Notes on Juncus for Flora Europaea

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Juncus gerardii Lois. subsp. *montanus* Snog. is described. Material has been seen from montane altitudes of Spain and Morocco. Affinities to eastern montane forms are proposed. The new combinations *Juncus acutus* L. subsp. *leopoldii* (Parlatore) Snog. and *Juncus* subgen. *Ensifolii* (Snog.) Snogerup are made.

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Juncus gerardii Lois. subsp. **montanus** Snogerup subsp. nov.

Typus subspeciei: Spain: Prov. de Teruel, Sierra de Camarena, lieux humides et herbeux, sur le calcaire, 1600 mètres. 7. 1892, Reverchon 787 (LD holotype and 3 isotypes; W 2 isotypes!).

Perennis, rhizomate crasso repente. Caules (5–)15–30 cm alti, rigide erecti, foliis subbasalibus 3–6, caulinis nullis vel uno parvo. Folia plerumque inflorescentiis breviora, auriculae breves, 0.3–1 mm longae, latae, in medio faciei dorsalis folii subcontiguae. Inflorescentia 1–5 cm longa, 5–30-flora, e florum glomerulis discretis composita. Tepala (2.5–)3–4 mm longa, centro et basi viridia, margine et apice atro-brunnea usque castanea, margo scariosa tepalorum interiorum apice lata, late obtusa vel emarginata. Capsula tepala paulo excedens, trigono-ellipsoidalis usque trigono-ovoidalis. Semina 0.6–0.7 mm longa, manifeste longitudinaliter c. 16-striata.

Perennial with creeping rhizome 1–2 mm in diameter, internodes 2–20 mm long, stems often in groups connected by elongated sections of the rhizome. *Stems* (5–)15–30 cm, rigidly erect, with 0–2 large basal sheaths and 3–6 leaves, leaves all sub-basal or at least in the lower 1/4 of the stem, or rarely one upper cauline leaf present. Non-flowering shoots often appearing both in the groups of stems and on the elongated sections of the rhizome. *Leaves* 5–10 cm, 0.5–1.5 mm broad, thick, in basal parts with convolute margins, apically semiterete, dorsal side flat, dorsal epidermal cells enlarged; auricles obtuse, broad, 0.3–1 mm, almost united on dorsal side of leaf base. *Inflorescence* considerably exceeding the leaves, usually 1–5 cm long, (1–)5–20(–30)-flowered, most flowers in clusters. Lowest *bracts* leaf-like, first one rarely up to 5 cm but not exceeding the flowers, upper bracts brown, partly scarious and gradually smaller upwards. First, adverse bracteole of side flowers 1–1.5 mm, scarious, those present at lower branchings longer, tubular. Involucral bracteoles 1–1.5 mm, broadly ovate, amplexicaul, obtuse or a few of them acute or emarginate, scarious, light to dark brown in basal part. *Tepals* (2.5–)3–4 mm, equal or outer ones slightly longer, usually all obtuse, with a herbaceous central part and a broad, dark brown to chestnut-coloured outer field. Outer tepals more or less cymbiform, with narrow and inconspicuous scarious margin, cucullate when young, rarely with subapical, dorsal mucro less than 0.05 mm long. Inner tepals with a broad scarious apical part, sometimes emarginate. *Stamens* 6, 3/5–4/5 as long as tepals, anthers 1.3–2.2 mm, 2.5–5 times as long as filaments. *Capsule* slightly exceeding the tepals, 3–4 mm long, broadly trigono-ellipsoidal to trigono-ovoidal, obtuse, mucro 0.2–0.4 mm long, light brown. *Seeds* 0.6–0.7 mm, obliquely ovoidal, with c. 16 prominent longitudinal striae, transverse striae weak.

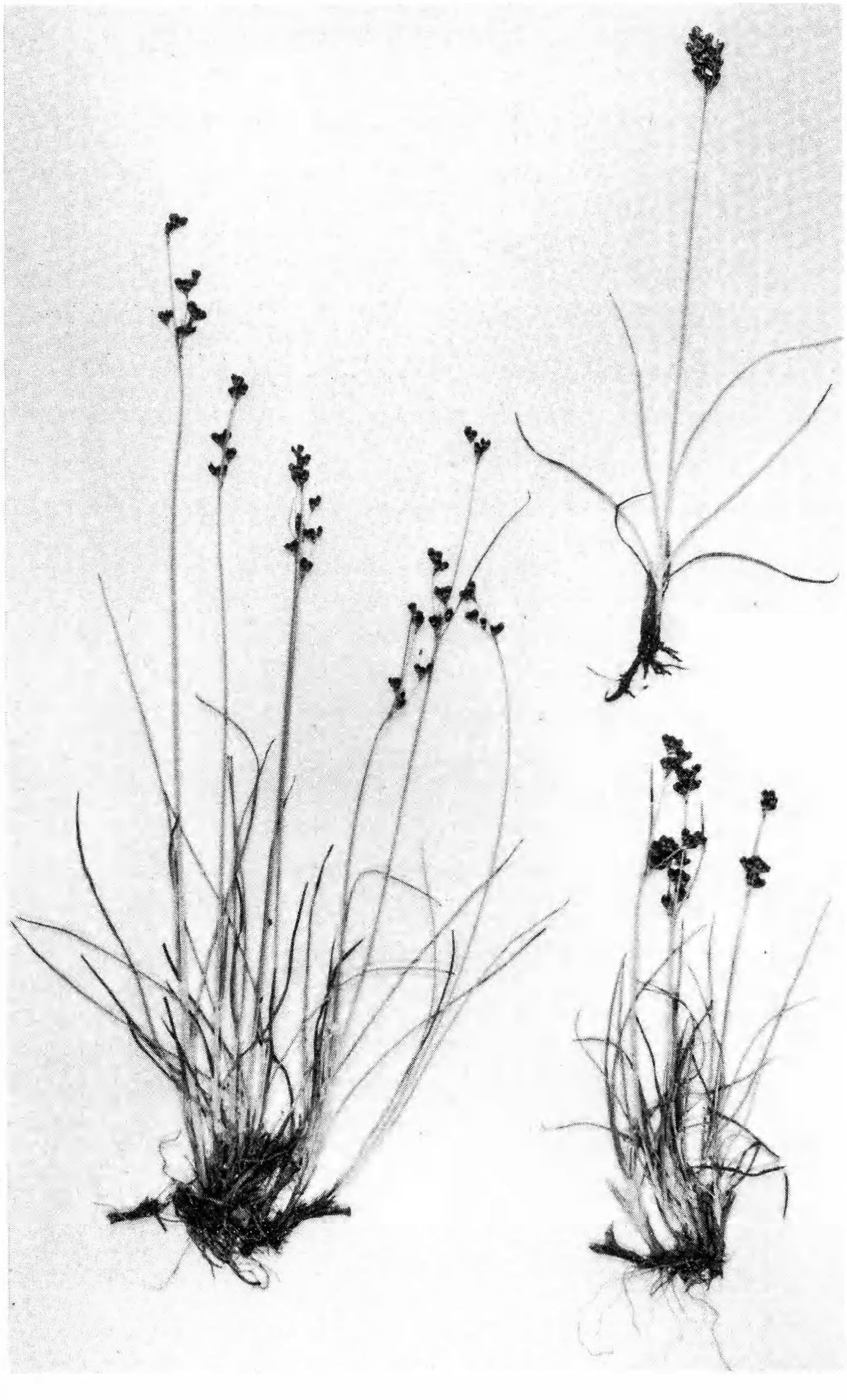

Fig. 1. *Juncus gerardii* subsp. *montanus*. Type collection. Upper right: Jahandiez 649. × 0.38.

Material seen in addition to the type: Morocco, Moyen Atlas, Bekrit, Vallée du Seroual, terrains salés, 1800 m, 18.6.1924, Jahandiez 649 (E, LD).

Morphologically this subspecies more closely resembles the eastern inland and montane subspecies *libanoticus, persicus* and *soranthus* than the geographically closer subsp. *gerardii* of W European seashores. Thus it is probably a relict of a formerly more widely distributed form series now broken up into these different subspecies.

I have not searched very thoroughly for material of it in the herbaria, so it may occur in more localities than those cited above.

The name *Juncus compressus* Jacq. subsp. *gerardi* (Lois.) Rouy var. *cristoflei* Litardière & Maire (1930 a, b) is probably a synonym, although given to an extreme and apparently constant dwarf form of the Atlas mountains, Morocco.

In the placing of the taxa of this complex on subspecies level I follow the practice of Hämet-Ahti (1966) and Snogerup (1971).

Juncus acutus L. subsp. **leopoldii** (Parl.) Snogerup comb. et stat. nov.

Basionym: *Juncus Leopoldii* Parlatore, Giorn. Bot. Ital. 2: 324–325 (1846). – *J. acutus* L. var. *Leopoldii* (Parl.) Buchenau, Abh. Naturw. Ver. Bremen 4: 421 (1875).

Differing from typical *J. acutus* in the capsule being obovoidal, blunt and usually dark brown to chestnut-coloured.

Subsp. *leopoldii* has a wide distribution, including S Africa, S America, SW North America and the Atlantic islands. It occurs in the typical form in some localities in SW Europe and NW Africa. In these areas, however, there are also some intermediate and fertile populations. Subsp. *acutus* occurs in Europe, the Mediterranean area, parts of SW Asia and N Africa. These two taxa probably became differentiated from each other very long ago, as indicated by their large areas of distribution and a considerable range of variation within each of them. As they show no signs of any sterility barriers in their present areas of contact I find it most appropriate to treat them as subspecies. This contact may have arisen largely through the activities of man during the last centuries. Subsp. *acutus* has also been introduced into Australia and New Zealand where it is now naturalized.

The entire synonymy and a more thorough taxonomic discussion will follow in a revision of subgen. *Juncus*, and is therefore not included here.

Juncus subgen. **Ensifolii** (Snog.) Snogerup stat. nov.

Basionym: *Juncus* sect. *Ensifolii* Rydberg ex Snogerup Bot. Notiser 116: 151 (1963). – Typus: *J. ensifolius* Wikstr.

This subgenus does not occur spontaneously in Europe, but the NW American species *J. ensifolius* Wikstr. has been introduced locally in Finland.

The primary subdivisions of *Juncus* must be treated as subgenera, to avoid changing the established names, as will be evident from the synonymy of the other subgenera (Snogerup 1971).

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A revision of the Juncus atratus group

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Juncus atratus Krocker, *J. thomasii* Tenore, *J. alpigenus* C. Koch and *J. anatolicus* Snogerup sp. nov. are treated.

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The present paper is necessitated by my treatment of this group in *Flora Europaea* and *Flora of Turkey*. The group belongs to subgen. *Septati* and its members have unitubulose, perfectly septate leaves. They differ from other members of the subgenus in the leaves having a few longitudinal ridges, giving them a polygonal transection in the fresh condition, the dorsal side in the basal part being broad and often concave (Fig. 1 A). When dried the leaves normally become flattened, but ridges and septa are easily visible with suitable magnification. All the species are normally dark-flowered with sharply pointed to cuspidate tepals. The best characters for species delimitation in the group are mainly size and habit, type of inflorescence, shape of capsule, size and number of anthers and length of style and stigmas.

The data on chromosomes are taken from Snogerup (1963).

Taxonomic discussion

The European plants of this group with obtuse capsules were first described by Tenore (1827) from S Italy. Similar plants from the Balkan were given several different names, and some montane forms with few heads were identified as *J. alpigenus* C. Koch (1848). Buchenau (1890, 1906) correctly identified the Balkan plants as belonging to *J. thomasii* Tenore, but he still kept the name *J. alpigenus* for the high montane types. This treatment has since been followed. However, even the most lowgrowing European plants with one or a few heads are much stouter, and have larger and thicker leaves than any specimens of true *J. alpigenus* from its Caucasian–NE Anatolian area of distribution. A more detailed investigation showed that shape of the inflorescence, number of stamens and size of the anthers also differ. Moreover, the study of specimens from the localities of "*J. alpigenus* auct." in Europe revealed a whole series of intermediates between typical *J. thomasii* and these subalpine forms. Plants of the subalpine form grown in the greenhouses of the Botanical Garden, Lund, from seed from Mt Vitosa, Bulgaria, were tall, thick-leaved and had a varying number of heads. On this evidence it seems clear that all the European plants of the group with obtuse capsules can be regarded as one species. As there is a gradient of variation, no subspecific division seems practical.

The plants occurring in W Anatolia proved to deviate greatly from *J. alpigenus* in shape of capsule as well as in number of stamens and size of style and stigmas. It is therefore described below as *J. anatolicus*. The mountains in this area contain a considerable number of other local species as well as disjunct occurrences of northern and western species.

J. atratus Krocker most resembles *J. thomasii* in habit, being a tall plant with long thick leaves, but differs chiefly in the proportions between the inner and outer tepals and in the shape of the capsule. Taxonomically it is no doubt the most isolated species of the group, and has also the largest distributional area. It has been correctly treated in floras, but often by collectors erroneously identified as *J. acutiflorus* Ehrh. ex Hoffm., a species with leaves of the type more usual in the subgenus, being circular to elliptical in transection with no pronounced ridges.

Key to the species

1\. Capsule acutely tapering 2
– Capsule broadly obtuse 3
2\. Inflorescence one agglomeration of closely packed heads; tepals equal or subequal .... 4. *J. anatolicus*
– Inflorescence of 15–50(–200) usually quite separate heads; inner tepals conspicuously longer .... 1. *J. atratus*
3\. Leaves usually 1–2 mm thick; normally only 3 stamens fully developed .... 3. *J. alpigenus*
– Leaves usually 2–4 mm thick, stamens 6 .... 2. *J. thomasii*

1. **Juncus atratus** Krocker – Fig. 2 A, 3

Krocker, Fl. Siles., 562–563 (1787) – *J. melananthos* Reichenbach, Fl. Germ. Excurs. I, 96 (1830), nom. illeg., orig. superfl. – *J. septangulus* Petermann, Flora 27, 361 (1844), nom. illeg., orig. superfl. – Typus: Schlesia (Poland), not located.

J. serotinus Schur, Herb. Transsilv., nom. nud.

Perennial, rhizome strong, creeping but short-noded, plant thus often more or less caespitose. *Stems* 40–80(–120) cm, usually without leafless basal sheaths, with 1–2 sub-basal and 2–3 upper cauline leaves. *Leaves* 10–25(–40) cm, 1–3 mm thick, with 7–11(–15) well-defined longitudinal ridges, in the fresh condition polygonal in transection, with a broad, flat to concave dorsal side; auricles 1.5–5 mm long, broadly obtuse. *Inflorescence* with 15–50(–200) usually distinctly separate heads, 4–12 × 2–7 cm. Heads 5–10(–15)-flowered. First bract of small inflorescences often sheath-like, 1–2 cm, that of large inflorescences usually with a thin lamina up to 10 cm. *Bracts* of heads and individual flowers broadly ovate, cuspidate, brown, the upper ones gradually more scarious, shorter than the flowers. *Tepals* 2.5–3.5 mm × 0.6–0.8 mm, usually the inner ones 0.2–0.5 mm longer, rarely subequal, narrowly ovate, cuspidate, outer ones boat-shaped, all usually dark to blackish-brown, rarely lighter brown, inner ones with a marked scarious margin. *Stamens* 6, anthers (0.8–)1.0–1.3 mm, filaments 0.6–0.8 mm, anther/filament ratio usually 1.2–1.6. *Style* (0.9–)1.1–1.3 mm, stigmas 1.5–2 mm. *Capsule* trigono-ovoidal, tapering rather sharply but usually abruptly contracted at the apex, 3–3.5 mm including the rostrum, when ripe exceeding the tepals or rarely equalling the inner ones. Rostrum (0.6–)0.9–1.2 mm, often oblique. Capsule dark to blackish-brown apically, basally lighter. *Seeds* 0.5–0.6 × 0.2–0.25 mm, ellipsoidal with two tips, c. 20-striate with rows of rather distinctly hexagonal fields between the striations.

Chromosome number $2n = 40$. One pair of chromosomes only c. 0.5 μm, other pairs forming a length series from 1 to 2 μm. Satellites present on one pair of chromosomes c. 1 μm long.

Krocker's original material has not been located. I consider, however, that the selection of a neotype should be delayed as long as there is still a chance of finding a holotype. The name is beyond doubt correctly applied, as the description is adequate and this is the only species of the group occurring in Poland.

Distribution and ecology. J. atratus occurs in the Caucasus, NE Anatolia, throughout the S parts of European USSR, in E and C Europe and on the Balkan Peninsula southwards to northern Greece. According to *Flora SSSR* it also occurs through temperate Asia eastwards to Siberia and Chinese Dzhungaria. I consider this correct, as I have seen specimens from the vicinity of Karaganda which were quite like European *J. atratus*.

Within the large area of distribution *J. atratus* is very unevenly distributed, with groups of localities occurring at great intervals. This dis-

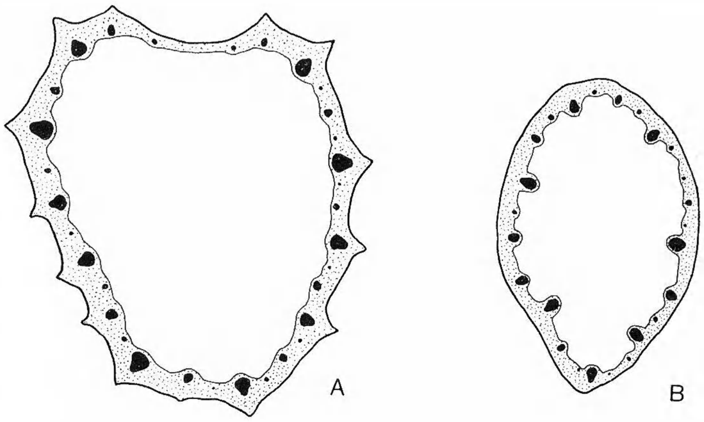

Fig. 1. Schematic drawings of leaf transects × 10. – A: A member of the *J. atratus* group, *J. thomasii* from Bulgaria, Mt Vitosa. – B: The common type of leaf in subgen. *Septati*. *J. anceps* from Denmark, Nymindegab. – Both transects from the basal part of large leaves.

tribution suggests that the present-day localities are at least partly of a relict nature.

J. atratus usually grows in moist meadow vegetation, more rarely along the margins of watercourses.

2. **Juncus thomasii** Tenore – Fig. 2 B, 4

Tenore, App. Cat. Seminum Hort. Reg. Neap. (sin. pag.) (1827) – Typus: Calabria, Sila, leg. Thomas (FI! K!).

J. Rochelianus J. A. & J. H. Schultes, Syst. Veg. ed. 7, II, 1658 (1830) – Typus: Valle Kornia-Reva et ad pedes Kraku-Sanozy Banatus, leg. Rochel.

J. sylvaticus Reichard β *multiflorus* Ant. Rochel, Plantae Banatus rar., 31 (1828) – Typus: Valle Kornia-Reva et ad pedes Kraku-Sanozy Banatus, leg. Rochel.

J. melanocephalus Frivaldzky, Flora 19, 437 (1836) – *J. thomasii* Ten. B. *melanocephalus* (Friv.) Ascherson & Graebner, Syn. Mitteleur. Fl. II: 2, 471 (1904) – Typus: Rumelia, 1835, Frivaldzky (W!).

J. thomasii Ten. ssp. *palensis* Maly, Glasnik Zemal. Mus. Bosn. Herzeg. 45: 57–59, Taf. IV–VI (1933) – Typus: in pratis rudis prope Maly, VIII. 1907, Maly (SARA holotype, LD!).

J. macedonicus Beauverd, Bull. Soc. Bot. Genève 32: 186–187 (1941) – Typus: Humbert & Topali 476 (G!).

(*J. alpigenus* C. Koch sensu Buchenau (1890, 1906) p.p. et alibi, non C. Koch 1848.)

Perennial, with a strong, horizontally creeping short-noded rhizome, often laxly caespitose. *Stems* 25–60(–100) cm, with (1–)2(–3) leafless basal sheaths and usually one with a tiny lamina,

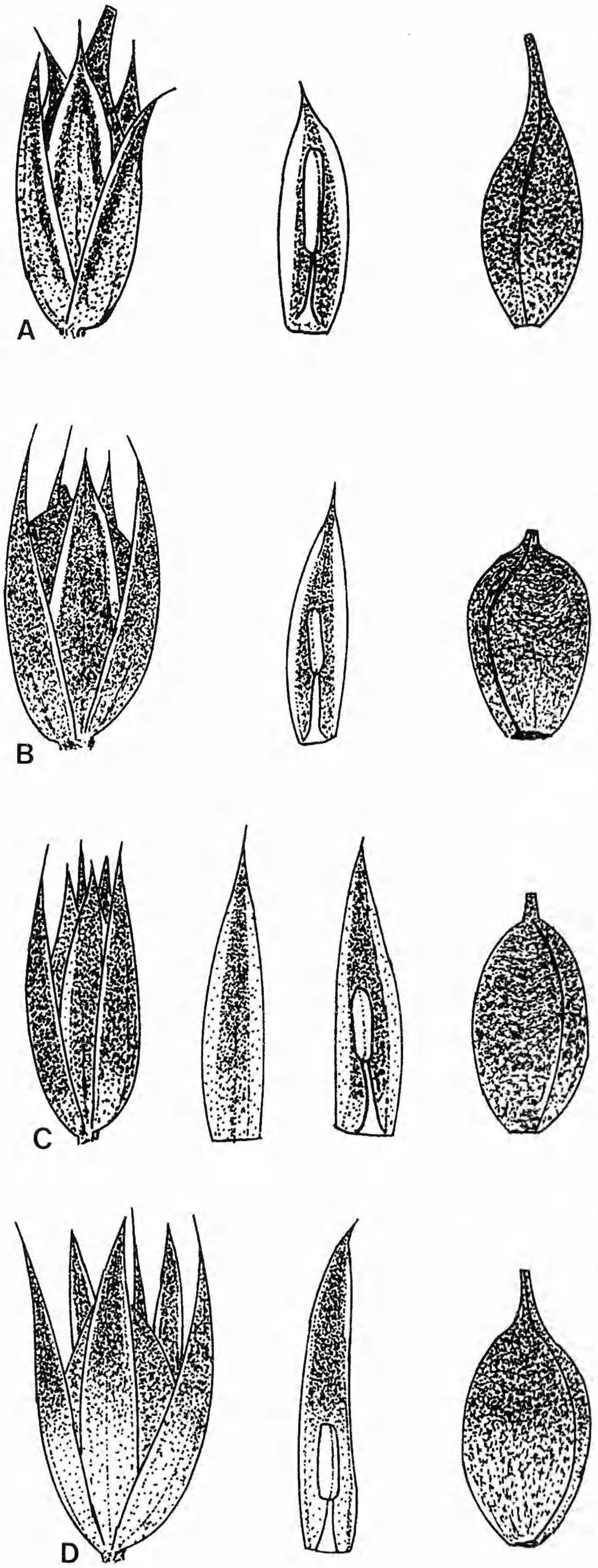

Fig. 2. Flowers, inner tepals with stamens and capsules × 10. – A: *J. atratus,* Austria, Marsegg, leg. Mürle and Hungaria, Ercsi, leg. Tauscher. – B: *J. thomasii,* Greece, Macedonia, Mt Pieria, Rechinger 17793, and S. Serbia, leg. Grebenchicoff. – C: *J. alpigenus,* Caucasus, leg. Frick and Turkey, Trabzon, Stainton & Hendersson 6183. – D: *J. anatolicus*. Type collection.

Fig. 3. Inflorescences, natural size. – Left: *J. atratus,* central Hungaria, Ercsi, leg. Tauscher. – Upper right: *J. atratus,* Austria, Marsegg, leg. Mürle. – Middle right: *J. anatolicus,* type collection. – Lower right: *J. alpigenus,* Erzurum, Kyrikan, Kotschy 544, Hakkari, Kara Dag, Davis & Polunin 24406 and Agri, S of Balik Göl, Davis 47286.

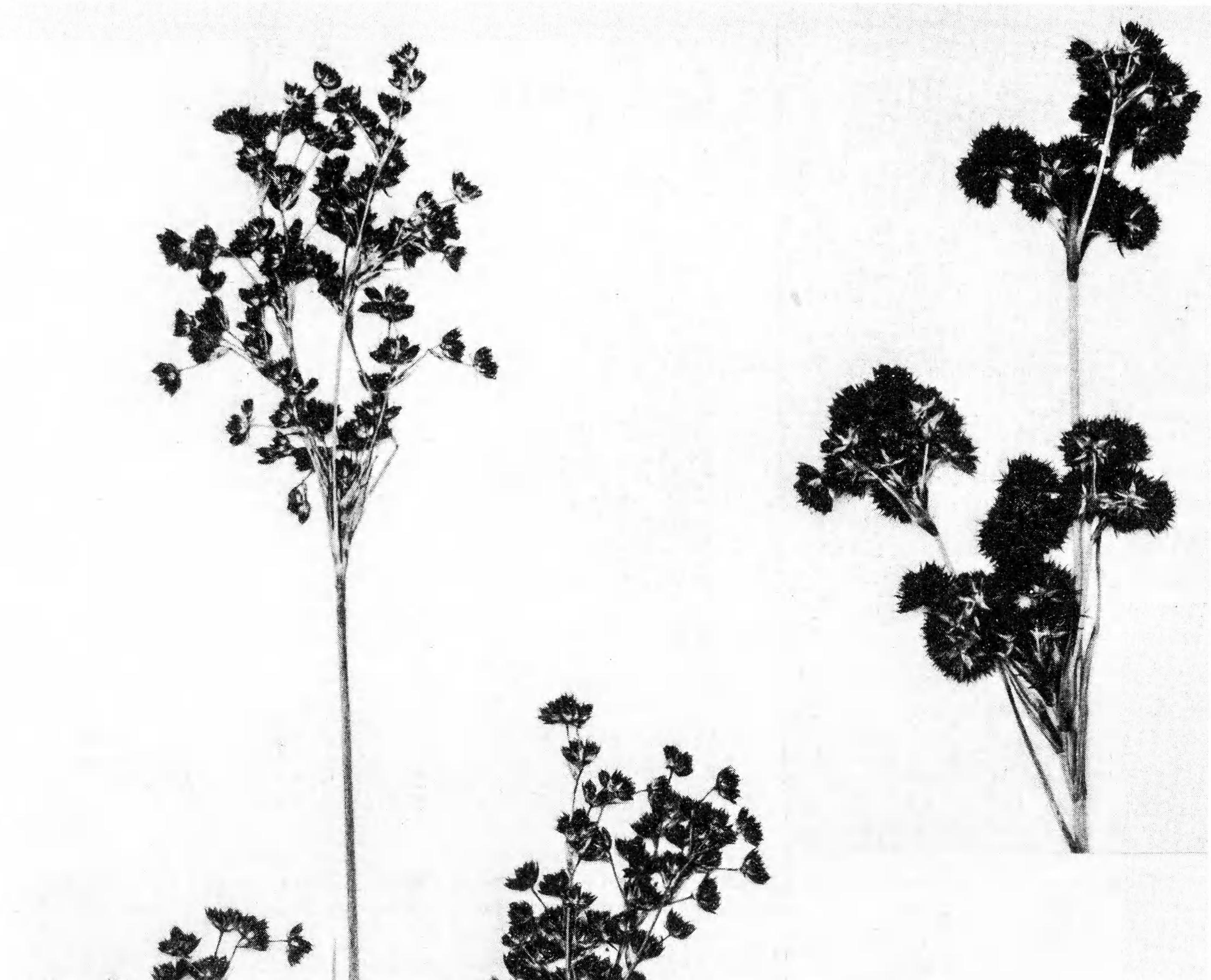

Fig. 4. *J. thomasii,* inflorescences, natural size. – Left: Jugoslavia, Bosnia, inter Pale et Korak, leg. Maly. – Upper right: Greece, Macedonia, Mt Pieria, Rechinger 17793. – Lower right: Greece, Mt Kaimaktschalan, leg. Beauverd.

1–3 sub-basal leaves and 1–2(–3) upper cauline ones. *Leaves* (10–)15–30(–40) cm, 2–4 mm thick, 7–11(–15)-striate, in the fresh condition polygonal in transection, with a broad, flat to concave dorsal side; auricles 2–4 mm long, thin, obtuse. *Inflorescence* with 5–30(–200), (5–)10–20(–many)-flowered heads, heads separate or more or less combined to several (rarely one) agglomerations. Lowest bract of inflorescence leaf-like with a lamina 0.5–5(–10) cm. *Bracts* of heads and individual flowers ovate, cuspidate, dark brown, the upper ones gradually more scarious, shorter than the flowers. *Tepals* 2.5–3.2 mm, equal or the outer ones slightly longer, narrowly ovate, usually dark to blackish-brown, rarely light brown, outer ones boat-shaped, cuspidate, inner ones acuminate, when young with narrow scarious margin. *Stamens* 6, anthers 0.5–1.0 mm, filaments 0.5–1.0 mm, anther/filament ratio 0.7–1.0. *Style* 0.3–0.75 mm, stigmata 0.8–1.0 mm. *Capsule* broadly trigono-ellipsoidal, broadly obtuse, 2–3.5 mm, shorter than, equalling or rarely exceeding the tepals, with a rostrum 0.2–0.4 mm long, apically dark to blackish-brown, basally lighter. *Seeds* 0.45–0.5 × 0.2–0.25 mm, ovoid-ellipsoidal with two dark tips, c. 25-striate with rows of hexagonal fields between the striations.

Chromosome number 2n = 40. One pair of chromosomes spherical, only c. 0.2 μm long, the other pairs rod-shaped and forming a length series from 0.5–1 μm.

The isotype at K (Herb. Gay) was erroneously identified by Gay with his *J. tricephalus*, which is a W Mediterranean form of *J. articulatus* L.

Distribution and ecology. J. thomasii occurs in S and C Italy, in the Balkan Peninsula and northeasterly as far as N Romania and Turkey-in-Europe (Fig. 5). It grows in wet meadows and along the margins of watercourses, from near sea level to 2000 m.

3. **Juncus alpigenus** C. Koch – Fig. 2 C, 3

C. Koch, Linnaea 21: 627 (1848) – Typus: Auf Matten der Vorhöhen des pontischen Gebirges mit Augit-Porphyrunterlage, c. 4000–5000′ hoch. Auf Trachytboden der plateauförmigen Höhen im Norden der Ebene von Musch, c. 5500–6000′ hoch (W in herb. Buchenau!).

J. melanocephalus Boissier & Kotschy in sched. (1859) nom. nud., Boissier Fl. Or. V, 360 (1884), nom. illeg. non Frivaldzky 1836 – Typus: Palantoken versus Kerikan, alt. 7600 ped., 10.8.1859, Th. Kotschy (W! G-BOISS!).

Perennial, with a strong, horizontally creeping, short-noded rhizome. *Stems* (15–)20–40(–50) cm, usually with two leafless basal sheaths and one with a small lamina, 1(–2) sub-basal and 1(0) upper cauline leaf. *Leaves* 10–20 cm, 1–2 mm thick, 9–17-striate, in the fresh condition polygonal in transection with a broad, usually concave dorsal side; auricles 0.5–1.5 mm long, thin, obtuse. *Inflorescence* normally consisting of one 0.5–1.5 × 0.5–1.5 cm wide agglomeration of indistinguishable heads, rarely with two such superheads, usually 50–100-flowered. Lowest bract 1–5 cm, often leaf-like. *Bracts* of heads and individual flowers dark brown, the upper ones gradually more scarious, ovate, cuspidate, shorter than flowers. *Tepals* 2.5–3.5 mm, equal or outer ones slightly longer, narrowly ovate, dark to blackish-brown, with lighter margins, outer ones boat-shaped, cuspidate, inner ones acuminate. *Stamens* usually 3, rarely 1–3 additional rudimentary ones, or (in two collections) 6 fully developed ones. Anthers 0.8–1.3 mm, filaments 0.6–1.0 mm, anther/filament ratio 0.9–1.3. *Style* 0.3–0.6 mm, stigmas 0.9–1.2 mm. *Capsule* broadly trigono-ellipsoidal to prismatic, broadly obtuse, 2–2.5 mm, shorter than the tepals, with a rostrum 0.2–0.3 mm long, apically dark to blackish-brown, basally lighter. *Seeds* 0.5–0.6 × 0.2–0.3 mm, ellipsoidal with two dark tips, c. 25-striate with rows of hexagonal fields between the striations.

The specimen in Buchenau Herbarium, W, might serve as lectotype, as it is stated to have been delivered by the author, via herb. E. Meyer. I consider, however, that the choice of lectotype should wait until the possibility of finding better-labelled original material has been more thoroughly investigated.

Distribution and ecology. Juncus alpigenus occurs in a limited area in the mountains of NE Anatolia and W Caucasus, between 1800 and 3200 m (Fig. 5). It grows in wet meadows and along the margins of streams and lakes.

4. **Juncus anatolicus** Snogerup sp. nov. – Fig. 2 D, 3

Typus: Anatolia: In uliginosis Olympi Bithyn. July 1974. Pichler 126 (W holotype! WU! BM! K!).

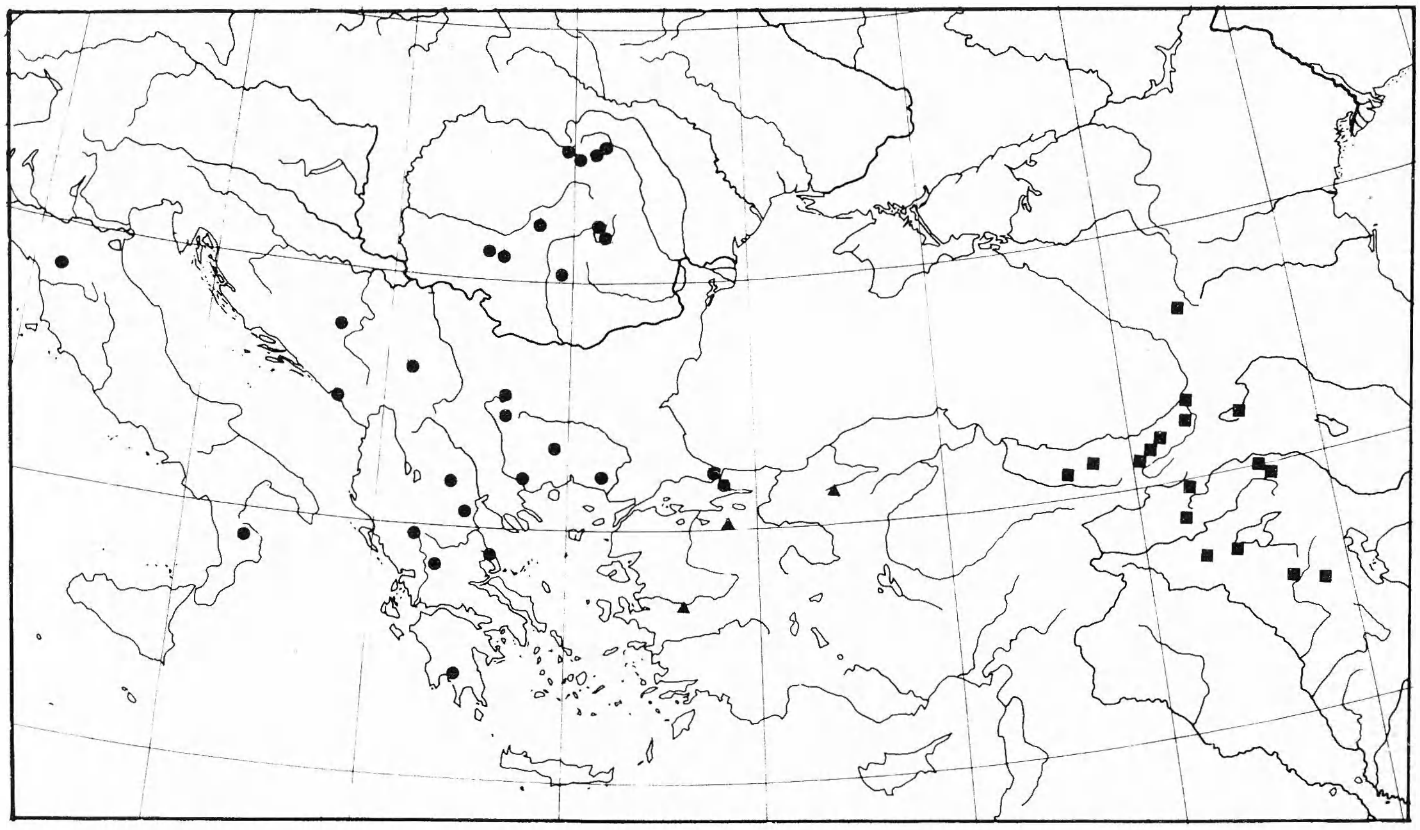

Fig. 5. Distributions according to revised material. – ●: *J. thomasii*. – ▲: *J. anatolicus*. – ■: *J. alpigenus*.

Perennis, rhizomate crasso repente. Caules erecti, 10–40 cm alti, vaginis basalibus 2–3 aphyllis, foliis 1–2 suprabasalibus, folio uno caulino. Folia 3–20 cm longa, 0.5–2 mm lata, 9–17-striata, unitubulosa, perfecte septata. Inflorescentia compacta, plerumque 50–100-flora. Flores 3–3.7 mm, castaneonigri. Stamina 6, antherae 0.65–0.85 mm, filamenta 0.65–0.9 mm longa. Stylus 0.9–1.1 mm longus, stigmata 1.3–1.8 mm longa. Capsula perigonium subaequans, trigono-ovoidea, in rostrum 0.4–0.7 mm longum attenuata. Semina 0.5–0.55 mm longa, ellipsoidea.

Perennial with a strong, horizontally creeping, usually short-noded rhizome. *Stems* (10–)20–40 cm, usually with 2 leafless basal sheaths and one with a tiny lamina, 1–2 sub-basal leaves and (0–)1 cauline leaf. *Leaves* 3–20 cm, 0.5–1.5(–2) mm thick, 9–17-striate, unitubulose, perfectly septate, in the fresh condition polygonal in transection with a broad, usually concave dorsal side; auricles 0.5–1.5 mm long, thin, obtuse. *Inflorescence* consisting of one agglomeration of quite indistinguishable heads, 0.5–1.5 mm wide, (25–)50–100-flowered. Lowest bract 0.5–3(–8) cm, usually with a leaf-like lamina. Upper bracts ovate, cuspidate, dark brown or most of them quite scarious, shorter than flowers. *Tepals* 3.0–3.7 mm, subequal, narrowly ovate, acuminate to cuspidate, outer ones boat-shaped, blackish-brown. *Stamens* 6, anthers 0.65–0.85 mm, filaments 0.65–0.9 mm, anther/filament ratio 0.75–1.2. *Style* 0.9–1.1 mm, stigmas (1.3–)1.6–1.8 mm. *Capsule* 3–3.2 × c. 1.5 mm, equalling or slightly shorter than the tepals, trigono-ovoidal, tapering to a mucro (0.4–)0.5–0.7 mm long, apically blackish-brown, basally lighter. *Seeds* 0.5–0.55 × c. 0.25 mm, ellipsoidal with two unequal darker tips, c. 25-striate with rows of hexagonal fields between the striations.

According to collectors' information *J. anatolicus* grows by streams and springs (distribution, Fig. 5). The altitude records available are 1700–1800 m.

Material examined apart from the type: Turkey, Anatolia, Ulu Dagh, 1700 m, Davis 14796 (E) – Prov. Izmir, distr. Ödemis, Bozdag, 1800 m, Davis 18186 (E).

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Collybia verna sp. nov. and Boletus junquilleus (Agaricales) from Sweden

Svengunnar Ryman

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Collybia verna Ryman sp. nov., a vernal species, is described and compared with *Agaricus extuberans* Fr. and *Agaricus ocior* Pers. *Boletus junquilleus* (Quél.) Boud. is reported as new to Sweden. *B. junquilleus* is not identical with *B. discolor* (Quél.) Big. & Guill. but is an older synonym of *B. pseudo-sulphureus* Kallenb.

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Collybia verna Ryman sp. nov. – Fig. 1

Holotypus: Suecia, Uplandia, par. Bondkyrka, Fäbodarna (prope Upsaliam), 13 aprilis 1975 Ryman 3380 (UPS).

Pileus 10–45 mm latus, e convexo explanatus, dein subdepressus, rufofuscus, hygrophanus, laevis, subviscidus; lamellae primo albidae, dein obscuriores; stipes 20–50 mm longus, 4–10 mm crassus, tenax, saepe flexus, deorsum rufofuscus, sursum pallidior, laevis, ad basim tomento rufofusco; sporae ovoideo-ellipsoideae, 5–7 × 3–4 μm; sporarum massa alba; vernus, ad ramulos dejectos in sylvis frondosis.

Cap 10–45 mm broad, at first convex (one specimen somewhat umbonate), then expanded, with centre slightly depressed; when moist reddish-brown, somewhat viscid, margin slightly striate, but soon drying and then becoming paler, dry and non-striate; when completely dried it has the colour of milky coffee; hygrophanous, smooth. *Gills* sinuate, whitish when young, then dirty buff. *Stem* 20–50 mm long, 4–10 mm thick, tough, hollow, thickening downwards, often bent, reddish-brown, upwards becoming paler, basally with a reddish-brown tomentum. *Flesh* whitish; smell fungoid; taste mild. *Basidia* 4-spored; no cystidia. *Spores* ovoid–ellipsoid, hyaline, smooth, inamyloid, 5–7 × 3–4 μm; spore deposit white. No clamp connections seen. Flesh gives no colour reaction with KOH (40%), $AgNO_3$, $FeSO_4$, lugol or phenol.

Vernal, in deciduous woods, often fruiting just after the snow-melt, solitary, or sometimes 2 or 3 together, on fallen, half-buried twigs and branches of deciduous trees. Fruit-bodies often completely hidden by last year's fallen leaves.

