

New and rare species of Pezizales from calcareous woodlands in Denmark

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A survey of two Danish calcareous woodlands has resulted in the discovery of three new morphologically defined species of Pezizales: *Peziza exogelatinosa* sp. nov., *Peziza retrocurvata* sp. nov. and *Marcelleina tuberculisporea* sp. nov.; *Scabropeziza scabrosa* is described and reported as new to Europe. The combination *Peziza polaripapulata* comb. nov. is proposed and a detailed description of this taxon is given. A lectotype is designated for *Peziza subcitrina* and this binomial is discussed in relation to *Peziza buxea*. *Peziza polaripapulata* and *P. subcitrina* are new to the Nordic countries. Diagnoses and re-descriptions are based on fresh material. Anatomical features based on ultra-thin sections and SEM of the spores are presented, as well as ecological data on each of the species.

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Introduction

Many species of Pezizales are known to prefer calcareous soils. It has been shown that high pH, and in some cases a low content of organic matter, is of significance for the occurrence of many of the species in Denmark (Petersen 1967, 1985). With the expectation of a high diversity of taxa of Pezizales, and a yield of considerable amount of information on distribution and ecology of the species involved, two calcareous woodlands, Klinteskov and Allindelille Fredskov, were chosen as sites for a fungistic and autecological survey of Pezizales. Klinteskov, primarily a beech forest, is situated on a coastal chalk cliff, on the island of Møn in south-eastern Denmark. Allindelille Fredskov, in southern Zealand, is likewise a beech dominated forest on chalk. A systematic registration of all Pezizales was undertaken and soil conditions, vegetation and habitat types were registered. Klinteskov was visited every second week from March 14th to November 17th 1994, and daily from 20th of August to 20th of Sep-

tember, 1994. Additionally, more scattered collecting was carried out in spring 1995 and 1996. Allindelille Fredskov was visited a couple of times in June and July 1994, 1995 and 1996. Six taxa of Pezizales, undescribed or rarely reported, discovered during this study are presented here.

Material and methods

The material was studied by Light Microscopy (LM). The descriptions are made from fresh, mature collections. Measurements and descriptions of microscopic characters were made on material mounted in water, unless otherwise stated. Other chemicals used were Melzer's reagent, Cotton Blue in lactic acid and Congo Red in ammonia. Only mature spores were measured, as defined by Baral (1992), as spores actively discharged by the internal pressure of the living ascus in a water mount without applying external pressure. The spore measurements are given as the average of 20 spores

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from one collection (the figures in the middle) and the size of the smallest and biggest spore. Scanning Electron Microscopy (SEM) photographs of the spore surfaces were made with a Phillips Scanning Microscope from spores discharged on a cover glass and coated with gold-palladium alloy. For studies of anatomical features, pieces of fresh apothecia were fixed in 2.5 % glutaraldehyde in 0.1 % phosphate buffer at pH 7.0. The material was dehydrated according to the method described by Feder & O'Brien (1968) before embedding in glycol methacrylat in three steps. Sections, 3 µm thick, were cut on a Reichter-Jung 2050 Supercut microtome. The sections were stained in Periodicacid-Schiff (PAS) and Alanine Blue Black. Sections were finally embedded in DePeX mounting medium.

Herbarium material was revived in water overnight. Hymenial elements were studied by teasing apart individual asci and paraphyses with a needle. Anatomic characters were studied on sections, 15-25 µm thick, cut on a freezing microtome stage.

The edaphic parameters: pH, content of CaCO₃ and organic matter (given as % of the dry soil), were measured on soil samples taken from the uppermost 5-10 cm of the soil, directly under the fruitbodies of a collection (for methods see Petersen 1985).

Microanatomical terminology follows Korf (1973). Colour-codes refer to Kornerup & Wanscher (1974). Colour photographs of the species will be included in a subsequent paper in Svampe (Danish Mycological Society Journal). The material was collected by K. Hansen and S. K. Sandal (KS) and were freeze dried, unless otherwise stated. All material, including holotypes, are deposited in the Botanical Museum, Copenhagen (C). Isotypes of the two new species of *Peziza* and duplicates of *P. subcitrina* and *P. polaripapulata* are deposited in Kew (K) and Farlow Herbarium (FH).

Morphotaxonomy

No monographic study of the large, heterogeneous and possibly paraphyletic (Norman & Egger 1996) genus *Peziza* Fr. exists, but important keys (Le Gal 1941; Moser 1963; Maas Geesteranus 1967; Romagnesi 1978; Häffner 1995) and papers (Donadini 1979a; Svrček 1970; Moravec 1985) on the European species have been published. The number of currently accepted species is close to 100 (Hohmeyer 1986), with at least 50 species occurring in the Nordic countries (Dissing, in press). Only a few subgenera and sections have been proposed, and new species are thus difficult to place within an infrageneric classification. Furthermore, the nomenclatural situation will not be stable until a monograph is produced.

The genus *Scabropezia* Dissing & Pfister includes

only two species, with *Scabropezia flavovirens* (Fuckel) Dissing & Pfister already recorded from the two investigated areas (Dissing & Pfister 1981). The second species, *S. scabrosa* (Cooke) Dissing & Pfister, hitherto only known from North America, is here reported from Klinteskov and two additional Danish localities. *Scabropezia* is morphologically close to *Peziza* and *Plicaria* Fuckel and the delimitation of these genera should be reevaluated when more characters have been studied.

As currently circumscribed the genus *Marcellina* Brumm., Korf & Rifai comprises seven species (Moravec 1987), of which three are known in the Nordic countries (Dissing, in press). The genus has been widely accepted, but two other genera, *Smardaea* Svrček and *Greletia* Donadini, are close and the morphological characters separating these will be presented.

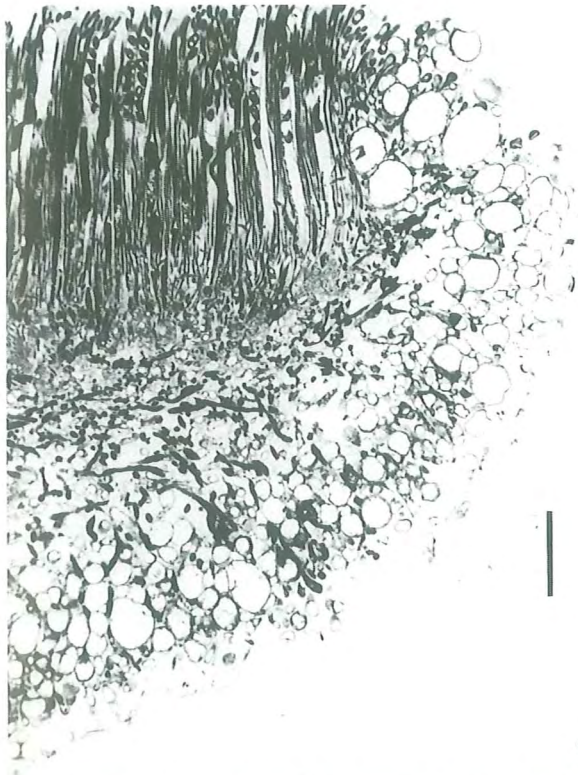
Descriptions

Peziza exogelatinosa K. Hansen & Sandal sp. nov.

Apothecia cupulata ad disciformia, 1.4-3.5 cm diam., sessilia; hymenio atroviolaceo (11F4 ad 10F4, 12F4, 16F5). Extus glabra, caesio (20B2), strato gelatinoso 20-50 µm crasso tecta. Sporae unifariae, ellipsoides, 16.3-17.4-18.8 × 8.8-9.7-10.0 µm magnae, hyalinae, ad polos guttulas duo continentes, per microscopium (LM) observatae subtilissime verrucosae, per SEM observatae verrucae regulares, densae, solitariae, humiles, subtiles, rotundatae, c. 0.3-0.7 (-0.9) µm latae, c. 0.15 µm altae. Paraphyses contentum luteo-brunneum, refractivo granulatum, sive guttulas 1-1.5 µm in diametro capitantes. – Figg. 1-4.

Holotypus die 13 september anni 1994 in faucibus, Jydelejeslugten, in quibus fons calcareus frigidus, crescens in calce humida nuda mobili, inter *Equisetum palustre*, *Festuca altissima*, *Potentilla reptans*, *Tussilago farfara*, et muscos *Anisothecium varium*, *Calliergonella cuspidata*, *Cratoneuron filicinum*, *Pellia* sp., Møns Klint, Dania, ab K. Hansen & S. K. Sandal lectus, sub numero KS-94-122 in Museo Botanico Hauniensi (C) depositus.

