

Contributions to the macrofungal diversity of Kilis Province

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Abstract: In this study, an attempt has been made to determine macrofungal specimens collected from Kilis in 2006 and 2007. After field and laboratory studies, 47 taxa belonging to 17 families and 2 divisions were identified: 4 taxa belong to Ascomycota and 43 to Basidiomycota. Three of them, *Inocybe taxocystis* (J.Favre & E.Horak) Senn-Irlet, *Russula laccata* Huijsman, and *Russula medullata* Romagn., are new records for Turkey.

Key words: Biodiversity, macrofungi, new records, Kilis, Turkey

1. Introduction

Many studies have been conducted on Turkish mycobiota. However, not all of the fungal diversity from different parts of Turkey has been determined. Through these kinds of studies Turkey's biological diversity will be presented. Some studies were conducted on the macrofungal diversity of areas near Kilis by Kaya et al. (2008, 2010, 2012), Kaya (2009a, 2009b), and Gücin et al. (2010). According to the current literature, there are 2 studies on the macromycota of the research area (Solak et al., 2008, 2009).

Kilis is situated in the C6 square in the southern part of Turkey and is bordered by Syria to the south and Gaziantep to the north, east, and west (Figure 1). The research area falls in the Mediterranean and Irano-Turanian floristic regions and possesses a semiarid Mediterranean climate. The annual average temperature is 17.1 °C, and the annual rainfall is about 481 kg/m². The forest and shrub vegetation of the study area is composed of *Pinus brutia* Ten., *Pinus pinea* L., *Arbutus andrachne* L., *Pistacia lentiscus* L., *Erica arborea* L., *Styrax officinalis* L., *Cistus creticus* L., and some members of *Juniperus* L. spp., *Cupressus* L. spp., *Quercus* L. spp., *Fraxinus* Tourn. ex L. spp., *Populus* L. spp., *Acacia* Mill. spp., *Olea* L. spp., and *Acer* L. spp.

The aim of this study is to contribute to the mycota of Turkey.

2. Materials and methods

The specimens of this study were collected from different localities within Kilis Province in 2006 and 2007 (Figure

1). The field studies were conducted in autumn and spring because these climatic conditions are more suitable for the growth of fungi. During field studies morphological and ecological characteristics of the macrofungi samples were recorded, and samples were photographed. After field studies, specimens were taken to the laboratory. Spore prints were then obtained and spores were photographed. Specimens were identified with the help of Marchand (1971–1986), Watling (1982), Moser (1983), Breitenbach and Kränzlin (1984–2000), Cappelli (1984), Pacioni (1985), Watling and Gregory (1987, 1989), Bresinsky and Besl (1990), Ellis and Ellis (1990), Kränzlin (2005), Phillips (2006), Knudsen and Vesterholt (2008), and Kibby (2012). Newly recorded taxa were checked with the relevant literature (Doğan et al., 2005; Solak et al., 2007; Servi et al., 2010; Allı, 2011; Akata et al., 2012; Doğan et al., 2012; Sesli and Denchev, 2012; Türkoğlu and Yağız, 2012; Güngör et al., 2013). Nomenclature is given according to *Index Fungorum* (Kirk, 2011). The identified specimens are kept at the fungarium of Muğla Sıtkı Koçman University.

3. Results

In this study 47 taxa belonging to 17 families were identified. These taxa are presented with their localities, habitats, collection dates, and accession numbers.

3.1. Ascomycota

Helvellaceae

1. *Helvella acetabulum* (L.) Quél.

Hatay-Kilis city border, Deliosman village, in pine forest, 9.4.2006, Solak 2039.

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Figure 1. Map of the study area.

2. *Helvella lacunosa* Afzel.

Hatay-Kilis city border, Deliosman village, in pine forest, 9.4.2006, *Solak* 2038.

3. *Helvella leucomelaena* (Pers.) Nannf.

