

**First record of *Scutellinia legaliae*
(Ascomycota, *Pyronemataceae*) from relict endemic
Liquidambar orientalis forest in Turkey**

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In the current study, *Scutellinia legaliae* is reported for the first time from Turkey. In addition, this is the first report of this taxon growing in a forest under the relict endemic *Liquidambar orientalis*. Description of the taxon is given together with macrophotographs and line drawings of microscopic structures. In addition, a key of the currently known species of the genus *Scutellinia* in Turkey is presented.

Key words: *Pezizales*, *Scutellinia*, fungal biodiversity, taxonomy.

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Studie přináší první zprávu o výskytu *Scutellinia legaliae* v Turecku; mimoto jde o první záznam o růstu této kosmatky pod reliktním endemitem *Liquidambar orientalis* (ambroň východní). Je zde uveden popis uvedeného taxonu s makrofotografiemi a kresbami mikroskopických struktur, doplněný o klíč k určení druhů rodu *Scutellinia*, v současné době známých z území Turecka.

INTRODUCTION

The genus *Scutellinia* (Cooke) Lambotte, a member of cup fungi in the family *Pyronemataceae* (*Pezizales*, Ascomycota), is generally known as Eyelash Cup (Das 2010, Giordano et al. 2013). It now includes approximately 50 taxa throughout the world (Kirk et al. 2008, Han et al. 2010, Choi et al. 2013). However only four *Scutellinia* species have been reported up to now from Turkey (Sesli &

Denchev 2008, Kaya 2009, Akata et al. 2011, Alli et al. 2011, Solak et al. 2015, Kaya et al. 2016).

Scutellinia species are sessile, disc-shaped or low cup-shaped, measuring 0.5–25 mm in diameter, with vivid reddish, orange or yellowish colours. Their asci are operculate, cylindrical and generally 8-spored. Their ascospores are globose, subglobose, ellipsoid or fusoid (inequilateral in one species), hyaline, with many oil drops, guttulate, with one to many internal guttules of variable size, and ornamented. The paraphyses are filiform but widened towards the apex. There are two different types of hairs: marginal and lateral. The saprotrophic species grow on soil, dung or decayed wood (Denison 1959, Kullman 1982, Schumacher 1990, Yao & Spooner 1996, Wang 1998, Hansen & Knudsen 2000, Choi et al. 2013).

As a result of both morphological, microscopic and molecular studies carried out by scientists, the genus *Scutellinia* is internally subdivided into two subgenera, seven sections and four series. These are subgen. *Scutellinia* (sect. *Scutellinia*, sect. *Reticulatae*, sect. *Geneospermae*, sect. *Globisporae*, sect. *Rotundispermae*) and subgen. *Legalia* (sect. *Legalia*: ser. *Legalia* and ser. *Sublaevispora*; sect. *Minutae*: ser. *Minutae* and ser. *Pseudotrechisporae*) (Schumacher 1990, Sierra et al. 2016). *Scutellinia legaliae* reported in this study is included in ser. *Legalia*, which is in sect. *Legalia* of subgen. *Legalia*.

Many studies have been performed by Turkish mycologists on macrofungal biodiversity (Sesli & Denchev 2008, Solak et al. 2015, Güngör et al. 2015, Kaya et al. 2016, Kaygusuz et al. 2016, Şen et al. 2016, Kaygusuz & Çolak 2017, Çolak et al. 2017), and approximately 2600 taxa have been reported from Turkey. Several species of the genus *Scutellinia* have been previously recorded in this country, but *S. legaliae* was recorded here for the first time. This study is a contribution to the knowledge of the biodiversity of Turkey by reporting a novel record for the mycobiota of the country.

MATERIAL AND METHODS

Specimens of *Scutellinia* were collected in Burdur Province in spring 2017. The morphological and ecological characteristics of the samples were noted and ascomata photographed in natural habitats. After field studies, the specimens were taken to the laboratory. Microcharacters were observed under oil immersion at a magnification of 400× and 1000× with a light microscope (Leica DM500, Leica Microsystems, Wetzlar, Germany). For microscopic analyses, dried material was rehydrated in distilled water and 5% KOH, and subsequently stained in Congo Red. At least 30 asci, ascospores, paraphyses and hairs from each ascoma were measured, and length and width ranges were recorded.

