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DISCOMYCETES OF MIDDLE ASIA. III  
OTIDEACEAE, HELVELLACEAE, MORCHELLACEAE AND  
SARCOSCYPHACEAE FROM THE TIEN-SHAN MOUNTAINS

The annotated list of the Tien-Shan Pezizales, partly published in our previous report (Dissing, Raitviir, 1973), is completed in this paper. A new species *Pustulina microspora* Dissing et Raitv. is described, and *Pseudopithyella magnispora* (Thind and Waraitch) Dissing et Raitv. is given a species rank.

OTIDEACEAE Eckbl.

*Geopyxis carbonaria* (Alb. et Schw. ex Fr.) Sacc. — The Zailiiski Alatau Mountains, valley of the river Malaya Almaatinka, Tchimbulak, 2400 m, on the ground, August 24, 1963; the Terskei Alatau Mountains, Teploklyutchenska, 1800 m, on the ground, August 25, 1965.

Spores 14.9—16.3—17.2/8.3—9.3—9.9  $\mu$ , smooth, without guttules, elliptic.

The spores are slightly larger than normally reported. This species normally grows on burnt places. Only occasionally it can be found elsewhere (see Petersen, 1970, p. 70).

*Pustulina catinus* (Holmskj. ex Fr.) Eckbl. — The Moldotau Mountains, valley of the Karatal River, 3000 m, on the ground, July 28, 1967.

Spores 23.1—25.4—27.1/10.6—12.0—13.2  $\mu$ , smooth, elliptic, with two large oil guttules.

It is to be questioned if the spores are actually smooth. Studies in the scanning microscope on spores of the very closely related species *Pustulina ochracea* (Boud.) have shown the spores to be very delicately wrinkled (Fig. 6).

*Pustulina cupularis* (L. ex Fr.) Eckbl. — The Moldotau Mountains, valley of the Karatal River, 3000 m, on the ground, July 28, 1967.

Spores 19.8—21.6—23.1/10.6—11.8—13.2  $\mu$ , smooth, elliptic, with two large oil guttules.

*Pustulina microspora* Dissing et Raitv. sp. nov.

Apothecia cupulata, tota sordide albida, sessilia vel breviter stipitata, 3—7 mm in diam., margine crenulato, extus furfuraceus. Sicca hymenium senatum, extus pallide aurantiacus vel griseo aurantiacus. Excipulum ectale ex textura angulata vel textura globulosa, cellulis 10—26/13—30  $\mu$ . Excipulum medullare solidum, ex textura intricata. Hymenium 190—210  $\mu$  in alt. Asci cylindranei, non amyloideae, 8.3—10  $\mu$  in diam. Sporae ellipsoideae, crassiparietales, laeves, biguttulatae, 10.5—11.9—12.6/6.3—6.9—8.0  $\mu$ . Paraphyses cylindratae, 2.0—3.5  $\mu$  in diam., apice subclavati. Ad terram crescit.

Holotypus: Tien-Shan borealis, Montes Zailiiski Alatau, apud vallim Fluvii Malaya Almaatinka, Tchimbulak, alt. 2400 m, ad terram, 24. VIII 1963. A. Raitviir legit (TAA-43416).

Species ab aliis generis sporis minoris differt.



Apothecia cup-shaped, totally whitish when fresh, sessile or with a short stipe. When dried, the cup is 3—5 (—7) mm broad, 2—3 mm high, margin even or crenate, for a long time incurved, finally expanded. Hymenium tan caramel to brownish orange. Outside scurfy, especially near the margin, light orange to greyish orange. Stipe indistinct, 0—2 mm high, often partially buried in the substrate, solid, even or slightly compressed, strongly scurfy, concolorous with outside. Outer excipulum of *textura angulata* to *textura globulosa*, 200—360  $\mu$  broad, individual cells 10—26/16—30  $\mu$ , thin-walled, towards the outside forming broad, irregular, conical warts of loosely arranged, 100—200  $\mu$  high, rows of cells. Medullary excipulum thick, 2 mm from the margin 640—760  $\mu$ , of *textura intricata*, hyphae interwoven, septate, branching, 9—11  $\mu$  broad; subhymenium distinct, 90—100  $\mu$ ; hymenium 190—210  $\mu$  high. Asci operculate, cylindrical, J-, 9.3—10  $\mu$  broad; young asci and hyphae in the subhymenium giving rise to asci heavily staining in cotton blue; paraphyses 2.0—3.5  $\mu$  broad, straight, thin-walled, septate, slightly enlarged above. Spores 10.5—11.9—12.6/6.3—6.9—8.0  $\mu$ , uniseriate, elliptic, thick-walled, smooth, with two oil guttules. (Figs. 1—3.)