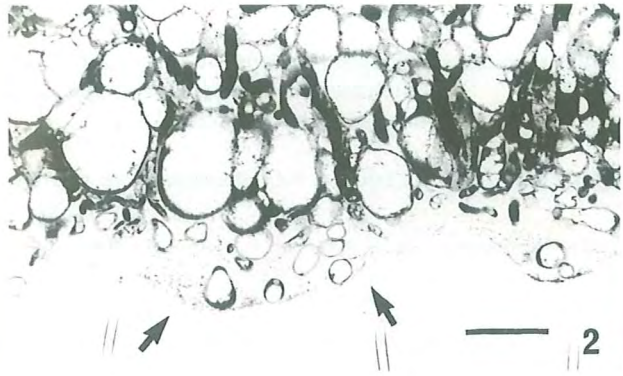
Apothecia cupulate to discoid, sessile, c. 1.4-3.5 cm in diam.; hymenium even, violet brown to dark violet (near 11F4 to 10F4, 12F4, 16F5), tending towards black; outside glabrous, gelatinous, bright pale greyish blue (20B2); margin indistinct, seen as a paler zone, ± undulate. Outer excipulum 100-150 µm thick, of textura globulosa (of predominantly globose cells, although the cells become more angular towards the base), 20-70 µm



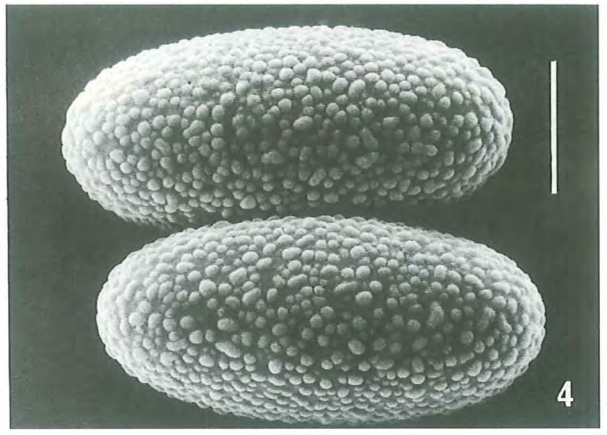
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Figs 1-4. *Peziza exogelatinosa*. – Fig. 1. Section of apothecium showing the margin and part of the excipulum structure. Medullary and outer excipulum near the margin only slightly differentiated, of globose cells intermixed with hyphae. Subhymenium of densely interwoven hyphae. Margin composed of globose cells. (KS-94-184). Scale bar = 100 μm . – Fig. 2. Close-up of outer excipulum, covered with a gelatinous layer (arrowed). Scale bar = 50 μm . – Fig. 3. LM of paraphyses (in water), with granular contents, darker and more dense in the uppermost cells, and asci, showing spores with 2 guttules at the poles. (KS-94-122). Scale bar = 20 μm . – Fig. 4. SEM of spore surface consisting of regular, dense, isolated, low, minute, rounded warts. (KS-94-122). Scale bar = 5 μm .

broad cells, and interwoven, 5-10 μm broad, hyphae. Outer excipulum covered with a gelatinous layer, 20-50 μm thick (Fig. 2). Medullary excipulum 350-450 μm thick at the base, gradually thinning towards the margin to c. 80-150 μm thick, of loose textura globulosa, 10-50 μm broad, intermixed with widely spaced, 8-10 μm

broad hyphae. Subhymenium 50-100 μm thick, of textura intricata, more or less densely interwoven, 6-10 μm broad hyphae. Margin 150-170 μm broad, of 20-60 μm broad globose cells, terminating at the level of or at a point lower down than the position of the asci and paraphyses apices. Hymenium 330-370 μm high (Fig.

Table 1. Diagnostic features for species of *Peziza* with a violet coloured hymenium and apothecia without lactiferous hyphae, and

Species	Apothecia size in diam.	Hymenium colour	Outer surface of apothecium
<i>P. exogelatinosa</i>	up to 3.5 cm	violet brown to dark violet	glabrous / gelatinous pale greyish blue
<i>P. subviolaceae</i> Svrček (1977) (= <i>P. violacea</i> ss auct.)	0.5-3.0 cm	primo obscure violaceo, denique pallide violaceo	pallide violacea vel griseo-violacea, pulveracea, dein subglabra
<i>P. violacea</i> Pers. (1801)	?	purpureo-caerulea	?
<i>P. tenacella</i> Phillips (Rifai 1968)	1-3 cm or some-times more	brownish purple to umber	purplish white, minutely scurfy to almost smooth
<i>P. praetervisa</i> Bres. (1897)	3-5 cm	violaceo-vinoso, demum carneo-fuscidulo	leviter furfuraceis, glabre-scentibus, pallide lilaceis vel violaceis
<i>P. martinii</i> Donadini (1984)	0.4-0.8 cm	violet sombre à violet clair passant lentement à l'ochracé	excipulum blanc grisâtre
<i>P. boltonii</i> Quéf. (1878)	2-5 cm	violet purpurin ou brunâtre	violet pâissant, parsemée de gros flocons granuleux violet foncé
<i>P. boltonii</i> Quéf. ss Marchetti & Franchi (1993)	3-5 (-6) cm	violetto ... violaceo-brunastri a maturità	concolore a più pallida, grossolanamente forforacea con punteggiature e fiocchi di colore violaceo-nerastri
<i>P. celtica</i> (Boud.) Moser (Boudier 1898)	3-5 cm	intense bruno-purpurascens	pallidius et vix furfuraceum ferè glabrum

1). Asci 8-spored, uppermost part staining intensely blue in Melzer's reagent, cylindrical, 330-370 × 13.8-15.0 µm, with a pleurorhynchous base. Spores uniseriate, ellipsoid, 16.3-17.4-18.8 × 8.8-9.7-10.0 µm, hyaline, with 2 distinct small guttules, c. 4.5 µm in diam., at the poles (Fig. 3), in LM apparently smooth or minutely warty (1000× oil imm.), in SEM with regular, dense, isolated, low, minute, c. 0.3-0.7 (-0.9) µm broad, c. 0.15 µm high, rounded warts (Fig. 4). Paraphyses simple, 3.8-5.0 µm broad, tips straight or curved, above gradually enlarged to 7.5-8.8 µm, with yellowish-brown, refractive granular or multi-guttulate contents, guttules 1-1.5 µm in diam., dense and darker in the uppermost cells (Fig. 3).

Etymology. Referring to the outer gelatinous layer of the excipulum.

Ecology. On naked, eroded, moist, calcareous soil, consisting of almost pure lime, c. 98% CaCO₃, pH 8.1 and a content of 1.6% organic matter. In Jydelejeslugten, a gorge with a calcareous spring with cold water, almost uniform temperature all year round, c. 20 specimens scattered in each of two sites (2 × 2 m), among *Equisetum palustre*, *Festuca altissima*, *Potentilla reptans*, *Tussilago farfara* and the bryophytes *Anisothecium varium*, *Calliergonella cuspidata*, *Cratoneuron filicinum*, *Pellia* sp. *Scutellinia trechispora* was collected the same place 6.IX.1994. The apothecia were recorded from September until November. In 1997 fruiting in large numbers in the falls all along the eroded chalk cliff beneath Klinteskov and further, on naked, clayey, calcareous soil in three localities in Jutland.

Material. Denmark. Møn, Store Klinteskov. Jy-

spores with an ornamentation of warts (without apiculi) and two guttules (taken from the original publications).

Spore size (µm) & guttules in spores	Spore ornamentation	Ecology
16.3-17.4-18.8 × 8.8-9.7-10.0 2 guttules (c. 4.5 µm in diam)	regular, low, dense, isolated, delicate rounded warts	on eroded, moist, calcareous or clayey soil
11-15 × 6-8 2 guttules	minute verrucosae (verrucis singularibus, parvis, non confluentibus)	in carbonariis, ad terram adustam et ad ligna carbonisata
?	?	rarius ad terram et in truncis cariosis
10.5-12 × 5.4-6.5 two oil globules	smooth walled but at complete maturity they appear very minutely warted (oil immer.)	on burnt ground
12-14 × 5-6 biguttulatis	asperulis	sulle vecchie carbonaie
14-16 × 8-10 biguttulées (3 µm environ)	verrues régulières de 1 µm environ, équiréparties ou non, pouvant composer deux systèmes verruqueux imbriqués (verrues „grosses“ et petites)	pousse sur terre nue argilo-calcaire (pH=7.5 environ)
0 mm, 018 ellipsoïde	finement picotée	sur les décombres mêlés de houille ou de charbon
15-18 × 7-9 biguttulate	con piccole verruche	su terreno sabbioso. ... in queste località il pH del substrato ... 7.10 e 7.7
[c. 16.2-18 × 9-10.8] biguttulatæ	adultæ verrucosæ fuscæ	dans la forêt de Carnelle ... sur le bord d'un chemin sablonneux

delejeslugten, 13.IX.1994, KS-94-122 (C holotype, K, FH isotypes); *ibid.*, 19.IX.1994, KS-94-149 (C, FH); *ibid.*, 27.IX.1994, KS-94-184 (C, K). Immature apothecia were recorded on the eroded cliff on the beach beneath Jydelejeslugten, 2.XI.1994 associated with *Melastiza cornubiensis* (Berk. & Broome) J. Moravec and *Scutellinia* sp; Hjortesølbanken, Tragten, 30. IX.1997, K. Hansen, C. Lange & J. H. Petersen, KH-97-75 (C); Jydelejeslugten, 30.IX.97, K. Hansen & C. Lange, KH-97-76 (C); Hylledals Slugt, S. A. Elborne, 30.IX.1997, KH-97-77 (C); On the eroded cliff on the beach beneath Liselund, 30.IX.1997, T. Læssøe, TL-4562 (C); Maglevands Fald, 27.IX.74, H. Knudsen s.n. (C); „Møns Klint“, on chalk, 27.IX.74, N. Tams & M. D. Paulsen s.n. (C). Jutland. Vejle, Staksrode Skov, 12.X.97, C. Lange, KH-97-110 (C); Rugård Sønder-skov, 15.X.97, C. Lange, KH-97-117 (C); *ibid.*,

15.X.97, KH-97-122 (C); Århus, Skåde Skov, C. Lange, KH-97-138 (C).

