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New contributions to the Turkish Ascomycota

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Abstract: Nine discomycete and one sordariomycete (Ascomycota) species are reported for the first time from Turkey. The genera *Coccomyces*, *Kompsoscypha*, *Pseudopithyella*, *Strobiloscypha*, and *Lasiosphaeris* have not been reported before in the country. *Anthracobia*, *Plicaria*, *Sclerotinia*, and *Pithya* species are new records added to the previous knowledge. Macro- and micromorphological descriptions and illustrations for each new taxon are provided.

Key words: Ascomycota, biodiversity, new records, Turkey

1. Introduction

The knowledge of higher fungi in Turkey has been increasing over the years. More than 2500 species has been identified so far in the country, and most of them have been published as checklists (Sesli and Denchev, 2014; Solak et al., 2015). The number of taxa reached almost 210 ascomycetes. Since then, nearly 90 more species of Ascomycota were added to the former list (Akata et al., 2016a, 2016b; Akçay and Uzun, 2016; Doğan et al., 2016; Dülger and Akata, 2016; Elliot et al., 2016; Kaya, 2016; Kaya et al., 2016; Taşkın et al., 2016; Acar and Uzun, 2017; Uzun et al., 2017a, 2017b, 2017c). Presently, the number of ascomycetes has reached almost 300. In this manuscript we present ten new reports for nine genera and seven families of Ascomycota.

The aim of this work is to contribute to the knowledge of Ascomycota biodiversity in Turkey.

2. Materials and methods

The samples were collected in Gaziantep and Trabzon provinces between 2014 and 2016. During field trips, macrophotographs were taken in their natural habitats. We made notes of morphological and ecological characteristics of the fruit bodies before collection. The ascocarps were cut free-hand and studied with a compound Nikon Eclipse Ci-S trinocular light microscope. Microscopic features were mainly described in water, Melzer's reagent, Congo red, and lactophenol cotton blue. The samples were identified with the help of Seaver (1942), Denison (1972), Breitenbach and Kränzlin (1984), Pfister (1989), Jordan (1995), Ellis and Ellis (1997), Candoussau et al. (2001), Spooner (2001), Monti and Marchetti (2003), Medardi (2006), Peric et al. (2013), Thompson (2013), and Beug et al. (2014).

Specimens are deposited at Karamanoğlu Mehmetbey University, Kamil Özdağ Science Faculty, Department of Biology.

3. Results

The systematics of the species are given according to Index Fungorum (www.indexfungorum.org; accessed 30 November 2017) and Wijayawardene et al. (2018). The taxa are listed in alphabetical order together with their brief descriptions, habitats, localities, collection dates, and accession numbers.

Ascomycota Caval.-Sm.
Leotiomycetes O.E. Erikss. & Winka
Helotiales Nannf. ex Korf & Lizoň
Sclerotiniaceae Whetzel

3.1. ***Sclerotinia trifoliorum*** Erikss., K. Landtbraksakoemiens handlingar och tidskrift 19: 28 (1880) (Figure 1)

Macroscopic and microscopic features: The fructifications arise from buried, irregular black sclerotium (8–18 mm). Apothecia 6–9 mm in diam., disc concave, light ocher brown to reddish brown, smooth and lighter than the receptacle, margin somewhat darker. Stipe 20–30 × 1–1.5 mm, cylindrical, tapering towards the base, concolorous with the outer surface of the disc. Ectal excipulum composed of globose cells. Asci 120–140 × 8–11 µm, cylindrical-clavate, 8-spored, uniseriate and arising from croziers. Paraphyses slightly clavate, septate, branched. Ascospores 10–17 × 7–9.5 µm, dimorphic

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Figure 1. *Sclerotinia trifoliorum*: a- ascocarps, b- asci and paraphyses (Congo red), c- ascospores (water).

in size, generally four smaller (10–12 × 7–7.5 µm) and the other four larger (13–17 × 7.5–9.5 µm), elliptical to amygdaliform, smooth, hyaline, with some big drops or several smaller.

Notes: Parasitic on *Trifolium pratense*, *T. repens*, and some other members of Leguminosae (Beug et al, 2014).

Specimen examined: Turkey, Gaziantep, Nurdağı, İncirli village, mixed forest, on herbaceous plant remains among mosses, 37°14′N, 36°59′E, 600 m, 05.12.2014, K.10884; Tüllüce Village, 37°08′N, 36°51′E, 600 m, 06.11.2015, K.12672; Sakçagöze village, 37°10′N, 36°55′E, 850 m, 07.11.2015, K.12701; Şahinbey, Yeşilce village, 37°10′N, 37°12′E, 1045 m, 16.11.2014, K.10697.

Rhytismatales M.E. Barr ex Minter

Rhytismataceae Chevall.

