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KAHRAMANMARAŞ SÜTÇÜ İMAM UNIVERSITY

GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES

SURVEYING WILD MUSHROOM IN DUHOK PROVINCE OF IRAQ

MOONER RAMADAN YASIN YASIN

MASTER'S THESIS

DEPARTMENT OF BIOENGINEERING AND SCIENCES

KAHRAMANMARAŞ, TURKEY 2016

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IRAK'IN DUHOK İLİNDEKİ YABANİ MANTAR TÜRLERİNİN BELİRLENMESİ

MOONER RAMADAN YASIN YASIN

(YÜKSEK LİSANS TEZİ)

ÖZET

Bu çalışma Duhok ilindeki yaşayan yabani mantarlar üzerinde gerçekleştirilmiştir. Makromantar örnekleri 2015 yılının ilkbahar ve sonbahar mevsimlerinde toplanmıştır. Alan çalışmaları esnasında örneklerin doğal çevre, ekolojik ve morfolojik özellikleri renkli fotoğraf şeklinde kaydedilmistir.

Alan ve laboratuvar araştırmalarına göre, toplamda 23 aileye ait, 43 farklı takson, Ascomycota ve Basidiomycota bölümünde tespit edilmistir. İki sınıf ve altı takım altında, 17 tanesi yenilebilir ve 24 tanesi zehirlidir. Ayrıca; bu çalışmaya göre, tanımlanan mantarların 38 tanesi Irak'ta yeni bir kayıttır. *Morchella* cinsi gıda ve tıbbı amaçlaryla dünyada ünlü bir mantardir fakat bu mantar Irak'ta ne üretilmiş ne de tüketilmiştir. *Terfezia claveryi, Amanita ovoidea, Pleurotus eryngii* ve *Pleurotus ostreatus* türleri ise gıda olarak kullanılmaktadır.

Anahtar Kelimeler: Yabani mantar, Mantar, yenilebilir mantar, zehirli mantar, Duhok ili, Irak.

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SURVEYING WILD MUSHROOM IN DUHOK PROVINCE OF IRAQ

MOONER RAMADAN YASIN YASIN

(M.Sc. THESIS)

ABSTRACT

The current study was carried out on wild mushroom grown in Duhok province area. Macrofungi sample were collected in Spring and Autumn in 2015. During field study, photographs were taken in nature and environmental ecological and morphological features of samples were recorded.

According to the field and laboratory investigations, total of 43 taxa belonging to 23 families, stated in Ascomycota and Basidiomycota divisions were identified. Fewer than two classes and six orders, 17 of them are edible, 24 of them are inedible and two of them are poisonous. On the other hand; with the present study, 38 of the identified mushrooms are new records in Iraq. The *Morchella spp* was a famous mushroom around the world for eaten and medicine but it not consumed and eaten in the whole Iraq. The other mushrooms such as *Terfezia claveryi*, *Amanita ovoidea*, *Pleurotus eryngii* and *Pleurotus ostreatus* used as food alone.

Key words*:* wild mushroom, edible mushroom, poisonous mushroom, Duhok province, Iraq.

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LIST OF ABBREVIATIONS

mL **:** Milliliter

m **:** Meter

°C **:** Celsius degree

mm **:** Millimeter

N **:** North

E **:** East

g: **:** Gram

1. INTRODUCTION

Mushroom is the fruiting body of a macrofungus (Usubharatana and Phungrassami 2016) broadly; consist of 90% water and 10% dry matter. The nutrition value of mushroom can be compared to those of milk, meat and eggs (Oei, 2003). The mushroom can speak to a decent common wellspring of sustenance, being rich in proteins and low in fat, adding to vitamin and mineral admission and giving dietary fiber. They even utilized as a part of pharmaceuticals and dietary supplements. Then again, wild eatable mushrooms can be risky to expend for the reason that of poisons or overwhelming mental focus. The frequency of mushroom harming shifts significantly around the globe, contingent upon nearby conventions, ways of life, nourishing variables, atmosphere and the event of wild consumable mushroom (Biagi et al., 2013).

Around 14,000 mushroom species, portrayed by guidelines of mycological terminology, speak to roughly 10% of the assessed number of species existing on the earth. More than 2000 species are passable for utilization, and around 700 species known not critical pharmacological properties. Data on a number of consumable species gathered for culinary purposes all through the world shifts generally somewhere around 200 and 3000. Roughly, 100 species can be developed monetarily, yet just 10–20 of them can be developed on a mechanical scale. The mushroom business has three fundamental sections: developed palatable, wild-developing and therapeutic mushrooms (Kalač, 2016).

