



FIRST RECORD OF THREE MYCOFUNGAL BASIDIOMYCOTA FROM IRAQ

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Abstract

The present study reports four fungal taxa, *Agrocybe pediades*, *Panaeolus guttulatus*, *Conocybe watlingii* and *Panaeolus guttulatus*, three of them, *A. pediades*, *C. watlingii*, *P. guttulatus* (Bolbitiaceae / Basidiomycota) were reported for the first time from Iraq, which were collected from Tikrit district, Salahadin Governorate (North Central of Iraq). As for the fourth taxa, *Panaeolus guttulatus* (Psathyrellaceae / Basidiomycota), it was collected from Baghdad district, capital of Iraq (Central of Iraq) and was reported for the first time from it.

Key words: Macrofungi, Agaricales, Bolbitiaceae, Basidiomycota, Tikrit, Baghdad.

Introduction

Macrofungi (or macromycetes) are fungi that produce fruiting bodies visible to the naked eye (Mueller *et al.*, 2007; Kirk *et al.*, 2008). Macrofungi are Basidiomycota or Ascomycota and most of them are saprotrophic or mutualistic (mycorrhizal) but some are plant pathogens (Mueller *et al.*, 2007; Devi and Shrivastava, 2016). Macrofungi play important roles in ecosystems including nutrient cycles and wood decomposition (Zotti *et al.*, 2013) as well as its nutritional and medicinal properties (Hilszczańska, 2012) and many other benefits (Redhead, 1997; De Silva *et al.*, 2013). Out of 1.5 million species of fungi estimated in the world, only 21,679 macrofungal species (that is, 1.5% of all known fungal species) have been described (Mueller *et al.*, 2007).

Tikrit is a district in Iraq (34° 36' 36" N, 43° 40' 48" E), located 140 kilometres northwest of Baghdad, the capital of Iraq (33° 20' 0" N, 44° 23' 0" E), on the Tigris River. It is the managerial center of the Saladin Governorate. The geography of Tikrit district is a desert plains with Himreen mountain to the East. The climati is hot – dry type with very hot Summer months temperatures reaching 45° C and 20% RH. Winter months are very cold and reaching 5° C with RH about 70 %. Rian is scares and limited to few Winter moths. Tikrit district have a limited variety of wild vegetation that grows on

few months depending on the rainy seasons, and also some wild shrubs and herbs that grow at the river banks including (Ex: *Populus* spp., *Ziziphus* sp., *Eucalyptus* spp.). The agriculture is rich with variety of crops and fruit trees species including (*Citrus* spp. and several flowering tree species) with different species of shrubs and herbs. These plants provide diverse habitats that sustain different macrofungal species in the district.

Despite its biogeographic significance, information on macrofungi from the district is very limited (Al – Khesrajii *et al.*, 2017). In the last few years, the progress of recording and describing macrofungi species in Iraq is evident, especially in northern Iraq (Al-Qaissi, 2014; Al-Khesrajii, 2016; Suliaman *et al.*, 2017; Al-Khesrajii, 2018) and in the western Iraq (Muslat and Owaid, 2015). However, many areas of the country with a great biodiversity remain unexplored and their mycota is unknown, such as the central region of Iraq.

The purpose of the present study is to contribute to the knowledge of Iraq mycota by adding new fungal records.

Materials and Methods

Macrofungi samples were collected from different localities from Tikrit district, Central North of Iraq, and Baghdad district, Central Iraq, during December to April

2018. Habit and habitat of the samples with season of fruiting body appearance were recorded and samples were photographed in their natural habitats. Macroscopic features (including features such as cap size, shape, color and surface texture; gills color, attachment to stipe (if present); stipe size, color and surface texture) and microscopic features (including characters like basidia size and their spore number, spore shape, size and color and presence or absence of cystidia and their shapes and types) of macrofungi were reported. Macrofungi were identified according to literatures, keys and monographs (Hausknecht, 1996; Kuo, 2006; 2011; Dogan *et al.*, 2012). All samples were deposited in Biology Department, College of Sciences, Tikrit University.

Results and Discussion

During field research in Tikrit and Baghdad districts four Basidiomycetous macrofungi were collected and identified as *Agrocybe pediades*, *Conocybe watlingii*, *Panaeolus guttulatus* and *Panaeolus guttulatus* belong to one Division, one class, one order and two family. Description, distribution, and edibility of the reported taxa are given below :

Kingdom: Mycetazae

Phylum : Basidiomycota

Class : Agaricomycetes

Order : Agaricales

Family : Bolbitiaceae

Species : *Agrocybe pediades*(Fr.) Fayod (Fig. 1).

