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Revisions of some Pliocene charophyte gyrogonites.

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In connection with an investigation of some gyrogonites from the Austrian Pliocene, the morphology and systematic affinities of which will be discussed in another paper, the writer has examined the records of Pliocene charophytes in the literature. Though no material has been available for comparison of most of these species, some rather informative figures and descriptions allowed generic re-identifications on the basis of the literature alone. As these imply considerable extensions of the geological ranges of some genera, and as the Pliocene charophyte floras are but little known, some short notes may be motivated.

In view of the many interesting problems connected with Paleogene and still older charophytes, it is hardly surprising that most studies of gyrogonites are more or less exclusively devoted to these forms. Neogene charophytes, on the other hand, have received relatively little notice. This refers particularly to the Pliocene and somewhat less to the Miocene gyrogonites. The neglect of the Pliocene species may in some degree have been caused by a statement by J. GROVES (1924, p. 84): »In some of the Pliocene and Pleistocene beds *Chara*-fruits are abundant, but, as might be expected, these resemble for the most part those of species common and widely distributed at the present day.» This statement may be true of at least parts of the Pleistocene, though with the reservation that few gyrogonites of that age have been critically studied. With regard to the Pliocene, on the other hand, and particularly to its lower parts, it seems somewhat exaggerated. Present observations seem to indicate that the charophyte floras of the Pliocene, though extremely fragmentarily known, differ rather strongly from the charophyte floras of today, and that no Pliocene gyrogonite can — at least for the present — be identified with any living species. This is perhaps also only what might be expected, considering the comparatively short period of existence of most species of fossil charophytes known in any great detail (MÄDLER 1953 a, p. 65), a fact that is rather important to their evaluation as stratigraphic fossils.

GROVES' check-list of fossil charophytes from 1933 enumerates only three species of gyrogonites ascribed to Pliocene deposits. Two of them, identified with still existing species, viz. *Chara connivens* SALZMANN ex BRAUN, *Nitellopsis obtusa* (DESVAUX) GROVES, were reported by GROVES (1924, p. 84, 88) from the Cromer Forest Bed of Norfolk, England; this deposit is for the present time considered Lower Pleistocene (KIRCHHEIMER 1940, p. 159, BADEN-POWELL 1950, p. 10, WOLDSTEDT 1950, p. 111), however, and the two Cromerian species have for that reason been omitted from the list of Pliocene charophytes at the end of this paper. The third species in GROVES' catalogue, *Chara zoberbieri,* had been described by v. FRITSCH (1885, p. 424) from the Rippersroda deposits of Thuringia, Germany, of Middle Pliocene (Reuverian) age (KIRCHHEIMER, op.c., p. 150). Three charophyte species were reported from the Pliocene deposits of Sinkiang by LU (1946, p. 273—277). The most noteworthy contribution so far in this field was recently made by PAPP (1951), who reported nine forms — among them five previously undescribed species — from the Austrian Pliocene. He has supplemented his account of these forms by drawings, which allow detailed comparisons with other known types of gyrogonites.

Before discussing the Pliocene gyrogonites, an introductory observation seems necessary. This concerns the circumstance that all Pliocene gyrogonites have been ascribed to *Chara,* while the comments in this paper indicate that some of them cannot possibly be included in that genus, and that none of the others can with absolute certainty be referred to it. It should be remembered in this connection, however, that the three types of fossil gyrogonites originally referred to *Chara* (BRONGNIART 1822, p. 320—322) comprise two species (*C. medicaginula, C. helicteres*) which definitely do not belong to that genus, while the generic identity of the third (*C. lemani*) has not been possible to establish with any certainty. Later students have generally adopted this usage, and apart from a few deviating types — the Kosmogyreae distinguished by STACHE 1889, the trochilisks and sycidiads studied by KARPINSKY 1906, the *Clavator* discovered by REID & GROVES 1916, and BELL's *Palaeochara acadica* of 1922 — all fossil gyrogonites have been referred to *Chara,* even in GROVES' catalogue of 1933. PIA's attempt (1927, p. 89) to refer all free gyrogonites except the *Kosmogyreae* and

Palaeochara to the organ-genus *Gyrogonites* [LAMARCK 1804, p. 356] LAMARCK 1822, p. 614 — once established for »*Chara*» *medicaginula* — met with no success and has been criticizised (PECK 1941, p. 289, RÁSKY 1945, p. 29, MÄDLER 1952, p. 3). The establishment of the name *Aclistochara* (PECK 1937, p. 86) for a type of gyrogonite deviating from present-day *Chara* in systematically important features (MÄDLER 1952, p. 7), and the segregation of some other genera of gyrogonites — *Sphaerochara* and *Obtusochara* — has led to a more differentiated outlook on the system of the Charophyta (MÄDLER 1952, p. 14—15; further discussed and commented upon by MÄDLER 1953 a, p. 63—65 and 1953 b, p. 474 ff.; cf. PECK 1953, p. 224—225). An inclusion of fossil charophytes in these new genera has accordingly not been possible until the last few years. The reference of all gyrogonites to the genus *Chara* — still adhered to by some students of this group — is rather a general designation of fossil charophytes than a reference to any particular generic group. This also implies that a re-examination of previously described types of gyrogonites will necessitate several generic transfers and new combinations.

Professor OLOF H. SELLING, Sc.D., has read the manuscript of this paper and has suggested several improvements. The writer is indebted to him for much help and encouragement.

Aclistochara, Sphaerochara, and Kosmogyra in the Pliocene.

1. *Aclistochara nana* (LU) H. AF R.

Aclistochara nana (LU) H. AF R., n. comb. (fig. 1 a—c).

Chara nana LU 1946, p. 276, fig. 2: 3 a—c.

»Oogonia small, elongate-subovoid in shape, tapering steadily and regularly to the apex and gradually to the somewhat obtuse bases with the greatest transverse diameter above mid-height. Length measuring about 715 μ, breadth 455 μ. Spiral-cells showing 11—12 convolutions, smooth, convex, with the sutures in broad and deep furrows. Width of the spiral-cells variable, measuring about 65 μ at the upper-half portion and 48 μ near the base. Equatorial angle about 15°. Tips pronounced, faintly swollen, giving rise to a distinct, slightly projecting rosette.» (LU l.c.).

Occurrence: »at Kizil-Ming-Oi . . ., about 8 km north of Kucha and $^1/_2$ km east of the Kucha-Bai motor road», Sinkiang. — Kucha Formation (=Kuchar Group of NORIN 1935 b and 1941), Middle Bed (=Series B of NORIN 1935 a, p. 80, 1935 b, p. 340 ff.). On the age of the latter CHANEY 1935, p. 97 writes: »It is clear that it can be referred to the Pliocene on the basis of its structure and lithology, and that the flora is related in kind and in climatic implications to Pliocene floras in Asia and in western North America. While the possibility must be considered that it may be as young as the Pleistocene, the evidence now at hand favours the reference of this flora to the Pliocene». NORIN (1941, p. 186) considers this bed »probably Pliocene».

The figures and descriptions of the apical regions of these gyrogonites show beyond any doubt that they should be referred to *Aclistochara,* as defined by present students of this group. In *A. nana* the spiral cells narrow in the periphery of the apical pole, but expand abruptly in the apical centre. This is a distinctive of one of the types referred to *Aclistochara* (see p. 9). Species of *Aclistochara* have usually a flat apical region, a character which was included in the diagnosis of the genus (PECK 1937, p. 86). As gyrogonites gradually tapering towards the summit, but provided with the apical structure characteristic of *Aclistochara,* have been encountered now and then (see e.g. MÄDLER 1952, Taf. B, fig. 29), this character seems less reliable from a systematic point of view.

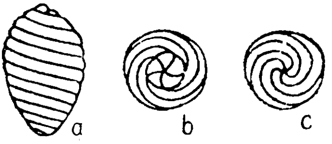

Fig. 1. *Aclistochara nana* (LU) H. AF R. Sinkiang: 8 km N of Kucha (Kuchar Group, Series B; Pliocene). — a: gyrogonite in lateral view; b: apical view; c: basal view. — After LU 1946, fig. 2: 3 a—c. — All fig. approx. 25/1.

Chara nana has been compared by LU (op.c., p. 277) with *C. escheri* UNGER (1850, p. 34) and *C. elegans* DOLLFUS & FRITEL (1920, p. 255). As figured by DOLLFUS & FRITEL (op.c., fig. 17), *C. elegans* does not belong to any of the types usually referred to *Aclistochara,* and is also in other respects rather different from *A. nana.* Whether the latter is distinct from some of the forms included in *C. escheri* seems more questionable, however. *C. escheri* — as usually interpreted — evidently comprises rather different forms, some of which belong to the Aclistochareae. As the taxonomy and variation of *C. escheri* is not well understood, and its typification not adequately investigated, a comparison with *A. nana* is difficult.

Our knowledge of the *Aclistochara* type of gyrogonites is of comparatively recent date.

PECK (1937, p. 86—90) united a group of seven species from the Upper Jurassic Morrison formation of Wyoming to a new genus, *Aclistochara,* defining them as comprising gyrogonites whose spiral cells »ascend to a truncated summit where they terminate without meeting in the center, leaving a conspicuous opening into the interior of each oogonium». From various Lower Cretaceous formations of U.S.A., PECK (1941, p. 290—292) described two additional species, but according to MÄDLER (1952, p. 8) one of these, *A. mundula,* probably belongs to the Clavatoraceae. In the same year, RÁSKY described *A. staubi* from the Lower Miocene of Hungary (RÁSKY 1941, p. 300) — up to the present the youngest recorded gyrogonites referable to these morphological types. Nine more species of the same genus were established by RÁSKY (1945, p. 40—46) from other Hungarian Middle Cretaceous, Paleocene, Eocene, and Oligocene deposits. An Eocene type of gyrogonite of this morphological group has been recorded from Peru (PECK & REKER 1947, p. 5), and four additional forms from the Eocene of U.S.A. (PECK & REKER 1948, p. 87—89). Some occurrences of *Aclistochara* from the Paleocene (BELL 1949, p. 36) and Lower Cretaceous (LORANGER 1951, p. 2357) of Alberta, Canada, have also been reported; the latter paper includes a description of a new species. HORN AF RANTZIEN (1951, p. 672—673) listed four species of *Aclistochara* from South America, one of them previously described as a *Chara,* and RÁSKY (1952, p. 43) gave a new record from the Eocene-Oligocene of Hungary. Fourteen new forms of *Aclistochara* were described by MÄDLER (1952, p. 18—30) from the Kimmeridge of NW Germany, eight of which were given specific rank. Two gyrogonite forms of *Aclistochara* type have finally been described by HORN AF RANTZIEN (1953, p. 6—7, 1954, in the press) from the Middle Triassic (Keuper or Muschelkalk) of South Sweden. The geological range of the morphological types of gyrogonites referred to *Aclistochara* is accordingly known to comprise the Middle Triassic, Upper Jurassic, Lower Cretaceous, the whole of the Paleogene, and the Lower Miocene. The present species widens this range also to the Pliocene.

It may be added that a still older record of *Aclistochara* than the Triassic exists, though this — apparently on account of some uncertainty attached to it — is not generally included when stating the range of this genus. This record refers to the discovery of a number of gyrogonites in a marine shale (Cherokee) of the Pennsylvanian of Missouri, U.S.A., described by PECK (1934 a, p. 54) as *Gyrogonites moreyi.* PECK's description and discussion, which is of considerable interest, is quoted *in extenso* below (his figures are reproduced here as fig. 2 a—e):

»*Gyrogonites moreyi,* n.sp. (Plate 1, figures 1—3, 5, 6.)

Oogonium subovate to ovate-rotundate, ranging from .3 to .4 mm. in height, higher than wide, greatest transverse diameter at or usually below mid-height. Spiral ridges intercellular, fairly broad, making a little more than one complete turn around the oogonium. At the center of each ridge is a fine furrow marking the lateral contact of the cells. The furrows separating the ridges are approximately equal to the ridges in width.

Occurrence. — Cherokee (Pennsylvanian) shale about thirtyfive feet above the Bevier coal at the Brick Plant, Columbia, Missouri; ? Winterset (Pennsylvanian) from Quarry at Swope Parkway and Prospect, Kansas City, Missouri; ? Waubaunsee (Pennsylvanian) near Manhattan, Kansas.

Holotypes and Paratypes. — Catalog numbers 31007—3, 31007—4, University of Missouri.

Approximately one hundred specimens of *G. moreyi* have been collected from the Cherokee by Mr. John Roberts and Mr. Philip Morey. They differ slightly in the length-width ratio, as is shown in the accompanying illustrations.

A single specimen has been collected from the Winterset limestone and another from the Waubaunsee formation. These forms are too poorly preserved to permit specific identifications and I am tentatively referring them to *G. moreyi.*»

Three years later, when establishing the genus *Aclistochara,* PECK (1937, p. 87) noted: »Species of charophyte oogonia that should be referred to *Aclistochara* are as follows: . . .; *Gyrogonites moreyi* Peck, Pennsylvanian, Missouri (Peck, 1934, p. 50, figs. 1—3, 5, 6).» In 1949, »about 50 specimens of *Chara moreyi* (Peck)» were reported from the Pennsylvanian of Iowa, U.S.A., »recovered from the Higginsville limestone member of the Ft. Scott formation exposed near Madrid in the N.E. 1/4, sec. 33, T. 82 N., R. 26 W.» (THOMAS 1949, p. 233).

Owing to some morphological similarities — not extending to the apical pole, however — between *G. moreyi* PECK and a Middle Triassic species of *Praechara,* the former was briefly discussed by HORN AF RANTZIEN (1954, in the press). Although it was pointed out there that according to PECK (1937) *G. moreyi* should be referred to *Aclistochara,* it was not included in the geological range of this genus. The reason was the somewhat incomplete correspondence between the holotype of *G. moreyi,* as figured in apical view by PECK (1934 a, pl. p. 50, fig. 2; this paper, fig. 2 b), and the holotype of *Aclistochara bransoni* — type of the genus — in summit view as reproduced by PECK (1937, pl. 14, fig. 9). It seems also rather difficult to refer the apical arrangement of *G. moreyi* to any of the three principal apical types of *Aclistochara* discussed below (p. 9). Apart from this, it was noted that the figures show rather large variations in shape, numbers of convolutions, etc.

The differences between *G. moreyi* and the aforesaid forms of *Aclistochara* may be due to heavy retouching or imperfect photographic reproductions of the former, and no inferences can be drawn from the figures alone regarding the possible systematic significance of these differences. It seems however, that we have better defer the inclusion of the Pennsylvanian record in the geological range of *Aclistochara* until the type material of *G. moreyi* has been re-examined.

The morphological interpretations of the *Aclistochara* gyrogonites have varied greatly. At the original establishment of this genus, the flattened apical region and the large apical opening were considered diagnostic, and motivating the generic distinction (PECK 1937, p. 86).

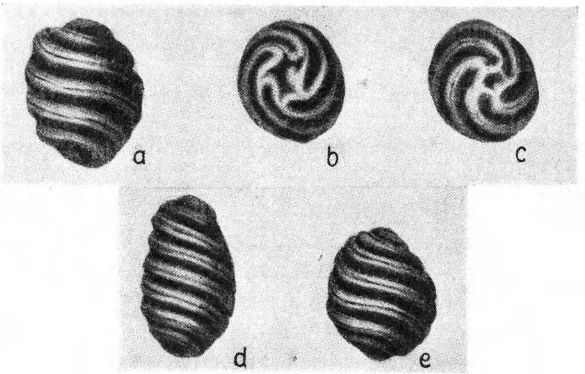

Fig. 2. *Gyrogonites moreyi* PECK (*Aclistochara moreyi* (PECK) PECK). U.S.A., Missouri: Columbia (Cherokee shale; Pennsylvanian). — a: holotype, gyrogonite in lateral view; b: holotype, apical view; c: holotype, basal view; d: paratype, lateral view; e: paratype, lateral view. — After PECK 1934 a, pl. (unnumb. in p. 50), fig. 1—3, 5, 6. — All fig. 54/1.

HARRIS (1939, p. 77—78) regarded the large apical hole as a less reliable feature, possibly due to the apex being accidentally broken off; this was also observed in a *Clavator grovesi* gyrogonite. HARRIS' statement has been discussed by RÁSKY (1945, p. 41) who stressed the distinctness of the large apical opening, and noted that HARRIS' observation »eher beweist, dass der Gyrogonit von *Clavator grovesi,* der auch in einer Abbildung gebracht wird (Plate X, Fig. 10), nichts anderes ist, als der einer *Aclistochara*-Art.»

The diagnosis of *Aclistochara* was amended by PECK (1941, p. 290). He defined the genus as comprising gyrogonites whose summit regions were characterized by »five calcified coronula cells resting on their distal extremities or, in the absence of coronula cells, indentations showing their former presence». The term »calcified coronula cells» apparently indicated the swelling of the spiral cell-tips in the apical centre, observed in several previously described species (see e.g. HEER 1855, Taf. IV, SCHIMPER 1870—1872, pl. V, DOLLFUS & FRITEL 1920, fig. 1—23). The breaking off of these »calcified coronula cells» exposed the large opening originally believed diagnostic of *Aclistochara.* However, the coronula cells of fossil and recent charophytes are not usually calcified (REID & GROVES 1921, p. 181, GROVES 1925, p. 12, 1926, p. 165, 1933, p. 3, RAO & RAO 1939, p. 2, RÁSKY 1941, p. 297) and such summit expansions — interpreted e.g. by DOLLFUS & FRITEL (1920, p. 254) as »vestiges de la coronule» — were therefore considered terminal expansions of the spiral cells (GROVES 1933, p. 3).

Real calcified coronula cells occur according to PECK (1934 b, p. 91—92) and CROFT (1952, p. 209) in some of the trochilisks (*Trochiliscus* subg. *Karpinskya*). A calcified coronula has moreover been recorded in *Chara sausari* from the Indian Intertrappeans (SAHNI & RAO 1943, p. 215 ff.).

With regard to these terminal structures, RÁSKY was able, however, to confirm PECK's record as to the presence of the »klar erkennbaren 5 Coronula-Zellen» in three Hungarian species of *Aclistochara* (RÁSKY 1945, p. 41). Some years later, PECK & REKER (1947, p. 5) reviewed on the base of large collections the characters of *Aclistochara* with the following comments: »We are unable to prove that the five collar-like nodes on the summits of the oogonia are separate from the calcareous spirals as true coronula cells should be. We are also unable to prove that the five nodes are simply terminal expansions of the regular spirals. We do find that the combination of characters, including . . . the presence of summit nodes (coronula cells) on well-preserved specimens, allows us to differentiate readily the one group of oogonia from the other group . . .». PECK (1953, p. 210, cf. also p. 221) maintains that in *Aclistochara* »coronula cells or evidence of their former presence are preserved». MASLOV (1947, p. 88) and PAPP (1951, p. 279), who — judging by the illustrations — seem to have dealt with forms close to the general concept of *Aclistochara,* apparently consider these structures terminal extensions of the spiral cells. MASLOV (l.c.) uses the expression »the base of coronule»; PAPP designates these structures »Krönchengestell» (op.c., p. 283 ff.).

