

Genus *Octospora* (Pezizales) in Estonia and Finland

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15 species of the genus *Octospora* have been found in Estonia and Finland. In Estonia 8 species have been found, of which 4 are new to Estonia: *Octospora axillaris* (Nees: Pers.) M.M. Moser, *O. crosslandii* (Dennis & Itzerott) Benkert, *O. rustica* (Velen.) J. Moravec, *O. wrightii* (Berk. & M.A. Curtis) J. Moravec, and 4 species recorded earlier, viz. *O. carbonicola* (Boud.) Yei-Zeng Wang, *O. humosa* (Fr.: Fr.) Dennis, *O. leucoloma* Hedw.: Gray and *O. tetraspora* (Fuckel) Korf. In Finland 11 species have been discovered. In addition to the earlier recorded *O. seaveri* (Benkert) Yei-Zeng Wang and *O. maireana* (Seaver) Yei-Zeng Wang, the following species have been found: *O. alpestris* (Sommerf.) Dennis & Itzerott, *O. borealis* (Eckblad) Caillet & Moyne, *O. humosa* (Fr.: Fr.) Dennis, *O. leucoloma* Hedw.: Gray, *O. melina* (Velen.) Dennis & Itzerott, *O. miniata* (De Not.) Caillet & Moyne, *O. rubens* (Boud.) M.M. Moser, *O. rustica* (Velen.) J. Moravec and *O. wrightii* (Berk. & M.A. Curtis) J. Moravec.

Key words: Ascomycetes, Pezizales, *Octospora*, *Lamprospora*, taxonomy, morphology, fungal anatomy, new records, vital taxonomy

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Introduction

The genus *Octospora* is treated in sensu Caillet and Moyne (1980). They transferred all species of the genus *Lamprospora* De Not. into the genus *Octospora*. This treatment is also supported by Wang and Kimbrough (1992) who established, by cladistic analysis, that the genus *Lamprospora* forms a paraphyletic group if it is treated separately from the genus *Octospora*. Several authors do not accept such a treatment (Engel & Hanff 1985, 1987; Benkert 1987, 1990; Schumacher 1993). However, no differences are found in the anatomy of apothecial structure between the genera *Octospora* and *Lamprospora*.

More than 70 species have been described in the genus *Octospora* (Itzerott 1981, Benkert

1987, Caillet & Moyne 1980, 1987); 23 species are known from Nordic countries (Dissing 1981; Dissing & Sivertsen 1983; Huhtinen 1987; Schumacher 1979, 1993).

Descriptions of several species of *Octospora* from Estonia and Finland have been presented (Dietrich 1856; Dietrich 1859; Raitviir 1963; Benkert 1987; Kullman 1991, 1997). Four species were known earlier from Estonia: *O. carbonicola* (Boud.) Yei-Zeng Wang, *O. humosa* (Fr.: Fr.) Dennis, *O. leucoloma* Hedw.: Gray and *O. tetraspora* (Fuckel) Korf.

This paper presents a survey of the species of the genus *Octospora* in Finland and in Estonia.

Material and methods

79 herbarium specimens of the genus *Octospora* from H, OULU, TAA and TUR were studied.

In addition, fresh specimens were examined. For SEM these were fixed in 4% glutaraldehyde in a phosphate buffer (pH 7). Further the specimens were moved, through a gradual ethanol series, into 100% ethanol, then they were critical-point dried, coated with a 20 nm layer of gold, and examined and photographed using a Tesla BS 301 scanning electron microscope.

Cross-sections of apothecia, with a thickness of 10–40 µm, were prepared from fixed and dried apothecia with the freezing-microtome "Microm HM 500 OM". The working temperature was –25° to –20°C. The cross-sections were photographed using a "Leitz" Labourlux microscope.

The fruitbodies were measured using the microscope "Amplival", and drawn by means of the drawing apparatus PA-6, (objective 40, immersion objective HI 100). A solution of cotton blue in lactophenol was used as the research medium.

The length (L) and width (W) of spores are presented in the following form: $(L_{\min})\bar{L}_{\min} - L_{\max}, (L_{\max}) \times (W_{\min})\bar{W}_{\min} - \bar{W}_{\max}(W_{\max}) \mu\text{m}$, where L_{\min} , L_{\max} , \bar{W}_{\min} and \bar{W}_{\max} denote the minimum and maximum mean values of 20 spore lengths and widths of specimens, and L_{\min} , W_{\min} and L_{\max} , W_{\max} , the minimum and maximum absolute values of length and width, respectively. The shape of ascospores is presented as an average ratio of spore length to spore width (Q).

List of species

1. *Octospora alpestris* (Sommerf.) Dennis & Itzerott, Kew Bull. 28:10. 1973. – Figs. 6, 17, 18A–B

Peziza alpestris Sommerf., Suppl. Florae Lapponicae: 290. 1826.

Peziza carneola Saut., Mitt. Ges. Salzburger Landesk. 18(2):7. 1878.

Humaria carneola (Saut.) Sacc., Syll. Fungorum 8: 123. 1889.

Octospora carneola (Saut.) Dennis, British Cup Fungi: 34. 1960.

Apothecium at first cupulate, later discoid, up to 4 mm in diam, concave, hymenium yellowish-orange when dry. Outside paler, base tomentose. Margin paler, distinct, dentate, fimbriate.

Receptacle two-layered, with ectal excipulum, 40–65 µm thick, consisting of *textura intricata*, hyphae 6–10 (30) µm in diam., thick-walled, wall 1.5–2 µm thick. Medullary excipulum 420–960 µm thick, consisting of *t. intricata*,

ta, hyphae 7–21 µm in diam., thin-walled, wall up to 1 µm thick. In bigger apothecia vertical orientation of hyphae may occur in the central part of medullary excipulum, analogous to *t. porrecta*. Marginal excipulum consists of *t. porrecta*, hyphae more regularly arranged, running parallel with the surface of receptacle, 7–21 µm in diam, obtuse end cells of long cylindrical hyphae form the margin. Hypothecium 50–60 µm thick, consisting of *t. intricata*, hyphae 3–5 µm in diam. Hymenium 145–190 µm thick.

Mature asci with 4 matured and 4 aborted ascospores. Immature asci contain 8 semimature ascospores. Ascospores cylindrical, hyaline, with one or two guttulae, (12.6) 13.4–14.4 (15.8) × (7.2) 7.9–8.5 (9.1) µm, excluding ornamentation, Q=1.7. Ornamentation consists of warts of an irregular size and shape. Paraphyses straight or slightly curved, up to 3–5 µm in diam at the apex.

O. alpestris grows exclusively on leaves and stems of the moss of the genus *Tetraplodon* associated with animal remains. *T. angustatus* in 9 specimens and *T. mnioides* in 9 specimens.

Specimens collected between 23 July and 4 October.

Specimens examined: Finland. Varsinais-Suomi: Nauvo, 662:20, 1994 *Huhtinen* (TUR); Oulun Pohjanmaa: Haukipudas, 7236:446, 1967 *Ulvinen* (OULU); Pudasjärvi, 72871:5170, 1971 *M. Ohenoja* (OULU); Koillismaa: Kuusamo, 7366:604, 1977 *Ulvinen* (OULU); 7366:602, 1974 *Ulvinen* (OULU); 7366:602, 1983 *E. Ohenoja* (OULU); Posio, 7323:554, 1979 *Ulvinen* (OULU); Sompion Lappi: Savukoski, 7484:558, 1975 *Vuokko* (OULU); Inarin Lappi: Inari, 7645:440, 1965 *Mäkinen* (TUR); 7675:453, 1965 *Mäkinen* (TUR); 7653:449, 1965 *Mäkinen* (TUR); 760:55, 1968 *Mäkinen* (TUR); Utsjoki, 774:49, 1961 *Kallio*; 7742:499, 1964 *Mäkinen* (TUR); 7738:501, 1965 *Mäkinen* (TUR).

Discussion. *Octospora alpestris* is easily distinguishable from the other species of the genus due to four aborted spores in the eight-spored ascus.

Excipular characters showed notable variability. In one specimen the diameter of hyphae in medullary excipulum was 7–10 µm, and in another specimen, 15–20 µm. Variation of the same degree has been found also in hyphae of ectal excipulum and margin (see Figs. 17C–D, 18A–B).

2. *Octospora axillaris* (Nees : Pers.) M.M. Moser, Gams, Kleine Kryptogamenflora 2A: 110. 1963. – Fig. 10

Peziza axillaris Nees : Pers., Mycologia Europaea I: 314. 1822.

Leucoloma axillaris (Nees : Pers.) Fuckel, Jahrb. Nassauischen Vereins Naturk. 23–24:318. 1870.

Apothecium minute, discoid, up to 1.5 mm in diameter, reddish-orange when dried. Outside whitish, tomentose, margin indistinct.

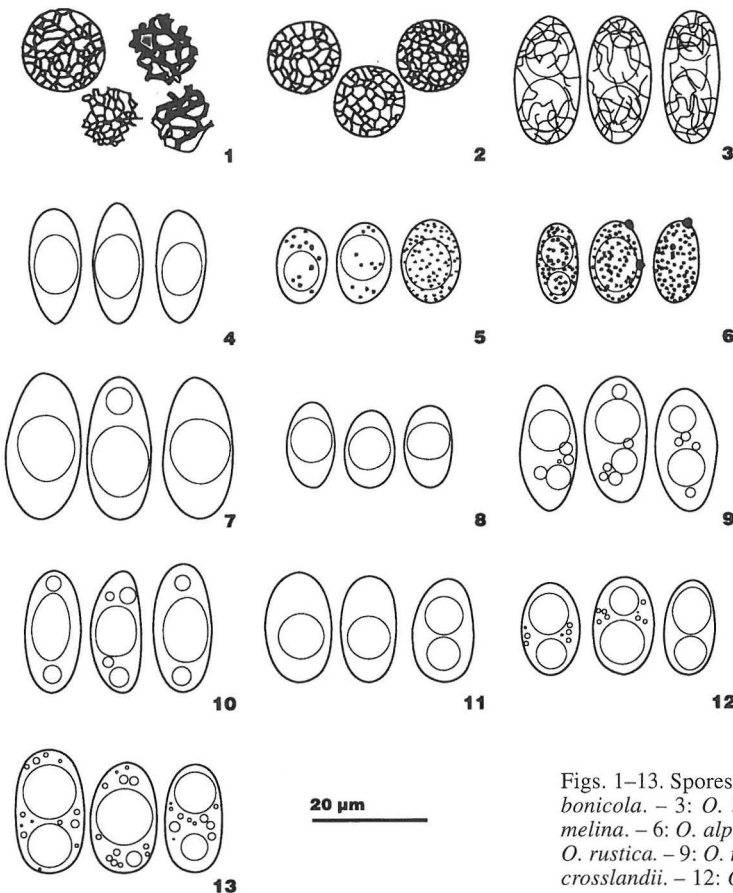
Receptacle two-layered, with ectal excipulum, 30–55 μm thick, consisting of *t. intricata*, hyphae 8–14 μm in diam, walls 1.5–2 μm thick. Medullary excipulum up to 130 μm thick, consisting of *t. intricata*, hyphae 6–14 μm in diam, wall up to 1 μm thick. Marginal excipulum con-

sists of *t. porrecta*, hyphae more regularly arranged, monilioid, running parallel with the surface of receptacle, 7–19 μm in diam, with obtuse, cylindrical end cells. Hypothecium consisting of *t. intricata*, hyphae 30–40 μm thick. Hymenium 225–260 μm thick.

Asci with 8 ascospores. Ascospores ellipsoid to subfusoid, hyaline, uniguttulate with some small guttulae, smooth, (20.3) 23.0 (27.1) \times (9.5) 10.5 (12.6) μm , Q=2.2. Paraphyses straight, diam at the apex up to 3–6 μm .

O. axillaris grows on calcium-rich soil amongst mosses *Bryum argenteum* and *Bryum* sp. and *Ceratodon purpureus*.

Specimen examined: Estonia. Tartumaa: Voldi, 6.IX.1993 Kullman (TAA 117949a).



Figs. 1–13. Spores. – 1: *Octospora seaveri*. – 2: *O. carbonicola*. – 3: *O. borealis*. – 4: *O. leucoloma*. – 5: *O. melina*. – 6: *O. alpestris*. – 7: *O.* sp. (TAA 118091). – 8: *O. rustica*. – 9: *O. tetraspora*. – 10: *O. axillaris*. – 11: *O. crosslandii*. – 12: *O. rubens*. – 13: *O. humosa*.