Macroscopic features : Cap 0.3 – 12 mm broad, convex, broadly convex, flat; tawny to pale brown with whitish scales in the inward curve margin, dry; Gills : attached to the stipe, brown, dark brown at age; Stipe 20 – 55 mm long, 1 – 2 mm thick, such as cap color, cylindrical, covered with scales, equal, grooved, dry, striate, solid,

central with bulbous base, ring and volva absent.

Microscopic features: Basidium 4 – spored; Spores $10 - 15 \times 5 - 10 \mu\text{m}$, elliptical with apical germ pore and nipple, smooth, brown, truncate; Cystidia $25 - 30 \times 5 - 10 \mu\text{m}$, lageni form to ventricose with rounded tips, hyaline. Habit and habitat : Solitary, scattered in garden between grasses, unknown edibility, Tikrit city/Salahadin Governorate, March – April. Here is the first detailed reported on *A. pediades* from Iraq. This fungus was found in Turkey (Sesli and Denchev, 2012), North America (Kuo, 2006), United Kingdom (Overall, 2009), Italy (Doveri, 2010) finally from Central and South America (Coimbra, 2015).

Macroscopic features: Cap 5–10 mm broad, oval, campanulate, umbonate, pale brown, covered with white scales, hygrophanous; Gills : Pale brown, adnate; stipe 25mm long, 4-5mm thick, cylindrical, smooth, grooved, dry, fragile, hollow, ring and volva absent.

Microscopic features: Basidium 4-spores, $25 \times 10 \mu\text{m}$; spores $8 - 12.5 \times 5 - 7.5 \mu\text{m}$, elliptical with broad apical germ pore, smooth, thick walled, brown; Cheilocystidia: Hyaline, lecythiform. Habit and habitat : Solitary in garden between grasses, unknown edibility, Tikrit city / Salahadin Governorate, March – April. Here is the first detailed reported on *C. watlingii* from Iraq. Reports on this fungal species are not available from countries bordering Iraq. This fungus was reported in Europe like Britain and Ireland (Hausknecht, 1996; Legon and Henrici, 2005). There is a paucity of resources available about this fungal species and its description.

Species : *Panaeolus guttulatus* Bres. (Fig. 3)

Macroscopic features : Cap 10 mm broad, convex, dark olive brown with persistent white scales, hygrophanous, regular margin; Gills : black, adnate; stipe 40 mm long, 2 mm thick, cylindrical, smooth, hollow, ring

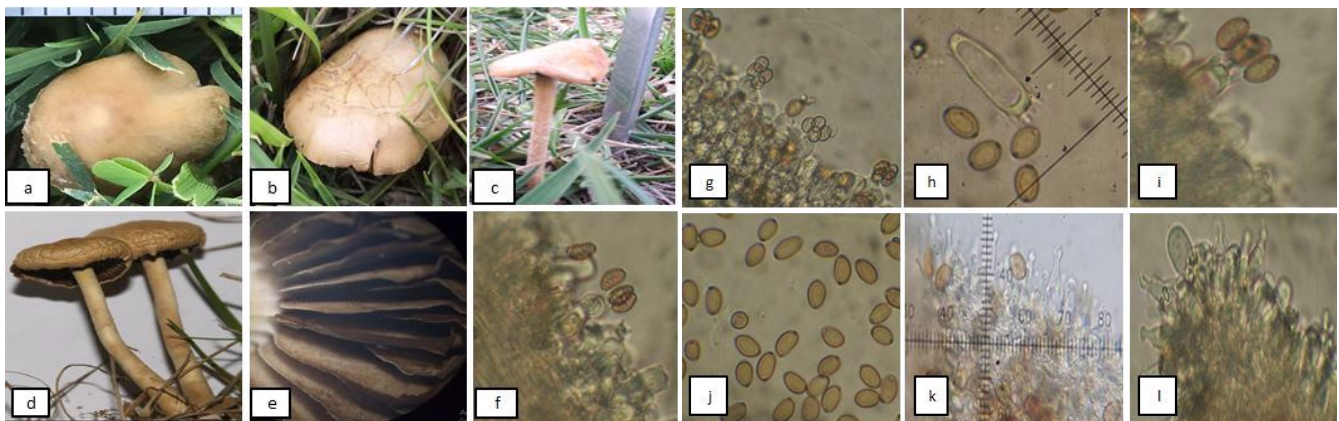


Fig. 1: *A. pediades*. a; b; c, fruiting body in natural habit; d, fruiting body in lab; e, gills; f; g; h; I, basidium; j, spores; k; l, cystidia. f–l(400 x).

