Plant Archives Vol. 19 No. 2, 2019 pp. 4067-4072 **e-ISSN:2581-6063 (online), ISSN:0972-5210**

FIVE NEW TAXA RECORDS FOR THE MACROMYCOTA OF IRAQ FROM SULIAMANIYA AND TIKRIT PROVINCES (IRAQ)

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Abstract

Five macrofungal taxa, *Cheilymenia fimicola, Helvella leucomelaena* (Ascomycota), *Rhizopogon luteolus*, *Phaeolus schweinitzii* and *Schizophyllum amplum* (Basidiomycota) collected from Suliamaniya and Tikrit provinces, are reported as new records for the macromycota of Iraq. Macro and microscopic descriptions, habitat, distribution and remarks on the species are provided.

Key words : Macromycota, Ascomycota, Basidiomycota, Sulaimaniya, Tikrit, Iraq.

Introduction

Suliamaniya is a province in the eastern north of Iraq (elevation 882m, 35° 332 263 N, 45° 262 83 E), on the Iraqi- Iranian borders, 385 Km north Baghdad. It is surrounded by Azmar, Goyija and Qaiwan Ranges in the northeast, Tasluja Hills in the west and Baranan Mountain in the south. Suliamaniya province is characterized by its semi- arid climate with hot dry summer and cool rainy winter. Rainfall is limited to the winter months. This province is rich in vegetation cover, including tree species (like *Acer* sp., *Juniper* sp., *Juglans* sp., *Pine* spp., *Pistacia* sp., *Populus* sp. and *Quercus* spp.) with different species of shrubs and herbs. Tikrit province (elevation 137m, $34^0$362 363 N$43^0$402 483) is located on the Tigris River, 140Km northwest of Baghdad, and the capital of Iraq. It is one of the most rural parts of Salahadin Governorate (north- central Iraq) with 22.1^{0}C average annual temperature and 182mm average rainfall. Tikrit is rich in vegetation, comprising tree species (like *Salix* sp., *Populus* spp., *Pinus* spp. and several fruit tree species) and different shrubs and herbs.

Macrofungi are those fungi that produce epigeous or hypogeous fruiting bodies large enough to be seen by the naked eye (Mueller *et al.,* 2007; Devi & Shrivastava, 2016). Macrofungi belong to Basidiomycota, Ascomycota or Zycomycota (Mueller *et al.,* 2007) and are represented by 41,000 species in the world (Priyamvada *et al.,* 2017). Ecologically these fungi are either saprotrophic, mutualistic or parasitic (Mueller *et al.,* 2007). Economically, macrofungi are important due to their role in food, medicine, industry and biocontrol (De Silva *et al.,* 2013; Zotti *et al.,* 2013; Mandal, 2019). Despite their ecological and economic significance, macrofungal diversity in Iraq (including Sulaimaniya and Tikrit provinces) are poorly explored though this country is rich in vegetation which expected to harbor a wide variety of macrofungal species (Al-Khesraji *et al.,* 2017; 2018). This study reports five macrofungal species as new records for the macromycota of Iraq from Suliamaniya and Tikrit provinces.

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Materials and Methods

Macrofungi specimens were collected from different localities in Suliamaniya and Tikrit provinces during March-May 2018. Habit and habitat were recorded. Macrofungal specimens were photographed in their natural habitats and in the laboratory. Macroscopic and microscopic features were reported. Distilled water, 5%KOH and Melzer s reagent were used for light microscopy. Macrofungal specimens were identified according to relevant literature, keys and field guides (Baseia and Milanez, 2002; Karadelev *et al.,* 2009; Akata, 2010; Hagle and Filip, 2010; Trappe, 2011; Cooper, 2012; Akata *et al.,* 2012; Asef, 2013; Pala *et al.,* 2013; Beug *et al.,* 2014; Desjardin *et al.,* 2015; Kuo, 2016; O'Reilly, 2016; Li *et al.,* 2016; Skrede *et al.,* 2017). All identified specimens were preserved in the Department of Biology, College of Education for Pure Sciences, Tikrit University,

Iraq.

Results and Discussion

In this study, *Cheilymenia fimicola, Helvella* leucomelaena (Ascomycota), *Rhizopogon luteolus*, *Phaeolus schweinitzii* and *Schizophyllum amplum* (Basidiomycota) are reported as new records for Iraq. Macro and microscopic descriptions, distribution, photos and remarks on the species are provided. The species are listed in alphabetical order.

