

## Descriptions of and comments on some species of *Octospora* and *Kotlabaea* (Pezizales, Humariaceae)

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**Abstract:** After examining type or authentic specimens, the author provides detailed descriptions and illustrations of twenty species of *Octospora*. These are: *O. purpurea*, *O. plumbeo-atra*, *O. indica*, *O. orthotrichi*, *O. kanousae*, *O. wrightii*, *O. insignispora*, *O. leucolomoides*, *O. humosa*, *O. peckii*, *O. musci-muralis*, *O. tetraspora*, *O. rubens*, *O. semiimmersa*, *O. subhepatica*, *O. euchroa*, *O. limbata*, *O. waterstonii*, *O. phyllogena*, and *O. convexula*. Comments on seven further species, *O. pumilata*, *O. moravecii*, *O. ithacaënsis*, *O. collinata*, *O. insolita*, *O. leucoloma*, and *O. decalvata* are provided. Twenty eight species of *Octospora* are keyed out. *Kotlabaea* differs from *Octospora* in having ellipsoid, eguttulate ascospores and being non-byrophilic. *Kotlabaea deformis*, *K. spaniosa*, and *K. alutacea*, the latter 2 newly combined, are described and commented.

**Key words:** bryophilic, discomycetes, taxonomy, Ascomycetes.

### Introduction

The genus *Octospora* was established by Hedwig (1789) to include more than 22 species, one of which was *Octospora leucoloma*. Most species were later transferred to other genera of operculate and inoperculate discomycetes (Dennis & Itzerott 1973). Gray (1821) took up the name *Octospora*, which was considered a revalidation according to the pre-1981 rules of botanical nomenclature. Korf (1954) designated *O. leucoloma* as lectotype of *Octospora* Hedw. and later Khare & Tewari (1975) designated a neotype specimen for this species.

Dennis & Itzerott (1973) and Itzerott (1981) recognized the association of mosses with species of *Octospora*; based on this association and the excipular tissues, they keyed out 22 species (including some new species and new combinations), and described them briefly. They also transferred four orange-disked bryophilic, hairy

species from the well-established genera *Neottiella* (Cooke) Sacc. and *Leucoscypha* Boud. to *Octospora*, taking the view that the hairy-exciple apothecia in bryophilic species with carotenoid pigments would not justify generic separation.

Another bryophilic genus, *Lamprospora* De Not. superficially resembles *Octospora*, but it has globose and elaborately ornamented ascospores. Rifai (1968) and Eckblad (1968) pointed out that, except for ascospore shape, *Lamprospora* is similar to *Octospora*, and subsequently Le Gal (1969) merged the two genera. Caillet & Moyne (1980) and Wang & Kimbrough (1992) followed Le Gal (1969) in treating *Lamprospora* as a synonym of *Octospora*. Caillet & Moyne (1987b), however, regarded several related bryophilic genera of the *Humariaceae* as sections of *Octospora*. Benkert (1987a, 1995) retained *Lamprospora* and *Neottiella* because of their distinct morphological features.

The observation that most terricolous *Octospora* species parasitize moss rhizoids provides a new criterion to the systematics of this genus and other bryophilic genera of the *Humariaceae*. This kind of parasitism has been established for several species of *Octospora* (Döbbeler 1979, Döbbeler & Itzerott 1981, Itzerott 1983a and b, Itzerott & Döbbeler 1982, Senn-Irlet 1988, Benkert 1998c). Most *Octospora* species studied form galls on subterranean rhizoids of mosses, with the exception of *O. roxheimii* Dennis & Itzerott, which forms apothecia on the leaves and the leaf axils, infecting them by the formation of appressoria (Döbbeler 1993).

Species of *Octospora* prefer a cool and moist climate and have mostly been reported from temperate regions, particularly Europe. Benkert (1993) described *Octospora* as a bryoparasitic genus. However, two European species, *O. rubens* (Boud.) M. Moser and *O. tetraspora* (Fuckel) Korf, were also collected on soil without mosses in the plains of India during winter. While some species seem closely associated with mosses, others are not specific (Caillet & Moyne 1987a and b). Some other species of *Octospora* in the present work, with a similar set of characters, are not associated with mosses, and have been found growing on rotten twigs, leaves and soil. From the literature it appears that the association of *Octospora* and related genera with mosses significantly affects their taxonomy, and non-bryophilic species might need to be placed elsewhere or accommodated in new genera. One such species, *Humaria calospora* Quél. (syn. *O. calospora* (Quél.) Caillet & Moyne), growing on soil and having broadly ellipsoid and reticulate ascospores, was assigned to a new genus, *Moravecchia*, by Benkert et al. (1987). This species with a characteristic ascospore ornamentation, except for the size of the apothecia, however, seems close to *Aleuria*. In the literature, divergent generic circumscriptions still prevail. Molecular and cultural studies, in addition to their ecological features, are expected to further elucidate relationships among species of *Octospora* and other closely related genera of the *Humariaceae*.

The author previously clarified the early history and typification of many species; he described new species, and validated new combinations of *Octospora* (Khare 1975a and b, 1976, Khare & Tewari 1975, 1978). In this paper, detailed descriptions and illustrations of twenty additional species are given together with comments on further seven species of *Octospora*. For some other species of *Octospora*, the following references should be consulted: Batra (1960), Moser (1963), Svrček & Kubička

(1963), Berthet (1964), Eckblad (1968), Rifai (1968), Dennis & Itzerott (1973), Itzerott (1974, 1976, 1981), Caillet & Moyne (1980, 1987a and b;), Benkert (1995, 1997, 1998a and b), and Rubio et al. (2000).

The non-bryophilic genus *Kotlabaea* Svrček, segregated from *Octospora*, and previously treated as a subgenus (Khare & Tewari 1978) is now recognized, following Korf (1972, 1973) and Dennis (1978). *Kotlabaea* is distinguished from *Octospora* by its ellipsoidal and eguttulate ascospores. The type species of this genus, *K. deformis* (P. Karst.) Svrček, based on the isotype specimen, and two additional newly combined species, *K. spaniosa* (K.B. Khare) K.B. Khare and *K. alutacea* (Berk. & Broome) K.B. Khare, are also described and keyed out.

Dried apothecia from herbaria were first wetted with 95% ethanol and soaked in water and then 2% KOH solution for five minutes. Apothecia thus rehydrated were photographed, then washed 2-3 times in water before any slide preparation. The rehydrated apothecia as well as the fresh ones were sectioned at 10-25 µm with the freezing microtome. All measurements and photomicrographs of morphological structures were taken from slides prepared in water and cotton blue in lactophenol, respectively. After examination, herbarium specimens were redried properly and returned to the herbarium, along with slides and photographs for further reference.

## Octospora Hedwig

Descriptio et adumbratio microscopico-analytica muscorum frondosorum 2: 4.  
Lipsiae. 1789.

### Key to 27 treated species of *Octospora*

1. Apothecia dark-coloured, violet, purplish-black, brownish-black; on soil..... 2
- 1\*. Apothecia light to bright-coloured, cream, yellow, orange, reddish-orange; on soil and among bryophytes..... 4
2. Ascospores smooth..... 3
- 2\*. Ascospores verrucose to inconspicuously reticulate; apothecia purplish brown; ascospores uniguttulate..... *O. purpurea* (21)
3. Apothecia deep violet to violet-black, releasing violet pigment in KOH; margin not raised; paraphyses with irregularly swollen tips..... *O. plumbeo-atra* (19)
- 3\*. Apothecia brownish black, finely pustulate; margin raised; paraphyses with curved tips..... *O. indica* (6)
4. Ascospores subglobose..... 5
- 4\*. Ascospores ellipsoid to oval..... 8
5. Ascospores smooth; apothecia on soil..... *O. pumilata* (20)
- 5\*. Ascospores verrucose or punctate..... 6
6. Medullary excipulum of *textura angularis*; apothecia associated with *Amblystegium serpens*..... *O. moravecii* (14)
- 6\*. Medullary excipulum of *textura intricata*..... 7
7. Asci clavate; ascospores punctate; apothecia associated with *Orthotrichum diaphanum*..... *O. orthotrichi* (16)

7*	Asci cylindrical; ascospores verrucose; on cushions of unidentified moss ( <i>Amblystegium serpens?</i> ).....	<i>O. wrightii</i> (27)
8.	Ascospores ornamented.....	9
8*	Ascospores smooth.....	13
9.	Ascospore markings in the form of ridges.....	10
9*	Ascospores verrucose.....	11
10.	Apothecia associated with <i>Pleurozium schreberi</i> ; ascospore ridges 1.5 µm high, forming an incomplete reticulum.....	<i>O. pleurozii</i> (not treated)
10*	Apothecia more frequently on soil than among mosses; spore ornamentation in the form of thick, 4-5 µm high bands.....	<i>O. insignispora</i> (7)
11.	Apothecia 1 mm diam; on <i>Marchantiapolyomorpha</i> .....	<i>O. ithacaënsis</i> (9)
11*	Apothecia not on bryophytes.....	12
12.	Apothecia on decayed wood; ascospores narrowly ellipsoidal; medullary excipulum of textura intricata.....	<i>O. collinata</i> (1)
12*	Apothecia on soil; ascospores broadly ellipsoidal to oval; medullary excipulum of textura angularis.....	<i>O. kanousae</i> (10)
13.	Ectal excipulum of long-celled tissue (textura intricata).....	14
13*	Ectal excipulum of short-celled tissue (textura angularis to t. prismatica).....	15
14.	Medullary excipulum of textura intricata with interhyphal spaces; apothecia on soil.....	<i>O. leucolomoides</i> (12)
14*	Medullary excipulum of textura prismatica, of brick-shaped cells; apothecia growing in association with <i>Polytrichum</i> , <i>Pogonatum</i> , <i>Pleuridium</i> , or <i>Ditrichum</i> species...	<i>O. humosa</i> (5)
15.	Ectal excipulum of textura prismatica; apothecia substipitate; on rotten leaves....	<i>O. insolita</i> (8)
15*	Ectal excipulum of textura angularis.....	16
16.	Apothecia on soil and among bryophytes.....	17
16*	Apothecia not on soil but on plant remains.....	26
17.	Medullary excipulum of textura intricata.....	18
17*	Medullary excipulum of textura angularis.....	20
18.	Paraphyses with straight apices; apothecia in cushions of <i>Bryum</i> , <i>Funaria</i> , or <i>Leptobryum</i> species.....	<i>O. leucoloma</i> (11)
18*	Paraphyses with curved apices.....	19
19.	Apothecia orange-red; ascospores more than 20 µm long; apothecia in cushions of <i>Grimmia pulvinata</i> .....	<i>O. musci-muralis</i> (15)
19*	Apothecia white; on soil; ascospores less than 20 µm long.....	<i>O. decalvata</i> (3)
20.	Paraphyses curved; apothecia growing in association mostly with <i>Ceratodon purpureus</i> , but also found among <i>Bryum</i> , <i>Pottia</i> , or <i>Phascum</i> species.....	<i>O. rubens</i> (22)
20*	Paraphyses for the major part straight.....	21
21.	Asci 4-spored; ascospores broadly fusoid; apothecia usually growing with <i>Bryum argenteum</i> , but also among <i>B. erythrocarpum</i> , <i>Pottia truncata</i> , or <i>Phascum cuspidatum</i> .....	<i>O. tetraspora</i> (25)
21*	Asci 8-spored.....	22
22.	Ascospores ellipsoidal.....	23
22*	Ascospores broadly fusoid.....	<i>O. convexula</i> (2)
23.	Apothecia immersed in soil.....	<i>O. semiimmersa</i> (23)
23*	Apothecia not immersed, but superficial on soil.....	24
24.	Ascospores regularly biguttulate, margin not raised.....	<i>O. euchroa</i> (4)
24*	Ascospores uniguttulate.....	25

25. Apothecial margin raised..... *O. limbata* (13)  
 25\*. Apothecial margin not raised..... *O. subhepatica* (24)
26. Apothecia on damp hay; ascospores uniguttulate..... *O. peckii* (17)  
 26\*. Apothecia not on hay; ascospores bi- to multiguttulate..... 27
27. Asci 275 µm long; ascospores multiguttulate..... *O. waterstonii* (26)  
 27\*. Asci less than 275 µm long; ascospores biguttulate..... *O. phyllogena* (18)

1. ***Octospora collinata*** K.B. Khare, Norw. J. Bot. 22: 260. 1975.

This species was treated in detail by Khare (1975a). Among the light-coloured species of *Octospora* with verrucose ascospores, the present species is close to *O. kanousae*, but it differs from the latter by the shape of ascospores and the type of tissue in the medullary excipulum. *O. collinata* has ellipsoidal ascospores and the medullary excipulum is of textura intricata, whereas *O. kanousae* has oval ascospores and the medullary excipulum is of textura angularis. In addition, the substrates of the two species are also different, the former growing on dead twigs and leaves, the latter on soil.

MATERIAL EXAMINED: Holotype specimen of *Octospora collinata* K.B. Khare, on decaying twigs and leaves, Camel Back Road, Mussoorie, India, leg. R.N. Singh, 22 Aug. 1969 (BHUPP 1234).

2. ***Octospora convexula*** (Pers. : Fr.) L.R. Batra & S.W.T. Batra, Kansas Bull. 44: 167. 1963. Plate 1, Figs 1-5

≡ *Peziza convexula* Pers., Syn. meth. Fung. 666: 1801 : Fries, Syst. mycol. 2: 73. 1822.

≡ *Humarina convexula* (Pers. : Fr.) Seaver, North Amer. Cup-Fungi (Operculates): 128. 1928.

Apothecia scattered among mosses, up to 1 mm diam, sessile; hymenium orange yellow, plane to slightly convex; externally lighter or concolorous with the hymenium, slightly tomentose. In section, hymenium 160-270 µm thick; subhymenium and medullary excipulum not distinguishable, together 60-130 µm thick, of textura angularis, cells thin-walled, angular to elongate, 12-15 µm diam, becoming smaller (3-5 µm diam) in the subhymenial region; ectal excipulum 30-50 µm thick, also of textura angularis, cells variously angled, 8-16 µm diam; margin slightly raised, of clavate, apically free cells; tomentum hyphae colourless, septate, short, up to 5 µm wide. Asci J-, 8-spored, cylindrical to clavate-cylindrical, narrowing below into short attenuated base, 150-200 × 15-20 µm. Ascospores hyaline, ellipsoidal, narrowing slightly towards the ends, smooth, biguttulate, uniseriate to partially biseriate, obliquely arranged, 23-28 × 11-13 µm. Paraphyses hyaline, septate, straight, simple to branched in the lower part, apices clavate, 5-8 µm wide.

MATERIAL EXAMINED: Fuckel, Fungi rhen. No. 1875, *Peziza convexula*, on soil among mosses (FH).

Rehm (1896) stated that it was impossible to establish the identity of Persoon's fungus since no material is extant. However, following Cooke (1875) and Winter (1881), he tried to pin down the name on Fuckel's exsiccatum. Fuckel Fungi rhen. No. 1875 (FH) may therefore, be accepted as **neotype** specimen for *O. convexula*. Batra & Batra (1963) described this species from India, but their material (BPI) on

examination was found to be an entirely different fungus. The ascospores in Batra's collection are much broader and more or less ovoid with a single guttule, and the medullary excipulum is composed of textura intricata of irregularly swollen, thick hyphae. Batra's specimen is much closer to *O. rubens*.

3. **Octospora decalvata** K.B. Khare, Norw. J. Bot. 22: 263. 1975.

This species was treated in detail by Khare (1975a). It is close to *Kotlabaea alutacea* (Berk. & Broome) K.B. Khare, growing under similar conditions. *O. decalvata* can, however, be distinguished from *K. alutacea* by having guttulate, smaller ascospores and an excipulum of textura angularis.

MATERIAL EXAMINED: Holotype specimen of *O. decalvata* (BHUPP 421), on soil, behind Chemistry Department, Banaras Hindu University, India, leg. K.B. Khare, 8 Sept. 1967.

4. **Octospora euchroa** (P. Karst) Berthet, Bull. Mens. Soc. Linn. Lyon 34: 228. 1965. Plate 11, Figs 5-8

≡ *Peziza euchroa* P. Karst., Mycol. Fenn., in Finlands Natur Folk 19: 46. 1871.

Apothecia scattered on soil, 3-6 mm diam, shallowly cupulate, sessile, pale yellow; externally smooth, concolorous with the hymenium. In section, hymenium 160-200 µm thick; subhymenium 30-40 µm thick, of short angular cells; medullary excipulum 80-300 µm thick, of textura angularis, cells elongate to irregular, 10-20 µm wide; ectal excipulum 40-70 µm thick, also of textura angularis but cells smaller (8-12 µm diam). Asci J-, 8-spored, cylindrical, narrowing below into a short base, 150-200 × 10-13 µm. Ascospores hyaline, ellipsoid, smooth, uni- to biguttulate, uniseriate, straightly or obliquely arranged, 15-22 × 8-10 µm. Paraphyses hyaline, straight, septate, usually once to twice branched near the base, up to 5 µm wide at their apices.

