name *agardhiana* be applied to this taxon.

Helminthocladia agardhiana nom. nov.

=*Helminthocladia hudsoni* J. G. Agardh, *Sp. Gen. Ord. Alg.,* 2: 413 (1851), pro parte, excl. syn.

Mesogloia hudsoni C. Agardh, *Syst. Alg.*: 50 (1824).

The Agardh herbarium, at the Botaniska Museet, Lund (LD), contains a single specimen [Herb. Alg. Agardh. 31937] with the annotations "*Chaetophora divaricata* sp. nov." and "Tingi" in Schousboe's hand, and "*Mesogl. hudsoni* Ag" in C. Agardh's hand. This specimen would appear to be that referred to by J. G. Agardh and it is obvious that this specimen should be taken as the holotype of *Helminthocladia agardhiana.*[1] There are no other specimens in the Lund herbarium which may have formed part of the same collection, nor any other annotated as '*Mesogloia hudsoni*' in C. Agardh's hand. There are, however, numerous Schousboe specimens in other herbaria, viz. British Museum (Natural History), Royal Botanic Gardens, Kew, Museum Nationale d'Histoire Naturelle, Paris, which may have formed part of the same collection as the holotype, but the frequent changes of identification and name made by Schousboe and the absence of dates of collection on the specimens make attribution impossible.

The exclusion by J. G. Agardh from his treatment of '*Helminthocladia hudsoni*' of the figure of '*Ulva rubra* Huds.' given in '*English Botany*' and his citation of the latter under *Halymenia* [*Halarachnion*] *ligulata* has been followed by many later authors (Crouan & Crouan, 1867; De Toni, 1905). Harvey (1847, Pl. cxii) cites both the illustration given in '*English Botany*' and the original description of *Ulva rubra* Hudson, whilst Feldmann (1939) quotes only the latter. This citation is of critical importance nomenclaturally, in that *Ulva rubra* Hudson (1778) antedates *Ulva ligulata* (Woodward, 1797). There is, however, no proof that the alga figured in '*English Botany*' under the name '*Ulva*

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[1] From the comments made by Kuckuck (1912, p. 190), it would appear that he had erred in regarding the Schousboe specimen preserved in the Museum National d'Histoire Naturelle, Paris as the 'original' specimen of *H. hudsoni* J. Ag.

rubra Hudson' bears any relation to the alga described originally by Hudson, even though this illustration is based reputedly upon a specimen which had once belonged to him. The survival of any of the original specimens used as the basis for the descriptions of either the first or second editions of '*Flora anglica*' (Hudson, 1762; 1778) has been shown to be highly improbable (Dixon, 1959 b); it would appear that such Hudson specimens as exist at the present day were collected *after* 1783. The original description of *Ulva rubra* given by Hudson (1778, p. 571) is extremely scanty, "*Ulva* gelatinosa filiformis dichotoma rubra" and, even if the additional comment "Frons sesquiuncialis, gelatinosa, filiformis, dichotoma, obtusa, rubra; ramis longis" is taken into account, it bears little relation to the alga known at the present day as *Halarachnion ligulatum*. C. Agardh (1817) on the other hand in an earlier publication, clearly regarded *Ulva rubra* Huds. as being synonymous with the alga known currently as *Nemalion multifidum* (Web. et Mohr) J. Ag. As typification of *Ulva rubra* Huds. would appear to be impossible at the present time the application of the epithet must remain in doubt, and there is no justification for any changes in the names of the algae currently known as *Nemalion multifidum* and *Halarachnion ligulatum*.

The dates of publication of S. G. Gmelin's '*Historia Fucorum*' and N. L. Burman's '*Flora Indica*'

The date of publication of the '*Historia Fucorum*' of S. G. Gmelin (1768), an extremely well-known algal text, much-quoted by later authors, has been accepted generally as 1768, which is the date on the title-page. The '*Flora Indica*' of N. L. Burman (1768), published in the same year as '*Historia Fucorum*', includes as an appendix the '*Prodromus Florae Capensis*', which contains descriptions of a considerable number of algae. These appear to have been overlooked by most later authors. The occurrence of independent descriptions of the same taxon by both Burman and Gmelin means that the determination of the dates of publication of these two works is an urgent necessity if problems of priority are to be resolved.

Because of the general lack of bibliographic data regarding the mid-eighteenth century, the difficulties involved in tracing publishers' records in Leiden and what is now Leningrad, and the time which has elapsed since the appearance of the two works, it has not been possible to determine the precise dates of publication, although sufficient in-formation has been obtained to indicate that of the two publications, Burman's '*Flora Indica*' is the earlier.

The long dedicatory preface of '*Historia Fucorum*' concludes with the statement "Scrips. d. XXIV. April. MDCCLXVIII.", whilst the following section '*Ad lectorem auctoris adloquium*' concludes with "Dabam Petropoli die primo Maii, MDCCLXVIII.". In this instance, the discrepancy existing between the calendars in use in western Europe and Russia must be taken into account. The change-over from the Julian to the Gregorian Calendar had taken place prior to 1768 in most of the countries of western Europe, whereas in Russia the Julian Calendar was retained until 1917. In 1768, the difference between the two calendars was approximately 11 days, so that the dates of the two parts of the preface are the 5th of May and the 12th of May respectively, on the Gregorian Calendar in use in western Europe. No evidence has been obtained to suggest that '*Historia Fucorum*' was published other than as a single item so that one must assume that the earliest possible date of publication of '*Historia Fucorum*' is the 12th of May, 1768.

Apart from the year of publication cited on the title-page, Burman does not date any part of the '*Flora Indica*' or of the '*Prodromus Florae Capensis*'. However, in the correspondence of Linnaeus (van Hall, 1830, pp. 89—91), there is a letter from Burman indicating that he despatched two complete copies of his publication to Linnaeus on the 6th of April, 1768. The reply from Linnaeus, acknowledging the receipt of the two copies, is dated May 7th, 1768. It must be assumed from this that Burman's '*Flora Indica*' was published prior to the 6th April, so that it antedates Gmelin's '*Historia Fucorum*' by at least a month. The citation of references to the illustrations in Burman by Linnaeus (1767) cannot be taken to indicate that the '*Prodromus*' was published at a much earlier date. It is obvious from the letter quoted above that the illustrations were completed in 1767 and copies forwarded to Linnaeus for comment.

One example where the relative date of publication of these two works is of critical importance is in relation to the alga which has been known widely as *Eucheuma spinosum* (L.) J. G. Agardh. The specific epithet *spinosum* is derived from *Fucus spinosus* Linnaeus (1771, p. 313), [*non F. spinosus* Gmelin, 1768, p. 161]. Collins and Hervey (1917, p. 108) first commented that Linneaus, in his original description of *F. spinosus,* cited *Fucus denticulatus* Burm. f. as a synonym. On the basis of this citation, Collins and Hervey claimed that *denticulatum* was the correct specific epithet for this taxon and made the necessary nomenclatural transfer. Weber van Bosse (1928, p. 413) objected to this nomenclatural change, pointing out that in the same year Gmelin had described the taxon under the name *Fucus muricatus,* giving not only an illustration, but also a description superior to that of Burman. It would appear that Weber van Bosse had noted the date given at the end of the dedicatory preface (but not that of the following section), in that she states that '*Historia Fucorum*' "a publie au mois d'Avril", in this way hinting that this was the earlier publication. For these reasons, Weber van Bosse indicated that the specific epithet *muricatum,* based on *F. muricatus* Gmelin, [*non F. muricatus* Turner] should be used in preference to *denticulatum,* based on *F. denticulatus* Burman, although it is obvious that she accepted the change from *Eucheuma spinosum* (L.) J. Ag. with extreme reluctance, "je crois que le nom spécifique de *muricatum* Gm. mérite d'être employé de préférence à celui de *denticulatum* Burm. si tant est vrai qu'on doit changer le nom donné par Linné.". This suggestion has been accepted generally, and the taxon referred to as *Eucheuma muricatum* (Gmel.) W. van Bosse in most recent publications (Yamada, 1936; Kylin, 1932, 1956; Nakamura, 1958 a, 1958 b, 1958 c). It is difficult to understand Weber van Bosse's reluctance to accept the change from *E. spinosum* (L.) J. Ag. Not only is *F. spinosus* L. antedated by both *F. muricatus* Gmel. and *F. denticulatus* Burm. f., but in addition, *F. spinosus* L. is an illegitimate name, in that it is a later homonym of *F. spinosus* Gmelin (1768, p. 161), a fact which appears to have been overlooked by Weber van Bosse. It has been shown above that Burman's '*Flora Indica*' antedates Gmelin's '*Historia Fucorum*' by at least a month, so that the earliest specific name applicable to the taxon under discussion is *denticulatum,* based on *F. denticulatus* Burm. f. The correct name and authority for the taxon is therefore *Eucheuma denticulatum* (Burm. f.) Collins & Hervey.

As has been stated previously, the algae described by Burman have been largely ignored by later authors, and for this reason there is further nomenclatural confusion involving *F. denticulatus* Burm. f. Forsskål (1775, p. 191), apparently in ignorance of the earlier *F. denticulatus* Burm. f., later described, independently, under that name an alga now attributed to the Phaeophyta. It is obvious that Agardh (1820, p. 8) in transferring this species to the genus *Sargassum* was aware of the nomenclatural confusion between *F. denticulatus* Burm. f. and *F. denticulatus* Forssk. in that he rejected the later *F. denticulatus* Forssk. and adopted for the taxon the first validly published specific epithet, *dentifolium,* based upon *F. dentifolius* Turner (1809, p. 64).

Børgesen (1932, p. 9) failed to appreciate that *F. denticulatus* Forssk., being a later homonym, was an illegitimate name, and erred by adopting the latter for the taxon under discussion, stating "in spite of the fact that C. Agardh in Spec. Alg., p. 8 quotes *Fucus denticulatus* Forssk. as well as *Fucus dentifolius* Turn. he adopts the younger name of Turner for the plant". Børgesen's action is particularly surprising in that Christensen (1922), in a previous analysis of the Forsskål herbarium, had indicated the existence of the earlier homonym, *F. denticulatus* Burm. f.

On the nomenclature of *Ceramium robustum* J. G. Agardh

Ceramium ciliatum sensu lato is a particularly polymorphic species of a notoriously difficult genus. In this species the number of cells comprising each spine is one morphological feature which is particularly variable. Most specimens of *C. ciliatum* from the Atlantic Ocean have spines containing three cells, although spines containing two or four cells occur also, even in the British Isles, and a number of specimens from the Atlantic coast of Spain and Morocco have been noted with a few spines composed of five cells. It has been assumed by a number of authors that all specimens of the *C. ciliatum* assemblage from within the Mediterranean Sea have spines composed of five (or more) cells, whilst all specimens from outside the Mediterranean have spines composed of only three cells; this assumption is completely false. During recent studies at Banyuls numerous specimens of *C. ciliatum* were collected, but in not one of these did the spines contain more than three cells. From the evidence which has been assembled it would appear that the range of form within the Mediterranean is similar to that which occurs in the Atlantic Ocean. It must be admitted that the proportion of specimens with spines containing more than three cells is higher in the Mediterranean than in the Atlantic Ocean, but this type of spine structure certainly does not occur exclusively in the Mediterranean specimens, neither is it completely absent from European shores of the Atlantic Ocean. A fuller discussion of the taxonomic implications of these observations will be published elsewhere.

Nomenclaturally, the position is extremely confused, because of the very large number of entities within the *C. ciliatum* assemblage described during the last century. For example, Kützing (1841, 1847, 1849, 1862) alone described some 20 'species'. These entities were largely reduced to synonyms within a few years, but, at a later date, J. G.

Agardh (1894, p. 35) stated that in his opinion the Mediterranean specimens were sufficiently different from those found in the Atlantic Ocean to warrant separation as a distinct species, to which Agardh gave the name *Ceramium robustum*. From the comments made by Agardh, it would appear that the taxon was based on the figure of "*Echinoceras ciliatum*" published previously by Kützing (1862, Pl. 86). This illustration was drawn from a specimen now preserved in the Rijksherbarium, Leyden [Herb. Lund. Bat. 940.265.114] — so that this specimen is therefore the type of *Ceramium robustum* J. G. Agardh. Subsequently, Mazoyer (1938) reduced *C. robustum* J. Ag. to the status of a variety of *C. ciliatum,* in a later study (Feldmann-Mazoyer, 1940) giving a long account of the structure, reproduction and ecology of the entity. The opinion first suggested by Mme. Feldmann, that the Mediterranean specimens of *C. ciliatum* should be regarded as "var. *robustum*" has been widely accepted, but it should be realised that the epithet *robustum* is illegitimate, both at specific and varietal level. At specific level, *robustum* is antedated by the epithets of a number of 'species' proposed by Kützing, viz. *Echinoceras hystrix, E. pellucidum, E. puberulum* (Kützing, 1841), *E. secundatum* (Kützing, 1847), *E. patens, E. distans, E. tenellum* (Kützing, 1862) and possibly also by those of a number proposed by Meneghini (1844) which it has not yet been possible to typify. At varietal level, *robustum* is antedated by the epithets *proliferum* derived from *Ceramium ciliatum* β *prolifera* C. Agardh (1828), and *tenellum,* derived from *E. hystrix* γ *tenellum* Kützing (1849), and, possibly, also by the epithet *horridum,* derived from *E. hystrix* β *horridum* (Menegh.) Kützing (1849), although in the absence of typification the latter citation is not certain.

Thus, if the Mediterranean material is to be regarded as an entity distinct from *Ceramium ciliatum* and, as has been shown, the evidence in favour of such a separation is by no means as conclusive as has been claimed, the epithet *robustum* cannot be applied to it at either specific or varietal level.

In conclusion, it should be indicated that Peterson (1929), apparently in ignorance of the previous use of the binomial *Ceramium robustum* by J. G. Agardh, described independently an entity of the *Ceramium rubrum* complex under this name.

Problems of typification, priority and citation, resulting from the mis-quotation of *nomina nuda*

Accuracy in the citation of the authority for a binomial is frequently regarded as being of little importance and as a result of this attitude many widely-accepted citations are, in fact, incorrect. One of the worst sources of error has resulted from the habit, by the early phycologists, of applying manuscript names to specimens, which then circulated widely. Frequently, these *nomina nuda* have been accepted, incorrectly, as being names validly published by the originator, whereas, in many instances, the epithets *have* been validly published, but at a much later date and by another person. This situation, frequently associated with heterogeneity of the material to which the *nomen nudum* was applied, means that typification and priority of the epithet need to be examined critically if taxonomic and nomenclatural errors are to be avoided.

The following examples of this type of problem have been studied recently and it is intended to give others in later papers of this series.

Ceramium pennatum

The authority for this binomial is quoted widely as "Crouan", but the first valid description of the taxon was actually given by J. G. Agardh (1851 a, p. 136), who states that it was based on a specimen received from the brothers Crouan. The specimen in question, now preserved in the Agardh herbarium [Herb. Alg. Agardh 20605], is annotated "*Ceramium rubrum* var. *pennatum* Crouan in herb.", "rade de Brest", "herb. Crouan" by one of the brothers.[1] This is clearly the original, unique, specimen used by J. G. Agardh in the preparation of the description of the taxon. The correct name and authority for the taxon is therefore *Ceramium pennatum* J. Ag., its type being the specimen cited above.

Chondria coerulescens

The iridescent species of *Chondria* to which the agove name has been generally applied was first detected by the brothers Crouan. Specimens were distributed by them in Lloyd's exsiccatae "*Algues de l'Ouest de la France*", as "*Laurencia dasyphylla* var." and, subsequently, in their own exsiccatae "*Algues marines du Finistère*" under the name

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[1] It is not possible at the present time to discriminate between the handwritings of the brothers Crouan.

Laurencia caerulescens. No formal description was given so that the latter name is a *nomen nudum.* J. G. Agardh (1863) supplied the first formal description, under the name *Chondriopsis coerulescens,* based upon Crouan material, the taxon being transferred subsequently to the genus *Chondria* by Falkenberg (1901). The correct authority for the binomial is therefore "(J. Agardh) Falkenberg", although most recent workers have misinterpreted the nomenclatural history of the taxon and given various incorrect citations.

The original description given by J. Agardh (1863) contains two citations, viz:

> "*Laurencia caerulescens* Crouan in Alg. Finist. n:o 282!"
> "*L. dasyphylla* var. Lloyd Alg. n:o 189!"

but it should be remembered that the second of these refers to a specimen furnished by the Crouans for distribution by Lloyd. From Agardh's additional comments, it is clear that only material emanating from the brothers Crouan had been available to him, but at first no trace of this could be found in the Agardh herbarium. Finally it was discovered that J. Agardh had kept his copy of the Crouan exsiccatae as a bound volume, separate from the main herbarium; it may be presumed from the citation given above, that the description was based entirely on the material of the taxon under discussion preserved therein, whilst the reference to the Lloyd' exsiccatae would appear to have been taken by Agardh from the citation given by the brothers Crouan in the text associated with that material. There are two specimens mounted as "282 *Laurencia caerulescens*" the upper of which has been selected as the lectotype of the taxon.

From the previous discussion, it is clear that in publishing the first description of the taxon, J. G. Agardh changed the spelling of the epithet from '*caerulescens*' to '*coerulescens*'. The former is the spelling of classical usage whilst the latter, a medieval form, was generally accepted during the last century, being used consistently by both J. G. Agardh and De Toni; usage of the spelling '*coerulescens*' cannot therefore be rejected merely as a typographic error. Alteration of the spelling of the epithet to the classical form '*caerulescens*' does not appear to be justifiable, although the latter spelling has been used frequently (Batters, 1902; Lyle, 1920; Newton, 1931; Parke, 1952, 1953).

The correct name and authority for the taxon under discussion is therefore *Chondria coerulescens* (J. Agardh) Falkenberg and its type is the specimen selected from the two preserved in J. G. Agardh's copy of the Crouan's "*Algues marines du Finistère*".

Crouania attenuata

The earliest reference to this taxon has been accepted generally as the description of *Mesogloia attenuata* C. Agardh (1824), the entity being transferred subsequently to the genus *Crouania* created for it by J. G. Agardh (1842). The C. Agardh description, however, contains a reference to "*Batrachospermum attenuatum,* Bonnemais." which has been accepted as a validlypublished basionym by all subsequent authors, who have cited the authority for *C. attenuata* as "(Bonnem.) J. Ag.". The Bonnemaison herbarium (now preserved in the Bibliothèque Municipale, Quimper) contains some five specimens of the taxon under discussion identified as "*Batrachospermum attenuatum*", whilst the Agardh herbarium contains a single specimen [Herb. Alg. Agardh. 20263] with the annotation "*Batrachospermum attenuatum* Bn ad littora armoricae" in Bonnemaison's hand, together with another specimen [Herb. Alg. Agardh 20261], which apparently originated from Bonnemaison but which is now annotated only in C. Agardh's hand. There is no evidence whatsoever to indicate that the binomial "*Batrachospermum attenuatum*" was ever validly published; the reference to this by C. Agardh is clearly only a quotation of the manuscript name written on the specimen used in the preparation of the original description of the taxon. The correct name and authority for the taxon is therefore *Crouania attenuata* (C. Ag.) J. Ag., its type being the specimen annotated by Bonnemaison, now in the Agardh herbarium [Herb. Alg. Agardh. 20263].

Bonnemaisonia clavata

Bonnemaisonia asparagoides (Woodw.) Ag., the more common of the two species of the genus found in western Europe, is monoecious but for many years comments on the occurrence of dioecious specimens appeared in the literature (Derbes and Solier, 1856; Bornet, 1892; De Toni, 1924; Chemin, 1928). Finally, Hamel (1930) separated the dioecious form, which differs from *B. asparagoides* in a number of other characters, as a distinct species to which he gave the name *B. clavata*. Hamel showed that Schousboe had given the name *Ceramium alternum* var. *clavata* to the dioecious form, the varietal epithet being taken up by him as the name for the species. Hamel quoted the authority for his new species as "(Schousboe) Hamel", a citation accepted by all subsequent workers (Feldmann and Feldmann, 1942; Feldmann, 1954; Parke, 1953). This citation is in fact incorrect, in that Schousboe's name was never published either by himself or any other author, and is clearly a *nomen nudum*. The correct name and authority for the species is therefore *Bonnemaisonia clavata* Hamel.

Hamel cites a number of records of the occurrence of this taxon in the original description, viz. "Roscoff (Chemin); Bresh (Crouan); Tanger (Schousboe); Marseille (Schousboe, Giraudy, Derbes et Solier)." Apart from the Chemin and Crouan records, these citations are based upon specimens now preserved in various herbaria of the Museum National d'Histoire Naturelle, Paris and represent specimens examined by Hamel in drawing up the description. Of the specimens cited, that labelled "Algae Schousboeana *Bonnemaisonia asparagoides* var. *mediterranea* 430 *Ceramium alternum* v. *clavata* Schousb. (Born.) Marseille" (in Bornet's hand), with the older label "*Ceramium alternum* var. *clavatum* est *Fucus asparagoides*", in Schousboe's hand, now in the Thuret/Bornet herbarium, has been selected as lectotype. What appear to be two fragments from this specimen, mounted on glass, are preserved in the General Herbarium.

Ctenosiphonia hypnoides

The authority for this binomial is widely, but incorrectly, cited as "(Welwitsch) Falkenberg". Welwitsch distributed specimens collected in Portugal in his exsiccata "Phycotheca lusitana" under the name *Polysiphonia hypnoides,* but no description was provided so that that name is a *nomen nudum*. The first formal description was given by J. G. Agardh (1863, p. 933) who attributed the name to Welwitsch and cited only the Welwitsch exsiccata in the description. One specimen of the exsiccata is present in the Agardh herbarium [Herb. Alg. Agardh. 39346]; this has been designated as the holotype.

The species was transferred to the newly-created genus *Ctenosiphonia* by Falkenberg (*in* Schmitz & Falkenberg, 1897), although many authors (c.f. De Toni, 1903) have failed to appreciate this and cite the later publication of the same author (Falkenberg, 1901) for the transfer. The correct name and authority for the taxon is therefore *Ctenosiphonia hypnoides* (Welwitsch ex J. Agardh) Falkenberg with the specimen cited above as holotype.

Acknowledgements

I am indebted to Mr. Ross for assistance in the preparation of this paper and to Professor N. A. Burges and to Dr M. T. Martin for critical comments. I would like to thank Mrs Y. Butler for considerable assistance with literature and specimens and the Directors and Curators of the following institutions for permission to examine herbarium specimens: British Museum (Natural History); Royal Botanic Gardens, Kew; Rijksherbarium, Leiden; Botaniska Museet, Lund; Bibliothèque Municipale, Quimper; Museum Nationale d'Histoire Naturelle, Paris. I am indebted to the Joint Committee on Research of the University of Liverpool for financial assistance.

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BOTANISKA NOTISER 1962 · VOL. 115 · FASC. 3 · LUND

Chromosome and Differentiation Studies in Flowering Plants of Skåne, South Sweden

I. General aspects. Type species with coastal differentiation

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(Meddelande från Lunds Botaniska Museum, Nr 164)

Introduction

The present paper is based on field studies as well as on investigations of cultivated material of wild origin. Most of the work has been carried out from spring 1957 until now, but in some cases studies and investigations from the period 1944—1957 are incorporated in the reports. The initiation of these studies was my work on the *Cardamine pratensis* complex (Lövkvist 1947, 1953, 1956, 1957) in which a very extreme cytological differentiation together with a morphological one was met with. At one chromosome number level, namely among the plants with $2n = 30$, constituting the main part of *C. pratensis* L., there was a wide morphological differentiation. The plants of the complex with higher numbers were included in *C. palustris* Peterm.

Now I am studying a number of phanerogams of Skåne, the southernmost Swedish province, in order to find out to what extent differentiation within one and the same Linnean species is dependent on several chromosome numbers or on gradual speciation. This is done in conjunction with cultivation experiments. Within the *Cardamine pratensis* complex plants with higher chromosome numbers grow at wetter places than those with lower numbers. Bearing the results in *Cardamine* in mind I have carried out the present studies on species with a wide ecological amplitude or species more or less split up into so called ecotypes. In some cases material from other provinces of Sweden as well as from abroad has been included.

The foreign material has been investigated mostly when it was found necessary to know more about the differentiation of a species in other parts of the world. This is applicable to biotypes living in areas which were situated outside the ice-cover during the large pleistocene glaciations. In those areas we have the best changes to find diploids of polyploid species or species groups found in Skåne. As has been pointed out in an earlier publication (Lövkvist 1956) the colonization period after the retreat of the icecap may have increased the chances for establishing new polyploids on grounds where normal competition did not work at the first step of plant invasion, and during following periods of rapidly changing climate. This may be the cause of the higher frequency of polyploids in formerly glaciated areas, compared with the situation in more undisturbed areas.

The present publication deals with some very common and polymorphic species. Their differentiation, as shown especially in the coast region of Skåne, is of interest not only from a speciation point of view, but also from a phytogeographical one. It is my opinion that a broad investigation of polymorphic complexes together with studies of phytogeographical trends of rare species will give us a more detailed view of the origin of the Skåne flora.

The writer is of the opinion that the multitude of ecological niches met with in Skåne is of great importance not only in connection with colonization but also during periods of differentiation processes. Therefore this paper begins with a short survey of bedrocks and soils in Skåne and a discussion about colonization, differentiation and present day vegetation.

The polymorphic species concerned in this paper represent three different types.

1. *Hieracium umbellatum.* Only the diploid number found in sexual plants. Wide ecological amplitude. Specialized biotype groups.
2. *Galium verum.* Diploids and tetraploids occur with only slight morphological differences. Wide ecological amplitude. Some specialized biotype groups.
3. *Tripleurospermum maritimum* s. lat. Diploids and tetraploids occur. Good morphological differences. Specialized biotype groups in the diploids.

Bedrocks and Soil in Skåne

Skåne is unique from a geological point of view. The nortehrn part of the province with its bedrocks of archean age belongs to Fennoscandia. Such bedrocks are also met with on Mt Kullen and the hill-chains called Linderödsåsen, Söderåsen and Romeleåsen outside the northern region. The southern part of Skåne is banded from southeast to northwest with narrower or broader strips of different geological formations belonging to mainly Cambrian, Ordovician, Silurian and Jurassic, while the southwestern corner is mainly cretaceous (danien) as are also the plains of eastern Skåne (but there senon). Some small districts within the cretaceous area are of tertiary origin and in the west triassic bedrocks are met with. Strips of older diabas are found in north mostly in a direction NNE—SSW and of younger diabas in a broad region from southeast to northwest, with the strips in the same direction. In the central part of the province about 50 basalt columns occur. In northwest carbonized zones from Raet-Lias exist.

As varied as the bedrocks are the soils. Southern and western Skåne have mostly different kinds of Baltic moraines, while the central, eastern and northern parts have Northeastern moraines. The Baltic moraines are often rich in lime and chalk and constitute the best agricultural districts in Sweden. The Northeast moraines with boulders, gravel and sand are on the contrary very poor. Thus, the moraines overlying the bedrocks are very different with regard both to their composition and to their thickness. Added to this are the organic substances which sometimes are of very great importance for the present vegetation.

In some places the bedrocks are bare. Archean rocks are visible in Mt Kullen, the island of Väderön, Mt Stenshuvud, and Mt Billebjer in the interior. — Cambrian and younger formations are bare here and there on the east coast south of Mt Stenshuvud (Gladsax, Simris, Brantevik, Vik, Skillinge, Gislöv).

All these facts ought to give opportunities for an extremely rich flora were it not for historical reasons, i.e. the glaciations. In fact, the flora af Skåne is very poor in species, with about 1250 indigenous species of phanerogams and higher cryptogams.

Colonization, Differentiation and Present Day Vegetation

During periods of cold climates most species in northwestern Europe have been reduced as to their biotype content, or have become extinct during their "migration" southwards, because of the severe barrier constituted by the central European mountains. For reasons mentioned above the variation was probably small within the species that immigrated after the Ice Age. Because of the low competition during the restocking period the variation within the species could, however, increase much more rapidly than might be the case in areas with old and dense plant communities.

During the first period of restocking Skåne was connected with Denmark. The eastern part of the North Sea of to-day was above sea level. The immigrants to Denmark could therefore arrive along a broad frontier. The migration from Denmark to Skåne, on the contrary, took place in a much narrower zone during some thousands of years from about 12000 to 5000 B.C.

As the species content within the area was limited a great number of ecological niches were for longer or shorter periods unoccupied. Extreme variants had therefore chances to find convenient habitats. Evidently, the differentiation within species has had an advantage in Skåne because of the extreme diversity of ecological niches, and because of the small number of species inhabiting the area. In the opinion of the present writer, the facts mentioned above contain the explanation why the differentiation within species is much more pronounced in Skåne, than for instance in Uppland (in central Sweden) or Central Europe.

It has to be pointed out that it is within just this region that Turesson (1922) found most of his ecotypes, the best examples being *Hieracium umbellatum* L. and *Centaurea jacea* L. These two species have to be regarded as differentiated into edaphic ecotypes while *Solidago virgaurea* (Turesson 1925) gives an example of a climatic ecotype. However, in the latter case Turesson points out that edaphic ecotypes might be met with in the lowland. His investigations of *Solidago virgaurea* include material from very different climatic regions. According to the opinion of the present writer we may look upon *S. virgaurea* as constituting a climatic cline from Central Europe to northern Scandinavia. But I agree completely with Turesson when he says that in the lowland edaphic ecotypes exist. This is true in Skåne, where, because of the edaphic-ecological discontinuities, ecolines are broken and groups of well-adapted biotypes, ecotypes, can be recognized.