3.2. *Coccomyces delta* (Kunze ex Fr.) Sacc., Bolm Soc. broteriana, Coimbra, sér. 1 11: 13 (1893) (Figure 2)

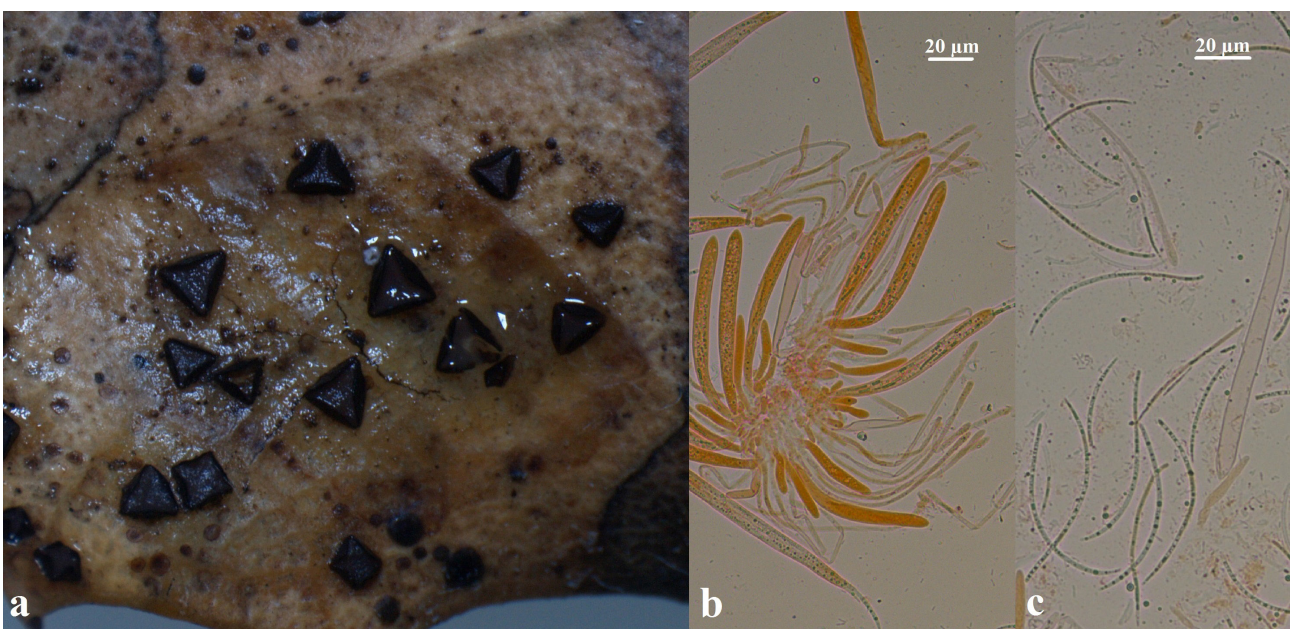

Figure 2. *Coccomyces delta*: a- ascocarps, b- asci and paraphyses (Congo red), c- ascospores (Congo red).

Macroscopic and microscopic features: Apothecia up to 1 mm in diam., embedded in leaf tissues and forming a black stromatic layer, usually triangular or pyramidal shape (sometimes 4-sided). Hymenial surface light colored, becomes visible after the black covering layer splits open by 3–4 teeth. Stromatized area of the leaf lighter than the surrounding tissue, creating patches like a mosaic, which are delimited by a black line. Asci 130–170 × 8–9.8 µm, cylindrical-claviform, acuminate, inoperculate, 8-spored, inamyloid, spores 2–3-seriate. Paraphyses slightly clavate, straight, unbranched, septate, more closely in the basal cells. Ascospores 80–85 × 1.9–2.4 µm, filiform, blunt edge in both extremes, smooth, hyaline and with numerous small guttules.

Notes: *Coccomyces delta* samples were found on leaves of *Quercus coccifera*; also reported by Honrubia et al. (1983).

Specimen examined: Turkey, Gaziantep, Araban, Emirhaydar village, oak forest, on decaying *Q. coccifera* leaves, 37°30′N, 37°42′E, 850 m, 30.11.2014, K.10778; Nurdağı, Olucak village, 37°10′N, 36°40′E, 950 m, 20.03.2015, K.11431; Ökkeşiye village, 37°04′N, 36°50′E, 1015 m, 12.04.2015, K.11746; Sakçagöze village, 37°09′N, 36°57′E, 920 m, 18.04.2015, K.11762.