Hatay-Kilis city border, Deliosman village, in pine forest, 9.4.2006, *Solak* 2046.

Pyronemataceae

4. *Tarzetta catinus* (Holmsk.) Korf & J.K.Rogers

Hatay-Kilis city border, Deliosman village, in pine forest, 9.4.2006, *Solak* 2027.

3.2. Basidiomycota

Agaricaceae

5. *Agaricus impudicus* (Rea) Pilát

Hatay-Kilis city border, Deliosman village, in pine forest, 9.12.2006, *Solak* 3065.

6. *Bovista plumbea* Pers.

Hatay-Kilis city border, Deliosman village, in meadows, 9.4.2006, *Solak* 2016, *Solak* 2050.

7. *Coprinus xanthothrix* Romagn

Kilis, Gülbaba village, in pine forest, 16.11.2007, *Solak* 3414.

8. *Lycoperdon excipuliforme* (Scop.) Pers.

Kilis, Demirciler village, in grassland, 9.12.2006, *Solak* 3062; Hatay-Kilis city border, Deliosman village, in pine forest, 9.12.2006, *Solak* 3074.

9. *Lycoperdon molle* Pers.

Kilis, Demirciler village, in pine forest, 9.12.2006, *Solak* 3041.

10. *Lycoperdon perlatum* Pers.

Hatay-Kilis city border, Deliosman village, in pine forest, 9.12.2006, *Solak* 3071.

11. *Lycoperdon pratense* Pers.

Kilis, Demirciler village, in grassland, 9.12.2006, *Solak* 3048.

12. *Macrolepiota excoriata* (Schaeff.) Wasser

Kilis, Demirciler village, in pine forest, 9.12.2006, *Solak* 3039; Hatay-Kilis city border, Deliosman village, in pine forest, 9.12.2006, *Solak* 3088.

Amanitaceae

13. *Amanita torrendii* Justo

Kilis, Demirciler village, in pine forest, 9.12.2006, *Solak* 3058; Hatay-Kilis city border, Deliosman village, in pine forest, 9.4.2006, *Solak* 2031.

14. *Amanita ovoidea* (Bull.) Link

Hatay-Kilis city border, Deliosman village, in pine forest, 9.12.2006, *Solak* 3089.

Gomphidiaceae

15. *Chroogomphus rutilus* (Schaeff.) O.K.Mill.

Hatay-Kilis city border, Deliosman village, in pine forest, 9.12.2006, *Solak* 3069.

Hydnangiaceae

16. *Laccaria laccata* (Scop.) Cooke

Hatay-Kilis city border, Deliosman village, in pine forest, 9.4.2006, *Solak* 2024.

Hygrophoraceae

17. *Hygrocybe virginea* (Wulfen) P.D.Orton & Watling

Hatay-Kilis city border, Deliosman village, in pine forest, 9.4.2006, *Solak* 2032.

Hymenochaetaceae

18. *Fuscoporia torulosa* (Pers.) T.Wagner & M.Fisch.

Kilis, Gülbaba village, on *Quercus*, 16.11.2007, *Solak* 3409.

Inocybaceae

19. *Inocybe bongardii* var. *pisciodora* (Donadini & Rioussset) Kuyper

Hatay-Kilis city border, Deliosman village, in pine forest, 9.4.2006, *Solak* 2044.

20. *Inocybe catalaunica* Singer

Hatay-Kilis city border, Deliosman village, in pine forest, 9.12.2006, *Solak* 3077.

21. *Inocybe ochroalba* Bruyl.

Hatay-Kilis city border, Deliosman village, in meadows, 9.4.2006, *Solak* 2037.

22. *Inocybe pallida* Velen.

Hatay-Kilis city border, Deliosman village, in pine forest, 9.4.2006, *Solak* 2018.

23. *Inocybe rimosa* var. *rimosa* (Bull.) P.Kumm.

