

NEW RECORDS OF MACROFUNGI FROM TRABZON PROVINCE (TURKEY)

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Abstract. This study was based on three macromycete samples collected during field studies carried out to determine the macrofungal biodiversity of Of and Çamburnu districts of Trabzon province (Turkey). As a result of necessary investigations, *Pluteus variabilicolor* Babos (Pluteaceae), *Coprinopsis urticicola* (Berk. & Broome) Redhead, Vilgalys & Moncalvo (Psathyrellaceae) and *Chroogomphus confusus* Y.C. Li & Zhu L. Yang (Gomphidiaceae) were recorded from Turkey for the first time. Brief descriptions and photographs related to macro- and micromorphologies of the species are provided together with their localities, geographical positions, collection date and Genbank number related to genetic sequences.

Keywords: biodiversity, Basidiomycota, *Pluteus*, *Coprinopsis*, *Chroogomphus*

Introduction

Due to its excellent flora and climate (Dündar et al., 2016), Turkey is assumed to be very rich in naturally growing macrofungi, and currently comprises about 2,500 macrofungi species more than 85% of which belong to the phylum Basidiomycota (Kaya and Uzun, 2018). The Basidiomycota is a large fungal division with over 30,000 species. Most of the macrofungi such as agarics, bracket fungi, puffballs, earth stars, stinkhorns, boletes, etc., are included in this division. A great majority of the basidiomycota are terrestrial with wind-dispersed spores. Most of them are saprotrophic and are involved in litter and wood decay, but there are also pathogens of trees such as the honey fungus, *Armillaria*. Common woodland mushrooms grow in a mutually symbiotic relationship with the roots of trees, forming ectotrophic mycorrhiza. As saprotrophs, basidiomycetes play a vital role in recycling nutrients but they also cause severe damage as agents of timber decay. Basidiocarps of many mushrooms are edible, and some are grown commercially for food. It is also well known that the basidiocarps of certain mushrooms are poisonous (Webster and Weber, 2007).

During routine field studies in Trabzon province, some macromycete samples were collected and identified as *Pluteus variabilicolor* Babos, *Coprinopsis urticicola* (Berk. & Broome) Redhead, Vilgalys & Moncalvo and *Chroogomphus confusus* Y.C. Li & Zhu L. Yang. Tracing the current literature it is found that almost 2200 basidiomycete taxa have been reported from Turkey, 24, 18 and 2 of which belong to the genera *Pluteus*, *Coprinopsis* and *Chroogomphus* respectively (Sesli and Denchev, 2014; Kaya, 2015; Solak et al., 2015; Akata et al., 2016; Allı et al., 2017; Uzun et al., 2017). But the check-lists on mycobiota of Turkey and recently contributed data (Işık and Türkeku, 2017; Kaya et al., 2016; Keleş and Oruç, 2017; Kaya and Uzun, 2018; Sadullahoğlu and Demirel, 2018; Sesli, 2018; Uzun and Acar, 2018; Uzun and Kaya, 2018; Uzun et al., 2018) reveals *Pluteus variabilicolor*, *Coprinopsis urticicola* and *Chroogomphus confusus* have not been previously reported from Turkey. The study aims to make a contribution to the mycobiota of Turkey by adding new records.

Materials and methods

Macrofungi sampling

Macrofungi samples were collected from Of and Çamburnu districts of Trabzon province in 2012 and 2014 (*Figure 1*). Trabzon province has surface area of 4664 km² and located in eastern Black Sea Region of Turkey, where the annual average temperature is 14.7°C and the average precipitation is 819.6 mm. During field studies, required ecological and morphological characteristic of the samples were noted and they were photographed in their natural habitats. Then the samples were taken to the fungarium. Microscopic investigations were carried out under a Leica DM500 light microscope. Morphological identification of the specimens were carried out with the help of Gierczyk et al. (2014), Li et al. (2009), Migliozi (2011), Desjardin et al. (2015) and Breitenbach and Kränzlin (1991). Using molecular methods, ITS region was investigated to conform the morphological identification. The samples are kept at the fungarium of Van Yüzüncü Yıl University in Van (VANF).