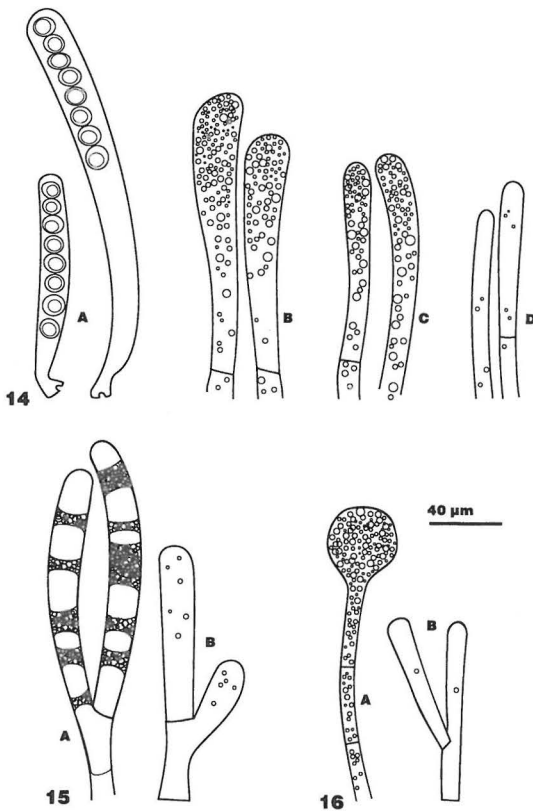


Fig 14A–D. *Octospora wrightii*: A) living and mature asci from the same apothecium in water, B) living paraphyses after being exposed for 2 h to high humidity, C) living paraphyses immediately after collecting, D) paraphyses after herbarization. – 15A–B. *O. humosa*: A) living paraphyse in water, B) herbarized paraphyse in water. – 16A–B. *O. rustica*: A) living paraphyse in water, B) herbarized paraphyse from the same specimen in water.

Discussion. *O. axillaris* is distinguishable from the other species of the genus by the shape and size of its spores. *O. axillaris* has clearly longer spores. According to literature, *O. axillaris* is known to occur with mosses *Phascum cuspidatum* and *Pottia lanceolata* (Itzerott 1981), and *Enthostodon fascicularis*, *Pottia rufescens*, *Barbula unguiculata* and *Bryum erythrocarpum* (Caillet & Moyne 1987).

3. *Octospora borealis* (Eckblad) Caillet & Moyne, Bull. Soc. Mycol. France 3:179–226. 1987. – Figs. 3, 18C–D, 19A–B

Leucoscypha borealis Eckblad, Nytt. Mag. Bot. 15:52–53. 1968.

Apothecium immersed, cupulate or discoid, concave, 3–6 mm in diam, hymenium orange when dried. Outside paler, slightly tomentose, base covered with dense, tomentose mycelium which anchors apothecium to the substratum.

Receptacle two-layered, diam of hyphae in ectal excipulum smaller and walls thicker than in medullary excipulum. Ectal excipulum 70–160 µm thick, consisting of *t. intricata*, hyphae 6–22 µm in diam, wall 2.5–5.5 µm thick. Medullary excipulum up to 480 µm thick, consisting of *t. porrecta*, hyphae parallel, 8–32 µm in diam, thick-walled, wall up to 3 µm thick. Margin consists of *t. porrecta*, hyphae 8–16 µm in diam. Hypothecium 65–80 µm thick, consisting of *t. intricata*, hyphae 2.5–4 µm in diameter. Hymenium 200–270 µm thick.

Asci with 8 ascospores. Ascospores ellipsoid, hyaline, with two guttulae, (18.3) 19.1–22.1 (23.6) × (9.5) 10.4–11.6 (12.0) µm, excluding ornamentation, Q=1.9–2.1. Ornamentation consists of fine ridges forming incomplete reticulum which is denser on the ends of ascospore. Paraphyses clavate, straight or slightly curved, diam at the apex 5–8 µm.

O. borealis grows on sandy soil with *Blepharostoma* sp., *Bryum* sp., *Calliergonella cuspidata*, *Ceratodon purpureus*, *Ditrichum* sp., *Mniobryum wahlenbergii*, *Pohlia* sp., *Polytrichum hyperboreum*, *Rhizomnium* sp. and *Sphagnum* sp.

Specimens collected between 28 July and 4 August.

Specimens examined: Finland. Oulun Pohjanmaa: Pudasjärvi, 72742:5157, *M. Ohenoja* (OULU); Sompion Lappi: Pelkosenniemi, 7450:510, 1985 *E. Ohenoja* (OULU); Inarin Lappi: Utsjoki, 7742:499, 1963 *Mäkinen* (TUR); 7759:501, 1965 *Mäkinen* (TUR); 7709:509, 1981 Kalamees (TAA 121985).

Discussion. *O. borealis* is similar to *O. humosa* (size and shape of spores, shape of apothecium) but differs clearly from the smooth-spored *O. humosa* by the fine ornamentation of spores. The ornamentation can be seen at higher magnification (with an oil immersion objective) when stained with CB.

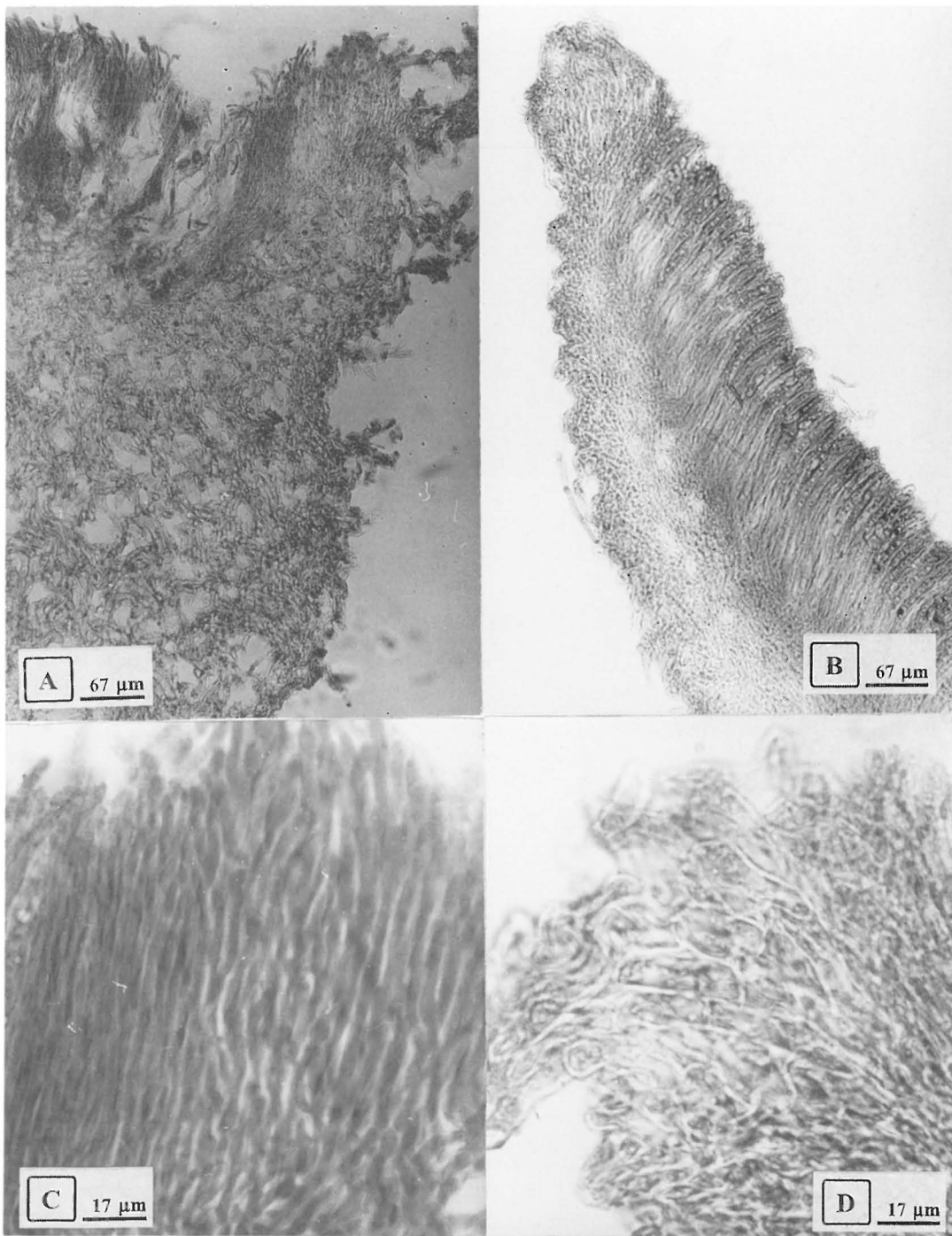


Fig. 17. *Octospora alpestris*: A) margin of cup-shaped apothecium (Ulvinen, 30.VIII.1977), B) margin of disc-shaped apothecium (Mäkinen, 22.VIII.1964). – C–D. Margin, *t. porrecta*: C) (Kallio, 18.VIII.1961), D) (Mäkinen, 22.VIII.1964).

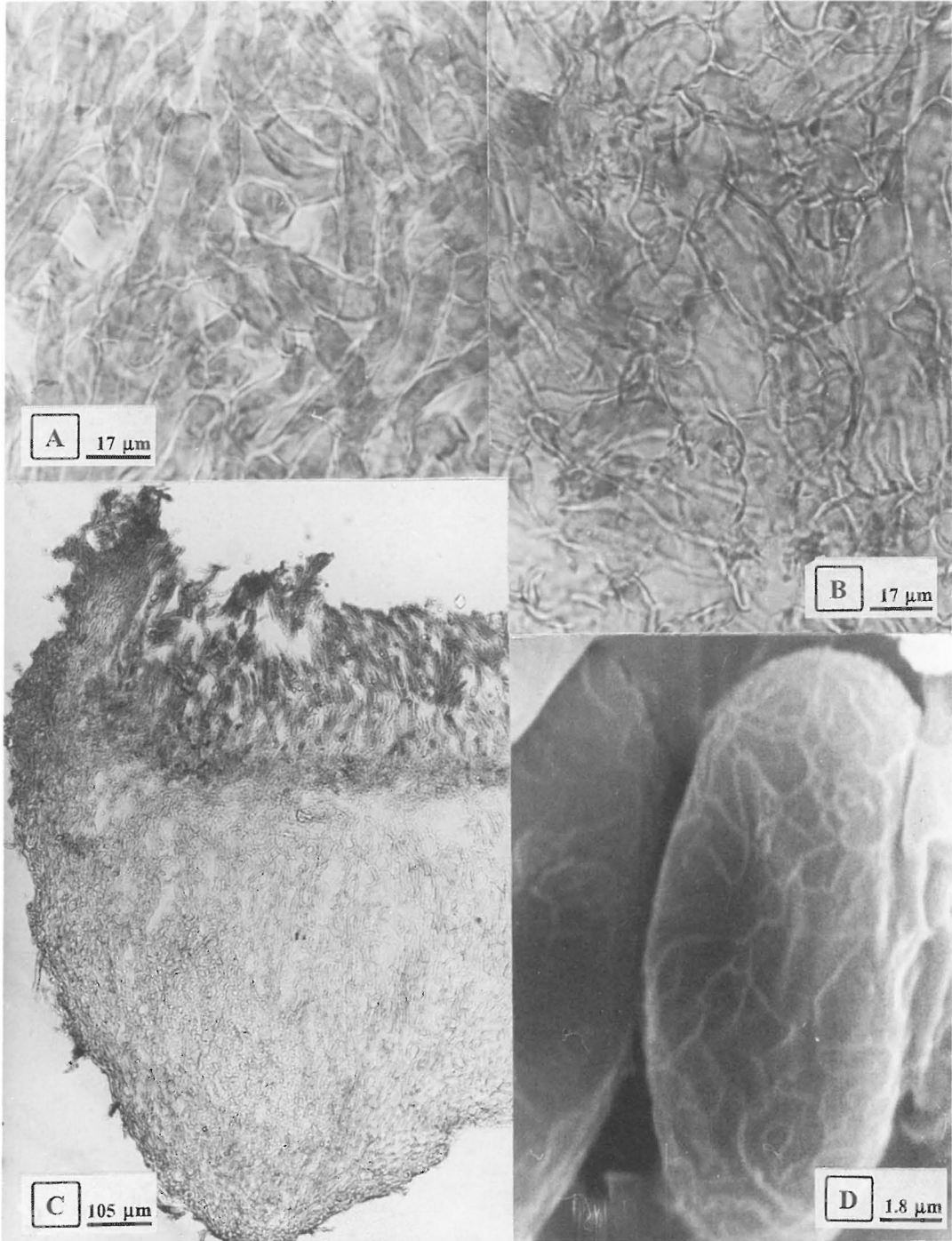


Fig. 18 A–B. *Octospora alpestris*, medulla, *t. intricata*: A) (Kallio, 18.VIII.1961), B) (Mäkinen, 1.VI.1965). – C–D. *O. borealis*: C) cup-shaped apothecium (Ohenoja, 6.VIII.1991), D) spore (TAA 121985).