The word “mushroom” is employ for a distinguish fruit body (mycocarp or carpophore) of a higher fungus or macro-fungus that is big sufficient to be seen by the naked eye and to stand picked up by hand. For edible species, the word is utilized for the processed, harvested and consumed part of macro-fungi. Fruit bodies are commonly above the earth, varying in shape, coloration and size for each mushroom species. The fruit body is the sexual part of a macro-fungus firmness spores. It grows from spacious hyphae or mycelia, mostly sub-ground, by the operation of fructification. Mycelium is the vegetative part of a mushroom, consisting of a dense of branched hyphae. The common terminology of a fruit body is shown in Figure. 1.1 The period of the mass of fruiting bodies is only about ten to fourteen days. In some species like *Comatus* genus, the life period is too short, even fugacious (Kalač, 2016).

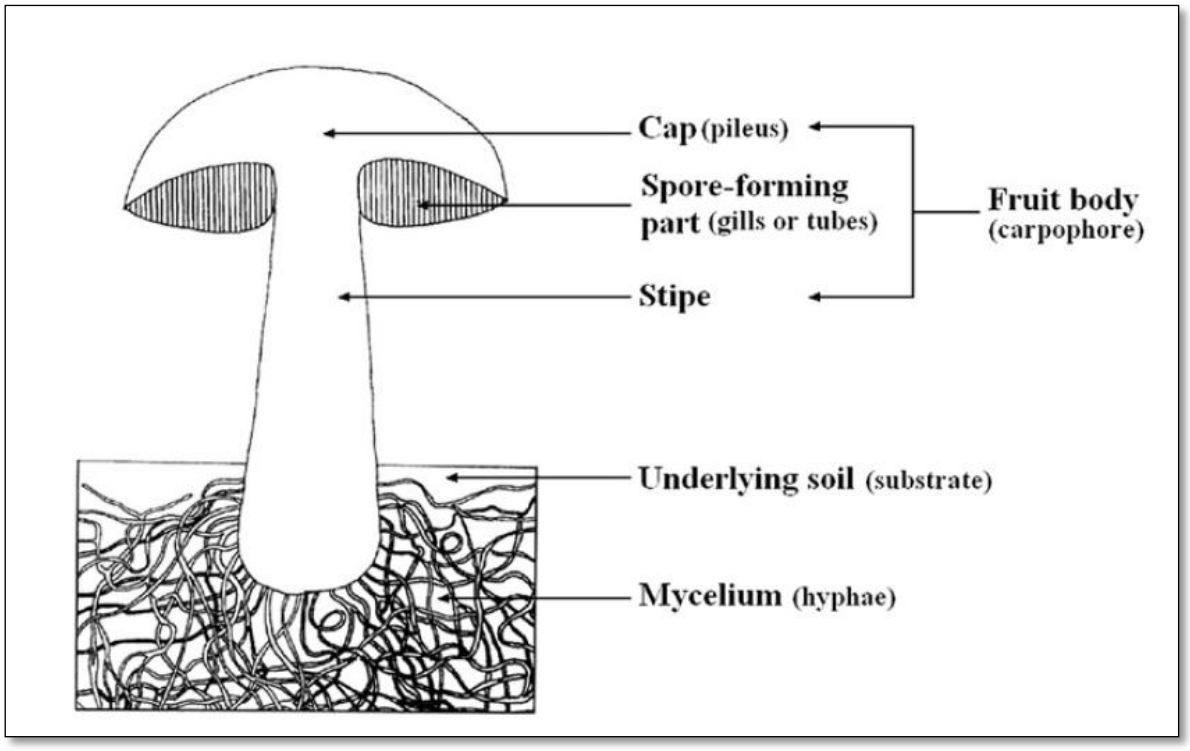

Figure 1.1 A sketch of a mushroom (Kalač, 2009).

There are several classifications of mushrooms; one of it according to ecological preferences there is dividing into three classes. Symbiotic species form a close, mutually beneficial relation with their steward vascular plant, commonly roots of a tree. Saprotrophic species obtain their nutrients from defunct organic materials. Several species of this group ware exploited for cultivation. The third class lives on other species in a no symbiotic relation, is a parasitic species, such as ligniperdous mushrooms on olive trees (Kalač, 2016). The classification of mushroom is done by the method shown in Figur 1.2.

Macrofungi and other fungi have an essential role in the equilibrium of nature. They are ordinary recyclers, serving to dispose of deceased organic matter and nourishing the soil. Without fungi, dead plants would pile up to massive depths in our forests and in/at/to another place. The soil would eventually remain so depleted of nutrients that green plants could not develop. Without plants, the earth's atmosphere would lose oxygen. Really, life could not exist without macrofungi and other fungi (Russell, 2006).