The above description is mainly based on dried material of the type collection, which counts 11 well-preserved apothecia. Macroscopically *Pustulina microspora* can be separated from other *Pustulina* species by its whitish colouring. In *P. catinus* (Holmskj. ex Fr.) Eckbl., *P. cupularis* (L. ex Fr.) Eckbl., *P. gaillardiana* (Boud.) Pant and Tewari, *P. insignis* (Berthet and Rioussset) Korf et Berthet, *P. ochracea* (Boud.), *P. velutinus* (Quel.), the colouring is cream to pale ochraceous or sometimes greyish, while in *Pustularia rosea* Rea and *Pustularia patavina* (Cooke and Sacc.) Boud. the colouring is rose and orange, respectively. In *P. rosea* and *P. patavina* (Danish finds) the medullary excipulum is of *textura angulata*. A revision of these species may show that they have affinity to other genera rather than *Pustulina* (see also Pant and Tewari, 1970).

Microscopically *P. microspora* can be separated on the basis of its smaller spores and the hyphae in the medullary excipulum, which are much broader (9—11  $\mu$ ) than found in other *Pustulina* species. In most species they are 3—5  $\mu$  broad, or 6—8  $\mu$  broad in *P. insignis* (Berthet and Rioussset, 1963).

### HELVELLACEAE

***Helvella aestivalis* (Heim et Remy) Dissing et Raitviir comb. nov.**  
 Basionymum: *Acetabula aestivalis* Heim and Remy, Bull. Soc. Myc. Fr. 41 : 460, Pl. XXIX, Figs. 10—12, 1925. — The Moldotau Mountains, valley of the Karatal River, 3000 m, on the ground, July 28, 1967 (TAA — 44 480, July 29, 1967, TAA — 44 529).

Apothecia sessile or with a short stipe, 1—2.5 cm broad, 1—2 cm high, regularly cup-shaped, in adults the margin is split into lobes, but not expanded; hymenium dark-brown with a reddish-violet tinge; outside glabrous to very delicately pubescent, above concolorous with hymenium, below gradually paler with a reddish tint. Stipe  $\pm$  distinct, with a few blunt ribs, which do not continue in the gradually widened outside. Outer excipulum of *textura angulata*, 140—170  $\mu$ , innermost cells 6—43/6—33  $\mu$ , outermost cells cylindrical to club-shaped, with brownish content, and deeply staining in cotton blue. Medullary excipulum of *textura intricata*, 150—200  $\mu$ , hyphae loosely interwoven, septate, branching, 3—4  $\mu$  broad, near the margin intermixed with swollen cells; subhymenium 33—50  $\mu$  broad, of densely interwoven hyphae, subparallel with hymenium, which is 355—385  $\mu$  high; asci 16.5—21.5  $\mu$  broad, paraphyses above enlarged to 6.6  $\mu$  broad, above with brownish content which stains deeply in cotton blue. Spores 23.1—24.3—26.4/13.2—14.0—15.8  $\mu$ , when young often with



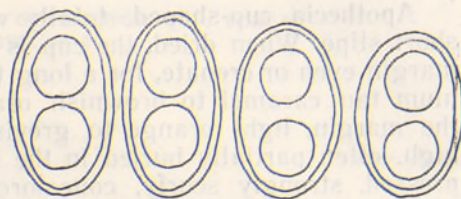
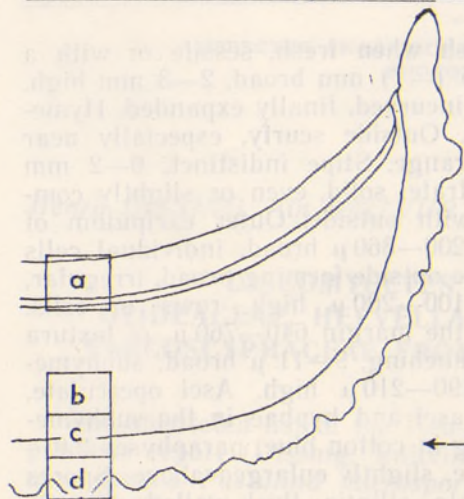


Fig. 3. *Pustulina microspora*, spores.  
× 1925.

Fig. 1. *Pustulina microspora*, marginal section, schematic a, b, c, d show the position of the drawings in Fig. 7. × 30.