MÄDLER (1952, p. 6—7, 1953 b, p. 478) has contributed much to an understanding of the apical structures of gyrogonites referred to *Aclistochara.* He denies that the terminal expansions can be calcified coronula cells. He furthermore stresses the systematic importance of a character found in some types of *Aclistochara* gyrogonites, viz. the decrease in width and weak calcification of the spiral cells in the apex periphery which forms a grooved, weak zone, along which the whole apical region is sometimes broken off, resulting in the large apical opening observed by PECK in 1937. MÄDLER (1953 b, p. 478) writes:

> »Das ist biologisch nicht ohne Bedeutung. Die rezenten Charophyten keimen so, dass das Würzelchen und der Vorkeim durch die Spitze des Gipfels hindurchstossen. Das dürfte bei den *Aclistochara*-Arten, bei denen die Spitze oft sogar durch Kalkablagerung verfestigt ist, nicht möglich gewesen sein . . . Es hat vielmehr den Anschein, als ob hier bei der Keimung der Oospore durch den inneren Quellungsdruck das ganze Gipfelstück herausgesprengt wurde. Dieser Umstand lässt es geraten erscheinen, die *Aclistochara*-Arten nicht zu der Unterfamilie der *Chareae* zu ziehen, sondern dafür eine besondere Unterfamilie *Aclistochareae* aufzustellen . . .»

Equally important is MÄDLER's observation that the gyrogonites referred to *Aclistochara* comprise some types of rather different apical structures. Some gyrogonites of this group are thus characterized by the narrowing of the spiral cells in the apical periphery, described above, and by the resultant formation of a peripheral, narrow, weakly calcified zone, along which the whole strongly calcified summit hood may break away, leaving a very large opening (MÄDLER 1952, Abb. 1 c—d, 1953 b, Abb. 17 c—d). *A. staubi* RÁSKY (1941, Taf. VII, fig. 2 a) appears to be a good representative of this type of apical structure. In other species of gyrogonites the walls of the spiral cells are reinforced towards the apical pole, become abruptly weaker near to their tips, and again reinforced in the tips themselves, the hood being mostly sunk below the surface of the other lime-shell (MÄDLER 1952, Abb. 1 b, 1953 b, Abb. 17 b). In that case a somewhat smaller part of the apical hood has probably been broken off at the germination. *A. thörensis* MÄDLER (1952, Taf. B, fig. 8) may serve as a typical example. A third type (MÄDLER 1952, Abb. 1 a, 1953 b, Abb. 17 a) seems to differ in principle from the others. In this type there is a rather small apical opening, the hood of which — if any — has not yet been observed. This apical orifice is delimited by the usually somewhat swollen tips of the spiral cells. There is, however, no distinct narrowing — nor any particularly weak calcification — of the spiral cells of the apex periphery, and germination may have taken place without any partial breaking off of the lime-shell. This structure is met with in several older forms, viz. *A. kimmeridgensis* MÄDLER (1952, Taf. B, fig. 13). MÄDLER (1953 b, p. 478) points out that these differences might be used for the further differentiation of the genus. Intergradations of the three types described are, however, rather common.

As defined by present students of this group, the genus *Aclistochara* is a somewhat heterogeneous assemblage of forms (MÄDLER 1952, p. 7). This does not refer only to the varying structures of the apical poles, but also to the considerable variations in size and shape of the gyrogonites, which are probably greater than in any other genus of charophytes. It should furthermore be remembered that gyrogonites in which the apical structures described above are combined with various types of tubercular decoration are known from the North American Eocene (PECK & REKER 1948, p. 88—89); if the tuberculate forms without such apical structures are segregated from other fossil gyrogonites — the genera *Kosmogyra* and *Kosmogyrina* of the Kosmogyreae — the tuberculate Aclistochareae should either be removed from that subfamily entirely, or perhaps better — as proposed by MÄDLER (1952, p. 8—9, 1953 b, p. 479) — form a separate genus within it. It should finally be noted that gyrogonites provided with the apical structures characterizing the Aclistochareae are rather widely distributed stratigraphically (see p. 5—6); they are among the most persistent of all morphological types of gyrogonites. The fossil species of charophytes so far investigated usually appear to have existed only for a short time (MÄDLER 1953 a, p. 65), and the investigations of the last few years seem to indicate that this apparently also applies to the genera, though of course to a less extent. The exceptionally wide stratigraphic range of *Aclistochara* may have something to do with the morphological heterogeneity observed within it. The writer's observations seem to point to different though overlapping stratigraphic ranges of distribution of the various types of apical structures of *Aclistochara* gyrogonites described by MÄDLER. This would moreover support the heterogeneous impression of this group.

Judging by the illustrations, several gyrogonites ascribed to various species of *Chara* seem to be provided with the apical structures considered characteristic of the Aclistochareae. A few of them were transferred in the first description of *Aclistochara* (PECK 1937, p. 87), and some other similar cases were mentioned by MÄDLER (1952, p. 9). An examination of the published figures of gyrogonites reveals a considerable number of such instances. Illustrations in HEER (1855, Taf. IV), SCHIMPER (1870—1872, pl. V), DOLLFUS & FRITEL (1920, fig. 1—23), REID & GROVES (1921, pl. IV—VI), and RAO & RAO (1939, pl. I—III) — to take but a few examples — are particularly informative in this respect. As gyrogonites of types referable to the Aclistochareae have often been confused with forms of entirely different apical structure, and original materials sometimes are mixtures of various forms, a general transfer to *Aclistochara* of forms like those illustrated in the papers cited above is rather useless without a check-up of the type material in each individual case.

2. *Aclistochara sinkiangensis* (LU) H. AF R.

Aclistochara sinkiangensis (LU) H. AF R., n. comb. (fig. 3 a—c).

Chara sinkiangensis LU 1945, p. 34, pl. I, fig. 1 a—c.

[As regards *Chara sinkiangensis* LU 1946, p. 274, see below].

»Oogonium large, obovoid in shape, swollen at the middle, with the sides converging rapidly from the greatest diameter to the somewhat obtuse base and gradually to the truncate, slightly depressed and broad apex. Length ranging from 1125 μ to 1280 μ, breadth 935—1060 μ. Spiral-cells showing 8—9 convolutions, smooth, convex, with the sutures in broad and deep furrows. Width of these cells uniform, measuring about 130—160 μ. Equatorial angle about 16—18°. Tips of the spiral cells at the apex slightly depressed, giving rise to a remarkable rosette.» (LU 1945, p. 34).

Occurrence: about 20 km N of Kucha, Sinkiang (acc. to LU 1946, p. 274; the first, brief record of this locality, LU 1945, p. 33, reads »near Kucha»). —

Fig. 3. *Aclistochara sinkiangensis* (Lu) H. af R. Sinkiang: 20 km N of Kucha (Kuchar Group, Series C; Cretaceous—Lower Tertiary). — a: gyrogonite in lateral view; b: apical view; c: basal view. — After Lu 1945, pl. I, fig. 1 a—c. — All fig. 32/1.

Kucha Formation (=Kuchar Group of Norin 1935 b and 1941), Lower Bed (=Series C of Norin 1935 a, p. 77—78, 1935 b, p. 340—341), being »of Cretaceous or possibly Lower Tertiary age» (Norin 1941, p. 186).

Furthermore reported (Lu 1946, p. 273—274) from »at Kizil-Ming-Oi . . ., about 8 km north of Kucha and $^{1}/_{2}$ km east of the Kucha-Bai motor road», Sinkiang. — Kucha Formation (=Kuchar Group of Norin 1935 b and 1941), Middle Bed (=Series B of Norin 1935 a, p. 80, 1935 b, p. 340 ff.), which is acc. to Chaney 1935, p. 97 and Norin 1941, p. 186 of Pliocene age. — Regarding the age determination of the Series B, see notes p. 3—4.

This species — which, according to the descriptions and figures is doubtless referable to *Aclistochara* as defined by present students — was described from Pre-Pliocene deposits. It is included in this review because of its supposed occurrence in Pliocene beds of the Kuchar Group. Of its affinities, Lu (1945, p. 34) writes: »this new species is similar to *Chara meriani* Unger from the Miocene and Oligocene of Europe in the size and shape, but is distinguished from the latter by its truncate and very broad apex.» Judging from Lu 1945, pl. I, fig. 1 b, this paper fig. 3 b, the apical structure of *A. sinkiangensis* may largely correspond to that of the *A. staubi* type (cf. p. 9).

The gyrogonites from the Pliocene Series B of the Kuchar Group were never formally described, but only a reference made to the Cretaceous or Early Tertiary specimens described as *A. sinkiangensis*.

Considering the apparently considerable difference in age between the Series B and C of the Kuchar Group according to Norin (1941, p. 186) and the brief existence of the species of fossil charophytes so far investigated (Mädler 1953 a, p. 65), it seems less probable that the Pliocene gyrogonites referred to *Chara sinkiangensis* by Lu (1946) should be conspecific with the Cretaceous — Lower Tertiary specimens described under that name by LU (1945). Gyrogonites of the same general type as *A. sinkiangensis* were not rare in the Tertiary. LU's determinations show that such forms are apparently represented in the Pliocene of Sinkiang too. A re-deposition by riverine action of older deposits containing gyrogonites, which would explain the presence of the Cretaceous — Lower Tertiary *A. sinkiangensis* in Pliocene strata, should also be considered, but seems in this case less probable; this question is dealt with at some length under *Kosmogyra nodosa* (p. 16—18). Summarizing the evidence relating to the Pliocene specimens referred by LU (1946) to *Chara sinkiangensis,* it might be said that although gyrogonites of the same general morphological type may be expected in strata of this age, the identity of these Pliocene specimens with the type material of *A. sinkiangensis* remains to be proved.

3. *Kosmogyra nodosa* (LU) H. AF R.

Kosmogyra nodosa (LU) H. AF R., n. comb. (fig. 4 a—d).

Chara nodosa LU 1946, p. 275, fig. 2: 1 a—c, 2.

»Oogonia large, ovoid in shape, with sides converging rapidly from the greatest transverse diameter at mid-height toward the apical portion and regularly to the somewhat truncate base. Length about 1080 μ; breadth varies from 840 μ to 715 μ. Spiral-cells showing 14—15 convolutions, flat or occasionally sligthly concave, decorated with rounded tubercles at nearly regular intervals and with the sutures in convex, very narrow, but distinct ridges. The width of these cells is uniform, measuring about 76 μ, with an equatorial angle of 8°—9°. Apex unknown. Base narrow, truncate, projecting slightly to the proximal end.» (LU l.c.).

Occurrence: »at Kizil-Ming-Oi . . ., about 8 km north of Kucha and $^1/_2$ km east of the Kucha-Bai motor road», Sinkiang. — Kucha Formation (=Kuchar Group of NORIN 1935 b and 1941), Middle Bed (=Series B of NORIN 1935 a, p. 80, 1935 b, p. 340 ff.), which is acc. to CHANEY 1935, p. 97 and NORIN 1941, p. 186 of Pliocene age. — Regarding the age determination of the Series B, see notes p. 3—4.

According to our present knowledge and the system of the Charophyta adopted by MÄDLER (1952, 1953 a & b; cf. PECK 1953), gyrogonites with tubercular decoration in which the tubercles are cellular, i.e. situated along the middle of the spiral cells, should be referred to the genus *Kosmogyra* STACHE (1889, p. 130). This genus was first described from the Paleocene, and similar forms have later been found in various Eocene and Oligocene deposits; there is also a single record from the Miocene (Sarmatian) of Hungary (RÁSKY 1941, p. 302). In the latest surveys the range of *Kosmogyra* is stated »Paläozän bis Eozän» (MÄD-

LER 1953 a, p. 64) or »Unt.-Mittl. Tertiär» (MÄDLER 1953 b, p. 483). The Pliocene specimens described by LU (1946) extend the geological range of this type of gyrogonite, and are therefore included in this discussion.

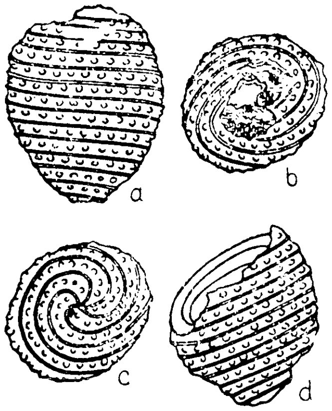

Fig. 4. *Kosmogyra nodosa* (LU) H. AF R. Sinkiang: 8 km N of Kucha (Kuchar Group, Series B; Pliocene). — a: the best preserved gyrogonite in lateral view; b: apical view; c: basal view; d: another specimen, lateral view. — After LU 1946, fig. 2: 1 a—c, 2. — All fig. approx. 25/1.

LU (op.c., p. 276) has compared the present species with the Lower Tertiary *Kosmogyra vasiformis* (REID & GROVES) PIA, to which it is rather similar in general shape. The latter — though varying in size — seems always to be considerably smaller and provided with fewer convolutions; judging by the original material of *K. vasiformis* — as figured by REID & GROVES (1921, pl. IV, fig. 13—15) — the arrangement of the tubercles differs in some degree from that of *K. nodosa*. This also applies to the gyrogonites which RAO & RAO (1939, p. 6, pl. I, fig. 5, pl. II, fig. 5 a—c) with some hesitation referred to REID & GROVES' species.

The nature of the tubercular decoration and the systematic position and affinities of these gyrogonites have been discussed repeatedly. Although some plausible explanations and important points have been brought out in the discussion, the problem still seems unsettled, at least partly. The writer wishes to stress that his reference of *Chara nodosa* to *Kosmogyra* does not mean that he has taken up a definite attitude to the rather intricate question whether a systematic distinction of so ornamented gyrogonites is tenable or not. The material necessary for that is not available. But it appears to be of some interest to point out that specimens of this particular type, which are especially characteristic of some Paleogene deposits, may have occurred up to the end of the Tertiary, a fact with some possible bearing on the morphological and systematical interpretation of these forms.

The present state of our knowledge of tuberculate gyrogonites will appear from the following brief summary.

Kosmogyra, described by STACHE (1889, p. 130), was made to include the large, spherical gyrogonites with tubercular decoration and flat or convex spiral cells occurring abundantly in some beds of the Middle »Liburnian Formation» (STACHE op.c., p. 86) which is considered equivalent to the Montian of the Paleocene (see e.g. EDWARDS 1932, p. 215). STACHE (op.c., p. 130) also established the genus *Kosmogyrella,* similar to *Kosmogyra,* but with concave spiral cells; both genera were included in the new subfamily *Kosmogyreae.* The latter division was adopted by MÄDLER (1952, p. 15, 1953 b, p. 483; see also PECK 1953, p. 225), but *Kosmogyrella* STACHE was dropped, and the new genus *Kosmogyrina* was established for gyrogonites with intercellular tubercular decorations (MÄDLER 1952, p. 5—6, 1953 b, p. 479).

Tuberculate gyrogonites were, however, known before STACHE established *Kosmogyra.* Such forms had been described by LYELL (1826, p. 94), HEER (1859, p. 150), and WATELET (1866, p. 54—56), and had been included in the genus *Chara.*

In 1913, TUZSON described a tuberculate type of gyrogonite as *Characeites verrucosa* (TUZSON 1913, p. 209). More or less similar specimens were by DOLLFUS & FRITEL (1920, p. 248—252) and by REID & GROVES (1921, p. 184—186) ascribed to *Chara.* However, in his survey of the fossil charophytes, PIA (1927, p. 90) referred all tuberculate gyrogonites — except two species of *Kosmogyrella* — to STACHE's *Kosmogyra.* This was amended to comprise not only the original spherical, but also the more or less oval types. PIA moreover included in *Kosmogyra* the Jurassic *Chara bleicheri* (SAPORTA 1873, p. 214), a form which, however, according to PECK & REKER (1947, p. 4, 1948, p. 85) belongs to the Clavatoraceae. GROVES (1933) again limited *Kosmogyra* to the original Liburnian species of STACHE, and listed the others under the genera in which they had been originally described. In recent years, gyrogonites of tubercular decoration have either been described as or referred to species of *Chara* (RAO & RAO 1939, p. 5—6, LU 1946, p. 275, PECK & REKER 1947, p. 4, 1948, p. 87), or included in *Kosmogyra* (RÁSKY 1941, p. 302—303, 1945, p. 46—52, 1952, p. 41—43). PECK & REKER (1948, p. 87—89) have proved that intercellular as well as cellular tubercular decorations occur in some species of *Aclistochara,* and MÄDLER has (1952, p. 6) referred a *Chara* species of RÁSKY (1945, p. 37) with intercellular tubercles to the new genus *Kosmogyrina.*

Opinions differ rather widely regarding the morphological interpretation of this kind of decoration. While for instance STACHE (1889, p. 130) considered the presence of tubercles sufficient to motivate the establishment of a new subfamily and new genera, DOLLFUS & FRITEL (1920, p. 247—249) included tuberculate and non-tuberculate forms in the same species, thus regarding tubercular decorations as not being important enough even for the delimitation of species. SCOURFIELD (in REID & GROVES 1921, p. 185) considered the tubercles of »*Chara*» *vasiformis* to be of organic origin, developed within the spiral cells, and REID & GROVES (op.c., p. 182) noted that no corresponding structure had been observed in recent »oospores». GROVES (1933, p. 41) left the matter open, noting that the tubercles, at least in some cases, »may merely represent an interrupted incrustation», a view »supported by the occurrence on a living species (*Chara delicatula*, Ag.) of an interrupted calcareous incrustation closely resembling the supposed tubercles on some of the fossils.» But GROVES also pointed out that »on the other hand, in many of the species enumerated below, the prominences are so evenly spaced, so symmetrical, and so definite in shape, as to seem to preclude the possibility of their being merely due to external incrustation.» With regard to some types of gyrogonites, RÁSKY (1941, p. 303) stressed that »die Verzierungen und Erhebungen der Spiralzellen waren derart gleichmässig verteilt und so regelmässig ausgebildet, dass ich es für ausgeschlossen halte, dass es sich dabei nur um Vorgänge der äusseren Rindenbildung handeln solle.» HORN AF RANTZIEN (1951, p. 664) noted that although the stage of growth may be responsible for some variation in tubercular arrangement in individual gyrogonites, and although the presence of tubercles may not be reliable evidence in the specific identification of a small specimen sample, the tendency to form tubercles seems to be of at least some systematic importance. PECK, who has considerable experience of tuberculate gyrogonites in North American deposits, holds an entirely different opinion, put forward in 1948 (PECK & REKER 1948, p. 88). These authors state that »tubercles may have little if any systematic value in the classification of the charophytes», and PECK (1953, p. 221) concludes »that the tubercles may or may not be present on a species and that, if present, they may be represented by varying degrees of prominence», and that »they [PECK & REKER] therefore included *Kosmogyra* as a synonym of *Chara*.» MÄDLER, on the other hand, considered »die Knoten eine taxonomische Besonderheit, die es rechtfertigt, der Gattung *Kosmogyra* eine besondere Unterfamilie *Kosmogyreae* in der Familie der *Characeae* einzuräumen» (MÄDLER 1953 b, p. 478). MÄDLER furthermore put forward two alternative interpretations of the nature of the tubercles. One postulates the existence of a hypothetical lamella situated in the inner wall of the spiral cell, a lamella which secretes calcium carbonate in the form of papillae at regular distances (MÄDLER 1952, p. 11). The other interpretation is that not only the walls of the spiral cells but also their nuclei — of which there are several in each cell — are calcified, and that the tubercles are formed by the latter (MÄDLER 1953 b, p. 478).