One kind of ecotype may be more commonly found around the world, viz. coast ecotypes of species mainly occurring in the inland. Coast ecotypes as well as coast species very often occupy localities where the biotic competition is small. In a few cases it seems plausible to regard the inland type (ecotype) as a derivative from a coast species. However, in such cases the inland types are usually met with in arable land as weeds.

In cases with one coast ecotype and one inland ecotype within a species, these types may be regarded as climatic ecotypes and not edaphic ones, as the most important selection pressure differing between the regions has to be climatic. Of course edaphic differences occur, too, but are of importance in a minor scale, when compared with the situation in species with several coast ecotypes within a small region. The differences are in such cases dependent on mere edaphic diversities.

In my opinion ecotype differentiation from a main population with a wide variation is not the only cause behind the phenomenon of polymorphic plant species in Skåne. I have to take up another line, namely that different waves of immigrants of the same species may have existed during different periods. The discussion around the ecotype concept has mainly been based on a single invasion of a species to a region, then an increase in variation, followed by selective ecological specialization. However, every invasion of a species must have been of types already selected for a special ecological niche.

During the last half century special differentiation processes have accelerated. This concerns above all weeds and other anthropeic plants. The destroying af natural plant communities, the changes in vegetation of cultivated land, the occurrences of quite new ecological niches, the development of a new microflora and fauna, the changing of the chemical composition of the soils through the use of commercial fertilizers result in alterations in selection pressures and biotic competitions. The use of weed killers sometimes results in an increasing frequency of monocotyledonous weeds in gramineous crops, a phenomenon followed up during 1955 to 1959 in Reng and St. Hammar in SW Skåne, regarding especially *Apera spica venti*. It is too early to discuss to-day, the importance for speciation of all these artificial changes, but in the near future it may be obvious.

Hieracium umbellatum L.

From a phytogeographical point of view *Hieracium umbellatum* belongs to a group of species classified by Hultén (1950) as boreal circumpolar plants without larger gaps in their distribution area. In a previous work (Hultén 1937) he says the gaps are "in Iceland and Greenland on the one hand and in the Bering Sea area on the other". Phytogeographers of Central Europe regard the species as "eurasiatic".

In Scandinavia *H. umbellatum* is widely spread and found in natural habitats as well as in cultivated areas. It is, however, not met with in northern Norway and the mountainous region of Swedish Lapland. In the mountains of central Scandinavia the species grows more or less commonly but never occurs above the tree limit.

In Skåne *H. umbellatum* is met with all over the province, of course

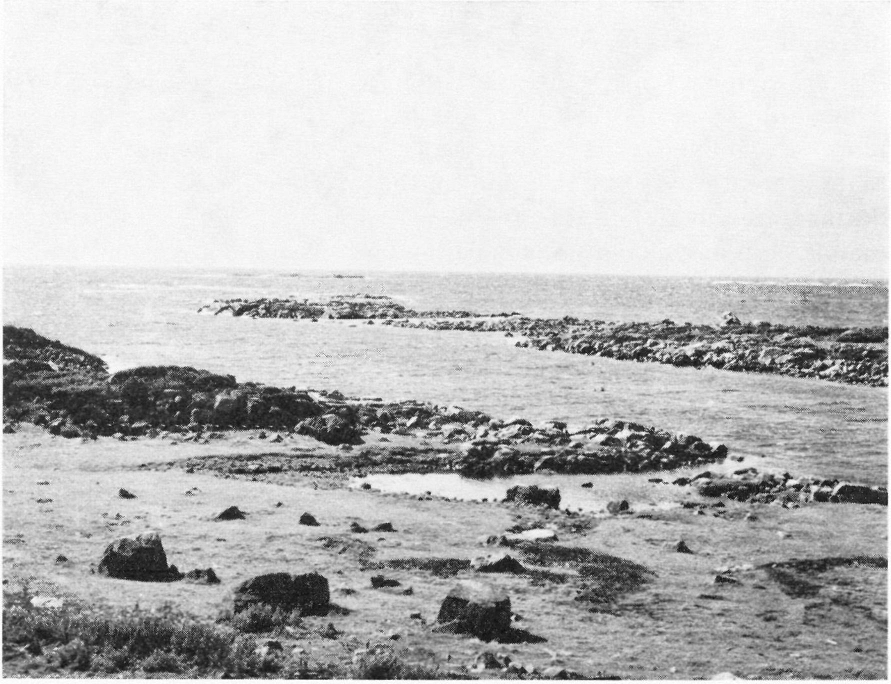

Fig. 1. Outer part of the island of Väderön at Möhamn, NW Skåne. On the cliffs types of *Hieracium umbellatum* and *Galium verum*. Photo G. & H. Weimarck.

with differences in frequency. In woods it has enough light only at the edges or in thin deciduous woods with old trees. The species is common in pine plantations, dry pastures with *Crataegus, Juniperus* and scattered trees, along stone walls and at rocky and sandy lake shores, but is not at all represented in low, moist parts with *Alnus*. The species is found in nearly all parts of the coast of Skåne, with a decrease in frequency at the southwestern marsh coast, and a maximum in the dune regions with white sand and in areas with archean rocks. *H. umbellatum* is also fairly common along roadsides.

Differentiation

It is a well known fact that *H. umbellatum* is a very variable species. This is particularly true in Skåne. The classical investigations of ecotypes within this species performed by Turesson (1922) have given the basis for an understanding of differentiation within a small geographical area with about the same major climate, but with ecological diversities of different selective values. The cultivation experiments carried out by Turesson gave the result that different biotype groups without any doubt occur and that morphological and physiological differences have a genetic basis. In *H. umbellatum* Turesson (1922) reports the following five types (ecotypes):

a. the dune type of the shifting dunes
b. the dune type of the arenaceous fields
c. the sea-cliff type of the west coast
d. the sea-cliff type of the east coast
e. the woodland type of the interior

In *H. umbellatum* the present writer has since 1957 collected a large amount of material for cultivation experiments and studies of chromosome numbers. The species has also been studied in nature. The number of localities from which determinations of chromosome numbers have been carried out are only 10, but in these are included all main types met with in Skåne, as well as two types from northern Germany. The experiments have been performed with material from more localities, but the chromosome numbers of these plants have not been determined.

From Turesson's cultivation experiments in *H. umbellatum* as well as from those of the present writer it is quite clear that a series of biotype groups exists much more pronounced along the coast than in the inland. The inland types on clay seem to be different from those on sand, but these studies are, however, not made in detail and will be completed later. The most extensive investigations have been performed along the coast of Skåne.

From the coast region examinations have been carried out and collections made from districts with white sand; the low, moraine coast; archean cliffs; cambric sandstone cliffs; cretaceous ground; stabilized moraine cliffs. Material from the interior originates from lake shores; roadsides; archean rocks.

One of the most interesting regions investigated is the white dune district at Löderup in the extreme southeast of the province. On the inner border of the beach dune *H. umbellatum* (Fig. 3 A) lives close to *Salix repens* v. *arenaria, Ammophila arenaria, Elymus arenarius, Festuca arenaria* and *Festuca polesica*. The biotypes of this very small zone resemble often the sea-cliff types met with in other regions of the coast. Only a small distance from the zone with *Salix repens* v. *arenaria* other biotypes of *H. umbellatum* grow on organogenic dunes (stabilized

Fig. 2. White sand dunes, Borrby at Mälarhusen, SE Scania. In the vegetation *Hieracium umbellatum* and *Galium verum*. Photo G. & H. Weimarck.

and stationary), and very similar types occur along the border of the planted pine forest. In the innermost area at Löderup where oaks grow, biotypes more or less constituting inland types are met with.

A similar zonation has been examined at Falsterbo on the south-western corner of Skåne. The biotype groups are here principally the same but this does not mean that the genetic constitution is exactly the same.

The white sand district north of Vitemölla on the east coast is inhabited by three biotype groups, and here too, the same zonation seems to be established. However, the beach dune is here less pronounced than at Löderup and Falsterbo, and plants resembling those growing among *Salix* are very rare, and dwell only at a few localities. Along the shore

Fig. 3. *Hieracium umbellatum* 2n=18. Dune types.

A. From Borrby, Mälarhusen, white sand dunes.

B. From Kivik, Vitemölla, white sand above the abrasion steep.

C. From Ilstorp, inland fluvial sand. Dwarf modification.

line but inside the beach dune (or abrasion steep) a type of *H. umbellatum* (Fig. 3 B) grows with *Agropyron junceum, Elymus arenarius, Carex arenaria, Lathyrus maritimus* and, further northwards, *Eryngium maritimum*. Other types of *H. umbellatum* grow on the slopes of stabilized dunes with *Anemone pratensis, Anthericum liliago, Artemisia campestris*, a few stands of *Astragalus arenarius, Dianthus arenarius, Galium verum, Festuca polesica* and *Thymus serpyllum. H. umbellatum* is also found here and there in the pine plantation on the plain above the slopes.

In inland fluvial sand districts a dune type sometimes modified to a dwarf plant is met with (Fig. 3 C). Unfortunately, this type has not been investigated cytologically.

Other types of *H. umbellatum* grow in the coast districts in northeastern Skåne. The coast is here low with some peninsulas and small islands off the coast. Along the coast strip wide pastures are situated with tree groups and shrubs. The species is most frequent among the shrubs but also along stone walls. Near the shore line it only grows in some of the higher parts and on some of the small islands, mostly in association with stones. No experiments comparing *H. umbellatum* from these two types of localities have been performed, but the differences found in nature may not be only modificatory, as is evident from other experiments within the species. The plants from the outer strip are low, more or less prostrate, with thick leaves and few inflorescences, very much resembling the type cultivated from Maglarp at point Stavsten. The plants from the shrub region of pastures are tall and rich in inflorescences; they probably represent an inland type.

On the island of Ven in the Sound a tall quick-growing type with a great number of inflorescences is found in more stationary vegetation of stabilized moraine cliffs. This type might seem somewhat strange here, but principally the same growth form develops in for instance *Centaurea jacea, Galium verum* and some other species at the same locality. The type is very similar to inland types from localities with rich soil in the region of Baltic moraines.

Among archean rocks at Mt Kullen "the sea-cliff type of the west coast" grows (Turesson 1922). The same form is met with at localities on the island of Väderön off the coast of northwestern Skåne, the sea-cliffs being of the same type as those of Mt Kullen. On both localities the plants are highly exposed to wind and salt-water spray.

Another sea-cliff type, but different from that of the west coast, occurs at the eastern coast. The form investigated by the present writer originates from the Cambrian sandstones at Brantevik (Fig. 4 A). The type found at Mt Stenshuvud, an archean formation on the eastcoast, resembles very much inland types growing where the Archean bedrocks are bare e.g. on Mt Billebjer and the hillchain Romeleåsen. The biotypes from Mt Stenshuvud differ greatly from those of Mt Kullen. This is quite evident and the selection pressure may be different. The most pronounced forms at Kullen are those found among the sea-cliffs, while the rocks at Mt Stenshuvud have not at all the same connection with sea and saltwater as those at Kullen.

Unfortunately plants of *H. umbellatum* from Cambrian formations of northwestern Skåne on the Bjäre peninsula have not been investigated up to now.

H. umbellatum of the interior of Skåne occurs in different types. As mentioned above it grows among bare rocks of Archean origin as

A B

Fig. 4. *Hieracium umbellatum* 2n=18.

A. Sea-cliff type from Brantevik, SE Skåne.

B. Inland type from Örkened, NE Skåne.

well as on rocks of cambric age. These types differ from those found on arable land (Fig. 4 B) and at roadsides, as well as from those growing in thin woods and along lake-shores. However, it is difficult to settle if the cliff type of the interior is more related to the sea-cliff types or if its origin is to be found in the common variable population of the interior.

The polymorphy within *H. umbellatum* is quite evident not only in Skåne, but also in many other parts of Europe. In Skåne, however, it seems plausible to think of hybridization between different form groups, probably immigrants in different "waves" as postulated above. The dune type of southeastern Scania may represent a near relative to one of the cliff-types. Among the inland types it is evident that at least two lines exist according to number and size of inflorescences, and it seems possible to correlate these with number of stem-leaves, probably also with shape and thickness of the leaves. Then there exists a more independent line with few hairy leaves and low number of inflorescences.

The four lines mentioned may be the main basis for the extreme polymorphy met with in Skåne. From these lines hybrids have arisen resulting in local hybrid swarms from which balanced, ecologically adapted derivatives have been selected after recombination.

As already mentioned by Turesson (1922) different ecotypes meet in some areas without giving rise to visible hybrid products. Turesson exemplifies this phenomenon from southeastern Skåne, but it also occurs in at least two other regions in the northwestern coast districts. In my opinion these facts may be considered regarding the above postulation of different invasions of a species.

Chromosome Studies

Apogamy and vegetative reproduction are common phenomena in the genus *Hieracium*. In the *H. pilosella* group both forms of apomixis are met with, while in *H. umbellatum* vegetative reproduction in most biotype groups is of restricted importance. Turesson (1922) reports that one of the dune ecotypes growing in localities with drifting sand has a pronounced vegetative reproduction and that this type thus has a chance to endure. The plant can produce shoots after having been covered with sand, while most other types of *H. umbellatum* would have succumbed in the same situation. Vegetative reproduction is thus important for this type. Experiments comparing the vegetative reproductive ability of the different types should be of great interest.

Apogamy is reported in *H. umbellatum* by some authors. All cases, except one, apply to triploid plants with $2n=27$. The first report is Rosenberg's (1917). He studied material which Ostenfeld (1910) had investigated embryologically. Very little is known as to the origin of these plants, but the seeds are said to have reached Copenhagen from St. Petersburg (Leningrad). Probably the material came from the Botanical Garden there. However, its wild origin is not proved and a hybrid origin seems not plausible as the Swedish *Hieracium* specialist Dahlstedt has confirmed that it represented true *H. umbellatum*.

A very important work on apogamy in *H. umbellatum* by Bergman (1935, 1941) shows that spontaneous triploids exist in the central part of Kamchatka at Klutchi, where seeds were collected by the Swedish entomologist R. Malaise.

In a diploid plant reported to belong to *H. umbellatum* Gentcheff (1941) has found apogamy. As apogamy in diploids is very rare, this report is somewhat doubtful and Gustafsson (1947) suggests that it "might have originated after crosses of diploid umbellatum and apomictic polyploids" (p. 258). However, in this case it should be of interest to investigate meiosis and seed production in hybrids between *H. umbellatum* and different related diploids.

The most common chromosome number in *H. umbellatum* is the diploid 2n=18. This number was reported by Juel as early as 1905, and has later been found by a number of workers, mostly without mentioning the origin of the investigated plants. One of the reasons why the present writer began to study this species was its polymorphy, and another was that he thought it possible to find apogamous as well as sexual populations in Skåne. However, hitherto only diploids have been met with, all of which may be sexual, but this has been proved in only seven plants, after isolation in 1957. Theoretically pseudogamy may occur. This small study confirms Turessons's statement that *H. umbellatum* is self-sterile and gives no seeds after isolation.

The material in which the chromosome numbers have been determined by the present writer is recorded in Table 1.

Table 1. Hieracium umbellatum. Origin of the writer's chromosome counted material. All collections have 2n = 18.

Sweden, Skåne.

Coast region, white sand.

No 794 Löderup, between a small river and a pine forest on sandy ground stabilized by pine plantations, formerly belonging to the inner ridge of shifting dunes.

870 Löderup, between an oak ridge and a pine forest on the southern slope of a stabilized dune with open vegetation.

1084 Löderup, at the eastern part of the Hagestad reservation among Salix repens var. arenaria, on sand with small shifting dunes.

733 Vitaby, at the sea shore N of Vitemölla inside the beach dune on a flat field with white sand, partly drifting.

Coast region, chalk and pebbles.

791 Maglarp, near the sea shore at Point Stavsten. Very thin soil rich in pebbles and chalk above cretaceous bedrocks (danien).

Coast region, moraine cliff.

809 Island of Ven near Norreborg, on dead moraine cliff.

Coast region, archean sea-cliffs.

921 Island of Väderön near Kappellshamn.
942 Island of Väderön at Kungshamn.

Coast region, cambric sea-cliffs.

2054 Gladsax on Vårhallarna
2344 Brantevik, sea-cliffs south of the harbour.

Coast region, fluvial sand.

2263 Vitaby, south-exposed sandy slope 1 km from the coast.

Inland region, lake shore.

1085 Osby, among small birches along lake Osbysjön near Skansen.

Foreign countries

No B179 Germany, Mecklenburg: Darss, cretaceous rocks on the coast of the Baltic Sea.
B232 Germany, Mecklenburg: Greifswald, near the sea.

Taxonomy

As in all other polymorphic species the taxonomic treatment varies widely in floras and handbooks. Some authors have tried to define groups while others are more careful, often saying that difficulties in infraspecific classification depend on absence of sufficiently large morphological discontinuities.

Hartman (1879) explains that the described taxa continue into each other without any limits.

Neuman & Ahlfvengren (1901) in their Swedish Flora write that the most pronounced varieties are var. *filifolium* Fr. and var. *dunense* Reyn. *H. umbellatum* var. *filifolium* has linear or nearly filiform leaves with revolute margins. This variety is met with at sandy seashores and on sea-cliffs. *H. umbellatum* var. *dunense* is prostrate with more or less broad dentate leaves with hirsute petioles. The stem is thick and more or less hirsute. Var. *dunense* grows at stone-rich sea-shores.

Lindman (1926) has the same varieties as Neuman & Ahlfvengren and the same description. As closely related to *H. umbellatum* he regards *H. chloromelanum* Dahlst., which species he does not give full species rank, as he includes it under the same species number as *H. umbellatum*. *H. chloromlanum* grows in northern Sweden. The species has only few and long-petioled capitula in the tops of the stems, but differs from *H. umbellatum* in more dentate leaves, larger heads and more appressed bracts in the common involucre.

In spite of differences in easily visible morphological characters *H. umbellatum* is difficult to divide into well-recognizable taxa. In the opinion of the present writer this is the result of a wide heterozygous constitution developed by hybridization between types now difficult to recognize, at least in southern Scandinavia, though sometimes possible to trace. It is probable that future investigations will give more details and that overlapping zones will have to be carefully studied.

The difficulty in classification is best exemplified by Zahn's treatment (1922) in Das Pflanzenreich. He has *H. umbellatum* as a "species principalis" under which he recognizes a number of subspecies and numerous varieties and formae. After these a number of "species intermediae collectivae inter Umbellata et sectiones reliquas" are given, most of them with numerous subspecies.

The present writer can only state that all the material investigated from Skåne is diploid and constitutes an allogamous aggregate. Polyploidy is met with in related species but is not proved within *H. umbellatum* in Skåne.

Galium verum L.

The distribution of *Galium verum* is very wide. The species is found over most of Europe, except the northernmost region, and in central Siberia eastwards. Whether it is indigenous or introduced in N. America is still a problem, but Hultén (1950) regards the species as belonging to his group "west-European—central-Siberian plants", thus without spontaneous distribution in America. In N. Europe the species is rather common in Denmark, south Sweden, the southern Norwegian coast districts and the lowland in the southeast. Its northern border in Sweden follows very near Limes Norlandicus, the localities northwards being scarce.

In Skåne *G. verum* is common and grows in natural habitats as well as on arable land and at roadsides. However, *G. verum* needs plant communities which are stable for at least three to four years. It is less common on clay than on sand and gravel, and the highest frequency is met with in dry sites. However, in central Skåne it occurs rarely in wet meadows among *Cirsium palustre, C. oleraceum, Geranium palustre, Filipendula ulmaria,* thus in a tall-growing plant community, an environment hitherto unknown for the species. *G. verum* is abundant along the coast and here it grows in nearly all soils e.g. white sand, along hedges in clay districts and even on cliffs. In the region with Northeast moraines the yellow colour of the flowers dominates hill slopes and roadsides during July.

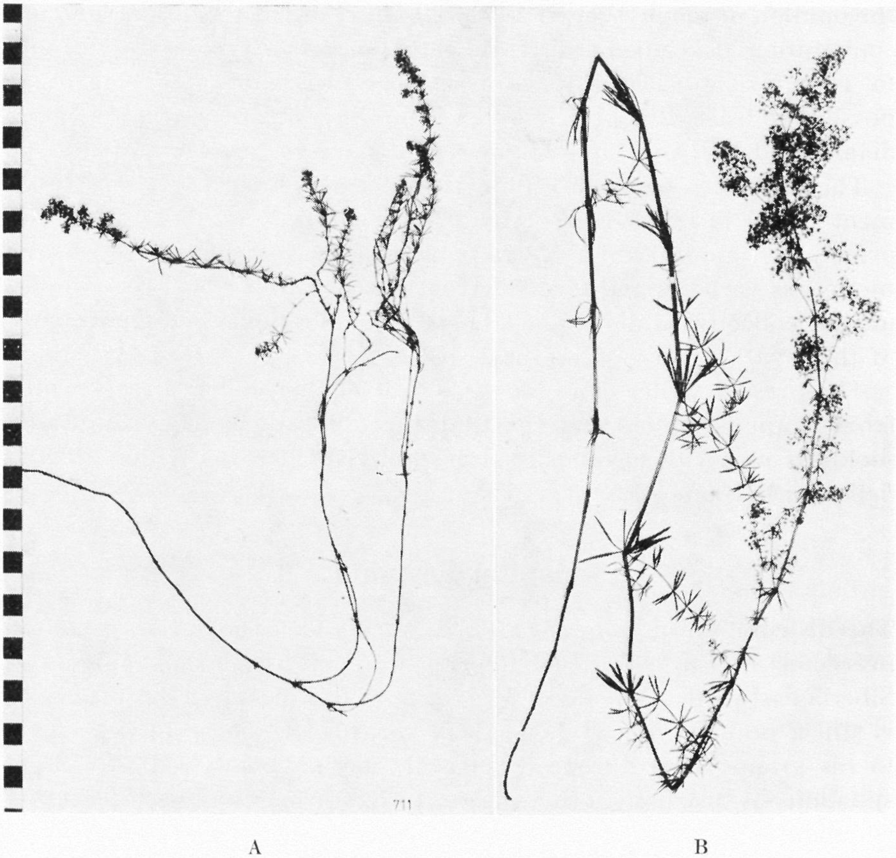

Fig. 5. *Galium verum* 2n=44.

A. From Åhus, E Skåne, white sand dunes.

B. From rich meadow, Trolleholm, Central Skåne.

Differentiation

G. verum is one of the most polymorphic plant species in Skåne. Its modificatory ability is wide, too. However, it is possible to recognize some types, two of which seem to be introduced now and then, without being naturalized in more than a few localities. One of these, *G. wirtgenii* F. Schultz, is often regarded as a good species. This species has nothing in common with the South Swedish material of *G. verum*. The present writer has had no living material available of Swedish origin. The second introduced type is often named *G. ruthenicum* Willd., sometimes placed within *G. verum* as var. *trachycarpum* DC.

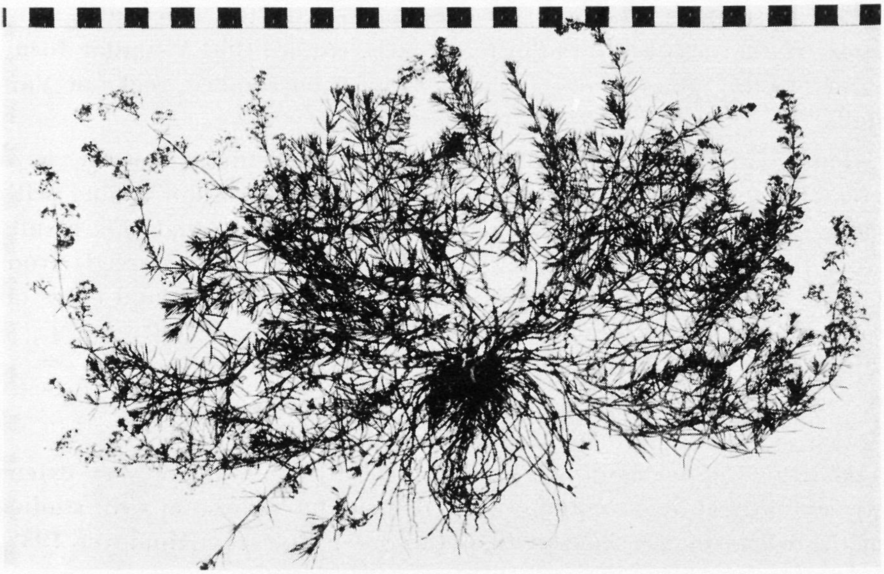

Fig. 6. *Galium verum* $2n=44$. From the island of Väderön, NW Skåne. Cliff-type.

The spontaneous types of *G. verum* in Skåne may include some material of foreign origin, but the last named is impossible to trace. In the sandy shore districts of the east and southeast coast and at the southwestern corner of the province grows a type (Fig. 5 A) with a tremendous, branched underground part, more or less prostrate stalks and needle-like leaves. It is very well adapted to shifting dunes, because of the underground system and the ability of the stems to grow like rhizomes when covered by sand.

A type somewhat similar to the preceding one is common on heavily grazed slopes, but mostly without flowering stems because of the grazing. When transplanted to the experimental field it grows more erect and flowers normally.

The type mentioned above as occurring in wet meadows (Fig. 5 B) is modified in the experimental field and does not grow so tall as in nature. It had difficulty in surviving in the comparing plots and all the plants died within a few years, while plants of other collections were easy to keep cultured.

On the island of Väderön off the NW coast, a striking type of *G. verum* (Fig. 6) is met with. It is found on wind-exposed archean rocks and looks like a pillow or carpet consisting of numerous short, prostrate stems, in summer with small inflorescences in the top. The stalks grow close to the rock, while the inflorescences rise a little. A similar form, probably the same, occurs at the east coast, on cambric rocks at Vårhallarna in Gladsax, close to the Baltic Sea.

The inland plants of *G. verum* are very difficult to classify, as a great number of types occur and a very wide variation is met with along roadsides and in waste places. It seems likely that this results from the introduction of different types with commercial seeds from abroad and the invasion by coast types and indigenous inland types on to the bare sandy soils when the roads were new or rebuilt.

Chromosome Studies

The genus *Galium* has for a long time been the subject of very extensive cytological investigations, some of them in connection with studies of the whole family *Rubiaceae* or the order *Rubiales* (Homeyer 1932, 1936; Fagerlind 1934, 1937; Poucques 1948, 1949).

Studies of *G. verum* have shown that diploids with 2n=22 as well as tetraploids with 2n=44 occur in nature (Fagerlind 1937, Poucques 1949). Fagerlind (l.c.) reports both the diploid and the tetraploid number in types which he called *G. verum* f. *ruthenicum* Willd. Some authors and compilers have regarded the diploid number as belonging only to *G. wirtgenii* and the tetraploid to *G. verum* s. str. From the present investigation of material from abroad it has to be emphasized that diploids not belonging to *G. wirtgenii* but to *G. verum* occur. Poucques (1949) gives the diploid number to *G. verum* and mentions nothing about *G. wirtgenii*. Therefore in the opinion of the present writer Löve & Löve (1961) should have been more careful when dealing with the *G. verum* group.

The *G. verum* group is, thus, composed of a diploid and a tetraploid group. *G. wirtgenii* is the most outstanding representative of the diploid group. The list of synonyms of *G. wirtgenii* found in the literature may be somewhat doubtful.

The plants from the province studied by the writer in nature and in comparing plots in the experimental field have all been tetraploid with 2n=44 (Table 2). The uniform number is met with in spite of the extreme ecological differentiation. Thus the types specialized for certain ecological niches as the white sand of sea-shores and the archean sea-cliffs can be regarded as ecotypes.

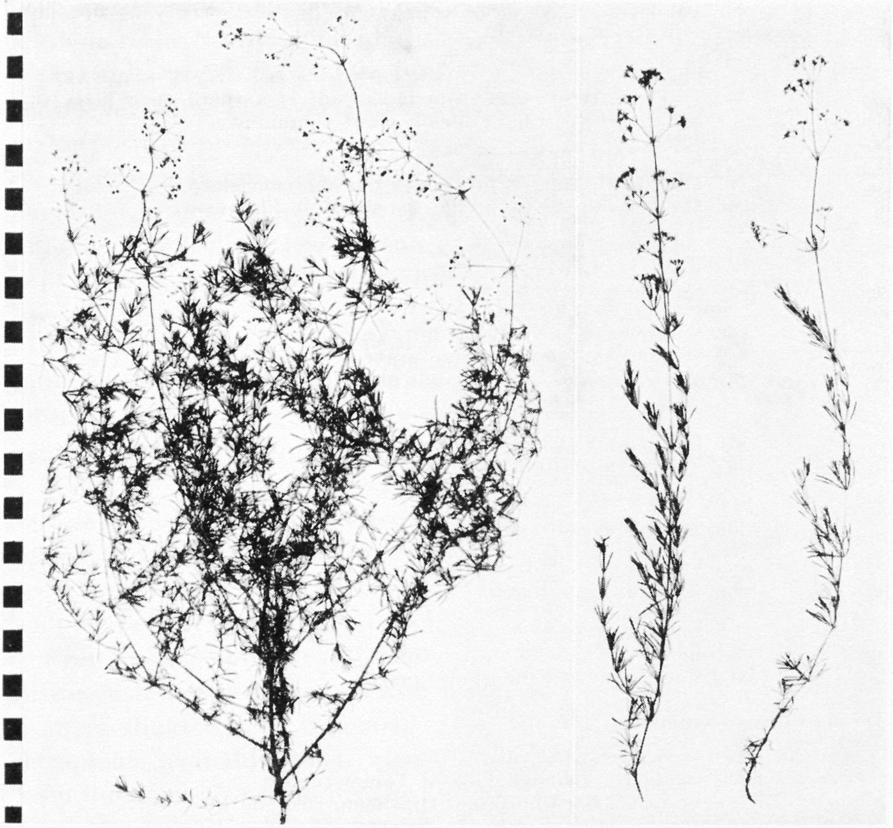

Fig. 7. *Galium verum* 2n=22. Three plants from the same locality near Udine, NE Italy.