Molecular studies

Total DNA was extracted from dry fungarium materials using a EurX GeneMATRIX Plant & Fungi DNA isolation kit (Poland). The internal transcribed spacer (ITS) regions, including the 5.8S nrDNA were amplified by the polymerase chain reaction (PCR) with the primer pair ITS1-F/ITS4 (White et al., 1990; Gardes and Bruns, 1993). The primer sequences used are given below;

- **ITS1-F** 5' TCCGTAGGTGAACCTGCGG 3'
- **ITS4** 5' TCCTCCGCTTATTGATATGC 3'

The amplification conditions were set as follows: denaturation at 95°C for 5 min, 35 cycles of 45 s at 95°C, 45 s min at 52°C, 60 s at 72°C, and a final extension of 5 min at 72°C. The PCR products were purified using the ExoSAP-IT™ PCR Product Cleanup Reagent and sequenced with an ABI 3730XL DNA analyzer (Applied Biosystems, Foster City, CA) and an BigDye Terminator v3.1 Cycle terminator cycle sequencing kit (Applied Biosystems, Foster City, CA). Consensus sequences were assembled using in BioEdit software, CAP contig.



Figure 1. Species collection locations

Results

Descriptions, photographs of fruiting bodies and images of microcharacters are provided. The taxonomy of the taxa are in accordance with Kirk et al. (2008).

Pluteus variabilicolor Babos

Macroscopic and microscopic features

Pileus 3-6 cm wide, surface smooth and streaked up to half, yellow and central umbo. Lamellae free, rather dense, creamy white. Stipe 2.5-6 × 0.4-0.7 cm, surface smooth, cylindrical, slightly enlarged at the base, striatum length, whitish yellow. Basidia 20-28 × 5.8-8 µm, clavate, 4-spores. Spores 5.4-7.0 × 4.5-5.6 µm, ellipsoid, subglobose, thin-walled. Cheilocystidia 40-48 × 12-15 µm, hyaline, thin-walled, short. Pleurocystidia 65-120 × 19-35 µm (Figure 2).