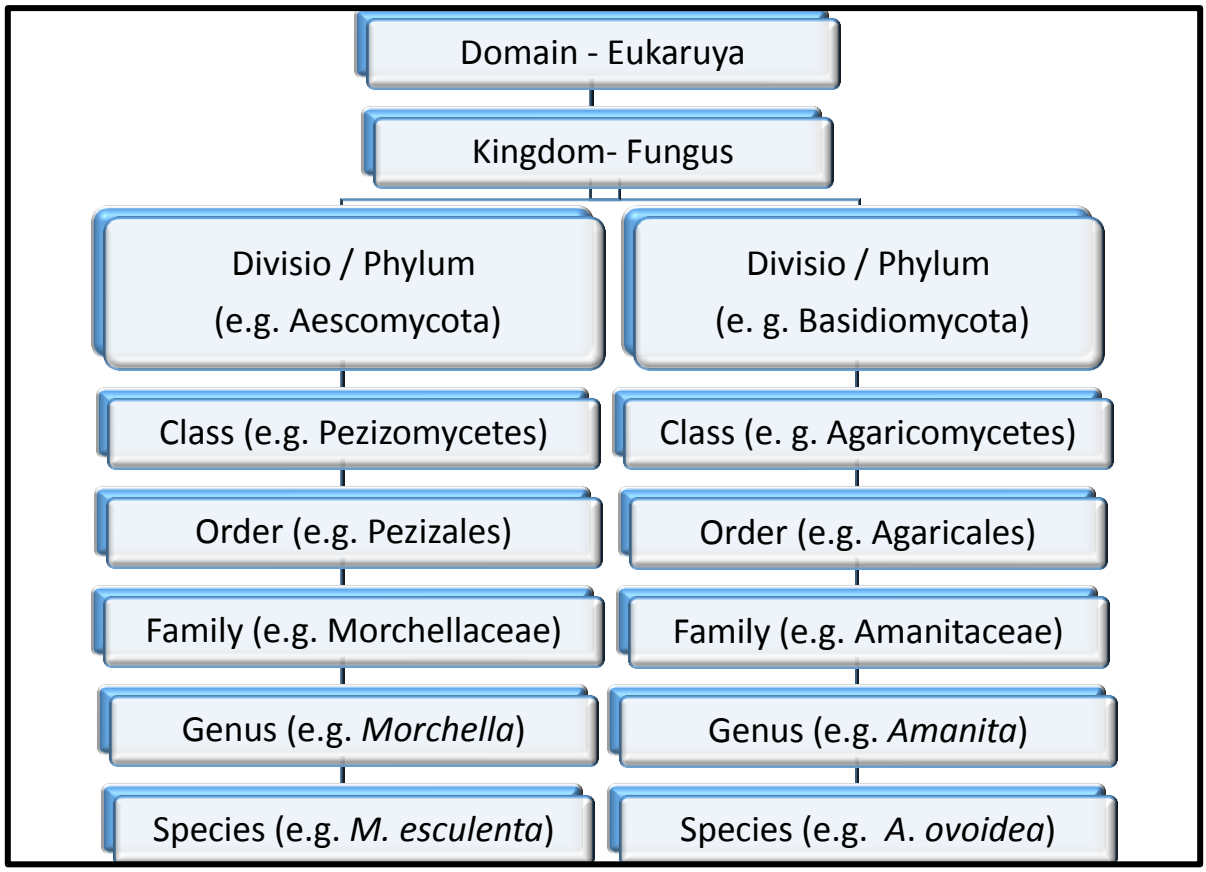

Figure 1.2. General classification method/pathway for mushroom.

The mushroom plays other roles; in addition, they are parasites attacking and killing target plants and animals. Many mushrooms are mycorrhizal living in a symbiotic and mutually beneficial relationship with an organism, exactly plant roots. They supply phosphorus, nitrogen, and increased moisture to the plant or tree, and the roots provide life-supporting carbon to the fungus, knowing these relationships and associations will help you find mushroom (Meuninck, 2015).

Numerous fungi have toxic compounds; the possessions sort from slight or very bad digestive upsets to hallucinogenic reactions and even death. Possibly, only around 10% of the fleshy mushrooms are desirable edibles, less than ten percentages are poisonous or toxic, and the remnant is not ordinarily eaten because of factors like their texture, bad taste, or small size. The poisonous mushrooms divided into seven groups by toxicologists according to substance containing. The first groups include mushrooms having cyclopeptides (that is, amanitins) that harm liver and kidney tissues, the symptoms occur from 6-24 hours after eating of the mushroom and include distorted vision, diarrhea, stomach cramps and vomiting generally led to die, like *Amanita bisporigera*, *A. verna*,

