BOTANISKA NOTISER 1940, LUND 1940.

Parthenogenesis and pseudogamy in Potentilla.

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The occurrence of pseudogamy.

The phenomenon of pseudogamy was until last year (1939) misinterpreted and its characteristic embryological features unknown. The term itself was created by FOCKE in 1881 to cover the cases of embryos formed without fertilization after the stimulating influence of foreign pollen.

In 1900 HURST gave some convincing data regarding its occurrence in the family of *Orchidaceae.* By pollinating *Zygopetalum Mackayi* with pollen from six different species of *Odontoglossum, Lycaste* and *Oncidium* he obtained progenies of individuals identical to pure *Zygopetalum Mackayi.* The first investigation of the embryology of *Zygopetalum* appeared as late as 1923 (SUESSENGUTH 1923). The ovule contains one embryosac, with synergids, eggcell, polar nuclei and antipodes. The embryosac is said to contain the reduced chromosome number. Pollination is necessary. Unpollinated flowers degenerate without seed or fruit development. Polyembryony is frequent, owing to the origin of embryos from the chalazal or integument regions (no gametophyte formation). Most probably apospory does not occur. Since most *Orchidaceae*-genera do not produce endosperm (SCHNARF 1929), the results obtained in *Hypericum* and *Potentilla* (cf. below) cannot be valid here. Still, the possibility of a slight embryo-development without any pollination is not excluded. The pollen stimulation might affect the fruit (and seed) development only, as in experimental parthenocarpy, and indirectly the full development of embryos. A more elaborate study of EMC- and PMC-development is very desirable.

The classic case of pseudogamy was described in a series of papers by LIDFORSS (1905, 1907 a, 1907 b, 1914). The complex subgenus *Eubatus* of *Rubus* contains a great number of apomictic and polyploid European biotypes (cf. GUSTAFSSON 1939 a). The few diploids known are sexual (*R. tomentosus* and *ulmifolius*), and all pseudogamous apomicts are triploid to heptaploid. The diploids, if used as mother-parents, give exclusively true F_1-hybrids after cross-pollination. When the polyploids are used as mothers, they give generally a more or less metroklinous progeny. The metroklinous descendants originate certainly by means of apomictic processes. It is surprising that the successful crosses produce hybrids, propagating sexually. F_2 is always immensely polymorphous. No embryological data were published by LIDFORSS or by later scientists. LIDFORSS interpreted the probable case of parthenogenesis in *Rubus* subgenus *Eubatus* as due to a stimulation from special substances in the pollen tube, effusing to the embryosac and the eggcell. This view has since then been regarded as valid for pseudogamy in general. WINKLER (1908) postulated the occurrence of a special growth-enzyme (Wuchsenzym) in the pollen-tube (p. 432).

The first embryological study on induced apomixis was published by PACE in 1913. The importance of this paper greatly increased after NOACK's work of 1939.

In the Amaryllidae *Zephyranthes* (*Atamosco*) *texana* the embryosac is produced without chromosome reduction. The egg-apparatus is normal. Pollen development is said to be regular. Pollen grains germinate abundantly on the style, their tubes growing down to the embryosacs. One of the sperm nuclei fuses with the polar nuclei to give a pentaploid endosperm. Frequently the other sperm nucleus is lying close to the eggcell but no fertilization takes place. Even when the eggcell begins its first mitosis, the degenerating contents of the sperm nucleus are seen close to the spindle. The high number of dividing eggcells studied, showing no evidence of any fusion, speaks in favour of the above interpretation. The fact is strengthened by WORSLEY's cross-experiments in *Habranthus* (*Zephyranthes*), where *Habranthus* × *Hippeastrum* gives a progeny without any trace of paternal influence (cited from ERNST 1918). But the exact proof that an induced embryo-formation (induced parthenogenesis) occurs in *Zephyranthes* is still lacking (cf. SCHNARF 1929, p. 522). Like the male-sterile apomict of *Potentilla collina*, mentioned below, the eggcell may divide without any external stimulation.

Apomixis was repeatedly reported in the genus *Rosa* (TÄCKHOLM 1922, GUSTAFSSON 1931 a and b). GUSTAFSSON showed that if apomixis is present it cannot be of the autonomous type, since emasculation experiments fail to produce seeds. Recent unpublished results suggest strongly that apomixis is considerably rarer than hitherto maintained. The peculiar way of chromosome distribution in male and female organs indicates a process of fertilization, similar to heterogamy. — Regarding the genus *Alchemilla,* see p. 125.

FORENBACHER found in 1914 that the ordinary EMC of *Potentilla silvestris* gives a haploid embryosac after chromosome reduction. Later this embryosac degenerates and is replaced by an unreduced aposporic embryosac in the chalaza region. The experimental proof that a great number of biotypes belonging to this complex genus are pseudogamous, was given by MÜNTZING (1928 and 1931). 3, 6, 7 and 2 biotypes respectively of *P. Tabernaemontani, argentea, collina* and *Crantzii* were examined. In emasculated flowers no seeds were formed (only 2 seeds from 157 flowers) and isolation experiments with the completely male-sterile type C—B of *P. collina* gave no seeds either.

Three apomicts of *P. Tabernaemontani* crossed inter se and with *P. argentea, collina* and *Crantzii* gave in all 22 individuals produced by pseudogamy and 1 aberrant (=4 %). Six apomicts of *P. argentea* (intra- and interspecific crosses) gave 598 mother-like plants and 4 aberrants (=0.7 %) and 7 apomicts of *P. collina* produced in different crosses 224 pseudogamous descendants and 3 aberrants (=1 %). Whether these aberrant individuals are sexually formed or not, MÜNTZING could not decide at that time. Pseudogamy is undoubtedly the most common way of seed production in the apomicts examined.

The chromosome numbers of these types vary from the diploid (2n=14) to the 12x-state (2n=84). MÜNTZING found the first case of a diploid apomict among higher plants (the questionable case of *Zephyranthes texana* excluded). *Potentilla argentea* contains namely diploid as well as hexaploid and octoploid apomicts.

POPOFF (1935) made interspecific crosses of 15 different *Potentilla*-species with chromosome numbers ranging from 2x to 12x. 21 crosses produced offspring. Two species are sexual (*P. geoides* and *P. rupestris,* both diploid). *P. arguta* is apomictic in spite of its diploid number and all polyploids examined are apomictic. No case of hybrid production occurred among the apomicts (160 plants raised). Pseudogamy seems to be obligate.

The same result was obtained in SHIMOTOMAI's experiments (1935). Eight different species were used as mother parents with chromosome numbers from 2x (*P. aurea)* to 6x. The progenies consisted of 867 individuals. Pseudogamy was always complete.

The embryology of *Potentilla* was recently described by POPOFF

(1935), SHIMOTOMAI (1935) and GENTCHEFF (1937). The structure of the archespore is essentially identical for most apomictic *Rosaceae*-genera — aside of *Potentilla* for *Alchemilla* (MURBECK 1901, BÖÖS 1924), *Rosa* (?, TÄCKHOLM 1922) and *Sorbus* (LILJEFORS 1934). The primary or axile EMC is surrounded by a great number of accessory EMC:s, which can display meiotic as well as ameiotic phenomena. The primary EMC always degenerates in *Alchemilla.* The same is apparently also the case in *Potentilla* (GENTCHEFF).

POPOFF fixed self-pollinated, cross-pollinated and emasculated material. In contrast to the results obtained by us he did not detect embryo formation in emasculated flowers (of *P. hirta*). Remnants of the pollen-tubes were never seen in the micropylar region or in the upper part of the embryosacs (*P. hirta* and *multifida*). Therefore, if these negative findings are valid, in the two species mentioned we have an embryo stimulation over long distances (cf. the hetero-auxin experiments below). In *P. multifida* nucellar embryony is frequent. Two or three embryos are commonly formed, most frequently around the micropyle close to the embryosac and the egg apparatus.

GENTCHEFF found frequent apospory in *P. argyrophylla.* Many aposporous embryosacs are formed, although one single embryo usually reaches full development. In *P. nepalensis*×*splendens,* which is completely sterile after self-pollination but produces some seed after backcrossing with *P. nepalensis,* most of the EMC:s degenerate fairly early. But after fertilization with *P. nepalensis* several nucellar cells enlarge and give embryos. POPOFF made the interesting finding that the sexual species *P. geoides* shows a certain tendency of nucellar embryony although the functioning embryo results from a fertilization process. This resembles the case of unstabilized apospory in *Leontodon hispidus* (BERGMAN 1935).

ÅKERBERG (1936 a and b) showed that *Poa pratensis* is pseudogamous and that unreduced embryosacs can be fertilized, a fact further supported by findings in 1939. Chromosome numbers of *Poa pratensis* are fairly high (see also MÜNTZING 1933 and 1940). Apomixis is connected with aposporous phenomena.

NOACK's paper of 1939 renders a new interpretation of the mechanism of pseudogamy possible. The tetraploid species *Hypericum perforatum* ($2n=32$) is aposporous and pseudogamous. Reduced embryosacs are formed but degenerate early and the reduced eggcell is only very infrequently functional. But even the unreduced eggcells can be fertilized. After self-pollination 28 % of all embryos are hexaploid

(4x+2x) and after pollination with *H. quadrangulum* (2n=16) 68 % of the embryos are pentaploid (4x+x). I. e. as in *Poa pratensis* the aposporous eggcells behave sexually as well as asexually. This remaining sexual tendency of the eggcell is manifested also by the behaviour of the endosperm, which needs fertilization even in the case of parthenogenesis. Only exceptionally can the endosperm divide without fertilization.

Some old cases of pseudogamy or presumed pseudogamy may also be mentioned here. According to STRASBURGER (1878) nucellar embryony is frequent in *Citrus aurantium, Funkia ovata* and *Nothoscordum fragrans.* The origin of nucellar embryos in *Citrus* is dependent on a stimulation from the fertilized eggcell, by that also from the pollen via the eggcell. The embryos arise close to the wall of the embryosac. — In *Funkia ovata* only one embryosac is formed with one eggcell and two synergids. Not until the time of eggcell fertilization does the development of adventive embryos take place. Their number is frequently high. Most of them arise from cells in the nucellus epidermis close to the eggcell. ERNST (1918) reexamined the nucellar embryony of *Funkia ovata* with regard to the question of pollen-stimulation. No seeds or fruits were formed after emasculation but arose after self- and cross-pollination, as well as after open-pollination. The same seems to be true of *Opuntia vulgaris* (GANONG 1898) and *Euphorbia dulcis* (HEGELMAIER 1903). In these two species a stimulation from or via the fertilized eggcell must occur in order to secure the growth and embryo formation of nucellar cells.

Nothoscordum fragrans is, as already mentioned, nucellar embryonic. STRASBURGER maintains that the formation of embryos begins without any pollen stimulation. The embryos degenerate, however, if the ovule and the ovular tissue are not stimulated by pollen to development. The necessity of a special substance, delivered by the pollen (auxin?), for the activation of the ovule seems plausible in this case. According to BALLY (1916) fruit and seed formation is however partially autonomous.

Pseudogamy has not often been referred to in animals. One case, examined by BELAR 1924, is of special interest in this connection. BELAR was able to prove that in certain species of *Rhabditis* fertilization is necessary despite the inhibition of nuclear fusion. Instead, the stimulation by the sperms consists in a delivery of centrosomes to the egg-nuclei, which then divide in the usual manner. The sperms themselves degenerate. The striking resemblance of this case to the endosperm fertilization in *Zephyranthes, Hypericum* and *Potentilla* is obvious.

Hetero-auxin experiments.

In the early spring of 1939 the writers agreed upon an experimental attack on the phenomenon of pseudogamy. Primarily the application or injection of hetero-auxins in different concentrations and form (paste or solution) was decided upon, pollen grains containing a high amount of auxins (SÖDING 1938) and pseudogamy being up to that time generally regarded as due to a delivery of special substances from the pollen tubes (Wuchsenzyme, WINKLER). As main material we have used a series of *Potentilla*-species and types, kindly placed at our disposal by Professor Dr. A. MÜNTZING. The treated species were *P. Tabernaemontani, argentea, Crantzii* and *collina,* all pseudogamous and preponderantly polyploid (some diploid *P. argentea*-biotypes are known). The concentrations were 1 %, 0.01 %, 0.001 % and 0.0001 % indole-acetic acid.

After the first experiments we concentrated our efforts on one completely male-sterile biotype of *P. collina* (C—B, $2n = 35$), emasculations not being necessary. This type propagates by ± obligate apomixis. Of 123 seedlings obtained in different crosses no more than one was aberrant, the others being metroklinous (MÜNTZING 1928), Aside of the auxin treatment folliculin, testosteron, aneurin were applied in different concentrations. In all experiments emasculated or (in the case of *P. collina* C—B) untreated flowers were left as controls. Fixations were made 2, 4, 6, 8 and 10 days after the treatment or the isolation. Unfortunately fixations were not performed after artificial pollination, since the embryology of the material was not examined until the end of the summer. Then, however, some flowers appearing in greenhouse material, were emasculated, pollinated and fixed.

The application of hetero-auxins had the wellknown effect of fruit-production (parthenocarpy), in the strongest concentration (1 % paste) as well as in the weakest (0.0001 % solution). The ripe carpels were large and well-developed, resembling those after open-pollination. All types examined gave identical results. Controls, folliculin-, testosteron- or aneurin-treated carpels did not enlarge. In no case were seeds produced, not even in the auxin-experiments where fruit formation was most successful, neither in the very low concentration of 0.0001 %, nor in the 1 % paste. The ovule as a whole and even the nucellus grew remarkably after these applications. The negative response of seed development is presumably in no way connected with a low degree of auxin penetration into the nucellus. If these findings can be generalized — and their correctness is proved for three or four biotypes — very few *Potentilla*-apomicts develop seeds after a stimulation of »Wuchsenzyme» exclusively.

Embryo development in Potentilla collina C—B.

As mentioned above seed is never produced after auxin treatment, only a stretching or a growth of the nucellus and the ovule takes place. The embryological examination of this apomict, completely male-sterile and pseudogamous, gave the surprising result, however, that the formation and development of embryos proceed with or without stimulation of auxins or sex-hormones until the embryos are fairly wellsized. Then they degenerate, owing to a lack of nutrients, since endosperm does not form.

This is not a rare phenomenon. We have counted hundreds of ovules containing one or more embryos. Polyembryony is frequent, as many as five or six embryos can reach the pluricellular stage and most commonly two or three embryos arise in the same ovule. This polyembryony is due to the occurrence of many embryosacs, rarely to the division and development of synergids. Antipode or endosperm embryos never occur.

Although we have not examined early embryosac or EMC stages in this study, we can give the following picture of the archespore and its development in *Potentilla* (POPOFF, SHIMOTOMAI, GENTCHEFF).

As in *Alchemilla* and *Sorbus* the primary or axile EMC is surrounded by cells, potentially generative. In some cases they may pass through mitotic divisions, developing aposporically, in other cases they may enter a meiotic prophase or even carry through the complete meiosis. Evidently the somatic divisions, depicted in SHIMOTOMAI's short paper (Figs. 2 and 3), were taken from lateral cells. If the data from *Alchemilla* and *Sorbus* can be applied also to *Potentilla* (cf. GENTCHEFF 1937), the true or axile EMC cannot develop but meiotically. Therefore the numerous embryosacs in *P. collina* C—B should be derived aposporically from lateral cells, potentially generative, or in some cases from the chalaza region.

The fact must be stressed immediately that the embryosacs are always regularly built. The two synergids and the eggcell are normal in appearance. The polar nuclei of ripe embryosacs lie in the middle, their number never being higher than two. One or two extra nuclei were never seen, in contrast to the case after fertilization or in *Alchemilla*. The fusion of the polar nuclei takes generally place when the eggcell has divided or the embryo has reached a fairly advanced stage. The antipodes disappear in ripe embryosacs. In young stages their number is three.

Most of the embryosacs reach maturity simultaneously but a delayed onset of aposporous gametophyte formation is not infrequent (Fig. 27). These late accessory embryosacs arise around the eggcell region. Evidently a vacuolisation force is spreading from there (cf. GUSTAFSSON 1939). The polyembryo-formation begins successively or simultaneously. In the same ovule embryos representing widely different stages can be found. In other ovules well-developed embryos can occur side by side.

Seeds are never formed without pollination. Finally the embryos, having sometimes reached the onehundred- or twohundred-cell stage, degenerate. The secondary embryosac nucleus (the fused polar nuclei) begins its degeneration even previously, generally lying close to the embryo. At an advanced stage the nucellus epidermis gets wrinkled around the embryo and encloses it, the contents of the nucellus being dissolved.

After this description the conclusion is warranted that parthenogenesis in *P. collina* type C—B is autonomous but seeds cannot develop since endosperm does not form without pollination. Endosperm development is pseudogamous, embryo formation is not. The influence of pollen tubes on the secondary embryosac nucleus may consist of one or both of the following processes: 1) Either a real fertilization of the secondary embryosac nucleus is necessary, seed formation of *P. collina* C—B being partially parthenogenetic, partially sexual, or 2) a hormonal stimulation exists in pollinated flowers, forcing the recalcitrant endosperm nucleus to mitotic divisions. Since the hormones used in these experiments cannot stimulate the onset of endosperm mitosis, not even as a poison effect, the first possibility seems most likely, the existence of a special and specific substance not being excluded, however, occurring abundantly in the pollen-tubes but in too low a concentration inside the central nucleus (cf. the autonomous beginning of mitosis in the eggcell).

Of all types studied this apomict shows the highest degree of polyembryony and autonomous embryo development. These characters are connected with complete male sterility. This state of things is probably no chance coincidence. The same is met with in *Alchemilla* (p. 126).

The embryo development of P. collina type C—G.

This pentaploid apomict ($2n=35$) produced 13 seedlings in MÜNTZING's experiments after pollination with *P. Tabernaemontani* and *P. collina* (type C—F), all individuals arisen after a pseudogamous process. *P. collina* C—G is not completely male-sterile but the pollen is poor, the percentage of good pollen being on an average 9 % (9 individuals examined). Material of young flower buds, open flowers, young and old fruits fixed after open pollination was placed at our disposal. The embryo development has been studied specially.

Two groups of ovules exist: 1) ovules containing embryos and endosperm, more or less developed, 2) embryos without endosperm but with one degenerating secondary embryosac nucleus or two degenerating polar nuclei. In the first case we conclude that pollination led to a stimulation process of the eggcell and the endosperm nucleus, inducing both to mitosis. In ripe embryosacs from fairly advanced stages three fusing nuclei can be seen frequently. Since the occurrence of three nuclei in *P. collina* type C—B has not been noticed, nor their occurrence in ovules from group 2 in *P. collina* type C—G, we regard the ovules from group 2 as not fertilized or not stimulated. Despite this embryos arise. However, if endosperm formation is excluded, they never gain the size or reach the development characteristic of embryos in *P. collina* C—B. Besides, they degenerate early. Polyembryony is infrequent and poorly expressed.

According to this interpretation the endosperm of ovules, belonging to group 1, is formed after the fusion of three nuclei, as this fusion was directly found. The onset of embryo formation without previous fertilization or stimulation is likely, not so marked however as in *P. collina* C—B.

The fusion of three nuclei being necessary for its development, the endosperm will contain a chromosome number higher than 10x $\left(5x+5x+\frac{5x}{2}\right)$. As the third nucleus most probably is derived from a reduced pollen grain (cf. *Alchemilla*, p. 128) and self-fertilization occurs. the actual chromosome number woud be $35+35+\frac{35}{2}=\pm 88$. Divisions being rare in the material examined and the chromosomes difficult to count accurately, no more than four endosperm numbers from different ovules could be determined. The best nucleus gave ±93 units and the three others ±91, ±90 and ±87 units. Apparently there is but small doubt that in these cases the central nucleus has really become fertilized.

Thus we have found that in this type 1) normal seed production is accompanied by endosperm formation (of the nuclear type), 2) that in ripe embryosacs three nuclei occur frequently, consisting of two polar nuclei and a third nucleus of foreign origin, 3) that embryos cannot reach maturity in cases when two polar nuclei still exist and endosperm is not formed, and 4) that the chromosome counts have proved a fusion of three nuclei in the case of endosperm formation. The embryosacs mentioned in 2) have probably been fertilized and the embryo formation in gametophytes with two polar nuclei (case 3) implies presumably an autonomous parthenogenesis, less conspicuous however than in *P. collina* C—B.

Embryo development in P. collina C—C and C—D.

P. collina C—C gave after pollination with *P. Tabernaemontani* and *Crantzii* 19 seedlings, 18 of which were metroklinous. *P. collina* C—D pollinated with *P. Tabernaemontani* produced an offspring of 37 metroklinous individuals. Both biotypes are predominantly or absolutely pseudogamous. The pollen fertility is 39 % and 44 % respectively and the somatic numbers $2n=42$. Pollen sterility is less expressed in the hexaploids than in the pentaploids.

Both types were emasculated in greenhouse cultures, some of the flowers pollinated after emasculation. Fixations were performed 2, 10 and 20 days after emasculation, resp. pollination. In emasculated flowers numerous embryos develop without endosperm formation, polyembryony and autonomous parthenogenesis being present. Embryos reach a greater size than in *P. collina* C—G, before they begin to degenerate, and are approximately equal-sized to the embryos in *P. collina* C—B. Two polar nuclei or one secondary embryosac nucleus are present. Sooner or later, without any mitosis occurring, they begin degenerating. In the case of pollination, however, endosperm is formed and its nuclei abundant, similar in appearance to those after open-pollination. No chromosome counts have been possible to make.

These two biotypes propagate by seeds, containing parthenogenetic embryos and pseudogamous endosperm, arisen after fertilization or stimulation.

Embryo development in P. argentea type A—H.

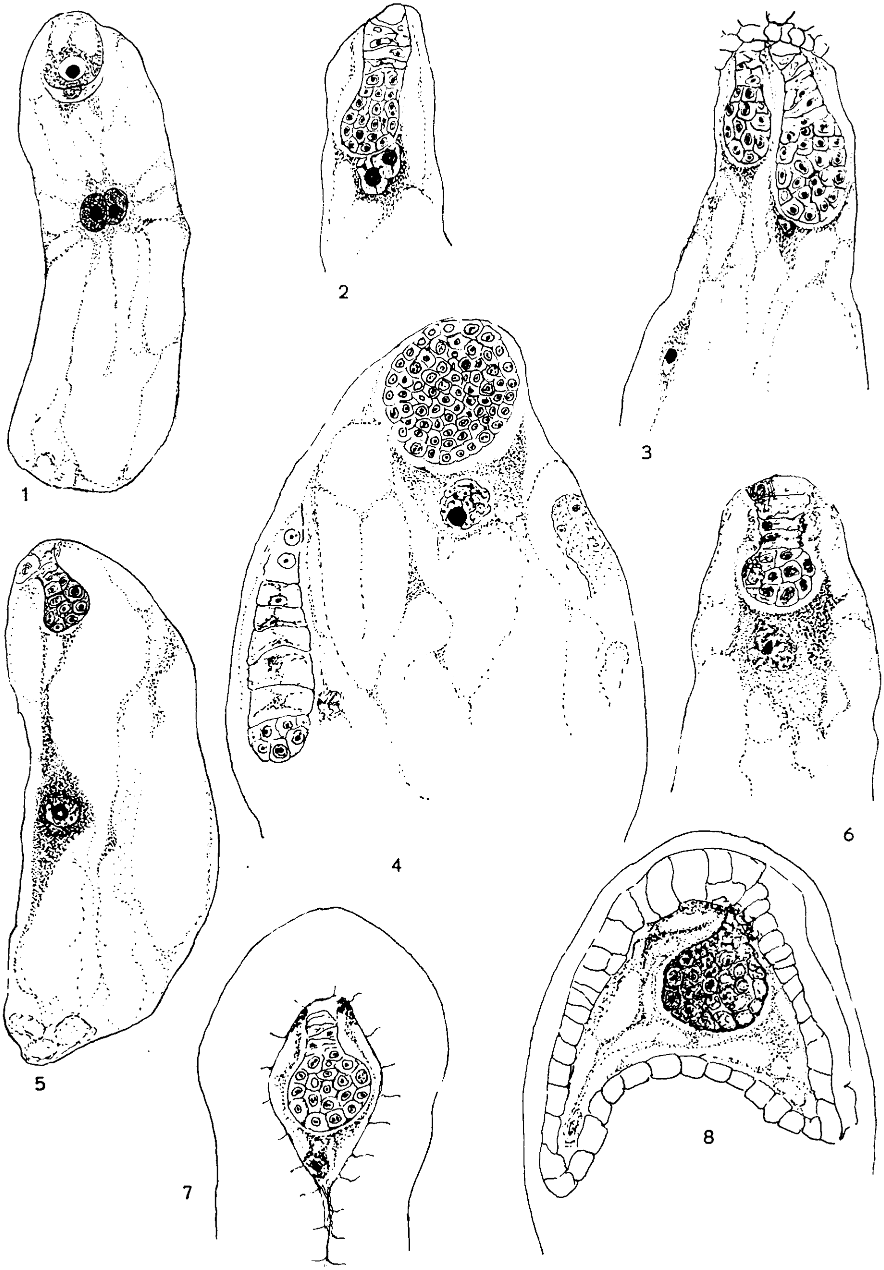
This hexaploid apomict ($2n=42$) was not included in MÜNTZING's previous experiments. Embedded material of buds, flowers, young and old fruits was placed at our disposal.

In open-pollinated flowers embryo and endosperm formation start almost simultaneously as in *P. collina* C—G. In some ovules, probably unpollinated, degenerating eggcells and polar nuclei (or secondary embryosac nuclei) were found. Infrequently degenerating embryos without endosperm could be observed. Ripe seeds arise exclusively if embryo and endosperm are present. The occurrence of three fusing nuclei in the central region of the embryosac was established.

A few good endosperm divisions were found. The best plate contained ±101 chromosomes $\left(=42+42+\frac{42?}{2}\right)$, two others from different ovules similar numbers (98 and 102). In all cases the number is certainly higher than 84. Fertilization and fusion of three nuclei is necessary.

A short description of the figures (1—24) will be given here. The eight microphotographs are explained in connection with the plates. Figs. 1—8 concern *P. collina* C—B (male-sterile), no pollination having occurred. Figs. 1—4 are from auxin-treated flowers, 2, 4, 4, 4 days after the application. The polar nuclei in Figs. 1 and 2 have not fused, in Fig. 2 they begin to degenerate, well-developed embryo occurring. In Fig. 3 two embryos are seen, the central nucleus having degenerated. In Fig. 4 the enormous nucellus growth is obvious, two embryos occurring, one of which is very large. The central nuclei begin to degenerate. Figs. 5—8 are from control material, fixed 2, 10, 10, 10 days after isolation. In Fig. 5 an embryo has developed, the central nucleus still lying separate. In Fig. 6 embryo as well as central nucleus show signs of degeneration. The contents of the nucellus have almost entirely disappeared in Figs. 7 and 8. Note especially the appearance of nucellus in Fig. 8. In no case has endosperm been formed.

Figs. 9—12 are from *P. collina* C—G (material fixed after open-pollination). Two groups of ovules appear (p. 117), one with embryo and endosperm, one without endosperm but without or with embryo. In the second case probably no fertilization has occurred. Figs. 9 and 10 illustrate embryosacs from ovules of type 2, showing one small embryo+one central nucleus, and one undivided eggcell+two polar nuclei respectively. In Figs. 11 and 12 embryo and endosperm are seen.



Figs. 1—8. *P. collina* C — B. — 1—4. Hetero-auxin treatment. Note the enlarged nucellus in Fig. 4. — 5—8. Controls. No pollination, no hormonal treatment. For further explanation, see the text. — × 235.

Figs. 13—15 are from *P. collina* C—G (greenhouse material). Embryo formation occurs in emasculated flowers (Figs. 13, 14: 20 days after emasculation). After pollination (Fig. 15: 20 days) endosperm develops as well.

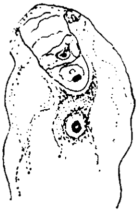
Figs. 16—20 are taken from fixed material of *P. argentea* A—H (open-pollination). As in *P. collina* C—G two groups of ovules occur, unfertilized and fertilized. Three nuclei in the central region can be seen (Fig. 17), leading to a di- to trisomatic endosperm. Embryo formation has taken place. Fig. 20 depicts a later stage with endosperm. Figs. 16, 18 and 19 are from unfertilized ovules, two polar nuclei occurring (Fig. 18), central nucleus degenerating (Fig. 16). In both cases the eggcells have not divided, this being the case however in Fig. 19.

Chromosome plates are illustrated in Figs. 21—24. A prophase of embryo mitosis with the somatic number ($2n=35$) is shown in Fig. 21 (*P. collina* C—G). The late prophase in Fig. 22 shows approximately 87 chromosomes and the metaphase in Fig. 23 ±93 units. Both originate from endosperm divisions in *P. collina* C—G. A similar metaphase from *P. argentea* A—H is seen in Fig. 24, the chromosome number being ±101.

Discussion.

Immediate results. — By this preliminary study evidence has accumulated that pseudogamy in *Potentilla* consists of two processes, 1) the development of the eggcell by parthenogenesis and 2) the formation of endosperm by stimulation or fertilization. These two processes are partly independent of each other, partly mutually interacting. In the most extreme cases parthenogenesis is undoubtedly autonomous, leading to a pluricellular embryo-stage without endosperm formation (no pollination). Developing endosperm without embryo is very rare (pollination). Even in the case of autonomous parthenogenesis endosperm must be stimulated or fertilized.

Applied hetero-auxin paste or solution has no effect whatsoever on endosperm formation, although fruits are formed and nucellus becomes enlarged. Future studies will show whether auxin treatment may induce parthenogenesis in apomicts, displaying a simultaneous onset of embryo and endosperm formation. Since the endosperm divisions found contain more than twice the somatic chromosome number and the occurrence of three fusing nuclei in the middle region of the embryosac is established, the conclusion does not seem out of the way that in order to produce endosperm the polar nuclei must



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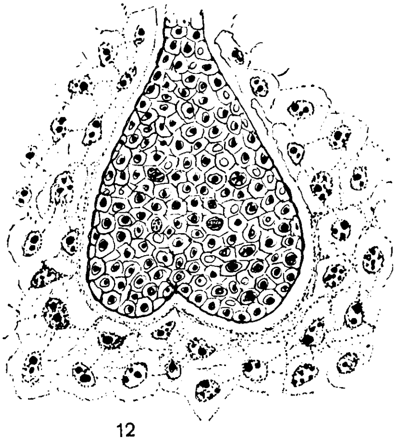

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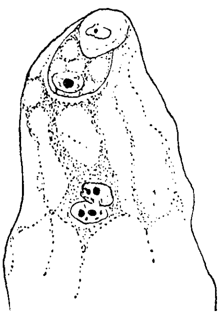

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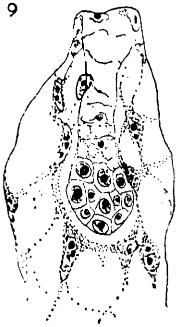

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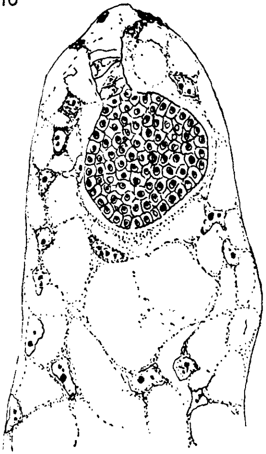

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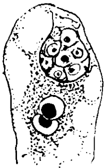

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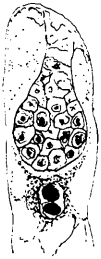

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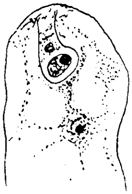

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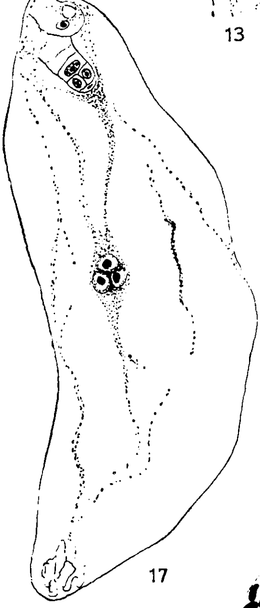

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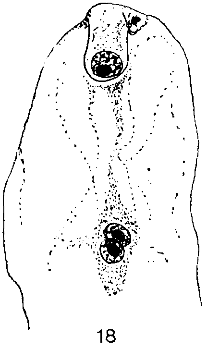

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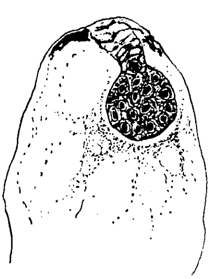

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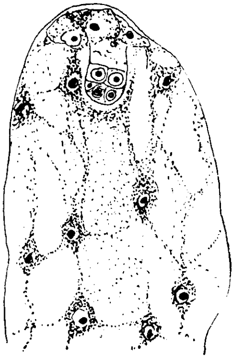

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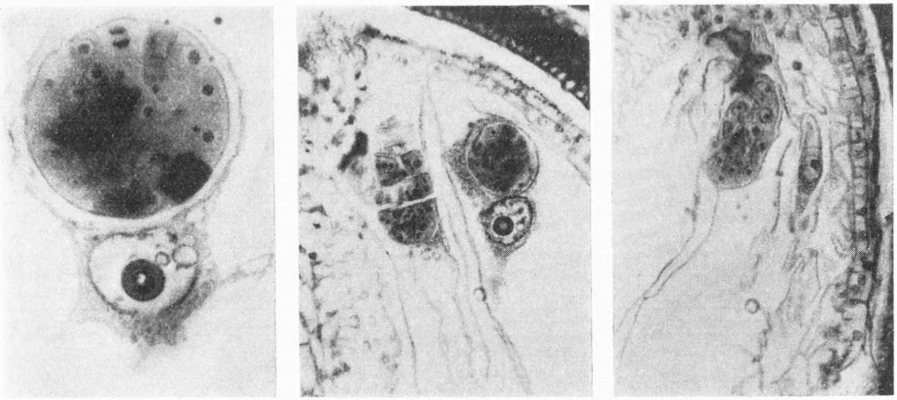


25 26 27

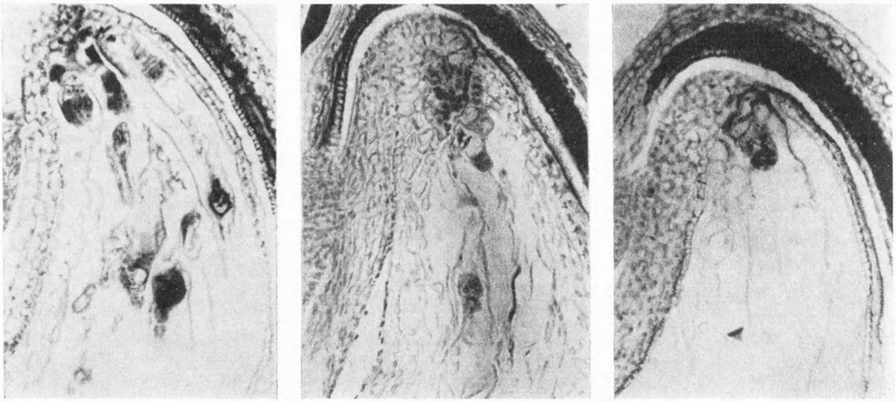
Figs. 25—27. Microphotographs from *P. collina* C — B. — 25. Old embryo + degenerating central nucleus. No pollination. — 26. Two embryos + one degenerating central nucleus. — 27. One embryo. A somatic nucellus cell enlarging to produce an aposporous gametophyte.

unite, not only among themselves, but with a third nucleus of foreign origin. Pseudogamy is the single apomictic method in *Potentilla*. Therefore the third nucleus is of male origin (in *Alchemilla* some findings warrant the idea that two polar nuclei may fuse with one antipode or synergid nucleus!). If these results become confirmed for a great material, pseudogamy would imply one process of apomixis and one of fertilization simultaneously.

Endosperm and embryo formation in relation to incompatibility. — In two papers MÜNTZING gave the outlines of a new explanation regarding the failure of seed-setting in crosses between diploids and polyploids (MÜNTZING 1930, 1933). According to him, the ratio of chromosomes in embryo : endosperm : soma is a fundamental principle for the survival or development of seeds among higher plants. This ratio is generally $2 : 3 : 2 = 1 : 1.50 : 1$, owing to double fertilization.

In this respect diplosporous and aposporous organisms behave

Figs. 9—12. *P. collina* C — G. Open pollination. — Figs. 13—15. *P. collina* C — C. In fig. 13 and 14 embryo formation without pollination. In fig. 15 endosperm 20 days after pollination. — Figs. 16—20. *P. argentea* A — H. Open pollination. Note the fusion of three nuclei in Fig. 17 (= the microphotograph in Fig. 29). — Figs. 21—24. Chromosome numbers from embryo (*P. collina* C — G 21, $2n = 35$), endosperm (*P. collina* C — G, 22—23, *P. argentea* A — H, 24). — Figs. 9—20 × 235, Figs. 21—24 × 2400.



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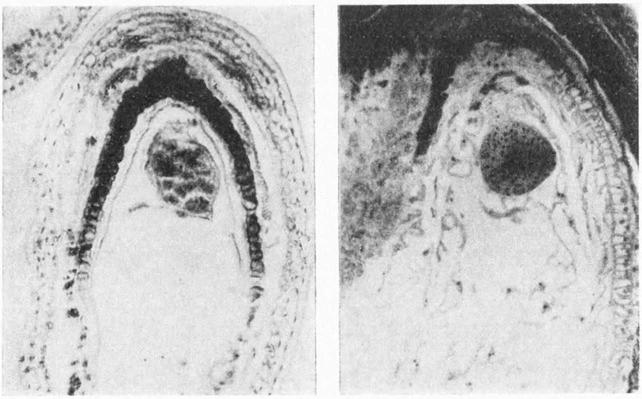
Figs. 28—30. — 28. *P. collina* C — B. Three embryos + two degenerating central nuclei. — 29. *P. argentea* A — H. Three-nucleus fusion in the polar nucleus region. Cf. Fig. 17. — Fig. 30. *P. collina* C — G. Young degenerating embryo. No fertilization has probably occurred.

quite differently from the normal. In *Antennaria dioica,* being sexual and diploid, the ratio is 32 : 48 : 32 = 1 : 1.50 : 1, but in *A. alpina* it is 84 : 84 : 84 = 1 : 1 : 1, due to the inhibited fusion of polar nuclei. In *Eupatorium cannabinum* it is likewise 1 : 1.50 : 1, but in *E. glandulosum* either 51 : 102 : 51 = 1 : 2.00 : 1 or 51 : 51 : 51 = 1 : 1 : 1, since polar nuclei may fuse or fail to fuse before endosperm development. In the pseudogamous *Potentilla collina* C—G the ratio is 35 : ± 93 : 35 = = 1 : 2.66 : 1, in the sexual *P. rupestris,* 1 : 1.50 : 1. In *Hypericum perforatum* (selfpollinated) the proportion is most commonly 32 : 80 : 32 = 1 : 2.50 : 1, exceptionally (the eggcell being fertilized) 48 : 80 : 32 = = 1.50 : 2.50 : 1. After pollination with *H. acutum* (2n = 16) the ratio is 40 : 72 : 32 = 1.25 : 2.25 : 1 or less frequently 32 : 72 : 32 = 1 : 2.25 : 1, i. e. self-pollination and cross-pollination give exactly opposite results regarding the chromosome ratios.