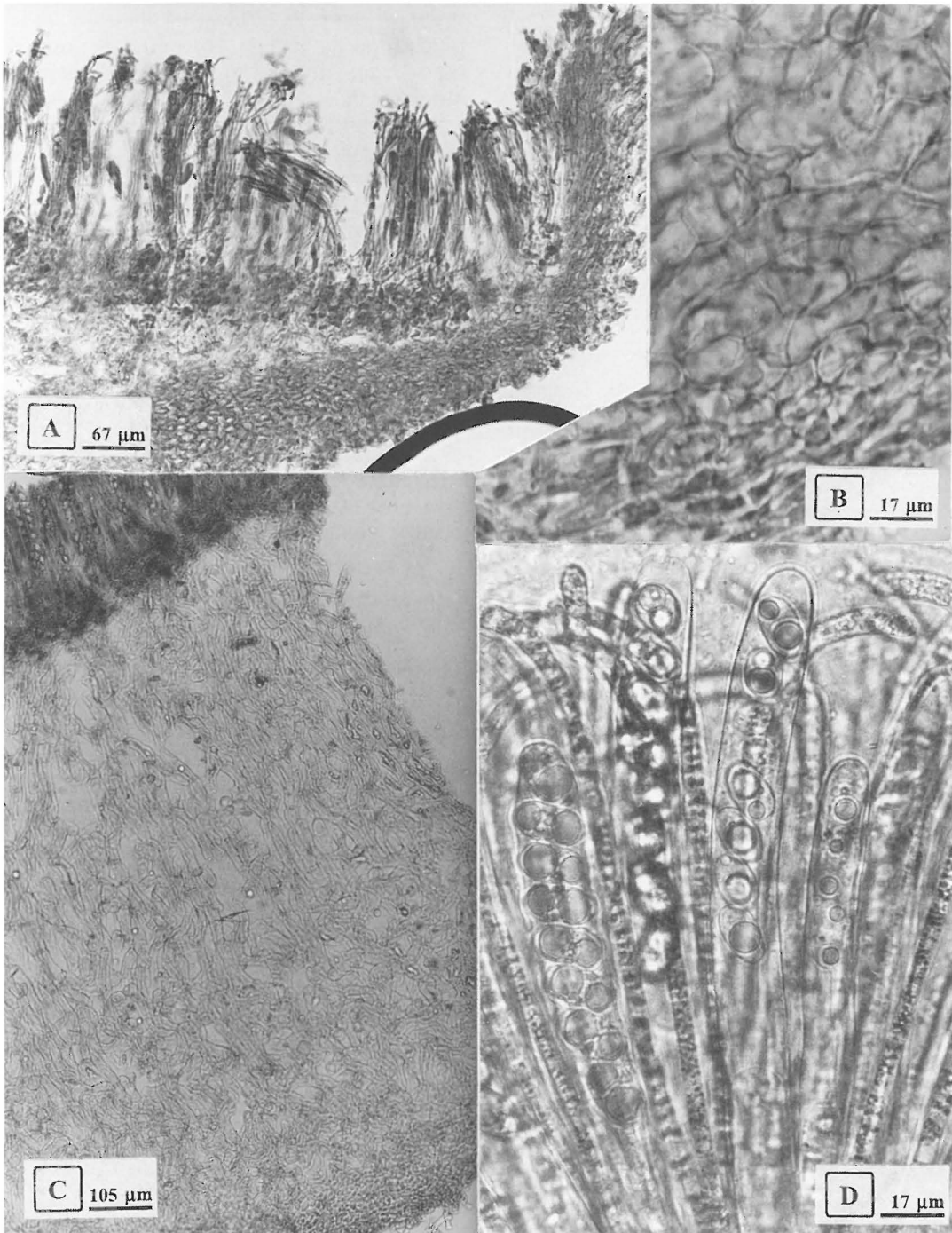


Fig. 19 A–B. *Octospora borealis*: A) margin of disc-shaped apothecium (Ohenoja, 10.VIII.1985), B) ectal excipulum, *t. intricata* (Ohenoja, 6.VIII.1991). – C–D. *O. humosa*: C) cross-section of apothecium (Heinonen, 22–88), D) asci and paraphyses from a living fruitbody in water (TAA 135658).

4. *Octospora carbonicola* (Boud.) Yei-Zeng Wang, Special Publ. Natl. Mus. Nat. Sci. Taiwan 4:41. 1992. – Fig. 2

Lamprospora carbonicola Boud., Hist. Class. Discom.: 68. 1907.

Lamprospora polytrichi (Schum.) Le Gal, Bull. Soc. Mycol. France 56:39. 1940.

Asci with 8 ascospores. Ascospores globose, uniguttulate, with fine ornamentation consisting of ridges which form a complete reticulum, ridges up to 0.6 µm in height, (11.3) 12.0 (12.6) µm excluding ornamentation.

Specimen examined: Estonia: Tartumaa: Lemmatsi, 7.X.1989 Kullman (TAA 117313).

Discussion. Because of insufficient material, *Octospora carbonicola* is described only by ascospore characters. Descriptions are based on a five-year-old slide.

This specimen has smaller ascospores than reported for this species in literature: 13–15 µm (Benkert 1987), 14–16 µm (Wang & Kimbrough 1992), but ornamentation is similar to that described in literature.

O. carbonicola is similar to many species by globose, reticulate spores, but has a specific, finer and denser reticulum.

5. *Octospora crosslandii* (Dennis & Itzerott) Benkert, Feddes Repert. 87(9–10):618. 1976. – Fig. 11

Octospora leucoloma var. *crosslandii* Dennis & Itzerott, Kew Bull. 28:15. 1973.

Apothecium minute, at first cupulate, with thick, raised margin, later flattened, with indistinct margin, 1–1.5 mm in diam, orange when dried. Outside concolorous, glabrous.

Receptacle two-layered, walls of hyphae thicker in ectal excipulum than in medullary excipulum. Ectal excipulum 30–50 µm thick, consisting of *t. intricata*, hyphae 10–20 µm in diam, wall 1.5–2 µm thick. Medullary excipulum 220–250 µm thick, consisting of *t. intricata*, hyphae 5–10 µm in diam, wall up to 1 µm thick. Hyphae are reoriented towards the margin of receptacle, their cells becoming longer and more regularly arranged, running parallel with the surface of receptacle, 5–11 µm in diam

at obtuse end cells of long, cylindrical hyphae which form the margin. Hypothecium consisting of *t. intricata*, up to 50 µm thick, hyphae 3–6 µm in diam. Hymenium 220–260 µm thick.

Asci with 8 ascospores. Ascospores asymmetrical, ellipsoid, hyaline, with one or two guttulae, smooth, (14.5) 20.6 (22.1) × (10.7) 11.6 (12.6) µm, Q=1.8. Paraphyses clavate, straight, diam at the apex 6–12 µm.

O. crosslandii grows on stems and leaves of *Tortella inclinata*.

Specimen examined: Estonia. Saaremaa: Tagarand, UTM 0617, 12.IX.1993, Jakobson (TAA 135634).

Discussion. *O. crosslandii* is similar to *O. leucoloma* but differs from this species by broader spores. Some ecological differences can also be detected. *O. leucoloma* grows mostly with moss *Bryum* but *O. crosslandii* has never been found together with this moss species.

6. *Octospora humosa* (Fr.: Fr.) Dennis, British Cup Fungi: 33. 1960. – Fig. 13, 15, 19C–D, 20

Peziza humosa Fr.:Fr., Mycologia Europaea I: 297. 1822 et Fr., Syst. Myc. 2:71. 1822.

Humaria humosa (Fr.: Fr.) Quél., Enchiridion Fungorum: 289. 1886.

Apothecium immersed, at first cupulate, later discoid, up to 10 mm in diam. Hymenium concave, grayish-orange to orange when dried. Outside paler, tomentose, covered with dense mycelium which anchors apothecium to the substratum. Margin raised, dentate, fimbriate.

Receptacle two-layered, walls of hyphae in ectal excipulum thicker than in medullary excipulum. Ectal excipulum 50–80 µm thick, consisting of *t. intricata*, hyphae 10–24 µm in diam, wall 2.5–3 µm thick. Medullary excipulum 550–1090 µm thick, consisting of *t. porrecta*, hyphae 13–24 µm in diam, wall up to 1.5 µm thick. Margin consists of *t. porrecta*, hyphae 6–21 µm in diam. Hypothecium up to 55 µm thick, consisting of *t. intricata*, hyphae 3–5 µm in diam. Hymenium 160–260 µm thick.

Asci with 8 ascospores. Ascospores cylindrical, with rounded ends, hyaline, with one or two big and many small guttulae, smooth, (17.0) 18.5–23.1 (25.9) × (9.5) 10.5–13.2 (14.5) µm, Q=1.57–1.92. Paraphyses clavate, straight or slightly curved, diam at the apex 3–8 µm.

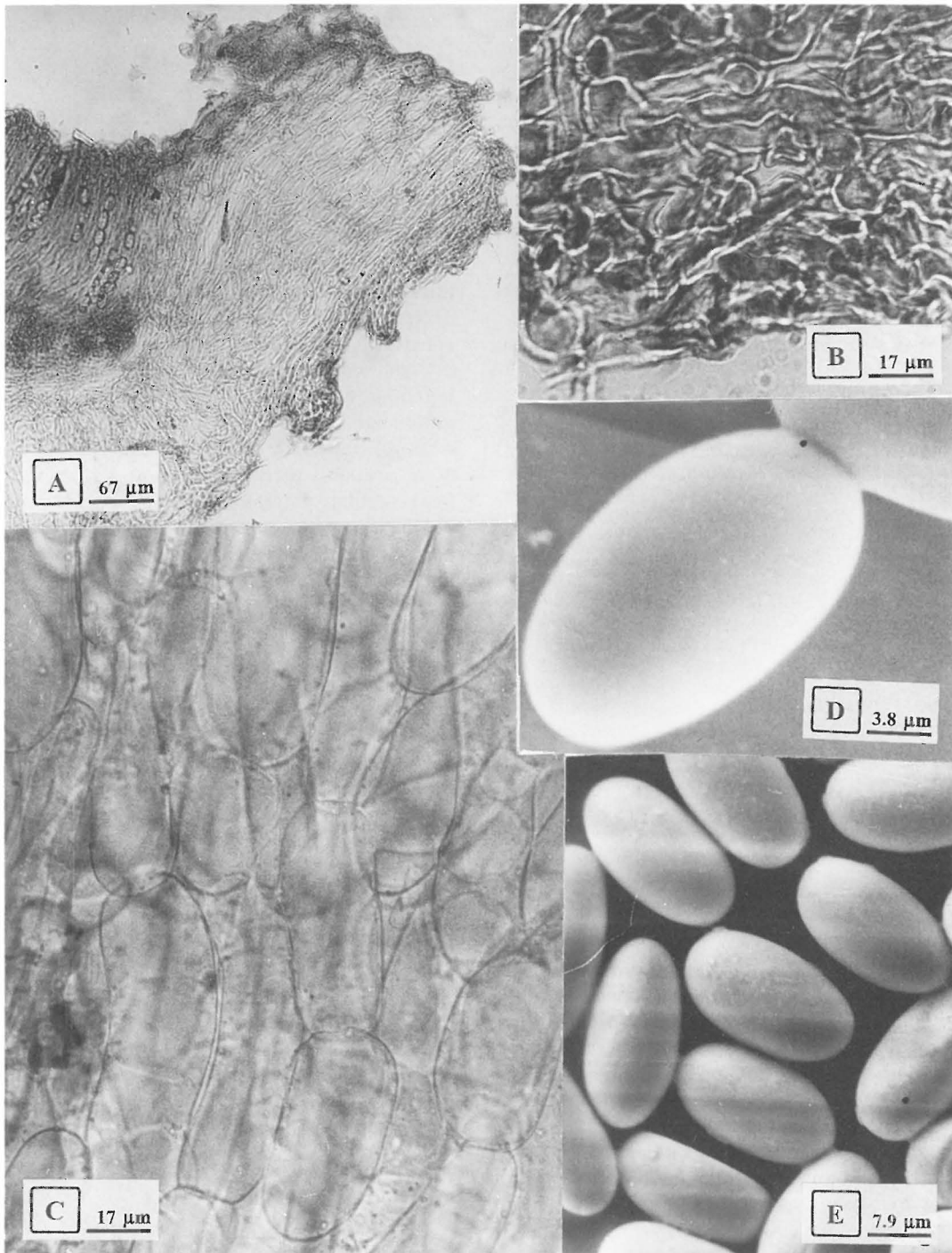


Fig. 20. *Octospora humosa*. – A) Margin, *t. porrecta* (TAA 135658), B) ectal excipulum, *t. intricata* (Mäkinen, 68-1497), C) medulla, *t. porrecta*, living hyphae in water (TAA 135658), D) spore (TAA 135672), E) spores (TAA 135658).

Grows amongst mosses *Bryum* sp. (in one specimen), *Calliargon* sp. (in one specimen), *Ceratodon purpureus* (in 16 specimens), *Dicranella* sp. (in 5 specimens), *Pogonatum urnigerum* (in one specimen), *Polytrichum hyperboreum* (in 3 specimens), *P. juniperum* (in 6 specimens), *P. piliferum* (in 6 specimens), *P. swartzii* (in one specimen), *Polytrichum* sp. (in one specimen), *Pohlia* sp. (in 10 specimens), *Oligotrichum* sp. (in one specimen).

Specimens collected between 20 July and 20 October.