Identification of the specimens was based on Kullman (1982), Breitenbach & Kränzlin (1984), Schumacher (1990), Yao & Spooner (1996), Hansen & Knudsen (2000), Medardi (2006) and Thompson (2013). The collections were deposited at the fungarium of Süleyman Demirel University (GUL). Taxa, family and author citations are quoted according to Kirk et al. (2008), Index Fungorum (www.indexfungorum.org) and MycoBank (www.mycobank.org).

RESULTS

Scutellinia legaliae Lohmeyer & Häffner, Westfälische Pilzbriefe 10–11: 204, 1983
Figs. 1–2

Description. Ascomata 0.3–0.7 cm in diam., sessile, disc-shaped, hymenium orangish red, outer surface appearing brownish due to lateral hairs, margin curved inward, with yellowish brown hairs.

Asci 260–300 × 20–25 µm, cylindrical, operculate, inamyloid, with eight uniseriate spores. Ascospores 16–19 × 16–17 µm, globose to subglobose, multi-guttulate, hyaline, ornamented with conical spines up to 2–3 µm in height. Paraphyses 4–5-septate, with slightly swollen tips, cylindrical, 3–4 µm wide in the lower part, clavate and 9–12 µm wide in the upper part, containing an orange pigment. Marginal and lateral hairs not differentiated, 250–750 × 15–25 µm, light to dark brown, 3- to 6-septate, with a simple, bi- or trifurcate rooting base, wall 4–6 µm thick.

Specimen examined

Turkey. Burdur Province, Bucak District, village of Kargı, Sweetgum forest conservation area, 210 m above sea level, on humus-rich soil in a wet place among small mosses, *Liquidambar orientalis* forest, 11 May 2017, leg. & det. Ö.F. Çolak (ÖFÇ 1295 in GUL).

DISCUSSION

Scutellinia is a highly cosmopolitan genus, occurring on every continent and from the tropics to the arctic, wherever there is sufficient local moisture (Denison 1959). Although *S. legaliae* was so far reported from Germany, Switzerland, France (Lohmeyer & Häffner 1983, Schumacher 1990, Van Vooren 2014), England (Yao & Spooner 1996, Thompson 2013), Slovakia (Jančovičová & Glejdura 1999), Spain (Alonso et al. 2001) and Italy (Medardi 2006), its global distribution is insufficiently known. Despite the fact that it was described as a member of a warm temperate species group (Schumacher 1990), it was also located at a high elevation (780 m a.s.l. in Poľana Mts.; Jančovičová & Glejdura 1999). However, our specimen was found at 210 m above sea level in a warm climate zone.



Fig. 1. *Scutellinia legaliae*, fresh ascomata, on natural substrate (ÖFÇ 1295). Photo by Ö.F. Çolak.

Besides, *Scutellinia* species grow on damp soil with mosses in groups or sometimes singly (Yao & Spooner 1996, Jančovičová & Glejdura 1999, Alonso et al. 2001, Medardi 2006, Thompson 2013). Some *Scutellinia* species grow on deciduous and coniferous wood or on a variety of dead organic substrates and materials