The figures mentioned should be sufficient to show that most probably the mutual relation of embryo, endosperm and somatic tissue is of no great influence in apomicts. These differing from sexuals in many respects, however, we dare not draw general conclusions from their behaviour.

The apomixis of Alchemilla. — A full account of the early stages was given by GUSTAFSSON 1935 and 1939 b. An interpretation with regard to the embryo development will be furnished



31 32

Figs. 31—32. *P. collina* C — C. — 31. Embryo degenerating. Emasculated flower. — 32. Normal embryo and endosperm formation after artificial pollination. — Microphotographs.

here in accordance with the data published by Murbeck 1901 a and b, 1902, as well as by Böös 1924.

A. arvensis belongs to the subgenus *Aphanes*. Its approximate chromosome number was reported as 48 (6×8, 8 being the basic number). The latter of the writers examined in 1935 some specimens from Lund Botanical Garden and found the number 49—50. Since the basic number is probably 7 (unpublished results from *A. vulgaris*-apomicts), this biotype ought to be heptaploid. Apospory of the *Alchemilla*-type is present. Pollen-tubes grow down to the micropyle through the style and the integument (chalazogamy, Murbeck 1901 b). Murbeck (1901 a) found that the endosperm nucleus and the eggcell begin mitosis almost simultaneously, the first endosperm division beginning somewhat earlier than the first egg-mitosis. In several slides bodies were noticed close to the eggcell and to the polar nuclei and regarded as sperm nuclei. The eggcell fertilization could not be observed. The bodies close to the eggcell consist according to Böös 1924 of discoloured particles. Pollen-tubes always occurring and apospory being present, apomictic propagation is probably pseudogamous. Pollen is regular and completely fertile.

Biotypes belonging to *Alchemilla* subgenus *Eualchemilla* have very high chromosome numbers (they are not oktoploid but 13—15—17-ploid, 2n = ±91—±105—±119, the basic number presumably being 7, Gustafsson). Some apomicts lack pollen entirely, so for instance

A. alpina, sericata, pubescens, vestita. Others, as *A. acutangula, subcrenata, alpestris,* produce fairly poor pollen. One type only (*A. arvensis* excluded) has regular pollen formation, i. e. *A. speciosa.* A marked connection between pollen degeneration and time of embryo formation exists (cf. *P. collina* type C—B).

The ripe embryosac contains eggcell and two synergids, two polar nuclei and three antipodes. Embryo formation and endosperm development are independent processes. The first mitosis of the egg in *A. alpina* (completely male-sterile) begins already at a stage when anthers and perigon have not yet opened. In one case 20 flower-buds were fixed approximately 8 hours previous to their opening. Three of these contained the first egg-mitosis, eight showed a two-celled embryo. In all cases the eggcell was covered with a cellulose-membrane. Eleven out of 20 buds contained an endosperm with 2—8 nuclei. The fusion of polar nuclei is most likely omitted, contrasting to the general behaviour. I. e. of all apomicts examined, *A. alpina* has left the sexual or even the pseudogamous state most conspicuously behind. The correlation between extreme parthenogenesis and complete male-sterility argues strongly for a hormonal interbalance of male and female organs. This idea is supported from the fact that diplosporous organisms display profound differences between male and female meiosis (GUSTAFSSON 1938).

Endosperm formation begins usually later in the male-fertile apomicts than in *A. alpina* and after the first egg-mitosis. In extreme cases the embryo might have reached a 10—50—100 cellular stage (*A. speciosa, pastoralis, acutangula, alpestris*) without any endosperm occurring. The embryological picture is similar to that in *P. collina* C—B. Endosperm formation is preceded by the fusion of polar nuclei. On the other hand, endosperm formation starts sometimes very early in relation to the egg-division, so for instance in *A. speciosa,* where the endosperm of two embryosacs had formed 8 respectively 32 nuclei, the eggcell still being undivided.

In several slides (no less than 26 cases) the occurrence of three (or even four) nuclei in the polar nucleus region was observed. According to MURBECK they consist of two polar nuclei plus one extra nucleus, either of antipode or synergid origin. Whether this is always the case or pseudogamy of the *Potentilla*-type can also be present, we dare not decide. The resemblance of these pictures to those occurring in *Potentilla* made us discuss the possibility that the three fusing nuclei in *P. collina* and *argentea* had similar origin. Especially the size of the third nucleus favoured this opinion. Since in the unpollinated flowers three fusing nuclei were never seen, we regard the objection as hardly probable. MURBECK found the three nuclei frequently lying close to each other and subsequently fusing to one central nucleus. According to him, most likely they also formed endosperm. In such a case an internal sexual condition remains, causing the origin of an endosperm with at least three times the somatic chromosome number. The common occurrence of more than two fusing nuclei is very noticeable.

The genesis of *Alchemilla* or its European representatives gets now an interesting explanation: First we have *A. arvensis* (the type examined by MURBECK and BÖÖS), still pseudogamous, with regular pollen and pollen-tube growth, the chromosome number being ± 49, then the great number of *Alchemilla vulgaris*-biotypes, partially pollen-sterile and autonomously parthenogenetic, with fusion of the two polar nuclei prevailing, endosperm frequently formed from three nuclei, chromosome numbers very high, many biotypes having ± 100 chromosomes, and finally *A. alpina,* completely male-sterile, with the fusion of the polar nuclei probably omitted, embryo formation beginning extremely early, chromosome number being very high, one biotype examined having ± 120 chromosomes.

Apospory, nucellar embryony and diplospory in relation to sexuality. — The findings of autonomous parthenogenesis in *Potentilla* together with the endosperm fertilization in *Hypericum* and *Potentilla* seem to us to furnish the necessary data for an understanding of the different processes leading to the origin of agamospermy.

In the case of apospory the following series of transitions from sexuality with double fertilization towards autonomous parthenogenesis exists:

A. No apomictic propagation but aposporous gametophytes are formed: *Leontodon hispidus* (BERGMAN 1935) and others.

B. Induced apomixis = pseudogamy.

  I. The eggcell has great sexual tendency (fertilization still possible in spite of the unreduced number) but may also develop parthenogenetically. The central nucleus must be fertilized. In the case of parthenogenetic development the eggcell is stimulated from the developing endosperm or from the pollen-tube: *Hypericum perforatum* (NOACK 1939).

  II. The eggcell can be fertilized or develop parthenogenetically. Fertilization or no fertilization of the central nucleus? Stimulation or no stimulation of the eggcell? *Poa pratensis* (ÅKERBERG 1939).

III. The central nucleus must be fertilized. The embryo formation ± stimulated from endosperm or pollen-tube. *Potentilla collina* C—G. Probably other *Potentilla*-apomicts.

IV. Fertilization of the central nucleus. Autonomous parthenogenesis: *P. collina* C—B and others.

V. Pollination necessary. Hormonal stimulation of eggcell and central nucleus without fertilization? Embryo and endosperm formed simultaneously: *Alchemilla arvensis* (MURBECK 1901, BÖÖS 1924).

C. Autonomous apomixis.

VI. Eggcell and central nucleus parthenogenetic. Polar nuclei still fuse. Internal three-nucleus fusions common: Many *Alchemilla vulgaris*-apomicts (MURBECK 1901).

VII. Eggcell and central nucleus divide autonomously. No three-nucleus fusions: *Hieracium pilosella*-type of apospory (ROSENBERG 1908).

VIII. = VI but polar nuclei do not fuse and embryo formation is extremely early: *Alchemilla alpina* (MURBECK 1901).

This scheme, as well as the following ones, does not claim to be complete or even correct in all details. Especially the embryology of pseudogamy in *Poa pratensis* and *Alchemilla arvensis* needs a careful study. The gradual increase in autonomous and obligate apomixis is however obvious.

In the case of diplospory the transitions between sexuality and autonomous apomixis are rare, *Poa alpina* not known for certain as pseudogamous. The following series exists:

A. = A in the case of apospory. For instance *Artemisia nitida* and *Ochna serrulata* (CHIARUGI 1926, CHIARUGI and FRANCINI 1930).

B. Induced apomixis = pseudogamy.

I. Pollination probable. Fertilization of the unreduced eggcell can occur. Stimulation of the eggcell? Fertilization or stimulation of the central nucleus? *Poa alpina* (MÜNTZING 1940).

II. Fertilization of the central nucleus necessary. Stimulation of the eggcell? *Zephyranthes texana* (PACE 1913).

C. Autonomous apomixis.

III. Most of the diplosporous species belong here. Polar nuclei may fuse or not. Meiosis with subsequent chromosome reduction may occur. The nature of the first meiotic division or its compensation serves as division principle (GUSTAFSSON, 1935, 1938, 1939).

In the case of nucellar embryony the same transitions exist as with regard to apospory. Pseudogamy does not imply a fertilization act in the same sense however. Very striking is the necessity in several genera of a normal egg fertilization, previous to the formation or initiation of nucellar embryos. Here the pollen-tubes do not contain the stimulative substances necessary but these are at first formed in the fertilized egg (or owing to the fertilization in the embryo-sac or nucellus). Other genera behave differently, the single stimulation by the pollen-tube being fruit and seed development without the initiation of embryo formation, this existing already in the unpollinated flowers. The substances working here are probably similar in effect and constitution to those causing natural and experimental parthenocarpy (growth hormones, auxins+hetero-auxins). In most cases of nucellar pseudogamy the embryos arise close to the eggcell, an intense growth force acting on integument or nucellar cells.

A. = A in the case of apospory and diplospory. The nucellar embryony only a tendency: *Potentilla geoides* (POPOFF 1935).

B. Induced nucellar embryony = pseudogamy.

- I. The formation of nucellar embryos dependent on the fertilization of the eggcell and the division of the fertilized egg: *Citrus aurantium* (STRASBURGER 1878).
- II. Nucellar embryony dependent on fertilization or pollen-tube stimulation. Almost similar to I: *Funkia ovata, Opuntia vulgaris, Euphorbia dulcis* (STRASBURGER 1878, GANONG 1898, HEGELMAIER 1903, CARANO 1925, 1926).
- III. Autonomous nucellar embryony but stimulation to seed and fruit formation by the pollen-tube: *Nothoscordum fragrans* (STRASBURGER 1878).

C. Autonomous nucellar embryony.

- IV. Pollen-tubes not necessary but increasing the tendency of apomictic embryo formation (?). Ripe embryosacs are not produced: *Nigritella nigra* (AFZELIUS 1928, 1932).
- V. No pollen-tubes or fertilization necessary but nucellar embryony stimulated by the degeneration of aposporous embryosacs (?): *Ochna serrulata* (CHIARUGI and FRANCINI 1930).
- VI. No pollen-tubes or fertilization necessary. Autonomous embryo, seed and fruit formation: *Caelobogyne ilicifolia, Xanthophyllum Bungei, Sarcococca pruniformis* (STRASBURGER 1878, LONGO 1908, WIGER 1930).

The occurrence of many transitions in apospory and nucellar embryony does not necessarily imply that the most extreme cases of apomixis have arisen *via* the less extreme cases. In many genera the apomictic propagation method in question may have arisen all at once, its nature being dependent on the genotypical basis of the species or genus. In other genera, as for instance *Alchemilla,* most probably the different transitions reflect the phylogenetic alterations of the species groups.

Finally it ought to be pointed out that investigations on the physiology or chemistry of eggcell development must also take the different capacity in pseudogamous organisms of mitosis in eggcells and central nuclei into account. Future work will presumably reveal great hormone differences within the embryosac.

Summary.

The writers have examined the embryological basis of pseudogamy in some biotypes of *Potentilla.* In *P. collina* C—B parthenogenesis is autonomous, i. e. embryos are formed without the stimulation of pollen or pollen-tubes. Endosperm cannot develop, however, without pollination. In *P. collina* C—G and *P. argentea* A—H the endosperm contains more than twice the somatic number (approximately $2n + 2n + \frac{2n}{2}$). A fertilization of the central nucleus is necessary to initiate endosperm division. Actually the fusion of three nuclei in the polar nucleus region was observed. The application of hetero-auxins in different concentrations failed to produce seeds. If these data can be generalized, pseudogamy of *Potentilla* consists of one process of apomixis and one process of fertilization.

The fixed material of *P. collina* C—G and *P. argentea* A—H, as well as the living plant material, was placed at our disposal by Professor Dr. A. MÜNTZING, Lund, Sweden. We are indebted to him for valuable help and criticism. The folliculin, testosteron and aneurin, used in these experiments, were kindly supplied by the Rockefeller Foundation, Paris.

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BOTANISKA NOTISER 1940, LUND 1940.

On the morphology of Agropyron junceum (L.) PB., A. repens (L.) PB. and their spontaneous hybrids.

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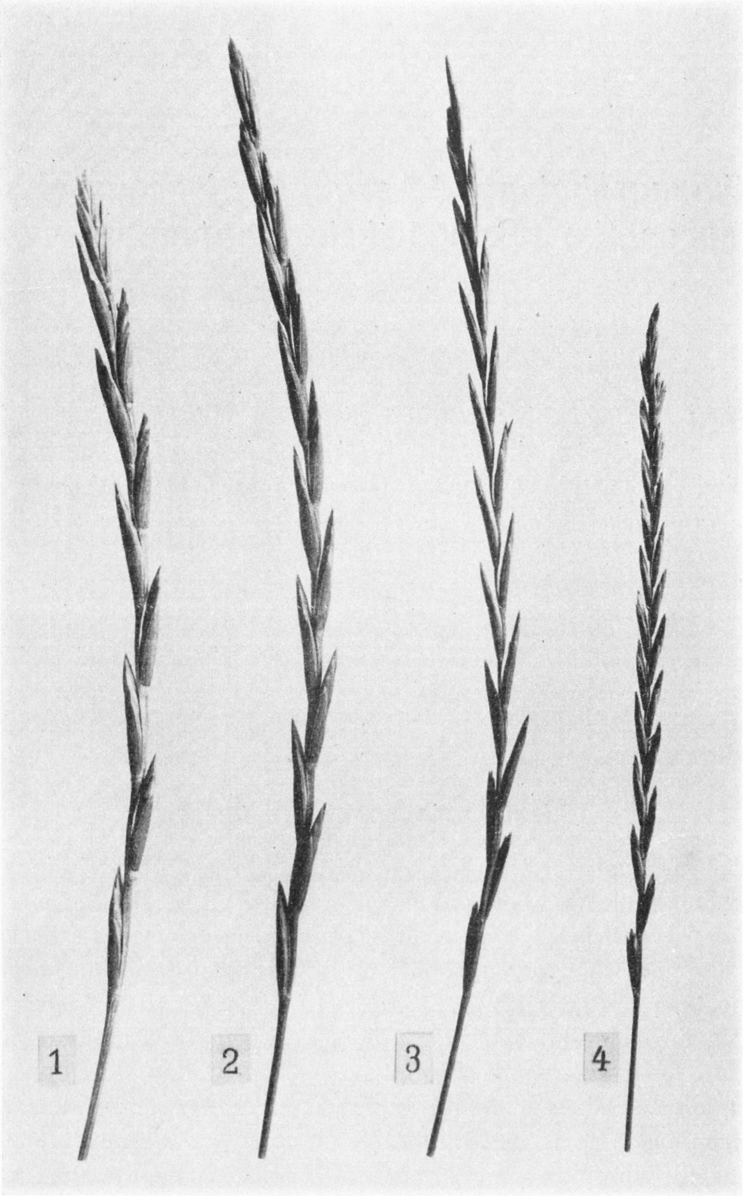
Institute of Genetics, Lund, Sweden.

The purpose of this paper is to give some notes on the morphology of the material cytologically studied by me in another paper (ÖSTERGREN 1940). The chromosome numbers of the two species are: *Agropyron junceum* (L.) P. B. 2n=28, and *A. repens* (L.) P. B. 2n=42. Seven of their hybrids were found to have 2n=35, as expected from the chromosome numbers of the parents. One hybrid was found to have 2n=49. This hybrid is supposed to contain two gametic chromosome sets from *A. junceum* and one from *A. repens* (14+14+21). Origin discussed in the cytological paper. The hybrid with 35 chromosomes is pentaploid, the one with 49 chromosomes heptaploid.

Identification of the material.

The material was identified with the aid of the descriptions given by HOLMBERG 1926. That the plants considered by me to be hybrids, really are so is evident from their extremely high sterility (ÖSTERGREN l. c.), the fact that they contain odd numbers of chromosome sets, their meiotic irregularities (ÖSTERGREN l. c.), and their morphology's being in most characters intermediate between the supposed parents. There are two types of *Agropyron* hybrids in Sweden which are rather similar to each other, *A. junceum* (L.) P. B.×*A. repens* (L.) P. B. and *A. junceum* (L.) P. B.×*A. litorale* (HOST) DUM. *A. junceum*×*litorale*, too, has the chromosome number 2n=35 (SIMONET 1935). In order to determine if the hybrids studied here could belong to *A. junceum*× *litorale,* they were compared also with the more extensive description of this hybrid given by VESTERGREN 1925. If the characters given there are reliable, it is rather certain that the individuals studied here cannot belong to *A. junceum*×*litorale.* The leaves of *A. junceum*×



Figs. 1—4. Spikes. — Fig. 1, *Agropyron junceum;* Fig. 2, *A. junceum* × *repens* (2n = 49); Fig. 3, *A. junceum* × *repens* (2n = 35); Fig. 4, *A. repens.*

Fig. 5. Top of lemma. — From left to right, *Agropyron junceum, A. junceum × repens* (2n = 49), *A. junceum × repens* (2n = 35), and *A. repens*.

litorale have larger nerves than those of *A. junceum×repens*. According to VESTERGREN (l. c. p. 270—271) there are about 15 in a leaf of 5 mm, whilst there are 25 in a 5 mm leaf of *A. junceum×repens*. This last number ist best in agreement with my material. VESTERGREN also describes the types of hairs present on the leaves of these hybrids, and I have the impression that the description of the conditions in *A. junceum×repens* agrees with my material. I have thus observed in my material (the heptaploid hybrid too) those long hairs which often occur on the nerves of *A. repens* and *junceum×repens*. It seems to me that they are more common on the lower leaves of a straw than on the upper ones. My hybrids do not have such bristles on the free border of the vagina as are often present in *A. junceum×litorale* (VESTERGREN l. c. p. 271). The essential character of *A. junceum×litorale,* however, is the form of the upper end of the lemma (VESTERGREN l. c. pp. 271—272). It is blunt but emarginate on either side of the central nerve which protrudes very slightly or not at all beyond the lateral lobes. There is no tendency in this way in my hybrids (fig. 5).

A. junceum×litorale is, as far as I can see, the only hybrid with which a confusion might be considered probable. It is true that foreign *Agropyron* species may occur occasionally in Sweden, these might form hybrids, and such hybrids might occur in my material. Thus HOLMBERG (l. c. pp. 275—276) mentions *A. intermedium* (HOST) P. B. and *A. elongatum* (HOST) P. B. I have, however, seen no characters in my hybrids that require another origin than that suggested.

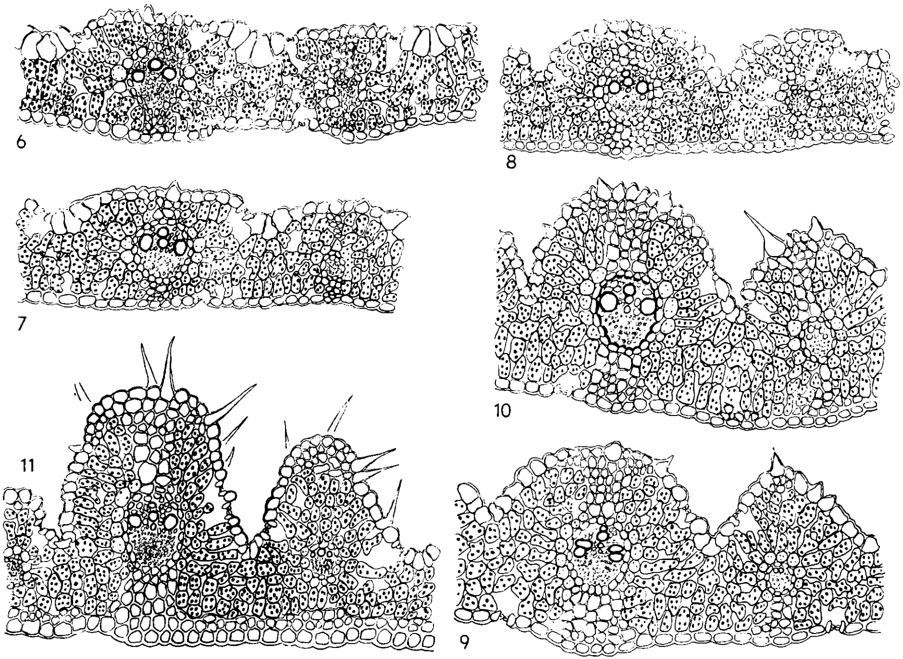
My hybrids are, then, hybrids between sections *Juncea* and *Repentia* in the system of PRAT 1932 (pp. 230—246). The hybrid *A. junceum×litorale* studied by SIMONET (1935) is a hybrid between sections *Juncea* and *Intermedia,* as it is stated by PRAT that *A. litorale* belongs to section *Intermedia* (l. c. p. 217 and 230—246). According to SIMONET 1934 the hybrid studied by him then, *A. junceum* (L.) P. B.×*A. littoreum* (SCH.) ROUY, is also a hybrid between *Juncea* and *Intermedia* (l. c. p. 805). HOLMBERG and VESTERGREN say that there are both bearded and beardless individuals belonging to *A. litorale* (HOST) DUM. SIMONET (1934) considers *A. litorale* (HOST) DUM. a beardless species and *A. littoreum* (SCH.) ROUY a bearded one. Perhaps then the plants considered by SIMONET as *A. littoreum* are identical with the bearded individuals of *A. litorale* in the sense of HOLMBERG and VESTERGREN. According to HOLMBERG *Triticum littoreum* SCH. is synonymous with *Triticum acutum* D. C., but according to SIMONET it is one of the parents of *A. acutum* (D. C.) ROEHM et S. The two authors are unanimous in considering *A. acutum* a hybrid, but have different opinions as to its parents. I do not think it necessary, however, to discuss these questions in more detail in this paper. It seems rather probable to me that neither SIMONET's hybrid *A. junceum*×*litorale* nor his *junceum*× *littoreum* are synonymous with my hybrids between *A. junceum* and *repens*. It seems to me that *A. junceum*×*repens* has not been studied cytologically before.

Morphology.

In their general appearance my pentaploid hybrids seem more similar to *A. repens* than to *A. junceum*. The heptaploid hybrid is more similar to *A. junceum* than are the pentaploid hybrids.

A. repens seems in general to be taller than *A. junceum*. The hybrids are rather variable in height. Some pentaploid individuals are more procumbent in their mode of growth than the most procumbent individuals of the parents ever seen by me. *A. repens,* however, is a very variable species, and there may perhaps be individuals of this species with a similar mode of growth, although I have not seen them. It is not impossible, however, that such a hybrid might be able to transgress its parents in some characters. Thus, JOHNSON (1938) has observed »transgressive expression» of some characters in F_1-hybrids between *Triticum* and *Agropyron* (l. c. pp. 432—435). The heptaploid hybrid is taller than the pentaploid ones, and taller also than some individuals of *A. repens*. In this respect, then, the heptaploid hybrid does not resemble *A. junceum* more than the others do, but rather the contrary. No measurements of plant height were made.

In the figures of the cross sections of the leaves (fig. 6—11) it can be seen that the leaves of *A. junceum* are thicker than those of *A. repens,* and that those of the hybrids are intermediate, the heptaploid type being most similar to *A. junceum*. The differences are due chiefly to the different heights of the nerves. I have the impression that such differences between the types studied are the rule, although no measurements were undertaken. (These differences can be seen even on the living plants, growing in the field; no sections are necessary for that purpose.)



Figs. 6—11. Cross sections of leaves. — Figs. 6—7, *Agropyron repens;* Figs. 8—9, *A. junceum* × *repens* (2n = 35); Fig. 10, *A. junceum* × *repens* (2n = 49); Fig. 11, *A. junceum.* — × 88.

These figures also show that the underside of the leaves of *A. junceum* has a subepidermal layer of mechanical tissue. In *A. repens* there is mechanical tissue under the epidermis only at the nerves. The pentaploid hybrids agree in this respect with *A. repens.* The heptaploid hybrid, however, has a slight tendency to the formation of mechanical tissue also between the nerves, small islands of mechanical cells occasionally being found there. As this subepidermal layer of mechanical tissue is characteristic of *A. junceum* (Duval-Jouve 1869, Prat 1932, and others), this tendency in the heptaploid hybrid is in my opinion strong evidence of its close relation to this species. (It seems probable, however, that the amount of mechanical tissue may vary, e. g. under the influence of environmental factors, and that the difference between the pentaploid and the heptaploid hybrids in this respect cannot be considered certain from a small number of observations.) Leaf anatomy was studied in *Triticum—Agropyron* hybrids by Johnson 1938 (pp. 428—430). The value of the cross section of the leaf in recognizing grass hybrids was pointed out by Knoll 1929.

Table I. Spike length.

Material		cm 3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	M ± m	n
A. repens 2 ind.	a	1	1	7	15	19	27	24	31	25	11	7									
	b					1	7	15	8	9	11	6	7	2							
	total	1	1	7	15	20	34	39	39	34	22	13	7	2						9,99 ± 0,15	234
A. junceum × *repens* 2n = 35								1		1	5	6	8	9	9	7	7	3		15,70 ± 0,29	56
A. junceum × *repens* 2n = 49						1		3	3	11	9	16	20	20	12	13	7	3		14,71 ± 0,23	118
A. junceum							1	3	11	17	29	19	20	15	5	5	1			13,32 ± 0,18	126

Table II. Number of spikelets per spike.

Material	Number 4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	M ± m	n
A. junceum	1	2	12	14	26	26	12	9															8,28 ± 0,15	102
A. repens										1	3	2	7	6	5	2	6	6	3	3	5	1	19,06 (± 0,44)	50
A. junceum × *repens* 2n = 49							5	5	13	16	9	1											12,45 ± 0,18	49
A. junceum × *repens* 2n = 35									1	5	12	6	10	8	7	1							15,52 (± 0,24)	50

Table III. Length of spikelets.

Material		mm											M ± m	n
		7	9	11	13	15	17	19	21	23	25	27		
A. junceum								5	19	21	5		23,04 ± 0,22	50
A. repens	a	14	31	10	2								10,00 ± 0,18	57
2 ind.	b		2	5	19	7							13,88 ± 0,26	33
A. junceum × *repens* 2n = 49						2	4	15	19	13	2		21,56 ± 0,29	55
A. junceum × *repens* 2n = 35					4	12	13	7	1				17,41 ± 0,31	37

The leaves of *A. junceum* lack auricles, and those of *A. repens* have them (at least in my material). My hybrids have auricles.

Measurements of the spike length of my material show that the hybrids have longer spikes than either parent species (table I). According to HOLMBERG (l. c. p. 278) this is usually the case. The related hybrid studied by SIMONET 1934 has according to him spikes of a length intermediate between its parents (l. c. p. 804). The longer spikes of my hybrids might perhaps be due to hybrid vigour, but may be explained also in other ways. It may be due to the fact that all characters in a hybrid are not exactly intermediate between the parents; the hybrid may in one character be more similar to one of the parents, and in another more similar to the other. The axis of the spike has in *A. junceum* a small number of long internodes, and in *A. repens* a great number of short internodes. If we assume that the hybrids resemble *A. junceum* more in the length of the internodes, and *A. repens* more in their number, the relation found can be understood.

The number of spikelets per spike is greatest in *A. repens,* and smallest in *A. junceum.* The two types of hybrids are intermediate, the pentaploid type being more similar to *A. repens,* and the heptaploid one more similar to *A. junceum* (table II). The length of the spikelets is also intermediate, and in this case, too, the heptaploid hybrid is more similar to *A. junceum* (table III).

The measurements given in these tables (I, II, and III) have in the case of *A. junceum* been made on many individuals, which do not show any pronounced morphological differences. In the case of the heptaploid hybrid they were made on a clone. The measurements on the pentaploid hybrid were made on 4 individuals which show some differences. In *A. repens* one or two (if two, both are given in the tables) individuals were measured. In my opinion the individuals measured are typical (the heptaploid hybrid cannot be judged in this respect as only one clone is known), and I feel inclined to consider the measurements as illustrating characteristic differences.

The glumes and the lemmas are much broader in *A. junceum* than in *A. repens,* and the hybrids are intermediate, the heptaploid one being in this respect much more similar to *A. junceum* (figs. 1—4). This relation is quite evident, although no measurements were made.

The hybrids in my material are beardless, although *A. repens* is often more or less bearded. It seems probable that beards are ± recessive (in the hybrid of SIMONET 1934 they were recessive).

The axis of the spike is much more fragile in *A. junceum* than in *A. repens.* I have the impression that the hybrids are intermediate, and that the fragility is more pronounced in the heptaploid one.

When the spikes are fully developed (during flowering and after) they are hanging in *A. junceum* but upright in *A. repens.* The hybrids have a slight tendency to hang and are thus intermediate. The heptaploid hybrid seems to have a stronger tendency than the others.

According to VESTERGREN the anthers do not come out of the flowers during flowering in such hybrids. RAUNKIAER, however, has seen them come out, and so have I.

The two species are not so closely related that the correlation usually found between chromosome number and morphology holds in a comparison between them. Thus the tetraploid species, *A. junceum,* has a thicker stem, thicker leaves, and bigger floral parts (spikelets) than the hexaploid *repens.* *A. repens,* however, is taller than *junceum.* Pollen and stomata were measured, and in most of the cases studied cell size was found to be larger in the tetraploid species. (For details on the correlation between morphology and chromosome number in closely related types, see MÜNTZING 1936.)

Discussion.

The assumption that the heptaploid hybrid contains two gametic chromosome sets of *A. junceum* and only one of *repens* is in agreement with the fact that this hybrid is in many respects more similar to *A. junceum* than are the others. It is evident that the morphology of an individual must be affected not only by the kind of genetic factors present in it, but also by the number of times the different factors are repeated. This is shown also by the well-known existence of morphological differences between the aneuploid types of a species and the corresponding normal type.

If the heptaploid hybrid in a certain character is more similar to *junceum* than are the pentaploid hybrids, it is probable that the difference between the two species in this character is caused by differences in chromatin quality. If it had been caused by the difference in chromosome number, we might have expected the heptaploid hybrid to be more similar to *repens* in this character. As the heptaploid hybrid in plant height is more similar to *repens,* it might be suggested that in this character the difference between the two species is caused chiefly by their chromosome numbers. (It is evident, however, that a single heptaploid clone can give no idea of the variation which may exist within hybrids of that kind, and that no certain conclusions can be made from so small a material.)

The discovery that the hybrid between *A. junceum* and *A. repens* consists of two caryologically different types contributes to the explanation of the variation for which this hybrid is well-known. It is known that some of the hybrids are more similar to one of the parents, and some of them more similar to the other. HOLMBERG 1926 (p. 278) thus mentions the forms *subjunceum* and *laxum.* FOCKE 1881 suggests that such types may have arisen through back-crosses to the parents (l. c. p. 411). As is suggested in my cytological paper, the heptaploid hybrid may have arisen in this way, but also in another way. If the egg-cells functioning in a back-cross were not unreduced, we might expect an occurrence of aneuploids. No certain aneuploids were found, however, in my rather small material. Evidence in favour of the occurrence of back-crosses is the fact that RAUNKIAER 1927 (p. 346) thinks he has found a triple hybrid *A. junceum*×*litorale*×*repens.* Another cause of the variation in *junceum*×*repens* is the variation of its parents, especially of *A. repens,* as *junceum* is a rather uniform species. (This cause of the variation is pointed out also by VESTERGREN l. c. p. 284. RAUNKIAER, too, has found *A. junceum* to be a uniform species l. c. p. 338.) As the variation is caused by more than one thing, we probably cannot simply identify my heptaploid hybrid with the form *subjunceum,* especially as this form is said to be a low type, whilst my heptaploid is taller than the common hybrids. Another cause why the hybrid between *junceum* and *repens* has been considered so variable is probably wrong determinations. In herbarium material VESTERGREN thus found among *A. junceum*×*repens* the hybrids *A. junceum*×*litorale*, and *A. litorale*×*repens*, and the species *A. elongatum*, *A. intermedium*, and *A. litorale*.

DARLINGTON 1937 (p. 234) has placed *A. acutum* among the species of known origin, considering it to be synonymous with *A. junceum*×*littoreum*, as suggested by SIMONET 1934. In the opinion of some other authors, e. g. HOLMBERG 1926, *Triticum acutum* is synonymous with *A. junceum*×*repens*. In my opinion it is quite impossible to consider *A. acutum* a species. It has, it is true, a pronounced vegetative propagation, but that cannot make a species of it. It has scarcely more right to such a position than any sterile F_1-hybrid. The fact that *A. acutum* some time, long ago, happened to be described as a species has no influence on that matter.

Summary.

The author has found *A. junceum* × *repens* to consist of two types with different chromosome numbers. One is considered to contain one gametic chromosome set from each parent, the other, two gametic sets from *junceum* and one from *repens*. The identity of the material is discussed, and it is considered rather certain that the hybrids really are *junceum* × *repens*. The morphology of the two hybrid types is described, and in most characters found to be in agreement with the assumptions made as to their constitution, the one supposed to contain more of *junceum* being more similar to that species. The discovery of two caryological types in *A. junceum* × *repens* contributes to some extent to the explanation of the variation of this hybrid.

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BOTANISKA NOTISER 1940, LUND 1940.

Artemisia borealis Pall. var. bottnica (Kindb.) Lindb. fil.

Dess systematiska ställning och förekomst i Fennoskandia.

AV STELLAN ERLANDSSON.

I Upsala botaniska bytesförenings katalog våren 1873 upptages en för vetenskapen ny *Artemisia*-art, *A. bottnica* LUNDSTRÖM, mscr. Originallokalen var belägen vid Pite älvs utlopp i Bottniska viken, och upptäckaren var framlidne prof. A. N. LUNDSTRÖM.

Som art blev *A. bottnica* icke långvarig. Redan samma år kallar KINDBERG (1873, p. 48) den för *A. campestris *bottnica.* Till skillnad från huvudarten skulle denna varietet hava »holkar dubbelt större, jämte bladen silkesludna» (KINDBERG l. c.). Även HARTMAN (1879) för den som varietet under *A. campestris.* Som motivering till denna placering framhåller HARTMAN, att han endast sett pressade exemplar, och på dem kan han icke avgöra, om *A. bottnica* är att betrakta som egen art eller blott en form, som från huvudarten avviker beträffande hårighet, korgarnas storlek m. m. Enligt HARTMAN (1879, p. 7) skiljer sig var. *bottnica* från huvudarten genom »blomkorg. dubb. större än hos hufvudformen, med starkare håriga holkfj. Var. liksom hufvudf. med mer och mindre håriga stjelkar och blad.»

I våra floror har den, allt sedan KINDBERG och HARTMAN placerade *A. bottnica* som varietet under *A. campestris,* fått behålla denna plats. Endast hos NEUMAN (1901, p. 21) finnes en antydan till en annan placeringsmöjlighet. NEUMAN (l. c.) skriver, att var. *bottnica* »bildar övergång mellan *A. campestris* och den sibiriska *A. borealis* PALLAS, till vilken den även kan föras.» Tidigare hade dock NEUMAN (1882, p. 178) uttalat den förmodan, att var. *bottnica* torde vara identisk med den i Skåne förekommande *A. campestris* β *sericea* f. *adscendens.* Han tillägger dessutom (NEUMAN, l. c.) »den bör liksom f. *prostrata* hänföras till β *sericea* såsom en av dess former».

Senare har dr. H. LINDBERG, Helsingfors, tagit upp frågan om var. *bottnicas* systematiska ställning. I ett brev till H. HJELT har han meddelat, att *A. b.* var. *bottnica* bör placeras under den mångformiga *A. borealis* PALL. Med anledning av detta meddelande har HJELT (1926, p. 75) fört den till *A. borealis.*

I samband med andra undersökningar kom jag in på frågan om var *A. b.* var. *bottnica* rätteligen hörde hemma. Att enbart på grund av dess isolerade utbredningsområde vid nordligaste delen av Bottniska vikens kust, såväl i Sverige som i Finland, föra den till *A. borealis,* låter sig icke göra, även om dess förekomst sammanfaller med *A. borealis'* cirkumpolära utbredning. Då LINDBERG icke offentliggjort de undersökningar, på vilka han grundar sin uppfattning, och på vars tillförlitlighet jag icke tvivlar, har jag icke haft någon annan utväg än att själv företaga en utredning för att förvissa mig om riktigheten av placeringen.

Var. *bottnica* företer likheter med såväl *A. borealis* som *campestris.* Då den förstnämnda av dessa först helt nyligen uppdagats inom Fennoskandias florområde (REGEL, 1928 p. 179) låg det ju nära till hands att föra den till *A. campestris.* Genomgång av herbariematerial av *A. borealis* från Asien, Nordamerika, Grönland och Alperna visade till fullo mångformigheten hos denna art. Men granskningen ådagalade också, att en typ, som liknade *A. b.* var. *bottnica,* finnes på Kamtchatka. Polymorfien visar sig i bladformen, korgarnas storlek, hårighet m. m. Den kan vara genetiskt betingad. Men ståndorten spelar även en stor roll. Detta har jag beträffande *A. b.* var. *bottnica* kunnat konstatera. Det är nämligen stor skillnad i utseendet på exemplar, som vuxit på ren sandmark, och sådana, som vuxit bland block och strandklapper.

På grund av stora variationer i habitus har jag vid mina undersökningar huvudsakligen hållit mig till holkfjällens och blommornas utseende. Förberedande undersökningar visade nämligen, att skillnader förefunnos i korgarna hos *A. borealis* och *campestris,* vilket gjorde det möjligt fastställa, till vilken av dessa arter var. *bottnica* borde höra. Vid undersökningarna har jag använt material av *A. borealis, A. b.* var. *nana, A. b.* var. *bottnica* och *A. campestris.* Hur resultaten av undersökningarna av holkfjällens och blommornas utseende utfallit framgår av teckningarna i fig. 1 och 2. Utom dessa teckningar har jag ytterligare en del, men på grund av nuvarande förhållanden har jag icke kunnat få dem publicerade, emedan jag måst begränsa uppsatsens omfång. Jag har därför endast medtagit de teckningar, vilka varit absolut nödvändiga.

