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Mycodiversity studies in selected ecosystems of Greece: 5. Basidiomycetes associated with woods dominated by *Castanea sativa* (Nafpactia Mts., central Greece)

ELIAS POLEMIS[1], DIMITRIS M. DIMOU[1,3], LEONIDAS POUNTZAS[4], DIMITRIS TZANOUDAKIS[2] & GEORGIOS I. ZERVAKIS[1*]

[1] *eliasp@ath.forthnet.gr, zervakis@aua.gr*
Agricultural University of Athens, Lab. of General & Agricultural Microbiology
Iera Odos 75, 11855 Athens, Greece
[2] *University of Patras, Dept. of Biology, Panepistimioupoli, 26500 Rion, Greece*
[3] *Koritsas 10, 15343 Agia Paraskevi, Greece*
[4] *Technological Educational Institute of Mesologgi, 30200 Mesologgi, Greece*

Abstract — Very scarce literature data are available on the macrofungi associated with sweet chestnut trees (*Castanea sativa*, *Fagaceae*). We report here the results of an inventory of basidiomycetes, which was undertaken in the region of Nafpactia Mts., central Greece. The investigated area, with woods dominated by *C. sativa*, was examined for the first time in respect to its mycodiversity. One hundred and four species belonging in 54 genera were recorded. Fifteen species (*Conocybe pseudocrispa, Entoloma nitens*, *Lactarius glaucescens, Lichenomphalia velutina*, *Parasola schroeteri*, *Pholiotina coprophila, Russula alutacea*, *R. azurea*, *R. pseudoaeruginea, R. pungens*, *R. vitellina, Sarcodon glaucopus*, *Tomentella badia*, *T. fibrosa* and *Tubulicrinis sororius*) are reported for the first time from Greece. In addition, 33 species constitute new habitats/hosts/substrates records.

Key words — biodiversity, macromycete, Mediterranean, mushroom

Introduction

Castanea sativa Mill., *Fagaceae* (sweet chestnut) generally prefers north-facing slopes where the rainfall is greater than 600 mm, on moderately acid soils (pH 4.5–6.5) with a light texture. It covers ca. 33,000 ha in Greece (National Forest Survey 1992); *C. sativa* coppices are mainly managed to produce timber and to a lesser extend for nuts harvesting. In the area studied (Nafpactia Mts.) it forms pure or mixed stands, in 700–1,100 m above sea level, with *Abies cephalonica* J.W. Loudon (*Abietion cephalonicae* alliance) succeeding *Quercion confertae* and *Quercion cocciferae* alliances which dominate in the lower altitudes.

The area investigated is located in the north-east part of the administrative prefecture of Aitoloakarnania, which belongs to the continental region of Sterea Hellas (central Greece). Nowadays, a major part of the area concerned

* corresponding author

(Naupactia Mts.) forms part of the former Apodotia municipality, which includes major villages such as Ano Chora, Kato Chora, Ampelakiotissa, Kryoneria etc. From geological point of view, the mother rock in Naupactia Mts. is mainly flysch (argilic–schist), and often older deposits of limestone emerge above it. The climate within the whole region is continental, with frequent rainfalls and harsh winters (snow-cover lasts from several weeks to 2–3 months depending on the altitude), and a period of summer drought of approximately 2 months (June–July).

The data presented in this work focus on the macrofungi associated with *C. sativa* trees in the region of Nafpactia Mts., which is examined for the first time in respect to its mycodiversity. The study is carried out in the frame of a systematic inventory of the macromycetes of selected ecosystems of Greece (Dimou et al. 2002, 2008; Zervakis et al. 2002a,b).

Methodology

The material was mainly collected during a four years study (2001–2004), and in the course of several forays conducted with time-intervals of approx. one month. Three particular sites within the larger area of study were selected for detailed monitoring and specimens collection: Site 1 [S1, 38°35′38″N 21°55′38″E]: Forested areas in N-NW facing slopes and altitudes 800-950 m along the path from Ano-Chora to Kato-Chora, consisting of mixed woods of *C. sativa* and *A. cephalonica*. Scattered trees of *Quercus pubescens* and *Juniperus oxycedrus* are also present. Site 2 [S2, 38°35′40″N 21°54′43″E]: NE facing slopes W of Ano-Chora in altitudes 1,000–1,100 m with stands of *C. sativa* and scattered *A. cephalonica* trees. Site 3 [S3, 38°36′26″N 21°55′05″E]: N-NW facing slopes NW of Ano-Chora, along the path that connects the village with the monastery of Ambelakiotissa in altitude 700–800 m. This site is laying on limestone, by the borders of the *Quercion cocciferae* and *Abietion cephalonicae* alliances with mixed woods of *C. sativa*, *A. cephalonica*, and *Quercus coccifera*.

Field parameters, macroscopic characteristics and some macro-chemical reactions of the collected specimens were recorded *in situ*. Microscopic observations and micro-chemical reactions were carried out as previously described (Dimou et al. 2002). All the species recorded during this study are kept in the ACA fungal dried reference collection. A photographic archive is also maintained. For specimens identification and classification pertinent key-references were used, e.g. Antonín & Noordeloos (1993, 1997), Bas et al. (1988–95), Breitenbach & Kränzlin (1984–2000), Eriksson et al. (1978–88), Eriksson & Ryvarden (1973–76), Hansen & Knudsen (1997–2000), Heilmann-Clausen et al. (1998), Hjortstam et al. (1987–88), Jülich (1984), Kõljalg (1996), Noordeloos et al. (2001), Sarnari (1998–2005), etc.