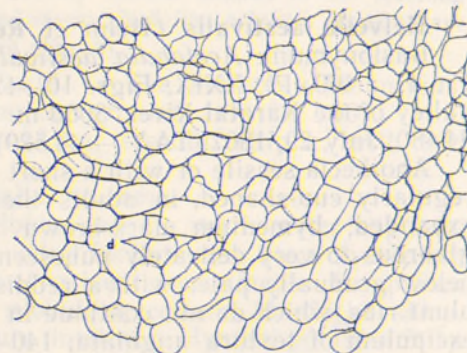
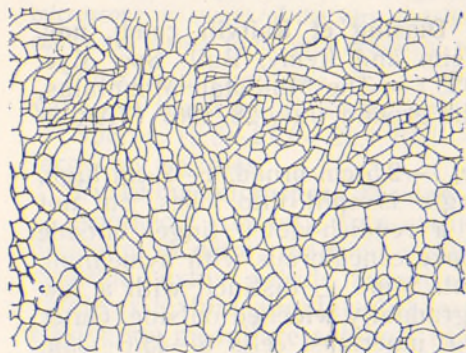
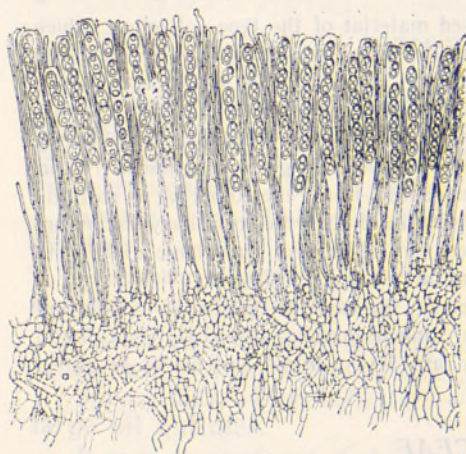


Fig. 2. *Pustulina microspora*. a — hymenium and subhymenium, b — part of medullary excipulum, c, d — medullary and outer excipulum with the cells forming the warts.  
a—d × 218.

pustules which may be connected by low ridges, thus making an irregular reticulate pattern when stained in cotton blue. In some asci the 8 spores have not developed regularly. Then the spores might be as large as  $28.1/16.5 \mu$ . (Fig. 4.)



The above description is based on dried material from coll. TAA — 44480. The type of *Acetabula aestivalis* has not been seen. It is not available (Heim, in litt.). *Helvella aestivalis* can be separated from all other *Helvella* species on the basis of its colouring. Heim and Remy described the colour of *Acetabula aestivalis* so: outside "roseo-cupra" and disc "cinereo-atra". The coloured illustration given by the same authors might not be fully reliable due to the somewhat simple technique applied in printing, but both description and illustrations indicate that their material had a more bright red outside than seen in the present material. However, since the colour variation in this rare species is not known, and since all other characters given by Heim and Remy fit well with our plant, it seems justified to consider it identical with *A. aestivalis*. The colouring of *H. aestivalis* is the same as in *Wynella silvicola* (Beck in Sacc.) Nannf. (= *W. auricola* (Schaeff.) Boud.) (also studied in the present investigation), but this species can easily be distinguished by its ear-shaped apothecia and by the excipulum characters. These latter differences are hard to point out in precise terms, since in both cases the outer excipulum is of *textura angulata* and the medullary excipulum is of *textura intricata*, but the ratio between the two layers is quite different from that found in *Helvella* species (Dissing, 1966, Figs. 7 and 9). *Wynella* has also a more tough consistence. Therefore it seems well justified to keep *Wynella* as a separate genus.

In many species of *Helvella* the young spores have pustules (easily recognized in cotton blue). It is remarkable that in *H. aestivalis* the young spores sometime have a somewhat reticulate pattern resembling that found in the spores of *Wynella* (see Dissing, 1966, Fig. 3b). The authors, placing main value on the fruitbody colouring, might well point out that this character of the spores indicates that *H. aestivalis* rather should be transferred to *Wynella*. Emphasizing the value of the anatomy, we believe that, due also to the shape of the apothecium and the spore size, it rather indicates a relationship to the species in the section on *leucomelaena* (see Dissing, 1.c.). However, the colour and the nearly glabrous outside, together with the characters of the spores, seem to justify that *H. aestivalis* should be placed in a section of its own.

Apart from this, *H. aestivalis* shows in a most convincing manner the idea that the genera *Helvella* and *Wynella* are closely related. In coll. No. 44529 the spores are slightly larger than in coll. No. 44480: 23.1—25.3—28.1/13.2—14.5—16.5  $\mu$ . No spores with pustules or reticulum were seen.

*Helvella costifera* Nannf. — The Moldotau Mountains, valley of the Karatal River, 2900 m, on the ground, July 29, 1967.