Kilis, Demirciler village, in pine forest, 9.12.2006, *Solak* 3040; Hatay-Kilis city border, Deliosman village, in pine forest, 9.12.2006, *Solak* 3067.

24. *Inocybe splendens* var. *splendens* R.Heim

Hatay-Kilis city border, Deliosman village, in pine forest, 9.4.2006, *Solak* 2023; Hatay-Kilis city border, Deliosman village, in pine forest, 9.12.2006, *Solak* 3080.

25. *Inocybe taxocystis* (J.Favre & E.Horak) Senn-Irlet

Cap 1.5–3 cm obtusely conical when young, later plane with an umbo, surface smooth and brownish at centre, finely radially fibrillose toward the margin dark red, brown to yellow at margin. Flesh white to light brown, odour somewhat spermatic, taste not distinctive. Lamellae whitish to ochraceous brown, narrowly attached. Stipe 2–3 × 0.3–0.5 cm, cylindrical, slightly bulbous toward base, surface smooth to longitudinally grooved, white to light brown, upper half whitish-pruinose. Spores 9–11 × 5–7 μm, has 4–7 tubercles, light brown. Basidia clavate, 28–34 × 10–11 μm. Cheilocystidia fusiform, with apical crystals, 50–70 × 18–25 μm. In heaths, among mosses (Figure 2).

Hatay-Kilis city border, Deliosman village, in pine forest, 9.4.2006, *Solak* 2012.

26. *Inocybe vaccina* Kühn.

Hatay-Kilis city border, Deliosman village, in pine forest, 9.4.2006, *Solak* 2053.

Marasmiaceae

27. *Gymnopus dryophilus* (Bull.) Murrill

Kilis, Demirciler village, in pine forest, 9.12.2006, *Solak* 3053; Kilis, Gülbaba village, in pine forest, 16.11.2007, *Solak* 3412.

Polyporaceae

28. *Polyporus arcularius* (Batsch) Fr.

Hatay-Kilis city border, Deliosman village, on branch, 9.4.2006, *Solak* 2040.

Rhizopogonaceae

29. *Rhizopogon luteolus* Fr.

Hatay-Kilis city border, Deliosman village, in pine forest, 9.4.2006, *Solak* 2035; Hatay-Kilis city border, Deliosman village, in pine forest, in meadows, 9.4.2006, *Solak* 2045; Kilis, Demirciler village, in pine forest, 9.12.2006, *Solak* 3063.

30. *Rhizopogon roseolus* (Corda) Th. Fr.

Kilis, Demirciler village, in pine forest, 9.12.2006, *Solak* 3055.

Russulaceae

31. *Lactarius deliciosus* (L.) Gray

Kilis, Demirciler village, in pine forest, 9.12.2006, *Solak* 3044.

32. *Lactarius deterrimus* Gröger

Hatay-Kilis city border, Deliosman village, in pine forest, 9.12.2006, *Solak* 3084.

33. *Russula delica* Fr.

Hatay-Kilis city border, Deliosman village, in *Quercus* forest, 9.12.2006, *Solak* 3092.

34. *Russula laccata* Huijsman

Syn.: *Russula norvegica* D.A.Reid

Cap 1.5–3 cm in diameter, convex or plane, sometimes indented in the centre, surface dull, lubricous when moist, dark blackish purple, then fading to cream-coloured, margin even and acute. Stipe 1–2.5 × 0.3–0.7 cm white, sometimes flesh-coloured at the base, also in flesh, taste acrid, smell insignificant. Lamellae white when young, later cream-coloured, narrowly attached to almost free,

