

## New additions to the Turkish Pezizales

Yasin UZUN<sup>1</sup>, Semiha YAKAR<sup>1</sup>, İbrahim Halil KARACAN<sup>2</sup>, Abdullah KAYA<sup>1\*</sup>

<sup>1</sup>Department of Biology, Kamil Özdağ Science Faculty, Karamanoğlu Mehmetbey University, Karaman, Turkey

<sup>2</sup>Ömer Özminar Religious Anatolian High School, Gaziantep, Turkey

Received: 09.08.2017 • Accepted/Published Online: 27.12.2017 • Final Version: 03.05.2018

**Abstract:** Twelve members of the order Pezizales are recorded for the first time from Turkey: *Ascobolus carbonarius* P.Karst.; *A. crenulatus* P.Karst.; *A. foliicola* Berk. & Broome; *A. immersus* Pers.; *Saccobolus glaber* (Pers.) Lambotte; *Thecotheus holmskioldii* (E.C.Hansen) Eckblad (Ascobolaceae Boud. ex Sacc.); *Lasiobolus cuniculi* Velen. (Ascodesmidaceae J.Schröt.); *Barssia hellenica* Kaounas, Agnello, P.Alvarado & Slavova (Helvellaceae Fr.); *Marcelleina atroviolacea* Brumm.; *M. rickii* (Rehm) Graddon (Pezizaceae Dumort.); *Cheilymenia pulcherrima* (P.Crouan & H.Crouan) Boud.; and *Sepultariella semi-immersa* (P.Karst.) Van Vooren, U.Lindem. & Healy (Pyronemataceae Corda). Three of them, *S. glaber* (Pers.) Lambotte; *B. hellenica* Kaounas, Agnello, P.Alvarado & Slavova; and *S. semi-immersa* (P.Karst.) Svrček, are new at the generic level. Brief descriptions of the taxa and their photographs are provided.

**Key words:** Biodiversity, Pezizales, new records, Turkey

### 1. Introduction

Pezizales is a group of operculate discomycetes and characterized by stalked or sessile apothecial ascomata, operculate asci, and single-celled, bilaterally symmetrical, roughly spherical to ellipsoidal ascospores (Hansen and Pfister, 2006; Kirk et al., 2008). Most of them are terrestrial and saprotrophic on soil, burnt ground, decaying wood, compost, or dung, but some form sheathing mycorrhiza with trees (Maia et al., 1996). Though some members form hypogeous ascomata, most species of Pezizales produce epigeous fruit bodies.

The order is a large one and contains 1683 taxa within 16 families and 199 genera (Kirk et al., 2008). As of the end of October 2017, 183 taxa of Pezizales within 12 families and 56 genera had so far been recorded from Turkey (Akata et al., 2014; Güngör et al., 2014, 2015; Keleş et al., 2014; Sesli and Denchev, 2014; Türkoğlu and Castellano, 2014; Uzun et al., 2014; Karacan et al., 2015; Kaya, 2015; Kaya and Uzun, 2015; Türkoğlu et al., 2015; Uzun et al., 2015; Acar and Uzun, 2016; Elliot et al., 2016; Kaya et al., 2016; Taşkın et al., 2016; Acar and Uzun, 2017; Uzun et al., 2017a, 2017b). Here we present 12 additional species for the Turkish Pezizales, belonging to eight genera and five families.

The study aims to make a contribution to the biodiversity of Pezizales in Turkey.

\* Correspondence: [kayaabd@hotmail.com](mailto:kayaabd@hotmail.com)

### 2. Materials and methods

The fungal specimens were collected from four districts (İslahiye, Nurdağı, Oğuzeli, and Şehitkamil) of Gaziantep Province during field trips in the years 2014 and 2015. The samples were photographed in their natural habitats and the characteristics related to their ecology and morphology were noted. The squash preparations of asci and ascospores were mounted in water, Melzer's reagent, lactophenol cotton blue, and Congo-Red, and microscopical examinations were carried out under a Nikon Eclipse Ci-S trinocular light microscope. The samples were identified with the help of Brummelen (1967, 1986), Bezerra and Kimbrough (1975), Waraitch (1976), Moravec (1970, 1992), Yao (1996), Medardi (2000, 2006a, 2006b), Richardson (2004, 2011), Piasai and Manoch (2009), Kristiansen (2012), Doveri (2014), Melo et al. (2014), and Kaounas et al. (2015). The samples are kept at Karamanoğlu Mehmetbey University, Kamil Özdağ Science Faculty, Department of Biology.

### 3. Results

The systematics of the taxa are given in accordance with Cannon and Kirk (2007), Kirk et al. (2008), and the Index Fungorum ([www.indexfungorum.org](http://www.indexfungorum.org); accessed 31 July 2017). The taxa are listed in alphabetical order together with their brief descriptions, habitats, localities, collection dates, and accession numbers.

### 3.1. Ascomycota Whittaker

#### Pezizales J.Schröt.

#### Ascobolaceae Boud. ex Sacc.

##### 3.1.1. *Ascobolus carbonarius* P.Karst.

Not. Sällsk. Fauna et Fl. Fenn. Förh. 11: 202 (1870) [Syn. *Ascobolus atrofuscus* W.Phillips & Plowr., *Ascobolus atrofuscus* W.Phillips & Plowr., var. *atrofuscus*, *Ascobolus atrofuscus* var. *pruinosis* Boud.] (Figure 1).

**Macroscopic and microscopic features:** Apothecia 2–8 mm in diameter, cup to saucer shaped, finally flattened, sessile, greenish-yellow when young, then brownish, blackish-brown when mature. Disk concave at first, then flat, yellowish-green, greenish-orange, brownish with age, finally almost black, dotted with black protruding tips of mature asci. Asci 180–230 × 20–22 μm, cylindrical, tapering downwards, eight-spored. Paraphyses cylindrical, septate, sometimes branched, slightly thickened above. Ascospores 18–24 × 12.5–14 μm, ellipsoid, hyaline when young, dark violet to dark purplish-brown, surface ornamented with rounded or irregular warts when mature. *A. carbonarius* grows gregariously on damp burnt residues (Brummelen, 1967; Medardi, 2000).

**Specimen examined:** Gaziantep, İslahiye, Altınüzüm village, mixed forest clearing, on ash, 36°54'N, 36°33'E, 480 m, 21.03.2015, K.11473.

##### 3.1.2. *Ascobolus crenulatus* P.Karst.

Fungi Fenniae Exsiccati, Fasc. 8: (1868) [Syn. *Ascobolus viridulus* W.Phillips & Plowr.] (Figure 2).

**Macroscopic and microscopic features:** Apothecia 0.3–2 mm in diameter, subglobular when young,

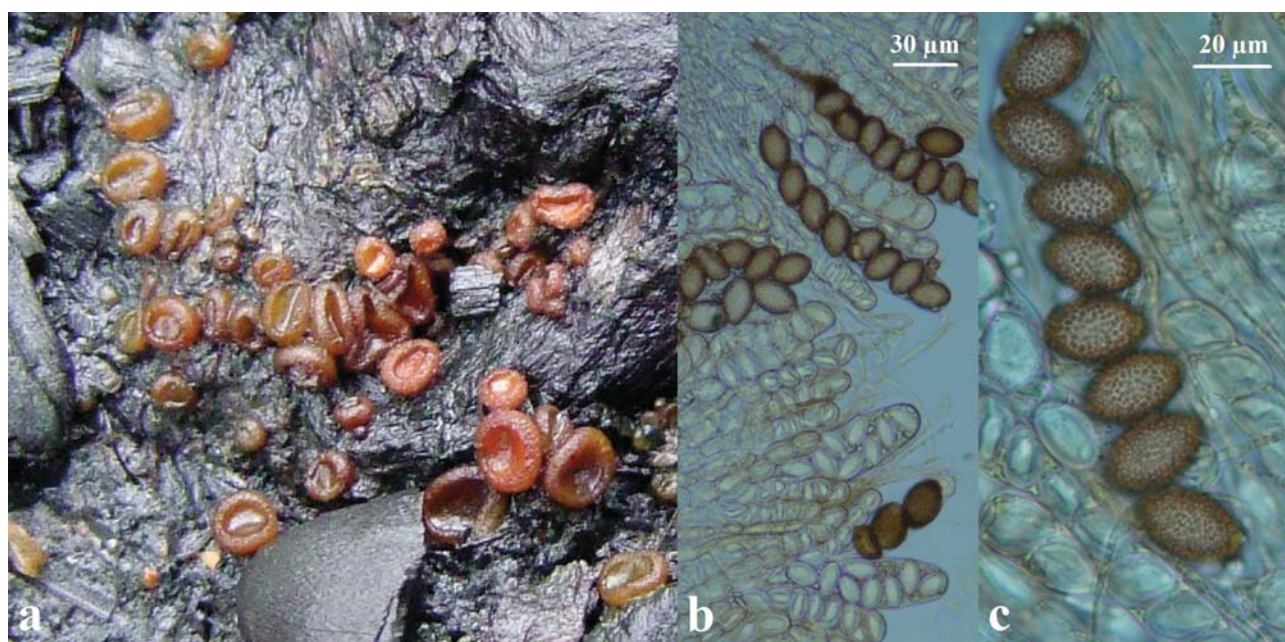
hemispherical when mature, greenish-yellow to pale olive-green. Disk concave at first, then flat with a crenulate margin, greenish-yellow, with dark purplish dots due to mature asci tips. Asci 125–150 × 13–15 μm, cylindrical-clavate. Paraphyses cylindrical, septate, sometimes branched. Ascospores 14–17 × 8–9 μm, ellipsoid, hyaline when young, violaceous to pale reddish brown when mature, with longitudinally striated ornamentation. *A. crenulatus* grows on rotten leaves of oak and herbs; on dung of animals such as deer, dog, goat, grouse, pheasant, pigeon, raven, rabbit, and sheep (Brummelen, 1967; Abdullah, 1982; Melo et al., 2014).