Nomenclature for identified taxa follows Index Fungorum (http://www.indexfungorum.org) unless otherwise stated.

Results and Discussion

This inventory resulted at the identification of 104 species and varieties of macrofungi, belonging in 54 genera. Fifteen species constitute new records for Greece and 33 represent first national reports for hosts/substrates/habitats (the former are marked by a preceding asterisk (*) and the latter by a preceding cross (†):

Agaricus pampeanus Speg.
Solitary and in large numbers at the edges of forest roads in the vicinity of sheep pens, October to November [S3]. Very common in Greece.
Albatrellus cristatus (Schaeff.) Kotl. & Pouzar
In clusters in a mixed *C. sativa* and *A. cephalonica* forest, August to October [S2]. Widespread in Greece.
Amanita caesarea (Scop.) Pers.
Gregarious in mixed stands of *C. sativa* and *A. cephalonica*, very common, August to September [S2 and S1]. Widespread in Greece.
Amanita excelsa var. ***spissa*** (Fr.) Neville & Poumarat
Solitary under chestnut in a mixed *C. sativa* and *A. cephalonica* forest, August [S2]. Uncommon in Greece.
Amanita franchetii (Boud.) Fayod
Solitary in a mixed *C. sativa* and *A. cephalonica* forest, August to September [S2]. Widespread in Greece, recorded from various types of broad-leaved and coniferous forests.
Amanita pantherina (DC.) Krombh.
Solitary in a mixed *C. sativa* and *A. cephalonica* forest, August [S2]. Widespread in Greece, recorded from various types of broad-leaved and coniferous forests**.**
Amanita phalloides (Vaill.) Link
Solitary in a mixed *C. sativa* and *A. cephalonica* forest, August [S2]. Widespread in Greece, very common in both broad-leaved and coniferous forests.
Amanita rubescens Pers. var. ***rubescens***
Solitary in a mixed *C. sativa* and *A. cephalonica* forest, August to September [S2 and S1]. Widespread and very common in Greece in both broad-leaved and coniferous forests.
Amanita vaginata (Bull.) Lam.
Solitary to subgregarious in a mixed *C. sativa* and *A. cephalonica* forest, common in June and August to September [S1 and S2]. Widespread and very common in Greece in both broad-leaved and coniferous forests.

Armillaria mellea (Vahl) P. Kumm.
In clusters on roots of *C. sativa*, October [S3]. Very common in Greece on a wide variety of hosts.
Boletus appendiculatus Schaeff.
In small groups in mixed stands of *C. sativa* and *A. cephalonica*, August [S2]. Widespread and relatively common in Greece in both broad-leaved and coniferous forests.
Boletus calopus Pers.
In clustered groups in mixed *C. sativa* and *A. cephalonica*, and in *A. cephalonica* forests, common, May to June and August to September [S1 and S2]. Widespread and common in Greece in both broad-leaved and coniferous forests.
Boletus edulis Bull.
Solitary or in groups in mixed *C. sativa* and *A. cephalonica*, and in *A. cephalonica* forests, common, August [S2 and S1]. Widespread and common in Greece in both broad-leaved and coniferous forests.
† ***Boletus legaliae*** Pilát
Solitary or in groups, very common in mixed *C. sativa* and *A. cephalonica* forests, August [S2 and S1]. Reported as *B. splendidus* Martin from other forest types such as *Fagus* sp., *A. cephalonica*, *Q. coccifera* and *Q. pubescens*.
Boletus luridus Schaeff.
Solitary in a mixed *C. sativa* and *A. cephalonica* forest, August [S2]. Widespread in Greece recorded from various broad-leaved and coniferous forests.
† ***Boletus pulverulentus*** Opat.
Solitary in a mixed *A. cephalonica*, *Q. coccifera* and *C. sativa* forest, September [S3]. Not common in Greece, recorded previously from *Quercus* spp. forests.
† ***Boletus queletii*** Schulzer
Solitary in a mixed *C. sativa* and *A. cephalonica* forest, June and August [S2]. Previously recorded in Greece from *Quercus* spp. forests.
† ***Boletus regius*** Krombh.
Solitary in a mixed *C. sativa* and *A. cephalonica* forest, August [S2]. Few previous records in Greece.
Boletus reticulatus Schaeff.
Solitary under chestnut trees in a mixed *C. sativa* and *A. cephalonica* forest, May to June [S2]. Few previous records from various broad-leaved forests (Dimou et al 2002, Constantinidis 2006), but probably common.