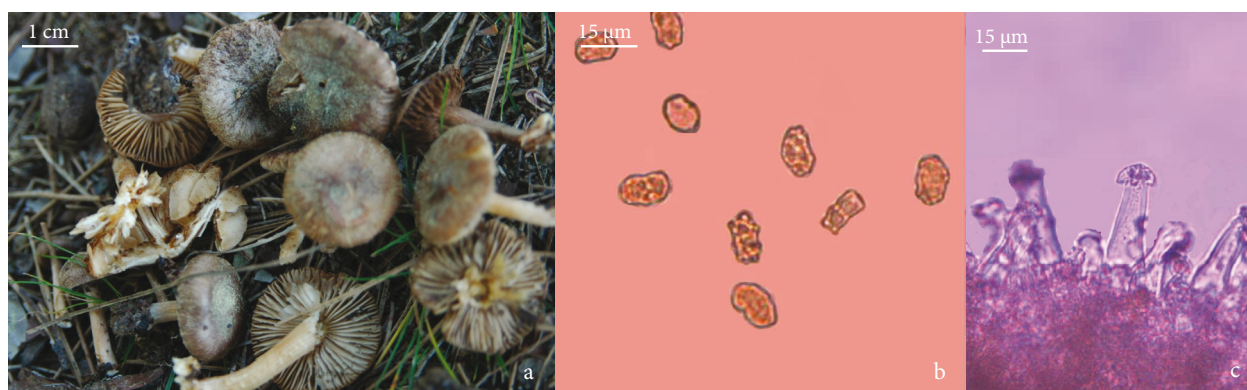


Figure 2. *Inocybe taxocystis*: a- fruit bodies, b- basidiospores, c- cheilocystidia.

edges entire. Spores $6.5\text{--}9 \times 6\text{--}7 \mu\text{m}$, elliptical, verrucose, partly reticulate. Basidia clavate, $35\text{--}45 \times 8\text{--}12 \mu\text{m}$. Cheilocystidia fusiform, $40\text{--}80 \times 6\text{--}9 \mu\text{m}$. Among dwarf willows, especially *Salix* L. (Figure 3).

Kilis, Demirciler village, near *Salix* sp., 9.12.2006, *Solak* 3049.

35. *Russula medullata* Romagn.

Cap 4–9 cm, hemispherical, convex to plane, with an overcast centre, surface matt, shiny and greasy when moist, later grey, light blue, olive green to brown, centre often brownish, margin somewhat striate. Flesh white, orange-pink with FeSO_4 , odour not distinctive, taste mild. Lamellae white to light ochre, narrowly attached. Stipe 4–7 \times 1–2 cm, cylindrical, hollow when old, surface venose, when young white, later light rust brown. Spores subglobose to globose, $6\text{--}8.5 \times 5\text{--}6 \mu\text{m}$, consist of isolated, blunt warts. Basidia clavate, $30\text{--}50 \times 10\text{--}11 \mu\text{m}$. Cheilocystidia fusiform to clavate, $50\text{--}80 \times 8\text{--}10 \mu\text{m}$. In hardwood forests, especially birches (Figure 4).

Kilis, Demirciler village, in pine forest, 9.12.2006, *Solak* 3046.

36. *Russula queletii* Fr.

Hatay-Kilis city border, Deliosman village, in pine forest, 9.12.2006, *Solak* 3076.

Stereaceae

37. *Stereum hirsutum* (Willd.) Pers.

Kilis, Demirciler village, on *Eucalyptus* sp., 9.12.2006, *Solak* 3050; Kilis, Demirciler village, on *Quercus*, 9.12.2006, *Solak* 3061; Hatay-Kilis city border, Deliosman village, on *Quercus* stump, 9.12.2006, *Solak* 3091.

Strophariaceae

38. *Stropharia inuncta* (Fr.) Quél.

Hatay-Kilis city border, Deliosman village, in meadows, 9.4.2006, *Solak* 2043.

39. *Stropharia semiglobata* (Batsch) Quél.

Hatay-Kilis city border, Deliosman village, in pine forest, 9.4.2006, *Solak* 2033.