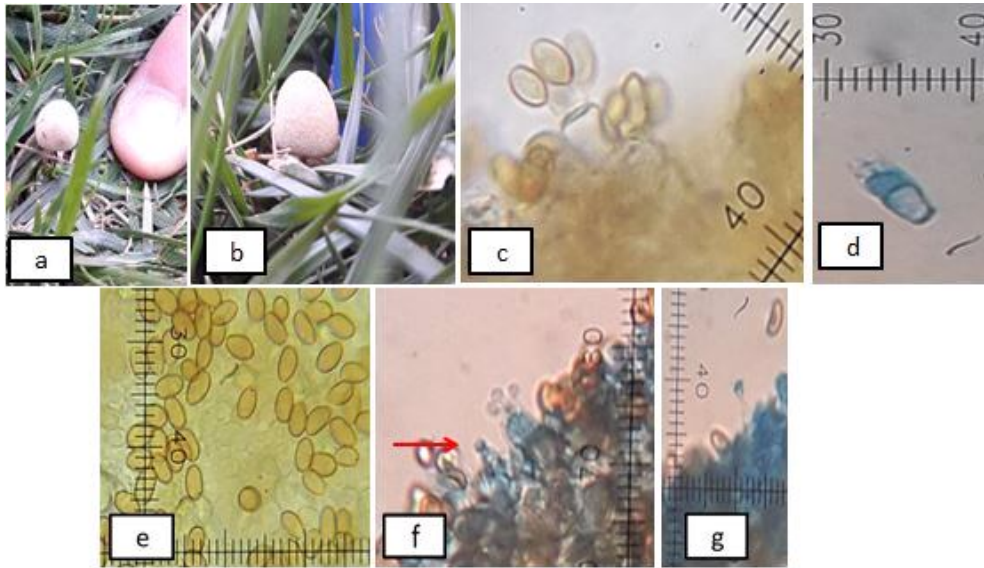


Fig. 2: *C. watlingii*. a, b, fruiting body in habitat; c, d, basidium; e, spores, f, g, cystidia. c – g (400 x).

and volva absent.

Microscopic features : Basidium 4–spores, $25\text{--}32.5 \times 7.5\text{--}9 \mu\text{m}$, cylindrical, hyaline; Spores $7.5\text{--}10 \times 4\text{--}6 \mu\text{m}$, narrowly elliptical with germ pore, smooth, thick walled, reddish brown; Cystidia $25 \times 5 \mu\text{m}$, cylindrical, hyaline. Habit and habitat : Solitary in garden between grasses, unknown edibility, Tikrit city / Salahadin Governorate, March – April. Here is the first detailed reported on *P. guttulatus* from Iraq. This fungus was reported from Turkey (Dogan *et al.*, 2012), Italy (Doveri, 2011), Island (Siquier *et al.*, 2011) and Greece (Kaounas *et al.*, 2016).

Family : Psathyrellaceae

Species : *Psathyrella candollena* (Fr.) Maire (Fig. 4 and 5).

Macroscopic features : Cap 20–70 mm, rounded, convex at young, broadly convex, umbonate, flat or slightly depressed with age, pale brown with white margin when young and splitting radially in places and turn upward when mature, white partial veil remnant at young and have hairy appearance at mature stage, hygrophanous; Gills : Whitish at first, becoming grayish then dark brown at age, attached to the stipe; Stipe 30–80 mm long, 20–50 mm thick, cylindrical, central, hollow, white, lined with white scales and condensed whitish hair at the base disappears at maturity, swollen at the base, ring and volva absent.