† ***Boletus rhodoxanthus*** (Krombh.) Kallenb.
Solitary in a mixed *C. sativa and A. cephalonica* forest, August [S2 and S1]. Two previous reports from Athanasiou & Theochari (2001) and Constantinidis (2006).
† ***Botryohypochnus isabellinus*** (Fr.) J. Erikss.
On the underside surface of rotten *C. sativa* wood, November [S2]. Previously recorded on *Fagus sylvatica* (Dimou et al. 2002) and *Quercus frainetto* (Zervakis et al. 2002b).
Bovista plumbea Pers.
In a grassy forest clearing within a mixed *C. sativa* and *A. cephalonica* forest, June [S2]. Very common and widespread in Greece in forests and mountain pastures.
† ***Calocybe ionides*** (Bull.) Donk
Gregarious in a mixed *C. sativa* and *A. cephalonica* forest, September [S3]. Pileus 2.5–5.0 μm hemispherical with incurved margin, applanate, violet to purple fading to grey vinaceous, surface smooth and matt. Stipe 3.0–4.0 × 0.5–0.8 cm, cylindrical, finely striate, same color as pileus. Smell and taste farinaceous. Spores ellipsoid, smooth, with oil drops, 4.0–6.0(6.5) × 2.0–3.0 μm. Previously reported by Constantinidis (2002).
Clitocybe gibba (Pers.) P. Kumm.
Gregarious in a mixed *C. sativa*, *Q. coccifera* and *A. cephalonica* forest, common, September [S3]. Common and widespread in Greece in both broad-leaved and coniferous forests.
Clitocybe odora (Bull.) P. Kumm.
Gregarious in a mixed *A. cephalonica* and *C. sativa* forest, very common, in September–October [S3]. Common and widespread in Greece in both broad-leaved and coniferous forests.
Clitopilus prunulus (Scop.) P. Kumm.
Solitary in a mixed *C. sativa* and *A. cephalonica* forest, August [S2]. Common and widespread in Greece in both broad-leaved and coniferous forests.
Collybia cirrhata (Schumach.) P. Kumm.
Hyperparasitic on mummified basidiomata of *Russulales*, in a mixed *C. sativa* and *A. cephalonica* forest, August [S1]. Few previous records in Greece from *Fagus* and *Abies* forests.
* ***Conocybe pseudocrispa*** (Hauskn.) Arnolds
On grassy soil in forest clearings, May [S3]. Pileus 0.7–1.5 cm, conical slightly expanding, whitish to cream-beige, smooth; stipe 3–6 × 0.10–0.15 cm. Spores 12–15 × 7–9 μm, ellipsoid not lentiform, yellowish, with large central germ-pore; 2-spored basidia; cheilocystidia lecythiform; caulocystidia lageniform often with long flexuose necks, hair-like. This taxon is separated

from the similar-looking *C. albipes* (G.H. Otth) Hauskn. microscopically by the 2-spored basidia (Hausknecht 2009).

Coprinopsis stercorea (Fr.) Redhead, Vilgalys & Moncalvo

On cattle excrements, November [S3]. Previously reported by Diamandis (1992) as *Coprinus velox*, by Konstantinidis (2006), and by Richardson (2008) on excretements of various herbivorous animals in several areas.

Coprinus comatus (O.F. Müll.) Pers.

In groups at the edges of forest roads, October [S3]. Very common in Greece.

† ***Cortinarius orellanus*** Fr.

In small groups in a mixed *C. sativa* and *A. cephalonica* forest, September [S1]. Only one previous record in Greece from Mt.Taygetos (Zervakis et al 2002a).

Craterellus cornucopioides (L.) Pers.

In a mixed *C. sativa and A. cephalonica* forest, common, September [S3]. Recorded in Greece in coniferous as well as in broadleaved forests.

† ***Cyathus olla*** (Batsch) Pers.

On cattle excrements, November [S3]. Common.

† ***Cystodermella granulosa*** (Batsch) Harmaja

On mossy soil in a mixed *C. sativa* and *A. cephalonica* forest, common, September–November [S1]. Very common in coniferous forests of Greece.

**** Entoloma nitens*** (Velen.) Noordel.

On mossy ground in a mixed *C. sativa* and *A. cephalonica* forest, May [S2]. Pileus hemispherical, hazel and striate up to disc, stipe 2–3 × 0.2–0.3 cm striate and pruinose above, lamellae emarginate, spores sub-isodiametrical 7–10(11) × 6.0–8.5 μm (mean Q = 1.15), cystidia absent, basidia 4-spored with basal clamp, pigment in pileipellis encrusting, and clamps absent.

Fistulina hepatica (Schaeff.) With.

On living *C. sativa* tree, August–September [S2 and S3]. Widespread in Greece, common on *Castanea sativa*.

† ***Geastrum fimbriatum*** Fr.

On mossy soil in a mixed *C. sativa* and *A. cephalonica* forest, not common, September [S3]. Reported from various types of broad-leaved and coniferous forests in Greece.

† ***Gymnopus brassicolens*** (Romagn.) Antonín & Noordel.

On rotten wood of *C. sativa*, August [S2]. Previously reported from *Pinus*, *Abies* and *Fagus* forests of Greece.

† ***Gymnopus dryophilus*** (Bull.) Murrill

On leaf-litter of *C. sativa*, common, May [S2]. Common in Greece in broad-leaved and coniferous forests.

Hebeloma crustuliniforme (Bull.) Quél.

Under chestnut trees in a mixed *C. sativa* and *A. cephalonica* forest, August [S2]. Common in Greece mainly in coniferous habitats.