and *A. virosa*. The second group mushroom contain monomethyl hydrazine (a component of gyromitrin) that harem liver tissue. Symptoms occur from 1.5-3 hours after eating of the mushroom and involve diarrhea, vomiting, nausea and cramps, like species of *Gyromitra*. The third group is mushroom contain coprine a toxin that induces chest pains, nausea, vomiting and a flushed feeling of the skin from 1.5-3 hours after eating but apparently only when alcohol is already in the body or is ingested with the mushroom. The fourth group is mushrooms contain muscarine influence the autonomic nervous system. Abdominal cramps perspiration, lacrimation and salivation, appear within 1.5 -3 hours after eating, occasionally escorted by a lessening of the pulse rate and decrease of blood pressure to dangerous levels. It may cause death, depending on the size of the victim and the quantity eaten. Like *Amanita muscaria* and *Inocybe fastigiata*. The fifth group mushroom contain mucimol or ibotinic acid the first symptoms occur 1.5-3 hours after ingestion of the mushroom and include confusion, loss of coordination, convulsions, vomiting and dizziness. Symptoms are different from person to person, and death rates are under one percent. Like *Amanita muscaria* and *A. pantherina*. The sixth group mushroom contains psilocybin or psilocin that may cause headaches, hallucinations, twitching, fever, vomiting, severe, dysphoria and convulsions occurring from 1-3 hours after eating; mortality rates are under one percent. The seventh group mushroom contains a wide variety of gastrointestinal toxins that may cause diarrhea, vomiting, headaches, and nausea within a few hours of eating. Commonly no cause the death. Like *Chlorophyllum molybdites, Gymnopus dryophilus, Russula emetica, Omphalotus illudens* (Huffman et al, 2008).

There is no clear interest by Iraqi researchers to survey and specify wild mushrooms. To our knowledge there, there is not been found any studies on this topic subject except three types of researches done in Erbil and Anbar. Aziz firstly identified 31 mushroom species in Arbil. Toma was identified 34 species of mushroom. In addition, Owaid identify nine genus of mushroom (Aziz and Toma 2012; Toma et al., 2013; Owaid et al., 2014).

Iraq is rich for mushroom, but the people do not know how to benefit from them. According to villagers, there is so little type of mushroom used for eating. In some area is eaten and in another area is not eaten because they fear of poisonous mushroom some type is edible but in here is not known as edible mushroom and not eaten like *Morchella spp.*

In another hand, poisonous mushroom has occurred in Iraq. Sometimes the people

used its mushroom as a food, therefore, led to death. There is no any statistic data to explain the number of poisoning and dying by mushroom but there are individual cases in the rural areas. This happens from time to time. However in turkey, around 1970-1975 there were 1315 cases of individual poisoning. Forty-four of them dead. Fifty people dead by poisonous mushroom in Cukurova in 1989. In addition, one hundred people poisoned by mushroom eating 40 of them died in October of 1990. One hundred and fifty people poisoned by mushroom eating 20 of them died in November of 1994. Nevertheless, in Europe, the number of people resulted in mushroom consumption died were less than Turkey because the European employ the media and books to awareness people during collecting time of mushroom. Therefore, this type of research is very important. (Erdem, 2008).

The aim of this study was to survey and identify wild edible and poisonous mushrooms existing in the Duhok province of Iraq. This is a first study on the surveying of wild mushroom in the whole Iraq.

2. LITERATURE REVIEW

2.1. Description of Identified Mushroom

2.1.1. *Morchella esculenta* (L.) Pers.

Cap: 3-9 cm long, 2-5 cm wide, subglobose to elongate, a cap like pits irregularly arranged to radially elongate, grayish, becoming yellowish brown, surrounded by paler ridges. Stalk 1.5-3 cm wide, 4-6 cm long, diameter generally, not more than two-thirds diameter of a cap, a little larger at base; white to cream; hollow, longitudinally depressed in places, dry too granulose. **Asci**: 220-230 * 18-22 µm, operculate, cylindrical, 8-spored. **Spores**: 20-25x12-16 µm, elliptical, smooth, hyaline; paraphyses numerous, enlarged above, faintly colored, spore print light yellow. Single to scattered on the ground under hardwoods in a vicinity of standing dead elms, in old orchards, at edge of woods, in river and stream bottoms with cottonwoods and soft maple, and in a bewildering variety of habitats; spring. This is a favorite edible fungus and probably is more hunted than any other is. Efforts to grow it commercially have only partially succeeded. Some have interpreted a later-fruiting *Morchella*, *M. crassipes*, like a large form of *M. esculenta. M. deliciosa* may also be considered part of this species (Huffman et al., 2008) the main components available in *M. esculenta* are (on dry basis): carbohydrates 38.0 %, fiber 17.6%, protein 32.7%, fat 2.0% and ash 9.7% (García-Pascual et al, 2006).