The medium-sized apothecia, with a violet brown to dark violet hymenium and a glabrous outside, in a combination with the spore measurements and ornamentation of dense, low, minute, rounded warts and the calcareous habitat, are diagnostic features for *P. exogelatinosa*.

The gelatinous outer layer is a character which apparently never has been recorded within the genus *Peziza*. Within the Pezizaceae the genus *Pachyella* has a well-developed cortical zone of globose cells terminating in hyaline, hyphoid hairs embedded in a gel. The gelatinous layer in *P. exogelatinosa* has no imbedded hyphoid hairs. Furthermore, *P. exogelatinosa* has a two-layered excipulum structure typical of the genus *Peziza*. Even

though the gelatinous layer covering the outer surface may have been overlooked by others, the above stated characters will separate it from other known species of *Peziza* with a violet hymenium and warty spores with two guttules (see Table 1). *Peziza exogelatinosa* is probably closely related to the pyrophilous *P. subviolacea* Svrček (*P. violacea* Pers.: Fr. ss auct.). It differs macroscopically by the smooth and paler outside of the apothecia, and microscopically, besides the presence of the gelatinous layer, in having smaller, rounded, low warts on the spores. Furthermore, the spores of *P. exogelatinosa* are longer and broader. *Peziza tenacella* W. Phillips described from Australia (Cooke 1887; Rifai 1968) may be conspecific with *P. subviolacea*. Svrček (1976, 1977) by describing *P. subviolacea* in reality, although this was not directly stated, chose to relegate *P. violacea* to *nomina ambigua*, an action we applaud, since there has been all too much confusion on the application of this name. *Peziza martinii* Donadini is, based on the description (Donadini 1984), another closely related taxon with a very similar morphology, but with smaller, pulvinate apothecia, up to 0.8 cm in diam., and smaller spores, 14-16 × 8-10 µm. Other species with more or less violet apothecia and warty spores include *P. celtica* (Boud.) M. M. Moser which however, has larger apothecia, with a furfuraceous or mealy outside (Boudier 1898, 1905-1910: plate 289). The size of the spores, c. 16.2-18 × 9-10.8 µm (corrected 10% down, according to Brummelen (1969)), are similar, but they have a much more marked, irregular warty ornamentation (Le Gal 1941: fig. 3: ill. nr. 24). *Peziza boltonii* Quélet is a problematic taxon right from when described (Quélet 1878), where Quélet referred to part of Boltons plate of *Helvella cochleata* (Bolton 1795-1820: tab. 99, f. a.). The plate, which probably will have to be the lectotype, shows a violet *Peziza* with coarse, dark violaceous granules on the outer surface. Danish herbarium material of *P. exogelatinosa* has been so named, but recently an altogether different, much thicker fleshed and more reddish purple species, with granules on the outside of the apothecia, has been named *P. boltonii* (Marchetti & Franchi 1993). *Peziza* taxonomy will probably be best served by relegating this name to *nomina ambigua*, since a proper type cannot be located and various interpretations are in circulation. Alternatively, the Italian concept could be adopted, but this would be unfortunate if their species cannot be proven to occur in the UK. *Peziza praetervisa* Bres. also has a nomenclatural and taxonomic turbulent history, but all interpretations deals with small spored taxa, different from *P. exogelatinosa*.

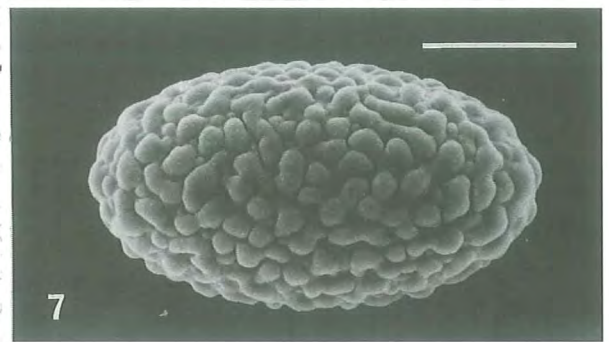
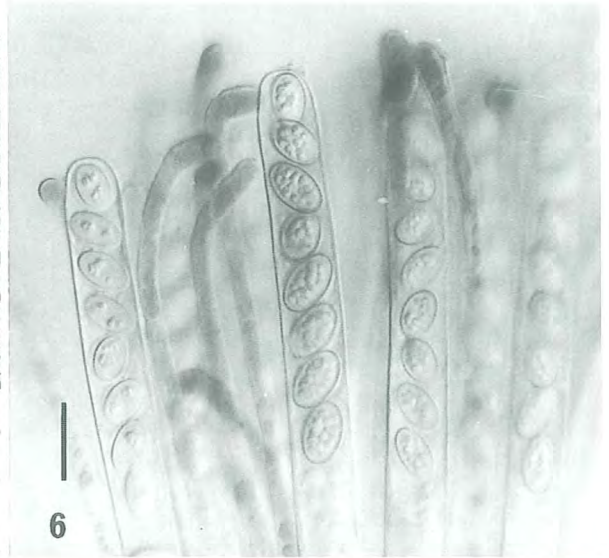
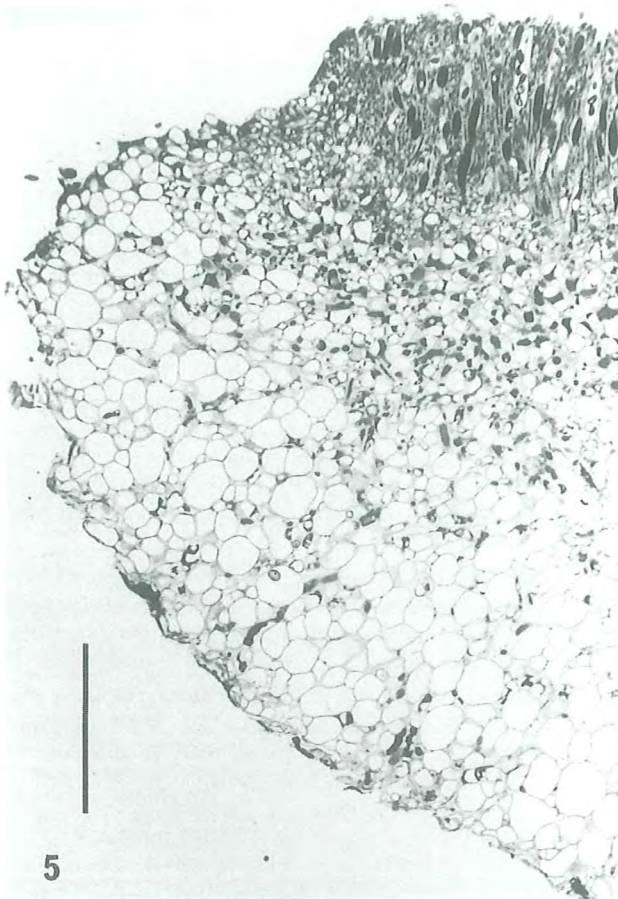
***Peziza retrocurvata* K. Hansen & Sandal sp. nov.**

Apothecia primo cupulata, maturitate disciformia, margine retrocurvato, 2.0-6.5 cm diam., sessilia; hymenio primo aequato, violaceo-badio (11F4-5), maturitate rugoso, hepatico (8F5-8 ad 7F5-8); extus ochracea (5C7-8), glabra vel subtiliter pubescentia; caro crasso, fragili. Sporae unifariae, ellipsoides, 13.8-14.9-16.3 × 7.5-8.4-8.8 µm magnae, hyalinae, guttulas parvas numerosas continentes, per microscopium (LM) observatae subtiliter verrucosae, per SEM observatae verrucas densas, parvas rotundatas, c. 0.6-1.3 µm latas et c. 0.5 µm altas, parum irregulares, plus minusve confluentes usque ad 2.3 × 0.7 µm latas. Paraphyses contentum luteo-brunneum granulatum capientes. – Figg. 5-7.

Holotypus die 26 september anni 1994, in truncis putrescentibus Piceae abietis, in parte nomine St. Ørnebjerg silva Klinteskoven, Møn, Dania, ab K. Hansen & S. K. Sandal lectus, sub numero KS-94-182 in Museo Botanico Hauniensi (C) depositus.