Suillaceae

40. *Suillus bellini* (Inzenga) Watling

Hatay-Kilis city border, Deliosman village, in pine forest, 9.12.2006, *Solak* 3072; Kilis, Demirciler village, in pine forest, 9.12.2006, *Solak* 3052; Hatay-Kilis city border,

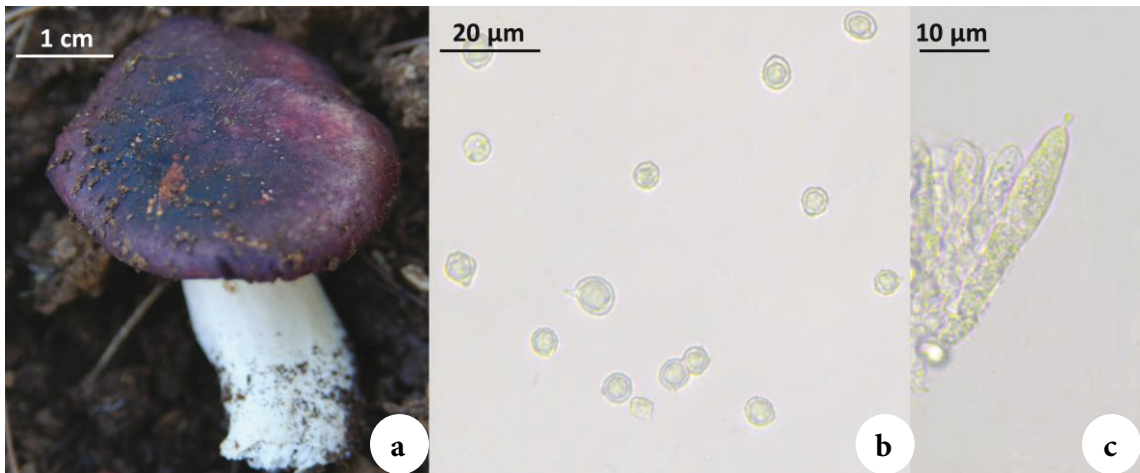


Figure 3. *Russula laccata*: a- fruit body, b- basidiospores, c-cheilocystidia.

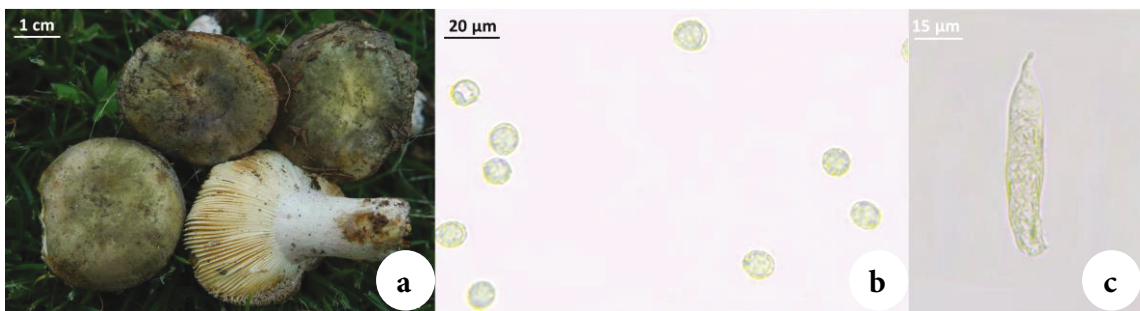


Figure 4. *Russula medullata*: a- fruit bodies, b- basidiospores, c-cheilocystidia.

Deliosman village, in pine forest, 9.12.2006, *Solak* 3068, Hatay-Kilis city border, Deliosman village, in *Quercus* forest, 9.12.2006, *Solak* 3093.

41. *Suillus bovinus* (Pers.) Roussel

Hatay-Kilis city border, Deliosman village, in pine forest, 9.12.2006, *Solak* 3082.

42. *Suillus collinitus* (Fr.) Kuntze

Hatay-Kilis city border, Deliosman village, in pine forest, 9.12.2006, *Solak* 3066.

Tricholomataceae

43. *Clitocybe vermicularis* (Fr.) Quél.