Ascomycota

Pyronemataceae

Cheilymenia fimicola Bagl.

Macroscopic features: Fruiting body 2-4mm across, sessile, cup-shaped when young, becoming flate or saucer-shaped at age, margin with thick-walled bristle-like septate hairs; inner surface (hymenium) concave to plane, yellow to yellowish-orange, glabrous; outer surface lighter than the hymenium with scattered hairs. Microscopic features: Asci 175-200 × 12.5-18µm, cylindrical, 8-spored, inamyloid, uniseriate; spores 15-18 × 10-12.5µm, ellipsoidal, smooth, eguttulate ; paraphyses cylindrical with tip enlarged to 7.5µm, containing brown granules. Habit and habitat: solitary, gregarious on animal manure (Fig. 1); March-May; Alalam and Almuhzam (Tikrit province). In Iraq, the genus *Cheilymenia* is represented only by *C. theleboloides* which was previously reported by Al-anbagi (2014). Thus *C. fimicola* is reported here as new record for the macromycota of Iraq. *C. fimicola* is a cosmopolitan coprophilic fungus and is known from different countries like Turkey (Sesli and Denchev, 2008, Akata *et al.,* 2012), India (Pednekar *et al.,* 2016), Morocco (Nmichi *et al.,* 2017), Britain and other European countries (O'Reilly, 2016). Similar species include *C. sterocorea* and *Scutellinia scutellata*. *C. fimicola* has one type of hairs (straight, septate, tapered and branched at the base) while *C. sterocorea* has two types of hairs, one similar to those of *C. fimicola* and the second is shorter and stellate – branched at the base of the apothecia (Doveri, 2004; Moravec, 2005). *C. theleboloides* is different from *C. fimicola* in some aspects, such as the size of apothecium (1-10mm in diameter), few scattered hairs and growth in waste soil (Al-anbagi, 2014). In contrast to *C. fimicola* (develops on dung with smooth, eguttulate spores), *S. scutellata* occurrs on rotting woods and ascospores with a rough exterior and several guttules (Kuo, 2009; Gamundi, 2010; Beug *et al*., 2014).

Helvellaceae

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

Macroscopic features: Fruiting body 1-5cm in diameter, sessile to substipitate 1.5-4cm high, deeply cup-shaped, at maturity the margin sometimes expanding with irregular lobes; hymenium grey-brown to black, smooth; external surface greyish brown above, whitish at the base; stipe if present very short with whitish blunt ribs. Microscopic features: 250- 300 × 12.5-15µm, cylindrical, 8-spored, uniseriate, inamyloid; ascospores18-25 × 11-13µm, smooth, ellipsoid, thin- walled, with single oil droplet at age; paraphyses clavate, pale brown. Habit and habitat: solitary to gregarious on soil, under the pine trees (Fig.2). February-March; Hawarishar Park and Azmir mountain (Suliamaniya province). Here is the first report of *H. leucomelaena* from Iraq. This species was found in Turkey (Sesli and Denchev, 2008), Iran (Asef, 2013), Morocco (ElAkil *et al.,* 2014), Argentina and European countries like Britain, Italy, France, Germany, Macedonia (Dissing, 1966; Karadelev *et al.,* 2009). All *Helvella* species are recently considered poisonous fungi (Dupuy, 2008). However, *H. leucomelaena* is added to the five *Helvella* species previously reported from Iraq by Al-Khesraji (2016).

Basidiomycota

Rhizopogonaceae

***Rhizopogon luteolus* Fr. and Nordholm**

Macro and microscopic features: Basidiomata 4cm in diameter, globose to subglobose, sessile, attached to the soil by mycelial threads ; outer surface brownish - yellow, gleba white to olive brown; basidiospores 5-10 × 2.5- 3µm, ellipsoid, smooth, containing two oil droplets. Habit and habitat: solitary under pine trees, in association with *H. leucomelaena* (Fig. 3); February-March; Hawarishar park and Azmir mountain (Suliamaniya province), locally, edibility unknown. This is the first record of *R. luteolus* from Iraq. This species is ectomycorrhizal with pine trees (Baseia and Milanez, 2002; O'Reilly, 2016). *R. luteolus* was reported from Turkey (Sesli and Denchev, 2008), Iran (Saber, 1997), Congo (Ducousso *et al.,* 2012), Brazil (Baseia and Milanez, 2002) China (Li *et al.,* 2016), Croatia (Tkalcec *et al.,* 2005), Finland (Haeggstrom, 1997), Macedonia (Karadelev *et al.,* 2018) and several other countries like Italy (Zotti *et al.,* 2010), USA, UK and Australia (Baseia and Milanez, 2002).