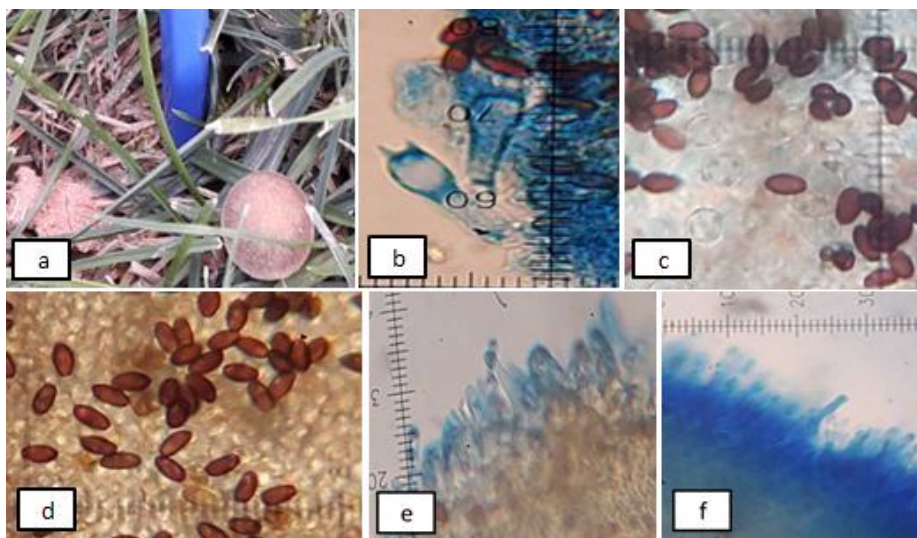


Fig. 3: *Panaeolus guttulatus*. a, fruiting in natural habitat; b, basidium; c, surface view of basidium and spores; d, spores; e, f, cystidia. b – f (400x).



Fig. 4: *P. candollena*. a; b, young fruiting body in natural habit; c; d; e, mature fruiting body in natural habit; f, gills (Not whitish gills in young fruiting body and brown gills in maturity stage); g – j fruiting body in the lab with different stage; k, spore print; l, surface view of basidium (400x).

Microscopic features: Basidium 4– spores, $25\text{--}32 \times 10\mu\text{m}$, hyaline; Spores $7.5\text{--}10 \times 5\mu\text{m}$, elliptical, truncate, smooth, brown; Cheilocystidia abundant, cylindrical, uniform, hyaline. Habit and habitat : Solitary or gregarious in garden between grasses, unknown edibility, Baghdad

city. December–April. This fungal species was first reported from Iraq (in subarid of Aljazira) by Al-Habib *et al.*, (2014) and by Al-Khesraji (2018) from North central of Iraq, and here is the first detailed reported on *P. candollena* from central of Iraq. *P. candolleana* was

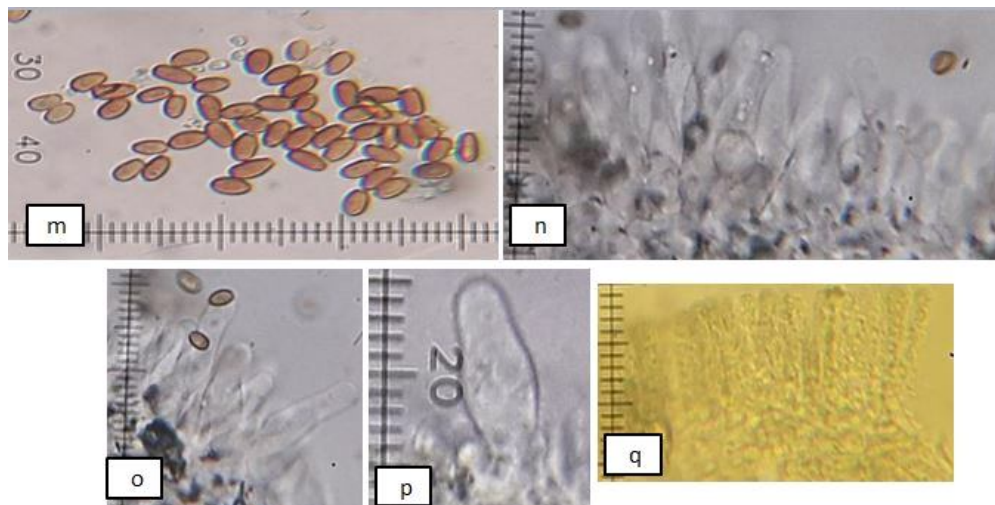


Fig. 5: *P. candollena*. m, spores; n; o, utriformcystidia; p, magnified utriformcystidia; q, cylindrical cystidia. m – q (400x).

reported from Poland (Ronikier, 2007) North America (Kuo, 2011), Iran (Karim *et al.*, 2013), Turkey (Kaya, 2009; Sesli and Denchev, 2012), Greece (Polemis *et al.*, 2012), Pakistan (Razaq *et al.*, 2014), Argentina (Niveiro and Alberto, 2013) and India (Pushpa and Purushothama, 2014; Amandeep *et al.*, 2015; Gogoi and Parkash, 2015).