MATERIAL EXAMINED: P.A. Karsten Nos. 816, 3009, 3010, 3011 & 3012, all on soil, leg. P.A. Karsten, 19 Aug. 1869 (H).

All five collections of this species were found to be identical. P.A.K. No. 3010 has sufficient apothecia in a good condition and is, therefore, here designated as **lectotype** specimen for this species. The combination of spore morphology, guttulation and a raised margin are helpful in identification. *O. euchroa* has been cultured by Berthet (1964) who reported it to have 1-4 nuclei in each cell of the paraphyses and 10-15 nuclei in the cells of the vegetative mycelium.

5. **Octospora humosa** (Fr. : Fr.) Dennis, British Cup Fungi: 33. 1960.

Plate 3, Figs 5-8

≡ *Peziza humosa* Fr. : Fr., Syst. mycol. 2: 71. 1822.

≡ *Aleuria humosa* (Fr. : Fr.) Gillet, Champ. Fr., Discomycètes: 56. 1879.

≡ *Humaria humosa* (Fr. : Fr.) Quélet, Enchiridion Fung.: 289. 1886.

≡ *Leucoloma humosum* (Fr. : Fr.) Lambotte, Fl. mycol. Belg.: 317. 1888.

Apothecia 2-3.5 mm diam, sessile, shallowly cupulate, orange-yellow; externally lighter, minutely tomentose; margin fringed, crenate and raised. In section, hymenium 225-280  $\mu\text{m}$  thick; subhymenium 50-70  $\mu\text{m}$  thick, of *textura intricata*, intermixed at places with short, irregular to elongate cells, staining deeply in cotton blue; medullary excipulum 80-750  $\mu\text{m}$  thick, of *textura prismatica*, with broad, rectangular hyphal cells vertically oriented, particularly in the middle, staining poorly in cotton blue; ectal excipulum 50-100  $\mu\text{m}$  thick, of *textura intricata*, the hyphal cells similar to those in the medullary excipulum; margin of similar or of slightly longer cells, protruding beyond the hymenium; tomentum hyphae short, colourless, septate, 5-8  $\mu\text{m}$  wide. Asci J-, 8-spored, narrowing below into a short attenuated base, 225-275  $\times$  16-20  $\mu\text{m}$ . Ascospores hyaline, broadly ellipsoidal, smooth, usually with one large guttule, uniseriate, straightly or obliquely arranged, 23-28  $\times$  16-20  $\mu\text{m}$ . Paraphyses simple or branched once near the base, hyaline, septate, with occasionally bifurcate, slightly bent and 6-9  $\mu\text{m}$  wide apices.

MATERIAL EXAMINED: Fungi Brit. Exsicc. No. 476 as *Peziza humosa* Fr., on soil, leg. C.R. Broome (FH).

Since Fries's specimen of this species is no longer extant (pers. comm. Prof. J.A. Nannfeldt), Fungi Brit. Exsicc. No. 476 being the oldest available is designated here the **neotype** for this species. The medullary excipulum in Cooke's specimen of this species is composed of *textura prismatica*, cells are brick-shaped, whereas in Dennis's specimen as illustrated by Rifai (1968) the cells were more variable both in shape and size. Ascospores were slightly smaller and paraphyses were curved in Dennis's fungus. Except for these differences, both specimens agree reasonably well. Itzerott (1981) found this species growing among *Polytrichum* sp. Caillet & Moyne (1987a), and Benkert (1993) described the species associated with many moss genera. *O. humosa* causes rhizoid galls on *Pogonatum aloides*, which resemble gemmae (Döbbeler & Itzerott 1981).

6. **Octospora indica** (K.S. Thind, E.K. Cash & P. Singh) D.C. Pant & Tewari, *Canad. J. Bot.* 56: 2118, 1978. Plate 2, Figs 1-7

≡ *Humarina indica* K.S. Thind, E.K. Cash & P. Singh, *Mycologia* 51: 463. 1959.

Apothecia scattered on soil, 5-10 mm diam, sessile, shallowly cupulate when young becoming discoid at full maturity; hymenium completely black; externally concolorous with the hymenium, finely pustulate and tomentose; margin crenate. In section, hymenium 140-220  $\mu\text{m}$  thick; subhymenium and medullary excipulum not distinguishable, together 60-280  $\mu\text{m}$  thick, of loose *textura intricata*, hyphae pale olive-brown, septate, 4-9  $\mu\text{m}$  wide; ectal excipulum 40-120  $\mu\text{m}$  thick, of *textura angularis*, cells brownish, 5-20  $\mu\text{m}$  thick, pustules formed of extension of ectal excipulum, of smaller and more or less globose cells; margin raised beyond the hymenium, also of *textura angularis*; tomentum hyphae hyaline, septate, 3-5  $\mu\text{m}$  wide. Asci J-, 8-spored, cylindrical, gradually narrowing below into a long base, 150-225  $\times$  9-13  $\mu\text{m}$ . Ascospores hyaline, ellipsoid, smooth, uni- to biguttulate, uniseriate, straightly or obliquely arranged, 9-15  $\times$  6-8  $\mu\text{m}$ . Paraphyses appearing pale brown in mass, curved or irregularly hooked, incrustated

and agglutinated at the top, up to 5  $\mu\text{m}$  thick at the apices, 1-3 times branched near the base.

MATERIAL EXAMINED: Holotype specimen of *Humarina indica*, on soil among mosses, Kanatal, Mussoorie, India, 22 Aug. 1956 (BPI). BHUPP 550, on soil, Shitalakhet, Almora, India, leg. V.P. Tewari, 15 Aug. 1967. BHUPP 1147, on soil, Dhobitalab, Ranikhet, India, leg. K.B. Khare, 11 Nov. 1969.

This is only dark-coloured *Octospora* which has a finely pustulate outer surface. Its closest relative is *O. plumbeo-atra* from which it differs in its pustulate surface and curved paraphyses.

7. ***Octospora insignispora*** (Boud. & Torrend) Tewari & Pant, Mycologia 58: 61. 1966. Plate 4, Figs 1-7

≡ *Humaria insignispora* Boud. & Torrend, Bull. Trimestriell Soc. Mycol. Fr. 27: 131. 1911.

Apothecia scattered, 4-9 mm diam, shallowly cupulate when young, becoming discoid to flattened in age; hymenium yellowish orange to deep orange; externally concolorous with the hymenium, smooth. In section, hymenium 185-225  $\mu\text{m}$  thick, yellowish orange due to pigmentation of paraphyses; subhymenium and medullary excipulum not distinguishable, together 65-375  $\mu\text{m}$  thick, of *textura intricata*, hyphae septate, 10-15  $\mu\text{m}$  wide, filled with dense protoplasm, closely intertwined near the subhymerial region; ectal excipulum 40-75  $\mu\text{m}$  thick, of *textura angularis*, 1-3 layers of angular to subglobose cells (12-40  $\mu\text{m}$  diam). Asci J-, 8-spored, cylindrical, narrowing below into a short base, 175-200  $\times$  12-15  $\mu\text{m}$ . Ascospores subhyaline, broadly ellipsoidal, sculptured, with markings in the form of long, straight to curved, free or occasionally anastomosing ridges, biguttulate when young, later droplets uniting into one large guttule, uniseriate, obliquely arranged, 17-22  $\times$  12-14  $\mu\text{m}$  (including ridges). Paraphyses simple or branched 1-2 times in the lower half, filled with orange granules, with 5-9  $\mu\text{m}$  thick, clavate apices.

MATERIAL EXAMINED: BHUPP 697, on soil, Aurangabad, Bihar, India, leg. V.P. Tewari & K.B. Khare, 15 July 1968. BHUPP 709, on soil among mosses, Varanasi, India, leg. K.B. Khare, 27 July 1968. BHUPP 714, on laterite soil, Forest Road, Dongia, Mirzapur, India, leg. V.P. Tewari, M. Lal & R.A. Singh, 28 July 1968. BHUPP 804, on soil, Dhobitalab, Ranikhet, India, leg. D.C. Pant & R.N. Singh, 31 July 1968. BHUPP 1037, on soil, Rajdari, Chakia, Varanasi, India, leg. V.P. Tewari & R.N. Singh, 20 July 1969. BHUPP 1187, on soil, Kalakhet, Ranikhet, India, leg. V.P. Tewari, 17 Aug. 1969.

This beautiful species was collected several times in the month of July and August both from plains and hills (2000 m alt.), more often on bare soil rather than soil among mosses. In the field the species may be confused with species of *Aleuria* because of its bright orange apothecia, but microscopically it is recognized at once by its characteristic spore markings: long straight to curved, free or occasionally anastomosing ridges spread over the surface. The type specimen of this species collected by Boudier in Portugal is fragile and scanty and could not be sent to the author for comparative study, but the original description given by Boudier & Torrend (op. cit.), an illustrated account of spore markings by Le Gal (1947) and an illustrated description of this species by Tewari & Pant (1966) leave no doubt about its identity. Tewari & Pant (op. cit.) described both ectal and medullary excipulum to be composed

of *textura angularis*. After examining several collections of this species, the author found only the ectal excipulum to be of *textura angularis*, whereas the medullary excipulum is of *textura intricata*, with thick, septate, 10-15 µm wide hyphae. Eckblad (1968) described *O. pleurozii* Eckblad on *Pleurozium schreberi* with more or less similar markings. However, the substipitate apothecia, special substrate and smaller ascospores differentiate Eckblad's species from *O. insignispora*. *O. gigantea* K.S. Thind & Waraitch (Thind & Waraitch 1971), later transferred to *Aleuria* by Moravec & Kaushal (in Kaushal 1976), is very similar to *O. insignispora* and may be synonymized with this species. Moravec (1980) confirmed this synonymy.

#### 8. *Octospora insolita* K.B. Khare, Norw. J. Bot. 22: 263.1975.

This species was described and illustrated by Khare (1975a). *O. insolita* is a very distinctive species because of its *textura prismatica* in the ectal zone and the presence of a short stipe. The tissue is reminiscent of that found in many inoperculate discomycetes belonging to *Hymenoscyphus*. Creamy-white, substipitate apothecia scattered on leaves, a medullary excipulum of *textura intricata* and an ectal excipulum of *textura prismatica*, operculate, cylindrical asci with oval, smooth ascospores characterize this species.

MATERIAL EXAMINED: BHUPP 1261 (holotype), on rotten leaves, road-side forest, Dehradun, India, leg. K.B. Khare, 23 Aug. 1969.

#### 9. *Octospora ithacaënsis* (Rehm) K.B. Khare, Norw. J. Bot. 22: 111. 1975.

≡ *Humaria ithacaënsis* Rehm, Ann. Mycol. 2: 35. 1904.

≡ *Humarina ithacaënsis* (Rehm) Seaver, North Amer. Cup-Fungi (Operculates): 124. 1928.

≡ *Neottiella ithacaënsis* (Rehm) Schweers, Rev. Mycol. 10: 69. 1945.

This species was described and illustrated by Khare (1975b). Schweers (1945) transferred it to *Neottiella* based on the study of superficially similar fungus also growing on *Marchantia polymorpha* near Mook, the Netherlands. Schweers had not seen the type specimen of Rehm's species and described his fungus as ectoparasitic, with the apothecia resembling perithecia and with abundant filiform, septate hairs on the under surface. However, in the holotype specimen of *Humaria ithacaënsis* Rehm, apothecia were found to be externally smooth and in this respect different from Schweers's material which is conspicuously hairy. Rehm (1904) correctly described the apothecia as 'glabra'.

This species can be distinguished from other species of *Octospora* by growing on the liverwort, *Marchantia polymorpha*, and having smaller apothecia, below 1 mm diam, finely verrucose, ellipsoidal ascospores, and an excipular tissue of isodiametric cells. Döbbeler (1979) observed that this species produced appressoria and haustoria in rhizoids of *M. polymorpha*. Benkert (1998c) discussed ecological and taxonomical aspects of this rare species.

MATERIAL EXAMINED: Holotype specimen of *Humaria ithacaënsis* Rehm, on *Marchantia polymorpha*, Ithaca, leg. E.J. Durand, 9 May 1902 ex Herb. Rehm No. 1357 (S).

10. **Octospora kanousae** Tewari & D.C. Pant, Mycologia 58: 60: 1966.

Plate 7, Figs 6-8

Apothecia 2-3 mm diam, scattered to gregarious, sessile, attached to the soil by a broad base; hymenium pale yellow to orange, discoid; externally lighter or concolorous with the hymenium, smooth. In section, hymenium 250-275  $\mu\text{m}$  thick (cotton blue mount); subhymenium 18-35  $\mu\text{m}$  thick, of small, narrow-elongate cells; medullary and ectal excipulum not distinguishable, together 250-400  $\mu\text{m}$  thick, of textura angularis, cells larger towards outside; basal hyphae septate and hyaline. Asci J-, 8-spored, cylindrical with attenuated base, 230-260  $\times$  16-20  $\mu\text{m}$ . Ascospores hyaline, oval to broadly ellipsoidal, biguttulate, verrucose, uniseriate, 15-23  $\times$  12-14  $\mu\text{m}$ . Paraphyses hyaline, septate, filled with yellowish granules, protruding 15  $\mu\text{m}$  beyond the hymenium.

MATERIAL EXAMINED: Holotype specimen of *O. kanousae* (BHUPP 6), on soil, Rai Bareilly, India, leg. V.P. Tewari, Dec. 1958.

Tewari & Pant (1966) considered *O. kanousae* closer to *Humaria subhepatica* Rehm, which they wrongly stated to be rough-spored. The study of the type specimen of *H. subhepatica* (Sydow, Mycoth. March. 967, S) showed it to be smooth-spored; it is thus quite distinct from *O. kanousae*, the ascospores of which are verrucose. *O. kanousae* resembles *O. orthotrichi* in spore markings but differs from it in habit, shape of the ascospores and type of tissue in the medullary excipulum. *O. kanousae* grows on soil, has ellipsoidal ascospores, and the medullary excipulum is of textura intricata. *O. orthotrichi* has subglobose ascospores and a medullary excipulum of textura angularis.

11. **Octospora leucoloma** Hedw., Descr. Musc. Frond. 2: 13. 1789 : Fries, Syst. mycol. 2: 71. 1822.

Korf (1954) designated *O. leucoloma*, the lectotype of *Octospora*. Detailed illustrated accounts of this species were given by Rifai (1968), Dennis & Itzerott (1973), and Khare & Tewari (1975). Dennis & Itzerott (1973) pointed out six misdeterminations of *O. leucoloma*. Khare & Tewari (1975), while designating a neotype specimen (Fuckel Fungi rhen. No.1219, FH), examined many old collections from different parts of the world and listed four additional misdeterminations of *O. leucoloma*. However, no confusion about its identity should occur after our characterization of this species. Dennis & Itzerott (1973) described a new variety, *O. leucoloma* var. *crosslandii* Dennis & Itzerott (later changed to *O. crosslandii* (Dennis & Itzerott) Benkert), which, according to them, would differ very slightly from *O. leucoloma* in having smaller ascospores; but they still are within the range as observed in the neotype specimen (Khare & Tewari 1975). This new variety, growing among *Barbula recurvirostra*, would also differ from *O. leucoloma* by its association with a different moss genus, its different fruiting season and having a somewhat obconical receptacle. Apothecia of *O. leucoloma* as reported by Dennis & Itzerott, occur in cushions of *Bryum argenteum*, whereas Rifai (1968) described a collection of this species growing on *Funaria*. Benkert (1995) described *O. crosslandii* growing on soil among the

moss genera *Barbula*, *Phascum*, *Pottia*, and *Bryoerythrophyllum*. It seems that, except for different moss hosts, *O. leucoloma* and *O. crosslandii* are similar.

12. ***Octospora leucolomoides*** (Rehm) K.B. Khare & Tewari, *Canad. J. Bot.* 56: 2118. 1978. Plate 3, Figs 1-4

≡ *Humaria leucolomoides* Rehm, in Rabenh. Krypt. Fl. 1 (3): 938. 1896.