Se vi först på teckningarna i fig. 1, kunna vi genast konstatera

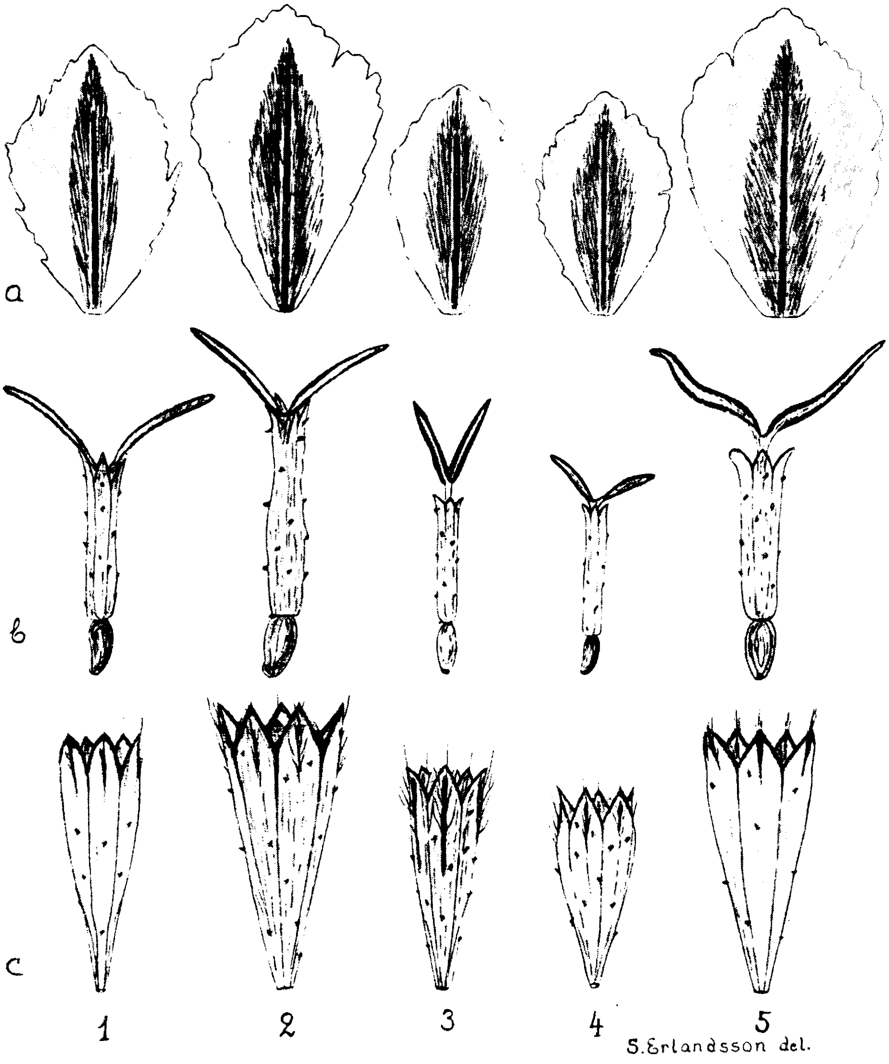

Fig. 1. a = *involucres* (holkfjäll), b = *ray-flowers* (strålblommor), c = *disk-flowers* (diskblommor) of 1. *Artemisia borealis;* Greenland occ.: Umanak (J. Lagerkranz, 1937); 2. *A. borealis;* Novaya Zemlya: Krestovii Fjord (B. Lynge, 1921); 3. *A. borealis* var. *bottnica;* Sweden: Pitsund (S. Erlandsson, 1934); 4. *A. b.* var. *bottnica:* Sweden: Sandskär (S. Erlandsson, 1934); 5. *A. borealis* var. *nana;* Germany: the Tyrol, Grossglockner (H. Friedel, 1936). Involucres 9 × magn., ray-flowers and disk-flowers 13 × magn.

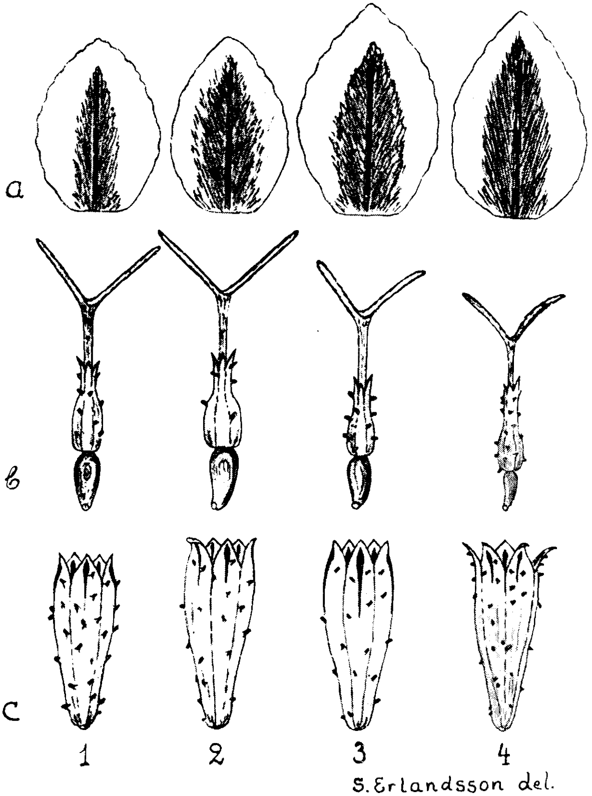

Fig. 2. a = *involucres*, b = *ray-flowers*, c = *disk-flowers* of *Artemisia campestris*. 1. Sweden: Upsala, Kronåsen (S. ERLANDSSON, 1937); 2. Sweden: Skövde, Våmb (S. ERLANDSSON, 1922); 3. Sweden: Malmö, Ribersborg (S. ERLANDSSON, 1937); 4. Belgium: Liège (O. DE DIEUDONNÉ). Involucres 9 × magn., ray-flowers and disk-flowers 13 × magn.

samstämmigheten i utseende hos holkfjäll, disk- och strålblommor. Den enda skillnad, som kan iakttagas, visar sig i storleksvariationen. Analysen av korgarna visar, att såväl *A. b.* var. *bottnica* som *A. b.* var. *nana* hör till *A. borealis'* formkrets. Beträffande hårigheten hos diskblommorna, är den icke konstant. Jag har nämligen sett exemplar av *A. borealis* från Grönland och *A. borealis* var. *nana* från Alperna, som sakna hår. Men i regel har diskblommorna hår.

Övergå vi så till fig. 2, kunna vi även för korgar från *A. campestris* konstatera den inbördes likformigheten i utseendet hos holkfjäll, disk- och strålblommor från olika individ och från skilda lokaler. Någon så stor inbördes storleksvariation som hos *A. borealis* coll. har jag icke kunnat konstatera hos *A. campestris*.

Av dessa teckningar framgår det med all önskvärd tydlighet, att LINDBERGS placering av var. *bottnica* under *A. borealis* är fullt motiverad.

I litteraturen påträffa vi en del mer eller mindre schematiska teckningar av holkfjäll och blommor hos *A. borealis* coll. Såväl BORZA (1933, Pl. II, fig. 18) som GAMS (HEGI, 1929, fig. 377) hava schematiska teckningar, vilket bl. a. framgår därav, att de på såväl disk- som strålblommor förekommande tuberklerna saknas. Likaledes saknas hår på diskblommorna, men frånvaro av dessa kan icke tillmätas någon större betydelse, efter vad jag tidigare påpekat om deras förekomst. Hos HALL and CLEMENTS (1923) förekomma utmärkta avbildningar av bl. a. disk- och strålblommor hos *A. campestris pacifica* (Pl. 14, fig. 8 and 10) och *A. campestris spithamaea* (tillhör *A. borealis*' formkrets; Pl. 15, fig. 8 and 10). Jämförelse mellan dessa figurer och de i fig. 1 och 2 visar överensstämmelsen mellan *A. campestris pacifica* och *A. campestris* å ena sidan och mellan *A. borealis* coll. med *A. campestris spithamaea* å den andra.

Hårigheten hos en del diskblommor har redan tidigt uppmärksammats. Sålunda anmärker LEDEBOUR (1844—46, p. 568—569) förekomsten av hår på blommorna hos två varieteter, men han omtalar icke, om det är hos disk- eller strålblommorna. Efter mina undersökningars resultat måste hårigheten i det här fallet gälla diskblommorna. LEDEBOUR (l. c.) skriver: *A. borealis* γ *Wormskjoldii* — — — »*corollis apice pilosiusculis glabrisve*» och för δ *Ledebourii* — — — »*corollis apice glabris v. raris pilosiusculis*».

Beträffande blommornas färg lämnar LEDEBOUR (1844—46) icke några upplysningar. Ej heller GAMS (HEGI, 1929) eller HALL and CLEMENTS (1923) angiver någon blomfärg. Däremot skriver HULTÉN (1930, p. 181) om *A. borealis* »with more or less pink flowers». HULTÉN har dessutom i ett brev meddelat mig, att alla exemplar av *A. borealis*, som han sett på Kamtchatka, haft röda blommor. Hos de flesta herbarieexemplar av arktiska *A. borealis*, som jag undersökt, ha blommorna varit mer eller mindre rödbruna, vilket tyder på, att de i levande tillstånd varit röda. Hos *A. b.* var. *bottnica* äro blommorna gula—gulröda. Såväl disk- som strålblommornas kronflikar äro i kanten mer eller mindre gulbruna—brunröda till färgen. Dessutom hava diskblommorna längsgående ränder av varierande längd och av samma färg som kronflikarnas kanter. Disk- och strålblommorna hava på utsidan oregelbundet strödda tuberkler.

Det har ifrågasatts, om *A. borealis* är en egen art eller icke. Detta beror säkerligen på den stora mångformigheten, i det att det finnes typer, vilka till habitus äro synnerligen lika *A. campestris,* t. ex. *A. b.* var. *bottnica.* Denna polymorfi resulterade tidigt i uppställande av ett flertal varieteter. Sålunda upptager LEDEBOUR (1844—46) icke mindre än sju av BESSER uppställda varieteter, nämligen *Purshii, Adamsii, Wormskjoldii, Ledebourii, Pallasii, Mertensii* och *Schanginii.* Därtill kommer den av FERNALD (1927, p. 93) beskrivna var. *latisecta* samt den även till *A. borealis* hörande *A. campestris spithamaea* (HULTÉN, 1930, p. 180).

HALL and CLEMENTS (1923) är av den åsikten, att *A. borealis* hör till *A. campestris.* I deras monografi över Nordamerikas Artemisior upptages följande sex underarter: *typica, pacifica, caudata, borealis, spithamaea* och *pycnocephala.* De tre förstnämnda av dessa bilda en grupp, de tre senare en annan.

Även GAMS har i HEGIS Illustrierte Flora von Mittel-Europa (1929) fört *A. borealis* till *A. campestris.* Enligt GAMS uppdelas den sistnämnda i följande underarter:

A. campestris subsp. *eu-campestris* BRIQUET et CAVALLIER (=subsp. *typica* HALL and CLEMENTS).
A. campestris subsp. *alpina* (DC. som varietet, FRITSCH som art) = (*Oligocarpus alpinus* JORDAN et FOURR. = *A. nana* var. *parviflora* GAUDIN).
A. campestris subsp. *borealis* (Pallas som art; inkl. *A. nana* GAUDIN).

Beträffande *A. b.* var. *bottnica* sätter GAMS den under subsp. *alpina* men framkastar samtidigt den möjligheten, att den kan vara uppkommen ur hybridisering mellan subsp. *alpina* och *borealis.*

HIITONEN (1933) har i sin finska flora accepterat GAMS system och sätter *A. campestris* L. subsp. *alpina* (DC.) GAMS var. *bottnica* (LUNDSTR.) LINDB. fil. och icke som hos HJELT *A. borealis* PALL. v. *bottnica* (LUNDSTR.) LINDB. fil.

HULTÉN (1930) bibehåller *A. borealis* PALL. i vid bemärkelse. Beträffande *A. borealis* på Kamtchatka framhåller HULTÉN (1930, p. 181) »Although a certain variation in the dissection of the leaves can be proved, almost all Kamtchatka specimens together form a fairly distinct type characterized by narrow linear leaf-sections adpressed silky pubescence and comparatively small heads with more or less pink flowers. They differ in these respects from the majority of the specimens from the shore of the Arctic Ocean (which more closely resemble the primitive figure given by PALLAS loc. cit.), and especially from the European, which have broader, often lanceolate leaf-sections (less dissected leaves), looser woolly pubescence and much larger heads. It seems clear that a pronounced genetical difference exists between these two types.» Han säger dessutom, att då han icke sett tillräckligt med material från Amerika och Central-Asien, kan han icke komma till klarhet beträffande de olika typerna. De ovan relaterade typerna hänför han till var. *Ledebourii* och var. *Mertensii* på grund av den huvudsakliga skillnaden i flikigheten hos bladen.

Att *A. b.* var. *bottnica* hör till *A. borealis* anser jag nu fastställt. Frågan gäller nu, om var. *bottnica* är identisk med någon av de hos LEDEBOUR upptagna varieteterna. Beträffande bladform och hårighet, även på holkfjäll, överensstämmer den närmast med beskrivningen för var. *Mertensii,* men även beträffande var. *Schanginii* har den likhet, särskilt korgarna, som hos denna varietet angives vara mindre än hos övriga varieteter. Hos dessa båda varieteter nämnes icke något om hår på blomkronans spetsar. Det går sålunda icke att helt identifiera *A. b.* var. *bottnica* med någon av de hos LEDEBOUR upptagna.

Taga vi i betraktande den relativt långa tidrymd, som förflutit, sedan *A. b.* var. *bottnica* inkom till Bottniska vikens kust och genom landhöjningen nått fram till sina nuvarande lokaler, är det icke något som hindrar, att den nuvarande populationen härstammar från några få genetiskt lika individ. I en tidigare uppsats har jag visat, att *A. b.* var. *bottnica* har det somatiska kromosomtalet $2n=36$, under det att *A. borealis* från Grönland har $2n=18$ (ERLANDSSON, 1939). Detta visar, att *A. borealis* är en polyploid art, och HULTÉNS (1930, p. 181) gjorda påstående om åtminstone två genetiskt skilda typer på Kamtchatka, anser jag mycket sannolikt. På grund av att var. *bottnica* genom sin isolering kommit att avvika så mycket från de i arktiska trakter förekommande typerna av *A. borealis,* anser jag, det vara bäst, bibehålla den som en särskild varietet, tills en fullständig revision av *A. borealis* föreligger.

HJELT (1926 p. 75) sätter på förslag av LINDBERG var. *bottnica* under *A. borealis* och kallar den *A. borealis* PALL. var. *bottnica* (LUNDSTR.) LINDB. fil. Emellertid tycks LUNDSTRÖM icke hava publicerat någon diagnos, ty HARTMAN (1879 p. 7) skriver *A. campestris* L. γ *bottnica* (LUNDSTR. in sched.). Jag har icke lyckats uppdriva någon beskrivning gjord av LUNDSTRÖM. KINDBERG (1873 p. 48) har lämnat en mycket kortfattad diagnos, och eftersom den är den första, har den enligt gällande nomenklaturregler prioritet. Varieteten skall sålunda heta:

Artemisia borealis PALL. var. *bottnica* (KINDB.) LINDB. fil. Som synonymer få vi följande:

A. bottnica LUNDSTR. mscr. (Upsala botaniska bytesförenings katalog våren 1873).
A. campestris L. **bottnica* LUNDSTR. (KINDBERG, 1873).
A. borealis PALL. var. *bottnica* (LUNDSTR.) LINDB. fil. (HJELT, Conspectus Florae Fennicae, Vol. VII, p. 75, 1926).
A. campestris subsp. *bottnica* (ARWIDSSON, 1931).
A. campestris L. subsp. *alpina* (DC.) GAMS var. *bottnica* (LUNDSTR.) LINDB. fil. (HIITONEN, Suomen Kasvio, 1933 p. 704).

Till habitus är det icke stor skillnad mellan *A. borealis* var. *bottnica* och *A. campestris*. De viktigaste olikheterna finnes i blomställningen.

Blomkorgar runda, 3,1—4,2 mm, skaftade och oskaftade i ganska tät klase. Holkfjäll omvänt äggrunda med bred, söndertrasad, hyalin kant. Från mitten utgå långa hår. Blommor gula—svagt gulröda med oregelbundet strödda tuberkler. Diskblommor bägarlika, med i spetsarna mer eller mindre långa hår. Strålblommor rörlika, hårlösa.

För närvarande kan man utan överdrift säga, att det råder verkligt virrvarr beträffande systematiken hos *A. borealis* tack vare den mångformighet, som förekommer. Som exempel på hur det för närvarande är, kan jag nämna följande. I Riksmusei herbarium ligga några Artemisior från Sibirien, vilka av R. PAMPANINI bestämt (1938) till *A. campestris* var. *robustior* KOCH (1837, p. 368). Denna varietet är av KOCH beskriven från Alperna och föres av GAMS (HEGI, 1929) till *A. campestris* subsp. *alpina*. Jag har i den mån det varit möjligt undersökt korgarna och därvid funnit, att ett individ från Jenisej, Vologovo (coll. M. BRENNER, 1876) tillhör *A. borealis*' formkrets och icke *A. campestris*. Enda avvikelsen är, att diskblommorna äro hårlösa. En grundlig revision av *A. borealis* coll. är mer än önskvärd. En sådan revision bör kombineras med kulturförsök bl. a. för kromosomtalsräkning och undersökningar över apomixis. Det senare av den anledningen att vi känna en apomiktisk art, nämligen *A. nitida* från Sydost-Alperna. I samband med revision bör även *A. canadensis* MICH. medtagas, då denna art otvivelaktigt hör till *A. borealis* (jfr HALL and CLEMENTS, 1923 p. 124).

Beträffande utbredningen av *A. borealis* var. *bottnica* i Fennoskandia är den begränsad till kusten och öarna vid nordligaste delen av

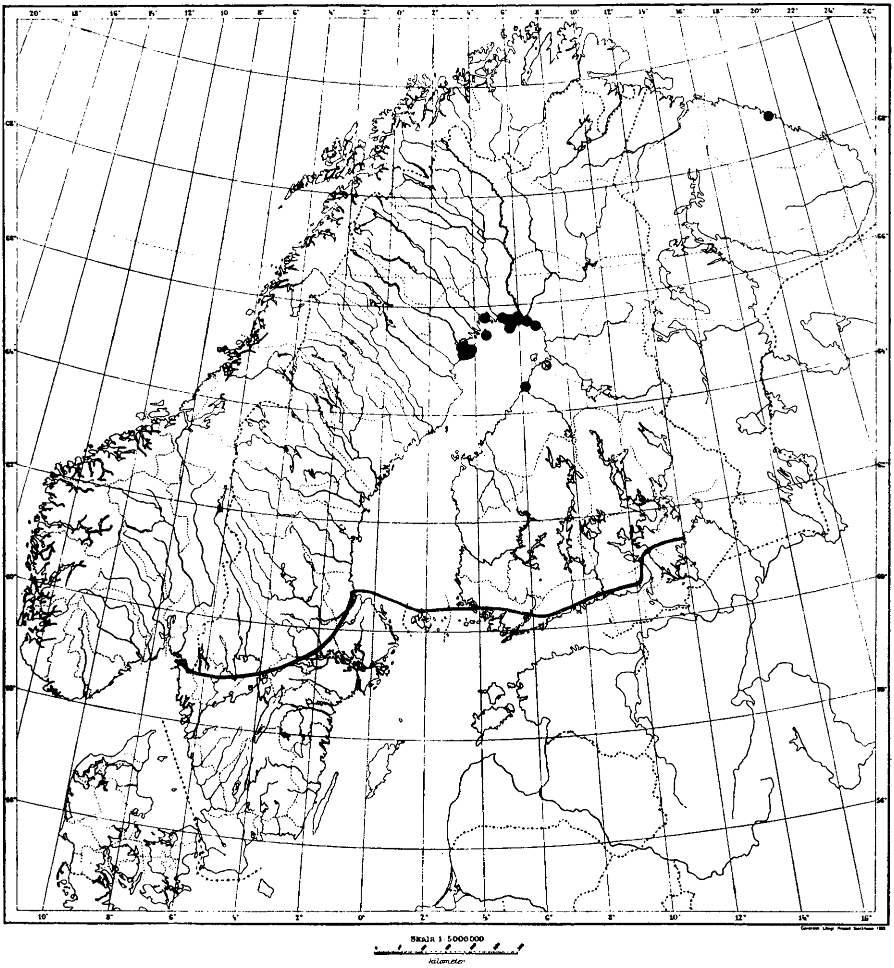

Fig. 3. The distribution of *Artemisia borealis* var. *bottnica* and *A. borealis* (the locality on the north coast of the Kola Peninsula) in Fennoscandia.
○ = without near specification of locality.
— = the north limit of *A. campestris* in Sweden and Finland.

Bottniska viken (fig. 3). Genom att *A. b.* var. *bottnica* blivit överflyttad från *A. campestris* till *A. borealis* få vi förklaring på dess nordliga isolerade utbredning. Den tillhör nämligen den intressanta *Primula sibirica*-gruppen, vars konstituenter invandrat till Bottniska vikens översta kustområden efter sista istiden (ERLANDSSON, 1939 b). Förekomsten av en *A. campestris*-typ på ett fåtal spontana lokaler långt norr om huvudartens nuvarande nordgräns i Fennoskandia är ju ur växtgeo-

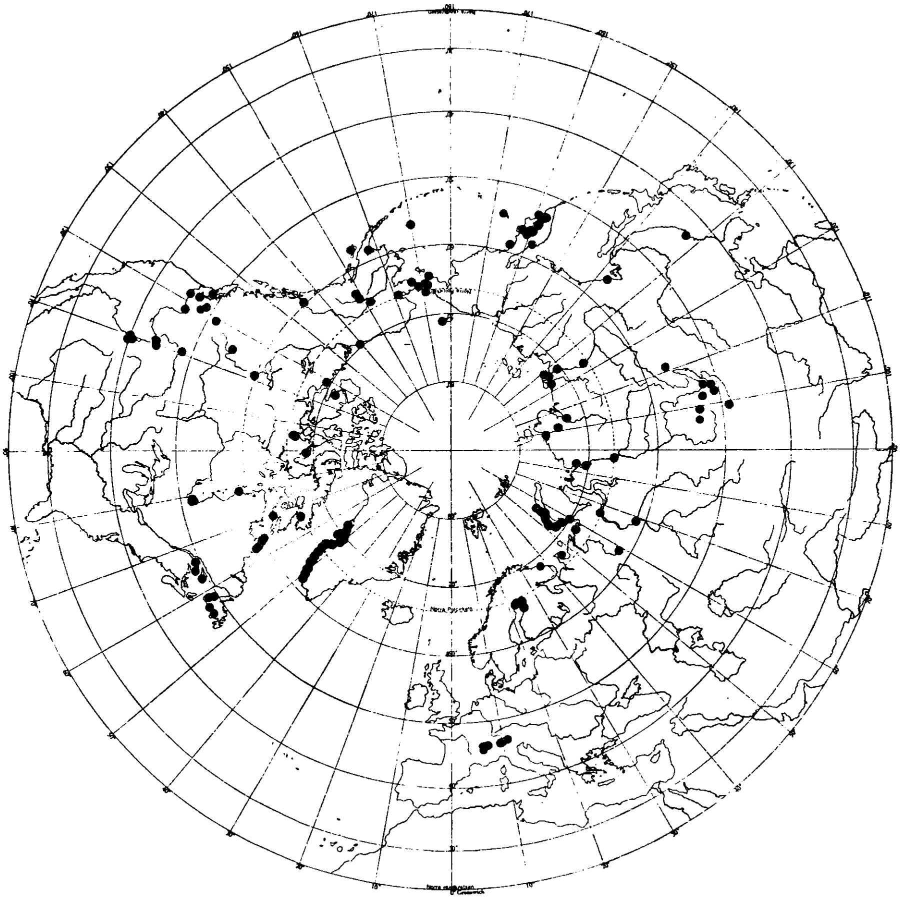

Fig. 4. The total distribution of *A. borealis* PALL. coll.

grafisk synpunkt ganska egendomlig. På kartan fig. 3 är nuvarande nordgränsen för *A. campestris* i Sverige och Finland markerad med en heldragen linje. (Jfr STERNER, 1922. Pl. 5. Map. 3.) ALMQUIST (1929, p. 417) räknar *A. campestris* till ekväxtgruppen i inskränkt bemärkelse. Denna grupp anser ALMQUIST i sin helhet i första hand vara beroende av temperaturförhållandena (1929, p. 419). Skulle *A. b.* var. *bottnica* höra till *A. campestris,* hade den möjligen kunnat räknas som relikt från postglaciala värmetiden. Nu när vi känna dess systematiska ställning, behöva vi icke tillgripa en sådan motivering för att förklara dess isolerade utbredning.

Att *A. b.* var. *bottnicas* utbredning sammanfaller med den totala för *A. borealis* framgår av kartan fig. 4. Som jag redan omtalat, är *A. borealis* funnen av Regel (1928, p. 179) vid Charlowka på Kolahalvöns nordkust. Genom detta fynd och placeringen av var. *bottnica* till *A. borealis* har denna art i sin cirkumpolära utbredning endast en lucka från nordkusten av Skandinavien till Öst-Grönland.

Kartan över *A. borealis*' cirkumpolära utbredning är sammanställd dels efter kartorna hos Fernald (1925, p. 339) och Hegi (1929, p. 670), dels från herbarierna i Stockholm, Upsala, Lund och Köpenhamn, samt doc. E. Hulténs privata. Dessutom har medtagits en del säkra litteraturuppgifter. På grund av utrymmesbrist medtages endast en lokalförteckning för *A. borealis* var. *bottnica*.

Till doc. E. Hultén, Lund, och dr. H. Lindberg, Helsingfors, ber jag få framföra mitt hjärtliga tack för älskvärt lämnade upplysningar.

I nedanstående lokalförteckning förekomma följande förkortningar av olika samlingar:

Universitetets Botaniska Museum, Upsala (U).
» Växtbiologiska Institution, Upsala (V).
» Botaniska Museum, Lund (L).
Botaniska Avdelningen, Naturhistoriska Riksmuseum, Stockholm (R).
Botaniska Trädgården, Göteborg (G).
Universitetets Botaniska Museum, Helsingfors (H).

Artemisia borealis Pall.

Lapponia murmanica. Charlowka (Regel, 1928, p. 179).

Artemisia borealis Pall. var. bottnica (Kindb.) Lindb. fil.

Sverige. Haparanda skärgård: Torne Furö. 1923 G. Littmark (R). — Hanhinkari, Harro, Sandskär. Th. Arwidsson (Bot. Not. 1931). — Seskarö, östsidan bland strandklapper. 1934 S. Erlandsson (R). — Torvikari, bland strandblock. Skär SE om Seskarö. 1934 S. Erlandsson (R). — Pölkky, bland block och strandklapper. Skär W om Seskarö. 1934 S. Erlandsson (R). — Malören. V. F. Holm (G). — Sandskär vid Malören. 1873 E. Bucht (U); 1934 S. Erlandsson. — Neder-Kalix: Båtskärsnäs, blockstrand. 1934 S. Erlandsson (R). — Råneå: Rörbäck, sandfält vid kusten. 1936 S. Erlandsson (R); 1923 K. Lindell (R). — Luleå skärgård: Småskären. 1875 E. Bäckström (L). — Piteå: Pite älvs utlopp 1. 9. och 15. 9. 1871 A. N. Lundström (G, R, U, V); 1870 E. Lundberg (V); D:o 1872 (L, R, U), 1879 (R); 1879 J. E. A. Degerman (L, U, R). — Pitsund. 1884 J. E. A. Degerman (R, V); 1893 A. Ulander (R). 1916 M. Ruben (L, R); 1917 M. Engstedt (R); 1908 och 1910 E. Marklund (G, L, R); 1932 E. Nordström (G); 1934 S. Erlandsson (R). — Pitholm, 1884 T. H. Björkblom (L); 1913 E. Marklund (R); 1934 E. Nordström (R); Pitholm, in litore. 1898 P. Johansson (R, U). —

Piteå skärgård: Rebben. 1917 E. MARKLUND (Sv. Bot. Tidskr.). — Huvan. 1878 E. LUNDBERG (G, L, R). — Kråkviken (på fastlandet), Degersten, Stor-Rebben, Stenskär, Stora Huran, Lilla Huran, Sandskärsgrundet, Inre Bondökallen. TH. ARWIDSSON (Bot. Not. 1931).

Finland. Kemi: mäki (backe). 1932 A. HEIKKINEN (H). — Kemi, Ajossaari. 1895, 1897—98 K. J. E. EHNBERG (G, H, L, R, U); 1895—96 A. RANTANIEMI (H); 1927 och 1929 M. J. KOTILAINEN (G, L, R). — Kemi; Ajos, Rivinnokka, hiekkakan tällä (sandfält); 1930 V. RÄSÄNEN (H). — Simo: Montaja, sandfält. 1901 V. W. WESTERLUND (H); 1902 H. LINDBERG (H). — Liminka s:n, utan närmare angiven lokal. M. BRENNER (Bot. Not. 1879, p. 134). — Pyhäjoki, in litore maritimo. L. J. WICHMANN (HJELT, 1926, p. 75).

Summary.

On the northern coast of the Gulf of Bothnia, also on the mainland and on the islands, there grows a form of *Artemisia,* the name of which hitherto has been *Artemisia campestris* L. var. *bottnica* (LUNDSTR.) LINDB. fil. The Finnish botanist, H. LINDBERG has explained, however, that this variety does not belong to *A. campestris* L. but to the arctic-circumpolar species *A. borealis* PALL. (HJELT, 1926, p. 75). As LINDBERG has not published his investigation, I have been able to make an investigation in order to form my own opinion on the taxonomical position of this variety.

A. borealis is a very polymorph species and this fact has lead to the description of several varieties. Introductory investigations showed that involucres, ray-flowers and disk-flowers in the heads of *A. borealis* PALL. and *A. campestris* L. were very different. The results of the investigation was that var. *bottnica* belonged to *A. borealis* and not to *A. campestris* (figs. 1 and 2).

Var. *bottnica* was at first regarded by its collector, the late prof. A. N. LUNDSTRÖM, as a separate species, which was named *A. bottnica.* We know now, that it is a variety of *A. borealis.* But LUNDSTRÖM has not described *A. bottnica.* The first short description is given by KINDBERG (1873, p. 48) and he also plased it as a variety of *A. campestris.* According to the rules of nomenclature the name of this variety is

Artemisia borealis PALL. var. *bottnica* (KINDB.) LINDB. fil. Syn.:

A. bottnica LUNDSTRÖM mscr. (Upsala botaniska bytesförenings katalog våren 1873).

A. campestris L. **bottnica* LUNDSTR. (KINDBERG, 1873).

A. borealis PALL. var. *bottnica* (LUNDSTR.) LINDB. fil. (HJELT, Conspectus Florae Fennica, Vol. VII. p. 75, 1926).

A. campestris subsp. *bottnica* (ARWIDSSON, 1931).

A. campestris L. subsp. *alpina* (DC.) GAMS var. *bottnica* (LUNDSTR.) LINDB. fil. (HIITONEN, Suomen Kasvio, 1933, p. 704).

It has been impossible to identify this variety with any earlier described. Until a complete revision of the polymorph *A. borealis* PALL. is made, this variety may for the present be called *A. borealis* var. *bottnica.*

The distribution of *A. borealis* var. *bottnica* in Fennoscandia is given in fig. 3 and of *A. borealis* coll. in fig. 4. The full drown line in fig. 3 shows the north limit of *A. campestris* in Sweden and Finland.

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BOTANISKA NOTISER 1940, LUND 1940.

Cyto-Genetic Studies in Rumex.

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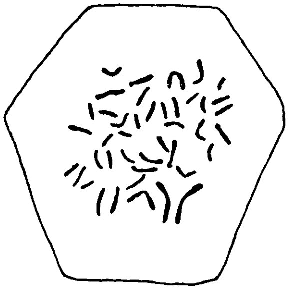
I. Studies on polyploidy and pollen size in Rumex Acetosella L.

The species *Rumex Acetocella* L. is the principal species in the section *Acetosella* MEISN. of the genus *Rumex* L. It is characterized by having the basal leaves hastate, the inside parts of the perigon unenlarged, and scarcely as big as the fruit itself. The plant is herbaceous and the flowers are dioecious (MURBECK 1899; ASCHERSON and GRAEBNER 1908—1913; STEFÁNSSON 1924; LINDMAN 1926). The plant, and particularly the leaves, are fleshy and with an acid taste. The species *Rumex Acetosella* L. has been divided into several forms and varieties according to different characters e. g. as to the form and colour of the fruit, or to the number of the basal lobes of the leaves (more than two: f. *multifidus* (L.) MURB.; none: f. *integrifolius* WALLR.). All the narrow-leaved plants with no, two or many basal lobes have also been called either var. *tenuifolius* A. & G. or f. *angustifolius* KOCH (WITTE 1906 a, b).

The geographical distribution of the species is not very well known. It seems, however, to be distributed all over the northern hemisphere, besides South Africa and the southern part of South America and Australia. It has probably been brought into many of these countries from western Europe. Still less is known about the distribution of the forms and varieties, but they seem to be found in most of the countries, where the main species grows.

Rumex Acetosella L. has been cytologically examined by ROTH (1906), who found the chromosome number n=16, and later among others by MEURMAN (1925 a, b), who was of the opinion that the chromosome number was 2n=41 in the male and 2n=42 in the female plant. Furthermore KIHARA (1925, 1927 a, b, 1929) found the chromosome number to be 2n=42, both in male and female individuals.



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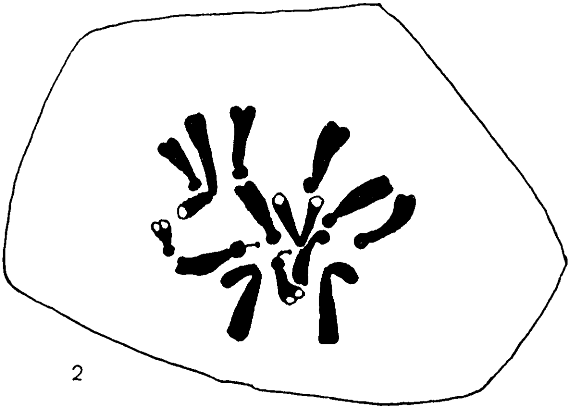


2

Fig. 1. Somatic metaphase chromosomes from a hexaploid root-tipcell in a male *Rumex Acetosella* (2n = 42) × 2300. — Fig. 2. somatic metaphase chromosomes from a diploid root-tipcell of a female plant of *Rumex Acetosa* (2n = 14) × 2300.

Jensen (1936 b), however, determined the number to be n = 22, 2n = 44. According to Tischler (1926, 1931, 1935, 1938) only numbers as 2n = ca 42 have been found in *Rumex Acetocella* L.

1. **Somatic chromosomes.** In the spring and summer of 1939, the main species and some of the forms and varieties of *Rumex Acetosella* L. were received from different parts of Sweden and from Iceland. They were all planted and cultivated on the fields belonging to the Institute of Genetics in Svalöf.

The root-tips were fixed in chrome-acetic-formalin and all preparations were stained according to the gentian-violet method.

The somatic number of the chromosomes in the main species was found to be 2n = 42, both in male and female plants. The same number has been determined by Kihara (1925, 1927, 1929), and according to his studies on the meiotic divisions, the species is hexaploid, with the basic number x = 7. All the chromosomes are very small, and at the magnification of ca. 2300 times, mostly used, the morphological details of very few of them can be seen after use of this fixative. It seems to me, however, that most of them have a subterminal or submedian centromere (Darlington's terminology 1937), as Ono (1930 b, 1932, 1935), Kihara and Yamamoto (1931), Yamamoto (1933 b, 1934, 1935 a, b, 1936, 1938) and Sinotô (1936, 1937 a, b) have found in *Rumex Acetosa* L. Yamamoto (1938) and Ono (1935) used the dif-

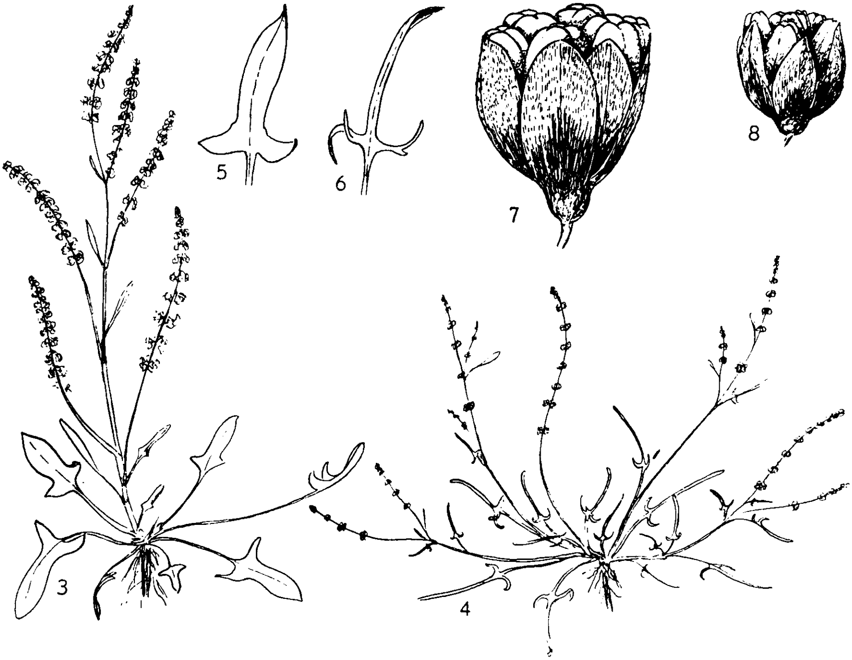


Fig. 3. The habitus of a normal hexaploid male plant of *Rumex Acetosella* (2n = 42). — Fig. 4. The habitus of a tetraploid male plant of the var. *tenuifolius* of *Rumex Acetosella* (2n = 28). Fig. 5. A leaf of the normal hexaploid *Rumex Acetosella.* — Fig. 6. A leaf of the tetraploid var. *tenuifolius.* — Fig. 7. A male flower of the hexaploid species. — Fig. 8. A male flower of the tetraploid variety.

ferent positions of the centromere for distinguishing a number of different karyotypes.

The size of the chromosomes in *Rumex Acetosa* L. is more than twice of that in *Rumex Acetosella* L. Fig. 1 shows the somatic chromosomes of a normal male plant of *Rumex Acetosella* (2n=42) and Fig. 2, for comparison, the size of the somatic chromosomes of a normal female plant of *Rumex Acetosa,* both enlarged ca. 2300 times.

2. **Comparison between tetraploid and hexaploid plants.** The morphology of a normal male plant of *Rumex Acetosella* L. is drawn in Fig. 3, on a somewhat reduced scale.

Some plants, however, which I have received from Uppsala in the central part of Sweden, Östersund in the province of Jämtland and Åhus in the province of Scania in South-Sweden, showed a different chromosome number. This was 2n=28, i. e. the tetraploid

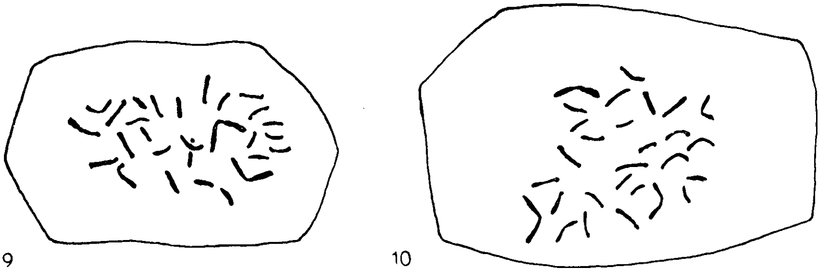


Fig. 9—10. Somatic metaphase chromosomes from the root-tipcells of the tetraploid *R. Acetosella* var. *tenuifolius* (2n = 28). Fig. 9 from a male, Fig. 10 from a female individual. × 2300.

number (Löve 1940). The morphology of these plants is indicated in Fig. 4, which rather well shows its habitus. All these plants belonged to var. *tenuifolius* A. & G., f. *multifidus* (L.) Murb. or f. *integrifolius* Wallr. The leaves are more narrow than those of the main species, which is best seen by comparing Fig. 5 — which shows a leaf of normal *Rumex Acetosella* L. (2n=42) — with Fig. 6, which shows a leaf of var. *tenuifolius* A. & G. (2n=28), both drawn at the same scale. The basal lobes are often more than two and as narrow as the leaf itself. The plants are prostrate and often form a thick carpet. Further, it seems that this type is able to multiply vegetatively with groundshoots more intensively than the main species. The stalks are numerous but prostrate, only raising some centimeters above the ground. The leaves are thicker than those of the main species, having more blue-green colour and tasting somewhat acidly.