Edibility: They are yummy in all dishes where mushrooms increase taste: omelets, burgers, pizza, pasta, frittatas, and veggie, burgers the first bunch of the season in a pinch of butter and olive oil and serve on sourdough toast points. Delicious with venison, cheese, beef, eggs, and duck caution to denature gastrointestinal irritants, always cook morels (Meuninck, 2015). **Habit**: it was on chalky soil under deciduous trees; occasionally with dwarf willow on calcareous dune slacks. **Distribution**: Britain, Ireland, Asian North America and Australia (URL20).

2.1.2. *Helvella acetabulum* (L.) Quél.

Cup: 2-6 cm diameter, inner or fertile surface pale brown, glabrous; lower surface yellow-brown to brown, with pallid to cream-colored ribs extending from the stipe base to the cup; margin incurved toward the center when young, irregular and torn in age. **Stipe**: 2-5 cm high, 2-4 cm thick, whitish to pale creamy, deeply ribbed. **Asci**: cylindrical, hyaline, eight spores. **Spores**: broad ellipsoid, hyaline, with an oil droplet, 15–18×10–13 µm.

spores found in ask that covers the concave upper outward of the cups shape. (Asef et al., 2010). The fruiting brown ribbed elfin cup is poisonous unless cooked well (Hall et al, 2003). **Distribution**: Israel (Barseghyan and Wasser, 2008), Mexico (Vite-Garín et al., 2006).

2.1.3. ***Helvella spadicea*** Schaeff.

Cap: 1.5–3 cm high, 1–1.5 cm wide, saddle-shaped with two lobes, under surface whitish to creamy buff, upper surface dark brown to black, glabrous or smooth, margin curving toward stipe. Flesh thin, elastic, whitish, with insignificant smell and taste. **Stipe**: white to pale cream, rounded, hollow, equal or tapering toward the top, 15–25 mm long, 5–10 mm thick, smooth, flattered or pitted near a base. **Asci**: cylindrical, non-amyloid, attenuated in the base, measure 300–350×18.4–23 µm, 8-spored. **Spores**: 16.1–18.4×9.2–11.5 µm, ellipsoid, hyaline, smooth, with large central oil-drop, and with many small oil drops around large drop. Paraphyses of 230–250×4.6–6 µm cylindrical, slender, septate, forked, and clavate in the apex. Humus saprotrophic very rare. **Distribution**: France, UK, Germany, Austria, Portugal, Belgium, Italy, Czech Republic, Netherlands, Hungary, Romania, Kyrgyzstan, USA, Turkey, Algeria and Israel (Barseghyan and Wasser, 2008).

2.1.4. ***Terfezia claveryi*** Chatin, La Truffe

Ascocarps: 4-6 cm wide, ball to semi- ball shaped, outward white at first, later red-brown, lastly black-brown or dark red-brown, in regularly when mature. Gleba off-white at first, later pale yellow with distinct sterile veins. **Peridium** 450-600 µm thick, off-white to pale yellow with a narrow brown zone at the outward; surface hyphae with pale brown walls, 13–17 µm broad, mixed with cells inflated up to 50 µm broad, walls ±1 µm thick. Gleba of hyaline, parallel hyphae, 7-12 µm broad, walls ±1 µm thick. **Asci:** randomly dispersed in the gleba, 60–80×50–70 µm, globose-ellipsoid, walls ±2 µm thick and 8-spored. **Spores:** globose 16–18×16–19 µm, excluding ornamentation of hyaline to pale brown, irregular reticulation, walls 3 µm tall and 2 µm thick (Turkoglu et al., 2015).

The first *T. claveryi* truffles were gotten the third year after plantation rather than in the first or second year. Since 1999, *T. claveryi* has been cultivated throughout southeastern Spain and specific places in Israel, Abu Dhabi, and Argentina, and all plantations have been established with mycorrhizal plants produced by special technology. Usually, the *T. claveryi* occure with Helianthemum genus (Zambonelli and Bonito, 2013). **Habit**: they have been found in arid and semi-arid zones and Mediterranean basin**.**

Distribution: Iran, Kuwait, Saudi Arabia, Qatar, Libya, Spain, Greece, Cyprus, Hungary, Croatia, and China (Loizides et al., 2012).

2.1.5. *Leucoagaricus leucothites* (Vittad.) Wasser

Cap: 5-9 cm in diameter, convex or irregularly convex when young ("lumpy looking"), becoming broadly convex, broadly bell-shaped, or nearly flat; dry; minutely to finely or moderately scaly, especially when young--but often becoming bald with age; soft; white or grayish white when fresh; sometimes staining and bruising yellowish to brownish, especially along the margin; the margin not lined. Gills Free from the stem; close; short-gills frequent; white. **Stipe**: 6-10 cm long; 1-1.5 cm thick; usually club-shaped; dry; bald; discoloring and bruising yellowish to brownish; becoming hollow; with a white ring on the upper stem that is fairly persistent but may fall away. **Spores**: 8-11x5-6.5 µm, amygdaliform to subellipsoid; thick-walled; with a tiny pore; smooth; hyaline to yellowish in KOH. **Habit**: growing alone or gregariously in grassy areas or on disturbed ground often in the vicinity of conifers; occasionally appearing in woods (URL1). **Distribution** Europe, Asia, North America, Africa and Australia (Vellinga, 2006).