The collections from abroad are diploid as well as tetraploid. All the diploids (Fig. 7) have been well within *G. verum* and not belonging to *G. wirtgenii*. The tetraploids are all within the variation amplitude of Swedish material.

Table 2. Galium verum. Origin of the writer's chromosome counted material.

2n=22 Foreign countries

No C594 Italy, Friuli-Giulia: just N of Udine.
F277 Austria, Carinthia: Norische Alpen.
F273 Poland: Lodz.

2n=44 Sweden, Skåne

Coast meadows.
No 833 Trolle-Ljungby at Bodarne in the upper part of a grazed coast meadow.

1936 Torekov, grazed meadow close to the sea, very thin soil layer above archean rocks.

Rich inland meadow.
744 Torrlösa, rich meadow on moist soil at a small open place in a beech forest, in tall-growing plant community.

Sea-shore, white sand.
711 Åhus at Ö. Täppet, just above the abrasion steep.
1969 Skanör, inner part of the sea-shore at Flommen.

Lake-shore, sandy soil.
1068 Vomb, at the southern shore of the lake.

Dry, sandy hillsides.
1268 Dagstorp, sandy morain hill, grazed.
1882 St. Slågarp, slope of large grave-mound.
2264 Vitaby, south-exposed, sandy slope 1 km from the coast(line).

Archean sea-cliffs.
916 Island of Väderön at Möhamnsviken.
2299 Brunnby, Mt Kullen.

Cambric sea-cliffs.
1905 Gladsax at Vårhallarna.

Inland cliffs, archean.
1069 S. Sandby, Mt Billebjer.

Waste places.
800 Fulltofta, weed along roadside.
2315 Vinslöv, at old limestone quarry.

$2n = 44$ Foreign countries

No F270 Norway, Sogn: Amla.
F269 Denmark, Zealand: hills at Tommerup.
F281 France, Alsace-Lorraine: Hipsheim, rieds de Ill.
B220 „ , Hte-Garonne: La Salvetat, St. Gilles, 170msm.
B111 Czecho-Slovakia, East Slovakia: near Kosice.
B171 Poland, Posnan: Trzcielin.
F268 Rumania, Reg. Bucuresti-Padorea: Buftea.
C529 Bulgaria: Mt Vitosa.

Taxonomy

Material from Skåne of *G. verum* has been investigated in the field and in herbaria as well as in cultivation. Herbarium studies have convinced the present writer that *G. wirtgenii* can be regarded as a separate species. In Skåne it is introduced in the western part and is found now and then only in a few localities at Landskrona. Unfortunately no living material has been available for comparing experiments and chromosome counts.

Fagerlind (1937) has shown in crossing experiments that the "*ruthenicum*"-(*trachycarpum*) character depends on a single gene occurring in diploids as well as in tetraploids. Individuals with this gene have been introduced in Skåne, but do not seem to be naturalized or only in a minor scale. No living plants have been found by the writer.

Making a useful taxonomic hierarchy is difficult, as in all polyploid complexes with wide variation. It is much easier to criticize than to make positive proposals. However, from a genetical point of view it seems strange to put all plants with the single gene for the "*ruthenicum*"-character in one taxon, when it is known that this gene occurs at the diploid as well as at the tetraploid level. This mutation type must be kept as forma *ruthenicum* Willd., as Fagerlind does, if it has to be used at all.

The two best recognized types of *G. verum* from Skåne can be put into the schemes of West European botanists. The type growing in the white sand districts seems to be var. *litorale* while the archean sea-cliff type is var. *humifusum*.

When in flower it is easy to recognize plants with yellow-white infloresceneses. They are named var. *albidum,* and sometimes said to be hybrid products of *G. mollugo* L. and *G. verum,* Swedish *albidum*-plants seem not to differ from normal plants in more than flower colour, and should therefor not be given as high rank as variety.

From a morphological point of view it seems to be possible to distinguish between diploids and tetraploids. The differences are however so slight that it is nearly necessary to have both diploids and tetraploids available when identifying. In such a case it is better to keep the name *G. verum* for the old Linnean species, excluding *G. wirtgenii.* From a genetical and speciation point of view the remaining aggregate consists of a *diplo-verum* and a *tetra-verum.* On both levels plants exist having the gene for the *ruthenicum* character and other plants with combinations resulting in yellow-white flowers. Plants with *litorale*- and *humifusum*-combinations are only known from the tetraploid level.

It is possible to arrange a scheme reflecting the situation discussed above even if such a system is only of theoretical interest and in conflict with the present rules of nomenclature. The scheme should be:

- *G. verum diplo-verum*
    - f. *ruthenicum*
    - f. *albidum*
- *G. verum tetra-verum*
    - f. *ruthenicum*
    - f. *albidum*
  - var. *litorale*
    - f. *albidum*
  - var. *humifusum*

So far, the classification in a *diplo-verum* and a *tetra-verum* has no practical meaning in Scandinavia, but it has to be kept in mind that it is necessary to remember that Scandinavian plants are mostly late immigrants from other parts of Europe and that species in Sweden divided in distinguished groups in Central Europe are often represented by one variable population.

Tripleurospermum maritimum (L.) Koch

(Syn. Matricaria maritima L.)

This aggregate species is by Hultén (1950) regarded as "west-European —central Siberian". Thus he must have excluded *T. ambiguum* (Ledeb.) Franch. & Savat. from the complex, but included *T. inodorum* (L.) Schultz-Bip.

The Scandinavian plants occur as perennials along the whole coast strip and as annual weeds in all regions with arable land. In Skåne the weed is extremely common, while the frequency of the spontaneous types differ from region to region. The latter grow abundantly in the zone of sea-weed drift and on the sea-cliffs. Temporarily they are found in other vegetation of the coast line. In parts of the coast where arable land is situated close to the sea the weed type and spontaneous types sometimes meet.

Differentiation

Taken in a wide sense all botanists agree that *T. maritimum* is very polymorphic. Unfortunately, no extensive studies have been performed comprising material from the whole distribution area.

Cultivation experiments were performed by Turesson (1922) in *T. maritimum*. He compared indigenous seashore types with the weed type. From his cultures he found it possible to state that there existed "the type of the west coast" and "the type of the east coast" and furthermore the annual weed, "the inland type".

Turesson (l.c.) performed crossing experiments between a coast type and the weed type and succeeded in getting hybrids. The whole F_1-generation was annual, thus like the weed. At the time of publication the F_2-generation was still in the rosette stage, but Turesson points out that segregation was very evident.

From Vaarama's (1953) investigations it is clear that F_1 is only partially fertile and F_2 is composed of more or less abberrant individuals. This may be the reason why intermediate populations do not exist in a large scale in the overlapping zones.

Field studies carried out by the writer have resulted in finding one hybrid locality at Hököpinge near Jonstorp. It was on a refuse heap placed just in the shore line.

Chromosome Numbers and Taxonomy

Chromosome numbers of some of the types of the complex were reported by Vaarama (1953). The most striking discovery is that the annual weed type is tetraploid with $2n=36$, while spontaneous perennial coast types are diploid with $2n=18$. This is contrary to what can be regarded as usual. Hypothetically there may exist a diploid annual somewhere. The weed type must presumably belong to a vegetation developed in southern Europe, like many other of our annual weeds.

The chromosome numbers found in Skåne are given in Table 3. As published by Vaarama, all coast types are diploid and the weeds tetraploid. Material from abroad has been compared with Skåne plants in the experiments.

If we look upon Scandinavian material only, it is possible to distinguish morphologically between the weed, being tetraploid, and the indigenous sea-shore plants being diploid. However, the situation for the whole complex is altogether more complicated. The diploid biotype group named *T. ambiguum* is circumpolar, but it is at least in northermost Europe in contact with other groups of the complex, and it is not known at all how these groups behave in overlapping areas. Along the Scandinavian west coast a number of biotype groups occur, and at Mt Kullen, in NW Skåne, *at least* two different types grow. The east coast type reported by Turesson (1922) may be another type different from those from the northwest.

Before an extensive investigation of the whole complex is made it seems proper to treat the coast types as one species, *T. maritimum* (Fig. 8 B), as far as the situation in Scandinavia alone is considered, and the weed type as *T. inodorum* (Fig. 8 A).

Table 3. Tripleurospermum. Origin of the writer's chromosome counted material

$2n=18$ Sweden, Skåne.

No 1625 Island of Väderön, archean sea-cliffs at Möhamnsviken.
2128 ,, , sandy sea-shore with seaweed drift.
1763 St. Hammar, western shore of L. Hammarsnäs, seaweed drift.
1711 Brunnby, Mt Kullen, archean sea-cliffs.

Foreign countries.

No D95 England, Cheshire: Wirral.
F337 „ , Lancashire: from the coast.
F336 Ireland: the coast near Dublin.
F339 France, Bretagne: Le Guilvinee.

2n=36 Sweden, Skåne.

No 1764 Bosarp, waste place near the railway station, weed.
2129 Annelöv, arable field, weed.

Sweden, Uppland.

No D133 Stockholm near Frescati, weed

Foreign countries

No F338 Czecho-Slovakia, Bohemia: arable field near Praha, weed

General Discussion

The three species, *Hieracium umbellatum, Galium verum* and *Tripleurospermum maritimum,* dealt with in this work, have in common that they all are divided into specialized biotype groups along the coasts of south Sweden, here mainly studied in Skåne. These biotype groups can be regarded as ecotypes. However, this does not mean that all the ecotypes of a species are differentiated from one and the same "common population". As mentioned above it seems more plausible to postulate different immigration waves during past times.

From a more ecological point of view some of the coast strips of Skåne might have had small chance to change vegetation in full scale parallel with the climatic changes during the quaternary period. This is true for the districts discussed above, the archean sea-cliffs at Mt Kullen, the cambrian rocks in SE Skåne, and some parts of the sandy shores. These ecological niches are very similar to niches in regions often far away from Skåne, but here too, it is possible to find similar types of these species.

At Mt Kullen the sea-cliff type of *H. umbellatum* occurs at its southernmost locality of western Scandinavia, and in my opinion it represents the first immigrantgroup of the species, still living at the same locality because of the extremeness of the niche. The later immigrants may have a different genetical constitution not adapted for the coast climate of the rocky districts. Even for *Tripleurospermum maritimum* at least one type of the indigenous coast plants has its southernmost locality at Mt Kullen, the other localities being scattered along the western coast of Scandinavia. The coast cliff type of *Galium verum* may be an early immigrant to Scandinavia occurring only at certain

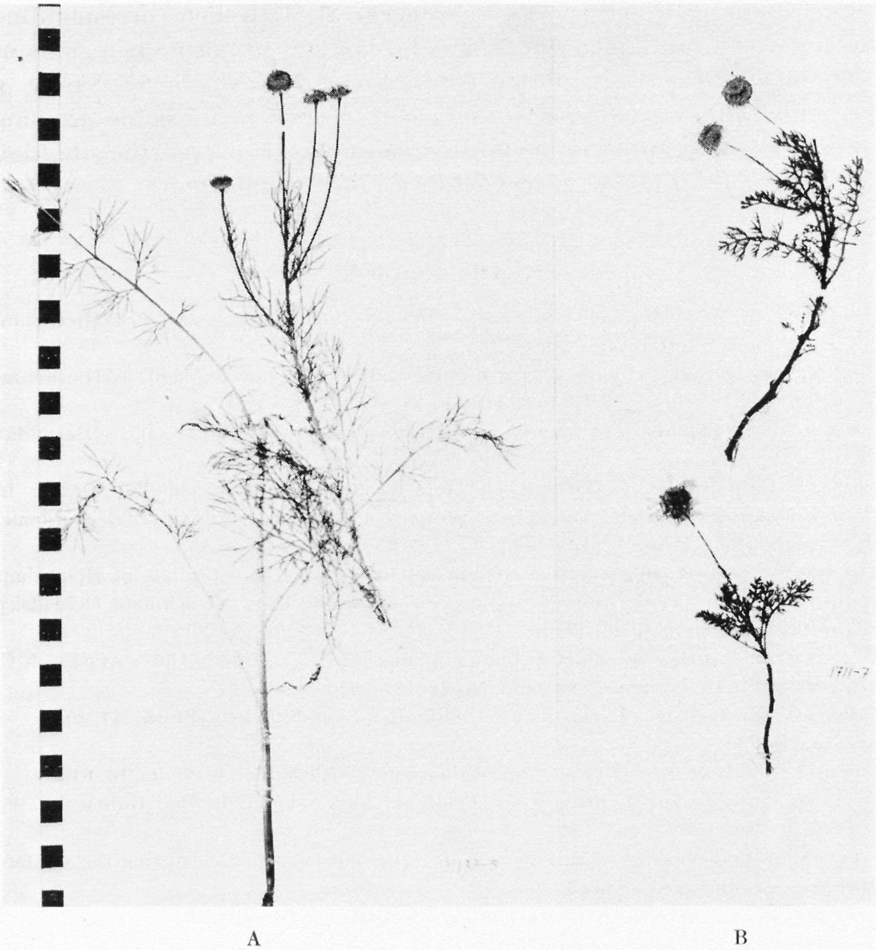

Fig. 8. A. *Tripleurospermum inodorum* $2n=36$. Weed plant from Frescati Stockholm.
B. *Tripleurospermum maritimum* $2n=18$. From Archean sea-cliffs, Mt Kullaberg, NW Skåne.

exposed localities near the sea. This type occurs also in the provinces Halland and Bohuslän.

The hypothesis that biotype groups may live as relicts in some areas of Skåne is based upon the fact that ecological niches in the sea-cliff regions have changed very little climatically compared with the change in the inland. The sea always levels the differences.

A similar phenomenon is met with in other species e.g. in *Campanula* *rotundifolia*, of which species types occur at Mt Kullen corresponding to those found in the province of Bohuslän and in northern regions of Scandinavia. On the cambrian cliffs close to the sea in SE Skåne, a perennial type of *Aster tripolium* grows, elsewhere in Skåne growing at only a few localities in the northwestern part. However, the situation for these species will be discussed in a future publication.

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Die Lösung des micrantha-Problems bei Fragaria vesca

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Im Jahre 1953 hat der Verfasser in einem mit mehreren photographischen Abbildungen illustrierten Aufsatz über seine Kreuzungsversuche mit einer eigentümlichen, kleinblütigen Form, *micrantha*, der *Fragaria vesca* und normalblütigen Erdbeertypen berichtet.

Die reziprok erzeugten Bastarde hatten gewöhnliche Erdbeerblüten; aber in der F_2-Generation spaltete sich nicht eine einzige Pflanze mit *micrantha*-Blüten aus. Nach Kreuzung zwischen dem *micrantha*-Typus und einer Varietät, die weisse Erdbeeren hatte, entstanden in F_2 Pflanzen, die allerdings mit weissen Rezeptakeln versehen waren, aber auch hier kamen keine *micrantha*-Exemplare zum Vorschein (Dahlgren 1953 und 1959).

Pflanzen, die von den Stolonen des *micrantha*-Typus erzeugt waren, zeigten immer die typischen *micrantha*-Merkmale (kleine Petala, die sich nicht berühren, die Blätter des Innenkelches sehr kurz und konkaviert; da die Perianthblätter so winzig sind, sind die gelben Staubbeutel und die Carpellen auch schon im Knospenstadium sichtbar). Die nach Selbstbefruchtung erzeugten Pflanzen dagegen bildeten immer normale Blüten aus. Der *micrantha*-Typus ist also konstant bei vegetativer Vermehrung; die auf sexuellem Wege erzeugten Pflanzen aber erhalten immer normale Blüten.

Um eine Erklärung dieser eigentümlichen Verhältnisse zu erhalten stellte ich die Arbeitshypothese auf: die Entwicklung der *micrantha*-Blüten könne auf der Einwirkung irgend eines Virus beruhen. Es ist bekannt, dass Virusstoffe ziemlich selten durch Infection der Embryonen übertragen werden. Auf diese Weise würde man eine Erklärung sowohl der Klonkonstanz als auch des Entstehens normaler Blüten nach Samenaussaat erhalten können. Indessen zeigten Propfungsversuche zwischen *micrantha*- und Normalpflanzen, dass eine Übertragung von *micrantha*-Merkmalen nicht zustande kam. Die Virushypothese musste also aufgegeben werden (Dahlgren 1959).

Kurz nach dem Publizieren dieses negativen Ausfalls der Pfropfungsversuche kam ich auf die Idee, dass sich die eigentümlichen Vererbungsverhältnisse des *micrantha*-Typus durch die Annahme erklären liessen, dass die Pflanze einmal durch eine somatische Mutation als eine Periklinalchimäre konstituiert sein könne. Wenn man nämlich annehmen darf, das die Entwicklung der *micrantha*-Blüten von der abweichenden Beschaffenheit der dermatogenen Zellenlage verursacht wäre, müssen natürlich auch die Klonpflanzen dieselbe Art von Blüten ausbilden. Die Sexualzellen stammen doch immer von Zellen der hypodermalen Zellenlage des Sprosscheitels ab, und wenn nun die genetische Konstitution dieser Zellenschicht „die gewöhnliche" ist, müssen offenbar die durch Samen entstandenen Pflanzen immer normale Blüten zeigen. Kollegen gegenüber und später in einem Vortrag bei einer Sitzung in der Kungl. Vetenskapssocieteten habe ich diese Möglichkeit erwähnt. Man hat nun unter den Pflanzen mehrmals spontane Periklinalchimären (auch Periklinalcytochimären) vorgefunden. Diese können zufällig einen Spross entwickeln, der von der alten Tunica befreit worden ist und also Merkmale zeigt, die von der Pflanze im übrigen abweichen. Auch die Zellen der Tunica selbst können ganz vereinzelt einen Spross entwickeln, gleichwie auch eine Inversion der Komponenten in periklinalchimärisch gebauten Pflanzen bekannt ist.

Um die Richtigkeit der Chimärentheorie endgültig beweisen zu können hat der Verfasser Anfang Juni 1960 eine Anzahl junger in Töpfen aufgezogener Rosettenpflanzen des *micrantha*-Typus auf das Versuchsfeld ausgesetzt, wo sie sich dann ungehindert durch Ausläufer propagieren konnten. Bei einer derartigen Massenvermehrung wäre nämlich möglicherweise zu erwarten, dass einmal ein Durchbruch zustande käme, so dass eine Pflanze, befreit von der ursprünglichen Tunica, und folglich mit normalen Erdbeerblüten entstehen würde. Unter gütiger Mitwirkung des Herrn Privatdozenten Dr. B. Kihlman wurden auch ein Dutzend junge Rosettenpflanzen vor dem Auspflanzen mit variierenden Röntgendosen von 500—2000 r bestrahlt. Auf diese Weise könnte man vielleicht einige dermatogene Zellen im Vegetationspunkt abtöten, um dadurch einen Durchbruch der zweitäussersten oder einer tieferen Schicht zu erleichtern. Sämtliche bestrahlten

Fig. 1. Von *Fragaria vesca* f. *micrantha* wurden im Frühjahr 1960 40 junge, in Töpfen kultivierte Rosettenpflanzen auf das Versuchsfeld ausgepflanzt. Mehrere derselben waren vorher röntgenbestrahlt worden. Im folgenden Jahr waren durch die Ausläufer Tausende von jungen Pflanzen entstanden. Unter diesen wurde 12/6 1962 ein einziges Individuum bemerkt, das gewöhnliche Erdbeerblüten hervorgebracht hatte. Dieses wurde unmittelbar photographiert und ist hier zusammen mit ihren *micrantha*-Nachbaren zu sehen. — Plants of *Fragaria vesca* f. *micrantha* with a normal individual that has arisen after x-ray irradiation. — Å. Danielsson photo.

Exemplare überlebten, wenn auch diejenigen, die 2000 r bekommen hatten, anfangs entwicklungsmässig etwas zurückblieben.

Im nächsten Jahr, 1961, habe ich vor meiner Abreise von der Stadt alle Erdbeerpflanzen, die zum Blühen gekommen waren, untersucht. Sämtliche 212 waren vom *micrantha*-Typus. Infolge der grossen Regenmenge des Sommers und des darauffolgenden schönen und warmen Herbstes wurde die vegetative Vermehrung so kräftig, dass das ganze Versuchsfeld, 40×1 m, schliesslich an einen grünen Teppich, auf den umgebenden nackten Erdboden gelegt, erinnerte.

Als ich das Versuchsfeld im folgenden Jahr 1962 am 12. Juni besuchte, fand ich wirklich under den nun Tausenden von blühenden *micrantha*-Pflanzen ein einziges Individuum, das normale Blumenblätter — zum Teil ein wenig gesägt — sowie auch ganz typische

Kelchblätter hatte. Die Pflanze stammte von einem der mit 2000 r bestrahlten Ursprungsexemplaren, eine Tatsache die jedenfalls nicht beweist, dass gerade die Röntgenbestrahlung diesen Effekt bewirkt hatte. Allerdings ist nur eine einzige Normalpflanze entstanden, aber *semel est satis*, ein Mal ist genügend, und damit ist wohl die Richtigkeit der Chimärentheorie endgültig festgestellt.

Summary

The Solving of the micrantha-Problem of Fragaria vesca

In 1927 a peculiar *micrantha*-variety of *Fragaria vesca* was detected at Fjällnäs in the province Härjedalen, in the alpine region of central Sweden, by Dr O. Östergren, professor in linguistics. The plant has been cultivated in the botanical garden of Uppsala.

The petals are small, not being in contact with each other. The sepals also are short and bending in a characteristic manner (but the epicalyx segments are of a more ordinary nature). Consequently already in relativ young flower-buds the yellow anthers and the carpels are visible.

After crossing with normal strawberry plants the F_1-individuals are normal, and in F_2 *micrantha*-plants are not at all segregated. Crossings of the *micantha*-type with a variety having white receptacles gave a "redfruited" F_1-generation, and in F_2 segregation of red and white strawberries but no one with *micrantha*-flowers. Also selfpollination of *micrantha* results only in normal strawberry flowers, in sharp contrast to the plants originating from the stolons. Vegetative propagation consequently results in nothing but *micrantha*-plants; but the *micrantha*-characteristics are omitted totally after sexual reproduction.

To explain these curious matters of fact I suggested as a working-hypothesis, that the *micrantha*-characteristics may be dependent of the influence of a virus. Such contagions often are not transmitted by sexual reproduction. Grafts were made between the stolons of *micrantha* and those from normal strawberries. These combinations, however, never result in a transmission of the *micrantha*-characteristics. The virus-hypothesis consequently was to be abandoned.

I understand, however, that the peculiar conditions of the *micrantha*-type could be entirely elucidated by the hypothesis that the plant in question may be a periclinal chimera. By assumption that the dermatogen is of such a quality, that its derivatives cause the development of the *micrantha*-characteristics, but that the hypodermal cells are of a "normal" constitution, all the vegetatively produced individuals must be of the *micrantha*-type; but the sexually reproduced ones must obtain normal flowers, since the gametes ultimately have their origin from the hypodermal cell layer.

It might be supposed that by X-rays some tunica cells in the shoot apices could be destroyed, so that the corpus cells could be uncovered and prolapse in a shoot developing normal flowers. In 1960 a number of young *micrantha*-plants, cultivated in pots, were irradiated with various doses of X-rays (500

—2,000 r), and later these and also untreated individuals were transplanted to a long bed for stolon-propagation.

Next year, before my depart from Uppsala in medio June, 212 individuals were already in anthesis, and all flowers were of the *micrantha*-type. The humid summer followed by a mild and sunny autumn procured an immense number of runner-plants, so that the long experimental field resembled a green rug. At June 12th, 1962, among thousands of *micrantha*-plants one specimen with normal strawberry flowers was observed. This derivated from one individual, that had obtained a dosis of 2,000 r, but it is naturally impossible to say that the irradiation has caused its appearance. *Semel est satis*: by the origin of a single specimen with the normal flowers the rightness of the chimera-theory is demonstrated.

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BOTANISKA NOTISER 1962 · VOL. 115 · FASC. 3 · LUND

A Taxonomical Study of the Species Luzula spicata (L.)DC. sensu lato in Europe

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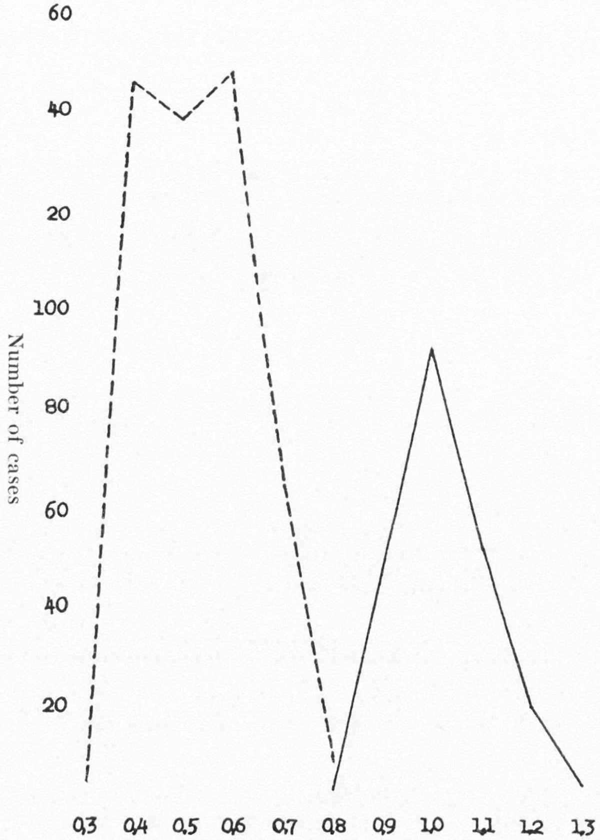
Introduction

Taxonomic and florogenetic problems regarding the development of the central-European high-montane flora have induced us to carry out a thorough analysis of the seemingly simple complex of the species *Luzula spicata* (L.) DC. The investigation of herbarium material has revealed the fact that the taxonomy of the mentioned species is not quite coherent and does not conform with its living, natural state.

By comparing the plants from the various European mountain ranges we have found that the collective species *Luzula spicata* forms two independent species — *Luzula spicata* (L.) DC. s. str. and *Luzula bulgarica* sp. n., which are very well differentiated phytogeographically. *Luzula spicata* grows in the mountain ranges of the whole of Europe with the exception of the Balkan peninsula, where it is represented by the species *Luzula bulgarica*.

The mentioned species differ from each other by the length of the anthers and by the relation of the size of the filaments to the anther. Within the scope of their area *L. spicata* and *L. bulgarica* are subdivided into units that may be differentiated morphologically, phytogeographically, and partially also cytologically.

We divide *L. spicata* into two independent subspecies — ssp. *spicata* (Scandinavia, Iceland, the northern part of Great Britain, the Giant Mountains, the Alps, and the Massif Central of France), and ssp. *mutabilis* ssp. n. (the Carpathians, the Alps, the Pyrenees, the Apennines, and the mountains of the Iberian peninsula). The species *L. bulgarica* is divided into ssp. *bulgarica* (Bulgaria, SE Jugoslavia, the Albania-Jugoslav border regions, the Greece-Bulgarian border land,



Length in mm.

Fig. 1. Graphical illustration of the length of anthers of the species *Luzula spicata* s. str. (- - - - -), and *L. bulgarica* (———).

and Turkey), and ssp. *pindica* (Greece, SE Jugoslavia, and the Albania-Jugoslav border land).

Material

For our studies we used the herbarium material of the Department of Botany of the Faculty of Natural sciences of the Charles University (PRC), of the Botanical Department of the National Museum in Prague (PR), and of the Botanical Museum of the University Lund (LD). We performed the phytometrical measuring of the capsules and seeds by means of the Brinela lens. Of the various specimens an average of 10 values of the capsule segments and ripe seeds were measured.

Special part

In the course of the study of the Czechoslovak herbarium material of the species *Luzula spicata* we found certain differences between plants from the Giant Mountains (Krkonoše) and those from the Carpathians. As these differences were rather outstanding, we set out to subject material from other European territories to a comparative study. Our further work fully confirmed the existence of these differences.

The genus *Luzula* is divided into three independent subgenera: *Pterodes* (Griseb.) Buch., *Anthelaea* (Griseb.) Buch., and *Gymnodes* (Griseb.) Buch. The species *Luzula spicata* belongs to the subgenus *Gymnodes*. To the intrageneric arrangement further attention will have to be paid.