Apothecia on soil, sessile, scattered or gregarious, 2-5 mm diam (up to 15 mm according to Rehm), cupulate, becoming convoluted due to mutual pressure; hymenium yellowish orange, externally lighter and tomentose. In section, hymenium 200-225 µm thick, subhymenium 40-60 µm thick, of *textura intricata*, hyphae thin, septate and intermixed with short angular cells; medullary and ectal excipulum not distinguishable, together 150-900 µm thick, also of *textura intricata*, hyphae septate, 8-12 µm wide, loosely interwoven, becoming parallel towards the margin; tomentum hyphae colourless, septate, thick-walled, 7-10 µm wide; margin slightly raised beyond the hymenium and of long hyphoid cells. Asci J-, 8-spored, cylindrical, narrowing below into a long stem-like base, 180-212 × 12-15 µm. Ascospores hyaline, broadly ellipsoidal with rounded end, smooth, usually with one large guttule, uniseriate, obliquely arranged, 18-23 × 9-12 µm. Paraphyses hyaline, straight, septate, branched 1-2 times at the lower portion, up to 6 µm thick at their apices.

MATERIAL EXAMINED: Holotype specimen of *Humaria leucolomoides* Rehm, Rehm Ascom. 351, labeled as *Leucoloma hedwigii* Fuckel on soil, 11 Nov. 1876 (S).

Rehm called this species *Leucoloma hedwigii* Fuckel in the exsiccatum (Rehm Ascom. 351, S) but later in 1896 he changed the name to *Humaria leucolomoides* after finding that his fungus was different from that of Fuckel. Moser (1963) doubtfully synonymized *H. leucolomoides* with *O. humosa*. Dennis & Itzerott (1973) also treated this species as a synonym of *O. humosa*. *H. leucolomoides* has a medullary excipulum quite different from that of *O. humosa*. Rehm (op. cit) related this species as similar to *Peziza euchroa* P. Karst., *P. fibrillosa* Curr. and *P. luculenta* Cooke. The author has not seen Currey's and Cooke's specimens but examined Karsten's type specimen of *P. euchroa* (P.A. Karsten. No. 3010, on soil, leg. P.A. Karsten, 19 Aug. 1869, H) which is quite distinct from the present species in having externally glabrous apothecia, an excipulum of *textura angularis* throughout, and biguttulate ascospores.

*O. leucolomoides* may be distinguished by its characteristic medullary excipulum of *textura intricata*, cupulate medium-sized apothecia with a tomentose external surface, and uniguttulate, broadly ellipsoidal ascospores.

13. ***Octospora limbata*** (Wallr.) K.B. Khare & Tewari, *Canad. J. Bot.* 56: 2118. 1978. Plate 5, Figs 1-4

≡ *Peziza limbata* Wallr., Fl. Crypt. Germ. 2: 470. 1833.

Apothecia scattered or gregarious, 2-5 mm diam, sessile; hymenium pale yellow, saucer-shaped to discoid or appanate with crenate to irregular margin; external surface

finely tomentose, concolorous with the hymenium. In section, hymenium 195-240 µm thick; margin slightly raised beyond the hymenial layer; subhymenium 30-50 µm thick, of small angular cells which become elongate towards the margin; medullary and ectal excipulum not distinguishable, together 75-500 µm thick, of textura angularis, cells 10-25 µm thick, angular to irregular, slightly larger towards the outside; tomentum hyphae septate, thin-walled, 3-6 µm wide. Asci J-, 8-spored, cylindrical to slightly clavate, tapering below into a short base, 150-250 × 15-20 µm. Ascospores hyaline, ellipsoid-fusoid, smooth, usually with a single large guttule (rarely 2 or 3), guttule masking the spore at maturity, uniseriate, irregularly or obliquely arranged, 20-26 × 10-14 µm. Paraphyses hyaline, septate, straight, 1-3 times branched, 3-5 µm wide at their apices, and projecting 6-10 µm beyond the hymenial layer.

MATERIAL EXAMINED: *Humarina ollaris* (Fr.) Seaver, on soil in pots in greenhouse, leg. F.J. Seaver, 19 May 1928 (NY).

The specimen of *Humarina ollaris* (Fr.) Seaver (NY) is, in reality, *Peziza limbata*. Rehm (1896, p. 939) listed *Peziza undella* var. *ollaris* Fr. as synonym of *P. limbata*. A collection of *P. limbata* was sent by Hennings to Rehm (now in S!) which, from the description given by Rehm, perfectly agrees with Seaver's specimen of *H. ollaris* (Fr.) Seaver. Incidentally, both Hennings' and Seaver's fungi were growing in flower pots in the Botanical Gardens of Kiel and New York, respectively. Fries's species cited by Seaver and Rehm is an entirely different fungus. On examination, Rabenh. Herb. No. 423, as *Peziza ollaris* Fr. (FH) proved to be a species of *Byssonectria* P. Karst.

#### 14. *Octospora moravecii* K.B. Khare, Canad. J. Bot. 54: 964. 1976.

This species was described and illustrated by Khare (1976). *O. moravecii* is based on Moravec's specimen of *O. wrightii* (Berk. & M.A. Curtis) Moravec (PRM No. 770326) which has become the holotype of this species. Moravec (1969) erroneously transferred *Peziza wrightii* Berk. & M.A. Curtis to *Octospora* without examining the type specimen. The type specimen of *P. wrightii* (C. Wright No. 3139 in Curtis Herbarium, FH) is entirely different, has dentate apothecia, with a raised margin of hyphoid cells, an ectal excipulum of textura prismatica, a medullary excipulum of textura intricata, and ascospores provided with short pointed warts. *O. moravecii* has, however, an unraised margin, the excipulum is of textura angularis, and the ascospores are smaller. The fungus is reported to produce appressoria and haustoria in the rhizoids of *Amblystegium serpens* (Döbberler 1979).

MATERIAL EXAMINED: Isotype, PRM No. 770326, under the name *Octospora wrightii*, leg. J. Moravec, 24 June 1967 (Isotype: BHUPP 1376).

#### 15. *Octospora musci-muralis* Graddon, Trans. Brit. Mycol. Soc. 58: 147. 1972. Plate 6, Figs 4-7

Apothecia growing among *Grimmia pulvinata*, up to 2.5 mm diam, sessile; hymenium shallowly cupulate to applanate, pale orange; externally lighter than the hymenium,

smooth. In section, hymenium 150-200 µm thick; subhymenium and medullary excipulum not distinguishable, together 75-135 µm thick, of *textura intricata*, hyphae septate, 5-6 µm wide, becoming narrower and short-celled at the base of the hymenium; ectal excipulum 50-100 µm thick, of *textura angularis*, cells 10-20 µm diam; margin fringed, raised beyond the hymenium, of long, narrow apically free cells (15-40 × 8-13 µm); basal hyphae colourless, septate, 5-6 µm wide. Asci J-, 8-spored, clavate-cylindrical, narrowing below into a short base, 150-200 × 20-30 µm. Ascospores hyaline, ellipsoid, smooth, biguttulate when young, the guttules latter uniting to form a single elongated guttule, partially biseriate or irregularly arranged, 22-30 × 8-11 µm. Paraphyses septate, slender, branched near the bases with bifurcate, swollen (ca 4-7 µm wide) and sharply curved apices.

MATERIAL EXAMINED: Among mosses, *Grimmia pulvinata* (wrongly stated as *Tortula muralis* by Moravec, see Gradon 1972), leg. J. Moravec, Nov. 1967 (J.M.).

*O. musci-muralis* is a new name for a small, orange discomycete growing among cushions of *Grimmia* with the epithet '*rubricosa*' as described by Fuckel (1870), Rehm (1896) and Cooke (1875). Dennis (1960, 1968), Gradon (1972), and Dennis & Itzerott (1973) expressed their doubts as to the identity of the fungus on the cushions of *Grimmia* with *Peziza rubricosa* Fr. whose habitat was, according to Fries (1822), 'ad terram in pinetis inter folia decidua pini passim in Suecia'. Moravec's specimen, labeled *O. rubricosa* (Fr.) M. Moser, agrees with the description of the type specimen of *O. musci-muralis* in all details except the excipulum. The ectal excipulum in Moravec's specimen is of *textura angularis* whereas Gradon (1972), Itzerott (1981) and Caillet & Moyné (1987a) described it to be of *textura intricata*. *O. musci-muralis* infects *Grimmia pulvinata* by the formation of appressoria and haustoria (Döbbeler 1979).

16. **Octospora orthotrichi** (Cooke & Ellis) K.B. Khare & Tewari, *Canad. J. Bot.* 56: 2118. 1978. Plate 7, Figs 1-5

≡ *Peziza orthotrichi* Cooke & Ellis, *Grevillea* 6: 7. 1877 (as '*orthotricha*').

≡ *Humaria orthotrichi* (Cooke & Ellis) Sacc., *Syll. Fung.* 8: 119. 1889.

≡ *Humarina orthotrichi* (Cooke & Ellis) Seaver, *North Amer. Cup-Fungi (Operculates)*: 127. 1942.

Apothecia small, up to 0.5 mm diam, scattered, seated in the axils of mosses, sessile, shallowly cupulate to applanate; hymenium pale yellow to yellowish orange, slightly depressed; externally pale white, tomentose. In section, subhymenium and medullary excipulum together 40-80 µm thick, of *textura intricata*, hyphae septate, 5-8 µm wide, at places swelling to form intercalary and irregular cells in the medullary excipulum, the hyphae much narrower and compact in the subhymenial region; ectal excipulum 25-50 µm thick, of *textura angularis*, cells angular to elongate, 5-10 µm diam; tomentum hyphae colourless, short, septate, 3-5 µm wide, originating from the outermost cells. Asci J-, 8-spored, subclavate, narrowed below into a short attenuated base, 100-150 × 18-20 µm. Ascospores hyaline, oval to subglobose, finely verrucose or punctate, uniseriate, obliquely or irregularly arranged, 17-21 × 13-16 µm. Paraphyses straight, septate, 1-2 times branched below, with 4-6 µm wide tips.

MATERIAL EXAMINED: Holotype specimen of *Peziza orthotrichi* Cooke & Ellis, on *Orthotrichum* sp., Newfield, J.B. Ellis, No. 2546 (NY, from the Herbarium of George Masee).

The specific epithet '*orthotricha*' is changed to '*orthotrichi*' following the *Code of Nomenclature*. The association with the specific moss genus *Orthotrichum* and nearly clavate asci with broadly, verrucose ascospores are characteristic of this species. It can be distinguished from *O. wrightii* and *O. moravecii* by the shape of the asci, ascospores and the habit. This species approaches *O. melina* var. *meslinii* (Le Gal) Dennis & Itzerott in spore markings, but has broader ascospores. Caillet & Moyne (1987a) reported the occurrence of *O. melina* var. *meslinii* on *Orthotrichum diaphanum* and other moss genera, which according to Benkert (1998b) seems to be *O. orthotrichi*.

17. **Octospora peckii** (House) K.B. Khare & Tewari, *Canad. J. Bot.* 56: 2118. 1978. Plate 6, Figs 1-3

≡ *Humaria peckii* House, *Bull. New York St. Mus.* 205-206: 38. 1919.

≡ *Humarina peckii* (House) Seaver, *North Amer. Cup-Fungi (Operculates)*: 133. 1928.

Apothecia scattered on rotten hay, 2-5 mm diam, sessile, shallowly cupulate, deep orange to reddish orange, brownish on drying; externally lighter than the hymenium, slightly tomentose. In section, hymenium 125-150 µm thick; subhymenium and medullary excipulum not distinguishable, together 100-260 µm thick, of *textura intricata*, hyphae hyaline, loosely intertwined, short-celled, 4-6 µm wide, becoming narrow and compact in the subhymenial region; ectal excipulum 30-70 µm thick, of *textura angularis*, cells angular, 4-15 µm diam, smaller towards the outside; margin also of *textura angularis*, of small angular to elongated cells, slightly raised beyond the hymenial level; tomentum hyphae colourless, septate, thin-walled, 25-75 × 2 µm. Asci J-, 8-spored, cylindrical, narrowing below into attenuated or forked base, 150-175 × 8-10 µm. Ascospores hyaline, ellipsoid, smooth, uniguttulate, uniseriate, straightly or obliquely arranged, 12-15 × 7-9 µm. Paraphyses hyaline, straight, septate, 2-3 times branched, not protruding beyond the hymenium, up to 4 µm wide at their apices.

MATERIAL EXAMINED: Two collections by C.H. Peck from Menandos, New York (parts of the holotype), on damp hay, April, 1890 (NY).

Some 1-2 mm diam, orange, sclerotium-like bodies are mixed with the hay sample but probably have no connection with this fungus. Sizes of the asci and ascospores given by Seaver (1928) for this species are slightly smaller than those found in the type specimen.

18. **O. phyllogena** (Seaver) K.B. Khare & Tewari, *Canad. J. Bot.* 56: 2118. 1978. Plate 12, Figs 6-8

≡ *Humaria phyllogena* Seaver, *Mycologia*, 17: 46. 1925.

≡ *Humarina phyllogena* (Seaver) Seaver, *North Amer. Cup-Fungi (Operculates)*: 134. 1928.

Apothecia scattered, 2-3 mm diam, sessile, discoid, hymenium deep orange; externally concolorous with the hymenium, attached to mid and lateral veins of leaves by white

mycelium. In section, hymenium 145-200  $\mu\text{m}$  thick; subhymenium and medullary excipulum not distinguishable, together 60-350  $\mu\text{m}$  thick, of *textura intricata*, hyphal cells indistinct, agglutinated; ectal excipulum 15-38  $\mu\text{m}$  thick, of *textura angularis*, cells short angular to elongate, 5-10  $\mu\text{m}$  thick; mycelium at the base hyaline, sparsely septate, 4-7  $\mu\text{m}$  wide. Asci J-, 8-spored, cylindrical, gradually tapering below into a stem-like base, 155-215  $\times$  11-14  $\mu\text{m}$ . Ascospores hyaline, broadly ellipsoidal, smooth, guttules not clearly visible (biguttulate according to Seaver), uniseriate, straightly arranged, 15-20  $\times$  10-14  $\mu\text{m}$ . Paraphyses hyaline, simple, septation not visible, 2-4  $\mu\text{m}$  wide at their apices.

MATERIAL EXAMINED: Holotype specimen of *Humaria phyllogena* Seaver, on leaves, leg. F.J. Seaver & C.E. Chardon, 24 Jan. to 5 Apr. 1923 (NY). BHUPP 843, on leaves, Pantnagar, Nainital, India, leg. V.P. Tewari & K.B. Khare, 1 Oct. 1968.

*O. phyllogena* is similar to *O. waterstonii* in tissue structure, but differs from it in having a subiculum on the base of the apothecium, biguttulate ascospores and shorter asci. An Indian collection (BHUPP 843) is very similar to the type specimen of this species, except for a tendency of spores to fuse in the ascus forming a much larger spore, and lower numbers of spores in the ascus; the spores are biguttulate and the asci are 20-30  $\mu\text{m}$  longer than in the type.

19. ***Octospora plumbeo-atra*** (E.K. Cash) D.C. Pant & Tewari, *Canad. J. Bot.* 56: 2118. 1978.

Plate 8, Figs 4-8

= *Humarina plumbeo-atra* E.K. Cash, *Mycologia* 40: 726. 1948.

Apothecia scattered to gregarious, 2-10 mm diam, shallowly cupulate, becoming flattened in age; hymenium deep violet to violet-black; externally concolorous or slightly darker than the hymenium, smooth; margin slightly crenate. In section, hymenium pale violet, 150-180  $\mu\text{m}$  thick; subhymenium 25-40  $\mu\text{m}$  thick, of short angular to elongated cells; medullary excipulum 50-100  $\mu\text{m}$  thick, of *textura intricata*, of septate, closely interwoven, 4-6  $\mu\text{m}$  wide hyphae; ectal excipulum 40-70  $\mu\text{m}$  thick, of *textura angularis*, with more or less isodiametric, 8-15  $\mu\text{m}$  diam cells, violet-brown; margin also of *textura angularis*, slightly raised beyond the hymenium. Asci J-, contents turning reddish brown in iodine, 8-spored, cylindrical, narrowing below into a short, bifurcate or gradually tapered base, 150-175  $\times$  10-11  $\mu\text{m}$ . Ascospores with a violet tinge, ellipsoid, with a guttule on each end, smooth, uniseriate, straightly or obliquely arranged, 12-15  $\times$  7-9  $\mu\text{m}$ . Paraphyses subhyaline, straight, septate, 1-3 times branched near the base, mostly with irregular swellings at the tips and 6-10  $\mu\text{m}$  wide apices, protruding beyond the hymenium by 12-15  $\mu\text{m}$ .

MATERIAL EXAMINED: Holotype specimen of *Humarina plumbeo-atra*, on soil, Ladhar, Sheikhpura, Punjab, Pakistan, leg. S. Ahmad (1640), 8 July 1946 (BPI). BHUPP 201, on soil, roadside, in front of Rajputana Hostel, Banaras Hindu University, leg. V.P. Tewari & D.C. Pant, 20 July 1964; and five other collections, BHUPP 401, 691, 693, 700 & 1027, all on soil, in the campus of the Banaras Hindu University, India.