3.3. *Coccomyces dentatus* (J.C. Schmidt) Sacc., Michelia 1 (no. 1): 59 (1877) (Figure 3)

Macroscopic and microscopic features: Apothecia approximately 1 mm in diam., immersed in the leaf tissues, stromatic layer gray-brown, disc with 4–5 sides, square or pentagon-shaped. Hymenial surface gray colored, visible after the rupture of the stromatic layer in 4–5 fissures. Stromatized area of the leaf lighter than the surrounding tissue, creating patches like a mosaic, which are delimited by a black line. Asci 75–110 × 6–9 µm, cylindrical-claviform, acuminate, 8-spored, inamyloid, spores 2–3-seriate with helicoid arrangement. Paraphyses slightly to medium lanceolate, straight or slightly curved, not branched, septate. Ascospores 50–66 × 1.5–2.3 µm, filiform or subulate, with obtuse or subacute extremes, smooth, hyaline and with numerous small guttules.

Notes: *Coccomyces dentatus* occurs on leaves of a wide range of plants such as *Castanea sativa*, *Quercus robur*, and *Quercus rubra* (Johnston, 1992; Beug et al., 2014).

Specimen examined: Turkey, Gaziantep, Araban, Emirhaydar village, oak forest, on decaying *Quercus coccifera* leaves, 37°30′N, 37°42′E, 850 m, 30.11.2014, K.10775.

Pezizomycetes O.E. Erikss. & Winka

Pezizales J. Schröt.

Pezizaceae Dumort.

3.4. *Plicaria carbonaria* Fuckel, Jb. nassau. Ver. Naturk. 23-24: 326 (1870) (Figure 4)

Macroscopic and microscopic features: Apothecia 12–25 mm in diam., sessile, cup-shaped at first, becomes flattened or shallowly cup-shaped at maturity, hymenial surface smooth to finely roughened, dark brown to blackish brown, margin entire when young, wavy when mature, both the margin and the outer surface concolorous, although sometimes dark grayish brown. Asci 200–250 × 12–18 µm, cylindrical, tips amyloid in Melzer's reagent, 8-spored. Paraphyses cylindrical, septate, swollen up to 8–10 µm at the apex. Ascospores 11–13 µm excluding warts, spherical, initially hyaline and smooth, coarsely warty when mature, sometimes with drops.

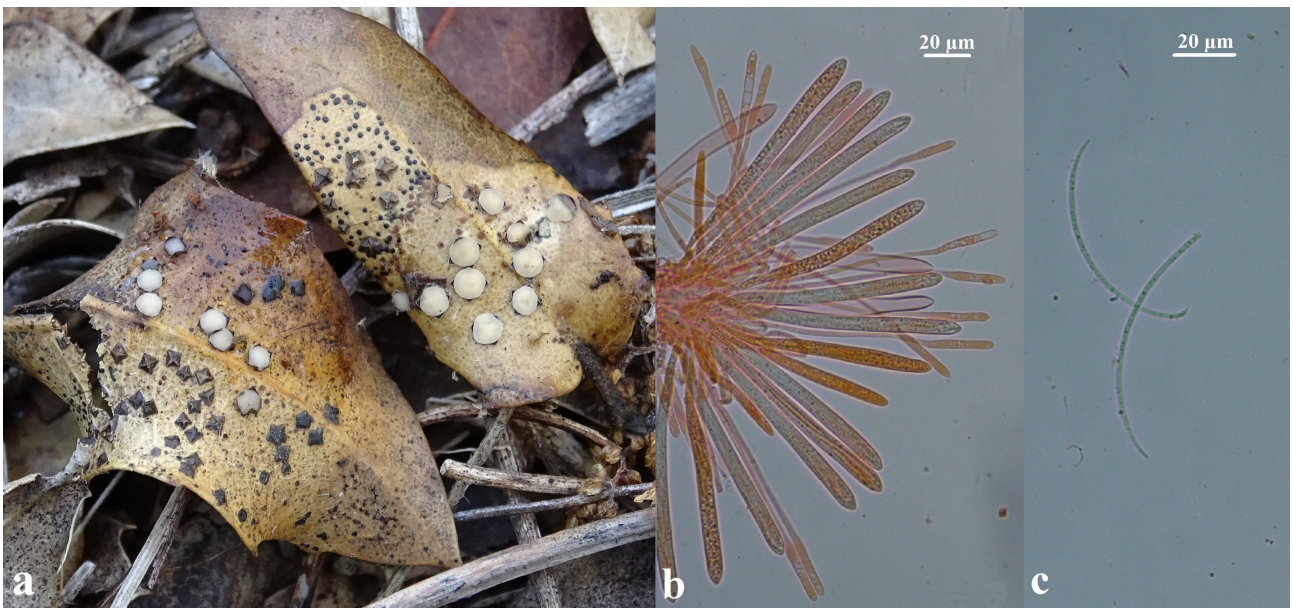

Figure 3. *Coccomyces dentatus*: a- ascocarps, b- asci and paraphyses (Congo red), c- ascospores (water).