**Specimen examined:** Gaziantep, Nurdağı, Gökçedere village, roadside, on goat dung, 37°09'N, 36°42'E, 495 m, 26.10.2014, K.10257.

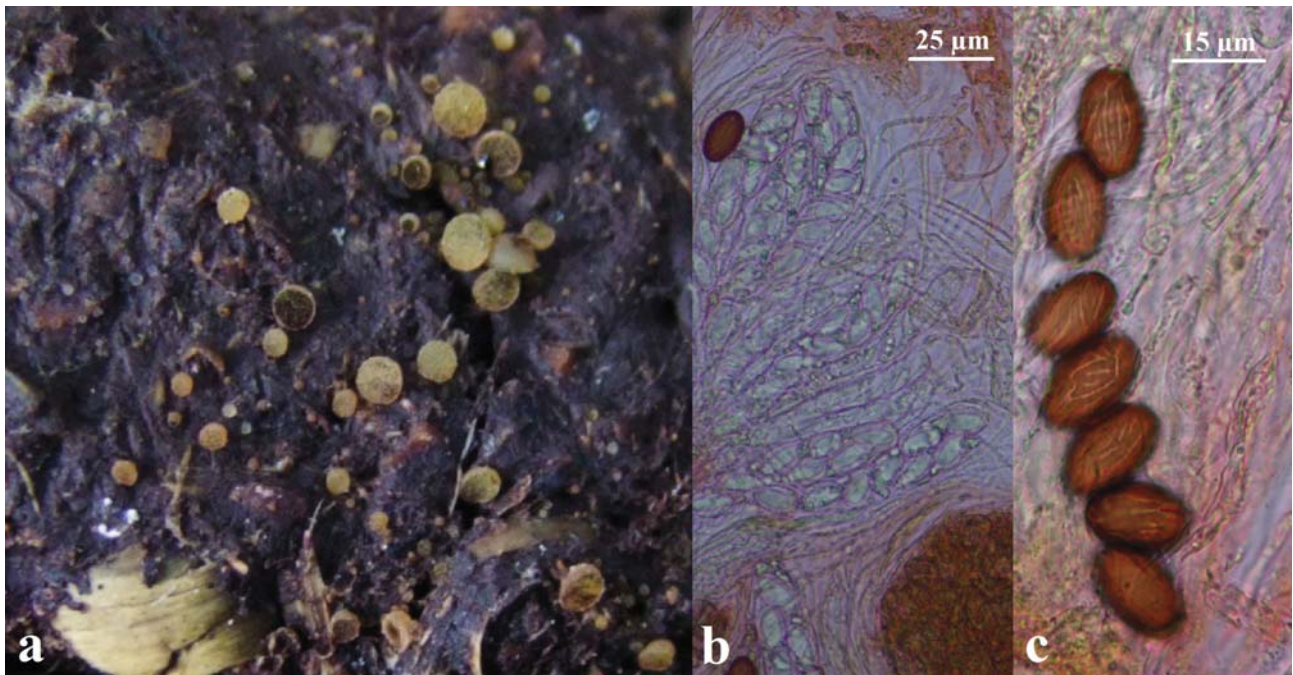
##### 3.1.3. *Ascobolus foliicola* Berk. & Broome

J. Linn. Soc., Bot. 14: 109 (1873) [Syn. *Ascobolus crouanii* Boud.] (Figure 3).

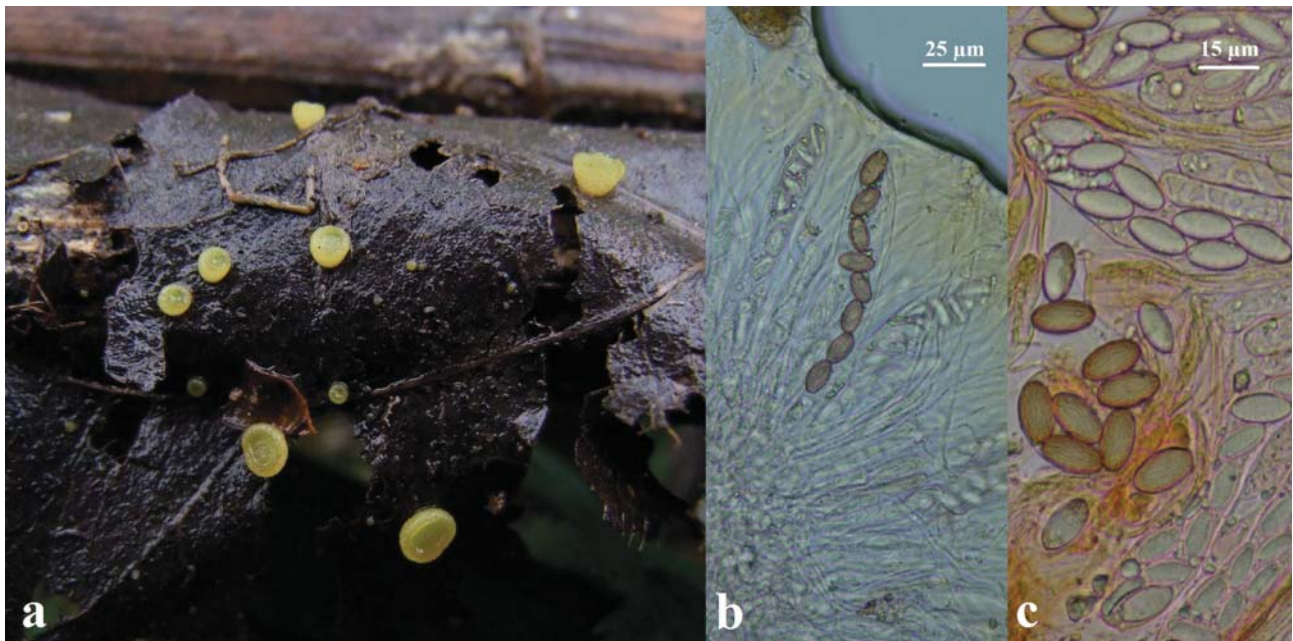
**Macroscopic and microscopic features:** Apothecia 1–3 mm in diameter, at first subglobular, then becomes cup-shaped to expanded with a short, subcentral stalk, greenish-yellow with reddish-brown particles or warts. Disk concave when young, later flat or undulated, greenish-yellow at first, then brownish with dots due to black tips of mature asci protruding from the surface. Asci 180–190 × 18–21 μm, cylindrical to clavate, eight-spored. Paraphyses cylindrical, branched, septate. Ascospores 16–20 × 8–11 μm, ellipsoid, hyaline when young, light to purplish-brown when mature, surface ornamented with longitudinal anastomosing striae. *A. foliicola* grows on