The new species belongs to *Collybia* sect. *Levipedes* (Fr.) Quél. The vernal fruit-bodies on dead wood, the reddish-brown, slightly viscid cap and the dirty buff colour of the gills readily separate it from the other members of this section. At first I identified it as *Collybia extuberans* (Fr.) Quél., a name used by e.g. Moser (1967). *Agaricus (Collybia) extuberans* Fries (1838) is described as a vernal, sometimes autumnal, species, with a reddish-brown, slightly viscid cap. Fries, however, in his description, stresses the umbonate cap, to which feature the epithet *extuberans* refers. My specimens has expanded, slightly depressed caps. Furthermore, *A. extuberans* is described as having white gills, a straight and slender stem and as growing gregariously and subcaespitosely. Later on Fries (1857) added that the cap is not hygrophanous. These characters do not match those of the present species. The illustration of *Bulla pileolo extuberante* given in Battarra (1755 table 28, fig. I), cited by Fries, also shows a tiny, umbonate agaric which cannot be conspecific with *Collybia verna*. The illustration of *Agaricus extuberans* given in Fries (1873 pl. 67, fig. 1) shows a grey, umbonate agaric with a rather thick, rooting stem. According to an annotation made on the original plate in UPS, it was collected in "Upsaliae, oct. 1859". It is obviously not conspecific with *C. verna* and is probably not even identical with the species described by Fries in 1838 (no material in herb. Fries).

The name *Agaricus extuberans* Fr. is illegitimate, since Fries (1838) cites *Agaricus ocior* Persoon (1828 p. 151) as a synonym. *Agaricus ocior* is described as a vernal, slender, umbonate species, which grows gregariously and caespitosely. Its identity is dubious and the name has since long been forgotten. According to the description it can not be identical with *C. verna* and it is probably not even conspecific with *A. extuberans*. However, I have seen some specimens of the *Collybia dryophila* complex, with reddish-brown caps, which were growing gregariously and caespitosely on wood debris and rotting tree stumps in early summer. Hence I consider it not unlikely that *Agaricus ocior* belongs to the *Collybia dryophila* complex.

Material studied

Collybia verna. Sweden, Uppland, Bondkyrka par., Fäbodarna, 10.IV.1973 Lundqvist 8374, 13.IV.1975 Ryman 3380 (holotype), 11.IV.1976 Ryman 3902, 2.V.1976 Ryman 3906 and 1.IV.1978 Ryman 4642. – Bondkyrka par., "Predikstolen", 13.IV.1975 Ryman 3381. – Bondkyrka par., Kvarnbo, 6.V.1973 Ryman 620, 12.IV.1976 Ryman 3904 and 4.V.1976 Ryman 3907. – All in UPS.

Collybia cf. *dryophila*. Sweden, Uppland, Bondkyrka par., Eriksberg, 18.VI.1976 Ryman 3920, 23.VI.1976 Ryman 3924 and Ryman 3925. – All in UPS.

Boletus junquilleus (Quél.) Boud.

Boudier 1910 pl. 148, 1911 p. 76 – *Dictyopus junquilleus* Quélet 1898 p. 450 – *Tubiporus junquilleus* (Quél.) Imler 1950 p. 190 – *Tubiporus erythropus* var. *junquilleus* (Quél.) Imler 1950 p. 195 – Non *Boletus junquilleus* sensu Orton (1960) et Watling (1970) q. e. *B. discolor* (Quél.) Big. & Guill.

Boletus pseudo-sulphureus Kallenbach 1923 p. 225.

Icones: Boudier 1910 pl. 148; Reid 1968 pl. 17 a; Kallenbach 1926 pl. 5; Singer 1967 pl. 3 fig. 1–6; Imler 1950 pl. 3.

Cap 4.5–10 cm broad, convex, then expanded, bright luteous or lemon chrome, slightly spotted vinaceous when older, turning dark blue when touched; surface minutely tomentose, particularly in young specimens. *Tubes* yellow at first, then greenish yellow with yellow pores, instantly dark blue on bruising. *Stem* 6–12 cm high and 2–3.5 cm thick, often up to 5 cm thick near the base, not or only inconspicuously rooting, lemon chrome with slightly darker, granular scales and with a reddish-brown tomentum near the base, turning blue when touched, occasionally with a few vinaceous spots; no stem net present. *Flesh* lemon chrome, slightly vinaceous where eaten away by snails, turning dark blue immediately when cut, on drying becomes somewhat vinaceous; taste mild; smell not distinct; the blue colouration of the cap, tubes, flesh etc. disappears after a while, to leave discoloured spots. Hyphae of flesh inamyloid. *Spores* 11–15 × 4.5–5.5 µm.

This is the first report of this species from Sweden. It is previously known from England, Belgium, France, Germany, Czechoslovakia and Hungary, growing with *Fagus, Quercus* or *Tilia* spp., more rarely in coniferous woods, and probably always on calcareous soils.

Boletus junquilleus is similar to *B. discolor* (Quél.) Big. & Guill., a species not yet found in Sweden. Although also a yellow bolete, that species has orange pores, a more slender stipe with orange-coloured, flocculose granules, and the hyphae of the flesh are pseudo-amyloid. The nomenclature is somewhat confused because the identity of Quélet's *Dictyopus junquilleus* has been variously interpreted. Orton (1960) and Watling (1970) identified it as *B. discolor,* using the name *B. pseudo-sulphureus* for the species described in this paper. I cannot agree with this view. Although Quélet's description of *D. junquilleus* is rather incomplete, he stresses that *D. junquilleus* "paraît être une forme de *discolor,* dont il ne diffère que par les pores concolor". This must mean that the pores are concolorous with the tubes or with the stem apex and cap, all the same colour, viz. yellow, in contrast to the orange pores of *B. discolor*. Furthermore, Boudier (1910 pl. 148) gives an illustration of *Boletus junquilleus,* and his specimens were collected in the same locality ("envoyée de Fontainebleau") by the same person (Feuilleaubois) as were the specimens described by Quélet. Thus one may reasonably presume that Quélet's and Boudier's specimens were conspecific. In his rather detailed description Boudier states that the cap is completely yellow, the stem has the same colour as the cap, with a swollen base covered with a red tomentum, the

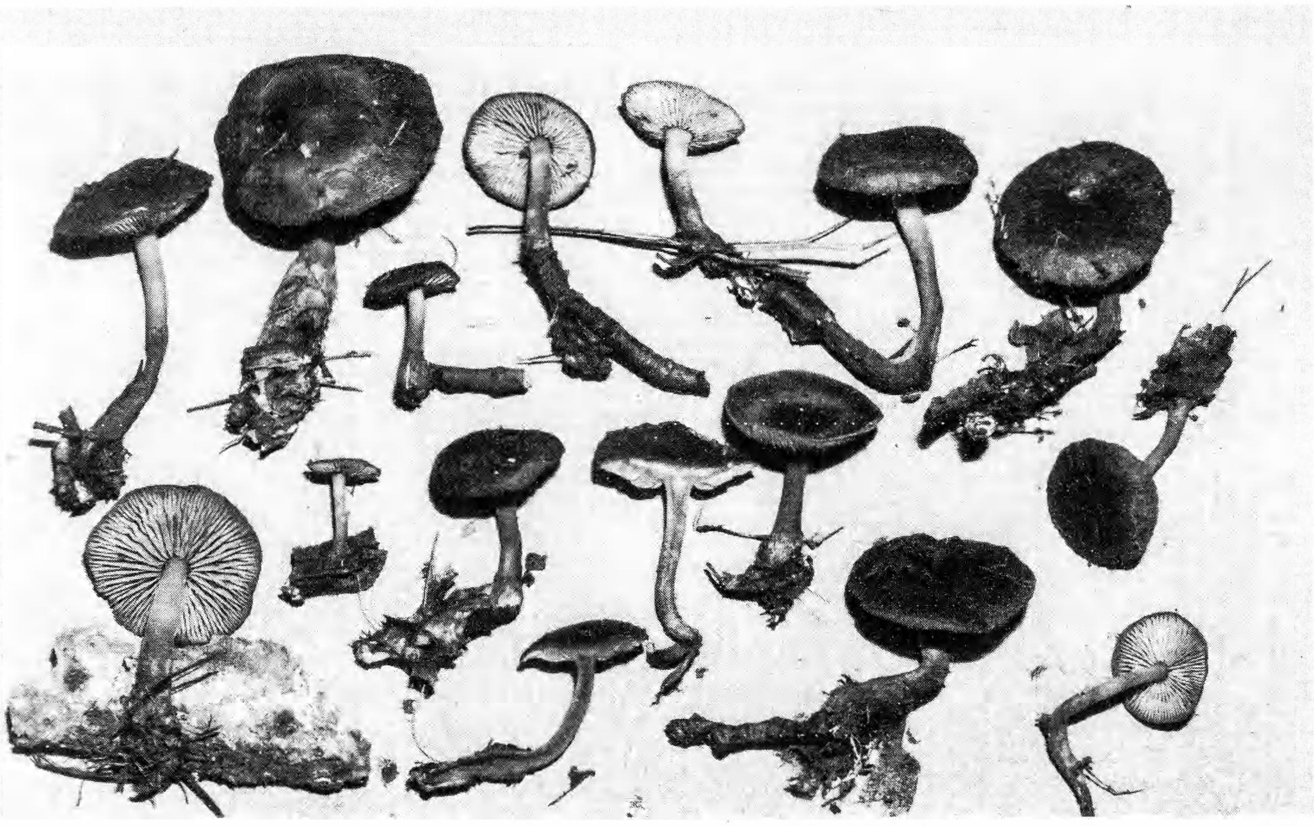

Fig. 1. *Collybia verna,* fresh fruitbodies. Holotype. Half natural size.

tubes are the same colour as the cap, and the flesh is yellow, immediately turning blue when touched. Boudier's illustration shows specimens with stem flesh of an unusually strong red colouration though Boudier does describe other specimens which bore only traces of red, like those depicted by Kallenbach (1926 Taf. 5). In their descriptions of *Boletus junquilleus* and *B. pseudo-sulphureus,* both Orton (1960) and Watling (1970) state that the flesh of *B. junquilleus* is yellow, but red in stem base, and that the flesh of *B. pseudo-sulphureus* is yellow, but not red in stem base. However, flesh colour cannot be used as a diagnostic character, since in the original description of *B. pseudo-sulphureus* Kallenbach (1923) describes the stem flesh as being "stellenweise mehr oder weniger karminweinrot, oft ganz auffallend weinrot werden, nach ein bis mehreren Tagen fast ganz rot". Consequently the name *Boletus junquilleus* cannot be applied to a species which has orange pores and an orange stem ornamentation, but must be considered as an older synonym of *Boletus pseudo-sulphureus.* If that view is not accepted, then the name *Boletus junquilleus* is better dropped to avoid future confusion.

Material studied

Boletus junquilleus. Sweden, Närke, Vintrosa par., Nadderboda, among *Hylocomium splendens* in spruce wood on calcareous bedrock, 1.VIII.1973 Ryman 810 (S, UPS).

Boletus discolor. Denmark, Jylland, Hov skov v. Mariager Fjord, 13.IX.1970 Karin Toft s.n. (C) and 16.VIII.1974 Karin Toft s.n. (C) – Both collections labelled as *Boletus junquilleus.*

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Floristic reports from the high mountains of Sterea Ellas, Greece 2

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Gustavsson, L.-Å. 1978 06 30: Floristic reports from the high mountains of Sterea Ellas, Greece 2. *Bot. Notiser 131:* 201–213. Stockholm. ISSN 0006-8195.

Notes on 47 taxa are given. *Thlaspi kotschyanum* Boiss. & Hohen. is new to Europe and the following 4 are new to Greece: *Alyssum nebrodense* Tineo, *Arabis nova* Vill., *Astragalus mayeri* K. Micevski and *Vicia canescens* Lab. ssp. *serinica* (Uechtr. & Huter) Davis. A further 39 taxa are reported for the first time from the mountains investigated. Chromosome numbers are given for 11 of the taxa, 5 of which have previously not been counted.

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In this second article on the alpine flora of mountains in Sterea Ellas, SC Greece localities for rare taxa or taxa new to the area are given. The mountains investigated were shown in Gustavsson (1978). Unless otherwise stated the nomenclature in this article is according to Tutin et al. (1964–1968) and Hayek (1933). All my collections are preserved at LD (not marked in the collection lists). Some duplicates are also in the Goulandris Museum, Kifissia (ATH) and/or Copenhagen (C).

DICOTYLEDONEAE

Brassicaceae

Alyssum minutum Schlecht. ex DC.

Collections: Mt Parnassos, 7 km W of Titorea, 1580 m, G 613; 4.5 km SW of Titorea, 2150–2250 m, G 721; 6 km NE of Arachova, 1700–1800 m, G 4447 b; 6 km NE–ENE of Arachova, c. 1900 m, G 4472 – Mt Kokkinari, 6 km WSW of Amfissa, c. 1900 m, G 5585 – Mt Giona, 6 km NE–NNE of Lidorikion, 1750–1900 m, G 824 and G 870; 7 km NE–NNE of Lidorikion, c. 1950 m, G 1034; 6 km ENE of Lidorikion, c. 1750 m, G 4527 – Mt Vardousia, 5 km WNW of Athanasios Diakos, c. 2070 m, G 1418; 6 and 5 km WSW of Athanasios Diakos, c. 2000 m, G 1462 and G 4896 – Mt Iti, 7 and 5.5 km SSE of Ipati, c. 1950 and 1850–1900 m, G 4706 and G 4770 – Mt Oxia, 7 km SSW and SW of Gardikion, 1800–1900 and c. 1875 m, G 5491 and G 5532 – Mt Yiorla, 3 km W–WSW of Lampirion, 1800–1850 m, G 6016 – Mt Kaliakouda, 3.5 km SSE of Megalo Chorio, c. 1800 m, G 5246 b – Mt Timfristos, 3.5 and 4 km N of Karpenision, 1850–1950 m, G 1548, G 1600 and G 5128; 4 km NNW of Karpenision, c. 2100 m, G 1637; 5 km NE of Karpenision, 1800–2000 m, G 4993.

New to Sterea Ellas. Probably overlooked in many parts of Greece. In the literature only some ten records have been seen from the mainland, Peloponnisos and the islands of Crete and Lesvos (Halácsy 1901, Hayek 1927, Rechinger 1943, etc.). No records have been seen from Pindhos, though, according to unpublished collections by Aldén it occurs in many localities there.

On the mountains investigated *A. minutum* grows in open communities in a wide range of habitats.

Chromosome number: 2n=16 (G 613, G 824, G 870, G 1462, G 1548, G 1600 and G 1637). No previous count.

General distribution: S and E Europe, Anatolia, Cyprus, Syria and NW Africa.

Alyssum nebrodense Tineo

Collection: Mt Vardousia, 7 km W of Athanasios Diakos, c. 1975 m, G 7229 (ATH, C).

New to Greece. The species was previously known as endemic to Sicily. Previous records of

A. nebrodense from NW Greece probably all belong to *A. smolikanum* which was distinguished from *A. nebrodense* by Nyárády. In habit it is, however, closer to procumbent specimens of *A. sibiricum* and *A. tortuosum*. These species are separated from *A. nebrodense* on the number of non-flowering stems, size and structure of the hairs, size and shape of the silicula and length of style. The Greek specimens match the Sicilian material well.

On Mt Vardousia *A. nebrodense* was found on bare, stony ground.

General distribution: SC Greece and Sicily.

Alyssum taygeteum Heldr.

Collection: Mt Giona, 7 km NW of Prosilion, c. 2200 m, G 6816 (ATH, C).

New to Sterea Ellas. Previously known as endemic to Mt Taygetos on Peloponnisos and possibly known only from Heldreich's original collection. According to Greuter (1974) it was erroneously reported by Quézel & Contandriopoulos (1965 a).

A. taygeteum is close to *A. doerfleri* Degen. On material (not seen by me) from Mt Parnassos (1400 m) and Mt Iti (altitude unknown) Greuter (1974) described two new varieties of the latter, which was previously known to occur in two localities in N Greece and S Jugoslavia. The two species are sometimes difficult to separate morphologically. The leaves and stems of *A. taygeteum* are generally shorter but specimens growing in tufts of grasses on Mt Giona have longer stems and leaves which agree with *A. doerfleri*. The best characters for distinguishing *A. taygeteum* from all varieties of *A. doerfleri* are the entire or only very slightly emarginate siliculae and in particular the length of the appendage of the shorter stamens (only 0.1–0.3 mm long, not 1.0–2.0 mm).

On Mt Giona it was found on almost bare stony ground on the top of a ridge.

General distribution: Endemic to S and SC Greece.

Arabis allionii DC.

Collections: Mt Iti, 6.5 km SE–SSE of Ipati, 1850–1950 m, G 1873; 5.5 km ENE of Neochorion, c. 2100 m, G 4811; 5 km E of Neochorion, c. 2050 m, G 6643 – Mt Timfristos, 5 km NE of Karpenision, 1800–2000 m, G 4974 and G 5014; 3 km NNE of Karpenision, c. 1850 m, G 5105.

New to Sterea Ellas. A polymorphic, still imperfectly known species. As interpreted in Tutin et al. (1964) it includes *A. constricta* Griseb., a taxon confined to the Balkan peninsula and which in Greece has previously been reported from a few mountains in Pindhos, Mt Olympos and Mt Falakron (Halácsy 1901, Hayek 1928, Kitanov 1943).

In Sterea Ellas *A. allionii* grows in dry to somewhat damp subalpine pastures.

Chromosome number: 2n=16 (G 1873), which agrees with previous counts on material from Moravia, the Carpathians and the SE Alps. 2n=32 is known in plants occurring in the SW Alps (see Hess et al. 1970).

General distribution: Alps, Carpathians and mountains on the Balkan peninsula.

Arabis laxa Sibth. & Sm.

Collection: Mt Oxia, 5 km SSW of Gardikion, 1400–1500 m, G 5556 (ATH, C).

Previously reported from Mt Korax (Mt Vardousia) by Leonis (in Halácsy 1901, as *A. dörfleri* Hal.). *A. laxa* is very rare in Greece. To my knowledge it has been recorded only once outside Sterea Ellas: "in agro Laconico" on Peloponnisos (Sibthorp in Halácsy 1901).

Hayek (1927) placed *Arabis laxa* in the genus *Turritis* L. whereas he kept *A. dörfleri* in *Arabis* L. though with some hesitation. In Tutin et al. (1964) the latter is treated as a synonym of *A. laxa*.

The plants collected are up to 100 cm high and the petals are somewhat longer than usual, 4–6 mm, and pale lilac.

On Mt Oxia the species grows in damp *Fagus sylvatica* woodland.

General distribution: Greece, S Jugoslavia, Anatolia, W Syria and Cyprus (map in Meusel et al. 1965).

Arabis nova Vill.

Collection: Mt Giona, 3 km W of Amfissa, c. 900 m, G 4615.

New to Greece. Nearest localities in Bulgaria and in Bosnia and Herzegovina.

The specimens from Mt Giona are 10–25 cm high. They bear immature siliquae up to 50 mm long and 1.2 mm broad on somewhat curved pedicels up to 9 mm long. The immature seeds are c. 0.9 mm long. The plants have no flowers.

On Mt Giona *A. nova* was found in a damp, stony gully in *Abies cephalonica* woodland at c. 900 m.

General distribution: S Spain, Pyrenees, Alps, Jura and Balkan peninsula (according to Hess et al. 1970).

Arabis recta Vill.

Collections: Mt Giona, 6 km NE–NNE of Lidorikion, 1750–1900 m, G 880 and G 897; 6 km NNE of Lidorikion, c. 1850 m, G 4600 – Mt Vardousia, 3.5 km W of Athanasios Diakos, c. 1750 m, G 4885; 5–6 km WNW of Athanasios Diakos, 1850–1950 m, G 4941 – Mt Iti, 4 km E–ENE of Neochorion, c. 1900 m, G 4836; 6 km SE–SSE of Ipati, 1850–1950 m, G 6550 – Mt Yiorla, 3 km W–WSW of Lampirion, 1750–1850 m, G 5826 – Mt Chelidon, 3.5 km W of Mikro Chorio, 1700–1900 m, G 5334 – Mt Kaliakouda, 3.5 km SSE of Megalo Chorio, 1800–1850 and 1800 m, G 5182 and G 5257 – Mt Timfristos, 2 km NNE of Karpenision, c. 1700 m, G 1518 and G 1586; 2.5 km NE–NNE of Karpenision, c. 1750 m, G 5097.

New to Sterea Ellas. Probably overlooked in many parts of Greece. In Halácsy (1901) only reported from Crete, but in Hayek (1927) it has also been recorded from Macedonia and S and C Greece (in both floras as *A. auriculata* Lam.).

The specimens collected in Sterea Ellas have petals up to 5 mm long, sepals up to 2.6 mm long, siliquae up to 38 × 1.0 mm, pedicels up to 5 mm long; the seeds are unwinged and 0.8–0.9 × 0.5 mm.

In Sterea Ellas *A. recta* is fairly common in dry, stony places up to 1950 m. It was found on most mountains visited.

Chromosome number: 2n=16 (G 897 and G 1518), which agrees with previous counts (Fedorov 1969).

General distribution: S and C Europe extending eastwards to Krym and Caucasus and SW Asia; NW Africa (according to Hess et al. 1970, map in Meusel et al. 1965).

Aurinia rupestris (Ten.) Cullen & Dudley

Ptilotrichum rupestre (Ten.) Boiss.

Collections: Mt Giona, c. 3 km E of Sikea, c. 2425 m, G 3920 (C); 8 km NNE of Lidorikion, 2000–2050 m, G 4593 – Mt Vardousia, 5 km WNW of Athanasios Diakos, 1750–1850 m and c. 2025 m, G 1387 and G 3681 (ATH); c. 6 km E–ESE of Artotina, 2100–2300 m, G 3203 – Mt Iti, c. 5 km E of Neochorion, c. 2150 m, G 4206; 4 km E–ENE of Neochorion, c. 1900 m, G 4829 – Mt Kaliakouda, c. 4.5 km SE of Megalo Chorio, 1900–2000 m, G 2675 – Mt Timfristos, 4 km NE–NNE of Karpenision, c. 2200 m, G 5057.

A. rupestris has previously been reported from Mt Giona (Quézel & Contandriopoulos 1965 a). Outside Sterea Ellas Greek localities have been recorded from mountains in NW Greece southwards to C Pindhos and Mt Kyllene and Mt Chelmos on Peloponnisos (e.g. Halácsy 1901, Bornmüller 1928, Zaganiaris 1939, 1940). Aldén has found it on 11 mountains in S and C Pindhos (unpublished).

According to Dudley (1964) the species is represented by ssp. *rupestris* in Italy, Jugoslavia, Albania and Greece while ssp. *cyclocarpa* (Boiss.) Cullen & Dudley (*Ptilotrichum cyclocarpum* Boiss.) occurs in Turkey. In Greece typical ssp. *rupestris* is known from mountains in NW Greece southwards to S Pindhos. The only consistent difference between the subspecies is said to be the pubescence of the fruits: in ssp. *rupestris* the fruits, at least when young, are pubescent all over whereas those of ssp. *cyclocarpa* are completely glabrous. Plants occurring in Albania, Epirus, Sterea Ellas and on Peloponnisos, determined as *Koniga scardica* Griseb. or *Ptilotrichum rupestre* (Ten.) Boiss. var. *scardicum* (Griseb.) Hal., are intermediate in that the mature fruits are glabrous. Dudley (1964) reports that the young fruits have the same type of indumentum as typical ssp. *rupestris* but in all my collections and in the Albanian collections examined it was found that the valves of the young fruits are glabrous (not pubescent), that the hairs are restricted to the replum and that the fruits are sometimes even completely glabrous. When mature they are always glabrous. Thus these plants agree almost entirely with the Turkish ssp. *cyclocarpa* which also sometimes has fruits with one or two hairs on the replum.

In Sterea Ellas *A. rupestris* grows mainly on bare stony ground and in fissures in calcareous rock.

Chromosome number: 2n=16 (G 3203 and G 3920). No previous count.

General distribution (*A. rupestris* s. lat.): Italy, Balkan peninsula and S, NE and E Anatolia.

Barbarea sicula C. Presl

Collections: Mt Vardousia, 3.5 km W of Athanasios Diakos, 1750–1800 m, G 4965 – Mt Iti, 6 km SSE of Ipati, 1850–1950 m, G 4752; 5.5 km SSE of Ipati, 1850–1900 m, G 4774 and G 4784 – Mt Timfristos, 3 km NNE of Karpenision, c. 1850 m, G 5111.

New to Sterea Ellas. The species has previously been reported from some mountains in Pindhos (Halácsy 1901, Quézel & Contandriopoulos 1965 b) and Macedonia (Zaganiaris 1939).

In Tutin et al. (1964) it is queried whether the Greek populations really belong to *B. sicula* which is close to the Bosnian endemic *B. bosniaca* Murb. and *B. intermedia* Boreau occurring in S and C Europe except for much of the Balkan peninsula. *B. sicula* is separated mainly on fruit characters but as these often overlap intermediates frequently occur. The group is in need of detailed investigation. As all my collections from Sterea Ellas have undeveloped siliquae it is not possible to determine them. When referring them to *B. sicula* I follow the traditional treatment of the Greek material.

In Sterea Ellas *B. sicula* grows in damp pastures by springs and rivulets in upper montane to subalpine regions.

General distribution: Greece, S Italy, Sicily and Corse.

Cardamine barbaraeoides Halácsy

Collection: Mt Timfristos, 6 km ENE of Karpenision, c. 1450 m, G 5083.

New to Sterea Ellas. A rare species in Greece. Published localities have been seen from mountains in N and C Pindhos (Halácsy 1901, Maire & Petitmengin 1908, Quézel & Contandriopoulos 1965 b) and from Florina in W Macedonia (Zaganiaris 1939). It has also been collected on Mt Smolikas (Rechinger 21076, LD) and on the Plastaria Mts (Aldén 4271).

On Mt Timfristos it was found in wet pastures by rivulets.

General distribution: Balkan peninsula southwards to SC Greece.

Iberis saxatilis L. ssp. **saxatilis**

Collections: Mt Kokkinari, 6 km WSW of Amfissa, c. 1900 m, G 5640 – Mt Giona, 8 km NNE of Lidorikion, c. 2000 m, G 1047; 3 km E of Lefkadition, 2150–2300 m, G 1082; 5.5 km NE of Lidorikion, c. 1825 m, G 2010; 4 km ESE of Lefkadition, c. 2050 m, G 3787; 6 km ENE of Lidorikion, c. 1750 m, G 4574 (ATH, C); 8 km NNE of Lidorikion, 2000–2050 m, G 4589.

New to Sterea Ellas. The species is very rare in Greece. It has previously been reported from Mt Falakron (Kitanov 1943) and Mt Chelmos (Quézel & Katrabassa 1974). Tutin et al. (1964) does not mention this taxon from Greece.

It is fairly abundant in the southern parts of the Giona massif and in the summit area of Mt Kokkinari. It was generally found in limestone fissures but also on stony ground and stabilized screes between 1750 and 2300 m.

Chromosome number: $2n=22$ (G 3787) which agrees with previous counts. No accessory chromosomes were observed, however, in the plants investigated though they have been observed in other material (Fedorov 1969).

General distribution: S Europe from Spain eastwards to Krym.

Thlaspi kotschyanum Boiss. & Hohen.

Collections: Mt Iti, c. 5 km E–ESE of Neochorion, c. 2140 m, G 6640 (ATH, C); c. 5 km E of Neochorion, c. 2025 m, G 7312 b (seed collection).

New to Europe. *T. kotschyanum* is an Irano-Turanian species previously known to occur at one station in Turkey, Mt Antitaurus in S Anatolia, and in N Iraq and Iran eastwards to W Pakistan and Tien Shan. It was thus very surprising to find it on Mt Iti, more than 1400 km from the nearest known locality.

It belongs to a critical group of closely related species of sect. *Thlaspi.* Characters such as shape of leaves, size of petals, size, shape and structure of siliculae and the density of the infructescence have been used to distinguish the different species which can be placed in two groups. The first includes *T. kotschyanum,* which is the most widespread (see below). *T. cardiocarpum* Hook. & Thoms., described from Afghanistan, was distinguished on slight differences in the size of the petals. Hedge (1968) regards it as being conspecific with *T. kotschyanum.* The Syrian and Lebanese *T. brevicaule* Boiss. & Kotschy is said to differ from *T. kotschyanum* mainly in having constantly acute (not obtuse) auricles at the leaf base. As the plants on Mt Iti have acute to obtuse auricles it seems more reasonable that also *T. brevicaule* is treated as conspecific with *T. kotschyanum.*

A second group contains rare taxa endemic to

Turkey (*T. orbiculatum* Stev. and *T. platycarpum* Fisch. & Mey.), Caucasus (*T. armenum* N. Busch) and Transcaucasia (*T. szovitsianum* Boiss.). The differences between them are so small that the taxa may be conspecific, but as there is very little material available it has not been possible to determine their status with certainty. In comparison with *T. kotschyanum* they are more robust (up to 50 cm), have larger petals (3–4 × 1–1.5 mm), loose infructescence, ± parallel nerves on fruit wings (not reticulate) and obcordate siliculae.

In the most variable characters of these species the plants from Mt Iti are as follows: Stem erect, 4–16 cm, simple or with 1–4 branches. Cauline leaves ovate, entire, amplexicaule with acute to obtuse auricles. Petals 2–2.5 mm long. Siliculae almost orbicular, 8–13 mm long and 8–15 mm broad. The fruiting pedicels are 2–4 mm, patent to somewhat ascending. Hedge (1968) states that the fruiting pedicels are 4–10 mm. Nevertheless 4 collections at LD, cited by him, have pedicels 2–4 mm long.

On Mt Iti *T. kotschyanum* was found in pastures and on almost bare stony ground manured by sheep in two adjacent localities just S of the main peak at c. 2140 m and c. 400 m N of the main peak at c. 2025 m.

Chromosome number: 2n=14 (G 7312 b). No previous count.

General distribution: SC Greece, S Anatolia, N Iraq, Iran, Afghanistan, W Pakistan, Pamir-Alaj and Tien Shan.

Fabaceae

Astragalus apollineus Boiss. & Heldr.

Collections: Mt Parnassos, 7 km N of Arachova, 2000–2250 m, G 497 (C); 6.5 km WSW of Titorea, 1880–1900 m, G 630; 8 km NNE of Arachova, 1900–2000 m, G 6759 (ATH, C); 4 km WSW of Titorea, c. 1800 m, G 7122 – Mt Giona, 7 km N of Prosilion, c. 1800 m, G 4636 (ATH); 7 km NW of Prosilion, c. 2200 m, G 6817; 3.5 km E of Sikea, c. 2000 m, G 6960 – Mt Yiorla, 3 km W–WSW of Lampirion, 1750–1850 and 1800–1920 m, G 5799 (ATH, C) and G 5958.

This species is not known outside Sterea Ellas. It has been recorded a few times from Mt Parnassos and Mt Giona (e.g. Heldreich 1890, Maire & Petitmengin 1908, Quézel & Contandriopoulos 1965 b). Recently Voliotis (1976 a) reported *A. apollineus* from Mt Iti above 2000 m where, however, I did not find it.

A. apollineus grows in a wide range of pastures and on stony ground mainly between 1800 and 2200 m. On Mt Parnassos it is fairly abundant whereas on the other mountains it is uncommon.

General distribution: Endemic to Sterea Ellas.

Astragalus mayeri K. Micevski

Collection: Mt Iti, 6 km SE–SSE of Ipati, 1850–1950 m, G 6535 (ATH, C).

New to Greece. This recently described species is previously known only from Galičica planina in S Jugoslavia (Micevski 1970).

It is close to *A. sericophyllus* Griseb. from which it can be distinguished on the more robust habit, the narrower, almost linear leaflets and the indumentum of the legumes which consists of dense black and white appressed hairs arranged in irregular patches of either black or white hairs.

Morphologically the plants from Mt Iti agree well with Micevski's description, which, however, can be complemented with the following measurements: Stems 1–4 cm. Leaflets (5–) 10–12(–20) × (1.0–)1.2–1.4(–2.1) mm, (5–)8–10 (–13) times as long as broad. Peduncles (8–) 15–20(–27) cm. Racemes with 3–10 flowers. Calyx 9–11 mm, teeth 1.5–3 mm. The legumes on my material are not mature; the best-developed legume is 23 × 3 mm.

On Mt Iti *A. mayeri* grows in crevices of hard limestone cliffs.

General distribution: SC Greece and S Jugoslavia.

Lathyrus cicera L.

Collection: Mt Giona, 8 km WNW of Prosilion, c. 1900 m, G 7277.

L. cicera is a mainly lowland to submontane species, occurring in most parts of Greece, but no locality is known to me in the area investigated.

On Mt Iti *A. mayeri* grows in crevices of hard in a stony, subalpine pasture.

General distribution: S Europe extending eastwards to Krym, C Asia and Syria; NW Africa.

Lathyrus nissolia L.

Collections: Mt Yiorla, 3 km W–WSW of Lampirion, 1800–1920 m, G 5974 – Mt Timfristos 4 km NW of Karpenisìon, 1450–1500 m, G 5158.

New to the mountains visited. A rare species in Greece. In Halácsy (1901) there are records from Messenia, Attica and near the monastery of Korona in Pindhos. Zaganiaris (1938) reported it from Litochoron on Mt Olympos.

It is a predominantly montane species. On Mt Yiorla, however, it grows 100–200 m above the present timber-line on dry stony slopes.

General distribution: W, C and S Europe, Krym, Caucasus, Anatolia, Syria, N Iran and NW Africa (map in Meusel et al. 1965).

Trifolium micranthum Viv.

Collection: Mt Oxia, 6 km SSW of Gardikion, 1750 m, G 6403 (ATH, C).

New to Sterea Ellas. In Greece previously known from a few localities in Thessaly and Macedonia and the islands of Thasos, Karpathos and Evvoia (Halácsy 1901 and Zaganiaris 1940 as *T. filiforme* L., Rechinger 1943, 1961).

The plants from Mt Oxia are erect, 5–20 cm high and simple to few-branched. The heads are 1- to 5-flowered. The capillary peduncles and pedicels are the most useful characters for separating *T. micranthum* from the closely related *T. dubium* Sibth.

On Mt Oxia *T. micranthum* inhabits wet, grassy meadows.

General distribution: W, C and S Europe, Anatolia, Georgia, Caucasus, N Iran and NW Africa.

Vicia canescens Lab. ssp. **serinica** (Uechtr. & Huter) Davis

Collections: Mt Kaliakouda, c. 3.5 km SE and SSE of Megalo Chorio, 1800–1850 m, G 2838 (ATH, C) and G 5180 – Mt Timfristos, 4 km NNW of Karpenision, 2050–2100 m, G 1633 (ATH, C) and G 4128 (seed collection); 5.5 km NE of Karpenision, c. 1650 m, G 1688; 4 km NE of Karpenision, 1950–2100 m, G 4057 (seed collection); c. 5 km NE of Karpenision, 1700–1850 m, G 4091.

New to Greece. This taxon was previously regarded as endemic to Monte del Papa in S Italy. Outside Sterea Ellas it has also been collected in Greece by Aldén on Mt Kakarditsa in Pindhos (A 3672, unpublished).

V. canescens s. lat. is a polymorphic species within which several subspecies are recognized (I follow the treatment by Davis 1970). In Europe the species is represented by ssp. *serinica* (*V. serinica* Uechtr. & Huter in Tutin et al. 1968), whereas all the other subspecies are distributed in Asia.

All plants from Sterea Ellas have densely villous legumes while those from Pindhos are much more laxly hirsute with shorter and somewhat appressed hairs. Similar variation also occurs in other subspecies of *V. canescens*. In other respects the Greek populations are fairly homogeneous and they agree well with the Italian material.

V. canescens ssp. *serinica* inhabits stony alpine pastures, mainly on slopes facing N. On Mt Timfristos it has been observed in altogether eight localities.

Chromosome number: 2n=10 (G 1633, G 4057, G 4091 and G 4128). No previous count. For ssp. *variegata* (Willd.) Davis the same number has been recorded (Fedorov 1969, as *V. variegata* Willd.).

General distribution: SC and C Greece and S Italy. (Outside Europe *V. canescens* s.lat. is distributed in Anatolia, Armenia, Iraq, Iran and Lebanon.)

Vicia hirsuta (L.) S. F. Gray

Collection: Mt Yiorla, 3 km W–WSW of Lampirion, 1800–1850 m, G 6014.

V. hirsuta is scattered in most parts of the Greek mainland and on some of the islands (Halácsy 1901, Hayek 1927, Rechinger 1943, etc.), but from the area investigated I have seen no previous report.

It was found in a stony pasture manured by sheep.

General distribution: Native to most of Europe, W Asia and N Africa; introduced in most parts of the world.

Vicia onobrychioides L.

Collections: Mt Kokkinari, 6 km W–WSW of Amfissa, 1400–1600 m, G 5564 – Mt Kaliakouda, 3.5 km SSE of Megalo Chorio, 1800–1850 m, G 5179.

New to Sterea Ellas. The species is rare in Greece. The following localities have previously been reported: "In Peloponneso et Archipelagi insulis'' and the island of Melos (Halácsy 1901), near Vodena in Macedonia (Zaganiaris 1940) and Mt Kajmakčalan (cf. Adamović 1904). In Pindhos it has been collected by Aldén in the following localities: between Mt Boustagani and Mt Boutaia (A 3193), Mt Boutaia (A 3394), Mt Kakarditsa (A 3468, A 3622 and A 3644) and between Mt Katafili and Mt Soufli (A 4698), all unpublished.

V. onobrychioides was found in dry, stony, montane and subalpine places.

General distribution: S Europe extending eastwards to Rodhos; NW Africa.

Vicia tetrasperma (L.) Schreber

Collection: Mt Oxia, 6 km SSW of Gardikion, 1750–1850 m, G 6399 (ATH).

New to Sterea Ellas. According to the literature *V. tetrasperma* is not common in Greece. The following localities on the mainland are known to me: near the monastery of Korona in Pindhos (Halácsy 1901), near Polyneri and Mt Lailias in Macedonia (Zaganiaris 1940, Voliotis 1976 b) and at Arnea on Chalkidhiki (Politis 1953). For localities on the islands see Halácsy (1901) and Rechinger (1943).

V. tetrasperma was found in wet meadows associated with *Asperula laevigata, Trifolium micranthum,* etc.

General distribution: Most of Europe, Caucasus, SW and C Asia, S Siberia and NW Africa.

Geraniaceae

Geranium asphodeloides Burm. fil.

Collection: Mt Iti, 6 km NW of Pavliani, c. 1500 m, G 4690.

New to the area. The species has previously been reported from most parts of the mainland and Evvoia and the Ionian islands (see Halácsy 1901, Hayek 1927).

G. asphodeloides was found in damp *Abies cephalonica* forests.

General distribution: S Europe from Sicily eastwards; Anatolia, Krym, W Caucasus, N Iran and Latakia.

Geranium peloponesiacum Boiss.

Collection: Mt Iti, 3 km W of Pavliani, c. 1400 m, G 4867 (C).

New to Sterea Ellas. *G. peloponesiacum* is a very rare species. In Greece it is previously known from a few localities on Peloponnisos (see Halácsy 1901).

On Mt Iti it was found in somewhat damp meadows in openings of the *Abies cephalonica* forest.

General distribution: S and SC Greece and Albania.

Rubiaceae

Asperula laevigata L.

Collection: Mt Oxia, 6 km SSW of Gardikion, 1750–1850 m, G 6400 (C).

New to Sterea Ellas. *A. laevigata* is rare in Greece. In Halácsy (1901, 1908) it is reported from Neuropolis in Thessaly, Mt Ghavellu in Pindhos and from Corfu, in Zaganiaris (1939) from Siatista in Macedonia and in Quézel & Contandriopoulos (1965 b) from a further two localities in Pindhos, Mt Karava and Castania.

A. laevigata is a mainly woodland species. On Mt Oxia, however, it inhabits wet subalpine pastures. Associated plants are *Botrychium lunaria, Carex stellulata, C. leporina, C. pallescens, Juncus thomasii, Trifolium micranthum, Vicia tetrasperma,* etc.

General distribution: S Europe and N Africa.

Santalaceae

Thesium arvense Horvátovszky

Collections: Mt Kaliakouda, c. 4 km SE of Megalo Chorio, 1750–1850 m, G 2794 (C) – Mt Timfristos, 6 km ENE of Karpenision, c. 1450 m, G 5072; 2.5 km NE–NNE of Karpenision, 1700–1750 m, G 5151; 5 km NE of Karpenision, 1800–2000 m, G 6050.

New to the area. The species is rare in Greece. Localities have been reported from the Athos peninsula, the surroundings of Athens (Hendrych 1968), Mt Neraidha in Pindhos (Aldén 1976) and Mt Pilion and Mt Chelmos (see Greuter 1977). Quézel & Contandriopoulos (1965 b) recorded *T. arvense* from Mt Peristeri and Mt Karava in Pindhos but according to Greuter the plants were incorrectly determined (see Aldén 1976).

It was found in dry pastures and on cliff ledges with luxuriant vegetation mainly on slopes facing N–NE between 1450 and 2000 m.

General distribution: E and EC Europe eastwards to C Asia.

Thesium brachyphyllum Boiss.

Collection: Mt Giona, 8 km NW of Prosilion, c. 1900 m, G 4678.

New to Sterea Ellas. *T. brachyphyllum* was recently reported as new to the Balkan peninsula by Aldén (1976), who found it on Mt Kazarma, Mt Neraidha and Mt Tringia in Pindhos.

The plants collected on Mt Giona were in flower. In spite of lacking nuts the specimens can be readily distinguished from the morphologically similar *T. parnassi,* which sometimes occurs in similar habitats, on the stout, woody, estoloniferous stock and the longer inflorescence with more flowers.

On Mt Giona *T. brachyphyllum* grows in dry pastures.

General distribution: Greece, Anatolia, Caucasus and Krym (Hendrych 1966).

Thesium linophyllon L. ssp. **linophyllon**

Collections: Mt Oxia, 7 and 6 km SSW of Gardikion, 1800–1900 m, G 6201 and G 6360 (ATH, C) – Mt Chelidon, 3.5 km W of Mikro Chorio, 1750–1850 m, G 5411.

New to Sterea Ellas. In Greece this taxon was first recorded from Mt Athos (cf. Hendrych 1969). It has recently been reported from several localities in Pindhos (Aldén 1976) and Greuter (1977) has published 5 collections made by Stamatiadou, Goulimis and Rechinger in NW Greece.

The nomenclature is according to Hendrych (1969).

On Mt Oxia it grows in pastures on sand and on Mt Chelidon it was found on ledges in limestone cliffs.

General distribution: C, SE and E Europe extending to the Ukraine (Hendrych 1969).

MONOCOTYLEDONEAE

Amaryllidaceae

Sternbergia colchiciflora Waldst. & Kit.