† ***Hydnellum aurantiacum*** (Batsch) P. Karst.
In a mixed *A. cephalonica* and *C. sativa* forest, August [S2]. Three previous reports from Mt. Mainalo (Arkadia), Mt. Oxya (Fthiotida) and Grevena in *Abies* forests (Diamandis & Minter 1983, Dimou et al. 2008, Constantinidis 2006).
† ***Hydnellum auratile*** (Britzelm.) Maas Geest.
In a mixed *A. cephalonica* and *C. sativa* forest, August [S2]. Three previous reports in Greece from Mt. Aroania (Achaia) in mixed *Abies* and *Pinus* forests (Delivorias & Gonou-Zagou 2000), in mixed *Abies borisii-regis* and *Quercus frainetto* (Athanasiou & Theochari 2001), and from Mt. Oxya (Fthiotida) in *A. cephalonica* (Dimou et al. 2008).
† ***Hydnellum concrescens*** (Pers.) Banker
In a mixed *A. cephalonica* and *C. sativa* forest, September [S3]. Previous records from Mt. Olympos in *Abies borisii-regis* (Perlerou & Diamandis 2000), from Paradisia (Arkadia) in *Q. pubescens* (Zervakis et al. 2002b) and from Mt. Oxya (Fthiotida) in *Abies cephalonica* (Dimou et al. 2008).
† ***Hydnellum ferrugineum*** (Fr.) P. Karst.
In a mixed *A. cephalonica* and *C. sativa* forest, August [S2]. A few reports from coniferous or mixed forests in Greece.
Hydnum rufescens Pers.
Gregarious in mixed stands of *A. cephalonica* and *C. sativa*, August [S2]. Widespread and relatively common in Greece in both broad-leaved and coniferous forests.
Hygrocybe conica (Schaeff.) P. Kumm.
Solitary or in groups, in clearings of a mixed *A. cephalonica* and *C. sativa* forest, September [S3]. Very common and widespread in both broad-leaved and coniferous habitats of Greece.
Hygrocybe persistens (Britzelm.) Singer var. ***persistens***
On bare moist soil by a stream [S2], and in clearings of a mixed *A. cephalonica* and *C. sativa* forest, August [S3]. Common and widespread in Greece, reported from a variety of different habitats.
Hygrophorus chrysodon (Batsch) Fr.
Gregarious in a mixed *A. cephalonica*, *Q. coccifera* and *C. sativa* forest, October [S3]. Common in Greece.
Inocybe rimosa (Bull.) P. Kumm.
In clearings of a mixed *C. sativa* and *A. cephalonica* forest, September [S3]. Relatively common in Greece in broad-leaved and coniferous forests.
Laccaria laccata (Scop.) Fr.
On mossy soil in a mixed *C. sativa* and *A. cephalonica* forest, May and September [S1 and S3]. Widespread in Greece.

Lacrymaria lacrymabunda (Bull.) Pat.
Gregarious or in small clusters, along a roadside by mixed *C. sativa* and *A. cephalonica* woods, October [S3]. Few previous reports from Greece in different types of forests. Noteworthy in the particular collection, is the presence of pleurocystidia, often clustered (not mentioned in literature), and cheilocystidia with considerably large capituli 9–15 μm broad.
† ***Lactarius azonites*** (Bull.) Fr.
Solitary under chestnut in a mixed *C. sativa* and *A. cephalonica* forest, June [S1]. Reported also from *Quercus* forests (Diamandis & Perlerou 1994, Constantinidis 2006).
† ***Lactarius controversus*** (Pers.) Pers.
Solitary or in groups in a mixed *C. sativa* and *A. cephalonica* forest, relatively common, August–September [S2 and S3]. Previously reported in Greece growing in association with *Populus* and *Fagus*. Athanasiou & Theochari's (1999) pertinent record from *P. nigra* is obviously a misidentification as this taxon is typically associated with angiospems.
* ***Lactarius glaucescens*** Crossl.
In groups within a mixed *C. sativa* and *A. cephalonica* forest, June [S1]. Spores 6.5–9 × 5.5–6.5 μm, broadly ellipsoid to ellipsoid, ornamentation very low, mostly of isolated warts, some connected by thin lines that never form a reticulum, plage inamyloid. Basidia 47–64 × 8–9 μm, clavate to narrowly clavate. Pleuromacrocystidia 50–107 × 6–10 μm, irregularly cylindrical, originating deep in the trama. Gill edge sterile, cheilomacrocystidia (50–)55–65 × 6-8 μm, strongly emergent, irregularly cylindrical to narrowly clavate. Pileipellis a hyphoepithelium, suprapellis 55–100 μm thick, consisting of thin hyphae (2–4 μm broad) hiding the cellular subpellis. Microscopically, *L. glaucescens* is distinguished from *L. piperatus* mainly by the thicker suprapellis, the presence of longer (55–70 × 7–9 μm) strongly emergent cheilomacrocystidia, and the sterile gill edge (Heilmann-Clausen et al. 1998).
Lactarius piperatus (L.) Pers.
Gregarious under *Castanea* trees in a mixed *C. sativa* and *A. cephalonica* forest, common, June and August to September [S1]. Common and widespread in Greek broad-leaved forests.
Lactarius volemus (Fr.) Fr.
Solitary under *Castanea* in a mixed *C. sativa* and *A. cephalonica* forest, June [S1 and S2]. Common in Greece in broad-leaved forests.
Lactarius zonarius (Bull.) Fr.
Solitary to subgregarious under *Castanea* in a mixed *C. sativa* and *A. cephalonica* forest, August [S1].
† ***Laeticorticium polygonioides*** (P. Karst.) Donk
On dead wood of *C. sativa* [S2]. Previously reported once on *Quercus frainetto* from Arkadia (Zervakis et al. 2002b).

*** *Lichenomphalia velutina*** (Quél.) Redhead, Lutzoni, Moncalvo & Vilgalys
On bare wet soil in a mixed *C. sativa* and *A. cephalonica* forest, May [S2]. Basidiomata small, pileus up to 8 mm, hygrophanous gray-brown striate when wet, greyish-buff when dry. Basidia 2-spored, spores 7–9 × 4–5(6) μm. Pileipellis a cutis of radialy arranged hyphae, pigment incrusting. Clamp-connections absent in all tissues.

Lycoperdon dermoxanthum Vittad.
In groups in manured grassy soil, November [S3]. Common in northern Greece (Konstantinidis 2006)

Lycoperdon perlatum Pers.
Solitary on mossy ground, in a mixed *C. sativa* and *A. cephalonica* forest, common in the entire investigated area, September–November [S1]. Very common throughout Greece.