The occurrence and state of preservation of *K. nodosa* show some interesting points. The matrix is described by LU (op.c., p. 274) as »one piece of pale grey calcareous sandstone crowded with numerous oogonia; . . . among 94 specimens studied 67 are referred to *Chara sinkiangensis,* 25 belong to *C. nana* (sp. nov.) and two specimens belong to *C. nodosa* (sp. nov.).» Two pages later on, he gives the additional information that »this form is represented by only two incomplete crushed specimens. The cross-section along equator is oval and not circular as in other species from the Kucha Formation.»

It has been pointed out that the state of preservation and relative abundance of gyrogonites in a deposit may sometimes supply some information regarding the sedimentation conditions of this deposit (HORN AF RANTZIEN 1953, p. 8—10, 1954, in the press). This has been investigated in respect of alternating marine and lacustrine sediments. In most — possibly in all cases — the presence of gyrogonites in a marine sediment thus indicates a marine re-deposition of fresh-water sediments.

Re-deposition of gyrogonites might also be caused by running water, however, In that case, the gyrogonites of some riverine deposits might have been primarily deposited in an older geological environment. As far as the writer knows, however, no published accounts of occurrences of gyrogonites in riverine sediments have interpreted them as older than the matrix. It seems, nevertheless, that this question ought to be considered as a possible explanation of some remarkable records of types of gyrogonites outside their known geological range.

When considering a possible re-deposition of gyrogonites, there are two circumstances relating to their state of preservation and relative abundance that might conceivably affect the decision. One is when the gyrogonites are superficially corroded or otherwise fragmentary and broken up. This may be a result of weathering and transport from the original place of sedimentation, or may simply be due to unfavourable geological conditions for the preservation of the sometimes fragile gyrogonites during or after fossilization. The other is when in a large material from a comparatively small and structurally homogeneous piece of matrix, indicating uniform sedimentary conditions, some species are abundantly represented, while others are only found in single specimens. Observations on recent charophytes, and studies of some occurrences of their fossil forms the vegetative parts of which are also preserved — e.g. in the British Purbeck strata (HARRIS 1939) and in the »Liburnian Formation» at

Trieste (STACHE 1889) — prove that charophytes mostly grow in associations containing one or a few species only; the »oospores» of these will then be found in the sediment in considerable abundance. Exceptions occur of course, especially when changing environmental conditions cause some species to disappear and others are close on their tracks. As a rule, however, one particular patch is during a given space of time inhabited by only one or a few species of charophytes.

If, consequently, the frequencies of different types of gyrogonites occurring in a riverine deposit differ rather widely; if moreover the most sparsely represented kinds of gyrogonites appear to be in a somewhat weathered, corroded, broken up, and fragmentary condition; and if finally these gyrogonites are of types common in much older deposits but not found in rocks contemporary with that which is examined, it would seem that the possibility of a re-deposition should be considered. This does of course not imply that all such occurrences necessarily are re-depositions.

In the case of *Kosmogyra nodosa,* some circumstances indicate the possibility of re-deposition. *K. nodosa* is of a morphological type characteristic of the Lower Tertiary, and besides the two Sinkiang specimens there is only one more Neogene record of this genus, viz. from the Hungarian Miocene, in which according to RÁSKY (1941, p. 302) »ein seitlich stark zusammengedrücktes und beschädigtes Exemplar» was found. From LU's description it is furthermore clear that he found only two specimens of the *Kosmogyra*-type in a piece of matrix crowded with oogonia — a very small number in comparison with the frequencies (67 and 25) of the two accompanying types of gyrogonites — and these two specimens were moreover »incomplete» and »crushed».

As mentioned above, LU (op.c., p. 274) determined the fossil horizon of the Pliocene specimens as »equivalent, both in lithology and in stratigraphic position, to bed B of Norin», i.e. the Series B of the Kuchar Group. NORIN (1935 b, p. 341—342, and 1941, p. 186—187) described the composition of this bed as follows:

»Lithologically the Pliocene sediments are very similar to those which are being deposited in the Tarim basin today, with the exception that strata, which can be interpreted as fossil sand dunes have not been identified. In all the regions mentioned the sediments are developed in similar fine-grained facies suggesting a quietely proceeding sedimentation by rivers, which often changed their course. According to Chaney the sediments are characterized by a flora of the same general type as the vegetation, which at present time covers the shore zone of the large rivers and the swamps of the Tarim basin . . . From the evidence of the sediments and their flora we can get a rough idea about the principal geographic features of the Tarim basin during the Pliocene. It was then as it is now a large, drainageless continental basin with its deepest part in the east. The rivers from the surrounding higher land deposited their silt and sand forming wide flood plains and deltas, which soon transformed the basin into the immense flat plain, which it is today.» (NORIN 1935 b).

»The middle division, Series B, consists of gray, cream-coloured, and yellowish, indurated silt and silty sandstones with a thickness exceeding 500 m. A striking feature is the scarcity of red coloured or coarse-grained sediments. Lithologically, these sediments are very similar to those which are being deposited in the basin by the Tarim River system today. Fossil plants occur in abundance at several levels but only few species are represented. In a large collection made at the ruins of Qizil-ming-öi, west of Kuchar, CHANEY (1935) identified *Carex* sp., *Nuphar bohlini, Populus norini, Spirea sinkianga,* and *Typha* sp. This flora has, according to CHANEY, a Pliocene aspect. It represents a vegetation of the same general type as fringes the large water courses and the swamps of the Tarim Basin in present time, and suggests a climate only slightly more humid than the present.» (NORIN 1941).

The locality of *Kosmogyra nodosa* seems to be very near, or almost identical with, that in which the above-mentioned macrofossils were found. The lithological aspect of the sediment is evidently riverine material slowly accumulated in the deeper parts of a large basin.

Summarizing the above discussion of a possible re-deposition of the *Kosmogyra nodosa* gyrogonites, one explanation of their presence — which is somewhat surprising in view of the scarcity of the *Kosmogyra* type of gyrogonite in Neogene strata — might be that they were originally laid down in older deposits, perhaps the Lower Tertiary rocks of the Kuchar C Series, and subsequently freed from this first environment by erosion, and carried by running water to their present location in the Pliocene sediments.

It must be emphasized, however, that this theory, although supported by some observations on the material, will naturally be very difficult definitely to prove, particularly as no comparable observations on gyrogonites from other strata have been made. In cases like the present, it seems, however, important to bear in mind the possibility of re-deposition as an eventual source of error in discussing instances where gyrogonites are used as stratigraphic markers.

Nothing is known of the lithological conditions of the sediment in which the single *Kosmogyra* specimen from the Miocene of Pécs, Hungary, was found. The sparse information on this find precludes any statement as to whether it can be explained in the same or any similar way.

4. *Sphaerochara globosaforma* (PAPP) H. AF R.

Sphaerochara globosaforma (PAPP) H. AF R., n. comb. (fig. 5 a—c).

Chara globosaforma PAPP 1951, p. 282, Taf. 1, fig. 2 a—c.

»Gehäuse kugelig, in der Seitenansicht zehn Spiralwindungen zeigend; die Basis zeigt ein sehr kleines, fünfeckiges Loch, zu welchem die Spiralkämme mit einem deutlichen Knick hinziehen. An der Oberseite laufen die Spiralwindungen zusammen, ohne dass ein Krönchengestell zur Ausbildung käme.

In der Seitenansicht erscheinen die Flanken der Spiralwindungen schwach konkav, die Nahtlinie ist etwas eingesenkt, was in der Seitenansicht sichtbar wird.» (PAPP op.c., p. 283).

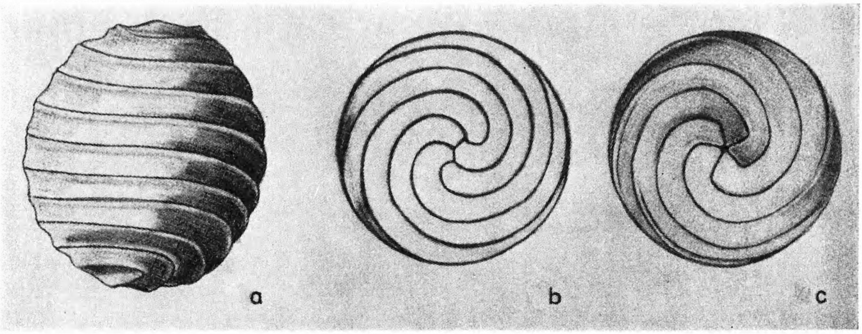

Fig. 5. *Sphaerochara globosaforma* (PAPP) H. AF R. Austria: Nieder-Österreich, Leobersdorf (Pliocene, Pannonian, Zone D). — a: holotype, gyrogonite in lateral view; b: holotype, apical view; c: holotype, basal view. — After PAPP 1951, Taf. 1, fig. 2 a—c. — All fig. approx. 33/1.

Occurrence: Ziegelei Polsterer, Leobersdorf, Nieder-Österreich, Austria. — Pliocene, Pannonian, Zone D (regarding the subdivisions of the Pannonian in the Vienna Basin, see PAPP 1948, p. 123 ff., and JANOSCHEK 1951, p. 599—610).

In 1925, GROVES, describing a new species of *Chara, C. brewsterensis,* from the Cretaceous of Texas, remarked that »these large broadly-ellipsoid fruits with more or less truncate extremities probably do not belong to the genus *Chara* as in its present restricted sense» (GROVES 1925, p. 13). A few years later GROVES (1933, p. 4) pointed out that »some of the fossil types . . . clearly do not belong to Chara, notably the large spherical type of the Upper Eocene and Oligocene Beds, of which C. medicaginula may be taken as the type.» A generic segregation of such gyrogonites from *Chara* thus seemed motivated, but was complicated by the fact that the typification and taxonomy of these large and spherical, often widely distributed forms of the Lower Tertiary were not well understood. As figured by some students, e.g. by DOLLFUS & FRITEL 1920, *Chara medicaginula* and *C. helicteres* — to take two of the most abundant forms — doubtless include gyrogonites with the apical structures characteristic of *Aclistochara,* but other gyrogonites that are neither referable to *Chara* s.str., nor to *Aclistochara* are also ascribed to the same species. As interpreted in later papers, many of these previously described species of gyrogonites are probably not conspecific with their types.

Spherical gyrogonites »vom Gipfelbau der Chareae und von ± kugeliger Gestalt ohne Verzierungen» were segregated by MÄDLER (1952,

p. 6), who referred these forms to the new genus *Sphaerochara*. The Upper Oligocene *Chara hirmeri* RÁSKY (1945, p. 36, Taf. I, Abb. 10—12) was selected as the genotype, and the above-mentioned *Chara brewsterensis* GROVES (1925, p. 12, fig. 1) and *C. perlata* PECK & REKER (1947, p. 3, pl. p. 2, fig. 19—21) as additional species. In a review of the stratigraphy of fossil charophytes, MÄDLER (1953 a, Taf. 1) indicated the distribution of these three species (Cretaceous and Oligocene). A gyrogonite of *Sphaerochara*, not specifically described, has recently been reported from the Middle Trias; in size and shape this comes rather close to the genotype (HORN AF RANTZIEN 1953, p. 7, 1954, in the press).

Besides of their spherical or very broadly oval shapes, the gyrogonites of *Sphaerochara* type are also characterized by the structures of their apical poles. The apical tips of the spiral cells are not at all, or very slightly, expanded, and turn together either into a point (*S. perlata* (PECK & REKER) MÄDLER, as figured by PECK & REKER 1947, pl. p. 2, fig. 19), or along a short broken line (the Middle Triassic *Sphaerochara* sp. acc. to HORN AF RANTZIEN 1954, in the press, or *S. brewsterensis* (GROVES) MÄDLER, as figured by GROVES 1925, fig. 1 b). One character relating to the calcification of the spiral cells has been pointed out by MÄDLER (1952, p. 11, Abb. 3 h—i), viz. that the spiral cells are hollow, though sometimes filled up with calcite, so that only a very small pore or slit is left of the original lumen. A possible explanation of this kind of structure, which was also observed and described by GROVES (1920, p. 126, fig. 1) and MASLOV (1947, p. 88, fig. 1), is that the calcite is excreted from the whole inner parietal surface of the spiral cell, while in other gyrogonites only the inner and lateral walls take part in the formation of the lime-shell. Although this feature may prove characteristic of the *Sphaerochara* species, similar phenomena have also been observed in gyrogonites whose apical structure conforms to that of the Aclistochareae (GROVES op.c., MASLOV op.c.). There is also a third character, which may possibly be of some use. The equatorial angles — i.e. the angles at which the enveloping cells cut the equator — of the so far known species of *Sphaerochara* are more acute than in other gyrogonites, except in some spherical species of the Aclistochareae and some of the Kosmogyreae (HORN AF RANTZIEN 1954, in the press).

Gyrogonites of *Sphaerochara* are apparently not particularly frequent, even if several more no doubt remain to be described. They seem at any rate to be less abundant than for instance forms referable to the Aclistochareae.

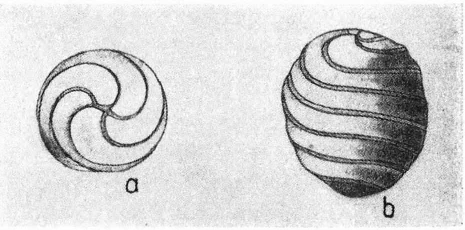

Fig. 6. *Sphaerochara rollei* (UNGER) H. AF R. Austria: Steiermark, Thal near Gratz (Miocene, Helvetian ?). — a: gyrogonite in apical view; b: lateral view. — After UNGER 1858, Taf. I, fig. 19—20. — Fig. 24/1.

In view of the few known instances of the occurrence of such forms, the present record from the Pliocene is of some interest. Only one specimen of *Chara globosaforma* is known, but according to the figures (PAPP 1951, Taf. 1, fig. 2 a—c), this seems to be very well preserved and fairly characteristic. The gyrogonite is figured as subspherical, the spiral cells as slightly convex or rather as flat, and the equatorial angle as between 5° and 10°; the tips of the spiral cells, which are not swollen, appear to unite at the apex into a short, broken line. As figured and described by PAPP, *Chara globosaforma* is doubtless referable to *Sphaerochara*, and is the latest known record of that genus.

As pointed out by PAPP (op.c., p. 282), *S. globosaforma* is rather similar to *Chara rollei* UNGER from the Miocene of Austria. This latter species is of some interest in this connection, and might for that reason be briefly discussed.

The type locality of *C. rollei* is the Castle of Thal in the vicinity of Gratz, Steiermark, Austria, and the type stratum Miocene beds, which with some doubt are ascribed to the Helvetian. The formal description (UNGER in ROLLE 1856, p. 546; cf. UNGER 1858, p. 9) reads:

»Ch. fructu elliptico. infra truncato (0.84 mm. longo, 0.76 mm. lato) valvis spiralibus a latere visis 7 concavis, commissura cristatis, basi intime conducatis, apice absque verrucis terminatis. — Terra lignitum ad castellum Thal prope Graecium, Stiriae.»

Figures of the original material (UNGER 1858, Taf. I, fig. 19—21; this paper, fig. 6 a—b) show the following features. In lateral view (UNGER op.c., fig. 19; this paper, fig. 6 b) the gyrogonite is of almost spherical shape. The upward directed pole — believed by UNGER to be the apical one — is slightly protruding, while the downward directed pole is more rounded. Judging by the figure, however, this should not be described as truncate. The spiral cells have 7 flat or slightly convex convolutions at a rather acute angle to the equator (in the separate, more magnified fig. 21 of the same paper the convolutions are reproduced as slightly concave). Fig. 20 (fig. 6 a of this paper) represents the same specimen from its lower, broader pole, which by UNGER is interpreted as the basal end. The tips of the enveloping cells are not united in a pore, but along a short broken line.

UNGER's figures and descriptions caused SCHIMPER (1869, p. 227) to say »M. Unger a pris le sommet pour la base, et c'est aussi dans ce sens qu'il a fait représenter ce fruit», and GROVES (1933, p. 29) also points out that »Unger evidently mistook the apex for the base». None of these authors gave any reasons for their opinions, but they are apparently quite right, for if the arrangement of the spiral cell-tips is correctly drawn in UNGER 1858, Taf. I, fig. 20 (this paper, fig. 6 a), the pole illustrated cannot be basal, but must be apical.[1] In another paper (HORN AF RANTZIEN 1954, in the press) the writer has attempted a brief survey of the various types of apical and basal arrangements met with in fossil gyrogonites and recent »oospores». Despite some variations the bases are in principle alike in one point, viz. in the presence of a small central pore, usually pentagonal, of less varying size than the apical orifice. In the living oogonium, this central basal pore was filled by an uncalcified basal cell. The basal tips of the enveloping cells, on the other hand, are never, as far as we know, meeting along a short broken line.

The spherical shape of the gyrogonite, and its apical structure, where the unexpanded spiral cell-tips meet along a broken line, show that *C. rollei* UNGER should be referred to *Sphaerochara*. Its citation and synonymy should be:

Sphaerochara rollei (UNGER) H. AF R., n. comb. (fig. 6 a—b).

Chara Rollei UNGER in ROLLE 1856, p. 546; UNGER 1858, p. 9, Taf. 1, fig. 19—21; SCHIMPER 1869, p. 227; GROVES 1933, p. 29; PAPP 1951, p. 283.

Gyrogonites Rollei PIA 1927, p. 90.

Our knowledge of the variations of *S. rollei* and *S. globosaforma* is not complete enough to show whether the two are sufficiently distinct to be maintained as separate species. The differences are, anyway, apparently small. *S. globosaforma* is larger (polar axis 1050 μ, largest equatorial diameter 900 μ) and ten convolutions are according to PAPP (op.c., p. 283) visible in lateral view (if also the partly visible convolutions at the poles are included, the specimen figured by PAPP, op.c., Taf. 1, fig. 2 a, has eleven convolutions). According to UNGER (1858, p. 9), *S. rollei* is 840 μ long and 760 μ at the equator; it has seven convolutions in lateral view. — *S. rollei* extends the range of the *Sphaerochara* gyrogonites also to the Miocene.