Collections: Mt Parnassos, 6.5 km WSW of Titorea, 1880–1900 m, G 641 b; 6 km WSW of Titorea, c. 1900 m, G 660 b; 7 km N of Arachova, 1850–1900 m, G 2244; 6 km NE of Arachova, 1700–1800 m, G 4410 – Mt Kokkinari, 6 km WSW of Amfissa, 1850–1910 m, G 5718 – Mt Giona, 6 km NE–NNE of Lidorikion, 1750–1900 m, G 855; 7 km NE–NNE of Lidorikion, c. 1950 m, G 1038 b; 7.5 km NE–NNE of Lidorikion, c. 1850 m, G 1103 b – Mt Vardousia, 4.5 km NE of Dichorion, c. 2050 m, G 2952; 4 km W of Athanasios Diakos, c. 1850 m, G 4921 – Mt Yiorla, 3 km W–WSW of Lampirion, c. 1850 m, G 5874 – Mt Chelidon, 3.5 km W of Mikro Chorio, c. 1900 m and 1700–1850 m, G 5295 and G 5406 – Mt Kaliakouda, 4 km SE of Megalo Chorio, 1850–2000 m, G 2833; 3.5 km SE of Megalo Chorio, 1800–1850 m, G 2858; 3.5 km SSE of Megalo Chorio, 1800–1850 m, G 5203 – Mt Timfristos, 3.5 km N of Karpenision, 1850–1950 m, G 1577 b; 5 km NE of Karpenision, 1800–2000 m, G 4973.

New to Sterea Ellas. In Greece the species has previously been reported from only a few scattered localities from Peloponnisos in the S to Thrace in the NE (Halácsy 1904, 1908, Zaganiaris 1940, Quézel & Contandriopoulos 1965 b).

In Sterea Ellas *S. colchiciflora* is fairly common in upper montane and alpine habitats up to 2050 m. It has been found on all the mountains I visited except Mt Iti.

Chromosome number: 2n=20 (G 2833, G 2858 and G 2952), which agrees with previous counts (Fedorov 1969).

General distribution: S Europe eastwards to Krym and Caucasus.

Cyperaceae

Carex goodenowii Gay

C. nigra (L.) Reich.

Collection: Mt Timfristos, 3 km NNE and 4 km N of Karpenision, 1800–1900 m, G 6166.

New to Sterea Ellas. Only five published records from Thessaly, Epirus and W Macedonia have been seen (Halácsy 1904, Zaganiaris 1939, Quézel & Contandriopoulos 1965 b, Strid 1978). The species has possibly been overlooked.

C. goodenowii occurs mainly in montane habitats. On Mt Timfristos it was found in wet subalpine pastures.

General distribution: Eurasia, N Africa, N and S America and Greenland.

Carex hirta L.

Collection: Mt Timfristos, 3 km NNE and 4 km N of Karpenision, 1800–1900 m, G 6150.

New to Sterea Ellas. *C. hirta* is apparently rare in Greece. Only four previous records have been seen in the literature: Messenia on Peloponnisos, Mt Zygos and Neuropolis in Pindhos and near Polyneri in Macedonia (Halácsy 1904, Zaganiaris 1940). Aldén has recently collected the species at Katara at c. 1700 m (A 1428) and on Mt Karava at c. 1900 m (A 4357) in Pindhos, both unpublished. According to Strid (pers. comm.) it has also been found at lower altitudes, from 10 to 880 m on Mt Olympos.

On Mt Timfristos it grows in damp, subalpine pastures together with *Nardus stricta* and *Plantago reniformis*, etc.

General distribution: Most of Europe extending eastwards to the Urals and Caucasus; introduced in N America.

Carex oederi Retz.

Collections: Mt Vardousia, 4 km W of Athanasios Diakos, c. 1700 m, G 1249 – Mt Oxia, 6.5 km SSW of Gardikion, 1750–1800 m, G 5545 – Mt Timfristos, 3 km NNE and 4 km N of Karpenision, 1800–1900 m, G 6155.

New to Sterea Ellas. This species is apparently rare in Greece. Only five published records have been seen: Mt Karava (Halácsy 1904, Quézel & Contandriopoulos 1965 b), near Samarina (Zaganiaris 1940), Mt Vermion (Quézel & Contandriopoulos 1968), Mt Kajmakčalan (Rechinger 1936) and Mt Falakron (Kitanov 1943). Aldén collected the species in some localities in Pindhos: Mt Milia (A 5055), at Katara (A 1429), the Plastaria Mts (A 4267) and Mt Karava (A 4358), all unpublished.

In Sterea Ellas *C. oederi* was found in wet, subalpine pastures by springs and rivulets.

General distribution: Europe, Siberia, Turkestan, Iran and NW Africa. Records from N America and New Zealand are doubtful.

Carex stellulata Good.

C. echinata Murr.

Collections: Mt Vardousia, 4 km W of Athanasios Diakos, c. 1700 m, G 1250 – Mt Iti, 7 km SSE of Ipati, c. 1900 m, G 4247; 5 km E–ENE of Neochorion, c. 2000 m, G 6587 – Mt Oxia, 6 km SSW of Gardikion, 1750–1850 m, G 6383 – Mt Timfristos, 3 km NNE and 4 km N of Karpenision, 1800–1900 m, G 6154 (ATH).

New to Sterea Ellas. In Greece this species is previously recorded from a few localities in the northwest: Mt Zygos (Halácsy 1904), Mt Timphi (Quézel & Contandriopoulos 1965 b), near Samarina (Zaganiaris 1940) and Mt Kajmakčalan (Strid 1978). In Pindhos Aldén found *C. stellulata* on Mt Karava (A 4359) and the Plastaria Mts (A 4258), both unpublished.

In Sterea Ellas it grows in wet, subalpine pastures.

General distribution (*C. stellulata* s. str.): Europe, Caucasus, N Iran, SW Asia, NW Africa and N America (map in Meusel et al. 1965 and Hultén 1958).

Juncaceae

Juncus alpinus Vill.

Collections: Mt Giona, 2.5 km E of Sikea, c. 2000 m, G 6979 – Mt Iti, 8 km SSE of Ipati, c. 1825 m, G 1828.

New to Sterea Ellas. A rare species in Greece. Localities have previously been reported from mountains in C and N Pindhos (Halácsy 1904, 1908, Quézel & Contandriopoulos 1965 b, etc.) and Mt Vermion (Ganiatsas 1939). Recently it has also been collected by Aldén in the following localities in C Pindhos: Mt Milia (A 5057), between Mt Milia and Mt Mavrovouni (A 5040), the Plastaria Mts (A 4255), Mt Peristeri (A 3780), between Mt Trapos and Mt Peristeri (A 3924) and on Mt Katarraxias (A 5367), all unpublished. Hayek (1933) did not report the species from Greece.

The plants in Greece have usually 1–3, rarely up to 10 heads.

In Sterea Ellas *J. alpinus* was found in wet, grazed pastures by springs and rivulets.

General distribution: Temperate Eurasia, NW Africa, N America and Greenland (map in Meusel et al. 1965).

Juncus effusus L.

Collections: Mt Iti, 7 km SSE of Ipati, c. 1800 m, G 1849 – Mt Oxia, 6 km SSW of Gardikion, 1750–1850 m, G 6411.

New to the area. A species with a number of known localities in N and C Greece but in the southern parts of the country it is rare. Localities are given in Halácsy (1904, 1908), Quézel & Contandriopoulos (1965 b), etc.

In Sterea Ellas *J. effusus* grows in damp pastures by springs and rivulets.

General distribution (*J. effusus* s. lat.): Cosmopolitan.

Juncus minutulus Alb. & Jah.

Collections: Mt Vardousia, c. 4 km W of Athanasios Diakos, c. 1750 m, G 3729 – Mt Iti, 6.5 km SSE of Ipati, 1850–1900 m, G 6510.

New to Sterea Ellas. In the *Juncus* L. manuscript for vol. 5 of Flora Europaea, which i follow, *J. minutulus* is reported from Greece, but I have seen no record in the literature. According to S. Snogerup (pers. comm.) the species is not uncommon in the montane and alpine zones on the whole mainland and also occurs on some of the islands.

J. minutulus is an imperfectly known species of the *J. bufonius* group. In most floras, e.g. Halácsy (1904) and Hayek (1933), it has not been separated from the closely related *J. bufonius* L. from which it is distinguished on the smaller capsule and anthers shorter in relation to the filaments.

In Halácsy (1904) *J. bufonius* is said to occur in the whole of Greece, but I have not seen it in the alpine zone of the mountains I visited. A record from Mt Iti (Regel 1944) has not yet been checked.

The plants from Mt Iti are densely caespitose while those from Mt Vardousia have a single stem or sometimes 2–3 stems. They were found growing in damp, almost bare soil.

General distribution: The distributional area is imperfectly known but coincides approximately with temperate Eurasia and N America.

Luzula multiflora (Retz.) Lej.

Collections: Mt Giona, 5 km E–ENE of Sikea, 2000–2150 m, G 6909 – Mt Iti, 8 km, 7 km and 5.5 km SSE of Ipati, c. 1825 m, c. 1800 m and 1850–1900 m, G 1824, G 1843 and G 4776 – Mt Oxia, 6 km SSW of Gardikion, 1750–1850 m, G 6380 – Mt Timfristos, 3 km NNE and 4 km N of Karpenision, 1800–1900 m, G 6169.

New to Sterea Ellas. Only some ten localities have been reported from N and NW Greece. In Halácsy (1904) the species was recorded from Neuropolis in Pindhos. The other known localities are Mt Vermion, Mt Lailias, Karlik Dagh (Rechinger 1939), the island of Samothraki (Rechinger 1943), Mt Falakron (Kitanov 1943), Metzovon (Quézel & Contandriopoulos 1965 b), Mt Bela Voda (Quézel & Contandriopoulos 1968) and Mt Kaimakčalan (Strid 1978). Aldén has recently collected it in the following localities in Pindhos: Katara (A 1269), Mt Tringia (A 268) and Mt Augo (A 2312), all unpublished. Snogerup and Bothmer found it on the island of Andros between 625 and 860 m (S & B 31881, unpublished, LD).

In Sterea Ellas *L. multiflora* occurs in montane and subalpine pastures.

Chromosome number: 2n=24 (G 6909), which agrees with some previous counts. 2n=12, 18, 28, 36 and 48 are also known (Fedorov 1969).

General distribution: Most of Europe eastwards to the Urals and Caucasus; NW Africa, N America, Greenland (map in Hultén 1962).

Luzula sudetica (Willd.) DC.

Collections: Mt Vardousia, 6 km WSW of Athanasios Diakos, 1850–1950 m, G 1443 – Mt Iti, 6.5 km SSE of Ipati, 1850–1900 m, G 6511.

New to Sterea Ellas. The species is very rare in Greece, where it has previously been found only once, viz. on Mt Bela Voda (Quézel & Contandriopoulos 1968, Quézel 1969).

In Sterea Ellas *L. sudetica* grows in dry and somewhat damp, subalpine pastures by springs and rivulets.

General distribution: N Europe and mountains in C and S Europe.

Luzula sylvatica (Hudson) Gaudin

Collections: Mt Iti, 6 km SE–SSE of Ipati, 1850–1950 m, G 6545 – Mt Timfristos, 6 km ENE of Karpenision, c. 1500 and 1600–1700 m, G 1670 and G 3995 (ATH).

New to Sterea Ellas. *L. sylvatica* is previously known from several localities in N Greece southwards to Mt Karava in S Pindhos (e.g. Hayek 1933, Quézel & Contandriopoulos 1965 b).

It is a mainly woodland species but on Mt Iti and Mt Timfristos it inhabits shady N-facing pastures just above the present timber-line.

Chromosome number: 2n=12 (G 3995), which agrees with several previous counts (Fedorov 1969).

General distribution: Much of Europe, mainly in the S, C and W parts; Anatolia and Caucasus (map in Meusel et al. 1965).

Liliaceae

Allium heldreichii Boiss.

Collection: Mt Giona, 2.5 km E of Sikea, c. 2050 m, G 6971.

New to Sterea Ellas. A rare Greek endemic previously reported from Mt Olympos (Halácsy 1904, etc.), Mt Vermion (Rechinger 1939, Ganiatsas 1939) and Mt Koziakas in C Pindhos (Aldén 1976).

A. heldreichii is a predominantly woodland species, but on Mt Giona it was found in an alpine pasture dominated by *Festuca varia* on a limestone rock ledge.

General distribution: Endemic to Greece.

Allium moschatum L.

Collections: Mt Parnassos, c. 8 km N of Arachova, 1900–2100 m, G 4284 – Mt Giona, 5.5 km NE of Lidorikion, c. 1825 m, G 2008.

New to Sterea Ellas. Localities are previously known from N and C Greece, Peloponnisos (Halácsy 1904, Zaganiaris 1940, Markgraf-Dannenberg 1976, etc.) and the island of Astipalaia (Rechinger 1943).

In Sterea Ellas *A. moschatum* was found in dry, stony subalpine pastures. In most other known Greek localities it is restricted to montane habitats.

Chromosome number: 2n=16 (G 4284), which agrees with most previous counts. 2n=24 has also been reported (Fedorov 1969).

General distribution: S Europe.

Anthericum liliago L.

Collection: Mt Parnassos, 7 km NE–ENE of Arachova, 1800–1950 m, G 6719.

New to Sterea Ellas. A very rare species in Greece, previously reported from Mt Chelmos, Mt Olympos (Halácsy 1904), Mt Smolikas (Phitos 1962) and Mt Falakron (Rechinger 1939, Kitanov 1943).

On Mt Parnassos only some ten specimens were found on bare, hard calcareous soil far above the present timber-line.

General distribution: S, C and W Europe extending northwards locally to S Sweden; Anatolia.

Gagea amblyopetala Boiss. & Heldr.

Collection: Mt Iti, 6 km SSE of Ipati, 1850–1950 m, G 4748 (ATH, C).

New to the area investigated. In Greece *G. amblyopetala* is previously known from less than ten localities in Attica, Thessaly, Macedonia and Thrace (Halácsy 1904, 1908, 1912, Hayek 1933, etc.) and on Mt Athos and the islands of Evvoia and Thasos (Rechinger 1943, Stojanov & Kitanov 1950).

On Mt Iti it was found in large numbers in grassy meadows partly influenced by melt water and by rivulets and small melt-water pools.

General distribution: SE Europe, from WC Macedonia and S Greece to Krym; Anatolia and Iran.

Gagea minima (L.) Ker-Gawler

Collections: Mt Parnassos, 6 km N–NNW of Arachova, 1250–1500 m, G 2233; 8 km N of Arachova, 1800–2050 m, G 2247 a – Mt Giona, 6 km ENE of Lidorikion, c. 1750 m, G 4547 (ATH) and G 4552; 7 km N of Prosilion, c. 1800 m, G 4640; 2.5 km E of Sikea, c. 2150 m, G 6974 – Mt Kaliakouda, 3.5 km SE–SSE of Megalo Chorio, 2100 m, G 5268 – Mt Timfristos, 3 km NNE of Karpenision, c. 1850 m, G 5109, G 5110 and G 5116 b.

New to Sterea Ellas. Previously reported from the following three localities in Greece: Mt Micikeli in Pindhos (Halácsy 1904), Mt Vermion (Ganiatsas 1939) and Mt Bela Voda (Zaganiaris 1939).

In Sterea Ellas *G. minima* occurs in different kinds of montane to alpine habitats, often by snow patches.

General distribution: Endemic to Greece.

parts in the west and southwest, extending eastwards to the Ob and Kazakstan (map in Meusel et al. 1965).

Poaceae

Agropyron sanctum (Janka) Hackl.

Collections: Mt Yiorla, c. 3 km W of Kato Lampirion, 1800–1850 m, G 3330 – Mt Kaliakouda, c. 4.5 km SE of Megalo Chorio, c. 1900 m, G 2644.

New to Sterea Ellas. A Greek endemic, previously reported from mountains in Pindhos (see Aldén 1976), Mt Athos (Rechinger 1943), Mt Falakron and Mt Pangeon (Rechinger 1939, Quézel & Contandriopoulos 1968).

In Sterea Ellas it inhabits dry, stony slopes just above the timber-line.

General distribution: Endemic to Greece.

Avena compacta Boiss. & Heldr.

Collection: Mt Kaliakouda, c. 4.5 km SE of Megalo Chorio, 1900–2000 m, G 2685.

New to Sterea Ellas. Outside this area *A. compacta* is reported from Mt Taygetos (Halácsy 1904) and Mt Chelmos (Maire & Petitmengin 1908, Bornmüller 1928) on Peloponnisos, Mt Cika Acrocerauniae, Mt Tzoumerka (Halácsy 1904) and Mt Timphi (Quézel & Contandriopoulos 1965 b) in Pindhos and from Mt Kajmakčalan (Zaganiaris 1938) and Mt Falakron (Kitanov 1945, Quézel & Contandriopoulos 1968) in Macedonia. Furthermore it has been collected by Aldén on the following mountains in Pindhos where it has not previously been found: Mt Katafili (A 4594), Mt Katarraxias (A 5323) and Mt Baros (A 3098).

On Mt Kaliakouda *A. compacta* grows in limestone crevices and among stones and boulders.

General distribution: Balkan peninsula, Anatolia and Caucasus.

Glyceria plicata Fr.

Collections: Mt Vardousia, 4 km W of Athanasios Diakos, c. 1700 and c. 1750 m, G 1239 and G 3718.

New to Sterea Ellas. A rare species in Greece though published localities have been seen from most parts of the mainland, Peloponnisos and Evvoia (Halácsy 1904, Maire 1921, Hayek 1933, Zaganiaris 1939, etc.).

G. plicata is a species with a wide altitudinal range, known from almost sea level but occurring mostly in the montane zone and on Mt Vardousia in subalpine habitats by springs and rivulets.

General distribution: Most of Europe extending eastwards to C Asia; N Africa.

Trisetum tenuiforme Jonsell

T. tenue (Hackel) Chrtek, non Steudel

Collections: Mt Parnassos, 7 km NNE of Arachova, 2300–2350 and c. 2080 m, G 587 and G 2080; c. 8 km N of Arachova, 1900–2100 m, G 4287 – Mt Giona, 5 km E of Sikea, c. 1950 m, G 6823 – Mt Vardousia, 3.5 km W of Athanasios Diakos, 1800–1900 m, G 7178 – Mt Timfristos, 4 km NNW of Karpenision, 2050–2100 m, G 1619 – G 587, G 1619, G 2080, G 4287 det. Bengt Jonsell, Stockholm.

New to Sterea Ellas. The species has previously only been reported from Mt Ghavellu and Mt Karava in Pindhos and Mt Taygetos on Peloponnisos (see Halácsy 1904, Maire & Petitmengin 1908, sub *T. flavescens* (L.) Beauv. var. *tenue* Hackel). Aldén has recently collected the species on two other mountains in Pindhos: Mt Kakarditsa (A 3542) and Mt Pteri (A 1841). The nomenclature is according to Heywood (1978).

In Sterea Ellas *T. tenuiforme* was found in a wide range of alpine habitats such as luxuriant N-facing meadows, dry stony pastures, almost bare stony ground, cliffs and rock ledges, etc.

General distribution: NW to S Greece; Albania.

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Two new setose hyphomycetes from India

K. I. Mani Varghese and V. G. Rao

Varghese, K. I. M. & Rao, V. G. 1978 06 30: Two new setose hyphomycetes from India. [Contribution No. 614 from the Department of Mycology and Plant Pathology.] *Bot. Notiser 131:* 215–217. Stockholm. ISSN 0006-8195.

The new species *Circinotrichum ponmudiensis* and *Menisporopsis pirozynskii* are described and illustrated. They have been collected on leaf litter at Ponmudy Forests, Kerala, S India. The genus *Menisporopsis* Hughes is new to India.

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Circinotrichum ponmudiensis Varghese & Rao sp. nov. – Fig. 1

Type: India, Kerala, Ponmudy Forest, on fallen leaves of a dicot plant, leg. K. I. M. V. 10.XI. 1976, No. AMH 3360 (holotype), IMI 210312 (isotype).

Coloniae punctiformes vel effusae, griseo-brunneae, velutinae. Mycelium partim superficiale, partim in substrato immersum. Setae dispersae, simplices, erectae, crassitunicatae, atro-brunneae, 160–300 μm longae, basim bulbosum versus 6–7.5 μm latae, usque ad 18-septatae, apicem acutum vel obtusum versus subhyalinae, cellulis conidiogenis ferentes. Cellulae conidiogenae aggregatae, partem centralem setarum cingentes, 100–165 μm longam, ampulliformes vel lageniformes, subhyalinae, 3.5–5 × 3.5–4 μm, unaquaque fasciculo usque ad 6 conidia efferens. Conidia continua, hyalina, anguste claviformia, 7–9.5 × 1.5–2 μm.

Colonies punctiform, effuse, greyish brown, velutinous. Mycelium partly superficial and partly immersed. Setae scattered, simple, erect, straight or somewhat curved, dark brown, paler towards the apex, 160–300 μm long, up to 18-septate, thick-walled, 6–7.5 μm wide at the bulbous base, tapering to 2–3 μm at the apex. Conidiogenous cells crowded, arising directly from the cells of the setae, or from subglobose to angular pale brown stalk cells which grow out from the setae, encasing a 100–165 μm long, central part of the setae, ampulliform to lageniform, subhyaline, 3.5–5 × 3.5–4 μm, each bearing a fasicicle of 4–6 conidia. Conidia continuous, hyaline, narrowly clavate, 7–9.5 × 1.5–2 μm.

This species comes closest to *Circinotrichum fertile* Pirozynski & Hodges (1973) in possessing conidiophores which are borne directly from the setae, but the conidia are smaller and typically cylindrical to fusiform.

Menisporopsis pirozynskii Varghese & Rao sp. nov. – Fig. 2

Type: India, Kerala, Ponmudy Forest, on fallen leaves of a dicot plant, leg. K. I. M. V. 10.XI.1976, No. AMH 3575 (holotype).

Coloniae hypophyllae, effusae, olivaceo-brunneae, velutinae vel pilosae. Mycelium visibile superficiale ex hyphis septatis subhyalinis vel pallide brunneis, laevibus, 1–2.5 μm crassis compositum. Setae erectae, rectae, subulatae, 10–15-septatae, atrobrunneae, apicem versus pallidiores, laeves, crasse tunicatae, usque ad 300 μm longae, basi 4.5–6 μm, apice 2–3 μm crassae. Conidiophora fasciculata, polyphialidica partem basalem setarum cingentes, 6–12, simplicia, erecta, 57–85 × 2–3.5 μm, aureo-brunnea, apicem versus inflata, subhyalina ad 4 μm crassa. Conidia leviter curvata, cylindrica vel fusiformia, hyalina, laevia, 17–20.5 × 2.5–3.5 μm, utrinque setulis duabus simplicibus, 7–12 μm longis praedita.

Colonies hypophyllous, effuse, olivaceous brown, velvety or hairy. Visible mycelium superficial, composed of subhyaline or pale brown, smooth, 1–2.5 μm thick hyphae. Setae erect,

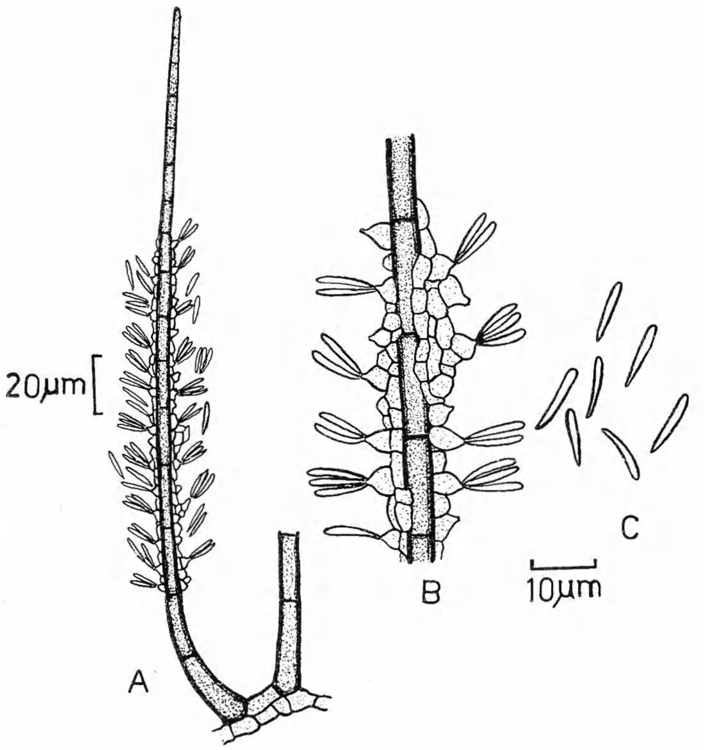

Fig. 1. *Circinotrichum ponmudiensis.* – A: Setae with conidiophores and conidia. – B: A fertile part magnified. – C: Conidia. – Full coverage of conidiophores around the setae not shown.

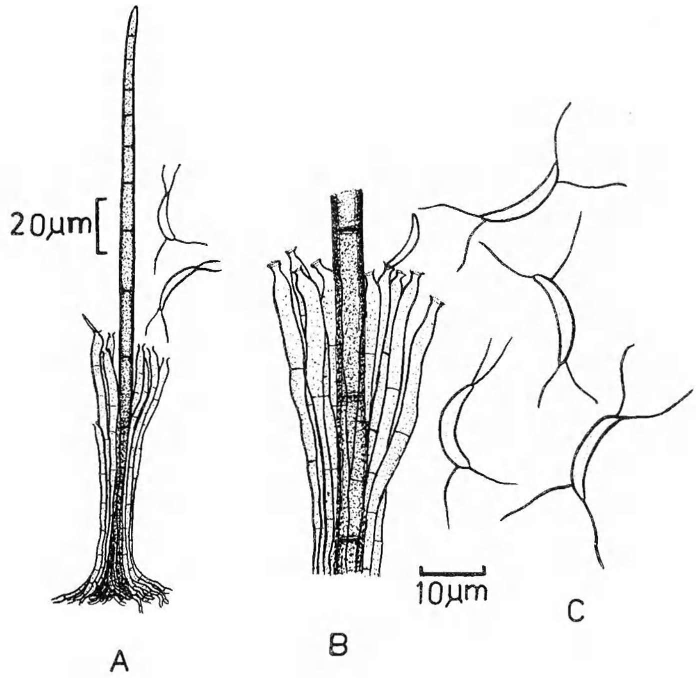

Fig. 2. *Menisporopsis pirozynskii.* – A: A typical seta with basal conidiophores and conidia. – B: Apical part of conidiophores showing phialides. – C: Conidia.

straight, subulate, 10–15-septate, dark brown, paler towards the apex, smooth, thick-walled, up to 300 µm long, 4.5–6 µm thick at the base, 2–3 µm at the apex. Conidiophores polyphialidic, forming a fascicle around the lower part of each seta; individual threads simple, 6–12, 57–85 × 2–3.5 µm, golden brown below, hyaline above and swelling to 3.5–4 µm. Conidia aggregated into colourless, glistening, slimy droplets at the apices of the conidiophores, slightly curved, cylindrical to fusiform, hyaline, smooth, 17–20.5 × 2.5–3.5 µm, with two uniform, 7–12 µm long setae at each end.

Table 1. Comparison between the species of *Menisporopsis.* Data from Hughes (1952), Hughes & Kendrick (1968), Pirozynski & Hodges (1973) and the present work.

Species	Setae	Conidiophores	Conidia
M. theobromae Hughes	200–420 × 4.5–7 µm, 21-septate	Up to 120 µm long, base 1 µm thick, apex 2.5–3 µm thick, up to 50 in one fascicle	Single-celled, 14–18 × 2–3 µm, single setula at each end
M. novae-zelandiae Hughes & Kendr.	220–820 × 7–10 µm, 17-septate	42–80 × 1.5–2 µm, up to 40 in one fascicle	2-celled, 15–18 × 2.5–3 µm, single setula at each end
M. profusa Piroz. & Hodges	150–250 × 4.5–6 µm, 10–15-septate	60–110 × 3 µm, 4–10 in one fascicle	Single-celled, 12–15 × 2–2.5 µm, single setula at each end
M. pirozynskii Varghese & Rao	Up to 300 µm long, 4.5–6 µm thick, 10–15-septate	57–85 × 2–3.5 µm, 6–12 in one fascicle	Single-celled, 17–20.5 × 2.5–3.5 µm, 2 setulae at each end

This species is distinct from the three previously-known species of *Menisporopsis* Hughes in possessing slightly larger conidia with a pair of setulae at each end (Table 1). The genus is new to India. The new species is named in honour of Dr K. A. Pirozynski, Ottawa, Canada.

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The genus Calceolaria in NW South America

I. Taxonomic characters and generic subdivision. Fasciculata, a new section

Ulf Molau

Molau, U. 1978 06 30: The genus Calceolaria in NW South America. I. Taxonomic characters and generic subdivision. Fasciculata, a new section. *Bot. Notiser 131:* 219–227. Stockholm. ISSN 0006-8195.

The genus *Calceolaria* L. (Scrophulariaceae) has been investigated in an area comprising Venezuela, Colombia, Ecuador and Peru N of the Piura Divide. The inflorescence is a thyrse with an abortive terminal florescence consisting of decussate axillary cymes. The morphology of corolla and anthers provide taxonomically useful characters. A suitable terminology is proposed and illustrated. A key to the sections present in the area is given. The section *Fasciculata* Molau sect. nov. comprises the following four species: *C. argentea* H. B. K., *C. cajabambae* Kränzlin, *C. reichlinii* Edwin, all restricted to N Peru, and *C. scabra,* which ranges from N Peru to Bolivia.

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The genus *Calceolaria* L. (Scrophulariaceae) comprises 250–300 species and is one of the largest genera in the Andes of South America, ranging from central Mexico to southern Chile. Phytogeographically the genus readily falls into three well-defined latitudinal groups (Pennell 1945 p. 138). This sequence of papers will consider the species of the northern group.

The investigated territory includes the Andean areas of Venezuela, Colombia, Ecuador and a small part of northernmost Peru (Fig. 1). Its southern boundary coincides with the Piura Divide, the deepest and widest depression in the High Andes and hence an important phytogeographical barrier (Pennell 1945). The Piura Divide runs from the southern border of Piura Dept., in the neighbourhood of Olmos, eastwards along the Río Chamaya valley into the northern part of Cajamarca Dept. Only about a dozen of species of *Calceolaria* are found on both sides of this gap, the majority being species which grow at relatively low altitudes. Striking effects of geographical isolation are evident in the separate populations of those few High-Andean species which occur on both sides of the divide.

Species of *Calceolaria* occur in the northern Andes at altitudes between 1500 and 4750 m, only occasionally lower down. The majority (subgenus *Cheiloncos*) occupy the drier habitats of otherwise humid and semi-humid areas. Species with erect and ± woody stems are often abundant in the páramo zone, while liane-like species thrive in the scrub found at lower altitudes. Many species of this subgenus are endemic, some of them restricted to a single valley or mountain. The species of subgenus *Calceolaria,* in contrast, occupy wide distributional areas and show a broad altitudinal range. The latter are all annual hydrophilous herbs, often autogamous, and are the only species of the genus found outside South and Central America.

Taxonomically important characters

Inflorescence

The inflorescence of *Calceolaria* is a *thyrse* with an abortive terminal florescence, built up of equivalent decussate axillary *cymes.* The terminology used in this series of papers is

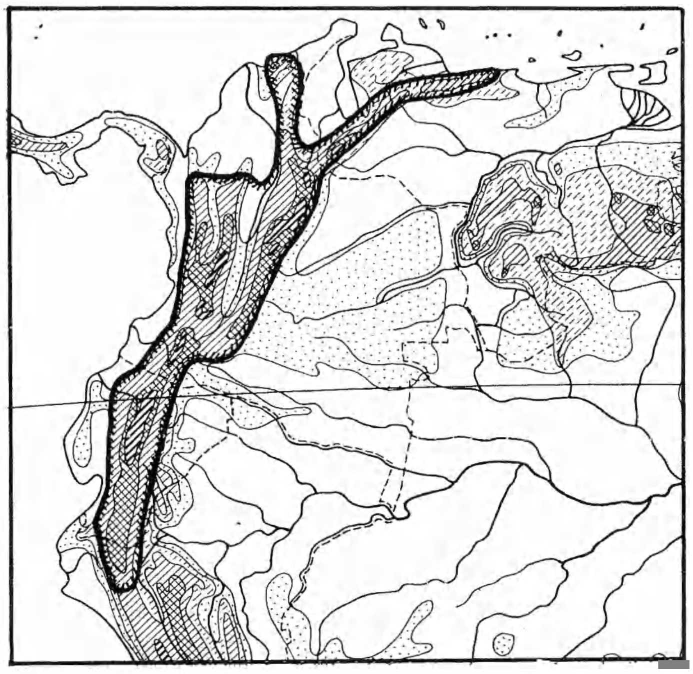

Fig. 1. Known distribution of *Calceolaria* within the investigated area.

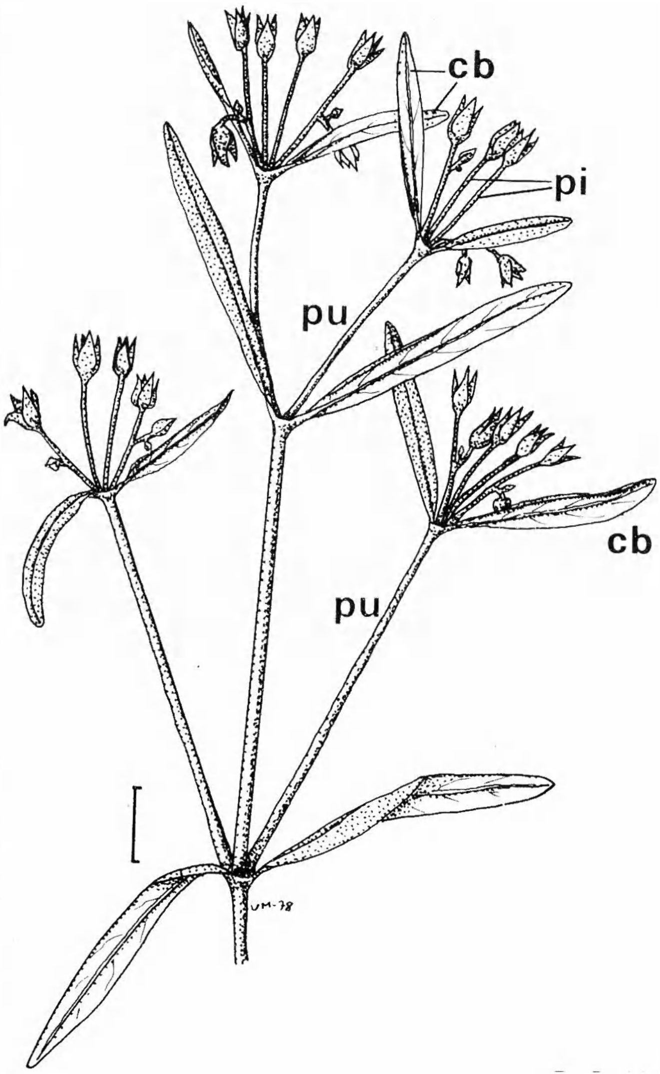

Fig. 2. Inflorescence of *Calceolaria hyssopifolia* (Balls 7236). – Symbols: cb cyme bract, pi primary pedicel, pu primary peduncle. – Scale 1 cm.

shown in Fig. 2. The *primary peduncles* which subtend the cymes arise axillary to normal foliage leaves and usually have a single pair of *cyme bracts*. The presence or absence of cyme bracts is often a reliable taxonomic character. In each cyme the terminal flower is abortive, being replaced by two axillary pedicels with solitary flowers (*primary pedicels*), which occupy decussate postition compared to the cyme bracts. Troll's (1964 p. 69 Fig. 61:2) schematic drawing of the inflorescence of *''Calceolaria rugosa''* shows well-developed terminal flowers in the cymes. This is not the case in any of the species found in the presently investigated territory, not even in wild specimens of *Calceolaria rugosa* R. & P. from Chile. However, this specific epithet is often confused with those of cultivated *Calceolaria* species and hybrids, which in many cases do possess the morphological deviation illustrated by Troll.

Axillary to the cyme bracts, two lateral flowering branches, with progressively shorter peduncles are always present. The flowers of the lateral branches may show a monochasial or mixed mono- and dichasial arrangement. These two types of arrangement are illustrated in Fig. 3. The proposed interpretations are supported by the facts that (1) both flowers of each pair are always at the same stage of development; (2) the primary pedicels (pi, Fig. 3) are decussate to the lateral cyme-branches; and (3) in exceptional cases a terminal cyme may arise. In some cases both the lateral branches of the cyme are one-flowered, while in others they produce a large number of flowers. In the latter case smaller, subordinate bracts may be present. In some species the terminal thyrse together with equivalent lateral inflorescences form a *synflorescence*.

Corolla

The corolla of the *Calceolaria* species of northwestern South America is yellow, excepting sect. *Lehmannina,* where white is the basic colour. The presence or absence of red spots and hairs in the *throat* of the lower lip is a character of taxonomic interest. In the sections *Chasmatochila* and *Phaeanthera* both corolla lips are about equal in size, but in all other sections the upper lip is smaller than the lower one. In the sections *Ericoides* and *Anacyrta* the upper

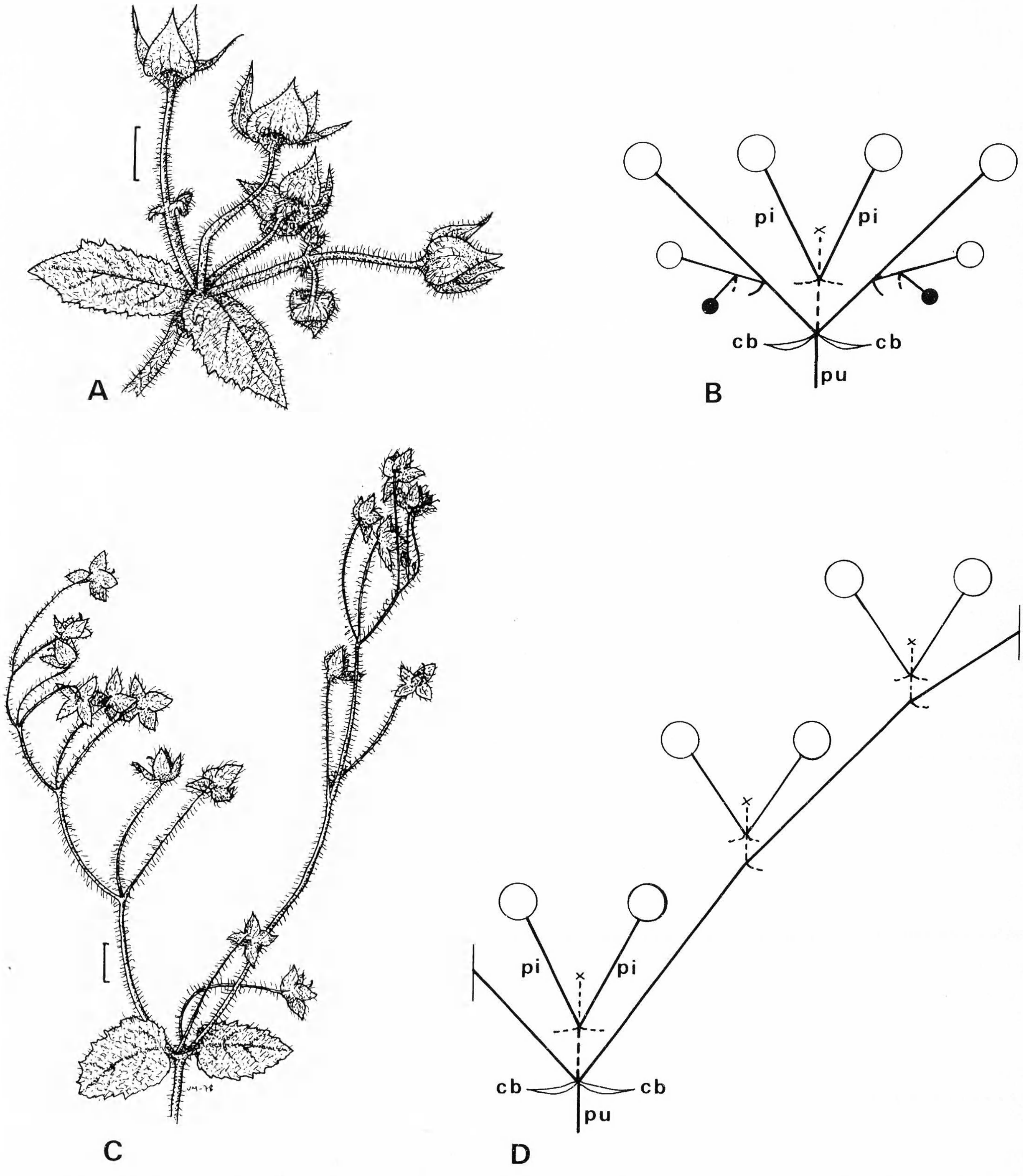

Fig. 3. Different cyme-types of *Calceolaria* with proposed interpretations. – A–B: *C. lojensis* (leg. Molau; Harling et al. 15122); lateral branches with monochasial arrangement. – C–D: *C. hispida* (Hutchison & Wright 5739); lateral branches with mixed mono- and dichasial arrangement. – Symbols: cb cyme bract, pi primary pedicel, pu primary peduncle. Dashed lines indicate condensed axes. – A drawn from cultivated material, C drawn from herbarium material. – Scales 1 cm.

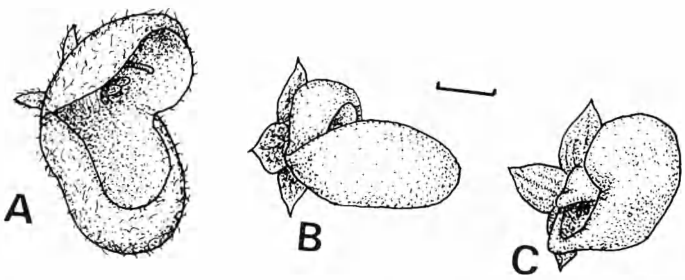

Fig. 4. Orientation types of the lower lip of the corolla in *Calceolaria*. – A: Pendent; *C. martinezii* (Asplund 8070). – B: Projecting; *C. helianthemoides* (leg. Molau; Harling et al. 15073). – C: Upcurved; *C. sericea* (leg. Molau; Harling et al. 14886). – A drawn from herbarium material, B and C drawn from photographs and field sketches. – Scale 5 mm.

lip is reduced to a narrow ring, 1–2 mm high, and the anthers are exposed. The lower lip is always saccate and may be *pendent, projecting* or *upcurved* (Fig. 4); its precise orientation forms an important taxonomic character at section level. In sect. *Aposecos* (subgenus *Calceolaria*) the corolla possesses certain elaborate morphological features which will be described in a later paper.