Lycoperdon pratense Pers.
On bare soil of bushy slopes, November [S3]. Common in Greece.

† *Lyophyllum connatum* (Schumach.) Singer
In a typically "connate" habit under *Castanea*, in a mixed *C. sativa* and *A. cephalonica* forest, September [S3]. Previously recorded from the protected forest of Frakto (Drama) in *Pinus* (Diamandis & Perlerou 1990) and from Mt. Oxya (Fthiotida) in *Fagus* (Dimou et al. 2002).

Macrolepiota procera (Scop.) Singer var. ***procera***
Solitary in a mixed *C. sativa* and *A. cephalonica* forest, September [S2]. Very common throughout Greece.

† *Marasmius epiphyllus* (Pers.) Fr.
On fallen leaves of *C. sativa*, November [S1]. Two previous reports from Greece on *Quercus* trees (Diamandis 1983) and on ivy plants (Constantinidis 2006).

Marasmius oreades (Bolton) Fr.
Gregarious in "fairy rings" in grassy mountain cattle pastures, openings of mixed *C. sativa* and *A. cephalonica* woods, May [S2]. Common and widespread in similar grassy habitats in Greece.

† *Mycena stylobates* (Pers.) P. Kumm.
On woody debris of *C. sativa*, August [S2]. Two previous reports from Mt. Oxya (Fthiotida) (Dimou et al. 2002) and from Mt. Grammos (Kastoria) on *Fagus* (Konstantinidis 2006).

Mycenastum corium (Guers.) Desv.
In small groups at the edges of forest roads, November [S3].

Omphalotus olearius (DC.) Singer
Under chestnut trees in a mixed *C. sativa* and *A. cephalonica* forest, August [S2]. Very common in Greece, mainly in *Olea europea* or in sclerophyllous *Quercus* spp.

Panellus stipticus (Bull.) P. Karst.
On fallen dead trunk of *C. sativa* trees, June [S2]. Common in Greece on various hardwoods.
**** Parasola schroeteri*** (P. Karst.) Redhead, Vilgalys & Hopple
On cattle excrements, in mountain pastures, locally common, November [S3]. Pileus up to 3 cm when fully expanded, with yellowish-rust coloured disc. Spores (10)11–15.5 × 9–12 × 7–9 μm, triangular-lentiform with eccentric germ pore; pleurocystidia vesiculose, pyriform 50–70 × 30–40 μm; pileipellis composed by sphaeropedunculate cells. Considered as rare in Holland and in the rest of Europe (Ulje in Noordeloos et al. 2005). Possibly common in Greece but overlooked, recently also reported from two Cyclades islands (Polemis 2010).
Paxillus involutus (Batsch.) Fr.
On moss covered *C. sativa* trunk at about 1m above the ground, in a mixed *C. sativa* and *A. cephalonica* forest, August [S2]. Relatively common in Greece in broad-leaved and coniferous forests.
Phanerochaete tuberculata (P. Karst.) Parmasto
On dead wood of *C. sativa*, November [S1]. Reported in Greece from the same host (Maire & Politis 1940) and from *F. sylvatica* (Dimou et al. 2002).
**** Pholiotina coprophila*** (Kühner) Singer
On cattle excrements, in mountain pastures, November [S3]. Basidiomata small-sized, pileus 0.5–1 cm, hygrophanous, dark brick and with striate margin when wet, buff to ochre on drying, stipe 1–2 × 0.1–0.2 cm. Spores 9–14 × 6–8 μm, 4-spored basidia, cheilocystidia 30–60 × 9–12 μm, lageniform. Main diagnostical features of this taxon are the coprophilous habitat, the large spores and lageniform cheilocystidia (Hausknecht 2009).
† *Phylloporus pelletieri* (Lév.) Quél.
Solitary, only one basidioma collected in a mixed *C. sativa* and *A. cephalonica* forest, September [S2]. It is only the second record in Greece of this rare species, which is included in the red-data lists of many European countries. One more record in Greece from *Fagus* forests of Lavda (Constantinidis 2006).
Ramaria botrytis (Pers.) Ricken
Solitary in a mixed *C. sativa* and *A. cephalonica* forest, September [S2]. Relatively common in Greece in various broadleaved and mixed forests.
† *Ramaria flava* (Tourn. ex Battarra) Quél.
Solitary in a mixed *C. sativa* and *A. cephalonica* forest, May [S2]. Common in broad-leaved and coniferous forests of Greece.
† *Russula acrifolia* Romagn.
In small groups under chestnut trees in a mixed *C. sativa* and *A. cephalonica* forest, June [S1]. One previous record from Mt. Taygetos in *Pinus nigra* & *A. cephalonica* (Zervakis et al. 2002a).