Figure 4. *Plicaria carbonaria*: a- ascocarps, b- asci tips (Melzer), c- asci and paraphyses (Congo red), d- ascospores in asci (lactophenol cotton blue).

Notes: *Plicaria carbonaria* grows on burned ground (Breitenbach and Kränzlin, 1984; Medardi, 2006; Thompson, 2013).

Specimen examined: Turkey, Trabzon, Tonya, Kozluca village, on burned ground in hazelnut garden, 40°56′N, 39°13′E, 1000 m, 13.11.2016, K.13400.

Pyronemataceae Corda

3.5. *Anthracobia macrocystis* (Cooke) Boud., Hist. Class. Discom. Eur. (Paris): 65 (1907) (Figure 5)

Macroscopic and microscopic features: Apothecia 1–3(–4) mm in diam., sessile, hemispheric to cup-shaped when young, flat when mature, hymenium smooth to slightly wrinkled, bright orange to orange-yellow, receptacle concolorous or paler. Slightly hairy due to the protruding

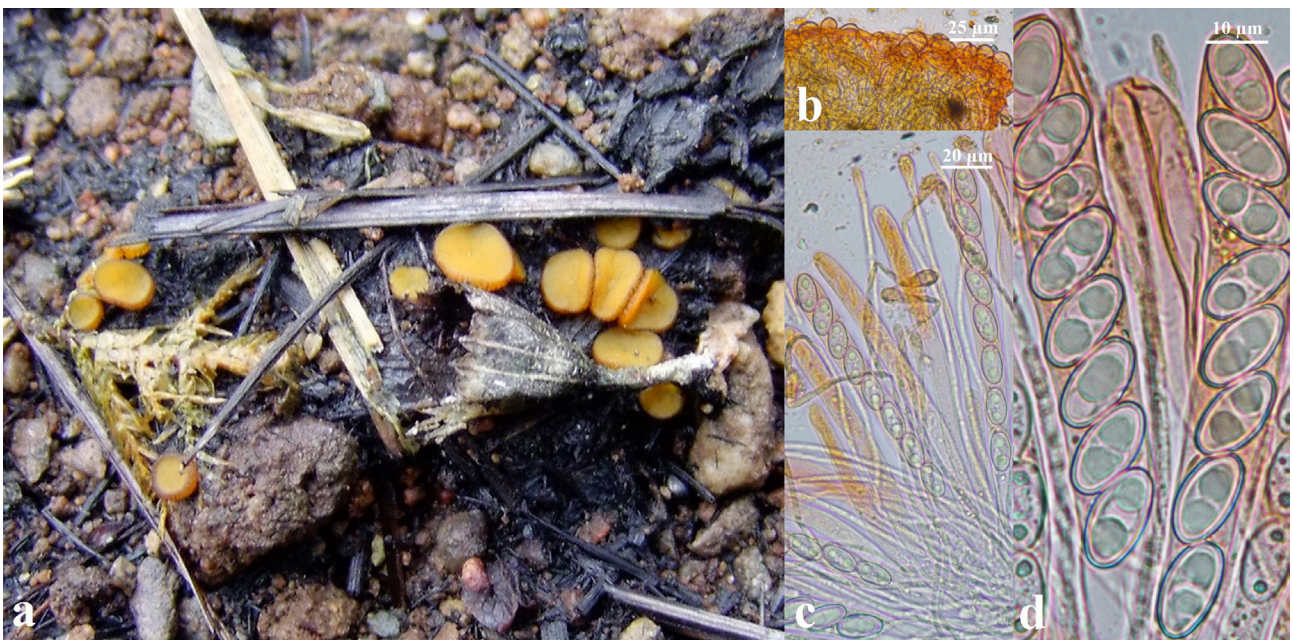

Figure 5. *Anthracobia macrocystis*: a- ascocarps, b- excipular cells (Congo red), c- asci and paraphyses (Congo red), d- ascospores (Congo red).

clavate-subglobose or globose brownish excipular cells. Asci 160–180 × 12–13 µm, cylindrical, tapering towards the base, inamyloid, 8-spored, uniseriate. Paraphyses cylindrical, septate, sometimes branched in lower cells, enlarged at the apex up to 7.5–8 µm. Ascospores 16–18.5 × 8–9 µm, ellipsoid, smooth, hyaline, and biguttulate.

Notes: *Anthracobia macrocystis* grows on burned ground and burned wood (Breitenbach and Kränzlin, 1984; Medardi, 2006; Beug et al, 2014).

Specimen examined: Turkey, Trabzon, Tonya, Hoşarlı village, on burned ground in hazelnut garden, 40°56′N, 39°19′E, 1100 m, 17.09.2015, K.12471.