Stamens

Anther morphology provides some of the most important taxonomic characters in *Calceolaria*. The connective is conspicuous only in subgenus *Calceolaria*, where it is ± elongated and separates the thecae (Fig. 5 A). In subgenus *Cheiloncos* it is reduced to a thin dividing wall between the two relatively large thecae (Fig. 5 B). Anther dehiscence varies in extent; the three main alternatives are illustrated in Fig. 6. The mode of dehiscence is constant for any particular species, but often shows great intrasectional variation.

The thecae are usually *equal* in size, but may be *unequal*. The angle formed between the two thecae is another important character at species level; the terminology employed is illustrated in Fig. 7. Anther colour also varies between different taxa.

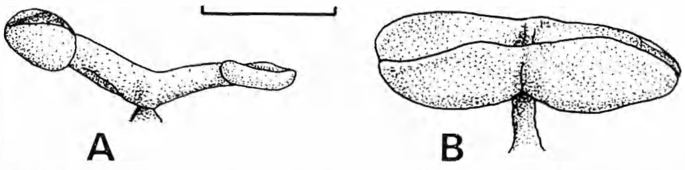

Fig. 5. Stamens of *Calceolaria*. – A: *C. mexicana* (D'Arcy 9974). – B: *C. rosmarinifolia* (Harling & Andersson 13169). – Scale 1 mm.

Other characters

While flower morphology is relatively constant in *Calceolaria*, the vegetative parts exhibit extreme diversity. Leaf form and vesture are important characters. For species which show a wide altitudinal amplitude the vegetative characters of individual specimens may also vary considerably, in response to environmental factors. The leaves of specimens from higher altitudes are usually smaller, more strongly revolute and more densely pubescent than those of specimens from lower altitudes.

Calyx morphology was formerly much used in taxonomic subdivision. Colour, vesture, form and size of the sepals are useful characters in many cases. When sepal length is used as a systematic character, however, one must bear in mind that in most taxa the sepals enlarge after anthesis.

Calceolaria L.

Calceolaria Linnaeus 1770 p. 288 – Type species: *Calceolaria pinnata* L.

Fagelia Schwencke 1774 p. 147 – Type species: *Fagelia flavicans* J. F. Gmel. (=*C. pinnata* L.).

Annual or perennial herbs or shrubs. Leaves simple, decussate. Inflorescence a thyrse, peduncles sometimes reduced and flowers then solitary, axillary. Calyx 4-partite, sepals valvate. Corolla bilabiate, yellow, rarely white or red; upper lip ± hooded, usually smaller than the lower one; lower lip saccate, inflated. Stamens 2; anthers relatively large; filaments usually much shorter than the anthers.

Subdivision. The species of *Calceolaria* are easily grouped into natural sections, 15 of which are known to occur in the investigated area. The first attempt at a generic subdivision was made by Bentham (1846). His proposed groups were to some extent adopted by Kränzlin (1907), whose works unfortunately contain many mistakes, as pointed out by Pennell (1945 p. 138), especially due to Kränzlin's complete lack of phytogeographical knowledge. The most important contribution to the taxonomy of the genus in the

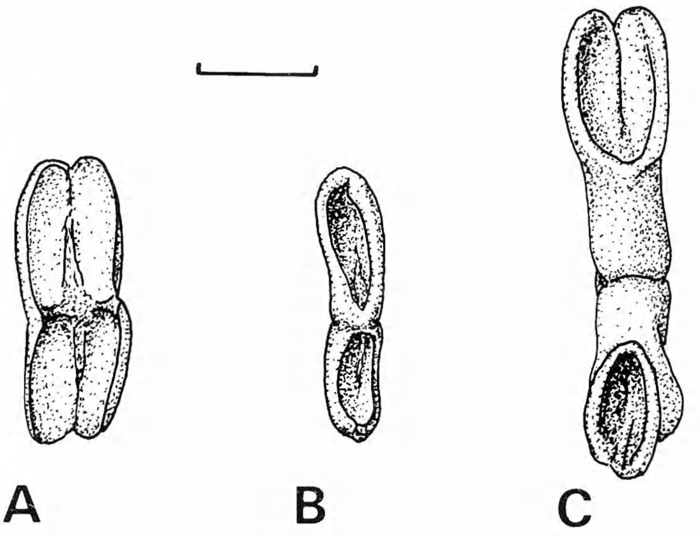

Fig. 6. Dehiscence of *Calceolaria* anthers. – A: Opening throughout; *C. crenata* (leg. Molau; Harling et al. 14845). – B: Opening to connective; *C. argentea* (Edwin & Schunke 3613). – C: Opening distally; *C. lojensis* (leg. Molau; Harling et al. 15122). – Scale 1 mm.

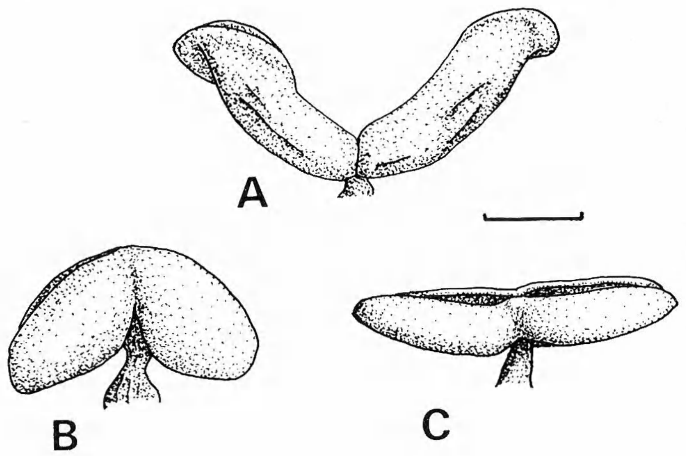

Fig. 7. Orientation types of thecae of *Calceolaria*. – A: Ascending; *C. lojensis* (leg. Molau; Harling et al. 15122). – B: Deflexed; *C. ferruginea* (Penland 510). – C: Divaricate; *C. hispida* (Mathews s. n.). – Scale 1 mm.

northern Andes was made by Pennell (1951), who introduced a completely new subdivision into natural sections. Although he made many mistakes at species level, his system has turned out to be a most useful one. Only minor changes to his scheme have subsequently been found necessary, even though the number of available collections has increased enormously since 1951.

Key to the subgenera

1. Annual hydrophilous herbs; leaves usually deeply pinnatifid; connective elongated, separating the thecae .... subgenus *Calceolaria*
– Annual or perennial herbs or shrubs of drier habitats; leaves not pinnatifid; thecae contiguous .... subgenus *Cheiloncos*

Subgenus **Calceolaria**

Calceolaria sect. *Eucalceolaria* Wettstein 1891.

In the northern Andes, this subgenus is only represented by one section, viz. sect. 15. *Aposecos*.

Subgenus **Cheiloncos** (Wettst.) Pennell

Pennell 1945 – *Calceolaria* sect. *Cheiloncos* Wettstein 1891 – Type species: *Calceolaria integrifolia* L.

Key to the sections of subgenus Cheiloncos

1. Leaves connate across the nodes; petioles (if present) winged 2
– Leaves not connate; petioles (if present) not winged 3
2. At least lower surface of leaves hairy; leaf-margin irregularly serrate, dentate or lobate .... sect. 14. *Zygophylla*
– Leaves glabrous except for some tomentum on the upper surface of the proximal part of the midrib, sessile .... sect. 6. *Symplocophylla*
3. Annual herbs with ovate, entire leaves; filaments much longer than the anthers .... sect. 13. *Micranthera*
– Annuals or perennials; filaments shorter than the anthers 4
4. Leaves at least twice as long as wide 5
– Leaves less than twice as long as wide 10

5. Leaves coriaceous, basally truncate or cuneate with well-defined petioles; margin serrate and ± flat ... sect. 7. *Dermatophylla*
– Leaves coriaceous or herbaceous, sessile or tapering into ill-defined petioles; margin ± revolute ... 6
6. Corolla white; peduncles long, ascending ... sect. 5. *Lehmannina*
– Corolla yellow; peduncles shorter ... 7
7. Leaves small, linear; lower lip of corolla upcurved; upper lip reduced, ring-like, 1–2 mm long ... sect. 4. *Ericoides*
– Leaves lanceate, lanceolate or elliptic, upper lip of corolla well-developed, hooded or arched, 3–15 mm long ... 8
8. Corolla lips about equal in size, flaring, exposing the orifice; length of thecae about equal to height ... sect. 2. *Chasmatochila*
– Upper lip of corolla much smaller than the lower one; orifice ± closed by the lower lip; length of thecae exceeds height ... 9
9. Anthers whitish, exposed, opening to the connective or less; thecae divaricate, unequal .. sect. 1. *Fasciculata*
– Anthers whitish or brownish, concealed by the upper lip of corolla, usually opening throughout; thecae divaricate or deflexed, equal ... sect. 3. *Thamnobia*
10. Lower lip of corolla upcurved, with red spots in the throat ... sect. 8. *Anacyrta*
– Lower lip of corolla pendent or projecting, rarely upcurved (but then both corolla lips about equal-sized and throat unspotted) ... 11
11. Pubescence brown or purplish; upper lip of corolla at least half the size of the lower one ... 12
– Pubescence white or pale yellowish; upper lip of corolla not more than 1/3 the size of the lower one ... 13
12. Lateral branches patent or somewhat deflexed; upper lip of corolla 1/2–2/3 as large as the lower one ... sect. 9. *Polyclada*
– Lateral branches ascending; corolla lips about equal in size ... sect. 10. *Phaeanthera*
13. Leaves ovate; margins serrate or crenate ... sect. 11. *Urticopsis*
– Leaves circular in outline, lobate ... sect. 12. *Lobatae*

Sect. 1. **Fasciculata** Molau sect. nov.

Type species: *Calceolaria scabra* R. & P.

Plantae humiles, suffrutescentes, caulibus erectis vel ascendentibus, sparse ramosis. Folia parva, ovata vel elliptica, margine ± revoluto, fasciculata in surculis condensatis. Corolla pro ratione grandis, lutea, labio superiore parvo, cucullato, antheras non abscondente, labio inferiore procurrente vel pendente, collo in plerisque speciebus maculis rubentibus obsito. Antherae luteolo-albae, expositae, longitudinaliter dehiscentes usque ad connectivum vel minus; thecae divaricatae, inaequales.

Low shrubby plants with erect or ascending, sparsely branched stems. Leaves small, ovate or elliptic, fasciculate on short shoots, margins ± revolute. Corolla relatively large, yellow; upper lip small, hooded, not concealing the anthers; lower lip projecting or pendent, in most species with reddish spots in the throat. Anthers whitish, exposed, opening to connective or less; thecae divaricate, unequal.

The most striking features of this section are the fasciculate leaves and the peculiar anther shape (Fig. 8 C). It is no doubt a very natural group. Whereas the growth habit and morphology of corolla and anthers are relatively constant, leaf morphology varies considerably within the section. The leaf fascicles arise in the axils of larger, often deciduous, leaves on the main stems. These leaves are here referred to as *primary leaves*.

The section comprises four species, almost entirely restricted to northern Peru. Only *C. argentea* occurs north of the Piura Divide, the other species being restricted to areas outside the territory concerned in the present study and are therefore only described in brief.

Key to the species

1. Foliage and inflorescence whitish sericeous or lanate ... 2
– Foliage and inflorescence with short hairs or glabrous ... 3
2. Leaves sericeous on both sides; corolla without spots ... 1. *C. argentea*
– Leaves lanate beneath; corolla with red spots in the throat ... 2. *C. reichlinii*
3. Leaves shortly petiolate, hispid above; margins crenate ... 3. *C. scabra*
4. Leaves sessile, glandular above; margins entire or distally denticulate ... 4. *C. cajabambae*

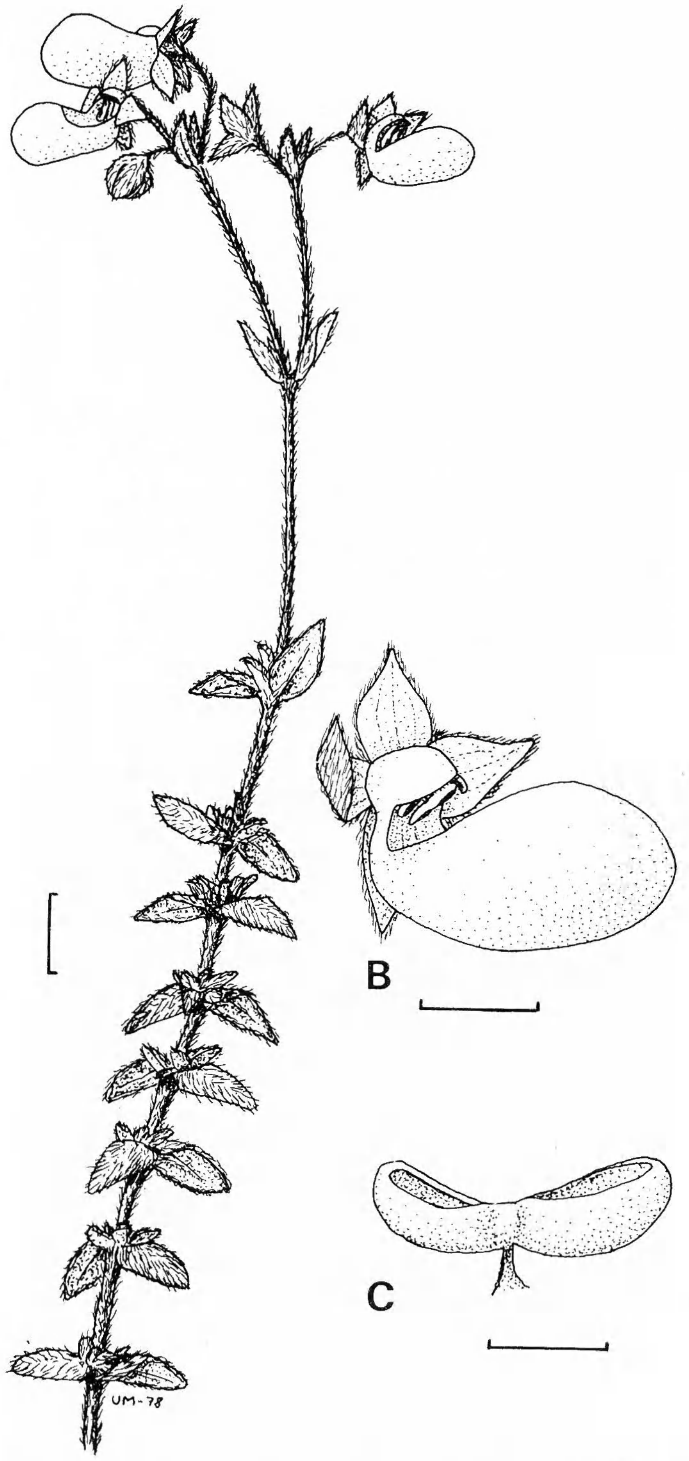

Fig. 8. *Calceolaria argentea* (Hutchison & Wright 5236). – A: Flowering branch. – B: Flower. – C: Stamen. – Scales: A 1 cm, B 5 mm, C 1 mm.

1. **Calceolaria argentea** H. B. K.

Humboldt, Bonpland & Kunth 1817 p. 387 – Orig. coll.: Bonpland 3503 (P holotype, B-WILLD, HAL).

Calceolaria decus-montium Kränzlin 1916 p. 20 – Orig. coll.: Weberbauer 6329 (PH holotype, F, G, GH).

Calceolaria ferreyrae López Guillén 1969 p. 30 – Orig. coll.: López Guillén 6319 (SMF holotype).

Illustrations. Fig. 8; Humboldt, Bonpland & Kunth 1817 Tab. 170; López Guillén 1969 pp. 31–34 (as *C. ferreyrae*).

Suffrutescent, 10–50 cm tall; foliage and inflorescence sericeous, densely covered with long, ascending, silvery-white hairs. *Stems* erect, sparsely branched, proximally villous, distally densely sericeous. *Primary leaves* 0.8–2.0(–3.0) × 0.3–1.2(–1.7) cm, ovate or elliptic, acute, cuneate to the sessile or shortly petiolated base, pubescence densest beneath, usually in lanate tufts; margin entire, revolute. Petioles 0–3 mm, largely concealed by hair cover. *Inflorescence* terminal, comprising a single pair of 2–6-flowered cymes on primary peduncles 1–6 cm long. Cyme bracts present, sometimes also subordinate bracts. Pedicels 1.0–2.2 cm. *Sepals* 6.0–9.0 × 3.0–4.5 mm at anthesis, ovate, slightly acuminate, externally densely sericeous, internally glabrous and light green. *Corolla* pale yellow, glabrous; upper lip 3–5 mm long and about as wide, hooded, globose; lower lip 15–22 mm long and 10–15 mm wide, saccate to 3/4 of its length, pendent or projecting; neck unspotted, glabrous. *Anthers* 2.5–3.0 mm; connective not thickened. *Filaments* 1.0–1.5 mm. *Ovary* villous. Style 2.5–3.5 mm, slightly curved. *Capsule* 6–8 mm, ovoid, slightly acuminate, puberulous.

Habitat. Rocky and scrub-covered slopes from 2400 to 3200 m.

Distribution. Fig. 9. N Peru in the departments of Piura and Cajamarca. Not common.

Remarks. This handsome species is easily recognizable by its dense silvery-white pubescence. The two known populations occur on either side of the Piura Divide, but at some distance from the pass. The intervening territory, however, is floristically poorly known. In sympatric areas (S parts of Cajamarca) *C. argentea* seems to hybridize with other species of this section.

Specimens studied. Peru. Piura: Páramo de Guamaní, between Gualcaquillo and Huancabamba, ca 3200 m, VIII.1802, Bonpland 3503 (HAL, P) – Between Huancabamba and Jicate, 2500–2600 m, V.1912, Weberbauer 6329 (F, G, GH, PH). – *Cajamarca:* 6 km NNE of Celendín, 29.V.1966, Edwin & Schunke 3591 (F) – 24 km NNE of Celendín, 29.V.1966, Edwin & Schunke 3601 (F, G, GH, NY, W), Edwin & Schunke 3603 (F, G, NY) – E slope of Cerro, just W of Celendín, 29.V.1966, Edwin & Schunke 3613 (F, G, GH) – Canyon of the Río Marañón above Balsas, 3–4 km below summit of the road to Celendín, 2950 m, 21.V.1964, Hutchison & Wright 5236 (F, G, GH, K, MO, NY, UC) – Mountain E of Celendín, 2400–2800 m, 15–17.IV.1948, Pennell 15173 (PH), Pennell 15177a (GH, PH) – Between Balsas and Abra Gulig, 3000 m, 27.II.1976, Plowman 5591 (GH) – Oxamarca–La Chota, 2900 m, 20.V.1976, Sagástegui et al. 8476 (MO).

Intermediate specimens

The following specimens are obviously intermediate between *Calceolaria argentea* and one or other species of the section, probably *C. scabra*. Further investigations and more material are required to elucidate the pattern of hybridization.

Peru. Cajamarca: E slope of Cerro, just W of Celendín, rare, 29.V.1966, Edwin & Schunke 3615 (F) – Canyon of the Río Marañón above Balsas, 3–4 km below summit of the road to Celendín, 2950 m, 21.V.1964, Hutchison & Wright 5238A (UC). – *La Libertad:* Río Marañón canyon, 4 km SW of summit above Aricapampa on the road to Huamachuco, 3900 m, 10.VIII.1964, Hutchison et al. 6270 (F, NY, UC).

2. **Calceolaria reichlinii** Edwin

Edwin 1970 p. 394 – Orig. coll.: Pennell & Ferreyra 14853 (PH holotype, GH, US).

Illustration. Edwin 1971 p. 516 Fig. 1 C (anther).

Leaves narrowly elliptic, white lanate beneath; margin entire or distally crenulate. Sepals greenish yellow. Corolla light yellow or greenish-yellow, frequently with purplish spots in the throat.

Calceolaria reichlinii is restricted to a small area of northern Peru, comprising the southern parts of the department of Cajamarca and adjacent areas of La Libertad, at 2600–3900 m altitude. A total of twenty collections have been studied.

Representative specimens. Peru. Cajamarca: About 29 km NNE of Cajamarca, just above Encañada on road to Celendín, 28.V.1966, Edwin & Schunke 3566 (F), 3568 (F, GH, NY) – On the road to Celendín, 9 km E of Cajamarca, 15.V.1964, Hutchison & Wright 5095 (F, K, MO, NY, UC) – Celendin, ca 2 km from town on the road to Balsas, 2700 m, 18.V.1964, Hutchison & Wright 5138 (F, G, GH, K, NY, MO, P, UC) – On "Cumbe" above Cajamarca, 3500 m, 3.III.1946, Olsson 2 (F, GH) – 15–20 km above Cajabamba, 2900 m, 16.III.1948, Pennell & Ferreyra 14853 (GH, PH, US). – *La Libertad:* Río Chusgón Valley, 26 km above and E of Pullac, on the road to Buldibuyo, 3200 m, 7.VIII.1964, Hutchison et al. 6158 (F, K, MO, NY, UC).

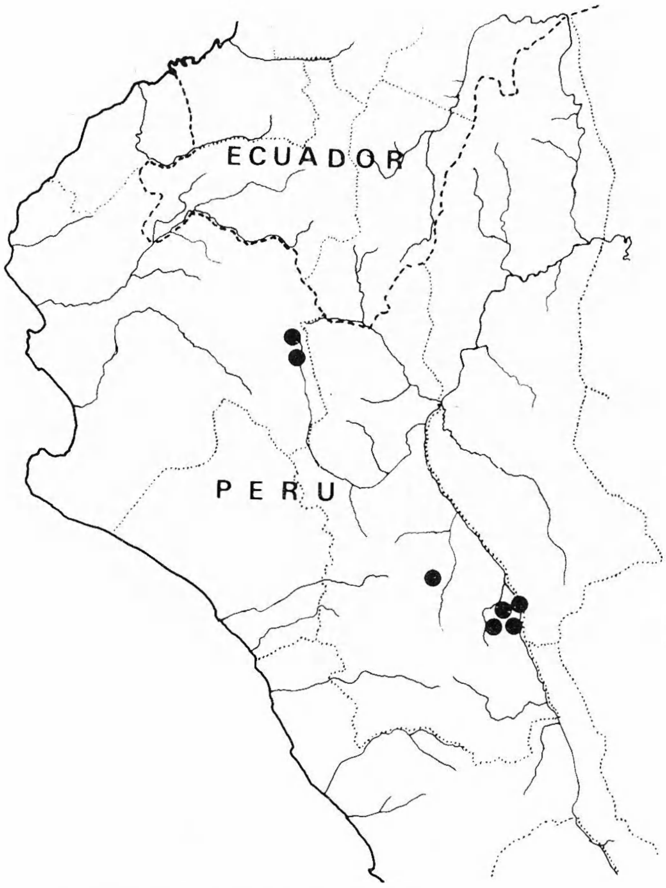

Fig. 9. Known distribution of *Calceolaria argentea*.

3. **Calceolaria scabra** R. & P.

Calceolaria scabra Ruiz & Pavón 1798 p. 19 – Orig. coll.: Pavón s. n. (MA holotype, G).

Calceolaria melissaefolia Bentham 1846 p. 214 – Orig. coll.: Mathews 1677 (K holotype, OXF).

Calceolaria pseudoscabra Edwin 1970 p. 392 – Orig. coll.: Pennell 15213 (PH holotype).

Illustrations. Ruiz & Pavón 1798 Tab. 29 a; Edwin 1971, p. 517 Fig. 2 C (anther).

Leaves elliptic or broadly elliptic, hispid above with coarse, white hairs, pilose or villous below; margins deeply crenate. Sepals green. Corolla yellow with red spots or bands in the throat.

Calceolaria scabra is the most widespread species of this section in Peru, ranging from the southern parts of the departments of Cajamarca and Amazonas to Junín and Lima at altitudes between 2400 and 4400 m. A disjunct population occurs in the mountains of Bolivia, but too little material is presently available to decide whether this should be treated as a subspecies or not. Altogether 46 collections have been studied.

Representative specimens. Peru. Cajamarca: Canyon of the Río Marañón above Balsas, 3–4 km below summit of the road to Celendín, 2950 m, 21.V.1964, Hutchison & Wright 5238 (G, K, MO, P, UC). – *Amazonas:* Prov. of Chachapoyas, 1839, Mathews 1677 (K, OXF) – Cold mountain forest above Colcamar, 3200–3400 m, 24–26.VI.1948, Pennell 15624 (B, GH). – *La Libertad:* Río Marañón Canyon, 4 km SE of summit above Aricapampa on the road to Huamachuco, 3900 m, 10.VIII.1964, Hutchison et al. 6276 (MO, UC). – *Ancash:* Below Chiquián, 3200–3300 m, 22.V.1948, Pennell 15409 (GH). – *Junín:* Casarajra, 15 km from La Oroya towards Junín, 3850 m, 9.IV.1953, Hjerting & Petersen 1376 (C). – *Lima:* Chicla, 4400 m, 6.VI.1940, Asplund 11471 (S) – Chiuchín, Pavón s. n. (G, MA). – *Bolivia. La Paz:* La Paz, 3900 m, 5.IV.1907, Buchtien s. n. (L, O, S). – *Cochabamba:* Colomi, 3650 m, 9.I.1949, Brooke 5090 (BM, U). – *Tarija:* La Aguada, 33 km from Tarija to Villazón, 3350 m, 27.II.1939, Balls 6118 (E).

4. **Calceolaria cajabambae** Kränzlin

Kränzlin 1905 p. 102 – Orig. coll.: Weberbauer 3062 (B holotype, destroyed, photographs at F and PH, isotype probably at SMF).

Calceolaria cajamarcensis López Guillén 1969 p. 26 – Orig coll.: Riccio 6338 (SMF holotype).

Calceolaria brachyantha Edwin 1970 p. 373 – Orig. coll.: Pennell & Anderson 15076 (PH holotype, BM, G, GH, K, S).

Calceolaria linearioides Edwin 1970 p. 387 – Orig. coll.: Macbride & Featherstone 1184 (F holotype).

Illustrations. Kränzlin 1907 p. 97 Fig. 19 D–F; López Guillén 1969 pp. 27–29 (as *C. cajamarcensis*);Edwin 1971 p. 517 Fig. 2 D (anther; as *C. brachyantha*).

Leaves narrowly elliptic, sometimes almost linear due to the strongly revolute margins, sessile, glandular and puberulous with short gland-tipped hairs on both sides, rarely glabrous; margins entire or distally denticulate. Sepals light green or olive green. Corolla light yellow or greenish yellow, usually with a band of red spots across the throat of lower lip.

Calceolaria cajabambae is restricted to northern Peru, ranging from the southernmost parts of the departments of Cajamarca and Amazonas south to the department of Lima, occurring at altitudes between 2750 and 4300 m. Altogether 41 collections have been studied.

Representative specimens. Peru. Cajamarca: On road from Celendín to Balsas, 6 km NNE of Celendín, 29.V.1966, Edwin & Schunke 3590 (GH, MO, P) – Ridge 11 km S of Cajamarca, 2750–2850 m, 10.IV.1948, Pennell & Anderson 15076 (BM, G, GH, K, PH, S). – *Amazonas:* Cerros Calla-Calla, west side, 45 km above Balsas, midway on the road to Leimebamba, 3100 m, 20.IV.1964, Hutchison & Wright 5771 (UC; specimens propagated from seeds at G, GH, MO, P, UC). – *La Libertad:* Road to Huamachuco, 8 km E of Agallpampa, 2870 m, 5.VIII.1964, Hutchison et al. 6132 (G, MO, S, UC). – *Ancash:* Calcareous field above Chiquián, 3500–3600 m, 22.V.1948, Pennell 15417 (B, BM, GH).

Uncertain taxa

The following taxa clearly belong to sect. *Fasciculata.* They are probably synonymous with *C. scabra* or *C. cajabambae.* However, no material has been available due to loan restrictions.

Calceolaria huamachucensis López Guillén 1968 p. 85 – Orig. coll.: López Guillén 1288 (SMF holotype) – Illustration: López Guillén 1968 p. 86.

Calceolaria truxillensis López Guillén 1968 p. 80 – Orig. coll.: López Guillén 1216 (SMF holotype) – Illustrations: López Guillén 1968 pp. 81, 83.

Calceolaria truxillensis ssp. *pivotiformis* López Guillén 1968 p. 82 – Orig. coll.: López Guillén 1292 (SMF holotype) – Illustration: López Guillén 1968 p. 84.

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The genus Microcalicium

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The originally monotypic genus *Microcalicum* Vain. (lichenized fungi, Caliciales) is emended to include four species, characterized by stalked or sessile apothecia with an aeruginose mazaedium, the formation of asci in chains without hook-formation, spore ontogeny and ornamentation, the occurrence of unidentified pigments which give characteristic colour reactions with KOH and HNO_3 in the apothecia and pycnidia, and the formation of pycnospores from phialides. The occurrence of ellipsoidal bodies in the ascospores is noted. The genera *Coniocybopsis* and *Strongylopsis* are considered as taxonomical synonyms of *Microcalicium*. Two species are new and new combinations have been proposed for two further species; ten specific names and four names of varieties and forms are considered to be taxonomic synonyms. Ten lectotypes and two neotypes have been designated. Species descriptions and nomenclatural comments are given together with information on general morphology, spore ultrastructure, chemistry, ecology and to some extent distribution of the species.

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Historical survey

When describing the first recognized species of *Microcalicium* Acharius (1817) gave it no fewer than three specific names, viz. *Cyphelium disseminatum, C. atomarium* and *C. viridulum*. In this paper it is called *Microcalicium subpedicellatum*. Acharius' recognition of three different species was based mainly on differences in the size and shape of the apothecia and on the structure of the thallus. The variation in the form of the apothecia is well illustrated in his Tab. VIII: 3–5 (Acharius 1817). Acharius placed the species in his newly described genus *Cyphelium* because of its shortly stalked or sessile apothecia. It is interesting to note that Acharius (in *Cyphelium viridulum*) correctly observed one of the characteristic features of the genus *Microcalicium,* viz. the greenish colour of the mazaedium.

Microcalicium arenarium was described by Massalongo (1856) as *Cyphelium arenarium*. The genus *Cyphelium* is here used in the sense of Massalongo (e.g. 1853) and is synonymous with *Chaenotheca* Th. Fr. In contrast to *M. subpedicellatum, M. arenarium* has stalked apothecia and was by most nineteenth-century authors referred to *Calicium,* as was *M. subpedicellatum*. Leighton (1857) gives a good drawing of *M. arenarium* when describing it as *Coniocybe citrina*.

Vainio (1927) reconsidered the taxonomy of the Caliciales on generic level. He strongly emphasized the characters of spore septation and biology, distinguishing on generic level between lichenized species, species parasitic on lichens and saprophytic species. The pertinent features of his taxonomical treatment are summarized in Table 1. In Vainio's treatment the species of *Microcalicium,* as conceived in the present paper, were distributed among the following genera, all described as new by Vainio (1927): *Coniocybopsis, Microcalicium* and *Strongylopsis*. In accord with his emphasis on the mode of nutrition he also described in the genus he considered lichenized (*Strongylopsis*)

Table 1. Synopsis of the generic concepts used by Vainio (1927).

Morphology	lichenized	parasitic on lichens	saprophytic
Spores 1-septate, apothecia stalked	*Calicium*	*Caliciella*	*Embolidium*
Spores non-septate, apothecia stalked	*Chaenothecopsis*	*Coniocybopsis*	*Mycocalicium*
Spores non-septate, apothecia short stalked	*Strongylopsis*	*Strongyleuma*	*Microcalicium*

new species due to the association with particular genera of algae. Thus *S. commixta* was characterized by its association with *Cystococcus* and *S. stichococci* with *Stichococcus*. Nádvorník (1942), following this concept, added one further species, *S. discreta,* associated with *Trentepohlia*.

In recent treatments both Vainio's generic and species concept have often been accepted (Nádvorník 1942, Tobolewski 1966). The poor state of knowledge of this group was reckoned in Poelt (1969), where several species were accepted but accommodated in the "Verlegenheitsprodukt" *Mycocalicium*.

Material and methods

Specimens from the following herbaria were investigated (abbreviations according to Index Herbariorum 1974): BERN, BM, BRA, C, E, G, H, K, MEL, O, OSC, S, TUR, UPS, WA, and from the private herbaria of Dr L. Pike, Eugene, Professor J. Poelt, Graz and Mr S. Sundell, Munkfors. Altogether 357 specimens have been investigated.

No effort was made to reveal the total distribution of the species, and this aspect is not emphasized in the present paper. The distribution of the species is indicated by the provinces of each country from where I have seen material. A detailed list of localities of the material studied is available on request from the Section for Botany, Swedish Museum of Natural History, S-104 05 Stockholm 50, Sweden. The main part of the material investigated orginates from Northern Europe.

Light Microscopy (LM). For the light microscope studies sections 10–15 μm thick were cut on a freezing microtome, using a dilute solution of gum arabicum as embedding medium. Lactic blue (Cotton blue in lactophenol) and Congo red in alkaline solution were used as stains for studying anatomical details. Measurements were recorded from water-mounted material.

Transmission Electron Microscopy (TEM). The material was prepared as described in Tibell (1975).

Scanning Electron Microscopy (SEM). Spores were dusted on a specimen stub and then coated with gold, either in a vacuum evaporator or in an ion sputter. Larger specimens were glued to the specimen stub and coated in the same manner. The specimens were examined in a JEOL JSM U-3 or JSM-35 scanning electron microscope operating at 5–15 kV. Shrivelling of the spores was frequently noted.

Measurements. Data on spore size were obtained by measuring mature spores in water. Spores with a well developed ornamentation and septation were considered to be mature. In each case 20 spores from one apothecium from three different collections were measured, and the following abbreviations are used to denote the statistical entities: N= total sample size, $\overline{X}$= arithmetic mean of the variate, $\overline{X}_l=\overline{X}$ for spore length, $\overline{X}_w=\overline{X}$ for width of spore, s_l=sample estimate standard deviation of spore length, s_w=ditto of spore width. In the descriptions the spore measurements are given as $\overline{X}\pm1$ s.d.

For the construction of Table 2 twenty apothecia from each collection of *Microcalicium subpedicellatum* were measured. The height of the apothecium was measured as the distance from the lower end to the edge of the excipulum, i.e. the mazaedium, which may protrude far beyond the edge of the excipulum, is excluded. Collections measured: see Appendix.

External morphology

Mycelium. The mycelium is immersed in either the substrate or in the thallus of the host species.

Apothecia. The apothecia are black, sessile–short-stalked (stalk shorter than the diameter of the apothecium) in *M. conversum* and *M. subpedicellatum* or fairly long stalked (stalk at least 3 times the diameter of the apothecium) in *M. arenarium* and *M. ahlneri*. The stalks of *M. arenarium* and *M. ahlneri* usually have a coarsely granular surface. In *M. arenarium* and *M. ahlneri* both the size and shape of the capitulum is fairly constant, whereas they vary widely in *M. subpedicellatum*. This variation has not been found to be correlated with other features. Examples of the range of apothecial shape and size in different populations of *M. subpedicellatum* are shown in Table 2.

The capitulum of *M. arenarium* is subglobose and the excipulum covers only a comparatively small area at its base (Fig. 3 D). In *M. subpedicellatum* the mazaedium is often very protuberant, and the mazaedial column may be two or three times longer than the excipulum (Fig. 8 A–B). The mazaedial column is greenish-coloured and is evidently held together by the more or less sclerotized paraphyses of the upper part. The greenish colour of the mazaedium is a striking feature, though in old apothecia it may become brownish. This pigmentation is dealt with later in the section on *Chemistry*. The edge of the excipulum in *M. subpedicellatum* sometimes has a faint whitish rim.

Anatomy

Mycelium. The mycelium consists of branched hyphae, 2–3 µm in diameter. The hyphae of *M. subpedicellatum* are very characteristic, as is particularly clearly seen after treatment with 10% KOH (Fig. 9 A). The mycelium is easily found in infected thalli. No penetration of the phycobiont cell wall was observed and hyphae of *Microcalicium* were never seen to enclose the phycobiont of the host. The hyphae of *M. ahlneri* and *M. arenarium* are less arched, have longer cells and are less intricately branched (Fig. 1 E).

Stalk. The apothecia are more or less stalked, but the anatomy of the stalk varies. In *M. arenarium* the stalk consists of distinct, rather straight hyphae which are not densely interwoven (Fig. 3 E). In *M. ahlneri* the stalk hyphae are much shorter, strongly arched and densely interwoven thus forming an almost paraplectenchymatous tissue (Fig. 1 D). In both these species the surface of the stalk is covered by irregular aggregates of dark, sclerotized hyphae (Fig. 1 C, 3 C), which render the surface of the stalk very coarse (Figs. 1 A, B, 3 A, B). The apothecia of *M. conversum* and *M. subpedicellatum* may have a short stalk, but it is then continuous with the excipular tissue and of the same type although often much paler coloured (Fig. 6 C).

Excipulum. The excipulum of *M. arenarium* and *M. ahlneri* is dark reddish brown, paraplectenchymatous and with large, thick-walled cells (Fig. 3 D). The excipulum in *M. conversum* and *M. subpedicellatum* consists of hyphae with thick-walled cells of rather uniform thickness.

Asci are formed successively in rows from the ascogenous hyphae (Fig. 9 B) and without any hook-formation. This type of ascus ontogeny has previously been described from Caliciales. Nádvorník (1941) reported it for *Coniocybe gracilenta* Ach. and Schmidt (1970) for *Strongylopsis commixta* Vain. (=*Microcalicium subpedicellatum*). The semi-mature spores are released from the asci becoming fully mature in the mazaedium.

Spores are formed by free cell formation in the young asci. At first the spore is bounded by a hyaline, irregular wall. Later on the wall becomes more electron-dense and a secondary wall is formed beneath the primary one (Fig. 4 B). The spore is now ellipsoidal in shape and still non-septate. Still later on a pattern of radially arranged pairs of electron-dense, wavy bands

Table 2. Shape of apothecia in *Microcalicium subpedicellatum*. The height of the apothecium is measured from the base to the edge of the excipulum. The width of the apothecium is measured as the maximum diameter of the excipulum. Measurements in mm.

Tibell coll. no.	Height of apothecium (arithmetic mean)	Sample estimate of standard deviation of height	Width of apothecium (arithmetic mean)	Sample estimate of standard deviation of width	Ratio height/width
5437	0.17	0.03	0.16	0.02	1.1
4396	0.13	0.02	0.15	0.02	0.87
5502	0.16	0.03	0.19	0.05	0.84
3741	0.14	0.03	0.28	0.07	0.50

appears in the primary wall (Fig. 4 B, C). The secondary wall becomes thicker and the spores are released from the dissolving asci. Outside the ascus and after further elongation the first septum forms (Fig. 9 D). In *M. subpedicellatum* additional septation and a considerable increase in size takes place (Fig. 9 E). Finally the spores acquire their distinctive ornamentation of spirally arranged ridges (Fig. 7 C). Spore ontogeny is thus very similar to that described for species of *Cyphelium* (Tibell 1971), *Calicium* (Tibell 1975) and *Thelomma* (Tibell 1976).

It is remarkable that ellipsoidal bodies should occur in the ascospores in *Microcalicium* (Fig. 10 A). These structures, so common in lichenized fungi, have not yet been reported from ascospores or asci (Peveling 1974).

Pycnidia are frequently present in *M. subpedicellatum* (Fig. 8 A, B). They also occur in *M. conversum,* but have not been observed in *M. ahlneri* and *M. arenarium.* The pycnidia of *M. conversum* and *M. subpedicellatum* are unilocular and with a rounded cirrus which protrudes from the ostiolum. The inner wall is lined by phialides, which produce single pycnospores (phialospores) (Fig. 11). The bases of the pycnospores are surrounded by the collar-like upper end of the phialides. The phialides themselves are formed from a large basal cell. The mature pycnospores are non-septate. They measure 2–3 × 2 μm in *M. subpedicellatum* and 3 × 1 μm in *M. conversum.*

Paraphyses. The paraphyses of *M. ahlneri, M. conversum* and *M. subpedicellatum* are persisting and sclerotized, but those of *M. arenarium* dissolve at an early stage. The paraphyses probably contribute to the toughness of the columnar mazaedium of *M. subpedicellatum.*

Chemistry

Except for a pigment occurring in the apothecia no secondary products were found in *Microcalicium.* This pigment (or pigments), however, gives a characteristic colouration to different parts of the apothecium, and provides valuable diagnostic features at the species level. In *M. arenarium* for example, the reddish brown colour of the excipulum contrasts strikingly to the aeruginose colour of the stalk. This is easily observed also in squash preparations of apothecia. The natural colours of the different parts of the apothecia as seen in water-mounts and the colour reactions in acid and alkaline solutions are shown in Table 3. The pigment dissolves in both acid and alkaline solutions, and according to the pH a greenish or yellowish brown colour is entering the surrounding medium. The pigment is aeruginose in acid and yellowish brown in alkaline solution. An apothecium can repeatedly be induced to change colour by adding first an acid and then an alkaline solution. It seems that under natural conditions, as observed in water-mounts, different parts of the apothecia have a different pH. These pH-differences are evidently genetically controlled and quite constant. In the upper part of the mazaedia of *M. arenarium* and *M. subpedicellatum* brownish areas are sometimes found. Such variegation may depend on local influences such as air pollution and following changes of the pH of the atmosphere, or the rainfall. It is noteworthy that pigments of the same type occur in the pycnidia of *M. subpedicellatum* and *M. conversum,* but it is most remarkable that in the pycnidia of *M. conversum* the pigment, unlike that in the tissues of other *Microcalicium* species turns aeruginose in alkaline and reddish brown in acid solutions (cf. Table 3).