Immature, but undoubtedly representing this species.

*Helvella fusca* Gill. sensu Bres. — The Zailiiski Alatau Mountains, valley of the river Malaya Almaatinka, Tchimbulak, 2400 m, on the ground, August 24, 1963.

Spores 18.2—19.7—21.5/12.5—13.2—13.9  $\mu$ . There are several well dried specimens, typical in habitus, but very rarely the spores are well developed. In most asci there are only 2 or 3 spores. Spore measurement based on 15 spores only.

*Helvella solitaria* (Karst.) Karst.

The Moldotau Mountains, Valley of the Karatal River, 2800—3000 m, on the ground, July 28—30, 1967.

Spores 19.8—21.3—23.1/12.5—13.9—15.8  $\mu$ . Typical for the species.

*Wynella silvicola* (Beck in Sacc.) Nannf. — The Tchatkal Mountains, Burgan-Suu, 2500 m, on the ground, July 22, 1967. The Moldotau Mountains, valley of the Karatal River, 2900 m, on the ground, July 30, 1967.

Spores 19.8—21.5—23.8/13.2—13.8—15.8  $\mu$ . In none of the studied collections asci with 8 well developed spores were seen. Otherwise the material seems typical for the species.

*Gyromitra infusa* (Schaeff. ex Fr.) Quel. — The Moldotau Mountains, valley of the Karatal River, 2900 m, on the ground, July 21, 1967.

The collection is made up of only one small, immature fruit body.



*Discina perlata* (Fr.) Fr. — The Terskei Alatau Mountains, Teploklytchenka, Aksu, 1900 m, on the ground, June 5, 1968.

Outer excipulum of *textura intricata*, 256—384  $\mu$  thick, of very densely interwoven septate hyphae, 3—6  $\mu$  broad. Medullary excipulum of *textura intricata*, 1000—1500  $\mu$  thick, of loosely interwoven, septate, branching hyphae, 7—20  $\mu$  broad. In the zone connecting the medullary and the outer excipulum there are scattered, septate, branching hyphae, deeply staining in cotton blue, 7—16  $\mu$  broad (oleiferous hyphae?, see McKnight, 1969). Subhymenium 120—150  $\mu$  thick. Hymenium 280—330  $\mu$  high; asci 16—21  $\mu$  broad, paraphyses 4—6  $\mu$  broad, above enlarged to 9—10 (—12)  $\mu$  broad, septate, below anastomosing, plasma deeply staining in cotton blue. Spores 22.4—23.5—26.4/9.9—11.2—12.5  $\mu$  (without appendages, which are up to 5  $\mu$  long), with very low, elongated warts, sometimes tending to form a reticulum. (Fig. 5.)

We have named this collection *D. perlata* with some hesitation. The spores are slightly smaller than given by McKnight (1969) and other authors. However, the thick medullary excipulum and the position of the oleiferous hyphae seem to separate our material well from *D. warnei* (Peck) Sacc. which, according to spore size, would fit much better with our collection. A study of *D. perlata* in the Lundell and Nannfeldt exsiccate No. 1352 revealed that the spore size in this material is much deviating (33.0—35.0—38.0/13.2—14.5—16.5  $\mu$ ) and the reticulum is also much more prominent (see Fig. 5). According to McKnight (1969) the Lundell and Nannfeldt material would probably key out as *D. macrospora* Bubák.

In Danish material of *Discina perlata* (Fig. 5*f*, H.D. 64.44) the spore size is equal to that of Coll. 60297, whereas the reticulum is slightly more pronounced.

Spores in our material and Lundell and Nannfeldt exsiccate 1352 were revived in KOH and stained in cotton blue before measuring.

### MORCHELLACEAE (Sacc.) Eckbl.

*Disciotis venosa* (Pers. ex Fr.) Bound. — The Ferghana Mountains, Arslan-Bob, 1300 m, on the ground, May 30, 1968.

Spores 19.8—22.0—23.8/11.6—12.1—13.2  $\mu$ , smooth, broadly elliptical, without oil guttules.

The examined material is considered to be fully mature. In all respects but one it fits well with current descriptions. The spores are thick-walled, the wall as seen in cotton blue is made up of several layers. And more curious: mostly, but not always, near the poles of the spores, are areas which stain deeply in cotton blue (Fig. 7). Since only one collection counting only two specimens has been studied, we shall abstain from too many speculations about this feature. But it would be very interesting to study some more material of this peculiar fungus from the same area.

*Morchella esculenta* Pers. ex Fr. — The Tchatkal Mountains, Sary-Tchelek reservate, 1200 m, on the ground, May 23, 1968.