Phomitopsidaceae

***Phaeolus schweinitzii* (Fr.) Pat.**

Macroscopic features: Fruiting body usually develops one to several circular to irregular lobed caps 5- 25cm wide, upper surface velvety in texture when young, bald in age, colors variable, ochre to orange, greenish-brown or reddish-brown with a yellow margin when young, dark brown to rusty brown in age with concentric zones. Stipe if present very short. Pore surface: yellow or orange when

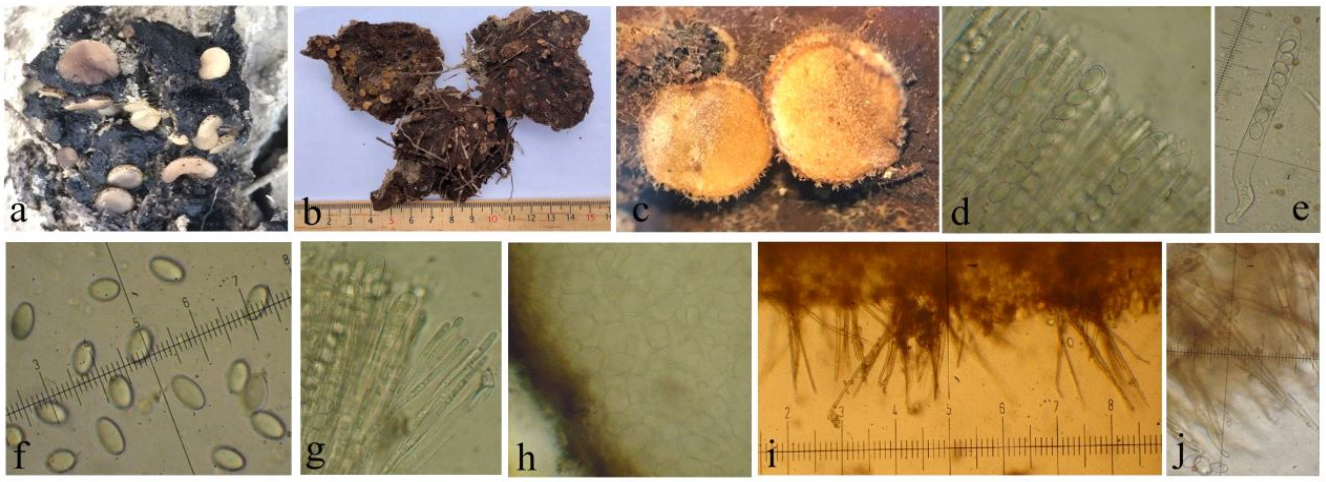

Fig.1: *C. fimicola* .a, in natural habitat; b, c, in lab.; d, asci; e, ascus; f, spores; g, paraphyses; h, ectal excipulum; i, j, hairs.