Specimens examined: **Estonia.** Põlvamaa: Taevaskoja, 1985 Kalamees (TAA 124501); 1987, *Kalamees* (TAA 125706); Viljandimaa: Kõpu, 1993 *Kullman* (TAA 117924). **Finland.** Varsinais-Suomi: Pöytyä, Kontolanrahka, 6478:269, 1994 *Jakobson* (TAA 135658); Kemiö, 6688:271, 1966 *Kankainen* (TUR); Koski, 672703:28960, 1988 *Heinonen* 22–88 (TUR); Nauvo, 6691:221, 1994 *Jakobson* (TAA 135672); Tenhola, 6665:278, 1987 *Saarenoksa* 16987 (H); Etelä-Häme: Somerniemi, 6725:491, 1968 *Mäkinen* 68–1479 (TUR); Pohjois-Häme: Jyväskylä, 1978 *Harmaja* (H); Pohjois-Savo: Kuopio, 6985:547, 1983 *Vauras* 1567 (TUR); Keski-Pohjanmaa: Pulkki, 1979 *Harmaja* (H); Oulun Pohjanmaa: Oulu, 7210:427, 1965 *Ulvinen* (OULU); Pudasjärvi, 72570:5181, 1991 *M. Ohenoja* (OULU); Perä-Pohjanmaa: Ylitornio, 7392:402, 1976 *Kaakinen & Karjalahti* (OULU); Koillismaa: Posio, 1969 *Ulvinen* (OULU); Enontekiön Lappi: Enontekiö, 1979 *Harmaja* (H); 763:36, 1971 *E. Ohenoja* (OULU); Inarin Lappi: Inari, 7608:520, 1965 *Pohjola* (TUR); 1972 *Mäkinen* 72–639 (TUR); 7612:518, 1968 *Kankainen* (TUR); Utsjoki, 770:50, 1962 *Kallio* (TUR); 7738:501, 1965 *Ulvinen* (OULU); 7741:501, 1965 *Ulvinen* (OULU); 7742:499, 1962 *Suominen* (TUR); 7741:500, *Mäkinen* (TUR); 7742:500, 1965 *Mäkinen* (TUR); 770:50, 1964 *Hulkko* (TUR); 7759:501, 1962 *Kallio* (TUR); 7742:500, 1968 *Kankainen* (TUR); 77420:5004, 1963 *Mäkinen* (TUR).

Discussion. Paraphyses studied in living state in water contained many small orange pigment guttulae among regularly distributed hyaline guttulae forming perpendicular stripes. When the same specimen was studied after herbarization, no hyaline guttulae were found, while only some orange guttulae were present (Fig. 15.).

A significant difference in thickness has been detected between the older (central, 260 µm) and younger (marginal, 160 µm) parts of the hymenium. Accordingly, the thickness of the hymenium (including ascus length) depends on the age of the apothecium.

7. *Octospora leucoloma* Hedw.: Gray, Natural Arrangement of British Plants I:667. 1821. – Figs. 4, 21, 22A–C, 31A

Peziza leucoloma (Hedw.: Gray) Pers., Mycologia Europaea I: 296. 1822.

Humaria leucoloma (Hedw.: Gray) Seaver, The North American Cup-Fungi (Operculates): 129. 1928.

Apothecium minute, immersed, discoid, up to 2 mm in diam, orange when dried. Outside paler, tomentose, totally covered with mycelium which anchors apothecium to the substratum. Margin indistinct, fimbriate.

Receptacle two-layered, walls of hyphae thicker in ectal excipulum than in medullary excipulum. Ectal excipulum 50–70 µm thick, consisting of *t. intricata*, hyphae 7–10 (24) µm in diam, walls 2–3 µm thick. Medullary excipulum 50–200 µm thick, *t. intricata*, hyphae 6–16 µm in diam, wall 1–2 µm thick. Hyphae are re-oriented towards the margin of receptacle, forming *t. porrecta*, their cells becoming longer and more regularly arranged, running parallel with the surface of receptacle, 5–11 µm in diam at obtuse end cells of hyphae which form the margin. Hypothecium 50–60 µm thick, consisting of *t. intricata*, hyphae 3–5 µm in diam. Hymenium 160–200 µm thick.

Asci with 8 ascospores asymmetrical, ellipsoid to subfusoid, hyaline, with one or occasionally two guttulae, smooth 19.2–20.8 (21.7) × (8.5) 9.5–9.9 (10.4) µm, Q=1.9–2.2. Paraphyses clavate, straight or slightly curved, diam at the apex 4–5 µm.

Grows on calcium rich soil with mosses.

Specimens collected between 25 July and 4 October.

Specimens examined: **Estonia.** Tartu: Aardla, on *Bryum argenteum*, *Ditrichum* sp. and *Phascum* sp., 1991 *Kullman* (TAA 117657); Lemmatsi, 1989 *Kullman* (TAA 117312). **Finland.** Varsinais-Suomi: Särkisalo, on *Bryum* sp., and *Dicranella varia*, 6672:270, 1994 *Jakobson* (TAA 135664a); Satakunta: Siikainen, on *Barbula convoluta*, *Bryum* sp. and *Leptobryum pyriforme* 6867:222, 1990 *Vauras & Huhtinen* (TUR).

8. *Octospora maireana* (Seaver) Yei-Zeng Wang, Special. Publ. Natl. Mus. Nat. Sci. Taiwan 4:41. 1992. – Figs. 22D, 23, 24A–B. Description see in *Kullman* (1997).

9. *Octospora melina* (Velen.) Dennis & Itzerott, Kew Bull., 28:17. 1973. – Figs. 5, 24C–D, 25A

Humaria melina Velen., Monogr. Discom. Bohemiae: 325. 1934.

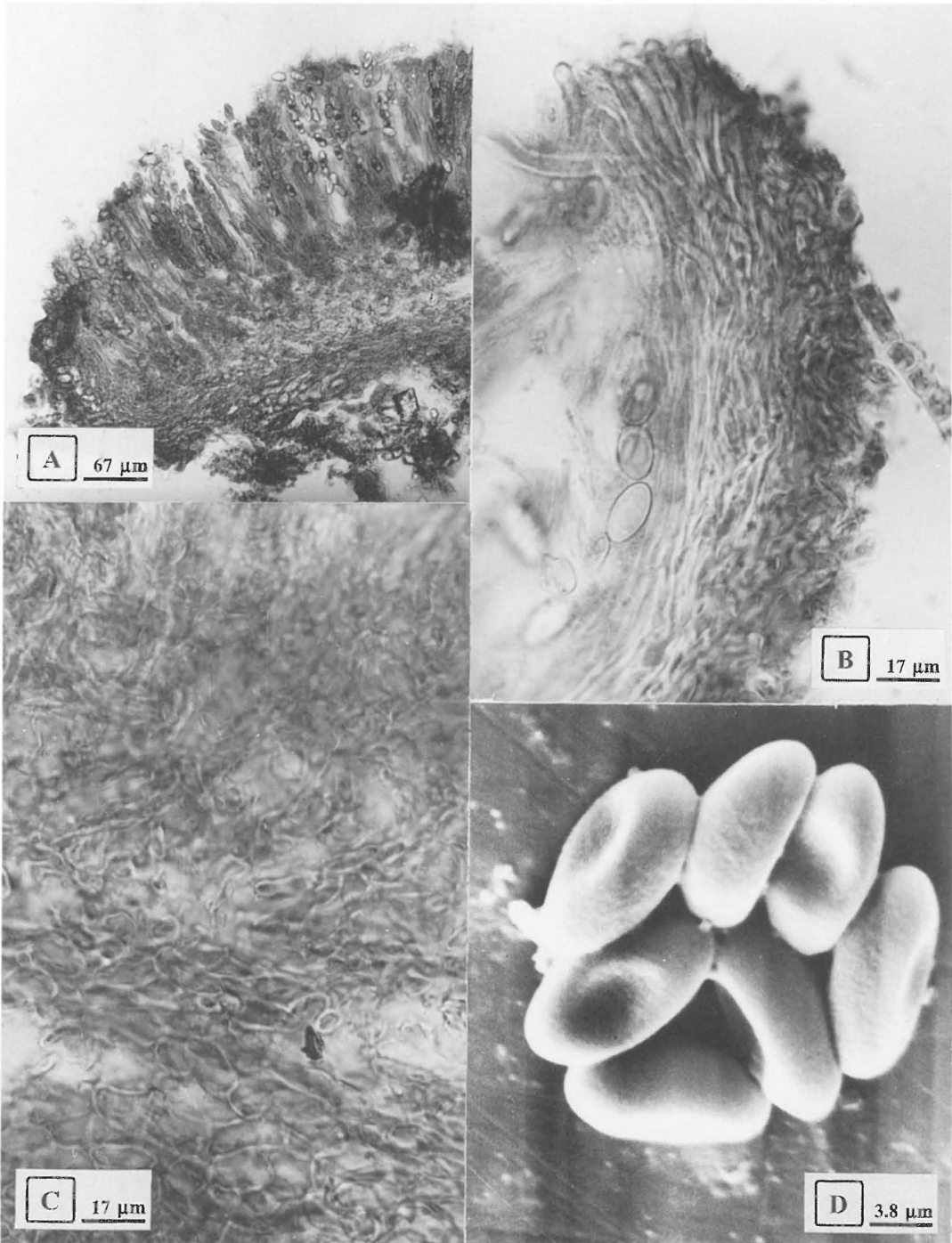


Fig. 21. *Octospora leucoloma*. – A) Cross-section of apothecium, B) margin, *t. porrecta*, C) ectal excipulum, medulla and hypothecium, *t. intricata* (TAA 117657), D) spores (TAA 117312).

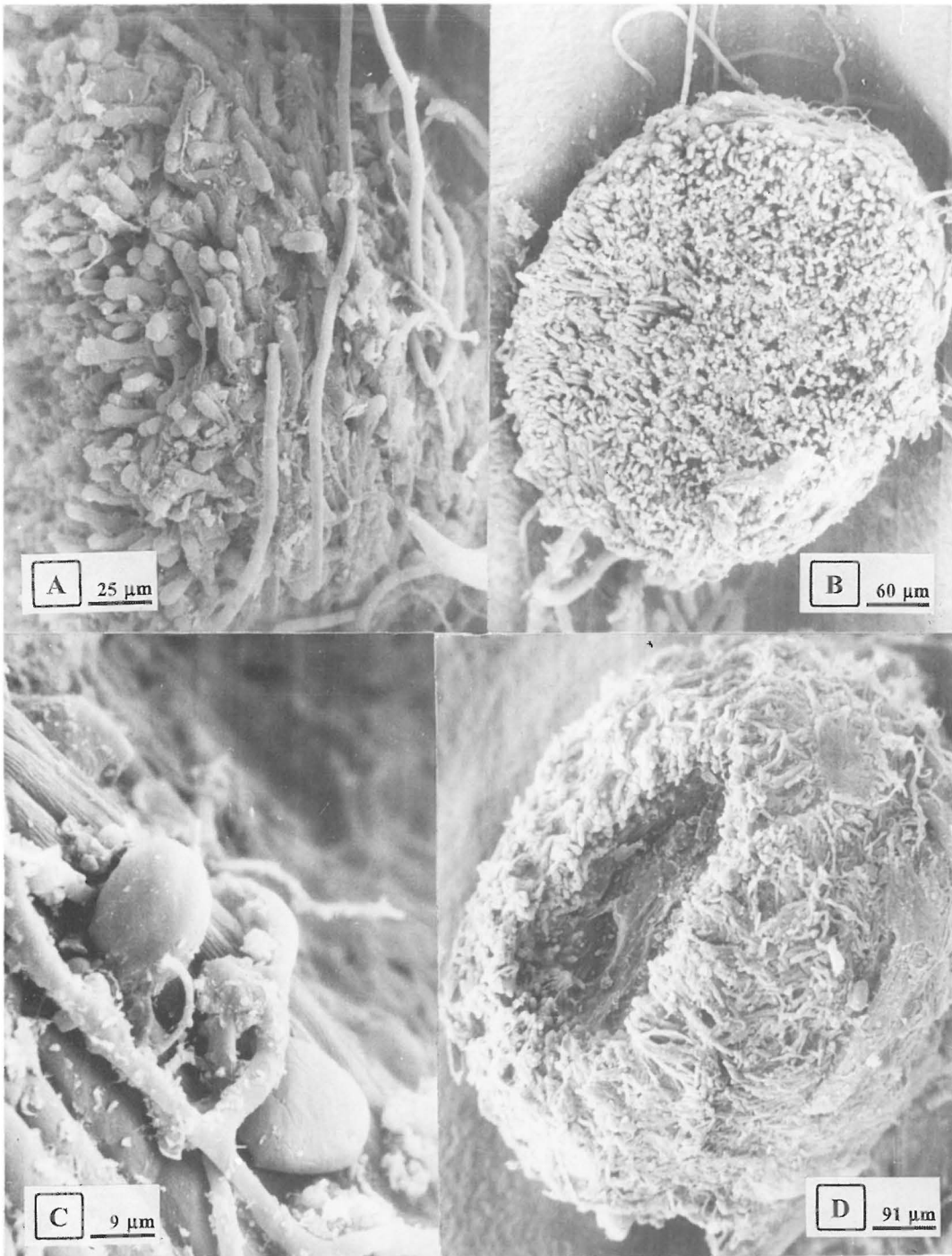


Fig. 22A–C. *Octospora leucoloma*. – A) Margin, *t. porrecta* (TAA 117657), B) fruitbody (TAA 117657), C) spores and hyphae on moss leaf (TAA 117657). – D. *O. maireana*: fruitbody (TAA 117649).