This species was found every year during rains from July to September growing on soil in the campus of the Banaras Hindu University. An examination of the type specimen from BPI showed that the apothecia are actually 1-2 mm diam. The contents

of young asci are light brown and the flesh of the apothecia when treated with 2% KOH releases violet pigment. These characters which are common to Indian collections as well as the type specimen, however, were not mentioned by Cash (1948). On comparison with the type specimen, our collections of this species agree quite well in anatomical and morphological details except for the size of the apothecia. Apothecia in our collections vary from 2-10 mm diam and the asci are slightly narrower than those of the type specimen.

20. ***Octospora pumilata*** K.B. Khare, *Canad. J. Bot.* 54: 960. 1976.

This species was treated in detail by Khare (1976). *O. pumilata* can be easily distinguished from other species of *Octospora* by its unraised apothecial margin, the excipulum of textura angularis, subglobose, smooth ascospores and straight paraphyses. This species is close to *O. subglobispora* Benkert (Berkert 1997).

MATERIAL EXAMINED: Holotype specimen, Sydow Mycoth. March. 882 (labelled as *Leucoloma hedwigii* Fuckel), on soil (FH).

21. ***Octospora purpurea*** (Seaver) K.B. Khare & Tewari, *Canad. J. Bot.* 56: 2118. 1978. Plate 8, Figs 1-3

≡ *Humarina purpurea* Seaver, *North Amer. Cup-Fungi (Operculates)*: 138. 1928.

Apothecia 1-2 mm diam, brownish black in dried condition, purplish brown when revived in water, shallowly cupulate to discoid, sessile; outer surface concolorous with the hymenium, finely tomentose. In section, hymenium 118-150  $\mu\text{m}$  thick; subhymenium 15-20  $\mu\text{m}$  thick, subhyaline, of short angular cells; medullary excipulum 20-50  $\mu\text{m}$  thick, subhyaline to pale brown, of textura angularis, cells elongate to angular, 8-15  $\mu\text{m}$  thick; ectal excipulum 25-65  $\mu\text{m}$  thick, dark brown, also of textura angularis, cells slightly larger, 10-20  $\mu\text{m}$  thick, with brown walls; margin not raised, similar to the ectal excipulum; tomentum of 2-5  $\mu\text{m}$  wide hyphae, colourless, septate, smooth, thin-walled, originating from the outermost cells. Asci J-, 8-spored, cylindrical, narrowing into a short base, 125-160  $\times$  7-10  $\mu\text{m}$ . Ascospores subhyaline to pale olivaceous, broadly ellipsoidal, marked with fine small warts, often uniting to form an inconspicuous reticulum, the warts sometimes projecting at the ends to form short apicules, with a single large central guttule, uniseriate, straightly or obliquely arranged, 11-16  $\times$  7-10  $\mu\text{m}$ . Paraphyses subhyaline, straight, septate, dichotomously branched once or twice in the middle part or near the tips, pigmented with dark brown granules, apices up to 4  $\mu\text{m}$  thick, not protruding beyond the hymenial layer.

MATERIAL EXAMINED: Holotype specimen of *Humarina purpurea* Seaver, on soil, Colorado, U.S.A., leg. E. Bethel, 1914 (NY).

*Octospora purpurea* is the only species of *Octospora* with dark-coloured apothecia and ornamented ascospores. Ascospores are marked with fine warts which often unite to form an inconspicuous reticulum. Unfortunately the preservation of the type specimen is not very good, therefore, many of the finer details of tissues structure were not clearly visible.

22. **Octospora rubens** (Boud.) M. Moser, Ascomyceten. Kleine Kryptogamenflora  
2a: 111. 1963. Plate 10, Figs 7-11

- ≡ *Humaria rubens* Boud., Bull. Trimestriell Soc. Mycol. Fr. 12: 13. 1896.
- ≡ *Humarina rubens* (Boud.) Seaver, North Amer. Cup-Fungi (Operculates): 127. 1928.
  - = *Humaria sanguinea* Velen., Monogr. Discomycetum Bohemiae: 325. 1934.
  - = *Humaria rustica* Velen., Monogr. Discomycetum Bohemiae: 327. 1934.
- ≡ *Octospora rustica* (Velen.) J. Moravec, Česká Mykol. 23: 226. 1969.
  - = *Octospora libussae* Svrček & Kubička, Česká Mykol. 17: 65. 1963.

Apothecia scattered among mosses, 1-2 mm diam, globose when young, becoming slightly cupulate or plane in age, sessile; hymenium deep orange; externally concolorous with the hymenium, smooth. In section, hymenium 190-200  $\mu\text{m}$  thick; subhymenium 20-40  $\mu\text{m}$  thick, of short angular cells; medullary excipulum 30-120  $\mu\text{m}$  thick, of textura angularis, cells irregular to polyhedral, 12-25  $\mu\text{m}$  wide; ectal excipulum 25-60  $\mu\text{m}$  thick, also of textura angularis, but of smaller cells (8-12  $\mu\text{m}$  diam); margin slightly fringed, of clavate, hyphoid cells, 20-30  $\times$  5-9  $\mu\text{m}$ . Asci J-, 8-spored, cylindrical, narrowing below into a short attenuated base, 175-212  $\times$  10-13  $\mu\text{m}$ . Ascospores hyaline, broadly ellipsoidal, usually with one large guttule, almost filling the spore, smooth, uniseriate, straightly or obliquely arranged, 14-16  $\times$  9-12  $\mu\text{m}$ . Paraphyses simple or branched below, septate, filled with orange granules which turn green in iodine, with occasionally bifurcate, slightly curved apices which are 5-8  $\mu\text{m}$  wide.

MATERIAL EXAMINED: All on soil & soil among mosses. BHUPP 464, Dhobitalab, Ranikhet, India, leg. K.B. Khare, 2 Nov. 1967; BHUPP 1341 idem, 5 Nov. 1969. BHUPP 583, Garivanpur village, Varanasi, India, leg. K.B. Khare, 29 Dec. 1967. BHUPP 1310, Bhowali, Nainital, India, leg. K.B. Khare, 2 Nov. 1969. BHUPP 1312, Bhowali, Nainital, India, leg. K.B. Khare, 2 Nov. 1969. Mladá Boleslav, Czech Republic, leg. J. Moravec, 21 Oct. 1967 (JM).

*Octospora rubens*, originally described from France, appears to be widespread, having been reported from the Czech Republic, Germany, U.S.A., U.K and India. This species was collected both on bare soil and soil among mosses in the plains of Uttar Pradesh as well as in the hills (India) at 1000-1830 m alt. This species is distinguished by small yellow-orange to bright orange, glabrous apothecia, a raised margin of hyphoid cells, uniguttulate ellipsoidal ascospores with broadly rounded ends, an excipulum of textura angularis and straight to slightly curved paraphyses. Seaver (1928), Dennis & Itzerott (1973) and Caillet & Moyne (1987a) did not mention the slight curvature of the paraphyses, which is frequently observed in the Indian collections as well as in Czech specimen of this species. Itzerott (1981), however, mentioned it for his German collection of this species. Itzerott (1981) and Benkert (1995) found it growing in association with *Ceratodon purpureus*, on the rhizoids of which it produces stalked galls (Itzerott & Döbbeler, 1982).

*Octospora roxheimii* Dennis & Itzerott which seems to be related to *O. rubens*, has longer asci, large uniguttulate, broadly ellipsoidal ascospores, 17-20  $\times$  13-15  $\mu\text{m}$ , and grows on leaves and leaf axils of the living host plant, *Funaria hygrometrica* (Dennis & Itzerott 1973; Döbbeler 1993).

23. **Octospora semiimmersa** (P. Karst.) K.B. Khare & Tewari, *Canad. J. Bot.* 56: 2118. 1978. Plate 9, Figs 1-5

≡ *Peziza semiimmersa* P. Karst., *Not. Fauna Fl. Fenn.* 10: 117. 1869.

≡ *Humaria semiimmersa* (P. Karst.) Sacc., *Syll. Fung.* 8: 143. 1889.

≡ *Humarina semiimmersa* (P. Karst.) Seaver, *North Amer. Cup-Fungi (Operculates)*: 130. 1928.

Apothecia scattered to gregarious, sessile, 3-7 mm diam, partially immersed in the soil. In section, hymenium 150-190  $\mu\text{m}$  thick; subhymenium 20-35  $\mu\text{m}$  thick, of short, polyhedral cells; medullary excipulum 75-300  $\mu\text{m}$  thick, of textura angularis, cells polyhedral to irregularly elongated, 7-20  $\mu\text{m}$  wide; ectal excipulum 40-75  $\mu\text{m}$  thick, also of textura angularis, with angular to subglobose, 12-30  $\mu\text{m}$  diam cells; tomentum hyphae hyaline, flexuous, septate, 5-8  $\mu\text{m}$  wide, originating from the outermost subglobose cells. Asci J-, 8-spored, cylindrical to slightly clavate, narrowing below into a short stem-like base, 160-200  $\times$  12-20  $\mu\text{m}$ . Ascospores hyaline, ellipsoid, smooth, biguttulate (rarely 3), mostly uniseriate, rarely partially biseriate or irregular, obliquely arranged, 18-27(-32)  $\times$  9-13(-17)  $\mu\text{m}$ . Paraphyses hyaline, simple, septate, not protruding beyond the hymenium.

MATERIAL EXAMINED: Holotype specimen of *Peziza semiimmersa* P. Karsten, on soil, leg. P. Karsten, 22 July 1869 (H).

Benkert (1987b) treated this species under *Inermisia* Rifai (*I. semiimmersa* (P. Karst.) D. Benkert) which is now a synonym to *Byssonectria* P. Karst. (Pfister 1993). *Byssonectria* as presently circumscribed is considered to include non-bryophilic species having fusoid ascospores with polar wall thickenings, apothecia clustered on a loose or dense subiculum. *O. semiimmersa*, though non-bryophilic, does not fit *Byssonectria* (= *Inermisia*) in other characters. This species is distinguished from other species of *Octospora* in having apothecia partially immersed in the soil, externally tomentose, smooth, ellipsoidal, biguttulate, ascospores, and an excipulum of textura angularis.

24. **Octospora subhepatica** (Rehm) K.B. Khare & Tewari, *Mycologia* 67: 975. 1975. Plate 11, Figs 1-4

≡ *Humaria subhepatica* Rehm, in *Rabenh. Kryptog. Flora*, 2. Aufl., 1(3): 948. 1896.

Apothecia scattered, 2-3 mm diam, sessile, shallowly cupulate to applanate, yellow white throughout; externally concolorous with the hymenium, finely tomentose. In section, hymenium 185-240  $\mu\text{m}$  thick; subhymenium 30-50  $\mu\text{m}$  thick, of short angular cells, cells 4-8  $\mu\text{m}$  diam, irregularly arranged; medullary and ectal excipulum not distinguishable, together 75-350  $\mu\text{m}$  diam, of textura angularis, cells angular to slightly elongated, 10-35  $\mu\text{m}$  thick, larger towards outside; margin also of textura angularis but of smaller cells; tomentum hyphae hyaline, short, septate, 5-8  $\mu\text{m}$  wide. Asci J-, 8-spored, cylindrical to slightly clavate, narrowing below into a short base, 175-250  $\times$  14-18  $\mu\text{m}$ . Ascospores hyaline, broadly ellipsoidal with narrow ends, smooth, usually biguttulate when young, droplets later uniting into one large guttule, uniseriate, obliquely or irregularly arranged, 22-27  $\times$  12-15  $\mu\text{m}$ . Paraphyses hyaline, straight, septate, 1-3 times branched at the lower portion, mostly bifurcate at the upper part, and 3-5  $\mu\text{m}$  wide at their apices.

MATERIAL EXAMINED: Sydow, Mycoth. March. No. 967, on soil at the edge of a ditch in Grunewald near Berlin, leg. P. Sydow, Oct. 1885 (S).

Rehm (1896) described the apothecia of this species as greenish brown with incurved margin. Neither of these characters is present in the exsiccatum, and the ascospores are slightly larger than indicated by him. He doubtfully identified his fungus with *O. viridans* Hedw. but nothing is known about the latter. Spegazzini's three collections identified as *Humaria leucoloma* (LPS Nos. 27319, 27321 & 27331) are all alike and similar to Rabenhorst's *Peziza leucoloma* (Rabenhorst's Fungi Europaei No. 513, FH). These two fungi are different from *O. leucoloma* (Khare & Tewari 1975), and may belong, in the author's opinion, to the present species.

25. ***Octospora tetraspora*** (Fuckel) Korf, Mycologia, 46: 838. 1954.

Plate 10, Figs 1-6

≡ *Ascobolus tetrasporus* Fuckel, Hedwigia 5: 4. 1866.

≡ *Leucoloma tetraspora* (Fuckel) Fuckel, Jahrb. Nassau. Ver. Naturk. 23-24: 317. 1870.

≡ *Aleuria tetraspora* (Fuckel) Gillet, Champ. Fr., Discomycètes: 207. 1879.

≡ *Humaria muralis* var. *tetraspora* (Fuckel) Quélet, Enchiridion Fung.: 287. 1886.

≡ *Humaria tetraspora* (Fuckel) Sacc., Syll. Fung. 8: 121. 1889.

≡ *Humarina tetraspora* (Fuckel) Seaver, North Amer. Cup-Fungi (Operculates): 134. 1928.

≡ *Byssonectria tetraspora* (Fuckel) Korf, Phytologia 21: 204, 1971.

Apothecia either scattered or gregarious among mosses, 0.5-2 mm diam, closed when young, becoming subdiscoid to plane at maturity, sessile; hymenium yellowish orange to deep orange; externally lighter than the hymenium, slightly tomentose, adhering to the soil by a broad base. In section, hymenium 150-200 µm thick: subhymenium and medullary excipulum not distinguishable, together 40-80 µm thick, of textura angularis, cells up to 10 µm diam, thin-walled, becoming smaller towards the subhymenial zone; ectal excipulum 20-35 µm diam, also of textura angularis, cells thick-walled, slightly larger (5-15 µm diam); margin raised, of hyphoid cells (15-25 × 5-6 µm); tomentum hyphae 2-5 µm wide, short, colourless, septate, originating from the outermost cells. Asci J-, 4-spored, subclavate, narrowing below into short, stem-like, attenuated base, 125-180 × 15-20 µm. Ascospores hyaline, broadly fusoid, smooth, usually biguttulate (with one large and a small guttule), uniseriate, straightly or obliquely arranged, 18-25(-30) × 8-13(-15) µm. Paraphyses filled with reddish orange granular contents, septate, once or twice branched near the base, apices slightly clavate, 3-4 µm wide.

MATERIAL EXAMINED: Isotype specimen of *Ascobolus tetrasporus* Fuckel, Fungi rhen. No. 1856 (FH). BHUPP 585, on soil among mosses, Garivanpur village, Varanasi, India, leg. K.B. Khare, 2 Jan. 1968. BHUPP 593, on soil, behind University Press, India, leg. V.P. Tewari, R.N. Singh & K.B. Khare, 20 Jan. 1968. BHUPP 684, on soil among mosses, behind the campus of Banaras Hindu University, India, leg. K.B. Khare, 2 Feb. 1968. On soil among mosses, Mladá Boleslav, Czech Rep., leg. J. Moravec (JM).

*O. tetraspora* grows in association with *Bryum argenteum* (Itzerott 1981; Benkert 1995). However, Caillet & Moyne (1987a) described this species associated with *Bryum erythrocarpum*, *Pottia truncata* and *Phascum cuspidatum*. Benkert (1998a)

treated *O. tetraspora* as a variety of *O. leucoloma*. He was followed by Dennis & Itzerott (1973) who suggested that *O. tetraspora* growing on the same host-moss and with similar excipular tissue may be no more than a four-spored variety of *O. leucoloma*. After comparing the isotype specimen of *Ascobolus tetrasporus* Fuckel (Fuckel, Fungi rhen. No. 1856 (FH) and Fuckel Fungi rhen. No. 1219 of *Peziza leucoloma* (Hedw.) Rebert. (FH), we found the two species to differ in excipular and ascospore size and designated a neotype specimen for *O. leucoloma* (Khare & Tewari 1975). *O. leucoloma* has smaller ascospores, 16-20 × 8-12 µm, with a single large guttule, a medullary excipulum of *textura intricata* and an ectal excipulum of *textura angularis*. *O. tetraspora* however, has larger ascospores, 18-25(-30) × 8-13 (-15) µm, with one large and a small guttule, the medullary and the ectal excipulum both being of *textura angularis*.