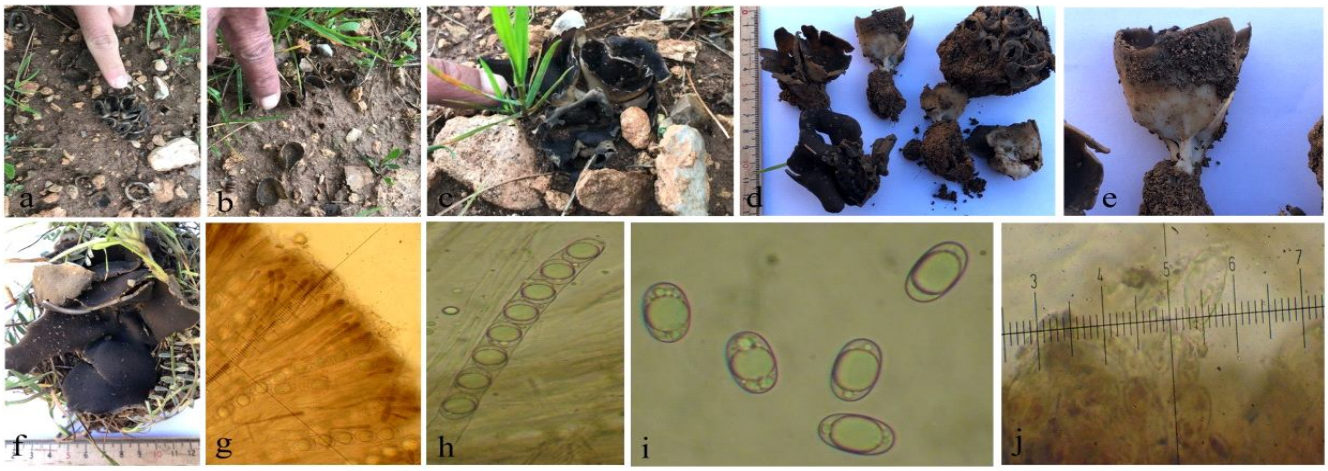

Fig. 2: *H. leucomelaena*. a-c, in natural habitat; d-f, in lab.; g, asci&paraphyses; h, ascus; i, spores; j, ectal excipulum.

Fig. 3: *R. luteolus*. a, in natural habita; b, c, in lab.; d, spores.

young, greenish-brown, yellowish-brown to rusty brown in age; pores angular 1-3pores/mm. Cap surface and flesh stained black with KOH. Microscopic features: Basidium 20-25 × 8-10µm, 4-spored, spores 5-8 × 3-5µm, and smooth, ellipsoidal, with oil droplets. Habit and habitat: solitary or overlapping caps, parasitic on the roots and trunks of living pine trees and saprobic on deadwood, causing brown rot (Fig. 4). March-June. ALalam (Tikrit province), locally, edibility unknown. This is the first report of *P. schweinitzii* from Iraq. *P. schweinitzii* was found in Turkey (Sesli and Denchev, 2008), Finland (Erkkila and Niemela, 1986), Spain (Duenas *et al.,* 2009), USA (Kuo, 2016), UK (O'Reilly, 2016), China (Dai *et al.,* 2004) and Macedonia (Karadelev *et al.,* 2018). Large fruiting

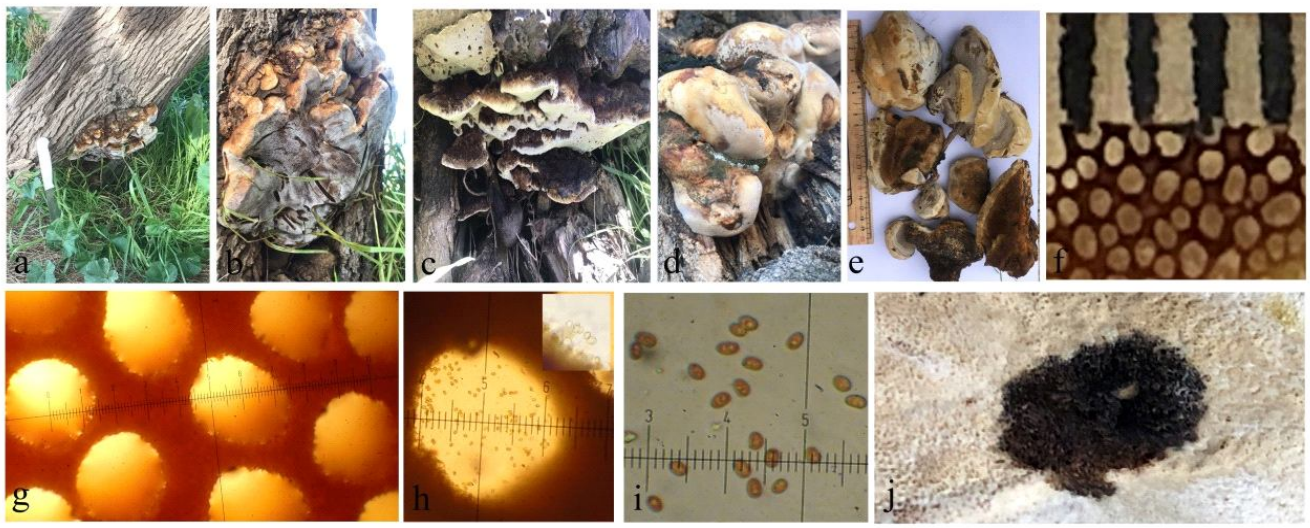

Fig. 4: *P. schweinitzii* . a-d, in natural habitat; e-h, pores, note spores inside the tube in h; i, spores; j, KOH black on cap surface.