*Morchella conica* Pers. — The Terskei Alatau Mountains, Teploklytchenka, Aksu, 1900, on the ground, June 5, 1968.

Fig. 4. *Helvella aestivalis*, left: ectal excipulum ( $\times 340$ ); right: 2 spores with pustules and ridges and a fully mature spore (see text).  $\times 2000$ .

Fig. 5. *Discina perlata*, spores. *a, b* — Lundell and Nannf. exc. No. 1352 (C), note the size and reticulum, *c* — TAA-60297, *d, e* — TAA-60297, SEM, note the very inconspicuous reticulum, *f* — SEM, Denmark, Jylland: Klitmøller Plantage, 18. 5. 1964, leg. Karin Tofft, H. D. 64.44 (C). *a-c*  $\times 1440$ , *d-f*  $\times 1545$ .



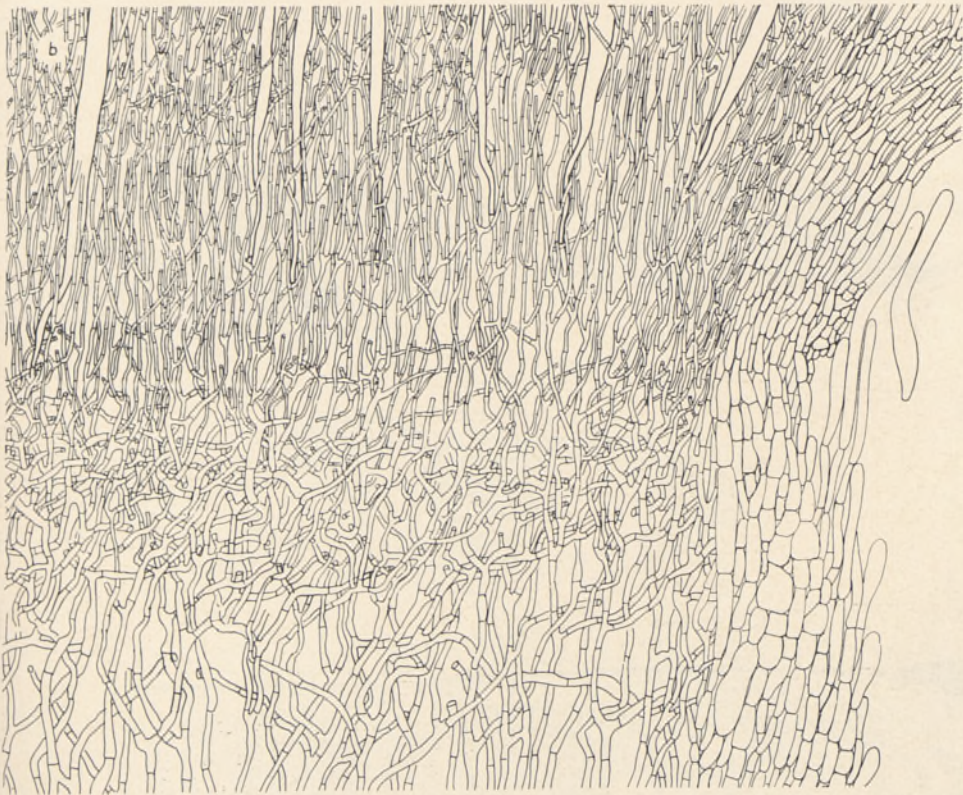
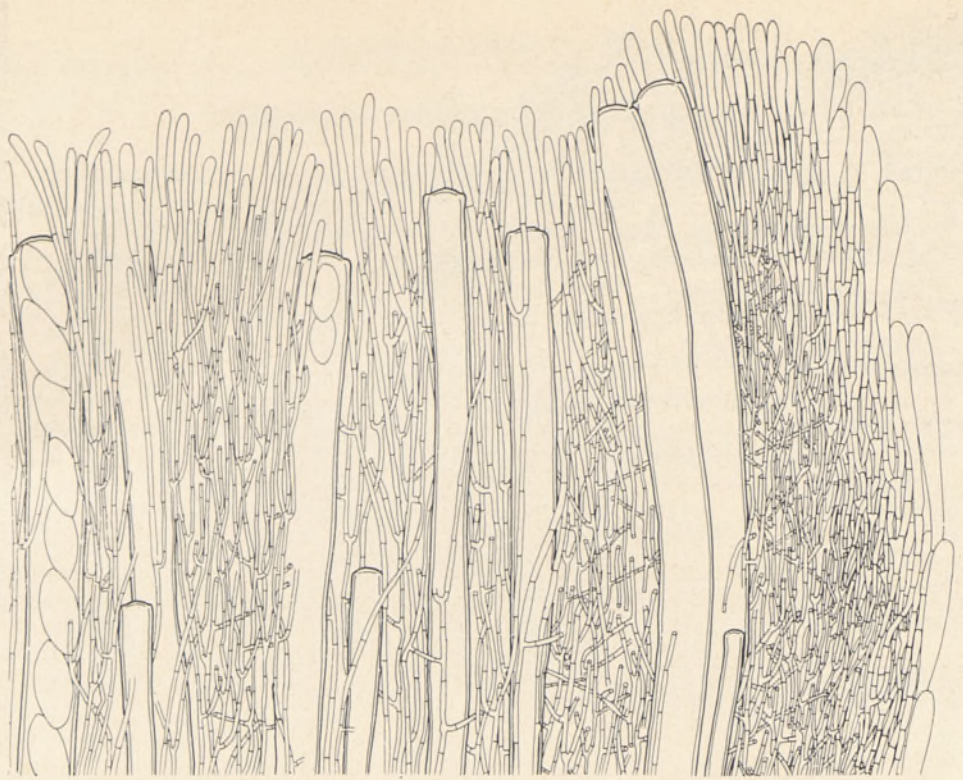