In the contemporary literature *Luzula spicata* has hitherto been considered a homogenous species. The variability of Alpine plants was noted above all by Mielichhofer (1839), who was interested particularly in types with a glomerular inflorescence. He described these deviations as the independent species *L. glomerata*. Further various deviations have been described, which, however, do not exceed the scope of the variety. In the descriptions of these deviations stress was laid expecially on the look of the plants and on the character of the inflorescence (glomerular, lobate inflorescence) and inflorescences with few or with many flowers. The majority of the described deviations referred to Alpine and Carpathian plants, whereas from Scandinavia and from the Giant Mountains very few lower taxa have been described. This fact conforms also with the actual state found in nature.

On the basis of the analysis of the herbarium material from the morphological point of view, we have found that in Europe *L. spicata* comprises two well defined species, i.e. *L. spicata* and *L. bulgarica*.

In Europe *L. spicata* s. str. forms two phytogeographically defined subspecies: ssp. *spicata*, and ssp. *mutabilis*. As the main distinguishing marks of both subspecies we consider the size of the capsules (i.e. of the capsular segments) and of the seeds (cf. Fig. 2 and 3). Besides this they also differ less conspicuously by the length of the anthers.

We have seen two specimens from the High Atlas mountain range of Marocco, which show a remarkably low growth of from 4 to 5 cm, firm

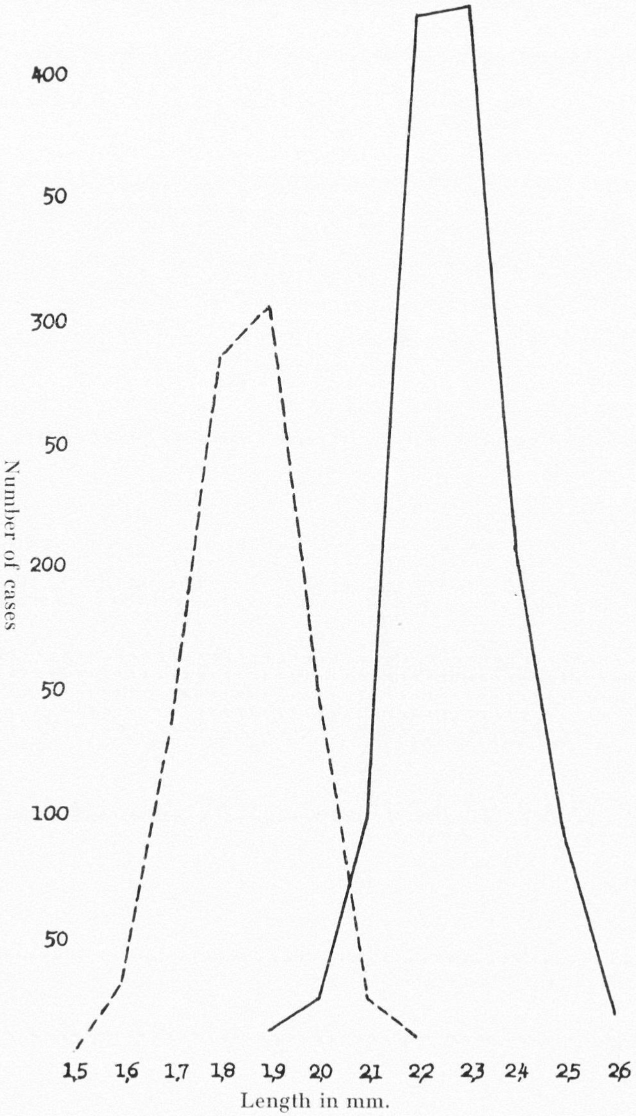


Fig. 2. Graphical illustration of the size of capsules (capsule segments) of the taxa *Luzula spicata* ssp. *mutabilis* (- - - - -), and *L. spicata* ssp. *spicata* (———).

short leaves, and a glomerular inflorescence. The possibility cannot be excluded that we have to do here with an independent taxon, which, for the time being, we do not describe because of lack of material.

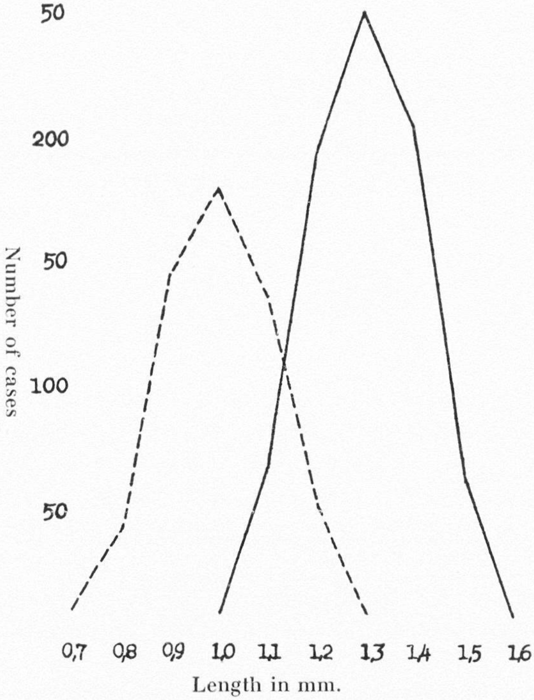


Fig. 3. Graphical illustration of the size of seeds of the taxa *Luzula spicata* ssp. *mutabilis* (- - - - -), and *L. spicata* ssp. *spicata* (———).

Plants similar as regards their appearance grow also in the Sierra Nevada range in Spain, where, however, also the typical *L. spicata* ssp. *mutabilis* grows.

We have not been able to evaluate critically plants from the Caucasus, as we had only a few flowering plants at our disposal and did not ascertain the size of the capsules and of the seeds, i.e. of marks that we consider as diacritical for the differentiation of both subspecies. Plants from Greenland come near the Carpatho-Alpine complex as regards the size of the capsules. The case is similar in North America require further taxonomic elaboration.

The chromosomal conditions of the species *L. spicata* and of other species of the subgenus *Gymnodes* were investigated by Nordenskiöld (1951). She performed cytological analyses of the plant material from the territories of North America, Greenland, and Europe. For the species *L. spicata* s.l. from Europe she mentions three chromosome races according to the chromosome numbers (12, 14, and 24). From Sweden (from 7 different localities) she mentions the number 2n=24 with a uniform chromosome type. From the Alps she mentions all three races. The somatic number 2n=24 was ascertained in plants coming from the Tyrol (from two localities), from material obtained in Steiermark (from 4 localities) she mentions 2n=14 chromosomes, and from the region of the High Tauern (Gross Glockner) 2n=12 chromosomes. The chromosome races with the numbers 12 and 24 have a uniform type of chromosomes. Chromosomes distinctly diminish in size with an ascending somatic number. The remaining third race with the number 2n=14 has two types of chromosomes. 10 chromosomes of the total set correspond to the chromosomes of the race with the number 12, and the 4 remaining chromosomes correspond to the race with the number 24. According to the author the third race is a sign of the aneuploid chromosome number, which here represents a special type of polyploidy having relations to endonuclear polyploidy.

Similar problems in the territory of the Carpathians were investigated by Michalska (1953), who found a chromosome number of 2n=12 in plants from the Tatra Mountains.

Clapham, Tutin et Warburg (1952, 1958) mention a chromosome number of 2n=24 in *L. spicata* from Great Britain; the same number was found by Chassagne (1956) in the Massif Central, and by Löve et Löve (1956) in Iceland.

The existence of chromosomal races has been confirmed also by our phytometric measuring. Plants having a chromosome number of 2n=24 (Scandinavia, the Massif Central, the Alps, and probably also the Giant Mountains) achieve the highest growth and the largest size of the capsules and seeds. Plants with a chromosome number of 2n=12 (the Carpathians, the Alps, and probably also the Pyrenees and the mountain ranges of the Iberian peninsula) show a lower growth and smaller capsules and seeds. Besides these two well defined types we found when studying the herbarium material from the Alps that there occur individuals which, as regards their habitus, resemble the chromosome race 2n=24. However, with regard to the size of their capsules and seeds they do not differ from the 2n=12 chromosomal race. We assume that these types represent the aneuploid race 2n=14. In our further taxonomic study we classify these types with the 2n=12 chromosomal race.

In the mountain ranges of the Balkan peninsula and of Asia Minor the *L. spicata* complex is represented by the species *L. bulgarica* sp. n., which differs from *L. spicata* above all by its long anthers (see Fig. 1) and by their relation to the filaments. We divide this species into two subspecies, which differ from each other by their growth, by their leaves, by the size of the capsules, by the shape of the single capsular segments, and by their distribution. The chromosomal conditions of this species has not yet been investigated by anybody. However, the size of the anthers, capsules, and of the seeds indicate that they are obviously polyploid types.

In Europe all the mentioned taxa are typical representatives of the high mountain flora. They grow on rocks, moraines, and on similar habitats from the sub-Alpine up to the nival zone most frequently in associations with Juncion trifidi and Nardo-caricion. In the subarctice region of Europe they descend to lower altitudes (tundras).

To provide a more comprehensible survey we have added a concise key for the determination of the European taxa from the range of the *L. spicata* complex.

1 a Anthers (0,3) 0,4—0,7 (0,8) mm long of ± equal length as filaments; capsules (1.5) 1.7—2,5 (2,6) mm long; seeds (0,7) 0,8—1,5 (1,6) mm long *L. spicata* (L.) DC. s. str. 2

1 b Anthers (0,8) 0,9—1,2 (1,3) mm long, mostly longer than filaments; capsules (2.2) 2.3—2,9 (3,1) mm long; seeds (1,2) 1,4—1,7 (2,0) mm long. *L. bulgarica* sp. n. 3

2 a Plants mostly tall (15—25) cm; capsules (1,9) 2,1—2,5 (2,6) mm long: seeds (1,0) 1.1—1,5 (1,6) mm long .... ssp. *spicata*

2 b Plants mostly low (7—15) cm; capsules (1,5) 1,7—2,0 (2,2) mm long; seeds (0,7) 0,8—1,2 (1,3) mm long .... ssp. *mutabilis* ssp. n.

3 a Stem leaves narrow, often convolute, erect standing off from stem; capsules (2.2) 2,3—2,6 (2,8) mm long; single capsule segments frequently ellipsoid; seeds (1.2) 1,3—1,4 (1,5) mm long .... ssp. *bulgarica*

3 b Stem leaves broad, flat, standing off from stem ± perpendicularly; capsules (2,4) 2.5—2,9 (3,1) mm, single capsule segments frequently ovoid; seeds (1.4) 1.5—1,7 (2,0) mm long .... ssp. *pindica* (Hausskn.) comb. n.

In the following part we evaluate the various taxa from the range of the above mentioned species.

Luzula spicata (L.) DC. s. str.

De Candolle in Lamarck et De Candolle, Fl. France, 3: 161, 1805.
Juncus spicatus Linné, Spec. pl., 330, 1753.

Plantae perennes, caespitosae, rhizoma breve, basi vaginis emortuis fuscis dense obtectum. Caules erecti superne plerumque attenuati, (5) 7—25 (45) cm alti. Folia innovationum linearia 1,2—3 (4) mm lata, plana usque canaliculata, glabra vel sparse longe ciliata. Folia caulina ± regulariter disposita (2—5) cum vaginis basi glabra vel dense longe ciliata. Inflorescentia circumscriptione simplex vel lobata, (1) 1,5—3,5 (4) cm longa, subnutans; bractea infima inflorescentiae ± aequilonga, bracteae florales aequilongae vel paulo longiores. Tepala lanceolata, aristato-mucronata, saepissime (2,0) 2,5—3,0 mm longa, medio castaneam apicem versus membranacea, antherae (0,3) 0,4—0,7 (0,8) mm longae, filamentis ± aequilongae. Fructus trigono-sphaerici, brevissime mucronati, (1,5) 1,7—2,5 (2,6) mm longi, fusci, vel obscuro-fusci usque nigri, semina (0,7) 0,8—1,5 (1,6) mm longa, fusca, breviter carunculata.

L. spicata subsp. *spicata*

Exsiccata: G. Samuelsson: Plantae Suecicae exsiccatae. Edidit E. Hultén. No 500.
C. Baenitz, Herbarium Europaeum, no 2702 (Flora Norvegica).
Flora selecta exsiccata par Ch. Magnier, no 988 (Puy-de-Dôme).
Tausch: Agrostotheca Bohemica, copia no 262.

Icones: Polívka: Názorná květena zemí koruny české, 4: 385, fig. 522, 1902.
Lagerberg T. et Holmboe J.: Våre ville planter, 1, foto 130, 1937.
Flora Murmanskoj oblasti, 2, tab. 61, 1954.

Plantae saepissime 15—25 cm altae, robustae, inflorescentia multiflora, circumscriptione lobata. Antherae (0,4) 0,5—0,7 (0,8) mm longae, fructus (1,9) 2,1—2,5 (2,6) mm longi, fusci, obscuro-fusci usque nigri; semina (1,0) 1,1—1,5 (1,6) mm longa, fusca.

This subspecies was described first by Linné (1753) from Lapland as *Juncus spicatus,* and therefore we consider this subspecies as nominative.

Through the study of herbarium material from European territories we have come to the following conclusions: the nominative subspecies of the species *L. spicata* shows a comparatively small variability. In the growth and in the shape we find certain deviations, which are probably the results of an individual variability. For this reason we do not evaluate the above mentioned deviations. Similarly also with regard to the size of the capsules we have not found any substantial differences between the individual population, which are frequently separated from one another by considerable distances. The attached table contains as an example the values obtained from herbarium material of populations from the Giant Mountains and from Scandinavia.

The size of the capsules (of the capsule segments).

mm	1,8	1,9	2,0	2,1	2,2	2,3	2,4	2,5	2,6	2.7	S
Giant Mt. (Krkonoše)	—	9	18	66	290	162	77	59	19	—	700
Scandinavia	—	3	7	32	133	264	128	32	—	—	599

The size of seeds.

mm	0,9	1,0	1,1	1,2	1,3	1,4	1,5	1,6	1,7	S
Giant Mt. (Krkonoše)	—	9	62	146	84	42	21	3	—	367
Scandinavia	—	—	5	48	166	161	42	2	—	424

From the attached tables it can be seen that the extent of the variability of both marks in the individual populations ranges approximately within the same limits and differs only by their maximum peaks. From the numerical values it appears that the plants from the Giant Mountains have somewhat shorter seeds and capsules than have the Scandinavian plants.

Because of insufficient material we could not carry out an analysis of the populations from the region of the Massif Central, from the Alps, and from Scotland. However, the values obtained from the small number of specimens from the mentioned regions did not exceed the scope of the variability of the subspecies. The morphological uniformity is supported also by the chromosomal uniformity. In all cases a chromosome number of 2n=24 was found.

Distribution: The most coherent occurrence of the subspecies is in northern Europe, where it grows in the montane regions of Scandinavia, further in northern Finland, on the Kola peninsula, and in the arctic regions of the European part of the Soviet Union it extends to the mountains of the northern Urals. Besides this it is spreading to the montane regions of Great Britain (the Snowdon range, the Lake district), Scotland, and to the adjoining islands (Hebrides, Shetlands), and also to Iceland. In central Europe it forms insular areas (the Giant Mountains, the Tyrol). In the Alps this subspecies is likely to be spread much more than we have been assuming hitherto. In western Europe it grows in the ranges of the Massif Central in France (Puy de Dôme, Ardeche, Cevennes).

For the illustration of the total area of this subspecies (and similarly of further subspecies) we have used, to a great extent, the maps published already by Hultén (1958). As regards the species *L. spicata* (i.e. both of its subspecies) we have not worked out a list of the ascertained specimens, as this list would be too extensive.

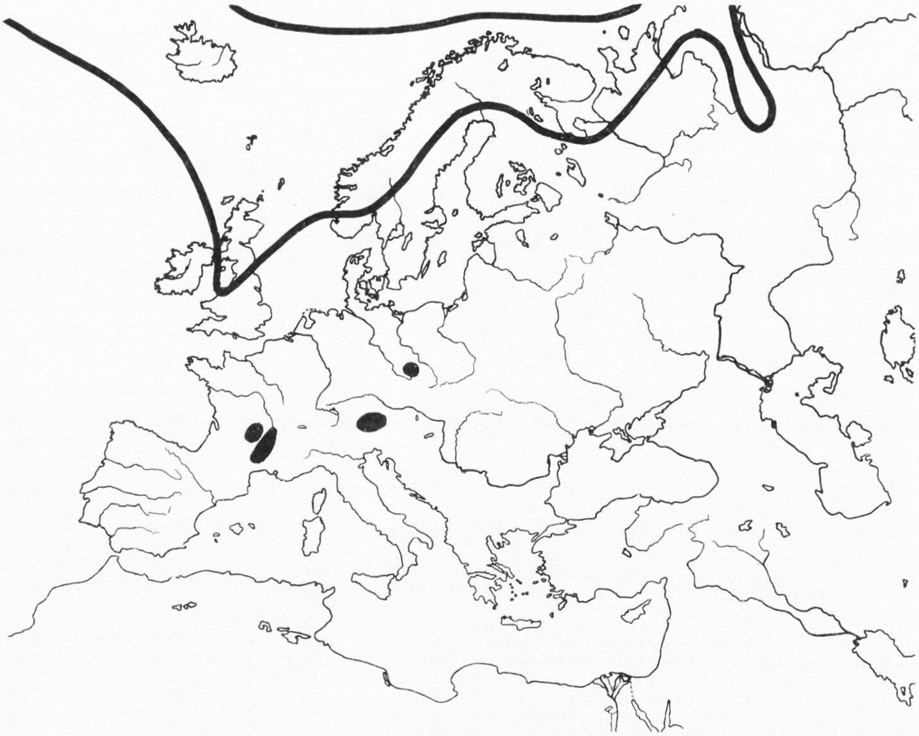


Fig. 4. The distribution of the species *Luzula spicata* ssp. *spicata* in Europe.

L. spicata subsp. ***mutabilis***, subsp. nova

Synonyma: *L. spicata* β *compacta* E. Meyer, Synops. Luzulorum, 19, 1823.
L. compacta (E. Meyer) Dalla Torre et Sarnthein, Farn und Blütenpfl. Tirol . . . 6., 437, 1906.
L. glomerata Mielichhofer, in Sched. t. Hoppe in Flora, 22: 489, 1839.
L. spicata β *conglomerata* Koch, Synop. ed. 2: 848, 1844.

Exsiccata: Cyperaceae, Juncaceae, Typhaceae et Sparganiaceae Hungaricae exsiccatae, no 170 (Vysoké Tatry).
K. Domin et V. Krajina: Flora Čechoslovenica exsiccata, no 337, (Vysoké Tatry).
Rośliny polskie (Plantae Poloniae exsiccatae), no 84 (Vysoké Tatry).
Flora Romaniae exsiccata Cluj, no 934 (Rodnen Mt.)
Flora exsiccata Austro-Hungarica, no 3914 (Tyrol).
A. Kneucker: Cyperaceae (exclus. Carices) et Juncaceae exsiccatae, no. 180 (Wallis).
F. Schultz, herbarium normale, nov. ser. Cent. 15, no 1483 (Tyrol).
C. Baenitz, Herbarium Europaeum (Tyrol).

Icones: Reichenbach Icones Fl. germ. et helv., 9, tab. 379, no 845, (β *glomerata*), 1847.

Hegi, Ill. Fl. v. Mitteleurop., 2, fig. 308, p. 182, 1909.
Kulczyński, Atlas Fl. Polskiej, 2/2, tab. 146, 1931.

Plantae saepissime 7—15 cm altae ± robustae, inflorescentia multiflora usque satis pauciflora circumscriptione, simplex vel lobata. Antherae (0,3) 0,4—0,6 mm longae, fructus (1,5) 1,7—2,0 (2,2) mm longi, fusci, obscuro-fusci usque nigri, semina (0,7) 0,8—1,2 (1,3) mm longa, fusca.

Typus: K. Domin et V. Krajina: Flora Čechoslovenica exsiccata. No 337. Slovakia septentrionalis: montes Vysoké Tatry, in monte Furkotský štít, altitudine 2400 m s. m., solo granitico, 21.8.1933, leg. V. Krajina. In herbario botanicae cathedrae Universitatis Carolinae Pragensis, Praga, conservatur.

The plants are variable particularly with regard to their growth and to the structure of the inflorescence. Most frequent are plants with a lower growth and with a more delicate structure than is the case with the preceding subspecies. Unlike in ssp. *spicata* the inflorescence may be glomerular or lobate. The variability of the structure of the inflorescence is rather considerable in ssp. *mutabilis*. On the basis of this mark two basic varieties are distinguished (var. *laxa* and var. *compacta*). As a typical variety of the subspecies *mutabilis* we consider types with glomerular inflorescences described hitherto as var. *compacta* (E. Meyer). This type of inflorescence has not been found in ssp. *spicata*. This fact was pointed out by Mielichhofer (1839), who describes the species *L. glomerata* just on the basis of the structure of the inflorescence. Simultaneously he also mentions the marks distinguishing it from the species *L. spicata,* and he compares the Alpine plants with those from Scandinavia (on the basis of Wahlenberg's work Flora Lapponica, 1812).

Both varieties, var. *mutabilis* with a glomerular inflorescence and var. *laxa* (Hoppe) with a lobate inflorescence, mutually overlap within the scope of their areas.

Similarly as in the case of the preceding subspecies we find smaller differences in the size of the capsules and of the seeds between more distant populations (in this case between Alpine and Carpathian populations). These differences are contained in the following table.

The size of the capsules (of the capsule segments).

mm	1,4	1,5	1,6	1,7	1,8	1,9	2,0	2,1	2,2	2,3	S
Alps	—	3	25	90	153	118	53	8	—	—	450
Carpathians	—	—	7	46	129	187	97	18	10	—	494

The size of seeds.

mm	0,6	0,7	0,8	0,9	1,0	1,1	1,2	1,3	1,4	S
Alps	—	10	42	118	91	23	13	4	—	301
Carpathians	—	—	—	27	88	113	38	3	—	269

In both cases it can be seen that the maxima of the Carpathian plants are shifted towards higher values.

Distribution: *L. spicata* ssp. *mutabilis* is spread in the Carpathians, in the Alps, in the Jura Mountains, in the Pyrenees, and in the mountains of the Iberian peninsula. In the northern Carpathians L. mutabilis grows in the Vysoké Tatry (Liptovské Hole, Vysoké Tatry and Belanské Tatry) and in the massif of the Černa gora in east Carpathians. In the central and in the southern parts of the Carpathians it is spread in the montane regions of Coziea, Buceci, Papusea, Fagarasul, Rodnen Mt., Retezat etc. — in Roumania.

In the Alps it grows dispersedly from the sub-Alpine to the nival zone where, as in other mountain ranges, it is a component of high-montane associations. From the Alps it reaches to the north probably to the Swiss Jura (Dôle), and to the south its spreading continues along the Apennines down to northern Calabria. On the Iberian peninsula it is spread, besides in the Pyrenees, also in the ranges of Sierra Gredos, Sierra Nevada, and Sierra Moncayo, and in the mountains of NW Spain.

Besides in these areas *L. spicata* s.l. is spread also in Corsica, Sardinia, and in the Caucasus. At present we have no clear picture of the value of these types, as from the mentioned regiones we have seen either no material at all or very little.

Luzula bulgarica species nova

Syn.: *Luzula spicata* auct. fl. balcan.

Plantae perennes, caespitosae, rhizoma breve, basi vaginis emortuis fuscis dense obtectum. Caules erecti, superne plerumque attenuati (9) 15—30 (45) cm alti. Folia innovatiorum linnearia, 1—4 mm lata, plana usque canaliculata, glabra vel sparse longe ciliata. Folia caulina ± regulariter disposita (3—5) cum vaginis basi glabra vel dense longe ciliata. Inflorescentia circumscriptione simplex vel lobata, 1—4 cm longa, subnutans; bractea infima inflorescentia brevior (ad 1/2 inflorescentiae), bracteae florales aequilongae vel paulo longiores, ciliatae.

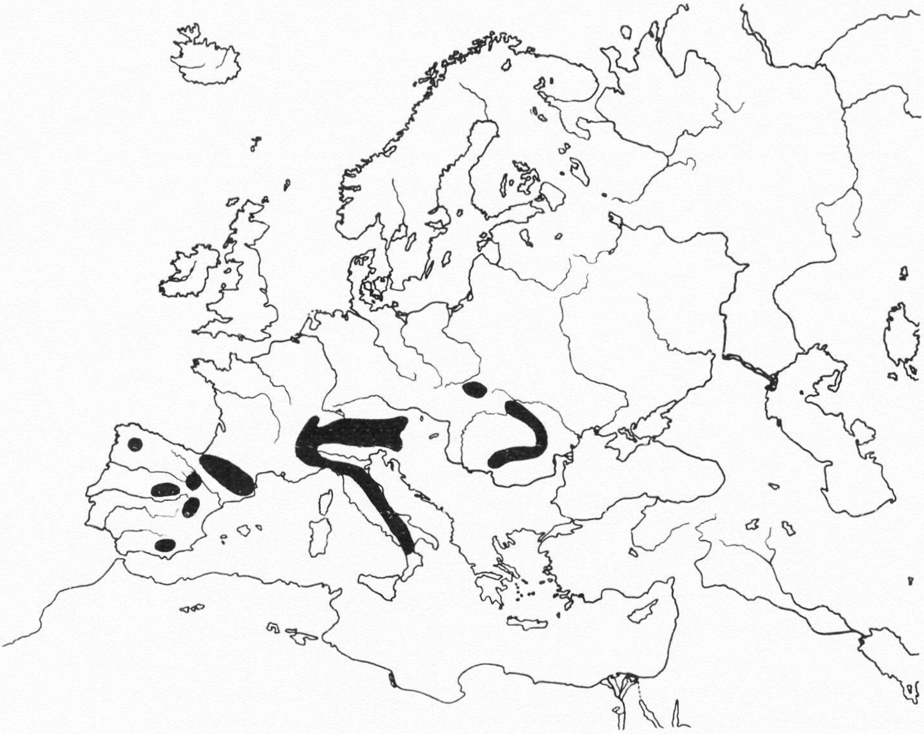


Fig. 5. The distribution of the species *Luzula spicata* ssp. *mutabilis* in Europe.

Tepala lanceolata, aristato-mucronata, saepissime ± 3,5 mm longa, medio castanea, apicem versus membranacea. Antherae (0,8) 0,9—1,2 (1,3) mm longae, filamentis aequilongae vel longiores. Fructus trigono-sphaerici, brevissime mucronati (2,2) 2,3—2,9 (3,1) mm longi, flavo-fusci vel obscuro-fusci usque nigri; semina (1,2) 1,3—1,7 (2,0) mm longa, fusca, breviter carunculata.

Typus: Bulgaria occid.: Rila planina-Edigeol: in saxosis graniticis supra lacum 2350 m s. m., 1.8.1923, leg. F. A. Novák; in herbario botanicae cathedrae Universitatis Carolinae Pragensis, Praga, conservatur.

As we have already mentioned, we divide this species into two independent subspecies. As the nominative subspecies (ssp. *bulgarica*) we consider plants with linear leaves of the ground shoots, very frequently markedly convolute, with narrow stem leaves, ± erect, and with capsules most frequently 2,3—2,6 mm long.

As ssp. *pindica* (Hausskn.) c.n. we denote plants with linear leaves of the ground shoots, but with shorter, flat leaves and ± standing off from the stem. Haussknecht (1899) first described this taxon at a varietal value. As is shown by his description: *Luzula spicata* (L.) DC. β *pindica* m. robusta, caules typo crassiores longiores, pedales v. sesquipedales, folia brevia lata plana, ea rosularum sterilium multo angustiora canaliculata, inflorescentia ob flores in omnibus partibus fere duplo majores typo multo compactior crassior, fructus perigonium superans, semina fere duplo majora, 2: $^1/_4$ mm, in typo 1—1 $^1/_4$: $^3/_4$ mm longis latis; . . . ., he included in his taxon only robust plants with broad, flat leaves. He did not consider the other Balkan plants belonging to the species *L. spicata* as identical with his new taxon, even if the length of the anthers was more or less the same.

Besides Haussknecht's intraspecific taxon β *pindica* no other taxon was described from the Balkan peninsula which, with its marks, would express the difference between the Balkan types and plants growing outside this region. Authors that had studied the Balkan flora or the flora of Asia Minor denoted all their collections unanimously as *L. spicata*. As an example we mention Adamovič (1911), Boissier (1884), Hayek (1933), Pančič (1874) Stojanov et Stefanov (1948), Urumov (1930), and Velenovský 1891.

L. bulgarica subsp. *bulgarica*

Folia innovatiorum lineata, canaliculata vel subcanaliculata, folia caulina ± erecta; fructus obscuro-fusci, pallido-fusci usque nigri, (2,2) 2,3—2,6 (2,8) mm longi, segmenta fructus elliptica; semina fusca, (1,2) 1,3—1,4 (1,5) mm longa, breviter carunculata. Typus vide *Luzula bulgarica*.

The investigation of herbarium material has shown that the subspecies *bulgarica* is spread above all in Bulgaria (Stara planina, the High Balkan, Vitosha, Rodopi etc.). Besides these localities we have found it in the mountains of south-eastern Jugoslavia and near the Albania-Jugoslav border region. Similarly it occurs also in the Bulgaria-Greece border land. Outside Europe *L. bulgarica* grows in the adjoining Asia Minor (the mountains in the vicinity of the former Troy, Paphlagonia). It is very likely to grow also in the Taurus massif.