**Figure 1.** *Ascobolus carbonarius*: a- ascocarps, b- asci and paraphyses, c- spores.



**Figure 2.** *Ascobolus crenulatus*: a- ascocarps, b- asci and paraphyses, c- spores.



**Figure 3.** *Ascobolus foliicola*: a- ascocarps, b- asci and paraphyses, c- spores.

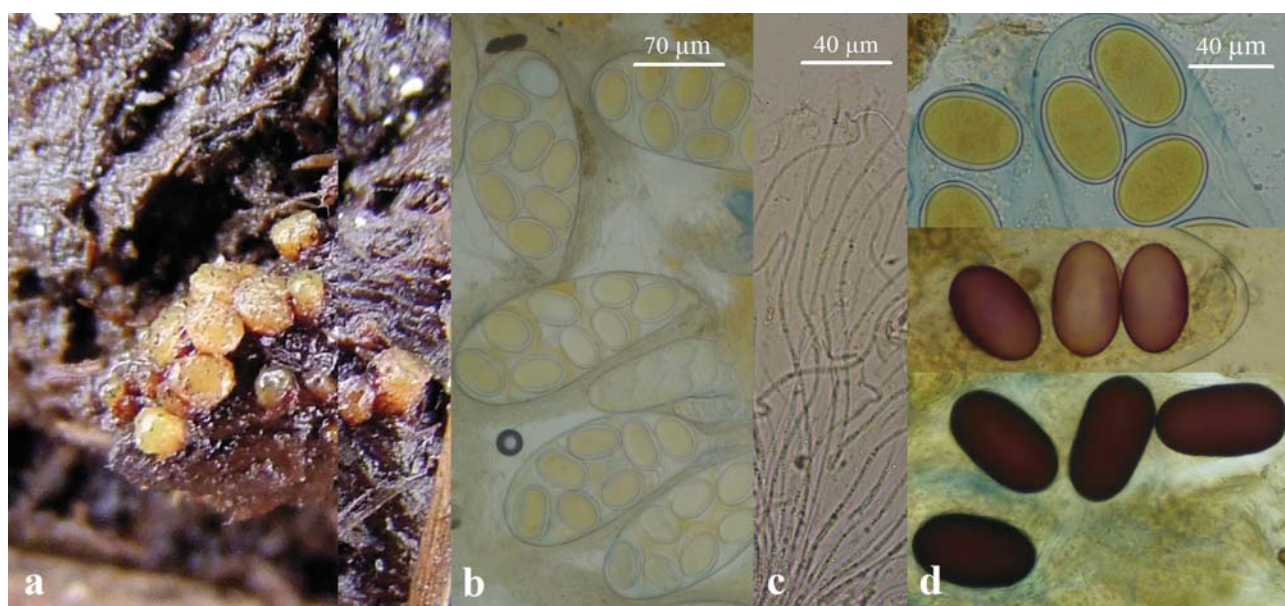
bare ground or on rotten leaves, stalks, wood, and bark of plants (Brummelen, 1967; Moravec, 1970).

**Specimen examined:** Gaziantep, Oğuzeli, center, poplar grove, on *Populus* sp. leaves and twigs, 36°58'N, 37°30'E, 700 m, 13.12.2014, K.11055.

#### 3.1.4. *Ascobolus immersus* Pers.

Neues Mag. Bot. 1: 115 (1794) [Syn. *Ascobolus immersus* var. *andinus* Speg., *Ascobolus immersus* var. *brevisporus*

Oudem., *Ascobolus immersus* Pers., var. *immersus*, *Ascobolus porphyrosporus* (Hedw.) Fr., *Dasyobolus immersus* (Pers.) Sacc., *Dasyobolus immersus* var. *brevisporus* (Oudem.) Sacc. & Traverso, *Dasyobolus immersus* (Pers.) Sacc. var. *immersus*, *Dasyobolus immersus* var. *porphyrosporus* (Hedw.) Boud., *Dasyobolus porphyrosporus* (Hedw.) Sacc., *Octospora porphyrospora* Hedw., *Peziza porphyrospora* (Hedw.) Lam.] (Figure 4).



**Figure 4.** *Ascobolus immersus*: a- ascocarps, b- asci, c- paraphyses, d- spores.

**Macroscopic and microscopic features:** Apothecia 0.5–1.5 mm in diameter, at first globose to ovoid, then becomes subglobose to pyriform, dark yellow to greenish-brown. Disk convex or flat, yellow or greenish-yellow. Asci 190–300 × 90–125 µm, broadly clavate, rounded above, eight-spored, the wall stains blue in Melzer's reagent. Paraphyses simple or branched, septate, filiform, not enlarged at the apex. Ascospores 35–80 × 25–40 µm, oblong ellipsoid to cylindrical or subglobular, rounded at the ends, generally smooth, thick-walled, at first hyaline, then purplish, finally sometimes purplish-brown. *A. immersus* grows on dung of herbivores such as cow, horse, sheep, goat, nilgai, antelope, elephant, dog, hare, and rabbit (Brummelen, 1967; Melo et al., 2014).

**Specimen examined:** Gaziantep, Nurdağı, Hamidiye village, roadside, on cow dung, 37°05'N, 36°53'E, 810 m, 12.12.2014, K.11018.

### 3.1.5. *Saccobolus glaber* (Pers.) Lambotte

Mém. Soc. roy. Sci. Liège, Série 2 14: 284 (prepr.) (1887) [Syn. *Ascobolus glaber* Pers., *Ascobolus glaber* var. *caprea* Beeli, *Ascobolus glaber* Pers. var. *glaber*, *Ascobolus glaber* var. *ruber* Pers., *Ascobolus glaber* var. *varius* Pers., *Ascobolus kervernii* P. Crouan & H. Crouan, *Ascobolus stercorarius* var. *glaber* (Pers.) Velen., *Saccobolus granulospermus* Soppitt & Crossl., *Saccobolus kervernii* (P. Crouan & H. Crouan) Boud., *Saccobolus kervernii* (P. Crouan & H. Crouan) Boud.f. *kervernii*, *Saccobolus kervernii* f. *minor* Rayss] (Figure 5).

**Macroscopic and microscopic features:** Apothecia 0.2–1 mm in diameter, sessile. Receptacle globular when young, then pulvinate, golden-yellow to amber-colored. Disk convex, golden-yellow, dotted with black protruding

tips of mature asci. Flesh thin. Asci 130–250 × 25–35 µm, cylindrical-clavate, eight-spored, the wall blue in Melzer's reagent. Paraphyses cylindrical, generally simple, some branched, septate. Ascospores 20–29 × 8.5–14 µm, ellipsoid or slightly asymmetrical, hyaline when young, then purplish-brown when mature, smooth or reticulated with irregular cracks. *S. glaber* grows on dung of bear, camel, cattle, cow, deer, elephant, gnu, horse, zebu, and sheep (Brummelen, 1967; Melo et al., 2014).

**Specimen examined:** Gaziantep, Nurdağı, Sakçağöz village, on cow dung, 37°10'N, 36°55'E, 850 m, 07.11.2015, K.12703.

### 3.1.6. *Thecotheus holmskioldii* (E.C.Hansen) Eckblad

Nytt Mag. Bot. 15(1–2): 25 (1968) [Syn. *Ascobolus holmskjoldii* (E.C.Hansen) G.Winter, *Ascophanella holmskjoldii* (E.C.Hansen) Faurel & Schotter, *Ascophanus holmskjoldii* E.C.Hansen, *Ascophanus holmskjoldii* var. *caprinus* Velen., *Ascophanus holmskjoldii* E.C.Hansen, var. *holmskjoldii*, *Ascophanus holmskjoldii* var. *leporinus* Velen., *Thecotheus rehmi* Zukal] (Figure 6).

**Macroscopic and microscopic features:** Apothecia 0.3–1.5 mm in diameter, subconical when young, later turbinate, sessile, soft, cream to grayish-white or grayish, hymenial surface concolorous with the external surface, whitish when dry, roughened by protruding asci tips. Asci 250–320 × 30–43 µm, cylindrical to broadly clavate, eight-spored. Paraphyses filiform, thin-walled, often septate. Ascospores 28–38 × 14–17 µm, ellipsoid, thick-walled, with rounded apiculus at both ends. *T. holmskioldii* was reported to grow on dung of herbivorous animals (Kozłowska et al., 2015).