Fig. 10. *Pseudopityella magnispora*, above, section of the upper part of hymenium (see Fig. 9), note the anastomosing paraphyses and the poorly developed excipulum; below, section of the lower part of hymenium, subhymenium and upper part of medullary excipulum.  $\times 583$ .



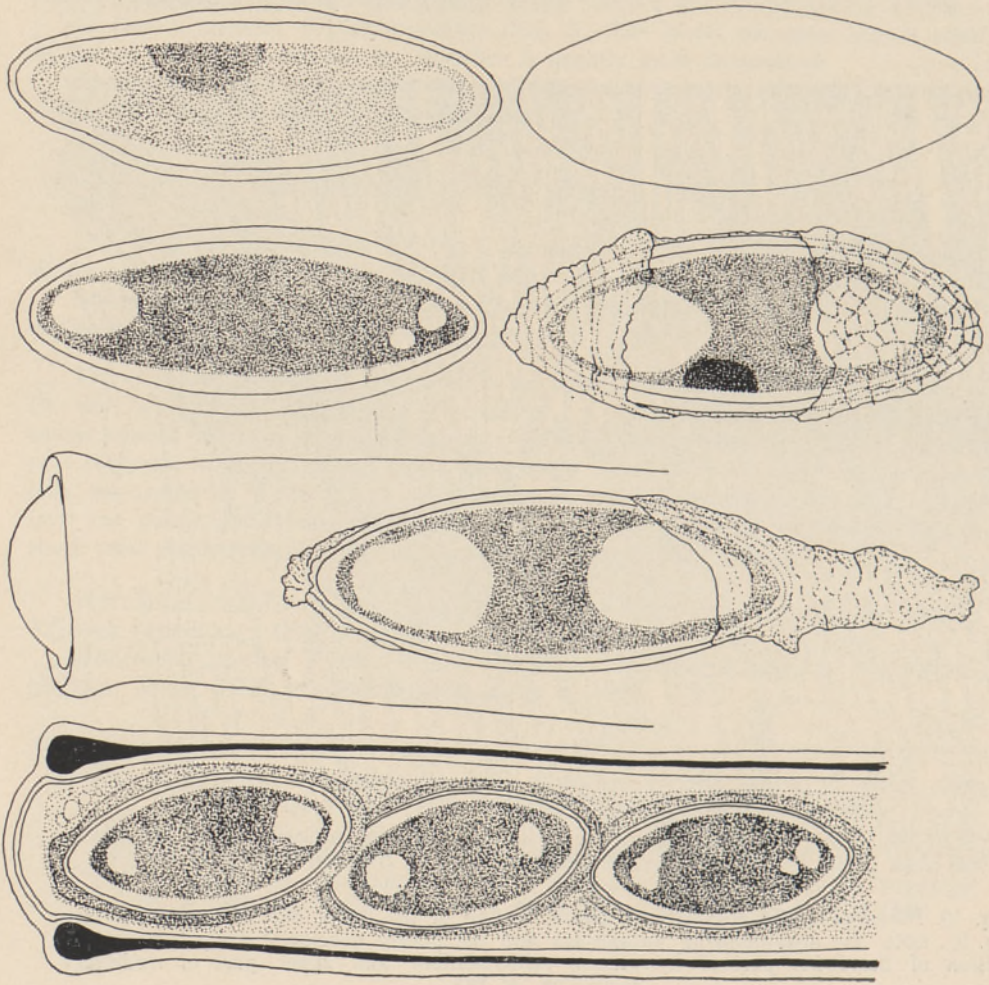


Fig. 11. *Pseudopithyella magnispora*, asci and spores; left: asci stained in congo red, note the layers; middle, below — immature spores with gelatinous cover; right, below — fully mature spore with smooth wall. X 2200.