Sarcoscyphaceae Le Gal ex Eckblad

3.6. *Kompsoscypha chudei* (Pat. ex Le Gal) Pfister, Mem. N. Y. Bot. Gdn 49: 341 (1989) (Figure 6)

Macroscopic and microscopic features: Apothecia 5–10 mm diam., cupulate or turbinate with a broad attachment, orange to orange-yellow. Asci 355–420 × 14–18 µm, cylindrical, attenuated at the base without croziers, 8-spored, inamyloid, spores uniseriate. Paraphyses cylindrical, uninflated, 1.5–2 µm broad, often anastomosing and sometimes branched in the lower cells. Ascospores 22–28 × 12–18 µm, ellipsoid, oligo- and multiguttulate.

Notes: *Kompsoscypha chudei* grows on leaves and small pieces of wood (Pfister, 1989).

Specimen examined: Turkey, Gaziantep, Yavuzeli, Halilbaşlı village, on decaying *Rubus* and *Populus* sp. leaves and twigs, 37°16′N, 37°31′E, 560 m, 02.11.2014, K.10496.

3.7. *Pithya cupressina* (Batsch) Fuckel, Jb. nassau. Ver. Naturk. 23–24: 317 (1870) (Figure 7)

Macroscopic and microscopic features: Apothecia 1–4 mm diam., at first nearly spherical, then becomes circular, elongated, flat or slightly concave at maturity, sessile or short-stipitate. Disc smooth, orange, receptacle concolorous and lighter. Asci 230–250 × 13–15 µm, cylindrical or subcylindrical, 8-spored, spores uniseriate. Paraphyses uninflated, cylindrical, branched in the lower or basal cells, slightly enlarged towards the apex. Ascospores 10–12 µm, globose, hyaline, smooth, multiguttulate.

Notes: Seaver (1942) reported the growth of *Pithya cupressina* on various species of *Juniperus*, *Cupressus*, *Thuja*, and *Sequoia*, while Kristiansen (2010) found it on dead twigs of Cupressaceae.

Specimen examined: Turkey, Gaziantep, Şehitkamil, city cemetery, on dead branches of *Cupressus sempervirens* L., 37°04′N, 37°23′E, 845 m, 27.02.2015, K.11333.

3.8. *Pseudopithyella minuscula* (Boud. & Torrend) Seaver, North American cup-fungi, (Operculates) (New York): 153 (1928) (Figure 8)

Macroscopic and microscopic features: Apothecia 1–3 mm in diameter, usually stipitate, almost globose when immature, becoming cupulate-discoid or turbinate narrow attachment when mature. Disc flat to concave, margin smooth, orange to bright red, becoming paler when dried. Stem whitish, slender and variable in length, up to 1.5 mm. Asci 350–500 × 12–16 µm, cylindrical, gradually tapering below, without croziers, apex furnished with a distinct collar somewhat below the rounded apex. Paraphyses slightly to medium clavate, septate, branched in the basal cells and with yellowish drops. Ascospores 15–17 × 10–12 µm, ellipsoid, smooth, oligoguttulate (two oil drops).

Figure 6. *Kompsoscypha chudei*: a- ascocarps, b- asci and paraphyses (water), c- ascospores (water).