2.1.6. *Panaeolus fimicola* (Fr.) Quél

Generally, small grayish agaric with mottled black gills and purple-brown stem; solitary or in small groups, annual, coprophilous, infrequent, odor and taste not distinctive and inedible. **Cap**: 0.4-1.2 cm at first parabolic becoming hemispherical with slight umbo with lever remnants overhanging the margin as fine regularly spaced teeth; at first greyish-brown fading to grayish with a hazel tinge, hygrophanous, smooth, finely crazed and wrinkled. Flesh gray and thin.Lamellae at first grey-olivaceous, becoming mottled black with white edge, adnate, moderately crowded, narrow, regular and short gills of 2 lengths. **Stipe**: 1.8-5.6 cm purple-brown/clay, slender, long, equal and finely pruinose. Flesh pallid brown, hollow and fragile. **Spore**: 6.5-7.3×5.2-6.5 µm. purple black, smooth and lemon-shaped to angular with an apical germ-pore. **Distribution**: Europe (Karun and Sridhar, 2015), Poland (Halama, 2014), India (Kaur et al, 1918), Pakistan (Sultana et al., 2007) and turkey (Kaya, 2009).

2.1.7. *Amanita ovoidea* (Bull.) Link

Cap: 10-30 cm, at first finely floury, then discoloring to straw white and smooth. **Stipe**: 5-10 cm long and 3-6 mm thick, stout, tapering slightly upward with a superior ring and volva. Gills at first, are white then whitish brown, crowded, free. Smell indistinct.

Flesh whitish. **Spores**: ellipsoid, smooth, 10-11x6-7 µm in size. **Habit**: solitary or in small groups. On soil in broad-leaved or mixed woods. **Distribution**: Pakistan (Razaq and Shahzad, 2016), Turkey (Doğan, 2013), Serbia (Lukić, 2008), Italy (Cocchi et al, 2006), Macedonian (Petrovska, 2001) and UK (Evans, 2006).

2.1.8. *Conocybe semiglobata* Kühner ex Singer

Cap: 20–30 mm wide, campanulate, yellowish brown, hygrophanous, translucently striate when moist. Lamellae adnate, moderately crowded, yellowish brown. **Stipe**: it was up to 150 mm long, 1–2 mm wide, evidently not rooting in exsiccatum, brighter yellowish brown than pileus, becoming darker brown near the base; surface completely pubescent. Exsiccatum: pileus, lamellae and stipe yellowish brown. **Spores**: 13–17×6.5–9.5 µm, average 14.9–16.1×7.9–8.3 µm, elongate ellipsoid, not lentiform, thick-walled with up to 2 µm broad germpore, red-brown in KOH. Basidia 4-spored, 21–31×12–16 µm. Clamp connections frequent. Cheilocystidia lecythiform, 15–22×6.5–10 µm, with 3–5 µm wide capitula. Ammonia reaction negative. Stipitipellis consisting of lecythiform caulocystidia similar to cheilocystidia 14–25×8-15 µm, with capitula 3.5–5.5 µm wide, in one collection intermixed with scattered cylindrical to ellipsoid non-lecythiform elements. Pileipellis hymeniform, consisting of sphaeropedunculate elements, no pileocystidia seen. **Habit**: the species occurs frequently in open grassland, from lowland to alpine elevations. It is one of the most common taxa worldwide. **Distribution**: Russia, Turkmenistan, Uzbekistan (Hausknecht et al, 2009), India (Amandeep et al, 2015), Burma (Thaung, 2007) and Greece (Zervakis et al., 2002).

2.1.9. *Boletus impolitus* Fr.

Cap: 5-12 cm in diameter and reach to 20 cm is at first hemispherical, but flattens with age, and is sometimes upturned when mature. It is pale brown, light tan, or tawny, often with a pale gray hoariness initially. It often has a 'hammered' look. **Stipe**: 5-15 cm high, 3.2 cm in diameter, and is slightly fatter at the base. It is pale yellow and often has a red flush. It has no network but sometimes has reddish dots. **Pores**: are pale yellow, with the pores being small and round, and they do 'not' bruise blue. The flesh is pale yellow and remains the same color when cut. It is soft and has a sour smell somewhat like iodine in the base. (URL2). **Spores** 10-14x4-5 µm pale smooth, yellowish brown, elongate. **Habit**: in deciduous woodland on calcareous soils. **Distribution**: Macedonia (Karadelev, 2006), Turkey (Doğan, 2012), Spain (Venturella and La Rocca 2001) and Sweden (Chen et al, 2001).