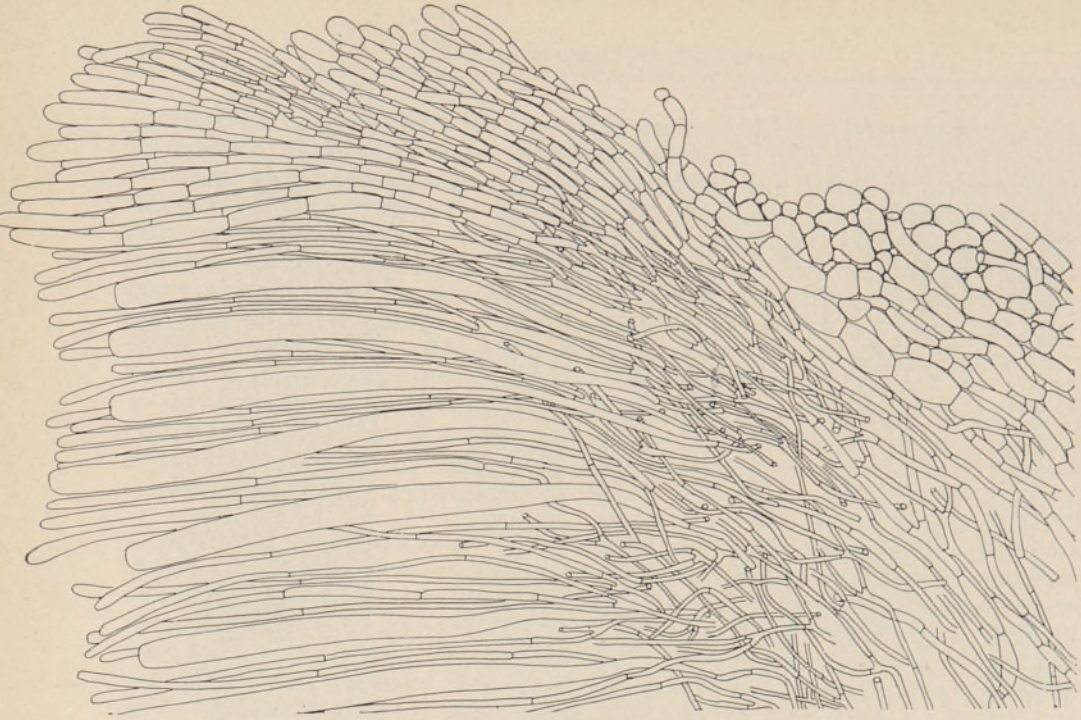


Fig. 12. *Pithya cupressina*, marginal section; see text and compare with Fig. 10, above. X 583.



## SARCOSCYPHACEAE Le Gal ex Eckbl.

*Pseudopithyella magnispora* (Thind et Waraitch) Dissing et Raitv. stat. nov.

Basionymum: *Pseudopithyella minuscula* (Boud. et Torrend) Seaver var. *magnispora* Thind et Waraitch, Journ. Ind. Bot. Soc. 43 (3) : 466, Fig. 5 (1964). — The Terskei Alatau Mountains, Teploklyutchenka, Aksu, 2000 m, on decaying needles of *Picea schrenkiana*, August 26, 1965.

Apothecia 0.5—1.0 mm broad, 0.7—1.2 mm high, solitary or gregarious on needles of *Picea schrenkiana*, obconical, regular; hymenium red, orange when dried, margin even, distinct but not raised, outside glabrous or slightly roughened, whitish to pale orange. Outer excipulum thin; at the base of textura globulosa, 33—50  $\mu$  broad, individual cells thin-walled, 6—16  $\mu$  broad, at the middle (Fig. 10, below) of textura angulata to textura prismatica, single cells 30—50/6—9  $\mu$ , above (Fig. 10, above) 9—16  $\mu$  broad, cells elongated, 3—4  $\mu$  broad. Medullary excipulum of textura intricata, hyphae loosely interwoven, septate, branching, 2—6  $\mu$  broad; subhymenium indistinct, of textura intricata, hyphae as in the medullary excipulum but mostly slightly more densely interwoven; hymenium 230—300  $\mu$  high.