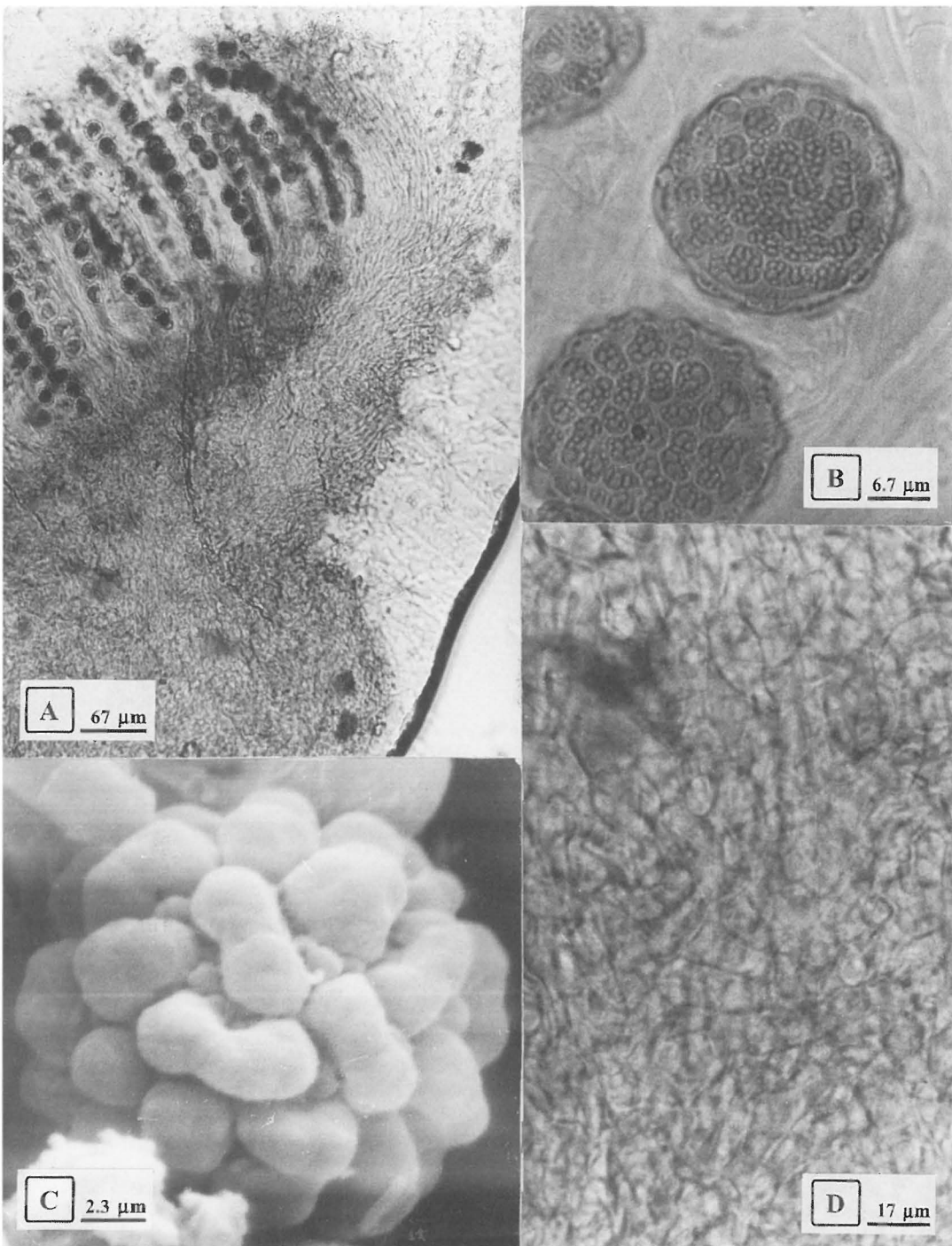


Fig. 23. *Octospora maireana*. – A) Cross-section, B) spores (*F.J. Seaver* 29.X.1913, isotype), C) spore (TAA 117649), D) medulla, *t. intricata* (isotype).

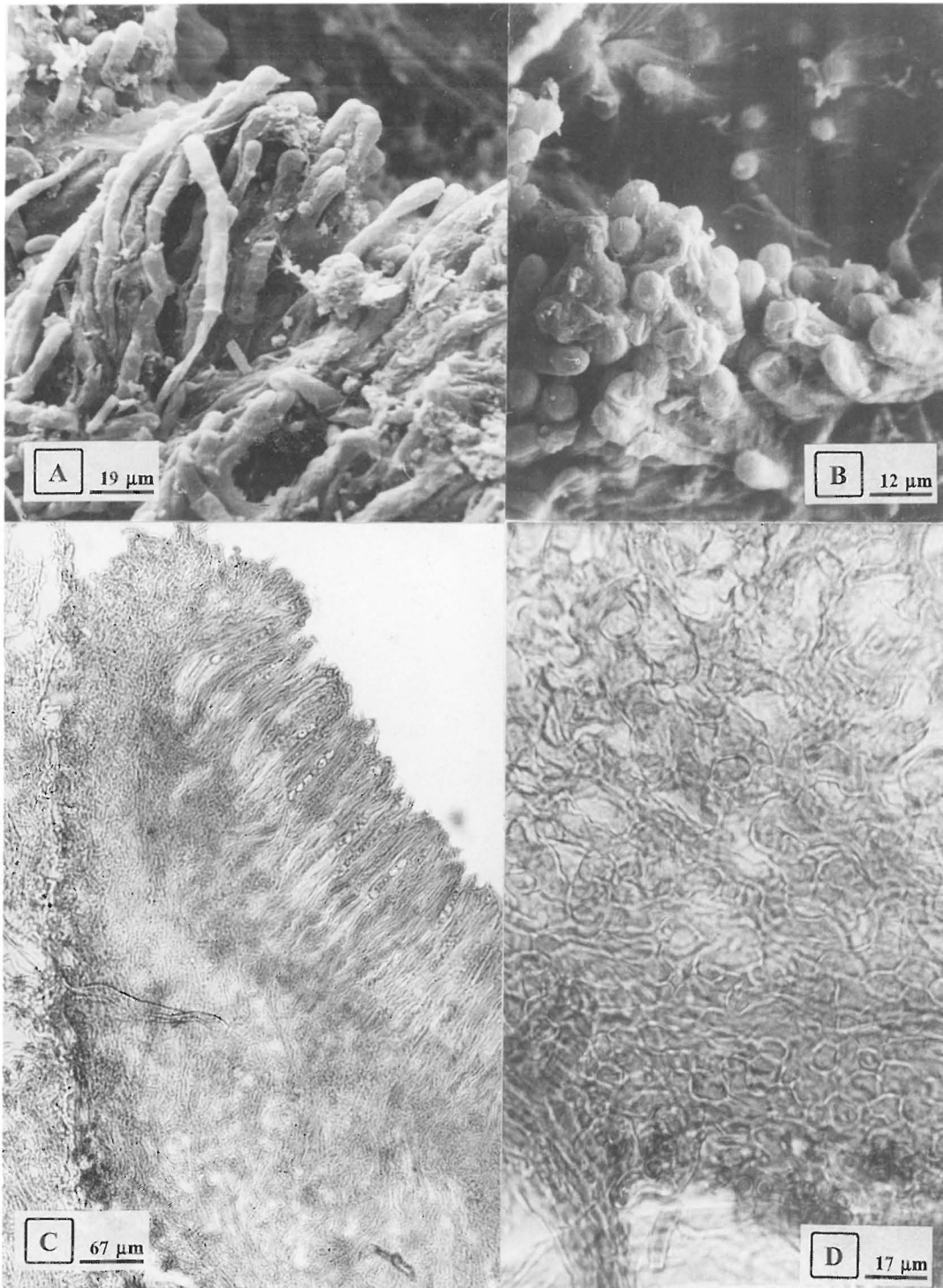


Fig. 24 A–B. *Octospora maireana*: A) margin, *t. porrecta*, B) margin (TAA 117649). – C–D. *O. melina*: C) cross-section of apothecium, D) ectal excipulum, *t. intricata* (Alho & Alava, 9.X.1969).

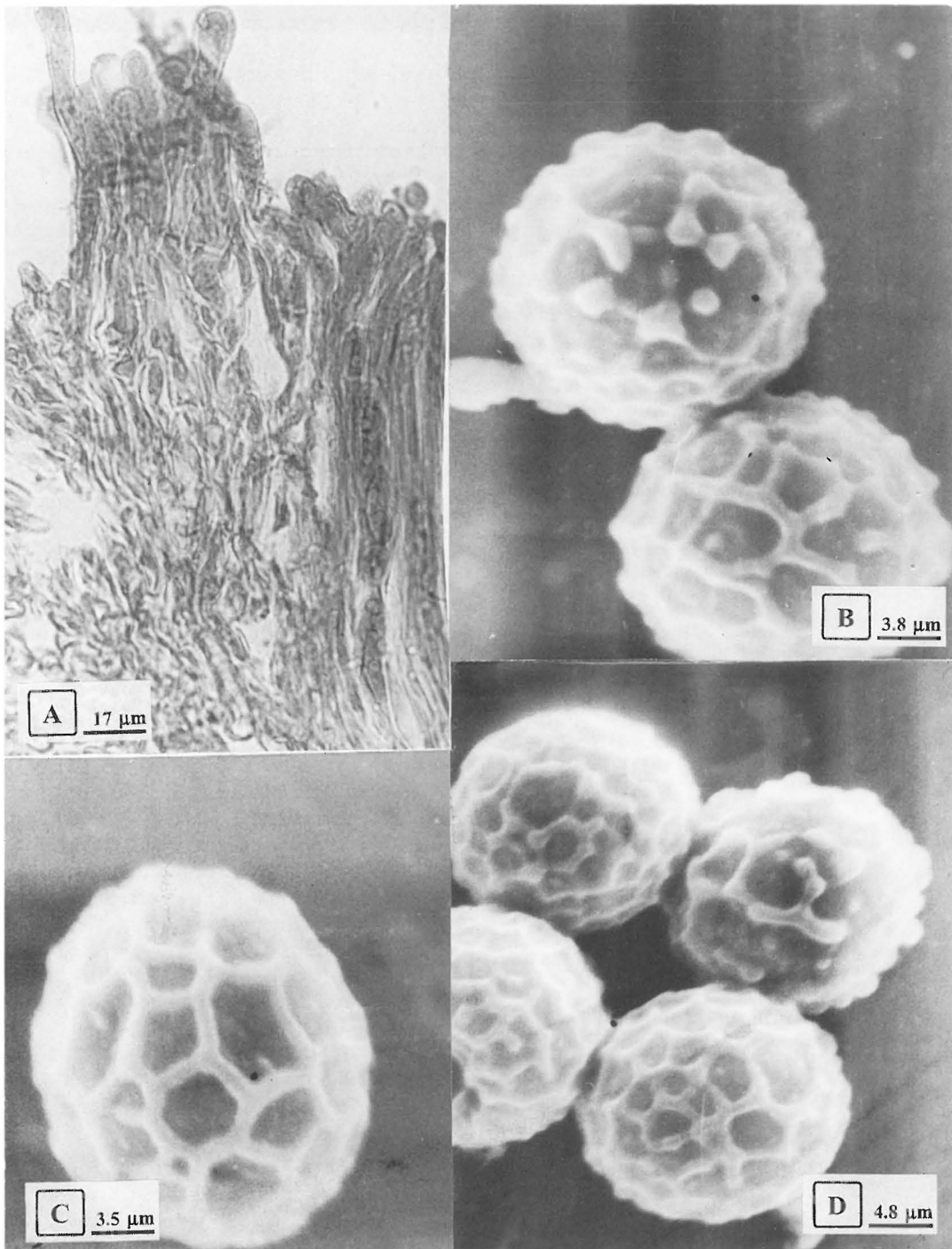


Fig. 25 A. *Octospora melina*: margin, *t. porrecta* (Alho & Alava, 9.X.1969). – B–D. *O. miniata*: different ornamentation of spores from the same fruitbody (TAA 135663).

Apothecium minute, cupulate, up to 2 mm in diam, greyish-orange when dried.

Receptacle two-layered, diameter of hyphae smaller and walls of hyphae thicker in ectal excipulum than in medullary excipulum. Ectal excipulum 50–65 µm thick, consisting of *t. intricata*, hyphae 5–10 µm in diam, wall 1.5–2 µm thick. Medullary excipulum 350–390 µm thick, *t. intricata*, hyphae 10–15 µm in diam, wall up to 1 µm thick. Hyphae are reoriented towards the margin of receptacle, forming *t. porrecta*, their cells becoming longer and more regularly arranged, running parallel with the surface of receptacle, 6–11 µm in diam, at obtuse end cells of long hyphae which form the margin. Hypothecium 85–95 µm thick, consisting of *t. intricata*, hyphae 3–5 µm in diam. Hymenium 190–210 µm thick.