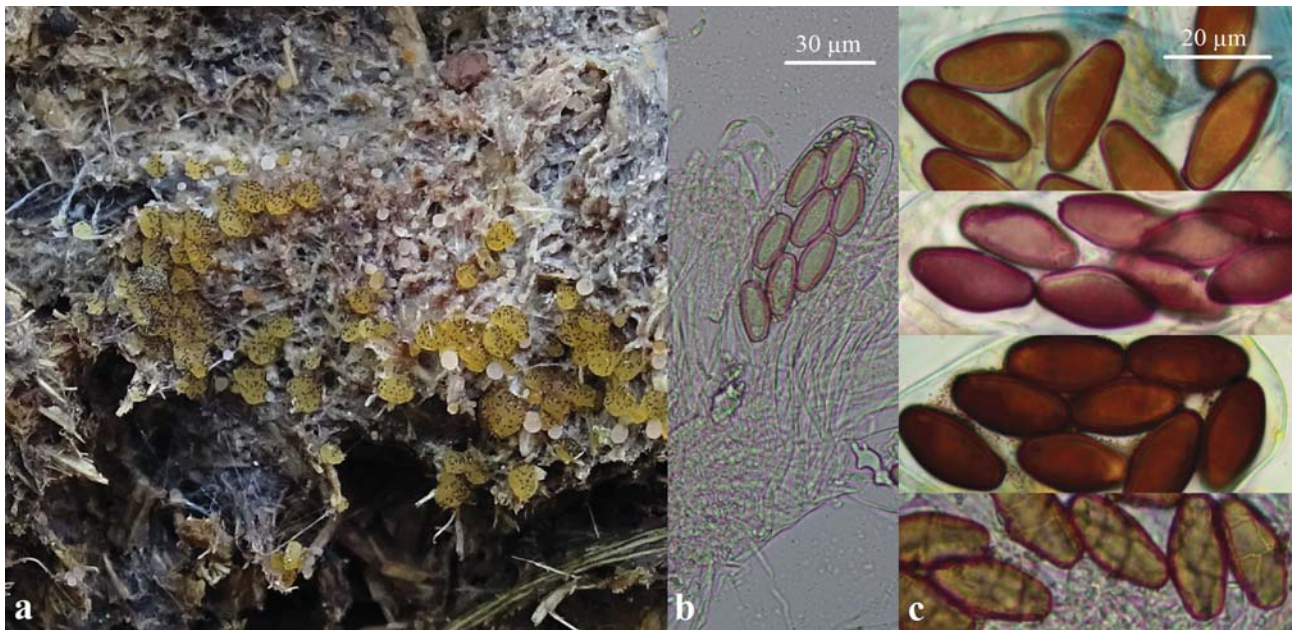


Figure 5. *Saccobolus glaber*: a- ascocarps, b- asci and paraphyses, c- spores.

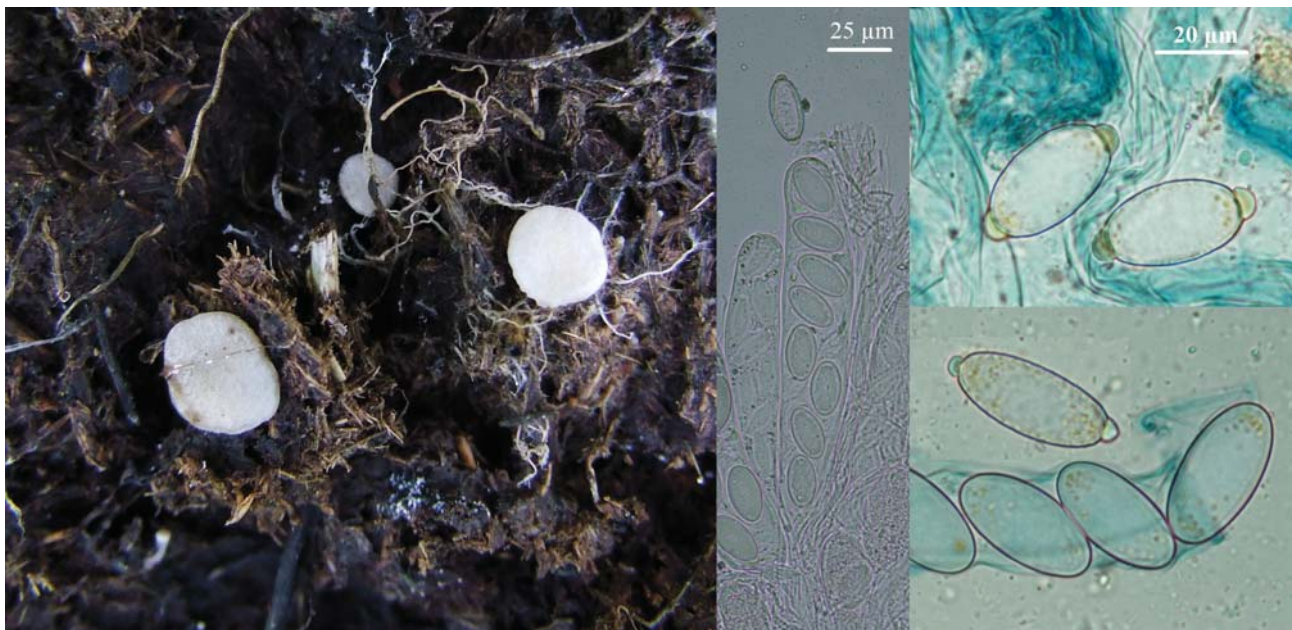


Figure 6. *Thecotheus holmskioldii*: a- ascocarps, b- asci and paraphyses, c- spores.

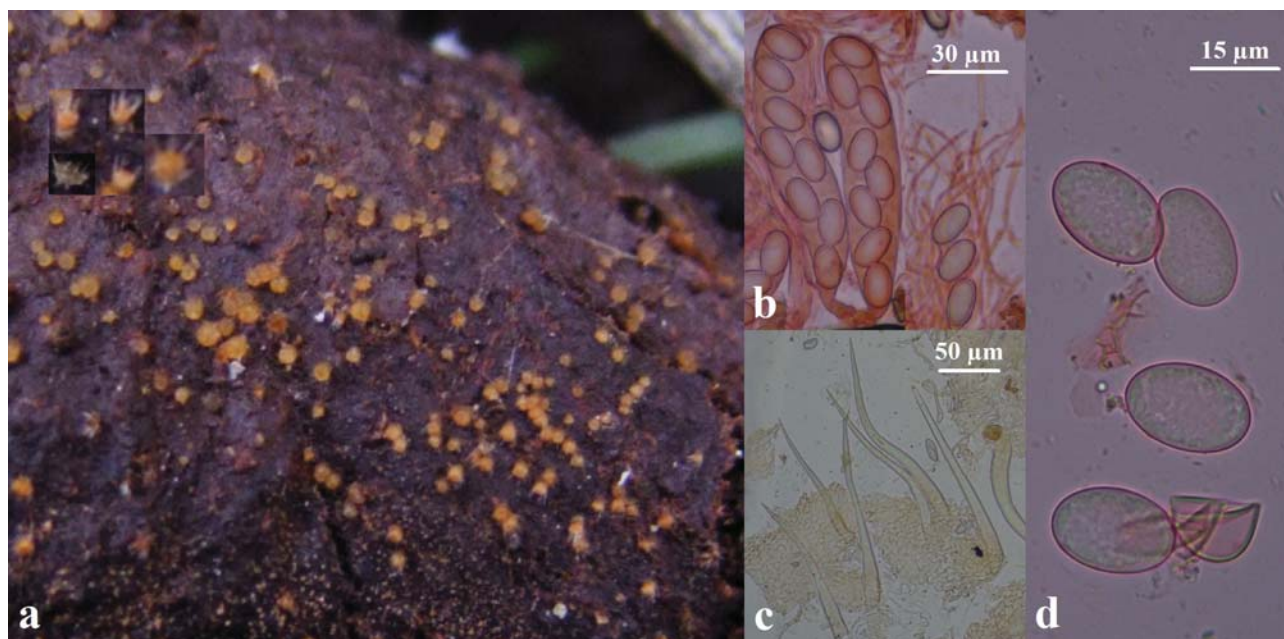
**Specimen examined:** Gaziantep, Nurdağı, Kirkpınar village, roadside, on cow dung, 37°03'N, 36°51'E, 920 m, 18.04.2015, K.11765.

### 3.2. Ascodesmidaceae J.Schröt.

#### 3.2.1. *Lasiobolus cuniculi* Velen.

Monogr. Discom. Bohem. (Prague): 363 (1934) (Figure 7).  
**Macroscopic and microscopic features:** Apothecia 0.2–1 mm in diameter. Receptacle obconical to cupulate, sessile, setose, yellow to orange-yellow. Disk flat to slightly

convex, smooth, concolorous with the receptacle, external surface covered with hyaline hairs of 100–400 µm long. Asci 100–210 × 18–35 µm, broadly clavate, rounded at the apex, eight-spored. Paraphyses cylindrical-filiform, septate, simple or branched, some slightly thickened at the apex. Ascospores 17–25 × 10–15 µm, ellipsoid to broadly ellipsoid, rounded at the ends, smooth, hyaline. *L. cuniculi* grows on dung of rabbit, hare, sheep, goat, raccoon, cow, horse, and other animals (Bezerra and Kimbrough, 1975).