Asci thick-walled, 10—13  $\mu$  broad, above with a collar-like thickening. Ascus wall of three layers (Figs. 8 and 11), middle layer staining in cotton blue, especially at the top, where the collar forms a broadening ring, innermost layer thin, though clearly staining and visible in the very top of ascus. Paraphyses 2—3  $\mu$  broad, septate, repeatedly branching, sometimes anastomosing, only slightly broadening above. Spores 23.1—24.6—26.4/9.9—10.7—11.6  $\mu$ , ellipsoid-fusiform, hyaline, thick-walled, smooth, mostly with two oil guttules. When young, the spores are covered by a gelatinous sheath (Figs. 10—11). Plasma in spores staining in cotton blue. In many spores an area near the middle is densely staining (nuclear area ?) (Figs. 8—11).

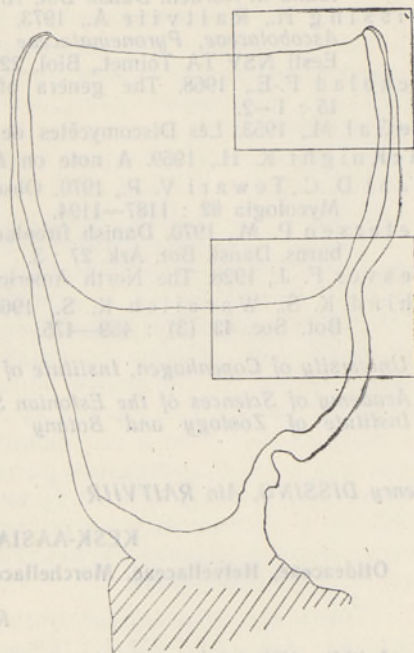


Fig. 9. *Pseudopithyella magnispora*, section of fruit body, schematic, showing position of sections in Fig. 10.  $\times 110$ .

Thind and Waraitch (1964) described the fresh material of *P. minuscula* var. *magnispora* as "external surface pink". These authors described the paraphyses as "rarely branched", and the wall of the ascospores "somewhat... and dark". This is in disaccordance with our observations. Otherwise our material is in essential characters in accordance with their description. No material has been seen of *P. minuscula*, but the descriptions by Seaver (1928) and Le Gal (1953) support that the characters of the spores separate the two taxa also on a species level. If our interpretation of the three layers in the ascus is correct (Figs. 8—11), this is clearly different from any known



ascus type inside the operculate discomycetes. EM studies might in fact show that there are more than three layers. According to the illustrations given by Eckblad (1968, Fig. 55). *P. minuscula* might well have the same ascus type. If such characters as the simple outer excipulum, the nearly lacking subhymenium and, perhaps, also the habit can be interpreted as primitive, this would indicate that also the ascus could be of an ancestry type. Studies of this interesting species from fresh material are highly wanted.

*Pithya cupressina* (Batsch ex Fr.) Fuck. — The Terskei Alatau Mountains, Dzhetty-Oguz, 2200 m, on dead twigs of *Juniperus turkestanica*, June 8, 1968.

Spores globose, 9–10  $\mu$ , smooth.\* As seen from Fig. 12, the anatomy of *P. cupressina* is of the same simple (? primitive) type as found in *Pseudopithyella magnispora*. Characters of the asci and spores, however, seem to separate the two genera well.

\* No fully mature spores seen. Only ten spores measured.

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Received  
Feb. 5, 1973

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#### KESK-AASIA LIUDSEENED. III

Otidaceae, Helvellaceae, Morchellaceae ja Sarcoscyphaceae Tjan-Šani mägedest

#### Resümee

Artiklis jätkatakse andmete avaldamist Tjan-Šani liudikulaadsete seente kohta. Seekord käsitletakse 4 sugukonda kuuluva 15 liigi levikut. Kirjeldatakse uut liiki *Pustulina microspora* Dissing et Raitv. *Pseudopithyella magnispora*'t (Thind et Waraitch) Dissing et Raitviir vaadeldakse iseseisva liigina, mitte liigi *P. minuscula* varieteedina. Märgitakse, et liikide *Discina perlata* ja *Disciotis venosa* Tjan-Šanist saadud eksemplarid erinevad mõnevõrra samade liikide Euroopa eksemplaridest. Kuna aga materjali on veel vähe, ei ole võimalik teha järeldusi nende liikide süstemaatika kohta.

Kopenhaageni Ülikooli Eostaimede Instituut  
Eesti NSV Teaduste Akadeemia  
Zooloogia ja Botaanika Instituut

Toimetusse saanud  
5. II 1973