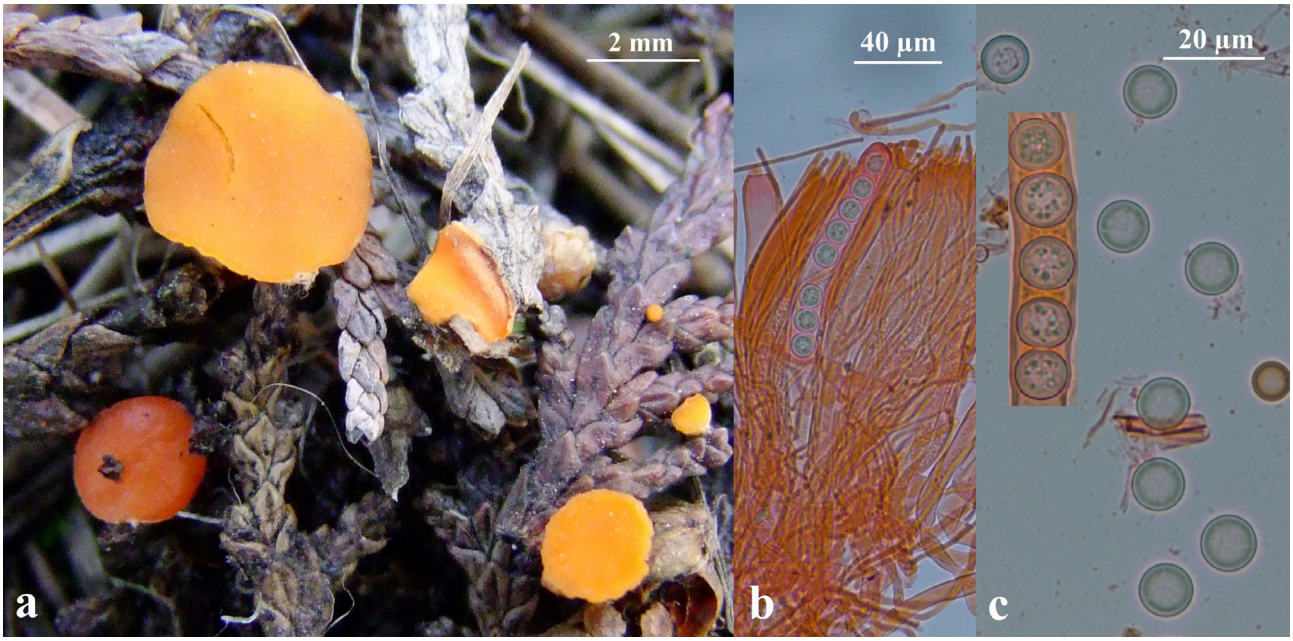

Figure 7. *Pithya cupressina*: a- ascocarps, b- asci and paraphyses (Congo red), c- ascospores and a fragment of ascus (Congo red).

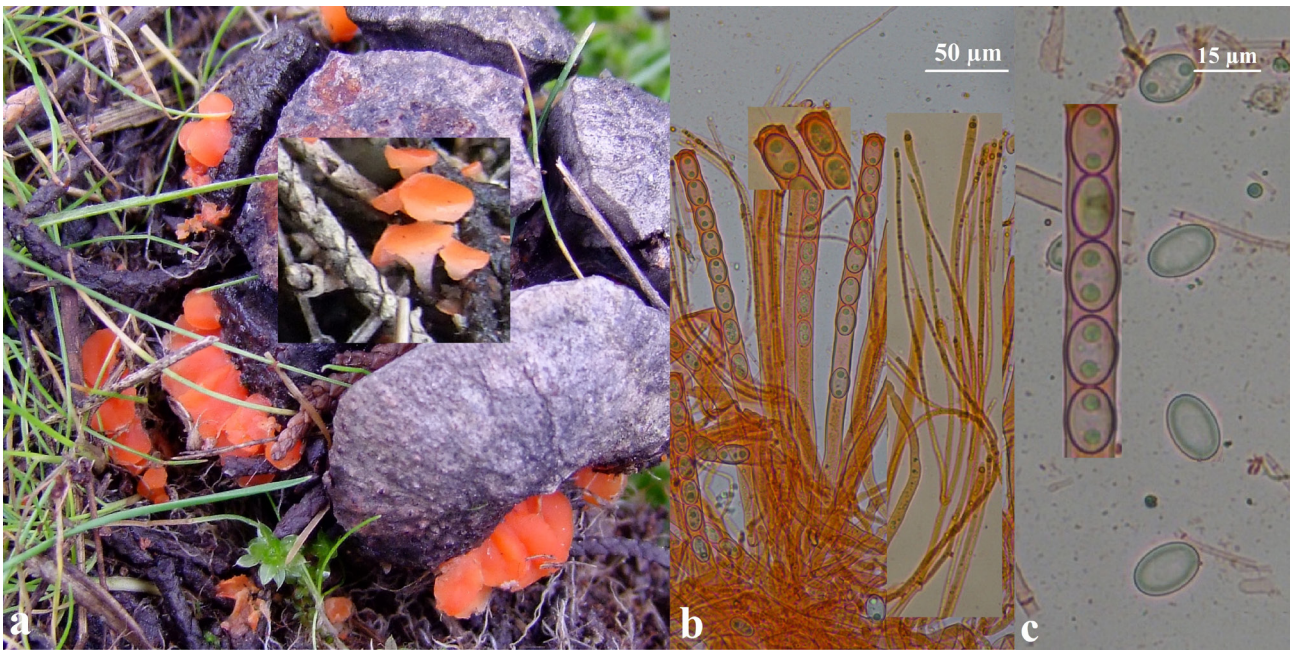

Figure 8. *Pseudopithyella minuscula*: a- ascocarps, b- asci and paraphyses (Congo red), c- ascospores and a fragment of ascus (Congo red).

Notes: *Pseudopithyella minuscula* has been reported on decaying foliage of cedar (Seaver, 1942) and dead twigs of Cupressaceae (Kristiansen, 2010).

Specimen examined: Turkey, Gaziantep, Şehitkamil, city cemetery, on dead branches of *Cupressus sempervirens*, 37°04′N, 37°23′E, 845 m, 04.01.2015, K.11148.

