



First Observations on the Mushroom in Mountain Area of Iraqi Kurdistan Region

Farhad H. Aziz^{1*} and Fareed M. Toma²

^{1*}Ecology Department and ²Biology Department, College of Science, Salahaddin-Erbil University, Kurdistan, Iraq.

Abstract: Based on the collections made for mushroom between 1996-2010 in mountain areas in Sulaimani and Erbil Governorate especially in Soran, Joman, Sedakan districts Qandil and Zalm areas upto more than 3000 m.a.s.l. A total of 34 species in 23 genera, 17 families and 7 orders belong to woody and fleshy species were identified at the first time in Iraq.

Keywords: Edible Mushroom, Erbil, Basidiomycetes, Ascomycetes.

1. Introduction

Mushroom is an organism of one of fungal lineage. It is the sister group of animals and plants and parts of the eukaryotic crown group that radiated about a billion years ago (Hawksworth, 1995). Most phyla appear to be terrestrial.

It has three chief characteristics: Basic structural units are almost hypha when more than one hypha connects called mycelium reproductive propagule almost always spore single-celled. Mushrooms are heterotrophic nutrition including saprobes, pathogens and symbiosis as mycorrhiza and lichens. However, they have other characteristics, nonmotile and with rigid cell wall containing chitin (Laessoe and Lincoff, 1998).

Mushrooms and toadstools are divided into two major groups basidiomycetes produce their spore on basidia cells and ascomycetes produce their spores in sac-like cells called ascus singular (asci plulare) Schaester, 1997.

The main body of the mushroom is its fruit body (cap) and stem, they are fleshy may be edible (called pod straw) which is an excellent source of protein, vitamins A and D, phosphorus and potassium, such mushrooms commonly known gilled or fleshy mushroom named Agaricales and referred to as Button mushroom or table mushroom or criminal mushroom and Boletales order each of them covering more than 100 species while, using death cap mushroom such as *Amanita* spp. Which is most terrifying poisonous cap

and responsible for the majority of serious fatal mushroom poisoning causing kidney and liver damage? Also, it contains a toxin called muscarine causes secretion of saliva tears, perspiration, stomach cramps, irregular heartbeat, decreasing blood pressure and difficulty breathing (Laessoe and Lincoff, 1998).

In Kurdistan, late autumn, late winter and early spring are very good time to see many of the mushrooms. The natural Oak forest especially under or at the base of oak trees are actually the best places to see common edible and rare mushrooms. However, in the grassland and at the edge of streams and rivers the best is seen on the old dead wood and veteran trees (Laessoe and Lincoff, 1998). Fomes and Trametes mushroom found mainly living on old dead trunks in forests Oaks. While there are a huge number of papers and books were published about, their morphology physiology and identifications, there is no any papers on mushroom identification in Iraq therefore, this work could be the first in Iraq.

2. Material and Methods

The woody mushroom specimens were collected from 2006-2010 in both Erbil and Sulaimani provinces, while fleshy mushroom was collected in 2010 only in mountain areas in forest Oaks within Soran, Joman and Sedakan district areas from late autumn to late spring season. The identifications were carried out depending on Nicholson and Brightman (1966), Laessoe and Lincoff (1998) and Polese (2005). The fleshy samples

*Corresponding author:
E-mail: aziz.farhad@yahoo.com.

are preserved in formal acetic Alcohol solution (FAA): consist of 131 formalin, 5ml of glacial acetic acid and 200ml of ethyl alcohol (50%). The photographs were made by digital camera and portable Olympus Zoom camera measurements were made according to Hawksworth *et al.*, (1995); Laessoe and Lincoff (1998). The descriptions of recorded genus and habitats are mentioned in description section.

3. Results and Discussion

It appears from table 1 a total of 34 species, 23 genus, 17 families and 7 orders of basidiomycetes were identified and classified at the first time in Iraq and Iraqi Kurdistan region that means all of them are new records to Iraqi mushrooms (Table 1) as follows:

Table 1. Classification of identified mushroom species.