Ecology

Although the material investigated in the present study is too limited to provide detailed information on the ecology and distribution of the species, some general comments may be made. *Microcalicium* species are primarily parasitic on lichens or on free-living colonies of algae. *M. arenarium* has been found on the leprose crusts of *Lecidea lucida* on rocks and on conifer rootlets. *M. ahlneri* seems to parasitize colonies of green algae on wood. *M. subpedicellatum* and *M. conversum* have a much more complex ecological pattern. They seem to occur most commonly as parasites on other species of Caliciales within the genera *Calicium* and *Chaenotheca,* where they normally occur on the thallus, but not rarely also on the stalks or the capitula of the apothecia (Fig. 8 A). They may also occur on the thalli of sterile crustose lichens growing on bark or lignum. *M. subpedicellatum* may even occur on lignum or bark apparently unassociated with algae, in which case it is prob-

Table 3. Natural colours and reactions of the pigments occurring in the apothecia of *Microcalicium*.

	Watermount	Alkaline solution (10% KOH)	Acid solution (10% HNO_3)
M. ahlneri			
Excipulum	reddish brown	dark yellowish brown	yellowish brown
Stalk	aeruginose, paler in basal part	yellowish brown	pale aeruginose
Spores	aeruginose	yellowish brown	aeruginose
M. arenarium			
Excipulum	reddish brown	dark yellowish brown	aeruginose
Stalk	aeruginose	yellowish brown	aeruginose
Spores	aeruginose	yellowish brown	aeruginose
M. conversum			
Excipulum	reddish brown	dark yellowish brown	yellowish brown or aeruginose in part
Spores	aeruginose	yellowish brown	aeruginose
Pycnidial wall	reddish brown to dark brown	aeruginose	dark reddish brown
M. subpedicellatum			
Excipulum	blackish green	brown	aeruginose
Spores	aeruginose	yellowish brown	aeruginose
Pycnidial wall	blackish green	brown	aeruginose

ably a saprophyte. *M. subpedicellatum* kills off the lichen thalli on which it grows. On attacked thalli *M. conversum* and *M. subpedicellatum* first produce pycnidia and later on apothecia. During attack the cortical structure of the host thallus disintegrates and the thallus colour changes. Finally the lichen thallus is completely broken down and only almost fully disintegrated fragments remain. Parasitism by *M. arenarium* seems more balanced, and the host thallus is not broken down, although the formation of fruiting bodies by the host is suppressed. We have here a relationship between the bionts which may be classified as intermediate between parasitism and parasymbiosis.

Microcalicium Vain. emend. L. Tibell

Vainio 1927: 77. – Originally monotypic. Type species: *M. disseminatum* (Ach. ex Fr.) Vain.

Coniocybopsis Vain. 1927: 75. – Originally monotypic. Type species: *C. arenaria* (Hampe ex Mass.) Vain.

Strongylopsis Vain. 1927: 66. – Lectotype (designated here): *S. commixta* Vain.

Parasitic on lichens and on colonies of free-living algae, or living saprophytically. Apothecia stalked or sessile, with a greenish mazaedium. Asci formed in chains without hook-formation, broadly ellipsoidal when mature. Spores in the asci non-septate. When the asci have disintegrated the spores continue to mature in the mazaedium, where they increase considerably in volume, septation takes place and the surface ornamentation of spirally arranged ridges forms. Mature spores 1–3(–7)-septate. In two species pycnidia with pycnospores formed from phialides occur.

Taxonomic remarks. The genus *Microcalicium* is here emended so as to comprise four species with similar nutritional biology, ascus and spore ontogeny, spore ornamentation and ultrastructure and chemistry. The genus has a wide distribution in the Northern Hemisphere. One of the species occurs in the Southern Hemisphere.

Because of its unique type of spore ornamentation, I consider the genus to have a rather isolated position in the Caliciales.

Key to the species

1. Apothecia with long stalks (3–14 times the diameter of the capitulum), mature spores ellipsoidal, one-septate, 5.5–8 µm long 2
– Apothecia sessile or subsessile, mature spores cylindrical, 1–3(–7)-septate, 9–15 µm long 3
2. Apothecia 0.6–1.8 mm high, hyphae of the stalk distinct (Fig. 3 E). Mazaedium without sclerotized hyphae .... 2. *M. arenarium*
– Apothecia 0.4–1.1 mm high, hyphae of the stalk strongly arched and forming an almost paraplectenchymatous tissue (Fig. 1 D). Mazaedium with sclerotized hyphae (Fig. 2 B) .... 1. *M. ahlneri*
3. Excipulum reddish brown, mature spores 1-septate, pycnidial wall reddish brown–dark brown, pycnospores narrowly ellipsoidal .... 3. *M. conversum*
– Excipulum very dark green, mature spores 3(–7)-septate, pycnidial wall very dark green, pycnospores broadly ellipsoidal .... 4. *M. subpedicellatum*

1. **Microcalicium ahlneri** L. Tibell, sp. nov.

Holotypus: Sweden, Jämtland, Offerdal par., 44 km NNE of Åre, Storbacken at Oldån close to Ytterolden, 63°40'N, 13°36'E. On decorticated stump of *Picea abies* in *P. abies* forest. 17.VIII.1975 Tibell 6299 (UPS).

Crescit cum coloniis algarum (Chlorophytorum non rite determinatorum) vel ad lignum vetustum sine consortio algarum. *Apothecia* amplitudine variabilia 0.36–1.1 mm alta. *Capitulum* 0.12–0.24 mm latum. *Mazaedium* quam latitudo capituli non altius, aeruginosum. *Stipes* 0.06–0.12 mm crassus impolite niger superficie inaequaliter granulari. Pars interior stipitis ex hyphis brevibus valde arcuatis implexis parietibus incrassatis constans. *Excipulum* in sectione transversali badium, praesertim in parte centrali infirme evolutum. *Asci* maturi late ellipsoidei, 6.5–9 × 4–5 µm. *Sporae* maturae uniseptatae ellipsoideae, 5.7–7.0 × 2.2–2.8 µm porcis spiratim dispositis distincte ornatae. *Paraphyses* obscurae scleroideae furcatae anastomosantes. Superficies paraphysium inaequalis, paraphysibus in mazaedio persistentibus. Stipes et sporae aeruginosae, KOH + flavescenti-fuscae.

Growing among colonies of unidentified green algae or on old wood without any apparent association with algae. *Apothecia* of variable size, 0.36–1.1 mm high, occasionally branched *Capitulum* 0.12–0.24 mm wide. *Mazaedium* not higher than the width of the capitulum, aeruginose. *Stalk* 0.06–0.12 mm thick, dull black and with a coarsely granular surface (Fig. 1 A, B), formed of irregular groups of sclerotized hyphae. Inner part of stalk consisting of short, strongly arched and interwoven, thick-walled hyphae (Fig. 1 D). *Excipulum* in section reddish brown, poorly developed, particularly in the central part. *Asci* when mature broadly ellipsoidal, 6.5–9 × 4–5 µm. *Spores* when mature one-septate, ellipsoidal, 5.7–7.0 × 2.2–2.8 µm (N=60, $\bar{X}_l = 6.3$ µm, $s_l = 0.63$ µm, $\bar{X}_w = 2.5$ µm, $s_w = 0.32$ µm) with a distinct ornamentation of spirally arranged ridges (Fig. 2 A, E). *Paraphyses* dark, sclerotized, branched and anastomosing (Fig. 2 B). The surface of the paraphyses is coarse and the paraphyses persist in the mazaedium. Stalk and spores aeruginose, turning yellowish brown with KOH (for other colour reactions, see Table 3).

Taxonomic remarks. M. ahlneri resembles *M. arenarium* in having one-septate spores and a stalk with a coarse surface as well as apothecia of similar colour and chemical reaction. However, *M. ahlneri* differs in always being short-stalked, with a different type of tissue in the central part of the stalk, and in having a poorly developed excipulum and persistant, sclerotized hyphae in the mazaedium.

Ecology and distribution. M. ahlneri occurs on decorticated stumps of conifers, in Europe on *Pinus sylvestris* and *Picea abies,* in North America on *Thuja occidentalis*. One collection from Sweden came from oak wood. It occurs only on heavily decayed wood which has been attacked by "brown rot".

The species is so far only known from a few localities. In Europe it occurs in the Southern, Middle and Norther Boreal Zones. The North American collections were made in the Hemiboreal Zone.

Scotland: East Inverness (V.C. 96), Guisachan Forest, 13.5 km SW of Cannich, Drichaid na Luib, 57°53'N, 4°53'W, 210 m, 1976 Tibell 6479 (UPS).

Sweden: Jämtland, Offerdal par., holotype – *Lule lappmark,* Kvikkjokk par., 3 km SSW of Kvikkjokk, S- and E-facing slope of Nammatj, 66°56'N, 17°42'E, 500–525 m, 1977 Tibell 7148 (UPS) – *Uppland,* Ärentuna par., 2.5 km SE of Storvreta, 1947 Hasselrot (S) – V. Ryd par., SE of Brunna, 1946 Ahlner (S) – *Värmland,* Dalby par., at Vingån, 1976 Sundell 11158 (UPS) – Långserud par., E of Björnklam, 1968 Sundell 6287 (S) – Lekvattnet par., Vittjärn, 1971 Sundell 7990 (Sundell).

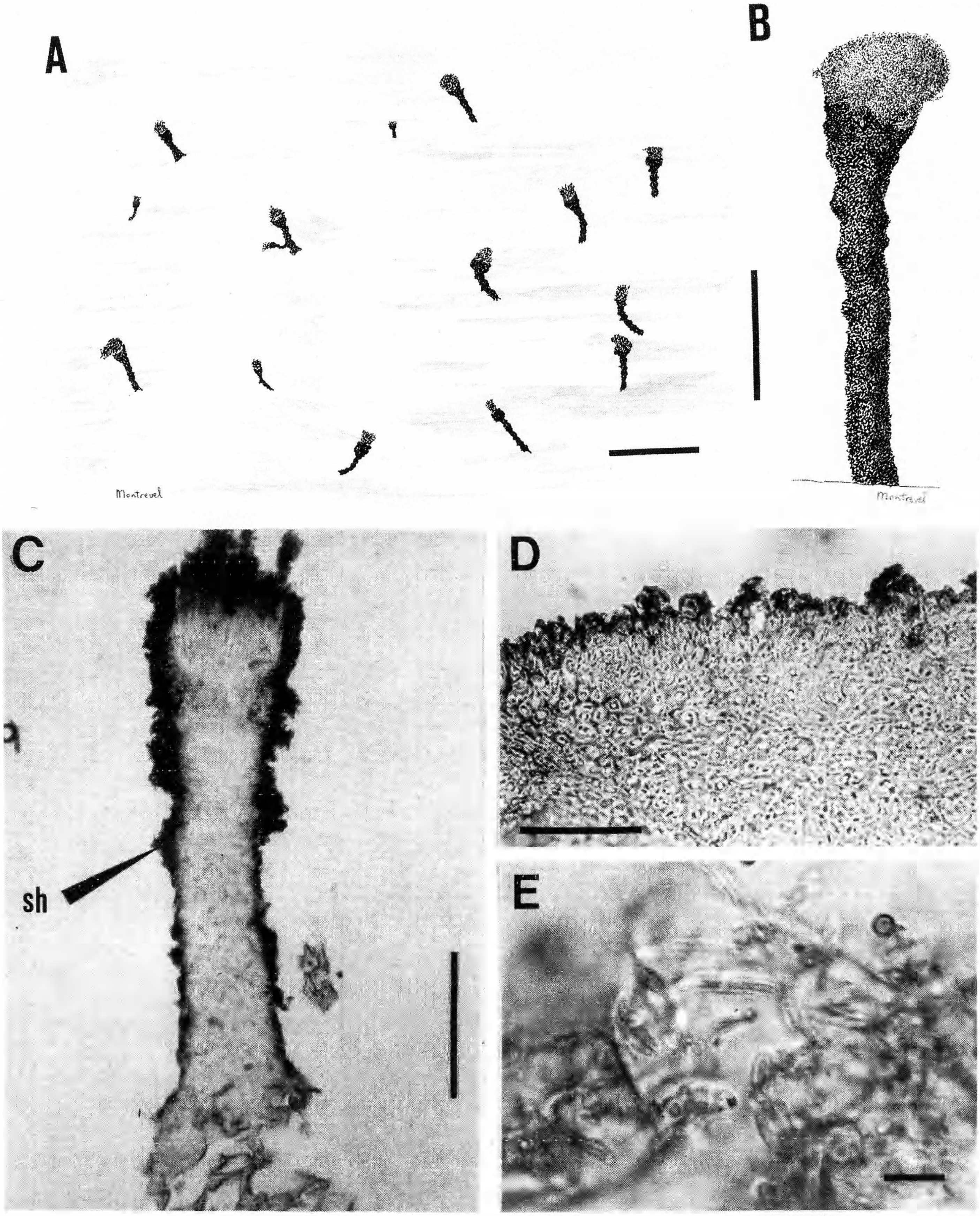

Fig. 1. *Microcalicium ahlneri*. – A: Scale 1 mm. – B: Scale 0.2 mm. – A–B: Tibell 7366. – C: Section of apothecium. Note the irregular aggregations of sclerotized hyphae (sh). Scale 100 μm. Tibell 7148. – D: Longitudinal section of stalk. The hyphae form a paraplectenchymatous tissue. Scale 25 μm. Tibell 6479. – E: Hyphae from the substrate. The hyphae are relatively straight. Scale 10 μm. Tibell 7148.

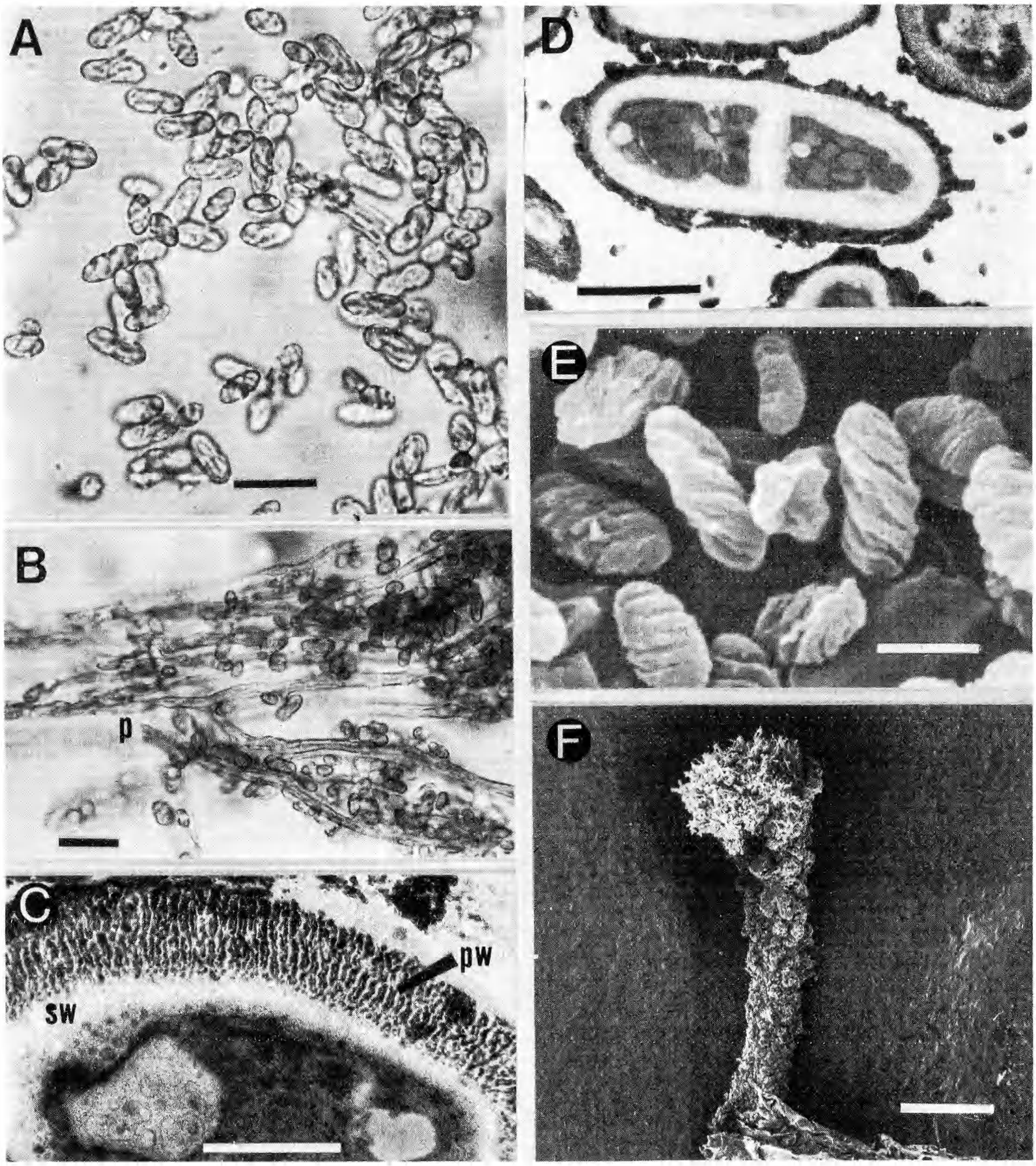

Fig. 2. *Microcalicium ahlneri*. – A: Mature spores: one-septate and distinctly ornamented with spirally arranged ridges. Scale 10 μm. Tibell 7148. – B: Sclerotized and branched paraphyses (p) from the mazaedium, and almost mature spores. Scale 10 μm. Holotype. – C: Semi-mature, non-septate spore. Primary wall (pw) distinctively patterned with paired parallel lamellae. The secondary wall (sw) in process of thickening. Scale 0.5 μm. Tibell 6479. –D: Mature spore. The septum consists of electron-lucent material resembling the secondary wall material. The primary wall remnants form irregular ridges on the spore surface. The characteristic lamellar structure of the primary wall is still discernible. Scale 2 μm. Tibell 6479. – E: Mature spores ornamented with spirally arranged ridges. Scale 3 μm. Holotype. – F: Mature apothecium. Note the irregular surface of the stalk. Scale 0.2 mm. Holotype.

U.S.A.: Michigan, Cheboygan Co., N of Burt Lake, Reeces Bog, 1977 Tibell 7366 (UPS), 7377 (UPS) – Just N of the Cheboygan to Levering Road, just W of its intersection with the Interstate Highway 75, 45°38'N, 84°39'W, 1977 Tibell 7462 (UPS) – Mackinac Co., Big Knob Campground, at Lake Michigan, 46°02'N, 84°39'W, 1977 Tibell 7444 (UPS).

The species has been named in honour of Dr Sten Ahlner. Although little of his vast knowledge of the Scandinavian Caliciales flora has yet appeared in print, his large collections from Sweden, Norway and Finland will be of the outmost importance for all later studies of this group. These collections cover a period of more than two decades, from the late 1930's onwards and are now kept in S. They have represented a continuous source of inspiration for me in my work with the Caliciales, as has Dr Ahlner's personal friendship.

2. **M. arenarium** (Hampe ex Massal.) L. Tibell, comb. nov.

Cyphelium arenarium Hampe ex Massal. 1856: 20. – Lectotype (designated here): "*Cyphelium arenarium* M. Ad rupes arenar. Blankenburg, Hercyn. Hampe." (UPS).

Coniocybe citrina Leight. 1857: 4. – Holotype: "*Calicium citrinum* Leight, on walls between Corwen and Bala, W.A.L." (Herb. Leighton, K).

Calycium pulverariae Auersw. 1858: 13. – Lectotype (designated here): "*Calycium pulverariae* Awd. n. sp. Utewalder Grunde in der sächsischen Schweiz, an Sandsteinenwand. 27. Juli 1855. Auerswald" (WA).

Calicium gneissicum Nyl. 1881: 449. – Holotype: "*Calicium gneissicum* Nyl. in Flora 1881. Supra saxa gneissacea alpis "Holica" prope pagum Teplicksa com. Liptó in Hung., Lojka" (H-NYL 40922).

Growing on either pure crusts of *Stichococcus* or sometimes on mixed crusts of *Stichococcus* and a member of Cystococcaceae. In some areas mainly parasitic on *Lecidea lucida* (Ach.) Ach. *Apothecia* very variable in size, 0.6–1.8(–2.5) mm high. *Capitulum* 0.14–0.28 mm wide. *Mazaedium* not higher than the width of the capitulum, slightly greenish in colour, sometimes brownish. *Stalk* 0.08–0.12 mm thick, dull black and with a coarsely granular surface. In very long-stalked apothecia the stalk is sometimes rather smooth and light greyish brown. Outer part of stalk covered by groups of dark, sclerotized hyphae (Fig. 3 C). Inner part of stalk consisting of pale and rather straight, interwoven hyphae (Fig. 3 E). *Excipulum* in section reddish brown, turning greenish with HNO_3 (cf. Table 3). *Asci* when mature broadly ellipsoidal, 9–11 × 5–6 µm. *Spores* when mature one-septate, 6.7–8.2 × 2.3–2.9 µm ($N=60$, $\bar{X}_l=7.5$ µm, $s_l=0.73$ µm, $\bar{X}_w=2.6$ µm, $s_w=0.30$ µm), distinctly ornamentated with spirally arranged ridges (Figs. 4 A, 5). *Paraphyses* not sclerotized, dissolving at an early stage. Stalk and spores turning brownish with KOH (cf. Table 3).

Taxonomic remarks. M. arenarium much resembles *M. ahlneri.* The differences are listed under the latter species.

Ecology and distribution. M. arenarium occurs in shaded and humid localities. It is most often found under overhanging, siliceous rocks and in such localities is often parasitic on *Lecidea lucida.* It also occurs on the roots of conifers which have been exposed along road-cuts or in gravelpits. In such localities it is normally associated with free-living colonies of *Stichococcus,* or with green algae belonging to the Cystococcaceae. It seems to be parasitic on these algal crusts.

M. arenarium is widely distributed in Europe, though rather rare. I have also seen material from Siberia and North America. It occurs in the Middle Boreal, Southern Boreal and Hemiboreal Zones and in the equivalent Oroboreal zones.

Exsiccata examined: Arnold, Lich. exs. 205 (S, UPS), 1061 (C, H, H-NYL, S, UPS) – Claudel & Harmand, Lich. gall. 221 (H, S, UPS) – Harmand, Guide Élem. 10 (UPS) – Harmand, Lich. Loth. 118 (UPS) – Leighton, Lich. Brit. 269 (BM, UPS) – Nádvorník, Calic. exs. 54 (UPS) – Rabenhorst, Lich. eur. 387 (S,UPS).

BRD: Baden-Württemberg, Bayern, Schleswig-Holstein. –*British Isles. Scotland:* Edinburgh, Forfar, Killin, Perthshire, *Wales:* Merioneth. *ČSR:* Bohemia, Moravia. *DDR:* Sachsen. *Finland:* Tavastia australis. *France:* Vosges. *Italy:* Trentino-Alto Adige. *Norway:* Buskerud. *Sweden:* Ångermanland, Bohuslän, Jämtland, Södermanland, Uppland, Västerbotten, Västergötland, Värmland. *USSR:* Siberia. Ob. *Canada:* British Columbia. *USA:* Alaska, Minnesota, Oregon.

3. **Microcalicium conversum** L. Tibell. sp. nov.

Holotypus: Chile, Magallanes, Rio Rubens, near Hotel Rio Rubens (about 50 km SE of Natales). On the underside of an inclining trunk of *Nothofagus pumilio* in a dense *N. pumilio* forest. 13.I.1941 R. Santesson 5619 (S).

Crescit ad alias species Calicialium. *Apothecia* sessilia vel subsessilia, 0.13–0.20 mm diametro, 0.16–0.24 mm alta. *Mazaedium* virellum, quam latitudo capituli non altius. *Excipulum* in sectione transversali badium, KOH + brunneum. HNO_3 + tarde flavovirens. *Asci* maturi ellipsoidei, 10–13 × 4–5.5 µm. *Sporae* maturae

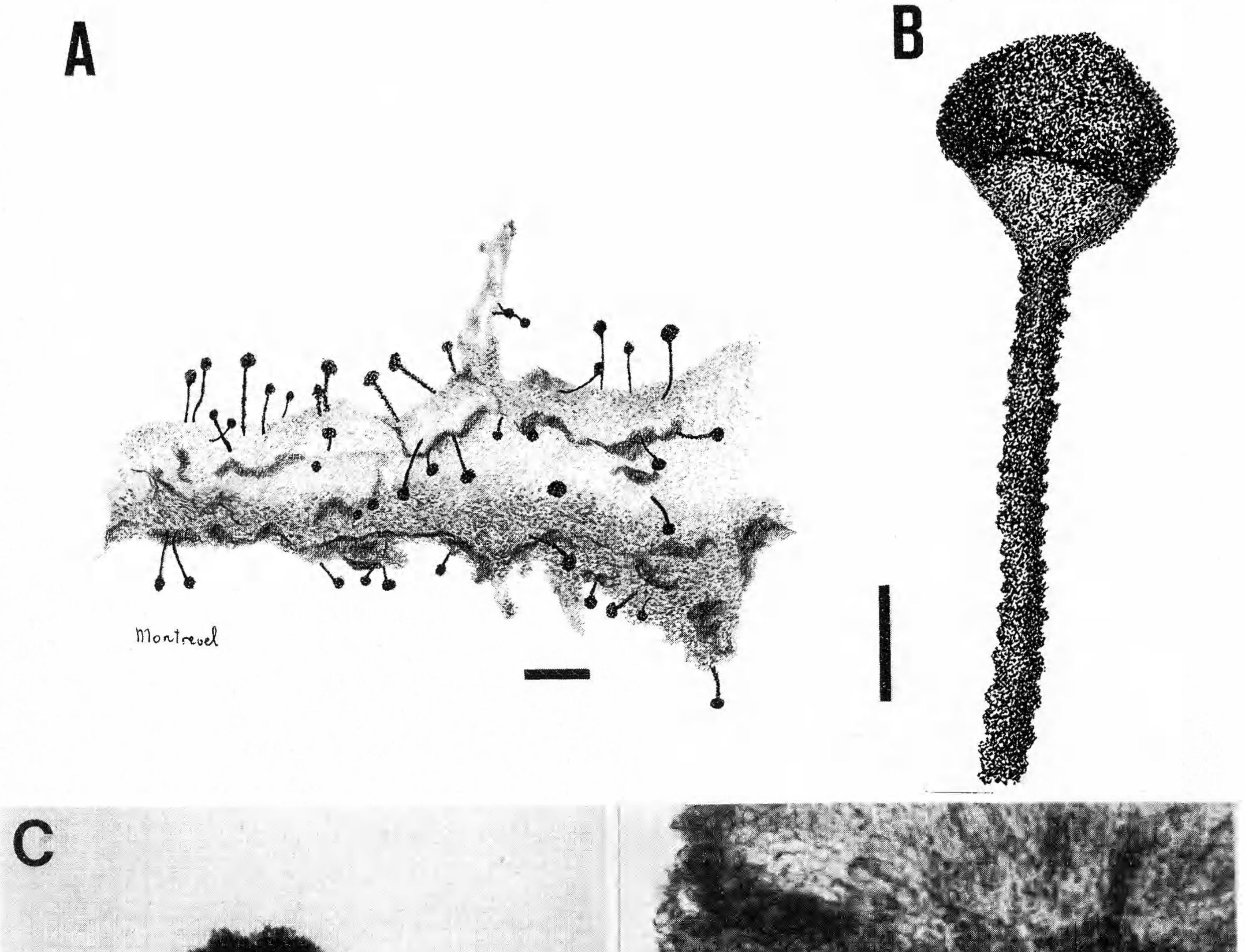

Fig. 3. *Microcalicium arenarium*. – A: Scale 1 mm. – B: Scale 0.2 mm. – A–B: Sweden, Uppland, Bondkyrko II, Kvarnbo, on rootlets, 1945 Ahlner (S). – C: Section of apothecium. Note the irregular aggregations of sclerotized hyphae (sh) on the surface of the stalk. Scale 0.1 mm. Coppins 1218 (E). – D: Excipulum of a mature apothecium. Scale 25 μm. Coppins 1218 (E). – E: Longitudinal section of stalk. The hyphae are distinct and straight, though densely interwoven. Scale 25 μm. Coppins 1218 (E).

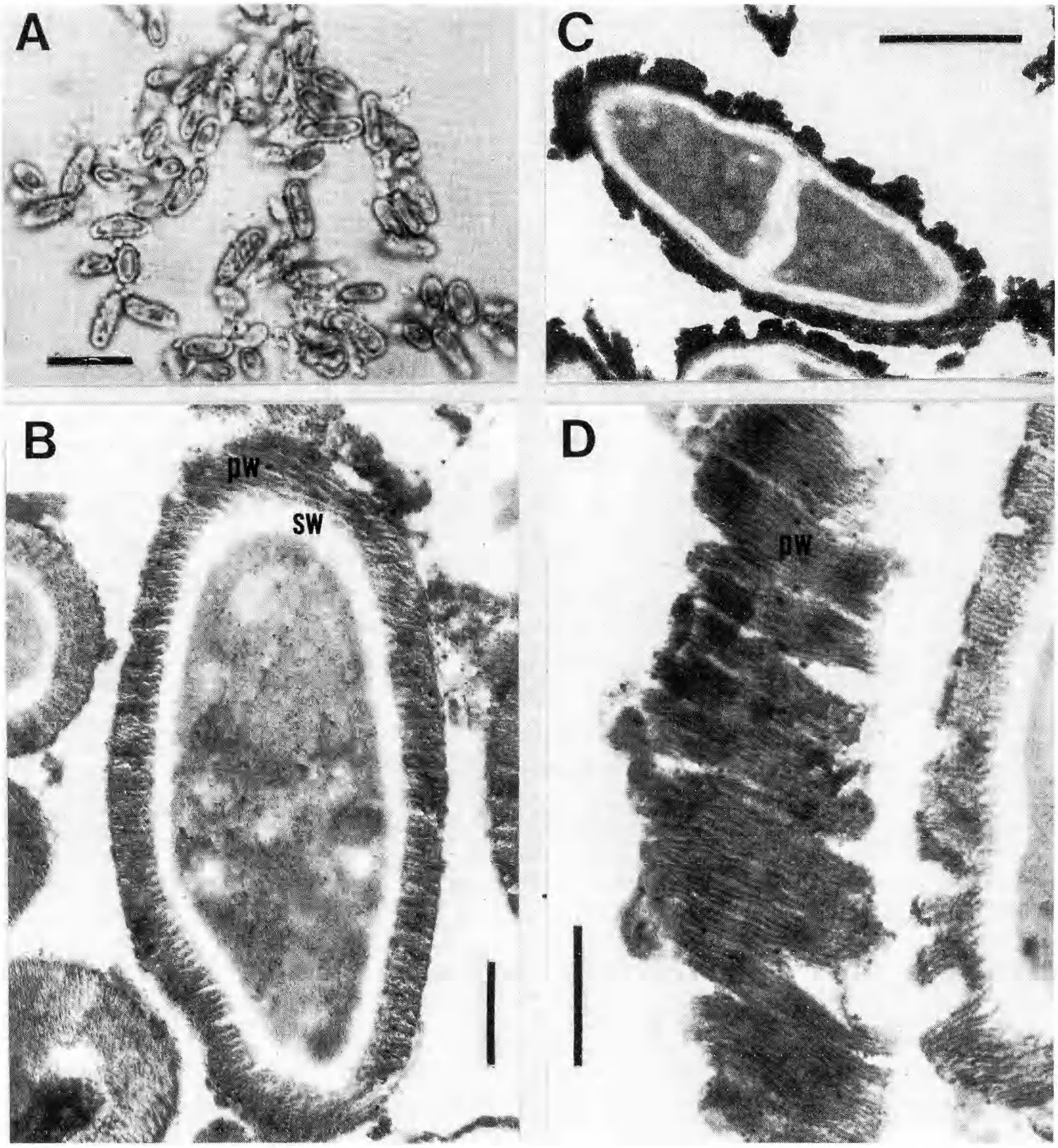

Fig. 4. *Microcalicium arenarium*. – A: Mature spores: one-septate and distinctly ornamented with spirally arranged ridges. Scale 10 μm. Coppins 1218 (E). – B: Semi-mature, still non-septate spore. Primary wall (pw), distinctively patterned with paired parallel lamellae and with an electron-lucent secondary wall (sw) beneath. Scale 0.5 μm. Tibell 5221. – C: Mature, one-septate spore. Primary wall remnants form an irregular ornamentation of spirally arranged ridges on the spore surface. Scale 2 μm. Tibell 5221. – D: Tangential section of a semi-mature spore. The primary spore wall (pw) contains electron-dense, parallell lamellae arranged in pairs. Scale 0.5 μm. Tibell 5221.

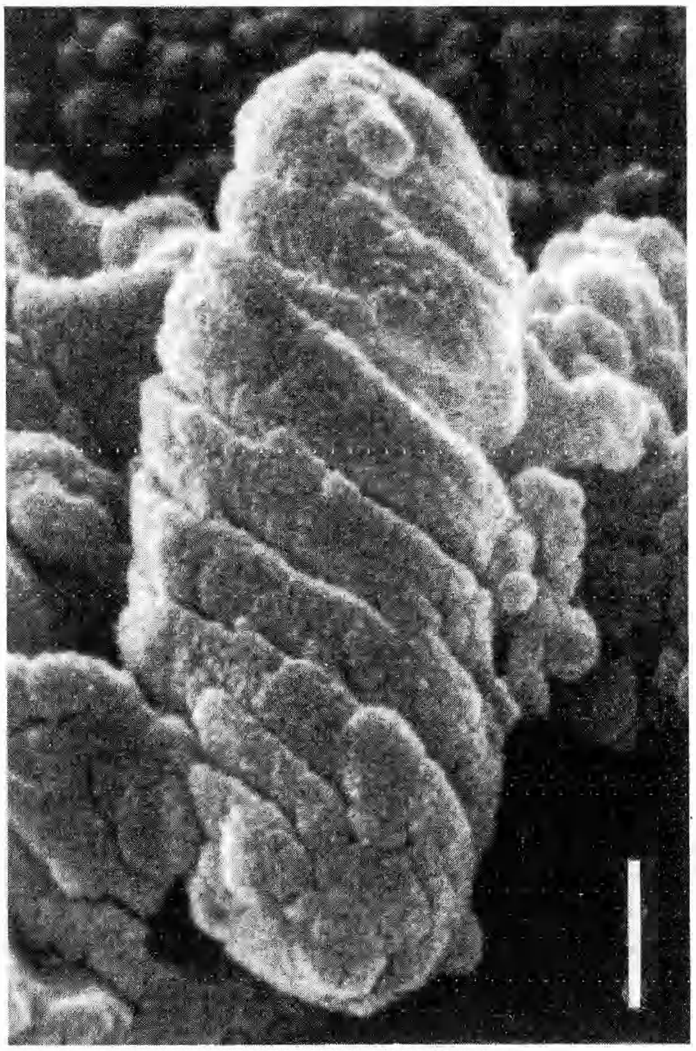

Fig. 5. *Microcalicium arenarium*. Mature spore with spirally arranged ridges. Scale 1 μm. Tibell 5221.

uniseptatae, ellipsoideae, 8.9–11.1 × 2.8–3.4 μm porcis spiratim dispositis distincte ornatae. *Paraphyses* scleroideae in mazaedio persistentes. *Pycnidia* 0.04–0.06 mm diametro, parietibus pycnidiorum badiis, KOH + viridibus. *Pycnosporae* anguste ellipsoideae, 2–3 × 1 μm, e phialidibus formatae.

Growing on other species of Caliciales. *Apothecia* sessile or subsessile, 0.13–0.20 mm in diam., 0.16–0.24 mm high. *Mazaedium* greenish, not higher than the width of the capitulum. *Excipulum* in section reddish brown, turning deeper brown with KOH and slowly turning yellowish green with HNO_3 (cf. Table 3). *Asci* when mature ellipsoidal, 10–13 × 4–5.5 μm. *Spores* when mature one-septate, ellipsoidal, 8.9–11.1 × 2.8–3.4 μm ($N=60$, $\bar{X}_l=10.0$ μm, $s_l=1.1$ μm, $\bar{X}_w=3.1$ μm, $s_w=0.31$ μm) with a distinct ornamentation of spirally arranged ridges (Figs. 6 B, 7 C). *Paraphyses* sclerotized, persistant in the mazaedium. *Pycnidia* 0.04–0.06 mm in diam. Walls of pycnidia reddish brown, turning green with KOH. *Pycnospores* narrowly ellipsoidal, 2–3 × 1 μm (Fig. 7 B), formed from phialides.

Taxonomic remarks. M. conversum resembles *M. subpedicellatum* in having sessile or subsessile apothecia, sclerotized and persistant paraphyses and in pycnidia production. It differs from *M. subpedicellatum* in having excipular and pycnidial walls reddish brown, in having smaller spores which are one-septate at maturity and in having narrowly ellipsoidal pycnospores. The colour reaction differences in acid and alkaline solutions are summarized in Table 3.

Ecology and distribution. M. conversum occurs with other species of Caliciales on live trunks of *Nothofagus antarctica* and *N. pumilio* in more or less dense *Nothofagus* forests and on lignum. It has been observed to parasitize *Calicium viride* and *Chaenotheca subroscida. M. conversum* is so far only known from four localities on Tierra del Fuego and Magallanes, between c. 150 and 400 m and from one locality in Tasmania.

Argentina: Tierra del Fuego, Lago Fagnano, Cabecera Lago at the eastern end of Lago Fagnano, near Mission Fagnano, 1940 R. Santesson 7861 A (S) – Sierra Sorondo, the northern slope above Las Cotorras (about 20 km ENE of Ushuaia), 1940 R. Santesson 759 (S).

Chile: Magallanes, Rio Rubens, near Hotel Rio Rubens, holotype; 1941 R. Santesson 5618 (S) – Punta Arenas, Cerros Mina Rica, 1940 R. Santesson 5232 (S).

Australia: Tasmania, southwest Tasmania, in rain forest area along the Cracroft River, in the vicinity of the Cracroft Hut (Cracroft Crossing), 1965 Filson 6723 (MEL).

4. **M. subpedicellatum** (Schaer.) L. Tibell, comb. nov.

Calicium subpedicellatum Schaer. 1821: 35. – Neotype (designated here): "In m. Gurnigel. Octob. 1844. Ex. helv. n. 504", ex Herb. Schaerer (G).

(*Cyphelium viridulum* Ach. 1817: 226 – Holotype: "*Cyphelium viridulum* Svecia" (H-ACH). Pre-starting point name.)

(*Cyphelium atomarium* Ach. 1817: 227. – Holotype: "*Cyphelium atomarium,* Svecia" (H-ACH). Pre-starting point name.)

(*Cyphelium disseminatum* Ach. 1817: 227. – Lectotype (designated here): "Smolandia, E. Fries" (UPS). Isotype in H-ACH, very scarce material. Prestarting point name.).

Calicium microcephalum α. patelliforme Schaer. 1833: 228. – Neotype (designated here): Fries, E. Lich. Suec. exs. 16 (G).

Strongylopsis commixta Vain. 1927: 66. – Lectotype

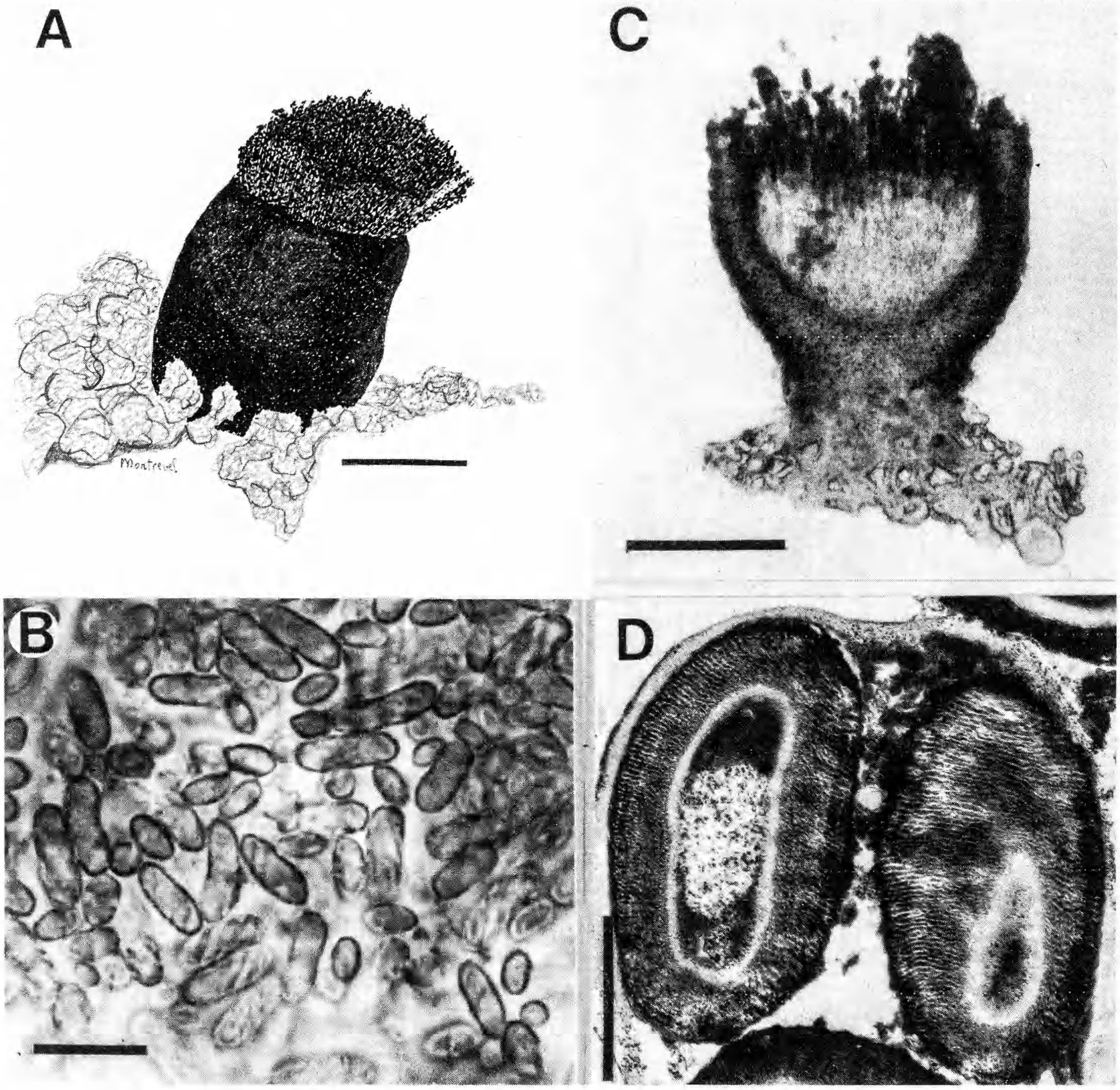

Fig. 6. *Microcalicium conversum*. – A: Mature apothecium on an unidentified host thallus. Scale 0.1mm. – B: Mature spores ornamented with spirally arranged ridges. Scale 10 μm. – C: Section of a mature apothecium with a short stalk. Scale 0.1 mm. – D: Semi-mature, still non-septate spores. The primary wall distinctively patterned with electron-dense, parallel lamellae arranged in pairs. Scale 1 μm. – All Santesson 7861 A.