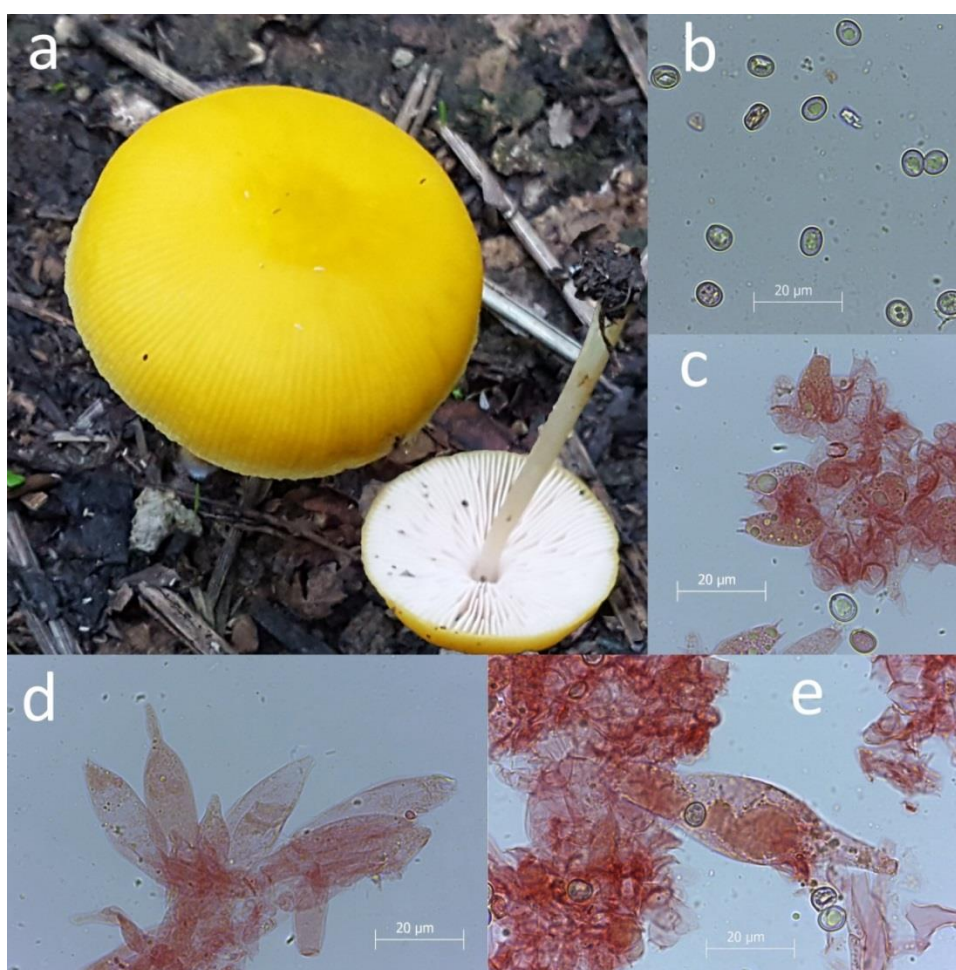


Figure 2. *Pluteus variabilicolor* a) Basidiocarp b) spores c) basidia d) Cheilocystidia e) Pleurocystidia

Specimen examined

Turkey - Trabzon, Of, Ballica neighborhood, under *Corylus* sp. trees, 40°52'845"N, 40°16'849"E, 86 m. 27.08.2015, AK. 2963, Genbank number MH 724931.

***Coprinopsis urticicola* (Berk. & Broome) Redhead, Vilgalys & Moncalvo**

Syn: *Agaricus urticicola* Berk. & Broome, *Coprinopsis urticicola* var. *hawaiiensis* Keirle, Hemmes & Desjardin, *C. urticicola* var. *salicicola* (Ulje & Noordel.) Walley, Verbeken, Kerckh., Keersm., Christiaens, Esprit, Leyman & Van de Kerckh., *C. urticicola* var. *salicicola* (Ulje & Noordel.) Noordel., *C. urticicola* (Berk. & Broome) Redhead, Vilgalys & Moncalvo, *Coprinus brassicae* Peck, *C. urticicola* (Berk. & Broome) Buller, *C. urticicola* var. *salicicola* Ulje & Noordel., *C. urticicola* var. *urticicola* (Berk. & Broome) Buller, *Pilosace urticicola* (Berk. & Broome) Kuntze, *Psathyra urticicola* (Berk. & Broome) Sacc.

Macroscopic and microscopic features

Pileus 0.4-0.8 × 0.2-0.4 cm, ellipsoid when young, then ellipsoid or egg-shaped, pure white. Flesh broken up into small white. Lamellae free, initially white, then greyish-brown and eventually black. Stipe 2-4 × 0.5-0.1 cm, cylindrical, surface smooth, white, slightly clavate base. Basidia 17-26 × 6-9.5 µm, 4-spored. Spores 5.5-8.7 × 4.7-6.2 µm, ellipsoid, pale brown, usually carries a wide germ pore on the base. Cheilocystidia 40-70 × 12-18 µm, globose and ellipsoid. Pleurocystidia 45-80 × 17-30 µm, cylindrical, narrowly conical (Figure 3).