Kingdom	Phylum	Order	Family	Genus	Species
Fungi	Basidiomycota	Agricales	Agaricaceae	<i>Agaricus</i>	<i>Agaricus arvensis</i> Sch.
					<i>Agaricus bernardii</i> (Quél.) Sacc.
					<i>Agaricus bisporus</i> (L.) Fr.
					<i>Agaricus campestris</i> (L.) Fr.
			<i>Macrolepiota</i>	<i>Macrolepiota</i> Sp.	
				<i>Cystoderma</i>	<i>Cystoderma amianthinum</i> (Scop.) Marbl.
			Crepidotaceae	<i>Crepidotus</i>	<i>Crepidotus variabilis</i>
			Inocybaceae	<i>Inocybe</i>	<i>Inocybe godeyi</i>
			Strophariaceae	<i>Hypholoma</i>	<i>Hypholoma fasciculare</i> (Huds.) ex Fr. Kumm.
					<i>Entoloma rhodopolium</i> (Fr.) P. Kumm.
			Entolomataceae	<i>Entoloma</i>	<i>Entoloma serrulatum</i> (Fr.) Hesler
					<i>Clitocybe metachroa</i> (Fr.) P. Kumm.
			Tricholomataceae	<i>Clitocybe</i>	<i>Clitocybe nebularis</i> (Batsch), Quél.
					<i>Clitocybe odora</i> (Bull. ex Fr.) Quél.
		<i>Tricholoma</i>			<i>Tricholoma sejunctum</i>
		Marasmiaceae			<i>Micromphale</i>
		Mycenaceae	<i>Mycena</i>	<i>Mycena arcangeliana</i>	
		Pleurotaceae	<i>Pleurotus</i>	<i>Pleurotus ostreatus</i> (Jacq.) Kumm.	
		Bolbitiaceae	<i>Panaeolus</i>	<i>Panaeolus papilionaceus</i> var. <i>papilionaceus</i> (Bull.) Quélet	
				<i>Panaeolus semiovatus</i> var. <i>semiovatus</i> (Lundell)	
		Russulales	Stereaceae	<i>Stereum</i>	<i>Stereum hirsutum</i> Pers.
			Russulaceae	<i>Russula</i>	<i>Russula aeruginea</i> Fr.
					<i>Russula ochroleuca</i> Pers. Fries
		<i>Lactarius</i> Pers.	<i>Lactarius vellereus</i> (Fr.) Fr.		
		Hymenochaetales	Hymenochaetaceae	<i>Phellinus</i>	<i>Phellinus igniarius</i> (L.) Quél.
		Polyporales	Meruliaceae	<i>Bjerkandera</i>	<i>Bjerkandera adusta</i>
				<i>Chondrostereum</i>	<i>Chondrostereum purpureum</i>
				<i>Fomes</i>	<i>Fomes fomentarius</i> (L.) Kickx
			Polyporaceae	<i>Trametes</i>	<i>Trametes versicolor</i> (L., Fr.) Pilat
					<i>Trametes ochracea</i>
		Fomitopsidaceae	<i>Fomitopsis</i>	<i>Fomitopsis pinicola</i>	
		Boletales	Paxillaceae	<i>Paxillus</i>	<i>Paxillus corrugatus</i>

4. Description of Recorded Species

- ***Agaricus arvensis* (Fig. 1, 2, 3):** This edible species has a rounded to convex cap with a smooth yellow to off-white surface. Stem yellowish-white stem, thickened at the base, cap and stem has a white flesh body. This mushroom colour changes slowly to orange. It has almonds smell. Contain high level cadmium (Laessoe and Lincoff, 1998 P. 157).



Fig. 1: *Agaricus arvensis*.



Fig. 2: *Agaricus arvensis*.



Fig. 3: *Agaricus arvensis*.

- ***Agaricus bernardii* (Fig. 4, 5, 6):** It is edible and has a flattened or convex white to gray-brownish colour cap with smooth surface, stem, whitish to brown, gills free, dark brown to reddish brown, cap 12cm wide, stem thick 5-6cm long. In Peran mountain in December, in Oak pasture land (Laessoe and Lincoff, 1998, P. 162).