(designated here): "Padasjoki, Nyystölä, 1872 Vainio", Herb. Vain. 29586 (TUR).

Strongylopsis leucopus Vain. 1927: 68. – Lectotype (designated here): Norrlin & Nylander, Herb. Lich. Fenn. 11, with Vainio's notes, specimen designated "A" by me (TUR).

Strongylopsis leucopus Vain. var. *pallidior* Vain. 1927: 69. – Lectotype (designated here): "Korpilahti, Soima, 1873 ad cort. abiet, E. Vainio", Herb. Vain. 29594 (TUR).

Strongylopsis stichococci Vain. 1927: 68. – Lectotype (designated here): "Tavastia australis: Padasjoki, Nyystölä, 1872. Ad corticem Betulae, Vainio", Herb. Vain. 29590 (TUR).

Microcalicium disseminatum f. *pedicellata* Vain. 1927: 78. – Lectotype (designated here): "Föglö, Gripö, 30.VII. 1923 Vainio", Herb. Vain. 29610 (TUR) as "*Calicium disseminatum* v. *subpedicellatum*". It is evident from the material in Herb. Vain. that Vainio later changed his concept of *Microcalicium disseminatum* f. *pedicellata* and renamed the collections belonging to it as indicated in the lectotype.

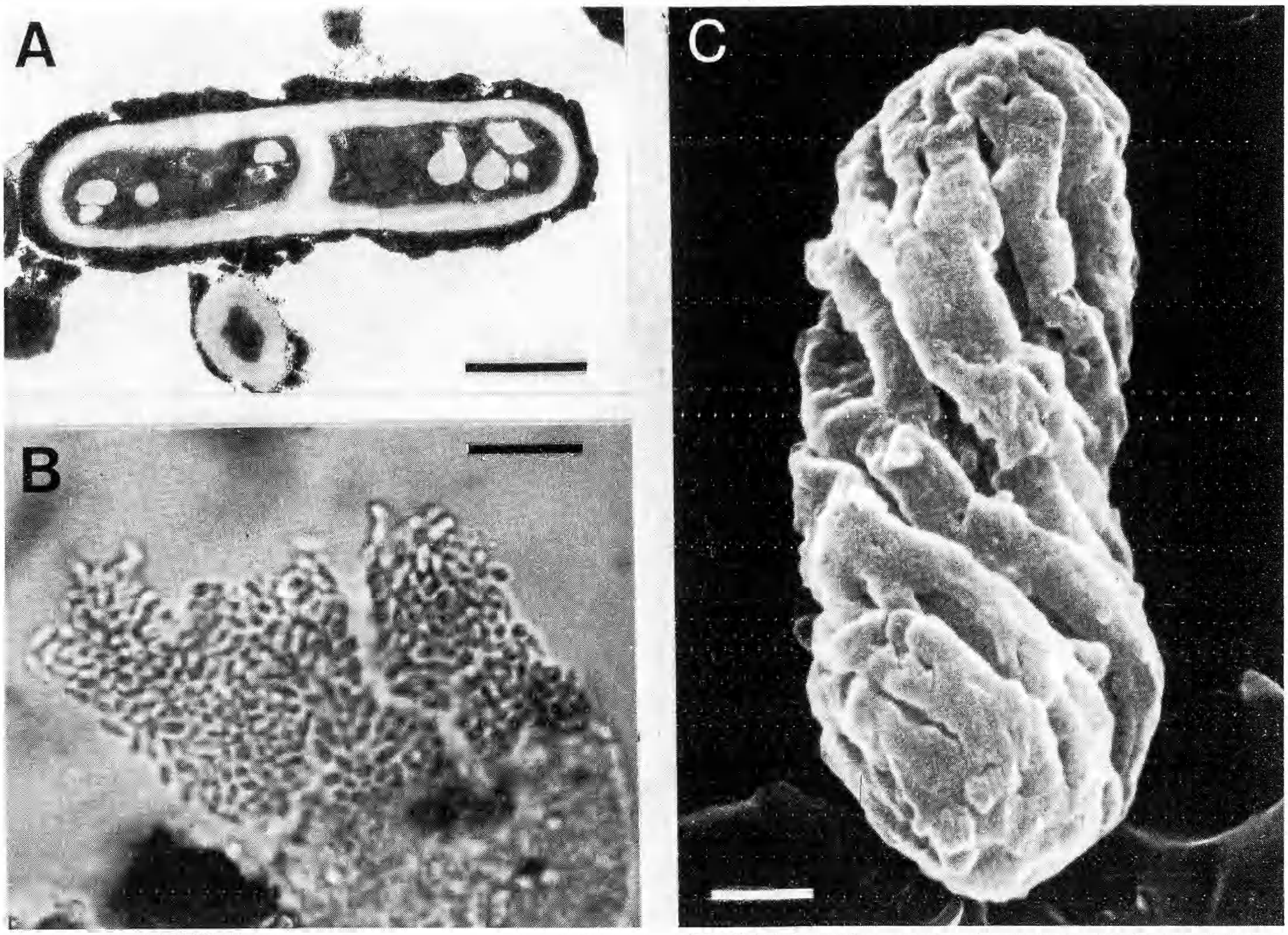

Fig. 7. *Microcalicium conversum.* – A: Mature, one-septate spore. Primary wall split into irregular remnants. Scale 2 µm. Santesson 7861 A. – B: Narrowly ellipsoidal pycnospores. Scale 10 µm. Holotype. – C: Mature spore ornamented with spirally arranged ridges. Santesson 7861 A.

Strongylopsis discreta Nádv. 1942: 33. – Lectotype (designated here): "*Strongylopsis discreta.* Rossia Subcarpathica: Černoholová, 5.9.1936, leg. et det. Ná.", Herb. Nádvorník (BRA).

Microcalicium disseminatum (Fr.) Vain. var. *aeruginosa* Räs. 1947: 25 – Lectotype (designated here): Räsänen, Lichenotheca Fenn. exs. 293, Herb. Räsänen (H).

Note. No type material of *Strongylopsis leucopus* Vain. var. *citrinula* Vain. 1927: 69 has been available to me but it probably belongs to *M. subpedicellatum.*

Growing on other species of Caliciales (Fig. 8 A, B) or on free-living crusts of green algae, or sometimes saprophytically on bark or wood with no apparent association with any algae. *Apothecia* sessile or subsessile, very variable in size and shape (cf. Table 2), 0.12–0.35 mm in diam., 0.14–0.20 mm high. *Mazaedium* greenish, often protruding as a column two or three times longer than the width of the apothecium (Fig. 8 A, B). *Excipulum* in section aeruginose turning brownish with KOH (cf. Table 3). *Asci* when mature broadly ellipsoidal, 13–14 × 5.5–7 µm. *Spores* when mature (1–)3-septate, 11.5–15.0 × 3.4–4.2 µm ($N=60$, $\bar{X}_l=13.2$ µm, $s_l=1.8$ µm, $\bar{X}_w=3.8$ µm, $s_w=0.43$ µm) with a distinct ornamentation of spirally arranged ridges (Figs. 9 C, 10 C). Some very large spores, up to 28 µm long, irregular in shape and with 4–5 septa are also found occasionally. *Paraphyses* sclerotized, persistant in the mazaedium. *Pycnidia* common and often frequent, 0.04–0.06 mm in diam. Wall aeruginose, turning brownish with KOH. *Pycnospores* broadly ellipsoidal, 2–3 × 2 µm, formed from phialides (Figs. 10 B, 11).

Taxonomic remarks. M. subpedicellatum much resembles *M. conversum.* The differences are listed under the latter species.

Ecology and distribution. M. subpedicellatum often occurs in localities with a rich Caliciales

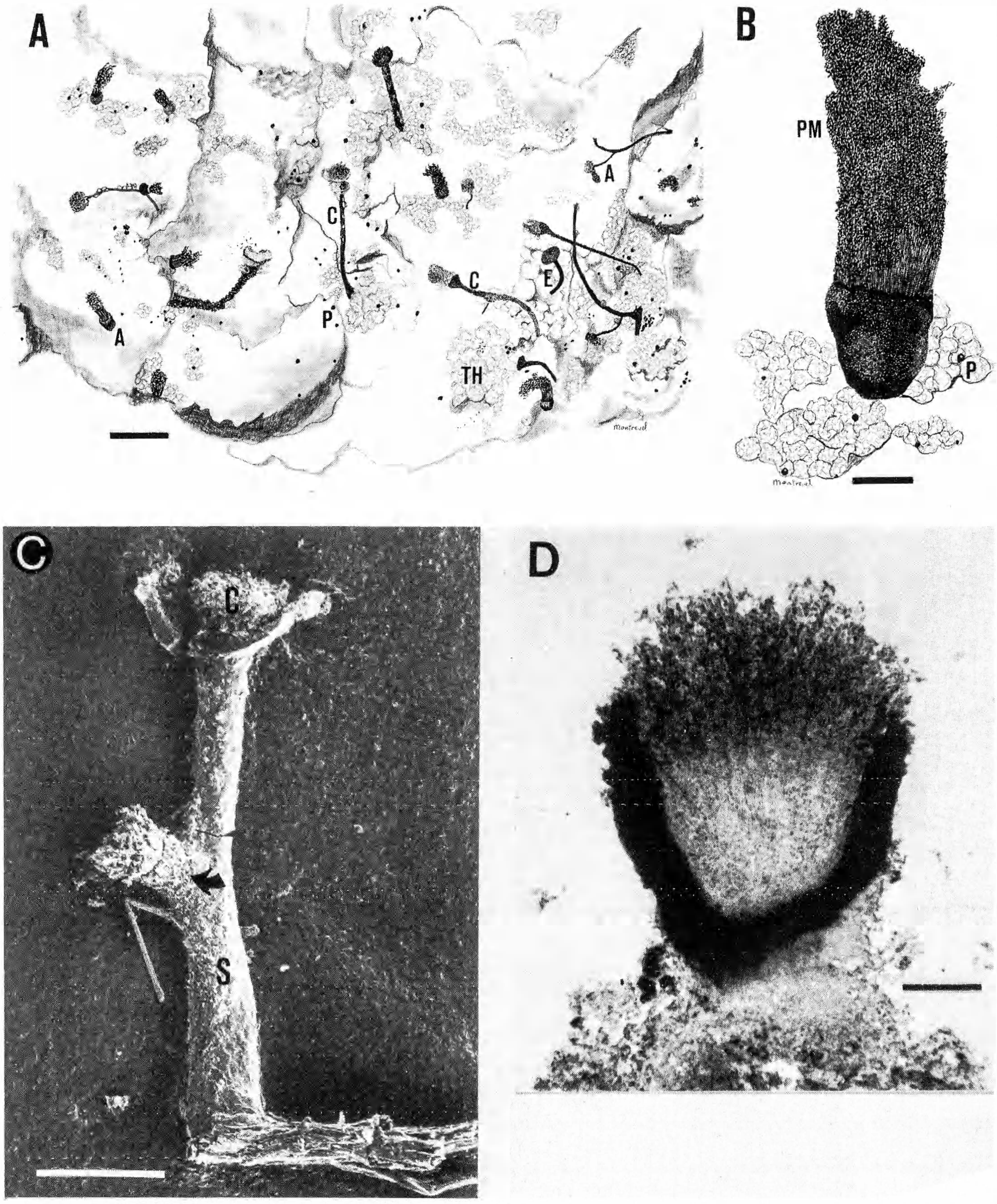

Fig. 8. *Microcalicium subpedicellatum*. – A: *Chaenotheca trichialis* parasitized by *M. subpedicellatum*. C apothecia of *Ch. trichialis* partly overgrown by algae. TH thallus of *Ch. trichialis*. A apothecia of *M. subpedicellatum*, one is growing on a stalk of *Ch. trichialis*. P pycnidia of *M. subpedicellatum*. E single apothecium of the parasitic *Chaenothecopsis epithallina* L. Tibell. Scale 1 mm. – B: Mature apothecium with protruberant mazaedium (PM) and pycnidia (P) on a decaying thallus of *Ch. trichialis*. Scale 0.1 mm. – A, B: Tibell 6266. – C: Apothecium (arrow) on stalk (S) of *Calicium glaucellum* Ach. The capitulum (C) of *C. glaucellum* has been partly destroyed during mounting. Scale 0.2 mm. Tibell 6300. – D: Section of mature apothecium. Scale 0.1 mm. Tibell 4560.

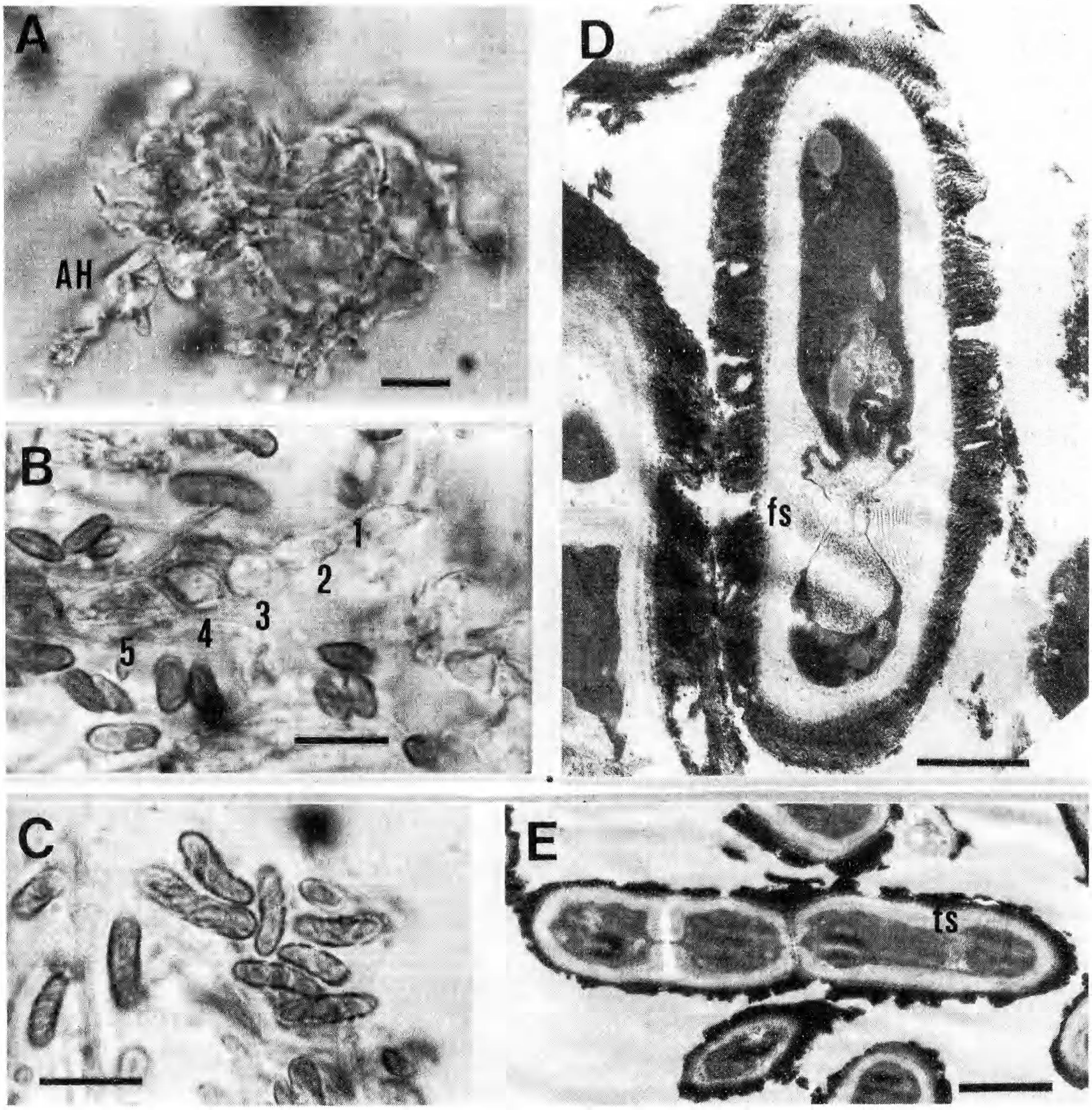

Fig. 9. *Microcalicium subpedicellatum.* – A: Hyphae from the substrate. The hyphae (AH) are strongly arched and interwoven. Scale 10 µm. Tibell 3913. – B: Asci formed in chains, without hooks. The asci are numbered from youngest to oldest. Scale 10 µm. Tibell 5437. – C: Mature, 3-septate spores ornamented with spirally arranged ridges. Scale 10 µm. Tibell 5437. – D: Semi-mature spore, during formation of the first septum (fs). The primary wall distinctively patterned with electron-dense, parallel lamellae arranged in pairs. Scale 1 µm. Tibell 4560. – E: Mature, 3-septate spore, with the third septum (ts) just being formed. Primary wall split into irregular remnants. Scale 2 µm. Tibell 4560.

vegetation, where it is parasitic on various species, such as *Calicium glaucellum, C. viride, Chaenotheca brunneola, Ch. chrysocephala, Ch. subroscida* and *Ch. trichialis* growing with *Chaenothecopsis epithallina, Ch. lignicola, Ch. viridialba* and *Cyphelium karelicum* on old trunks of *Picea abies* and lignum. The host thallus gradually deteriorates, losing its colour and morphological characteristics. Pycnidia of the parasite are produced on the host thallus at a comparatively early stage of attack. The apothecia of *M. subpedicellatum* develop later, at which stage

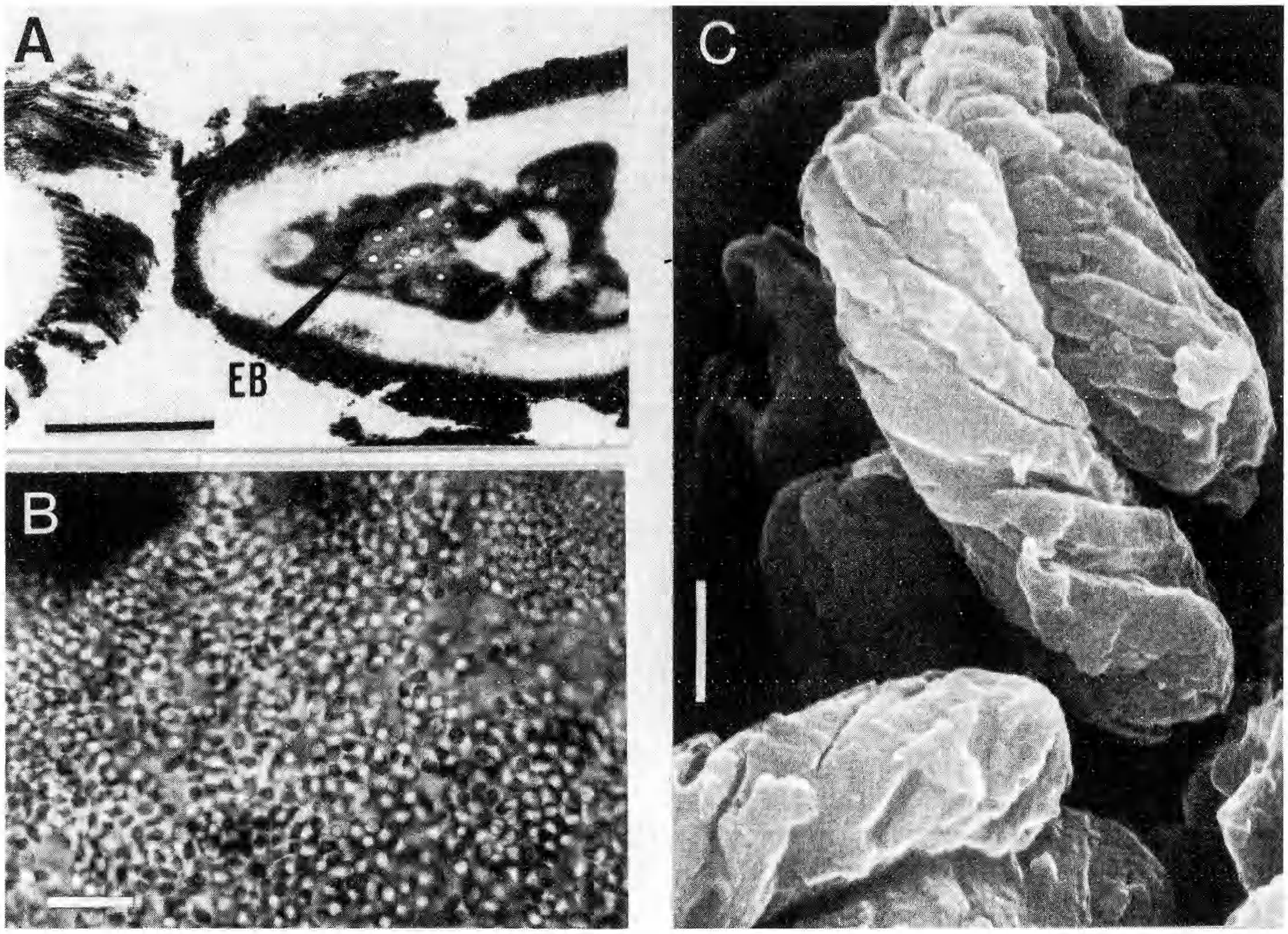

Fig. 10. *Microcalicium subpedicellatum.* – A: Mature spore with ellipsoidal bodies (EB). Scale 1 μm. Tibell 4560. – B: Broadly ellipsoidal pycnospores. Scale 10 μm. Tibell 3913. – C: Mature spores with spirally arranged ridges. Scale 2 μm. Tibell 3913.

the host thallus is often difficult to recognize. The apothecia are sometimes developed on the stalks, or even on the capitula of the host species (Fig. 8 A, C). When occurring on *Quercus* bark the association of *M. subpedicellatum* with other Caliciales species is usually less obvious, and *M. subpedicellatum* here often occurs on the sterile crusts of lichens or on crusts of free-living algae. On bark and wood it is sometimes found unassociated with algae and may there occur as a saprophyte, or may have fully destroyed the lichen thallus initially attacked. The association of *M. subpedicellatum* with different genera and species of algae has led several earlier authors to describe them as different species, as pointed out previously (see Historical survey).

M. subpedicellatum is widely distributed in the Northern Hemisphere, and seems not to be so uncommon in Northern Europe and Siberia as well as in parts of North America. It occurs from the Temperate to the Northern Boreal Zones and in the equivalent Oroboreal zones.

Exsiccata examined: Anzi, Lich. Lang. 505 (S) – Anzi, Lich. Ven. 113 (S, UPS) – Flotow, Lich. exs. 14 (UPS) – Fries, Lich. Suec. 16 (G, S, UPS). 17 (S, UPS) – Hepp, Flechten Eur. 327 (S, TUR, UPS) – Mougeot & Nestler, Stirp. Crypt. 1333 (UPS) – Nádvorník, Calic. exs. 24 (BRA, UPS) – – Norrlin & Nylander, Herb. Lich. Fenn. 11 (UPS) – Nylander, Herb. Lich. Par. 8 (UPS), 104 (UPS) – Rabenhorst, Lich. Eur. 389 (UPS) – Räsänen, Lich. Herb. Fenn. 540 (H, S, UPS) – Räsänen, Lichenoth. Fenn. 293 (H, UPS), 745 (H, S, UPS), 791 (H, UPS) – Roumeguère, Lich. Gall. 174 (UPS) – Schaerer, Lich. Helv. 503 (G, UPS), 504 (G, UPS) – Stenhammar, Lich. Suec. 228 (UPS) – Zwackh-Holzhausen, Lich. exs. 243 (UPS), 514 (S, UPS).

Austria: Tirol. –*BRD:* Baden-Württemberg, Bayern. –*British Isles. Scotland,* Easterness, Inverness. –*Finland:* Alandia, Isthmus karelicus, Karelia borealis, Kuusamo, Lapponia kemensis, Ostrobottnia australis, Ostrobottnia borealis, Ostrobottnia kajanensis, Regio aboënsis, Satakunta, Savonia borealis, Tavastia australis, Tavastia borealis. – *France:* Seine-et-Marne. – *Italy:* Trentino-Alto Adige. – *Norway:* Hedmark,

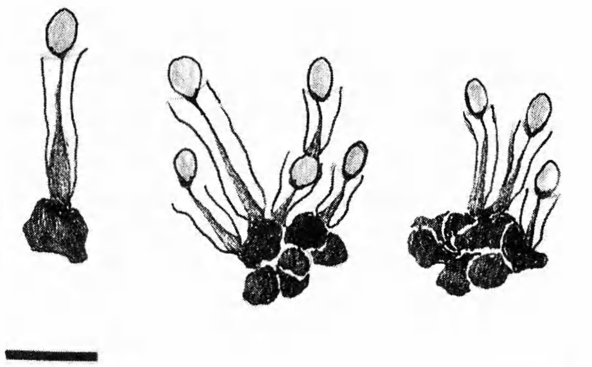

Fig. 11. *Microcalicium subpedicellatum.* Phialides with phialospores. Scale 5 µm. Tibell 3913.

Opland, Telemark. – *Sweden:* Ångermanland, Åsele lappmark, Dalarna, Gästrikland, Gotland, Hälsingland, Härjedalen, Jämtland, Lule lappmark, Närke, Norrbotten, Östergötland, Småland, Södermanland, Uppland, Värmland, Västergötland. – *Switzerland:* Bern. – *USSR:* Karelia-Lapland, Upper Dniester, Ob. – *Canada:* British Columbia, Ontario. – *USA:* Michigan.

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Appendix: collections measured

To construct Table 2, 20 mature apothecia from each of the following collections of *M. subpedicellatum* were measured. *Sweden: Dalarna,* Tibell 5437 (UPS). *Härjedalen,* Tibell 5502 (UPS). *Uppland,* Tibell 3741, 4396 (UPS).

For the calculation of spore size 20 mature spores from three different collections were measured.

M. ahlneri. British Isles. Scotland: East Inverness, Tibell 6479 (UPS). – *Sweden: Jämtland,* holotype. – *U.S.A.: Michigan,* Tibell 7444 (UPS).

M. arenarium. British Isles. Scotland: Angus. Coppins 1218 (E). – *Sweden: Uppland,* Uppsala, 1943 Hasselrot (S). – *Canada: British Columbia,* Tibell 5221 (UPS).

M. conversum. Argentina: Tierra del Fuego, Santesson 759 (S) and 7861 A (S). – *Chile: Magallanes,* Santesson 5619 (S).

M. subpedicellatum. Sweden: Dalarna, Tibell 3913 (UPS), 5437 (UPS). – *Canada: British Columbia,* Tibell 4945 (UPS).

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Two new species of Ustilaginales from Hungary

Kálmán Vánky and János Gönczöl

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Two new species of Ustilaginales are described from Hungary: *Ustilago heleochloae* Vánky & Gönczöl in the ovaries of *Heleochloa schoenoides* (L.) Host, and *Orphanomyces hungaricus* Vánky & Gönczöl on the leaves of *Carex acuta* L.

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Ustilago heleochloae Vánky & Gönczöl sp. nov.

Typus: Hungaria, Budapest, prope Pestlőrinc, in loco parum salso, alt. ca. 130 m, 10.X.1977, leg. J. Gönczöl (holotypus in Herb. Vánky (HUV 6514), isotypi in BP et S).

Sori inconspicui, in ovariis dispersis evoluti, ovoidei, 1.5–3 mm longi et 1–1.2 mm crassi, membrana tenui, cinerascenti, mature irregulariter dehiscenti et massam sporarum obscure olivaceo-brunneam, semipulveraceam detegenti, a glumis perfecte vel partim cooperti. *Sporae* globosae vel subglobosae vel ovoideae vel nonnunquam pyriformes vel irregulares, 9–11(–12) × 10–14(–16) µm, pallide olivaceo-brunneae, episporio 0.7–0.8 µm crasso, per microscopium aut sparse aut densiuscule, sed distincte punctato, per SEM spinulis 0.45–0.75 (plerumque 0.6) µm altis instructo. Columella nulla, cellulae steriles nullae, sed nonnunquam inter sporas maturas sporae immaturae paucae. Matrix: *Heleochloa schoenoides* (L.) Host (Gramineae).

Sori (Fig. 2) inconspicuous, ovoid, 1.5–3 mm long and 1–1.2 mm wide bodies, borne within occasional ovaries, covered or half-covered by the glumes, enclosed by a thin, greyish membrane which ruptures irregularly to reveal a semi-powdery, dark olivaceous-brown spore mass. *Spores* globose, subglobose, ovoidal, sometimes pyriform or irregular, 9–11(–12) × 10–14(–16) µm in diameter, light olivaceous-brown. Wall 0.7–0.8 µm thick, under LM (Fig. 1 A) appearing fairly to moderately dense, but clearly dotted, under SEM (Fig. 1 B) seen to be covered with spinules 0.45–0.75 (mostly 0.60) µm long. No columella and no sterile cells, but sometimes immature spores are present among the mature ones. On *Heleochloa schoenoides* (L.) Host (Gramineae).

Orphanomyces hungaricus Vánky & Gönczöl sp. nov.

Typus: Hungaria, Comit. Bács-Kiskun, reservatio naturalis Tőserdő, ad ripam partis inertis fluminis Tisza, alt. ca. 86 m, 30.VI.1977, leg. J. Gönczöl (holotypus in Herb. Vánky (HUV 6693), isotypi in BP et S).

Sori in superficie foliorum matricis crustulas nigras, tenues, granulatas – pulverulentas, nonnunquam strias vel maculas parvas inter venas formantes. *Glomeruli sporarum* subglobosi, ovoidei, elongati – irregulares, satis firmiter conglutinati, 30–60 × 45–80(–100) µm, e sporis 10–60 vel pluribus, habitu aequalibus compositi. *Sporae* globosae, ovoideae, parum irregulares, in siccitate saepe ab uno latere compressae, 11–16 × 14–23 µm, dilute flavobrunneae – mediocriter rubrobrunneae. Superficies earum per microscopium verruculosa – irregulariter et imperfecte reticulata, per SEM aut verrucis irregularibus, 0.3–1 µm altis, separatim dispositis, aut saepe verrucis per asserculos irregulares, humiles, interruptas connectis, reticulata. Germinatio sporarum ignota. Planta nutriens systemice infecta et sterilis. Matrix: *Carex acuta* L. (=*C. gracilis* Curt.).

Sori (Fig. 3) forming thin, granular-powdery black crusts on the leaf surface, sometimes forming striae or small spots arranged in rows on the epidermis between veins. *Spore balls* subglobose, ovoid, elongate or irregular in shape, rather permanent, 30–60 × 45–80(–100) µm in

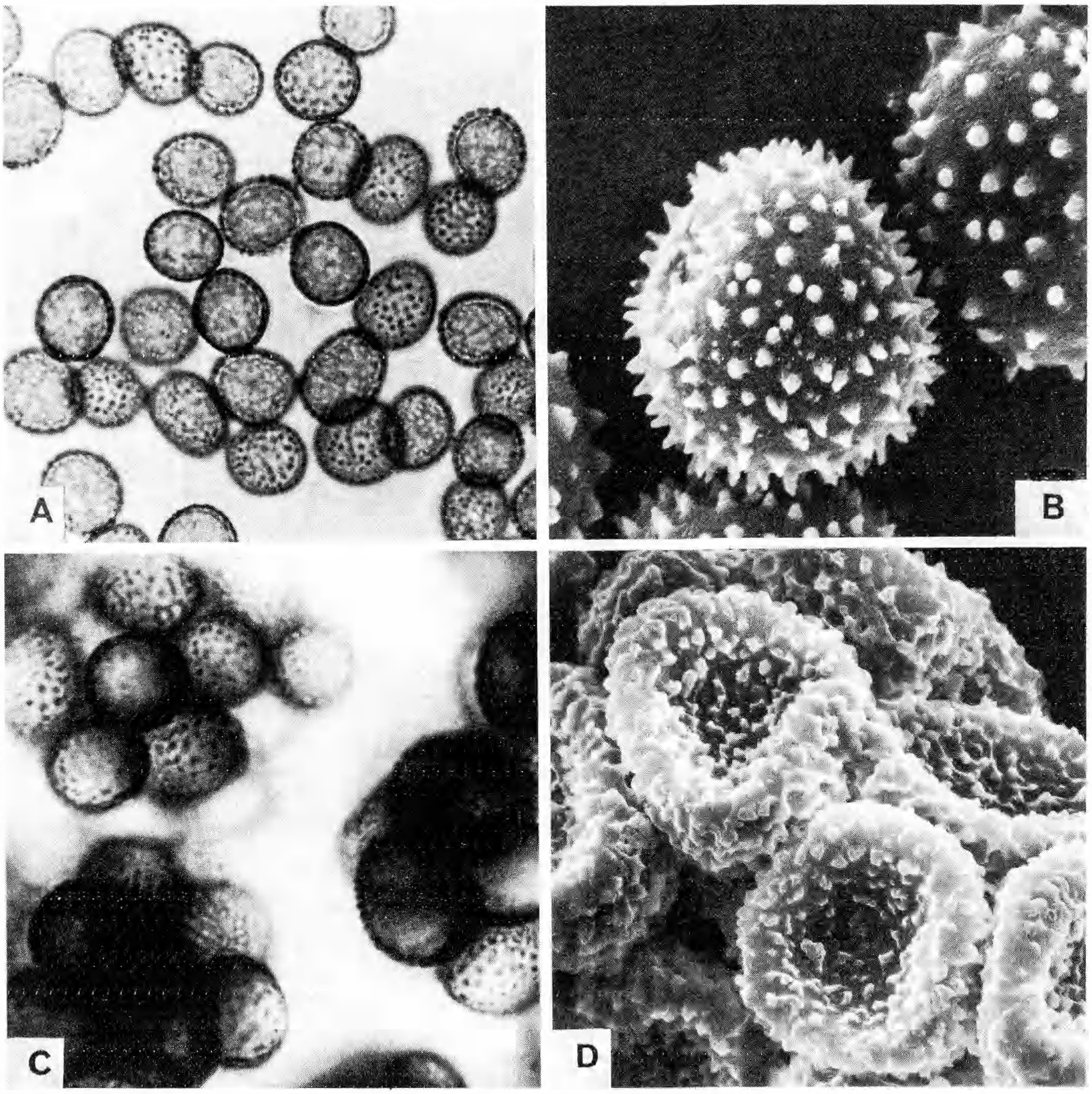

Fig. 1. A, B: Spores of *Ustilago heleochloae*. – A: LM, c. 1000×. – B: SEM, c. 5500×. – C, D: Spore balls of *Orphanomyces hungaricus*, partially crushed by pressing. – C: LM, c. 1000×. D: SEM, c. 2700×. Photo K. Vánky.

diameter, composed of 10–60 or more spores, all similar in character. *Spores* globose, ovoid or slightly irregular, often unilaterally compressed when dried, 11–16 × 14–23 μm in diameter, from a light yellowish-brown to medium reddish-brown. Spore surface under LM (Fig. 1 C) verruculose to irregularly and incompletely reticulate, under SEM (Fig. 1 D) seen to be covered with 0.3–1 μm high warts, which are often interconnected by low, irregular and incomplete ridges which give the spore surface an irregularly reticulate appearance. Spore germination unknown. The systematically infected host plants are sterile. On *Carex acuta* L. (=*C. gracilis* Curt.).

With certain reservations this new species should be placed in the genus *Orphanomyces,* a genus newly erected by Savile (1974). The type species is *O. arcticus* (Rostrup) Savile (=*Tilletia arctica* Rostr., =*Cintractia arctica* (Rostr.) Lgh., =*Ustilago arctica* (Rostr.) B. Lindeb.)

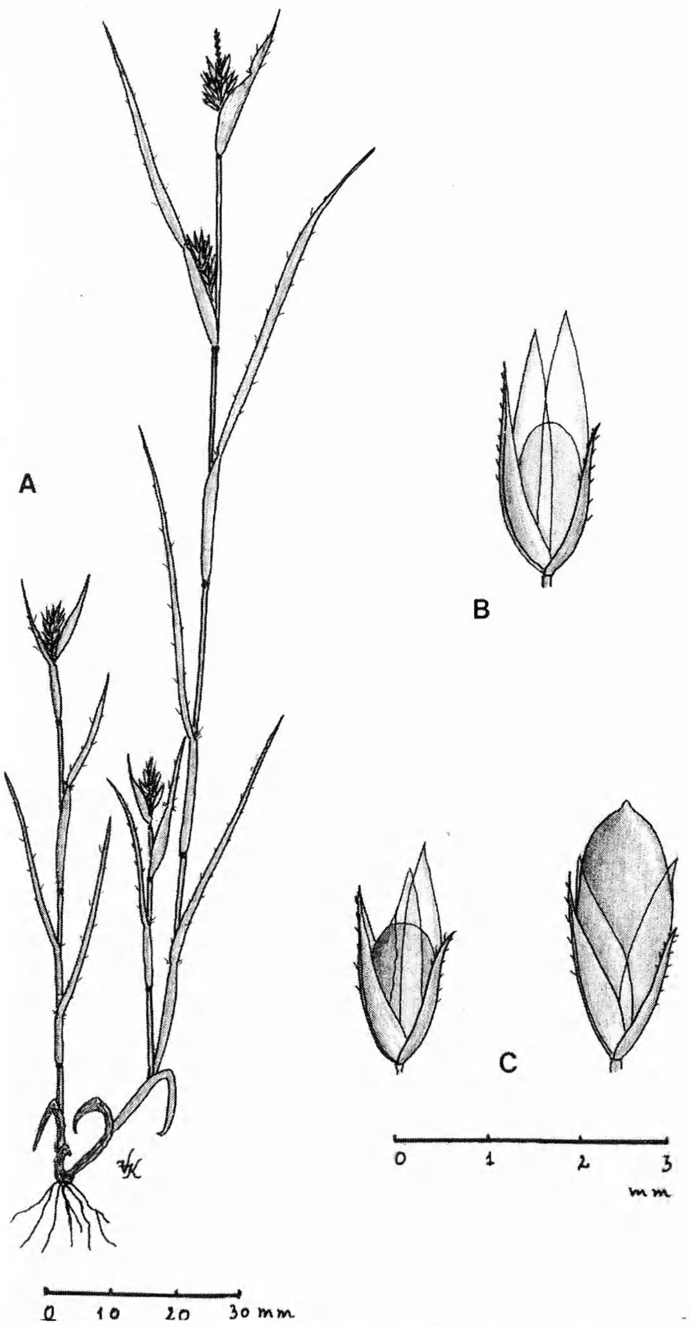

Fig. 2. A: *Heleochloa schoenoides* (L.) Host, infected by *Ustilago heleochloae*. – B: A spikelet with a ripe caryopsis. – C: Two spikelets with sori of *Ustilago heleochloae* in the ovaries.

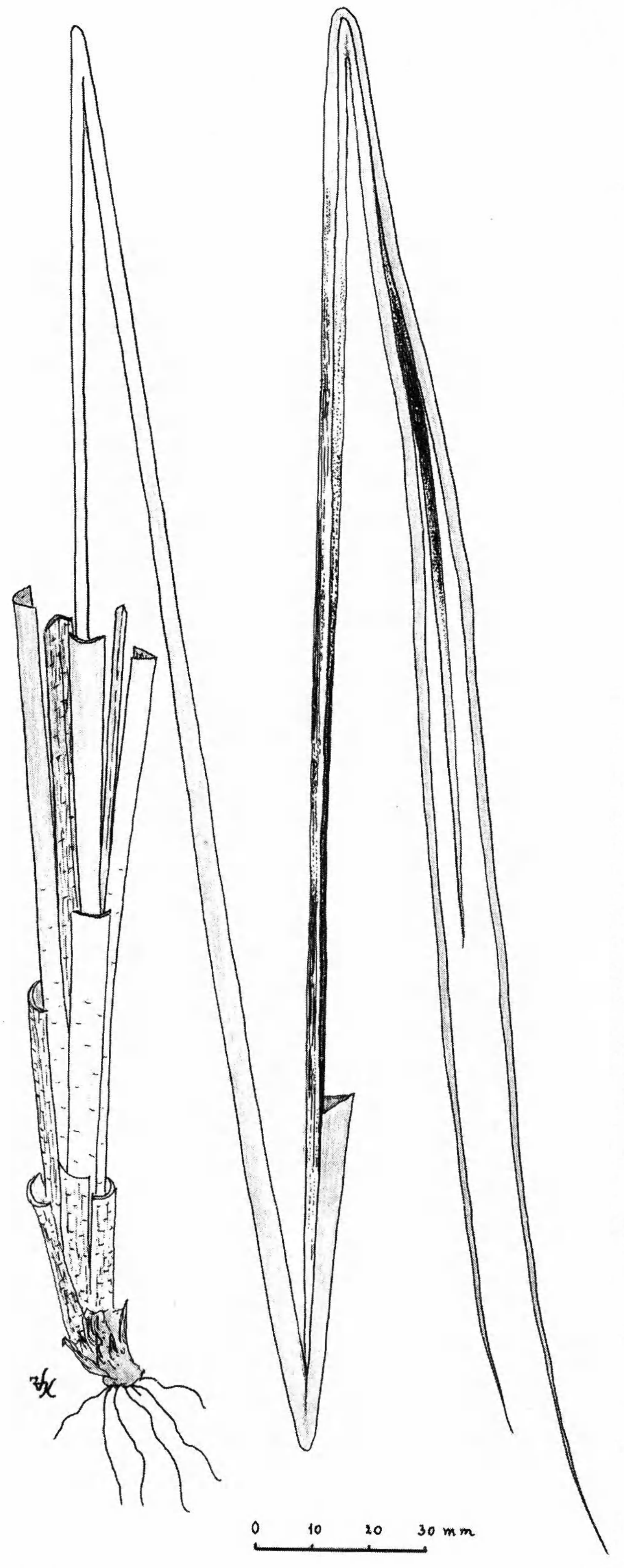

Fig. 3. Sori of *Orphanomyces hungaricus* on the leaves of *Carex acuta* L.

known from N Europe, N America and Mongolia on different *Carex* species (*C. brunnescens, C. canescens, C. eburnea, C. glareosa, C. lachenalii* (=*C. lagopina*), *C. macloviana* (=*C. festiva*), *C. nubicola*). The sori form black, semipowdery crusts on the leaf surface. The spores are solitary, 11–16 × 13–21 μm in diameter. The spore surface is more or less regularly foveolate-reticulate (Fig. 4 A, B).