In this connection it might be of interest to note that the variations in the so far known gyrogonites of the *Sphaerochara* type are comparatively small, mostly variations in size. The Oligocene *S. hirmeri* is a rather small form, its polar axis being 500—550 μ and largest equatorial diameter 460—550 μ. It is of regular spherical shape, and its spiral cells, with 10—11 convolutions, cut the equator at a very acute angle

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[1] For that reason, fig. 19 of UNGER op.c. has been reversed in fig. 6 b of this paper, the apical end thus pointing upwards, according to the general usage when figuring gyrogonites.

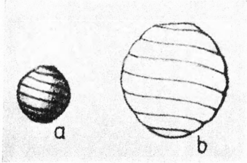

Fig. 7. »*Chara*» *granulifera* HEER. Switzerland: Kt. Vaud, Paudex and Belmont (to which of these localities the specimens figured are to be ascribed is unknown) (Miocene, Aquitanian ?). — a: gyrogonite in lateral view; b: lateral view. — After HEER 1855, Taf. IV, fig. 8 a—b. — a: 15/1; b: approx. 30/1.

($< 5^\circ$). It is not known whether the apical tips of its enveloping cells unite at a point or along a short line. The undescribed Triassic species is close to the genotype, but still smaller (polar axis c. 450 μ, largest equatorial diameter c. 460 μ), and shows 12 flat, cellular convolutions. Its equatorial angle is about 8°, and the apical cell-tips unite along a short broken line. This Triassic specimen belongs to the rather few known instances of gyrogonites whose equatorial widths exceed their lengths. This is still more pronounced in the apparently rather distinct *S. perlata* from the Cretaceous of Peru (polar axis 780 μ, largest equatorial diameter 810 μ). *S. perlata* differs from all other known species of *Sphaerochara* in being clearly truncate above and provided with high, rather narrow intercellular ridges; its convolutions — 7 or 8 in number — are accordingly concave. Apically, the spiral cells unite at a point. The Cretaceous *S. brewsterensis* from Texas belongs to the same size-group, but it is very broadly ovoid rather than spherical (polar axis c. 750 μ, largest equatorial diameter 650—675 μ). There are 12—13 flat or slightly convex, cellular convolutions at an acute equatorial angle; as figured by GROVES (1925, fig. 1 b), its spiral cells unite apically at a point. The Miocene *S. rollei* is slightly larger than *S. brewsterensis,* but otherwise of similar shape; as described by UNGER, the principal differences are: fewer convolutions (7), less convex spirals, and the apical cell-tips meeting in a broken line. The Pliocene *S. globosaforma* is the largest known species of *Sphaerochara*. It is similar to *S. rollei,* but larger, and more convolutions are visible.

In this connection it may be noted that another Miocene type of gyrogonite, *Chara granulifera* HEER (1855, p. 27), might possibly, according to the description (»Ch. fructu globoso, minimo, obtuso, spiris a latere visis, 7—8, planis, rarius convexiusculis») and illustrations (HEER op.c., Taf. IV, fig. 8 a—b, reproduced in SCHIMPER 1870—1872, as pl. V, fig. 47, and in this paper as fig. 7 a—b), have to be referred to *Sphaerochara,* but absence of adequate information on its apical pole structure makes this question difficult to decide without access to the type material. It has been reported from deposits in Switzerland and Alsace ascribed to the Aquitanian.

List of Pliocene Charophyta.

Besides the four species revised and discussed above, there are records of some more Pliocene charophytes, most of which have recently been published in a paper by PAPP (1951) on the Neogene gyrogonites of Austria. They have all been ascribed to the genus *Chara*. Several probably belong to other genera, but in most cases the information available does not permit their definitely referred to any particular organ-genus. For the sake of convenience, the Pliocene charophyte species known to the writer are listed below in alphabetical order.

1. ***Aclistochara nana*** (LU) H. AF R. See p. 3.

2. ***Aclistochara sinkiangensis*** (LU) H. AF R. See p. 10.

3. ***Chara escheri*** BRAUN ex UNGER.

Chara Escheri »ALEX. BRAUN *Manusc.*» UNGER 1850, p. 34.
Gyrogonites Escheri PIA 1927, p. 90.

For synonymy and illustrations up to 1933, see GROVES 1933, p. 17. Later contributions: PAPP 1951, p. 287, Taf. 3, fig. 11—14; CROFT 1952, p. 212, pl. 19, fig. 21—28, text-fig. 7 A, C.

Pliocene occurrences: Burgau, Burgenland, Austria (Pannonian, Zone D, acc. to PAPP l.c.). — Eichkogel at Mödling, Nieder-Österreich, Austria (Pannonian, Zone H, acc. to PAPP op.c., p. 288). — As to the subdivisions of the Pannonian in the Vienna Basin, see PAPP 1948, p. 123 ff. and JANOSCHEK 1951, p. 599—610. — For Pre-Pliocene records (ascribed to the Oligocene — Miocene), see references in GROVES l.c. and PAPP 1951, p. 287.

C. escheri — a common, widely distributed type of gyrogonite — is complex and ill-defined. Some gyrogonites ascribed to this species doubtless belong to the Aclistochareae, others may possibly be referred to *Chara* s.str. One of the forms referred to this species has been studied in detail by CROFT (l.c).

4. ***Chara longovata*** PAPP.

Chara longovata PAPP 1951, p. 289, Taf. 3, fig. 17—18.

Pliocene occurrence: Delsenbachgasse, Vienna, Austria (Pannonian, Zone E, acc. to PAPP l.c.). — Regarding the Pannonian subdivisions, see *C. escheri*.

This is a fairly characteristic type of gyrogonite, oblong or subcylindrical with more or less truncate poles and 13—14 narrow, convex, flat or slightly concave convolutions. Its polar axis is 500—600 μ long, its largest equatorial diameter 350 μ. More or less similar gyrogonites have been described from older deposits, e.g. *Aclistochara minima* MÄDLER (1952, p. 21, Taf. A, fig. 30—35) of the Kimmeridge, *A. jonesi* PECK and *A. elongata* PECK of the Morrison (PECK 1937, p. 88—89, pl. 14, fig. 12—15, 24—25), *A. cylindrica* PECK (1941, p. 291, pl. 42, fig. 38—39, 41—44) of the Draney and the Bear River of the Lower Cretaceous, and *Chara tornata* REID & GROVES and *C. subcylindrica* REID & GROVES of the Upper Eocene (REID & GROVES 1921, p. 187, pl. V, fig. 1—5). *C. longovata* differs in a number of characters from the gyrogonites mentioned above, however. In the general shape it also shows some resemblance to the »oospores» of some recent species of *Chara* s.str., which have less pointed poles than is usual in the genus, e.g. *C. aculeolata* KÜTZING ex REICHENB. (*C. polycantha* BRAUN ex LEONH.). *C. longovata* may belong to the types usually referred to the Aclistochareae, but its systematical position cannot be ascertained without access to the type material.

5. *Chara majoriformis* PAPP.

Chara majoriformis PAPP 1951, p. 282, Taf. 1, fig. 1.

Pliocene occurrence: Eichkogel at Mödling, Nieder-Österreich, Austria (Pannonian, Zone H, acc. to PAPP l.c.). — Regarding the Pannonian subdivisions, see *C. escheri*.

Two specimens of an almost spherical, very large gyrogonite (polar axis 1370 μ) were found by PAPP among *Chara meriani*. From PAPP's description they appear to have the apical structure characteristic of the Aclistochareae, though this question cannot be settled with certainty. PAPP points out that they may be allied to *C. meriani*.

6. *Chara meriani* BRAUN ex UNGER.

Chara Meriani »ALEX. BRAUN *Manusc.*» UNGER 1850, p. 34.

Chara meriani meriani PAPP 1951, p. 283, Taf. 1, fig. 3, 4 a—c.

Gyrogonites Meriani PIA 1927, p. 90.

A list of synonyms and illustrations is given by GROVES 1933, p. 25—26. Later contributions: MASLOV 1947, p. 81, 88, fig. 7—11; PAPP l.c.

Pliocene occurrences: Ziegelei and Sandgrube, Leobersdorf, Nieder-Österreich, Austria (Pannonian, Zone C). — Götzendorf, Moosbrunn, Nieder-Österreich, Austria (Pannonian, Zone F). — Mödling, Eichkogel, Nieder-Österreich, Austria (Pannonian, Zone H). — Tihany, Öcs, Hungary (Pannonian, »obere Congerienschichten»). All references acc. to PAPP op.c., p. 284. — Regarding the Pannonian subdivisions, see *C. escheri*. — For Pre-Pliocene records (ascribed to the Oligocene—Miocene) see references in GROVES 1933, p. 26, and moreover MASLOV op.c., p. 90, PAPP l.c.

The remarks as to the imperfect knowledge of the taxonomy of *C. escheri* also apply to this species. Pliocene specimens — as figured by PAPP — have apical characters which might motivate their inclusion in the Aclistochareae as defined by MÄDLER (1952).

7. *Chara meriani* ssp. *minoritesta* PAPP.

Chara meriani minoritesta PAPP 1951, p. 284, Taf. 2, fig. 5—6.
Pliocene occurrence: Mödling, Eichkogel, Nieder-Österreich, Austria (Pannonian, Zone H, acc. to PAPP l.c.). — Regarding the Pannonian subdivisions, see *C. escheri.*

These gyrogonites are slightly smaller (polar axis 1010 μ) than those of *C. meriani meriani* of PAPP 1951, p. 284 (polar axis 1300 μ). They were found in association with the latter.

8. *Chara multispira* PAPP.

Chara multispira PAPP 1951, p. 289, Taf. 3, fig. 16.
Pliocene occurrence: Delsenbachgasse, Vienna, Austria (Pannonian, Zone E, acc. to PAPP l.c.). — Regarding the Pannonian subdivisions, see *C. escheri.*

A broadly ovoid type of gyrogonite, polar axis, c. 550 μ, with 13 slightly convex, narrow, cellular convolutions. The rather truncate apical pole, as figured by PAPP, might indicate some affinity with the Aclistochareae, or with *Obtusochara* among the Chareae, but definite evidence is lacking.

9. *Chara spirocarinata* PAPP.

Chara spirocarinata PAPP 1951, p. 285, Taf. 2, fig. 8 a—b.
Pliocene occurrence: Mödling, Eichkogel, Nieder-Österreich, Austria (Pannonian, Zone H, acc. to PAPP l.c.). — Regarding the Pannonian subdivisions, see *C. escheri.*

As described and figured by PAPP, *C. spirocarinata* doubtless belongs to the Aclistochareae as defined by MÄDLER (1952). The structure of its apical pole is diagnostic. Owing to its somewhat doubtful distinctness as a species, no formal transfer to the Aclistochareae has so far been considered desirable.

10. *Chara stiriaca* UNGER.

Chara stiriaca UNGER in ROLLE 1860, p. 49, Taf. IV, fig. 6.
Gyrogonites stiriacus PIA 1927, p. 90.

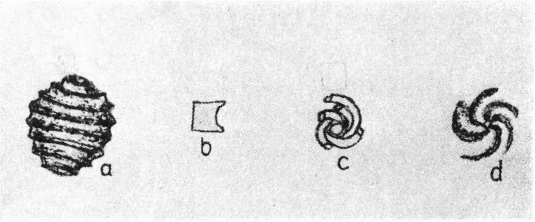

Fig. 8. »*Chara*» *zoberbieri* v. FRITSCH. Germany: Thuringia, Rippersroda (Pliocene, Reuverian). — a: gyrogonite »von der Seite»; b: »ungefährer Umriss des Durchschnittes eines der Spiralbänder»; c: »Obertheil der Frucht von innen gesehen. Scheibe unter der Coronula»; d: »Unteres Ende von aussen.» After v. FRITSCH 1885, Taf. XXVI, fig. 2—5. — a, c, d: approx. 20/1; 6: approx. 40/1.

References in GROVES 1933; p. 31; see furthermore PAPP 1951, p. 285, Taf. 2, fig. 7 a—b.

Pliocene occurrence: »Pannon, Ziegelei Polsterer bei Leobersdorf (Zone D nach Papp) ein Exemplar (Bestimmung unsicher)» (PAPP l.c.).

C. stiriaca (described from Hundsdorf in Steiermark, Austria; Miocene) seems a fairly characteristic species. As figured by UNGER (l.c.) and PAPP (l.c.) it might possibly be referred to the Aclistochareae, in which case it would be allied to the species of *Aclistochara* characterized by very narrow apical openings (cf. MÄDLER 1952, Abb. 1 a, 1953 b, Abb. 17 a), i.e. of the apical type of *A. kimmeridgensis*.

11. *Chara zoberbieri* v. FRITSCH.

Chara Zoberbieri v. FRITSCH 1885, p. 424, Taf. XXVI, fig. 2—5; this paper fig. 8 a—d.

Gyrogonites Zoberbieri PIA 1927, p. 90.

»Kleine fast kugelige Früchte von 0,62—0,65 Millimeter Länge, 0,55—0,56 Millimeter Breite. Die zusammengerollten 5 Valven gehen je 1 ½ mal um die Spore, so dass mann von aussen 8 Rippen sieht, die der Verbindung je zweier, mit erhöhten Rändern an einander stossenden (also aussen ausgehöhlten) Spiralschalen entsprechen. Zwischen je zweien der Spiralbänder wird die feine Trennungslinie unter dem Mikroskop sichtbar. Die Coronula scheint auf einer kreisrunden, von innen sichtbar werdenden Scheibe gestanden zu haben.» (v. FRITSCH l.c.).

References in GROVES 1933, p. 37.

Pliocene occurrence: Rippersroda, at »der zahmen Gera», Thuringia, Germany (v. FRITSCH l.c.). Acc. to KIRCHHEIMER (1940, p. 150) this deposit is Middle Pliocene (Reuverian).

The description and figures cannot be used for a reference of this species to any of the Tertiary genera of fossil charophytes. Its almost spherical shape, and the description of its apical pole, do not appear to conform very well to the corresponding features of *Chara* s.str. gyrogonites. Its ascription to that genus is accordingly open to doubt. It may belong to the Aclistochareae or to *Sphaerochara* according to the definitions of these groups of gyrogonites, but this cannot be decided without examining the type material.

v. FRITSCH has compared the gyrogonites of *C. zoberbieri* with the smaller and more oblong-oval *Chara sadleri* UNGER of the Ödenburg Miocene (cf. UNGER 1850, p. 36, 1852, p. 81, pl. 25, fig. 7—9).

Also another type of gyrogonite is mentioned from the Rippersroda deposits (v. FRITSCH op.c., p. 425). This differs considerably from *C. zoberbieri,* but as it has not been specifically described it has not been separately listed in the present paper.

12. ***Kosmogyra nodosa*** (LU) H. AF R. See p. 12.

13. ***Sphaerochara globosa*** (PAPP) H. AF R. See p. 18.

Summary.

In connection with a survey of the records of charophyte gyrogonites in Pliocene deposits (p. 24—28), some revisions have been made on the basis of descriptions and illustrations of various species.

1) *Chara nana* LU from the Pliocene Bed B of the Kuchar Group of Sinkiang belongs to the genus *Aclistochara* as defined by present students of this group, and the new combination *Aclistochara nana* (LU) H. AF R. is made. *Chara sinkiangensis* LU from the lower Bed C (Cretaceous—Lower Tertiary) of the Kuchar Group, with a doubtful record also from the Pliocene Bed B of the same group, also belongs to this genus (*Aclistochara sinkiangensis* (LU) H. AF R., n.comb.). With regard to further Pliocene occurrences of the Aclistochareae, it is noted that *Chara spirocarinata* PAPP (Pannonian, Austria) doubtless belongs to this group, as probably also *Chara stiriaca* UNGER (Austrian Miocene, a doubtful record from the Austrian Pliocene). New nomenclatural combinations of the two latter species have not been made. The diagnostic characters of *Aclistochara* and their morphological interpretations are briefly reviewed. *Aclistochara* is a rather heterogeneous assemblage of forms that ought to be divided further. The stratigraphic distribution of this group is wide, and includes the Middle Trias, Upper Jurassic, Cretaceous, and most of the Tertiary up to the Lower Miocene; the present paper shows that some species also occur in the Pliocene. Some records from the Pennsylvanian ascribed to *Aclistochara* are also discussed; the affinities of these Pennsylvanian remains seem still doubtful, however.

2) The gyrogonites of tubercular decoration, referred to the Kosmogyreae, and found in the Paleocene—Miocene, are also represented in the Pliocene, *Chara nodosa* LU from the Pliocene Bed B of the Kuchar Group of Sinkiang being doubtless referable to that group (*Kosmogyra nodosa* (LU) H. AF R., n. comb.). The Kosmogyreae are surveyed, and the nature of their tubercular decoration discussed. As regards the isolated finds of tuberculate gyrogonites from the Miocene (Sarmatian) and the Pliocene, the possibility of interpreting them by a re-deposition of older deposits by river action is discussed. Even though there is no conclusive evidence of re-deposition, Miocene and Pliocene finds of tuberculate gyrogonites may be explained in this way, in which case the primary occurrences of these gyrogonites would be Paleogene.

3) A spherical gyrogonite from the Austrian Pliocene (Pannonian), *Chara globosaforma* PAPP, should — as described and figured — be referred to the genus *Sphaerochara* (*S. globosaforma* (PAPP) H. AF R., n. comb.). Species referred to *Sphaerochara* and their morphology are discussed. The present species is compared with other forms of the same genus, and also with *Chara rollei* UNGER (Miocene of Austria). According to the illustrations published, the latter species should be referred to *Sphaerochara* as *S. rollei* (UNGER) H. AF R., n. comb. A further Miocene type of gyrogonite, *Chara granulifera* HEER, might possibly also be included in the same genus, but its systematical position can only be settled by an examination of the type material. Forms referable to *Sphaerochara* are known from the Middle Trias, Cretaceous, and Oligocene; species discussed in this paper widen the geological range of this genus to include also the Miocene and the Pliocene.

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BOTANISKA NOTISER 1954, HÄFTE 1. LUND

The distribution of Pseudoperonospora erodii (Fuck.) Wilson in Skåne (Scania), South Sweden.

By ARNE GUSTAVSSON.

(Meddelanden från Lunds Botaniska Museum nr. 107.)

In an earlier paper (GUSTAVSSON, 1953) I mentioned some collections of this fungus from the autumn of 1952. Then I found it in five localities in South Sweden, which was rather interesting as it had not earlier been reported from our country.

GÄUMANN (1923) gave the distribution of the fungus on *Erodium cicutarium* (L.) L'Hér. as the following countries: Germany, Austria, Denmark and Russia. Moreover DENNIS (DENNIS and WAKEFIELD, 1946) reported a finding from England. In a personal communication to me he wrote that he had not seen the fungus since then, but that it »is a very inconspicious fungus and may be more plentiful than the records suggest».