Russula adulterina Fr.
In a mixed *C. sativa* and *A. cephalonica* forest, August to September [S2]. Recently reported to occur in Mt. Aroania (Achaia) and in Mt. Oxya (Fthiotida) in conifers (Delivorias & Gonou-Zagou 2000, Dimou et al. 2008).
*** *Russula alutacea*** (Fr.) Fr.
Solitary under chestnut trees in a mixed *C. sativa* and *A. cephalonica* forest, June [S1]. This taxon is a member of the subsection *Olivaceinae* Singer, which is characterised by the absence of incrustation in primordial hyphae, mild taste, vinaceous to purplish reaction with phenol and ochre-yellow spore-print (Singer 1986). Additionally, our specimens possess pilei with mixed vinaceous, yellow and olivaceous colours and spores 7–9 × 6–7 μm bluntly warty, with connections forming an incomplete reticulum.
Russula amethystina Quél.
In a mixed *C. sativa* and *A. cephalonica* forest, August [S2]. Two previous reports in conifer forests (Athanasiou & Theochari 2001, Zervakis et al. 2002a).
† *Russula aurea* Pers.
In a mixed *C. sativa* and *A. cephalonica* forest, August [S2]. Two previous records in Greece from Mt. Parnitha (Attiki) in *A. cephalonica* (Pantidou 1980) and from Kalloni (Grevena) in *Quercus* spp. (Constantinidis 2006).
*** *Russula azurea*** Bres.
Under chestnut trees in a mixed *C. sativa* and *A. cephalonica* forest, June [S2]. Basidiomata small-sized, pileus 4-5 cm with violaceous colours mixed with ochre and olivaceous, surface viscid when wet. Stipe 2.5–3.5 × 0.9–1.3 cm fragile. Taste mild. Pileipellis only with prominent incrusted primordial hyphae, spores broadly ellipsoid 8.0–9.5(10.2) × 6.5–7.6 μm (mean Q = 1.27), with low more or less isolated warts up to 0.7 μm long, rarely possessing few connections.
† *Russula chloroides* (Krombh.) Bres.
Gregarious in a mixed *C. sativa* and *A. cephalonica* forest, quite common in June and August [S2]. Expected to be quite common in Greece, although there are few previous records in *Quercus* spp. and one in *A. cephalonica* forests (Dimou et al. 2008).
† *Russula cyanoxantha* (Schaeff.) Fr.
In a mixed *C. sativa* and *A. cephalonica* forest, August [S2]. Common in Greece mostly in broad-leaved forests.
† *Russula foetens* (Pers.) Pers.
In groups in a mixed *C. sativa* and *A. cephalonica* forest, common in August [S2]. Previously reported in Greece from *Quercus* and *Fagus* forests.

Russula galochroa (Fr.) Fr.
Under chestnut trees in a mixed *C. sativa* and *A. cephalonica* forest, June [S1]. One previous record from a similar habitat in Mt. Oxya (Dimou et al. 2008)
Russula nigricans (Bull.) Fr.
Solitary under chestnut trees in a mixed *C. sativa* and *A. cephalonica* forest, June [S1]. Three previous reports from Attiki in *Pinus* (Maire & Politis 1940), from *C. sativa* (Diamandis and Perlerou 2001), and from Grevena and Kozani in *Quercus* sp. (Constantinidis 2006).
*** *Russula pseudoaeruginea*** (Romagn.) Kuyper & Vuure
In a mixed *C. sativa* and *A. cephalonica* forest, August [S2]. A member of the section *Griseinae* Schaef., which is characterised by the olivaceous-buff colours of pileus, long cylindrical and papillate dermatocystidia mixed with pointed "hairs" in the pileipellis (Sarnari 1998); spores were ovoid verrucose with few connections measuring 5.3–8.7 × 5.7–7.2 μm.
*** *Russula pungens*** Beardslee
Solitary but abundant in a mixed *C. sativa* and *A. cephalonica* forest, August [S2]. This taxon is characterised by the acrid taste, red colours, ochre spore-print and large septate and incrusted dermatocystidia up to 9 μm broad (Hansen & Knudsen 1992). Spores 6.8–9.0(10.5) × 6.0–7.6(9.8) μm with low warts partly connected.
Russula risigallina (Batsch.) Sacc.
In a mixed *C. sativa* and *A. cephalonica* forest, August [S2]. A member of the section *Lilaceinae* Melzer & Zvara. Basidiomata small sized, pilei 3.5–6.0 cm with pale yellowish-ochre to salmon colours, with dull surface, very fragile, spore-print ochre, taste mild. Pileipellis with incrusted primordial hyphae, dermatocystidia absent, spores 6.0–8.5(9.0) × 5.5–7.0(7.5) μm. Identification and nomenclature follows Sarnari (2005). Three previous records from Greece (Athanassiou & Theochari 2001; Konstantinidis 2002, 2006), the two most recent as *R. vitellina* from *C. sativa* habitats.
Russula rosea Pers.
Widespread in a mixed *C. sativa* and *A. cephalonica* forests, common in August [S2]. Common and widespread in Greece in broad-leaved and coniferous forests.
Russula virescens (Schaeff.) Fr.
In a mixed *C. sativa* and *A. cephalonica* forest, August [S2]. Relatively common, mainly in broad-leaved forests of Greece.
*** *R. vitellina*** (Pers.) Gray
Under *Castanea* in a mixed *C. sativa* and *A. cephalonica* forest, June [S1]. Basidiomata small-sized, pileus 4–5 cm with ochre-yellow or cream colours, surface viscid when wet, margin striate, stipe 4.0–5.0 × 1.0 cm, spore-print ochre, flesh relatively firm, taste mild. Pileipellis with incrusted, primordial

hyphae tapering and hairs with club-shaped end cells, spores broadly ellipsoid 7.0–8.5(9.1) × 5.5–7.2 µm (mean Q = 1.27) with isolated warts up to 1 µm long.

*** *Sarcodon glaucopus*** Maas Geest. & Nannf.

Solitary in a mixed *C. sativa* and *A. cephalonica* forest, August [S2]. Pileus diameter up to 14 cm, surface initially smooth to tomentose, soon areolate-scaly violaceous brown. Spores 5.0–6.6 × 4.0–5.0(5.3) µm tuberculate, often with double tubercules, clamps absent.