Apothecia at first cupulate, at maturity expanding to discoid, margin curved to reflexed, sessile, 2.0-6.5 cm diam.; hymenium at first even, violet brown (11F4-5), at maturity wrinkled, reddish brown to dark brown (c. 8F5-8 to 7F5-8); outside glabrous to finely pubescent, brownish yellow (c. 5C7-8); flesh thick, fragile. Outer excipulum 200-250 µm thick, of textura angularis (with only very few interwoven hyphae), cells of varying size, 10-60 µm broad. Medullary excipulum 500-700 µm thick, of textura globulosa, cells 10-50 µm broad, with interwoven, 5-10 µm broad, septate hyphae. Subhymenium 100-150 µm thick, of densely interwoven hyphae. Margin 200 (-250) µm broad, of textura globulosa, terminating at a point lower down than the position of the asci and paraphyses apices, broadly rounded. Hymenium 250-300 µm high (Fig. 5). Asci 8-spored, staining intensely blue all over in Melzer's reagent, cylindrical, gradually narrowing downwards, 225-270 × 12.5-15.0 µm, with an aporhynchous base. Spores uniseriate, ellipsoid, 13.8-14.9-16.3 × 7.5-8.4-8.8 µm, hyaline, with numerous small guttules (Fig. 6), in LM with small warts, in SEM with dense, low, small, rounded, c. 0.6-1.3 µm broad and c. 0.5 µm high warts, slightly irregular, ± confluent, up to c. 2.3 × 0.7 µm broad (Fig. 7). Paraphyses straight, curved or strongly bent, 5 µm broad, above slightly enlarged to 7.5 µm, septate, with yellowish brown, granular contents, more dense in the uppermost cells (Fig. 6). Paraphyses staining red-brown in Melzer's reagent,

Etymology. Referring to backward curved apothecial margin.



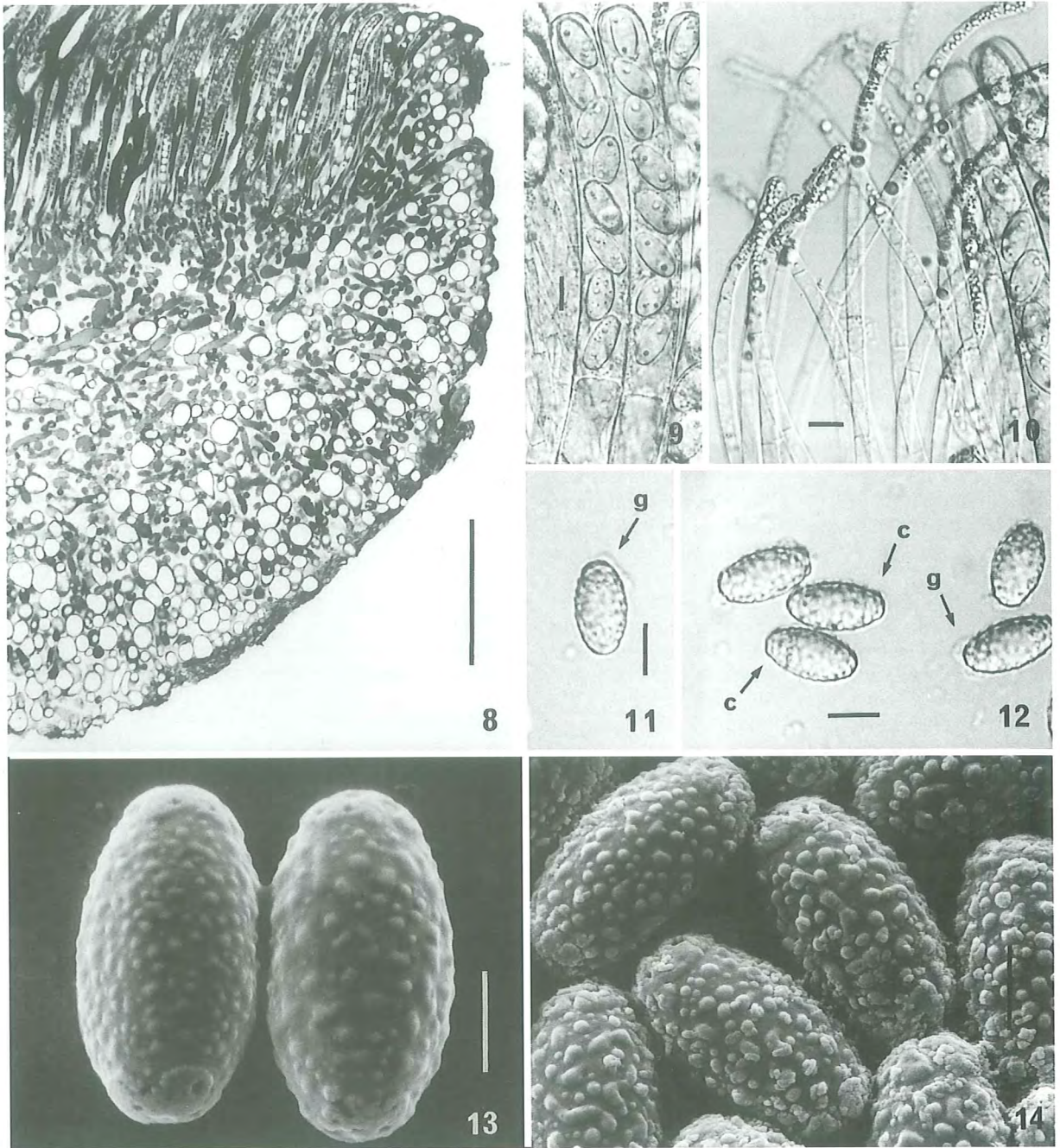
Figs 5-7. *Peziza retrocurvata*. – Fig. 5. Section of apothecium showing the margin and part of the excipulum structure. Medullary excipulum of globose cells with interwoven hyphae, outer excipulum of angular cells. Subhymenium of densely interwoven hyphae. Margin, of globose cells, ending at a point lower down than the position of the ascus and paraphyses apices. (KS-94-182). Scale bar = 200 μm . – Fig. 6. LM of paraphyses (in water), with granular contents, and asci, showing broadly ellipsoid, multiguttulate spores. (KS-94-207). Scale bar = 20 μm . – Fig. 7. SEM of spore surface consisting of dense, low, small, rounded, slightly irregular, more or less confluent warts. (KS-94-182). Scale bar = 5 μm .

Ecology. On very rotten stumps of *Picea abies* (confirmed by Jette Dahl Møller) on calcareous soil, solitary or more often in groups of up to 20 specimens. *Peziza retrocurvata* was especially common, at St. Ørnebjerg, where the spruce stumps are situated in a rather open area now dominated by *Fagus sylvatica* and in places also by *Sambucus nigra*. The apothecia were recorded from late September to mid-October.

Material. Denmark. Møn, Store Klinteskov. Immature fruitbodies recorded at Havrelukkevej 24.IX.1994, still immature 3.X.1994, KS-94-207 (C); mature fruitbodies recorded at St. Ørnebjerg 26.IX.1994, KS-94-182 (C holotype, K, FH isotypes); *ibid.*, 4.X.1994, KS-94-205 (C, K, FH); Jydelejeslugten 10.X.1994, KS-94-214 (C).

Peziza retrocurvata is distinguished from other species of *Peziza* growing on wood by the small, broadly ellipsoid, multiguttulate spores, with an ornamentation of dense, low, rounded, slightly irregular, more and less confluent warts. Besides, the combination of macroscopic characters, e.g. the large, first violet brown, then reddish brown to dark brown apothecia, not yielding a juice when cut or bruised, is not found in any other described *Peziza*.

Macroscopically it might be confused with *Pachyella violaceonigra* (Rehm) Pfister and *Pachyella punctispora* Pfister (Pfister 1973), however, *Peziza retrocurvata* lacks excipular gel and must be referred to *Peziza*.



Figs 8-14. *Peziza polaripapulata*. – Fig. 8. Section of apothecium showing the margin and part of the excipulum structure. Medullary excipulum of globose cells intermixed with loosely woven hyphae, outer excipulum of smaller globose cells and interwoven hyphae. Outside covered by patches of appressed hyphae. Subhymenium of cells in chains of uneven shape and size. (KS-95-10). Scale bar = 200 μm . – Fig. 9. LM of asci (in water), showing immature, smooth spores, with two small guttules at the poles. (KS-95-10). Scale bar = 10 μm . – Fig. 10. LM of slightly curved, septate paraphyses, with distinct refractive guttules in the uppermost cells (in water). (KS-95-10). Scale bar = 10 μm . – Figs 11-12. LM of discharged, mature, nearly truncate spores with isolated, slightly elongated warts, note the cap-like thickening at the poles (arrow c) and the gelatinous coating close to or at the poles (arrow g) (in water) (KS-95-10). Scale bar = 10 μm . – Fig. 13. SEM, note the very thin membranous layer (or gelatinous coating) covering the spores. (K-96-11). Scale bar = 5 μm . – Fig. 14. SEM of spores, showing scattered, irregular, rounded to elongated warts, sometimes forming a few short, low ridges, becoming confluent at the poles and forming a cap-like thickening. (K-96-04). Scale bar = 5 μm .