2.1.10. *Chalciporus piperatus* (Bull.) Bataille

Cap: 1.6-9 cm diameter that is initially convex before flattening out in age, the surface can be furrowed, shiny when dry, it can be a little sticky when wet. **Pores**: surface ranges from cinnamon to dark reddish brown color in maturity. When bruised, the pore surface stains brown. Individual pores are angular, measuring about 0.5-2 mm wide, while the tubes are 3–10 mm deep. **Stipe**: 4-9.5 cm high, 0.5–1.5 cm thick, and is either roughly the same width throughout its length, or slightly thicker near the base. The color of the stipe is like to the cap, or lighter. The flesh is yellow, sometimes with reddish tones, maturing to purplish brown. It has no odor. **Spores**: 7-12x3-5 µm are smooth, narrowly fusiform. **Habit**: it usually found near pines, spruce, and sometimes fir. This mushroom is edible but very peppery that recommends only using it to add flavor to other mushrooms. It has been used as a condiment in many countries. The mushroom should be well cooked before consumption to minimize the risk of gastric symptoms; the peppery taste is lost with cooking. In powdered form, it loses its peppery taste quickly. Some guidebooks classify *C. piperatus* as inedible. Fruit bodies can be used for mushroom dyeing; depending on the mordant used, yellow, orange, or greenish-brown dyes can be made. **Distribution**: Austria, Czech Republic, Greece, Italy, Spain and Germany (URL3; Winner et al, 2004).

2.1.11 *Coprinellus disseminatus* (Pers.) J.E. Lange

Cap: 0.7–1.5 cm diameter 0.5-1 cm in height, convex to obtusely conical or conic-cylindrical when young, expanding with maturity to broadly conical, striate to sulcate to the disc, often with a shallow umbilicus; surface finely granulose, with sparse, micaceous-glistening, hyaline to pale brownish orange granules when young, this detersile and surface becoming glabrous in age, surface also finely pruinose when young becoming less pruinose in age. **Stipe**: 10-35×0.5-2 mm, central, terete, cylindrical, equal or with a slightly enlarged base or slightly tapering upwards, hollow, brittle, glabrous to minutely pruinose above, base pubescent, dull to shiny, dry, at first pale orangish white, becoming white in age. Annulus and volva absent. **Spores**: 6.8-9.2×4.4-5.2 µm, ellipsoid or utriform in face view to phaseoliform or amygdaliform or narrowly amygdaliform inside view, mildly to broadly truncate, apiculus visible, with a central germ pore, smooth, pale to dark earth brown sometimes with yellowish or chestnut. **Habit**: found on bark and wood of dead *Corynocarpus laevigatus*, *Acacia koa* Gray in Montane, gathered on *Pandanus tectorius* branches and under coastal casuarina. **Distribution**: Europe, East Africa, North America, South America, Japan, Australia, Sri Lanka and Hawaii (Keirle et al., 2004).

2.1.12. *Coprinellus micaceus* (Bull.) Vilgalys, Hopple & Jacq. Johnson

Cap: 1-2.5 cm diameter, 1-2 cm thick, obtusely cylindrical when young, expanding to convex, campanulas or planar-convex in age, striate to the disc; surface covered by small, white, mica-like flecks or granules, these in clusters at first then diffuse in age, becoming glabrous at maturity, moist; at first light brown overall, disc remaining so through maturity, margin fading to tan or cream buff, as basidiospores mature and pileus deliquesces, color darkens to dark brown or black. Lamellae ascending, free, close to crowded, broad 2–4 mm, white becoming black. **Stipe**: 28–55mm high 2–3 mm thick, tomentose to smooth, equal or narrowed upwards, white overall, base bruising pale grayish brown. **Spores**: 7–10x4.5–6 µm, reddish-brown, generally, they are lentiform, but viewed from the side they appear more almond-shaped or spindle-shaped, while in front view they appear oval or mitriform. **Habit**: *C. micaceus* is a saprotrophic species, deriving nutrients from dead and decomposing organic matter and grows in and around logs or stumps of broad-leaved trees or attached to buried wood. **Distribution**: Europe, Australia, East Africa, North America, South America, Japan, Hawai'i. (Keirle et al, 2004), Turkey (Kaya, 2010) and Azerbaijan (Seyidova and Hüseyin, 2012).