Sarcodon leucopus (Pers.) Maas Geest. & Nannf.

Solitary in a mixed *C. sativa* and *A. cephalonica sativa* forest, September [S2]. A few other reports from conifer forests in Greece.

† *Scleroderma citrinum* Pers.

Gregarious in a mixed *C. sativa* and *A. cephalonica* forest, August [S3]. Two previous records in *Quercus* (Diamandis 1992) and from Mt. Oxya (Fthiotida) in *Fagus* (Dimou et al. 2002).

Stropharia semiglobata (Batsch) Quél.

On cattle excrements and on manured soil, November [S3]. Common in Greece.

*** *Tomentella badia*** (Link) Stalpers

On the underside of a *C. sativa* trunk, May [S2]. This taxon belongs to the subgenus *Alytosporium* Link. due to the absence of hyphal chords (Kõljalg 1996). Basidiomata resupinate, grey-black with pruinose (mucedinate) surface. Microscopically characterised by the absence of cystidia and clamps, spores subglogose to irregular, triangular in side view, yellow-brown echinulate 8.5-12.0 µm with echinuli up to 1.5(2) µm.

*** *Tomentella fibrosa*** (Berk. & M.A. Curtis) Kõljalg

On the underside of a *C. sativa* trunk, May [S2]. Basidiomata rust coloured arachnoid with fimbriate margin and conspicuous dimitic hyphal chords. Clamps absent, cystidia like septate tramal hyphae projecting, spores 6.5–9.0 µm subglobose – lobed bi- or trifurcate in lateral view.

*** *Tubulicrinis sororius*** (Bourdot & Galzin) Oberw.

On the underside of a *C. sativa* trunk, May [S2]. Greyish, thin, resupinate basidiomata, without a delimited margin. Lyocystidia capitate 55–80 µm long 9–11 µm broad at apex, weakly amyloid with symmetrically thickened walls and a bi-rooted base. Spores allantoid 5.5–6.5 × 1.5–2.0 µm.

Xerocomus chrysenteron (Bull.) Quél.

Solitary, in a mixed *C. sativa* and *A. cephalonica* forest, September [S2]. Widespread and very common in Greece, reported from both broad-leaved and coniferous forests.

† *Xerocomus moravicus* (Vacek) Herink

Solitary in a mixed *C. sativa* and *A. cephalonica* forest, August [S1]. Easily recognizable species due to its ellipsoid and almost hyaline spores measuring

8–11(12) × 4.5–5.5 μm. One previous report from *Quercus* sp. forests (Constantinidis 2006).

Xerocomus subtomentosus (L.) Quél.

In a mixed *C. sativa* and *A. cephalonica* forest, August [S1]. Common in Greece in both broad-leaved and coniferous forests.

† ***Xerula pudens*** (Pers.) Singer

Under chestnut trees in a mixed *C. sativa* and *A. cephalonica* forest, September [S3]. Two previous reports from *Fagus* forests of Greece (Diamandis 1992, Dimou et al. 2002).

Very few data have been published so far on macrofungi associated with chestnut trees in Europe (Baptista et al. 2010, Diamandis & Perlerou 2001, Pantidou & Gonou 1984, Venturella et al. 2006). Although *C. sativa* forms extended stands in several Greek mountains, only 25 species recorded in the present inventory were also previously reported from such habitats in Greece. Furthermore, *Phylloporus rhodoxanthus*, a red-listed mushroom species in many European countries, as well as several others considered as rare (i.e. *Boletus rhodoxanthus*, *B. regius*, *Sarcodon glaucopus* and several *Hydnellum* spp.) were also recorded. This outlines the need of more extensive spatial and temporal studies on the diversity of macrofungi in poorly investigated areas of the Mediterranean region, in conjunction with the development of red-data lists based on more accurate information covering larger and more representative parts of the European continent.

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Literature cited

Antonín V, Noordeloos ME. 1993. A Monograph of *Marasmius*, *Collybia* and related genera in Europe, I. *Marasmius*, *Setulipes* and *Marasmiellus*. Libri Bot. 8, 229 p. IHV-Verlag. Eching.

Antonín V, Noordeloos ME. 1997. A Monograph of *Marasmius*, *Collybia* and related genera in Europe, II. *Collybia*, *Gymnopus*, *Rhodocollybia, Crinipellis*, *Chaetocalathus*, and additions to *Marasmiellus*. Libri Bot. 17, 256 p. IHV-Verlag. Eching.

Athanasiou Z, Theochari I. 2001. Compléments à l'inventaire des Basidiomycètes de Grèce. Mycotaxon 79: 401–415.

Baptista P, Martins A, Tavares RM, Lino-Neto T. 2010. Diversity and fruiting pattern of macrofungi associated with chestnut (*Castanea sativa*) in the Trás-os-Montes region (Northeast Portugal). Fungal Ecol. 3: 9–19. doi:10.1016/j.funeco.2009.06.002

Bas C, Kuyper TW, Noordeloos ME, Vellinga EC. (eds.) 1988–95. Flora Agaricina Neerlandica, vols 1-3. A.A. Balkema, Rotterdam.

Breitenbach J, Kränzlin F. 1984–2000. The Fungi of Switzerland, Vols 1–5. Mycologia Luzerne, Lucerne.

Constantinidis G. 2002. Mushrooms: A fabulous microcosm, 240 pp. Kapon, Athens [in Greek].

Constantinidis G. 2006. One thousand mushrooms of western Makedonia, 523 pp. "The Mushroom Friends Society of Western Makedonia", Kastoria [in Greek].