Sarcosomataceae Kobayasi

3.9. *Strobiloscypha cupressina* B. Perić & Pfister, Mycologia Montenegrina 16: 9 (2013) (Figure 9)

Macroscopic and microscopic features: Apothecia 1–5 mm in diam., sessile, cupulate-discoid with narrow attachment, hemispherical when young, then expands, forming a deepened disk. Disc smooth or finely granulated, shiny, gray whitish. Margin circular, raised, rarely slightly

Figure 9. *Strobiloscypha cupressina*: a- ascocarps, b- asci and paraphyses (Congo red), c- ascospores in the fragments of asci (Congo red).

undulating. Receptacle brownish, finely ornamented with brown granules. Asci 220–320 × 11–18 µm, cylindrical, operculate, 8-spored, hyaline, inamyloid, apex obtuse rounded, base narrowed and without croziers. Paraphyses slightly to medium clavate, straight, apex up to 5–7.5 µm, some bifurcate at the basal cells, septate, with small grayish drops. Ascospores 14.5–20 × 9–12 µm, ellipsoid or subfusiform, with rounded to subacute extremes, hyaline, thin-walled, containing 1–3 oligoguttules.

Notes: *Strobiloscypha cupressina* grows on the cones and tips of rotting 1-year-old branches of *Cupressus sempervirens* (Perić et al., 2013).

Specimen examined: Turkey, Gaziantep, Şehitkamil, city cemetery, on dead *Cupressus* sp. cones, 37°04′N, 37°23′E, 860 m, 27.02.2015, K.11320; 27.03.2015, K.11518.

Sordariomycetes O.E. Erikss. & Winka

Sordariales Chadef. ex D. Hawksw. & O.E. Erikss.

Lasiosphaeriaceae Nannf.

3.10. *Lasiosphaeris hirsuta* (Fr.) A.N. Mill. & Huhndorf, Mycol. Res. 108(1): 31 (2004) (Figure 10)

Macroscopic and microscopic features: Perithecia 0.4–0.8 mm in diam., globose-pyriform, dark brown to black, completely covered with dark brown to black hairs. Ostiole at the apex, hard, carbonous, and brittle. Asci 210–250 × 8.5–12 µm, cylindrical-fusoid, 8-spored, irregularly biseriate, nonamyloid. Paraphyses cylindrical, septate. Ascospores 50–75 × 5.5–7 µm, cylindrical, hyaline to yellowish-brown at maturity, curvate, sigmoid or geniculate (at least with one curved end), aseptate to 7 septate when mature. Hairs 120–190 × 3.5–4.5 µm, cylindrical, straight, septate, thick-walled, dark brown, lighter at the apical cells.

Notes: *Lasiosphaeris hirsuta* grows on dead bark, leaves, and rotten wood (Minter and Cannon, 2016).

Specimen examined: Turkey, Gaziantep, Karkamış, Yurtbağı village, river side, on *Populus* sp. twigs, 36°50′N, 38°00′E, 330 m, 25.10.2014, K.10214.

4. Discussion

Ten ascomycetous macrofungi species belonging to three classes, four orders, seven families, and nine genera are new records for the mycobiota of Turkey. The genera *Coccomyces*, *Kompsoscypha*, *Lasiosphaeris*, *Pseudopithyella*, and *Strobiloscypha* are recorded for the first time in the country. Nine taxa are discomycetes (Ekanayaka et al., 2017), while one belongs to Sordariomycetes (Maharachchikumbura et al., 2016). Generally, the morphological features and the habitats of the taxa agreed with those given in the literature.

The discomycete genus *Sclerotinia* are saprobes or pathogens found worldwide with an estimated 15 species (Wijayawardene et al., 2017). *Sclerotinia trifoliorum* recorded here is also pathogenic on plants (Boland and Hall, 1994; Clarkson et al., 2003). Among these pathogens, *S. trifoliorum* can morphologically be confused especially with *S. sclerotiorum* and *S. minor*. However, the host range and dimorphic ascospores of *S. trifolium* differentiate it from *S. sclerotiorum* (Kohn, 1979). The size of sclerotia, on the other hand, is an easy way to separate *S. trifoliorum* from *S. minor*, which has rather small sclerotia compared to the former species (Ekins et al., 2005).