The second species of *Orphanomyces, O. vankyi* Savile (1974), appears on the leaves of *Carex acutiformis* Ehrh. It is known from Transylvania, Romania. This species differs from *O. arcticus* in having larger spores (12–22 × 17–26 μm) with an irregular, often incompletely reticulate surface (Fig. 4 C, D).

The spores of *O. vankyi* form spore balls, while those of *O. arcticus* do not. The spore

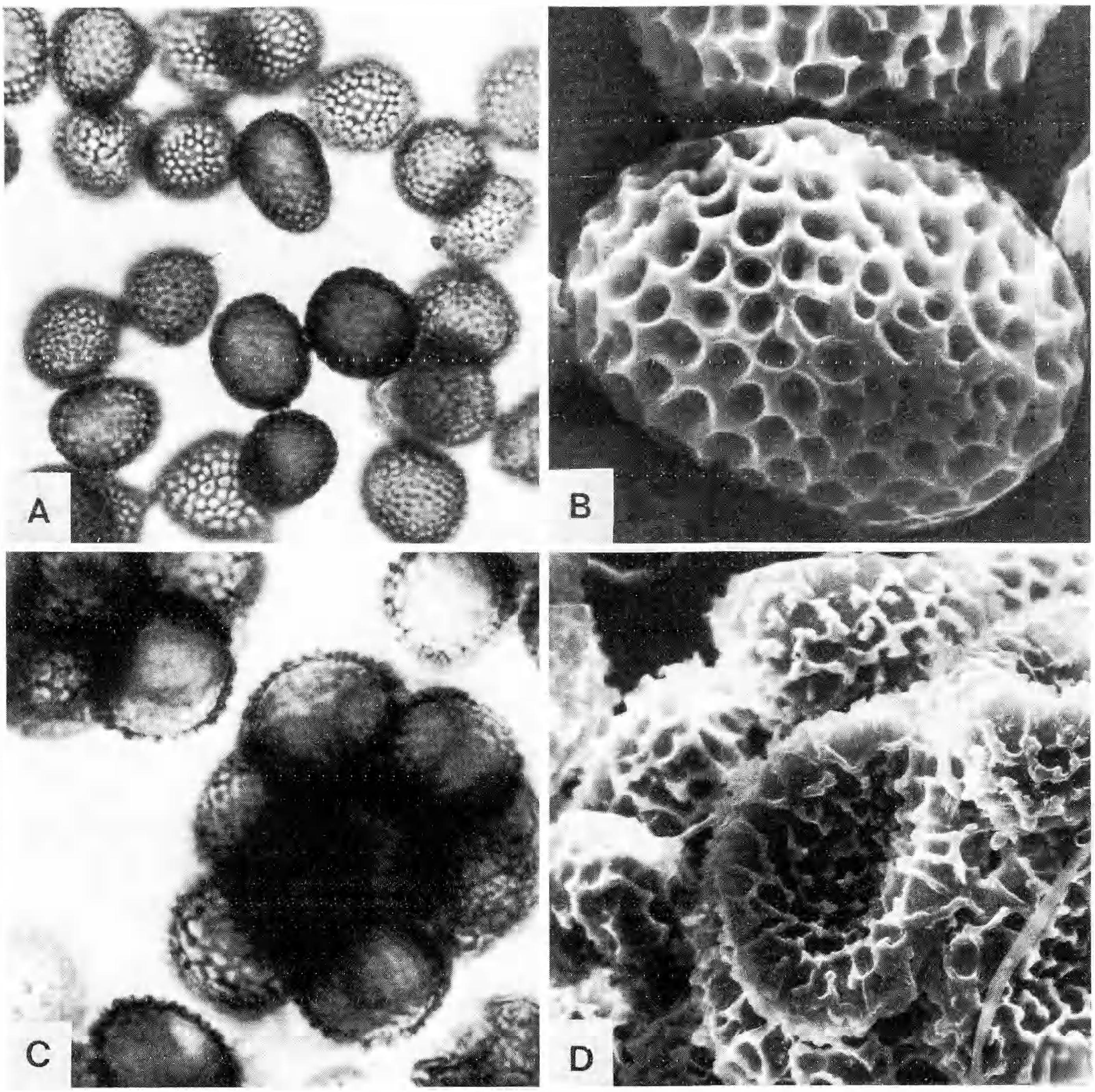

Fig. 4. A–B: Spores of *Orphanomyces arcticus*. – A: LM, c. 1000 ×. – B: SEM, c. 5500 ×. – C, D: Spore balls of *O. vankyi*. – C: LM, c. 1000 ×. – D: SEM, c. 2700 ×. – Photo K. Vánky.

germination of *O. vankyi* (unpublished data) differs also from that of *O. arcticus* published by Duran & Safeeulla (1968). These characteristics are taxonomically important and further studies are needed to elucidate whether these two species really belong within the same genus. *O. hungaricus* resembles *O. vankyi* in sorus characteristics and in the formation of spore balls. It differs in having smaller spores (11–16 × 14–23 μm) with a different kind of surface ornamentation.

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New taxa of Diceratella and Farsetia (Cruciferae) from E Tropical Africa

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In the arid areas of E Tropical Africa some genera of Cruciferae have a centre of diversity with many endemic species. This concerns particularly *Diceratella* and its close allies (tribus Hesperideae) and *Farsetia* (tribus Alysseae), both with their connections to the Saharo-Sindian phytogeographical region. *Farsetia* extends into upland Kenya and N Tanzania. From there *F. undulicarpa* Jonsell sp. nov. and *F. stenoptera* Hochst. subsp. *speciosa* Jonsell subsp. nov. are described. *Diceratella smithii* (Bak. f.) Jonsell comb. nov. is transferred from *Matthiola*.

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In East Tropical Africa the family Cruciferae is poorly represented, being only in the Afromontane and Afro-alpine flora a component of some significance (Hedberg 1957, 1965). This is in contrast to the situation in the North African arid areas, where the Cruciferae is qualitatively important and has a major centre of diversity (Hedge 1976).

The arid areas of East Tropical Africa, mainly situated on the so-called Horn of Africa lack most of the Saharan genera of Cruciferae but show a few examples of diversification leading to considerable endemism on species level, possibly even to the generic one (Moggi 1965 p. 259). These endemic taxa are found particularly within two of the tribes most significant for the Saharo-Sindian region, namely Hesperideae s. lat. (*Diceratella* and allied genera) and Alysseae (*Farsetia*). In addition there are apparently undescribed species also from other tribes, notably Brassiceae, to be found in the sparse material collected from the area.

Important parts of the vegetation of the Horn of Africa were described by Gillett (1941), Gilliland (1952) and Pichi-Sermolli (1957). The latter designates vast parts of the area as xerophilous open *Acacia–Commiphora* woodland. In addition subdesert scrub and steppe vegetation play important roles.

Hemming (1968) remarks upon the richness in species and the considerable number of new discoveries made in this area lately. Notable forms of Cruciferae occur up into the highest parts of the Somalian–E Ethiopian plateau (c. 2400 m), which are situated near Erigavo in northern Somalia, close to the escarpment towards the Gulf of Aden.

These comments will give the background for some new descriptions and combinations needed for an account of Cruciferae for the Flora of Tropical East Africa (FTEA; Jonsell, in press). The presentation of new taxa in *Farsetia* anticipates the results of a monographic study undertaken of that genus.

Diceratella

One group of apparently closely related genera within the tribe Hesperideae is delimited by Schulz (1936) and more strongly emphasized by Moggi (1965). It comprises a number of small, partly monotypic genera distributed from the northern part of the Irano-Turanian region (*Tetracme* Bunge) through vast parts of the Saharo-Sindian region (*Lonchophora* Durieu, *Morettia* DC., *Notoceras* R. Br.) to the Canary Islands in the west (*Parolinia* Webb) and the Somalian area in the south (*Diceratella* Boiss.).

They are characterized by tardily dehiscent siliquae with thick valves, in which the seeds lie in cavities often so deep as to make the siliquae transversely septate. Each valve usually bears one or two horn-like processes (lacking in *Morettia*). The generic circumscriptions within the group and the delimitation towards *Matthiola* are still disputable and should be elucidated by studies of other characters than those pertaining to the adaptive complex of the fruit.

Diceratella has a disjunct distribution with two species in S Iran and six species described from the Horn of Africa, including Socotra (cf. below). Zohary (1972 p. 92 ff.) stresses that these floristic connections between E Africa and S Iran are worth further attention. The number of *Diceratella* collections is small both from Iran (Hedge & Rechinger 1968) and Africa. Four of the African species are known only or nearly only from the type material. The few additional African collections are rarely in close agreement with any type material, which may indicate that in reality there are fewer but more variable species. Most collections have been referred to *D. sinuata* (Franch.) Oliv. ex James & Thrupp, represented from N Somalia to N Kenya and variable both in fruit and habit characters. The Socotran *D. incana* Balfour fil. (1882) was in fact already by its author regarded as conspecific with *D. sinuata* (Balfour 1888) though it has later been held as separate (Popov 1957; cf., however, Hutchinson & Bruce 1941 p. 86). They are here regarded as conspecific, and the name *D. incana* takes priority.

D. umbrosa Engl. makes the impression of a form of *D. incana* from shaded and less dry environments, and is here included in that species.

One species of *Matthiola, M. smithii* Bak. fil., has a siliqua of *Diceratella* type, and is here presented as *Diceratella smithii* (Bak. fil.) Jonsell comb. nov. It is distinguished from *D. incana* particularly by decurrent valval horns not surpassing the style (Fig. 1) and by petals shorter than 18 mm (longer than 20 mm in *D. incana*).

Two of the species described by Engler (1902 a, b), *D. erlangerana* and *D. ruspoliana* are, to judge from type material, inseparable from *D. smithii,* with which Engler did not compare them. The siliqua is of the shape shown in Fig. 1 C. They are here regarded as taxonomic synonyms of *D. smithii*. The remaining species from this area, *D. psilotrichoides* Chiovenda (1929 p. 76), described from Central Somalia is extremely woody and has small, spatulate leaves.

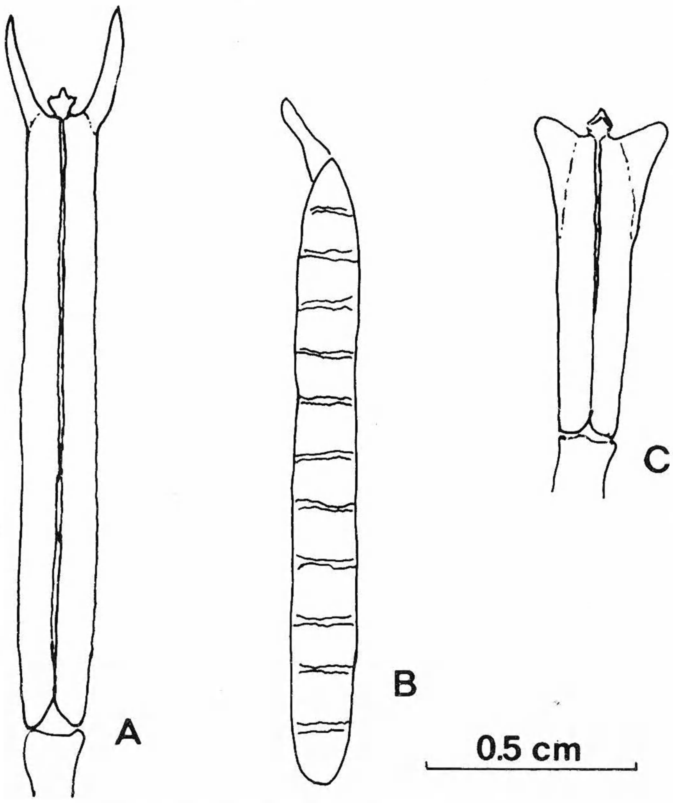

Fig. 1. Fruits of *Diceratella*. – A, B: *D. incana* (Matthew 6681, EA). – A: Ripe siliqua. – B: Inner side of siliqua valve with transverse septa. – C: *D. smithii* (Lort Phillips s.n., BM). Ripe siliqua.

Diceratella canescens (Boiss.) Boiss. from S Iran and *D. incana* are similar in flowers and fruits, although *D. canescens* has much narrower styles. At present they seem distinct enough to be kept separate, but with further collections at hands they may turn out to be conspecific.

Diceratella incana Balfour fil.

Balfour 1882: 500 (by author dated 6th Feb.). – Orig. coll.: Socotra, Balfour 136 (E holotype, BM, K isotypes!).

Notoceras sinuata Franchet in Revoil 1882: 9 (by author dated 1 st June). –*Diceratella sinuata* (Franchet) Oliver ex James & Thrupp 1888: 318. – Orig. coll.: Somalia, N Region, Revoil s.n. (P holotype!),

Diceratella umbrosa Engler 1902 b: 98. – Orig. coll.: Ethiopia, Galle, Wabi, Ellenbeck 1158 (B holotype!).

Subshrub (young flowering plants herbaceous), green to light green by sparse to moderate cover by rather appressed whitish branched hairs.

Stems 20–70 cm, ascending, branched. *Leaves* moderately to densely crowded, petioles 4–18 mm; lamina elliptic, 18–65 × 8–30 mm, obtuse, attenuate at base, distantly sinuately dentate to subentire. *Racemes* with few to several showy flowers, but only one or two simultaneously in bloom, at fruit-ripening up to 30 cm; pedicels usually erect, stiff, 2.5–9.0 mm. *Sepals* oblong, obtuse, 8–12 × c. 1.3 mm, outer ones slightly saccate. *Petals* clawed, pale lilac to lilac (? also yellowish), c. 25 mm; claw 10–13 mm, blade broadly spatulate, c. 12 × 10 mm, apically rounded. *Siliqua* linear, straight or slightly curved, 11–26 × 2.5 mm, tardily dehiscent, quadrangulate, transversely septate between the seeds; valves keeled, each apically with a projecting, non-decurrent, narrow, c. 5 mm long horn. *Style* c. 1 mm long and about as broad. *Seeds* reddish brown, wingless or slightly winged, very finely reticulate, suborbicular, compressed, c. 1.5 mm.

Distribution: Socotra, Somalia, SE Ethiopia, N Kenya.

Diceratella smithii (Baker fil.) Jonsell comb. nov.

Matthiola smithii Baker fil. 1896: 50. – Orig. coll.: Ethiopia, Ogaden, Sibe, Donaldson-Smith s.n. (BM holotype!).

Diceratella erlangerana Engler 1902 b: 99. – Orig. coll.: Ethiopia, Arussi-Galla, Wabi, Ellenbeck 1357 (B holotype!).

Diceratella ruspoliana Engler 1902 a: 248. – Orig. coll.: Ethiopia, Ogaden, Riva (in coll. Ruspoli) 60, 859, 1073, 1084 (B, FI syntypes!).

Subshrub, often strongly woody and brownish below, otherwise whitish green by dense cover of branched, somewhat floccose hairs. *Stems* up to 100 cm, richly branched. *Leaves* loose to rather crowded, nearly sessile or (in lower leaves) with short petioles; lamina elliptic to narrowly elliptic, 10–40 × 4–15 mm, obtuse, attenuate at base, entire, serrate or dentate. *Racemes* with few to several flowers, but only one or two simultaneously in bloom, at fruit-ripening up to c. 30 cm; pedicels erect or ascending, stiff, 3.0–12 mm. *Sepals* oblong, obtuse, 6.5–11 × c. 1 mm, not saccate. *Petals* clawed, rose, lilac or mauve, 9–18 mm long, blade spatulate, c. 5 mm broad. *Siliqua* linear, straight or slightly arcuate, 7–18 × 2.5–3 mm, tardily dehiscent, quadrangulate, transversely septate between the seeds; valves keeled, each apically with a decurrent, rather broad horn up to c. 2 mm long, equalling or only slightly projecting beyond the stigma. *Style* c. 1 mm long and about as broad. *Seeds* reddish brown, wingless, very finely reticulate, suborbicular, compressed, 1–1.5 mm.

Distribution: N Somalia, E Ethiopia (Ogaden).

Farsetia

Farsetia Turra is a very distinct genus characterized by bifid, medifixed, appressed hairs and very flat siliquae with a markedly fibrous septum. *Fibigia* Medik., which is probably closely allied, was previously often included in *Farsetia* but is distinct by forked or stellate hairs as well as deviating flower and fruit structures. A map showing the total distribution of *Farsetia* was presented by Hedge (1976 p. 25), from which, however, an isolated area in the USSR east of Lake Balkhash should be excluded as representing a *Fibigia* species (cf. Busch 1939 p. 332 in which *Farsetia* is taken sensu lato). *Farsetia* is distributed over the whole Saharo-Sindian region (c. 7 species), and extends southwards to E Africa, where it is not confined to desert or semi-desert but is ecologically varied with species in savanna grassland, thickets and stony hillsides as well. East Tropical Africa includes the foremost centre of diversity of the genus. Only one or two of the 10–12 species present here also occur outside the area. The growth forms range from annuals (*F. ramosissima* Fourn. and often *F. stenoptera* Hochst.) to small trees (*F. somalensis* (Pax) Gilg & Bened.). Most species are pollacanthic subshrubs.

From the regions where the genus probably shows the greatest diversity (Somalia, Ogaden and N Kenya) the material is still very scarce, while much has accumulated from the rest of Kenya and from Tanzania. Within the FTEA area six species have been distinguished. Three of these, *F. boivinii* Fourn. (a slender species mainly in the Kenyan coastal area), *F. stenoptera* and *F. undulicarpa* Jonsell sp. nov., are apparently closely related and have in common acute narrow leaves, long and narrow siliquae with style shorter than 3 mm, siliqua septum with predominantly transverse fibres and large hyaline areas. They all occur in bushland and grassland, but *F. boivinii* and *F. stenoptera* grow

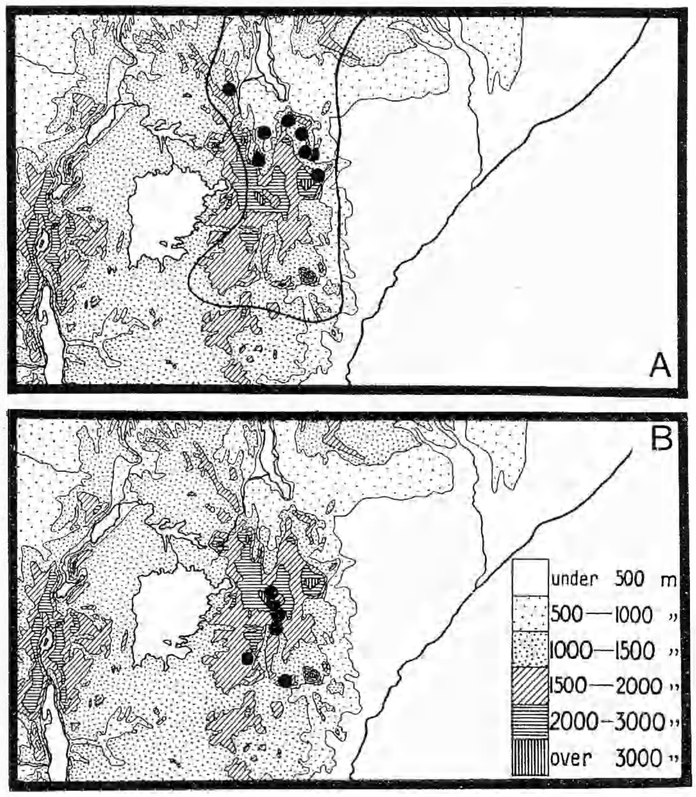

Fig. 2. A: Known distribution of *Farsetia stenoptera* subsp. *speciosa* (dots). The line surrounds approximately the area from which *F. stenoptera* subsp. *stenoptera* is known in East Africa. – B: Known distribution of *F. undulicarpa*.

as herbs or subshrubs and do not become strongly woody, while *F. undulicarpa* is a tall shrub.

Within *F. stenoptera* (occurring from Sudan and Ethiopia to N Tanzania) a form with very showy flowers, erect pedicels (Fig. 3) and greyish hair cover gathered a few times within a limited area in N Kenya is described here as a subspecies, subsp. *speciosa* Jonsell. It seems warranted to name this entity within the variable *F. stenoptera* because it is the only one distinguishable by more than one character and it has a definable distribution in the transition area between bushland and semi-desert in N Kenya (Fig. 2 A). The small number of collections, some of which are in some respects transitional to subsp. *stenoptera* makes, so far, subspecies rank most appropriate.

F. undulicarpa is a more or less scandent shrub up to 2 m high, richly branched with numerous terminal branchlets bearing densely crowded leaves (Fig. 4 A). The racemes are markedly corymbose in flower and do not become very elongate in fruit. The pedicels are always longer than in *F. stenoptera*. The fully ripe siliquae are markedly torulose and usually transversely undulate (Fig. 4 B), while other reproductive features fall within the variation range of *F. stenoptera*. It is known only from a restricted area along the Kenyan Rift Valley (Naivasha and Nakuru Districts), where it seems to be frequent at dry, sunny cliffs and escarpments, and from two collections in N Tanzania (Fig. 2 B). It was drawn attention to by Agnew (1974) under the designation "*Farsetia* sp. A".

Farsetia stenoptera Hochst. subsp. **speciosa** Jonsell subsp. nov.

Orig. coll.: Kenya, N Frontier Prov., Samburu Distr., Waragess, 3.XII.1958, Newbould 3095 (K holotype!)

A subsp. *stenoptera* differt sepalis longioribus, petalis longioribus latioribusque et manifeste unguiculatis, pedicellis siliquarum erectis, nectariis lateralibus subhippocrepicis.

Herb or subshrub, 60 to at least 100 cm, usually greyish green by dense medifixed hairs, un-

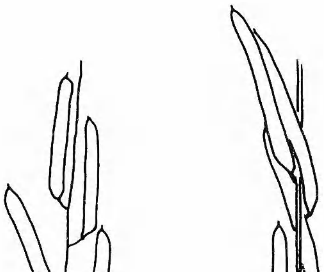

Fig. 3. Fruiting branches of *Farsetia stenoptera*. – A: subsp. *stenoptera* (Polhill & Greenway 430, K). – B: subsp. *speciosa* (Newbould 3095, K).

Fig. 4. *Farsetia undulicarpa* (Verdcourt 2159, K). – A: Upper branches with flowers and fruits, ×c. 0.6. – B: Siliquae, ×c. 2.5.

branched or with sparse elongate, ascending branches. *Leaves* rather dispersed, never congested, lanceolate, from c. 3 to c. 7 times as long as broad, acute, attenuate into an indistinct petiole. *Racemes* elongate with numerous flowers, in fruit much prolonged (up to 40 cm) with 2–3(–5) mm long, erect pedicels. *Sepals* 13–18 mm. *Petals* whitish to yellowish, darkening into purplish with age, distinctly clawed, 25–33 × 7–14 mm. Long *filaments* subulate, at least towards the base 3-nerved, short filaments nearly linear, 1-nerved. Outside each lateral stamen a horse shoe-like nectary with attenuate ends continuing towards the median stamen bases. *Ovary* 4.5–6.5 mm, hairy all round, style thick, c. 0.5 mm long; stigma conoidal, bifid, c. 1.5 mm long. *Siliqua* broadly linear, 13–35 × 3.0–3.8 mm, plane; septum with predominant transverse to obliquely transverse fibers and large hyaline areas. *Style* (incl. stigma) 0.8–2.2 mm long, subulate. *Seeds* (excl. wing) 1.5–2.3 mm across; wing 0.5–1 mm broad.

Distribution: N Kenya (Fig. 2 A).

Farsetia undulicarpa Jonsell sp. nov.

Orig. coll.: Kenya, Rift Valley Prov., Naivasha Distr., Naivasha–Eburru Road Gorge, 18.XI.1971, Greenway 14909 (K holotype! EA, M isotypes!).

Frutex scandens ad 2 m altus, ramis patentibus. *Folia* in brevibus ramis lateralibus congesta, lanceolata vel linearia, acuta, indistincte petiolata. *Racemi* corymbosi ramos numerosos cum 10 ad 25 floribus terminantes. *Inflorescentia* in fructu ad 15 cm longa. *Sepala* 8.5–11 mm longa. *Petala* rosea ad purpurea indistincte unguiculata, 15–20 mm longa. *Siliquae* late lineares, torulosa vel transverse undulata; septum transverse vel oblique fibrosum et areis hyalinis magnibus munitum. *Semina* complanata, alata.

Shrub, ± scandent, up to 2 m high with numerous long patent branches. Old *stems* with grey- to light-brown bark; young parts green to greyish green with dense medifixed hairs. *Leaves* in younger parts of shoots congested, particularly on short side-branches (in elongate main branches looser but probably soon falling off), lanceolate to narrowly linear and somtimes inrolled, 20–95 × 1–16 mm, acute, attenuate into an indistinct petiole. *Racemes* ebracteate, terminating numerous side-branches, ± corymbose with 10–25 flowers on 5–9 mm long pedicels; fruiting racemes up to 15 cm long with 6–11 mm long pedicels. *Sepals* 8.5–11 mm. *Petals* pink to bright purple with deep purple veins, not markedly clawed, 15–20 × 2.5–3.5 mm, tapered towards an obtuse apex. *Filaments* nearly linear, 1-nerved. Each lateral stamen at base surrounded by a broadly V-shaped nectary. *Ovary* 4.5–5.5 mm, hairy all round; style thick, very short; stigma broadly conoidal, bifid, 1.0–1.5 mm long. *Siliqua* broadly linear, 24–32 × 3.2–4.2 mm, when fully ripe torulose to strongly transversely undulate; septum with predominant transverse to obliquely transverse fibers and large hyaline areas. *Style* (stigma incl.) 1.5–2.0 mm, subulate. *Seeds* (excl. wing) 2.2–2.5 mm across; wing c. 1 mm broad.

Distribution: Central upland Kenya, N Tanzania (Fig. 2 B).

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Overlooked names and new combinations in Phaeophyscia (Lichenes)

Roland Moberg

Moberg, R. 1978 06 30: Overlooked names and new combinations in Phaeophyscia (Lichenes). *Bot. Notiser 131:* 259–262. Stockholm. ISSN 0006-8195.

Five species *Phaeophyscia chloantha, P. hispidula, P. hirsuta, P. insignis* and *P. rubropulchra,* all new combinations, are briefly discussed. *Physcia labrata, P. luganensis* and *P. ticinensis* are treated as synonyms of *Phaeophyscia hirsuta, P. chloantha* and *P. insignis* respectively.

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In connection with my study of the Fennoscandian species of this genus (Moberg 1977) I came upon some species known from other parts of the northern hemisphere. Those described by Mereschkowsky (1919) and Nádvornik (1947) were of particular interest, especially since Frey (1963) has already made some rearrangements and reduced several names to synonyms. From my experience most of the statements by Frey are correct, but in a few cases he seems to have misinterpreted the material (e.g. *Physcia insignis* and *P. ticinensis*).

For the lectotypification of the names published by Mereschkowsky all the material cited by him has been examined (G). Some of the specimens are annotated "Specimen originale 1, 2, 3, etc." but the lectotypes have been selected from such annotated specimens only where no good exsiccate material (Mereschk. Lich. tic.) is available.

The examination of the Acharian material in H and UPS revealed an overlooked name for the fairly wellknown species *Physcia luganensis*.

Phaeophyscia chloantha (Ach.) Moberg comb. nov. – Fig. 1

Parmelia chloantha Ach. 1814 p. 217. – Holotype: Switzerland (H, herb. Ach. n. 1396, see Fig. 2). Isotype UPS.

Physcia luganensis Mereschk. 1919 p. 190. – Lectotype (sel. here): Switzerland, Lugano, at the foot of Mt San Salvatore, 1915 Mereschkowsky (Lich. Tic. exs. n. 68 (G)). Isolectotypes: G, UPS.

Physcia labrata var. *intermedia* Mereschk. 1919 p. 187. – Lectotype (sel. here): Switzerland, Lugano-Vezia, 1917 Mereschkowsky (G).

Physcia pragensis Nádv. 1947 p. 105 – Lectotype (Esslinger 1975 in herb.): Czechoslovakia, Moravia, Uher, Hradiste, Ostrozska Lhota, 1943 Nádvornik (BRA).

Physcia pragensis f. *convoluta* Nádv. 1947 p. 105. – Lectotype (Esslinger 1975 in herb.): Czechoslovakia, Bohemia, Praha-Hostivar, Botio, 1943 Nádvornik (BRA).

Physcia pragensis f. *ignota* Nádv. 1947 p. 106. – Lectotype (Esslinger 1975 in herb.): Czechoslovakia, Bohemia, Chroustovice, Podecely, 1942 Nádvornik (BRA).

Physcia pragensis f. *tremulicola* Nádv. 1947 p. 106. – Lectotype (Esslinger 1975 in herb.): USSR, Rossia Subcarpatica, Uzhorod, Czikera, 1932 Nádvornik (BRA).

Thallus orbicular to irregular, usually confluent with other thalli, ± loosely appressed, brownish grey to brown, usually paler along the lobe-margins. Lobes ± loosely appressed, or ascending when sorediate at the tips, 0.5–2 mm broad. Soralia lip-shaped often with the upper cortex reflexed. Underside white to pale brown with a few mostly marginal, white to pale brown rhizinae. Upper cortex paraplectenchymatous; lower cortex prosoplectenchymatous. *Apothecia* rare, up to 1 mm across, ± stipitate, sometimes with sorediate margins; spores 18–24 × 7.5–11

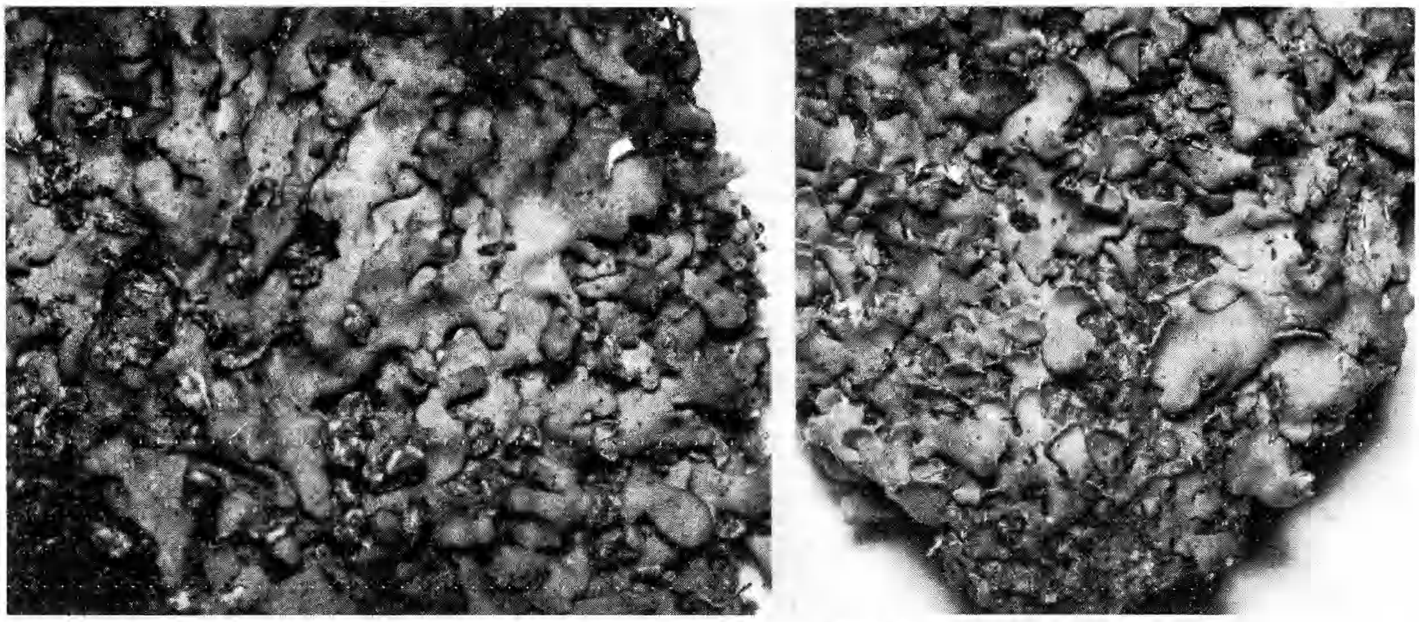

Fig. 1. *Phaeophyscia chloantha*. Spain, Asturias, 1959 Santesson 13082a (UPS).

μm. *Pycnidia* ± common, mostly immersed in the thallus; pycnoconidia ellipsoid, 2.5–3.5 × 1 μm.

No lichen substances found.

P. chloantha is easily distinguished from other *Phaeophyscia* species because of its distinct, lip-shaped soralia, pale underside with only a few, pale rhizinae, and prosoplectenchymatous lower cortex. Frey (1963 p. 453) regarded this species to be in an isolated position among the European species and treated it in a series of its own, *Subalbida,* under the subsection *Obscura*. The subgeneric rank that this species should represent is a matter for further examination, but that it has no close relatives in Europe is obvious since no other species has a prosoplectenchymatous lower cortex.

While typifying *Physcia pragensis* and its forms it has been difficult to judge what material Nádvornik had used for his descriptions. Obviously he had redetermined some of the material without annotating the envelopes, and some of the cited localities do not exactly correspond to the original labels. However, in 1975, T. Esslinger of the U.S. Nat. Herbarium (US) suggested lectotypes on the herbarium material and these are accepted here.

According to Nádvornik and Frey, *P. chloantha* is a corticolous species which occasionally grows on rocks. This is confirmed by my own field studies in Yugoslavia and by the herbarium material on which the present investigation is based. The species is known from the southern part of Europe and from Central North America (Esslinger 1973).

Phaeophyscia hispidula (Ach.) Moberg comb. nov.

Parmelia hispidula Ach. 1810 p. 468. – *Physcia hispidula* (Ach.) Frey 1963 p. 474. – Holotype: Switzerland, Schleicher (H, herb. Ach., see Frey 1963 Fig. 26). Isotype UPS.

Parmelia setosa Ach. 1814 p. 203. – *Physcia setosa* (Ach.) Nyl. 1860 p. 429. – Holotype: North America (H, herb. Ach., see Frey 1963 Fig. 27). Isotype UPS.

This species is characterized by the broad lobes with long projecting rhizinae and indistinctly delimited laminal soralia. It is rare in Europe but becomes more abundant in tropical areas (Poelt 1969) which is confirmed by the author's field studies in tropical East Africa.

The relationships between *P. hispidula* and *Physcia setosa* were discussed by Frey (1963), but an examination of the cited material has revealed that the two species involved were *P. hispidula* and *P. kairamoi* (Vain.) Moberg. What Frey calls "starke Isidienbildung" is characteristic of *P. kairamoi* and not of the type material of *Physcia setosa*. From my study of North American material of "*P. setosa*" and *P. kairamoi* they can be of about the same size (not the case for European material) and this study also supports an inclusion of "*P. setosa*" in the variation of *P. hispidula* (cf. also Poelt 1969).

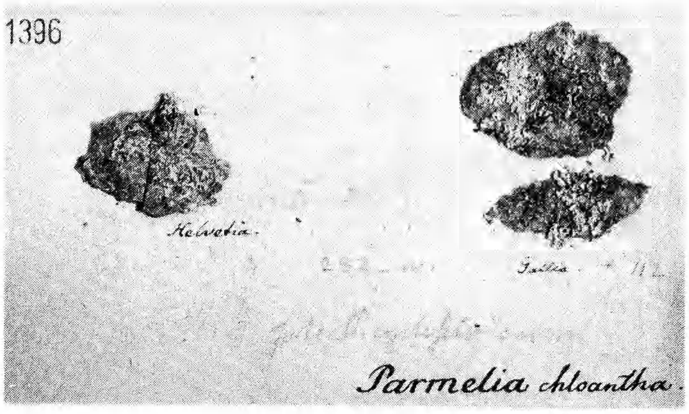

Fig. 2. Holotype of *Parmelia chloantha* (Helvetia) in Acharius' herbarium (H).

Phaeophyscia hirsuta (Mereschk.) Moberg comb. nov.

Physcia hirsuta Mereschk. 1919 p. 181. – Lectotype (sel. here): Switzerland, Lugano, Mereschkowsky (Lich. tic. exs. 61 (G)). Isolectotype: UPS (judging from the substrate).

Physcia labrata Mereschk. 1919 p. 183. – Lectotype (sel. here): Switzerland, Lugano, Cassarate, Mereschkowsky (Lich. tic. exs. 62 (G)). Isolectotype: UPS.

Physcia labrata var. *olivacea* Mereschk. 1919 p. 184. – Lectotype (sel. here): Switzerland, Lugano, Castagnola, Mereschkowsky (Lich. tic. exs. 64 (G)). Isolectotypes: G, UPS.

Thallus orbicular, usually confluent with other thalli, ± loosely appressed, grey-brown to dark-brown, provided with ± abundant hyaline hairs on the upper surfaces, particularly at the lobe-tips. Lobes radiating, very variable in width (up to 2 mm), sometimes overlapping, mostly ascending at the tips. Soralia marginal and predominantly lip-shaped. Underside black almost to the very tips, with abundant black rhizinae. Upper and lower cortex paraplectenchymatous. *Apothecia* rare, up to 1 mm in diameter, with rhizinae on the underside (corona) and hyaline hairs along the margins; spores 16–21 × 6–9 μm. *Pycnidia* rare, immersed in the thallus; pycnoconidia ellipsoid, 2.5–3.5 × 1–1.5 μm.

No lichen substances found.

P. hirsuta is separated from other European *Phaeophyscia* species because of the hyaline hairs on the upper side and the short ascending lobes with lip-shaped soralia. The hairs are sometimes found to be sparse (e.g. the type of *Physcia labrata*), being easily broken off in the herbarium, if the material is not handled with care.

From field and herbarium studies, it is evident that this species exhibits a wider range of variation in thallus and lobe size than was indicated by Frey (1963 p. 482). A more broad-lobed modification is represented by, for exampele, the type of *Physcia labrata*.

P. hirsuta is predominantly corticolous and is often found growing mixed with *P. chloantha*.It is known from South Europe and Central North America.

Phaeophyscia insignis (Mereschk.) Moberg comb. nov. – Fig. 3

Physcia insignis Mereschk. 1919 p. 191. – Lectotype (sel. here): Switzerland, Lugano, Mereschkowsky, Lich. tic. exs. 69 (G). Isolectotype: UPS.

Physcia virella var. *gracilis* f. *ticinensis* Mereschk. 1919 p. 180. – *Physcia ticinensis* (Mereschk.) Frey 1963 p. 479. – Lectotype (sel. here): Switzerland, Lugano, Castagnola, 1915 Mereschkowsky (G). Isolectotypes: G, UPS (Lich. tic. ecs. 59).

Physcia virella var. *gracilis* Mereschk. 1919 p 179. – Lectotype (sel. here): Switzerland, Lugano, Mereschkowsky, Lich. tic. exs. 58 (G). Isolectotype: UPS.

Physcia virella var. *gracilis* f. *pallidior* Mereschk. 1919 p. 180. – Holotype: Switzerland, Lugano, via Tesserete, 1917 Mereschkowsky (G).

Physcia virella f. *tenuisecta* Mereschk. 1919 p. 178. – Lectotype (sel. here): Switzerland, Lugano-Cassarate, Mereschkowsky, Lich. tic. exs. 57 (G). Isolectotype: UPS.

Thallus orbicular, small, rarely exceeding 1 cm in diameter, usually confluent with other thalli, often closely appressed, brown (rarely greyish) to dark brown, very often paler towards the lobe-ends. Lobes radiating, up to 0.5 mm broad, ± closely appressed and distinctly separated. Soralia laminal, more or less capitate and distinctly delimited, each usually as broad or even broader than a lobe. Underside pale to dark brown, never black, with simple rhizinae of the same colour or slightly darker. Upper and lower cortex paraplectenchymatous. *Apothecia* ± rare, sessile, up to 1 mm in diameter, usually with rhizinae (corona) on the underside. Spores 18–24 × 8–11 μm. *Pycnidia* ± common, immersed in the thallus; pycnoconidia ellipsoid, 2.5–3.5 × 1–1.5 μm.

No lichen substances found.

P. insignis is separated from its supposed relative, *P. orbicularis,* mainly because of its smaller and more appressed thallus, its distinctly delimited laminal soralia which are usually as broad

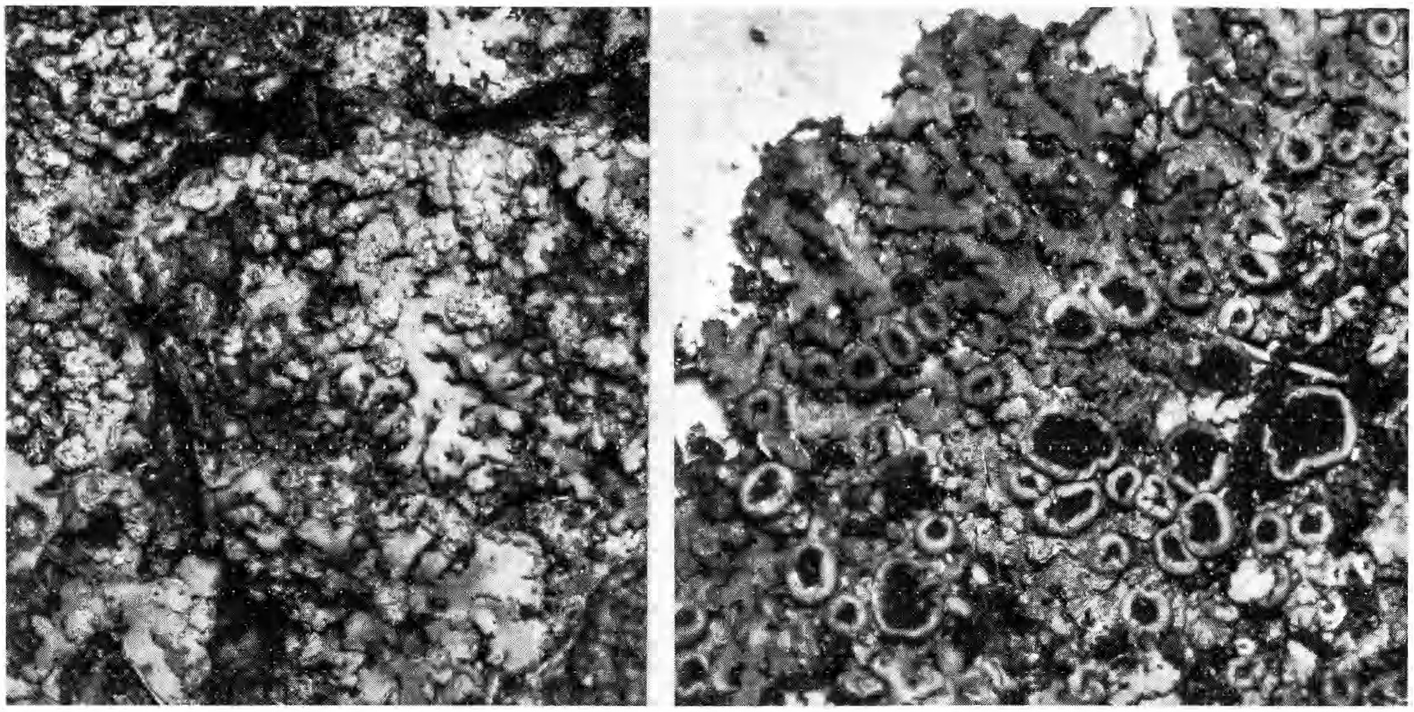

Fig. 3. *Phaeophyscia insignis*. – Left: growing together with *P. orbicularis* (lower part of the figure), Yugoslavia, Croatia, 1972 Moberg 1648b (UPS, herb. Mob.). – Right: Italy, Varazze, 1922 Gresino (UPS).

as the lobes, and the colour of the underside.