**Figure 7.** *Lasiobolus cuniculi*: a- ascocarps, b- asci and paraphyses, c- hairs, d- spores.

**Specimen examined:** Gaziantep, İslahiye, Hasanlök village, roadside, on sheep dung, 36°54'N, 36°34'E, 810 m, 19.10.2014, K.10031.

### 3.3. Helvellaceae Fr.

#### 3.3.1. *Barssia hellenica* Kaounas, Agnello, P.Alvarado & Slavova

Ascomycete.org 7(5): 213 (2015) (Figure 8).

**Macroscopic and microscopic features:** Ascocarp 10–30 × 10–20 mm in diameter, hypogeous, subspherical to spherical, more or less lobed, folded, or irregular in shape, covered with irregular polygonal warts, reddish-orange to brownish-red or blackish-brown. Gleba whitish, mostly compact. Asci 120–180 × 35–45 µm, irregularly clavate to broadly ellipsoid, eight-spored. Paraphyses cylindrical, hyaline, simple or forked. Ascospores 21–26 × 16–20 µm, ovoid to subspherical, smooth, hyaline, some with one or two large oil drops, or several smaller droplets. *Barssia hellenica* was reported to grow hypogeously under *Abies cephalonica* Loudon (Kaounas et al., 2015).

**Specimen examined:** Gaziantep, İslahiye, Tandır village, Huzurlu high plateau, in soil, under *Abies cilicica* (Ant. et Kotschy) Carr. subsp. *cilicica* (Ant. et Kotschy) Carr. in mixed forest, 36°58'N, 36°29'E, 1600 m, 26.04.2014, K.8864.

### 3.4. Pezizaceae Dumort.

#### 3.4.1. *Marcelleina atroviolacea* Brumm.

Persoonia, Suppl. 1: 233 (1967) [Syn. *Marcelleina atroviolacea* Brumm. var. *atroviolacea*, *Peziza atroviolacea* Delile] (Figure 9).

**Macroscopic and microscopic features:** Apothecia 10–25 mm in diameter, first cup-shaped, then concave and finally flattened, sessile, purplish-dark blue, dark violaceous to almost black, hymenial surface smooth or slightly undulating, concolorous with the outer surface or slightly lighter. Asci 190–230 × 8.5–12.5 µm, cylindrical, eight-spored. Paraphyses cylindrical, longer than asci, and slightly thickened and curved towards the apex. Ascospores 9–12 µm, globose to spherical, smooth, hyaline, sometimes with some small guttules. *M. atroviolacea* grows on soil among moss (Medardi, 2006a).

**Specimen examined:** Gaziantep, Oğuzeli, city cemetery, on sandy soil, 36°57'N, 37°30'E, 670 m, 05.04.2015, K.11643.

#### 3.4.2. *Marcelleina rickii* (Rehm) Graddon

Trans. Br. Mycol. Soc. 66(1): 170 (1976) [Syn. *Barlaea rickii* Rehm, *Barlaeina rickii* (Rehm) Sacc. & Syd., *Barlaeina rickii* Rehm ex Sacc., *Detonia rickii* Rehm, *Lamprospora rickii* (Rehm) Boud., *Pulparia rickii* (Rehm) Donadini] (Figure 10).

**Macroscopic and microscopic features:** Apothecia 3–15 mm in diameter, cup to saucer shaped or flattened, sessile, purplish-brown or brown-violaceous, hymenial surface smooth or slightly pruinose, concolorous with the outer surface or slightly lighter. Asci 200–220 × 12–14 µm, cylindrical, eight-spored. Paraphyses cylindrical and some slightly enlarged towards the apex. Ascospores 8–10 µm, spherical, hyaline, smooth, or with scarcely reticulate ridges. *M. rickii* grows individually or gregariously on humid bare ground, often near mossy carpets, among herbs (Medardi, 2006b).

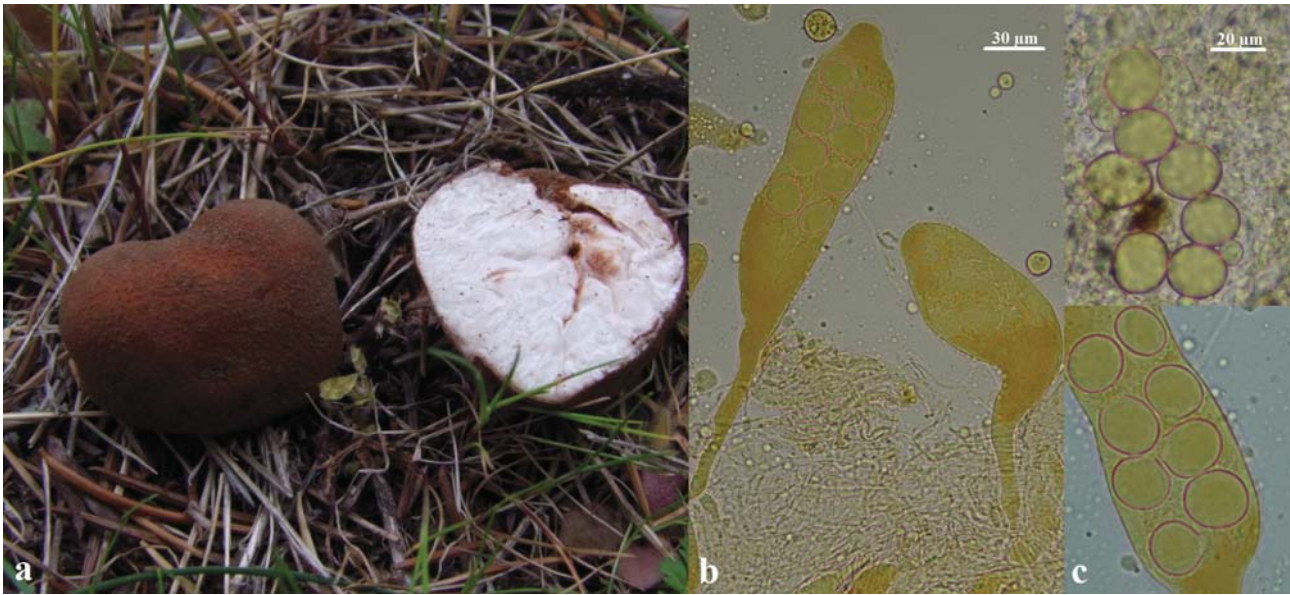


Figure 8. *Barssia hellenica*: a- ascocarps, b- ascus and paraphyses, c- spores.

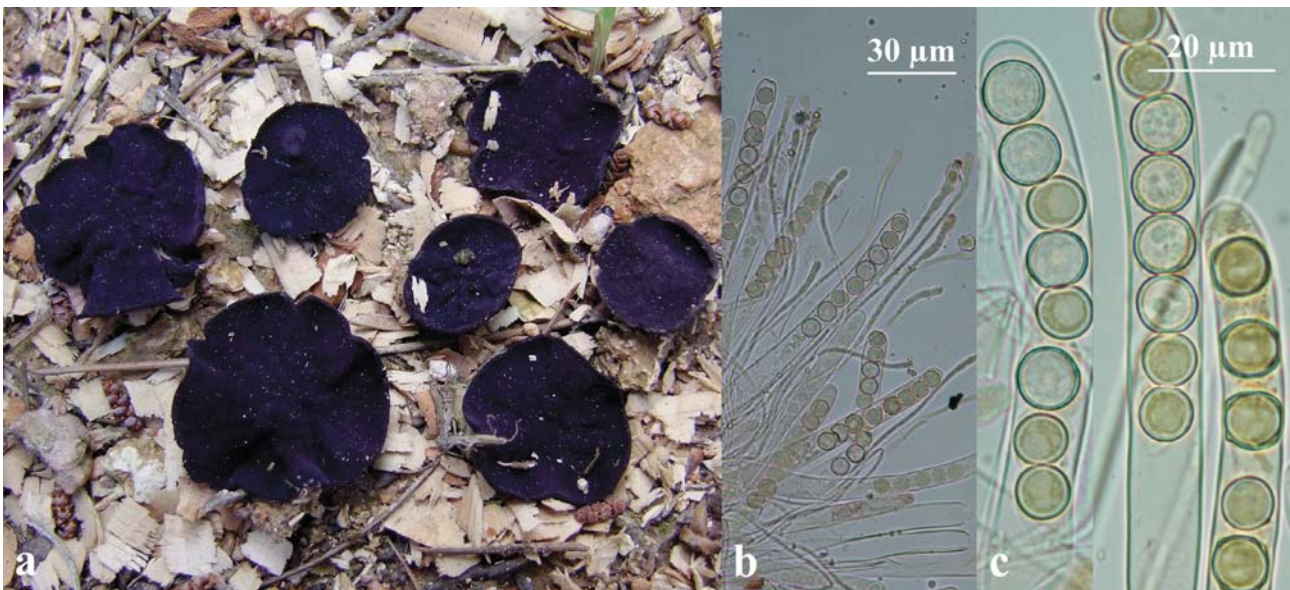


Figure 9. *Marcelleina atrovioleacea*: a- ascocarps, b- asci and paraphyses, c- spores.