Plants of a similar look are formed by the taxonomically closest species *L. spicata* in the Carpathians (the Carpathian Ukraine, and in the central and southern Carpathians). Analysis of the morphological marks (length of anthers, relation of anthers to filaments, size of capsules and seeds) has shown that they are types belonging to the

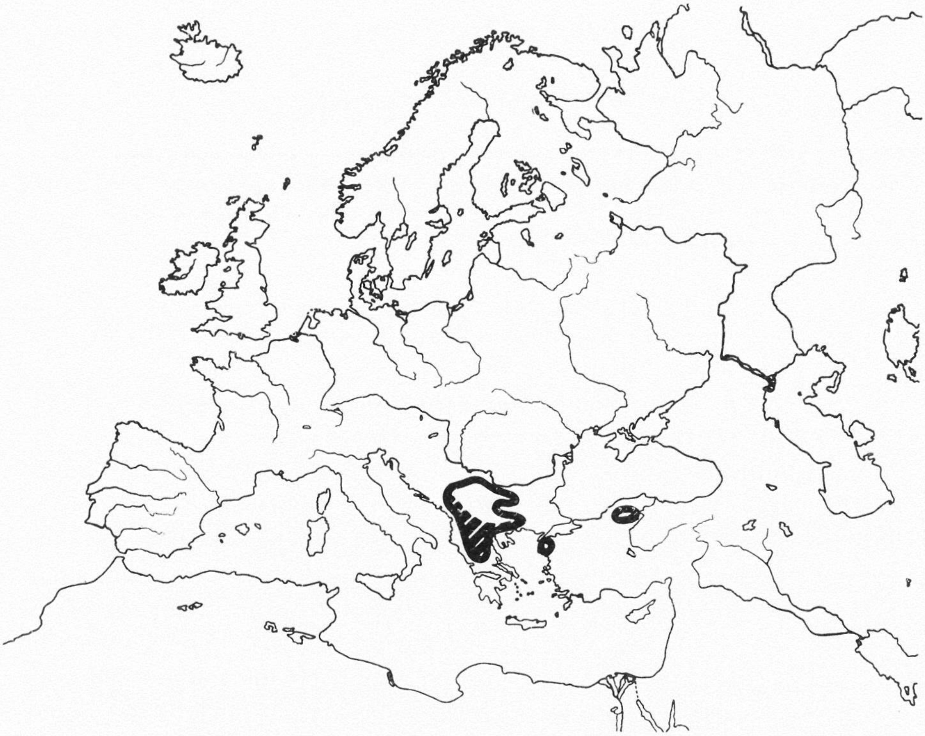


Fig. 6. The distribution of the species *Luzula bulgarica* in Europe and in Asia Minor. *Luzula bulgarica* ssp. *pindica* is in map shaded indicated.

plants of the species *L. spicata* s. str. Types similar in appearance are found also in the Alps and in the Pyrenees. Also in this case we have to do with types of the species *L. spicata* s. str.

Specimina visa:

Bulgaria:

Stara planina: in saxosis m. Vražuja Glava, VII., 1894, leg. Adamovič, (PRC); in graminosis alpinis m. Com, VII., 1877, leg. J. Velenovský, (PRC).

High Balkan: po najvisokich vrch na Jumruk Čal-Rachmalarska planina, sine dato, leg. Bajev (PRC); po visokit trvenisti msta na Jumruk Čal v Rachmalarska planina, sine dato leg. Bajev (PRC).

Vitosha: in saxosis m. Vitoš, VII., 1887, leg. J. Velenovský, (PR).

Rila planina: in saxosis excelsis m. Rilo, VII., 1889, leg. Velenovský, (PRC); Edigeol, in saxosis graniticis supra lacum, 2350 m s. m., 1.8.1923, leg. F. A. Novák, (PRC).

Rodopi: in rupibus graniticis ad declivia septentr. montis Mus Alla, 2850 m s. m., 19.8.1936, leg. J. Dostál, (PRC); Musalla, VII., 1908, leg. Vandas, (PR); Musallah prope Čamkoria, reg. alp., 24—26.7.1930, alt. ca 2300—2700, leg. K. H. Rechinger fil., (LD).

Jugoslavia:

Monte Negro: in m. Maglić, VIII., 1905, leg. J. Rohlena, (PRC).

Asia Minor: P. Sintenis-Iter trojanum, no 965, M. Ida in jugo, 12.6.1883, (LD); P. Sintenis-Iter orientale, no 3929, Paphlagonia, Wilajet Kastambuli, Pitsshim ad Mt. Ilkazdagh, 28.5.1892, (LD).

L. bulgarica subsp. *pindica* (Hausskn.) comb. n.

Bas.: *Luzula spicata* β *pindica* Haussknecht in Mitteil. Thür. Bot. Verein 13—14: 33, Weimar, 1899.

Syn.: *Luzula spicata* var. *pindica* (Hausskn.) Buchenau in Pflanzenreich IV/36: 74, 1906.

Folia innovatiorum lineata, plana vel subcanaliculata, folia caulina brevia, plana, lata, a caule distantia; fructus saepissime flavo-fusci vel obscuro-fusci, (2,4) 2,5—2,9 (3,1) mm longi; segmenta fructus ovoidea; semina fusca, (1,4) 1,5—1,7 (2,0) mm longa, breviter carunculata.

Haussknecht describes this taxon from the Zygos mountain of the Pindos range. The study of the herbarium material has shown that this subspecies is more frequent in the regions of the Balkan peninsula than has been mentioned up to now. It grows not only in the Pindos mountain range, but also in Macedonia, and it is spread sporadically in the mountains along the Albania-Jugoslav border up to Monte Negro. In the East it is spread to Thessalia.

Together with the mentioned two subspecies of the species *L. bulgarica* also types grow on the Balkan peninsula that can not be evaluted and reliably ascribed to the various subspecies without any study of the terrain. Between both subspecies there are individuals with transitory marks.

Specimina visa:

Jugoslavia:

Monte Negro: Javorje planina, VII., 1903, leg. J. Rohlena (PRC); Štavna pod Komem, VII., 1903, leg. J. Rohlena, (PRC); in graminosis montis Kom, ca 2000 m s. m., 1903, leg. Rohlena, (PR), (LD); in decl. saxosis m. Ljubonička Štavnjica, 1880 m s. m., 1914, leg. Vandas, (PR).

Macedonia: Pepelad (supra lacus), ca 2000 m s. m., 11.8.1922, leg. Vandas, (PR); Veverska planina, VIII., 1898, leg. Formánek, (PR); Peristeri, VIII., 1898, leg. Formánek, (PR); in Scardo supra Štrba, ca 2100 m s. m., 18.9.1922, leg. Vandas, (PR); in cacum. m. Ljuboten. 2500 m s. m., 9.9.1922, leg. Vandas, (PR).

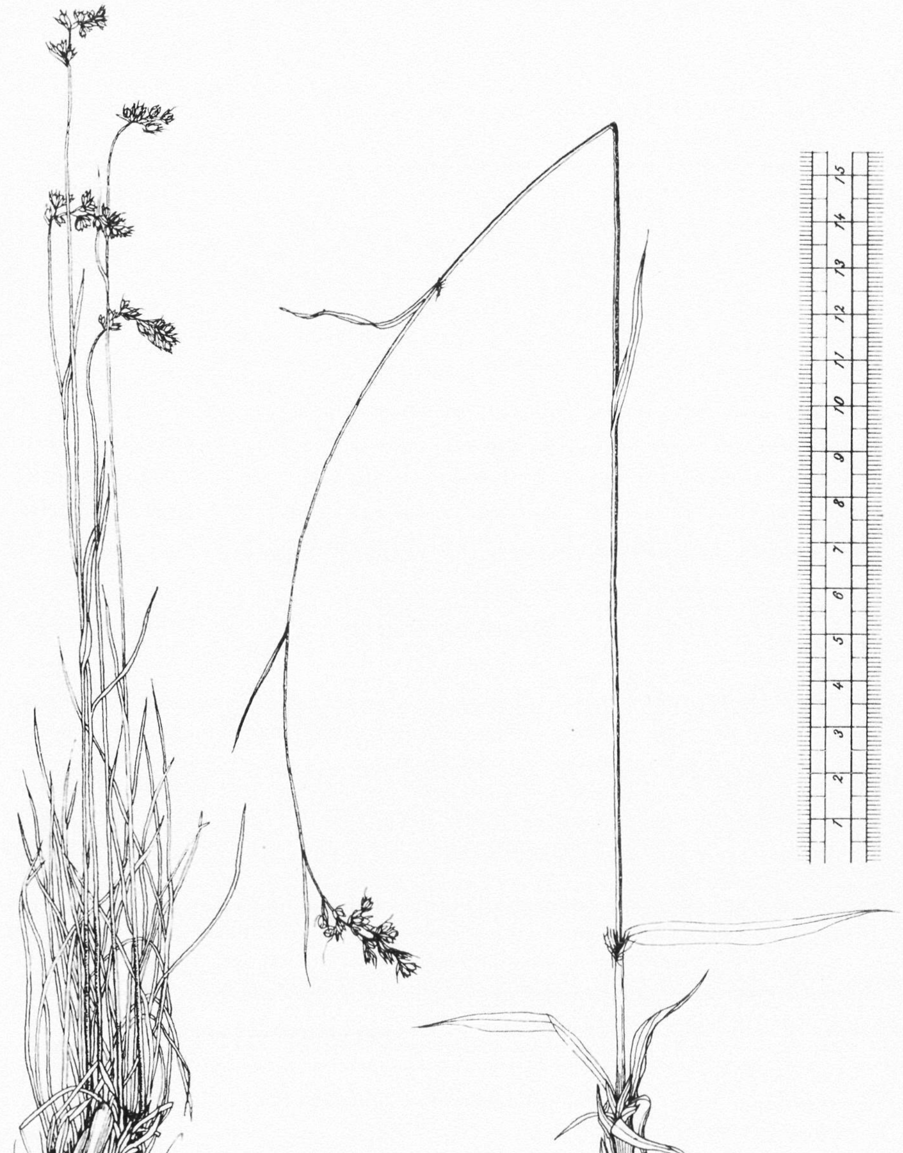


Fig. 7. *Luzula bulgarica.* Left: ssp. *bulgarica,* right: ssp. *pindica.*

Greece: Pindus Typhaneus in prat. subalpin. Dokimi, 24.6.1896, leg. Haussknecht (sub *L. italica* Parl.), (PRC), (LD) — P. Sintenis Iter Thessalicum, 1896, no 844; in pasquis alpinis Mt. Porta, pag. Huma opp. Ghevgheli, 1900 m s. m., VI., 1909, leg. Dimonie, (PRC), (LD); P. Sintenis Iter Thessalicum, no 844 b, Malakasi — in prat. subalp. mont. Sina, 13.6.1896, (LD).

Conclusion

In this paper we have endeavoured to point out the diversity of the species *L. spicata*. However, a great number of problems has remained unsolved in this work. The taxonomic order of plants from Sardinia and Corsica remains obscure, and similarly also of plants from the Caucasus. At present taxonomically quite obscure remain also plants from the mountains of central Asia. In future a thorough taxonomical study of the species *L. spicata* complex is sure to produce further solutions of the problems regarding this complex.

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BOTANISKA NOTISER 1962 · VOL. 115 · FASC. 3 · LUND

Hepaticae Collected by Dr. O. H. Selling in Central Australia, Tasmania and New Zealand in 1949

By SIGFRID ARNELL

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In 1948—1949, Professor Olof H. Selling, Sc. D., now Director of the Paleobotanical Department, Swedish Museum of Natural History, Stockholm, made botanical and paleobotanical travels in Australia (all the states) and the Southwest Pacific (New Zealand, New Caledonia, and Fiji). During these travels (see map in Statens Naturvetenskapliga Forskningsråds Årsbok, 3, 1950) he collected i.a. some 4.500 bryophytes which were handed over to the above institute. The New Caledonian mosses and liverworts, including nine new taxa (i.a. the new genus *Perssoniella*), have been published by Bartram (Bot. Notiser, 1953: 2, 1953) and Herzog (Ark. f. Bot., 2: 4, 1952, and 3: 3, 1953). Among Dr. Selling's collections of liverworts from Australia and New Zealand, the working up of which has been entrusted to me, are many species of special interest regarding distributions and also some species new to science. The following is a list of some of the most interesting of his finds.

I am indebted to Mrs. E. A. Hodgson, Wairoa, New Zealand, for help with the determination of some critical species and for notes on their distribution and morphology.

1. Central Australia

Riccia Sellingii S. Arn. nov. spec. (Fig. 1).

Australia, Northern Territory (Central Australia): Macdonnell Ranges, bank of the Finke River at mouth of Cycas Gorge 3. IV. 1949.

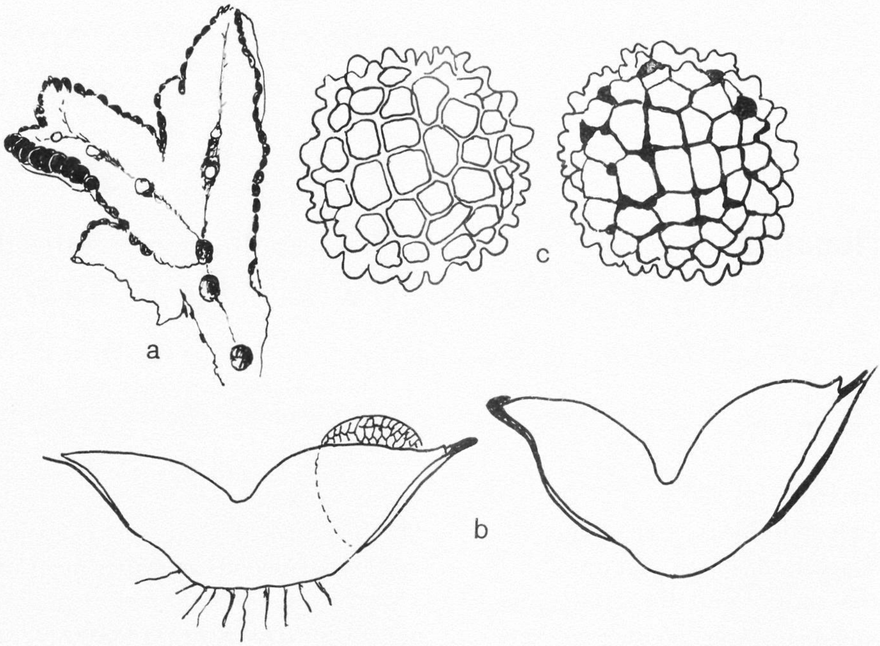

Fig. 1. *Riccia Sellingii* S. Arn. n. sp. (Central Australia: Mcdonnell Ranges, 1949 3/IV, leg. O. H. Selling). — *a.* Thallus in dorsal view. *b.* Cross section of thallus. *c.* Spores, outer face.

Type specimen in the Paleobotanical Department, Swedish Museum of Natural History, Stockholm.

Monoica, major, obscure flavo-virens. Frons usque ad 20 mm longa, furcata, profunde sulcata. Squamae purpureae, dense imbricatae, integerrimae, frondis marginem excedentes. Sporae fusco-purpureae, 80—90 μ, reticulatim lamellatae, in angulis truncato-papillatis, foveolis 12—20 μ, margine dense papillato.

Monoicous. In incomplete rosettes, colour dirty yellowish green, in the young parts pale yellowish green. Thallus 10—20 mm long, 3—4 mm broad, 2—3 times dichotomously branched, segments ± cuneate with a sharp channel and gradually thinner towards the sharp margin, upper face biconvex, apex cuneate. Ventral scales dark purple, exceeding the margin of the thallus, imbricate, rounded, margin entire, cells about 40×60 μ, resembling those of *Riccia limbata* Bisch. Cross section of the thallus 3 times as broad as high, sharply channeled above, broadly convex below, the sides gradually ascending to the sharp margin. Epidermal cells thin-walled, roundedly rectangular. Both tuberculate and smooth-walled rhizoids occur. Spores 80—90 μ in diameter, dark purple brown, margin densely papillose with obtuse-truncate papillae, outer face with 5—6 areolae across the diameter, areolae 14—20 μ wide. Inner face with areolae smaller, 8—12 μ in diameter. Wing lacking. Antheridia in the midline of the segments, ostioles dark purple, measuring up to over 200 μ.

Spores much smaller than in *R. macrospora* ST. *Riccia limbata* Bisch. has spores pale brown, the convex face with an incomplete reticulum, areolae smaller and a narrow, crenate wing.

2. Tasmania

Acromastigium integrifolium (Aust.) Evs. — Kentish Municipality: Cradle Mt. above Waldheim, ca 3.500 ft elev., rain forest w. *Nothofagus Cunninghamii*, 25. I. 1949.

New to Tasmania. Previously collected in Hawaii and the North Island of New Zealand.

Lembidium isodictyon Herz. -- New Norfolk Municipality: Mt. Field Nat. Park, road-side above Telopea hut (below Lake Dobson), ca 3.600 ft elev., 16. I. 1949, together with *Isotachis Gunniana* Mitt. and *Balantiopsis diplophylla* Tayl.

New to Tasmania. Previously collected in Rotorua, North Island of New Zealand.

Monoclea Forsteri Hook. — W. Coast, Zeehan Municipality: nr Henty River Bridge, 12 miles from (NW of) Queenstown along Zeehan road, rain forest w. *Nothofagus Cunninghamii*, 20. I. 1949.

New to Tasmania. Previously collected in New Zealand and Patagonia.

Lophocolea excipulata St. — W. Coast: nr Henty River Bridge, 12 miles from (NW of) Queenstown along Zeehan road, rain forest w. *Nothofagus Cunninghamii*, 20. I. 1949. Farrell Rvt (the Henty River Valley), 15 1/2 miles from Queenstown along Zeehan road, same type of rain forest, same day. Cradle Mt. above Waldheim, ca 3.200 ft elev.; Cradle Mt. above Waldheim, ca 3.500 ft elev., rain forest w. *Nothofagus Cunninghamii*, 25. I. 1949. Mt. Field Nat. Park, at Lake Dobson, ca 3.800 ft elev., 16. I. 1949.

Previously collected in Tasmania.

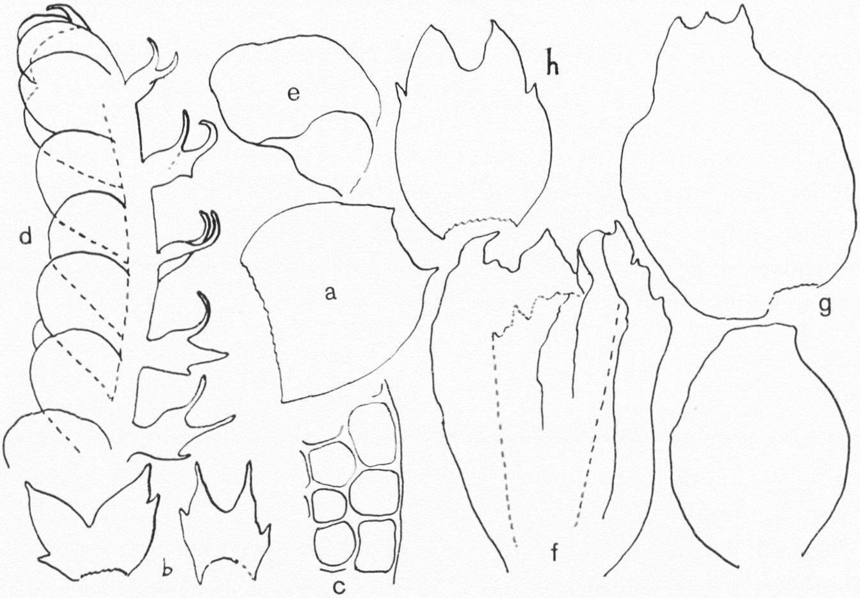

Fig. 2. *Lophocolea Sellingii* S. Arn. n. sp. (Tasmania: nr Targa, 1949 9/I; leg. O. H. Selling). — *a.* Leaf. *b.* Amphigastria. *c.* Marginal cells from a leaf. *d.* Apex of an androecium, side view. *e.* Male bract. *f.* Perianth. *g.* Female bracts. *h.* Female bracteole.

This species has perianths both terminal and lateral on short branches and androecia both spicate and intercalary. I have compared specimens determined by Stephani of this species and of *Chiloscyphus heterophyllus* St. and they seem to be identical. As *Lophocolea excipulata* is the older name, it must be retained, and *Chiloscyphus heterophyllus* is a synonym. Mrs. Hodgson maintains (Trans. Roy. Soc. N. Zeal. 73 (1): 32) that *Chiloscyphus compactus* Col. shows the same arrangement of the sexual organs. Both these species thus are intermediates between *Lophocolea* and *Chiloscyphus*.

Lophocolea Sellingii S. Arn. nov. spec. (Fig. 2).

Australia: Tasmania: St. Leonards Municipality, creek bank near Targa, ca 15 miles NE of Launceston (21 miles from L. along road to Scottsdale), in tall *Eucalyptus* forest w. *Acacia*, 9. I. 1949.

Type specimen in the Paleobotanical Department, Swedish Museum of Natural History, Stockholm.

Autoica, mediocris, flaccida, fusco-virens. Caulis ad 3 cm longus, ad 200 μ diam. Folia caulina imbricata-approximata, alternata, recte patula, disticha, late ovata vel subrotunda, apice breviter bidentata. Cellulae marginales ca 20 μ, trigonis parvis. Amphigastria libera, basi utrinque dentata, apice ad $^2/_3$ bifida, lobis lanceolatis-triangulatis. Folia floralia caulinis multo majora, apice breviter uni-tridentata. Amphigastrium florale magnum, ovatum, margine unidentato, apice breviter bifidum.

Autoicous. Medium-sized, up to 30 mm long, flaccid, dark olivaceous green-brown. Stem brown, up to 200 μ in diameter. Leaves imbricate-approximate, alternate, shortly bidentate, broadly ovate-subrotund, about as long as wide, plano-distichous or slightly dorsally secund, margins arched, the dorsal one a little less so than the ventral, and little or not decurrent, apex shortly bidentate, sinus shallowly lunate, broad. Marginal cells about 20 μ (16×16—14×20 μ), cells in the middle of the leaf also about 20 μ (14—24 μ), the basal cells slightly larger; walls thin, trigones absent or small and indistinct. Amphigastria free, ± patent with lobes incurved towards the stem, bilobed to $^1/_2$—$^2/_3$, lobes lanceolate-triangulate with apex acute and spiniform, on both sides a marginal tooth, base ± decurrent, sinus acute-obtuse. Female organ apical, bracts larger than the leaves, margin entire except for 1—3 short apical teeth, apex narrowed. Bracteole large, ovoid, bilobed to $^1/_5$ and with a marginal tooth at each side, sinus obtuse. Perianth trigonous, mouth trilobed, almost entire. Andrœcia long, in branches from below the perianth, or in separate plants. Bracts imbricate, smaller than the leaves, with a saccate lobule.

Differs from *L. macrostipula* Tayl. by having smaller cells and being autoicous.

Lophocolea turgescens (Tayl.) Hodgson. — Mt. Field. Nat. Park, at Lake Dobson, 3390 ft elev., 16. I. 1949.

New to Tasmania. Area: Auckland Islands, New Zealand, and Desolation Island.

Lophocolea villosa Mitt.—W. Coast: Farrell Rvt. (the Henty River Valley), 15 $^1/_2$ miles from (NW of) Queenstown along Zeehan road, rain forest w. *Nothofagus Cunninghamii,* 20. I. 1949.

New to Tasmania. Previously collected in New Zealand.

Rectolejeunea richmondensis St. — Creek bank nr Targa, ca 15 miles NE of Launceston (21 miles from L. along road to Scottsdale) in tall *Eucalyptus* forest w. *Acacia,* 9. I. 1949.

New to Tasmania. Previously collected: New South Wales.

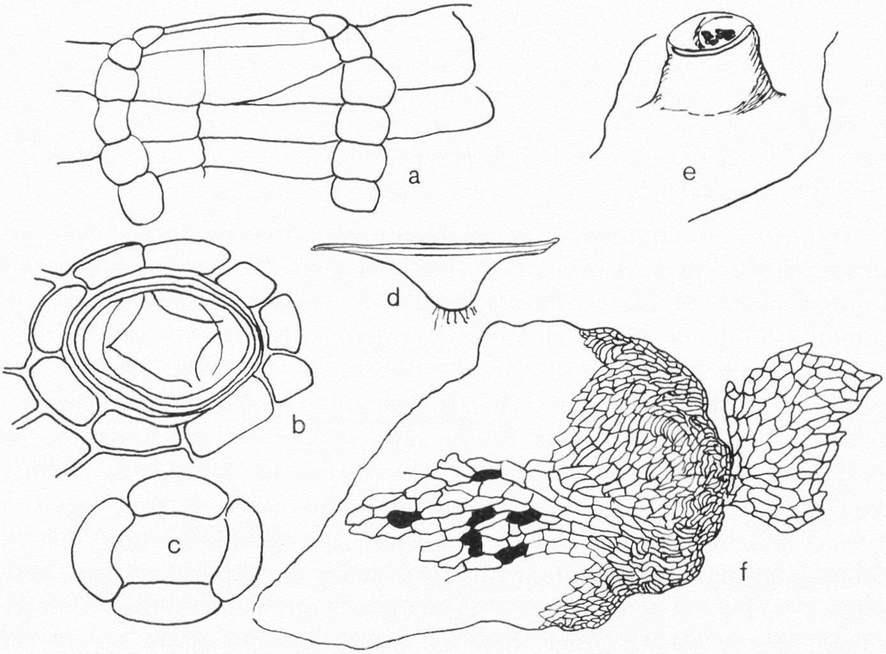

Fig. 3. *Marchantia pallida* St. (New Zealand, S. Isl.: nr Fox Glacier. 1949 2/III; leg. O. H. Selling). — *a.* Section of a pore. *b.* Pore, dorsal view. *c.* Basal cells of a pore. *d.* Cross section of thallus. *e.* Receptaculum for gemmaæ. *f.* Ventral scale.

Lepidozia hippurioides Tayl. — Cradle Mt. nr Waldheim, rain forest w. *Nothofagus Cunninghamii*, ca 3.500 ft elev., 25. I. 1949.

New to Tasmania. Previously collected: Auckland Islands and New Zealand.

Schistochila tuloides (Tayl.) St. — W. Coast, nr Henty River bridge, 9 miles from (NE of) Queenstown along Zeehan road, rain forest w. *Nothofagus Cunninghamii*, 20. I. 1949. (Det. E. A. Hodgson.)

New to Tasmania. Previously collected: New Zealand.

Trichocolea minutifolia St. (ined.). — W. Coast: nr Henty River bridge, 12 miles from (NE of) Queenstown along Zeehan road, rain forest w. *Nothofagus Cunninghamii*, 20. I. 1949.

New to Tasmania. Previously collected in mainland Australia (Watts).

3. New Zealand

Marchantia pallida St. — South Island: Westland, nr Fox Glacier, rain forest w. *Weinmannia* and *Hemitelia,* 2. III. 1949.

This species was previously known from the type locality only (Hume River, Australia). I have also examined a specimen collected by Mrs. E. A. Hodgson (S. Island, Rotohua), and compared it with the type specimen. As the species is little known, I will give a description and some drawings of the Fox Glacier plants.

Dioicous. Thallus 3—4 mm wide and up to 30 mm long, dorsal face pale green, margins frequently brownish, ventral face dark purple — almost black. Pores ± wide, 5—6 cells high, basal cells cushion-like, only slightly projecting. Basal scales purple, basal and interior cells large, oil cells scattered, marginal cells much smaller and frequently paler, sometimes pale yellow. Appendage triangular-cordate, purple-pale yellow, margin dentate, marginal cells about 20×40 μ, interior cells larger, about 24×60 μ. Receptacles for gemmæ in the midline of the dorsal face of the thallus, almost cylindrical and frequently as high as broad, margin ± smooth, gemmæ discoid. Female receptacles with a short peduncle, 8-lobed, lobes short, roundedly triangular.

BOTANISKA NOTISER 1962 · VOL. 115 · FASC. 3 · LUND

Kärlväxtfloran i en serie sydexponerade branter och brantavsnitt på fjället Vakketjåkko, Torne lappmark, samt några iakttagelser rörande sydväxtbergflorans ståndortsekologi

AV KARL-GÖRAN BRINGER

Linköping

Inledning

De norrländska brantberg, som hyser ett antal för området i övrigt främmande arter med en sydligare huvudutbredning, har varit föremål för livligt intresse bland botanister, sedan termen »sydberg» skapades av Andersson och Birger. En sammanfattning av sydbergsdiskussionen har publicerats av Du Rietz (1954). I det följande använder jag i likhet med Du Rietz följande termer:

Sydväxtberg = berg med åtminstone någon sydväxtbrant, d.v.s. en brant, som innehåller sydliga floraelement.

Sydväxter och sydflora (Schiöler 1934) = arter med en sydligare huvudutbredning och m.el.m. isolerade lokaler inom området.

De olika delarna av en brant med rasmaterial benämner jag i likhet med Rapp (1958):

Vägg = en tvärbrant bergsida. Jag undviker den i botaniska sammanhang ofta använda benämningen »hammare», då detta ord på norska kan betyda ett utskjutande klipparti i sin helhet.