Hatay-Kilis city border, Deliosman village, in pine forest, 9.4.2006, *Solak* 2028.

44. *Melanoleuca excissa* (Fr.) Singer

Hatay-Kilis city border, Deliosman village, in pine forest, 9.4.2006, *Solak* 2051.

45. *Melanoleuca paedida* (Fr.) Kühner & Maire

Hatay-Kilis city border, Deliosman village, in pine forest, 9.4.2006, *Solak* 2029; Hatay-Kilis city border, Deliosman village, under almond tree, 9.4.2006, *Solak* 2030.

46. *Tricholoma fracticum* (Britzelm.) Kreisel

Hatay-Kilis city border, Deliosman village, in pine forest, 9.12.2006, *Solak* 3087.

47. *Tricholoma terreum* (Schaeff.) P.Kumm.

Hatay-Kilis city border, Deliosman village, in pine forest, 9.12.2006, *Solak* 308.

4. Discussion

In this study, 47 taxa belonging to 17 families and 2 classes were identified: 4 taxa belong to Ascomycota and 43 to Basidiomycota. Three of these, *Inocybe taxocystis*, *Russula laccata*, and *Russula medullata*, are new records for Turkey. Members of Helvellaceae, Pyronemataceae, Hygrophoraceae, Hymenochaetaceae, Marasmiaceae, Polyporaceae, and Stereaceae were found for the first time in Kilis. The distribution of the taxa's families is as follows: Helvellaceae, 3; Pyronemataceae, 1; Agaricaceae, 8; Amanitaceae, 2; Gomphidiaceae, 1; Hydangiaceae, 1; Hygrophoraceae, 1; Hymenochaetaceae, 1; Inocybaceae, 8; Marasmiaceae, 1; Polyporaceae, 1; Rhizopogonaceae, 2; Russulaceae, 6; Stereaceae, 1; Strophariaceae, 2; Suillaceae, 3; and Tricholomataceae, 5. Our research demonstrates that there are certain similarities between the macrofungi found in Kilis and those reported in earlier studies carried out near our research area (Table), which may be because of similarities in vegetation and climatic conditions. Most of the determined taxa belong to the families Agaricaceae and Inocybaceae (17% each), Russulaceae (12.7%),

Table. Similarity percentages of earlier studies carried out in Kilis and studies neighbouring the research area.

References	Number of identical taxa	Total taxa	Similarity percentage (%)
Solak et al. (2008)	18	19	94.7
Kaya (2009a)	13	105	12.3
Kaya (2009b)	25	312	8
Kaya et al. (2012)	8	53	15

and Tricholomataceae (10.6%). This study significantly contributes to the knowledge of Turkish mycota.

With this study, 28 species were added to the previously recorded 19 taxa, increasing the total number of taxa to 47.

References

Akata I, Kaya A, Uzun Y (2012). New Ascomycete records for Turkish macromycota. *Turk J Bot* 36: 420–424.

Allı H (2011). Macrofungi of Kemaliye district (Erzincan). *Turk J Bot* 35: 299–308.

Breitenbach J, Kränzlin F (1984–2000). Fungi of Switzerland. Vols. 1–5. Luzern, Switzerland: Verlag Mykologia.

Bresinsky A, Besl H (1990). Colour Atlas of Poisonous Fungi. Stuttgart, Germany: Wolfe Publishing Ltd.

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Cappelli A (1984). Fungi Europaei, Agaricus. Saronno, Italy: Libreria Editrice Biella Giovanna.

Doğan HH, Aktaş S, Öztürk C, Kaşık G (2012). Macrofungi distribution of Cocakdere valley (Arslanköy, Mersin). *Turk J Bot* 36: 83–84.

Doğan HH, Öztürk C, Kaşık G, Aktaş S (2005). A checklist of Aphylophorales of Turkey. *Pak J Bot* 37: 459–485.