References

- Al-Habib, M.N., J.C. Holliday and D. Tura (2014). The pale brittle stem mushroom, *Psathyrella candolleana* (higher Basidiomycetes): An indigenous medicinal mushroom new to Iraq. *Int. J. Med. Mushroom.* **16(6)**: 617- 622.
- Al-Khesraji, T.O. (2016). Seven new records of ascomycetous macro fungi from Suliamaniya province (Northeast of Iraq). *Journal of Biology, Agriculture and Healthcare*, **6(16)**: 94-107.
- Al-Khesraji, T.O., A.H.M. Shugran and R.S. Augul (2017). Some Basidiomycota Macro fungal Species from Salahadin Governorate (North Central Iraq), with the Addition of Four New Species to Iraq. *Int. J. Curr. Res. Biosci Plant Biol.*, **4(10)**: 74-84.
- Al-Khesraji, T.O. (2018). Ten Previously Unreported Basidiomycota Macro fungi from Salahadin Governorate Including Five New Records to Iraq. *Int. J. Curr. Res. Biosci. Plant Biol.*, **5(6)**: 11-24.
- Al-Qaissi, A.R. (2014). A study on the activity of some mushrooms in bioremediation of petroleum wastewater in refineries company- Baji. PhD thesis Biology Department, College of Education for Pure Sciences, Tikrit University, Iraq.
- Amandeep, K., N.S. Atri and K. Munruchi (2015). *Psathyrella* (Psathyrellaceae, Agaricales) species collected on dung from Punjab, India. *Curr. Res. Environm. Appl. Mycol.*, **5(2)**: 128-137.
- Coimbra, V.R.M. (2015). Checklist of Central and South American Agaricales (Basidiomycota) II: Strophariaceae. *Mycosphere Online-Journal of Fungal Biology*, **6** : 441-458.
- De Silva, D.D., S. Rapior, E. Sudarman, M. Stadler, J. Xu, S.A. Alias and K.D. Hyde (2013). Bioactive metabolites from macrofungi: ethnopharmacology, biological activities and chemistry. *Fungal Divers.*, **62(1)**: 1-40.
- Doveri, F. (2010). Occurrence of coprophilous Agaricales in Italy, new records, and comparisons with their European and extraeuropean distribution. *Mycosphere*, **1(2)**: 103-140.
- Devi, K. and K. Shrivastava (2016). Diversity of macrofungi in 'Jalukbari reserve forest' of Kamrup District, Assam. Pelagia Research Library, *Adv. Appl. Sci. Res.*, **7(1)**:115-119.
- Dođan, H.H., S. Akta°, C. Öztürk and G. KA°IK (2012). Macrofungi distribution of Cocakdere valley (Arslanköy, Mersin). *Turk. J. Bot.*, **36(1)**: 83-94.
- Doveri, F. (2011). Additions to "Fungi Fimicolitalici": An update on the occurrence of coprophilous Basidiomycetes and Ascomycetes in Italy with new records and descriptions. *Mycosphere*, **2(4)**, pp.331-427. Hjortstam, K., T. Iturriaga, K.H. Larsson and Lodge (2007). Global diversity and distribution of macro fungi. *Biodivers. Conserv.*, **16(1)**: 37-48.
- Gogoi, G and V. Parkash (2015). A checklist of gilled mushrooms (Basidiomycota: Agaricomycetes) with diversity analysis in Hollongapar Gibbon Wildlife Sanctuary, Assam, India. *JoTT.*, **7(15)**: 8272-8287.
- Hausknecht, A. (1996). Beiträge zur Kenntnis der Bolbitiaceae 3. *Europäische Conocybe-Artenmitwur zelnde modertiefim Substrate ingesenktem Stiel. Österreichische Zeitschrift für Pilzkunde*, **5**:161-202.
- Hilszczańska, D. (2012). Medicinal properties of macrofungi. *Forest Research Papers*, **73(4)**: 347-353.
- Kaounas, V., G. Konstantinidis, D. Sofronis, M. Gkilas and L. Kottis (2016). Seven interesting basidiomycetes recorded in Greece for the first time. *Mycologia*.
- Karim, M., M.R. Kavosi and G. Hajizadeh (2013). Macrofungal Communities in Hyrcanian Forests, North of Iran: Relationships with Season and Forest Types. *Ecologia Balkanica*, **5(1)**: 87 – 96.
- Kaya, A. (2009). Macrofungal diversity of Adýyaman province (Turkey). *Mycotaxon*, **110(1)**: 43-46.
- Kirk, P., P. Cannon, D. Minter and J. Stalpers (2008). *Dictionary of the Fungi*. (10th edn). Wallingford, UK.
- Kuo, M. (2006). September. *Agrocybepediades*. Retrieved from the Mushroom Expert.Com.Web site: http://www.mushroomexpert.com/agrocybe_pediades.html
- Kuo, M. (2011). January. *Psathyrellacandolleana*. Retrieved from the MushroomExpert.Com Web site: http://www.mushroomexpert.com/psathyrella_candolleana.html
- Legon, N.W. and A. Henrici (2005). Checklist of the British and Irish Basidiomycota. Royal Botanic Gardens.
- Mueller, G.M., J.P. Schmit, P.R. Leacock, B. Buyck, J. Cifuentes, D.E. Desjardin, R.E. Halling, K. Hjortstam, T. Iturriaga, K.H. Larsson and D.J. Lodge (2007). Global diversity and distribution of macrofungi. *Biodivers. Conserv.*, **16(1)**: 37-48.
- Muslat, M.M. and M.N. Owaid (2015). *Polyporus* spp. (Polyporaceae, Basidiomycota): Rare record from ecosystem of Fallujah, Iraq. *International Journal of Environment*, **4(3)**: 185-189.
- Niveiro, N. and E. Albertó (2013). Checklist of the Argentine Agaricales 5. Agaricaceae. *Mycotaxon*, **122(491)**, pp.1-25.
- Overall, A. (2009). Richmond Park Fungi Survey Report.
- Polemis, E., D.M. Dimou, D. Tzanoudakis and G.I. Zervakis (2012). Annotated checklist of Basidiomycota (subclass Agaricomycetidae) from the islands of Naxos and Amorgos