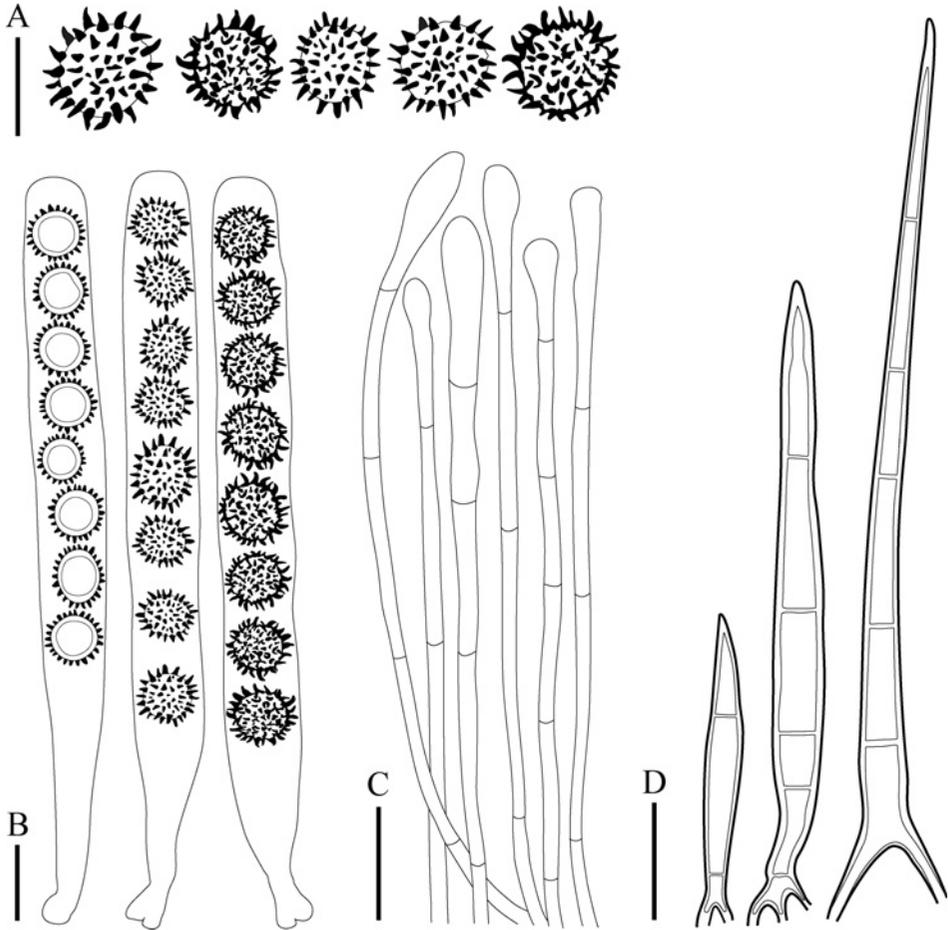


Fig. 2. *Scutellinia legaliae*, microscopic characters (ÖFÇ 1295). **A** – ascospores; **B** – asci; **C** – paraphyses; **D** – hairs. Scale bars = 20 μm (A), 30 μm (B, C), 100 μm (D). Line drawings by O. Kaygusuz.

(Schumacher 1990). *Scutellinia legaliae* is recognised as a humus saprotrophic species (Schumacher 1990). Our collection of *S. legaliae* was found on humus-rich soil in a wet place among small mosses in a *Liquidambar orientalis* forest. The local distribution of the relict endemic *L. orientalis* is limited to the southwestern coastal area of Turkey (Köyceğiz, Fethiye, Marmaris and Milas) (Kaygusuz et al. 2016), but it also occurs on the island of Rhodes, Greece (Strid 2016a, 2016b). However, *Scutellinia* species reported from Turkey were found to grow on nutrient-rich soil and among mosses on the ground of broadleaved and coniferous forests (Sesli & Denchev 2008, Solak et al. 2015). Therefore, the substrate may prove to be important in understanding the diversity of *Scutellinia*.

The main features important in identifying *Scutellinia* species at the infra-generic and species level are the shape, size and ornamentation of the ascospores and the size and form of the marginal hairs (Greaves 2014). In previous studies, detailed information on morphological characters, such as size of asci, ascospores, warts, paraphyses and hairs of *S. legaliae* has been provided (Schumacher 1990, Yao & Spooner 1996, Jančovičová & Glejdura 1999, Alonso et al. 2001, Medardi 2006, Thompson 2013, Van Vooren 2014). A comparative analysis of the Turkish specimen of *S. legaliae* and data given by other authors are presented in Tab. 1. According to this table, the sizes of asci, ascospores, warts, paraphyses and hairs of our specimen are in agreement with the previous findings.

Tab. 1. Comparison of microscopic morphology of *Scutellinia legaliae*.