Asci with 8 ascospores. Ascospores ellipsoid, hyaline, uniguttulate, (12.6) 13.4–14.4 (15.8) × (7.2) 7.9–8.5 (9.1) µm, excluding ornamentation, Q=1.7. Ornamentation consisting of small warts. Paraphyses straight, up to 3–5 µm in diam at the apex.

Grows on calcium-rich soil with mosses.

Specimens examined: Finland. Varsinais-Suomi: Parainen, 6696:234, on *Aloina brevirostris*, *Bryum* sp., *Ditrichum flexicaule* and *Encalypta* sp., 9.X.1969 Alava & Alho (TUR); Etelä-Häme: Tammela, on *Bryum* sp. and *Ceratodon purpureus*, 27.IX.1866 Karsten (H).

10. *Octospora miniata* (De Not.) Caillet & Moyne, Bull. Soc. Mycol. France 96:180. 1980. –Figs. 25B–D, 26A–B, 31C

Lamprospora miniata De Not., Comm. Soc. Critt. Ital. 1:388. 1864.

Apothecium minute, at first cupulate, later flattened, up to 1.5 mm in diam, reddish-orange when dried. Outside concolorous, glabrous. Margin dentate, fimbriate, at first raised, later backward turned.

Receptacle two-layered, walls of hyphae thicker in ectal excipulum than in medullary excipulum. Ectal excipulum 50–80 µm thick, consisting of *t. intricata* with interwoven epidermoid hyphae, these 8–22 µm in diam, wall 1.5–3 µm thick. Medullary excipulum 130–160 µm thick, consisting of *t. intricata*, hyphae 5–8 µm in diam, wall up to 1 µm thick. Hyphae are reoriented towards the margin of receptacle,

forming *t. porrecta*, their cells becoming longer and more regularly arranged, running parallel with the surface of receptacle, 6–10 µm in diam at obtuse end cells of long hyphae which form the margin. Hypothecium 45–60 µm thick, consisting of *t. intricata*, hyphae 3–7 µm in diam. Hymenium 260–270 µm thick.

Asci with 8 ascospores. Ascospores globose, hyaline, uniguttulate; reticulate ornamentation may be incomplete on some ascospores, ridges 0.6–0.9 µm wide and 0.5–0.9 µm high, (13.9) 14.7 (15.8) excluding ornamentation. Paraphyses straight, diam at the apex 3–4 µm.

Grows on leaves and stems of the moss *Encalypta streptocarpa*.

Specimen examined: Finland. Varsinais-Suomi: Särkisalo, 66721:2704, 23.IX.1994 Jakobson (TAA 135663).

11. *Octospora rubens* (Boud.) M.M. Moser, Kleine Kryptogamenflora IIA, Ascomyceten: 110. 1963. – Figs. 12, 26C–D

Humaria rubens (Boud.) Seaver, The North American Cup-fungi (Operculates): 127. 1928.

Apothecium cupulate, 2–3 mm in diam, orange when dried.

Receptacle two-layered, ectal excipulum 110–130 µm thick, consisting of *t. intricata*, hyphae 10–15 µm in diam, wall 2.5–4 µm thick. Medullary excipulum 420–960 µm thick, consisting of *t. intricata*, hyphae 20–40 µm in diam, wall 1–2 µm thick. In the central part of medullary excipulum vertical orientation of hyphae may occur. Margin consisting of parallel running hyphae which form *t. porrecta*. Hypothecium 50–65 µm thick, consisting of *t. intricata*, hyphae 4–6 µm in diam. Hymenium 180–240 µm thick.

Asci with 8 ascospores. Ascospores ellipsoid, hyaline, with two guttulae, smooth, (15.1) 16.6–17.4 (18.6) × (9.8) 10.4–10.9 (11.6) µm, Q = 1.5–1.6. Paraphyses slightly clavate, straight or slightly curved, diam at the apex 5–8 µm.

Grows on soil with mosses.

Specimens examined: Finland. Kittilän Lappi: Kittilä, with *Ditrichum cylindricum*, *Pogonatum dentatum*, *Oligotrichum* sp., 76748:2530, 16.IX.1991 Väre (OULU); Inarin Lappi: Utsjoki, with *Ceratodon purpureus*, *Ditrichum* sp., *Polytrichum alpinum*, *Pohlia* sp., 7735:503, 18.IX.1965, *Pohjola* (TUR).

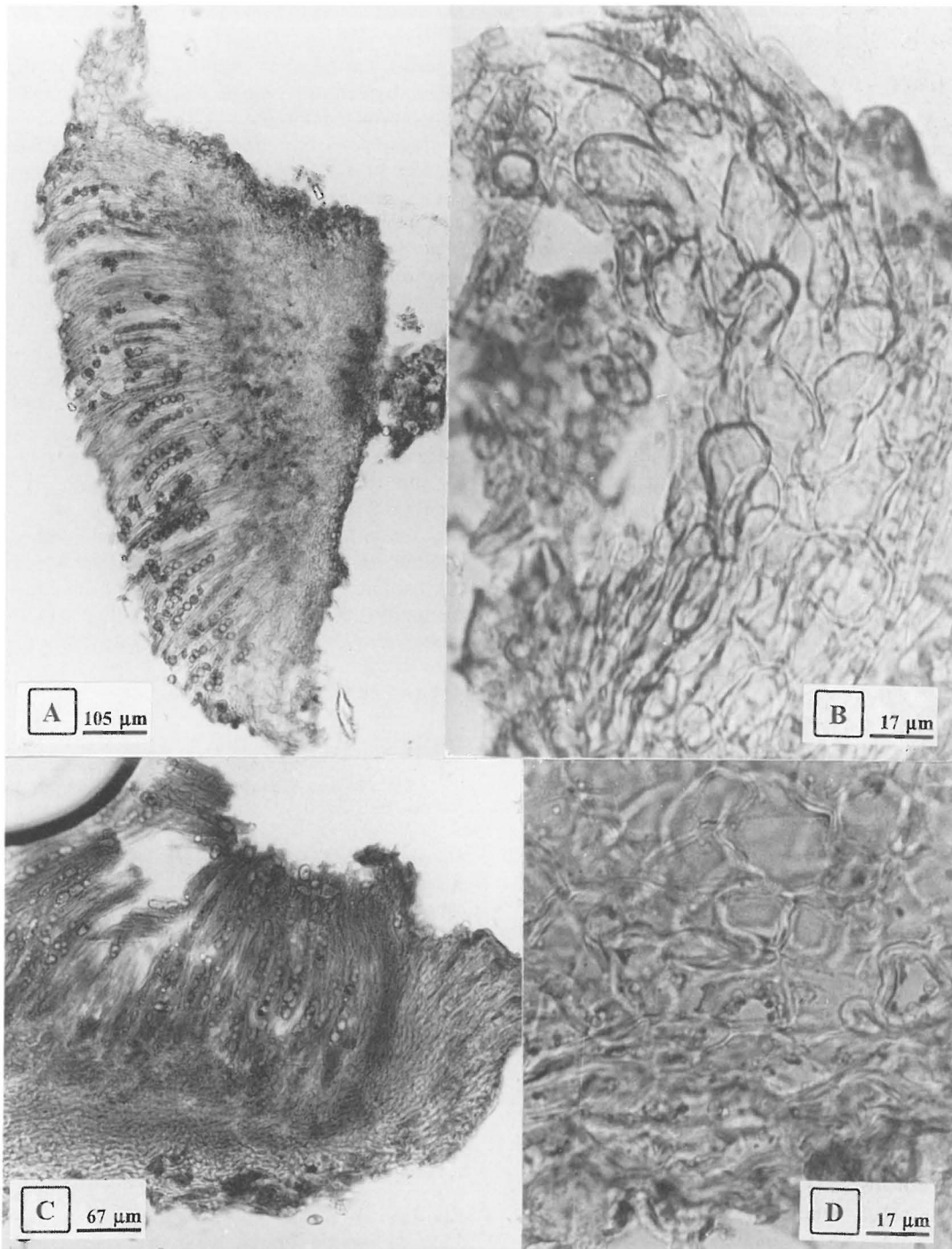


Fig. 26 A–B. *Octospora miniata*: A) cross-section of fruitbody, B) margin, *t. porrecta* (TAA 135663). – C–D. *O. rubens*: C) margin, D) ectal excipulum, *t. porrecta* (Pohjola, 18.IX.1965).

12. *Octospora rustica* (Velen.) J. Moravec, *Česká Mykologie* 23:226. 1969. – Figs. 8, 16, 27

Humaria rustica Velen., Monogr. Discom. Bohemiae: 372. 1934.

Octospora libussae Svrček & Kubička, *Česká Mykologie* 17:65. 1963.

Apothecium minute, cupulate to discoid, up to 2 mm in diam, orange when dried. Outside glabrous, concolorous. Margin indistinct.

Receptacle two-layered, walls of hyphae thicker in ectal excipulum than in medullary excipulum. Ectal excipulum 50–55 µm thick, consisting of *t. intricata*, hyphae 6–13 µm in diameter, walls 1.5–2 µm thick. Medullary excipulum 160–190 µm thick, of *t. intricata*, hyphae 8–15 (23) µm in diam, wall up to 1 µm thick. Hyphae are reoriented towards the margin of receptacle forming *t. porrecta*, their cells becoming longer and more regularly arranged, running parallel with the surface of receptacle, 5–10 µm in diam at obtuse end cells which form the margin. Hypothecium 40–55 µm thick, consisting of *t. intricata*, hyphae 4–8 µm in diam. Hymenium 150–200 µm thick.

Asci with 8 ascospores. Ascospores asymmetrical, ellipsoid, hyaline, with one or two guttulae, smooth, (13.2) 14.4–15.4 (17.0) × (7.2) 8.0–9.4 (10.1) µm, Q = 1.8.

Paraphyses straight or slightly curved, in herbarized material slightly clavate consisting of few orange guttulae, apex 4.5–7 µm in diam. Living paraphyses, studied in water, are strongly clavate, diameter at the apex 5.5–14.5 µm, filled with orange guttulae.

Grows on fireplaces, on soils rich in calcium or on clay with mosses.

Specimens examined: **Estonia.** Viljandimaa: Kõpu, on *Pohlia* sp., 23.IX.1993 Kullman (TAA 117888). **Finland.** Varsinais-Suomi: Pöytyä, on *Ceratodon purpureus*, 6478:269, 21.IX.1994 Jakobson (TAA 135656; TAA 135659); Särkisalo, on *Bryum* sp. and *Dicranella varia*, 6672:270, 23.IX.1994 Jakobson (TAA 135664); Pohjois-Häme: Äänekoski, 29.VII.1982, *Harmaja* (H).

Discussion. *O. rustica* is similar to *O. rubens*. *O. rubens* has bigger spores and bigger apothecia.

13. *Octospora seaveri* (Benkert) Yei-Zeng Wang, Special Publ. Natl. Mus. Nat. Sci. Taiwan 4:41. 1992. – Fig. 1

Lamprospora seaveri Benkert, Zeitschr. Mykol. 53:241. 1987.

Apothecium minute, cupulate, up to 1 mm in diam, hymenium orange when dried. Outside concolorous, glabrous.

Receptacle two-layered, walls of hyphae thicker in ectal excipulum than in medullary excipulum. Ectal excipulum up to 60 µm thick, consisting of *t. intricata* with epidermoid hyphae 8–13 µm in diam, walls 1.5–2 µm thick. Medullary excipulum 260–290 µm thick, of *t. intricata*, hyphae 10–14 µm in diam, wall up to 1 µm thick. Hyphae are reoriented towards the margin of receptacle forming *t. porrecta*, their cells becoming longer and more regularly arranged, running parallel with the surface of receptacle, 10–22 µm in diameter at obtuse end cells which form the margin. Hypothecium 45–65 µm thick, consisting of *t. intricata*. Hymenium 210–250 µm thick.

Asci with 8 ascospores. Ascospores globose, hyaline, uniguttulate, (13.2) 14.7–14.9 (16.4) µm excluding ornamentation. Reticulate ornamentation, ridges 0.6–1.3 µm in diam. Paraphyses straight, slightly clavate, diameter at the apex 4–7 µm.

Grows on soil with mosses.

Specimens examined: **Finland.** Uusimaa: Helsinki, on *Bryum* sp., *Ceratodon purpureus*, 05.XI.1860 Nylander (H); Etelä-Häme: Tammela: Mustiala, 26.IX.1866 Karsten 2901 (H).

Discussion. *O. seaveri* differs from the other species by globose spores with a more irregular reticulate ornamentation. The specimens described in this paper were identified by Dr. D. Benkert.

14. *Octospora tetraspora* (Fuckel) Korf, Mycologia 46:838. 1945. – Figs. 9, 28, 29A-B

Ascobolus tetrasporus Fuckel, Hedwigia 5:4. 1866.

Peziza tetraspora (Fuckel) Cooke, Grevillea 3:73. 1874. *Humaria tetraspora* (Fuckel) Seaver, The North American Cup-Fungi (Operculates): 134. 1928.