- Ellis MB, Ellis JP (1990). Fungi Without Gills (Hymenomycetes and Gasteromycetes), An Identification Handbook. London, UK: Chapman and Hall.
- Gücin F, Kaya A, Soylu MK, Uzun Y (2010). *Picoa* Vittad., a new truffle genus record for Turkey. *Biological Diversity and Conservation* 3: 23–25.
- Güngör H, Allı H, Işıloğlu M (2013). Three new macrofungi records for Turkey. *Turk J Bot* 37: 411–413.
- Kaya A (2009a). Macrofungi of Huzurlu high plateau (Gaziantep-Turkey). *Turk J Bot* 33: 429–437.
- Kaya A (2009b). Macromycetes of Kahramanmaraş province (Turkey). *Mycotaxon* 108: 31–34.
- Kaya A, Demirel K, Uzun K (2012). Macrofungi diversity of Araban (Gaziantep/Turkey) district. *Biodicon* 5: 162–166.
- Kaya A, Uzun Y, Demirel K, Karacan İH (2008). Two new *Arrhenia* Fr. records for the macrofungi of Turkey. *Turk J Bot* 32: 419–420.
- Kaya A, Uzun Y, Keleş A, Demirel K (2010). Three coprinoid macrofungi taxa, new to Turkey. *Turk J Bot* 34: 351–354.
- Kibby G (2012). The Genus *Russula* in Great Britain: With Synoptic Keys to Species. Geoffrey Kibby (privately published).
- Kirk P (2011) onward (continuously updated). Index Fungorum. Website: <http://www.indexfungorum.org> [accessed 20 Nov 2012].
- Knudsen H, Vesterholt J (2008). *Funga Nordica*. Copenhagen, Denmark: Narayana Press.
- Kränzlin F (2005). Fungi of Switzerland, Vol. 6. Luzern, Switzerland: Verlag Mykologia.
- Marchand A (1971–1986). Champignons du Nord et du Midi. Vols 1–9. Perpignan, France: Societe Mycologique des Pyrenees Mediterraneennes.
- Moser M (1983). Keys to Agarics and Boleti. Stuttgart, Germany: Gustav Fischer.
- Pacioni G (1985). Mushrooms and Toadstools. London, UK: MacDonald and Ltd.
- Phillips R (2006). Mushrooms. London, UK: Pan Macmillan Ltd.
- Servi H, Akata I, Çetin B (2010). Macrofungi diversity of Bolu Abant Nature Park (Turkey). *Afr J Biotechnol* 9: 3622–3628.
- Sesli E, Denchev CM (2012). Checklists of the myxomycetes, larger ascomycetes, and larger basidiomycetes in Turkey. [online]. Website: <http://www.mycotaxon.com> [accessed 21 Nov 2012].
- Solak MH, Allı H, Işıloğlu M, Kalmış E (2008). Kilis yöresinde yetişen bazı yenen mantarlar, Türkiye VIII. Yemeklik Mantar Kongresi. 15–17 October 2008, p. 29 (in Turkish).
- Solak MH, Allı H, Işıloğlu M, Kalmış E (2009). Some new records of *Inocybe* (Fr.) Fr. from Turkey. *Turk J Bot* 33: 65–69.
- Solak MH, Işıloğlu M, Kalmış E, Allı H (2007). Macrofungi of Turkey Checklist. İzmir, Turkey: Üniversiteler Ofset.
- Türkoğlu A, Yağız D (2012). Contributions to the macrofungi diversity of Uşak Province. *Turk J Bot* 36: 580–589.
- Watling R, Gregory NM (1987). British Fungus Flora. Agarics and Boleti 5: Strophoriaceae & Coprinaceae. Edinburgh, UK: Royal Botanic Garden.
- Watling R, Gregory NM (1989). British Fungus Flora. Agarics and Boleti 6: Crepidotaceae, Pleurotaceae and Other Pleurotoid Agarics. Edinburgh, UK: Royal Botanic Garden.