Specimen examined: Gaziantep, Şehitkamil, city cemetery, on mossy damp soil, 37°04'N, 37°23'E, 860 m, 27.03.2015, K.11510.

### 3.5. Pyronemataceae Corda

#### 3.5.1. *Cheilymenia pulcherrima* (P.Crouan & H.Crouan) Boud.

Hist. Class. Discom. Eur. (Paris): 63 (1907) [Syn. *Ascobolus pulcherrima* P.Crouan & H.Crouan, *Humaria pulcherrima* (P.Crouan & H.Crouan) Speg., *Humaria stercorea* var. *pulcherrima* (P.Crouan & H.Crouan) Quél., *Lachnea pulcherrima* (P.Crouan & H.Crouan) Cooke, *Lachnea pulcherrima* (P.Crouan & H.Crouan) Gillet, *Lasiobolus*

*pulcherrimus* (P.Crouan & H.Crouan) J.Schröt., *Patella pulcherrima* (P.Crouan & H.Crouan) Seaver, *Peziza pulcherrima* (P.Crouan & H.Crouan) Cooke, *Scutellinia pulcherrima* (P.Crouan & H.Crouan) Kuntze] (Figure 11).

Macroscopic and microscopic features: Apothecia 0.3–2 mm in diameter, turbinate, subcylindrical to barrel shaped, sessile, yellowish-orange, covered with pale brown hairs, hymenium discoid to flattened, bright orange-yellow. Asci 180–230 × 17.5–21 µm, cylindrical, eight-spored. Paraphyses cylindrical, septate, slightly enlarged towards the apex, containing many small yellow pigment granules or oil-globules. Ascospores 20–23 × 12.5–13.5

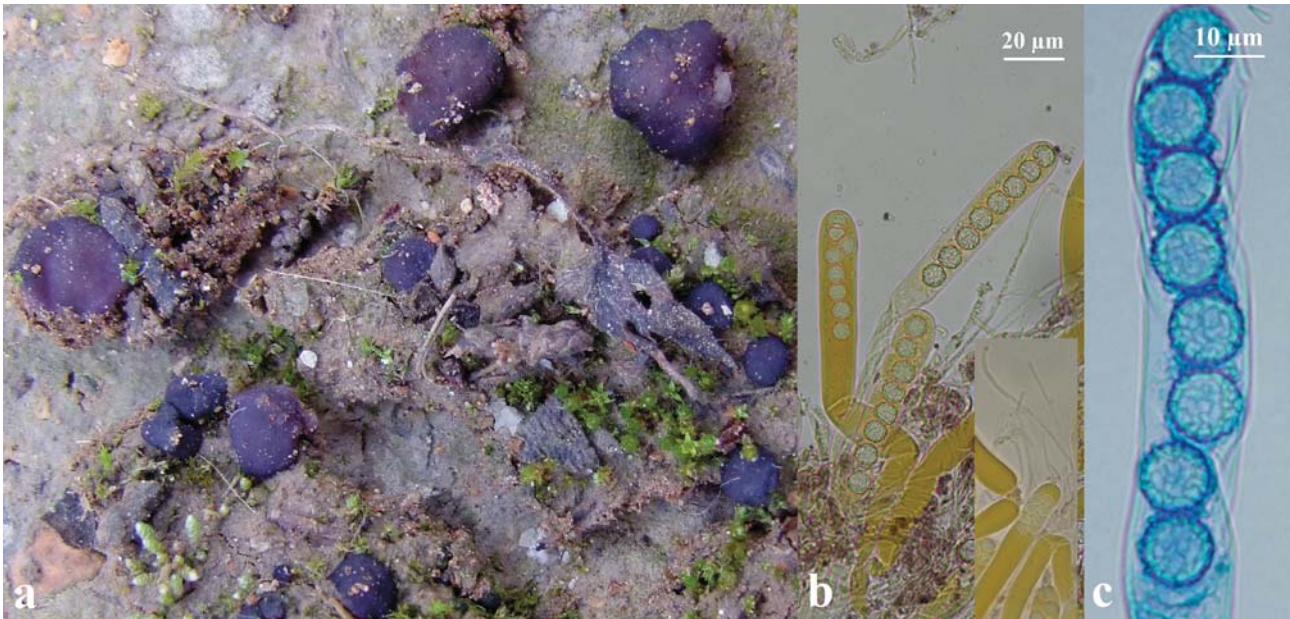


Figure 10. *Marcelleina rickii*: a- ascocarps, b- asci and paraphyses, c- spores.

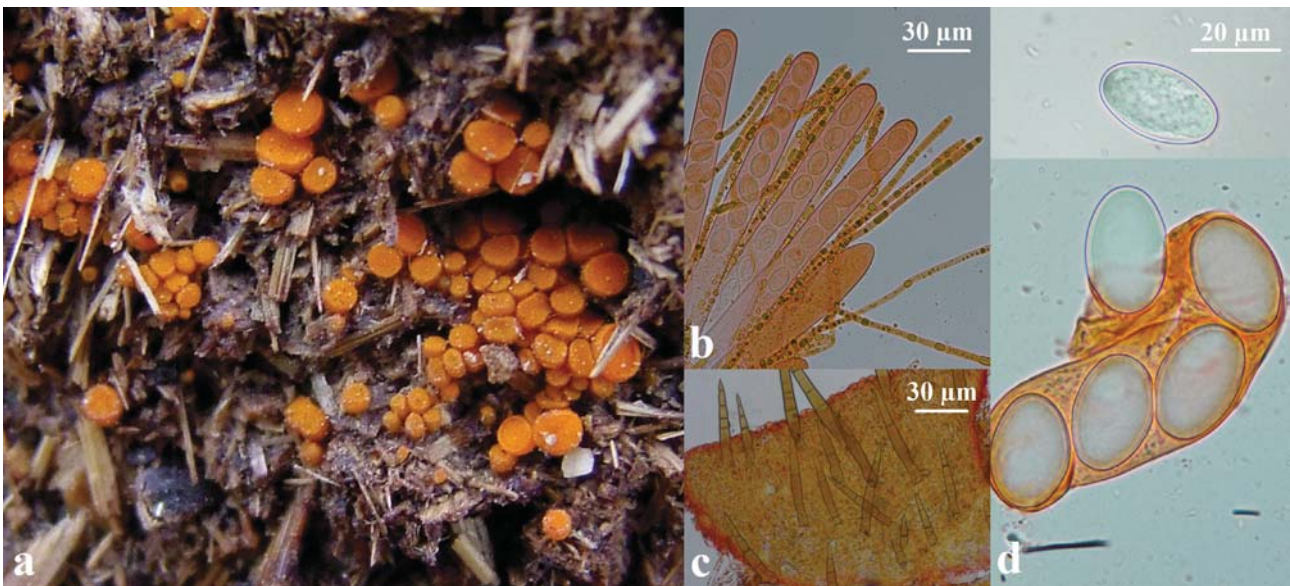


Figure 11. *Cheilymenia pulcherrima*: a- ascocarps, b- asci and paraphyses, c- hairs, d- spores.

µm, ellipsoid, smooth, uniseriate, hyaline at first, later pale yellowish-brown, without oil-globules or granules. *C. pulcherrima* grows on old cow dung (Krug, 1972; Brummelen, 1986; Moravec, 1992).

**Specimen examined:** Gaziantep, İslahiye, Kabaklar village, roadside, on cow dung, 37°02'N, 36°34'E, 730 m, 28.03.2015, K.11545.