Apothecium minute, discoid, up to 2 mm in diam, hymenium orange when dried, somewhat darker (brownish) than in *Octospora leucoloma*. Margin not prominent, fimbriate, dentate.

Receptacle two-layered, walls of hyphae thicker in ectal excipulum than in medullary

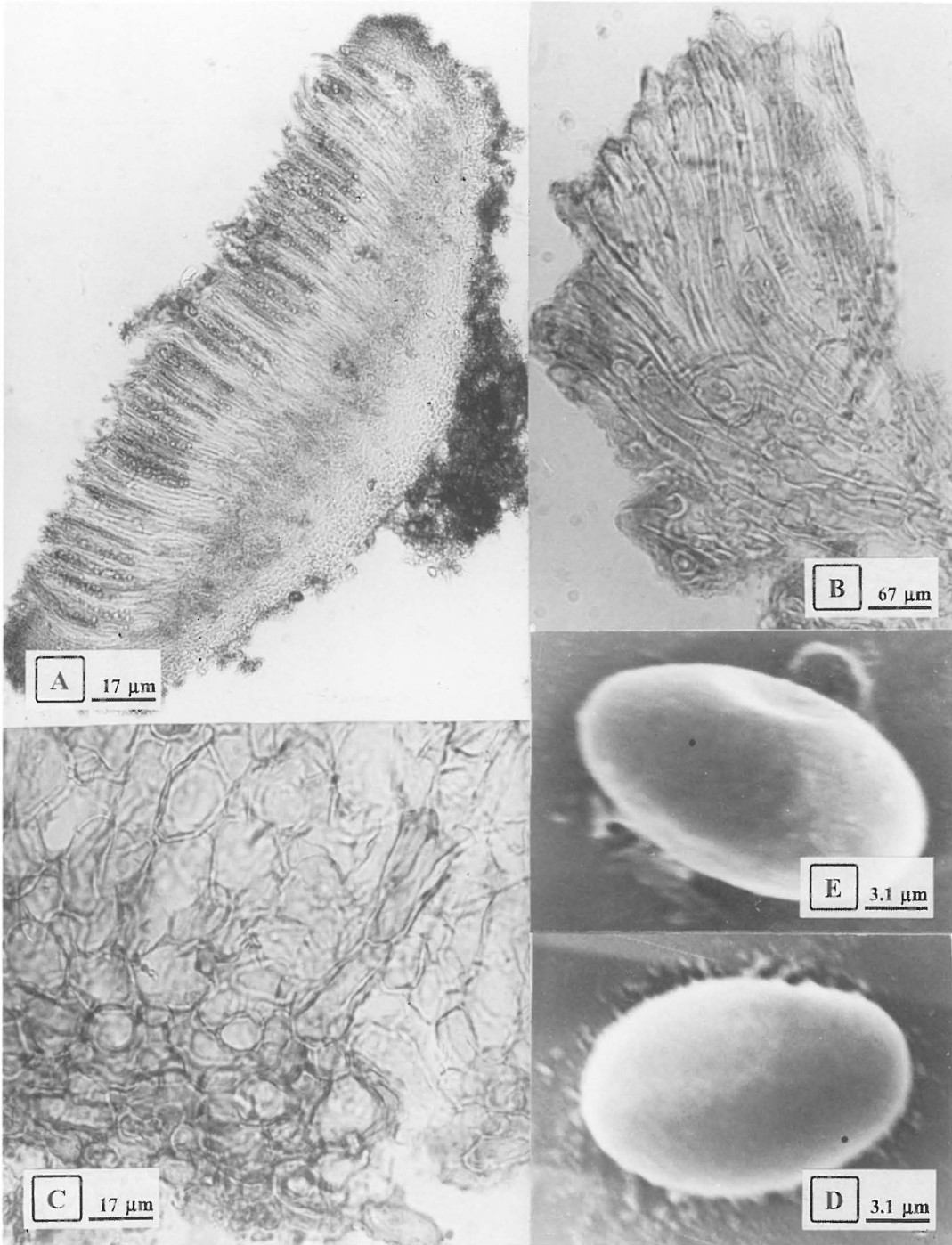


Fig. 27. *Octospora rustica*: A) cross-section of fruitbody (TAA 135656), B) margin, *t. porrecta*, C) medulla and ectal excipulum, *t. porrecta* (TAA 135664), D–E) spores (TAA 135659).

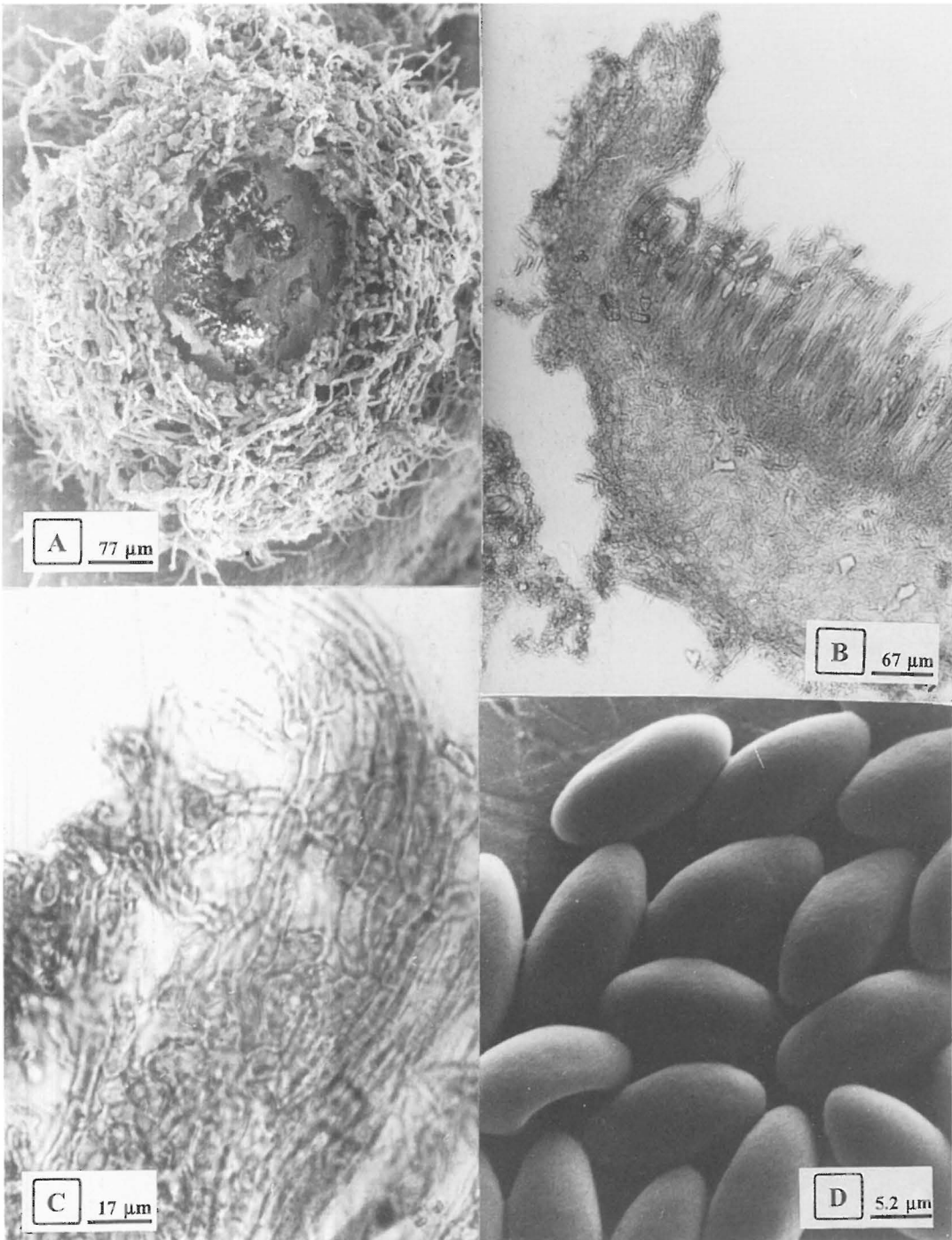


Fig. 28. *Octospora tetraspora*: A) outer surface of hymenium (TAA 117656), B) cross-section of fruitbody, C) margin, *t. porrecta* (TAA 117226), D) spores (TAA 117 226).

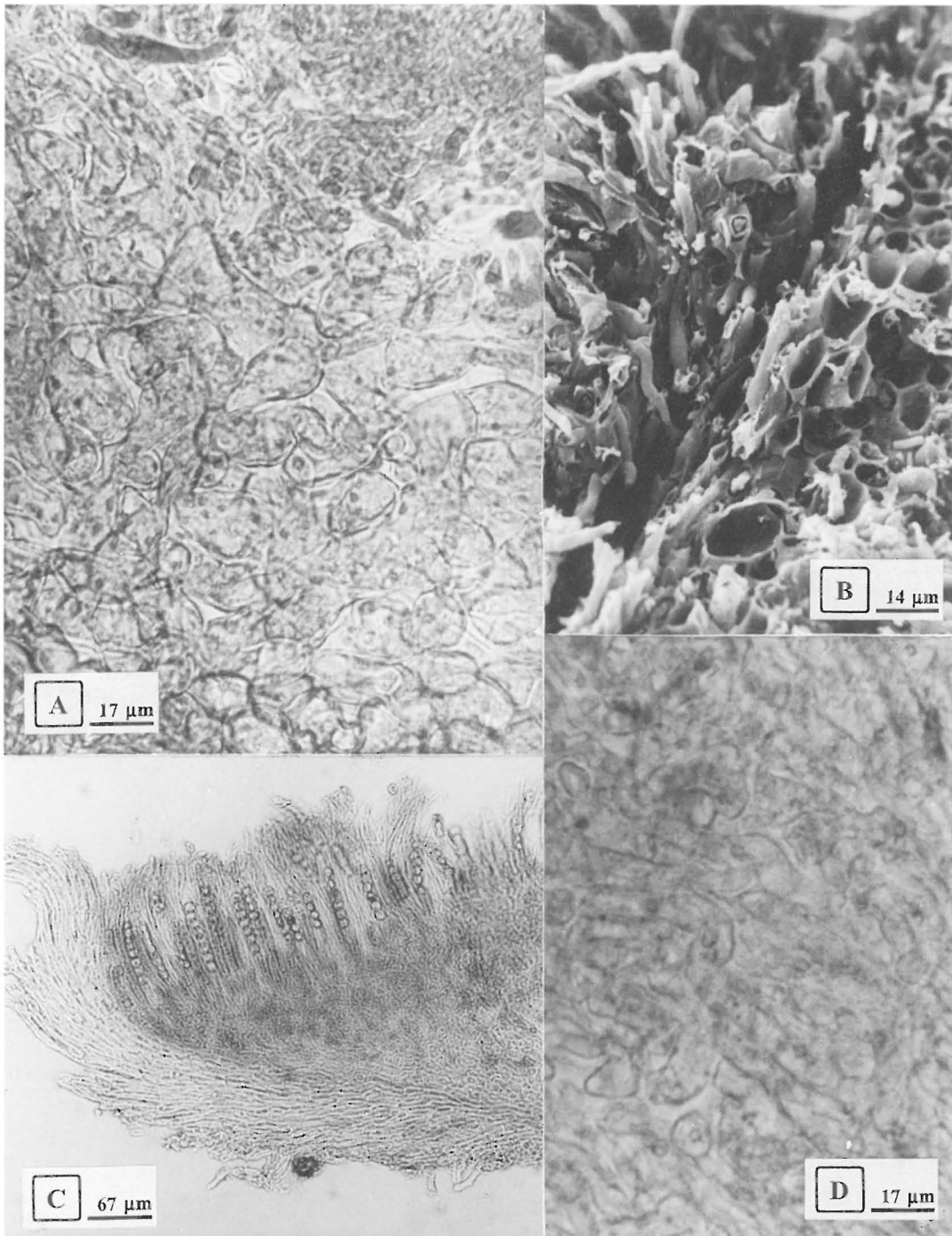


Fig. 29 A–B. *Octospora tetraspora*: A) ectal excipulum, medulla and hypothecium, *t. intricata*, B) medulla and hypothecium (TAA 117876). – C–D. *O. wrightii*: C) cross-section of fruitbody, D) medulla, *t. intricata* (TAA 135661).