Talus = från väggen nedrasat löst material.

Bergrot är en av Andersson och Birger (1912) utnyttjad term för ett område med oftast finare talusmaterial närmast väggen. Jag har bibehållit termen och menar därmed zonen närmast intill en väggs nedre kant oberoende av, om där finns talusmaterial eller inte.

I sitt arbete om de norrländska sydbergen anger Andersson och Birger ett antal sydväxtlokaler i fjällen norr om Torneträsk från Vadvetjåkko i väster till Ripainen vid sjöns östra ände. Stråket med sydväxtlokaler kan utsträckas ytterligare ett stycke väster ut till området kring Vassijaure och Riksgränsen, där fjällen Vassivarto, Råtjovare och Kätavare hyser en flora med sydbergsanknytning. De förnämsta fyndorterna för sydväxter anträffas dock i stråkets centrala delar med en koncentration av sydarter i fjällen Lullihatjårros och Vakketjåkkos branter av kalksten resp. dolomit. Se Lagerberg (1909), Alm (1921), Persson och Runemark (1950) m.fl. Faktorer som en cirkumneutral till basisk markreaktion, sydexponering och förekomst av branter, delvis med öppen talus, erbjuder där flertalet av Torneträsk-områdets sydväxter gynnsamma levnadsvillkor.

En översikt av sydfloran i branterna norr om Torneträsk lämnas av Runemark (op. c.). Inom denna urskiljer Runemark tre huvudelement på grundval av de olika arternas ståndortskrav:

1. Klippelement, bundna till solbelysta, sydexponerade klippor.
2. Ängselement, som kräver skugga.
3. Taluselement, som förekommer i vittringsgrus omedelbart under klippväggen.

I det följande kommer uppmärksamheten huvudsakligen att ägnas åt arter ur grupp 1 och 3.

Undersökningsområdet på Vakketjåkko

Somrarna 1953—1956 har jag under perioder av växlande längd vistats på ett av sydväxtbergen norr om Torneträsk, Vakketjåkko (Ortovare), för botaniska studier. Mitt huvudintresse har därvid varit koncentrerat kring floran och olika vegetationstyper på fjällets vidsträckta dolomitförekomster. Vakketjåkko är ett rundkulligt lågfjäll (högsta punkten 993 m.), som i väster endast är otydligt avsatt från det intilliggande Pesisvare. I öster skiljs fjället från det avsevärt högre Maivattjåkko-Tuoptertjåkko — massivet av en bred dalgång, som genomflytes av den vattenrika Vakkejåkk. Fjällets geologi har behandlats av Pettersen (1887), Svenonius (1916) och Kulling (1930). På en av den sistnämnde nyligen publicerad geologisk karta [Kulling (1960), reproducerad hos Rapp (1961)] finns läget av fjällets dolomitförekomster markerade. Ur den rikhaltiga botaniska litteratur, som berör förhållandena på Vakketjåkko samt i Vakkejåkks dalgång, kan följande arbeten nämnas, där uppgifter om kärlväxter och vegetation förekommer: Ekstrand (1881), Hägerström (1882), Sondén (1907), Lagerberg (1909, 1910), Fries och

Mårtensson (1910), Fries (1913), Sylvén (1914), Sterner (1916), Almquist (1917), Alm (1921, 1944), Smith (1924), Alm och Fries (1925), Arwidsson (1943), Persson och Runemark (1950) samt Persson (1961).

I Vakketjåkkos branta sydsluttning löper den sammanhängande skogsgränsen omkring 600 m, men i anslutning till sydbranterna kan den tänjas några tiotal meter uppåt för att åter pressas ned av de vidsträckta dolomithällmarkerna. Ängsbjörkskogar spelar en stor roll, och stundom domineras fältskiktet av högvuxna ormbunkar. På olika nivåer anträffas myrar, övervägande av rikkärrtyp. Se Persson (1950, 1961, 1962).

Cirka 5 km väster om Vakkejåkks mynning sträcker sig från stranden av Torneträsk ett dolomitstråk av varierande bredd snett upp mot öster i fjällsidan. Vegetationen på den nedersta dolomitklippan vid sjön är till stor del förstörd av sprängningar i samband med provbrytning av fjällets dolomit. I fortsättningen går dolomiten här och var i dagen i form av en serie mestadels sydexponerade små branter, och detta stråk fortsätter med smärre avbrott upp mot skogsgränsen. Nedanför branterna på lägre nivå saknas ofta talusmaterial eller förekommer endast i obetydlig mängd, så att högörtdominerad ängsvegetation kan gå ända fram till väggen. Ibland förekommer där även busksnår av en med inslag av *Ribes spicatum* ssp. *lapponicum*. Björk, rönn, hägg, *Salix myrsinifolia* v. *borealis* och sällsynt *S. caprea* v. *coaetanea* går ofta ända fram till klippan och kan skugga bergroten och väggens nedre delar. Omkring 150 m över sjön börjar en längre sammanhängande brant med rikligare och något grövre talusmaterial. Trädvegetationen närmast väggen glesnar här och var, och ljustillgången ökar. Här finner man först de exklusiva sydarterna *Gymnocarpium robertianum* och *Epipactis atrorubens*.

Fjällets största sydexponerade dolomitbrant finner man nära skogsgränsen, där en kraftig vägg med rikligt, delvis relativt grov talusmaterial nedanför är väl synlig från södra stranden av Torneträsk som ett vitt streck i fjällsidan. Denna brant kallas i fortsättningen »den stora dolomitbranten». Talusbranten är endast delvis trädbevuxen, och man kan här och var se en antydan till utbildning av en övre och nedre sydbergsskog (Lundqvist 1961), medan fjällets övriga branter är för små, för att en sådan zonering skall uppstå. På de trädlösa ytorna, främst i talusbrantens östra del, förekommer fläckar av *Dryas octopetala* och *Arctostaphylos uva-ursi*. Den mot öster stigande dolomitbanken, som ger upphov till den stora dolomitbranten, underlagras av lös skiffer, som i sin tur ger upphov till mindre talusanhopningar och blandas med dolomiten i talusbranten. Väster om och ovanför den stora dolomitbranten, som bildar gräns mellan den subalpina och alpina regionen, anträffas upp till cirka 750 meters nivå en serie mindre dolomitbranter utan eller med ganska obetydliga talusanhopningar. Dolomiten är här i regel mera lättvittrad än i de subalpina branterna.

Metodik

För att få en bild av brantflorans sammansättning och utbredning på Vakketjåkko utförde jag sommaren 1954 (vissa kompletteringar 1956) en inventering av kärlväxtbeståndet i en serie branter och brantavsnitt från olika nivåer i fjällets sydsluttning. Resultaten framgår av tabellen. Jag har noterat förekommande kärlväxter såväl på hyllor och i skrevor i väggen som i det nedom väggen belägna talusmaterialet, där sådant funnits. I de fall, då sluten ängs- eller hedvegetation går ända fram till väggen, har jag endast medtagit den chasmofytiska floran. Jag har försökt undvika att ta med branter, som haft större hyllor med vegetationsfläckar av tydlig hed- eller ängskaraktär. I de fall, då någon sådan hylla tydligt ökat inslaget av normalt inte chasmofytiska element, har detta angivits i beskrivningen av branten. Storleken av de undersökta brantpartierna varierar allt efter lokalens utseende. I den följande kortfattade beskrivningen anges väggens ungefärliga längd resp. största höjd i meter med beteckningar av typen 10×4. De talusytor, från vilka arter har antecknats, är också variabla till sin storlek men utgör i regel en remsa utefter väggen av 1—3 meters bredd. Höjdsiffrorna (temperaturkorrigerade) har erhållits genom mätning i bergroten med Paulin-aneroid. För att i tabellen markera en arts förekomst i själva väggen använder jag beteckningen v, medan förekomst i talus betecknas med t. vt anger, att en art på en lokal förekommer i såväl vägg som talus.

De i tabellen upptagna branterna har genomgående ordnats efter stigande nivå. Ett undantag utgör n:r 23, som ligger isolerad från de två stråk eller grupper av branter, som resten av materialet är hämtat från. Jag har följt dolomitstråken nedifrån och uppåt, och där någon termofil eller alpin art tillkommit på hyllor eller i talus, har jag försökt finna ett lämpligt undersökningsavsnitt så nära som möjligt för att i tabellen få fram artsammansättningen i anslutning till artens lägsta förekomst.

För att ge läsaren en uppfattning om olika arters förhållande till sydläge och brantlokaler över huvud taget inom Torneträsk-området har jag försökt klassificera dem enligt följande system: (Bokstavsbeteckningarna återfinns längst till höger i tabellen.)

Arter, som svagt gynnas av ett m.el.m. rent sydläge .... S
» » klart » » » » » » .... SS
» » är praktiskt taget helt bundna till ett m.el.m. rent sydläge . . . SSS

Arter med svag preferens för branter eller talus .... B
» » klar » » » » » .... BB
Arter, vilka så gott som helt är inskränkta till lokaler i branter och talus BBB

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		T	T		T			T		T	T	T	T	T	T
Equisetum scirpoides	v	.	.	v	t	.	.	.	.	.	v	.	.	.	.
Cystopteris fragilis s. lat.	v	v	vt	v	v	v	v	v	v	v	v	v	v	v	v
Juniperus communis	v	v	.	.	t	.	v	v	v	v	vt	v	t	vt	t
Festuca ovina	v	vt	v	v	vt	.	v	v	v	v	v	v	v	vt	vt
Poa glauca	v	.	.	v	v	v	v	v	.	vt	v	v	v	v	vt
Salix phyllicifolia	v	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Betula pubescens	v	.	t	.	t	.	v	.	v	.	t	.	.	t	t
Stellaria graminea	v	v	.	.	.	.	v	.	v	.	v	.	vt	.	.
Cerastium alpinum	v	.	v	v	.	.	.	.	.	.	.	.	.	t	v
Draba hirta	v	.	v	v	.	v	v	v	.	vt	v	v	v	vt	vt
Saxifraga nivalis	v	v	.	v	.	v	v	.	.	v	.	.	v	.	.
Chamaenerion angustifolium	v	v	vt	v	vt	v	v	v	v	t	v	v	vt	t	t
Vaccinium vitis-idaea	v	.	.	.	.	.	.	.	.	.	.	.	.	t	.
Empetrum hermaphroditum	v	.	.	.	.	.	.	v	.	.	.	.	.	.	.
Campanula rotundifolia	v	.	v	v	.	.	v	.	v	vt	v	v	vt	v	vt
Solidago virgaurea	v	t	.	v	t	.	v	t	.	t	vt	.	t	t	t
Antennaria alpina	v	.	.	.	.	.	.	.	.	.	v	v	v	t	.
Equisetum arvense	.	vt	t	.	.	.	.	t	.	.	.	.	.	.	.
— variegatum	.	t	.	.	.	.	.	.	.	.	.	.	.	.	.
Botrychium lunaria	.	t	.	.	.	.	.	.	.	.	.	.	.	.	.
Gymnocarpium dryopteris	.	t	t	.	.	.	.	t	v	.	.	.	.	.	.
Polystichum lonchitis	.	t	.	.	.	.	.	.	.	.	t	t	.	t	.
Asplenium viride	.	t	.	.	.	v	v	v	v	v	v	v	v	v	.
Paris quadrifolia	.	t	.	.	.	t	.	.	t	.	.	.	.	.	.
Luzula pilosa	.	t	.	.	.	.	v	t	.	.	.	.	.	.	.
Melica nutans	.	t	.	.	t	.	v	t	v	t	t	.	vt	t	t
Poa nemoralis	.	vt	vt	v	t	.	.	t	v	t	.	.	.	t	.
Milium effusum	.	t	t	.	.	v	v	.	.	t	.	.	.	.	.
Rubus saxatilis	.	vt	vt	.	t	v	v	t	v	vt	t	v	t	t	t
Geranium silvaticum	.	t	t	.	.	.	.	t	.	t	.	.	.	t	.
Trientalis europaea	.	vt	.	.	t	.	v	t	.	.	t	.	.	t	.
Melampyrum silvaticum	.	t	.	.	t	.	v	t	.	.	t	.	t	.	.
Linnaea borealis	.	v	t	v	t	.	v	v	v	t	.	t	.	t	.
Erigeron acre ssp. politum	.	t	.	v	t	v	v	v	v	v	vt	v	t	.	.
Saussurea alpina	.	v	.	v	.	.	v	t	v	.	.	.	.	.	.
Hieracium spp.	.	t	.	.	.	.	.	.	.	t	t	v	t	t	t
Cystopteris montana	.	.	t	v	t	.	v	.	.	.	.	.	.	.	t
Stellaria nemorum ssp. montana	.	.	t	.	.	.	.	.	.	.	.	.	.	.	.
Saxifraga oppositifolia	.	.	v	v	.	.	.	.	.	.	.	v	.	v	v
Ribes spicatum v. lapponicum	.	.	vt	.	t	.	v	.	v	t	vt	v	.	.	.
Sorbus aucuparia	.	.	vt	.	.	.	.	.	.	.	.	.	t	.	.
Viola biflora	.	.	t	v	.	.	v	t	.	.	.	.	.	.	.
Anthriscus silvestris	.	.	t	.	.	.	.	t	v	t	.	v	t	.	.
Myosotis silvatica ssp. frigida	.	.	t	.	.	.	.	t	v	.	.	.	.	.	.
Valeriana sambucifolia	.	.	t	.	.	.	.	.	.	.	.	t	.	.	.
Cirsium heterophyllum	.	.	t	.	.	.	.	.	.	.	.	.	.	.	.
Poa alpina	.	.	.	v	.	.	v	.	.	vt	t	.	.	v	.
Carex media	.	.	.	v	.	.	.	.	.	.	.	.	.	.	.
— vaginata	.	.	.	v	.	.	.	.	.	.	.	.	.	.	.
Polygonum viviparum	.	.	.	v	.	.	.	.	.	.	.	.	.	.	.
Thalictrum alpinum	.	.	.	v	.	.	.	.	.	.	.	.	.	.	.
Trollius europaeus	.	.	.	v	.	.	.	.	.	.	.	.	.	.	.
Saxifraga cernua	.	.	.	v	.	.	.	.	.	.	.	.	.	.	.
Pinguicula vulgaris	.	.	.	v	.	.	.	.	.	.	.	.	.	.	.
Roegneria canina	.	.	.	.	t	.	.	.	.	t	.	.	.	.	t
Populus tremula	.	.	.	.	v	.	.	.	.	.	.	.	t	t	.
Actaea sp.	.	.	.	.	t	.	.	.	.	.	t	.	.	.	.

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v	.	v	.	v	.	vt	.	.	v	v	v	v	v	v	vt	vt	.	.	.	BB
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v	.	v	v	v	.	vt	.	.	.	.	.	.	.	.	v	.	.	.	.	SBB
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vt	v	v	v	v	v	vt	.	vt	v	.	vt	v	v	.	.	.	.	.	.	SBB
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Ranunculus nivalis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
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Arter med huvudutbredning inom andra vegetationstyper men med tämligen regelbunden förekomst i branter och talus på lämplig nivå och passande substrat .... R

Arter, som endast tillfälligt anträffas i branter och talus .... O

T ovanför en kolumn innebär, att brantavsnittet i fråga innehåller talusmaterial.

Beskrivning av i tabellen behandlade branter och brantavsnitt på Vakketjåkko

1. 342 m. Dolomitklippa vid stranden av Torneträsk. Vegetationen var vid undersökningstillfället starkt skadad av sprängning. Ingen talusvegetation. 6×3.
2. 368 m. Lättvittrad, relativt mörk dolomit med talus. 5×2.
3. 374 m. Som föreg. Klippan genomskärs av en bäck, varför miljön är fuktigare än i andra subalpina branter, som här behandlas. Obetydlig mängd talus. 3×5.
4. 377 m. Vid den nyssnämnda bäcken. Dolomiten är här av den inom Torneträsk-området vanliga ljusa, hårda och täta typen, vilket också är fallet i de följande branterna, såvida inte annat angives. Hyllorna är breda, något fuktiga och mossrika och expositionen närmast västlig. 5×4.
5. 384 m. Breda hyllor i väggen samt talus. 4×3.
6. 392 m. Låg brant med obetydliga hyllor och utan talus. 10×2.
7. 402 m. Lång, låg brant med breda, övervuxna hyllor. Ingen talus. 20×1—2.
8. 417 m. Brant med talus. 10×3.
9. 442 m. Delvis mera lättvittrat material i väggen. Ingen talus. 10×3.
10. 468 m. Brant med 3—4 meter brett talusbälte. Ljusare och öppnare miljö intill väggen än på tidigare behandlade lokaler. 8×2—3.
11. 482 m. Här börjar en i huvudsak sammanhängande brant, som kan följas ett par hundra meter snett upp åt öster i fjällsidan. Under den 4—5 m höga väggen finns mestadels en väl utvecklad taluszon med grovt och kantigt material. Hyllorna i väggen är genomgående små. Denna och närmast följande uppteckningar har gjorts från segment av denna långa brant. 4×4.
12. 492 m. Se föreg. 5×4.

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13. 501 m. Se föreg. 5×4.
14. 508 m. » » 5×4.
15. 524 m. » » 4×3.
16. 524 m. » » 6×4.
17. 527 m. » » 5×4.
18. 527 m. Brant av mera lättvittrat material. Nedanför väggen finkornig skredjord. 4×3.
19. 560 m. Mindre brant utan talus. 4×3.
20. 592 m. Brant med stor hylla och obetydlig talus. 5×3.
21. 610 m. Liten brant utan talus. 3×2.
22. 612 m. Västligaste delen av Vakketjåkkos stora dolomitbrant. Förteckningen omfattar ett tämligen stort avsnitt av väggen och talusbranten. De hittills beskrivna brantavsnitten förekommer i anslutning till dolomitstråket mellan Torneträsk och den stora dolomitbranten. Den senares centrala och östra del behandlas inte i detta sammanhang.
23. 557 m. Denna brant ligger något lägre än de närmast föregående på en utlöpare från ett längre öster ut beläget, huvudsakligen alpint dolomitområde. Branten är belägen nära skogsgränsen, som här är nedpressad av dolomithällmark. Relativt rikligt med talusmaterial. 6×2.

Följande branter är belägna väster och ovanför den stora dolomitbranten. Bergarten är delvis mera lättvittrad och visar tendens att spricka sönder i skivor. Björkskogen är glesare än som varit fallet i tidigare behandlade branter.

24. 612 m. Brant med ganska sent utsmält, grov talus. Nära skogsgränsen. 5×3.
25. 612 m. Brant med breda hyllor och utan talus. Glesare björkskog än vid n:r 24. 7×3.
26. 630 m. Stor brant med breda hyllor och utan talus. 15×5.
27. 642 m. Brant ovanför den sammanhängande skogsgränsen men med isolerade trädformiga björkar i bergroten. 3 m brett talusbälte. 10×2.
28. 642 m. Mera alpint betonad brant än föreg. 6×2.
29. 652 m. Låg brant, starkt sönderskuren i skrevor och hyllor med områdets översta trädformiga björkar i bergroten. Ingen talus. 10×2.
30. 653 m. Låg brant med obetydlig talus. 10×2.

31. 666 m. Brant med anhopning av jordblandad talus nedanför. 4×2—3.
32. 667 m. Två mindre branter med talus belägna bredvid varandra. Tillsammans cirka 6×3.
33. 737 m. Brant med tämligen sent utsmält talus. 10×4.
34. 748 m. Som föreg. 7×2.
35. 752 m. » » 12×2.

Några iakttagelser rörande vissa sydväxtbergarters utbredning inom undersökningsområdet på Vakketjåkko

Att mera generellt uttala sig om olika arters ståndortskrav i sydväxtberg är vanskligt, då lokala förhållanden synbarligen ofta kan orsaka, att växternas uppträdande tycks variera från berg till berg. En art, som på en lokal ger intryck av att vara mycket konkurrenssvag, kan på en annan visa god vitalitet i sluten vegetation. Den kommande framställningen kommer därför att huvudsakligen koncentreras kring förhållandena på Vakketjåkko.

Tabellen från Vakketjåkko visar, att där representerade arter, som inom Torneträsk-området är m.el.m. starkt gynnade av eller bundna till sydbranter och sydsluttningar, erbjuder vissa olikheter i sin utbredningsbild på fjället. I fråga om arternas utbredning i vertikalled kan man där urskilja två grupper:

1. Arter, för vilka tyngdpunkten i utbredningen är klart belägen inom björkskogsregionen, och där lokaler i eller närmast ovan skogsgränsen gör intryck av att vara utpostlokaler på i något avseende speciellt gynnade ståndorter.

2. Arter med huvudutbredning något högre upp och normal förekomst i trakten kring skogsgränsen eller där ovanför.

Bland sydväxterna på Vakketjåkko kan följande arter ur tabellen klart föras till grupp 1:

Gymnocarpium robertianum
Epipactis atrorubens
Arabis hirsuta
Erysimum hieraciifolium

Bland andra sydväxtbergarter med liknande utbredning, som också förekommer på Vakketjåkko men som saknas i tabellens branter, kan nämnas:

Woodsia ilvensis
Polypodium vulgare
Sedum annuum
Fragaria vesca
Viola montana
Epilobium collinum

Ingen av här nämnda arter har iakttagits ovan skogsgränsen på Vakketjåkko.

Från sydsluttningarna av fjällen längre väster ut längs Torneträsks nordsida tillkommer bl.a. följande arter, vars utbredning där anknyter till de tidigare nämnda arterna ur grupp 1:

Asplenium ruta muraria
Silene rupestris
Veronica officinalis

Några av arterna i de bägge sista artförteckningarna hör till de mest vidspridda inom de norrländska sydväxtbergens sydflora, och deras frånvaro i de undersökta dolomitbranterna på Vakketjåkko kan förvåna. Det har i sydbergsdiskussionen framhållits, t.ex. av Halden (1950), att berggrundens eller sippervattnets kalkhalt kan spela en betydande roll för sydväxternas existens på utpostlokaler i vissa branter, och att kalkfaktorn där skulle kunna ha större betydelse än lokalklimatiska faktorer. Tendensen hos vissa arter att i utkanten av sitt utbredningsområde visa dragning mot en cirkumneutral markreaktion omnämns bl.a. av Selander (1950 a., s. 135 och följ.), vilken också anger ett antal arter, som är att betrakta som acidiklina i södra Sverige men markant basifila i Lule lappmark. Jfr även Wistrand (1962), som t.ex. för *Sedum annuum* till de arter, som är kalkgynnade i Pite lappmark. Förskjutningen mot ståndorter med högre kalkhalt hos vissa i Sydsverige m.el.m. kalkskyende arter tycks dock inte gå så långt, att dessa inom Torneträsk-området börjar uppträda direkt på underlag av kalksten eller dolomit. Följande arter undviker inom området klart dessa bergarter, medan de uppträder i sydlägen på olika typer av områdets hårdare skiffrar:

Polypodium vulgare	(Några föga vitala blad på ett stort dolomitblock på Vakketjåkko Det är för övrigt inte ovanligt, att eljest dolomitskyende arter uppträder på topparna av friliggande dolomitblock.)
Woodsia ilvensis	
Silene rupestris	
Sedum annuum	

Möjligen bör *Viola montana* och *Veronica officinalis* föras till samma kategori. *Viola montana* förekommer i sydlägen på bl.a. Vakketjåkko, Lullihatjårro, Pålnovarats och Vassivarto, men jag har inte sett den växa i direkt anslutning till dessa fjälls kalksten eller dolomit. Båda anträffas dock i en skiffersluttning på Lullihatjårro i närheten av en så exklusiv kalkväxt som *Gymnocarpium robertianum*. *Fragaria* *vescas* ställning är i detta avseende oklar. Jag har aldrig funnit smultron i Vakketjåkkos dolomitbranter, medan arten uppträder här och var på fjällets subalpina skiffrar. På Lullihatjårro förekommer dock *Fragaria vesca* även i bergrot och talusanhopningar under kalkstensbranter tillsammans med bl.a. *Epipactis atrorubens*. Dahl (1934) uppger arten från lokaler i Finnmark, där underlaget betecknas som kalkhaltigt. Dock nämns den inte i någon artlista från områdets dolomitförekomster. Man kan för närvarande inte helt utesluta möjligheten, att dolomit och kalksten inte är fullt likvärdiga substrat för smultron. Pesola (1934) har lämnat artförteckningar från 55 klipplokaler inom Kuusamo-området. *Fragaria vesca* uppträder på 12 av dessa men saknas på de 9 klippor, där berggrunden uppges vara dolomit.

Som framgår av tabellen finns det också en serie för vissa norrländska sydväxtberg typiska arter, som här kan representera den tidigare nämnda utbredningsgrupp 2 på Vakketjåkko, och vars tyngdpunkt i utbredningen alltså ligger på en något högre nivå än som var fallet med grupp 1:s arter. Grupp 2:s arter är dessutom i mindre grad bundna till verkliga brantlokaler än flertalet av grupp 1:s arter. Till grupp 2 kan t.ex. föras:

Anthyllis vulneraria ssp. *lapponica*: Förekommer på Vakketjåkko tämligen individrikt på ett par lokaler i dolomittalus och hällmark strax nedom skogsgränsen, där björkarna står glest. Den är också funnen på två lokaler i lågalpin rished strax ovan skogsgränsen tillsammans med bl.a. *Dryas octopetala, Betula nana, Vaccinium uliginosum* och *V. vitis-idaea*. På Lullihatjårro förekommer *Anthyllis vulneraria* ssp. *lapponica* rikligt kring de större kalkstensbranterna strax nedom skogsgränsen. På dessa lokaler samt på Pålnovarats ger växten intryck av att vara klart heliofil och undviker beskuggning.

Viola rupestris ssp. *relicta*: Växten intar en mellanställning mellan utbredningsgrupperna 1 och 2, i det att den förekommer tämligen rikligt bland representanterna för grupp 1 i björkskogsregionen, medan den högre upp på Vakketjåkko kan gå över i alpin vegetation. Sålunda finner man den där i de starkt exponerade dolomitryggarnas *Dryas*-hed samt på hyllor i alpina dolomitbranter, någon gång även i sådana med närmast östlig exposition. Högsta lokalen på fjället har uppmätts till 748 m, d.v.s. c:a 150 m över den genomsnittliga skogsgränsen. Den har alltså en för en sydbrantväxt anmärkningsvärt vid ståndortsamplitud och kan uppträda tillsammans med arter med så olika krav på ståndort som *Gymnocarpium robertianum* och *Carex glacialis*. *Viola rupestris* ssp. *relicta* tycks kunna genomleva vintern med mycket obetydligt snöskydd och kan följaktligen även växa i skrevor och på små hyllor i väggen. Den tål en viss beskuggning men är känslig för konkurrens. Denna taxons isolerade förekomst i norra Skandinavien har gjort, att den stundom ansetts höra till istidsövervintrarna (Jalas 1950, Selander 1950 a.). Genom att den kan växa på vintertid starkt utsatta lokaler, borde den varit bättre rustad att uthärda förhållandena på ett eventuellt refugium än andra inte utpräglat alpina arter. På Vakketjåkko visar *Poa glauca* (högsta lokal 755 m) en om violen påminnande utbredningsbild med lokaler i branternas skrevor samt i exponerade segment av *Dryas*-hed i det lågalpina bältets nedre del.

Lotus corniculatus v. *borealis*: Anges från Vakketjåkko av Alm & Fries (1925), men har av mig inte anträffats. Dess uppträdande inom andra delar av Torneträsk-området visar dock, att växten i sin utbredning ansluter sig till de bägge föregående växterna ur grupp 2. På Lullihatjårro växer *Lotus corniculatus* v. *borealis* rikligt i samma zon som dessa men har en i vissa avseenden vidare ståndortsamplitud, i det att den t.ex. är jämförelsevis konkurrenskraftigare med lokaler i björkskogens ris- och ängssamhällen. Däremot tycks växten inte lika gärna gå ut i instabil talus (jfr Selander 1950 b., s. 103). Den är heliofil, dock inte lika utpräglat som *Anthyllis vulneraria* ssp. *lapponica*. På fjället Vassivarto samt vid väständan av sjön Pajep Njuorajaure förekommer *Lotus corniculatus* v. *borealis* med några små bestånd kring ett par branter i skogsgränsen. Växten förekommer i Lule lappmark även i sjöarnas inundatzon (Björkman 1939). Några strandlokaler i Torne lappmark känner jag dock inte till.

De olika formerna av *Anthyllis vulneraria, Viola rupestris* och *Lotus corniculatus* har ingående behandlats av Jalas (1950), som betraktar de bägge förstnämndas fjällformer som säkra istidsövervintrare och anser, att detsamma kan vara fallet med *Lotus corniculatus* v. *borealis*. Dessa taxa förekommer som nämnts huvudsakligen i öppna lägen och tycks liksom fjällfloran i allmänhet vara heliofila. Alla tre har tyngdpunkten i sin utbredning förlagd till Skanderna och dess närmaste omgivningar, även om t.ex. *Anthyllis vulneraria* ssp. *lapponica* också uppträder i de nord- och mellansvenska floddalarna. Benämningen »sydväxter» är knappast lämplig för dessa taxa, även om begreppet är adekvat, om man betraktar arterna i vidsträckt bemärkelse. Då emellertid alla tre i fjällen tycks vara gynnade av en sydlig exposition hos växtplatsen, något som inom mitt undersökningsområde kanske är mera påfallande än i t.ex. Lule lappmark, är det befogat att anta, att lokalklimatiska faktorer i sydväxtbergen spelar roll även för dem.