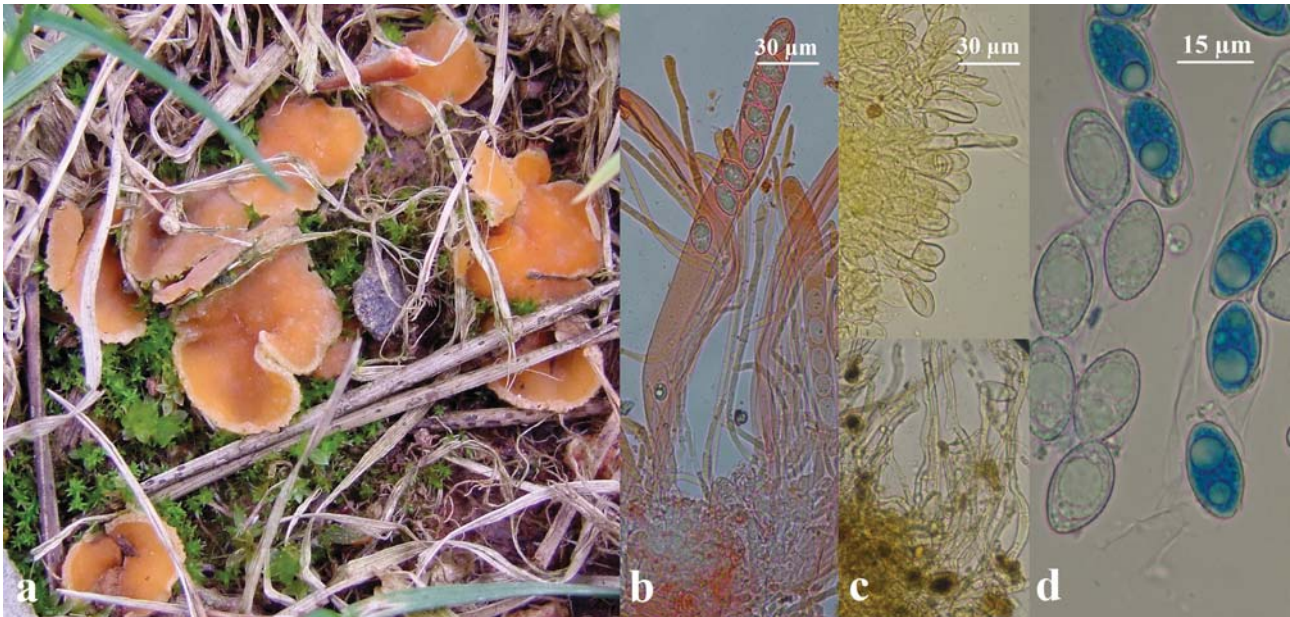
**3.5.2. *Sepultariella semi-immersa* (P.Karst.) Van Vooren, U.Lindem. & Healy**

Ascomycete.org 9(4): 118 (2017) [Syn. *Byssonectria semi-immersa* (P.Karst.) Benkert, *Humaria semi-immersa*

(P.Karst.) Sacc., *Leucoscypha semi-immersa* (P. Karst.) Svrček, *Octospora semi-immersa* (P.Karst.) K.B.Khare & V.P.Tewari, *Peziza semi-immersa* P.Karst., *Sepultaria semi-immersa* (P.Karst.) Masee] (Figure 12).

**Macroscopic and microscopic features:** Apothecia 1.5–5 mm in diameter, cupulate, disk to cup shaped, sessile, ochre-orange to brownish-orange, slightly tomentose, hymenial surface smooth, concolorous with the external surface, margin crenulate with small whitish teeth, upper marginal hairs short and bicellular, lower ones are longer and multicellular. Asci 180–200 × 10–15 µm,





**Figure 12.** *Sepultariella semi-immersa*: a- ascocarps, b- asci and paraphyses, c- hairs, d- spores.

cylindrical, eight-spored. Paraphyses cylindrical, septate, slightly thickened at the apex. Ascospores  $21\text{--}23 \times 10.5\text{--}12 \mu\text{m}$ , ellipsoidal to slightly fusiform, usually with one or two large oil drops. *Sepultariella semi-immersa* grows on land in burned places, but not on ashes (Ribes, 2011).

**Specimen examined:** Gaziantep, Şehitkamil, city cemetery, on soil among woody debris on burnt ground,  $37^{\circ}04'N$ ,  $37^{\circ}23'E$ , 845 m, 06.03.2015, K.11381.

#### 4. Discussion

One hundred and eighty-three members of Pezizales belonging to 12 families currently exist in Turkey. Among them, members of the family Pyronemataceae Corda are the most diverse ones with 58 species. Pezizaceae Dumort., Morchellaceae Rchb., Helvellaceae Fr., Tuberaceae Dumort., Discinaceae Benedix, Sarcosomataceae Kobayasi, Sarcoscyphaceae Le Gal ex Eckblad, and Ascobolaceae Boud. ex Sacc. follow Pyronemataceae with 38, 27, 26, 11, 9, 4, 3, and 2 taxa, respectively. The rest of the families, Ascodesmidaceae J.Schröt., Caloscyphaceae Harmaja, and Rhizinaceae Bonord., are represented with only one taxon. With this study 12 additional members of Pezizales, within five families and eight genera, were reported for the first time from Turkey, increasing the existing taxa number of Pezizales to 195. Among them, *Saccobolus glaber* (Pers.) Lambotte; *Barssia hellenica* Kaounas, Agnello, P.Alvarado & Slavova; and *Sepultariella semi-immersa* (P.Karst.) Van Vooren, U.Lindem. & Healy, are new at the generic level, while the rest of the taxa are new at the species level.

In general, most of the characteristics of the determined taxa are in agreement with those given in the literature.

Four of them belong to the genus *Ascobolus*, and all have widespread distribution (Brummelen, 1967; Medardi, 2000; Melo et al., 2014).

*Ascobolus carbonarius* was found to grow on ash. It is not the only species of the genus able to grow on burnt residues. *A. pusillus* Boud. may share the same habitat, but the small ascocarp, smaller spores with rather pointy ends, and the ability to grow on ground distinguishes it from *A. carbonarius* (Medardi, 2000).

As the epithet indicates, the main distinguishing morphological characteristic of *Ascobolus crenulatus* is the crenulated margin of receptacle. The presence of episporium, presenting longitudinal and occasionally anastomosing subparallel fissures, is also another typical characteristic of this species (Melo et al., 2014). *Ascobolus crenulatus* is close to *A. cubensis* Berk. & M.A.Curtis, *A. crosslandii* Boud., and *A. cervinus* Berk. & Broome, but the narrow receptacle margin and ornamentation of the episporium distinguish it from the first one. The shape of the ascospore is the main differentiating characteristic from the second one, while the lighter color of the young fruit-bodies and the size of ascospores differs it from the third one (Brummelen, 1967).

Although *Ascobolus foliicola* may be confused with *A. singeri* Brumm., they can be easily distinguished from each other by the characteristic ornamentation of the episporium of the latter. The absence of the stalk is also another differentiating characteristic of *A. singeri*.

*Ascobolus immersus* can easily be recognized by the very large and variable ascospores with a thick conspicuous gelatinous envelope surrounding each spore (Brummelen,

1967; Melo et al., 2014). It is closely related to *A. bistisii* Gamundí & Ranalli, but differs with oblong ellipsoid or subcylindrical with rounded or obtuse ended spores (Brummelen, 1967).

*Saccobolus glaber* resembles *S. citrinus* Boud. & Torrend in general morphology, being distinguished by the color of the receptacle, usually darker, in shades of amber, golden to dark yellow, and by its slightly longer ascospores with rounded tips (Melo et al., 2014).

*Lasiobolus cuniculi* is close to *L. ciliatus*, but it has broader asci and narrower setae (Bezerra and Kimbrough, 1975). Macroscopically *Lasiobolus* can be confused with species of the genus *Cheilymenia* Boud., especially with *C. stercorea* (Pers.: Fr.) Boud, which also grows on manure, but the species of this genus has septate hairs and concretely this species has them more long, 700 µm, with brown and smaller spores of 18–20 × 9 µm.

*Barssia hellenica* can be easily discriminated from other species due to its particular morphological and ecological features. Morphologically it differs by its ovoid ascospores

of intermediate size, shape and size of the asci, and the habitat restricted to *Abies* sp. (Kaounas et al. 2015).