Coccomyces delta and *C. dentatus* are related according to their morphology and substrate. The triangular apothecia and longer spores differentiate *C. delta* from

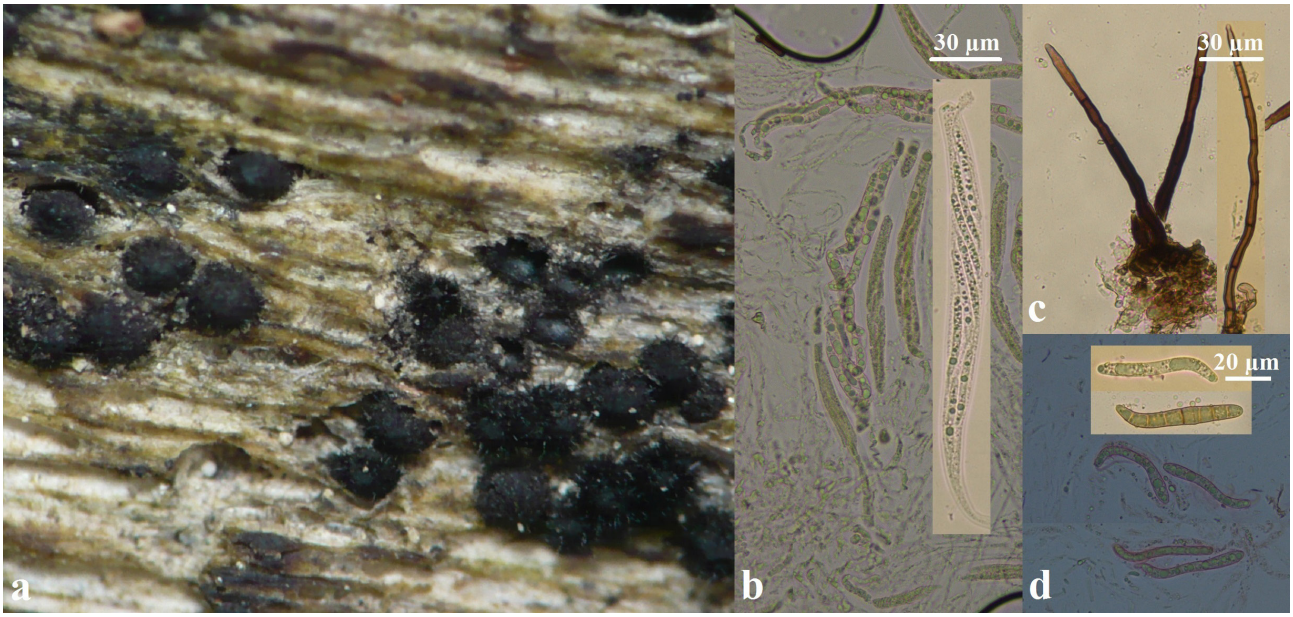

Figure 10. *Lasiosphaeris hirsuta*: a- ascocarps, b- asci and paraphyses (Melzer), c- hairs (Congo red), d- ascospores (Congo red).

C. dentatus, which has 4–5-sided apothecia and shorter spores (Medardi, 2006).

The habitat and morphology of *Plicaria carbonaria* are similar to *P. trachycarpa*. However, the coarse warts on the spores of *P. carbonaria* differentiate it from the latter species (Waraitch, 1977).

Like members of *Anthracobia*, some species of *Pyronema* also grow on burned ground, but they have neither hyphae nor tufts of hair on the outer surface (Breitenbach and Kränzlin, 1984). *A. macrocystis* is morphologically very similar to *A. maurilabra* and *A. melaloma*. However, it differs due to its one- or two-celled hyphal outgrowths (hairs) with respect to the latter two species whose hyphal outgrowths have more than two cells (Breitenbach and Kränzlin, 1984).

The family Sarcoscyphaceae comprises 13 genera (Wijayawardene et al., 2018) and we have found three genera in Turkey. The genus *Kompsoscypha* is saprobic worldwide, with four species (Wijayawardene et al., 2017). *Kompsoscypha chudei* was collected on dead twigs and leaves of *Rubus* and *Populus* sp. *Pithya* and *Pseudopithyella* are saprobes with five and two species, respectively (Wijayawardene et al., 2017). *Pithya cupressina* and *Pseudopithyella minuscula* occurred on dead cones and twigs of *Cupressus sempervirens*. Microscopically, *Pithya cupressina* is similar to some inoperculate species of the genera *Hymenoscyphus* Gray and *Bisporella* Sacc. The spherical or subspherical ascospores and the operculate asci of *Pithya cupressina*, however, differentiate it from these taxa, which have ellipsoid, ellipsoid-fusiform, fusiform, or cylindrical spores and inoperculate asci (Seaver, 1942; Breitenbach and Kränzlin, 1984; Beug et al., 2014). Although *Pseudopithyella minuscula* and *Pithya cupressina* are very similar in their macroscopy and habitat, the typical collar at the apex of asci of *P. minuscula* is a very distinguishing feature between the two taxa, although spore shape is also different (Kristiansen, 2010).

Strobiloscypha cupressina was also collected on cones of *Cupressus sempervirens*. This species shares some morphological characters with *Strobiloscypha keliae* N.S. Weber & Denison. Even though the ascospores of both species are ellipsoid, spores of *S. keliae* are larger, finely ornamented, and without guttules (Peric et al., 2013).

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