- (Cyclades, Greece). In *Annales Botanici Fennici* (pp. 145-161). Finnish Zoological.
- Pushpa, H. and K.B. Purushothama (2014). Taxonomic studies and molecular characterisation of *Tricholomagiganteum* and *Calocybeindica* isolates from Bangalore. *Journal of Biochemical Technology*, **3(5)**: 218-220.
- Razaq, A., S. Shahzad, H. Ali and A. Noor (2014). New reported species of macrofungi from Pakistan.
- Redhead, S. (1997). Standardized Inventory Methodologies for Components of British Columbia's Biodiversity: Macrofungi. Resource Inventory Committee, Vancouver.
- Ronikier, A. (2007). Rare and interesting species of *Psathyrella* found in the Tatra National Park. *Acta Mycol.*, **42(1)**: 85-92.
- Sesli, E. and C.M. Denchev (2012). Checklists of the myxomycetes, larger ascomycetes, and larger basidiomycetes in Turkey. *Mycotaxon*, **106**: 65-67.
- Siquier, J.L., J. Salom, J. Espinosa and A. Serra (2011). Notes corològiques sobre la flora micològica d' Eivissa (Illes Balears, Espanya). III. *Rev. Catalana Micol.*, **33**. Łuszczynski, J (2007). Diversity of Basidiomycetes in various ecosystems of the Góry Ćwiętokrzyskie Mts. *Monogr. Bot.*, **97**:1-220
- Suliaman, S.Q., T.O. Al-Khesraji and A. Hassan (2017). New records of basidiomycetou macrofungi from Kurdistan region – Northern Iraq. *Afr. J. Plant Sci.*, **11(6)**: 209-219.
- Zotti, M., A.M. Persiani, E. Ambrosio, A. Vizzini, G. Venturella, D. Donnini, P. Angelini, S. Di Piazza, M. Pavarino, D. Lunghini and R. Venanzoni (2013). Macrofungi as ecosystem resources: Conservation versus exploitation. *Plant Biosystems-An International Journal Dealing with all Aspects of Plant Biology*, **147(1)**: 219-225.