Size of asci (μm)	Length of ascospores (μm)	Height of warts (μm)	Width of paraphyses at the top (μm)	Size (length) of marginal hairs (μm)	References
245–290 \times 17–21.5	15.6–18.4	3–5	6–10	100–800 \times 16–35	Schumacher (1990)
220–305 \times 18–25(29)	15.5–17.5(18)	1.5–2(2.5)	6–9	140–270 \times 15–20	Yao & Spooner (1996)
220–280 \times 16–20	16.8–18	2.0–2.5(4.8)	6–9	100–480 \times 15–28	Jančovičová & Glejdura (1999)
282–392.4 \times 17.6–30.4	16.8–19.2	1.6–3.5	8.8–12.8	140–712 \times 22–40	Alonso et al. (2001)
300 \times 20–25	17–18	3–5	10	500–800	Medardi (2006)
–	16.25–18.25	2.5	–	450–800	Thompson (2013)
250–300 \times 22–30	16–18(20)	2–3	8–10	240–1200 \times 20–37	Van Vooren (2014)
260–300 \times 20–25	16–19	2–3	9–12	250–750 \times 15–25	This study

Scutellinia legaliae may commonly be confused with *S. trechispora* (Berk. & Broome) Lambotte (syn. *S. armatospora* after Schumacher 1990). However, *S. legaliae* has globose or subglobose ascospores, the sculpturing of which consists of acuminate spines, while *S. trechispora* has only globose ascospores consisting of bluntly conical spines (Schumacher 1990). In addition, *S. legaliae* has short marginal hairs, varying between 100 and 1200 μm in length, whereas the marginal hairs of *S. trechispora* are longer (500–2060 μm in length) (Schumacher 1990, Van Vooren 2014).

To avoid misidentification of the *Scutellinia* species it is useful to have some knowledge of other species such as *S. barlae* (Boud.) Maire, *S. citrina* (Masse & Crossl.) Y.J. Yao & Spooner and *S. hyperborea* T. Schumach. The ascospores of the above-mentioned species are larger (*S. barlae* 17.5–24.5 μm , *S. citrina* 23–33 μm and *S. hyperborea* 19–23 μm) than those of *S. legaliae* (16–19 μm) (Schumacher 1990, Yao & Spooner 1996). However, the wall ornamentation of these species is totally different, so *S. legaliae* cannot be confused with these three species.

Scutellinia legaliae and *S. heimii* Le Gal can be misidentified due to the similarity of the type of spore sculpturing. However, ascospores of *S. legaliae* are globose or subglobose and short, while ascospores of *S. heimii* are ellipsoid and longer, 18.2–24.8 × 12.8–16.7 µm (Schumacher 1990).

CONCLUSIONS

Consulting the current mycobiota checklists (Sesli & Denchev 2008, Solak et al. 2015) and the recent contributions regarding ascomycetes in Turkey (Güngör et al. 2015, Kaya et al. 2016, Şen et al. 2016), we have concluded that *Scutellinia legaliae* is a new record for the mycota of Turkey. With the present study, the number of species reported in this genus rises to five. *Liquidambar orientalis* forest has been found to be a new habitat for the *Scutellinia* species discovered here.

In addition, a key of the currently known species of the genus *Scutellinia* in Turkey is presented, based on comparison of data obtained in this study with descriptions by Sesli & Denchev (2008), Kaya (2009), Akata et al. (2011), Allı et al. (2011), Solak et al. (2015) and Kaya et al. (2016).

Key to Turkish species of *Scutellinia*

- | | | |
|----|--|---|
| 1 | Ascospores globose to subglobose | 2 |
| 1' | Ascospores broadly ellipsoid to ellipsoid | 4 |
| 2 | Ascospore ornamentation comprising mainly truncate to rounded warts, mostly lower than 2 µm; ascospores longer than 19 µm | <i>S. bartae</i> |
| 2' | Ascospore ornamentation comprising almost cylindrical or conical warts, mostly higher than 2 µm; ascospores shorter than 19 µm | 3 |
| 3 | Warts on ascospores mostly truncated at apex, ascospores 14–17 µm long, marginal hairs commonly with many septa | <i>S. trechispora</i> (syn. <i>S. armatospora</i>) |
| 3' | Warts on ascospores conical, pointed at apex, ascospores 16–19 µm long, marginal hairs with 3–6 septa | <i>S. legaliae</i> |
| 4 | Apothecia 3–15 mm diam., ascospores 17.5–22(23) µm long (up to 13 µm wide), marginal hairs generally longer than 1000 µm | <i>S. scutellata</i> |
| 4' | Apothecia 3–8 mm diam., ascospores 16.8–25.2 µm long (up to 17 µm wide), marginal hairs often shorter than 1000 µm | <i>S. umbrorum</i> |

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