The asci in our specimens of this species were regularly 4-spored, whereas 1-5-spored asci were found in the Norwegian specimen (Eckblad 1968). In the Czech material and the specimen described by Moser (1963), asci were found to be 4-6-spored. Indian collections of this species very much resemble Fuckel's *exsiccatum* in morphology and anatomical details. Though Fuckel pointed out that 1-6 spores may mature in each ascus, his specimen as well as our collections of this species show only 4-spored asci.

26. ***Octospora waterstonii*** (Seaver) K.B. Khare & Tewari, *Canad. J. Bot.* 56: 2118. 1978. Plate 12, Figs 1-5

≡ *Humarina waterstonii* Seaver, *Mycologia* 31: 533. 1939.

= *Humarina ziziphi* E.K. Cash, *Mycologia* 40: 727. 1948 (as '*zizyphī*').pe

Apothecia isolated or clustered, 1-5 mm diam, sessile or very short-stipitate; hymenium pale yellow to yellowish orange, shallowly cupulate; external surface pale yellow, smooth. In section, hymenium 225-300 µm thick; subhymenium and medullary excipulum not distinguishable, together 100-500 µm thick, of *textura intricata*, hyphae colourless, septate, 3-5 µm wide; ectal excipulum 35-75 µm thick, of *textura angularis*, cells angular to elongate, thick-walled, 5-18 µm thick. Asci J-, 8-spored, long-cylindrical with rounded apex, tapering below into a long stem-like, usually swollen base, 275-375(-500) × 12-18 µm. Ascospores hyaline, broadly ellipsoidal to oval, filled with numerous oil drops, smooth, uniseriate, straightly or obliquely arranged, 18-28 × 11-17 µm. Paraphyses simple, septate, not protruding beyond the hymenial layer, up to 4 µm wide at their apices.

MATERIAL EXAMINED: Holotype specimen of *Humarina waterstonii*, Bermuda Fungi No. 10, on partially buried seeds of *Livistona chinensis*, leg. F.J. Seaver and J.M. Waterston, 28 Nov. 1938 (NY). Holotype specimen of *Humarina ziziphi*, on dead branches of *Ziziphus jujuba*, Ladhar, Sheikhpura, Punjab, Pakistan, leg. S. Ahmad (No. 419), 23 Sept. 1941 (BPI). BHUPP 217 & 221, on rotten leaves and twigs, Botanical Garden, Banaras Hindu University, India, leg. V.P. Tewari & D.C. Pant, 21, 31 Aug. 1964. BHUPP 409, on twig of *Inga* sp., Botanical Garden, Banaras Hindu University, India, leg. V.P. Tewari, 24 Aug. 1967. BHUPP 415 & 594, on rotten twigs, near Banaras Hindu University Press, leg. K.B. Khare, V.P. Tewari & R.N. Singh, 27 Aug. 1967 & 21 Jan. 1968. BHUPP 696, on twig, National Park, Chhipadaur, Palamu, Bihar, India, leg. V.P. Tewari & K.B. Khare, 14 July 1968. BHUPP 701, on leaves & twigs, in front of Plant Physiology Lab., Banaras

Hindu University, India, leg. K.B. Khare, 19 July 1968. BHUPP 715, on rotten woods, Botanical Garden, Banaras Hindu University, India, 30 July 1968.

This species was originally reported on buried seeds of *Livistona chinensis* from Bermuda, West Indies. Cash (1948) redescribed the species as *Humarina ziziphi* on stones and twigs of *Ziziphus jujuba* from the Punjab. This species has been collected on many other types of plant remains like pods of *Inga dulcis*, mango twigs and fruits etc. The species can be identified by its ascospores which are filled with many oil drops, its habitat on plant remains and usually long and distinctly operculate asci.

27. **Octospora wrightii** (Berk. & M.A. Curtis) Moravec, *Česká Mycol.* 23: 227. 1969. Plate 13, Figs 1-6

≡ *Peziza wrightii* Berk. & M.A. Curtis, *Ann. Mag. Nat. Hist.* III, 15: 444. 1865.

≡ *Barlaea wrightii* (Berk. & M.A. Curtis) Sacc., *Syll. Fung.* 8: 112. 1889.

≡ *Humaria wrightii* (Berk. & M.A. Curtis) Boud., *Hist. Classif. Discom.* Eur. 68: 1907.

≡ *Lamprospora wrightii* (Berk. & M.A. Curtis) Seaver, *Mycologia* 6: 15: 1914.

Apothecia scattered in axils of mosses, 0.5-1 mm diam, shallowly cupulate to slightly discoid, sessile; hymenium yellowish orange; externally lighter than the hymenium; margin dentate. In section, hymenium 150-200  $\mu\text{m}$  thick; subhymenium and medullary excipulum together 40-125  $\mu\text{m}$  thick, of *textura intricata*, hyphae colourless, septate, 3-5  $\mu\text{m}$  wide, thinner and more compact in the subhymenium; ectal excipulum 30-50  $\mu\text{m}$  thick, of *textura prismatica*, cells 12-30  $\times$  4-5  $\mu\text{m}$ , extending up to the raised margin; basal anchoring hyphae colourless, septate, thick-walled, 5-8  $\mu\text{m}$  wide, not easily staining with the cotton blue. Asci J-, 8-spored, cylindrical with broad apices, narrowing below into a short base, 150-190  $\times$  16-22  $\mu\text{m}$ . Ascospores hyaline, subglobose to broad ellipsoidal, usually with one large guttule, marked with closely arranged, up to 1  $\mu\text{m}$  high warts, uniseriate, 18-23  $\times$  14-20  $\mu\text{m}$ . Paraphyses straight, septate, simple to branched in the lower part, often with bifurcate ends, 4-6  $\mu\text{m}$  wide at the apices.

MATERIAL EXAMINED: Isotype specimen of *Peziza wrightii* Berk. & M.A. Curtis, C. Wright No. 3139, on soil among mosses, from Curtis Herbarium (FH).

This species was placed in *Lamprospora* by Seaver because of its nearly globose and marked ascospores. Rifai (1968) pointed out that, except for the shape of the ascospores, the genus *Lamprospora* is similar to *Octospora*. Caillet & Moyne (1980) and Wang & Kimbrough (1992), following Le Gal (1969), merged the two genera. However, in the type specimen of this species ascospores are not completely globose but subglobose to broadly ellipsoidal. The ectal excipulum is of *textura prismatica*, which is otherwise uncommon in *Octospora*, but it is also present in *O. insolita* K.B. Khare (Khare 1975a).

Benkert (1998b) described *O. texensis* Benkert based on the same exsiccatum, C. Wright No. 3139 as *Peziza wrightii* Berk. & M.A. Curtis at K, while he accepted *O. wrightii*; but the reason for creating a new name based on *P. wrightii* is not clear since there is no homonym. It seems from the descriptions and figures that European collections of *O. wrightii* growing in association with *Amblystegium serpens* (Dennis

& Itzerott 1973; Itzerott 1974, 1981; Caillet & Moyne 1980; Benkert 1998b) are close to *O. moravecii*. *O. moravecii* is compared with *O. wrightii* under the former species.

**Kotlabaea** Svrček, Česká Mykol. 23: 85. 1969.

Non-bryophilic; apothecia small, rarely exceeding 5 mm diam, sessile, shallowly cupulate to discoid; hymenium cream-coloured, yellow or orange; externally glabrous or slightly tomentose, concolorous or usually lighter than the hymenium. Asci J-, 8-spored, but often 2-6 spores attaining maturity. Ascospores eguttulate, hyaline, ellipsoidal, smooth or in one case indistinctly reticulate. Paraphyses filiform, septate with slightly thickened apices, straight or curved.

Type species. *Peziza deformis* P. Karst.

**Key to the treated species**

- 1. Ascospores ornamented with an indistinct reticulum..... *K. spaniosa* (3)
- 1\*. Ascospores smooth..... 2
- 2. Ascospores more than 15 µm long; ectal excipulum of textura angularis of large cells (25-40 µm diam)..... *K. deformis* (2)
- 2\*. Ascospores less than 15 µm long; ectal excipulum of smaller cells (less than 20 µm diam).....  
..... *K. alutacea* (1)

**1. Kotlabaea alutacea** (Berk. & Broome) K.B. Khare, comb. nov.

Plate 5, Figs 5-7

- ≡ *Helotium alutaceum* Berk. & Broome, J. Linn. Soc. 14: 107. 1873 (basionym).
- ≡ *Octospora alutacea* (Berk. & Broome) Dennis, Persoonia 3: 34. 1964.

Apothecia scattered to gregarious, 1-2 mm diam, sessile, shallowly cupulate to appanate; hymenium pale yellow to creamy-white, on drying becoming pinkish; externally pallid, smooth. In section, hymenium 100-145 µm thick; subhymenium and medullary excipulum not distinguishable, together 35-75 µm thick, of textura intricata, of thin, septate, hyphae up to 3 µm wide, hyphae becoming narrow, compact, and intermixed with short irregular cells in the subhymenium; ectal excipulum 40-100 µm thick, of textura globulosa, cells 5-10 µm diam; margin not raised, also of textura globulosa but of smaller cells. Asci J-, 2-8-spored, short, cylindrical, narrowing below into a short attenuate to bifurcate base, 100-140 × 7.5-12.5 µm. Ascospores hyaline, ellipsoidal, smooth, filled with numerous small oil drops, uniseriate, straightly to obliquely arranged, 10-13(-14) × 5.5-8 µm. Paraphyses hyaline, thin, septate, several times branched below, curved and up to 2 µm thick at the apices, slightly longer than the asci.

MATERIAL EXAMINED: On dead leaves of *Loranthus* sp. (BHUPP 218) and on *Pandanus fascicularis* (BHUPP 224), Old Botanical Garden, Banaras Hindu University, India, leg. V.P. Tewari, 8 Aug. 1964 and 7 Sept. 1964.

This species can easily be identified by its small apothecia, curved paraphyses and eguttulate ascospores. Sometimes in shaded places the apothecia may even be white although the normal colour is light yellow.

2. **Kotlabaea deformis** (P. Karst.) Svrček, *Česká Mykol.* 23: 87. 1969.

Plate 14, Figs 1-5

≡ *Peziza deformis* P. Karst., *Fungi Fenn. Exs.* No. 628. 1867.

≡ *Humaria deformis* (P. Karst.) Sacc., *Syll. Fung.* 8: 131. 1889.

≡ *Octospora deformis* (P. Karst.) Gamundí, *Lilloa* 30: 300. 1960.

Apothecia scattered to gregarious, up to 1 mm diam, sessile, shallowly cupulate to turbinate; hymenium yellow-orange, slightly convex; externally smooth, pale yellow. In section, hymenium 170-200 µm thick; subhymenium and medullary excipulum not distinguishable, together 150-800 µm thick, of *textura angularis*, cells thin walled, angular or irregularly elongated at places, 10-20 µm thick, becoming smaller in the subhymenial region; ectal excipulum 50-75 µm thick, also of *textura angularis*, cells variously angled, large, 25-40 µm thick. Asci J-, cylindrical, narrowing below into a short base, usually 2-6 ascospores attaining maturity, 150-200 × 10-12 µm. Ascospores hyaline, ellipsoidal, smooth, non-guttulate, uniseriate, straightly or obliquely arranged, 15.5-18.5 × 8.5-11 µm. Paraphyses hyaline, septate, simple, straight, slightly larger than the asci, up to 4 µm wide at their apices.

MATERIAL EXAMINED: Isotype specimen of *Peziza deformis*, P.A. Karsten No. 3013, on soil, Finland, leg. P.A. Karsten, 4 July 1866 (H).

The Argentinian specimen of this species described by Gamundí (1960) appears more or less similar to the type specimen in anatomy and apothecial morphology but differs in spore size and the number of spores maturing in each ascus. Gamundí's specimen has slightly larger ascospores and regularly 8-spored asci, whereas the type specimen has asci with 2-6 fully developed ascospores. This species is the type of *Kotlabaea* Svrček.

3. **Kotlabaea spaniosa** (K.B. Khare) K.B. Khare, comb. nov.

≡ *Octospora spaniosa* K.B. Khare, *Norw. J. Bot.* 22: 267. 1975 (basionym).

This species was treated in detail by Khare (1975a). It can be identified by its pale yellow apothecia 1-3 mm diam, small, very finely reticulate ascospores, an excipulum of *textura angularis*, and curved paraphyses. Reticulation of the ascospores is visible only under the oil-immersion lens, and the meshes are very small and more or less round. External surfaces of the apothecia are finely tomentose and the margin is not raised.

MATERIAL EXAMINED: Holotype specimen of *O. spaniosa* (BHUPP 751), on decaying leaves, Nainital roadside, Pantnagar, India, leg. R.N. Singh, 26 July 1968.

## Explanations to the illustrations

- Plate 1 – Figs 1-5. *Octospora convexula*. 1. Apothecia,  $\times 15$ . 2. Marginal tissue,  $\times 250$ . 3. Part of ectal and medullary excipulum,  $\times 500$ . 4. Asci and ascospores,  $\times 350$ . 5. Ascospores,  $\times 1000$ .
- Plate 2 – Figs 1-7. *Octospora indica*. 1. Apothecia,  $\times 1.5$ . 2. Part of hymenium and excipulum,  $\times 70$ . 3. Raised margin,  $\times 200$ . 4. Pustules of ectal excipulum and a part of medullary excipulum,  $\times 200$ . 5. A branched paraphysis,  $\times 150$ . 6. A complete ascus,  $\times 200$ . 7. Ascospores,  $\times 800$ .
- Plate 3 – Figs 1-4. *Octosporaleucomoides*. 1. Apothecia,  $\times 2$ . 2. Part of medullary excipulum,  $\times 200$ . 3. Part of ectal excipulum,  $\times 200$ . 4. Ascospores,  $\times 550$ . Figs 5-8. *Octospora humosa*. 5. Excipular and marginal tissue,  $\times 60$ . 6. Part of ectal and medullary excipulum,  $\times 450$ . 8. Ascospores,  $\times 800$ .
- Plate 4 – Figs 1-7. *Octospora insignispora*. 1. Apothecia (natural size). 2, 3 & 4. Excipular and marginal tissue in three different collections,  $\times 100$ . 5. Part of an ectal and medullary excipulum,  $\times 250$ . 6. Ascus and ascospores,  $\times 350$ . 7. Ascospores,  $\times 900$ .
- Plate 5 – Figs 1-4. *Octospora limbata*. 1. Apothecia,  $\times 3$ . 2. Excipular and marginal tissue,  $\times 100$ . 3. Part of ectal and medullary excipulum,  $\times 400$ . 4. Asci, ascospores and paraphyses,  $\times 450$ . Figs 5-7. *Kotlabaea alutacea*. 5. Apothecia,  $\times 10$ . 6. Excipular and marginal tissue,  $\times 200$ . 7. Asci and ascospores,  $\times 850$ .
- Plate 6 – Figs 1-3. *Octospora peckii*. 1. Apothecia,  $\times 2$ . 2. Excipular and marginal tissue,  $\times 200$ . 3. Ascospores,  $\times 700$ . Figs 4-7. *Octospora musci-muralis*. 4. Apothecia,  $\times 2$ . 5. Part of ectal and medullary excipulum,  $\times 225$ . 6. Marginal tissue,  $\times 225$ . 7. Asci, paraphyses and ascospores,  $\times 225$ .
- Plate 7 – Figs 1-5. *Octospora orthotrichi*. 1. Apothecia,  $\times 8$ . 2. Excipular tissue,  $\times 150$ . 3. Ectal and medullary excipulum,  $\times 300$ . 4. Asci and paraphyses,  $\times 400$ . 5. Ascospores,  $\times 1000$ . Figs 6-8. *Octosporakanousae*. 6. Excipular and marginal tissue,  $\times 70$ . 7. Part of ectal and medullary excipulum,  $\times 150$ . 8. Ascospores,  $\times 800$ .
- Plate 8 – Figs 1-3. *Octospora purpurea*. 1. Apothecium,  $\times 4$ . 2. Cross section of an apothecium showing tissue structure,  $\times 30$ . 3. Ascospores in ascus,  $\times 700$ . Figs 4-8. *Octospora plumbeo-atra*. 4. Apothecia,  $\times 2$ . 5. Excipular and marginal tissue,  $\times 120$ . 6. Part of ectal and medullary excipulum,  $\times 350$ . 7. A complete ascus,  $\times 350$ . 8. Ascospores,  $\times 850$ .
- Plate 9 – Figs 1-5. *Octospora semiimmersa*. 1. Apothecia (natural size). 2. Apothecium,  $\times 4$ . 3. Cross section of a part of an apothecium,  $\times 75$ . 4. Part of ectal and medullary excipulum,  $\times 350$ . 5. Ascospores,  $\times 650$ .
- Plate 10 – Figs 1-6. *Octospora tetraspora*. 1. Apothecia,  $\times 3$ . 2. Marginal tissue,  $\times 200$ . 3. Part of hymenium and excipulum,  $\times 100$ . 4. Marginal tissue (Czech. Coll.),  $\times 350$ . 5. Asci and paraphyses,  $\times 170$ . 6. Ascospores,  $\times 650$ . Figs 7-11. *Octospora rubens*. 7. Marginal tissues,  $\times 150$ . 8. Part of ectal and medullary excipulum,  $\times 150$ . 9. Marginal tissue (Czech. Coll.),  $\times 200$ . 10. Asci and paraphyses,  $\times 200$ . 11. Ascospores,  $\times 650$ .
- Plate 11 – Figs 1-4. *Octospora subhepatica*. 1. Apothecia,  $\times 7$ . 2. Marginal and excipular tissue,  $\times 90$ . 3. Part of ectal and medullary excipulum,  $\times 225$ . 4. Ascospores,  $\times 900$ . Figs 5-8. *Octospora euchroa*. 5. Apothecium,  $\times 5$ . 6. Marginal and excipular tissue,  $\times 90$ . 7. Asci, ascospores and paraphyses,  $\times 275$ . 8. Ascospores,  $\times 900$ .
- Plate 12 – Figs 1-5. *Octospora waterstonii*. 1. Apothecia,  $\times 6$ . 2. Excipular and marginal tissue,  $\times 70$ . 3. Part of ectal and medullary excipulum,  $\times 300$ . 4. Asci, ascospores and paraphyses,  $\times 300$ . 5. A complete ascus,  $\times 300$ . Figs 6-8. *Octospora phyllogena*. 6. Apothecia,  $\times 12$ . 7. Excipular and marginal tissue,  $\times 100$ . 8. Asci and ascospores,  $\times 400$ .
- Plate 13 – Figs 1-6. *Octospora wrightii*. 1. Apothecia,  $\times 10$ . 2. Cross section of an entire apothecium,  $\times 75$ . 3. Marginal tissue,  $\times 150$ . 4. Asci and ascospores,  $\times 600$ . 5. Ascospores,  $\times 600$ . 6. Part of hymenium, ectal and medullary excipulum,  $\times 200$ .
- Plate 14 – Figs 1-5. *Kotlabaea deformis*. 1. Apothecia,  $\times 10$ . 2. Excipular and marginal tissue,  $\times 120$ . 3. Part of ectal and medullary excipulum,  $\times 400$ . 4. Asci, ascospores and paraphyses,  $\times 400$ . 5. Ascospores,  $\times 520$ .