It is easy to recognize *Marcelleina atrovioleacea* with its dark violet fruiting bodies. Though some Pezizales species also have violet tones, they do not have curved paraphyses at the apex (Medardi, 2006a). The main characteristics of *M. rickii* are the dimensions and the scarce ornamentation of the spores; the brownish colors of the apothecia can also be a valuable hint for its determination. There are some other species of *Marcelleina* Brumm., Korf & Rifai confusable with *M. rickii*. For example, *M. brevicostatispora* J.Moravec is entirely blue-violet and has 9–11 µm spores with coarse isolated warts and very short ridges. Likewise, *M. benkertii* J.Moravec is evenly dark blackish-blue and has smooth spores with 9–11.4 µm in diameter (Medardi, 2006a).

#### Acknowledgments

The authors would like to thank TÜBİTAK for supporting the project (212T112) financially.

#### References

- Abdullah SK (1982). Coprophilous mycoflora on different dung types in southern desert of Iraq. *Sydowia* 35: 1-5.
- Acar İ, Uzun Y (2016). *Peziza granularis* Donadini Türkiye Mikobiyotası için yeni bir kayıt. *Yüzüncü Yıl Üniversitesi Fen Bilimleri Enstitüsü Dergisi* 21: 39-42 (in Turkish).
- Acar İ, Uzun Y (2017). An interesting half-free morel record for Turkish Mycobiota (*Morchella populiphila* M.Kuo, M.C.Carter & J.D.Moore). *Journal of Fungus* 8: 125-128.
- Akata I, Uzun Y, Kaya A (2014). Macromycetes determined in Yomra (Trabzon) district. *Turk J Bot* 38: 999-1012.
- Bezerra JL, Kimbrough JW (1975). The genus *Lasiobolus* (Pezizales, Ascomycetes). *Can J Bot* 53: 1206-1229.
- Brummelen JV (1967). A world-monograph of the genera *Ascobolus* and *Saccobolus* (Ascomycetes, Pezizales). Leiden, the Netherlands: Rijks Herbarium.
- Brummelen JV (1986). Notes on cup-fungi-3 on three species of *Cheilymenia*. *Persoonia* 13: 89-96.
- Cannon PF, Kirk PM (2007). *Fungal Families of the World*. Wallingford, UK: CAB International.
- Doveri F (2014). An update of the genera *Ascobolus* and *Saccobolus* with keys and descriptions of three coprophilous species, new to Italy. *Mycosphere* 5: 86-135.
- Elliot TF, Türkoğlu A, Trappe JM, Yaratankul Güngör M. (2016). Turkish truffles 2: eight new records from Anatolia. *Mycotaxon* 131: 439-453.
- Güngör H, Solak MH, Allı H, Işıloğlu M, Kalmış E (2014). New macrofungi records to the Turkish mycobiota. *Biological Diversity and Conservation* 7: 126-129.
- Güngör H, Şen İ, Allı H, Solak MH (2015). Two new Ascomycete records for Turkish Mycota. *Biological Diversity and Conservation* 8: 19-21.
- Hansen K, Pfister DH (2006). Systematics of the Pezizomycetes--the operculate discomycetes. *Mycologia* 98: 1029-1040.
- Kaounas V, Agnello C, Alvarado P, Slavova M (2015). *Barssia hellenica* sp. nov. (Ascomycota, Pezizales), a new hypogeous species from Greece. *Ascomycete.org* 7: 213-219.
- Karacan İH, Uzun Y, Kaya A, Yakar S (2015). *Pulvinula* Boud., a new genus and three pulvinuloid macrofungi taxa new for Turkey. *Biological Diversity and Conservation* 8: 161-164.
- Kaya A (2015). Contributions to the macrofungal diversity of Atatürk Dam Lake basin. *Turk J Bot* 39: 162-172.
- Kaya A, Uzun Y (2015). Six new genus records for Turkish Pezizales from Gaziantep province. *Turk J Bot* 39: 506-511.
- Kaya A, Uzun Y, Karacan İH, Yakar S (2016). Contributions to Turkish Pyrenomataceae from Gaziantep province. *Turk J Bot* 40: 298-307.
- Keleş A, Demirel K, Uzun Y, Kaya A (2014). Macrofungi of Ayder (Rize/Turkey) high plateau. *Biological Diversity and Conservation* 7: 177-183.
- Kirk PM, Cannon PF, Minter DW, Stalpers JA (2008). *Dictionary of the Fungi*. 10th ed. Wallingford, UK: CAB International.
- Kozłowska M, Mułenko W, Heluta VP (2015). Fungi of the Roztocze Region (Poland and Ukraine) Part II. A Checklist of Microfungi and Larger Ascomycota. Lublin, Poland: Libropolis.
- Kristiansen R (2012). Unusual species of the genus *Ascobolus* (Pezizales) in Norway. *Agarica* 32: 37-48.

- Krug JC (1972). Some new records of Ascomycetes from Scotland. Transactions of the Botanical Society of Edinburgh 41: 197-199.
- Maia LC, Yano AM, Kimbrough JW (1996). Species of Ascomycota forming ectomycorrhiza. Mycotaxon 57: 371-390.
- Medardi G (2000). Studio su alcune specie non fimicole del genere *Ascobolus* Pers., trovate in Italia. Rivista di Micologia 4: 347-358 (in Italian).
- Medardi G (2006a). Ascomiceti d'Italia. Trento, Italy: A.M.B. Fondazione Centro Studio Micologici (in Italian).
- Medardi G (2006b). Non fimicolous arctic-alpine Ascomycetes collected in Austria 1. Österreichischen Zeitschrift für Pilzkunde 15: 21-29.
- Melo RFR, Miller AN, Santiago ALCMA, Maia LC (2014). The genera *Ascobolus* and *Saccobolus* (Ascobolaceae, Pezizales) in Brazil. Mycosphere 5: 780-804.
- Moravec J (1970). Operculate discomycetes of the family Ascobolaceae Sacc. from the Mladá Boleslav district in central Bohemia. Česká Mykologie 24: 134-145.
- Moravec J (1992). Taxonomic revision of the genus *Cheilymenia*-4, the section Paracheilymentiae. Mycotaxon 44: 59-72.
- Piasai O, Manoch L (2009). Coprophilous Ascomycetes from Phu Luang wildlife sanctuary and Khao Yai national park in Thailand. Kasetsart Journal, Natural Sciences 43: 34-40.
- Ribes MA (2011). *Leucoscypha semi-immersa*. Website <http://www.micobotanicajaen.com/Revista/Articulos/MARibesR/Tenerife004/Leucoscypha%20semiimmersa%20261209%2013.pdf> (accessed 01.08.2017).
- Richardson MJ (2004). Coprophilous fungi from Iceland. Acta Botanica Islandica 14: 77-104.
- Richardson MJ (2011). Additions to the coprophilous Mycota of Iceland. Acta Botanica Islandica 15: 23-49.
- Sesli E, Denchev CM (2014). Checklists of the Myxomycetes, Larger Ascomycetes, and Larger Basidiomycetes in Turkey. 6th ed. Mycotaxon Checklists Online. Website <http://www.mycotaxon.com/resources/checklists/sesli-v106-checklist.pdf>.
- Taşkın H, Doğan HH, Büyükalaca S, Clowez P, Moreau PA, O'Donnell K (2016). Four new morel (*Morchella*) species in the elata subclade (M. sect. Distantes) from Turkey. Mycotaxon 131: 467-482.
- Türkoğlu A, Castellano MA (2014). New records of some Ascomycete truffle fungi from Turkey. Turk J Bot 38: 406-416.
- Türkoğlu A, Castellano MA, Trappe JM, Güngör Yaratankul M (2015). Turkish truffles I: 18 new records for Turkey. Turk J Bot 39: 359-376.
- Uzun Y, Acar İ, Akçay ME, Akata I (2014). Additions to the Turkish Discomycetes. Turk J Bot 38: 617-622.
- Uzun Y, Acar İ, Akçay ME, Kaya A (2017a). Contributions to the macrofungi of Bingöl, Turkey. Turk J Bot 41: 516-534.
- Uzun Y, Karacan İH, Yakar S, Kaya A (2017b). *Octospora* Hedw., a new genus record for Turkish Pyronemataceae. Anatolian Journal of Botany 1: 18-20.
- Uzun Y, Kaya A, Karacan İH, Kaya ÖF, Yakar S (2015). Macromycetes determined in Islahiye (Gaziantep/Turkey) district. Biological Diversity and Conservation 8: 209-217.
- Waraitch KS (1976). A Contribution to the Knowledge of coprophilous Pezizales of India. Sydowia 29: 1-9.
- Yao YJ (1996). Notes on British species of *Lasiobolus*. Mycol Res 100: 737-739.