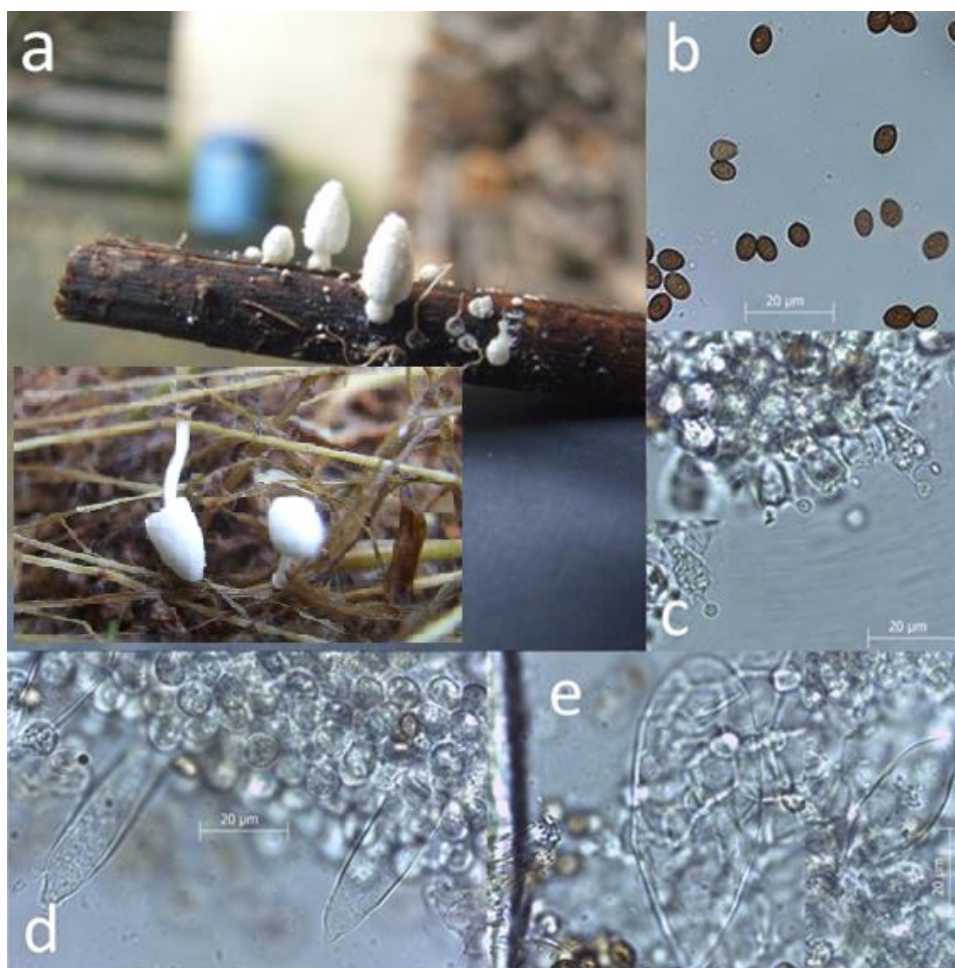


Figure 3. *Coprinopsis urticicola* a) Basidiocarp b) spores c) basidia d) Cheilocystidia e) Pleurocystidia

Specimen examined

Trabzon, Of, Ballica neighborhood, on *Urtica* sp. remains, 40°52'492"N, 40°16'474"E, 121 m 31.07.2012, AK. 2044, Genbank number MH 748639.

***Chroogomphus confusus* Y.C. Li & Zhu L. Yang**

Macroscopic and microscopic features

Pileus 4-8 cm wide, convex, surface smooth and bright, hairless, grayish brown or reddish brown. Lamellae decurrent, greyish orange. Stipe 5-10 × 1-2 cm, subcylindric, yellowish to pale orange. Basidia 38-60 × 9-18 µm, 4-spored. Spores 14-21.6 × 6-7.5 µm, smooth, ellipsoid, dextrinoid and dark gray. Cystidia 110-160 × 18-22 µm, subclavate (*Figure 4*).



Figure 4. *Chroogomphus confusus* a) Basidiocarp b) spores c) basidia d) Cheilocystidia

Specimen examined

Turkey – Trabzon, Çamburnu, around Maritime Faculty, under pine trees, 40°55'390"N, 40°12'596"E, 16m. 29.10.2014, AK. 2871, Genbank number MH 724933.

Discussion

With this study three Basidiomycete taxa, *Pluteus variabilicolor*, *Coprinopsis urticicola* and *Chroogomphus confusus* were reported from Turkey for the first time. General characteristics of all the three taxa are in agreement with those given in literature.

Pluteus variabilicolor was erected by Babos (1978) from Hungary. It is generally characterised by yellowish orange pileus colour when young which turns to light yellow later on. It differs from many other *Pluteus* species by having dimorphic pileipellis and caulocystidial elements (Lezzi et al., 2014). Macro and micromorphological characteristics of *P.* was compared with similar *Pluteus* species in Table 1.

