



Two *Lactarius* species mycorrhizal with *Cistus laurifolius* in Turkey

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Abstract

In this study, two *Lactarius* species are reported which form mycorrhizal associations with *Cistus laurifolius*. Of these, *Lactarius tesquorum* is a rare species in the mycota of Turkey, and *L. cistophilus* is a new record. Microscopic drawings and detailed descriptions of the taxa are given together with morphological photographs.

Key words – biodiversity – ectomycorrhiza – milk caps – Russulaceae – Turkish mycobiota.

Introduction

Biodiversity as a concept is a product of the last 30 years, and its introduction, use and spread has been effected mostly by amateur nature-lovers and civil society organizations. However, one of the most important groups to carry out work in this field have been taxonomists (Lévêque & Mounolou 2008, Başbüyük et al. 2013).

Along with studies on other life forms in this country, many studies have been performed by Turkish mycologists on macrofungal biodiversity, and approximately 2400 taxa have been reported (Sesli & Denchev 2008, Solak et al. 2015). Among this number are more than 50 species representing the *Lactarius* Pers. genus, which are easily distinguishable from other genera by the milk-like liquid which they produce when cut or damaged (Işıloğlu et al. 2004, Kibby 2014). They also known in English as milk caps (Buyck et al. 2010).

Members of this genus form mycorrhizal associations with many species of trees and shrubs, among them *Cistus* L. species (Comandini et al. 2006, Kibby 2014, Leonardi et al. 2016).

Cistus species grow mainly in the Mediterranean region (Başlar et al. 2002, Guzmán & Vargas 2005, Comandini et al. 2006, Yücel 2012, Hernández-Rodríguez et al. 2013). Five species from this genus are found in Turkey. These are *C. creticus* L., *C. laurifolius* L., *C. monspeliensis* L., *C. parviflorus* Lam. and *C. salviifolius* L. (Güvenç et al. 2005).

The purpose of this study was to contribute to the biodiversity of this country by reporting two interesting species of the genus *Lactarius*, one of which is rare and the other is a new record for the mycobiota of Turkey, growing in mycorrhizal association with *Cistus laurifolius*.

Materials & Methods

The specimens were collected from Simav (Kütahya) in 2014. Morphological and ecological characteristics of the samples were noted and photographed in their natural habitats. After field

studies, specimens were taken to the laboratory. Micromorphological characters were observed by light microscopy using Melzer's reagent, congo red and distilled water. The identification of the taxa was carried out using the literature (Malençon 1979, Basso 1999, Dähncke 2006, Roux 2006). The collections were deposited at the personal fungarium in Süleyman Demirel University.

Results

Lactarius cistophilus and *L. tesquorum* were identified following laboratory studies. Examination of the checklists and current literature shows that *L. cistophilus* is new record and *L. tesquorum* is a rare record for Turkish mycobiota (Sesli & Denchev 2008, Karasüleymanoğlu et al. 2014, Solak et al. 2015, Çınar Yılmaz & Işıloğlu 2016). The systematic status of the taxon is given by Mycobank (URL 1).

Fungi Bartling

Basidiomycota Whittaker ex Moore

Agaricomycotina Doweld

Agaricomycetes Doweld

Russulales Kreisel ex P.M. Kirk, P.F. Cannon & J.C. David

Russulaceae Lotsy

Lactarius Pers.

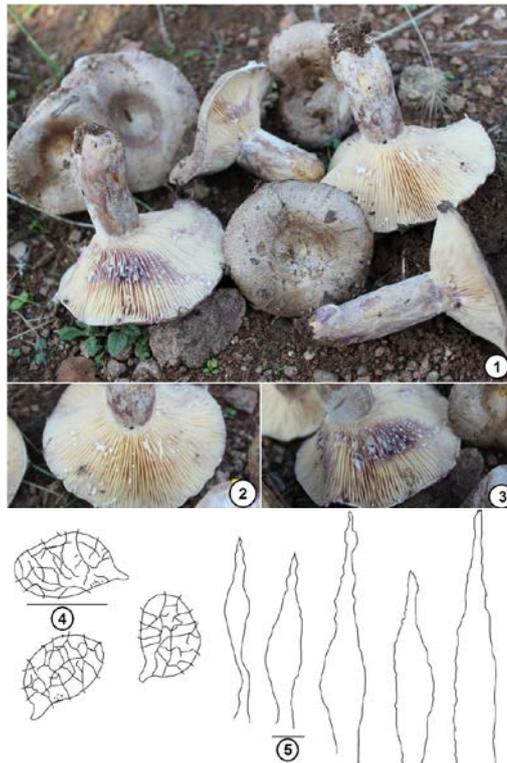
Lactarius cistophilus Bon & Trimbach, *Documents Mycologiques* 8 (29): 36 (1978). Figs 1–3