The chromosome number of this type was exactly the same both in the male and the female individuals. The size of the chromosomes was about the same as in the normal hexaploid species. Fig. 9 shows a somatic metaphase plate from a root-tipcell of the male tetraploid plant, and Fig. 10 the same of a tetraploid female individual.

The type with the chromosome number 2n=28 is quite normal sexually. No intersexes have yet been found, neither in this nor in the main type.

Comparing the tetraploid and hexaploid plants we find, that the morphological differences are very distinct, as has been previously mentioned. The comparison of the details shows the same differences as often before have been found between diploid and tetraploid plants of same species (Müntzing 1936).

The tetraploid plant had smaller stomata than the hexaploid

Table 1. Length of stomata in tetraploid and hexaploid *Rumex Acetosella* L. 1 unit = 2,5 μ.

	Length of stomata in units												n	M ± m	Ratio
	12	13	14	15	16	17	18	19	20	21	22	23			
Hexaploid ...				2	4	1	11	11	9	6	1	1	46	18,89 ± 0,26	118
Tetraploid ...	2	3	8	9	7	6	5	1					46	16,00 ± 0,29	100

Difference 2,89 ± 0,39; D/m 7,45.

(Table 1). The difference in length was 2,89 ± 0,39 (D/m = 7,45) calculated from the measurements of the stomata on the central parts of the leaves. The ratio tetraploid : hexaploid was 100 : 118.

The flowers of the tetraploid, and particularly the male flowers are smaller than those of the hexaploid. Fig. 7 shows a male flower of the hexaploid type with $2n=42$, and Fig. 8 the same of the tetraploid type with $2n=28$ chromosomes, both in the same magnification. The fruits too are evidently of a smaller size. Measurements of the anthers showed a distinct difference in length, and the ratio of the tetraploid : hexaploid was 100 : 122. The anthers of *Rumex Acetosa* L. ($2n=14$, 15) are considerably larger (ratio tetraploid *Rumex Acetosella :* hexaploid *Rumex Acetosella* : diploid *Rumex Acetosa* 100 : 122 : 178.).

Both types of *Rumex Acetosella* studied were found to have rather good pollen.

3. **Sex determination and pollen size.** The determination of sex in *Rumex Acetosella* L. has been discussed rather much since the cytological studies on it began again. MEURMAN (1925 a, b) said that it had tripartite sex-chromosomes, which also KIHARA and ONO (1923 b) had found in *Rumex Acetosa* L. MEURMAN supposed that the female plants had 4 X-chromosomes ($2 X_1 + 2 X_2$) and the somatic number $2n=42$, but the male individuals 2 X+Y-chromosomes ($X_1 + X_2 + Y$) and the somatic chromosome number $2n=41$. Shortly afterwards KIHARA (1925) declared, that he had found both males and females with the somatic number $2n=42$ but also one male plant with $2n=41$. Later on KIHARA (1927, 1929) states that *Rumex Acetosella* L. have no visible sex-chromosomes. In 1930 ONO (1930 a) reports that he had found an intersexual plant with $2n=41$; $n=20$, 21. JENSEN (1936 a, b) says, that the number is $n=22$, and that no sex-chromosomes are distinct in *Rumex Acetosella* L.

Table 2. Pollen diameter in *Rumex Acetosella* L. and *Rumex Acetosa* L. (Units: 1 = 2,5 μ).

	Plant No.	Units						M ± m
		7	8	9	10	11	n	
R. Acetosella $2n = 42$	R. 0101	—	9	104	150	5	268	9,56
	R. 085	—	14	56	150	22	243	9,37
	R. 074	—	38	156	250	8	452	9,50
	R. 067	—	22	115	200	13	350	9,58
	Total	—	83	431	750	48	1312	9,58 ± 0,02
R. Acetosella $2n = 28$	R. 1a	1	41	150	15	—	207	8,86
	R. 5a	4	64	150	3	—	221	8,69
	R. 14a	5	17	150	29	—	201	9,01
	R. 17a	2	46	150	4	—	202	8,77
	R. 0110	—	32	150	34	—	216	9,01
	Total	12	200	750	85	—	1047	8,86 ± 0,03
R. Acetosa $2n = 14,15$	R. 1	21	150	130	25	—	326	8,51
	R. 10	13	150	22	—	—	185	8,09
	R. 13	41	150	9	—	—	200	7,88
	R. 16	16	150	37	—	—	203	8,14
	R. 18	71	150	12	1	—	234	7,83
	Total	162	750	210	26	—	1128	8,09 ± 0,02

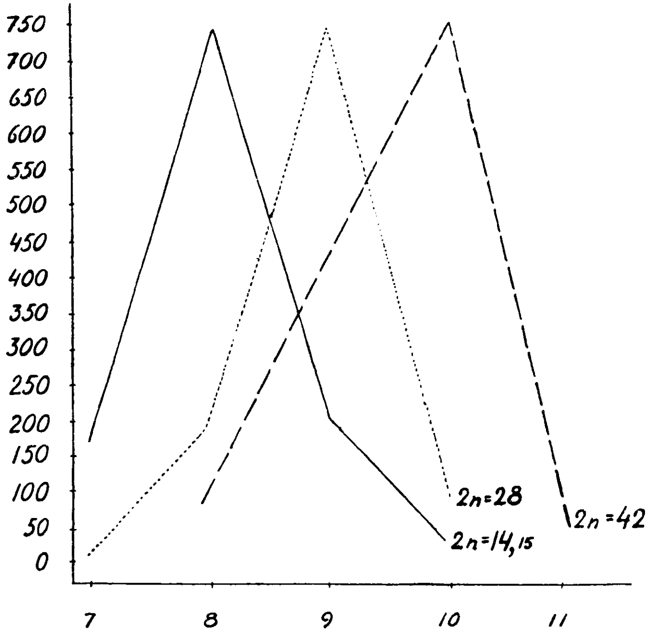
It is rather difficult to settle this question because the chromosomes are very small and crowded. I myself have only found the chromosome numbers $2n = 42$ in the main species and $2n = 28$ in the variety. But according to the metaphase plates of the root-tipcells one pair of chromosomes seems to be somewhat larger than the rest, and this may be the sex-chromosomes.

In nature the female plants of *Rumex Acetosella* L. are on the whole in majority (Ohga; cit. from Sinotô 1929, p. 177). However, since the same plant is able to multiply vegetatively over a wide area, it is not easy to count the proportions of each sex. The same preponderance of females has been found in various other dioecious plants, as e. g. in *Rumex Acetosa* L. (Hoffmann 1885, Roth 1906, Correns 1922, Kihara and Ono 1923 b, Turesson 1925), *Rumex thyrsiflorus* Fingerh. (Raunkiaer 1918), *Melandrium* (Strasburger 1900, Shull 1910, Correns 1917, 1927), *Cannabis sativa* L. (Winge 1923, Sinotô 1929, Riede 1925), *Humulus lupulus* L. (Winge 1923, Sinotô 1929), *Humulus japonicus* S. & Z. (Winge 1923, Sinotô 1929) etc.

The reason for this has been very much discussed, but many workers have supposed that it is due to pollen tube competition (cf. Correns 1922). Therefore, some investigators (cf. Sinotô 1929) have suggested that, on account of the different mass of chromatin in the pollen grains with X and Y, measurements of the pollen size might give a bimodal curve. SINOTÔ (1929) measured 500 pollen grains but got as a result an unimodal curve.

I myself measured 1312 pollen grains of the mains species (2n = 42) and also got a distinctly unimodal curve (Table 2, diagram 1). The measurements of 1047 pollen grains from the var. *tenuifolius* A. & G. (2n = 28) gave the same result (Table 2, diagram 1). The tetraploid plant had smaller pollen grains than the hexaploid, as can be seen in the table. The difference was 0,72 ± 0,037 (D/m = 19,46). The ratio hexaploid : tetraploid was 100 : 92. Even though the chromatin mass of *Rumex Acetosa* L. seems to be considerably larger than that of *Rumex Acetosella* L., the pollen grains from diploid plants of this species (2n = 14, 15) are smaller than those of the tetraploid *Rumex Acetosella* L. (2n = 28). The difference was 0,77 ± 0,037 (D/m = 20,51). The ratio was here 100 : 91 (or hexaploid *Rumex Acetosella* : tetraploid *Rumex Acetosella* : diploid *Rumex Acetosa* 100 : 92 : 84). In spite of this chromosomes, anthers, stomata, flowers and fruits of *Rumex Acetosa* are in every respect larger than those of *Rumex Acetosella*.

Diagram 1. Pollen size in *Rumex* types with 14—15, 28 and 42 chromosomes.



No unreduced pollen grains have been observed, neither in tetraploid nor hexaploid plants.

4. **Geographical distribution.** In connection with his genecological investigations TURESSON (1925) discusses *Rumex Acetosella* L. He has observed two different types, one with rather broad leaves and erect habitus from gravelly localities in Scania, the other with narrow leaves and prostrate habite from calcareous localities on Öland. The latter type is f. *angustifolius* KOCH or var. *tenuifolius* A. & G., which according to TURESSON constitutes an *oecotypus campestris* of the species *Rumex Acetosella* L.

According to the results described above, this type distinctly differs from the main species by another number of chromosomes. So far crosses between this type and the main species have not been undertaken, but no hybrids have been found in nature. Therefore I do not think it is correct to call this type an ecotype, following the terminology of TURESSON (1922 a, b).

Judging from the few observations hitherto performed on the distribution of both types in Sweden and Iceland, the hexaploid type grows on the whole on gravelly localities on the lowland and in the neighbourhood of cultivated fields. The tetraploid type, however, is particularly to be found on sandy localities near the coast or in calcareous mountain regions, and is most common where plants as e. g. *Festuca ovina, Calluna vulgaris, Antennaria dioeca, Cetraria islandica* and *Cladonia* are to be found.

Thus it seems, that the tetraploid type is more hardy than the hexaploid, a fact which also HAGERUP (1933) has found in the diploid *Vaccinium uliginosum* L. f. *microphylla* LGE. from the arctic regions of Greenland and the northern arctic continents, where the tetraploid *Vaccinium uliginosum* L. (f. *genuina* HERD.) can not grow.

II. Chromosomes and pollen size of Rumex Acetosa L.

The investigations on *Rumex Acetosa* L. from Sweden and Iceland have shown, that the chromosome number is the same in both these countries and the same as in the material examined before, or 2n = 14 ♀, 15 ♂. (KIHARA and ONO 1923 a, b, 1925, 1927, SINOTÔ 1924, 1925, 1928, 1936, 1937 a, b, JARETZKY 1928, ONO and SHIMOTOMAI 1928, ONO 1928, 1930 a, b, 1935, KIHARA and YAMAMOTO 1931, TAKENAKA 1931, 1935, 1936, 1937, 1938, YAMAMOTO 1933 a, b, 1935 a, 1936, 1937,

Table 3. The sex ratio in *Rumex Acetosa* L.

Locality	Females		Males	
	Number	%	Number	%
Källstorp	160	69,9	69	30,1
Skäralid	93	73,2	34	26,8
Trolleholm	132	75,0	44	25,0
Total	385	72,4	147	27,6
Ratio	100		38	

1938). In my material from Iceland I have found the karyotypes VI and VII and from Sweden the karyotypes I, IV, V, and VI, according to the terminology of YAMAMOTO 1938. Since my material has not yet been thoroughly examined from this point of view, a more full account will be given later on.

In a certain *Carex* species HEILBORN (1939) reported, that material from the Faeroes seems to have larger chromosomes than the Swedish material. Similar conditions seem to occur in *Rumex Acetosa* L. material from Iceland showing somewhat larger chromosomes than plants from Sweden.

As mentioned above, female plants of *Rumex Acetosa* L. are known to preponderate over the males. (HOFFMANN 1885, ROTH 1906, CORRENS 1922, KIHARA and ONO 1923 b, TURESSON 1925).

Counting this interrelation in some localities in Scania I got the ratio 100 female : 38 male individuals (Table 3).

The reason for this preponderance of females has been very much discussed. ROTH (1906) is of the opinion that it is due to apogamy. SINOTÔ (1929) does not think, that this is possible, but suggests instead of this, that it is due to certation between male and female determining pollen grains. In connection with this, SINOTÔ supposes that, since the chromatin mass of Y_1+Y_2 is likely to be larger than that of X, the mass of the male- and female-determining pollen grains is not the same. Because of this, the pollen size might give a bimodal curve, and, indeed, after measurements of 605 pollen grains he got a vaguely bimodal curve.

I myself measured the size of 1128 pollen grains from five different plants of *Rumex Acetosa* L. with the result given in table 2 and diagram 1. The curve is here distinctly unimodal.

Summary.

Rumex Acetosella L. and *Rumex Acetosa* L. from various localities in Sweden and Iceland were cyto-genetically examined.

1) It was demonstrated, that the common type of *Rumex Acetosella* L. is hexaploid with the somatic chromosome number $2n = 42$, but in the var. *tenuifolius* A. & G. the tetraploid number $2n = 28$ was found. This number is new in *Rumex Acetosella* L.

2) A distinct difference was found between the size of pollen grains, flowers, anthers, stomata, and the morphology of both the types. The ratio of stomata length in tetraploid : hexaploid was 100 : 118, and of the anther length 100 : 122.

3) The size of the pollen grains showed distinctly unimodal curves in both types of *Rumex Acetosella* L. and in *Rumex Acetosa* L.

4) The hexaploid *Rumex Acetosella* L. grows mostly on gravelly localities, on fields, at road-sides etc., but the tetraploid grows on sandy or calcareous localities and in the mountains.

5) The chromosome number of *Rumex Acetosa* L. proved to be $2n = 14$, 15, both in the types from Sweden and Iceland, and some of the karyotypes of YAMAMOTO (1938) were found.

6) The pollen size of *Rumex Acetosa* L. was not so large as in the tetraploid *Rumex Acetosella* L. The ratio of pollen size of hexaploid *Rumex Acetosella* : tetraploid *Rumex Acetosella* : diploid *Rumex Acetosa* was 100 : 92 : 84. However, the chromosomes, anthers, stomata, flowers and fruits of *Rumex Acetosa* are in every respect larger than those of hexaploid *Rumex Acetosella*.

Acknowledgements. Finally I wish to acknowledge my deep gratitude to Professor ARNE MÜNTZING, head of this institution, and Miss DORIS WAHLÉN for their kind help and encouragement during my work. I also offer my thanks to Fil. mag. SVEN KILANDER, Östersund and Mag. scient. INGÓLFUR DAVIDSSON, Reykjavík, for valuable assistance in collecting the material.

Lund, Institute of Genetics, January, 1940.

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The identity of the genus Acroschizocarpus.

By Eric Hultén.

(Meddelanden från Lunds Botaniska Museum, N:r 48.)

In »Botanikai Közlemények» bd 37 (1940) p. 1 Dr. E. Gombocz described a new Cruciferous Genus, *Acroschizocarpus* and in the same place a new species *A. Kolianus* as the single representative of that genus.

The specimens on which this new species was founded were collected by Dr. Elizabeth Kol of the University of Szeged, at Savage River in Mount Mc Kinley National Park, Central Alaska. The description was accompanied by a photographic picture of the plant and two drawn figures. These figures show beyond any doubt that the plant Dr. Gombocz had at hand, when he described the genus *Acroschizocarpus* was *Melanidion boreale* Greene. This plant was described in Ottawa Naturalist 25 (1912) p. 146. The type-specimen was collected by the Canadian geologist D. D. Cairnes on July 4th, 1911 north of Runt Creek at the boundary-line between Yukon and Alaska territories (long. 141° W, lat. 66° 18′ N) at an altitude of 2.300 feet. Next year Cairnes collected the plant again 42 miles north of the first locality at long. 141° W and lat. 67° N (Geol. Surv. Canada, Dept. of Mines Summ. Rep. 1912 p. 439). Both specimens are preserved in the Ottawa herbarium. With the exception of a small specimen in the author's herbarium obtained from one of Mr. Cairne's assistants this is all material known of the genus *Melanidion* until it was found in Mc Kinley Park by Dr. Kol and described as *Acroschizocarpus* by Gombocz. The type-specimen, which is a fruiting branch without basal leaves is figured in fig. 1, together with two of the three specimens from the second collection of Cairne's, which are in flower. This photograph was kindly sent to me some years ago by Mr. A. E. Porsild, keeper of the Ottawa herbarium and I express my best thanks to him for sending it. Later I myself had an opportunity of examining the type-specimen in Ottawa.

Fig. 1. *Melanidion boreale* GREENE. The typespecimen to the right.

As the name *Acroschizocarpus* indicates GOMBOCZ lays much stress upon the opening of the laterally compressed pods, which he considered to take place from the apex and not as usual within the family *Cruciferae* from the base. This conception might be based on too small material. Several pods in the Ottawa material of the plant open along one side, while the opposite suture is only partly or not at all burst open. It seems to me that not too much stress should be laid on the mode of opening of the pod, as its walls are very thick and firm and does not always burst along the sutural lines. Pods that do not open at all are not rare within the family, and the pod of *Melanidion* can be said to represent an intermediate stage between a dehishent and a indehishent pod, this being caused by the thickness of the tissues in the valves.

GOMBOCZ thought that the petals were white. This is also the case with the dried fragments of the petals found in fruiting specimens, but when the plant is in flower they are purple.

Without doubt *Melanidion* is a very isolated genus. GREENE says that he is unable to name any genus to which it is closely allied, and GOMBOCZ considers it to be closest related to the genus *Hedinia* from Central Asia. *Hedinia* has, however, a characteristic, which is rare within the family, viz. foliaceous bracts in the raceme. *Melanidion* lacks this characteristic.

To me it seems that it should be placed close to *Smelowskia.* In *Smelowskia ovalis* JONES the sepals are persistent and the pods open, sometimes seemingly from the apex, much in the same way as in *Melanidion.*

BOTANISKA NOTISER 1940, LUND 1940.

Bidrag till Skånes Flora.

6. Om floran i Sjöbotrakten.

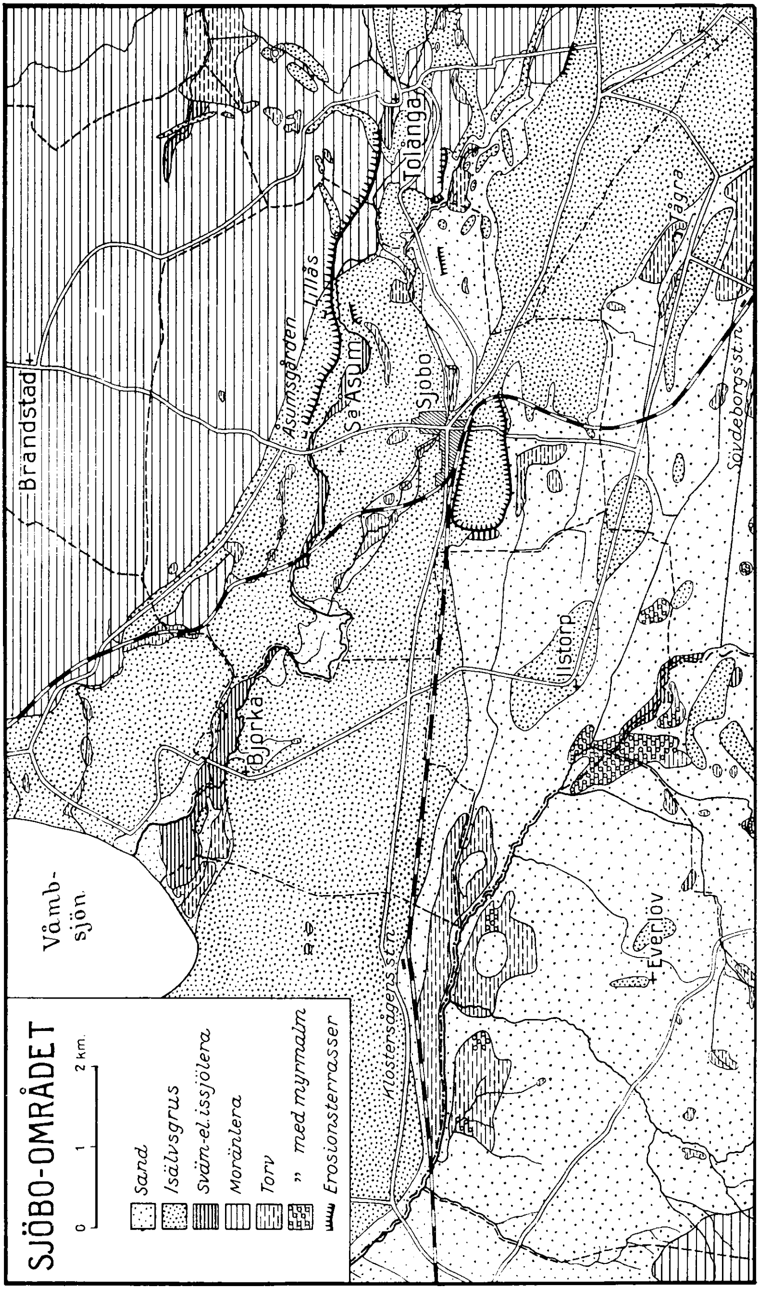
AV H. WEIMARCK.

(Meddelanden från Lunds Botaniska Museum, N:r 49.)

Som ett led i den pågående inventeringen av Skånes flora undersökte jag sommaren 1939 floran i ett antal socknar i det centrala Skåne. Då utgångspunkten för exkursionerna var Sjöbo, har området för enkelhetens skull här kallats Sjöbo-området eller Sjöbotrakten. Området omfattar Björka, Blentarp, Everlöv, Ilstorp, S. Åsum, Sövde och södra delen av Öveds socken till landsvägen Sjöbo—Öveds station och strandremsan mellan Våmbsjön och järnvägen till omkr. 500 m NNV denna station. Området har en areal av omkr. 210 kvkm.

Det är med spänning, som man första gången beger sig ut till det område, man valt för sommarens inventering, ty även om åtskilliga växtarter äro bekanta från bestämda lokaler inom detta område, måste det ändå betraktas som förhållandevis okänt. Okänt därför, att först när kunskapen om området och dess flora sammanförts på en hand, kan den sammanfattande översikten nås. Härmed menar jag naturligtvis ej, att allt det spridda kunnandet är till ingen nytta. Tvärtom, ty om man vet, att en viss art med bestämda krav förekommer på en bestämd lokal, så är just den lokalen intressant och lockande redan från början. Det är främst i denna mening, som all den gamla litteraturen, d. v. s. de äldre generationernas arbete, har en så stor betydelse och nödvändig uppgift i det nu pågående fältarbetet. Också när det gäller förståelsen av den hastigt eller långsamt skeende förändringen i miljö eller artsammansättning, utvecklingen i en bestämd riktning, äro dessa äldre uppgifter nödvändiga. Varje bidrag som kan givas till vår alltför bristfälliga kunskap om denna utveckling, är av största värde.

Arbetet har bedrivits efter samma linjer som i Örkened (jmf. WEIMARCK 1939). Efter ett antal orienterande exkursioner ha på generalstabskartan 24 sektioner markerats, vilka använts som areal-


SJÖBO-OMRÅDET
0
1
2 km.
Sand
Isälvsgrus
Sväm-el. issjölera
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Torv
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Erosionsterrasser
Brandstad
Åsumsgården
Lillås
Tolånga
Sö Åsum
Sjöbo
Björka
Våmb-sjön
Klostersågens st.n.
Sövdeborgs st.n.
Istorp
Everlöv
ägra

Fig. 1.

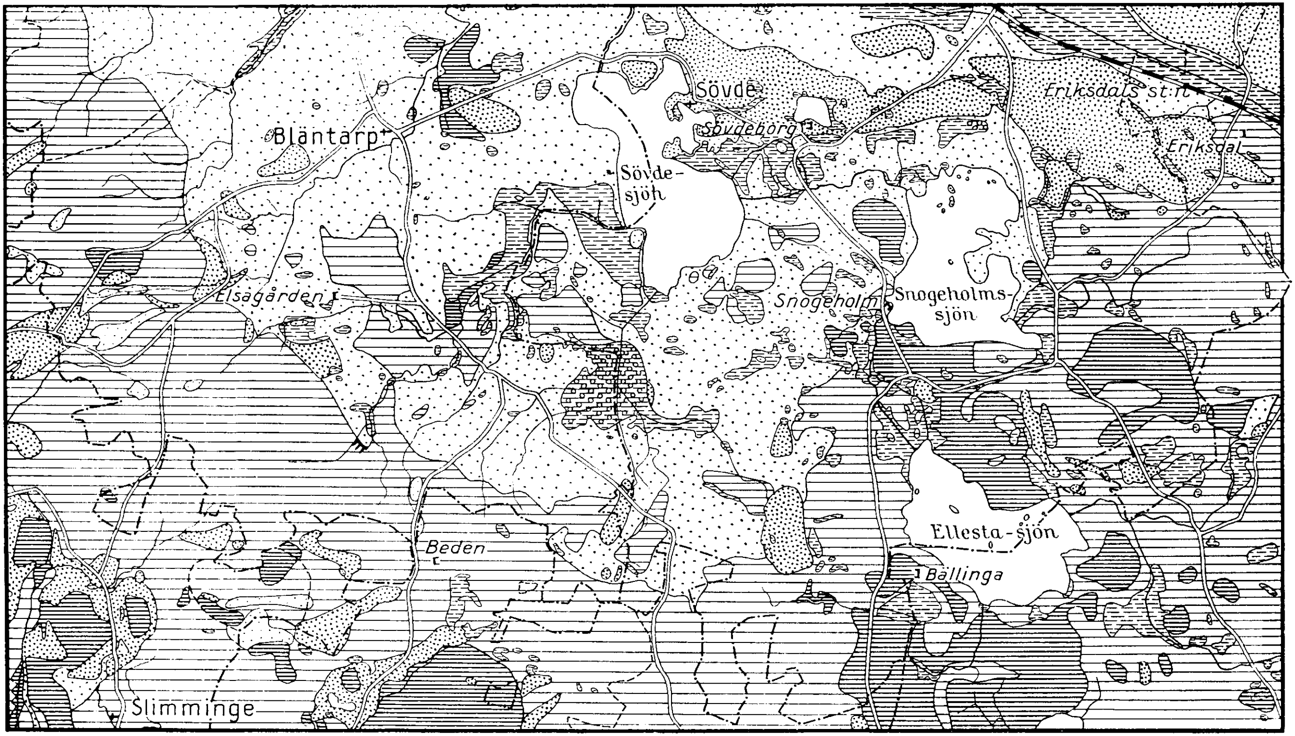

Fig. 2.

Fig. 1 o. 2. Geologisk karta över Sjöbo-området, något schematiserad efter geologiska kartbladet »Sövdeborg». I enstaka fall, då förf:s erfarenhet i fält strider mot originalkartans uppgifter, ha korrigeringar gjorts. Den viktigaste gäller det stora kärret SSV Sövdesjöns sydspets, där det geologiska kartbladet ej noterar förekomst av myrmalm. En stor del av detta kärr är numera dränerat och företer den typiska myrmalmsfärgen och -konsistensen. Sådan jord kallas på orten »rödynga» och anses vara förträfflig att odla eller utläggas till betesmark. I det ännu kvarvarande kärrets vegetation ingår *Viola epipsila* som en karakteristisk konstituent. — Karta förminskad till 1 : 100.000; ritad av FRITZ JÖNSSON 1940.

enheter. Den tidigare använda orienteringsmetoden för bestämmande av en lokals exakta läge har delvis övergivits av den orsaken, att då nu nya generalstabsblad så småningom utarbetats över landskapet, orternas namn ofta givas en annan placering. Den förut använda metoden att angiva lokalen i förhållande till en viss bokstav i ett ortsnamn kan därför ej användas.

Undersökningarna började tidigt på våren: den första exkursionen gjordes den 10 april, vid vilken tidpunkt flera arter hade hunnit fram till blomning. Våren 1939 var ovanligt tidig, vilket bl. a. framgår därav, att de sista exemplaren av *Gagea stenopetala* antecknades den andre maj. Den arten är praktiskt taget omöjlig att upptäcka, då blomningen är passerad.

Under tiden 10 april—15 maj företogos, så snart tiden tillät, förnyade exkursioner inom området. Den 15 maj flyttade jag med familjen ut till Sjöbo för att sedan under hela sommaren fram till den 27 augusti ägna mig uteslutande åt uppgiften.

Under exkursionerna ha 780 arter kärlväxter antecknats inom området. Åtskilliga av dessa äro specialiserade på ståndorter av säregen natur och äro därför anträffade på endast en eller ett fåtal lokaler. 72 arter ha antecknats från alla 24 sektionerna och dessutom 165 från minst 19 (omkr. 80 %) sektioner. Motsvarande siffror för Örkened voro 542 anträffade arter, varav 114 från alla 25 sektionerna och 72 från 20 (80 %) sektioner. De betydande olikheter, som vi här finna vid en jämförelse av de båda områdena, sammanhänger framför allt därmed, att Örkened är en artfattig och tämligen enhetlig socken, medan Sjöbo-området är artrikt och synnerligen heterogent och mosaikartat uppbyggt med hänsyn till markbeskaffenhet, närings- och vattentillgång.

För den rätta förståelsen av detta komplicerade område är en kort beskrivning av dess topografi, jordarter och historia efter istiden nödvändig. (Denna följer i huvudsak MUNTHE, JOHANSSON och GRÖNWALL 1920.)

Sjöbo-området utgör den sydöstra hälften av en avlång skål, som i väster och söder begränsas av Romeleåsens urberg, i öster och norr huvudsakligen av höjder med bergarter från silur (colonusskiffer) och jura. Skålens botten ligger på en höjd över havet av 30 à 40 m, medan Romeleåsen reser sig 100, ja med smärre områden omkr. 150 m högre. I öster och norr utgör nivåskillnaden 70 à 80 m. I sydost genombrytes skålkanten av Fyledalen vid Eriksdal, och i nordväst fortsättes den av Kävlingeådalens väldiga stråk.

Då vid istidens slut isen började avsmälta från Skåne, skedde detta först i de centrala delarna. I söder och sydost lågo ismassorna länge kvar, varigenom det i landskapets inre bildade smältvattnet hindrades att avrinna åt det hållet. En liknande barriär kvarlåg i Romeleåsens fortsättning norrut åt Eslövshållet och på Söderåsen. Vattnet i Sjöboskålen steg därför så länge, tills det slutligen började avtappas över den lägsta passpunkten, i trakten av Eslöv. Allteftersom isen i nordväst smälte undan, tog sig smältvattnet nya vägar, först sannolikt genom Bråån vid Örtofta och sedan genom det nuvarande utloppet genom Kävlingeåns dalgång.

Denna utveckling karakteriseras av etappvisa sänkningar av issjöns yta med perioder av stagnation däremellan. En sådan stagnation markeras av Nedre Romeleissjön och senare av Sövdeissjön, som hade en höjd över havet av 60 à 80 m. Vid dessa sjöars stränder bildades erosionsterrasser, delvis ännu väl synliga, t. ex. på flera ställen mellan Simonstorp och Ågerup i Blentarps socken. Till det noggrannare fastställandet av dessa linjers förlopp i terrängen, kan utbredningen av vissa växter lämna goda upplysningar. En sådan ledart är *Teesdalia nudicaulis,* vilken uppträder som karaktärsart på sand och grus nedom strandlinjerna men helt eller nästan helt saknas därovan. I själva strandlinjen, där leran urlakats och sand och grus kvarlämnats, bildar *Teesdalia* på flera ställen en jämn och tät bård, lätt att observera.

Vid ett senare, lägre stadium i issjöns historia (ungefär 50-metersnivån) avplanades isälvsgrusfälten vid Sjöbo, Sabelbjär väster om Sövde och Vallerödsbacken öster om Blentarp till ungefär vattenytans nivå. Vid någon äldre stagnation har den över stora områden ganska jämna sjöbottnen varit täckt av issjölera, ty platåerna av isälvsgrus, vilka bildats av isälvar vid hastig avsmältning, underlagras av ett lager sådan lera. Detta förhållande är, som vi senare skola finna, av den allra största betydelse för förståelsen av den överraskande goda distributionen av mera eutrofa eller kalkgynnade arter.

Sänkningen av vattennivån har sedan framskridit så långt, att endast vissa djupare depressioner framträda som sjöar. Dessa äro Ellestasjön, Snogeholmssjön, Sövdesjön och Vâmbsjön. Flera av dem ha genom kanalisering ytterligare sänkts. Flera starrtorvkärr, där f. ö. så gott som undantagslöst bränntorv brutits, markera sådana sänkor, vilka till en början varit vattenfyllda småsjöar men så småningom växt igen och utfyllts.

De två viktigaste åarna inom området äro Åsumsån (Tolånga—

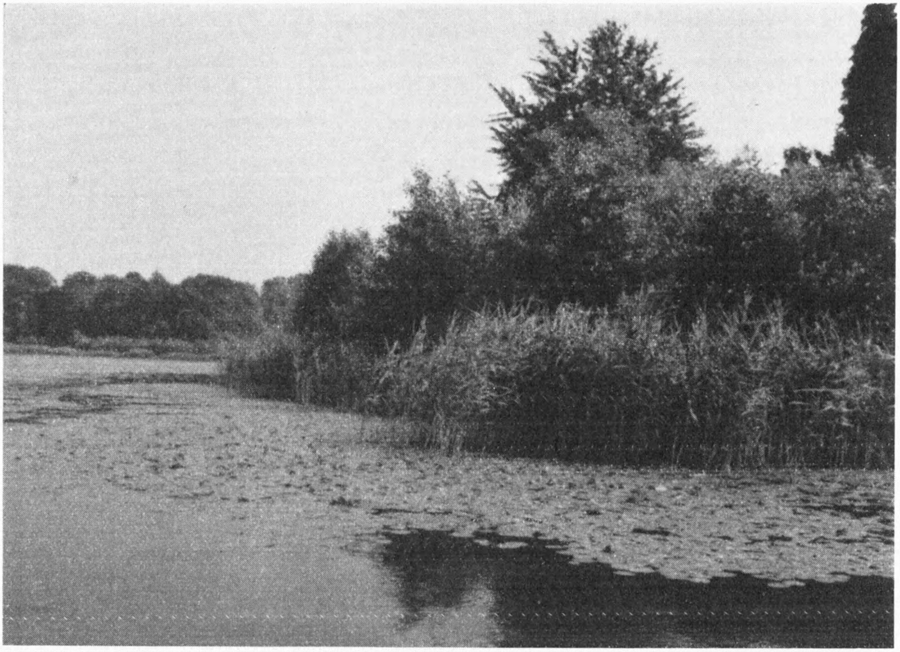

Fig. 3. Snogeholmssjön vid holmen strax öster om Snogeholm. Nymphaeid-bården är bildad uteslutande av *Limnanthemum;* därinnanför ett bälte av *Phragmites*. Sjön har sänkts i början av 1930-talet. *Alnus* har snabbt erövrat den blottlagda sjöbottnen, vilket tydligt framgår av bilden såväl på den närliggande holmen (till höger) som på den längre bort belägna stranden (till vänster). — Foto OSCAR GEHLIN, 7. 1939.

Åsums—Björkaån) och Klingvallsån. Åsumsån upprinner på södra delarna av Linderödsåsen och genomsätter därefter siluriska skifferområden, innan den når Sjöboskålen. Den har delvis en betydande dalgång, t. ex. öster om S. Åsums kyrka, med ofta väl markerade strandbrinkar högt ovan den nuvarande nivån. Dessa grusiga, ofta steniga och väl vatten- och luftdränerade sluttningar översilas i kontaktzonen mellan underlagrande lerlager och grusskikt av vatten, härstammande från de norr därom utsträckta skifferhöjderna och lermoränområdena. Härigenom skapas förutsättningen för den frodiga lundvegetation, som är så karakteristisk för dessa stråk. Eken är det dominerande trädslaget. I våraspekten framträda särskilt *Alchemilla pratensis, Corydalis intermedia, Corydalis pumila, Pulmonaria officinalis, Ranunculus ficaria* och *Viola hirta.* Något senare täckas områdena av *Lamium Galeobdolon-Melica uniflora*-samhällen. Inom om-

Fig. 4. *Eriophorum latifolium* på den översilade sluttningen vid Vitabäck. — Foto H. Weimarck, 7. 1939.

rådet endast här anträffade äro *Brachypodium pinnatum, Corydalis cava* och *Geranium palustre.* I de torrare delarna av det grusiga stråk, som markerar den forna isälvens övre rand, uppträder den annars sällsynta *Peucedanum Oreoselinum* som karaktärsart.

Klingvallsåns källsjö är Ellestasjön. Denna ligger på och gränsar intill områden, täckta av issjö- och moränlera. Ellestasjön och de nedanför liggande Snogeholms- och Sövdesjöarna ha åtminstone delvis av denna orsak eutroft vatten. I synnerhet gäller detta Sövdesjön, som ligger inom de näringsfattiga sand- och grustrakterna, så karakteristiska för stora delar av Sövde socken. Från Ellestasjöns litoral härstamma de enda fynden inom området av *Echinodorus ranunculoides,* och i Snogeholmssjön har den från början odlade *Limnanthemum nymphoides* numera spritt sig så, att den övertagit näckrosornas roll.

Klingvallsån får också ett betydande vattentillskott från de östra kanterna av Sjöboskålen. Källorna och översilningsområdena, som framträda från trakten nordväst om Eriksdals station och förbi Tågra, torde till stor del dränera områden, uppbyggda av siluriska skiffrar.

Fig. 5. Karups kärr. Myrmalmskärren i Sjöbotrakten ligga alla på sandslätten på någon km:s avstånd från Romeleåsens urbergsområde. — Foto H. Weimarck, 5. 1939.

I de fall, då jag varit i tillfälle att bestämma dessa vattens pH, har detta visat sig ligga anmärkningsvärt högt: flera källor här nådde ett pH av 8,2. I översilningsområdet vid Vitabäck är t. o. m. kalkstuffsbildning i gång. Områdena, som bevattnas av dessa källvatten, bestå av isälvsgrus och sand och ha en frodig, calcifil flora. Vid Vitabäck och kärret därnedanför antecknades de enda lokalerna för *Juncus subnodulosus* och *Schoenus ferrugineus*. Bland andra, men inom området även på andra håll uppträdande arter av samma kategori, märkas *Carex flava, Eriophorum latifolium, Juncus fuscoater* och *Petasites albus*. Särskilt de två förstnämnda arterna, *Juncus subnodulosus* och *Schoenus ferrugineus,* få betecknas som indikatorer på ståndort med hög kalkhalt.

Ett särskilt beaktande förtjäna de här och var inom sand- och grusområdena uppträdande översilningskärren. De uppträda på grusterrassernas sluttningar i kontaktzonen mellan isälvsgrusen och underlagrande issjölera. Ofta är sluttningen övertäckt av grusras eller flygsand, så att issjölerans närvaro

Fig. 6. Våraspekt i naken bokskog på sand c:a 800 m SO Sövdeborg. — Foto Sydsv. Dagbl. Snällp., 27. 4. 1939.

blott röjes genom den eutrofa vegetationen på den fuktiga sluttningen. Med någon vana upptäcker man emellertid, att vattnet inom samma platåområde överallt framväller på ungefär samma horisontalnivå. Detta är särskilt tydligt beträffande nordsluttningen av den grusplatå, som sträcker sig förbi Björka till S. Åsums kyrka. Typiska för dessa översilningsområden äro *Carex lepidocarpa, Hypericum acutum, Scirpus compressus, S. pauciflorus* och *Sparganium ramosum.*

Av en annan typ än kalkkärren och översilningskärren äro de särskilt väster om Klingvallsån förekommande myrmalmskärren. Dessa få sitt vattentillskott huvudsakligen från Romeleåsens urbergsområden. Den höga järnhalten får därigenom sin förklaring. Floran inom dessa kärr är eutrof: de flesta arterna äro gemensamma med de kalkrika kärren men icke med de oligotrofa kärren. Differentierande art, d. v. s. typisk för myrmalmskärren men ej representerad i kalkkärren, äro *Viola epipsila.* Arten återfinnes ej heller inom någon annan kärrtyp inom området. *Viola epipsila* är här indikator på myrmalmskärr.