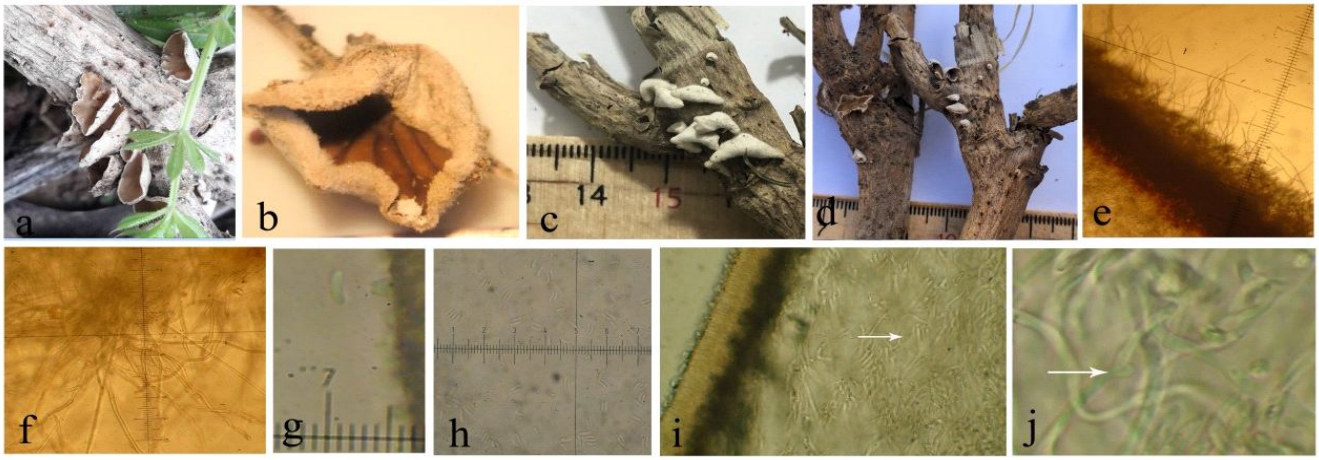

Fig. 5: *S. amplum* . a, b, in natural habitat; c, d, in lab; e, f, hairs from lower surface; g, basidium; h, spores; I, j, hyphae in context (note clamp-connection/ arrow).

body, greenish-yellow pore surface and growth in overlapping caps are the main features distinguishing *P. schweinitzii* from the similar species *Inonotus tomentosus*. *P. schweinitzii*, known as dyers polypore or dyers mazegill, is an important natural source of yellow, brown or orange dye used in dyeing fibres of the fabrics (O'Reilly, 2016).

Schizophyllaceae

***Schizophyllum amplum* (Lev.) Nakasone**

Microscopic features: fruiting body up to 1cm broad, sessile, rounded to the cup-shaped, upper surface (the hymenium) smooth with some veins, brown to orange-brown, lower surface, velvety, white. Microscopic features: Basidia 20-25 × 5-6µm, 4-spored, spores' 8-12 × 2.5-3.75µm, cylindrical, somewhat arched, clamp connections present. Habit and habitat: singly or gregarious on dead branches (fallen or still- attached) of *Populus* sp. and *Salix* sp. (Fig.5). All year; Tikrit University campus, Alalam, Almuhzam and Albotoama (Tikrit province). Here is the first report of *S. amplum* from Iraq. *S. amplum* was reported from Serbia (Vukojevic *et al.,* 2016), UK (Overall, 2009), Turkey (Akata *et al.,* 2010), Okraine (Ordynets *et al.,* 2013), Macedonia (Karadelev *et al.,* 2018), also reported from Iran, USA, New Zealand, Canada, France, Russia, Australia, Spain, Romania, Austria, Germany, Hungary, Denmark and Yugoslavia (Nakasone, 1996). Morphological studies demonstrated similarities (habit,habitat, pileal surface, dimitic hyphal system, shape and size of basidia, and ellipsoid spores) between *Schizophyllum* and *Auriculariopsis* and similarly, molecular data supporting both the close relationship between the two taxa and the synonymy of *Auriculariopsis* under *Schizophyllum* (Nakasone, 1996).

Conclusion

During this study, five macrofungal species were

reported as new records for the macromycota of Iraq from Suliamaniya and Tikrit provinces. Vegetation richness provides different habitats for the occurrence of a wide diversity of macrofungi in the study area. This group of fungi play a significant role in both natural and agro-ecosystems, medicine, industry and human nutrition. Therefore, further studies on these fungi are very essential for their documentation and conservation and for producing a checklist of macrofungi in Iraq.

Conflict of interest statement

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

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