During the summer and autumn of 1953 I was also interested in *Pseudoperonospora erodii* and tried to clarify its distribution in Skåne. The investigation has indicated that this fungus, not earlier known from Sweden, seems to be rather common in Skåne. DENNIS is undoubtedly right when he says that the fungus is difficult to discover, but it forms so characteristic spots on the leaves of the host that with a little practice it is rather easily detected. The spots are often numerous but, as a rule, rather small. Their colour changes from faint greenish yellow to dark red. The attacks are often weak, but sometimes a great part of the underside of the leaves is covered by the dense greyish violet felt formed by the conidiophores.

As is seen from the map (fig. 1), I have found the fungus in many places in Skåne. The small intervals here and there are probably not due to the absence of the fungus in these places. They are more likely

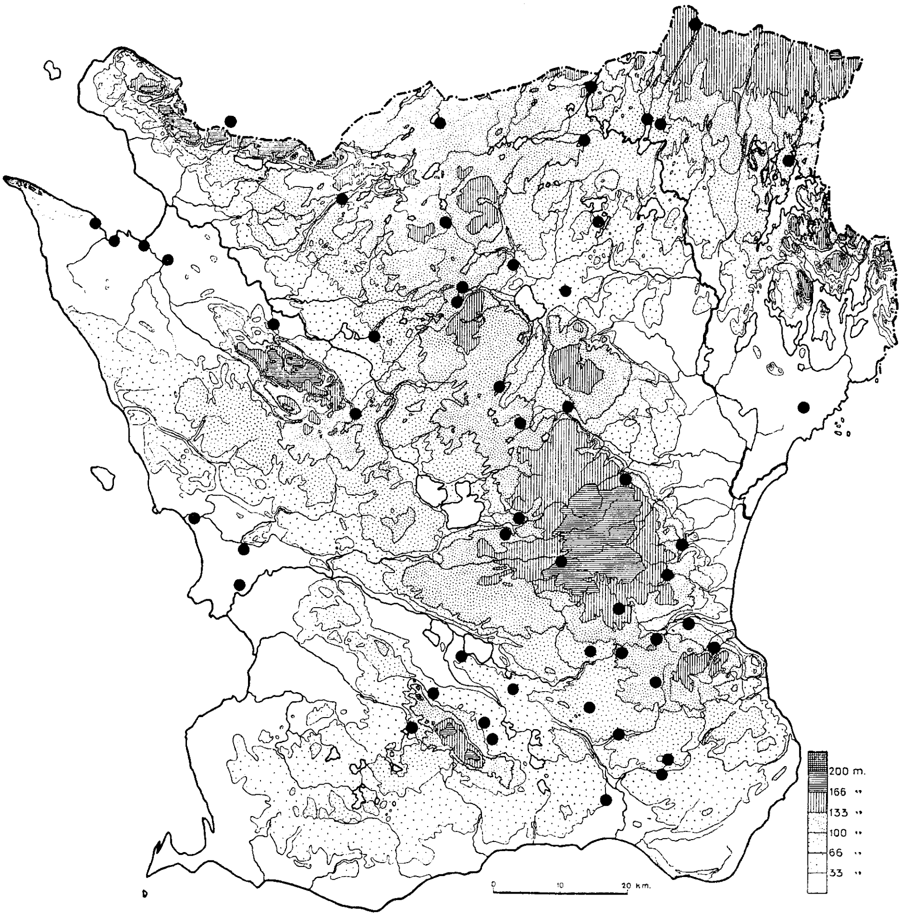

Fig. 1. Map of the distribution of *Pseudoperonospora erodii* in Skåne.

to be regarded as gaps in the investigation. As all these are not very extensive, I believe that they have no greater importance.

This fungus is not mentioned in the list of the micromycetes of Skåne that was published by HAMMARLUND in 1932. It seems rather curious that HAMMARLUND, who had worked on the list for several years, quite overlooked this species. However, this shows how easily such a fungus may escape notice. It may be very difficult to discover the first time, but after this it may be found more frequently.

The appearance of the conidiophores has been treated by both GÄUMANN and DENNIS, therefore only a photograph of a conidiophore (fig. 2) is included here.

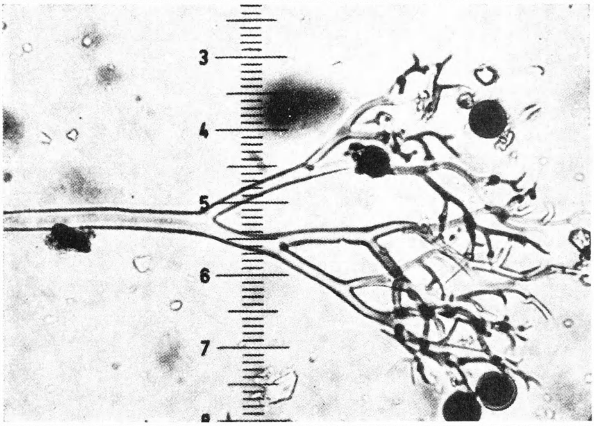

Fig. 2. Conidiophore from *Pseudoperonospora erodii*. 8×40. Ten divisions of the scale correspond to about 42 μ. From collection no. 3748: Tryde, 300 m. northwest of the church, field. 22/9 1953.

The conidia are as a rule somewhat ovoid or almost circular. In order to determine the variation between different localities I have measured 100 conidia from each of 20 collections according to the method employed in my earlier investigation (GUSTAVSSON, 1953). The average values thus obtained have been placed into a coordinate system (fig. 3). As may be seen from this, the variation in length and breadth is rather great. The average length varies between 21.9 and 24.6 μ with a rather marked concentration of the points between 22.5 and 23.5 μ. The average breadth lies between 18.9 and 21.9 μ. Most of the points are concentrated in this case between 20.0 and 21.5 μ. The quotient of length divided by breadth varies between 1.08 and 1.18. Almost half of these values lies between 1.08 and 1.11.

In my last paper I discussed some of the conceivable causes of this variation. I mentioned there as possible factors, in addition to the natural variation, the humidity and the temperature of the air with reference to GÄUMANN among others. Furthermore, the age of the condia may perhaps have a certain influence on the results; younger conidia may give lower values than older ones. Too old conidia may also change the result somewhat; especially those of old collections where many conidia often are destroyed and perhaps impossible to measure.

Finally, I will mention a cause of error, which is surely of very little importance but still may be worth mentioning. Many times it is difficult to decide whether a certain conidium really lies under the cover glass in such a position that the real length and breadth are measured. If a conidium lies inclined, this is rather easily seen, but it cannot be detected whether the conidium is standing on edge. When the conidia are long

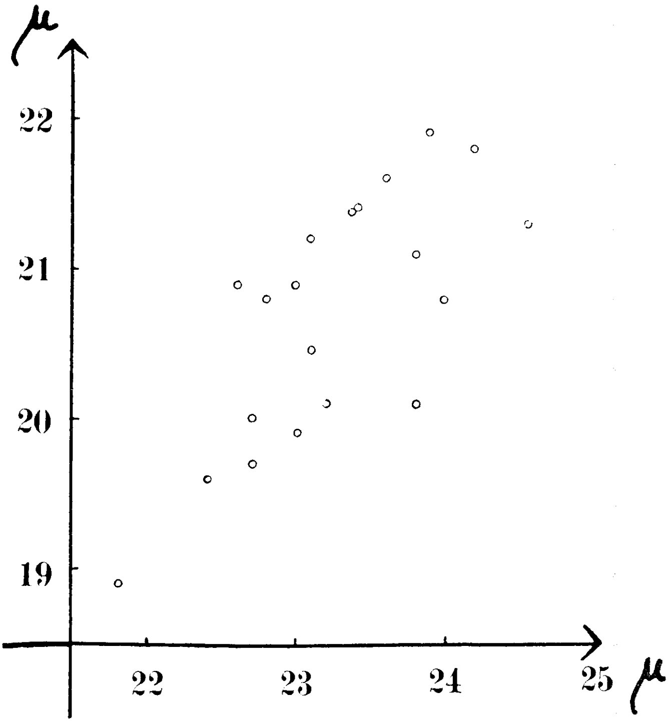

Fig. 3. Diagram over the size of the conidia in 20 collections of *Pseudoperonospora erodii.*

and narrow, this possibility is probably rather slight, but when, as is the case with *Pseudoperonospora erodii,* they are almost globular, the possibility must be much greater. The average length and consequently also the quotient will then be a little too small.

Several authors, when describing new species of this and related genera, have measured conidia from a single collection and then given very exact statements about the average length and breadth of the conidia. As the variation between different collections of the same fungus can be as great as this little investigation shows (fig. 3), this method should not be used. It would be better to give only approximate maximum and minimum values for the measurements.

This variation between different collections has also been shown by HOLM (1946), who placed values from several collections into a coordinate system in the same manner as described here. He had been working with several species of *Plasmopara* and tried to show that it may be possible to separate them in this way. As I have material from only a single species of *Pseudoperonospora,* I cannot carry out a similar investigation. However, later on I hope I shall be able to make the same type of study with some species of the related genus *Peronospora.*

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BOTANISKA NOTISER 1954, HÄFTE 1. LUND

On Neohodgsonia H. Perss., the new hepatic genus from New Zealand and Tristan da Cunha.

By HERMAN PERSSON.

Five years ago, I received for determination from Professor G. E. DU RIETZ of Uppsala a collection of bryophytes from his journey in New Zealand in 1926—1927. Among them was a specimen of *Marchantiales* which was immediately recognized as representing a new genus. I made inquiries about this plant and, through the kindness of Mrs. E. A. HODGSON, I got in touch with Mr. K. W. ALLISON, one of the most successful collectors in New Zealand. He had not collected this hepatic himself but had some material from certain other localities. He was kind enough to send me part of this — rather scanty — material, mainly dried specimens.

Later I surprisingly found that the new genus was represented from several localities in a collection brought home from Tristan da Cunha by the Norwegian expedition in 1937—1938 under the leadership of Dr. E. CHRISTOPHERSEN [the Tristan plant (fig. 2), which is at least nearly related to the New Zealand, will be dealt with by Dr. S. ARNELL in his work on the hepatic collections of the Norwegian expedition].

Due to special circumstances the new genus was preliminarily published, without any illustrations, under the name of *Hodgsonia* in December, 1953 (PERSSON 1953). Unfortunately I had overlooked that the name of *Hodgsonia* had been used some 100 years ago for a genus of phanerogams. In a brief correction I published the name of *Neohodgsonia* for this genus (PERSSON 1954).

Since these publications are less accessible, it seems appropriate to publish here a somewhat extended description of *Neohodgsonia*. A serie of photographs will be added. For a more detailed description the reader is referred to a forthcoming paper, based on fresh material, by Miss E. CAMPBELL, Palmerston North, N.Z.

The new genus has been named for Mrs. E. A. HODGSON, Wairoa, the wellknown New Zealand hepaticologist.

Neohodgsonia H. PERSS. (*Marchantiaceae*)

Neohodgsonia H. PERSS., Correction, Stockholm 14.I.1954. — Syn.: *Hodgsonia* H. PERSS., Stockholm 22.XII.1953, non HOOK. f. et THOMS. in Proc. Linn. Soc. ii. (1853) 257, non. F. MUELL. Fragm. ii. (1860).

Polyoica (monoica et dioica). Thallus habitu staturaque generi Marchantiae simillimus. Stratum anticum altum, cavernosum. Stomata composita, cellulis 4—6, triseriatis cincta. Squamae posticae uniseriales. Pedunculus carpocephali 5—12-capsulus, ex apice frondis, sulco uno rhizophoro, superne bis bifurcatus, ramulis carpocephalo capsulis 2—3 ferentibus vel modo bifurcatus, carpocephalo bilobato lobisque iterum bilobatis, utrisque capsula una instructis. Capsula ovoidea, in sinuum caverniformem inclusa, pariete ventrali cuius rimis longitudinalibus disrumpet. Elateres c. 400 μ, bispiri. Pedunculus masculinus dioicus ex apice frondis, monoicus ex parte mediano thalli, prope pedunculum carpocephali ortus. Scyphuli formam posituramque iis Marchantiae similes.

Species singula adhuc nota, Novae Zeelandiae.

Neohodgsonia mirabilis H. PERSS.

Neohodgsonia mirabilis H. PERSS., Correction, Stockholm 14.I.1954. — Syn.: *Hodgsonia mirabilis* H. PERSS., Stockholm 22.XII.1953.

Thallus c. 3 cm longus, c. 0,8 cm latus, iterum bifurcatus, apice breviter incisus, tenuiter reticulatus. Costa c. sextam partem diametrum thalli metientem, sensim in alas attenuata, ventro parum prominens, rhizoideis numerosis vel latis, parietibus tenuibus vel valde angustioribus, parietibus crassis praedita. Stratum anticum altum cavernosum, cavernis bi- vel subtristratis. Stomata composita, triseriatis cincta, serie utraque cellulis 4(—6), poro externo magno, c. 45 μ longo, aperto, inferno subquadrato. Cellulae epidermidis ubique leptodermes, c. 30—40×60—90 μ. Squamae posticae mediocres, uniseriales, oblongae ovatae

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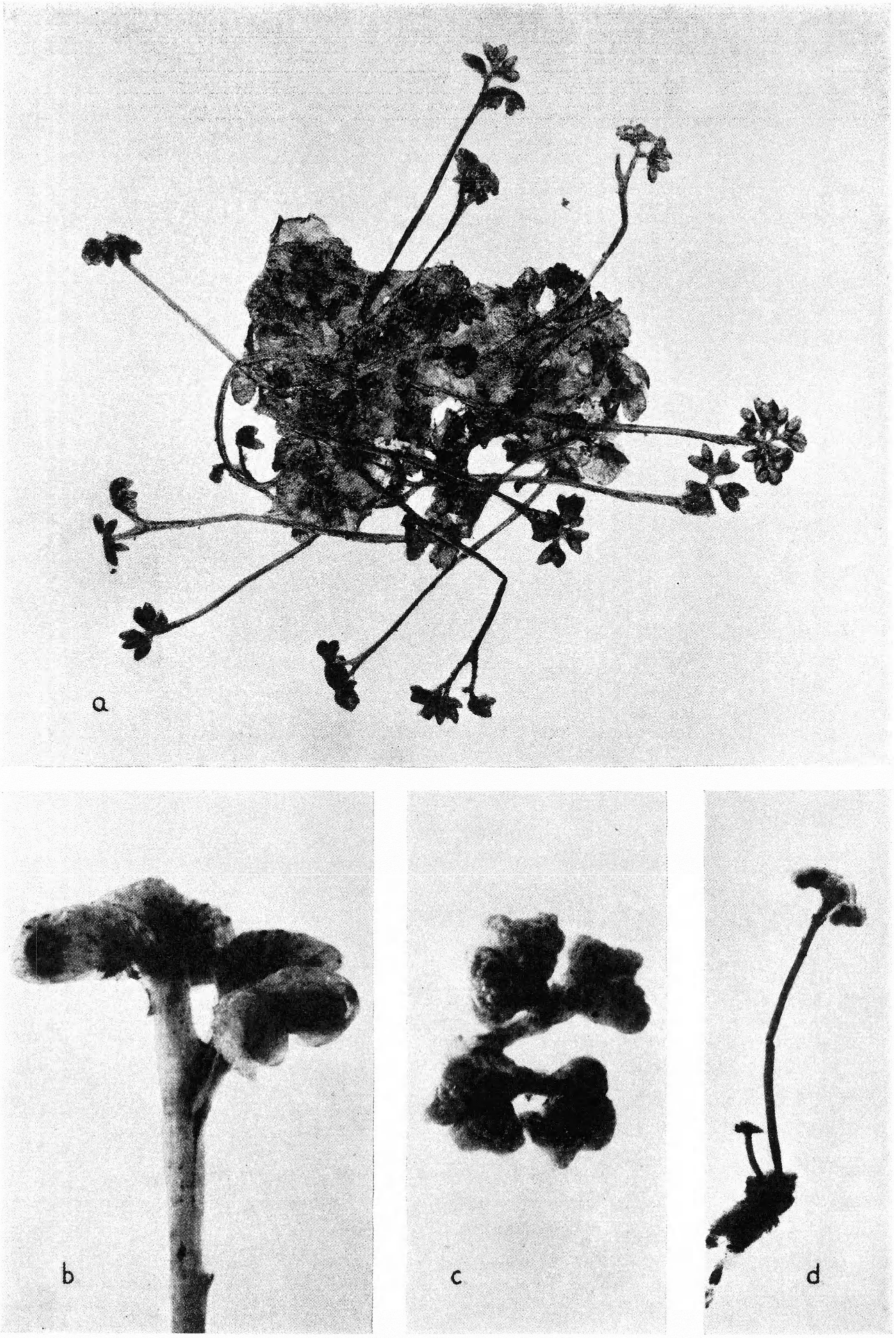
Fig. 1. *Neohodgsonia mirabilis* H. PERSS. a: part of the type from New Zealand, Doubtful Sound, G. E. & G. DU RIETZ 2035: 1. Dried. 1/1. — b: upper part of a female receptacle seen side-face, New Zealand, Mt Holdsworth, N. S. BUTLER 2583. Alcohol. 5/1. — c: female receptacle seen from above, do. — d: thallus with female (the longer one) and male receptacle, do. Dried. 1/1 (all: material in Herb. Palaeobot. Dept., Swedish Museum of Natural History, Stockholm). — Photo: K. E. SAMUELSSON.


a
b
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— lingulatae, obtusae — subacutae, integerrimae vel leviter crenulatae, non appendiculatae, secus marginem costae collocatae. Alae tenuissimae pellucidae, ventro plumiformiter cristulatae, cristulis rubro-brunneis, intus cavernis stomatophoris praeditae et inter eas canalibus latis, 75—200 μ diametro (etiam costa canalibus similibus instructa), succo rubro-brunneo saepeque corporibus ± ovoideis rubro-brunneis, c. 30 μ longis completis (corporibus oleiferis?). Pedunculus carpocephali 5—12-capsulus, ex apice frondis ortus, pallidus, plerumque 2—5 cm longus, squamae minores ovoideae — lanceolatae, subacutae sparse vestitus, sulco uno rhizophoro supra medium pedunculi bifurcato institutus (latere opposito sulci strato cavernoso, cavernis uniserialibus), superne bis bifurcatus, ramulis carpocephalo triangulari, capsulis 2—3 ferentibus vel modo bifurcatus, carpocephalo bilobato lobisque iterum bilobatis, utrisque capsula una instructis. Carpocephalus dorso grosse verrucosus, strato cavernoso vestitus, cavernis stomatophoris, sat magnis numerosis, ventro strato tenui bicellulari, basi corona squamarum parvarum ornatus. Capsula ovoidea, parietum incrassatio nodulosa et incompletiter semiannulata, in sinum caverniformem inclusa pariete ventrali cuius rimis longitudinalibus disrumpet. Sporae rubro-brunneae, angulato-globosae, c. 17—23 μ diametro, ± glabrae, sat late alatae. Elateres c. 400 μ longi, bispiri. Pedunculus masculinus c. 1 cm longus, dioicus ex apice frondis, monoicus ex parte mediano thalli, prope pedunculum carpocephali ortus. Capitulum masculinum parvum, disciforme, fere circulare, margine lato tenuissimo, pori canalium antheridiorum dorsales. Scyphuli (quod continent ignotum est) rari, 2—2,5 mm diametro, formam posituramque iis generi Marchantiae similes, lobati, margine ciliato-denticulato.