I såväl de kalkrika kärren som i myrmalmskärren har en intensiv bränntorvstäkt förekommit. I dessa försiggår fortfarande igenväxningen och återuppbyggnaden. De blötaste partierna koloniseras först av *Typha latifolia,* ofta också av *Phragmites.* Sedan den av dessa arter nybildade torven nått vattenytan, övertages deras roll av *Carex paniculata.* Åtminstone i de fall då en viss variation i vattenståndet under olika årstider gör sig gällande, får *paniculata*-kärret typen av ett pelarkärr.

I depressioner inom sand- och grusområden förekomma också oligotrofkärr. Dessa äro helt omslutna av sand och grus och torde i regel åtminstone ej nå kontakt med eventuellt underlagrande lera. Ett utpräglat sådant kärr finna vi strax öster om Sövdeborg och flera i områdena sydost om Sövdesjön. Kärret vid Sövdeborg har man sökt dränera genom ett omkr. meterdjupt dike, som slutar blint i den kringgärdande sandåsen. Här går sanden åtminstone ned till dikets botten. Indikatorer på oligotrofkärr av denna typ äro inom Sjöbo-området *Eriophorum vaginatum, Trientalis, Vaccinium myrtillus, V. uliginosum* och *V. vitis idaea.*

Västliga arter.

Inom området äro 14 ± utpräglat västliga arter representerade. Dessa äro karakteristiska för Sydsveriges suboceaniska provins men äro ej eller blott sparsamt företrädda inom den mellanbaltiska. De västliga arterna ha edafiskt vitt skilda krav: några böra närmast föras till den oligotrofa typen, andra till den eutrofa, några förekomma uteslutande på fuktiga lokaler, andra på torra, sandiga. Dessa arters lokal- och individfrekvens äro därför inom området i första hand beroende på de förhandenvarande, edafiska betingelserna. Ingen av arterna befinner sig efter allt att döma här nära sin (absoluta) klimatiska ostgräns.

Den västliga gruppen indelas här i 5 underavdelningar, varvid hänsyn tagits till ståndortens beskaffenhet.

a. Huvudsakligen oligotrofa arter, förekommande i mossar, kärr och på fuktiga hedar.

Erica tetralix — Sövde sekt. 4, c. 400 m NO Höghult, på tuvor i dränerat kärr; Sövde, sekt. 9, c. 500 m SO Tannhuset, på *Sphagnum palustre*-tuva.

Den rikaste av de båda lokalerna är den vid Höghult, där arten uppträder talrikt. *Erica* intager här tuvor i det något upphöjda mittpartiet och förekommer tillsammans med *Andromeda polifolia, Eriophorum polystachyum, E. vaginatum* och *Vaccinium uliginosum.* I den södra, lågt belägna kanten av kärret, där dräneringsvatten från de ovanför belägna leråkrarna kommer, uppträda *Carex pulicaris* och *Primula farinosa.* Detta vatten avledes emellertid genom ett dike till ett närbeläget större floddike, varigenom de mera oligotrofa arternas ståndort ej torde influeras därav. — Den andra lokalen, den i kalkkärret nära Tannhuset, utgöres av en liten mossbänk, höjande sig omkring $^1/_2$ m över de omgivande bränntorvstagen. Medan pH för *Erica*'s ståndort bestämdes till 5,6, var pH i det närbelägna kärrvattnet vid bänkens bas 8,2.

Egendomligt är, att *Erica* helt saknas på de vidsträckta, ställvis ganska sanka hedmarker, kallade Sövde ljung, som sträcka sig mellan Lottenstorp och Trulstorpsgårdarna. De likna mycket Skanörs ljung, där *Erica* uppträder som karaktärsväxt, likaså hedarna på Jylland. Sannolikt är luftfuktigheten för låg i Sjöbo-området, för att *Erica* skulle kunna hävda sig på dylika ståndorter.

Gentiana pneumonanthe — Sövde, sekt. 8, c. 500 m SV Trulstorp, fuktig sandmark.

Arten hör till de sent blommande typerna, vilka, liksom de tidigaste vårväxterna, alltid äro svårast att få med någorlunda fullständigt vid en inventering. Folkskoleinspektör BRANDT har meddelat mig, att han funnit arten nära Sövdesjöns sydöstra del, där liknande sankmarker äro vanliga. Sannolikt är denna art representerad på flera lokaler inom området.

Galium saxatile — allmän och ofta uppträdande massvis på fuktiga marker, huvudsakligen inom det flacka sandområdet; antecknad från 17 sektioner.

Hydrocotyle vulgaris — spridd över hela området; känd från 21 sektioner.

Juncus squarrosus — här och där på fuktiga hedar och mader; antecknad från 10 sektioner.

Pedicularis silvatica — observerad inom 6 sektioner.

Radiola multiflora — Blentarp, sekt. 3, nedom Ramnakullen vid bäcken; Sövde, sekt. 8, 1 km NO Trulstorp, fuktig sandmark. — Prosten N. JOHANSSON har meddelat mig, att han iakttagit *Radiola* i Blentarp, sekt. 4, c. 1,5 km NNV Blentarps kyrka, på en gångstig, som emellertid 1939 upplöjts.

b. Arter uppträdande på mera näringsrika lokaler, vid bäckar eller vid källor.

Scirpus setaceus — Blentarp, sekt. 3, nedom Ramnakullen, i bäckfåra; Blentarp, sekt. 4, 800 m NO Simonstorp, källflöde vid bäck; d:o, Råsåkra, i litet kärr; Everlöv, sekt. 1, 300 m N Rödde, i kärr; Everlöv, sekt. 2, 500 m NV Östarp, vid källflöde i bäckdalen; Everlöv, sekt. 3, 500 m NO Henriksdal, i kanten av alkärr; d:o, c. 1 km NV Everlövs kyrka, vid bäcken; Sövde, sekt. 5, c. 300 m N Roshus, i fuktigt stråk; Öved, c. 500 m S Torp, fuktig, N-exponerad sluttning.

Då arten synes vara mycket förbisedd, ha alla lokalerna här uppräknats. Den uppträder ofta i ringa mängd. Den mest typiska lokalen är översilningsmarker, som uppstå i kontaktzonen mellan isälvsgrus och underlagrande issjölera. Arten bör därför sökas framför allt på grusplatåernas sluttningar.

c. Mera eutrofa arter, huvudsakligen i lundar och fuktiga bok- och ekskogar.

Geranium palustre — S. Åsum, sekt. 3, c. 1 km OSO Åsums gård, fuktig sluttning invid Åsumsån.

Polygonatum verticillatum — här och där inom hela området; funnen i 12 sektioner.

d. Arter uppträdande på torr, sandig eller grusig mark.

Hypochoeris glabra — ofta uppträdande massvis, särskilt på sandiga åkrar tillsammans med *Arnoseris minima;* antecknad från 11 sektioner.

Hypochoeris radicata — allmän; känd från alla (24) sektioner.

Teesdalia nudicaulis — allmän och karaktärsart för de sandiga områdena; funnen i 22 sektioner.

Teesdalia synes icke uppträda på lera. Dess gräns t. ex. mot moränleran på Romeleåsen är synnerligen skarp. Så uppträder den vid Ramnakullens fot och strax väster om Simonstorp (båda lokalerna i Blentarp, sekt. 3) som en täckande bård just i Romeleissjöns strandbrink. Därovan saknas den helt.

e. Uppträdande på åkrar.

Stachys arvensis — Ilstorp, åker 300 m O Ilstorps kyrka, sparsamt; S. Åsum, sekt. 3, åker 500 m V Barleja, sparsamt. — Arten är sannolikt vanligare än som ovan kunnat angivas. Den är synnerligen lätt att förbigå, om den uppträder i ringa mängd.

Östliga arter.

Vid diskussionen av arterna inom denna grupp har jag medtagit de arter, som HÅRD (1924) räknar till *Herniaria*-gruppen, även om några av dem ej äro särskilt utpräglade eller rent av borde inordnas på annat håll. (Jmf. ALMQUIST, 1929.) Många av dessa arter äro eutrofer eller kulturmarksarter. Av denna anledning äro åtskilliga av dem ganska allmänna inom området, lika allmänna som *Hypochoeris radicata* och *Teesdalia* bland de västliga arterna.

Allmänna till tämligen allmänna äro:

Aphanes microcarpa (13 sektioner), *Anchusa officinalis* (21 sekt.), *Chaerophyllum temulum* (12 sekt.), *Herniaria glabra* (21 sekt.), *Papaver Argemone* (15 sekt.), *Papaver dubium* (21 sekt.) och *Potentilla reptans* (13 sekt.).

Mera spridda äro:

Aphanes arvensis (8 sekt.), *Campanula persicifolia* (6 sekt.), *Dianthus deltoides* (8 sekt.), *Gagea minima* (4 sekt.), *Helleborine latifolia* (6 sekt.), *Lithospermum arvense* (7 sekt.), *Malva alcea* (6 sekt.), *Satureia Acinos* (5 sekt.), *Veronica hederifolia* (8 sekt.), *Viola hirta* (8 sekt.), *Viola stagnina* (flera lokaler i 3 sekt.) och *Vogelia paniculata* (5 sekt.).

Av de övriga arterna, som av HÅRD räknas till denna grupp, äro några ± sällsynta, andra ej alls anträffade.

De sällsyntare äro:

Allium scorodoprasum — kulturmarksart; funnen i Ilstorp samt i S. Åsum sekt. 2 och 3.

Arabis hirsuta — känd från Björka, S. Åsum sekt. 1 och Öved.

Arctium lappa — kulturmarksart; antecknad från Sövde sekt. 2 och 8.

Carex vulpina — i ängar; S. Åsum sekt. 1 och Sövde sekt. 4.

Corydalis cava — S. Åsum, sekt. 2, c. 500 m NV S. Åsums kyrka, i sydsluttning mot Åsumsån (notarie H. KOLLIND).

Av LECHE (1744, n. 54), uppgiven för »Blentarp, Lillevång» men har där ej återfunnits under inventeringen, trots noggrant sökande. Denna art brukar höra till de av ortsbefolkningen mera kända, men den är ej bekant för blentarpsborna såsom växande där. Sannolikt har växtlokalen genom hygge eller rent av genom uppodling så förändrats, att arten försvunnit.

Corydalis pumila — Björka, 1 km O Björka kyrka i bokbacke nära ån; S. Åsum, sekt. 1, 500 m SO S. Åsums kyrka i ekbacke; S. Åsum, sekt. 2, 500 m NV Åsums kyrka i sydsluttning mot ån; S. Åsum, sekt. 3, 600 m O Åsums gård, sydbrant i ekbacke. — Samtliga lokaler befinna sig i Åsums-Björkaåns dalgång, på lerblandad morän eller i sluttningar, som översilas av vatten, dränerande lermorän.

Cuviera europaea — Sövde, sekt. 9, 500 m SO Skäpperöd, fuktig ekbokbacke.

Arten är sedan gammalt känd från Röddinge, där den växer på liknande lokal. Området S Skäpperöd bevattnas av en rad källflöden, framspringande nedom de höga grusbranterna och sannolikt åtminstone delvis härstammande från silurlagren i höjderna ovanför. Lokalen hör till de rikaste inom området, en ängsskog med bl. a. *Agropyrum caninum, Brachypodium silvaticum, Bromus asper, B. racemosus, Helleborine latifolia, Neottia nidus avis* och *Sanicula europaea.*

Datura stramonium — kulturbetingad eller förvildad; Sövde, sekt. 6, vid Sövde kyrka på kyrkogårdsmurens sydsida; Blentarp, sekt. 5, Bosarpsutmark, vid ladugården.

Delphinium consolida — Everlöv, sekt. 1, 1 km SV Hemmestorp (norra). — Lokalen är meddelad av prosten N. JOHANSSON. Då arten är en sent blommande höstväxt, är det troligt, att den finnes på flera ställen men ej blivit antecknad; kompletterande uppgifter önskvärda.

Gagea stenopetala — Everlöv, sekt. 3, sandiga åkrar, 1 km och 1,3 km OSO, 500 m S, 1 km V och 1 km SV Everlövs kyrka; Ilstorp, 400 m N Ilstorps kyrka, sandig åker.

Denna art är sannolikt ej ovanlig inom dessa områden. Den tillhör emellertid de allra tidigaste vårväxterna, och blomningen är hastigt över. De sista fynden gjordes den andra maj! Kompletterande uppgifter äro därför i hög grad önskvärda.

Onopordon acanthium — tidigare växande i S. Åsum, sekt. 1, strax O kyrkan, dit den emellertid blivit inplanterad. Är numera genom vägbreddning försvunnen.

Ribes alpinum — antecknad från Björka, Blentarp, sekt. 2, Everlöv, sekt. 2 och S. Åsum, sekt. 1.

Silene nutans — endast anträffad i Sövde, sekt. 8.

Trifolium agrarium — känd från Blentarp, sekt. 2 och 5, Sövde, sekt. 9 och S. Åsum, sekt. 2. Den rikaste förekomsten är den i Blentarp, sekt. 5, på Vallerödsbacken, c. 1 km O Blentarps kyrka i vägskärning.

Bromus tectorum — S. Åsum, sekt. 1 och 2, i sydsluttningar på isälvsgrus.

Av andra östliga arter, funna inom området, märkas framför andra *Draba muralis* och *Helianthemum nummularium.*

Draba muralis — Björka, vid bron över ån, c. 400 m N kyrkan; d:o, i vägskärning, c. 800 VNV kyrkan; S. Åsum, sekt. 2, 300 m N vadstället vid Nymölla, brant grusbacke; d:o, 500 m O Nymölla på banvallen; Öved, 500 m S Torp, på banvallen.

Helianthemum nummularium — S. Åsum, sekt. 2, 800 m ONO Nymölla, på sydexponerad, stenig backe, ett 10-tal individ.

Andra anmärkningsvärda växtfynd.

Alopecurus aequalis — Ilstorp, c. 1 km O Skarrie, kärräng på isälvsgrus.

Blechnum spicant — Blentarp, sekt. 6, c. 1 km V Karups gård i bäckfåra (leg. S. WALDHEIM). — Arten är tidigare uppgiven för området av LECHE (1744, 20, 21), som anger Simonstorp, »Folahagen», som fyndort. Den har förgäves eftersökts där.

Calamagrostis neglecta — S. Åsum, sekt. 1, c. 1 km N Sjöbo station i litet kärr; Sövde, sekt. 5, 100 m N Roshus i videkärr.

Carex caespitosa — S. Åsum, sekt. 2, c. 700 m NO Nymölla i kalkkärr; Öved, c. 500 m SO Torp i kärr.

Carex flava — Blentarp, sekt. 4, c. 1,3 km NO Blentarps kyrka i kärr; d:o, c. 800 m NO Simonstorp, kärräng i bäckdal; Everlöv, sekt. 1, c. 1,2 km NO Blentarps kyrka i kärr; Everlöv, sekt. 2, 500 m NO Östarp i bäckdal; Ilstorp, 1 km NO Ilstorps kyrka, vid dike; S. Åsum, sekt. 2, 300 m NV Åsums kyrka på sluttning mot ån; d:o, 700 m och 800 m NNO Nymölla i kärr; S. Åsum, sekt. 3, c. 2 km NV Åsums kyrka i kärr; Sövde, sekt. 1, c. 1 km SO N. Lien i kärräng; Sövde, sekt. 9, 500 m SO Tannhuset i kärr; d:o, 300 m NV Vitabäck översilad sluttning med kalktuff; Öved, 500 m SO Torp i kärräng.

Arten är inom Skåne mycket förbisedd och kommer säkerligen inom de mera eutrofa delarna att visa sig vara ganska vanlig. Inom området föredrager den kalkrika lokaler och uppträder i större mängd endast där. — Lokalen i Blentarp sekt. 4, 800 m NO Simonstorp, är synnerligen rik på *Carices* av denna grupp. Här anträffades nämligen *C. Hornschuchiana, C. lepidocarpa, C. Oederi* v. *oedocarpa, C. flava*×*Hornschuchiana, C. flava*×*lepidocarpa* och *C. flava*×*Oederi* v. *oedocarpa.*

Carex Hartmani — S. Åsum, sekt. 2, kalkkärr c. 800 m NO Nymölla; S. Åsum, sekt. 3, c. 2 km NV Åsums kyrka, kalkkärr i bokskogsbrynet.

Carex Hartmani beskrevs som ny av Cajander (1935). Den har förut betraktats som identisk med *C. polygama* Schkuhr eller med vissa typer inom denna arts formkrets. Då *C. Hartmani,* så vitt jag har mig bekant, icke har omtalats i svensk litteratur, må det anses lämpligt att efter Cajanders framställning i nedanstående schema meddela de viktigaste eller åtminstone de lättast iakttagbara karaktärer, som utmärka de båda arterna till skillnad från varandra. Härvid har föga hänsyn tagits till de båda underarter, i vilka Cajander uppdelat *C. polygama.* Beträffande dessas differentiering hänvisas till originalarbetet. Slutligen förtjänar det i detta sammanhang påpekas, att inom Skåne hittills blott påträffats *C. Hartmani,* medan *C. polygama* ej är anträffad.

C. polygama.	*C. Hartmani.*
Blad (ljust) blå- eller blågrå-gröna; toppax klubbformigt med väl utvecklad ♂-del; ♀-ax i regel 2—3, rundade—avlånga; fruktgömme med raka eller svagt krökta kanter, otydliga nerver och åtminstone till mitten med stora papiller; nöt nående till mitten av fruktgömmet eller något högre.	Blad rent gröna, blott i nedre delen ± blågröna; toppax cylindriskt, ♂-del svagt utvecklad eller saknas; ♀-ax i regel 3—4, de understa cylindriska; fruktgömme med tydligt krökta kanter, framträdande nerver och överallt fina papiller; nöt nående till fruktgömmets topp.

Carex lasiocarpa — Sövde, sekt. 8, c. 1 km V Sövdeborg i kärr.

Carex lepidocarpa — funnen inom 11 sektioner. — Arten betraktas i allmänhet som kalkbunden, vilket emellertid ej synes vara så utpräglat inom detta område som på andra håll. Den är här i detta avseende i varje fall mindre utpräglad än *C. flava. C. lepidocarpa* är liksom sistnämnda art inom Skåne mycket förbisedd och synes ofta vara förväxlad med *C. Oederi* (v. *oedocarpa*!).

Carex paniculata×*remota* (*C. Boenninghauseniana*) — Sövde, sekt. 9, c. 800 m NO Tågra vid källa i bokskog. Hybriden uppträdde i en ensam tuva och anträffades av deltagare i den botaniska kursen i Sjöbo. Denna hybrid var förut känd blott från tre lokaler i Sverige (HOLMBERG, 1927; NILSSON, 1930).

Chimaphila umbellata — Everlöv, sekt. 3, c. 1,5 km NV Östarp i tallskog intill landsvägen Everlöv—Veberöd; Sövde, sekt. 6, i tallskogen nära Bellevue. — Den förstnämnda lokalen påvisades för mig av prosten JOHANSSON, som iakttagit den där under många år; den sistnämnda fyndorten är sedan länge (LILJA, 1870) känd i botanisk litteratur.

Echinodorus ranunculoides — Sövde, sekt. 3, Ellestasjöns strand, 400 m OSO Ladugård, talrik.

Elymus arenarius — Björka, grusbacke 400 m SO Björka kyrka; d:o, 300 m N Skarrie vid basen av flygsandsdyn; Everlöv, sekt. 1, Rödde, vid vägen nära bron över bäcken; Everlöv, sekt. 2, 400 m SSO Hemmestorp (norra), vid basen av sandkulle; d:o, c. 1 km NV Östarp, på sandsluttning; Sövde sekt. 6 o. 7, Bökeberga å ömse sidor om vägen Sjöbo—Sövestad, nedom stråket av isälvsgrus; Öved, vid Våmbsjön 400 m V Öveds station, på stranddyner.

En markant skillnad kan iakttagas i denna arts uppträdande vid havs- eller insjöstränder och på sandmarker, avlägsna från vatten. Vid stränderna intager nämligen *Elymus* gärna dynernas rygg, i de mera torra områdena däremot alltid deras bas. Trots sin utpräglat xeromorfa byggnad torde denna art således icke tåla en alltför stark uttorkning.

Epilobium adnatum — Sövde, sekt. 7, c. 1 km ONO Snogeholm vid stranden av Snogeholmssjön.

Epilobium collinum — Blentarp, sekt. 1, c. 1,5 km SO Bonnarp, på vägkant; S. Åsum sekt. 2, c. 1,5 km NV S. Åsums kyrka vid markväg.

Denna arts utbredning i Skåne är mycket obetydligt känd. Den förväxlas lätt i fält med *E. montanum*, men uppträder gärna på torrare ståndorter än denna. Steniga, torra backsluttningar synas vara dess rätta hemvist.

Euphrasia suecica — Everlöv, sekt. 2, c. 400 m SO Hemmestorps mölla, på fuktig ängsmark. — Arten intog här något 10-tal kvm och uppträdde talrikt. Den stod i full blom vid mitt besök på platsen den 12 juni.

Festuca ovina v. *capillata* — Blentarp, sekt. 4, c. 1 km NNV Blentarps kyrka i odlad tallskog.

Filipendula hexapetala — S. Åsum, sekt. 1, Grimstofta, på stenig, något fuktig ljungbacke nära Åsumsån; S. Åsum, sekt. 2, 500 m V S. Åsums kyrka i ekbacke nära Åsumsån; S. Åsum, sekt. 3, ängsmark c. 1 km O Åsums gård; Sövde, sekt. 8, c. 600 m V Sövde kyrka, på grusbackens sluttning mot Sövdesjön; Öved, c. 300 m SO Torp, på stenig, något fuktig backe av urbergsmorän.

Filipendula hexapetala får sannolikt anses vara sparsam även i andra delar av mellersta Skåne. Arten synes endast uppträda i en bestämd miljö, nämligen steniga eller grusiga och något fuktiga backar (jmf. HÅRD, 1924, 92, 93). Denna ståndortstyp är ej särdeles vanlig i södra och mellersta Skåne.

Gymnadenia conopsea — Blentarp, sekt. 4, c. 800 m NO Simonstorp, på äng vid bäcken; Everlöv, sekt. 1, c. 1,2 km NO Simonstorp, på äng vid bäcken.

Hypericum hirsutum — S. Åsum, sekt. 2, kalkkärr c. 800 m NO Nymölla; S. Åsum, sekt. 3, c. 2 km NV Åsums kyrka, i kalkkärr i bokskogsbrynet; Sövde, sekt. 4, c. 700 m O Assmåsa, på fuktig, lerblandad urbergsmorän.

Hypericum humifusum — här och var inom områdets flacka grus- och sandfält; funnen i 10 sektioner.

Juncus subnodulosus — Sövde, sekt. 9, kärret 400 m SO Tannhuset. — Arten växer här utefter diken och bäckstråk, som vattnas från i sluttningarna i NO framspringande källor. Vattnet är här synnerligen kalkhaltigt. Ett flertal vattenprov från artens ståndort visade pH = 8,2.

Koeleria glauca — Björka, c. 500 m V Skarrie, på flygsandsdyn; Everlöv, sekt. 1, 300 m NO Rödde, på flygsand (S. WALDHEIM). — En sedan länge känd lokal inom området är den på sanddynerna intill Öveds station. Här eftersöktes arten emellertid ett flertal gånger förgäves. Sannolikt har den här utplånats, då detta område numera är en livligt besökt badplats. Däremot återfanns lokalen invid Klostersågens station i Våmbs socken, där arten fortfarande uppträder i mängd.

Linnaea borealis — Blentarp, sekt. 4, c. 1 km NNV Blentarps kyrka, i odlad tallskog. Lokalen påvisad för mig av prosten N. JOHANSSON.

Litorella uniflora — Sövde, sekt. 3, c. 500 m SV Ellesta vid Ellestasjön; Sövde, sekt. 8, c. 300 m SO Trulstorp vid dike på sandmark.

Myrica gale — Sövde, sekt. 9, c. 300 m SSO Jordboden, på mossbänk i kalkkärr.

Fyndet, som utgjordes av en enda buske, måste anses mycket överraskande, då *Myrica* är att beteckna som en oligotrof växt. Busken växte på en vall, som kvarlämnats mellan två torvgravar. Det kapillärt från det underliggande kalkkärret uppstigande vattnet måste vara mycket obetydligt. Jämför i detta avseende den i samma kärr uppträdande *Erica* (sid. 183).

Ornithopus perpusillus — Everlöv, sekt. 1, c. 1,5 km NO Simonstorp, på sandig åker, massvis; Everlöv, sekt. 2, c. 1 km V Östarp, sandig åker, sparsamt; S. Åsum, sekt. 1, 600 m S Gumparp, mellan sandig åker och ljungbacke, talrikt.

Denna art är tidigare bekant som vildväxande endast på Nybrofältet öster om Ystad. Hur växten kommit in inom området, om genom fågelspridning, genom klöverfrö eller på annat sätt, undandrager sig vårt bedömande. Mycket möjligt är, att den under lång tid förekommit här, men att den blott under mycket varma och torra somrar som den år 1939 förmår nämnvärt hävda sig. Erfarenheten om dess mycket växlande uppträdande vid Nybro tyder på ett sådant samband.

Petasites albus — Blentarp, sekt. 2, 700 m NO Ågerup, i bäckfåra i bokskog; Everlöv, sekt. 1, alsnår vid bäck, 500 m NV Röddemölla; d:o, 300 m NO Stampen vid bäck; d:o, 600 m SV Östarp i alkärr; Sövde, sekt. 2, 300 m NNV Getsholmen, vid bäck, massvis; Sövde, sekt. 9, 300 m V Jordboden, alkärr vid källa.

Picris hieracioides — S. Åsum, sekt. 3, c. 1 km NO Åsums gård, på backe med i dagen gående skiffer.

Sanguisorba minor — Blentarp, sekt. 5, c. 1 km O Blentarps kyrka, i vägskärningen på Vallerödsbacken.

Schoenus ferrugineus — 300 m NV Vitabäck, på översilad sluttning med ung kalktuff; d:o kalkkärr, 300 m SSO Jordboden.

Sedum sexangulare — Sövde, sekt. 6, 600 m SV Sövdeborgs slott, i ekbacke, täckande omkr. 1 kvm. — Lokalen är sedan länge bekant (FRIES, 1835, 98).

Trifolium striatum — S. Åsum, sekt. 1, c. 1 km NNO Sjöbo station, på gruskulle (S. WALDHEIM); Sövde, sekt. 1, 600 m SV Ugglesjö, på stenig moränbacke; Sövde, sekt. 3, 500 m SV Ellesta nära Ellestasjön, grusbacke.

Veronica montana — Blentarp, sekt. 1, 1 km SO Bonnarp, fuktig bokskog vid bäck; Blentarp, sekt. 3, 500 m SV Simonstorp, bäckfåra i bokskog; Sövde, sekt. 4, 700 m SO Assmåsa, i fuktig bokskog; Sövde, sekt. 5, 500 m SV Snogeholm, i bokskogskärr; Sövde, sekt. 7, 700 m NV Sågmöllan, bokskogskärr.

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BOTANISKA NOTISER 1940, LUND 1940.

Über die Nomenklatur zweier Ranunculus-(Halerpestes-)Arten.

Von NILS HYLANDER.

Vorliegender kleiner Aufsatz ist durch die Arbeit von H. LINDBERG: *Ranunculus salsuginosus* Pallas. (*R. cymbalaria* Pursh.) in Botaniska Notiser 1939 veranlasst und beabsichtigt nur, ein nomenklatorisches Übersehen darin zu berichtigen, um zu vermeiden, dass die schon vorher allzu verwickelte Nomenklatur der skandinavischen Gefässpflanzen noch mit einem überflüssigen — weil unbrauchbaren — Namen belastet wird, nämlich *Ranunculus salsuginosus* Pall. — von *Ranunculus salsuginosus* Georgi um ein Jahr antedatiert.

In der Tat wurde die zugrunde liegende Namensverwechselung i. J. 1819 durch VON SCHLECHTENDAL geklärt, und beide Namen — PALLAS' sowie GEORGI's — sind im INDEX KEWENSIS getrennt aufgeführt, obwohl der letztere merkwürdigerweise ohne Identifizierung. Betreffs der von LINDBERG vorgenommenen Zusammenführung sowohl des asiatischen »*R. sarmentosus* Adams» wie des amerikanischen *R. Cymbalaria* Pursh (sowie auch südamerikanischer Formen) wage ich mich, wegen mangelnder Kenntnis grösserer Herbarmaterialien, nicht näher zu äussern als mit einer Vermutung ihrer Richtigkeit. HANDEL-MAZZETTI (1939) nimmt zwar wie OVCZINNOKIV (in Fl. URSS. VII, 1937) den entgegengesetzten Standpunkt ein; andererseits fassen manche früheren Autoren seit den Zeiten DE CANDOLLE's die Art in demselben weiten Umfang wie LINDBERG, höchstens unter Erwähnung einiger Extremformen als »Rassen» oder »Varietäten» (z. B. DE CANDOLLE 1818 u. 1824, v. SCHLECHTENDAL 1819, LEDEBOUR 1830 u. 1842, BRITTON & BROWN 1913, und — nach HANDEL-MAZZETTI 1939, worauf ich hinweisen möchte — »autt. plur. asiat.»; so auch FRISENDAHL 1921).

Wie LINDBERG sagt, wurde diese Art, und zwar eine asiatische Form davon, mit binärer Nomenklatur erst von PALLAS 1776 publiziert, zwar ohne nähere Beschreibung aber durch den Hinweis auf die Tafel XIII: 2 bei AMMANN 1739 und das Aufnehmen des dazu gehörigen

Textes in klarer und auch nach den neuesten Nomenklaturregeln befriedigender Weise. Unglücklicherweise war aber schon ein Jahr früher in der Arbeit: Bemerkungen einer Reise im Russischen Reich im Jahre 1772 von J. G. GEORGI ein *Ranunculus salsuginosus* auch gültig beschrieben worden, der zunächst auf den *Ranunculus foliis radicalibus oualibus, petiolatis tridentatis* bei GMELIN 1769 fusste, unter dessen Belegen aber durch diesen Hinweis auch eine Pflanze aus demselben Werke AMMANN's wie oben war; jedoch nicht die Nr. 107 — die *R. salsuginosus* Pall. ausmacht — sondern Nr. 105. Samen dieser Pflanze, die durch die Beschreibung von GMELIN sowie durch die von ihm herangezogenen Synonyme ihrer Identität nach ganz klar ist, wurden offenbar schon in den nächsten Jahren aus Russland nach verschiedenen ausländischen botanischen Gärten gesandt, wodurch man die Pflanze gut kennen lernte, während gleichzeitig ihre Beschreibung durch GEORGI aus irgend einem Grunde verschollen wurde — nicht aber die spätere PALLAS'sche Publikation der anderen Art. So kam es, dass AMMANN's *Ranunculus* Nr 105 binnen kurzem von zwei verschiedenen Autoren nach kultivierten Exemplaren beschrieben und schön abgebildet wurde. 1776 erschien *R. ruthenicus* Jacq., 1778 *R. plantaginifolius* Murr., und unter einem dieser Namen ist die Art seither meistens bekannt — ihre Artrecht der vorigen Art gegenüber wurde wohl niemals bezweifelt, denn sie ist besonders durch die weit grösseren Blüten und durch die dickeren, beinahe lederartigen Blätter mit ± ovaler, ganzrandiger oder nur an der Spitze (2-)3-gekerbter Spreite leicht kenntlich und gut geschieden. Merkwürdigerweise geriet aber JACQUIN bei der Neubeschreibung fehlerhaft als ein Synonym die AMMANN'sche Art Nr. 107 anzuführen; dies kann meines Erachtens aber kaum Anlass geben, den JACQUIN'schen Namen als ungültig zu betrachten, denn seine Beschreibung ist ja ganz deutlich auf die von ihm gesehenen Gartenexemplare begründet. Dieser Unfall bei JACQUIN scheint späteren Forschern entgangen zu sein; dagegen hebt VON SCHLECHTENDAL (1819) hervor, dass bei MURRAY (1778) in der Synonymie seines neuen *R. plantaginifolius* dasselbe falsche Zitat sich finde. Dies ist nicht ganz richtig: die Sache liegt bei MURRAY etwas komplizierter; ja, es scheint mir sogar ganz unklar, wie man diesen Fall nach der modernen Typenmethode beurteilen soll. MURRAY zieht nämlich gleichzeitig mit seiner eigenen Beschreibung zwei ältere, in der Tat hierher gehörende Namen als Synonyme heran, und zwar GMELIN's *Ranunculus foliis radicalibus oualibus, petiolatis tridentatis* sowie den auch vom letzgenannten Autor dazu geführten *Ranunculus plantaginis folio, foliis* *partim integris partim bifidis vel trifidis* aus einem STELLER'schen Manuskript — daneben aber auch, obwohl mit deutlichem Zaudern, die Nr. 107 bei AMMANN mit der Bemerkung: »Descriptio forsitan huc pertinet, non vero icon cit. Tab. 13. fig. 2». Aber von der mit MURRAY's »neuer» Art sicher identischen Nr. 105 bei AMMANN sagt er, diese möge vielleicht hierhergehören, die Beschreibung sei aber zu dürftig, um sichere Schlüsse zu erlauben; besser dürfte jedoch — nach MURRAY — jene Art, AMMANN Nr. 105, mit *R. salsuginosus* Pallas passen, wäre es nur nicht so, dass dieser Autor sich bei seiner Beschreibung auf das Bild (XIII: 2) bei AMMANN stütze, ein Bild das wohl doch unmöglich zu *R. plantaginifolius* passe. Wozu er die erstaunende Bemerkung fügt, er sei verwundert, dass GEORGI — obschon ohne PALLAS' Namen zu nennen — *Ranunculus salsuginosus* mit dem obenerwähnten Synonym von GMELIN versehen und doch nicht die Verschiedenheit zwischen diesem und der Figur (XIII: 2) bei AMMANN bemerkt habe. MURRAY's selbstbewusste Schlusswörter, seine neue Beschreibung und Abbildung sollen diese »memorabilem plantam» aus dem Dunkel hervorziehen, sind also von ein wenig beschränkter Wahrheit.

Für die Nomenklatur von noch grösserer Bedeutung war es aber, dass die Verwechselung der beiden homonymen Arten von GEORGI und PALLAS auch in dem grundlegenden Werke, DE CANDOLLE's Systema naturale zurückkam, sodass die GEORGI'sche Art als »*Ranunculus salsuginosus* Pall.» bezeichnet wurde, während im übrigen alle Literaturangaben betreffs beider Arten richtig sind. Wie schon oben gesagt, wurde dies in VON SCHLECHTENDAL's Animadversiones 1819 korrigiert, ohne dass jedoch DE CANDOLLE, bei der einige Jahre später folgenden Bearbeitung der Ranunculazeen im Prodromus, auf SCHLECHTENDAL's Berichtigungen — in diesem Falle wie überhaupt — irgend eine Rücksicht nahm. Die nicht selten gebrauchte Bezeichnung »*R. salsuginosus* DC.» sollte also mit *R. salsuginosus* Georgi ersetzt werden. Das Verdienst um die Wiederentdeckung des GEORGI'schen Namen gebührt HANDEL-MAZZETTI. Dieser — der in seiner Arbeit 1939 die Gattung *Halerpestes* aufrechthaltet — hat aber da den Namen *R. salsuginosus* als ein Nomen ambiguum verworfen und für die GEORGI'sche Art den Namen *Halerpestes ruthenica* (Jacq.) Ovcz. gewählt. Der Schluss ist bei dieser Gattungsabgrenzung richtig, die Prämissen aber nicht. Es handelt sich ja nämlich hier nicht um eine Art, deren ursprüngliche Fassung von verschiedenen Forschern verschieden beurteilt und deren Name damit auf verschiedene Sippen bezogen wurde, sondern eine Verwechselung zweier, von verschiedenen Autoren beschriebener, auf verschiedene Typen begründeter aber mit gleichlautenden Namen versehener Arten, von denen die ältere unrichtigerweise vernachlässigt wurde. Solange die Nomenklaturregeln keine Nomina specifica conservanda et rejicienda zulassen, muss der Name *Ranunculus salsuginosus* Georgi statt *R. ruthenicus* Jacq. (oder *R. plantaginifolius* Murr.) gelten. Unter *Halerpestes* ist dagegen eine Kombination von GEORGI's Namen nach der heutigen Homonymregel leider nicht möglich, denn es gibt schon eine von GREENE (bei der Veröffentlichung der Gattung *Halerpestes*) gebildete Kombination *Halerpestes salsuginosa* (nicht *salsuginea*, wie es bei LINDBERG l. c., p. 686 steht), die auf *R. salsuginosus* Pallas begründet wurde. (Da GREENE l. c. offenbar beabsichtigt, sämtliche *Halerpestes*-Arten — soweit sicher unterscheidbar — aufzuzählen, die GEORGI'sche Art aber gar nicht erwähnt, ist es denkbar, dass er diese und die von PALLAS nicht hat auseinanderhalten können; oder hat er wirklich gemeint, »*R. ruthenicus*» gehöre nicht in dieselbe Gattung?) Da JACQUIN's Name *R. ruthenicus* nach der Typenmethode nicht »überflüssig» war, ist unter *Halerpestes* der richtige Name *H. ruthenica* (Jacq.) Ovcz.

Der älteste gültige Name der anderen Art (AMMANN Nr. 107) ist — bei der weiten Fassung von LINDBERG — *R. Cymbalaria* Pursh, der aus 1814 stammt, oder — als *Halerpestes* — *H. Cymbalaria* (Pursh) Greene (1900); führt man dagegen die asiatischen Formen in eine besondere Art zusammen, soll diese *Ranunculus sarmentosus* Adams — bzw. *Halerpestes sarmentosus* (Adams) Kom. — heissen, falls nicht *R. halophilus* Schlecht. (1820) hierhergehört.