Fig. 4: *Agaricus bernardii*.



Fig. 5: *Agaricus bernardii*.



Fig. 6: *Agaricus bernardii*.

- ***Agaricus bisporus* (Fig. 7, 8, 9):** This species is edible, it has a conveyor, and cap stem is light brown, cap 7cm stem 4cm spore chocolate, dark brown gills whitish-brown to reddish-brown. Found in Oak field in mountain area in Peran Mountain in the fall season in November (Laessoe and Lincoff, 1998; P. 161).



Fig. 7: *Agaricus bisporus*.



Fig. 8: *Agaricus bisporus*.



Fig. 9: *Agaricus bisporus*.

- ***Agaricus campestris* (Fig. 10, 11, 12):** This is a familiar edible mushroom; yellowish to reddish-brown cap, the cap is convex with a flat, smooth to fibrillose surface, edges paler in colour. Stem and gills are, White Cap 6-8cm, steam 10cm. found in Oak pasture land in mountain area (Peran Mountain, Sedakan) in the fall season (Laessoe and Lincoff, 1998; P. 160).



Fig. 10: *Agaricus campestris*.



Fig. 11: *Agaricus campestris*.



Fig. 12: *Agaricus campestris*.

- ***Macrolepiota* sp. (Fig. 13, 14):** It has a rounded to convex cap, with yellowish-white surface. The stem 7-15cm, yellowish, thickened at the base, gill is crowded with a wheel-like structure from underside Cap 7-15cm. It has almond smells and is edible containing cadmium. Found in pasture land among Oak trees in the spring season, wide spread in High Mountain in Sedakan areas (Laessoe and Lincoff, 1998).



Fig. 13: *Macrolepiota*.



Fig. 14: *Macrolepiota*.

- ***Chondrostereum purpureum* (Fig. 15):** This species is easy to identify, due to its multitude and wavy or undulated – margined brackets, leathery flesh to gelatinous when wet and hard when dry. Upper surface yellowish-light to dark brown, rough, underside is smooth and purple-brown, while upper downside white, caps in tiers and rows 2-5cm × 1-2cm. Found on a dead Salix tree, at the base of the Qandil Mountain in late spring season (Laessoe and Lincoff, 1998, P. 231).



Fig. 15: *Chondrostereum purpureum*.

- ***Stereum rugosum* (Fig. 16):** It is found on stumps and Foren trunks and branches and in living trees at all time of the year. Lies flex in the wood producing a surface cap of yellowish-Baff, margins are upturned at the other side is light brownish-yellow and wrinkled. Found in Malakan and Qandil mountain areas (Nicholson and Brightman, 1966, P. 156-157. Fig. 3 and Laessoe and Lincoff, 1998, P. 232).



Fig. 16: *Stereum rugosum*.

- ***Creolophus cirrhatus* (Fig. 17):** This mushroom is spotted growing along the dead trunk of *Salix* and has a breathtaking sight; it has a wheat straw colour, fruit body consisting of white numerous brittle coral like branches. The lower surface with long straw colour spines. Cap is 10-20 × 10-25cm. Found in bottom of large dead trees bark in Malakan village in late spring (Laessoe and Lincoff, 1998, P. 239).



Fig. 17: *Creolophus cirrhatus*.

- ***Bjerkandera adusta* (Fig. 18):** This species produces a thin annual bracket with brown zone, a pored surface, warped with slightly lobed margin. The tube layer distinctly in Rosti, 2 – 3cm thick in cross section, Underside surface is fleshy cottony, soft, yellowish-light brown. Found on deciduous trees. Qandil Mountain Asha-Qulka village and in Rusti village (Laessoe and Lincoff, 1998 p. 225).



Fig. 18: *Bjerkandera adusta*.