New Zealand: South Island, Fiord Bot. Distr., Doubful Sound, track from Wilmot Pass to Deep Cove, montane forest belt, March 1, 1927, G. EINAR & GRETA DU RIETZ 2035: 1 (Type in Herb. Palaeobot. Dept., Swedish Museum of Natural History, Stockholm); South Island, Head of Lake Manapouri, January 8, 1947, G. SIMPSON (Herb. K. W. ALLISON H 891). North Island, Tararua Mts, near Table Top, in water course north of Field Hut, c. 2,600 ft., January 1, 1934, V. L. ZOTOV 7485; North Island, Tararua Mts, Mt Holdsworth, on a forest bank, c. 3,000 ft., March 18, 1950, N. S. BUTLER 2583.

This striking hepatic is at a glance characterized by the female organs: the stalk of the receptacle is twice bifurcated (sometimes the branches of the first order may be undivided). This is unlike everything so far known in *Marchantiales*. Interesting is that the number of the involucres (and capsules), 5—12, corresponds well with conditions in *Marchantia*.

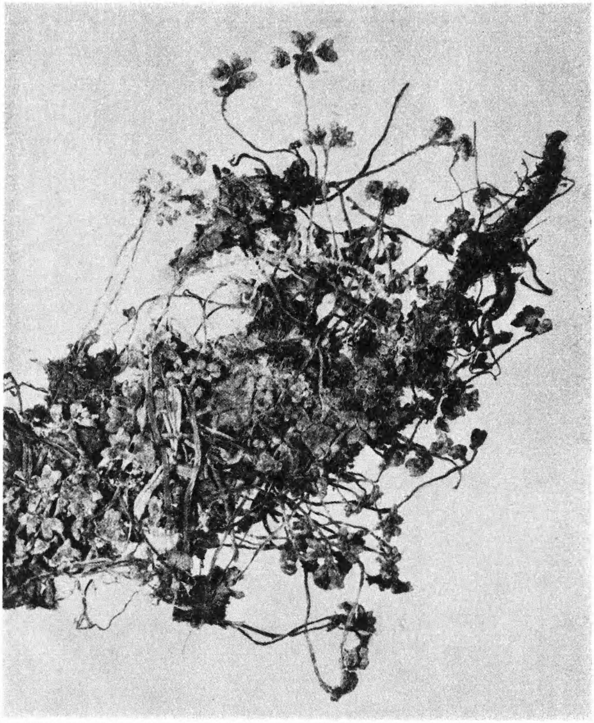

Fig. 2. *Neohodgsonia* spec. from Tristan da Cunha, forest W. of 3rd gulch, 550—600 m. alt., January 8, 1938, E. CHRISTOPHERSEN & Y. MEJLAND 930. Dried. 1/1 (material in Herb. Palaeobot. Dept., Swedish Museum of Natural History, Stockholm). — Photo: K. E. SAMUELSSON.

The stalk of the female receptacles has one [by *Marchantia* 2(—4)] rhizoid furrows. The carpocephalus is coarsely tuberculate in a manner resembling, e.g., several *Fimbriaria* species (Fig. 1: b and c).

The thallus, which varies as to size, is not unlike that of *Marchantia* but differs above all by its very soft structure. This is partly due to the fact that the epidermal cells (and most other cells too) are fragile and thin-walled, and partly to the unusually rich development of the air-chamber layer. Interesting are the big brownish channels, which, on the ventral side of the thallus, are visible to the naked eye. Noticable is also that the upper surface of the thallus which has large areolae forming a distinct network, is not plain as in *Marchantia* and most other *Marchantiales* but uneven. This is due to the fact that the areolae are somewhat bulging and somewhat resemble conditions in some *Marchantiales* such as *Clevea* and *Sauteria* and — yet more pronounced — *Exorrmotheca*.

The pores are of the barrel type. The cup-shaped cupules are rather similar to those in *Marchantia*. The ventral scales are arranged in only one row on each side (in *Marchantia* typically three rows).

The systematic position of *Neohodgsonia* is not easy to settle. This would need detailed investigations of fixed material. No doubt it is closely related to the family *Marchantiaceae* DUM. (1829) emend. K. MÜLL. (1940), where I have provisionally placed it. The bifurcated carpocephalus makes a primitive impression. It appears possible that *Neohodgsonia* represents a branch from the phylum leading to *Marchantia*.

From a phytogeographical point of view it is interesting that *Neohodgsonia* occurs in Tristan da Cunha as well as in New Zealand.

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BOTANISKA NOTISER 1954, HÄFTE 1. LUND

Zur Problematik der »Steppenböden».

Von E. SCHLICHTING.

Institut für Pflanzenernährung und Bodenkunde der Universität Kiel.

In der bodenkundlichen und pflanzensoziologischen Literatur sind Steppen- und steppenartige Böden bzw. Pflanzengesellschaften mehrfach beschrieben worden. Dabei hat es sich nicht nur um Böden der heutigen Steppen gehandelt, sondern man hat darüber hinaus Böden mit bestimmter Genese bzw. Ökologie darunter verstanden wissen wollen. Wo sich also heutiges Klima und Vorkommen von »Steppenböden» bzw. Steppenpflanzengesellschaften nicht in Einklang bringen liessen, war man gezwungen, die Ausprägung des Bodenprofils in frühere Zeiten zu verlegen bzw. die Pflanzengesellschaften als Reliktformen aufzufassen. Es ist zweifelhaft, ob man damit in allen Fällen das Richtige tat.

Als erstes sei die Frage erörtert, ob es überhaupt zweckmässig ist, den Begriff »Steppenboden» zu verwenden. Das ist im Wesentlichen ein Nomenklaturproblem. In der Bodenkunde wird heute fast allgemein anerkannt, dass man zur Klassifizierung bodeneigene Merkmale benutzen sollte.[1] Dagegen verstösst die Bezeichnung »Steppenboden». Sie ist überdies als Bodentypenbegriff nicht spezifisch, denn in den Steppen finden wir verschiedene, gut gegeneinander abgrenzbare Formen, wie Sierosem, Burosem, Kastanosem und Tschernosem (KUBIENA, 1953). Auf der anderen Seite ist die Gleichsetzung von Böden mit AC-Profil und Steppenböden (WALDHEIM, 1947, S. 73) nicht gerechtfertigt, da auch solche Böden ein AC-Profil haben, die man nicht zu den Böden der Steppen rechnen darf (z.B. Ranker und Rendzina). — Meist hat man wohl mit »Steppenboden» den Tschernosem (die Schwarzerde) und mit

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[1] Eine Einteilung nach den Faktoren der Bodenbildung, wie sie besonders von STREMME und seinen Schülern geübt wird, ist anfechtbar, weil bislang keine systematischen quantitativen Untersuchungen über die relative Bedeutung der einzelnen Faktoren vorliegen (vgl. JENNY, 1941).

»steppenartig veränderten» Böden schwarzerdeähnliche Bildungen gemeint (z.B. STREMME, 1936).

Die Berechtigung der Bezeichnung »steppenartig» oder schwarzerdeartig für bestimmte Bodenformen des humiden Klimabereichs wird bei Abwesenheit von Steppenpflanzengesellschaften meist aus der Tatsache hergeleitet, dass diese Böden über mehr oder minder kalkreichem Muttergestein ähnlich dunkle und z.T. auch ähnlich mächtige A-Horizonte haben wie die Schwarzerden. Darin sind sie aber auch den Rendzinen und mehr noch gewissen Pararendzinen ähnlich. In der Literatur ist schon mehrfach auf die Verbindung zwischen Schwarzerden und Rendzinen hingewiesen worden (z.B. STEBUTT, 1930). Weil früher das Primat des Klimas unter den Faktoren der Bodenbildung postuliert wurde, stellte man die Schwarzerde quasi als den Normalfall und die Rendzina als den (intrazonalen) Sonderfall hin. Logischerweise sollte aber zur Klassifizierung und Namengebung das gemeinsame (bodeneigene) Merkmal benutzt werden, das die stärkste Differenzierung gegenüber anderen Formen ausdrückt (vgl. SCHLICHTING, 1953 a), in diesem Fall also der mehr oder minder hohe Kalkgehalt. So sieht KUBIENA (1948) die Schwarzerde auch als Mullpararendzina der Steppe an und belässt ihr lediglich aus historischen und Zweckmässigkeitsgründen ihre Eigenstellung. Das umgekehrte Vorgehen, die Rendzina als Kalksteinschwarzerde zu bezeichnen (STREMME, o. J.), verstösst gegen die von uns erhobene Forderung. Für die oben erwähnten Böden sollte man also statt der Bezeichnungen »steppenartig» oder schwarzerdeartig den Namen rendzinaähnlich bzw. Pararendzina wählen.

Dieses Vorgehen ist sicherlich dort gerechtfertigt, wo auch floristisch keine Beweise für eine rezente oder subfossile Steppenvegetation mehr beizubringen sind (z.B. auf Fehmarn, vgl. SCHLICHTING, 1953 b). Wie verhält es sich aber dort, wo Pflanzensoziologen ausserhalb des Steppengebietes »steppenartige» Gesellschaften kartieren: kann man diese Böden als schwarzerdeartig bezeichnen? Eine sichere Deutung solcher Schwarzerden ist nur in den Fällen möglich, wo sowohl eindeutig der Nachweis geführt wird, dass diese Pflanzengesellschaften Relikte einer echten Steppenvegetation sind, als auch der Charakter der Bodenprofile die ehemalige Schwarzerdenatur erkennen lässt.

Aus der Pflanzengesellschaft allein die Bezeichnung für einen Boden abzuleiten, ist so lange unsicher, wie nicht erwiesen ist, dass diese Gesellschaft spezifisch für eine bestimmte Bodenform ist. Zwar steht auch heute noch eine einwandfreie Definition des Begriffes »Steppe» aus (BRAUN-BLANQUET, 1951, S. 554), aber für unsere Zwecke mag genügen, sie als Landschaftsform in einem semiariden, kalttemperierten Klima anzusprechen, deren Böden die geringen Niederschlagsmengen bis zu einem gewissen Grade in ihren oberen Lagen zu speichern vermögen (LUNDEGÅRDH, 1949, S. 240). Sind aber die Steppenpflanzen durch diese Standortsverhältnisse so eindeutig charakterisiert, dass umgekehrt alle Böden mit solchen Pflanzengesellschaften als »Steppenböden» bezeichnet werden können? Diese Frage lässt sich z.T. bereits durch ihre Umkehrung beantworten: Wenn »Steppenpflanzen»-Gesellschaften auch ausserhalb der Steppe vorkommen, so kann das auch als Beweis dafür angesehen werden, dass sie nicht spezifisch für diese sind, hier also ihren Namen zu Unrecht tragen. Doch bedarf dieser Schluss noch der Erläuterung.

Der Zeigerwert einer Pflanzengesellschaft ist um so sicherer, je besser ihre Ökologie bekannt ist. Die Feststellung, dass sich Ökologie und floristische Gruppierung der Gesellschaft zueinander verhalten wie die noch recht wenig bekannte Ursache zur sichtbaren Wirkung (BRAUN-BLANQUET, l.c., S. 554), klingt wenig ermutigend. Wenn aber die Beziehung zwischen Pflanzensoziologie und Bodenkunde aus dem empirischen Bereich in den kausalen verlagert werden soll, muss die Ökologie in den Mittelpunkt gerückt werden. Wir wollen dabei analog zu unserem Vorgehen bei der Besprechung der Beziehungen zwischen gewissen Rendzinen und Tschernosemen die gemeinsamen Merkmale von Kalk- und Steppenpflanzen ihren Unterschieden gegenüberstellen (wobei wir uns z.T. an die eingehenden Untersuchungen von WALDHEIM in Schonen anlehnen).

Kalk- und Steppenpflanzen sind angepasst an einen hohen Elektrolytgehalt der Bodenlösung, in der im Gegensatz zu derjenigen von Marsch- und Alkaliböden die Erdalkalikarbonate und -sulfate über die Alkalihalogenide dominieren. Der hohe Ca- und Mg-Gehalt der Rendzinen und Tschernoseme bewirkt gleichzeitig hohe pH-Werte und damit z.B. eine geringere Anlieferung von Mn und Fe. Es ist auch zu vermuten, dass solche Pflanzen empfindlich gegen grössere Al-Mengen sind.

Anpassung an hohen Elektrolytgehalt der Bodenlösung bedeutet aber auch, dass die Pflanzen einen hohen osmotischen Druck aufbringen, um genügend Wasser aufnehmen zu können, oder einen geringen Wasserbedarf haben müssen. Im Jahresdurchschnitt betrachtet gleicht der Wasserhaushalt der Rendzinen und Pararendzinen im humiden Klima sehr dem des Tschernosems, und zwar um so mehr, je geringer der Tongehalt (und die Verwitterungstiefe) und je steiler die Hanglage ist (am stärksten ausgeprägt bei Süd-Exposition). Wir haben es hier also mit einem Faktorenersatz (vgl. BACH, 1950): trockenes Grossklima — geringe Wasserkapazität zu tun. Die Mergelrendzinen und -pararendzinen im humiden Klima versorgen dagegen dank ihrer hohen Wasserkapazität ihre Pflanzen gut mit Wasser (sie sind daher natürliche Waldstandorte).

Überblickt man diese Verhältnisse, so wird man WALDHEIM (l.c.) in seiner Feststellung zustimmen müssen, dass die Steppenvegetation im weitesten Sinne eine Kalkflora sei. Besonders die Kalktrockenpflanzen und die Steppenpflanzen sind als homologe Gesellschaften aufzufassen. Das Differenzialmerkmal (Anpassung an das Grossklima durch kurze Entwicklungszeit) ist nur den Steppenpflanzen eigen. Daher schlägt Verf. vor, sie ökologisch nur als Sondergruppe der Kalkpflanzen zu betrachten (vielleicht gelingt es einmal, diese Gesellschaften auch pflanzensoziologisch schärfer zu umgrenzen als es bisher der Fall war). Damit entfiele die Berechtigung, die »steppenartigen» Gesellschaften im humiden Klimagebiet noch weiter als solche und die betreffenden Böden als »Steppenböden» zu bezeichnen. Es sind vielmehr Kalktrockenrasengesellschaften (wie sie in der pflanzensoziologischen Literatur auch schon vielfach genannt werden) und Rendzinen bzw. Pararendzinen.

Für die betreffenden Böden in Schonen bemerkt WALDHEIM selbst, dass sie mehr an die Rendzinen als an die eigentlichen Steppenböden erinnerten; nennt sie aber trotzdem »Steppenböden». Verf. hatte Gelegenheit, mehrere der von WALDHEIM beschriebenen Profile aufzunehmen. Ein schwarzerdeartiger Charakter war in keinem Fall festzustellen, es handelte sich vielmehr um trockene mullartige Pararendzinen, z.T. um Ranker.

Zusammenfassend lässt sich feststellen, dass Steppenpflanzengesellschaften und Kalktrockenrasengesellschaften ebenso als homologe Formationen aufgefasst werden können wie Schwarzerde und Pararendzina. Der Name »Steppenpflanzen» sollte daher auf die Pflanzen der Steppen beschränkt bleiben und entsprechend der Name »Steppenböden» auf die Böden der Steppen.

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BOTANISKA NOTISER 1954, HÄFTE 1. LUND

Smärre uppsatser och meddelanden.

Oedipodium Griffithianum (Dicks.) Schwaegr. funnen i Dalarna.

Under ett par sommarveckor 1951 hade jag förmånen att åtfölja lektor FOLKE LUNDBERG, Kungälv, på en bilfärd, som berörde stora delar av Dalarna. Min exkursionskamrat ägnade sitt huvudintresse åt planktonundersökningar men deltog flitigt och med stor framgång i det bryologiska fältarbetet.

Under bestigningen av den i Idre sn belägna Städjan (1,130 m) den 6 juli fann LUNDBERG i en liten klippskreva på östsidan av stortoppen en mossa, som frapperade honom. Till min överraskning kunde jag konstatera, att det var en av våra sällsyntaste och samtidigt egendomligaste bladmossor, den för Dalarna nya *Oedipodium Griffithianum*. Det visade sig sedermera att den förekom riklikt på liknande ståndorter i närheten.

Lokalen var belägen på ca 1,000 m:s höjd och utgjordes av små hålor och skrevor i den sparagmitformation, som uppbygger fjället. Topografien här på stortoppens östsida är brant. Som vanligt växte *Oedipodium* ej direkt på berget utan på ett jordlager. Den om en levermossa starkt påminnande, nästan ärggröna mossan bildade ofta små mattor på botten av hålorna. I regel var den steril men väl utvecklade frukter anträffades också. Den övriga vegetationen var, som vanligt då det gäller *Oedipodium,* sparsam och artfattig. Den utgjordes endast av dåligt utvecklade former av *Ditrichum homomallum* koll., *Lophozia alpestris* och *Webera nutans*.

Oedipodium Griffithianum, som får räknas till de kalkskygga mossorna, är enda arten av sitt släkte. Detta anses oftast bilda en egen familj, *Oedipodiaceae,* men förs ej sällan, på ungefär lika goda grunder, till familjen *Splachnaceae*. Ej blott till sitt utseende och byggnad är det en högst märklig art, även dess i hög grad splittrade utbredning förtjänar uppmärksamhet: Storbritannien, Skandinavien, Grönland (såväl v. som o.kusten), Alaska (Kodiak-ön) och Falklandsöarna (där den 1907 upptäcktes av T. G. HALLE och C. SKOTTSBERG). En utbredning påminnande om denna uppvisar levermossan *Gymnomitrium crenulatum*: Storbritannien, Norge (*Ilex*-regionen), Alaska och Sydgeorgien, den är emellertid, till skillnad från *Oedipodium,* utpräglat kustbunden. Bägge måste räknas till de oceaniska mossorna, för *Oedipodium* särskilt utmärkande skulle vara den stora amplituden vad temperaturfordringarna beträffar. I det fallet påminner den starkt om den oceaniska-suboceaniska levermossan *Anastrepta orcadensis,* som vi dagen innan i vackra tuvor anträffade på 800 m:s höjd å Storfjället i Transtrand sn (den är i Sverige ungefär lika sällsynt som *Oedipodium*; i Dalarna var den förut tagen på en lokal i Idre sn. Totalutbredning: Europa, Färöarna, Himalaya, Kina, Japan, Alaska och Hawaii).