Plate 1

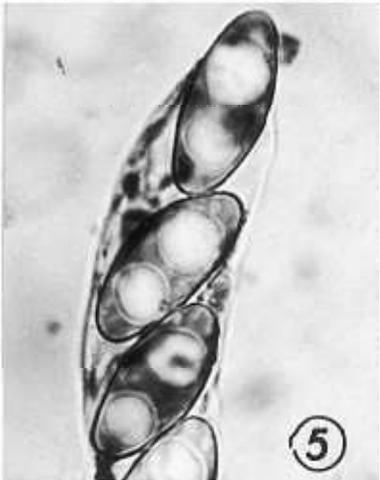
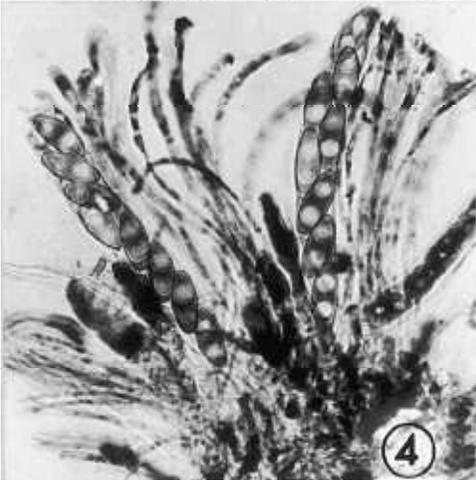
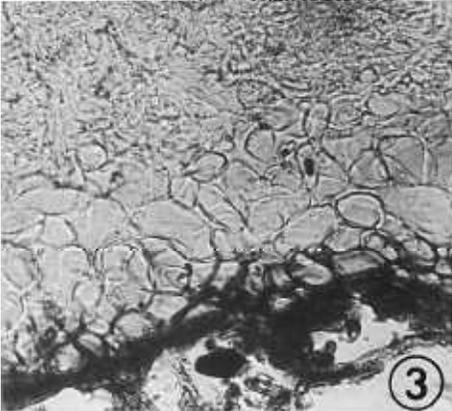
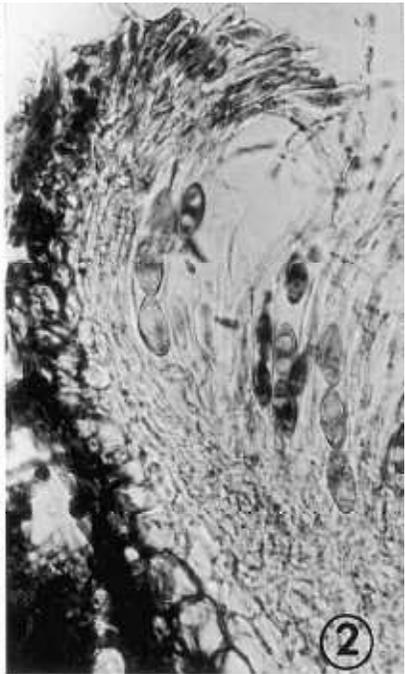
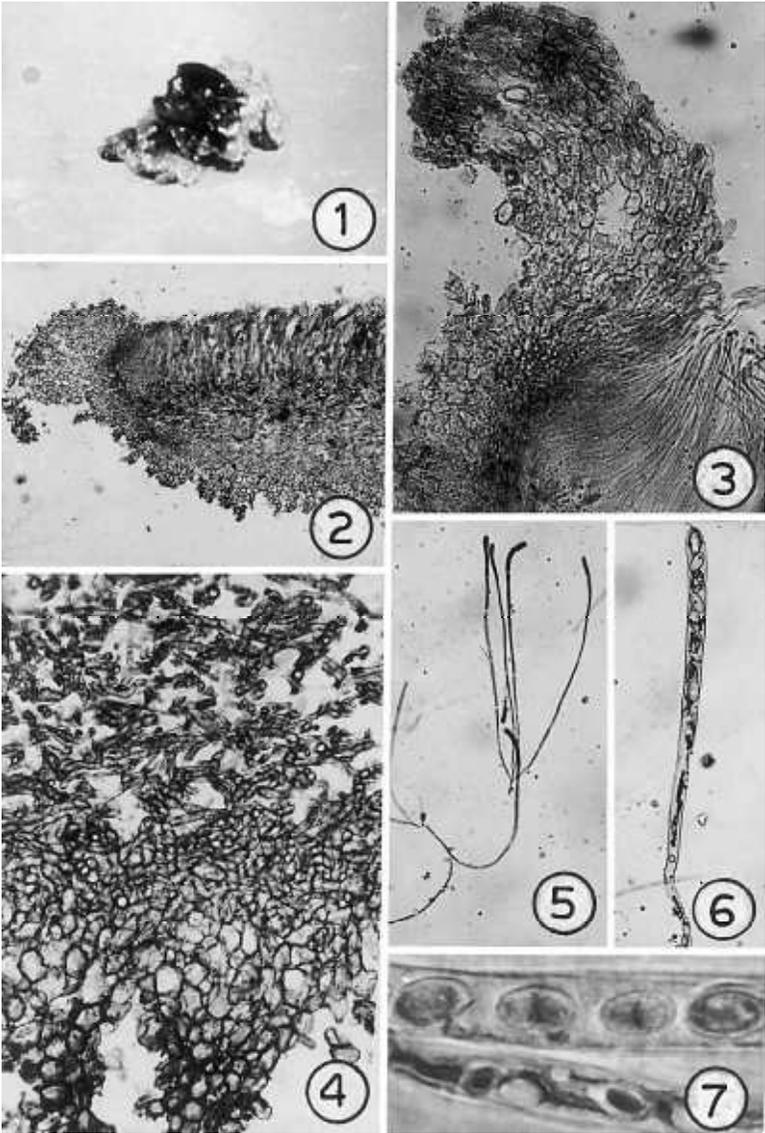


Plate 2



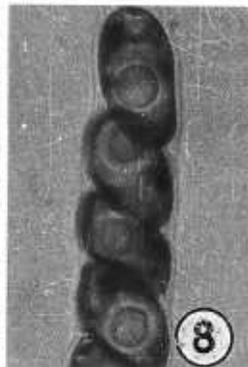
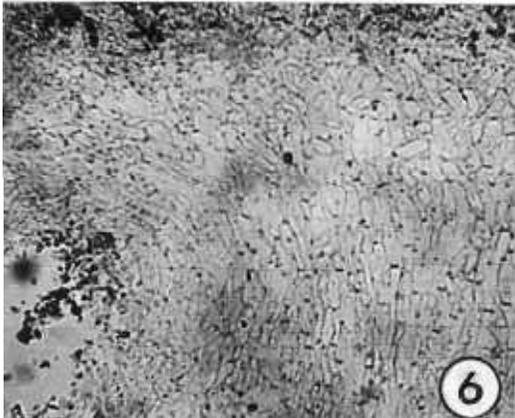
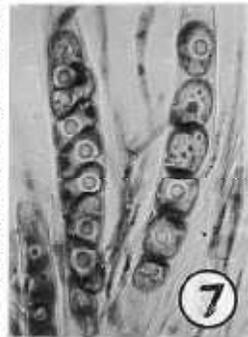
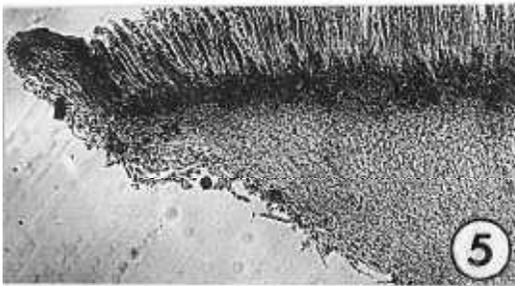
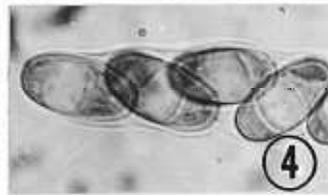
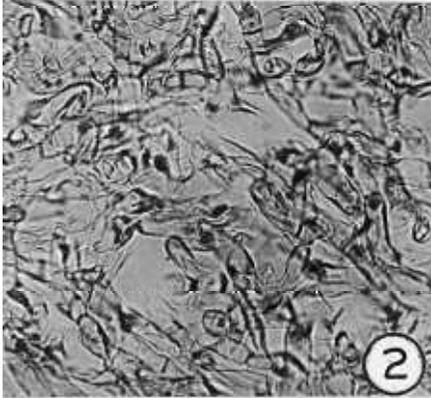
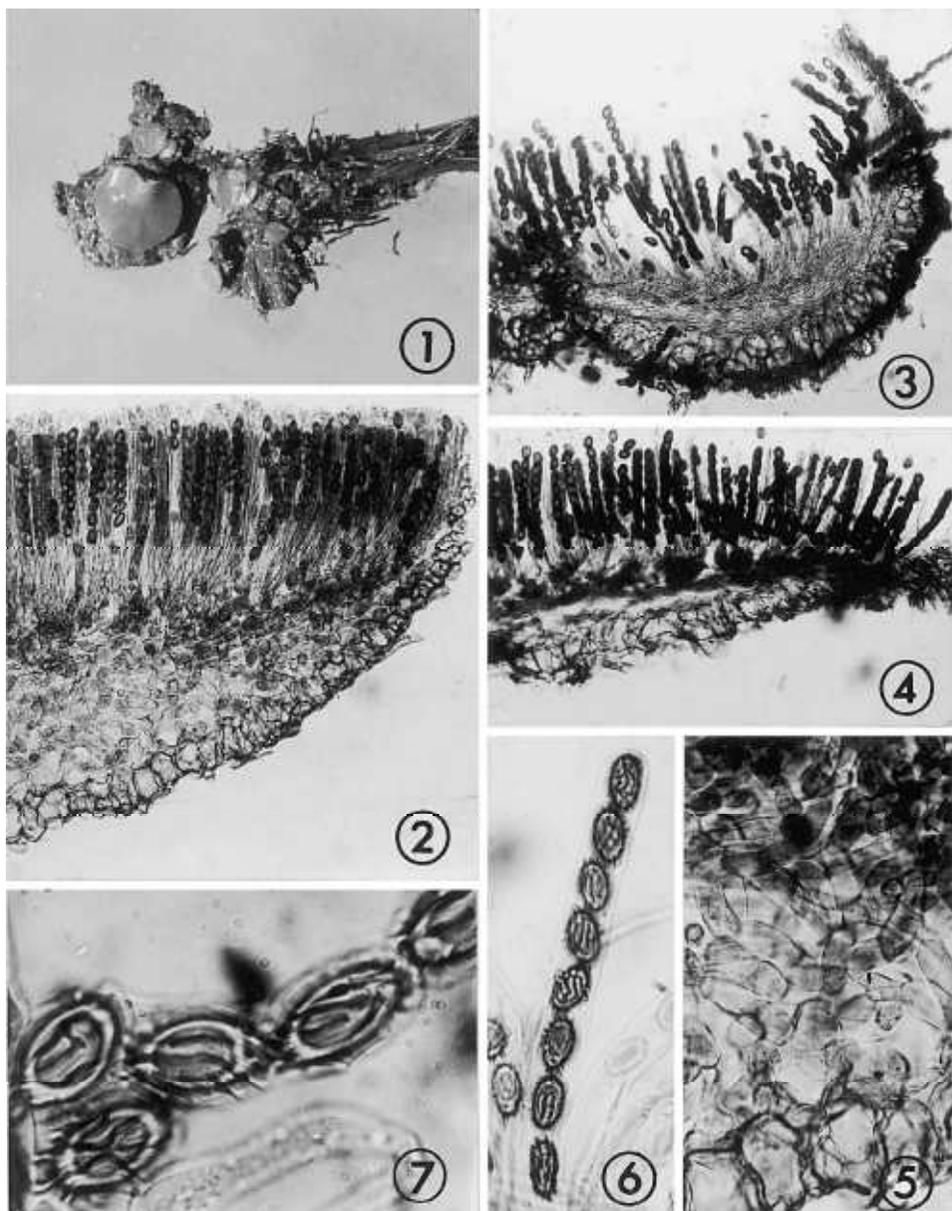
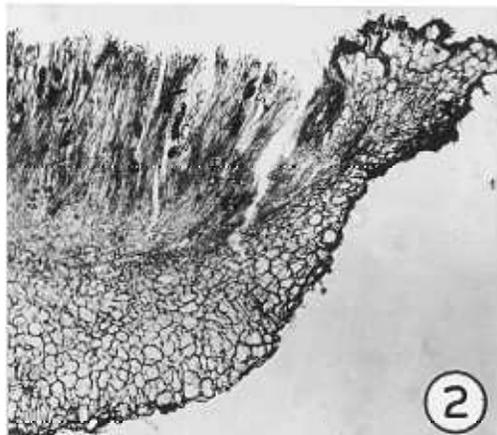
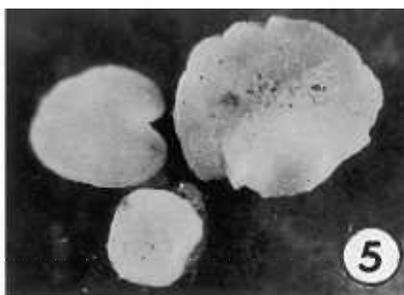
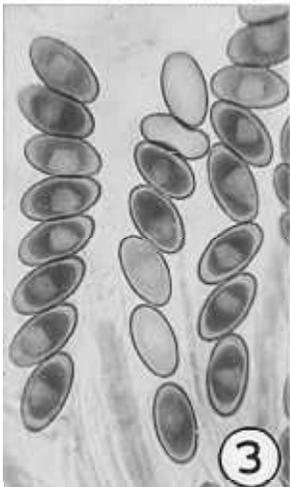
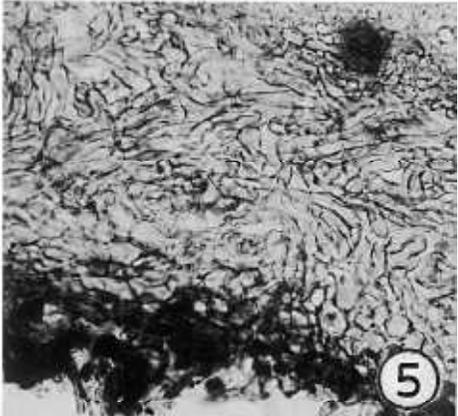