- ***Phellinus igniarius* (Fig. 19, 20):** It is a woody mushroom, perennials, large, gray to black colour, hoot-shaped with thick margins. This bracket mushroom living for a long time on host trees. The rings are growing year by year 1-16mm long, rusty brown colour, some cracking occur on black surface, living singly or a few together on living trees widespread in cold and relatively in humid mountain areas (Laessoe and Lincoff, 1998, P. 218).



Fig. 19: *Phellinus igniarius*.



Fig. 20: *Phellinus igniarius*.

- ***Fomes fomentarius* (Fig. 21, 22):** It is a famous Polypore mushroom it has a hoof-shaped, woody, with smooth surface perennial bracket, with zones varying from dark brown to pale brown at the margin surface. Underside is whitish-yellow with dark rings. Found on *Salix* trees, widespread in Malakan village Kawashan mountain and Zalm 5 – 2cm wide (Laessoe and Lincoff, 1998, P. 219).



Fig. 21: *Fomes fomentarius*.



Fig. 22: *Fomes fomentarius*.

- ***Fomitopsis pinicola* (Fig. 23):** This Polypore has a hoof-shaped woody (ring) perennial, bracket, gray, has a yellow and red zone near its margin. A new brown tube layer grows annually; each tale layer is about 5mm thick parasitic on deciduous trees, it has hard yellowish-white flesh with light yellow pores, widespread among *Salix* and other trees. Widespread in mountain areas at high altitude region (Laessoe and Lincoff, 1998, P 219).



Fig. 23: *Fomitopsis pinicola*.

- ***Trametes versicolor* (Fig. 24):** Thin layered brackets, fan-shaped with alternating zones either with gray or brown-shaded areas, underside surface edge yellow, and brackets 2-7cm × 1-5cm poisonous attached the substrate by a narrow area. Founal on woods, widely distributed (Laessoe and Lincoff, 1998, P. 224).



Fig. 24: *Trametes versicolor*.

- ***Paxillus corrugatus* (Fig. 25):** Distinctly furrowed with raged gills, yellowish-brown to olive organs, Oyster-shaped cap, widely spaced. Spores yellowish brown. Edible, cap 10-25cm at wide, stem 2-5cm long. Found growing on a deed *Salix* tree in Zalm village in Sulaimani area, woodland; near stream (Laessoe and Lincoff, 1998, P. 182).



Fig. 25: *Paxillus corrugatus*.

- ***Trametes ochracea* (Fig. 26):** Thin layer bracket's with alternating zones, dark brown surface with light brown to yellowish-white edge. The surface ringed, rough, perennial, the fruit body further develops in the spring forming rings. The tube layer is brown when dry, 3mm thick there are 3-4 pores per mm on tree Brackets 15×10cm poisons on deciduous wood, Grtko Rusti village (Nicholson and Brightman, 1968 and Laessoe and Lincoff, 1998, P 225).



Fig. 26: *Trametes ochracea*.

- ***Crepidotus variabilis* (Fig. 27, 28):** The cap or gills often faced towards the stem, stem very short joined to the side and the cap is sessile. Covered with very fine hairs, the margin incurved, the cap and gills whitish gray. The spore is pale brown. Found on sticks in Zalm, Sulaimani near stream edge in Oak mountain forest area (Nicholson and Brightman, 1966, P. 144, Fig. 2 and Laessoe Lincoff, P. 183).



Fig. 27: *Crepidotus variabilis*.



Fig. 28: *Crepidotus variabilis*.

- ***Inocybe godeyi* (Fig. 29, 30):** Cap is fibrous, conical to bell-shaped, creamy white to pale, turned to bright orange-red colour, stem white with fine meals and bulbous base; gills are cream to reddish brown. Among Oak trees in autumn (Laessoe and Lincoff, 1998, P. 99).



Fig. 29: *Inocybe godeyi*.



Fig. 30: *Inocybe godeyi*.

- ***Hypholoma fasciculare* (Fig. 31):** This mushroom is small, yellowish-light brown surface darker at the center yellowish-green gill, growing in cluster on dead wood. It has a convex cap 3×4cm, stem narrow 2-3cm poison, the shape, the white rail visible at the cap margin, sulfur smell, hot taste. Found on dead rang tree at my home Erbil city in spring season.