Cap 30–70 mm, at first convex, later edges bent outwards and partly funnel-shaped, central surface zoned and edges hairy, colour dirty brown, greyish-violet or purple, and ochre especially at the centre. Gills very crowded and curved in shape, subdecurrent or slightly emarginate, colour various shades of creamy ochre, but when damaged take a characteristic violet colour. Latex plentiful and white in colour, may fade with time but in contact with the lamellae or fleshy parts, this part turns purple-violet. Stem 20–50 × 7–15 mm, spongy or hollow, surface dusty white, like hairy, with contact violet colored, then yellowish- ochre spotted colour. Flesh whitish in colour, but when exposed to air may take on a slight faded violet colour. Odour pleasant, slightly resinous. Taste after some time may be slightly bitter. Spore print whitish-cream. Basidiospores 10–14 × 7–9 µm, elliptical, 0.5 µm warts and surface reticulate (Fig. 4). Basidia 35–65 × 10–12 µm, clavate, with 4 spores. Cystidia 40–80 × 6–10 µm, subfusiform, with articulations on the upper parts (Fig. 5). Pileipellis ixocutis-ixotricoderm, intertwined and composed of filamentous hyphae, hyphae 3–5 µm broad, obtuse, gelatinized. Habitat: characteristically mycorrhizal with *Cistus* spp. (Basso 1999).

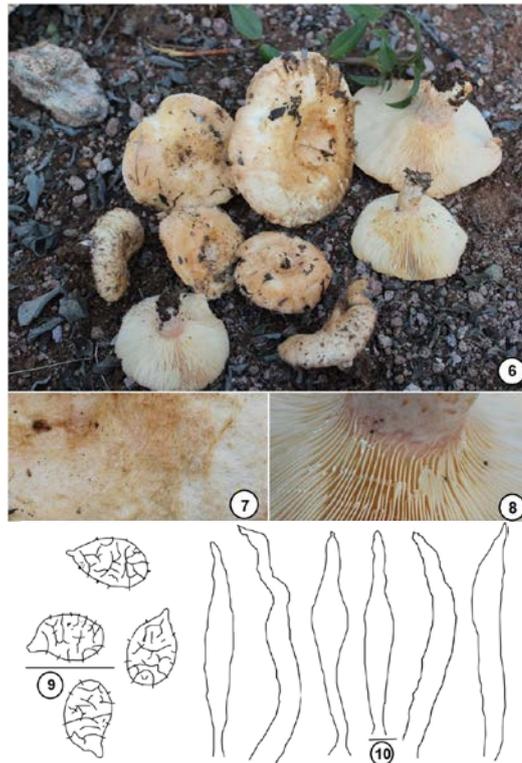
Lactarius tesquorum Malençon, *Beihefte zur Sydowia* 8: 263 (1979). Figs 6–8

Cap 30–80 mm, when young funnel-shaped with edges bent outwards, later slightly flattening, surface characteristically extremely hairy–felty, light mustard yellowish pink in colour, may be partly ochre-brownish. Gills very crowded, decurrent, partly branched, some lamellae do not reach the stem, from cream to light salmon pink in colour, take on a light yellowish colour when touched. Latex unchanging milk–white in colour. Stem 10–20 × 8–13 mm, hollow, surface dusty white, hairless, a ring-shaped pinkish–colour is observed, at the place where the gills join with the stem. Flesh cream to salmon pink in colour. Odour sour fruity, slightly pelargonium. Taste very strong acrid. Spore print creamy, partly light ochre. Basidiospores 6.5–9 × 5–6.5 µm, ellipsoid, warts 0.5 µm in height and incompletely reticulate (Fig. 9). Basidia 35–50 × 7–10 µm, clavate, 4-spored. Cystidia 50–70 × 8–10 µm, fusiform, acute, often appendiculate (Fig. 10). Pileipellis ixocutis-ixotricoderm, hyphae 3–5 µm broad, gelatinized. Habitat: a rare species, characteristically mycorrhizal with *Cistus* spp. (Malençon 1979, Dähncke 2006, Roux 2006).