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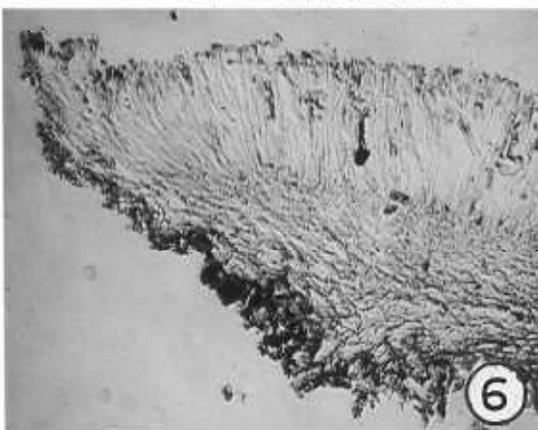
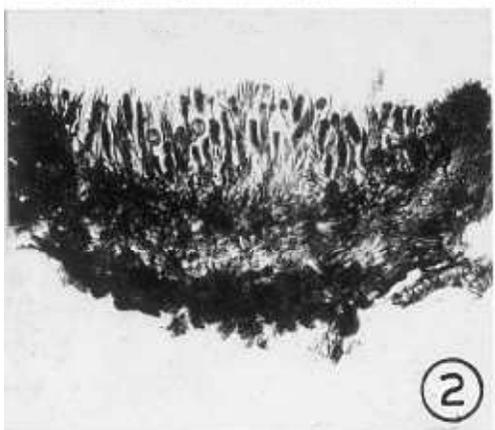


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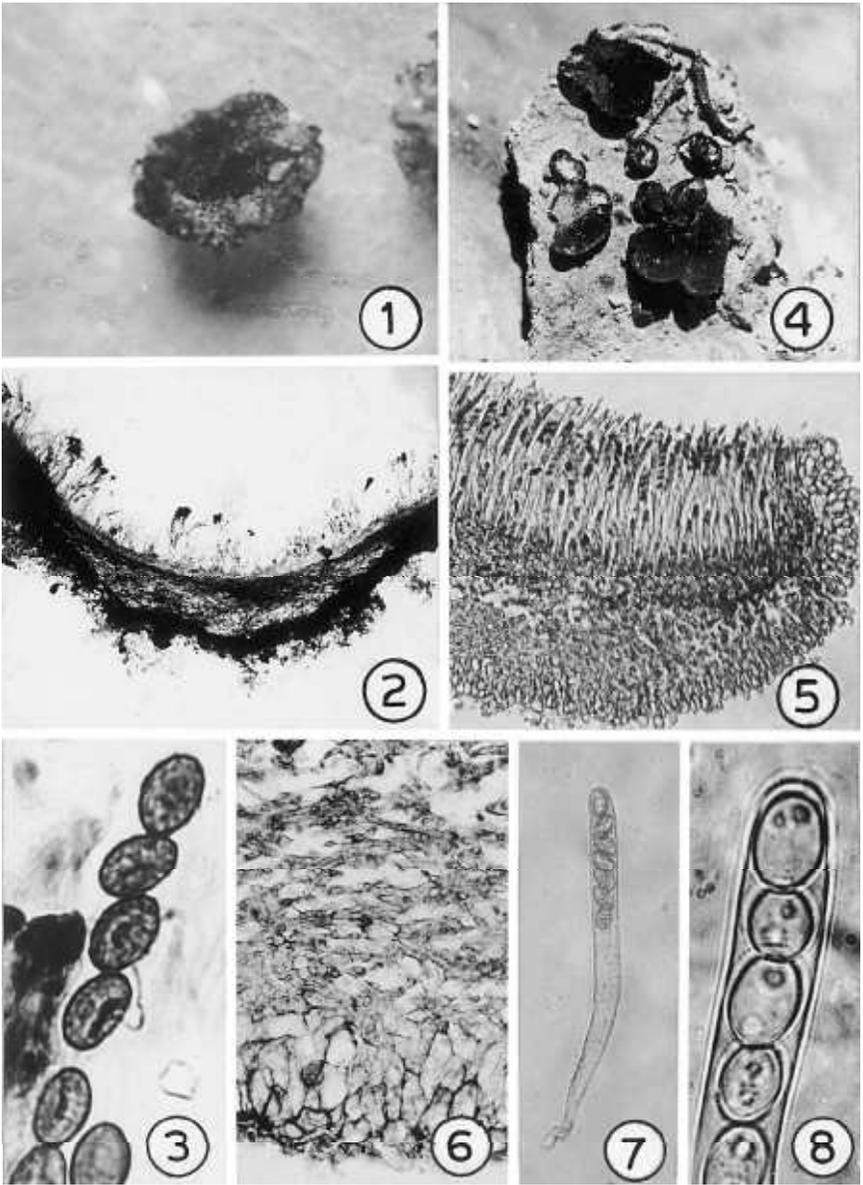


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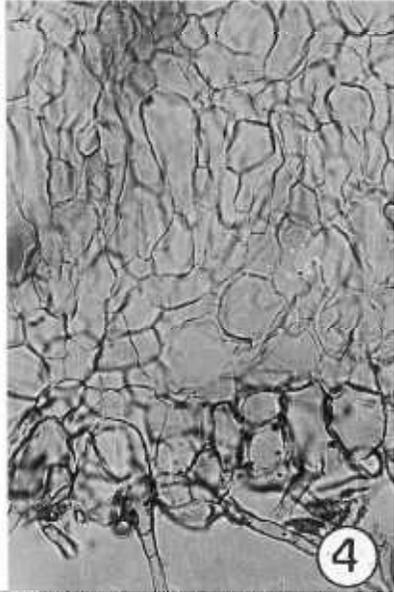
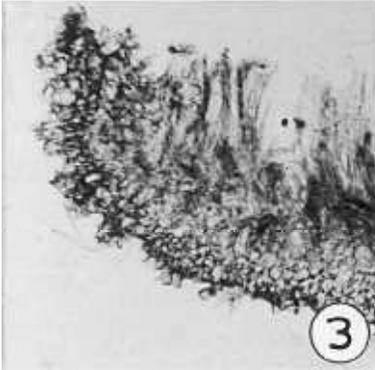
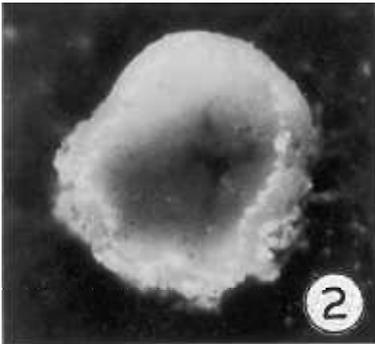
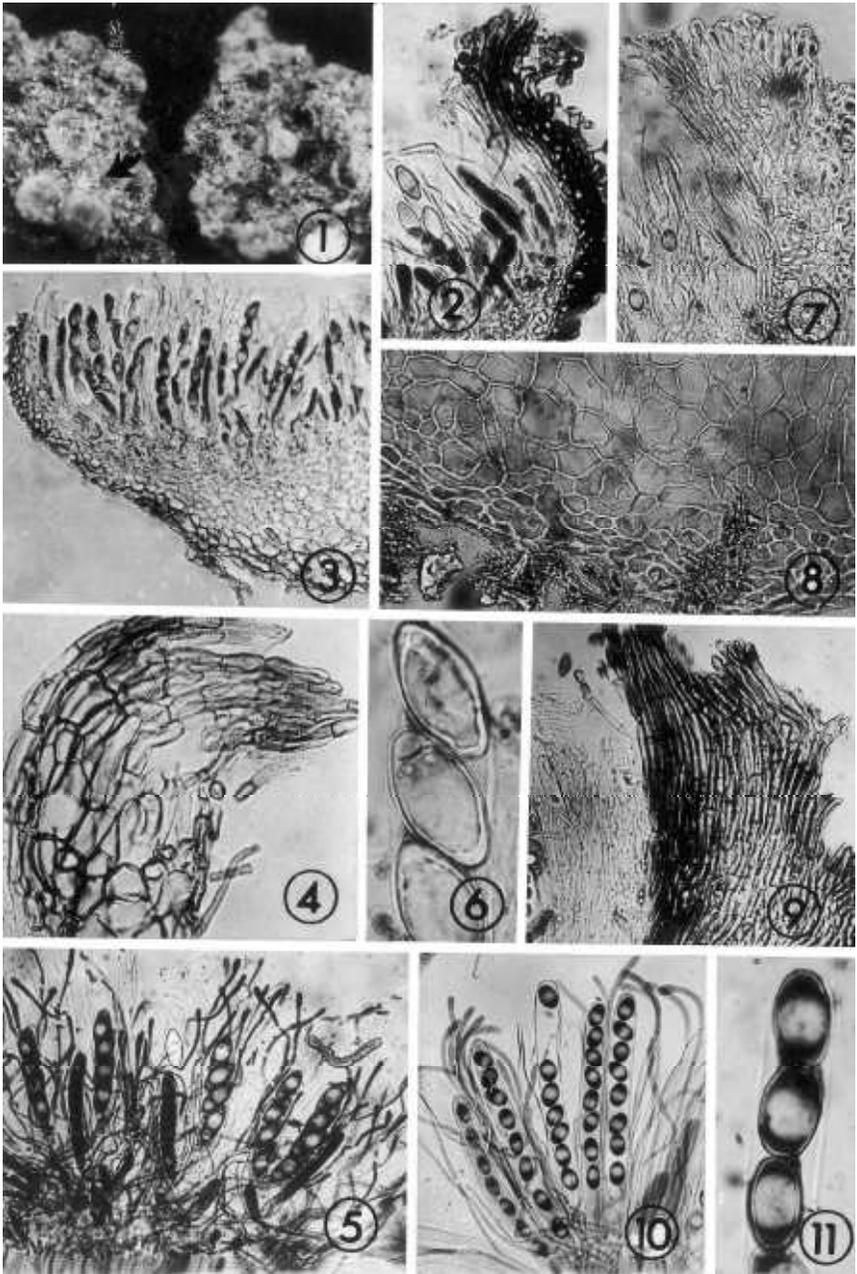
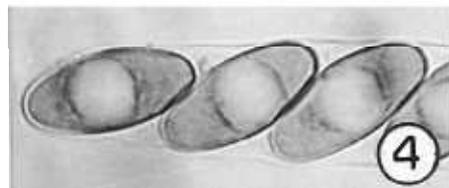
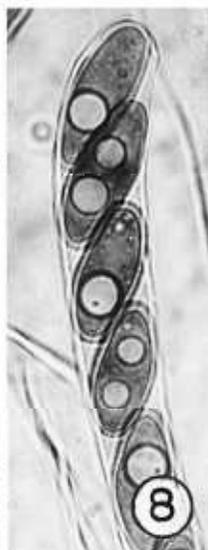
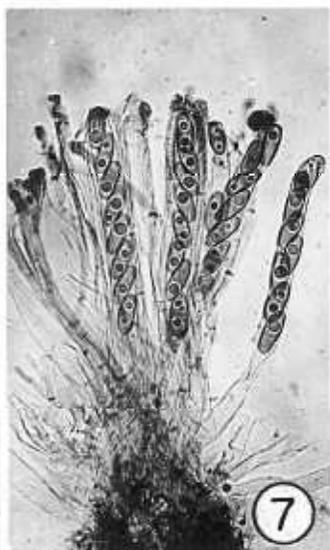
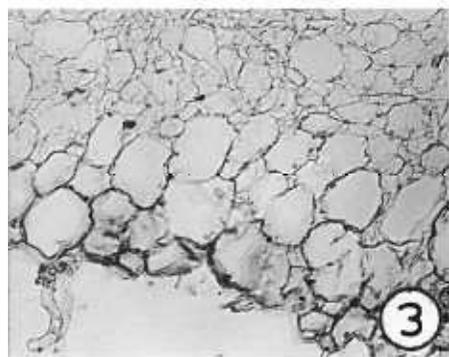
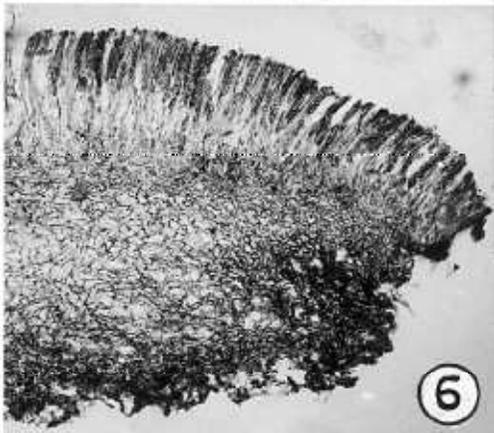
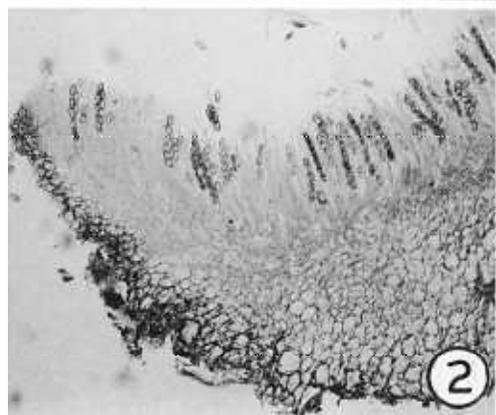
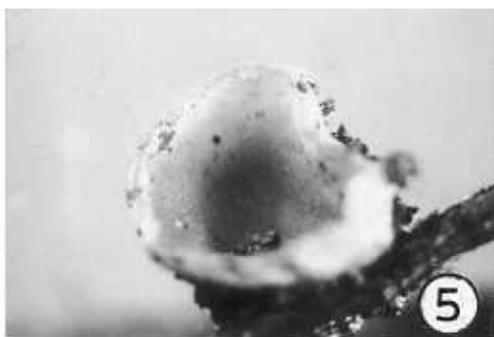
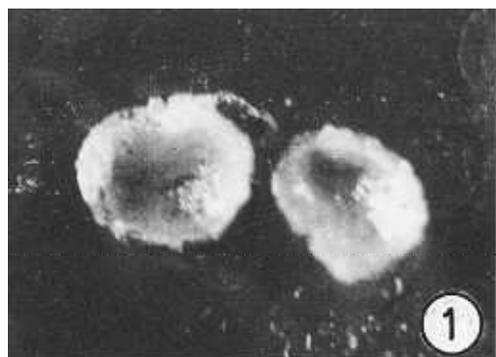
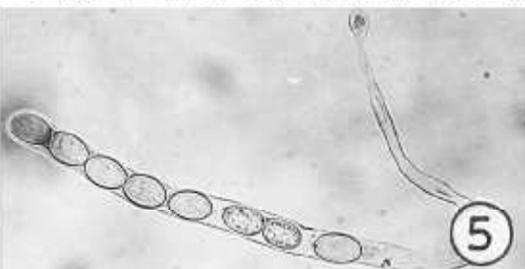
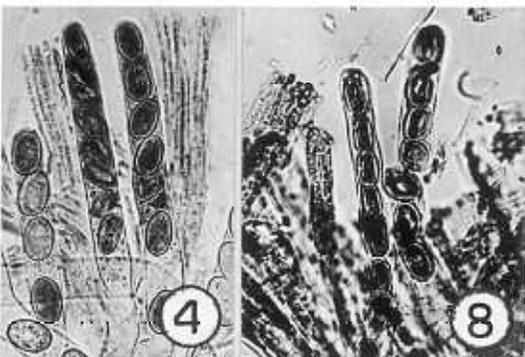
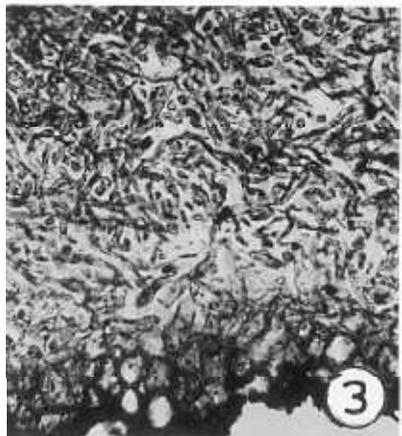
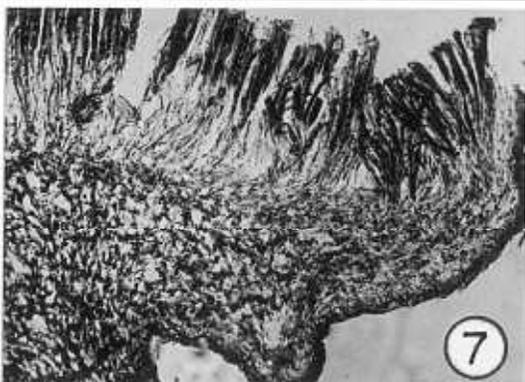
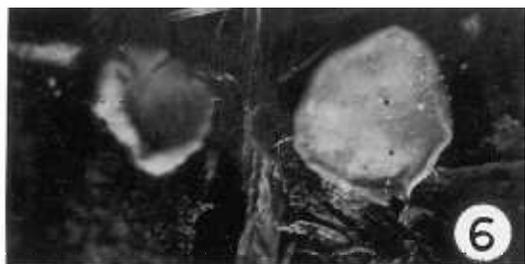
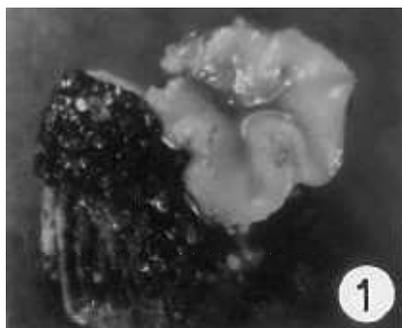
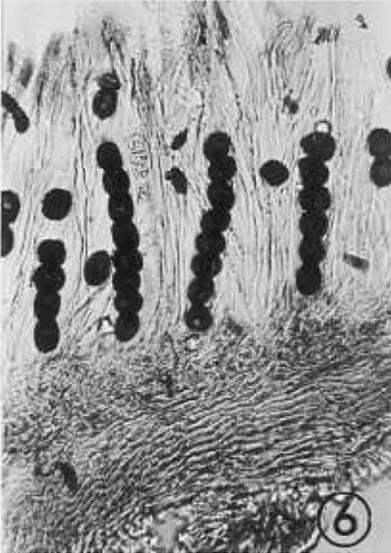
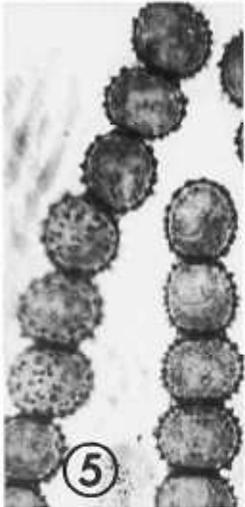
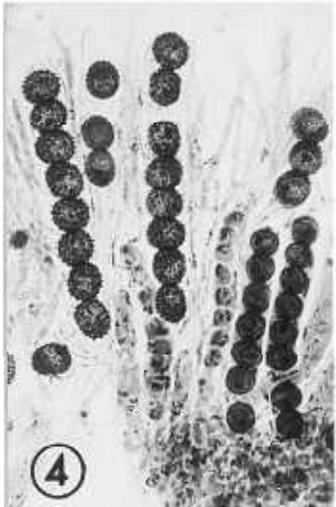
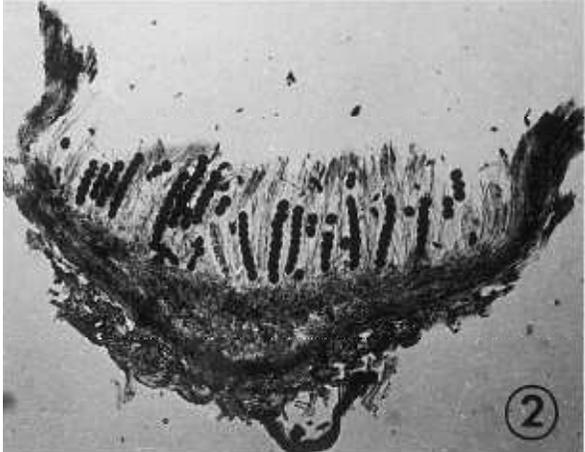
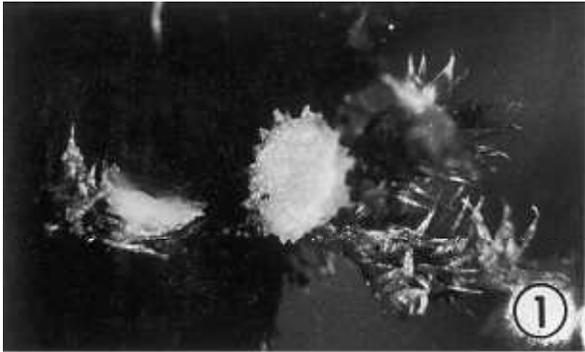