***Peziza polaripapulata* (J. Moravec) K.
Hansen comb. nov.**

Basionym: *Galactinia polaripapulata* J. Moravec, Ěeská Mykol. 23(1): 33, 1969.

Apothecia shallowly cupulate to discoid, sessile on a broad base, 1.5-4.0 cm diam.; hymenium even, at first warm yellow (4B8), then more brownish yellow (5C8) to golden brown (5D8), at maturity dark brown (c. 6F6), with an olivaceous tinge, or warm olive yellow (c. 3D7) to olive (c. 2-3F6); outside glabrous, tobacco brown (5F6) or more often furfuraceous with small, reddish brown (8-9F4) tufts, especially near the margin; flesh thick, fragile; margin slightly inrolled. Hymenium yielding a sparing whitish yellowish juice only seen under a dissecting microscope. Outer excipulum 200-300 μm thick, of dense textura globulosa, 10-30 μm broad cells, and interwoven, (5-) 11 (-14) μm broad hyphae, only slightly differentiated from medullary excipulum. Medullary excipulum c. 1200 μm wide at the base, gradually thinning towards the margin to c. 200 μm , of loose textura globulosa, cells of varying size, 10-50 μm broad, intermixed with widely spaced, (5-) 7.5 (-11) μm broad hyphae. Subhymenium 100-150 μm thick, only slightly differentiated from medullary excipulum, of chain forming cells of uneven shape and size, some with a hook-like thickening, contents staining light-blue in PAS/Aniline Blue Black. Margin c. 150 μm wide, terminating at the level of the apices of the asci and paraphyses, thinning in the upper portion. Hymenium 270-330 μm high (Fig. 8). Excipular cells bright yellow in fresh sections. Asci 8-spored, uppermost part staining blue in Melzer's reagent, the inner part staining strongly orange, cylindrical, 310-350 \times 15-17.5 μm , rounded or truncate, with aporhynchous base. Spores uniseriate, hyaline, at first smooth, ellipsoid, with two small guttules, 1.3-2.5 μm in diam., at the poles (seen clearly in immature spores) (Fig. 9), when mature broadly ellipsoid with rounded to truncate ends, 17.5-18.7-20.0 \times 8.8-9.8-10.0 μm . In LM with isolated, slightly elongated warts (clearly visible in water \times 400), at the poles a cap-like thickening (Fig. 12), which like the warts stain blue in Cotton blue, in SEM with scattered, irregular, rounded to elongated warts, sometimes forming a few short, low ridges, becoming \pm fused at the poles (the cap is not as marked in SEM as in LM) (Fig. 14). In Melzer's reagent the outer spore wall and the warts are distinctly golden yellow, and in Cotten Blue strongly cyanophilic. A gelatinous coating seems to stick to the spores in a characteristic way close to or at the poles (Fig. 11) - in SEM most of the spores were covered by a very thin membranous layer (Fig. 13). Paraphyses simple, straight to slightly curved, c. 5 μm broad, above slightly enlarged, up to 7.5 μm broad, septate, with dis-

tinged refractive yellow guttules, up to 5 μm in diam., in the uppermost cells (Fig. 10).

Ecology. In one site (Møn) on sawdust (pile 2 \times 1.5 m), c. 50 specimens, solitary or in groups of 3-5 apothecia. In the other site (Allindelille Fredskov) on a very rotten and moist trunk of *Fagus sylvatica*, in 1995 two groups of 3 and 4 specimens, together with *Gyromitra parva*, in 1996 about 20 specimens, scattered, together with *Psathyrella populina* and *Ceriporia* cf. *excelsa*. Both sites on calcareous soil, in deciduous forest. Apparently the apothecia of *P. polaripapulata* take a long time to mature and are thus difficult to collect at the right time. Many succumb to drought, snails etc. The type specimen was reported from moist naked calcareous soil in mid-September.

Material. Denmark. Zealand. Allindelille Fredskov, 12.VI.1995, K. Hansen, H. Knudsen & S. K. Sandal, KS.-All-95-4 (C); *ibid.*, a few mature fruitbodies, 15.VI.1996 (immature fruitbodies recorded 2.VI.1996), K. Hansen & T. Læssøe, KH-96-4, air-dried (K); Møn. Store Klinteskov, 25.VI.1995, H. Knudsen & M. Sasa, KS-95-10, half of the collection air-dried and half freeze dried (C); *ibid.*, numerous immature fruitbodies, only two mature, 25.VI.1996 (immature fruitbodies recorded 11.VI.1996), K. Hansen & T. Læssøe, KH-96-11 (C, FH). Slovakia, montes Vysoké Tatry, 19.IX.1967, J. Moravec, PRM 842949 (PRM, isotype).

The nearly truncate spores, with two small guttules and a characteristic ornamentation of scattered, irregular, rounded to elongated warts, which become more or less fused at the poles and the paraphyses, with distinct refractive yellow guttules, are diagnostic features of *P. polaripapulata*. Likewise, the bright yellow excipulum cells in fresh sections, and the broad hyphal elements in the loosely woven medullary excipulum are noteworthy.

Galactinia polaripapulata was invalidly transferred to *Peziza* by Svrček (1981), since the basionym was not cited. Häffner (1995) cited the basionym, but did not state the combination and placed the generic name *Peziza* in quotation marks, " *Peziza* " *polaripapulata* J. Moravec ". Häffner provided a detailed description of newly collected material, from a rotten trunk of *Carpinus betulus* and from soil with a large content of sawdust, but did not re-examine the type specimen. The original diagnosis by Moravec (1969) is rather meagre and without illustrations. A small piece of an apothecium of the isotype has been received on loan and sectioned on a freezing microtome. The excipular cells were collapsed and did not rehydrate sufficiently to be studied, presumably due to the widely spaced structure of the medullary excipulum and the conditions under which the material was dried. Moravec described

the excipulum as "cellulis globosis ... et e cellulis crasse cylindraceis, septatis ... " which is in agreement with our material. The paraphyses were more or less collapsed but seemed to be filled with guttules, a feature not mentioned by Moravec. A distinctive character was the spore ornamentation; the warts were less fused and more highly marked at the poles than in the Danish collections. To establish the range of variation in the spore ornamentation within this rare species more collections are needed. The revived excipulum cells were strongly yellowish-brown. The description by Häffner (l.c.) is in accordance with our material, except that the drawings of the anatomical features of the apothecia show the excipulum to be primarily *textura angularis*.

Peziza polaripapulata is placed in subgenus *Phaeopezia* (Sacc.) J. Moravec (Häffner 1995). The species of *Peziza* with apiculate spores form a group of small, olivaceous brown species, with preference for calcareous soil and rotten wood (Pfister 1979; Dissing & Sivertsen 1983). All have warty spores; there is a intergrading series from those having apical cap-like thickenings to those with distinct apical projections (apiculi). Macroscopically *P. polaripapulata* is much like *P. obtusapiculata* J. Moravec (1984) (= *P. apiculata* Cooke ss. Moravec, 1977) with its shallowly cupulate to discoid, fleshy apothecia with a broad base and with characteristic olive to olive-brown colours. Both species fruit on rotten hardwood (*Fagus*). The spores of *P. polaripapulata* are however without the obtusely conical apiculi characteristic of *P. obtusapiculata* spores. It should be noted that some mature spores of *P. obtusapiculata* and *P. apiculata* s. orig. can have truncate ends and immature spores are without apiculi, thus resembling the spores of *P. polaripapulata*, but spores with various degrees of pointed appendages are always present (Moravec 1985). Material of *P. obtusapiculata* (Dissing 1984, as *P. apiculata*) has been studied for comparison. *Peziza prosthetica* Dissing & Sivertsen, growing on calcareous soil or rotten wood (*Picea*), resembles *P. polaripapulata*, but differs in having smaller spores with blunt appendages (Dissing & Sivertsen 1983: SEM, fig. 9) intermediate between *P. obtusapiculata* and *P. polaripapulata*.

The apothecial colours of *P. polaripapulata* varied considerable in our material from the first to the second year of fruiting, and in the different stages of maturity, ranging from warm yellow to olive to dark brown, with an olivaceous tinge. The size of the apothecia developing in the two habitats, differed as well, being much smaller in the natural habitat.

Peziza subcitrina (Bres.) Korf, *Mycotaxon* 14: 1, 1982.

Basionym: *Plicaria subcitrina* Bres. in Rehm, *Hedwigia*, Beibl. 40: 102, 1901.