Was nun schliesslich die Frage nach der Gattung betrifft, so scheint mir der verschiedene Bau der Fruchtwand dieser beiden Arten den echten *Ranunculi* gegenüber — im ersteren Falle ohne, im letzteren mit Hartschicht; siehe PRANTL 1888, LONAY 1901 — ein so durchgreifendes Merkmal zu sein, dass es am richtigsten ist, sie von *Ranunculus* zu trennen. Vielleicht hat diese Gruppe[1] — wie es PRANTL will, GREENE aber verneint — mit der asiatischen Gattung *Oxygraphis* (wie sie HANDEL-MAZZETTI abgrenzt) eine nähere verwandtschaftliche Beziehung; es dürfte jedoch sicherer sein, mit HANDEL-MAZZETTI die bei-

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[1] Zu dieser sind nach HANDEL-MAZZETTI 1939 noch die beiden asiatischen Arten *H. tricuspis* (Maxim.) Hand.-Mzt. und *H. lancifolia* (Bertol.) Hand.-Mzt. zu rechnen; auch gehört wohl hierher wenigstens ein Teil der von DE CANDOLLE (ll. cc.) in die Nähe von *Ranunculus Cymbalaria* gestellten Arten, einige vielleicht nicht einmal als von dieser artverschieden (cfr INDEX KEWENSIS unter *R. tridentatus* H. B. K.).

den Gattungen *Halerpestes* und *Oxygraphis* bis auf weiteres getrennt zu halten. [Unter *Oxygraphis* sollten sonst die korrekten Namen der beiden Arten bzw. *Oxygraphis salsuginosa* (Georgi) Hyl. n. c. und *O. Cymbalaria* (Pursh) Prantl sein.] Die Typart der Gattung *Oxygraphis* Bunge ist *O. glacialis* (Fisch.) Bge, mit der die *Halerpestes*-Arten im Fruchtbau übereinstimmen; als Gattungscharakter wurde aber vom Autor nicht nur dieses Merkmal sondern auch ein anderes hervorgehoben, nämlich das Persistieren des Kelches während der Postfloration. Wegen dieser beiden Abweichungen vom normalen *Ranunculus*-Schema wurde in späteren Zeiten die Gattung *Oxygraphis* nach zwei ganz verschiedenen Richtungen erweitert. Erstens wurde sie um einige Arten vermehrt, bei denen wie bei der Typart der Kelch (bisweilen auch die Corolle) während der Postfloration stehen bleibt; so wurde von AITCHISON & HEMSLEY (ap. AITCHISON 1882) eine *Oxygraphis Shaftoana* aus Afghanistan aufgestellt und von FREYN *R. glacialis* L., *R. Chamissonis* Schlecht. und *R. Andersoni* A. Gray hierhergezogen (ersterer als *O. vulgaris* Freyn). Eine solche Erweiterung muss man aber mit HANDEL-MAZZETTI ganz ablehnen; denn diese zwar biologisch interessante Erscheinung — deren Vorhandensein bei *R. glacialis* wohl zum erstenmal, wie VON SCHLECHTENDAL angibt, von WAHLENBERG 1812 beschrieben wurde — tritt offenbar in verschiedenen Verwandtschaftskreisen der Gruppe *Ranunculeae* auf und berechtigt daher nicht, die genannten Arten von *Ranunculus* loszulösen (wie schon WAHLENBERG für *R. glacialis* vorschlug), noch weniger mit *Oxygraphis* zu vereinigen. Ebenso wenig geglückt scheint mir das Vornehmen PRANTL's, mit *Oxygraphis* auf Grund des ähnlichen Fruchtbaues die amerikanischen Gattungen *Kumlienia* Greene und *Cyrtorrhyncha* Nutt. einzuverleiben (in welch letztere *R. Cymbalaria* trotz der ganz fremden Tracht von BRITTON eingezogen wurde). Es scheint mir dies auf eine Überschätzung eines einzigen »feineren» morphologischen Kennzeichens gegenüber den sämtlichen Habitusmerkmalen (wie auch gewissen Blütenmerkmalen) zu beruhen, die zu einer beinahe gleich unnatürlichen Sammelgattung wie *Ranunculus* in der Fassung von ASA GRAY führt. Nimmt man so noch — wie PRANTL 1891 geneigt ist und LONAY 1908 tut — *Trautvetteria* F. & M. in *Oxygraphis* auf, so hat man m. E. die Gattung in eine Karikatur einer natürlichen Gruppe verwandelt.

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BOTANISKA NOTISER 1940, LUND 1940.

Notes on South African Marine Algae. I.

By GEORGE F. PAPENFUSS.

Since the latter part of 1935 the writer has been engaged in a study of the marine algae of South Africa. The first three years and a half provided an opportunity of becoming familiar with a large number of species in their natural state, while the past year has been spent at Lund in a more critical microscopic study of the species, and a consultation of the types and the literature. It is hoped that the results of this study will finally appear in monographic form; but as it will require several years before that objective is realized, certain preliminary notes will be published from time to time. The present paper is the first of a short series dealing with such notes.

In the course of this investigation the writer has received and is still receiving generous assistance from many persons and institutions. These will be acknowledged in the final work. The writer should like to express his appreciation here, however, to Professor HARALD KYLIN for granting the facilities of his laboratory and for professional assistance in many problems, and to the Carnegie Corporation of New York for financial assistance provided through the University of Cape Town.

Chlorophyceae.

Chaetomorpha robusta (Aresch.) comb. nov. *Lychaete robusta* Aresch., Phyc. Cap.: 8, 1851. *Chaetomorpha clavata* Kütz., Spec. Alg.: 380, 1849 (in part); Tab. Phyc., 3: 19, pl. 62, fig. 1, 1853 (not *Conferva clavata* C. Ag., Syst. Alg.: 99, 1824).

This species is commonly known by the name *Chaetomorpha clavata* but an examination of the type of *C. clavata* (No. 7787 in Herb. Agardh), which was described by C. AGARDH (1824, p. 99) on a plant from the West Indies, has shown that the South African plant is an entirely different species; and it is necessary to restore the specific name *robusta* under which it was described by Areschoug (1851, p. 8).

Chaetomorpha clavata is a small species. Howe (1920, p. 599) who has obtained it in the Bahama Islands gives the diameter of the filaments as 400—800 μ. In the type the filaments measure about 2 cm in length and about 700 μ in diameter. *C. robusta* (fig. 1) on the other hand is one of the largest of known species of *Chaetomorpha,* the filaments frequently attaining a length of 20 cm or more and a diameter of 1—1,5 mm.

In this connection attention might be drawn to the fact that Howe (loc. cit.) places (with a query) the *Conferva intestinalis* Ag. as a synonym under *Chaetomorpha clavata.* The type specimens of these two plants suggest, however, that they represent distinct species.

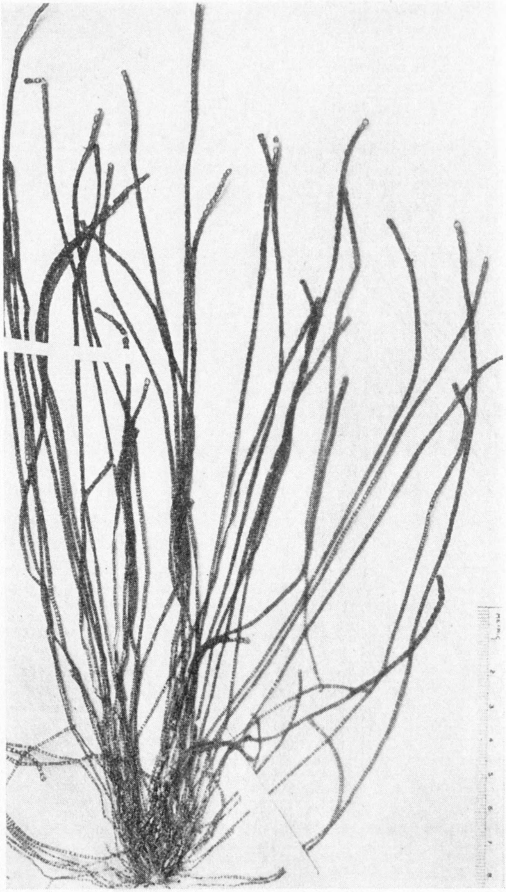
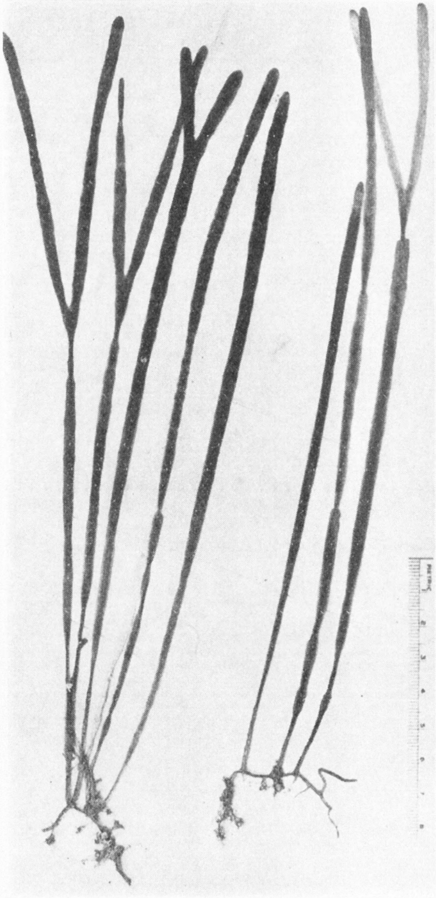


Fig. 1. *Chaetomorpha robusta* (Aresch..) Papenf. (in Herb. G. F. Papenfuss).

Caulerpa filiformis (Suhr) Hering, Ann. and Mag. Nat. Hist., 8: 91, 1841. *Amphibolis filiformis* Suhr, Flora, 17: 737, pl. 2, fig. 13, 1834. *Caulerpa ligulata* Harv. ex J. Ag., Till Alg. Syst., 1: 10, 1872. *Caulerpa flagelliformis* forma *typica* (in part) and forma *ligulata* Web.-v. Bosse, Monogr. des Caulerpes: 274, pl. 24, figs. 7—8, 1898.

This species (fig. 2) is known in South Africa by the name *Caulerpa ligulata* but this name must yield to the older *C. filiformis.* Weber-van Bosse considers the South African plant to be a form of *C. flagelliformis* (fig. 3) which was described by C. Agardh (1822, p. 447) on a specimen that was collected at Cadiz by Cabrera. *C. flagelliformis*



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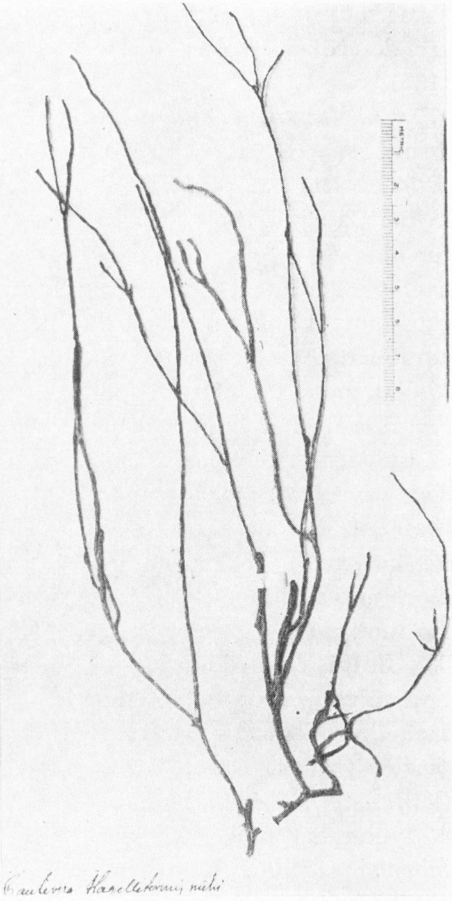

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Fig. 2. *Caulerpa filiformis* (Suhr) Hering (in Herb. G. F. Papenfuss). — Fig. 3. *Caulerpa flagelliformis* C. Ag. The larger of the two specimens on the type sheet (in Herb. Agardh).

seems to be a very rare species and is known only from the type specimen (No. 16375 in Herb. Agardh). A comparison of South African specimens with the plant from Cadiz shows, however, that *C. filiformis* should be retained as a distinct species. In *C. flagelliformis* the frond is more or less cylindrical while it is compressed in *C. filiformis*. The bases of the fronds in the South African plant have, moreover, distinct annular constrictions, a feature which is not apparent in *C. flagelliformis,* in the dried condition, although it is diagnosed by

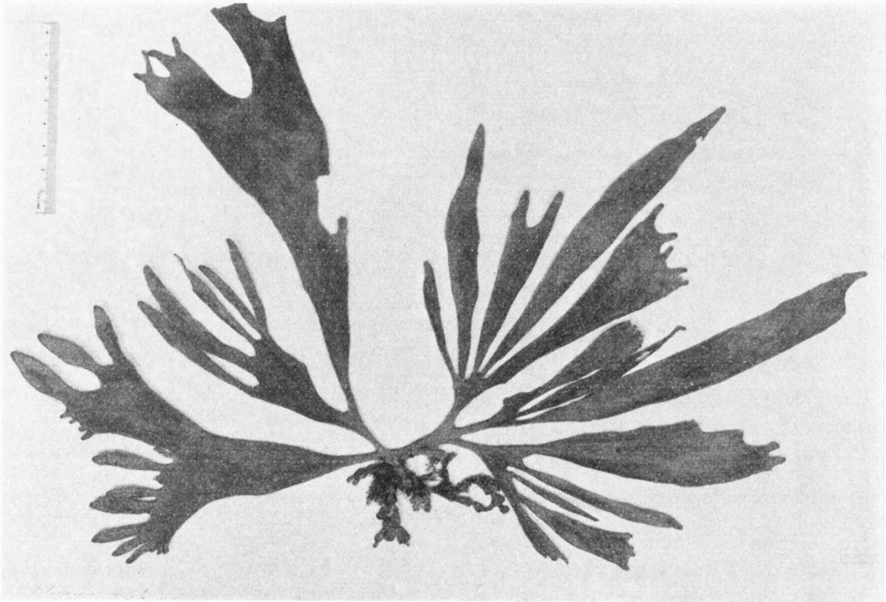

Fig. 4. *Codium platylobium* Aresch., lectotype (in Mus. Botan. Stockholm).

C. AGARDH as being subarticulate. Another striking difference between the two species lies in the fact that the bases of the fronds and the rhizome are much thicker and tougher in *C. flagelliformis* than in *C. filiformis.*

WEBER-VAN BOSSE refers to and has figured (loc. cit., pl. 24, fig. 8) a South African specimen in HOHENACKER's Algae marinae siccatae, No. 480, which she believes to be representative of *C. flagelliformis.* The writer has not had the opportunity of examining the specimen in question but the one under this number in the issue of HOHENACKER's exsiccata belonging to Herb. Mus. Uppsala is typical *C. filiformis.* It might also be added that the writer has had ample opportunity of becoming familiar with *C. filiformis,* which is very common in certain parts of South Africa, but has not seen plants that could be referred to *C. flagelliformis.*

Caulerpa Van Bosseae nom. nov. *Caulerpa filiformis* Harv. ex J. Ag., Till Alg. Syst., 1: 5, 1872.

This species is not known to occur in South Africa. It was described by J. AGARDH on one of HARVEY's specimens from Friendly Island. The binomial *Caulerpa filiformis* Harv. ex J. Ag. (1872) is invalidated, however, by *C. filiformis* (Suhr) Her. (1841) and the species is accordingly renamed in honour of Madame WEBER-VAN BOSSE who has contributed much to our knowledge of the genus *Caulerpa*. The type specimen is No. 16347 in Herb. Agardh.

Codium platylobium Aresch., Nova Acta Reg. Soc. Sc. Upsal., Ser. 3, 1: 367, 1854. *Codium Lindenbergii* Binder ex Kütz., Tab. Phyc., 6: 34, pl. 97, 1856; Schmidt, Bibl. Bot. 23, Heft 91: 60, fig. 43, 1923.

An examination of ARESCHOUG's specimens of *Codium platylobium* has shown that they are of the plant that is generally known as *C. Lindenbergii*. As the binomial *C. platylobium* is the older, it must supplant *C. Lindenbergii*. The specimen that has been selected as the type is photographically reproduced as figure 4.

Phaeophyceae.

Chlanidophora plumbea (Aresch.) comb. nov. *Zonaria plumbea* Aresch., Phyc. Cap.: 25, 1851; Nova Acta Reg. Soc. Sc. Upsal., Ser. 3, 1: 362, 1854.

An examination of the type of this little known plant (fig. 5) has shown that the thallus is distromatic and the species is accordingly transferred to *Chlanidophora*. Certain species of *Padina* are also distromatic but ARESCHOUG's specimens lack the inrolled meristematic margin and the concentric zones of sori characteristic of this genus. (According to ARESCHOUG, loc. cit., the sori of this species are »in lineas concentricas subapproximatis»; but his specimens, two in number, contain very few sori and these can not be said to be arranged in concentric zones.)

Chlanidophora plumbea differs in certain features from the type species of *Chlanidophora, C. microphylla* (Harv.) J. Ag. (1894, p. 16). In *C. microphylla* the cells in the two layers are of equal dimensions while in *C. plumbea* the cells on one surface are considerably elongated in a direction perpendicular to the plane of the thallus. *C. microphylla* resembles *Halopteris* in general habit while *C. plumbea* resembles *Stypopodium zonale* or certain species of *Padina*.

Two other species of *Chlanidophora* have been described thus far, *C. repens* Okam. (1907, p. 112; 1931, p. 55) and *C. abyssicola* Setch. and Gardn. (1925, p. 658). *C. plumbea* agrees with *C. repens* in the absence of paraphyses in the sporangial sori and in having these covered by an indusium. *C. abyssicola* differs from *C. plumbea* in containing para-

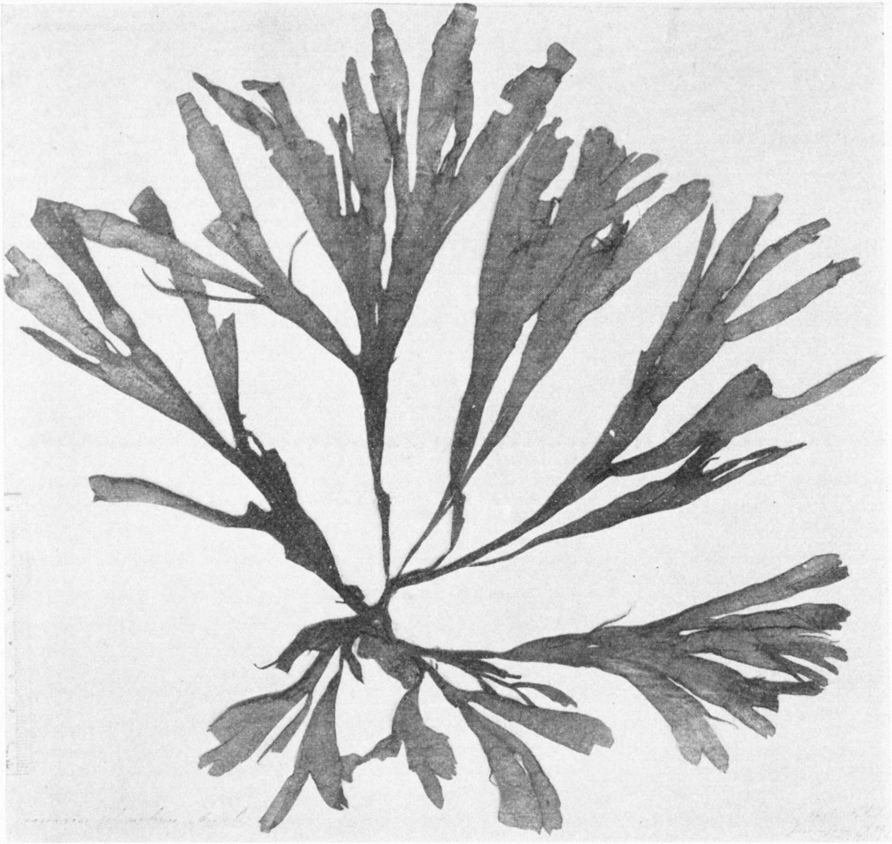

Fig. 5. *Chlanidophora plumbea* (Aresch.) Papenf. The larger of the two specimens on the type sheet (in Mus. Botan. Stockholm).

physes in the sporangial sori and in having multisporic sporangia. In *C. plumbea* the sporangia are tetrapartite.

From the foregoing discussion it seems likely that at least two genera are included in *Chlanidophora,* one containing paraphyses in the sporangial sori and the other lacking them; but until the asexual reproductive organs in the type species, *C. microphylla,* have been discovered, it is not possible to decide which of the species should be removed to a new genus.

Stypopodium zonale (Lamour.) comb. nov. *Fucus zonalis* Lamour., Diss.: 38, pl. 25, fig. 1, 1905. *Zonaria zonata* C. Ag., Syn. Alg. Scand.: XX, 1817. *Zonaria zonalis* Howe in Britton, Flora of Bermuda: 507, 1918. *Zonaria lobata* C. Ag., Syst. Alg.: 265, 1824. *Stypopodium lobatum* Kütz., Tab. Phyc., 9: 25, pl. 63, fig. 1, 1859.

Certain authors (BØRGESEN, 1914, p. 43; 1926, p. 94; HOWE, 1918, p. 507; SETCHELL and GARDNER, 1925, p. 659; TAYLOR, 1928, p. 125; and others) do not accept *Stypopodium* as a distinct genus but include it under *Zonaria*. As has been pointed out by WEBER-VAN BOSSE (1913, p. 177) it differs, however, from *Zonaria* in the irregular arrangement of its medullary cells. Additional features in which *Stypopodium* and *Zonaria* differ from each other are: (a) In *Stypopodium* each medullary cell is covered by a layer composed of several epidermal cells while in *Zonaria* each medullary cell is covered by a layer consisting of only two epidermal cells. (b) In *Stypopodium* the sporangia form four spores while in *Zonaria* they usually form eight spores. (c) In *Zonaria* the sporangial sori contain paraphyses while in *Stypopodium* they lack paraphyses. In view of these differences it seems desirable to retain *Stypopodium* as a genus distinct from *Zonaria*. The writer has not had the opportunity of examining the type of *Stypopodium zonale* (from Santo Domingo, Haiti) but the South African plants agree well with the specimens from the West Indies that are in Herb. AGARDH.

In this connection it might be pointed out that KJELLMAN and SVEDELIUS (1910, p. 186) and SCHMIDT (1938, p. 217) distinguish the *Zonariinae* from the *Padininae* by the absence of hairs on the sterile parts of the thallus in the former. This character does not hold, however, for it has been shown by HAUPT (1932) that the sterile parts of the thallus in *Zonaria Farlowii* contain concentric bands of hairs and the writer has also observed hairs on the sterile thallus of an as yet undetermined species of *Zonaria* from South Africa.

Dilophus Suhrii (Kütz.) comb. nov. *Stoechospermum Suhrii* Kütz., Tab. Phyc., 9: 17, pl. 41, fig. 2, 1859. *Zonaria marginata* Suhr, Flora, 17, Bd. 2: 723, pl. 1, fig. 6, 1834 (not *Zonaria marginata* C. Ag., Syst. Alg.: 266, 1824). *Dictyota marginata* Aresch., Phyc. Cap.: 23, 1851. *Dictyota prolifera* Suhr, Flora, 22, Bd. 1: 66, pl. 1, fig. 39, 1839; Kütz., Tab. Phyc., 9: 5, pl. 9, fig. 3, 1859 (not *Dictyota prolifera* Lamour., Nouv. Bull. Sc. Soc. Philom., 1: 331, 1809).

In this species the thallus grows by means of an apical cell and contains a polystromatic medulla. These features show that the plant must be referred to *Dilophus*.

As a synonym under *Dilophus Suhrii* should be included *Dictyota* *prolifera* Suhr (1839, p. 66), the only existing specimen of which is now in Mus. Botan. Stockholm. This specimen had been in Herb. SONDER (acquired by Stockholm) where KÜTZING saw it and made the figure reproduced in his Tabulae Phycologicae, 9, pl. 9 (fig. 3). SUHR when describing the species gave the locality as Madagascar and remarked that he had received only one specimen. The specimen does not agree entirely with SUHR's figure of the habit but agrees fairly well with KÜTZING's figure. KÜTZING (loc. cit.) points out that the type locality, Madagascar, as given by SUHR is in error and that the specimen was collected at Algoa Bay by ECKLON. On the sheet containing the specimen the locality name »Algoa Bai» has been crossed out and »Madagascar» substituted. In addition the sheet contains the following note by SONDER: »*Zonaria prolifera* Suhr. *Dictyota*! Sdr. SUHR hat den richtigen Standort durchstrichen und Madagascar dafür hingeschrieben. ECKLON hat sie in der Algoabay gesammelt — Das ganze ist ein junges Pflänzchen. Sdr. Kütz. tab. phycol. Vol. IX. t. 2315».

As SONDER correctly remarked, the specimen is a young plant; but of its identity with *Dilophus Suhrii* there seems to be no doubt. Its place of origin, Algoa Bay, is also the type locality of *D. Suhrii*, the original specimens of which were likewise collected by ECKLON.

In connection with *Dictyota prolifera* Lamouroux (1809, p. 331), which invalidates *D. prolifera* Suhr, it might be pointed out that a study of LAMOUROUX's type (from Australia) may prove it to be identical with a subsequently described species of the *Dictyotales*. J. AGARDH (1848, p. 97) places *D. prolifera* Lamour. under »species inquirendae». He cites LAMOUROUX's Essai p. 58, where only the name of the species is given, and remarks that the species is not described. The species was, however, described by LAMOUROUX in 1809.

Ecklonia fastigiata (Endl. et Dies.) comb. nov. *Pinnaria fastigiata* Endl. et Dies., Bot. Zeit., 3: 289, 1845.

This species is known only from the type (fig. 6) which is preserved in Herb. Naturhist. Mus. Vienna. The specimen was collected at Port Natal by PÖPPIG and apparently represents a distinct species of *Ecklonia*.

The most obvious characters that distinguish *E. fastigiata* from other species of *Ecklonia* are found in its pinnae. These are slender, uncorrugated, spineless, and very narrow, almost stipitate, at the base. The latter feature was also referred to by ENDLICHER and DIESING in their diagnosis of the species.

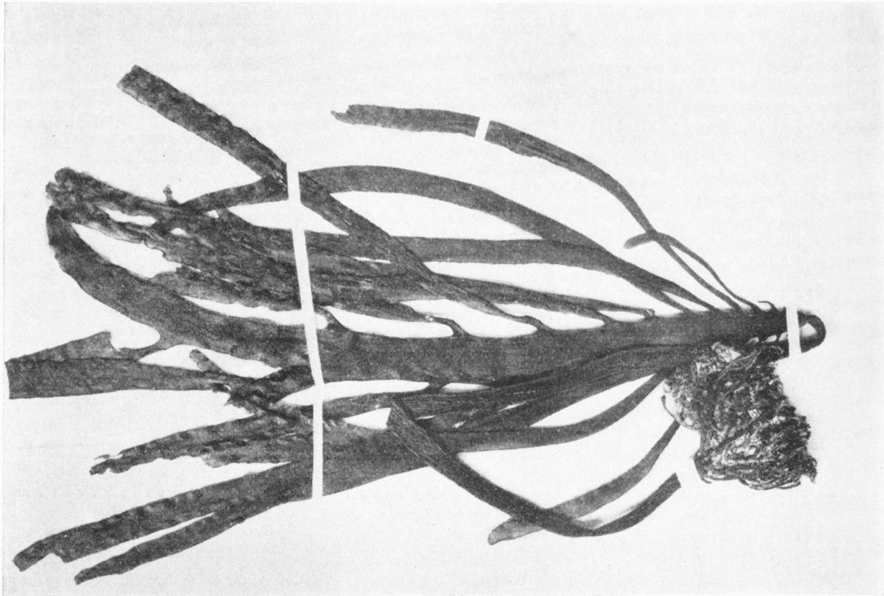

Fig. 6. *Ecklonia fastigiata* (Endl. et Dies.) Papenf. Type specimen, about $^1/_4$ nat. size (in Herb. Naturhist. Mus. Vienna).

It seems probable that Pöppig had obtained his specimen from the drift as a fair amount of collecting has been done in the Durban region without anyone, as far as the writer is aware, having found this species again. It is likely that the plant occurs in the St. Lucia Bay region. This possibility is suggested by the fact that Dr. M. A. Pocock gathered on the beach at St. Lucia Bay two unidentifiable specimens of an *Ecklonia* which an inhabitant of the region suspected of being representative of a »large» seaweed occuring along that coast. None of the other South African species of *Ecklonia* apparently extend as far north as Durban.

Ecklonia Richardiana J. Ag., Sp. Alg. 1: 147, 1848.

This species, described by J. Agardh from New Zealand and Australia, is here recorded for the first time from South Africa. The writer is indebted to Miss H. M. L. Rayment of Rhodes University College, Grahamstown, for calling his attention to the fact that a spineless *Ecklonia* of the *E. radiata* type occurs on the Transkei coast at Dwesa (Bashee River mouth), and for a specimen of the species from this locality. The plant (fig. 7) has been collected subsequently

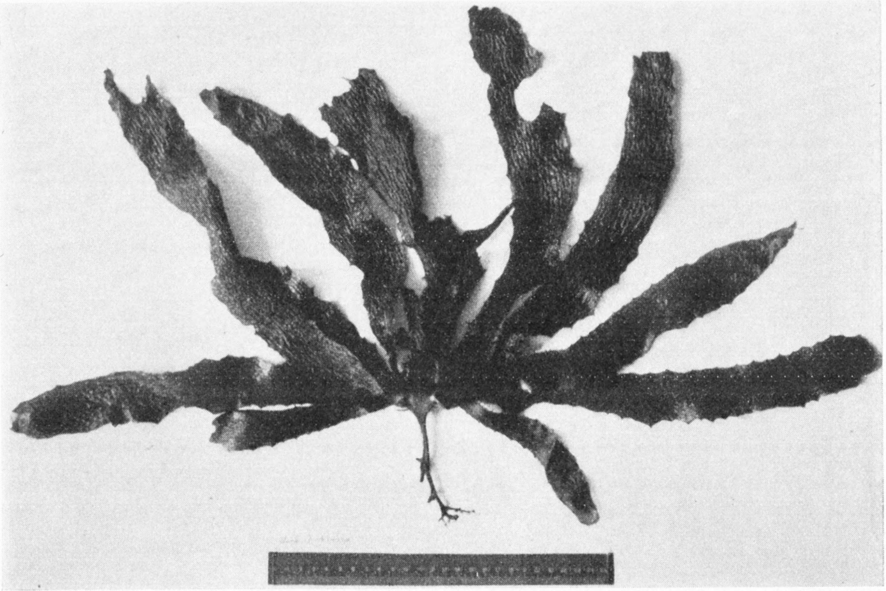

Fig. 7. *Ecklonia Richardiana* J. Ag., specimen from South Africa, about $^1/_5$ nat. size (in Herb. G. F. Papenfuss). Photo, Dr. M. A. Pocock.

by Dr. POCOCK and the writer at Qora River mouth and by Dr. POCOCK at Cape Morgan, near Kei River mouth. It seems likely that the species is of fairly wide distribution on the east coast of the Cape Province but has been overlooked by earlier collectors. The South African plants agree well with those of this species from New Zealand and Australia that are in Herb. AGARDH.

DE TONI (1889, p. 786; 1895, p. 355) regards *E. Richardiana* as a form of *E. radiata*. It seems desirable, however, to retain it as a separate species as it differs in certain features from *E. radiata*. In *E. Richardiana* (fig. 7) the pinnae are simple while in *E. radiata* (fig. 8)[1] they are lobed. The lobed condition of the pinnae in *E. radiata* is also clearly shown in TURNER's (1809, pl. 134) excellent figure of the species. In *E. radiata* the pinnae are also broader and longer and the plant as a whole is much more robust than in *E. Richardiana*.

E. Richardiana differs from *E. fastigiata* in containing teeth along the margin of the pinnae, in having shorter and broader pinnae and in having a shorter and thinner stipe (cf. figs. 7 and 6).

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[1] The writer is indebted to Mrs. G. E. PERRIN of Launceston, Tasmania, for the specimen (ex Low Head, Tas.) which is photographically reproduced as figure 8.

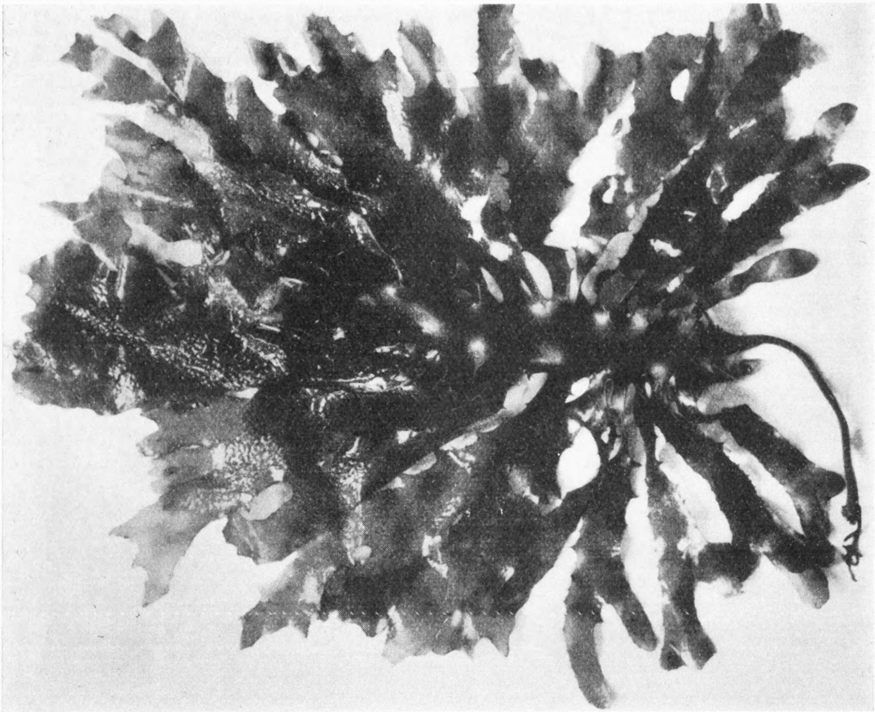

Fig. 8. *Ecklonia radiata* (Turn.) J. Ag. Specimen from Low Head, Tasmania, 1/5 nat. size (in Herb. G. F. Papenfuss). Photo, Dr. M. A. Pocock.

Ecklonia exasperata (Turn.) J. Ag., Sp. Alg., 1: 146, 1848. *Fucus radiatus* β *exasperatus* Turner, Fuci, 2: 161, 1809.

De Toni (1889, p. 786; 1895, p. 354), in agreement with Turner, places *Ecklonia exasperata* (fig. 9) as a form under *E. radiata* (fig. 8). It seems necessary, however, to regard these two plants as different species, as was done by J. Agardh (1848, p. 146). The most obvious difference between them is that the rhachis and the pinnae in *E. exasperata* contain numerous spine-like processes while these are absent in *E. radiata*. *E. radiata* is also a more robust species than *E. exasperata* (compare figs. 8 and 9).

In the South African plants of *E. exasperata,* the pinnae are of a somewhat thicker texture and are less sinuated than in the Australian specimens of this species that are in Herb. Agardh. The general habit of the plants from the two regions suggests, however, that they are of the same species.

According to Barton (1893, p. 112) this species is recorded by

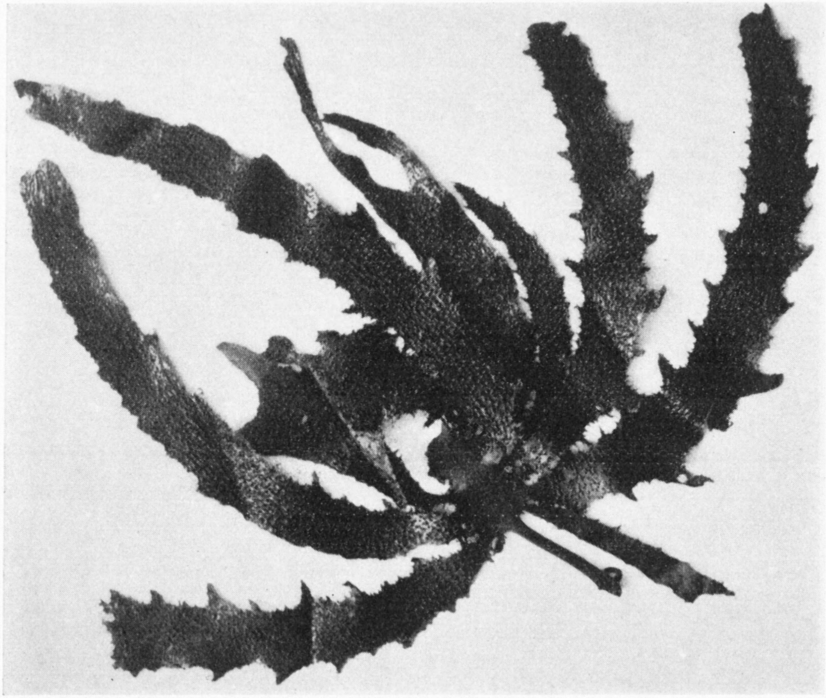

Fig. 9. *Ecklonia exasperata* (Turn.) J. Ag. Specimen from South Africa, 1/5 nat. size (in Herb. G. F. Papenfuss). Photo, Dr. M. A. Pocock.

Areschoug from Table Bay; but this statement is in error as Areschoug (1851, p. 30; 1854, p. 360) states that it is not known from Table Bay, which is in accordance with the fact. It is a species that in South Africa attains its best development along the east coast of the Cape Province.

Bifurcariopsis gen. nov.

Plantae solitariae, e basi lignosa modice ramosa exeuntes; frondes erectae, teretes, dichotome ramosae; receptacula terminalia, juvenilia versus apicem angustata, adultiora ± truncata, sectione transversali ramis sustinentibus majora; oogonia oosporas 4 efficientia.[1]

Plants solitary, arising from a slightly branched woody holdfast; fronds erect, terete, dichotomously branched; receptacles terminal,

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[1] The writer is indebted to Docent H. Weimarck for the Latin version of the description.

(Fig. 10. *Bifurcariopsis capensis* (Aresch.) Papenf. (in Herb. G. F. Papenfuss).

tapering when young, in older stages ending more or less abruptly and of greater diameter than the supporting branches; oogonia producing four oospheres.

Bifurcariopsis capensis (Aresch.) comb. nov. *Fucodium capense* Aresch., Nova Acta Reg. Soc. Sc. Upsal., Ser. 3, 1: 339, 1854. *Fucus capensis* Kütz., Tab. Phyc., 10: 7, pl. 16, fig. 2, 1860. *Pelvetia capensis* De Toni, Syll. Alg., 3: 215, 1895. *Pycnophycus laevigatus*

Kütz., Tab. Phyc., 10: 9, pl. 22, fig. 2, 1860. *Bifurcaria laevigata* Barton, Journ. Bot., 31: 82, 1893: Schmidt, Hedwigia, 77: 230, 1938. *Fucodium tuberculatum* var. *dumosa* J. Ag., Sp. Alg., 1: 205, 1848.

This species (fig. 10) has been placed in various genera by different authors. ARESCHOUG (1854, p. 339), who first described the species, placed it in *Fucodium,* a genus which is synonymous with *Xiphophora, Pelvetia,* and several other genera of the *Fucales.* DE TONI (1895, p. 215) places it in *Pelvetia* to which it obviously does not belong as this genus is characterized by having flat fronds and oogonia with two oospheres. *Pycnophycus* Kützing (1843, p. 359), under which genus KÜTZING (1860, p. 9) described the species as *P. laevigatus,* is not available as it is founded on *Bifurcaria tuberculata,* the type species of the genus *Bifurcaria.*

BARTON (1893, p. 82) and SCHMIDT (1938, p. 230) refer the species to *Bifurcaria.* It differs, however, from the other species of *Bifurcaria, B. tuberculata* and *B. brassicaeformis,* in two important features viz., the absence of a rhizome and the formation of four oospheres in the oogonia. These characters show that this species should be excluded from *Bifurcaria.*

Bifurcariopsis might be compared with *Xiphophora* in which genus each oogonium also forms four oospheres. *Xiphophora* has compressed fronds, however, and in that respect differs from *Bifurcariopsis* in which the fronds are terete.