I Skandinavien har *Oedipodium* sin huvudutbredning inom *Ilex*-regionen i Norge, där den ej kan sägas vara sällsynt och där den ofta växer vid havets nivå. Märkligt är därför att den så ofta förekommer i fjällen och här ej sällan, även fertil, på hög nivå. I Norge är den funnen på ett flertal lokaler i olika fjällområden, samtliga söder om Trondheimsfjorden, och når på Gausta en höjd av 1,550 m. I Sverige var den då MÖLLER 1936 gjorde sin sammanställning känd från en lokal i vardera Härjedalen, Jämtland samt de fyra sydligaste lappmarkerna och dessutom från en lokal i låglandet: Partille i Götebrogs-trakten. Härtill kan, förutom lokalen på Städjan, läggas följande nya lokaler: Jämtland. Hallen sn, Dromskåran, ca 1,000 m, st., 15 juli, 1944, OLAV GJAEREVOLL samt Lycksele lappmark. Tärna sn, Brantfjället, klyfta mellan stenblock på toppen, ca 1,000 m, st., 15 juli, 1946, A. HÜLPHERS. Högst når *Oedipodium* i Sverige på Storsola i Sylmassivet, där den tagits på 1,300 m:s höjd. I Finland är den endast känd från Nord-Saana i Kilpisjärvi-området. Den intressanta arten förtjänar att eftersökas, förvisso är den endast funnen på en ringa bråkdel av sina förekomster.

HERMAN PERSSON.

Växtanteckningar från trakten kring Torne träsk sommaren 1952.

Under tiden 27.6.—23.8. 1952 arbetade jag vid Abisko Naturvetenskapliga station med insamling av växter till en botanisk trädgård i Björkliden. Härvid iakttogs många intressanta och för trakten nya eller sällsynta arter, vilka kanske kan vara av intresse. Som framgår av listan är de flesta iakttagna på kulturpåverkad mark i Björkliden eller intill järnvägen. Vid angivande av lokaler har den flygfotogrammetriska sommarkartan »Abisko, Björkliden, Riksgränsen» använts.

Equisetum hiemale×*variegatum* (*E. trachyodon*). Mellan bv.-stugan vid Tornehamn och Pesujärvi i fjällbjörkskogen på 500 m ö.h.

Deschampsia atropurpurea (WG.) SCHEELE. Allmän på V-sidan av Kuokel (550 m ö.h.).

Phippsia algida (SOL.) R. BR. Allmän på Jebrentjåkko på 1.050 m ö.h. tillsammans med *Ranunculus glacialis*. L och *Saxifraga tenuis*. (WG.) H. SM.

Agropyron mutabile. DROB., T. VEST. I fjällbjörkskogen på Nuoljatunneln tillsammans med *A. caninum*. (L.) PB.

Carex rufina DREJ. Översilad, ± blottad eller mossbevuxen grusmark på V-sidan av Kuokel på 500 m ö.h. omkring den 15.8. tillsammans med *Koenigia islandica* L, vilken är en stor sällsynthet i trakten. Arterna växte tämligen allmänt tillsammans på flera lokaler utefter samma sträckning av småsjöar från Vadvetjåkko till Björkstugan.

Chamorchis alpina (L.) L. C. RICH. Tämligen allmän ovan trädgränsen på N-sluttningen av Nuolja (600 m ö.h.) samt på skifferhäll Ö. Pesujärvi. På det sistnämnda stället växte arten tillsammans med *Erigeron unalaschkense* (DC.) Vierh.

Gymnadenia conopsea (L.) R. Br. och *f. alba.* I *Scirpus cæspitosus* — kärr N. Björkliden. Här växte även *Orchis maculata.* L. De båda arterna förekom rikligt tillsammans. Trots ivrigt sökande kunde inte något hybridliknande exemplar upptäckas.

Polygonatum verticillatum (L.) All. I fjällbjörkskogen vid Jebrenjåkkstugan 1951.

Salix herbacea×polaris. Vid fallen i Ridonjira, Nuolja 1951.

Silene Cucubalus Wib. Björkliden samt jv-vallen S. därom.

Thalictrum alpinum L. Ljusgrön form vid Rallarkyrkogården, Tornehamn (=lokalen för *Cardamine amara* L.)

Ranunculus auricomus L. Björkliden.

Rorippa islandica (Oeder) Borb. Lokal som föregående!

Fragaria vesca L. Lokal som nästföregående på jv.-vallen!

Potentilla nivea L. Snoritjåkko (925 m ö.h.) och NV-sidan av Låktatjåkko.

P. norvegica L. Björkliden.

Alchemilla alpina L. Klippan mellan skidlinbanan och Kåppasjåkk, Björkliden.

Trifolium spadiceum L. Jv-bron över Rakkasjåkk, Björkliden.

Polygala Amarella Cr. Lokal som föregående samt slänten vid bv.-stugan vid Tornehamn, vilket torde vara Sveriges nordligaste lokal för arten.

Hippuris vulgaris L. Liten göl mellan Pålnoviken och Njuoraätno (»Lerälven») tillsammans med *Utricularia vulgaris* L.

Heracleum Sphondylium L. *ssp. sibiricum.* (L.) Ahlfv. Björkliden samt jv.-vallen N och S därom i enstaka exemplar.

Primula stricta Horn. Stranden av Torne träsk vid Djupviken och Abisko Östra samt vid Silverfallet i Rakkasjåkk.

Myosotis silvatica Ehrh. *ssp. frigida.* T. Vest. *f. alba.* N. Rallarkyrkogården, Tornehamn.

M. arvensis (L.) Hill. Björkliden.

Prunella vulgaris L. Gångstig vid Lugnet, N. Björkliden.

Veronica serpyllifolia L. Björkliden.

Plantago major L. Nuoljatunneln, Lugnet och Björkliden samt jv.-vallen.

P. media L. Lokal som föregående!

Antennaria alpina (L.) Gærtn. ♂. 6 exemplar den 21.7. på SV-sluttningen av Jebrentjåkko (950 m ö.h.) på snölegemark. Här växte rikligt med honindivider av arten samt *A. dioeca.* (L.) Gærtn., ♂ och ♀.

Anthemis tinctoria L. Björkliden (troligen nordligaste lokalen i Sverige.)

Ingvar Nordin, Västerås.

Växtanteckningar från trakten kring Vemdalen, Härjedalen sommaren 1950.

I början av juli 1950 deltog jag i ett av Sveriges Fältbiologiska Ungdomsförening arrangerat läger i NO-delen av Härjedalen och intilliggande delar av Jämtland. De besökta fjällen visade sig vara mycket karga och fattiga, och endast från Sånfjället noterades några mer krävande arter. Listan upptar de intressantaste fynden under en tiodagars vistelse.

Cryptogramma crispa (L.) R. BR. 1 exemplar nära toppen på N. Skalsfjället.
Matteuccia Struthiopteris (L.) TOD. Fuktig fjällbjörkskog på N-sluttningen av Varggransfjället.
Listera cordata (L.) R. BR. Tämligen allmän vid Skorvdals- och Skalsfjällen. Även sedd på N-sluttningen av Sånfjället tillsammans med *Coeloglossum viride* (L.) HARTM.
Corallorhiza trifida CHÂT. Enstaka exemplar här och var, bland annat vid Varggrans-, Hög- och Sånfjällen.
Thalictrum simplex L. Stranden av Vikarsjön, Hedeviken.
Viola montana L. Bäckravin mellan Skalsfjällen.
Epilobium lactiflorum HAUSSKN. Fjällbäck mellan Skalsfjällen, tillsammans med *E. Hornemanni.* RCHB.
Moneses uniflora (L.) A. GR. Enstaka exemplar på S-sidan av N. Skalsfjället.
Loiseleuria procumbens (L.) DESV. På skiffermark vid en fjällbäck på NO-sidan av Sånfjället samt nära toppen på Oxsjövålen (Jmt.).
Cassiope hypnoides (L.) D. DON. Fjällbäck på NO-sidan av Sånfjället.
Arctostaphylos alpina (L.) SPRENG. Lokal som föregående samt på Oxsjövålen och i fjällbjörkskogen på N-sluttningen av Högfjället.
Diapensia lapponica L. Lokal som *Cassiope*!
Gentianella Amarella (L.) H. SM. Röjans jv.-station (Jmt.).
Bartsia alpina L. Tämligen allmän på lågäng på S-sidan av Vikarsjön tillsammans med *Pedicularis Sceptrum-Carolinum* L., vilken även sågs vid Oxsjön (Jmt.).
Taraxacum nævosum. DT. Vägkant vid Vemdalsskalets pensionat den 14.7.
T. spectabile DT. Lokal som föregående den 11.7.
T. boreum DT. Fuktig gräsmark nära Vemdalsskalets pensionat den 14.7. Arten är endast uppgiven för Norge. Bestämningarna av maskrosorna har utförts av fil. dr GUSTAF HAGLUND.

INGVAR NORDIN, Västerås.

Nya växtlokaler för kärlväxter i Jämtland.

Nedanstående växtfynd har gjorts vid korta besök i Jämtland 1948—1952, sistnämnda år tillsammans med docent B. HYLMÖ och kamrer P. OLROG. Växtlokalerna finnes icke angivna i LANGES Jämtlandsflora, HULTÉNS atlas eller HYLANDERS nya flora.

Art- och lokalförteckning:

Cystopteris fragilis (L.) BERNH. *ssp. alpina* (WULF.) HARTM. Frostviken: bäckravin på Raudeks ostsida i sent framsmält skreva. Reg. alp. Ny för Jämtland.
Cystopteris fragilis (L.) BERNH. *ssp. dickieana* (SIM) HYL. Frostviken: Hylla på Fågelbergets sydbrant. Reg. silv. Ny för norra Jämtland.
Botrychium lanceolatum (S. G. GMEL.) ÅNGSTR. Stugun: Borglunda på torrbacke invid landsvägen, 1 ex.
Calamagrostis canescens (WEB.) ROTH×*epigeios* (L.) ROTH. Stugun: Fredrikslund på grusås mot älven. Ny för Jämtland.

Carex Bigelowii TORR.×*rufina* DREJ. Åre: Skurudalsbergen och Blåhammaren i reg. alp. tillsammans med föräldraarterna. Ståndorterna intermediära mellan föräldraarternas. Hybriden iakttogs på ett tiotal lokaler och återfinnes säkerligen i detta område på de flesta ställen, där *rufina* växer. Bestämningen har confirmerats av fru ELSA NYHOLM, som undersökt bladanatomien. Hybriden har icke angivits tidigare från Jämtland.

Carex atrata L.×*norvegica* RETZ. Åre: Gräslifjäll, reg. alp.

Luzula pallescens SW. Frostviken: Fågelbergets brantsida på klipphyllor i reg. silv.

Chamorchis alpina (L.) L. C. RICH. Åre: Skurudalshöjdens västsida, reg. alp. riklig.

Saxifraga adscendens L. Frostviken: På Raudek i reg. alp. förekommer rikligt en form med rosafärgade blommor, som enligt fil. dr TH. LANGE av honom aldrig iakttagits i Jämtland.

Myricaria germanica (L.) DESV. Åre: Sandrevlar i Handölan ca 5 km ovanför Handöl.

Bjuv i januari 1954.

K. E. FLINCK.

A Note on the Viability of Aseptic Moss Cultures.

In microbiology, methods have been worked out, e.g. lyophilization and treatment with mineral oil, which make it possible to preserve cultures of fungi and bacteria aseptic and alive for a long period of time without the trouble of repeated transfers. In the case of mosses, which are more rarely studied in pure culture, the question of preservation has probably not so often been encountered. To bryologists and physiologists interested in studies of that sort, however, the following observations may be of some value.

About twelve years ago I isolated a number of moss species from spores or gamophyte shoots (FRIES 1942) and grew them in sterile culture under various conditions. In order to keep these cultures alive as long as possible without transfer to a new medium I kept the stock-cultures on agar in so-called Freudenreich flasks (Fig. 1). The moss-studies were discontinued in 1943, and since then no further transfers of the stock-cultures were made. However, when ten years had passed I thought it might be interesting to establish whether any of the cultures was still living.

During these ten years the flasks had been placed in a laboratory window, facing east. The temperature of the room had varied between 18° C and 22° C, but especially in the summer mornings the strong sun-light may have raised the temperature of the flasks considerably.

Each one of these 50 ml Freudenreich flasks contained 10 ml of a nutrient medium solidified with 1.5 % agar, representing a slanting surface on which the moss was growing. The medium consisted of: KNO_3 1.2 g., $Ca(NO_3)_2$ 0.12 g., K_2HPO_4 0.12 g., $MgSO_4 \cdot 7\,H_2O$ 0.24 g., and $FeCl_3$ traces, per litre of distilled water. Gas exchange occurred through the narrow tube at the top of the flask and probably also to a certain degree through the ground joint be-

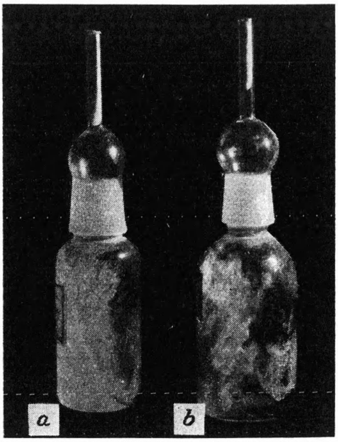

Fig. 1. Two cultures of *Hylocomium squarrosum* on agar in Freudenreich flasks. Age of the cultures, one year (a) and eleven years (b). Half natural size.

tween the cap and the basal part of the flask. Since the diameter as well as the length of the top tube differed rather much from one flask to another the rate of evaporation varied correspondingly.

In September 1952 the medium appeared completely dry in most flasks, and the protonema and gamophyte shoots were white or brownish. In none of these cases any further growth was observed from the samples transferred to fresh agar medium. Nine flasks, however, still contained water and in six of them the moss proved to be living and capable of developing new shoots when transferred to the new culture flask. These six species were, *Funaria hygrometrica, Ceratodon purpureus, Hylocomium squarrosum, Mnium undulatum, Mnium pseudo-punctatum,* and *Aulacomnium palustre.* The three non-viable cultures, viz. *Leptobryum pyriforme, Hylocomium triquetrum,* and a duplicate of *Funaria hygrometrica,* contained less water than the others.

In no case the new protonema and the shoots developing from the inocula on the fresh medium showed any signs of damage or degeneration. Thus it appears that growing moss cultures can be maintained without any drawbacks for at least ten years in Freudenreich flasks, provided the evaporation is not permitted to proceed too far.

Institute of Physiological Botany, University of Uppsala, February 23, 1954.

NILS FRIES.

Literature.

FRIES, N. 1942. Eine Methode zur Erzielung absoluter Reinkulturen von Laubmoosen. — Bot. Not. 1942. Lund.

BOTANISKA NOTISER 1954, HÄFTE 1. LUND

Från Lunds Botaniska Förenings förhandlingar 1953.

Den 12 februari. Laborator TORE LEVRING, Göteborg, höll föredrag om »Befruktningen hos fucaceerna och ulvaceerna».

Inledningsvis redogjorde föredragshållaren för befruktningsförloppet hos fucaceerna samt för gameternas byggnad. Bl.a. hade påvisats, att spermatozoiderna voro omgivna av ett tunt geléhölje av fucoidin.

Ytan hos mogna, obefruktade ägg består av följande lager: ytterst ett skiktat geléhölje, äggmembranen, lipoproteinmembranen samt innerst ett kortikalskikt. Efter befruktningen framträder snabbt en befruktningsmembran, som är tvåskiktad. Det inre skiktet är starkt negativt dubbelbrytande och innehåller bl.a. cellulosa och fucoidin. Det yttre består av äggmembranen jämte återstoden av gelého̊ljet. I kortikallagret, som levererar väggmaterial efter befruktningen, har polysackaridsulfat (fucoidin) frigjorts.

Föredragshållaren visade sedan en av honom upptagen film, som illustrerade fortplantningsorganens och gameternas byggnad samt befruktningsförloppet hos fucaceerna.

Till slut visades en färgfilm om generationsväxlingen hos *Ulva lactuca,* varvid föredragshållaren lämnade en kort redogörelse för gameternas och zoosporernas byggnad samt deras reaktionssätt vid fortplantningen.

Den 9 mars. Valdes Professor GÖTE TURESSON, Ultuna, till föreningens hedersledamot.

Uppläste Docent OVE ALMBORN revisionsberättelser för 1952 års räkenskaper. Full ansvarsfrihet beviljades tacksamt räkenskapsförarna.

Höll Dr KÄTHE SEIDEL från Hydrobiologische Anstalt der Max-Planck-Gesellschaft in Plön (Holstein) föredrag över ämnet »*Scirpus lacustris.* Wert und Auswertung».

Dr SEIDEL talade om sävens förekomst och användning nu och i äldre tider. Redan de gamla grekerna kände till konsten att fläta föremål av säven. Föredragshållaren nämnde, vilken utomordentligt stor nytta folk i alla världsdelar haft och ha av säven. Bl.a. gavs som exempel att de kända balsabåtarna på Titicaca-sjön ofta är utrustade med segel flätade av sävstrån.

Under Dr SEIDELs ledning bedrives i Nordtyskland sedan flera år tillbaka ett omfattande arbete för att utforska sävens användbarhet. Den har bl.a. i fråga om äggvite-, kali- och fosfathalt visat sig överträffa både majs och lupin, var-för den är ett högvärdigt foder. Kompostjord av *Scirpus lacustris* har visat sig utomordentligt värdefull. Odling av grönsaker och blommor på dylik jord har framkallat verkliga jätteformer.

Säven är en förträfflig sandbindare och har under senare tid även börjat planteras som strandskydd. Då den även bildar kraftig rothumus söker man genom »Binsenkultur» vid Nord- och Östersjökusterna vinna mark för åkerbruk.

Den 20 april. Firade föreningen sitt 95-årsjubileum.

Föreningens stipendium ur Jubileumsfonden, kr. 200: —, tilldelades Fru ELSA NYHOLM för exkursioner i Torne Lappmark. Ur Svante Murbecks fond tilldelades Amanuens BENGT ULF kr. 382: 50 som bidrag till studieresa till Zürich samt till fotografiutrustning.

Som nytt namn på Botaniska Notisers Supplement bestämdes »Opera Botanica».

I ett hälsningstal hyllade ordf. den nyvalde hedersledamoten, Professor GÖTE TURESSON, som därefter höll föredrag över ämnet »*Hieracium pilosella,* kromosomtal och utbredning».

Kvällens andra föredrag över experimentellt taxonomiska undersökningar hos *Poa* hölls av Professor T. G. TUTIN från Leicester, England.