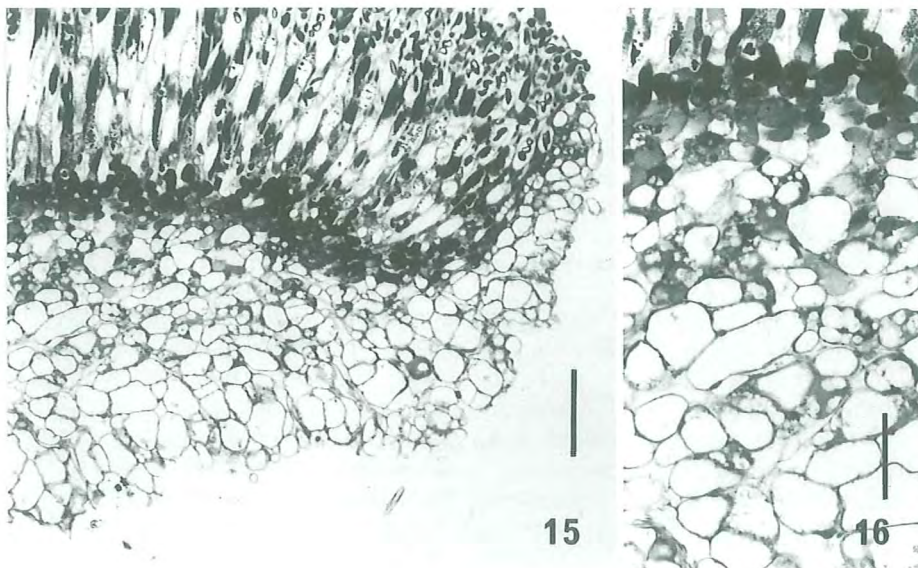
Synonyms: *Humaria subcitrina* (Bres.) Sacc., *Syll. Fung.* 18: 25, 1906; *Aleuria subcitrina* (Bres.) Boud., *Hist. Class. Discom. d'Eur.* p. 45, 1907.

Lectotype designated here: labelled: „*Peziza subcitrina* Bres. n. sp. in litt. Bres. N20/5 1900. In vinacey majo 1900 - Trento Bresadola“. S (Herb. Rehm). Consists of five well preserved fruitbodies and a few fragments, on the remains of grape marc. Isolectotype: labelled: „*Peziza subcitrina* Bres. n. sp. (*Humaria subcitrina*)“. S (Herb. Bresadola). This material is glued to the label, but at least five fruitbodies are well preserved.

Apothecia discoid, sessile, broadly attached to the substrate, 0.7-1.4 cm diam.; hymenium even, yellowish brown to golden yellow (4B6 to 4C6); outside paler, glabrous to delicately furfuraceous; margin outlined by the colour change between the outside and the hymenium, \pm irregularly undulate. Outer excipulum 125-150 μ m thick, of *textura angularis*, cells 20-60 μ m broad, staining blue in PAS/Aniline Blue Black (Fig. 15). Medullary excipulum 150-230 μ m thick, of *textura angularis*, cells 30-80 (-95) μ m broad, with intercellular spaces and the long axes of the cells more or less parallel to the exterior, staining pink in PAS/Alanine Blue Black. Subhymenium 25-50 μ m thick, of dense, globose, 10-30 μ m broad ascogenous cells, contents staining intensely pink in PAS/Aniline Blue Black (Figs 15-16). Margin c. 50 μ m broad, of *textura angularis*, terminating at the level of or slightly below the apices of the asci and paraphyses, gradually narrowing towards the apex. Hymenium 250-300 μ m high (Fig. 15). Asci 8-spored, staining distinctly blue in Melzer's reagent at the apex, cylindrical, truncate, 240-300 \times 12.5-15.0 μ m, with an aporphous base. Spores uniseriate, ellipsoid, 17.5-18.0-20.0 \times 8.8-9.2-10.0 μ m, hyaline, with an unilateral gelatinous coating, without guttules, smooth both in LM and SEM. Paraphyses straight, 2.5-3.8 μ m broad, above gradually enlarged to 7.5-8.8 μ m, septate, containing yellowish brown granules in the uppermost cells.

Ecology. On compact, naked soil in a deep wheel track, c. 4% CaCO₃, pH 7.6 and a content of 8.0% organic matter, solitary or in groups of 8-10 specimens, together with *Ascobolus denudatus*. Under *Fagus sylvatica* and *Acer pseudoplatanus*; in a vegetation of *Hordelymus europaeus*, *Mercurialis perennis*, *Scrophularia nodosa*, *Taraxacum* sp. and *Urtica dioica*. *Aleuria aurantia* and *Melastiza cornubiensis* were recorded in the same area.

Figs 15-16. *Peziza subcitrina*. – Fig. 15. Section of apothecium. Two layered excipulum: both layers of textura angularis; the cells of the medullary excipulum more elongated, with intercellular spaces and the long axes of the cells more or less parallel to the exterior. Subhymenium of dense, globose ascogenous cells. Margin of textura angularis. (KS-94-123). Scale bar = 100 μ m. – Fig. 16. Close-up of the cells of subhymenium and medullary excipulum. (KS-94-123). Scale bar = 50 μ m.



The material of *P. subcitrina*, collected by Bresadola, was reported from grape marc (Boudier 1905-1910). J. Rick found it on silty, moist soil (Rehm 1901). The Danish collections are from mid-September, whereas the Italian material was collected in May.

Material. Denmark. Møn, Store Klinteskov. Stengården, 12.IX.1994, KS-94-123 (C); *ibid.*, 14.IX.1994, KS-94-240 (K); *ibid.*, 17.IX.1994, KS-94-133 (C, FH); *ibid.*, 19.IX.1994, KS-94-150 (C). The Netherlands. Valkenburg (Limburg), 1900, Rehm Asc. exsic. 1355 (FH; Herb. von Höhnelt) and an undistributed exsiccata collection, J. Rick (as *Plicaria subcitrina* Bres.). The Netherlands (all det. as *P. buxea* Quél. by R. A. Maas Geesteranus). Noord-Holland, 's-Graveland, Boekesteijn, 19.X.1966, J. Daams s.n. (L); *ibid.*, 25.X.1966 s.n. (L); *ibid.*, 31.VIII.1955 s.n. (L); Utrecht, Oud-Loosdrecht, 25.X.1966, J. Daams n.s. (L).

We have adopted the name *P. subcitrina* for the specimens studied here although e.g. Maas Geesteranus (1967) has used *P. buxea* Quél. for this taxon. Apart from the paraphyses being filled with granules for the whole length, and the spores being slightly smaller, all microscopic and anatomical features of the Netherlands material are in accordance with the Danish material. No authentic material of *P. buxea* is known to exist and the description plus accompanying line drawings (Quélet 1884: Pl. VII fig. 6. in C.R. Ass. franç. Av. Sci. 12: 509) are not sufficiently diagnostic. Nevertheless, this name could be readopted if a suitable epitype could be located. Furthermore, we feel that the differences between these two taxa (e.g. the darker colours in *P.*

buxea) pointed out by Boudier (1905-1910) could be genuine, although great caution should be applied when using shades of hymenial colour in *Peziza*. Some of the differences observed by Boudier (l.c.) could possibly be caused by the rather poor condition of the Bresadola material (e.g. shape and pigmentation of the paraphyses). Boudier described the paraphyses of *P. subcitrina* as „... simples, jaunâtres, granuleuses intérieurement ... un peu épaissies au sommet et légèrement courbées,“ in contrast to *P. buxea* which he described with straight paraphyses and contents of „... au sommet et remplies à leurs extrémités de gouttelettes oléagineuses colorées“ (plate 270, with large orange guttules). In the lectotype, paraphyses and asci were more or less glued together in sections mounted in water. The paraphyses were yellowish brown all over, darker in the upper region, but no distinct pigment granules were evident (the pigments in the paraphyses dissolve completely in KOH). Whether the adherence of the hymenial elements is due to the age of the material and the way it has been dried, or if it has been treated with some amorphous substance, used to bind the substrate in the collection, is not known. In the part of the exsiccata (FH) examined, the paraphyses appeared curved as stated by Boudier. However, this material is not well-preserved and an amorphous substance was likewise covering the hymenium, even more pronounced.

The typification of *P. subcitrina* poses some problems. Rehm evidently adopted Bresadola's name from a letter. Since the description published by Rehm is in quotation marks, we assume that the full description is taken directly from Bresadola's letter. The Rick material Rehm distributed with the description (issued in

Rehm's exsiccatae as number 1355) was probably never studied by Bresadola and thus cannot be considered part of the type material. The original Bresadola material consists of two parts. Since the part in herb. Rehm (S) is in better condition than the part conserved in Bresadola's herbarium (S) this material has been selected. A possible further part may be present in the Boudier herbarium, since Boudier (l.c.) stated that Bresadola had sent him the material he used for his description and plate of *P. subcitrina* (l.c.: plate 271). Apparently material named as *P. subcitrina* has not been reported since, although the name has been included in all compiled modern keys.

The relationship of *P. subcitrina* seems to lie with *P. granulosa* Schum. ss. Boud. Both taxa have small, often plane or convex apothecia and smooth, non-guttulate spores with an unilateral gelatinous coating. The spores of the lectotype of *P. subcitrina* were confirmed to be smooth by SEM. The unilateral gelatinous coating on the spores, which we observed in fresh material, has not been mentioned by earlier authors, but it is difficult to observe. *Peziza granulosa* differs in having apothecia with a crenulate margin and a strongly furfuraceous outer surface. The paraphyses in *P. granulosa* contains conspicuous yellow guttules, are irregularly swollen apically and tend to be bent at a sharp angle.