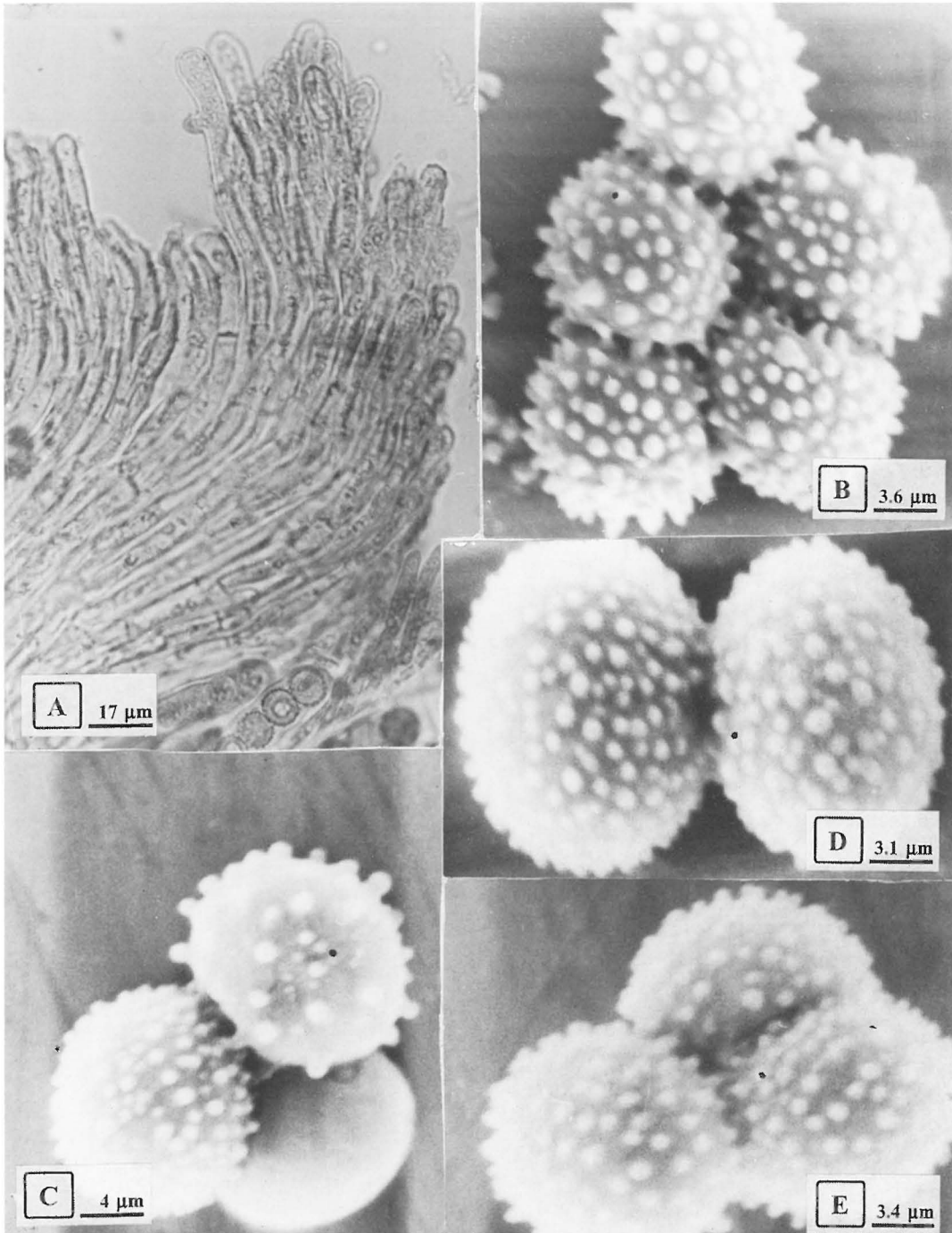


Fig. 30. *Octospora wrightii*: - A) Margin, *t. porrecta*. - B-E. Different ornamentation of spores: B) (TAA 135661), C-E) (TAA 135675).

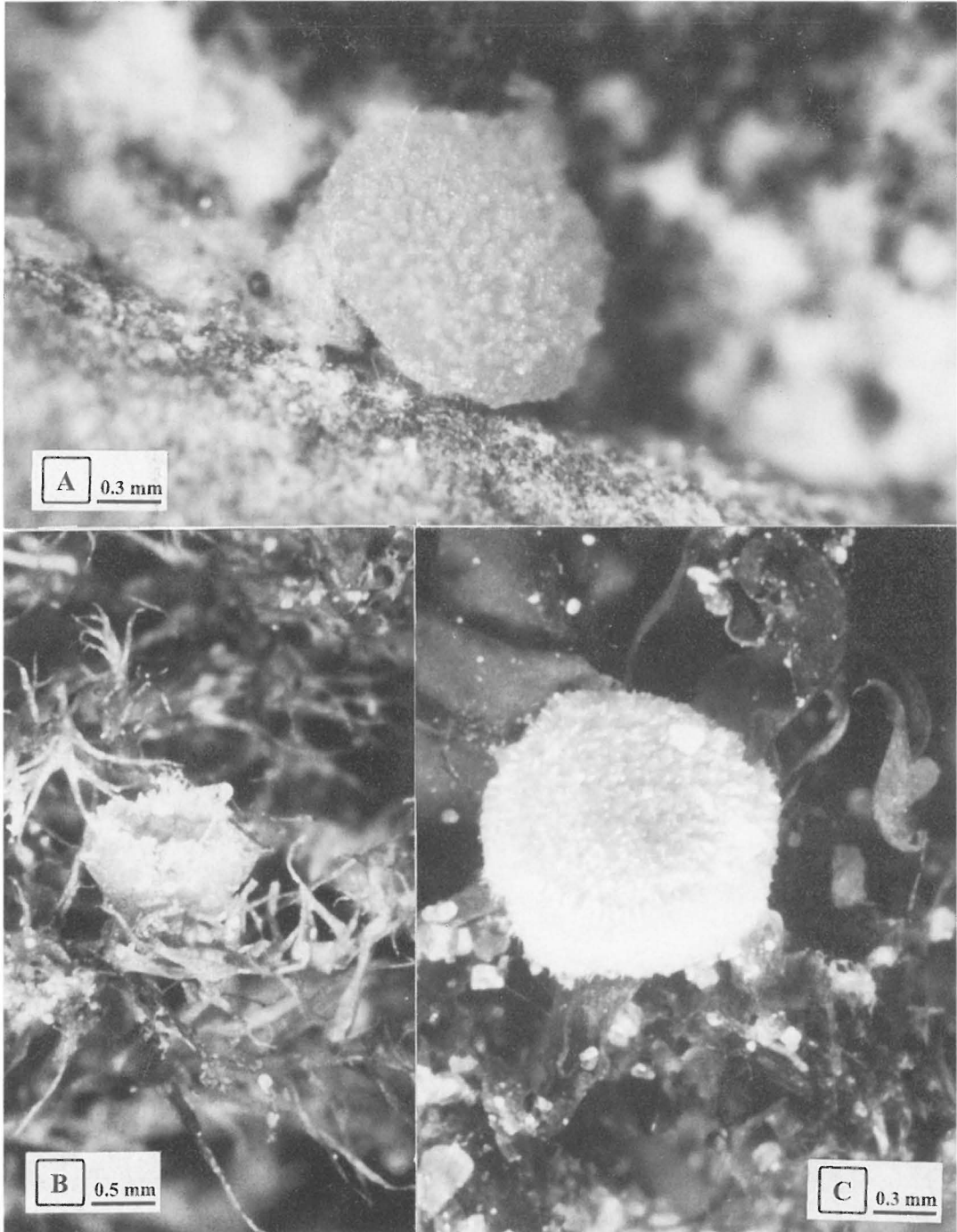


Fig. 31 A. *Octospora leucoloma* (TAA 135664A). – B. *O. wrightii* (TAA 135661). – C. *O. miniata* (TAA 135663).

excipulum. Ectal excipulum 20–30 µm thick, consisting of *t. intricata*, hyphae 5–11 µm in diam, wall up to 1.5 µm thick. Medullary excipulum 150–180 µm thick, consisting of *t. intricata*, hyphae 7–15 µm in diam, wall up to 1 µm thick. Hyphae are reoriented towards the margin of receptacle forming *t. porrecta*, their cells becoming longer and more regularly arranged, running parallel with the surface of receptacle, 6–11 µm in diam at obtuse end cells which form the margin. Hypothecium 30–40 µm thick, consisting of *t. intricata*, 3–5 µm in diam.

Asci with 4 ascospores. Ascospores asymmetrical, ellipsoid to subfusoid, hyaline, with one or two big and some small guttulae, smooth, (18.9) 22.0–24.4 (25.2) × (9.5) 10.9–11.3 (12.0) µm, Q = 2.1. Paraphyses clavate, straight or slightly curved, diam at the apex 3.5–4 µm.

Grows on calcium-rich soil, typically among *Bryum argenteum*.

Specimens collected between 5 July and 14 November.

Specimens examined: **Estonia.** Raplamaa: Kohila, 1995 *Jakobson* (TAA 135682). Viljandimaa: Kõpu, 1993 *Kullman* (TAA 117876); Loodi, 1989 *Kullman* (TAA 117226). Tartu: Aardla, 1991 *Kullman* (TAA 117656); Räni, 1989 *Kullman* (TAA 117353).

Discussion. *O. tetraspora* resembles eight-spored *O. leucoloma* but differs from it by four-spored asci and bigger ascospores.

15. *Octospora wrightii* (Berk. & M.A. Curtis) J. Moravec, *Česká Mykologie* 23:227. 1969. – Fig. 14, 29C–D, 30, 31B

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

Humaria wrightii Boud., *Hist. Class. Discom. Eur.*: 68. 1907.

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

Apothecium immersed or superficial, minute, at first cupulate, concave, with prominent, thick margin, later flattened, convex, with thin margin, up to 2 mm in diam, hymenium orange when dried. Outside concolorous, glabrous. Margin fimbriate, dentate.

Receptacle two-layered, walls of hyphae thicker in ectal excipulum than in medullary excipulum. Ectal excipulum 65–100 µm thick,

consisting of *t. intricata*, hyphae 5–11 µm in diam, wall 1.5–2 µm thick. Medullary excipulum 120–190 µm thick, of *t. intricata*, hyphae 8–11 µm in diam, thin-walled, wall up to 1 µm thick. Hyphae are reoriented towards the margin of receptacle forming *t. porrecta*, their cells becoming longer and more regularly arranged, running parallel with the surface of receptacle, 8–10 µm in diam at obtuse end cells which form the margin. Hypothecium 45–65 µm thick, consisting of *t. intricata*, hyphae 3–6 mm in diam. Hymenium 160–190 µm thick.

Asci with 8 ascospores. Ascospores subglobose to broadly ellipsoid, hyaline, uniguttulate, ornamentation consisting of warts, (12.3) 13.1 (14.5) × (10.7) 11.5 (12.0) µm, excluding ornamentation, Q = 1.2. Paraphyses straight, slightly clavate, diam at the apex 4.5–9.5 µm.

Grows on sandy soil on stems and leaves or among the moss *Amblystegium serpens*.

Specimens examined: **Estonia.** Tartumaa: Tartu, UTM 3316, 27.V.–10.X.1995 *Jakobson* (TAA 135675). **Finland.** Varsinais-Suomi: Särkisalo, 6672:270, 23.IX.1994 *Jakobson* (TAA 135661).

Discussion. When measured in water from a living apothecium immediately after collecting, the diameter of the apex of paraphyses was 4.5–5.5 µm, after being exposed for 2 hours to high humidity in a box, the diameter was 7.5–9.5 µm (Fig. 14.).

The length of asci from the same apothecium was found to be very variable. Differences in the length on matured living asci were almost two-fold, from 110 to 200 µm (Fig. 14). Such a difference may be caused by the fact that the tips of matured asci arise clearly above the level of the hymenium. This effect can be seen only on a living apothecium.

O. wrightii is characterized by the subglobose spores and by their tuberculate ornamentation. *O. wrightii* is always found with the moss *Amblystegium serpens*. It is phenologically interesting that the Estonian specimen was collected from the same place during a very long period (27.05.–10.10.).

16. *Octospora sp.*, TAA 118091. – Fig. 7

Apothecium semi-immersed, minute, discoid, concave, up to 1.5 mm in diam, hymenium reddish-orange when dried. Outside concolorous,

covered with hyphae which anchor apothecium to the substrate. Margin not prominent, thin, fimbriate.

Receptacle two-layered, walls of hyphae thicker in ectal excipulum than in medullary excipulum. Ectal excipulum 50–55 µm thick, consisting of *t. intricata*, hyphae 8–14 µm in diam, wall 2–3 µm thick. Medullary excipulum 65–80 µm thick, of *t. intricata*, hyphae 8–13 µm in diam, thin-walled, wall up to 1 µm thick. Hyphae are reoriented towards the margin of receptacle forming *t. porrecta*, their cells becoming longer and more regularly arranged, running parallel with the surface of receptacle, 8–13 µm in diam at obtuse end cells which form the margin. Hypothecium 30–55 µm thick, consisting of *t. intricata*, hyphae 5–7 µm in diam. Hymenium 275–300 µm thick.

Asci with 8 ascospores. Ascospores ellipsoid to subfusoid, hyaline, with one or occasionally two guttulae, smooth, (22.7) 24.1 (26.5) × (11.7) 12.4 (13.9) µm, Q = 1.9. Paraphyses clavate, straight, diam at the apex 3.5–4 µm.

Grows on soil with *Ceratodon purpureus*.

Specimen examined: **Estonia**. Läänemaa: Palivere, 24.IX.1994 Kullman (TAA 118091).

Discussion. This specimen is similar to *O. axillarlis* but differs from it by broader spores. The value of Q for spores of *O. axillarlis* is commonly higher than 2 (2.2 in this work); however, the value of Q for spores of this specimen is 1.9.

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