Jalas anser ljustillgången vara en faktor, som måhända i lika hög grad som ett värmetillskott kommer växterna att visa preferens för sydlig eller västlig exposition. Inom ett så nordligt område som Torneträsk-området har man dock svårt att tro, att skillnaden i ljustillgången i öppna lägen i nord- och sydsidor kan spela en avgörande roll för att förklara växternas förkärlek för sydlägen.

I samband med behandlingen av utbredningsgrupp 2 kan ytterligare några av Torneträsk-områdets arter nämnas, vilka tillhör eller i något avseende visar anknytning till densamma:

Saxifraga adscendens: Arten förekommer i Vakketjåkkos sydsluttning från området strax nedom skogsgränsen och därefter i anslutning till de branter med isolerade björkbestånd, som anträffas upp mot 700 m (högsta lokalen 660 m). Den är dock inte bunden till branter, utan uppträder också i sådan någorlunda snöskyddad dolomithällmark strax ovan skogsgränsen, som inte upptas av *Dryas-Carex rupestris*-samhällen. *Saxifraga adscendens* tål ingen beskuggning, och detsamma är fallet på de lokaler, som jag sett på Lullihatjårro, Kätavare samt vid Pajep Njuorajaure.

Erigeron boreale: Förekommer på Vakketjåkko inom ungefär samma zon som *Saxifraga adscendens* (högsta lokal c:a 650 m) och är där i än mindre grad bunden till branter utan uppträder även i ängsartad vegetation.

Veronica fruticans: Inom området är *Veronica fruticans* inte alls lika bunden till sydväxtbergens samhällen som tidigare behandlade arter utan ingår i ett flertal vegetationstyper oberoende av ståndortens exponeringsriktning. Arten visar dock en tydligt stegrad frekvens i sydsluttningarnas vegetation. Den är heliofil men tål också en viss beskuggning och tycks på Vakketjåkko nå optimala livsbetingelser i en bred zon kring skogsgränsen i likhet med andra arter ur grupp 2. Dess högsta lokal i fjällets sydslutning har uppmätts till 764 m, alltså något högre än *Viola rupestris* ssp *relicta.*

Cystopteris fragilis ssp. *alpina*: På några lokaler i nedersta delen av regio alpina inom ungefär samma zon som *Saxifraga adscendens* förekommer denna i våra fjälltrakter föga uppmärksammade växt. *Cystopteris fragilis* (L.) Bernh. ssp. *alpina* (Wulf.) Hartm. visar ståndortsekologiskt en viss anknytning till arterna i grupp 2. Beträffande dess ståndorter skriver Benum (1958 s. 72) »sems to occur in the mountains, chiefly near the wood limit», vilket väl passar in på de lokaler, som jag sett på Vakketjåkko och Lullihatjårro. Underarten förefaller vara en utpräglad basofyt, som möjligen visar preferens för sydlägen att döma av de sparsamma uppgifter, som finns om ormbunkens utbredning i Sverige. Dess kända svenska lokaler tycks vara belägna inom zonen från allra översta delen av björkskogsregionen till mellersta delen av det lågalpina bältet (se Kilander 1955, s. 98). På Vakketjåkko förekommer ormbunken i och kring några dolomitbranter ett litet stycke ovan skogsgränsen, där den uppträder såväl i skrevor i själva väggen som i talus och även i närmast ängsartad vegetation intill branterna. Jag har fått intrycket att denna underart förhållandevis ofta uppträder i senare utsmälta lägen och därför ofta anträffas tillsammans med inte allt för högvuxna ängsarter. Jfr Flinck (1954). Jag har sett den på en liknande ståndort på Lullihatjårro. I avvaktan på resultatet av en pågående systematisk utredning av *Cystopteris fragilis*-komplexet, avstår jag tills vidare från att närmare gå in på underarten *alpinas* utbredning i Skanderna.

Ett studium av *Hieracium*-floran i sydväxtbergen norr om Torneträsk skulle möjligen ge ytterligare material till den här behandlade gruppen av arter, vilka utan att i egentlig mening kunna kallas sydarter i större eller mindre grad gynnas av i sydväxtbergen verksamma faktorer. Mina iakttagelser i detta avseende är mycket fragmentariska, men jag vill dock fästa uppmärksamheten på ett par fibblor, som kan ha intresse.

På fjället Maivattjåkko närmast öster om Vakketjåkko fann Hägerström (1882) strax ovan björkregionen en fibbla tillhörande gruppen *Praealtina,* som av honom beskrevs under namnet *Hieracium hyperboreum.* Jag har endast sett den på Lullihatjårro, där den växer på breda avsatser i kalkstensbranter inom ett litet område strax nedom skogsgränsen. Den förefaller vara konkurrenssvag och klart heliofil och överensstämmer i detta avseende med arter ur samma grupp från alvarens växtsamhällen. Inom samma område men ännu något närmare skogsgränsen finner man sparsamt en annan fibbla tillhörande gruppen *Prenanthoidea genuina,* som förefaller vara en sydväxtbergart. Enligt lektor Erik Almquist, som granskat mina exemplar från Lullihatjårro och det närbelägna berget Pålnovarats, kommer växten mycket nära *H. psilocaulon* Dahlst. Se Dahlstedt (1925). *H. prenanthoides* anges från lokaler norr om Torneträsk av Samuelsson (1920). På Pålnovarats har jag sett denna fibbla växa i klart subalpin miljö, dock ett stycke ovanför de egentliga sydväxtlokalerna, varför det är osäkert, i vilken utsträckning den kan jämföras med förut behandlade arter i utbredningsgrupp 2.

De alpina arternas förekomst i vägg respektive talus i Vakketjåkkos sydbranter

Floran i fjällkedjans sydväxtberg innehåller såväl alpina arter som sydliga låglandsarter. Hur representanterna för dessa två utbredningsgrupper fördelar sig mellan bergvägg och talus har studerats av Frödin (1915, 1917) i Lule lappmark resp. Kebnekaise-området. Denne påpekar (1915 s. 206), att »sydbergens fjällväxter öfvervägande uppträder i hammaren, medan de sydskandinaviska arterna äro mera jämnt fördelade mellan denna och rasmarken».

Från 6 sydväxtberg i Lule lappmark anför Frödin (op. c.) nedan angivna nordliga-alpina arter, av vilka det övervägande flertalet endast anträffades i själva väggen. Samtliga utom *Draba nivalis* har jag iakttagit i Vakketjåkos subalpina branter, några dock enbart i andra branter än de, som lämnat material till tabellen i denna uppsats. Antalet alpina arter, som kan anpassa sig till förhållandena i en subalpin sydbrant är troligen ganska begränsat. Jfr även Andersson & Birger (1912), Selander (1950 a., s. 48), Svedmark (1957 s. 350) och Wistrand (1962, s. 179). I vilken utsträckning de i de undersökta subalpina branterna (1—26 i tabellen) förekommande arterna uppträder i vägg resp. talus på sina lägsta tabellokaler på Vakketjåkko har markerats med t=talus och v=vägg i Frödins artlista. En beteckning av typen 2v betyder, att arten är noterad från 2 vägglokaler nedom sin lägsta taluslokal, och 1t, att den noterats från en talusförekomst, innan den först observerades i väggen. Beteckningen vt anger, att en art på sin nedersta lokal förekom såväl i vägg som talus. *Frödins* nomenklatur har överförts till den nu använda. I fråga om *Carex Halleri* är det ovisst, om *C. norvegica* eller *C. media* avses.

Woodsia alpina
Juncus trifidus
Luzula spicata
Poa glauca 6v
Carex Halleri
Cerastium alpinum 3v
Viscaria alpina 1v
Draba hirta 6v
— *nivalis*

Sedum roseum vt
Saxifraga oppositifolia 5v
— *nivalis* endast v-lokaler
— *adscendens* 1t
— *cernua* 1v
— *caespitosa* endast v-lokaler
Astragalus alpinus 1v
Antennaria alpina 4v

I de subalpina sydbranterna på Vakketjåkko tillkommer ytterligare ett antal nordliga eller alpina arter, såsom:

Equisetum scirpoides 2v
Cystopteris montana 1t
Asplenium viride 1t, därefter 9v
Poa alpina 2v
Trisetum spicatum 3v
Carex rupestris 1v
Salix reticulata vt
Thalictrum alpinum 1v
Draba incana 4t
Arabis alpina 1v
Saxifraga aizoides 1v
Potentilla crantzii 1t
Veronica fruticans 1v
Pinguicula alpina 1t
Saussurea alpina 3v

Fr.o.m. de tre översta subalpina branterna (nr 24—26), där björkskogen glesnar, ökar antalet alpina arter hastigare:

Carex atrata vt
Minuartia biflora 1v
Silene acaulis 1t
Dryas octopetala 2v
Veronica alpina 1t
Bartsia alpina 1v
Erigeron uniflorus 1v

Arternas uppträdande i bergvägg resp. talus ger vid handen, att Frödins iakttagelser i Lule lappmark i stort sett är giltiga även på Vakketjåkko. Flertalet av de aktuella fjällarterna har dock taluslokaler i fjällets subalpina bälte. Man märker emellertid, även om hänsyn tas till den felkälla, som ligger i, att en del branter saknar talus eller endast hyser mindre kvantiteter därav, en klar tendens hos fjällväxterna att på sina nedersta brantlokaler uppträda i skrevor och på hyllor i väggen. Med stigande nivå sker så en nedvandring i talusmaterialet. Kring skogsgränsen suddas olikheterna mellan artbestånden i vägg och talus ut. Högre upp i den alpina regionen kan skillnaden stundom åter bli större, ifall snö ackumuleras nedanför väggen, så att floran där påverkas av den försenade snösmältningen.

Den gynnsamma zonen på Vakketjåkko för klipp- och talusarterna i sydfloran är synbarligen belägen mellan c:a 475—625 meters nivå. Hoppet från Torneträsk till den egentliga sydväxtzonens nedersta del, kan eventuellt förklaras av den avkylande effekt, som en sjö av Torneträsks storlek måste utöva under vegetationsperioden eller delar därav. Den temperaturinversion, som av Björkman (1939) använts som förklaring till fjällväxternas uppträdande i dalbottnar i den s.k. regio alpina descensa, har ingående studerats av laborator Gustaf Sandberg på grundval av flera års temperaturregistreringar i Abiskotrakten. Mätningar, som demonstrerar den positiva temperaturanomalien i en sydbrant, har utförts av Frödin (1915). Inget material finns dock publicerat, som kan ge upplysning om temperaturvariationerna på olika nivåer samt om läget av det termiskt mest gynnade området i en sydexponerad fjällsida i förhållande till skogsgränsen och en eventuell sjö i dalbotten. Det är likaledes en öppen fråga, om en sådan zons läge är konstant eller förskjuts under olika tider av året. På vilket sätt eller under vilken tid på året som ett extra värmetillskott kan ha betydelse för vissa arter, är likaledes outrett. Utan en ingående lokal- och mikroklimatisk undersökning av förhållandena i olika delar av ett sydväxtberg under skilda årstider kommer varje försök till lösning av problemen rörande olika floraelements förekomst och fördelning där att hänga i luften. Sådana undersökningar bedrivs för närvarande i Pite lappmark (se Lundqvist 1961), och man kan på goda grunder hoppas, att ett rikt klimatologiskt material skall ge nytt material och en ordentlig grundval för sydbergsdiskussionen. Trots denna brist på konkret material vill jag dock här försöka göra vissa spekulationer kring de alpina arternas uppträdande i Vakketjåkkos sydbranter.

Beträffande temperaturen i olika delar av vägg och talus i en brant föreligger, som framgått av det föregående, inga mätningar. Jag kan tills vidare endast förmoda, att den högsta temperaturen soliga sommardagar förekommer i övergångszonen mellan vägg och talus, alltså i bergroten. I t.ex. väggens övre delar kan en något lägre temperatur misstänkas. Huruvida en viss höjning av temperaturen verkligen påverkar fjällväxter i negativ riktning har ofta ifrågasatts. Se t.ex. Selander (1950 a., s. 48—49). Jfr även Wistrand (1962 s. 181). Undersökningar av Dahl (1951) tyder dock på, att sommarens maximitemperatur kan vara en utbredningsreglerande faktor för ett stort antal fjällväxter. Om så är fallet, och om man genom framtida mätningar kan påvisa tillräckligt höga temperaturmaxima i sydväxtbergens bergrot, bör den naturliga följden bli, att fjällväxterna på vissa nivåer blir hänvisade till väggen. Först med stigande nivå skulle då bergroten bli tillgänglig för dem.

Frödin (1917 s. 206—208) vill åtminstone delvis förklara fjällväxternas förkärlek för själva bergväggen med, att där ofta framsipprar grundvatten, medan så nästan aldrig är fallet i talusmaterialet. Vattnet skulle då åstadkomma en temperatursänkning, som Frödin anser gynna de alpina arterna. Denna förklaring kan knappast användas på Vakketjåkko, där branterna genomgående är helt sommartorra. Ett undantag utgör branterna 3 och 4 i tabellen, där en bäck genombryter dolomitstråket och åstadkommer ett fuktigare och troligen också svalare lokalklimat, än som i övrigt är fallet i de undersökta brantavsnitten i närheten. I den närmast västexponerade brant 4 förekommer på breda mossrika hyllor några arter, som visar en tydlig utbredningslucka till sina närmaste förekomster i branterna högre upp, nämligen

Carex vaginata, Polygonum viviparum, Thalictrum alpinum och *Saxifraga cernua.* För *Poa alpina* och *Saxifraga oppositifolia* är luckan mindre tydlig. Det förefaller troligt, att just de lokalklimatiska faktorerna skapade av det rinnande vattnet är en bidragande orsak till den isolerade förekomsten av dessa arter. Man ser för övrigt sällan spår av några torkskador hos vägghyllornas växter i de mindre branterna på Vakketjåkko. Här förefaller sommarnederbörden vara tillräcklig, för att dessa skall förbli gröna under större delen av vegetationsperioden. Jfr Stålfelt (1960 s. 205—206).

Man kan dock misstänka, att torkskador vintertid utgör en fara för väggens kärlväxter. Arter, som växer på smärre hyllor ett stycke upp i bergväggen, får genomleva vintern med inget eller obetydligt snöskydd, vilket bör ha en selektiv verkan. De vindexponerade, obetydligt snöskyddade *Dryas*-hedarna i den alpina dolomithällmarken har på Vakketjåkko åtskilliga arter gemensamma med de subalpina branternas chasmofytiska vegetation. Sådana är:

Luzula spicata
Festuca ovina
Poa alpina
— *glauca*
Carex rupestris
Draba norvegica
Draba incana
Saxifraga oppositifolia
— *nivalis*
— *caespitosa*
Viola rupestris ssp. *relicta*

Många alpina arter är konkurrenssvaga eller lever under suboptimala förhållanden i den subalpina regionen. De blir då där bundna till lokaler, där vegetationen inte slutes, såsom sjö- och flodstränder, deltan och talusbranter. Runemark (1950) påpekar just den svaga konkurrensen som en möjlig förklaring till det alpina inslaget i branternas klippelement. Frödin (1915 s. 206) anser dock, att en för stark konkurrens knappast kan vara den faktor, som utestänger de alpina arterna från talusbranterna, då dessa i det av honom undersökta området aldrig varit helt vegetationstäckta. På lägre nivå på Vakketjåkko kan möjligen konkurrensen från *Rubus saxatilis* tillsammans med vissa andra ängsbjörkskogsarter lokalt tänkas utestänga vissa arter. Detsamma gäller beträffande de talrika ensnåren. I övrigt råder dock inte någon direkt brist på öppet talusmaterial, varför det är svårt att tillmäta konkurrensfaktorn någon avgörande betydelse, när det gäller att förklara frånvaron av alpina arter. Många sydarter ur brantflorans taluselement visar ju också tydliga tecken på att vara känsliga för konkurrens. Att konkurrensen är avsevärt nedsatt i talusbranterna, kan belysas genom en förteckning över ett urval av arter, som normalt undviker såväl klipphyllor som talusbildningar. En sådan kommer att rymma några av ängsseriens och hedseriens mest konkurrenskraftiga arter inom området, vilkas försvinnande bör medföra en avsevärd lättnad för svagare arter. Från Vakketjåkko kan följande ängsbjörkskogsarter nämnas.

Equisetum silvaticum
Matteuccia struthiopteris
Athyrium filix-femina
Lastrea phegopteris
Dryopteris dilatata
Alnus incana
Stellaria nemorum ssp. *montana*
Filipendula ulmaria
Alchemilla glomerulans
Geum rivale
Astragalus frigidus
Lactuca alpina
Crepis paludosa

I rent subalpina klippväggar utan allt för breda hyllor saknas vidare normalt alla ris utom någon gång *Vaccinium vitis-idaea*. Lingon kan även uppträda med enstaka exemplar i dolomit-talus, där även *Arctostaphylos*-arterna i vissa fall tillkommer, medan inslag av andra ris endast är tillfälligt. Andra förekommande lignoser, som lokalt kan spela roll för höjande av konkurrensen i Vakketjåkkos talusbranter, är som nämnts *Juniperus communis, Ribes spicatum* ssp. *lapponicum* samt *Salix hastata*.

Frödin (1915 s. 208) framhåller vidare talusmaterialets rörlighet som en faktor, vilken kan verka hämmande på långsamt växande alpina arter. Flertalet av branternas alpina arter går dock, som nämnts, ned i talus på högre nivåer. Rent alpina talusbranter av lösa, lättvittrade skiffrar hyser ofta en rik flora. Om talusmaterialets rörlighet hade en avgörande, kolonisationshämmande effekt på de aktuella alpina arterna, borde dessa i första hand uppträda i Vakketjåkkos dolomitbranter på lägre nivå, där talusmaterialet verkar vara bäst stabiliserat. I själva verket möter man, som nämnts, det alpina inslaget i talusfloran högre upp, där de större öppna eller vegetationsfattiga ytorna gör vissa rörelser eller en viss pålagring av material från väggen tänkbara.

En faktor, som bör nämnas i detta sammanhang och som har avgjord betydelse för fjällväxterna, är ljustillgången. I bergroten på Vakketjåkko förekommer på lägre nivåer ofta en rik trädvegetation av björk, rönn, hägg och *Salix myrsinifolia* v. *borealis*. Trädens skuggande effekt på väggen, framför allt på dennas övre delar, blir vanligen mindre än på talusmaterialet i bergroten. Högre upp, där talusmaterialet blir rikligare och kanske också något mindre stabilt, glesnar den skuggande trädvegetationen ungefär samtidigt som den påvisade nedvandringen av de alpina arterna från vägg till talus börjar göra sig gällande.

I sitt arbete om Pite lappmarks flora har Wistrand (1962) påpekat, att fjällväxterna i skogslandet visar förkärlek för klipplokaler. Diskussionen kring denna fråga (Wistrand op. c. s. 180 o. följ.) har direkt anknytning till här behandlade problem kring fjällväxternas förhållande till väggståndorter och talusståndorter i björkskogsregionen.

Summary

The vascular plants of south facing bluffs on Vakketjåkko, a mountain in the Torneträsk area, northern Swedish Lappland, and some observations concerning their distribution and ecology

The Torneträsk area is situated in the northernmost part of the Swedish Scandes. The author has studied the vascular plants on the south facing slopes of some mountains along the northern shore of lake Torneträsk. On the bluffs and talus slopes of these mountains some plants occur in isolated localities far from their main distribution area in Sweden. One of these mountains, Vakketjåkko (993 m) has been the object of a more close investigation. The upper limit of the birch forest is situated at an altitude of about 600 m. 35 different bluffs or parts of bluffs of dolomitic rock between 342—750 m s. m. have been investigated. Most of the precipices are rather small, 2—4 m high and 4—10 m. long. In the table on p. 322—327 the vascular plants are noted. The following symbols are used:

v = species occurring in crevices of the rock in a certain locality.
t = species occurring in talus close to the precipice.

In order to show the relations of different plants to a south facing situation and localities in precipices and scree in the Torneträsk area the following symbols are used:

S = Species slightly favoured by a south facing situation.
SS = Species clearly favoured by a south facing situation.
SSS = Species almost exclusively restricted to south facing situations.
B = Species slightly preferring precipices or scree.
BB = Species clearly preferring precipices or scree.
BBB = Species almost exclusively restricted to precipices or scree.
R = Species regularly occurring in the vegetation of precipices or scree in certain altitudes but with their main distribution area in other plant communities.
O = Species only occasionally occurring in precipices or scree.

Problems concerning the distribution and ecology of some plants are discussed. As appears from the table it is possible to separate some different groups of distribution among the vascular plants in the south facing slopes of Vakketjåkko. The following groups are treated:

1. Species more or less restricted to slopes facing south and with their main distribution area in the central parts of the birch forest region, e.g. typical

lowland plants as *Gymnocarpium robertianum, Epipactis atrorubens, Arabis hirsuta* and *Fragaria vesca.*

2. Species more or less restricted to localities with a south facing situation but with their main distribution area above the species of the preceding group and with a concentration around the forest limit, e.g. *Anthyllis vulneraria* ssp. *lapponica, Lotus corniculatus* v. *borealis, Viola rupestris* ssp. *relicta, Hieracium hyperboreum* and *Cystopteris fragilis* ssp. *alpina.*

3. Alpine plants occurring more occasionally in the precipices of the subalpine region. As appears from the table most of the alpine species are found in the crevices of the rock in their lower localities. With increasing altitude many alpine plants are also found on the talus slopes.

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BOTANISKA NOTISER 1962 · VOL. 115 · FASC. 3 · LUND

On Two Recently Described Species of Cotoneaster of Northwestern Europe

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Cotoneaster is a genus with a pronounced centre of distribution in western China. About 40 species are described from Yünnan and Szechuan, which provinces were intensely investigated by "plant hunters" during the first four decennia of this century. This number is rapidly declining, but in the western Himalayas there are still 10—15 species (Browicz 1959).

For a long time only two species were noted in the flora of northwestern Europe, *C. integerrimus* Med. and *C. melanocarpus* Lodd., but Kihlman (1900) drew our attention to a taxon from the Kola Peninsula, which he identified as *C. uniflorus* Bunge. This species was not earlier known from Europe, but as early as 1830 it was described from a specimen collected in Altai. Later on the taxon has been noted as a variety, *C. integerrimus* Med. var. *uniflorus* (Bge) Lindb. fil., under which name it will be found in Hylander's (1955) list of plants.

Examining the Swedish herbaria we noticed that *C. uniflorus* was easy to distinguish from *C. integerrimus*, and we also noticed that many specimens from Russian Karelia bore resemblance to *C. uniflorus,* although they were not identical with this taxon. In Karelia *C. uniflorus* was not known to exist. This fact prompted us to make a closer observation of *Cotoneaster* from Russian Fennoscandia. Dr. Nils Hylander of Upsala drew our attention to the fact that the Kola-taxon in a Russian flora of the alps of Chibinä (Mischkin 1953) had been separated from *C. uniflorus* and described as *C. cinnabarinus* (Juzepczuk 1950). At the same time Juzepczuk (1950) described a second species, *C. Antoninae*, from Karelia, north of Ladoga. This species appeared to be the taxon we had been wondering about. This taxon had earlier been observed also by Pojarkowa (1939), but she looked upon it as the hybrid *C. uniflorus*×*melanocarpus*. She observed, however, that this hybrid was hereditarily constant and was more widely distributed then *C. uniflorus* (now *C. cinnabarinus*). It is remarkable that this Russian systematist observed the special mode of inheritance a long time before Sax (1954) noticed apomixy in the genus. In the series of both *Integerrimae* and *Melanocarpae* some of the species are certainly apomictic. In cultivating experiments we found them to breed true. From *C. cinnabarinus* we have still, however, only a single plant in cultivation and from *C. Antoninae* we have never seen any living material.

We classify both *C. cinnabarinus* and *C. Antoninae* in the series of *Integerrimae* Pojark. This series has a wide range of distribution. It is represented in western Himalaya (Kashmir) by *C. humilis* Dunn, which is close to *C. uniflorus* from Altai. From the area between these two territories, Pamir-Alai and Thian-Shan, a new species, *C. Pojarkovae* Zak. was described (1955), from which we have not yet seen any material. *C. uniflorus* is even known from Ural. Besides, *C. integerrimus* is distributed within European Soviet only on Caucausus and Crimes, and there it is considered to belong to the main species, like in the scattered localities of the south and middle of Europe and in the Scandinavia.

C. humilis Dunn was described as related to *C. acuminatus* Lindb. There is, however, no doubt that *C. humilis* belongs to the series of *Integerrimae*. In the herbaria of the British Museum and of Kew we have seen a large number of specimens collected in the western Himalayas which we consider to represent *C. humilis*. It is of interest to note that a good many of the specimens were collected at high altitudes and rather often at glaciers or glacier-streams. The relationship between *C. Pojarkovae* and *C. humilis* requires a closer investigation.

We have had the pleasure of examining material from Russian Fennoscandia in the herbarium of Helsingfors and have proved that most specimens belong to *C. Antoninae*. *C. cinnabarinus* of Kola was represented only by a few specimens. Only a few specimens remain when these two species have been sorted away and they represent *C. melanocarpus*. Most of Hultén's (1950) and Kalela's (1961) localities in Karelia and on Kola on the maps of *C. melanocarpus* have to be withdrawn. For distributional maps, see Orlova (1959). We have verified neither *C. cinnabarinus* nor *C. Antoninae* outside the boundaries of Soviet. In the discussion about routes of immigration of arctic-

Fig. 1. *Cotoneaster uniflorus* Bunge. Isotype in herbarium of Copenhagen; Altai, legit Bunge.

montane plants after the last glaciation Tralau (1961) mentions *C. melanocarpus* as one of the elements in the group of survivals, which has come very early from areas free from the ice at the coast of the White Sea. The phytogeographical discussion may be of still more interest after the division into *C. Antoninae* and *C. melanocarpus,* where *C. Antoninae* may be the arctic-montane element. By way of conjecture both *C. Antoninae* and *C. cinnabarinus* survived the last glaciation east of the ice sheet, but they like many other taxa of Kola have not succeeded in re-imigrating.

C. cinnabarinus and *C. Antoninae* are specifically distinct and can on dry material be defined and rather easily distinguished also from *C. integerrimus* and *C. melanocarpus.*

C. cinnabarinus is a low, seldom over 60 cm high, bush with decumbent branches. The thin leaves are broad-ovate to orbicular with obtuse apices, rounded at base, green and glabrous above; pale green and sparsely pilose with prominent nerves below (Orlova 1959 tab. 15). The nodding flowers are single (seldom two) on very short spurs. The pedicel is shorter than the flower, and glabrous or almost glabrous. The fruit is globose, reddish orange with (2—) 3—4 nutlets. This newly described species is readily distinguished from *C. uniflorus,* which has elliptic leaves with acute apice and base and crimson fruits. *C. cinnabarinus* forms an intermediate link between *C. uniflorus* of Altai and *C. integerrimus* of western Scandinavia. This latter species is in all parts bigger and coarser than *C. cinnabarinus* and has often 2—3 flowers in the inflorescence.