Rhodophyceae.

Erythrotrichia Harveyi (Aresch.) comb. nov. *Bangia Harveyi* Aresch., Phyc. Cap.: 17, 1851.

An examination of ARESCHOUG's type material, as well as material collected by the writer, has shown that this species belongs to *Erythrotrichia.* The plant occurs on *Macrocystis* in Table Bay and belongs to that section of the genus in which the erect filaments arise from a basal disc. The filaments are gregarious, unbranched, uniseriate at first, the distal parts later becoming several cells wide and ribbon-shaped with a maximum width of about 85 μ. The maximum length of the filaments is about 5 mm.

Chaetangium ovale (Suhr) comb. nov. *Dumontia ovalis* Suhr, Flora, 23: 274, 1840. *Delesseria saccata* Lamour., [Ann. Mus. Hist. Nat., 20: 125, 1813 (in part)]. *Chaetangium saccatum* J. Ag., Öfv. Kgl.

Sv. Vetensk. Akad. Förhandl., 6: 89, 1849; Sp. Alg., 2(2): 459, 1852. *Halymenia saccata* β *simplex* C. Ag., Sp. Alg. 1(2): 208, 1822 (in part).

The change in name of this well known species is unfortunately necessary owing to the fact that *Delesseria saccata* Lamour., based in part on the South African plant, is a *nomen nudum* and the binomial *Dumontia ovalis* Suhr (1840) antedates *Chaetangium saccatum* J. Ag. (1849).

Delisea flaccida (Suhr) comb. nov. *Sphaerococcus flaccidus* Suhr, Flora, 17, Bd. 1: 728, pl. 1, fig. 11, 1834. *Chondrodon flaccidus* Kütz., Tab. Phyc., 18: 25, pl. 70, figs. a—c, 1868. *Calocladia Suhrii* J. Ag., Linnaea, 15: 21, 1841. *Delisea Suhrii* J. Ag., Sp. Alg., 2(3): 783, 1863.

It is necessary to restore the specific epithet under which this plant was first described by SUHR (1834). J. AGARDH (1841) renamed the species owing to the fact that the name given to it by SUHR was not appropriate; but this custom is not in conformity with the rules of botanical nomenclature.

Ptilophora diversifolia (Suhr) comb. nov. *Phyllophora diversifolia* Suhr, Flora 23, Bd. 1: 262, 1840; Drège, Zwei Pflanzengeogr. Doc.: 155, 211, 1843. *Polyphacum Smithiae* Barton, Journ. Bot., 31: 175, 1893. *Ptilophora spissa* Barton, Journ. Bot., 34: 197, 1896; Delf and Michell, Ann. Bolus Herb., 3: 104, 1922.

The writer has been fortunate in being able to examine one of SUHR's specimens (in Herb. Berlin) of this little known plant and to establish that it is a species of *Ptilophora*. Since the plant was first collected by DRÈGE (1843, p. 155) on the east coast of South Africa between the Umtentu and Umzimkulu Rivers, it has apparently been found only by Flanagan at Kei Mouth. The record of BARTON (1893, p. 175) of *Polyphacum Smithiae* and those of Barton (1896, p. 97) and DELF and MICHELL (1922, p. 104) of *Ptilophora spissa* are based on FLANAGAN's specimens of *P. diversifolia* (in Herb. TYSON, Dept. Botany, Univ. Cape Town).

The true *Ptilophora spissa* (cf. KÜTZING, Tab. Phyc., 19: 17, pl. 45, figs. e—g) also seems to be a very rare plant and has apparently been collected only by DRÈGE on whose specimens the species was described by SUHR (1840, p. 262). DRÈGE (1843, p. 157) found it on the coast between the Umzimkulu and Umkomaas Rivers.

The specimen of *P. diversifolia* that is in Herb. Berlin (fig. 11) is cystocarpic. The cystocarps are formed on small lateral branches and are bilocular. One of Flanagan's specimens in Herb. Tyson is tetrasporic and shows that the sporangia are likewise formed on small lateral branches.

A characteristic feature of both *P. diversifolia* and *P. spissa* is the presence of small proliferations on the surface of the fronds (cf. Kützing, 1869, pl. 45, figs. e, f).

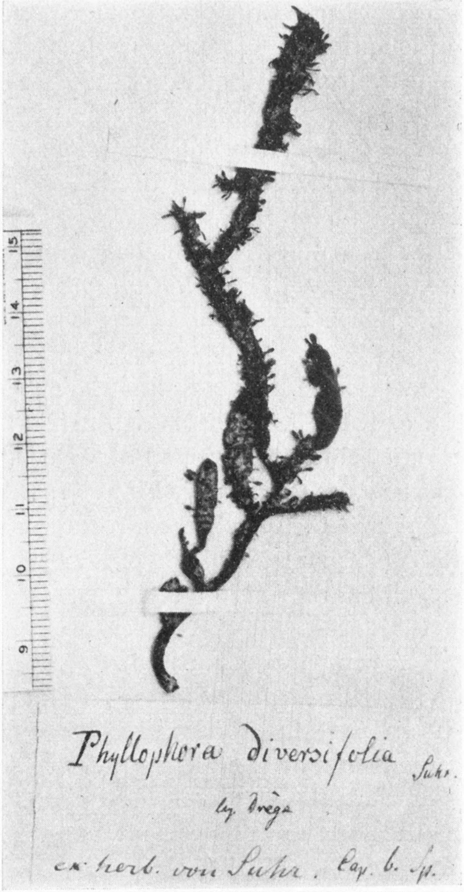

Fig. 11. *Ptilophora diversifolia* (Suhr) Papenf. Lectotype (in Herb. Berlin).

Attention should be called to the fact that Kützing (1847, p. 25) in his diagnosis of *Ptilophora* gives as one of the characters of the genus the presence of microscopic bristles on the thallus (cf. Kützing, 1869, pl. 45, fig. g). Schmitz (1894, p. 193) attaches considerable importance to these bristles as a character of this genus, and says in connection with his reasons for rejecting *Ptilophora prolifera* (Harv.) J. Ag. as a species of *Ptilophora:* »Dasjenige Merkmal, das am auffallendsten *Ptilophora spissa* auszeichnet, die eigentümlichen Stachelhaare, das fehlt *Pt. prolifera* vollständig». These bristles are also present in *P. diversifolia* but a study of them in both *P. diversifolia* and *P. spissa* has shown that they are not a part of these plants but the spicules of an incrusting sponge. An examination of sections of the plants shows that the spicules project from the surface of the thallus but are not united with the cells of the plants. Final proof of their animal nature was obtained through the kind assistance of Professor T. Gislén of the zoological institute of Lund. It was found that if parts of the plants are boiled for a short time in potassium hydroxide

(KOH), the animal tissue is broken down and the spicules become detached from the plants while the plant tissue retains its normal appearance.

In the preceding paragraph it was noted that SCHMITZ does not accept *Ptilophora prolifera* (Harv.) J. Ag. as a species of *Ptilophora*. Several fine specimens of this Australian plant, including one communicated by HARVEY, are present in Herb. AGARDH. In habit they show a striking resemblance with *P. spissa* and *P. diversifolia* and it seems likely that *Gelidium proliferum* Harv. should be referred to *Ptilophora*.

Desmia Hornemannii Lyngbye,[1] Tent. Hydr. Dan.: 35, pl. 7, fig. c, 1819; J. Ag., Sp. Alg., 2 (2): 641, 1852. *Chondrococcus Hornemanni* Schmitz, Engler's Bot. Jahrb., 21: 170, 1896 (in part). *Sphaerococcus Lambertii* Suhr, Flora 17, Bd. 2: 728, 1834 (not *Sphaerococcus Lambertii* C. Ag.). *Chondrococcus Lambertii* Kütz., Bot. Zeit., 5: 23, 1847 (in part); Tab. Phyc., 17: 28, pl. 95, figs. a—b, 1867; Schmitz, loc. cit., 21: 171, 1896; Kylin, Lunds Univ. Årsskr., N. F., Avd. 2, 34 (8): 8, 1938.

A comparison of some of SUHR's specimens of *Sphaerococcus Lambertii* with LYNGBYE's original material of *Desmia Hornemanni* has shown that these names apply to the same species. SUHR's plants came from South Africa while the place of origin of LYNGBYE's material is uncertain. LYNGBYE (1819, p. 35) gave the locality as Helsingör in the Öresund, but this was in error, as has been pointed out by SCHMITZ (1896, p. 171) and by ROSENVINGE (1931, p. 617), and the plants probably were collected by FORSSKÅL, during his expedition to Arabia and Egypt, somewhere in the Red Sea or in the north western part of the Indian Ocean.

In connection with the South African plant that SUHR called

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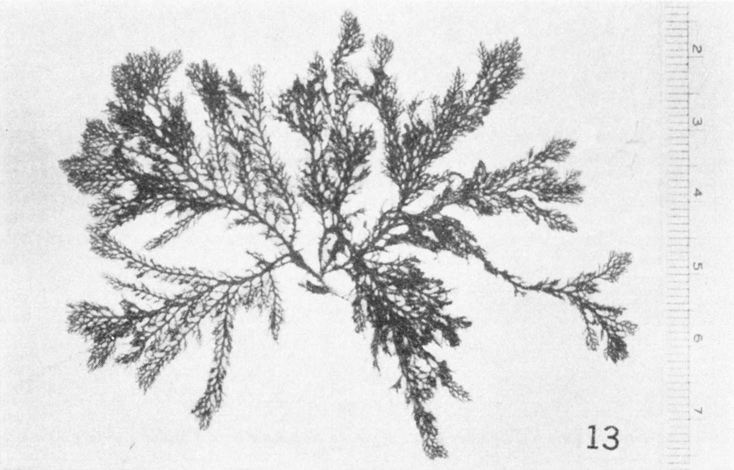
[1] It is to be noted that this species has alway been credited to MERTENS who presumably wrote the review of TURNER's Fuci in Göttingische gelehrte Anzeigen for 1815, Bd. 1, Stück 64 (pp. 625—640) where on p. 633 reference is made to *Fucus Hornemanni*. No author's name accompanies this article nor is it listed under MERTENS's name in the index number covering this period of this journal. It may be assumed, however, that the article was written by MERTENS as it is credited to him by his contemporaries, and as, according to ROSENVINGE (1931, p. 617), the writing in the name *Fucus Hornemanni* on the type sheet of the species is that of MERTENS. The name *Fucus Hornemanni* as used by MERTENS is, however, a nomen nudum and the validity of this species dates from 1819 when it was first described by LYNGBYE.



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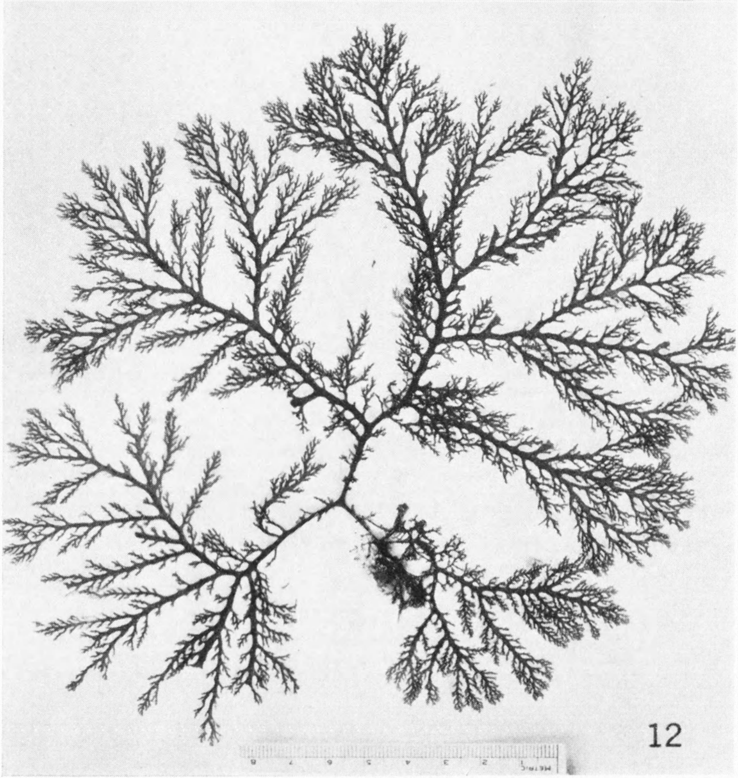

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Fig. 12. *Desmia Hornemannii* Lyngb. Specimen from South Africa (in Herb. G. F. Papenfuss). — Fig. 13. *Desmia tripinnata* (Hering) J. Ag. (in Herb. G. F. Papenfuss).

Sphaerococcus Lambertii, it should be noted that SUHR, although usually credited with the species, did not describe it as new but referred it to *Sphaerococcus Lambertii* C. Ag., which is the Australian *Callophyllis Lambertii* (Turn.) Grev. This nomenclatural complexity is, however, dissolved by the fact that *Sphaerococcus Lambertii* Suhr (1834) is synonymous with *Desmia Hornemanni* Lyngbye (1819).

SCHMITZ (loc. cit.) and subsequent authors dealing with *Desmia Hornemannii* (fig. 12) have assigned it to the genus *Chondrococcus* KÜTZING. This procedure is, however, contrary to articles 50 and 51 of the International Rules of Botanical Nomenclature (1935) and it seems desirable to restore the generic name *Desmia,* even though two of the three original species of this genus belong to *Desmarestia* Lamouroux (1813). The genus *Chondrococcus* was, moreover, founded by KÜTZING (1847, p. 23) on two species, *C. Lambertii* and *C. abscissus,* of which only part of *C. Lambertii,* judging from KÜTZING's synonymy in his Species Algarum (1849, p. 752), consisted of material of *Chondrococcus* as interpreted by later authors. The remaining portion of KÜTZING's *Chondrococcus Lambertii* belongs to *Callophyllis* Kützing (1843) viz., *Callophyllis Lambertii,* and his *Chondrococcus abscissus* belongs to *Melanthalia* Montagne (1843) viz., *M. abscissa.*

Desmia tripinnata (Her.) J. Ag., Sp. Alg., 2 (2): 640, 1852. *Rhodhymenia tripinnata* Hering *in* Krauss, Flora, N. R., 4, Bd. 1: 209, 1846. *Chondrococcus tripinnata* Delf and Michell, Ann. Bolus Herb., 3: 118, 1922. *Chondrococcus Hornemannii* Kylin, Lunds Univ. Årsskr., N. F., Avd. 2, 34 (8): 8, 1938.

This species (fig. 13) has frequently been referred to *Desmia Hornemannii* (as *Chondrococcus Hornemannii*) from which it differs, however, in its smaller size and more delicate fronds. It also inhabits a different level on the shore, being exposed during low tide while *D. Hornemannii* grows in the upper levels of the sublittoral zone or in rockpools somewhat higher up and apparently never, or but rarely, becomes exposed.

Anatheca dentata (Suhr) comb. nov. *Halymenia dentata* Suhr, Flora, 17, Bd. 2: 734, pl. 1, fig. 8, 1834 (not *Kallymenia dentata* J. Ag.). *Sarcodia capensis* J. Ag., Till Alg. Syst., Afd. 4: 65, 1884; Kylin, Florideenordn. Gigart.: 56, pl. 20, fig. 50, 1932.

An examination of some of SUHR's specimens of this species (in Mus. Botan. Stockholm) has shown that his plants represent the tetrasporic generation of the plant that was later described by J. AGARDH as *Sarcodia capensis.* The species should, however, be referred to *Anatheca* which agrees with *Sarcodia* in many respects but differs from it in forming its procarps on papillae and not directly on the frond. The type species of the genus *Sarcodia* is *S. Montagneana* (Hook. et Harv.) J. Ag. of which the writer has seen a number of specimens in Herb. AGARDH, including a cystocarpic plant (No. 29853) of the original material of HOOKER and HARVEY from New Zealand. In none of the cystocarpic specimens in Herb. AGARDH do the cystocarps occur on papillae.

SCHMITZ (1896, p. 374) when describing *Anatheca* did not refer to papillae but KYLIN who has examined a fragment of an authentic specimen of the type species, *A. Montagnei,* says (1932, p. 24): »Gonimoblasten in besonderen kleinen Papillen in der Thallusfläche eingelagert, — — —» and on p. 25: »Die Karpogonäste kommen in kleinen Papillen an der Thallusfläche vor, und zwar in etwa derselben Weise wie bei *Meristotheca papulosa,* — — —». For a characterization of the genera *Anatheca* and *Sarcodia* and the families to which they belong compare KYLIN (1932, pp. 13, 24, 54, 56).

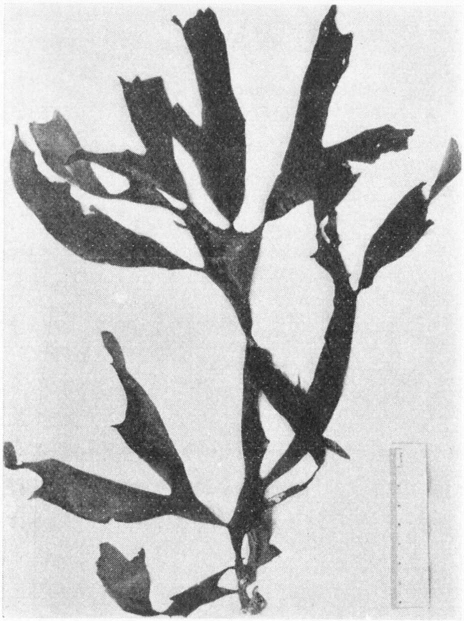
Dicurella scutellata (Her.) comb. nov. *Sphaerococcus* (*Chondrus*) *scutellatus* Hering, Ann. and Mag. Nat. Hist., 8: 91, 1841. *Chondrus scutellatus* Krauss, Flora, N. R., 4, Bd. 1: 210, 1846. *Gigartina fastigiata* J. Ag., Sp. Alg., 2 (1): 276, 1851 (with respect to syn. of Hering only); Barton, Journ. Bot., 34: 459, 1896; De Toni, Syll. Alg., 4 (1): 206, 1897 (with respect to syn. of Hering only). *Phyllotylis flabellatus* J. Ag., Öfv. Kgl. Sv. Vetensk. Akad. Förhandl., 4: 9, 1847. *Dicurella flabellata* Harv., Ner. Austr.: pl. 50, 1847; J. Ag., Sp. Alg., 2 (2): 632, 1852; Kylin, Florideenordn. Gigart.: 55, 1932. *Dicurella affinis* J. Ag., Sp. Alg., 2 (2): 632, 1852; Kylin, loc. cit.: 55, pl. 19, fig. 48.

This species of HERING has suffered misinterpretation ever since it was founded. In 1851 J. AGARDH (Sp. Alg., 2 (1), p. 276) placed it (with a query) as a synonym under *Gigartina fastigiata* J. Ag. and it has remained in this equivocal position up to the present time. BARTON (1896, p. 459), who has reexamined HERING's type, says: »Major REINBOLD most kindly sent me from the Hamburg Herbarium the original specimen of *Chondrus scutellatus* Hering, collected by KRAUSS at Port Natal. The fruiting specimen=*Gigartina fastigiata* J. Ag., and the sterile plant is clearly different, having the whole interior filled with roundish, thick-walled cells». The writer has had the opportunity of studying these particular specimens. They are accompanied by a label containing HERING's original description in a slightly modified form as well as one inscribed with »*Gigartina fastigiata* J. Ag.» in BARTON's handwriting. The sterile plant (consisting of a few fragments) referred to by BARTON is indeterminable. Fortunately, however, these fragments are of no significance as far as the identity of *Sphaerococcus scutellatus* is concerned, as it is clear from HERING's diagnosis of the species that he was dealing with a fertile plant. BARTON identified the fertile plant as *Gigartina fastigiata* J. Ag., but this determination is incorrect. The plant differs from *G. fastigiata* J. Ag. or any other species of *Gigartina* not only in its anatomical structure, which is entirely cellular, but also in having seriately divided tetrasporangia which occur in superficial sori at the apices of the branches. These features suggest a relationship with *Dicurella* and a comparison with the species of this genus has shown that *Sphaerococcus* (*Chondrus*) *scutellatus* Hering is identical with the later described *Dicurella flabellata* (J. Ag.) Harv. As a synonym under *Dicurella scutellata* should be included also *D. affinis* J. Ag., the validity of which species has been questioned previously by KYLIN (1932, p. 55).

Before ending this account of *Dicurella scutellata,* it is necessary to discuss the question regarding the probable place of origin of the type specimen. HERING, in his original description of the species, did not give the locality while KRAUSS (1846, p. 210), who collected the specimen, gives Table Bay as the locality. On the label accompanying the type is written: »Port Natal coll. Dr. KRAUSS». The locality name »Port Natal» was probably assigned to the specimen by HERING but is in error as this species does not occur at Port Natal. Its easternmost region of occurrence in South Africa probably does not extend much beyond Port Elizabeth where, however, it is still present. It seems safe to conclude that the type locality is Table Bay where the plant is common and from which place KRAUSS recorded it.

Tylotus capensis (Schm. ex Mazza) comb. nov. *Gracilaria capensis* Schm. ex Mazza, Nuova Not., 18: 134, No. 166, 1907.

This species (fig. 14) was described for the first time by MAZZA on material sent to him by BECKER who collected it at Port Alfred. The writer has not had the opportunity of studying MAZZA's specimens, which are in the herbarium of the Royal University of Padova, but has seen BECKER's duplicates, which are in the herbarium of the botanical department of the University of Cape Town, and has also himself collected the plant at the type locality.



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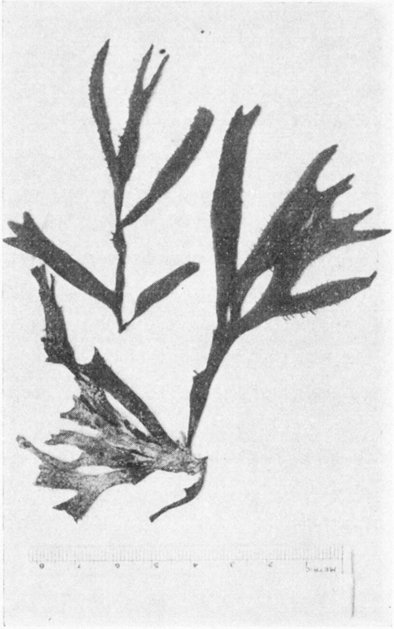

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Fig. 14. *Tylotus capensis* (Schm. ex Mazza) Papenf. (in Herb. Becker, Dept. Botany, Univ. Cape Town). — Fig. 15. *Tylotus denticulatus* (Schm. ex Mazza) Papenf. (in Herb. G. F. Papenfuss).

An examination of the species shows that it belongs to the *Gracilariaceae*. It, however, forms its tetrasporangia in sori and accordingly does not belong to *Gracilaria*. The sori are not localized at the tips of the branches which fact suggests that it belongs either to *Curdiea* or to *Tylotus*. The anatomy of the thallus and the structure of the gonimoblast show, however, that the species should be referred to *Tylotus*.

Tylotus denticulatus (Schm. ex Mazza) comb. nov. *Gracilaria denticulata* Schm. ex Mazza, Nuova Not., 18: 138, No. 172, 1907.

This species (fig. 15), like the preceding one, was described by MAZZA on material sent to him by BECKER who collected it at Port Alfred. The writer has seen BECKER's duplicates and has also collected the plant at Port Alfred and other localities on the east coast of South Africa. The species should be referred to *Tylotus* for the same reasons as those given under *Tylotus capensis*.

Epymenia capensis (J. Ag.) comb. nov. *Rhodymenia capensis* J. Ag., Anal. Alg., Cont. 2: 58, 1894; Kylin, Florideenordn. Rhodymeniales: 21, pl. 8, fig. 19, 1931. *Epymenia stenoloba* Schm. ex Mazza, Nuova Not., 18: 191, No. 199. 1907: Kylin, loc. cit.: 32, pl. 19, fig. 45.

An examination of J. AGARDH's specimens of this species has shown that the reproductive organs are formed on proliferations arising from the surface of the thallus and the species is accordingly transferred to *Epymenia*. It is proposed to designate as type the specimen (No. 26950) that has been photographically reproduced by KYLIN (1931, pl. 8, fig. 19). As a synonym under *E. capensis* should be included *E. stenoloba* Schm. ex Mazza, authentic material of which the writer has seen in BECKER's herbarium (Univ. of Cape Town).

Griffithsia confervoides Suhr, Flora, 23, Bd. 1: 281, 1840. *Griffithsia caespitosa* Harv. ex J. Ag., Sp. Alg., 2 (1): 82, 1851. *Griffithsia corallina* Barton, Journ. Bot., 31: 113, 1893; Delf and Michell, Ann. Bolus Herb., 3: 115, 1922.

This species is commonly known in South Africa as *Griffithsia corallina* but a comparison of it with the European plant of this name has shown that the South African plant is a different species. SUHR in 1840 described it (from False Bay) under the name *Griffithsia confervoides* and remarked that he had also seen a few filaments from the Kaffrarian coast. The writer has not been successful in locating any of SUHR's specimens from False Bay but has seen three specimens (two in Mus. Botan. Stockholm and one in Herb. Agardh, No. 19762) under this name in SUHR's writing from »Kaffernküste». SUHR probably received these specimens after his description of the species had been published. It has not yet been established whether the plant from the East coast (= Kaffrarian coast) is identical with the plant from False Bay and neighbouring regions, but from the three specimens of SUHR from »Kaffernküste» it is clear that the binomial *Griffithsia confervoides* applies to the species which in South Africa passes as *G. corallina*.

Ballia sertularioides (Suhr) comb. nov. *Callithamnion sertularioides* Suhr, Flora, 23, Bd. 1: 282, 1840.

The writer has been fortunate in being able to examine one of SUHR's specimens (Herb. Berlin) of this little known species. The type locality is Table Bay where it has also been found once by Dr. M. A. POCOCK on a specimen of *Plocamium membranaceum* which was cast ashore at Blaauwberg, and once by the writer at Oudekraal. In addition it has been collected in fair quantity at Lamberts Bay by members of the Department of Zoology of the University of Cape Town. A portion of Dr. POCOCK's specimen is photographically reproduced as figure 16. As will be seen from this figure, the plant is a *Ballia.* All the material thus far examined has been sterile but the vegetative structure of the species leaves no doubt as to its generic position. A characteristic feature of the species is that it does not become corticated.

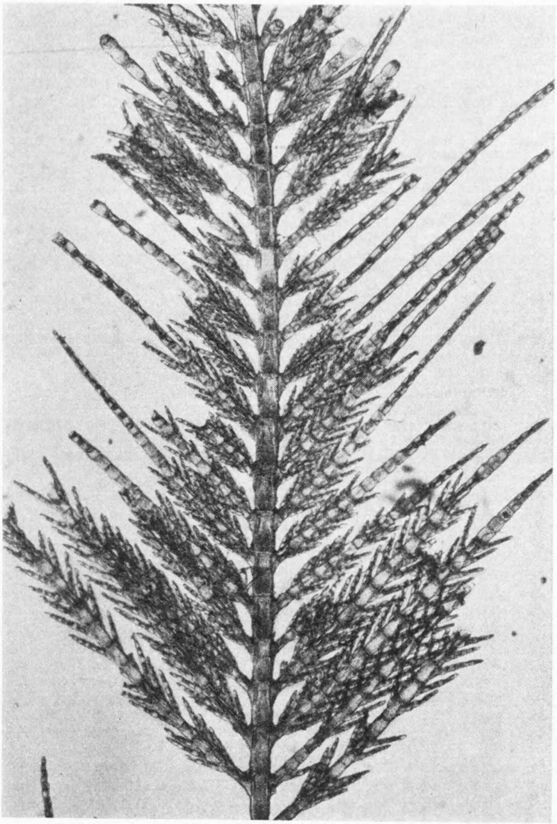

Fig. 16. *Ballia sertularioides* (Suhr) Papenf. × 33 (in Herb. M. A. Pocock).

Microcladia capensis (Kütz.) comb. nov. *Ceramium capense* Kütz., Linnaea, 15: 740, 1841; Tab. Phyc., 13: 3, pl. 5, figs. c—e, 1863.

Various authors have referred a South African plant to *Ceramium rubrum* but a comparison of this plant with preserved material of *C. rubrum,* collected by Dr. E. BAARDSETH at Herdla on the west coast of Norway, has shown that the South African plant differs from *C. rubrum* in having larger primary cortical cells and in being more extensively corticated. Judging from KÜTZING's description of *Ceramium capense* in Linnaea (Vol. 15, p. 740) and from his figures in Tabulae Phycologicae (Bd. 13, pl. 5), it is safe to conclude that the so-called South African *C. rubrum* should be referred to this little known species of KÜTZING. The plant is fairly common in certain localities but has suffered misinterpretation. It is the only South

African *Ceramium*-like plant that permits comparison with *C. rubrum*; but as KÜTZING (1841, p. 740) correctly remarked the cortical cells (especially the primary ones) are larger in the South African plant. As pointed out above, *C. capense* Kütz. is also more extensively corticated than *C. rubrum* and for this reason it is here transferred to *Microcladia* with which genus it has more in common than with *Ceramium*.

Acrosorium maculatum (Kütz.) comb. nov. *Aglaophyllum maculatum* Kütz., Tab. Phyc., 16: 13, pl. 34, figs. d—e, 1866. *Nitophyllum maculatum* Grun., Algae Novara: 85, 1867. *Nitophyllum uncinatum* var.? *maculatum* De Toni, Syll. Alg., 4 (2): 651, 1900.

This species was founded by KÜTZING in 1866 on a specimen that he saw in Herb. SONDER. The writer has not had the opportunity of seeing this specimen but has seen the one on which GRUNOW independently described the species in 1867. GRUNOW'S specimen (Collectio GRUNOW No. 17254, in Herb. Naturhist. Mus. Vienna) was sent to him by REINHARDT who found it in Herb. BINDER under the mscr. name *Nitophyllum maculatum* Sonder. GRUNOW gives a good description of the species. His specimen is sterile but agrees with KÜTZING'S excellent figure of the habit of the plant. The species is fairly common along the east coast of South Africa and characteristically has the discoloured spots mentioned by GRUNOW and clearly indicated in KÜTZING'S figure d (loc. cit., pl. 34). GRUNOW mistook these spots for tetrasporangial sori, but as will be seen from KÜTZING'S figures the sori are localized at the apices of the branches, a feature which shows that the species belongs to the genus *Acrosorium* (cf. KYLIN, 1924, p. 76).

In addition to the plant received from Herb. BINDER, GRUNOW also had specimens that occurred as epiphytes on *Cladophora Ecklonii*. The latter specimens could not be located in Herb. Naturhist. Mus. Vienna, but they probably are not of *Acrosorium maculatum* as the region of distribution of this species does not coincide with that of *Cladophora Ecklonii* (=*C. capensis*), which inhabits the colder south and west coast waters of South Africa.

The Botanical Laboratory, University of Lund. April, 1940.

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BOTANISKA NOTISER 1940, LUND 1940.

Some new Salix species and hybrids.

BY BJÖRN FLODERUS.

Salix bhutanensis FLODERUS, spec. nov. (♀).

Frutex 1,5—3 m altus. Ramuli divaricati, biennes 4 mm crassi nodosi brunnei vibicibus ligneis nullis, annotini (amentiferi) haud tenuiores in parte inferiore glabri in superiore sat dense cano-lanati, novelli c. 1,8 mm crassi dense albo-cane lanati foliis c. 11 praediti. Stipulae nullae vel usque 2 mm longae lanceolatae glanduloso-serratae hirsutae. Petioli c. 3 mm longi crassi cum basi costae dense albo-lanati. Folia c. 30×15(—50×20) mm magna elliptica basi obtusa (—truncata) apice acutiuscula integerrima plana, nervis secundariis c. 8—11 vix elevatis et reticulo supra obsolete impresso instructa, supra viridia subtus glaucescentia utrinque demum costa albo-lanata excepta glabrescentia.

Ramuli novelli floriferi c. 10 infra ramulos novellos foliiferos superiores (1—)2 e gemmis usque 7 mm longis ovoideis castaneo-fuscis hirsutis caducis erupti; gemmae inferiores (requiescentes) usque 3(—5) mm longae obtusae nitide rutilae—brunneae glaberrimae. Pedunculi feminei c. 10 mm longi crassi lanati, foliis 3—4 c. 10 mm longis ovato-rotundatis supra glabrescentibus subtus albo-micante longisericeis caducis praediti. Amenta feminea (permatura) praecocia divaricata 50—70×20 mm magna densiflora. Squamae c. 1,8 mm longae lanceolatae brunnescentes—fulvae longisericeae. Nectaria feminea singula ventralia c. 0,8 mm longa cylindrica integra. Pedicelli usque 1 mm longi villosi. Capsulae usque 6 mm longae anguste ovoideo-conicae apice rostratae demum stramineae vel viridule brunnescentes glabri. Styli 1—1,5 mm longi integri vel apice fissi. Stigmata suberecta apice saepissime fissa. Semina 1,5 mm longa.

Hab. Asia, Bhutan centr. Chendesi 7500′ 12. V. 1937 F. LUDLOM et G. SHERRIFF 3028 ♀ Hb. Brit. Mus. — Fig. 1.

In a small *Salix*-collection from Bhutan the author recently found a rich sheet of this form which may represent an undescribed species. Though the structure of staminate aments is unknown, it is evident that the species belongs to the *Salices Chrysanthae* KOCH. Its right to a place in this group is proved, in the author's opinion, by its thick, lanate shoots and glossy, orange-coloured basal buds, its short, stoutish, woolhairy and small-leaved peduncles and precocious, long and multiflorous catkins with long-hairy, silky-tomentose scales and single, ventral, cylindrical nectaries, long and finepointed, pale and glabrous capsules, long styles and narrow, frequently cleft stigmas.

Salix caprea L. × *rorida* LACKSCH., hybr. nov.

Differt a *S. caprea* L. ramulis tenuioribus aequalioribus nitidule subolivaceis, gemmis minoribus acutis subrubicunde fulvis, petiolis brevioribus (5—10 mm longis) teneris, supra cum basi costae plerumque hirsutis subtus glabris, stipulis (rarissime persistentibus) rotundatis, foliis lanceolatis apice acutis tenuioribus planis, nervis secundariis magis numerosis (c. 10—12) gracilibus ornatis, et a *S. rorida* LACKSCH. foliis remote serrulatis obsolete glanduliferis partim subintegris, utrinque pilis brevibus curvatis villosulis vel glabratis. (FLODERUS.)

Hab. Sibir. Altai, Kalmuckia Muita 4. IX 1924 S. J. ENANDER »*S. caprea* L.×*daphnoides* VILL. sf. Pihlii» Hb. Stockh. 52 fol.

The specimen on which the foregoing diagnosis is founded was brought home from Altai in 1924 by the Swedish salicologist S. J. ENANDER. Owing to the advanced season at which the material was collected it lacks some characteristic type-attributes. But it is evidently to be interpreted as the bastard between *S. caprea* L. and *S. rorida* LACKSCH., which seems to have been overlooked hitherto. On the same occasion Dr. ENANDER found genuine specimens of *S. rorida* in the same habitat; though the branches of these have lost their previous pruinose coating, as have also those of the hybrid, their well-preserved rounded stipules, however, fully confirm the determination.

S. caprea×*rorida* displays an interesting analogy with the closely related hybrids *S. caprea*×*daphnoides* and *S. acutifolia*×*caprea*×*daphnoides* which occur in several localities in Europe.

Salix helvetica VILL.×*purpurea* L. hybr. nov. ♀.

Synon. *S. Traunsteineri* (*supercaprea* × *purpurea*) A. & J. KERN., Austerr. Weid. 143; ANDERSS. ap. DC., Prodr. XVI: 2 (1868) p. 308; SEEM., Synops. (1909) p. 296.

Differt a *S. helvetica* VILL. ramulis sat aequalibus, gemmis rostratis, foliis estipulatis, maturis apice acutatis acriterque glanduloso-serratis

Fig. 1. *Salix bhutanensis* FLOD., size 1 : 1.

supra glabrescentibus, plurinerviis (usque 18), amentis sessilibus haud foliatis, stylis vix manifestis, et a *S. purpurea* L. foliis novellis obtusis subintegris supra puberulis subtus pilis densissimis sat longis praesertim apice micante albo-sericeis, amentis crassioribus cano-tomentosis.

Hab. Austr. Tirol. bor. N:o 143 *Salix Traunsteineri* Nobis (*supercaprea×purpurea*) Kitzbühel in Nordtirol. KERNER. — *Salix Traunsteineri* A. KERNER ♀. Tirol: Jagerstätten pr. Kitzbühel c:a 1840, leg. TRAUNSTEINER comm. J. MURR.

In the Herbarium Stockholmiense the author has been in a position to make a detailed examination of three authentical specimens of *S. Traunsteineri* KERN. (♀). This rare *Salix*-form was interpreted as a bastard between *S. caprea* L. and *S. purpurea* L. by earlier salicologists — N. J. ANDERSSON and O. V. SEEMEN —, by the former, however, with some reservation.

That *S. purpurea* is one of the parents of *S. Traunsteineri* is evident, but of *S. caprea* the author has not been able to find any characteristic traces. Everything goes to prove that the other component of the hybrid is *S. helvetica* VILL. The following features characteristic of this species can be recognized in *S. Traunsteineri*: its brown-black young branches, its shorter and narrower, dense flowering aments, its extremely short and lanuginous pedicels and short and lanate capsules and, finally, the densely glossy-haired surface of the underside of the young leaves. Evidently, the last-mentioned characteristic feature cannot be due to a crossing between *S. caprea* and *S. purpurea.*

The nearest relative of this hybrid, known to the author, will be *S. lapponum* L.×*S. purpurea* L., which hybrid was produced in the year 1919 in several forms (♂ ♀) by Dr. E. MARKLUND during his numerous *Salix*-hybridizing experiments at the Botanic Garden of the University of Uppsala.

BOTANISKA NOTISER 1940, LUND 1940.

Über den Gynäzeumbau der Gattung Scleranthus.

Von K. V. OSSIAN DAHLGREN.

In seiner Arbeit über die Embryologie der Centrospermen schreibt ROCÉN (1927, S. 149) wie folgt: »Das Gynäzeum von *Scleranthus* wird von zwei Fruchtblättern konstituiert, bei deren Verwachsung ein deutlich markierter Griffelkanal entsteht. Dieser ist schon anfänglich stark papillos (Fig. 250 a) und erleidet eine bemerkenswerte Entwicklung, die sich u. a. aus Fig. 250 b ergeben dürfte. Man sieht dort an einem älteren Stadium, dass der obere Teil des Fruchtknotens papillos aufgeschlitztes Aussehen erhält, während der eigentliche Griffel rückgebildet wird.» Um die Darstellung zu verdeutlichen reproduziere ich hier (Bild 1) die beiden angeführten Bilder in ROCÉNS Abhandlung. Der Autor kann wohl kaum etwas anderes meinen als dass »ein deutlich markierter Griffelkanal» auf Bild 1 *a* zu sehen sei; und es müssen wohl weiter die in diesem »Kanal» sichtbaren Papillen sein, die nachher so kräftig an Grösse zunehmen, dass der Fruchtknoten ein »papillos aufgeschlitztes Aussehen» bekommen soll (Bild 1 *b*). Man fragt sich wirklich, wo die beiden Griffel oder Narben, die eine *Scleranthus*-Blüte kennzeichnen, auf der Zeichnung geblieben sind. (Diese gibt einen Fruchtknoten wieder, dessen sagittal geschnittene Samenanlage offenbar einen fertigen Embryosack hat.) — Danach heisst es etwas dunkel: »Diese eigentümliche Ausbildung eines Teils der Fruchtknotenwand ist um so bemerkenswerter, da ja *Scleranthus* eine trockene Schliessfrucht hat.» ROCÉN sagt er habe »dem diesbezüglichen Entwicklungsverlauf» nicht folgen können und fügt hinzu: »Aber wenigstens bei den *Caryophyllaceen* steht dieses Verhältnis ziemlich (sic!) vereinzelt da.»