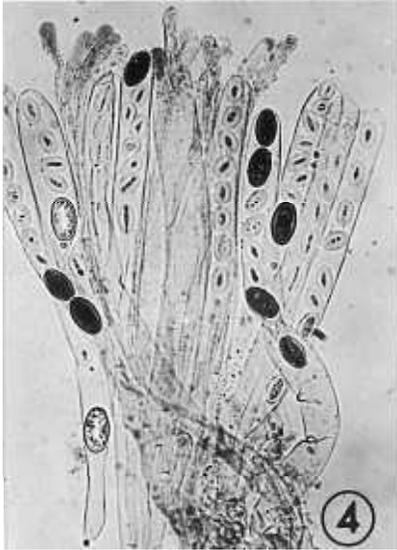
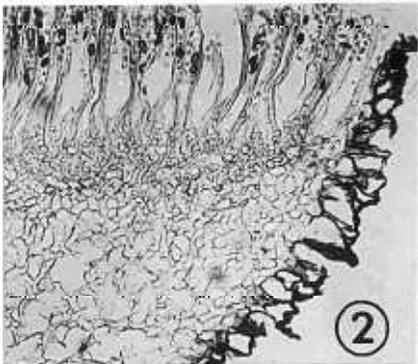
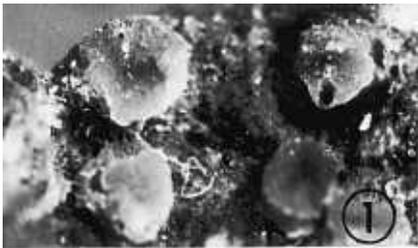
Plate 10











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## References

- BATRA, L.R. (1960): New species of Discomycetes from India I. - *Mycologia* **52**: 524-527.
- BATRA, L.R. & S.W.T. BATRA (1963): Indian Discomycetes. - *Univ. Kansas Bull.* **44**: 109-256.
- BENKERT, D. (1987a): Beiträge zur Taxonomie der Gattung *Lamprospora* (Pezizales). - *Z. Mykol.* **53**: 195-271.
- BENKERT, D. (1987b): Bemerkenswerte Ascomyceten aus der DDR. ix. Die Gattung *Byssonectria*. - *Gleditschia* **15**: 173-187.
- BENKERT, D. (1993): Bryoparasitic Pezizales: Ecology and Systematics. - In: D.N. Pegler, L. Boddy, B. Ing & P.M. Kirk (Eds). *Fungi of Europe: Investigation, recording and conservation*, pp. 147-156, Royal Botanic Gardens, Kew.
- BENKERT, D. (1995): Becherlinge als Moosparasiten. - *Boletus* **19**: 97-127.
- BENKERT, D. (1997): Beiträge zur Kenntnis bryophiler Pezizales-Arten. 5. Neue Arten der Gattung *Octospora*. - *Beitr. Kenntn. Pilze Mitteleur.* **11**: 35-42.
- BENKERT, D. (1998a): Beiträge zur Kenntnis bryophiler Pezizales-Arten. 8. Viersporige Taxa der Gattung *Octospora*. - *Österr. Z. Pilzk.* **7**: 39-63.
- BENKERT, D. (1998b): Beiträge zur Kenntnis bryophiler Pezizales-Arten. 6. Wrightoideae, eine neue Sektion der Gattung *Octospora*. - *Z. Mykol.* **64**: 17-40.
- BENKERT, D. (1998c): Beiträge zur Kenntnis bryophiler Pezizales-Arten. 7. *Octospora ithacaënsis*. - *Z. Mykol.* **64**: 41-44.
- BENKERT, D., CAILLET, M. & G. MOYNE (1987): *Moravecchia*, eine neue Gattung der Pyrenomataceae (Pezizales). - *Z. Mykol.* **53**: 139-144.
- BERTHET, P. (1964): *Essai biotaxinomique sur les Discomycètes*. - Thèse, Lyon. 157 pp.
- CAILLET, M. & G. MOYNE (1980): Contribution à l'étude du genre *Octospora* Hedw. ex S.F. Gray emend. Le Gal. Espèces à spores ornementées, globuleuses ou subglobuleuses. - *Bull. Trimestriel Soc. Mycol. Fr.* **96**: 175-205.
- CAILLET, M. & G. MOYNE (1987a): Contribution à l'étude du genre *Octospora* Hedw. ex S.F. Gray (Pezizales). Espèces à spores elliptiques ou fusiformes. - *Bull. Trimestriel Soc. Mycol. Fr.* **103**: 179-226.
- CAILLET, M. & G. MOYNE (1987b): Contribution à l'étude du genre *Octospora* Hedw. ex S.F. Gray (Pezizales). Écologie et morphologie. - *Bull. Trimestriel Soc. Mycol. Fr.* **103**: 277-304.
- CASH, E.K. (1948): Six new Indian Discomycetes. - *Mycologia* **40**: 724-727.

- COOKE, M.C. (1875): *Mycographia, seu icones fungorum* **1**: 1-44, pl. 1-20.
- DENNIS, R.W.G. (1960): *British Cup Fungi and their Allies*. - Ray Soc., London. DENNIS, R.W.G. (1968): *British Ascomycetes*. - J. Cramer, Lehre.
- DENNIS, R.W.G. (1978): *British Ascomycetes*, revised and enlarged edition. - J. Cramer, Vaduz.
- DENNIS, R.W.G. & H. ITZEROTT (1973): *Octospora* and *Inermisia* in Western Europe. - Kew Bull. **28**: 5-23.
- DÖBBELER, P. (1979): Untersuchungen an moosparasitischen Pezizales aus der Verwandtschaft von *Octospora*. - Nova Hedwigia **31**: 817-864.
- DÖBBELER, P. (1993): The infecting structures of *Octospora roxheimii* (Pezizales). - Arnoldia **6**: 12-14.
- DÖBBELER, P. & H. ITZEROTT (1981): Zur Biologie von *Octospora libussae* und *O. humosa*, zwei im Moosprotonema wachsenden Pezizales. - Nova Hedwigia **34**: 127-136.
- ECKBLAD, F. E. (1968): The genera of Operculate Discomycetes. A re-evaluation of their taxonomy, phylogeny and nomenclature. - Nytt Mag. Bot. **15**: 1-191.
- FRIES, E.M. (1822): *Systema mycologicum* 2 (1). Lundae.
- FUCKEL, K.W.G.L. (1870): *Symbolae mycologicae*. - Jahrb. Nassau. Ver. Naturk. **23-24**: 1-459.
- GAMUNDÍ, I. J. (1960): *Discomycetes Operculados de la Argentina. Familias Pezizaceae y Humariaceae*. - Lilloa **30**: 257-338.
- GRADDON, W.D. (1972): Some new discomycete species 2. - Trans. Brit. Mycol. Soc. **58**: 147-159.
- GRAY, S.F. (1821): *A natural arrangement of British Plants*. I. London.
- HEDWIG, J. (1789): *Descriptio et adumbratio microscopico-analytica Muscorum frondosorum* 2. - Lipsiae (Leipzig).
- ITZEROTT, H. (1974): Scheibenpilze in Moosen. - Mikrokosmos **10**: 293-297.
- ITZEROTT, H. (1976): The genus *Octospora* and an attempt to solve its taxonomic problems. - Kew Bull. **31**: 497-502.
- ITZEROTT, H. (1981): Die Gattung *Octospora* mit besonderer Berücksichtigung der Pfälzer Arten - Nova Hedwigia **34**: 265-283.
- ITZEROTT, H. (1983a): *Octospora melina*, ein seltener Gallbildner. - Agarica **4**: 108-114.
- ITZEROTT, H. (1983b): *Octospora rustica*, ein parasitischer Brandstellenbewohner. - Agarica **4**: 115-120.
- ITZEROTT, H & P. DÖBBELER (1982): *Octospora meslinii* und *O. rubens* (Pezizales), zwei weitere bryophile Gallbildner. - Mitt. Bot. München. **18**: 201-212.
- KAUSHAL, S.C. (1976): The genus *Aleuria* in India. - Mycologia **68**: 1020-1026.
- KHARE, K.B. (1975a): Four new *Octospora* species from India. - Norw. J. Bot., **22**: 259-268.
- KHARE, K.B. (1975b): On *Humaria ithacaënsis*. - Norw. J. Bot., **22**: 111-113.
- KHARE, K.B. (1976): Two new species of the genus *Octospora*. - Canad. J. Bot., **54**: 960-965.
- KHARE, K.B. & V.P. TEWARI (1975): The genus *Octospora* and its typification. - Mycologia **67**: 972-979.
- KHARE, K.B. & V.P. TEWARI (1978): Taxonomy and relationship within the genus *Octospora*. - Canad. J. Bot., **56**: 2114-2118.
- KORF, R. P. (1954): *Discomycetae Exsiccatae*, Fasc. I. - Mycologia **46**: 837 - 841.

- KORF, R.P. (1972): Synoptic key to the genera of the Pezizales. - *Mycologia* **64**: 937-994.
- KORF, R.P. (1973): Discomycetes and Tuberales. - In: *The Fungi, an advanced treatise*. Vol. IVA. (G.C. Ainsworth, F.K. Sparrow, & A.S. Sussman, eds). Academic Press, New York, London.
- LE GAL, M. (1947): Recherches sur les ornements sporales des Discomycètes Operculés. - *Ann. Sci. Nat. Bot. Sér. 11*, **8**: 73-297.
- LE GAL, M. (1969): Position taxonomique du genre *Phaedropezia* Le Gal et révision de la famille de Humariaceae. - *Bull. Trimestriel Soc. Mycol. Fr.* **85**: 5-19.
- MORAVEC, J. (1969): Some operculate discomycetes from the districts of Mladá Boleslav and Jičín (Bohemia). - *eská Mykol.* **23**: 222-235.
- MORAVEC, J. (1980): A new collection of *Aleuria cestricea* (Ell. et Ev.) Seaver from Bulgaria and comments to *Aleuria dalhousiensis* Thind et Waraitch. - *eská Mykol.* **34**: 217-220.
- MOSER, M. (1963): Ascomyceten. In: *Kleine Kryptogamenflora*. Vol. 2a. - Gustav Fischer, Stuttgart.
- PFISTER, D.H. (1993): A synopsis of the North American species of *Byssonectria* (Pezizales) with comments on the ontogeny of two species. *Mycologia* **85**: 952-962.
- REHM, H. (1887-1896): Ascomyceten: Hysteriaceen und Discomyceten. In *Dr. Rabenhorst's Kryptogamenflora von Deutschland, Oesterreich und der Schweiz* (G. Winter and H. Rehm, eds.), 2<sup>nd</sup> ed., Vol. I, part 3, Kummer, Leipzig.
- REHM, H. (1904): Ascomycetes Americae borealis. - *Ann. Mycol.* **2**: 32-37.
- RIFAI, M.A. (1968): The Australasian Pezizales in the herbarium of the Royal Botanic Gardens, Kew. - *Verh. Kon. Nederl. Akad. Wet., Afd. Natuurk., Tweede Reeks* **57** (3): 1-295.
- RUBIO, E., SUAREZ, A. & M.A. MIRANDA (2000): El género *Octospora* Hedw.: S.F. Gray (Ascomycetes, Pezizales) en Asturias y León. - *Bol. Soc. Micol. Madrid* **25**: 111-126.
- SCHWEERS, A. C. S. (1945): *Neottiella ithacaënsis* Rehm n. c. - *Rev. Mycol.* **10**: 69-72.
- SEEVER, F.J. (1928): *The North American Cup-Fungi (Operculates)*. - Publ. by the author, New York.
- SENN-IRLET, B. (1988): Zum Nachweis der bryoparasitischen Lebensweise von *Octospora orthotricha* und *O. tetraspora* (Pezizales, Ascomycetes). - *Mycol. Helv.* **3**: 173-181.
- SVRČEK, M. & J. KUBIČKA (1963): Druhý příspěvek k operkulátním diskomycetum z okolí rybníka Dvořiší v jižních Čechách. - *Česká Mykol.* **17**: 61-70.
- TEWARI, V.P. & D.C. PANT (1966): Ascomycetes of India. I. - *Mycologia* **58**: 57-66.
- THIND, K.S. & K.S. WARAITCH (1971): The Pezizales of India-14. - *Proc. Indian Acad. Sci.* **74**: 269-277.
- WANG, Y.Z. & J.W. KIMBROUGH (1992): Monographic studies of North American species of *Octospora* previously ascribed to *Lamprospora* (Pezizales, Ascomycetes). - *Spec. Publ. Natn. Mus. Nat. Sci., Taiwan* **4**: i-vii, 1-68.
- WINTER, G. (1881): *Pezizae Sauterianae*. - *Hedwigia* **20**: 129-134.

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