Fig. 31: *Hypholoma fasciculare*.

- ***Entoloma rhodopolium* (Fig. 32, 33, 34):** These are much arrived species and are difficult to identify, cap and stem with adnexed to andante gills cap is concave or flat. The whitish-gray steam also long and slender, with pale brown flesh gills odorless, poisonous cap 15cm, stem 15cm, spore dirty pink. On Oakland's in rich soil in late autumn season in Soran and Joman areas (Laessoe and Lincoff, 1998, P. 68).



Fig. 32: *Entoloma rhodopolium*.



Fig. 33: *Entoloma rhodopolium*.



Fig. 34: *Entoloma rhodopolium*.

- *Entoloma serrulatum* (Fig. 35, 36): It has, the convex, dark-black cap and stem, gills have the similar colour some white lighter, gills adnexed large, clear. Cap 1-3cm wide stem 2-6cm any. In grassland, widespread in mountain areas among Oak trees near roadside (Laessoe and Lincoff, 1998, P. 144).



Fig. 35: *Entoloma serrulatum*.



Fig. 36: *Entoloma serrulatum*.

- *Russula aeruginea* (Fig. 37, 38): The cap is convex, to depressed green colour, marked with rust to dark brown spots, gills crowded, white adnexed. Stem cylindrical white. Caps 4-9cm, stem 4-7cm. Found among Oak trees in autumn to early winter (Laessoe and Lincoff, 1998, P.125).



Fig. 37: *Russula aeruginea*.



Fig. 38: *Russula aeruginea*.

- *Russula ochroleuca* (Fig. 39, 40): The cap is whitish brown to orange or yellowish-white; the gills are yellow in color. It is a large species, with a funnel-shaped cap 8-14cm wide, convex stem 5cm long, gills decurrent, creamy, and crowded. Found in Oak pasture in mountain in Peran Mountain (Laessoe and Lincoff, 1998, P 123).



Fig. 39: *Russula ochroleuca*.



Fig. 40: *Russula ochroleuca*.

- ***Lactarius vellereus* (Fig. 41):** Very large species, white-pale brown or white to yellowish-brown, smooth cap when dry, has clear central depression, become funnel-shape at maturity, stem short 10-25cm wide, and gills yellowish-brown, very crowded, decurrent. Found under Oak trees in higher mountainous areas in Sedakan in autumn (Laessoe and Lincoff, 1998, P. 44).



Fig. 41: *Lactarius vellereus*.

- ***Clitocybe metachroa* (Fig. 42, 43):** This mushroom is small poison, pale gray brown to yellowish brown, cap concave 2-5cm, stem narrow 3-6cm long margin with darker ring. Found among trees in pasture Oak land in the spring season (Laessoe and Lincoff, 1998, P. 34).



Fig. 42: *Clitocybe metachroa*.



Fig. 43: *Clitocybe metachroa*.

- ***Clitocybe nebularis* (Fig. 44, 45):** It is a large and funnel-shaped mushroom, cap fleshy with a central umbo on a tall stem, both pale leather-brown, gill

clear many, cap 5-12cm, stem 8-20cm, poison, in finding the early winter (Laessoe and Lincoff, 1998, P. 33).



Fig. 44: *Clitocybe nebularis*.



Fig. 45: *Clitocybe nebularis*.

- ***Clitocybe odora* (Fig. 46):** This species also with a convex cap, has a gray-brown colour, darker at the center, cap 3-6cm, gill many, stems short 1-4cm long. Found in pastures among trees in early spring season, edible (Laessoe and Lincoff, 1998, P. 39).



Fig. 46: *Clitocybe odora*.

- ***Cystoderma amianthinum* (Fig. 47):** The cap is yellow, bell-shaped than becoming flat with shot fringed margin with of its center is pinkish-gray, the stem is granular, gills are crowded, adnexed, white, cap 1-4cm, stem 5cm. Among mosses and Oak trees in autumn (Laessoe and Lincoff, 1998. P. 97).