Ich habe ROCÉNS Angaben nicht bestätigen können. Wie aus meinen Mikrophotographien hervorgeht ist die angebliche papillose Ausbildung des Fruchtknotens weder bei *Scleranthus perennis* noch bei *Scl. annuus* vorhanden. (Die obere Partie der Fruchtknotenwand wird viel dicker im Vergleich zu der unteren wie z. B. die Bilder 2 und

4 *b* zeigen). Wahrscheinlich hat ROCÉN nur einige wenige Präparate[1] gemacht, und die auf Bild 1 *b* reproduzierten haarähnlichen Papillen nach einem schiefgeschnittenen, schlecht gefärbten Schnitt, den er in der Eile gänzlich missdeutet hat, gezeichnet.

Dass ich dazu gekommen bin mich etwas mit *Scleranthus* zu beschäftigen ist durch folgende Angabe bei ROCÉN veranlasst worden: »Eigentümlicherweise ist die endgültige Orientierung der Samenanlagen bei den beiden untersuchten Arten nicht gleich. *Scleranthus perennis* kehrt nämlich die Mikropyle nach oben, *Scleranthus annuus* nach unten.» Dass zwei Arten derselben Gattung ihre Samenanlagen in verschiedener Weise orientieren ist allerdings sehr bemerkenswert jedoch nicht einzig dastehend. So hat schon BUCHENAU (1869) beobachtet, dass die Samenanlage bei *Alisma natans* epitrop war im Gegensatz zum Verhältnis bei *Alisma plantago* und anderen Spezien innerhalb der Familie, die apotrope Samenanlagen haben. Er hat dies so bedeutungsvoll gefunden, dass er für die erstgenannte Art die noch bestehende Gattung *Elisma* geschaffen hat. Nun ist es sehr interessant, dass die Samenanlagen bei der Gattung *Damasonium* zwei Samenanlagen haben, eine epi- und eine apotrope. (Siehe auch DAHLGREN 1928, Bild 8.) Von diesem Typus sagt BUCHENAU sehr zutreffend: »Durch Fehlschlagen bald der einen, bald der anderen Samenknospe könnten beide Fälle daraus hervorgehen, —». Ein anderer Fall von verschiedener Orientierung der Samenanlagen ist bei der Gattung *Stilbe* (*Verbenaceae*) nachgewiesen worden, wo

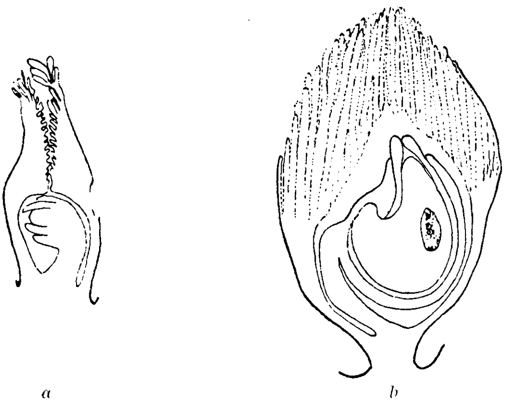

Bild 1. *a. Scleranthus annuus.* Nach ROCÉN. *b. Scleranthus perennis.* Der obere Teil des Fruchtknotens sollte papillos aufgeschlitzt sein. Nach ROCÉN. — Vergr. 60.

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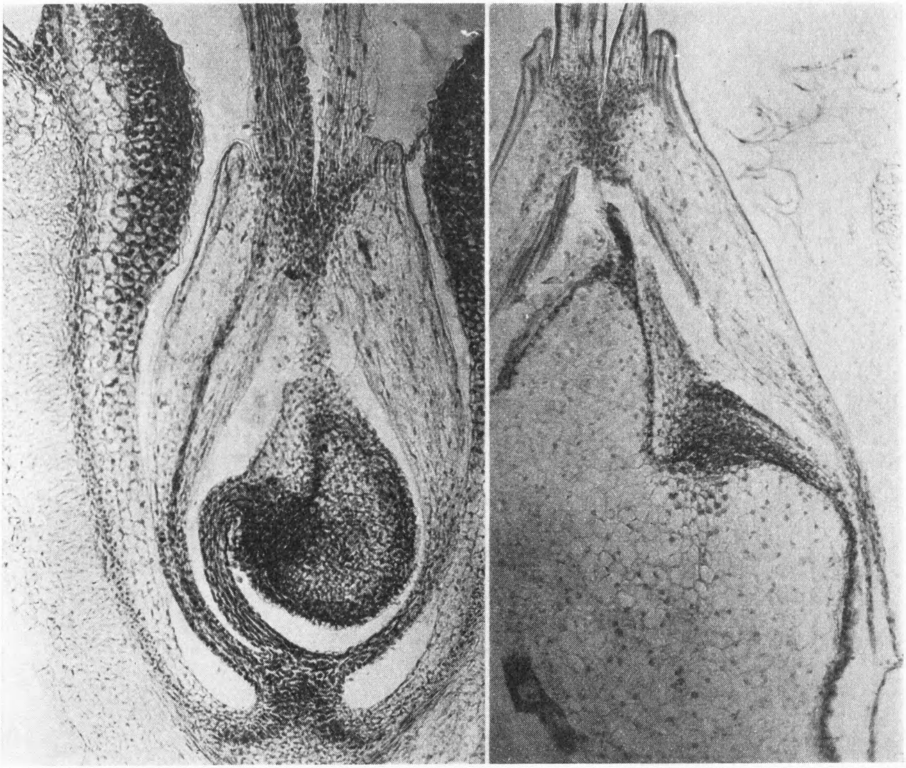
[1] »Die embryologische Untersuchung», schreibt ROCÉN, (l. c. S. 148), »ist hier mit nicht geringen Schwierigkeiten vereint, da die Beschaffenheit der Fruchtwand, besonders bei älteren Stadien, die Güte der Fixierungen beeinträchtigt und das Schnitten (sic!) erschwert.» Die Schwierigkeiten dürften jedoch vorzugsweise von der Beschaffenheit des urnenförmigen Rezeptaculums herrühren; der Name *Scleranthus* (Hartblüte) wird wohl auch damit zusammenhängen.



a *b*

Bild 2. *Scleranthus perennis.* *a.* Samenanlage (mit fertigem Embryosack im folgenden Schnitte). Vergr. 110. *b.* Samenanlage mit jungem Embryo. Vergr. 100.

Junell (1934, S. 54) bei *St. ericoides* apotrope Samenanlagen konstatiert hat, obwohl diejenigen der anderen Arten epitrop sind.

Während einer Excursion in Schonen 1924 habe ich auf einem Sandfeld bei Harlösa Material vom Bastard *Scleranthus annuus*×*perennis* eingesammelt. In dem grellen Sonnenlicht stach der Bastard deutlich gegen seine Elternarten ab, unter denen er recht häufig vorkam. Nachdem Rocéns Abhandlung erschienen war, interessierte es mich nachzusehen welcher Orientierungstypus der Samenanlage beim Bastard der dominierende sei. Es zeigte sich, dass die Mikropyle nach oben gekehrt war, wie es bei *Scleranthus perennis* der Fall ist.

Von *Scleranthus annuus* hatte ich allerdings schon 1916 einige Notizen nebenbei mitgeteilt, meine Präparate sind aber leider verloren gegangen, und ich konnte mich nicht an die Beschaffenheit der Samenanlage erinnern. Indessen kam mir die Angabe über die Orientierung der Samenanlage bei dieser Art etwas fraglich vor. KRAFTS (1917, S. 322) Umrisszeichnungen von frühen Stadien der Entwicklung der Samenanlage gaben keinen Anhalt für die Beurteilung der Sache; aus einer mehrmals reproduzierten Zeichnung (z. B. in ENGLERS Syllabus) geht doch hervor, dass der gebogene Embryo im reifen Samen seine Radicula und seine Cotyledonen nach oben kehren, was ja nicht besonders gut mit der angegebenen Richtung der Mikropyle übereinstimmt. Einige Probeschnitte zeigten auch, dass die Samenanlage — trotzdem dass ROCÉN bestimmt das Gegenteil behauptet — von demselben Typus ist wie bei *Scleranthus perennis* (Bild 4), obwohl ich erst jetzt dazu komme diese Beobachtungen zu veröffentlichen.

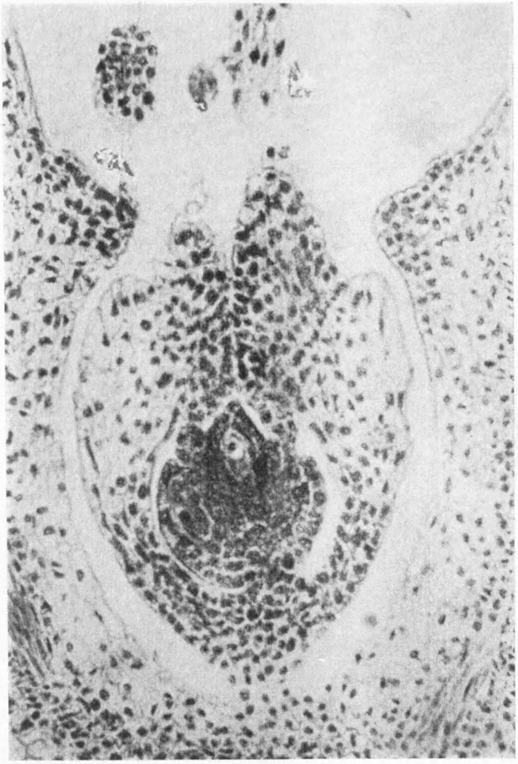


Bild 3. *Scleranthus annuus.* Junge Samenanlage mit Embryosackmutterzelle. Vergr. 210.

Die von ROCÉN (Bild 1 *a*) mitgeteilte Figur eines Schnittes durch ein junges Gynäzeum bei *Scleranthus annuus* ist der Wirklichkeit derart unähnlich, dass die Frage berechtigt ist, ob er überhaupt eine *Scleranthus*-Blüte abgezeichnet hat. Bild 3 zeigt also eine junge Samenanlage mit einer Embryosackmutterzelle, und auf Bild 4 *a* sehen wir eine andere mit einem zweikernigen Embryosack. Irgend welche Umkehrung der Samenanlage ist nicht eingetreten, und der Suspensor des Embryos [1] bleibt daher auch nach oben gerichtet (Bild 4 *b*).

Von *Scleranthus perennis* schreibt ROCÉN, dass die Entwicklung

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[1] Neulich hat SOUÈGES (1938, S. 1404) eine ausführliche Darstellung der speziellen Embryoentwicklung bei *Scleranthus perennis* gegeben.

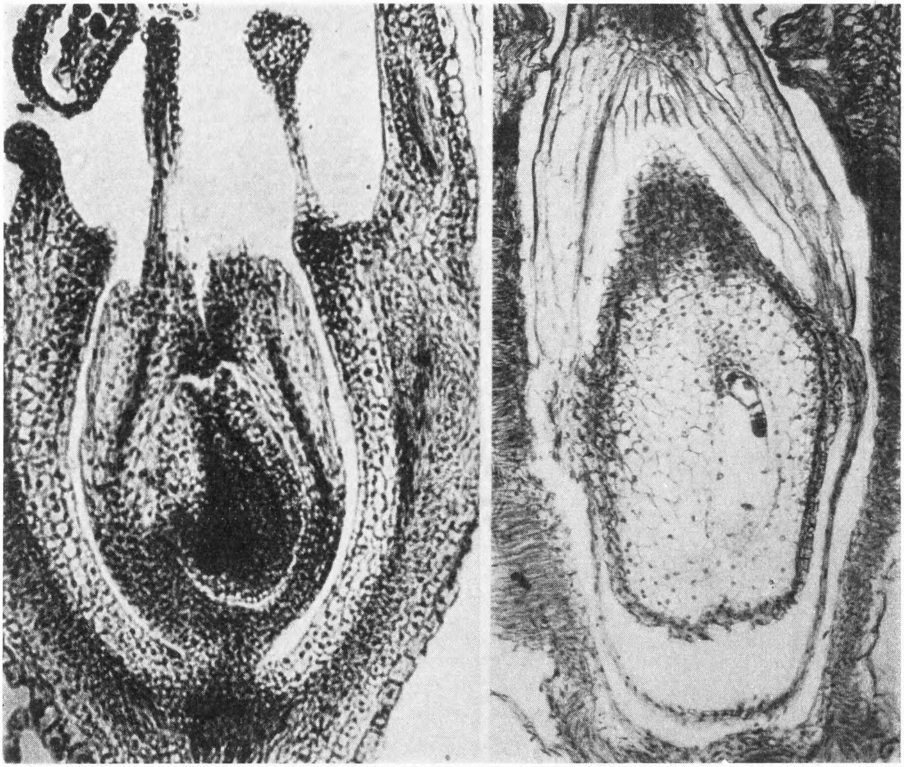
a *b*

Bild 4. *Scleranthus annuus*. *a*. Samenanlage mit zweikernigem Embryosack. Vergr. 110. *b*. Samenanlage mit fünfzelligem Embryo. Vergr. 100.

anfangs wie bei *Scl. annuus* verläuft, dass aber allmählich »eine eigentümliche Rückkrümmung» der Samenanlage eintritt, wodurch die Mikropyle gegen die Griffelbasis gewandt wird. »Der Fall», schreibt er, »besitzt bei den von mir untersuchten Arten der Caryophyllaceen kein Gegenstück»; leider kommt er nicht einmal bei *Scleranthus perennis* vor.

Zusammenfassung.

1) Die von ROCÉN bei *Scleranthus* angegebene papillose Ausbildung des oberen Teils des Fruchtknotens existiert nicht.

2) Fehlerhaft ist auch seine Behauptung, dass die Samenanlage bei *Scleranthus annuus* ihre Mikropyle nach unten kehrt.

Uppsala, Botanisches Laboratorium, März 1940.

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Smärre uppsatser och meddelanden.

A short note on parasitic Fungi from the Azores.

In 1937 the Swedish botanist Dr. Herman Persson and his wife visited the Azores, chiefly for studies of the Mosses. However, they also brought home with them a collection of ferns and phanerogams. Part of this collection now belongs to the Botanical Garden, Gothenburg and part to the Botanical Department of the Swedish Museum of Natural History in Stockholm. Personally I have studied the material belonging to our museum and tried to pick out the few parasitic fungi represented in it. Dr. Persson has studied the material in Gothenburg and sent me the specimens he thought were with fungi.

The material I have at my disposal is neither large nor very important, but as we still know very little about the fungi of the Azores I think it will be of some value to publish the determinations. Probably many valuable news concerning the fungi of the Azores would be found if one studied the whole collection of phanerogams from the islands, which are in different herbaria. I have had no reason, however, to make such a study.

I know only of the following papers dealing with the fungi of the Azores. Berkely (1874) mentions only 2 species collected by the Challenger expedition on San Miguel. Trelease has listed 43 species of fungi from the islands, of which 14 belong to Uredinales. Tutin and Warburg mention 5 species from the Azores, all Uredinae, 3 of which have not earlier been known from the islands.

In my list here are mentioned 10 species from the Azores 8 of which are new to the islands. With the 46 species from the Azores already known, we still have only 54 from these islands, which of course, is a very small parantage of all existing species. Since I am sure many species of great interest are to be found in these islands, with their remarkable flora of higher plants.

Dothideaceae. Phyllachora Trifolii Fckl. San Miguel: Furnas on *Trifolium Ligusticum* Balb. Sao Jorge: Villas das Velas on *Trifolium scabrum* L.

Mycosphaerellaceae. Mycosphaerella sp. Sao Jorge: between Calheta and Topas on dead leaves of *Carex azorica* Gay. The very common genus *Mycosphaerella* was not recorded hitherto from the Azores.

Mollisiaceae. Fabraea Saniculae (Wallr.) Rehm. St. Jorge: inter Calheta et Topas c. 600 m s. m. on *Sanicula azorica* Guthn. No *Fabraea* is hitherto mentioned as occurring on the Azores.

It is very uncertain if *F. Saniculae* really belongs to the genus *Fabraea,* but no research has been made on this point. I was not able to find any differences between the *Fabraea*-specimens on *Sanicula azorica*, which species is endemic on the Azores and is very close to *S. europaea* L.

Melampsoraceae. *Hyalospora Adianti—Capilli veneris* P. et H. Sydow. San Miguel: Capellas on *Adianthum capillus veneris* L.

This interesting species which occurs in Southern Europe, Algeria, and Persia is new to the flora of the Azores

Melampsora hypericorum (DC.) Schroet. Pico: inter Lageno et Caes, on *Hypericum humifusum* L. San Miguel: Lagoa do Congro on the same host.

This species has earlier been collected on the islands on *Hypericum foliosum* Dryand.

Pucciniaceae. *Phragmidium Potentillae* (Pers.) Karst. San Miguel: Furnas on *Potentilla procumbens* Sibth. This species is not hitherto recorded from the Azores.

Puccinia Frankeniae Link. On specimens of *Frankenia pulverulenta* in the herbarium collected at San Miguel: Ponta Delgada 1898 by KNUT BOHLIN. The species which is not hitherto recorded from the Azores was also collected on the island San Miguel by HUNT.

Puccinia obscura Schroet. San Miguel: Lagoa do Congro. On leaves of *Luzula multiflora* (Retz.) Lej. This fungus is not earlier recorded from the Azores.

There has been much confusion concerning the *Luzula multiflora*-group in the Azores. TRELEASE mentions *L. campestris* DC. and TUTIN and WARBURG *L. multiflora* DC. var. *congesta* Lej. As already stated above, the material collected by PERSSON belongs to *L. multiflora* (Retz.) Lej.

Puccinia silvatica Schroeter. San Miguel: Lagoa do Congro. On *Carex vulcanica* Hochst. The species is new to the flora of the Azores.

KÜKENTHAL in his *Carex*-monograph states that *Carex vulcanica* is only a subspecies of *Carex pilulifera* L. Regarding this I agree with more recent authors, who consider *C. vulcanica* to be a distinct species.

Uromyces Poae Rabenh. II, III. San Miguel: Furnas on *Poa trivialis* L. This common, widely distributed species is new to the flora of the Azores.

Mucedinaceae. *Ramularia punctiformis* (Schlecht.) v. Höh. San Miguel: Furnas — *Epilobium obscurum* Schub.

This is the first *Ramularia* mentioned from the Azores. It seems possible that this species (Syn. *Ramularia Epilobii* Karst., *Ramularia montana* Speg.) is polymorphous although the species on *Chamaenerium, Epilobium palustre, E. roseum* and *E. Hornemanni* has been considered as distinct new species. Since, however, personally I have never studied thoroughly the difficult genus *Ramularia* I am unable to clear up this question at present.

Stockholm, Botanical Department, Swedish Museum of Natural History.

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Th. Arwidsson.

Inventeringen av Skånes Flora.

Under år 1939 har inventeringsarbetet bedrivits efter samma principer som år 1938 (jmf. Bot. Not. 1939, 397—398).

Registreringen. Disponent Gustaf Svenson har under år 1939 fortsatt arbetet med litteraturen och praktiskt taget slutfört detta. Överste Georg Björnström har fullbordat registreringen av äldre anteckningar, och folkskoleinspektör Th. Brandt har avslutat arbetet med registrering av lektor Hård av Segerstads anteckningar. Genom vart och ett av dessa registreringsarbeten ha omkr. 25,000 lokaluppgifter tillkommit. Dessutom ha överste Georg Björnström, kyrkoherde O. J. Hasslow och tandläkare P. Tufvesson lämnat uppgifter på lokaler, belagda med exemplar i deras herbarier. Sammanlagt omfattar nu det registrerade materialet omkr. 80,000 uppgifter. Registerlapparna ha under vintern 1938/39 ordnats på arter och äro därmed klara att införas i kortfackskåpets slutliga register. Härmed ha ett antal yngre deltagare varit sysselsatta en kväll i veckan.

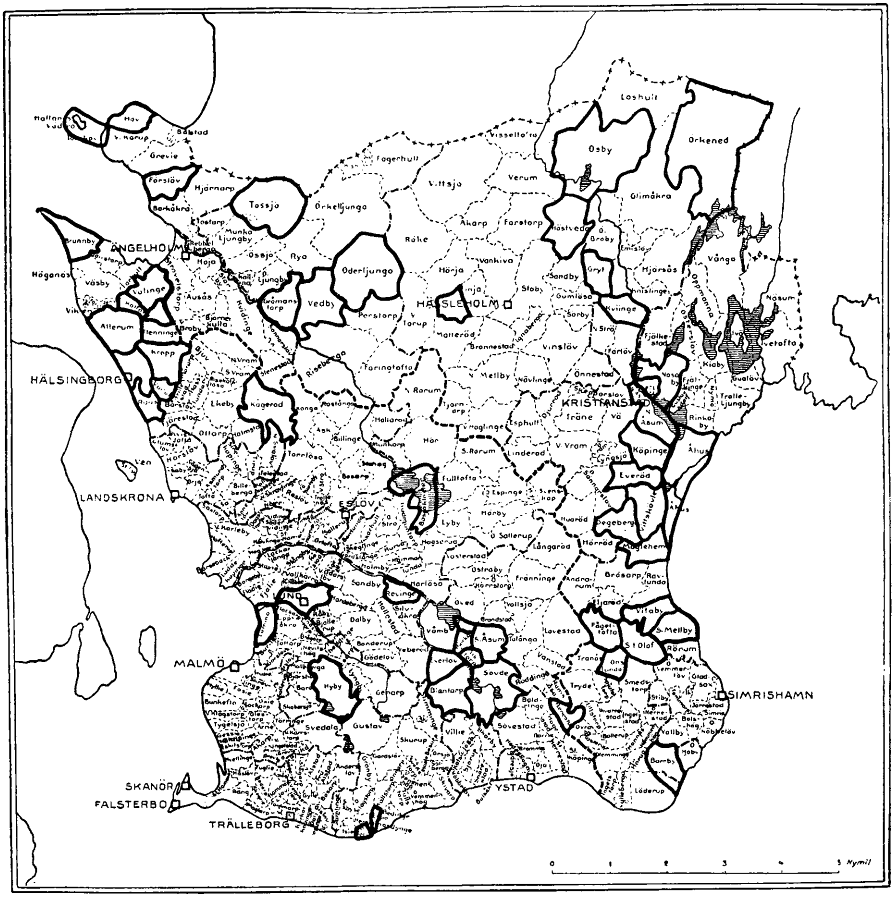
Fältarbetet. Under året ha flera Skånebotanister slutfört de år 1938 påbörjade områdena, andra ha påbörjat eller slutfört nya. Sammanlagt ha nu 26 botanister varit verksamma vid detta arbete. — Av de nedan som nya upptagna områdena har Södra Mellby undersökts för flera år sedan.

Följande socknar ha under 1939 inventerats eller äro fortfarande föremål för inventering:

Benestad: Börje Emilsson
Björka: H. Weimarck
Blentarp: H. Weimarck
Brunnby: Severin Axell
Espö: Georg Björnström
Everlöv: H. Weimarck
Finja (västra delen): Georg Björnström
Förslöv: A. Uggla
Gråmanstorp: Tore Donnér
Ilstorp: H. Weimarck
Lund: Gustaf Svenson
Södra Mellby: E. Asplund
Oderljunga: Asta Lundh
Sövde: H. Weimarck
Tossjö: Severin Axell
Välinge: Gertrud Jönsson
Södra Åsum: H. Weimarck
Öved (södra delen, 1 sekt.): H. Weimarck.

De inventerade områdenas läge och storlek framgår av omstående karta, där de i likhet med föregående år utmärkts med en bred, heldragen ram. Den inventerade delen utgör omkr. 2,000 kvkm, d. v. s. något mer än $^1/_6$ av hela landskapet.

I likhet med föregående år ha specialister på kritiska släkten och vissa kryptogamgrupper varit verksamma inom landskapet.



Under 1939 höll Sektionen Skånes Flora två sammanträden

den 15 februari, årsdagen för Sektionens tillkomst, med föredrag av H. Weimarck om floran i Örkened;

den 18 november med föredrag av Th. Brandt, Asta Lundh, Börje Emilsson och Olof Andersson om resp. Hyby, Oderljunga, Benestad och den skånska svampfloran. Efter föredragen följde samkväm på Botaniska Museets föreläsningssal.

Sektionen Skånes Flora vill här framföra sitt vördsamma tack till

Kungl. Fysiografiska Sällskapet i Lund, som i likhet med år 1938 understödde arbetet med 800 kr., varav 635 kr. fördelades mellan 5 studerande för undersökningar inom Skåne och 135 kr. användes till inköp av anteckningsböcker, papper och kartor samt till biträde vid pressning;

alla dem, som bidragit till utförandet av det omfattande registrerings- och fältarbetet.

Arbetsutskottet.

Inlägg i fråga om nordgränsens läge inom Sverige för Centaurium umbellatum Gilib.

Uti Botaniska Notiser har RIKARD STERNER nyligen (1939, h. 4) publicerat en ingående, sorgfällig utredning av nomenklaturen för släktet *Centaurium* och för två av dess arter: *C. vulgare* Rafn och (i viss mån) *C. umbellatum* Gilib.

Om den sistnämnda arten, betecknad som »the rarest and most southerly» av Sveriges tre väsentligare arter (den 3:e = *C. pulchellum* Druce), säger STERNER: »In south Sweden it reaches its northern limit as far south as in the northern part of Götaland.» (Spärr vid citer.) Denna utsago synes tarva någon kommentering resp. korrigering.

Förekomst av *C. umbellatum* inom Svealands provins Södermanland är nämligen, redan i lätt tillgänglig litteratur, väl konstaterad. Efter det att år 1858 (i HARTMAN's flora, uppl. 7) en lokal publicerats: »Södmld. Åkerö: C. DRAKE.», och en annan tillkommit i samma floras uppl. 10 (1870): »Södmld. Utåcker i Råby enl. C. IND[EBETOU].», giver THEDENIUS i sin flora (1871) följande sammanfattning: »Nyköpings län: i grannskapet av de stora sjöarna Yngaren och Långhalsen, t. ex. vid Utåker i Råby socken; Åkerö i Bettna socken och i Björkvik [socken].» I enlighet härmed upptages också denna provins — Södermanland — som den nordligaste i flororna av HARTMAN (1879), NEUMAN-ALFVENGREN (1901), LINDMAN (1918 o. 1926) och KROK-ALMQUIST (1935).

Utöver de 3 redan publicerade socknarna (Råby, Bettna och Björkvik) kunna här framläggas tvenne, nämligen:

dels, på grund av förf:s egen iakttagelse (under en jakttur omkr. 1890): Lerbo sn (Gotthardsberg),

dels, med stöd av herbarie-exemplar i Riksmuseum: Bogsta sn (Törnby) — AX. LINDSTRÖM 1891.

Summa summarum hava alltså 5 Södermanlands socknar uppvisat *Centaurium umbellatum* som gäst inom sina gränser.

I Upsala Bot:a instit. och i Riksmuseum förefintliga pressexemplar med uppgiven fyndort: »Södertelje» resp. »Nicolai sn (Andebol)» hava härvidlag icke blivit medräknade, enär i förra fallet etiketten uppenbarligen är skriven av en mycket ung scolaris, och i senare fallet etiketten härrör från en man, vilkens lokaluppgifter å fackmannahåll »anses i viss utsträckning bero på s. k. etikettförväxlingar».

Eljest förefaller sistnämnda uppgift skäligen rimlig, i det att lokalen nära ansluter sig, som ett S-O:ligt led, till här beskrivna 5-sockenbältet.

Dessa 5 Södermanlands-socknar äro placerade inom ett tvärbälte, med Lerbo som W-lig utpost och Bogsta som den O-ligaste. Från de 4 härovan nämnda detaljlokalerna — Gotthardsberg, Åkerö, Utåker och Törnby — utgör avståndet till närmaste punkt å Södermanland-Östergötlandsgränsen (= Svealand-Götaland-gränsen) resp. 16, 18, 25 och 33 km.

Vid beaktande av nu nämnda faktiska förhållanden finner förf:n STERNER's förläggande av nordgränsen till nordliga delen av Götaland ej vara nöjaktigt exakt (bl. a. strider ju detsamma mot — i och för sig riktiga — uppgifterna i gängse floror om Södermanland som nordligaste provins för utbredningen). Riktigare hade naturligt nog varit att angiva artens svenska nordgräns såsom förefintlig inom södra delen av Svealand (in the southern part of Svealand)!

CARL TH. MÖRNER.

Litteratur.

Die natürlichen Pflanzenfamilien nebst ihren Gattungen und wichtigeren Arten, insbesondere den Nutzpflanzen. Unter Mitwirkung zahlreicher hervorragender Fachgelehrten begründet von A. ENGLER und K. PRANTL. Zweite stark vermehrte und verbesserte Auflage herausgegeben von A. ENGLER (†). Fortgesetzt von H. HARMS. — Leipzig, Verlag von WILHELM ENGELMANN.

Band 17 b. Angiospermae. Reihen Rhoeadales und Sarraceniales, redigiert von H. HARMS. 779 S., 486 Fig. 1936.

Band 5 b. VIII. Abteilung: Eumycetes (Fungi). Klasse: Ascomycetes. Reihe Euascales. Unterreihe VIII. Tuberineae, bearbeitet von EDUARD FISCHER. 42 S., 22 Fig. 1938.

I det senast utgivna fanerogambandet av ENGLER-PRANTLS andra upplaga ha följande stått för bearbetningen av de olika familjerna: FR. BOLLE (Resedaceae), L. DIELS (Droseraceae), FR. FEDDE (Papaveraceae), H. HARMS (Nepenthaceae), F. PAX (Moringacae, Bretschneideriaceae), F. PAX und K. HOFFMANN (Capparidaceae, Tovariacae), O. E. SCHULZ (Cruciferae) och J. C. TH. UPHOF (Sarraceniaceae). HARMS lämnar en redogörelse för de olika åsikterna om ordningarna Rhoeadales' och Sarraceniales' omfattning och deras ställning i systemet. Utgivaren kan inte ansluta sig till de av E. R. SAUNDERS m. fl. förfäktade åsikterna om fruktbladens morfologi. Det vanliga antalet karpeller tolkas därför som 2 i st. f. 4 (2 fertila och 2 sterila). Frågan utvecklas vidare av respektive medarbetare under de olika familjerna.

Papaveracéernas blombyggnad erbjuder särskilt intresse på grund av talförhållandena (2- eller 3-talsserier) och den hos de zygomorfa blommorna utvecklade transversaldorsiventraliteten. Anmälaren vill ifrågasätta lämpligheten av att, som i kapitlet om blommans byggnad skett, använda termen »symmetrisk» som beteckning för en blomma med endast ett symmetriplan. »Ensymmetrisk» hade varit tydligare. FEDDE går vid behandlingen av blombyggnaden ut från MURBECKS omfattande och noggrant utförda undersökningar. Blomkapitlet avslutas med en överskådlig uppställning av de olika släktenas blomformler. Som flertalet forskare anser FEDDE Fumarioideae vara den mest härledda underfamiljen i motsats till LÉGER, vars avbildade fylogenetiska schema går ut på en evolution i motsatt riktning. Familjens systematiska ställning dryftas ingående. För vissa specialutredningar hänvisas till författarens monografi i ENGLERS Das Pflanzenreich.

Den ojämförligt största parten av innehållet tillkommer familjen Cruciferae. Ett flertal forskare har gjort beaktansvärda försök att klassificera dessa växter. De olika systemen har emellertid blivit mer eller mindre artificiella. Det av SCHULZ uppgjorda stamträdet över Cruciferae grundar sig i första hand på blommans och fruktens byggnad samt hjärtbladens läge i fröna. Stor betydelse tillmätes också honungskörtlarnas gestalt och anordning liksom form och inbördes förhållanden hos epidermiscellerna i fruktens skiljevägg. Som mindre viktiga i sammanhanget betecknas olika slags hårighet samt märkets form och gynoforens utbildning.

Vid behandlingen av fam. Sarraceniaceae lämnas utförliga uppgifter i fråga om de insekter, som tjäna växten till föda, liksom i fråga om dessa växtarters ekologi. I översikten av fam. Nepenthaceae tilldrar sig de olika refererade åsikterna om Nepenthes-bladets morfologi ett stort intresse. Sarraceniaceae och Nepenthaceae förmodas ha uppkommit ur en gemensam Ranales-gren. Droseraceae anses ej vara närmare besläktad.

Band 5 b (Ascomycetes) utkommer i häften. Nu föreligger en bearbetning av Tuberineae av EDUARD FISCHER. I den utförliga litteraturförteckningen finner man även en avdelning för lokala bearbetningar, där TH. M. FRIES svenskspråkiga översikt av de skandinaviska formerna också har tagits upp. Ontogenin är, som framgår av texten, blott ofullständigt känd. Geografisk utbredning, ståndortsförhållanden och användning beskrives ingående.

För en privatperson ligger det i regel utanför möjligheternas gräns att anskaffa Engler-Prantls standardverk med dessa många välskrivna och rikt illustrerade band. Man får hoppas på större spridning till biblioteken av detta förnämsta allmänt botaniska uppslagsverk i vår tid. På de biologiska läroverksinstitutionerna har arbetet en uppgift att fylla, inte minst som utgångspunkt för allehanda vetenskapliga undersökningar.

ARNE HÄSSLER.

Notiser.

Letterstedtska priset, 650 kronor, tilldelades vid K. Vetenskapsakademiens sammanträde den 28 februari 1940 docent RUDOLF FLORIN för hans arbete »Die Koniferen des Oberkarbons und des unteren Perms, T. I—IV».

Doktorsdisputation vid Lunds Universitet. Fil. lic. HÅKAN HJELMQVIST försvarade för vinnande av filosofie doktorsgrad den 6 mars 1940 en avhandling »Studien über die Abhängigkeit der Baumgrenzen von den Temperaturverhältnissen unter besonderer Berücksichtigung der Buche und ihrer Klimarassen».

K. Vetenskapssocietetens i Uppsala Linnépris tilldelades 1940 docent G. MALMSTRÖM, Stockholm, för hans arbete »Hallands skogar under de senaste tre hundra åren» och professor H. OSVALD, Uppsala, för hans arbete »Myrar och myrodling».

En kommission »Skånes Flora» inom K. Fysiografiska Sällskapet i Lund. Vid sammanträde den 10 april 1940 beslöt K. Fysiografiska Sällskapet att inom Sällskapet inrätta en kommission »Skånes Flora» med ändamål att övervaka användningen av de medel, som av Sällskapet ställes till disposition för inventeringen av Skånes Flora samt att genom redogörelser vid sammanträden underrätta Sällskapet om arbetets fortskridande. Till ledamöter i kommissionen utsågos professor H. KYLIN, professor HERIBERT NILSSON och docent O. GERTZ.

Undertecknad önskar för en cytogenetisk undersökning erhålla material av *Anthoxanthum* från alla delar av landet (frön eller plantor). Frön från olika plantor böra ej blandas. Noggranna lokaluppgifter böra medfölja.

GUNNAR ÖSTERGREN
e. o. amanuens
Institutionen för ärftlighetsforskning, Svalöv.

BOTANISKA NOTISER 1940, LUND 1940.

Insamlingen till Botaniska Notisers Jubileumsårgång 1939.

Våren 1938 utsände styrelsen för Lunds Botaniska Förening ett upprop med vädjan till Föreningens medlemmar att genom penningbidrag medverka till utgivandet av en jubileumsårgång av Botaniska Notiser för år 1939.

Följande personer hörsammade styrelsens vädjan:

K. Afzelius
E. Almquist
Axel Andersson
Sven Andersson
K. Anerud
A. Arrhenius
Th. Arwidsson
E. Asplund
Hj. Barr
J. B. Bengtsson
Å. Berg
G. Bernström
Ch. Birch-Iensen
K. Björling
G. Björnström
C. Bliding
G. Borgström
T. Borgvall
Th. Brandt
K. Bökman
G. Böös
G. R. Cedergren
O. Dahlgren
Th. Dahlgren
G. Drake af Hagelsrum
A. Edelstam
B. Egerström
G. Elander
R. Erhardt
K. Falck
E. Flodmark
R. Florin
Th. Folin
S.-S. Forssell
E. Th. Fries
H. Fries
R. E. Fries
O. Gertz
C. E. Gustafsson
Å. Gustafsson
A. Hafström
N. Hagman
T. Hasselrot
B. Hederén
O. Heilborn
H. Hesselman
H. Hjelmquist
Hj. Holm
Bj. Holmgren
E. Hultén
A. Håkansson
G. Ilien
E. Ingvarsson
A. Jansson
E. Jonsson
C. L. Kiellander
N. Kierkegaard
E. Kjellgren
S. Lagergren
J. Lagerkranz
R. Lamm
H. Lamprecht
Gunvor Landgren
S. A. Larsson
Ebba Larsson
T. Levring
O. Lidén
J. Linders
C. G. Lillieroth
B. Lindquist
A. Lindstedt
Hildur Ljungdahl
E. Ljungström
H. Lundborg
Sara Lundborg
L. Lundström
J. Lybing
C. Malmström

J. Mauritzon
A. Müntzing
S. Mårtensson
Hj. Möller
C. Th. Mörner
J. A. Nannfeldt
H. Nilsson
Heribert Nilsson
G. Nilsson-Leissner
T. Norlindh
C. M. Norrman
G. Norrman
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Louise Overton
O. Palmgren
H. Persson
J. Rasmusson
E. Rennerfelt
A. Roos
A. von Rosen
O. Rosenberg
G. Samuelsson
C. Scholander
C. Schäffer
R. Sernander
J. Sjögren
L. G. Sjöstedt
M. Sjöwall
J. A. O. Skårman
J. A. Snell
H. Stenar
R. Sterner
S. Suneson
N. Svedelius
S. Thunmark
G. Tometorp
S. Torgård
Vivi Täckholm
Å. Uddling
A. Ulrici
H. Vallin
A. Vilke
H. Virgin
E. Wall
H. Weibull
H. Weimarck
S. Wiedling
H. Witte
Th. Wolf
G. Åberg
E. Åkerlund
Å. Åkerman

Dessutom bidrog *Nordstedtska Fonden* genom professorerna *Harald Kylin* och *Heribert Nilsson* med ett större belopp.

Insamlingen inbragte sammanlagt kronor 2,674: 17, nämligen under år 1938 1,252: 41 och under år 1939 1,421: 76. Sekreterarens räkenskaper över insamlingen ha utan anmärkning reviderats för år 1938 av *G. Nilsson-Leissner* och *Olof Tedin* den 4 mars 1939 och för år 1939 av *Sven T. Andersson* och *Oscar Palmgren* den 21 april 1940. Föreningen beviljade vid sammanträde den 26 april 1940 full och tacksam ansvarsfrihet.

Till alla de personer, genom vilkas välvilliga stöd utgivandet av Botaniska Notisers jubileumsårgång möjliggjordes, och till alla dem, som år 1939 bidrogo med vetenskapliga uppsatser och avhandlingar i tidskriften, få undertecknade framföra ett varmt och vördsamt tack.

Lund i april 1940.

Svante Suneson
ordförande i Lunds Botaniska Förening

H. Weimarck
redaktör för Botaniska Notiser