Marcelleina tuberculispora K. Hansen & Sandal sp. nov.

Apothecia discoidea vel pulvinata, sessilia 1.8-3.5 mm diametro; hymenio atrovioleaceo (16F5-6), extus pallidiora, glabra vel pubescentia. Excipulum exterius c. 20-30 μm crassum, vix conspicue, e cellulis hyalinis, globosis vel angularibus, c. 8-11 μm latis, in uno vel duobus stratis collocatis compositum, ex quibus series dispersae et breves cellularum, aliquae quarum claviformes, c. 9-11 \times 19-22 μm , procurrent. Excipulum medullare c. 200-300 μm crassum, textura angulari, cellulis hyalinis, inaequalibus, 10.0-37.5 μm crassis. Subhymenium 50-75 μm crassum, textura intricata, cellulis hyphoidibus dense intertextis, 7.5 \times 17.5 (-20.0) μm crassis. Sectio subhymenii in aqua posita porphyrea, densa. Margo c. 60 μm crassa, e cellulis in seriebus ad superficiem parallelis composita, plana vel parum sub hymenio, apicem versus gradatim decrescens. Hymenium 250 μm crassum. Sporae unifariae, globulares, 11.3-11.8-12.5 μm diametro, hyalinae, guttulam singulam continentes, in LM verrucas magnitudine variabiles, in SEM verrucas densas, humiles, rotundatas et in magnitudine variabiles, c. 0.4-1.9 μm latis et c. 0.4-1.3 μm altas, exhibentes. Pars superior paraphysum et ascorum porphyrea videtur, sed sedes pigmenti difficile agnoscitur. - Figg. 17-20.

Holotypus die Julii anni 1994 in fossa silvae Allindelille Fredskov in insula Daniæ Selandia, in solo nudo, calcareo cum *Tarzetta gaillardiana* et *Scutellinia trechispora* inter muscos dispersos *Fissidens taxifolius*, *Bryum* sp., *Oxyrrhynchium swartzii*, *Marchantia polymorpha*, a K. Hansen & S.K. Sandal lectus, sub numero KS.-All-94-8 in Museo Botanico Hauniensi (C) depositus.

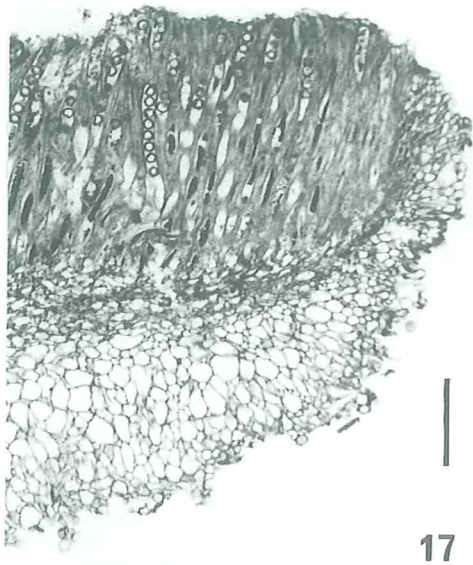
Apothecia discoid to pulvinate, sessile, 1.8-3.5 mm in diam.; hymenium dark violet (16F5-6); outside a little paler, glabrous (in hand-cut sections mounted in water, with dark winding hyphae), margin outlined by the colour change between the outside and the hymenium. Outer excipulum c. 20-30 μm thick, hardly discernible, composed of globose to angular hyaline cells, c. 8-11 μm broad, one or two layers thick from which scattered short rows of cells project, with some cells more club-shaped, c. 9-11 \times 19-22 μm . Medullary excipulum c. 200-230 μm thick, of textura angularis, of hyaline cells of varying size, 10.0-37.5 μm broad, somewhat arranged in rows perpendicular to the outer surface. Subhymenium 50-75 μm thick, of textura intricata, composed of densely interwoven, 7.5 \times 17.5 (-20.0) μm broad, hyphae (Figs 17-18). In water mounts the subhymenium is bright red-brown and dense. Margin c. 60 μm broad, of 4-7 μm broad cells arranged in rows parallel to the outer surface, terminating at the level of or slightly below the apices of the asci and paraphyses, gradually narrowing towards the apex. Hymenium 250 μm high (Fig. 17). In sections mounted in water the upper part of the paraphyses and asci can be seen to be (red-) brown, but where the pigment actually is placed is difficult to see. Asci 8-spored, non-amyloid, cylindrical, 200-260 \times 12.5-17.5 μm , with a pleurorhynchous base. Spores uniseriate, globose, 11.3-11.8-12.5 μm , hyaline, with one large guttule, in LM with warts of variable size (Fig. 19), in SEM with dense, low, rounded warts of variable size, c. 0.4-1.9 μm broad and c. 0.4 to 1.3 μm high (Fig. 20). Paraphyses straight, simple, 3.8(-5) μm broad, septate.

Etymology. Referring to the spore ornamentation of rounded warts.

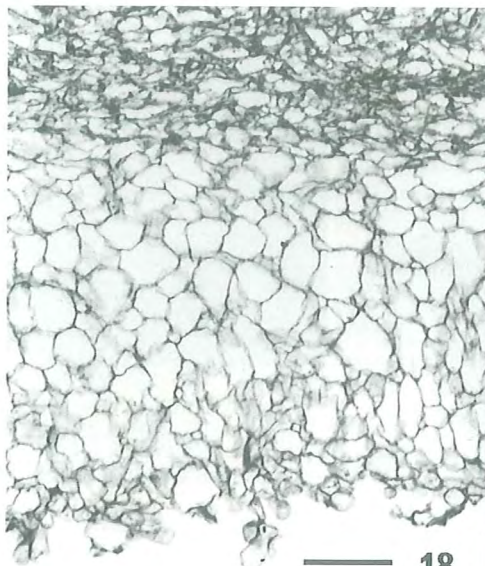
Ecology. On naked, very moist, calcareous soil, solitary or 2-3 together, c. 40 apothecia in an area of 30 \times 30 cm, together with *Tarzetta gaillardiana* and *Scutellinia trechispora*. In a ditch from a dried-up bog, overshadowed by *Fagus sylvatica*, among scattered bryophytes: *Fissidens taxifolius*, *Bryum* sp., *Oxyrrhynchium swartzii*, *Marchantia polymorpha*.

Material. Denmark. Zealand. Allindelille Fredskov, 31.VII.1994, KS.- All-94-8, air-dried (C, holotype).

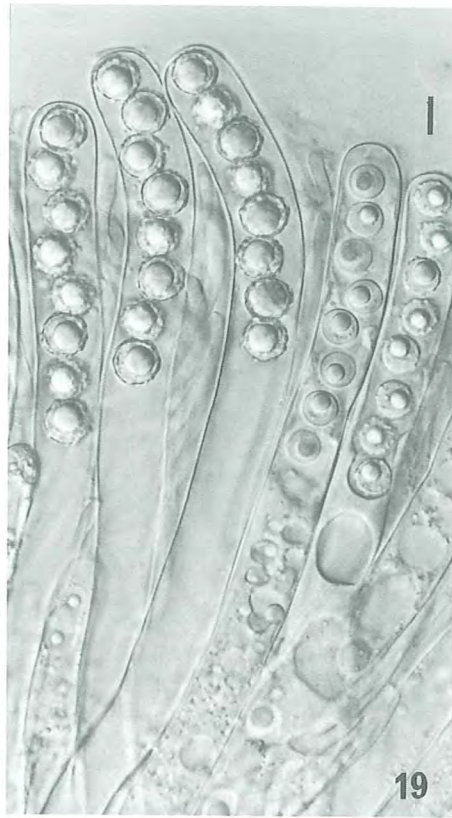
Figs 17-20. *Marcelleina tuberculispora*. – Fig. 17. Section of apothecium, showing the two layered excipulum and the margin, composed of cells arranged in rows parallel to the outer surface (KS.-All-94-8). Scale bar = 100 μm . – Fig. 18. Close-up of excipulum: medullary of angular, uneven-sized cells, outer excipulum hardly discernable, of globose to angular cells, one or two layers thick from which scattered short rows of cells project, with some cells more club-shaped. Subhymenium of densely interwoven hyphae. (KS.-All-94-8). Scale bar = 50 μm . – Fig. 19. LM of hymenium (in water), showing immature and mature asci, and spores with one large guttule. (KS.-All-94-8). Scale bar = 10 μm . – Fig. 20. SEM of spore surface of dense, low, rounded warts of variable size. (KS.-All-94-8). Scale bar = 5 μm .