Fig. 47: *Cystoderma amianthinum*.

- ***Micromphale foetidum* (Fig. 48):** This is fairly the smallest species, can be detected by strong small, along similar to rotten cabbage. It has convex, smooth dark brown to orange brown colour, cap 0.5-3cm, stem blackish-brown 3cm long and 2cm thick (Laessoe and Lincoff, 1998, P. 134).



Fig. 48: *Micromphale foetidum*.

- ***Mycena arcangeliana* (Fig. 49):** It is very easy to break down, pale yellowish-brown, the cap has convex to ball shape dull gray with white to pink gills, caps have a lilac stem, gills adnexed. It has iodine like smell (Laessoe and Lincoff, 1998, P. 134).



Fig. 49: *Mycena arcangeliana*.

- ***Panaeolus semiovatus* (Fig. 50):** It has a bell distinguishing feature cap shape, gray-blue in colour, wrinkled when dry smooth when wet. The erect stem has a white rings. Cap 1-4cm, stem

4-6cm, widely distributes in dense forests near the stream edge (Laessoe and Lincoff 1998, P. 95).



Fig. 50: *Panaeolus semiovatus*.

- ***Panaeolus papilionaceus* (Fig. 51):** This species is gray brown to whiten-blue. Grow in cluster very easy to break down, thin and soft, stem lighter in colour, the cap bell-shaped, convex. In woodlands among deciduous trees especially near stream edge (Iquban village). Cap 1-2cm, stem 3-6cm, poisonous (Laessoe and Lincoff, 1998, P. 107).



Fig. 51: *Panaeolus papilionaceus*.

- ***Pleurotus ostreatus* (Fig. 52):** The cap has an oyster-shaped, with a creamy blackish dame, brown colour, smooth, with dark brown-black spots as an irregular line, margin has been whitish-pink with crowded gills, the stem is white very short not centrally placed. Found among Oak trees in autumn-winter season (Laessoe and Lincoff, 1998, P. 178).
- ***Tricholoma sejunctum* (Fig. 53):** The green or brown cap of this species is moist, flattened with age its surface center has a dark colour with a white captured fibril, the stem yellowish-white, cap 5-10cm stem 5-8cm poison. Found among Oak trees in early winter (Laessoe and Lincoff, 1998, P. 63).

Fig. 52: *Pleurotus ostreatus*.Fig. 53: *Tricholoma sejunctum*.

Acknowledgment

We would like to express my thanks to hand drawer Fakhir for redrawing. Special thanks to Miss Hoveida Mousa Abdullah for typing and collecting. Thanks to Smaeil Ali Smaeil, Zana Ghazi Assad and Abdullah Balaky photographer who had taken photographs of specimens in the field and in the laboratory.

References

- [1]. Polese, J.M. (2005). The Pocket Guide to Mushroom. English Edition, Tandem Verlag GmbH. Printed in Slovakia, 364 P.
- [2]. Nicholson, B.E. and Brightman, F.H. (1966). The Oxford Book of Flowerless Plants. Oxford Univ. Press. U.K. 208 P.
- [3]. Laessoe, L. and Lincoff, G. (1998). Mushrooms (Eyewitness Handbooks). Kyodo Printing Co. Singapore. 303 P.
- [4]. Warcup, J.H. (1990) Mycorrhiza. In 'Orchids of South Australia'. (Eds RJ Bates, JZ Weber) pp. 21–26 (South Australian Government Printer: Adelaide).
- [5]. Hawksworth, D.L., Kirk, P.M., Sutton, B.C. and Pegler, D.N. (1995). Ainsworth and Bisby's: Dictionary of the Fungi. Eighth Edition. Wallingford, UK: CAB INTERNATIONAL, 616 P.
- [6]. <https://forestpathology.org>.
- [7]. www.ucmp.berkeley.edu/fungi/fungi.html.
- [8]. <http://www.tolweb.org/fungi> (file:///H:\sar-new\% Fungi.htm).