As seen from the synonyms listed, this species has been given various namens by Mereschkowsky and it is clear from the study of both the descriptions and the type material that he often treated modifications as taxa of their own. This had already been pointed out by Frey (1963 p. 478), who also reduced some of the names to synonyms. However, Frey did not realize that the type specimens of *P. insignis* and *Physcia ticinensis* fall within the variation of a single taxon which is also supported by comparing the two descriptions.

P. insignis is probably overlooked in South Europe. Frey reported it (as *Physcia ticinensis*) from a few localities in Switzerland and Poelt (1969 p. 515) regarded it as known from "Tessin" only. According to the material collected by Mereschkowsky it is common in Lugano, and from Yugoslavia both Vězda (Lich. sel. 1194) and myself have collected rich material. It grows on the trunks of various deciduous trees, or on rocks in both sunny and shaded positions.

Phaeophyscia rubropulchra (Degel.) Moberg comb. nov.

Physcia orbicularis f. *rubropulchra* Degel. 1940 p. 58. – *Physcia rubropulchra* (Degel.) Moberg 1974 p. 287.

This species was discussed earlier by Moberg (1974) and no further comments will be given here.

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Two new species of Schoenoxiphium (Cyperaceae)

Ilkka Kukkonen

Kukkonen, I. 1978 06 30: Two new species of Schoenoxiphium (Cyperaceae). *Bot. Notiser 131:* 263–267. Stockholm. ISSN 0006-8195.

Two new species of the genus *Schoenoxiphium* (Cyperaceae-Cariceae) are described. *S. distinctum* grows in alpine meadows of the Drakensbergen, Lesotho. *S. perdensum* is known from the Keiskamahoek Mts. (Cape Province) and Drakensbergen (Natal Province) in South Africa. Both species are distinct and no close relatives are known.

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The tribe Cariceae (Cyperaceae) comprises only four genera: *Carex, Kobresia, Schoenoxiphium* and *Uncinia*. The boundaries between them are extremely difficult to draw. The monographic work by Kükenthal (1909) has been criticized, but hardly any improvements have been suggested. The treatment by Clarke (1908) was never completed. The first comprehensive discussion is found in Krechetowich (1936). *Carex* subgenus *Primocarex* was further discussed by Nelmes (1952), who examined the relationships between the four genera. Meanwhile, Kükenthal (1940) described a new species of *Schoenoxiphium* from Sumatra, which did not have the flat rhachilla characteristic of all the African species of the genus. After critically considering the boundaries of the genera, Kern (1958) transferred Kükenthal's Sumatran species to *Kobresia;* further transfers were made by Koyama (1961). A break with the traditional views was made by Ivanova (1939), who assigned one part of *Schoenoxiphium* to the genus *Archaeocarex* and transferred some Central Asian species of *Kobresia* to the remainder of *Schoenoxiphium*.

The confusion does not only exist between *Kobresia* and *Schoenoxiphium,* but also involves *Carex*. Confronted with a somewhat similar situation in the collective genus *Centaurea,* Wagenitz (1963) considered the general knowledge too fragmentary to allow a division into several genera. Since Kükenthal (1909), we have become accustomed to dealing with four genera within Cyperaceae-Cariceae, and the situation can scarcely be inproved by merging the four genera in one way or another. On the other hand, an attempt to delimit more natural genera without ample additional experimental observations would be definitely premature. To take one concrete example, the homology of the utricle and the prophyll mentioned by Kern (1958 p. 786) is not yet clearly established (see Kukkonen 1967, Koyama 1969 p. 223). Hence the traditional four genera are accepted here and, in accordance with Kern (1974 p. 752), the genus *Schoenoxiphium* is considered to be restricted to Africa and Madagascar.

Schoenoxiphium distinctum Kukkonen sp. nov. – Fig. 1

Herba perenne rhizomate leviter caespitante, 12–17 cm alta, glauco-viridis. Surculi juvenes cinereo-brunnei vaginis aphyllis ornati. *Culmi* foliosi, foliis culmum non multum superantibus, 1.5–2.5 mm latis rectis vel leviter retrocurvatis, imo in sectione transversali V-formibus, in parte superiore planis, in subulam gradatim attenuantibus. Imum culmi c. 0.8 mm diam., ± subcirculare, sulcatum, ceterum laeve; desuper triangulare, angulis aculeatis, aculeis ut videtur mox caducis. *Inflorescentia* ferruginea, angusta, subspicata, interrupta, 2.5–3.5(–5.0) cm longa, spiculis

Fig. 1. *Schoenoxiphium distinctum*. – A: Habit (scale 2 cm). – B: Part of inflorescence (scale 1 cm). – C, D: Utricle, adaxial (C) and abaxial (D) view (scale 2 mm). In C the rhachilla with pistillate and staminate flowers is seen. – Holotype.

numerosis erectis angustis, superioribus approximatis sessilibus, infimis ± distantibus breviter pedunculatis. *Spiculae* imae 10–13 mm longae, in parte basilari floribus ♀ 2–4 tristigmaticis, superne variis ♂ instructae. *Bracteae* ± longe vaginantes, superiores setaceae aut aphyllae, inferiores foliaceae, inflorescentiam aequantes vel aliquantum superantes. *Squamae* 3–4 mm longae ferrugineae marginibus late hyalinis, e nervo viridi mucronatae. *Utriculus* 3.5–4.0 × 0.7–0.8 mm, viridis, nervosus, rostro c. 0.8 mm, pedunculo 0.3 mm longo; margine oris membranaceo hyalino, in latere adaxiali breviter fisso. *Nux* (immatura) 2.5–2.8 × 0.6 mm. *Rhachilla* complanata binervis viridis, nuce aliquantum longior.

A perennial 12–17 cm tall, caespitose or forming loose tufts. Bladeless sheaths in new growth greyish brown, c. 2 cm. *Stem* terete, grooved, c. 0.8 mm in diameter, smooth, triquetrous below the inflorescence; several of the higher stem leaves subtending inflorescense branches. *Leaves* green, about as tall as stem; sheath scarious on one side, margin U-shaped, light brown, ligule c. 0.25 mm; leaf blade straight or slightly falcate, acute, 1.5–2.5 mm wide; leaf margin flat, smooth, but apically ± triangular with barbs; adaxial sides of leaf papillose, abaxial side smooth. *Inflorescence* a panicle, topmost part of inflorescence c. 2.5–3.0 cm; brown, narrowly elliptic; lowermost lateral branches 10–13 mm long, narrow, with 2–4 tristigmatic basal female flowers and with several male flowers at top. Subtending bracts of lateral inflorescence branches long, the lowermost up to 3 cm long, setaceous. *Bracts* brown, acute, 3–4 mm long, middle vein green, margins widely scarious, equal in length with the utricle. *Utricles* 3.5–4.0 × 0.7–0.8 mm, with a very short stipe (c. 0.3 mm), beak not clearly delimited, brown, c. 0.8 mm, apex with scarious margins; body of the utricle green, more conspicuously veined abaxially, mouth cleft on adaxial side, wide. *Rhachilla* green, with barbed margins, two veins, and a scale on its tip, slightly longer than the nutlet. *Nutlet* (not completely mature) narrowly oblong, trigonal, 2.5–2.8 × c. 0.6 mm.

Specimens studied. Lesotho, between Indumeni Dome and Castle Buttress locally common in alpine grassveld on summit of Drakensberg, 9800′, 10.XII.1957, D. J. B. Killick 2274 (BM holotype, K isotype); Killick 2272 (K).

Schoenoxiphium perdensum Kukkonen sp. nov. – Fig. 2

Herba perenne densissime caespitosa, s. 30 cm alta. *Culmus* capillaceus c. 0.5 mm diam., omnino moderate foliosus, infra vaginas subrotundus–biangularis, ramis axillaribus 3–4 usque 10 cm longis tenuissimis fertilibus. Basis 2–3 cm alta culmi aliquanto tumida squamis (flavo-)brunneis obtecta. *Folia* canaliculata 0.5–1.0 mm lata, usque 15 cm longa; vaginae 2.0–2.5 mm longae. *Inflorescentia* parvula spicata interrupta, spiculae inferne fl. ♀ 2–4, superne fl. ♂ nonnullis instructae. *Squamae* c. 2 mm longae, latae brunneae mucronatae, utriculis breviores. *Utriculus* flavo-brunneus, c. 3.0 mm longus, c. 1.5 mm diam., nervis viridibus, rostro c. 0.75 mm longo; rostrum cum basi in planitia adaxiali. Apex rhachillae orem utriculi modice superans.

A densely caespitose perennial, c. 30 cm tall. Basal parts slightly swollen, with bladeless sheaths c. 2–3 cm, which disintegrate into threads when older. *Leaves* very narrow, overtopping culms, 0.5–1.0 mm wide, convolute when dry, up to 15 cm, margin smooth or apically barbed; sheaths up to 2.5 cm, adaxial side scarious to about half-way, mouth on this side shallowly U-shaped, ligule brown, c. 0.2 mm. *Culm* terete, difficult to distinguish among leaves, c. 0.5 mm in diam., with several (3–4) nodes and leaves; culm two-angled below the nodes, angles barbed; culm branching at the nodes; branches very thin, less than 0.5 mm in diam., c. 10 cm, sometimes rebranching once or even twice, each branch ending with a few-flowered, sparse spike. *Inflorescence* formed by 2–4 female flowers and a few male flowers on top. *Bracts* of female flowers caducous, brown, cuspidate, c. 2 mm long, shorter than utricles. *Utricle* covering nutlet tightly, trigonal, c. 3.0 mm long (beak 0.75 mm), 1.5 mm wide; stipe and beak on the same plane with adaxial surface, forming one side of a triangle in cross-section; abaxial surface, forming the other two sides, with one conspicuous vein on each side; 10–12 minor veins evenly distributed on abaxial side, three on adaxial side; veins greenish; beak brown. *Rhachilla* slightly longer than utricle, greenish, flat, one-veined, margins barbed, visible on adaxial side through the utricle.

Specimens studied. South Africa, Cape Province, Distr. King William Town, Keiskama Hoek, near Ghulu Kop, experimental plot; scarce amongst grass, 4000′, XI.–XII.1925, R. A. Dyer 245 a (K holotype, isotype). – Natal Province, Distr. Estcourt, Tabamhlope (Table Mt.), craggy places on upper N slopes, locally common, 6000–6300′, 26.IV.1943, J. P. H. Acocks 11463 (BM).

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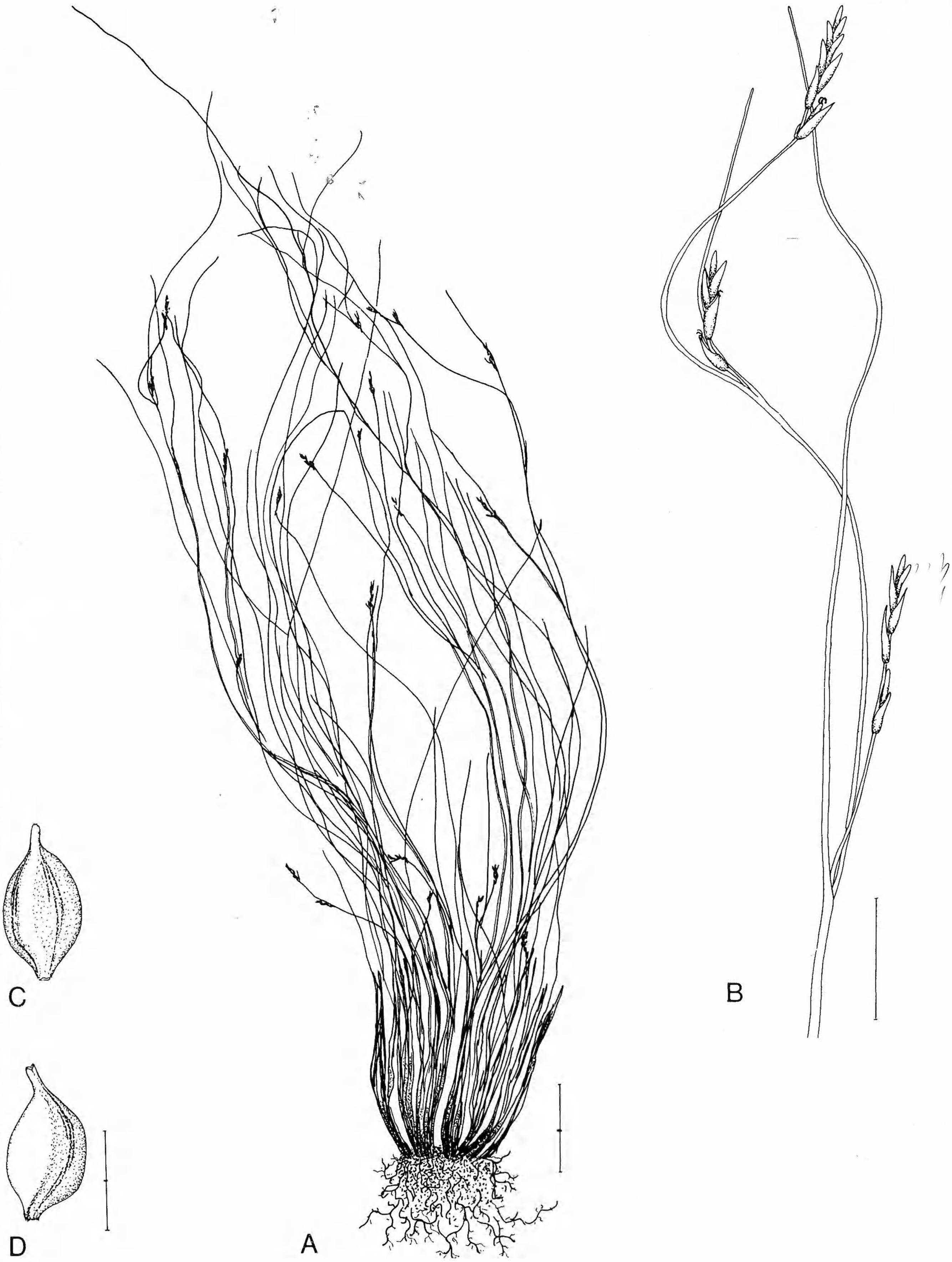

Fig. 2. *Schoenoxiphium perdensum*. – A: Habit (scale 2 cm). – B: Inflorescence (scale 1 cm). – C, D: Utricle, abaxial (C) and adaxial (D) view (scale 2 mm). In C the two main veins, one on each side, are seen. – Holotype.

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Meiotic configurations and fertility in Juncus alpinus subsp. nodulosus × articulatus

Susanna Riebe

Riebe, S. 1978 06 30: Meiotic configurations and fertility in Juncus alpinus subsp. nodulosus × articulatus. *Bot. Notiser 131:* 269–272. Stockholm. ISSN 0006-8195.

In the hybrid *Juncus alpinus* Vill. subsp. *nodulosus* (Wahlenb.) Lindm. × *articulatus* L. the chromosomes form 20 bivalents and 20 univalents during meiosis. Similar configurations have been found by previous workers in *J. acutiflorus* Ehrh. × *articulatus*. Jointly these results indicate that *J. articulatus* is the allotetraploid derivative of *J. acutiflorus* and *J. alpinus*. The hybrid *J. alpinus* subsp. *nodulosus* × *articulatus* has a pollen stainability exceeding 90% whereas seed production is very low.

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The aim of this study was to see if the pairing of chromosomes in *Juncus alpinus* Vill. subsp. *nodulosus* (Wahlenb.) Lindm. × *articulatus* L. follows the same pattern as was found by Timm & Clapham (1940) in *J. acutiflorus* Ehrh. × *articulatus*. In the latter hybrid 0 to 4 trivalents, 16 to 20 bivalents and 16 to 20 univalents are formed during first meiotic metaphase. According to Timm & Clapham this is "evidence in favour of considering *J. articulatus* as having originated by tetraploidy from *J. acutiflorus* or from a hybrid having *J. acutiflorus* as one parent". In addition the fertility of *J. alpinus* subsp. *nodulosus* × *articulatus* as shown by both seed production and pollen stainability has been studied.

Material and methods

The specimens studied were collected in August 1977 along the shores of six oligotrophic lakes in southernmost Sweden, viz. Västersjön (coordinates in the UTM system: UC 804 439), Sjöaltesjön (UC 899 474), Hultasjön (VC 001 443), Lärkesholmssjön (VC 004 393), Bälingesjön (UC 994 355) and Tydingen (VC 400 349). The specimens were collected along c. 200 m of the shorelines of each lake. The morphology of the hybrid as well as the parental species has been accounted for by Nilsson & Snogerup (1972) and Křísa (1963). Voucher specimens are deposited at LD.

Plants for the study of meiosis were gathered on August 28, 1977 on the shores of Västersjön. Next day the buds were fixed in Carnoy's fluid 2 (1 part glacial acetic acid : 3 parts chloroform : 6 parts 95% ethanol) and left for about 24 hours. The buds were stained in HCl-carmine (Snow 1963). The anthers were squashed in Hoyer's medium (Beeks 1955).

Pollen preparations in cotton blue were made on August 3, 10 and 17 in the field at the last four of the above lakes. The pollen stainability was determined by counting 200 pollen tetrads in each preparation. Each preparation contained pollen from several flowers from one culm. The figures in Table 1 represent means from several culms from each lake.

The number of seeds per capsule was counted from dried specimens collected on August 3, 10 and 17 from Västersjön, Sjöaltesjön, Hultasjön and Tydingen. Seeds were counted in 5 capsules from each parental culm and in 10 from each hybrid culm. In each head the ripest capsules were used (maximum 5). Two or 3 heads were chosen randomly. One (2) parental and 4 hybrid culms were taken from each lake.

Meiosis

Of 15 late metaphase I plates 1 contained 19_{II} and 22_{I} (Fig. 1 A), 11 contained 20_{II} and 20_{I} (Fig. 1 B), and 3 21_{II} and 18_{I}. In some of the plates there is a slight uncertainty as to whether two of the chromosomes are one bivalent, two half-bivalents or two univalents. Of the 15 cells studied 14 were on the same slide.

There were also many cells at second meta-

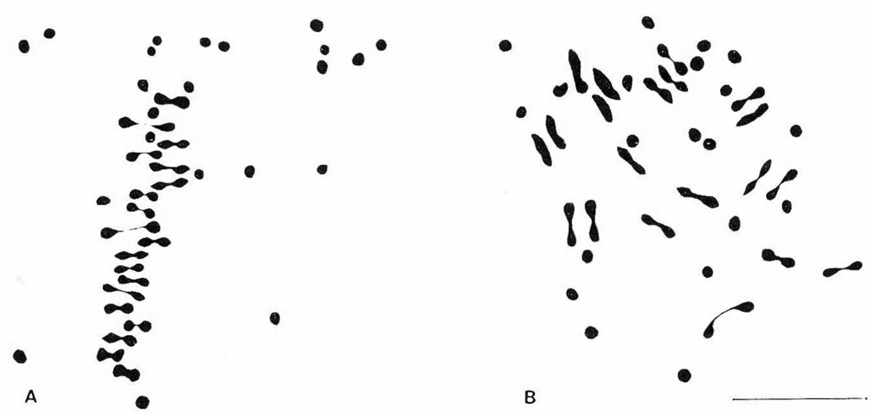

Fig. 1. Pollen meiosis in *J. alpinus* subsp. *nodulosus* × *articulatus*. Late first metaphase. – A: $19_{II}+22_{I}$. – B: $20_{II}+20_{I}$. – Scale 10 μm.

phase. They were somewhat difficult to count. Nevertheless it was clear that the number of chromosomes in each nucleus varied between 20 and 40. The univalents thus seem to be distributed to the poles at random. No laggards or micronuclei were observed. Only one bridge persisting into second metaphase was observed.

Pollen stainability and seed production

The percentage of fully stained pollen tetrads in the hybrid was very high. Both hybrid and parents have a mean pollen stainability of more than 90% (Table 1).

The capsules contained two types of yellow-brown seeds which were counted separately: (1) normally developed round ones and (2) flat, somewhat shrivelled ones. The latter may be abortive but they may also be unripe seeds which would have become round if they had not been harvested. The former explanation is the most likely and the flat seeds will probably not germinate.

Only 9% of the capsules of the hybrid held round seeds but taking into account both round and flat seeds there were seeds in 46% of the capsules. In the parents there were round seeds in 98% of the capsules and no capsules were without seeds, most of them having 20–60 round ones. When round seeds were found in the hybrid there were only 1–3 per capsule (Table 2). In the hybrid the mean number of seeds per capsule was 0.1 for round seeds and 1.8 if both round and flat seeds are taken into account. In *J. alpinus* subsp. *nodulosus* the corresponding figures are 40.0 and 45.9, in *J. articulatus* 34.1 and 36.0.

Table 1. Pollen stainability (arithmetic mean and extreme values) of *J. alpinus* subsp. *nodulosus* (from Hultasjön and Tydingen), *J. articulatus* (from Bälingesjön and Lärkesholmssjön) and their hybrid (from Bälingesjön and Hultasjön).

Taxon	min	$\bar{x}$	max
J. alpinus	86.5	94.1	99.0
J. articulatus	96.0	97.8	99.5
Hybrid	91.0	95.0	98.5

Discussion

In the hybrid the frequency of bivalents and univalents in meiosis indicates that one of the genomes from *J. articulatus* is homologous with the genome from *J. alpinus* subsp. *nodulosus*. This hypothesis and that of Timm & Clapham (1940) can be combined. *J. articulatus* is probably the allotetraploid derivative of *J. acutiflorus* and *J. alpinus* (or of their ancestors or allied species).

J. articulatus may have originated by chromosome doubling in the primary hybrid (Fig. 2), or by the union of unreduced gametes, one from each parent.

J. articulatus is consistently tetraploid, 2n=80 (Snogerup 1960, Timm & Clapham 1940). *J. alpinus* and *J. acutiflorus* are diploid, 2n=40 (Hämet-Ahti & Virrankoski 1970, Jörgensen et al. 1958, Snogerup 1958, Timm & Clapham 1940). There is only one report of 2n=80 in *J. alpinus* (Löve & Löve 1948).

In at least two localities in the Alps (N Switzerland and S Germany) the hybrid between *J. acutiflorus* and another subspecies of *J. alpinus*, subsp. *alpinus* has arisen spontaneously (herbarium specimens in LD). To prove without doubt that *J. articulatus* derived from *J. acutiflorus* and *J. alpinus* it is necessary to car-

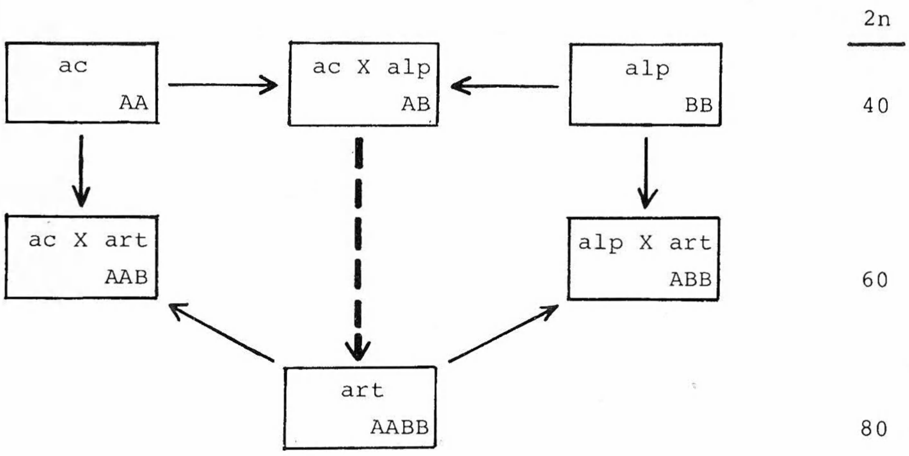

Fig. 2. The probable relationship between *J. acutiflorus, J. alpinus* and *J. articulatus*. A and B denote the genomes of the two ancestral species. – Dotted line: Hypothetical origin of *J. articulatus* by chromosome doubling.

ry out crossing experiments. An allopolyploid derivative of the Alp hybrid must be obtained. When crossing this tetraploid with *J. articulatus* pairing during meiosis should be almost complete.

The remarkably high pollen stainability combined with low seed production in the hybrid *J. alpinus* subsp. *nodulosus* × *articulatus* could be explained by the fact that each cell in the tetrad has one complete genome derived from bivalents at first metaphase and a varying number of extra chromosomes derived from univalents. The complete genome probably has a buffering effect allowing normal cytoplasm to form. This may be the reason for the high pollen stainability. Another explanation of this may be that the entire tetrad always has a complete chromosome complement. High pollen stainability does not necessarily indicate that the pollen is capable of fertilization, or if so, of producing viable zygotes. The fact that in Sweden only F_1 hybrids are found (pers. comm. S. Snogerup) and that

Table 2. Number of round, normally developed seeds in capsules of *J. alpinus* subsp. *nodulosus, J. articulatus* and their hybrid. The figures in the table give the number of capsules with the number of seeds indicated in the table head. $\bar{x}$: Mean number of seeds per capsule. V Västersjön, S Sjöaltesjön, H Hultasjön, T Tydingen.

Lake	Number of round seeds per capsule														
	0	1	2	3	4	5	6–10	11–15	16–20	21–30	31–40	41–50	51–60	61–70	$\bar{x}$
J. alpinus subsp. **nodulosus**															
V	.	.	.	.	.	.	.	.	.	1	1	2	.	1	41.4
S	.	.	.	.	.	.	.	.	.	.	.	4	1	.	46.0
H	.	.	.	.	.	.	.	.	1	.	2	.	2	.	39.8
T	1	.	.	.	.	.	.	.	.	.	2	2	.	.	32.8
J. articulatus															
V	.	.	.	.	.	.	.	.	.	1	1	.	3	.	44.0
S	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
H	.	.	.	.	.	.	.	.	1	4	.	.	.	.	24.4
T	.	.	.	.	.	1	.	.	.	.	7	2	.	.	34.0
Hybrid															
V	36	4	.	.	.	.	.	.	.	.	.	.	.	.	0.1
S	33	5	2	.	.	.	.	.	.	.	.	.	.	.	0.2
H	36	2	1	1	.	.	.	.	.	.	.	.	.	.	0.2
T	40	.	.	.	.	.	.	.	.	.	.	.	.	.	0.0

they produce few seeds indicates that the pollen does not function as well as the high pollen stainability might suggest.

Acknowledgements. I am greatly indebted to Dr Sven Snogerup for supervising the project and for valuable discussions and criticism. I also wish to thank all others at the Department of Plant Taxonomy in Lund who have given me help and advice.

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Botanical literature

Brunsberg, K. 1977: *Biosystematics of the Lathyrus pratensis complex*. Opera Botanica 41. Stockholm. 78 pages, 43 figures. ISSN 0078-5237. ISBN 91-546-0210-6. Price SKr 70.

This study of the diversity and taxonomy of *Lathyrus* sect. *Pratenses* reports the results of fifteen years of observations of a rich herbarium material and more than 2000 living representatives of about 500 population samples from various parts of Europe, in addition to hybrids and other experimental material. The report itself comprises only 78 pages, many of which are occupied by illustrations and tables. The observations as a whole are highly significant and the discussions largely logical, although a couple of the conclusions seem to be too inconsistent to be left unchallenged.

Chromosome studies are an essential part of the book, and those who are familiar with the technical efforts behind such investigations are apt to be impressed by their volume. It is a pity that the author has overlooked some ten reports for her table of previous observations of chromosome numbers, althouth that affects none of her conclusions. I am a little peeved by seeing that our observations from Iceland of the naturalized diploid and the probably not established tetraploid are reported as being from "Is NW Europe" and "Europe" respectively, instead of simply "Is". The reference to 42 chromosomes for *L. pratensis* from the Flora of the Pacific Northwest by Hitchcock & Cronquist (1961) must be a *lapsus calami* since the taxon is not mentioned in that book. And it is certainly misguided to include in this table the triploid number 21 and especially the polytriploid number 42 which have been observed twice and once respectively as sterile deviations in otherwise diploid and tetraploid populations, since especially the latter may be misunderstood by those uninitiated as representing natural populations rather than individual exceptions of no taxonomical significance, as was actually done in Flora Europaea.

The author states that the aim of her study is "to carry out a taxonomic revision of the *Lathyrus pratensis* complex and to investigate the possible occurrence of autopolyploidy in the complex". She then surveys the taxonomy of the group and mentions five species names that have been used in the past, i.e. *L. pratensis* L., *L. sepium* Scop., *L. hallersteinii* Baumg., *L. lusseri* Heer, and *L. binatus* Pančić. She states that *L. lusseri* has not been validly published, or "non rite publ." as she puts it later, a statement caused by some misunderstanding of the International Code, and indicates that both this and *L. sepium* are synonymous with *L. pratensis*. It is also mentioned that "Löve & Löve (1956) suggested on loose grounds that tetraploid *L. pratensis* should be named *L. lusseri* Heer", a hardly ladylike distortion since we actually used the words "might be identical with" this species and gave as a reason the larger and more deeply yellow flowers, the somewhat broader leaves, and some minor characters not closer described. She joins the recent revisers Ball and Bässler in omitting the taxon *L. velutinus* DC. of the western Alps. That species and *L. lusseri* are accepted, depictured and described by the very critical and certainly skilled authors of the Flora der Schweiz that was published in 1970 although it apparently remained unknown to the author in 1976.

Nobody has recently doubted that *L. binatus* and *L. hallersteinii* are distinct from *L. pratensis* but the results from this study strengthen that conclusion considerably. Besides *L. velutinus,* the only taxonomical problem left is that of the diploid and tetraploid taxa that the author prefers to regard as indistinguishable and in no need of taxonomic recognition. That is not a revision but a capitulation. Nevertheless, her investigation confirms that hybrids between these taxa are unknown even where they are sympatric so their reproductive isolation seems to be complete. Her study also shows that the natural area of the diploid is more continental and northern than that of the tetraploid, which is more littoral in western and southern Europe.

The author presents only diagrammatically, without even rudimentary statistics, the results of her measurements of selected morphological characters. This is unfortunate. She also tends to make statements only as to her inability to see differences that others have declared that they can clearly see. That is deplorable because it renders the morphological chapter less helpful for those who prefer to evaluate rather than swallow her conclusions. As could be expected from the chromosome number differences, however, the stomata, pollen grains and seeds are significantly larger in the tetraploid than in the diploid, so that flowering and fruiting specimens are easily identified by aid of these characters in nature and in the herbarium. Although the author declares a lack of distinction also in these characters, her drawings confirm the observation by the authors of the Flora der Schweiz, which I have corroborated in nature, that the calyx is longer in the tetraploid and that the longer calyx teeth of the tetraploid are 1–1 1/2 as long as the calyx tube, as contrasted to only 2/3–4/5 as long in the diploid.

From these observations it is difficult to comprehend how the author has been able to evade the conclusion that the tetraploid must be accepted as a good species according to any standard, just as the diploid taxa. The problem, however, is not that of distinction but rather one of nomenclature. The correct name for the diploid is indisputably *L. pratensis* in the strict sense, the only taxon known to Linnaeus. The tetraploid is certainly identical with the species *L. lusseri* Heer as conceived by this reviewer and by the authors of the Flora der Schweiz, and the author herself has shown that even the population at the type locality is tetraploid. That, however, does not solve the problem, because there is an earlier name, *L. sepium* Scop., given by Scopoli in his Flora carniolica to a plant deviating from typical *L. pratensis* from the Görz region of Austria which presently is the Gorizia or Gorica region on the border of Italy and Slovenia. After counting the diploid chromosome number from a sample of a single population identified only as the collective species from the Italian Gorizia and not as the Scopoli species, the author summarily discards *L. sepium* as a diploid and thus as a simple synonym of the Linnaean species that Scopoli also knew. That is fallacious. I have spent two summers for botanical research in northern Yugoslavia during which I had ample opportunities to visit the area covered by Scopoli's flora. According to my observations, most of the lowland and montane populations of the yellow-flowered *Lathyrus* in this area belong to the typical Linnaean species, and samples of these were found to be diploid. In copses and hedges in somewhat richer soils and preferably at higher elevations in montane and subalpine situations, however, we observed rare but deviating populations, often with fewer and somewhat deeper yellow flowers with a tendency to form a one-sided inflorescence, hastate rather than sagittate stipules, and the longer calyx teeth as long as or longer than the ovary in contrast to shorter than the ovary of the lowland plants. Since these are the distinguishing characters of *L. sepium*, according to Scopoli, we concluded that these populations should be regarded as topotypes of that species. We found these plants to have larger seeds than the lowland plants, and all samples taken were tetraploid. Although the flowers of this plant seem to be relatively smaller than those of *L. lusseri* from the Alps, we believe it to be just a minor racial deviation of the same species and thus venture to conclude that *L. sepium* Scop. is the earliest correct name for the tetraploid species, leaving *L. lusseri* as a later synonym. Difference in opinion is not a sin. But I am confident that the author and any other critical botanist would have arrived at that conclusion if she had planned her collection and study of this taxon more carefully and approached its problems with "the cold neutrality of an impartial judge", without any mistaken bias by non-geneticists of a different taxonomical significance of reproductive isolation caused by different kinds of polyploidy.

The author discusses in some detail the characteristics of autopolyploids and concludes that the tetraploids studied belong to that category. From the same premises, I would infer that they are neither auto- nor alloploids but intermediate, as most natural polyploids seem to be. Her discussion overlooks the fact that the reported occurrence of polytriploid individuals (here called "hexaploids") among otherwise normally tetraploid plants may be an indication of at least secondary alloploidy. I believe it is a misconception that the degree of morphological differences could be useful for distinguishing auto- and alloploids, as is evident, e.g., from the certainly alloploid *Leymus arenarius* and its parent species, which differ only slightly. What actually matters is not how the polyploid was originally formed, but that it has been able to survive since the Tertiary and form a significant area of its own, and that the reproductive barrier formed is absolute, irrespective of the amplitude of the morphological differences which are biologically unimportant though necessary for identification. To ignore or even minimize such observations is, in my opinion, not a slight but a serious evasion of the basic principles of evolutionary taxonomy.

It is only fair to acknowledge that this study adds considerably to the perception of a noteworthy complex in the European flora and to the understanding of some biological phenomena observed. The detailed investigations are executed with considerable skill and much perseverance. Although a couple of the conclusions may not be to my liking, I fully agree with most of the reasoning and admire the patience demonstrated by the completion of a study of such an unusual dimension.

Áskell Löve

Gustafsson, M. 1976: *Evolutionary trends in the Atriplex prostrata group of Scandinavia. Taxonomy and morphological variation.* Opera Botanica 39. Lund. 63 pages, 38 figures. ISSN 0078-5237. Price SKr 56.

Although the importance of detailed observations of populations has long been recognized, only a handful of organisms have been thoroughly studied from this point of view. Therefore, there is a good reason to welcome a superior study of the evolutionary trends and relationships of the six Scandinavian taxa of the socalled *Atriplex prostrata* group, a diploid and allogamous complex of annuals of the coasts of northern Europe, some of which have reached an almost worldwide distribution as introduced aliens. The present paper emphasizes morphological variability in this complex and proposes its classification; three previous papers discussed hybrid sterility and its relation to chromosome differentiation as skilfully studied in natural and experimental hybrids.

The investigation concerns various characters that have been used to identify the different taxa. The author discusses the diversity of these characters within and between individuals and populations of each taxon and between taxa, both regionally and totally and in their first and second generation hybrids. Since the results are not treated statistically but instead shown in diagrams and schematical drawings, the extent of the material and its variation are not always evident, but the presentation is clear and convincing. On basis of this and the cytological observations published in earlier papers the author concludes that all the taxa are cytologically closely related, though the fertility values of the hybrids vary considerably depending upon the geographical origin of the parents even within morphologically similar taxa. This may, of course, be interpreted as an indication that some of these populations are at least genetically heterogeneous; some recent authors have even distinguished minor geographical races, that they call species, from within one of the subspecies.

It is proposed that the reduced fertility of hybrids between different populations might be largely caused by heterozygosity for paracentric inversions and perhaps a few smaller inversions. These chromosomal rearrangements may or may not have preceded the division of the populations into several local demes that survived at least the last Pleistocene glaciation in various refugia in northern and southern Scandinavia. Their assumed age, however, could perhaps have been more accurately determined by adding to the already extensive experiments some hybridization involving populations from Iceland, where three of the taxa certainly survived at least the last and perhaps even all the glaciations. That is a matter for future studies. It is apparent that the inversions observed are insufficient for the formation of an effective reproductive isolation so that the observed cytological disturbances are tolerated to such a degree that considerable introgression occurs whenever the taxa grow sympatrically. Nevertheless, the differences between the major populations have not been wiped out by this hybridization, perhaps because of some still unobserved principle. Therefore, the author wisely hesitates to unite them all under a single species name but accepts preliminarily their classification as the three sometimes critical species *A. glabriuscula* Edmonst., *A. longipes* Drej. and *A. prostrata* Boucher, the two latter including the geographical races ssp. *longipes* and ssp. *praecox* (Hülph.) Turesson, and ssp. *prostrata* and ssp. *calotheca* (Rafn) M. Gust., respectively.

Although this is one of the finest studies of a diploid complex of allogamous annual species that remain only vaguely reproductively isolated, it is hardly unfair to mention that at least this reviewer believes that the author has left in it some trivial flaws the exclusion of which could have given more strength to his conclusions. One of these is the lack of information on the total distribution of the taxa, both natural and naturalized, another is the lack of statistical evaluation of the experimental results. But perhaps the most serious of these minor imperfections is that the maps of the Scandinavian distribution rest on material from only seven Scandinavian herbaria. Significant collections available elsewhere, especially at Bergen, Trondheim, Tromsö, Leningrad and the herbaria in Finland outside Helsinki, the Baltic States, and northern Germany and Poland, have been ignored.

This is a work of an unusually high quality that could serve as a model for evolutionary studies of a kind that have been largely neglected by botanists in recent decades. It is to be hoped that the author will use his thorough technical and theoretical skills to solve still more of the problems connected with various evolutionary trends in these unstable seashore plants, because they are apparently an unusually suitable material in the hands of an able evolutionist.

Áskell Löve

Ettl, H. 1978: *Xanthophyceae. 1. Teil.* Süsswasserflora von Mitteleuropa. Band 3. 530 pp., 636 figs. Gustav Fischer Verlag, Stuttgart. ISBN 3-437-30250-7. Price DM 98.

The reviewed book is the first of the newly revised edition of the *Süsswasserflora*. It is to be hoped that subsequent volumes will follow in fairly rapid succession, for they have been needed for a long time. The majority of the volumes in the first edition are very much outdated.

The present flora includes the Xanthophyceae, excepting the Vaucheriales which will be treated in a forthcoming volume. In the first edition Pascher (1925) dealt with the Xanthophyceae in 118 pages. The revised edition contains 518 pages, reflecting the vast increase in information during the past half-century. Pascher (1939) later published a separate monograph of the Xanthophyceae, as volume 11 of the *Kryptogamen-Flora*. This has been, and still is, our main source of information concerning this group of algae. In recent years both Polish and Russian manuals of the Xanthophyceae have been published.

The author of the present manual is Dr Hanuš Ettl. He has studied this group of algae for many years and has already published several papers. Accordingly, he has considerable personal knowledge of the Xanthophyceae. The result is a masterpiece of descriptive writing accompanied by excellent illustrations. One cannot but marvel at his immense industry, since he has also recently produced two bulky volumes on the Chlamydomonadaceae, both based on comprehensive personal experience.

I hope that this book will stimulate interest in further study of the Xanthophyceae. They are widespread, mainly found in fresh-water, and including planktic as well as benthic forms. However, they are very often overlooked. Most probably they are frequently misidentified as Chlorococcales because of their similarity in shape. A number of taxa which were previously considered to belong to the Chlorococcales have turned out to belong to Xanthophyceae instead. Partly because of this possibility of misinterpretation, our knowledge of the ecology and distribution of these algae in Sweden is still rather scanty, to say the least. However, as the recent study from the USA published by Tarapchak (1972) shows, they are there for the finding.

I can only warmly recommend this excellent manual. A few very minor points can be made. I have looked in vain for *Centritractus heteracanthus* Vodeničarov (1970), *Goniochloris punctulata* (Reinsch) Komárek, and for *Isthmochloron subtetraedricum* (Reinsch) Skuja, although the latter taxon may belong to *Pseudostaurastrum* like some forms of *Isthmochloron lobulatum* (Näg.) Skuja. *Ophiocytium elongatum* West & West (1907) might also have been mentioned. For those brought up on Pascher's monograph the fact that most *Harpochytrium* species have now been transferred to the Chlorophyceae might have been worth pointing out.

The bibliography is comprehensive and, naturally enough, the index. The price is fairly high, but, since the revision is exceptional in quantity as well as quality, it is indeed a very good purchase.

Kuno Thomasson