Delivorias P, Gonou-Zagou Z. 2000. A taxonomic study of macromycetes from the Aroania Mountains. In Proceedings of the 8th Scientific Congress of the Greek Botanical Society, pp. 139–142. Patra, Greece [in Greek].

Diamandis S. 1983. A contribution to the mycoflora of the Greek forest ecosystems. Dassiki Erevna 1: 59–66 [in Greek].

Diamandis S. 1992. The mushrooms of Greece, 591 p. Ion, Athens [in Greek].

Diamandis S, Minter DW. 1983. A contribution to the mycoflora of Greek fir (*Abies cephalonica* Loud.). Part II. Dassiki Erevna 4: 131–136 [in Greek].

Diamandis S, Perlerou C. 1990. New recordings of higher basidiomycetes and ascomycetes in Greece. Scientific Annals of the Dept. of Forestry & Natural Environment, Aristotelian University of Thessaloniki [in Greek].

Diamandis S, Perlerou C. 1994. New records of macrofungi in Greece. Ann. Mus. Goulandris 9: 113–123.

Diamandis S., Perlerou C. 2001. The mycoflora of the chestnut ecosystems in Greece. Forest Snow Landscape Res. 76: 499–504.

Dimou DM, Zervakis GI, Polemis E. 2002. Mycodiversity studies in selected ecosystems of Greece: I. Macrofungi from the southernmost *Fagus* forest in the Balkans (Oxya Mountain, central Greece). Mycotaxon 81: 177–207.

Dimou DM, Zervakis GI, Polemis E. 2008. Mycodiversity studies in selected ecosystems of Greece: 4. Macrofungi from *Abies cephalonica* forests and from other intermixed tree species (Oxya Mt., central Greece). Mycotaxon 104: 39–42.

Eriksson J, Hjortstam K, Ryvarden L. 1978–88. The Corticiaceae of North Europe, Vols 5–7. Fungiflora, Oslo.

Eriksson J, Ryvarden L. 1973–76. The Corticiaceae of North Europe, Vols 2–4. Fungiflora, Oslo.

Hansen L, Knudsen H. (eds.) 1992–2000. Nordic Macromycetes, Vol. 1–3. Nordsvamp, Copenhagen.

Hausknecht A. 2009. A monograph of the genera *Conocybe* Fayod and *Pholiotina* Fayod in Europe. Fungi Europaei 11. Edizioni Candusso, Alassio.

Heilmann-Clausen J, Verbeken A, Vesterholt J. 1998. The genus *Lactarius*. Fungi of Northern Europe, Vol. 2. Low Budget Publishing, Oddense.

Hjortstam K, Larsson, KH, Ryvarden L. 1987–88. The Corticiaceae of North Europe, Vols 1 & 8. Fungiflora, Oslo.

Jülich W. 1984. Die Nichtblätterpilze Gallertpilze und Bauchpilze. Gustav Fischer Verlag, Stuttgard.

Kõljalg U. 1996. *Tomentella* (Basidiomycota) and related genera in temperate Eurasia. Synopsis Fungorum, Vol. 9, 213 p. Fungiflora, Oslo.

Maire R, Politis J. 1940. Fungi Helleniki. Act. Inst. Bot. Univ. Athénes 1: 27–179.

Noordeloos ME, Kuyper TW, Vellinga EC (eds.). 2001. Flora Agaricina Neerlandica, Vol. 5, 170 p. A.A. Balkema Publishers, Lisse.

Noordeloos ME, Kuyper TH, Vellinga EC. (eds.). 2005. Flora Agaricina Neerlandica, Vol. 6, 227 p. Taylor & Francis Group, Boca Raton, London, New York, Singapore.

National Forest Survey 1992. Greek Forest Service, Ministry of Agriculture, Athens.

Pantidou M, Gonou ZN. 1984. Macrofungi in forests of *Castanea sativa* and *Fagus sylvatica* in Greece. Nova Hedwigia 39: 245–257.

Polemis E. (2010). Contribution to the knowledge of biodiversity of the Cyclades (central Aegean area): a study of Basidiomycetes (subphylum *Agaricomycotina*) in the islands Andros, Naxos and Amorgos. PhD Dissertation, 264 pp. University of Patras [in Greek].

Richardson MJ. 2008. Coprophilous fungi from the Greek Aegean islands. Mycol. Balc. 5: 23–32.

Romagnesi H. 1967. Les Russules d' Europe et d' Afrique du Nord, 998p. Edition Bordas, Paris.

Sarnari M. 1998-2005. Monografia illustrata del Genere *Russula* in Europa, Vols. I & II. Associazione Micologica Bresadola, Trento.

Singer R. 1986. The Agaricales in Modern Taxonomy, 4th edition, 981 p. + 88 plates. Koeltz Scientific Books, Koenigstein.

Venturella G, Saitta A, Pecorella E. 2006. Fungal biodiversity in chestnut woods of Sicily (southern Italy). Adv. Hort. Sci. 20: 16–20.

Zervakis GI, Dimou D, Polemis E, Karadelev M. 2002a. Mycodiversity studies in selected ecosystems of Greece: II. Macrofungi associated with conifers in Taygetos Mountain (Peloponnese). Mycotaxon 83: 97–126.

Zervakis GI, Polemis E, Dimou D. 2002b. Mycodiversity studies in selected ecosystems of Greece: III. Macrofungi recorded in *Quercus* forests in southern Peloponnese. Mycotaxon 84: 141–162.