It is of interest to note that in culture in southern Sweden *C. cinnabarinus* flowers c. 1 week earlier than *C. integerrimus* and thus earlier than any other species of *Cotoneaster.* In the fall *C. cinnabarinus* sheds its leaf already in the middle of August about one month earlier than *C. integerrimus.*

C. cinnabarinus is distributed in Fennoscandia only on the Kola Peninsula and there only on the alps of Chibinä (Umptek) and in the area around (Kandalaksha). Orlova (1959) looks upon *C. cinnabarinus* as a species endemic to Fennoscandia. We have not been able to prove Orlova's (1959, map No 19) reports that *C. cinnabarinus* grows along the east coast of Kola. The collections we have seen from this area have been *C. Antoninae.* As lectotype for *C. cinnabarinus* we regard the specimen "C. integerrimus Medik. var. uniflora (Bunge)" Plantae Finlandiae exiccatae No 752 in Herb. Inst. bot. Ac. Sc. URSS (Leningrad) which has been collected by H. Lindberg in Rossia, Lapponica

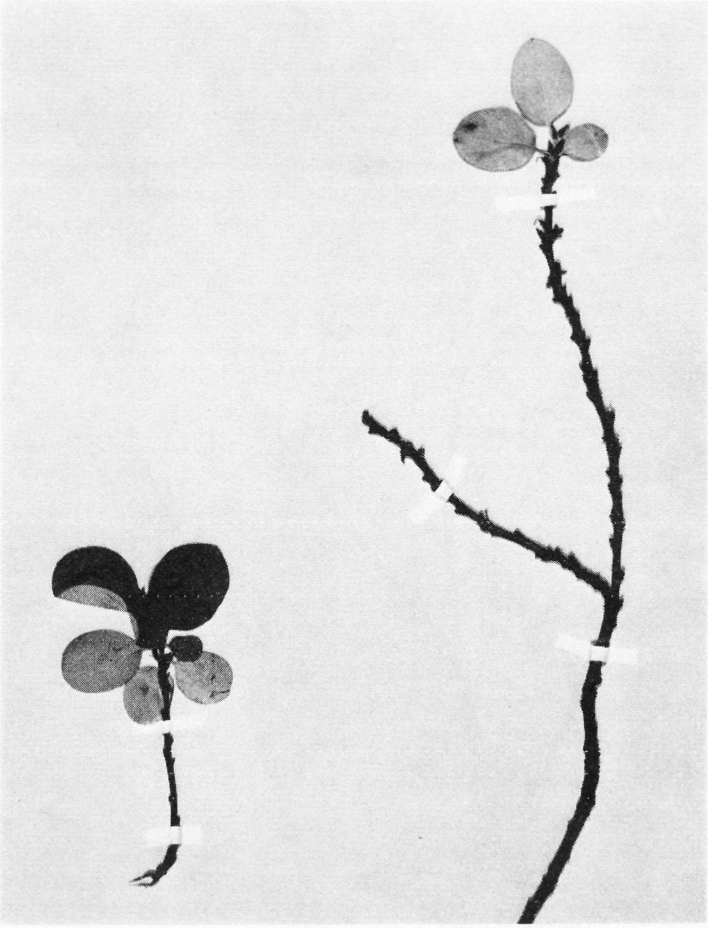
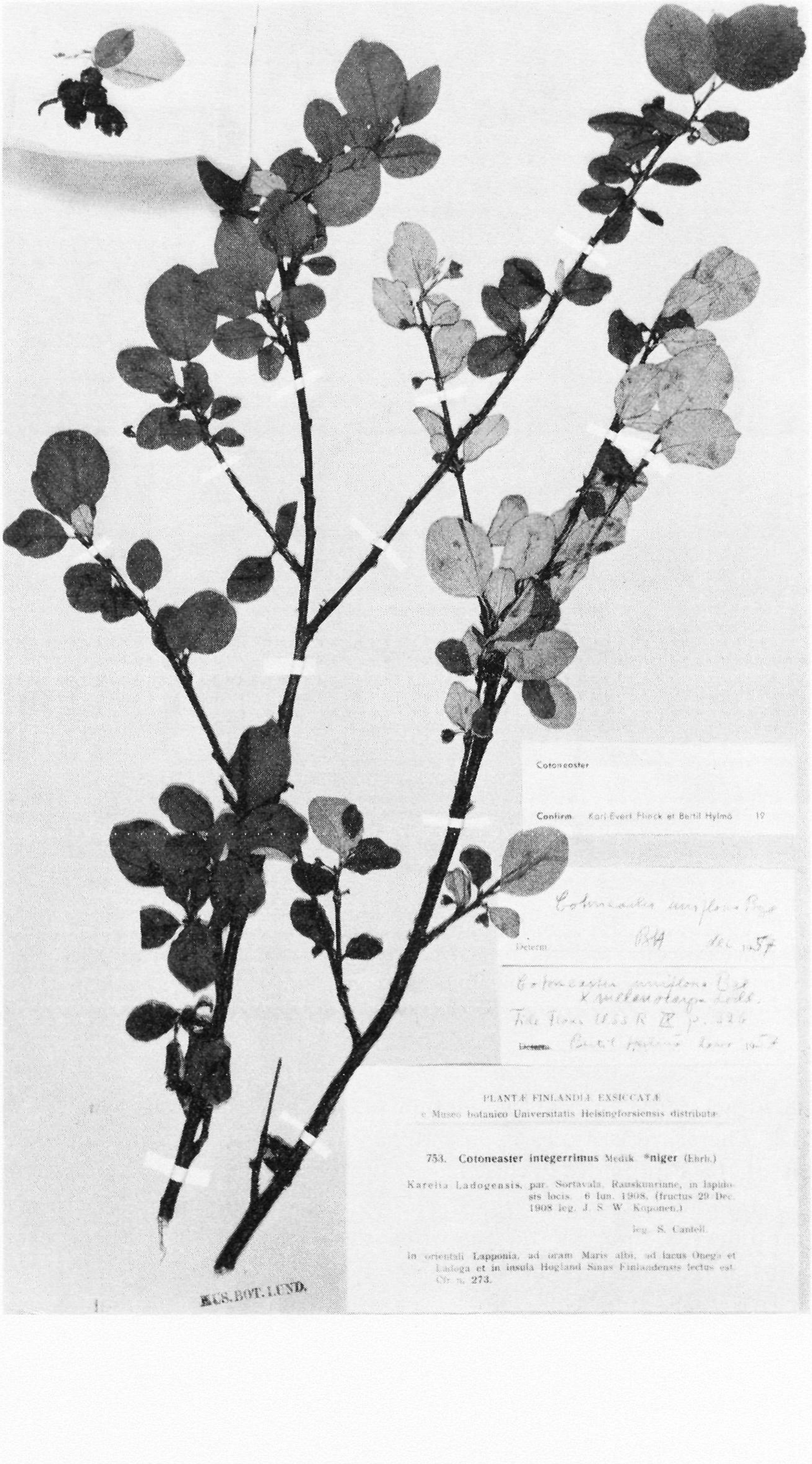


Fig. 2. *Cotoneaster cinnabarinus* Juzepczuk. Isotype in herbarium of Lund, Plantae Finlandiae exsiccatae 752. "C. integerrimus Medik. var. uniflora (Bunge)", leg. Harald Lindberg, Rossia, Lapponia Imandrae, parce in alpe Schelesna prope pag. Kandalakscha. 25 Iul. 1913.

Imandrae, parce in alpe Schelesma prope pag. Kandalakscha. 25 Jul. 1913. There are isotypes in Scandinavian herbaria of the same collection of the Finnish exsiccate.

C. Antoninae diverges from *C. cinnabarinus* through longer branches, sometimes as long as 1.5 m, often decumbent 1—2 (—3) flowered cymes with longer pedicels, pilose at base on more extended spurs (Orlova 1959, tab. 16). The leaves are ovate, ovale or suborbicular,



Cotoneaster

Confirm. Karl-Evert Flinck et Bertil Hylmö 19

Cotoneaster uniflora Bge

Determ. BH dec 1957

Cotoneaster uniflora Bge
× melanocarpa Lodd.
Fide Flora USSR IX p. 326
~~Determ.~~ Bertil Hylmö dec 1957

PLANTÆ FINLANDIÆ EXSICCATÆ
e Museo botanico Universitatis Helsingforsiensis distributæ

753. **Cotoneaster integerrimus** Medik. ***niger** (Ehrh.)

Karelia Ladogensis, par. Sortavala, Rauskunrinne, in lapidosis locis. 6 Iun. 1908. (fructus 29 Dec. 1908 leg. J. S. W. Koponen.)

leg. S. Cantell.

In orientali **Lapponia**, ad oram Maris albi, ad lacus Onega et Ladoga et in insula Hogland Sinus Finlandensis lectus est. Cfr. n. **273**.

rounded at base, obtuse or acute, below pilose. Above the leaves are always as young and often also as old sparsely pilose. The last-mentioned attribute is a sure and quick way of determining this species. The fruits are red to crimson with bluish covering. *C. Antoninae,* as we have already mentioned, has earlier been included in *C. melanocarpus* or exceptionally in *C. cinnabarinus. C. melanocarpus,* which grows also in Karelia and on Kola, has, however, the leaves villose on the upper side as very young, but they quickly become glabrous or nearly glabrous with only single hairs left at the centre nerve. The inflorescence are multiflowered, 3—8 (—12) with longer pedicels, often many times longer than the flower on longer spurs. The fruits are as fully ripe bluish black with a blue pruinose cover.

Juzepczuk (1950) described *C. Antoninae* as a new species, based on Pojarkowa's *C. uniflora* Bge.×*C. melanocarpa* Lodd. (saltem pro parte) and on *C. nigra α pauciflora* Regel (1873). No holotype was, however, chosen. We regard the specimen No 753 in Plantae Finlandiae exsiccatae (sub. nom. *C. integerrima* Medik. **niger* Ehrh.) collected in Karelia Ladogensis, par. Sortavala, Rauskunrinne, in lapidosis locis. 6 Iun. 1908, (legit S. Cantell) in Herb. Inst. bot. Ac. Sc. URSS (Leningrad) as lectotype. There are isotypes under the same number of 753 Plantae Finlandiae exsiccatae among others in the herbaria of Lund, Kew, Stockholm and Upsala.

Distribution

Cotoneaster cinnabarinus Juz. Lapponia Imandrae: Chibinä (Umtek in alpe), Imandra, Maanselkä, Turij, Porjeguba and Schelesma (in alpe).

Cotoneaster Antoninae Juz. Lapponia Murmanica: Voroninsk. Lapponia ponojensis: Ponoj and Orlowa. Lapponia Imandrae: Kandalakscha. Karelia pomorica occidentalis: Paatene and Nemetski. Karelia transonegensis: Padun. Karelia onegensis: Jallarti, Uksjärvi, Pertliniemi, Suisaari and Kontupohja. Karelia borealis: Suojärvi. Karelia ladogensis: Hiitola, Jaakkima, Impilaks, Taabima, Ranthallio, Kurkijoki, Haukkajärvi, Sortavala and Isle of Valamo.

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Fig. 3. *Cotoneaster Antoninae* Juzepczuk. Isotype in herbarium of Lund, Plantae Finlandiae exsiccatae 753. "C. integerrimus Medik. *niger (Ehrh.)", leg. S. Cantell, Karelia Ladogensis, par. Sortavala, Rauskunrinne, in lapidosis locis. 6 Iun. 1908.

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Litteratur

Nye tidsskrifter

På ganske kort tid er det nå startet tre nye tidsskrifter som har direkte tilknytning til plantefysiologi. I tillegg til disse har også et, med en kanskje noe optimistisk målsetning, som behandler naturvitenskap i alminnelighet begynt å komme ut. Alle utgis av Pergamon Press.

Phytochemistry. Utövende redaktör T. SWAIN. Vol. I, No 1. Oktober 1961.

Redaktörene fastslår innledningsvis at nok er de grunnleggende metaboliske prosessene de samme for mikroorganismer, planter og dyr, men de håper at tidsskriftet vil bli et forum for den delen av biokjemien som spesielt karakteriserer plantene. En vektig grunn for å starte tidsskriftet legger de fram når de minner oss om at den delen av biokjemien som omfatter mikroorganismer og dyr til en stor del er blitt en del av medisinsk forskning. Dette har forårsaket at den botaniske biokjemien unektelig er blitt noe distansert, og en utkrystallisering vil utvilsomt være gunstig.

Photochemistry and Photobiology. Utövende redaktör A. D. MCLAREN. Vol. 1. Januar—mars 1962.

Det har lenge vært klart at fotobiologer har kunnet snakke med hverandre på tvers av disiplingrenser uten å komme i for store vanskeligheter. Nå er altså tiden blitt moden for et felles tidsskrift. Beslutningen om start ble tatt på den 3. Internasjonale Fotobiologkongress i Köbenhavn i 1960. I motsetning til målsetningen for Phytochemistry har dette tidsskriftet tenkt å arbeide uavhengig av fagområder. Dette kan man tillate seg innen denne relativt unge forskningsgrenen, der det framdeles er mulig å holde seg orientert om mesteparten av det som skjer på de forskjellige frontene. Om 10—15 år blir det kanskje nödvendig med en oppdeling analogt med den som skapte Phytochemistry.

Radiation Botany. Utövende redaktör A. H. SPARROW. Vol. I No 1. September 1961.

Tiden har tydeligvis også vært inne for et tidsskrift som omfatter de ioniserende strålers virkning på planter. De som sysler med ioniserende bestrålningseffekter har mer og mer monopolisert begrepet radiation, og det er kanskje like greit. Det gjelder bare å innstille seg på dette. Redaktörene har også bestemt seg for å avgrense tidsskriftet til denne kategori. Fotobiologer kan jo få plasert sine artikler i Photochemistry and Photobiology. Det förste heftet gir kanskje et tverrsnitt av hva vi vil komme til å finne her i fremtiden. Artiklene omfatter både fysiologiske effekter, cytologi og morfologi.

Life Sciences. Utövende redaktör R. MAXWELL. Number 1. Januar 1962.

Moderne vitenskap undergår to prinsipielt forskjellige utviklinger. Den ene er en stadig tendens til spesialisering slik at problemene blir mer og mer avgrenset til detaljer. Den andre er en ökende tendens til å söke lösninger av problemene innen andre disipliner. Life Sciences har tenkt å avhjelpe den sistnevnte av disse to utviklingene og har som mål å publisere virkelig betydningsfulle nyvinninger innen to til seks uker etterat de mottas. Ideen er utmerket, men det er et åpent spörsmål om den kan realiseres i den grad som det kommer til uttrykk i redaktörenes innledning til förste hefte. Det stiller store krav til redaktörene når det gjelder utvalg av artikler, og kanskje enda större krav til artiklenes forfattere som kanskje vil ha vanskeligheter når det gjelder å finne en terminologi som kan begripes av den gruppe meget heterogene leser som tidsskriftet er tiltenkt. Fremtiden vil vise om redaktörer og forfattere vil mestre dette. Det vi som lesere håper dette tidsskriftet blant annet vil hjelpe oss med, er å få de forskjellige nyvinningene innen disiplinene vurdert. Kan vi være sikre på at det som kommer i Life Sciences virkelig er noe epokegjörende nytt som kan få betydning også for andre forskningsgrener, kommer tidsskriftet nok til å få en stor lesekrets.

PER HALLDAL

GOTTFRIED HUBER-PESTALOZZI: Das Phytoplankton des Süsswassers, Teil 5 Chlorophyceae (Grünalgen) Ordnung: Volvocales. — Schweizerbart'sche Verlagsbuchhandlung 1961. Inb. 198 M.

Redan 1938 förelåg första volymen, omfattande blågrönalger, bakterier och svampar av Huber-Pestalozzis stort upplagda verk i tryck (nytryck av denna utsålda volym utlovas komma snarast). Hela verket var då avsett att omfatta fem delar. På grund av den intensiva forskningen, särskilt av de stora grupperna av flagellerade alger, vilka genom sin egenrörelse kunna inrymmas i det tänjbara begreppet plankton, kom klorofycévolymen att svälla i så hög grad att volvokalerna i vidsträckt omfattning ensamt kräver sin volym.

Denna del 5 omfattar nämligen VIII+744 sidor med 52 textfigurer vartill kommer 158 planscher med 4426 detaljfigurer. Taxonomiskt omfattar den familjerna *Polyblepharidaceae, Nephroselmidaceae, Sphaerellaceae, Chlamydomonadaceae, Coronaceae, Spondylomoraceae, Volvocaceae* och *Astrephomenaceae* med 84 släkten, innehållande sötvattnets 974 arter, 58 varieteter och 15 formae. Majoriteten intages av *Chlamydomonas* med 549 taxa upptagande 300 sidor och 65 planscher, d.v.s. mer än $^1/_3$ av hela boken. Såsom bevis på forskningsintensiteten kan påpekas, att man år 1927 kände blott 116 taxa av *Chlamydomonas*. Även monotypiska familjer finnas: *Coronaceae* och *Astrephomenaceae*.

Såväl familjerna som släktena äro presenterade i värdefulla morfologiska översikter och äro försedda med utförliga bestämningsnycklar. Diagnoserna äro utförliga med morfologiska, ontogenetiska och i vissa fall även mikrokemiska karaktärer samt angivande av biotop och hittills känd geografisk utbredning.

Man kan inte vara författaren nog tacksam för detta verk, som ger en utomordentlig handledning över praktiskt taget allt som är känt om *Volvocales.* Den bör vara en mäktig stimulans för de många, som stått tvekande inför mångformigheten hos denna tjusande grupp och sakna den omfattande litteraturen, splittrad som den är och oftast svåråtkomlig. Speciellt *Chlamydomonas*-arterna torde genom sin förekomst i snart sagt varje sött naturvatten vara ett lättåtkomligt och tacksamt studieobjekt för de naturintresserade, som ha tillgång till mikroskop. Här finns ett omfattande fält för bidrag av taxonomisk natur, de flesta taxa äro hittills antecknade för en eller ett fåtal fyndorter. Även ontogenetiska rön i enkla kulturer kunna utföras av intresserade amatörforskare.

Tillsammans med redan utkomna delar är denna volym ett monument över en forskare med ovanlig energi och hängiven kärlek till en *scientia amabilis,* författaren är nu över 80 år gammal! Algologerna kunna blott uttala en from önskan, att han må bli i tillfälle att slutföra sitt storstilade verk med volymen över de planktiska tetrasporalerna, klorokockalerna, heterokonterna och desmidiéerna. Denna, liksom en del 7 med fytoplanktonets geografiska utbredning samt en tacknämlig litteraturförteckning över hela verket uppgives av förlaget befinna sig i påbörjad sättning.

Einar Teiling

Atlas of the British Flora. Edited for the Botanical Society of the British Isles by F. H. Perring and S. M. Walters. Thomas Nelson & Sons Ltd. London and Edinburgh 1962. XXIV, 432 s. 4:o. Pris £5,5s.

Botanical Society of the British Isles startade år 1954 en stort upplagd inventering av den brittiska floran för utarbetande av utbredningskartor för dess samtliga arter. Resultatet av denna inventering föreligger nu i en ståtlig volym innehållande ca 1600 prickkartor. Vid kartornas utarbetande har man använt den metoden, att området indelats i ett rutnät med rutor av 1 kvadratmils storlek, och förekomsten i en sådan ruta anges med en prick. Härigenom erhålles naturligtvis ingen föreställning om artens detaljutbredning — för detta behövs kartor i större skala —, men man får en utmärkt översikt över utbredningsområdet i stort, byggd på exakta data. Man kan på detta sätt lätt jämföra de olika, ofta knivskarpt avgränsade utbredningstyper som här finns bredvid varandra och som ibland kan vara mycket olika även inom samma släkte, t.ex. inom *Primula,* där *P. farinosa* har sin utbredning i mellersta delen av Storbritannien, *P. scotica* i allra nordligaste Skottland och *P. elatior* i ett begränsat område i sydöst. De skilda utbredningstyperna framträder f.ö. alltid klart av kartorna: en nordlig typ, inskränkt till Skottland, omfattar t.ex. många av våra skandinaviska arter, som *Sagina-* och *Saxifraga*-arter, *Draba norvegica* och *Polygonatum verticillatum*; en sydlig grupp återigen innesluter sådana för oss främmande element som *Sibthorpia europaea* och *Wolffia arrhiza* men även sådana skandinaviska arter som *Centaurea jacea, Cirsium acaulon* och *Polygonum dumetorum.* Endast i huvudöns mellersta delar förekommer t.ex. *Actaea spicata, Carex flava* och *ornithopoda* samt *Cypripedium calceolus.* Bland de speciella irländska arterna är *Saxifraga hirsuta* och *spathularis, Sarracenia purpurea, Arbutus unedo, Eriocaulon septangulare,* två *Sisyrinchium*-arter och orkidén *Neotinea intacta.*

För de flesta arter anges med särskilda tecken de förekomster som härstammar från tiden före 1930 och de som är av senare datum; på detta sätt kan man jämföra utbredningen i äldre och nyare tid. Bland arter som gått tillbaka är *Agrostemma githago, Bromus secalinus* och *arvensis* samt *Ruppia spiralis*. Rätt många arter har tydligen på senare tid försvunnit; bland dem som är betecknade med »extinct» är *Holosteum umbellatum, Crassula aquatica, Pinguicula alpina, Najas graminea* och *Schoenus ferrugineus. Scheuchzeria palustris* har försvunnit från sina lokaler i England och på Irland men finnes alltjämt kvar i Skottland.

Det mycket omfattande arbetet med att insamla de uppgifter som ligger till grund för atlasen har utförts med hjälp av ett stort antal frivilliga krafter. De inkomna uppgifterna har sedan noggrant granskats på olika sätt; för vissa kritiska släkten (*Fumaria* och *Potamogeton*) har specialister bearbetat det mesta materialet och de av dem granskade uppgifterna har fått särskilda beteckningar. En del kritiska grupper har ej ännu medtagits utan deras behandling har uppskjutits till en senare tidpunkt.

För att möjliggöra en jämförelse av utbredningen med olika faktorer som kan tänkas vara av betydelse för densamma har till atlasen fogats ett antal transparenta fysiskt-geografiska kartor avsedd att läggas över de växtgeografiska.

Genom det rikhaltiga källmaterialet, den omsorgsfulla bearbetningen och det förstklassiga typografiska utförandet är Atlas of the British Flora ett standardverk som är av stort värde även för skandinaviska forskare.

H. HJELMQVIST

A. R. CLAPHAM, T. G. TUTIN and E. F. WARBURG: Flora of the British Isles. Second edition. Cambridge, University Press 1962. 1269 s. Pris 70 s.

Samtidigt med Atlas of the British Flora har en ny upplaga utkommit av Claphams, Tutins och Warburgs välkända flora över de brittiska öarna; de båda arbetena komplettera varandra förträffligt.

Den nya floraeditionen är upplagd efter samma principer som den föregående, av år 1952, men talrika omarbetningar och tillägg har gjorts med hänsyn till de nya fynd och framför allt den livliga taxonomiska verksamhet som det senaste decenniet medfört i England. Bland nya arter som tillkommit är de båda på senare år i Skottland upptäckta arterna *Diapensia lapponica* och *Artemisia norvegica,* samt givetvis åtskilliga adventiva arter. Nya bearbetningar har gjorts — med hjälp av en rad specialister — av bl.a. släktena *Dryopteris, Salicornia* (med tillägg av nya arter), *Polygonum, Oxalis* (många införda arter medtagna), *Mentha, Gentianella* och *Dactylorchis.*

Liksom i tidigare upplaga behandlas de stora apomiktiska släktena tämligen summariskt; med hänsyn till att floran är avsedd för en större läsekrets upptages ej alla småarter utan blott vissa artgrupper. Inom *Sorbus* är behandlingen dock mera utförlig och även försedd med avbildningar av olika apomiktiska arter.

En uppgift, att *Aphanes arvensis* är apomiktisk, är ej alldeles korrekt.

H. HJELMQVIST

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Notiser

Nya professorer. Till professor i växtbiologi vid Uppsala universitet har utnämnts laboratorn vid skogshögskolan Hugo Sjörs. Laborator Hemming Virgin, Uppsala, har utnämnts till professor i fysiologisk botanik vid Göteborgs universitet. Vid lantbrukshögskolan har docenten därstädes Sven Jansson utnämnts till professor i växtnäringslära och avdelningsföreståndaren vid Sveriges utsädesförening, agr. dr James Mac Key utnämnts till professor i växtförädling.

Docenturer. Till docenter i växtbiologi vid Lunds universitet har förordnats fil. dr Nils Malmer och fil. dr Åke Persson.

Forskningsanslag. Statens naturvetenskapliga forskningsråd har vid sitt sammanträde den 22 maj 1962 utdelat följande anslag till botanisk forskning: Till doc. O. Almborn, Lund, 18.026 kr. för utarbetande av en flora över Sydafrikas lavar; agr. lic. G. Almgård, Uppsala, 9.360 kr. för undersökning av interspecifika hybrider inom släktet *Poa* samt haploider inom samma släkte; doc. Gerd Bendz och doc. O. Mårtensson, Uppsala, 8.400 kr. för isolering och undersökning av i olika bladmossor förekommande substanser, i första hand gula och röda pigment av anthocyan- och flavontyp; prof. G. E. Du Rietz, Uppsala, 10.000 kr. för bearbetning av material belysande växtsamhällenas forna sammansättning och fördelning inom det genom Suorva-dämningen dränkta området i Lule lappmark; fil. dr J. Eriksson, Göteborg, 3.850 kr. för studium av virkessvampar; doc. Lisbeth Fries, Uppsala, 11.076 kr. för undersökning av rödalgernas näringsfysiologi under kontrollerade betingelser; fil. dr S. Fröst, Lund, 2.000 kr. för insamling av frömaterial av *Centaurea rhenana* i Polen; doc. S. Gatenbeck, Lund, 17.000 kr. för studier av sekundära produkters biogenes i mikroorganismer; genetiska institutionen, Lund, 6.000 kr. för kromosomanalytiska arbeten inom *Secale* och *Agropyron*; doc. P. Halldal, Lund, 9.996 kr. för fotobiologiska studier; doc. O. Hedberg, Uppsala, 4.062 kr. för växtsystematiska, speciellt cyto-taxonomiska undersökningar; fil. lic. G. Ising, Lund, 7.715 kr. för forskningsresa till Sydafrika för studium av variationen inom *Cyrtanthus* och insamling av material av släktet; kommittén för forskning rörande våra naturresursers bevarande och utnyttjande, Stockholm, 10.000 kr. för undersökning av luftföroreningars inverkan på lavfloran i Stockholm och Göteborg och för kommitténs verksamhet i övrigt; prof. H. Lamprecht, Landskrona, 17.000 kr. för genanalytiska undersökningar hos *Pisum* och *Phaseolus*, artificiella och spontana mutationer, kartläggning av gener och kromosomstruktur; doc. A. Lundqvist, Lund, 16.000 kr. för forskning rörande självsterilitetssystemets ursprung och verkningsmekanism inom gräsfamiljen; marinbotaniska Medelhavsexpeditionen, Uppsala, 23.000 kr. för systematisk-ekologiska och fysiologiska studier över Medelhavets marina vegetation och flora; doc. B. Norén, Lund, 16.412 kr. för undersökningar över cellaggregationsföreteelsen och fruktkroppsbildningen hos myxobakterier m.m.; doc. N. Nybom, Balsgård, 2.355 kr. för utbyggnad av kobolt-60-källan vid Bogesund och förflyttning av gamla kobolt-60-källan vid Bogesund till Balsgård; doc. N. Quennerstedt, Uppsala, 4.000 kr. för studier av vattenvegetation i U.S.A.; doc. H. Rufelt, Uppsala, 8.510 kr. för undersökningar över vattenpermeabiliteten i rötter; prof. F. Sandberg, Stockholm, 16.116 kr. för fytokemiska undersökningar av *Haloxylon salicornicum;* prof. D. v. Wettstein, Köpenhamn, 23.816 kr. för undersökning över plastidernas molekulära biologi; doc. M. Wærn, Uppsala, 4.533 kr. för systematisk-ekologiska undersökningar över Medelhavets marina vegetation och flora; samt fil. lic. H. Zech, Stockholm, 9.000 kr. för elektronmikroskopiska, kemiska och fysikaliska undersökningar över mekanismen och lokalisationen av tobaksmosaikvirus-förökningen i individuella hårceller hos *Nicotiana tabacum.*

Av Jordbrukets forskningsråd har vid sammanträden den 22 febr., 27 april och 18 juni 1962 utdelats bl.a. följande anslag: Till fil. dr G. Andersson och fil. lic. L.-Å. Appelqvist, Svalöv, 6.500 kr. för undersökning av lipidbildningen hos raps under olika utvecklingsstadier; fil. dr G. Andersson, Svalöv och fil. dr G. Olsson, Skara, 4.000 kr för undersökning rörande negativa urval efter fröantal per skida och oljehalt hos vitsenap samt bedömning av effekten av positiva och negativa urval beträffande dessa egenskaper; doc. S. Bingefors, Uppsala, och fil. lic. S. Ellerström, Svalöv, 8.000 kr. för undersökning av effekten av olika urvalsmetoder på frösättningen hos tetraploid rödklöver; prof. L. Ehrenberg, Stockholm, 23.160 kr. för pågående mutationsexperiment; assistent G. Eriksson, prof. L. Ehrenberg och prof. Å. Gustafsson, Stockholm, 20.000 kr. för bestämning av mutagena effekter av låga doser hos högre växter; doc. F. Fajersson, Landskrona, 5.500 kr. för undersökning över sambandet mellan vetets proteinkvalitet och dess hårdhetsgrad, inkluderande studium av olika miljöers (klimattypers) inverkan på de nämnda faktorerna och sambandet mellan dem; doc. A. Hagberg och fil. lic. V. Stoy, Svalöv, 5.000 kr. för studier över axtäthetsmutationernas biokemiska bakgrund och fysiologiska reaktioner gentemot olika tillväxtreglerande substanser hos korn; doc. A. Heiken och amanuens G. Ewertson, Uppsala, 3.200 kr. för undersökning av somatiska *Solanum*-arter; agr. lic. T. Hermelin, Uppsala, 8.000 kr. för studiet över akut och kronisk gammabestrålning av korn; doc. R. Larsson, Uppsala, 7.000 kr. för studier av sådjupets inflytande på plant- och beståndsutvecklingen i kombinerade sådjups- och såtidsförsök med höstsäd; fil. lic. J. O. Mattsson, Åkarp, 9.000 kr. för studier av mikroklimatet i potatisbestånd och detta klimats beroende av väderleken i stort samt vegetationsutvecklingen; Statens trädgårdsförsök, Alnarp, 15.000 kr. för undersökning av jordtrötthet i fruktodlingar och plantskolor; fil. kand. B. Walles, Stockholm, 4.000 kr. för undersökning över upptagning och inbyggnad av leucin jämte lokalisering av den biokemiska blockeringen hos en leucinautotrof mutant av korn; samt prof. D. v. Wettstein, Köpenhamn, 8.000 kr. för arbeten rörande plastidernas makromolekulära biologi hos korn och bönor.

Dessutom har båda de anslagsbeviljande råden i många fall utdelat understöd för fortsättande av undersökningar som tidigare erhållit bidrag från råden och då omnämnts i tidskriften.