Den tetraploida *Poa annua* med 28 kromosomer skulle enligt ett förmodande av Prof. NANNFELDT vara en kombination av de båda arterna *P. supina* och *infirma.*

Föredragshållaren hade prövat denna hypotes. *P. annua,* korsad med *supina,* gav en triploid med 7 bivalenter och 7 univalenter i meios. Samma resultat erhölls då *annua* korsades med *infirma.* Korsning av *supina* och *infirma* gav mest sterila, diploida hybrider, men också enstaka tetraploida med relativt normal meios. Kombinationen överensstämde med *P. annua,* varmed Prof. NANNFELDTS hypotes var bekräftad.

Födelseplatsen förlade Prof. TUTIN till västra medelhavskusterna där de båda föräldraarterna finnas icke alltför långt ifrån varandra.

Den 17 maj. Föreningens vårexkursion hade anordnats i samarbete med Hälsingborgs Botaniska Förening och Föreningen Landskronatraktens Natur.

Första målet var Ålabodarna där Försöksledare ARVID NILSSON, Landskrona, visade lokalerna för den sällsynta *Orobanche major,* varav vinterståndare fanns kvar, och *Equisetum telmateia.*

Vid Gea-gården i Åvarp berättar Lektor HERVID VALLIN, Hälsingborg, om den säregna omgivningen, den enbevuxna fäladsmarken.

Exkursionen fortsatte därefter under ledning av Folkskollärare PER MÅRTENSON, Hälsingborg, till Hallabäcken och en i närheten av denna belägen äng med bl.a. *Orchis mascula, Gagea spathacea* och *Thalictrum aquilegifolium.* Nästa etappmål var en ängsbokskog vid Söderåsen där huvudattraktionen var den nordligast kända lokalen för *Petasites albus.* För ängsbokskogen typiska arter kunde studeras: *Lathyrus vernus, Rumex sanguineus, Carex silvatica* och *Lathraea sqaumaria.* En god uppfattning om kontrasten mellan denna bördiga bokskog och sådan på urbergsmorän fick deltagarna en stund senare, då ett bokbestånd uppe på Söderåsen besöktes. Här var floran mycket fattigare och utmärktes av bl.a. *Deschampsia flexuosa, Galium saxatile* och *Trientalis europaea.*

Uppe på Söderåsen besöktes även ett fattigkärr liksom en lokal för *Blechnum spicant* i närheten av länsgränsen.

Den 5 juli. Sommarexkursion till Møns Klint under ledning av Professor THORVALD SÖRENSEN, Köpenhamn.

Kring det gamla godset Liselund sågs rikliga bestånd av *Bromus Benekeni* och *B. ramosus, Circaea lutetiana* och *Rumex sanguineus* liksom förvildade exemplar av *Daphne laureola.*

Efter besök vid Lilleklint, där buskvegetationen på branterna huvudsakligen utgjordes av *Hippophaë,* gick resan till Jydelejet där *Epipactis atrorubens, Orchis ustulata* och *purpurea* studerades. Møn är känt för sin rikedom på orkideer och i skogen kring Store Klint fick deltagarna tillfälle se två stora sällsyntheter: *Cephalanthera rubra* och *C. Damasonium.* Stort intresse tilldrog sig även de frodiga bestånden av jättefräken, *Equisetum telmateia.*

Slutligen förevisade Prof. SÖRENSEN Høvblegebackarna. Detta skoglösa parti i sydvästra hörnet av Klinteskoven uppvisar en egendomlig vegetation. Karakteristiska arter voro: *Linum austriacum, Onobrychis viciifolia, Sanguisorba minor* ssp. *muricata* och *Reseda lutea.* På dessa till synes mycket torra backar växte även *Parnassia palustris.*

Den 4 oktober. Svampexkursion till Eriksdal, Röddinge, Lyckås och Löderup under ledning av Fröken MAJA-LENA NILSSON, Ystad.

Den 6 oktober. Höll Fil. mag. HENRY RUFELT föredrag om »Auxiner och geotropism».

Efter en kort genomgång av termer och definitioner i anslutning till de geotropiska fenomenen gav föredragshållaren en kort överblick av den nuvarande uppfattningen av den ortogeotropiska reaktionens förlopp enligt WENT-CHOLODNYS auxinteori.

Mag. RUFELT hade genom att tillföra auxin och antiauxin till rötter av lin och vete försökt variera deras naturliga auxinhalter och genom att studera deras reaktioner under dessa förhållanden försökt klargöra problemen. Under försökens gång hade vissa resultat framkommit, som kunde förklaras med existensen av en reaktion, som motverkar den normala positiva reaktionen. Denna negativa reaktion har tidigare påvisats av LUNDEGÅRDH. Det visade sig att denna reaktion påverkas av ett använt antiauxin, p-klorfenoxi-isosmörsyra medan den däremot tycks vara okänslig för indolylättiksyra. Precis motsatta förhållanden visade sig gälla för den normala positiva reaktionen, som kan förskjutas med IAA men är okänslig för PCIB. Följaktligen tycks IAA och PCIB icke vara direkta antagonister utan får antagas inverka på olika system i rötterna.

Ämneslärare CHARLES REIMER, Alnarp, demonstrerade CARL SCHILDBACKS Holzbibliothek varav en samling på 200 band tillhör Alnarps trädgårdsinstitut.

Den 13 november. Val av styrelse för kommande verksamhetsår förrättades. Den nya styrelsen fick följande sammansättning: Ordf. Fil. dr ASTA ALMESTRAND, omval; v. ordf. Docent HEMMING VIRGIN, nyval; sekr. Amanuens LENNART ELIASSON, nyval; v. sekr. Amanuens ROLF DAHLGREN, nyval; styrelseledamöter utan särskild funktion, Proff. HANS BURSTRÖM och HENNING WEIMARCK samt Direktör K. E. FLINCK, omval; revisorer, Lektor OSCAR PALMGREN, nyval och Docent OVE ALMBORN, omval; rev.suppl., Docent BERTIL HYLMÖ och Assistent ANDERS KYLIN, omval.

Professor HUGO OSVALD, Uppsala, höll föredrag över ämnet: »Myrar på Nya Zeeland».

Föredragshållaren redogjorde för resultat och intryck från en resa 1951 i syfte att studera kärrmarkerna på Nya Zeeland, att söka parallellisera dem med myrar och kärr på norra halvklotet samt att bistå vid planeringen av deras skötsel och uppodling.

Myrarna behandlades i olika kategorier alltefter artsammansättningen:

Podocarpus-skogarna representerade en näringsrik kärrmarkstyp med snabb förmultning och relativt ringa torvlager. Underskiktet utgjordes ofta av *Cordyline*.

Phormium tenax-kärren hade ringare men dock relativt god näringstillförsel. Här växte också bl.a. *Carex* och *Blechnum* men även *Cordyline*.

Ännu näringsfattigare myrar hade *Cladium teretifolium* som karaktärsväxt.

De nyzeeländska kärrmarkerna uppvisade en rad för oss ovanliga egenskaper. Artsammansättningen var helt främmande. Icke många släkten och ännu färre arter voro gemensamma med de nordeuropeiska myrarnas.

Myrarna uppvisade aldrig några täckande mattor av *Sphagnum*, delvis kanske beroende på de ofta förekommande bränderna, som syntes ingå som en normal faktor i mossarnas regenerationsförlopp. En typisk egenskap för de nyzeeländska myrarna var vidare frånvaron av laggar.

Den 15 december. Ett stipendium på 100: — kronor ur fonden »Gertrud Jönssons Minne» tilldelades fil. stud. GERTRUD NILSSON.

Fil. mag. HENRY RUFELT uppläste revisionsberättelse för årets växtbyte. Full ansvarsfrihet för bytesföreståndaren föreslogs och beviljades.

Efter livlig diskussion beslöt föreningen att fr.o.m. 1954 höja medlemsavgiften till 18: — kr. (för studerande till 12: — kr.).

Amanuens BENGT ULF höll föredrag över »Vegetationen i Kungsmarken». Områdets historia kan följas sedan lång tid tillbaka. Den från dammen i ungefär östlig riktning löpande gärdesgården har bevisligen existerats sedan 1600-talets slut, troligen längre. Området norr om denna gärdesgård har under hela denna tid varit betesmark, medan området söder därom varit slåtteräng fram till omkring 1900 och först därefter betats. Det geologiska underlaget på ömse sidor om gärdesgården är detsamma. Vegetationen visar emellertid stora olikheter på de båda sidorna. Den norra delen består av en mager, tuvig äng med kraftigt inslag av *Carex*-arter och på tuvorna *Cirsium acaule,* medan den södra delen utgöres av en betydligt rikare äng med kraftig gräsväxt och ett stort inslag av diverse örter, som äro mycket sällsynta på norra området och ofta t.o.m. saknas där.

Dessa skillnader i vegetationen kunna knappast bero på något annat än olika behandling under mycket lång tid. Vegetationsanalyser i fasta provytor utförda av amanuens ULF under sommaren 1952 ge exakt besked om olikheterna i vegetationen. Bottenskiktet är svagt utvecklat på båda sidor.

Avkastningsförsök utförda under sommaren 1953 visa, att det södra området ger ungefär dubbelt så mycket hö per m^2 som det norra.

BO PETERSON.

Litteratur.

K. MYRBÄCK, Enzymatische Katalyse. — de Gruyter & Co, Berlin 1953. — 181 S.

I handböcker i växtfysiologi förekommer i allmänhet kortfattade enzymkemiska framställningar, begränsade till den förhållandevis ofullständiga bild man har av växternas enzymkemi. I speciallitteraturen stöter man däremot allt oftare på hänvisningar till den bättre kända animaliska och mikrobiella enzymkemin, och växtfysiologen i gemen blir tvungen att konsultera biokemiska handböcker. Det finns också magnifika sådana, inte minst av prof. MYRBÄCKS hand. Man hälsar dock med tillfredsställelse föreliggande volym av samme rutinerade handboksförfattare, som en koncentrerad och lätthanterlig uppslagsbok, vilken som referensverk för icke-specialister har påtagliga fördelar framför de stora verken. — Boken börjar med ca 40 sidor »Allgemeine Chemie der Enzyme», som kan rekommenderas som kursläsning i växtfysiologi. Huvuddelen, som behandlar de speciella enzymen, är inte endast en mycket detaljrik katalog över enzym, deras struktur, förekomst och verkningssätt, utan den ger också en sammanfattande bild av de viktigaste respirationssystemen. — Man får också ett klart och korrekt intryck av hur litet man vet om de speciellt växtfysiologiska processernas, särskilt assimilationsförloppens enzymkemi; det man vet kunde därför ha kommit fram tydligare. Så saknar man hänvisningar till den — låt vara ofullständigt kända — enzymatiska omsättningen av auxin, och molybdenkatalysen av nitratreduktionen. — Förf. har fått in en otrolig mängd fakta på bokens 180 sidor och framställningen är överskådlig. Verket kan rekommenderas alla växtfysiologer. Det ringa omfånget gör dessutom, att man vågar hoppas på nya upplagor, så att boken inte föråldras, utan utvecklas i takt med det livaktiga ämne, som den behandlar.

HANS BURSTRÖM.

A. W. HAUPT: Plant Morphology. Mc Graw-Hill Book Co., New York, Toronto, London 1953. 464 s., $ 8.

Handböcker i växtmorfologi kunna vara upplagda på mycket olika sätt. HAUPTS Plant Morphology är en speciell morfologi, som behandlar olika växtgrupper var för sig, varvid huvudparten av framställningen ägnas åt kryptogamerna. För varje ordning skildras byggnad och fortplantning, antingen för hela ordningen eller för vissa typiska släkten. Framställningen belyses av talrika goda illustrationer, av vilka de flesta äro original. Det är en mängd fakta, som på detta sätt bli framlagda, och åtskilliga av dem ha blivit kända genom nyare undersökningar. För att nämna ett exempel så uppgiver förf. beträffande

Equisetums protallier, att de ej äro dioika, som förut antagits och ofta alltjämt uppgives, utan att de typiskt äro monoika; dock utvecklas anteridier och arkegonier på olika tid, och dåligt utvecklade protallier bära ibland endast anteridier, vilket gett upphov till den gamla uppfattningen. Förf. lägger stor vikt vid fylogenetiska förhållanden; slutkapitlet i boken behandlar utvecklingen inom växtriket, olika utvecklingstendenser och utvecklingsserier, och även i den mera speciella behandlingen söker förf. klargöra de utvecklingslinjer, som finnas.

Beträffande förf:s systematiska indelning observerar man, att de behandlade flagellaterna delas upp i fyra olika klasser, vilket säkerligen är motiverat med hänsyn till gruppens heterogena natur. Å andra sidan räknas conjugaterna endast som en ordning under *Chlorophyceae,* en anordning som kanske är mera diskutabel. Till svamparna föras även klasserna *Schizomycetes* och *Myxomycetes.* F.ö. lägger man märke till att bland levermossorna *Sphaerocarpales* urskiljes som en särskild ordning bredvid *Marchantiales, Jungermanniales* och *Anthocerotales,* och att bland pteridofyterna förf. i likhet med vissa andra systematiker sammanför *Psilotales* med *Psilophytales* till klassen *Psilophytinae.* Det senare motiveras morfologiskt med antagandet, att sporangierna hos *Psilotales* äro terminala på dikotomiskt anordnade grenar, alltså en likhet med arrangemanget hos *Psilophytales.* Bland gymnospermerna föras alltjämt *Ephedra, Gnetum* och *Welwitschia* till samma ordning, trots deras stora olikheter, och man saknar här i övrigt hänvisningar till FLORINS undersökningar; tydligen har förf. ej utnyttjat dessa, vilket medfört en del oriktiga uppgifter och antaganden beträffande fylogenien. För angiospermernas del ges en allmänt morfologisk framställning, varvid bl.a. olika embryologiska typer få en förtjänstfull behandling — förf. har på denna punkt samarbetat med P. MAHESHWARI —, och de viktigare ordningarna anföras även, dock mycket summariskt, mest i form av en uppräkning av deras karakteristika.

Framställningen i HAUPTS morfologi är klar och lättillgänglig; särskilt för den som undervisar i någon del av det behandlade ämnet utgör boken en värdefull källa, som kompletterar andra framställningar, genom sina talrika sakuppgifter och även genom sitt rikhaltiga och belysande illustrationsmaterial.

H. HJELMQVIST.

BOTANISKA NOTISER 1954, HÄFTE 1. LUND

Notiser.

Docentförordnande. Till docent i växtfysiologi vid Lantbrukshögskolan har förordnats fil. dr Ivar Ekdahl.

Utmärkelse. Letterstedtska författarpriset har av K. Vetenskapsakademien utdelats till professor Carl Skottsberg för arbetet: »The vegetation of the Juan Fernandez Islands».

Uppdrag i utlandet. Professor Åke Gustafsson, Statens Skogsforskningsinstitut, har av universitetet i Algier kallats att under jan.—mars 1954 därstädes bedriva forskning och hanleda avancerade yngre forskare i genetik och allmän biologi. — Professor Henning Weimarck har genom British Council mottagit en inbjudan från Department of Botany vid universitetet i Leicester till föreläsningar. Avsikten är att knyta kontakt med andra botaniska institut.

Forskningsanslag. Statens naturvetenskapliga forskningsråd har i december 1953 utdelat följande anslag till botanisk forskning: Till fil. lic. O. Andersson 1.800 kr. för avslutande undersökningar av den svenska ädellövskogens storsvampar; till Botaniska sällskapet, Stockholm, 3.500 kr. för utforskande av Stockholms-traktens moss- och lavflora; till fil. dr G. Erdtman 6.200 kr. för bestridande av kostnader för det palynologiska laboratoriet i Bromma; till fil. lic. O. Hedberg 8.300 kr. för studier av den afroalpina florans uppkomst och utveckling; till laborator A. Levan 18.500 kr. för studier över yttre faktorers inverkan på cytologiska förhållanden; till professor H. Lundegårdh 7.250 kr. för instrumentanskaffning för växtfysiologiska undersökningar; till fil. lic. M. Matell 3.050 kr. för fortsatta arbeten över syntetiska tillväxtämnen med asymmetrisk byggnad; till fil. kand. Ulla Regnell 800 kr. för bestämning av mikrofossil i två sedimentkärnor ur Albatrossexpeditionens Atlantmaterial; till professor C. Skottsberg 613:50 kr. för ytterligare framställningskostnader för två vegetationskartor över Juan Fernandez-öarna; till professor Vivi Täckholm 6.000 kr. för botaniska studier i Genève och Kew för fullföljande av del 4 av »Flora of Egypt».

Från Magnus Bergvalls stiftelse ha bl.a. följande anslag utdelats: Till fil. lic. S. Björkman 2.000 kr. för cyto-taxonomiska undersökningar inom släktet *Agrostis*; till fil. lic. L. Ehrenberg 10.000 kr. för forskningar rörande fruktträdens vintervila; till fil. dr I. Granhall 12.000 kr. för undersökningar av sambandet mellan vintervila, köldhärdighet och strålningskänslighet hos knoppar och frön av fruktträd; till agr. lic. P. E. Nilsson 8.000 kr. för undersökning rörande relationerna mellan växten och markens mikrobflora; till docent Hedda Nordenskiöld 4.500 kr. för genetiska studier över artbildningsproblemet inom släktet Luzula; till laborator W. Rodhe 7.000 kr. för undersökning av fytoplanktonproduktionen i sjön Erken.

K. Lantbruksakademien har vid sin högtidssammankomst den 28 jan. 1954 utdelat bl.a. 4.000 kr. till agr. lic. S. Bingefors för fortsatta undersökningar angående ärftlighetsförhållandena hos rödklöver med hänsyn till resistensen mot stjälknematod m.m.; 2.220 kr. till docent E. Åkerberg och agr. lic. S. Bingefors för undersökningar rörande fröbildningen hos *Medicago falcata* och hos hybriden mellan *M. falcata* och *sativa*; 1.000 kr. till agr. lic. J. Mac Key för fortsatta undersökningar rörande röntgeninducerade mutationer i vete.

K. Vetenskapsakademien har i februari 1954 från Krokska fonden utdelat 500 kr. till fil. lic. O. Rune för en inventering av serpentinfloran i nordvästra Lule Lappmark; 500 kr. till fil. mag. Tord Ingmar för undersökning av myrområdet »Floran» i norra Uppland; från H. E. Johanssons fond lektor E. Almquist 1.200 kr. för hieraciologiska fältundersökningar. Det Letterstedtska understödet för maktpåliggande undersökningar utdelades av akademien till fil. lic. L. Ehrenbeg för undersökningar över kemiska effekter av joniserande strålning m.m.

Från Konung Gustaf VI Adolfs 70-årsfond för svensk kultur har utdelats bl.a. 4.000 kr. till fil. lic. E. Wikberg för undersökningar över biokemiska mutationer hos svampar.

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Hj. Hylander.