Specimens examined: TURKEY, Kütahya province, Simav district, Kiçir village-Simav road 6th km, with *Cistus laurifolius* (Fig. 11), 17 Nov. 2014 (ÖFÇ 1147: *L. tesquorum*, ÖFÇ 1151: *L. cistophilus*).



Figs 1–5 – *Lactarius cistophilus*. 1. basidiomata 2. moment of injury 3. after a few minutes 4. basidiospores 5. hymenial cystidia. Bars = 10 μ m.



Figs 6–10 – *Lactarius tesquorum* 6. basidiomata 7. felt-like cap surface 8. moment of injury 9. basidiospores 10. hymenial cystidia. Bars = 10 μ m.



Fig. 11 – Habitat of *Cistus laurifolius* in Turkish.

Discussion

Examining the list of macrofungi in Turkey, it is seen that 56 species of the *Lactarius* genus have been reported not including the present study (Sesli & Denchev 2008, Solak et al. 2015). With the present study, the number of species reported in this genus rises to 57.

Cistus species are particularly common in the west of the country that is within the boundaries of the Mediterranean phytogeographic area (Tilki 2008).

They are generally found in pine forests as ground cover under pine trees. As can be seen in (Fig. 11), the habitat where we collected our specimens consisted entirely of individuals of the species *Cistus laurifolius*. This area is located at the intersection of the Mediterranean and the Irano-Turanian phytogeographic regions (Sesli & Denchev 2008). In addition, as seen in Figs 1 and 6, very many fungarium samples of both species were collected from this area, and however rare the species may be in their distribution in the region, they seemed to be in no danger.

As a result of both morphological-microscopic and molecular studies carried out by scientists, the *Lactarius* genus is internally divided into three separate subgenera (Kibby 2014, Leonardi et al. 2016). These are *Piperites* (Fr. ex J. Kickx f.) Kauffman, *Russularia* (Fr. ex Burl.) Kauffman and *Plinthogalus* (Berk.) Hesler and A.H. Sm. Both species reported in our study are in the subgenus *Piperites*, but they fall into different sections (Roux 2006, Agerer et al. 2008).

Lactarius tesquorum, in section *Piperites* (Fr. ex J. Kickx f.) Burl., was previously reported in Aydın province by Karasüleymanoğlu et al. (2014) using molecular techniques. However, no detailed information was given on either the morphological or the microscopic description of the species. This species shows great similarity to *L. torminosus* (Schaeff.) Pers, which is in the same section, but it can be easily distinguished by smell and habitat differences. As stated above, *L. tesquorum* forms mycorrhiza with *Cistus* species, whereas *L. torminosus* associates with *Betula* (Dähncke 2006, Roux 2006, Çınar Yılmaz & Işıloğlu 2016).

Lactarius cistophilus, in section *Uvidi* (Konr.) M. Bon, is similar to the species *L. flavidus* Boud., *L. uvidus* (Fr.) Fr. and *L. violascens* (J. Otto) Fr. in the same section in turning violet-purple with bruising. *L. cistophilus* can be easily distinguished from the other species both by spore size and by habitat differences (Yılmaz Ersel 2005, Kranzlin 2005, Kibby 2014).

Although there is no definite information on either of the two species reported, it is thought that they may be toxic or inedible. However, the spectacular colour changes particularly of *L. cistophilus* have been valued for research such as by De Gussem et al. (2006).