Table 1. Comparison of *Pluteus variabilicolor* with similar *Pluteus* species (Vizzini and Ercole, 2011; Kuo, 2015)

Species	<i>P. variabilicolor</i>	<i>P. aurantiorugosus</i>	<i>P. leoninus</i>
Habitat	under <i>Corulus</i> sp. trees	on decaying hardwood	on decaying hardwood
Pileus	3-6 cm	2-5 cm	3-5 cm
Pileus color	lemon yellowish	bright scarlet to orange when young, fading to orangish yellow in age	Gold-yellow with abrown-yellow center
Stipe	2.5-6 × 0.4-0.7 cm	1.5-4 × 0.2-0.4 cm	4-5(9) × 0.2-0.5 cm
Basidia	20-28 × 5.8-8.3 µm	25-30 × 6-8 µm	20-37 × 7.5-10 µm
Spores	5.4-7 × 4.5-5.6 µm	5.5-8 × 4-5 µm	5.5-7 × 5-6 µm
Cheilocystidia	40-48 × 12-15 µm	35-45 × 12.5-22.5 µm	65 × 12 µm
Pleurocystidia	65-120 × 19-35 µm	40-55(60) × 20-23 µm	100 × 28 µm

Coprinopsis urticicola is characterized by its habitat on rotting stems of herbs as well as on fine branchlets, the small fruiting bodies, the branched velar hyphae, and the primarily elliptical spores < 9 µm long (Breitenbach and Kränzlin, 1991). *Coprinopsis urticicola* was compared with morphologically similar species in the following Table 2.

Table 2. Comparison of *Coprinopsis urticicola* with closer *Coprinopsis* species (Gierczyk et al., 2011; Amandeep et al., 2012)

Species	<i>C. urticicola</i>	<i>C. vermiculifer</i>	<i>C. gonophylla</i>
Habitat	on herbs remnants	on burnt places or bare, clayey soil	on the sandy and stony meadow
Pileus size	0.4-0.8 × 0.2-0.4 cm	1.4-1.7 cm	up to 0.3 cm
Pileus color	pure white	brownish gray, pileal scales grayish white	Veil white, breaking into patches
Stipe	2-4 × 0.5-0.1 cm	2.5-2.8 cm	6 × 0.1-0.3 cm
Basidia	17-27 × 5.5-10 µm	17-22 × 12-13.6 µm	15-30 × 7-9 µm
Spores	5.6-8.7 × 4.7-6.2 µm	(9.3)10-13.6 × (6.8)7.6-9.3 µm	7.0-8.5 × 6.5-8.0 × 5.5-6.0 µm
Cheilocystidia	40-70 × 12-18 µm	39-59.5 × 27-35.7 µm	40-85 × 25-45 µm
Pleurocystidia	45-80 × 17-30 µm	34-85 × 25.4-37.4 µm	50-120 × 40-20 µm

Chroogomphus confusus has a brownish orange to orange pileus, a nonamyloid pileipellis and reduced amyloidity in the pileal trama (Li et al., 2009). *Chroogomphus confusus* was compared with morphologically similar species in the following Table 3.

Table 3. Comparison of *Chroogomphus confusus* with closer *Chroogomphus* species (Li et al., 2009; Martin et al., 2016; Razaq et al., 2016)

Species	<i>C. confusus</i>	<i>C. mediterraneus</i>	<i>C. rutilus</i>
Habibat	under pine trees	growing under <i>Pinus halepensis</i>	in mixed forests
Pileus size	4-8 cm	2.5-7 (8) cm	2-8 (10) cm
Pileus color	grayish brown or reddish brown	grayish, cream-orange, vinaceous to dingy vinaceous brown	grayish, vinaceous to dingy vinaceous brown
Stipe	5-10 × 1-2 cm	6-10 × 1-2 cm	5-8 (12) × 0.5-1.5 cm
Basidia	38-60 × 9-18 µm	50-60 × 10- 15 µm	40-50 × 12-14 µm
Spores	14-21.6 × 6-7.5 µm	(15.5)16-19(21) × (5.5)6-7.5(8) µm	16.5-19(21) × (5.5)6-8 µm
Cheilocystidia	110-160 × 18-22 µm	(90) 100-175 × 17-21 µm	118-170 × 16-23 µm
Pleurocystidia		(90) 100-175 × 17-21 µm	118-170 × 16-23 µm

Conclusion

Pluteus variabilicolor, *Coprinopsis urticicola* and *Chroogomphus confusus* were given as new records from Turkey, increasing the current taxa numbers of the genera *Pluteus*, *Coprinopsis* and *Chroogomphus*, in Turkey, to 24, 25 and 2 respectively. The current determined taxa number and the current plant biodiversity of Turkey indicate that, macrofungal biodiversity studies should be handled with top priority.

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