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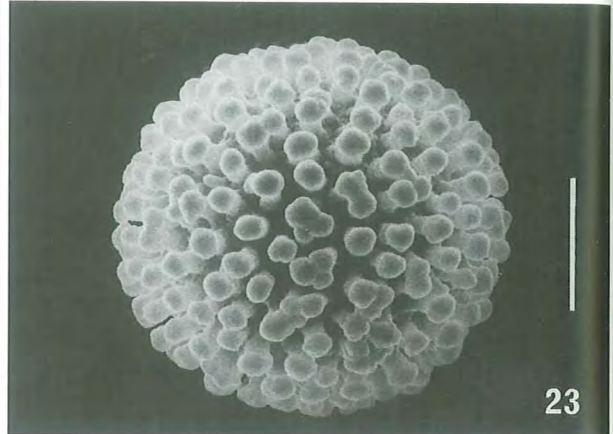
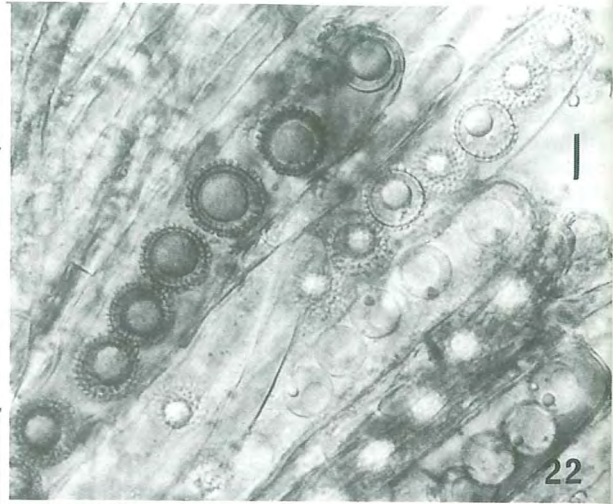
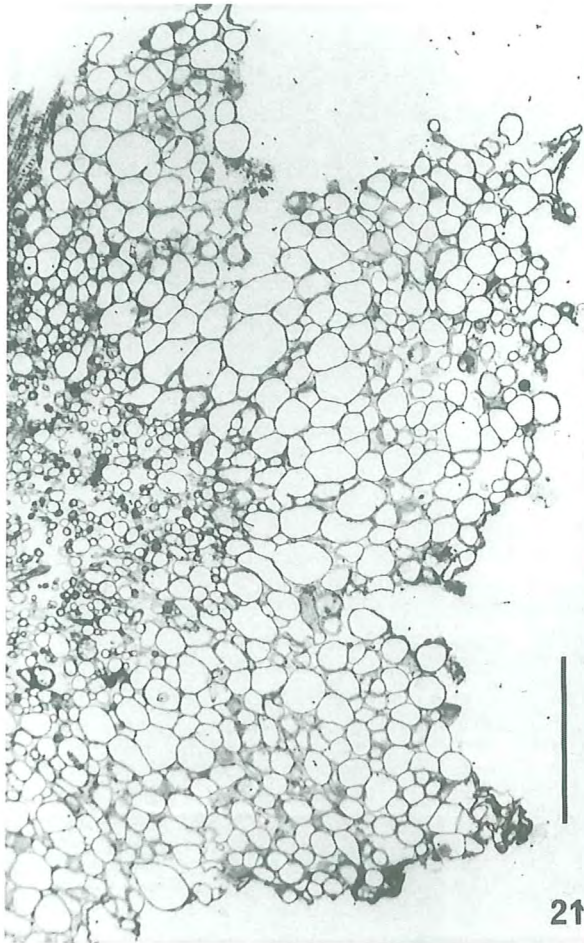
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Marcelleina in its current definition is restricted to species with small purplish apothecia with light brown pigments in the hyphal walls of the outer excipulum and hyaline spores (Moravec 1987). The purplish pigments are only found in the paraphyses, whereas the presumed closely related genera *Greletia* and *Smardaea* both have purplish pigments in all parts, including the spore ornamentation (Svr̃ek 1969; Donadini 1979b; Moravec 1987). The latter genera also have a clearly differentiated medullary excipulum unlike in species of *Marcelleina*, where the excipular layers are poorly differentiated. The species described here clearly belong within

Marcelleina, but it is evident that the separation of these genera needs further testing, including more characters (e.g. molecular characters) in the analysis. Species separation in these genera rely heavily on spore ornamentation characters. The ornament found in *M. tuberculispora* has not been described in any previously published *Marcelleina* species. *Marcelleina pseudoanthracina* J. Moravec has isolated, more scattered, broad, irregularly rounded to angular warts (Moravec 1987: SEM fig. 16) and the spores are much smaller (7-8.5 μm in diam.). *Greletia verrucispora* (Donadini & Monier) Donadini has spores, 9-12 μm in diam. and an



Figs 21-23. *Scabropezia scabrosa*. – Fig. 21. Section of marginal pustules, composed of globose cells. (KS-94-148). Scale bar = 200 μm . – Fig. 22. LM of immature asci with smooth spores, and mature asci with dark-coloured, ornamented spores (in water). (KS-94-148). Scale bar = 10 μm . – Fig. 23. SEM of spore surface of high, obtuse truncate, isolated warts. (KS-94-148). Scale bar = 5 μm .

ornamentation of large warts (Donadini 1976: SEM plate I.c,d,e), much like the spore-ornamentation in our material. However, a comparison of material of this species from the type locality: Le Petit Lubéron, Vaucluse 23.X.1974 (C), determined by Donadini, showed, that the spore markings in SEM is of nearly truncate, isolated warts. Though, the purplish pigment placed in the spore-ornamentation and paraphyses, as described by Donadini (1976), was very weak or totally dissolved in water, it possessed the other characters of *Greletia*, such as the presence of conspicuous purplish-red pigment in all parts of the excipulum.

***Scabropezia scabrosa* (Cooke) Dissing & Pfister, Nord. J. Bot. 1: 103, 1981.**

Apothecia cupulate, sessile, 2 cm in diam., 0.5-0.7 cm high; hymenium dark brown to almost black with a greenish tint; margin incurved with an irregular curved rim; outside densely covered with conical pustules, very dark red-brown. Outer excipulum 200-500 μm thick, of textura globulosa, the outermost cells thick-walled (mounted in water with \pm brownish pigment), forming 150-400 μm high and 200-500 μm broad pustules (Fig. 21), the innermost layer 150-250 μm thick. Medullary excipulum 400-500 μm thick, of textura intricata, loosely interwoven, septate, 5-12 μm broad hyphae. Subhymenium 120-200 μm thick, dense, of globose to angular cells of uneven size, 15-40 μm broad, with in-

terwoven hyphae. Hymenium 330-390 μm high. Asci 8-spored, staining blue in Melzer's reagent all over, but especially at the apex, cylindrical, when mature 330-370 \times 20.0-22.5 μm , with a pleurorhynchous base. Spores at first bi- or multiseriate, hyaline, smooth, when mature uniseriate, yellowish-brown, globose, 11.3-12.9-13.8 μm in diam., with one large guttule, in LM with 1.3 μm high, truncate warts (Fig. 22), in SEM with obtuse truncate, isolated or \pm fused warts (Fig. 23). Paraphyses 5.0-6.3 μm broad, above enlarged to 8.8-10.0 μm , straight, septate, the uppermost cell often with brownish granular contents. Paraphyses and asci above embedded in brownish, amorphous matter.

Ecology. In 1994 collected on naked, eroded, moist, calcareous soil containing c. 91.5% CaCO_3 , pH 8.0 and a content of 4% organic matter. In Jydelejeslugten, a gorge with a calcareous spring with cold water and almost uniform temperature all year round, only a single apothecium was found. In 1997 collected in two localities along brooklets, on naked, clayey soil, in deciduous forest. One site (Jutland) reported to be calcareous. It is recorded from U.S., on soil or more often rotten wood, from late August until late September.

Material. Denmark. Møn, Store Klinteskov. Jydelejeslugten, 19.IX.1994, KS-94-148 (C); Zealand. Leestrup Skov, only half of a mature fruitbody, 14.IX.1997, K. Hansen, KH-97-56 (C); Jutland. Vejle, Grund Skov near sanatorium, 12.X.1997, M. Christensen, KH-97-111 (C).

Scabropezia scabrosa is new to Europe. The cupulate apothecia, the dark brown hymenium and the red-brown outer surface covered with prominent pustules are distinct characters making it easily recognizable in the field.

The genus *Scabropezia* is distinguished from the other genera in the family Pezizaceae by the anatomy of the apothecia, which is unique with the pustulate outside, composed of aggregates of globose to angular cells, clearly separated from the medullary excipulum of textura intricata. For a discussion of the generic delimitation see Dissing & Pfister (1981).

The ultra-thin sections from our material showed an outer excipulum of textura globulosa, in contrast to the textura angularis as described by Dissing & Pfister (1981), which most probably could be due to their use of dried material. *Scabropezia scabrosa* is easily separated from *S. flavovirens*, which has very delicately ornamented spores and a green hymenium. Material of *S. flavovirens* from Denmark has been compared: Zealand, Bromme Lillesø, 27.VIII.1975, M. D. Paulsen & H. Dissing s.n. (C). Møn, Klinteskov, 18.IX.1980, H. Dissing s.n. (C). Material of *S. scabrosa*, from U.S.:

Vermont, Dunwoodie, Bennington, VIII.1980, R. Lowen (FH) has been examined and matches the Danish collection.

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