References

- Agerer R, Danielson RM, Egli S, Ingleby K et al. 2008 – Descriptions of ectomycorrhizae. 11/12, 83–88.
- Basso MT. 1999 – *Lactarius* Pers. Fungi Europaei 7. Mykoflora, Alassio.
- Başbüyük HH, Yılmaz A, Kılınç S (eds). 2013 – Biyoçeşitlilik, Biyolojik Devrimler ve Koruma, (2. Baskıdan çeviri). Palme yayıncılık, Ankara.
- Başlar S, Doğan Y, Mert HH. 2002 – A study on the soil-plant interactions of some *Cistus* L. species distributed in West Anatolia. Turkish Journal of Botany 26(3), 149–159.
- Buyck B, Hofstetter V, Verbeken A, Walley R. 2010 – Proposal to conserve *Lactarius* nom. cons.(Basidiomycota) with a conserved type. Taxon 59(1), 295–296.
- Comandini O, Contu M, Rinaldi AC. 2006 – An overview of *Cistus* ectomycorrhizal fungi. Mycorrhiza 16(6), 381–395.
- Çınar Yılmaz H, Işıloğlu M. 2016 – Some *Lactarius* species from the Aegen region of Turkey. Mugla Journal of Science and Technology, Special Issue: 19–20.
- Dähncke RM. 2006 – Pilze in Farbfotos. AT Verlag, Stuttgart.
- De Gussem K, Verbeken A, Vandenabeele P, De Gelder J et al. 2006 – Raman spectroscopic monitoring of *Lactarius* latex. Phytochemistry 67(23), 2580–2589.
- Guzmán B, Vargas P. 2005 – Systematics, character evolution, and biogeography of *Cistus* L.(Cistaceae) based on ITS, trnL-trnF, and matK sequences. Molecular phylogenetics and evolution 37(3), 644–660.
- Güvenç A, Yıldız S, Özkan AM, Erdurak CS et al. 2005 – Antimicrobiological studies on Turkish *Cistus* species. Pharmaceutical biology 43(2), 178–183.
- Hernández-Rodríguez M, Oria-de-Rueda JA, Martín-Pinto P. 2013 – Post-fire fungal succession in a Mediterranean ecosystem dominated by *Cistus ladanifer* L. Forest Ecology and Management 289, 48–57.
- Işıloğlu M, Allı H, Solak MH, Yılmaz Ersel F. 2004 – *Lactarius* taxa of Turkey. In 4th European Conference on the Conservation of Wild Plants, Valencia, Spain.
- Karasüleymanoğlu KŞ, Bıyık HH, Işıloğlu M. 2014 – Bazı *Lactarius* Türlerinin Morfolojik ve Moleküler Tanısı. 22. Ulusal Biyoloji Kongresi, Eskişehir, Türkiye.
- Kibby G. 2014 – British Milkcaps *Lactarius* & *Lactifluus*. Privately published: available from <http://www.nhbs.com>
- Kränzlin F. 2005 – Fungi of Switzerland, Volume 6. Verlag Mykologia, Luzern.
- Leonardi M, Comandini O, Rinaldi AC. 2016 – Peering into the Mediterranean black box: *Lactifluus rugatus* ectomycorrhizas on *Cistus*. IMA FUNGUS 7(2), 275–284.
- Lévêque C, Mounolou JC. 2008 – Biodiversité-2e éd.: Dynamique biologique et conservation. Dunod.
- Malençon G. 1979 – Champignons du Maroc. Beih Sydowia Ann Mycol Ser II 8, 258–267.
- Roux P. 2006 – Mille et un champignons. Sainte Sigolene, France.
- Sesli E, Denchev CM. 2008 – Checklists of the myxomycetes, larger ascomycetes, and larger basidiomycetes in Turkey. Mycotaxon 106: 65–67. + [complete version, 1–145, new version uploaded in January 2014].
- Solak MH, Işıloğlu M, Kalmış E, Allı H. 2015 – Macrofungi of Turkey, Checklist, Vol. 2. Üniversiteliler Ofset, İzmir, Turkey.
- Tilki F. 2008 – Seed germination of *Cistus creticus* L. and *Cistus laurifolius* L. as influenced by dry-heat, soaking in distilled water and gibberellic acid. Journal of Environmental Biology 29(2), 193.
- Yılmaz Ersel F. 2005 – New records for the macromycota of Turkey from Balıkesir Province. Turkish Journal of Botany 29(4), 333–336.
- Yücel E. 2012 – Ağaçlar ve Çalılar. Türmatsan Yayınları, İstanbul. <http://www.mycobank.org> (accessed 2016).