2.1.13. *Parasola kuehneri* (Uljé & Bas) Redhead

Cap: 1.5-2 cm in diameter, 1-1.5 cm thick, ordinarily rather dark red-brown but may be paler yellow-brown or orange, fading rapidly with the original, but paler cap color remaining in the center. Gills: free, crowded, separated from the stem by a pseudocollarium, that is occasionally indistinct**. Spores**: 6.5–10.4x5.5–8.4 µm, strongly lentiform; in face, view rounded triangular, rhomboid, mitriform, ovate with conical apex to rounded heart-shaped; inside view ellipsoid to somewhat amygdaliform. Cheilocystidia elongate-utriform too cylindrical, sometimes clavate to (sub) globose. Basidia 4-spored. Ecology and **Habit**: founded on soil under trees or shrubs, less often in grassland, occasionally on wood chip and rarely on dung widespread and common, probably under-recorded because of confusion with another species, Inedible. **Distribution:** UK (Schafer, 2014), Turkey (Türkoğlu, 2008), Switzerland (González, 2008**)** and Hawaiian Islands. (Keirle et al., 2004).

2.1.14. *Chroogomphus rutilus* (Schaeff.) O.K. Mill.

Cap: 5-12 cm in diameter the coppery caps of it take on a metallic sheen on sunny days. Occasional specimens flatten fully, sometimes with a sharp umbo, but more often,

the caps remain convex when mature. The pale cap flesh is red. In wet weather, the caps of this species are viscid, drying with a smooth shiny surface. **Stipe**: 6-12 cm high and 0.5-1.5 cm in diameter and, the stems are reddish or red towards the top and yellow towards the base. There is a ring at the apex, where the stem narrows abruptly to the region where the gills wre attached**. Spores**: 15-22x5.5-7 µm. **Habit**: quite common species, it grows, in Summer and in Autumn, under two-needle pines *Pinus pinea* in a Mediterranean environment, *Pinus nigra* and *Pinus sylvestris* in the mountains. **Distribution**: Britain, Ireland, Europe and USA (URL4).

2.1.15. *Phellinus hartigii* (Allesch. & Schnabl) Pat.

Cap: not found, Mushroom body 5-20x5-15 cm, smooth to deeply cracked above, often with a broad sterile marginal band. **Pores**: 4-6 per mm, context bright yellowish-brown, the hyphae septate 3-7 µm in diameter; setae none; basidia 9-11 µm in diameter; **spores** subglobose 5-8 µm in diameter. **Habit**: grow on hardwoods or conifers throughout. **Distribution**: the United States, British, Columbia, Alaska, Mexico, Nicaragua, and Jamaica (Lowe, 1954).

2.1.16. *Phellinus torulosus* (Pers.) Bourdot & Galzin

Cap: not found, the fruiting bodies are semicircular or shell-shaped, with dimensions of 12–30 cm broad by 4–10 cm long. The brackets are typically 1–3 cm thick, although it can be considerably thicker at the point of the broad attachment to the tree. Maximum fruiting body found dimensions of 46 cm wide by 28 cm long by 11 cm thick. The fruiting body margin is rounded, and sometimes wavy, felt-like or tomentose on the flattened upper surface, which is typically orange-brown to rusty-brown in color. The color of the lower pore-bearing surface is cinnamon, rust, or red-brown. **Pores**: there are 5 to 6 pores per millimeter. **Spores**: are ovoid or ellipsoid, hyaline, smooth, with dimensions of 4-6×3-4 µm. The basidia are club-shaped, 4-spored, with dimensions of 14-16×5-6 µm **Habit**: commonly preferred host is *Quercus*. it has been reported growing in a variety of hardwood trees: *Acer, Arbutus, Calluna, Castanea, Celtis, Ceratonia, Cercis, Cistus, Citrus, Cornus, Cratageus, Cydonia, Erica, Eucalyptus, Euonymus, Fagus, Fraxinus, Grevillea, Helianthemum, Juglans, Laurus, Malus, Melaleuca, Morus, Myrtus, Olea, Ostrya, Parrotia, Phillyrea, Pistacia, Pittosporium, Populus, Prunus, Punica, Pryus, Robinia, Rosa, Salix, Spartium, Ulex, Ulmus, Viburnum* and *Vitis*, (URL5). **Distribution**: North America (Gilbertson and Burdsall, 1972), Italy (Panconesi et al., 1994), China (Dai, 2011) and Turkey (Dulger, 2005).

2.1.17. *Inocybe ayeri* Furrer-Ziogas

Cap 2-5 cm diameter, at first hemispherical, soon convex to plane, surface woolly-fibrillose when young, cream-ochre to light grey-ochre. Flesh whitish, thin, odor spermatic, taste mild. Lamellae gray-white, soon light brown, broad, edges white-ciliate. **Stipe**: 2-5 × 5-1 mm, cylindrical, solid, fragile, surface brownish with white woolly or white-fibrillose **Spores**: 8-11×4-6 μm, thick-walled, elliptical to phaseoliform, smooth, light ochre-yellow. The *Inocybe ayeri* contain muscarine effect the autonomic nervous system, abdominal cramps perspiration, lacrimation and salivation, appear within 1.5-3 hours after eating, occasionally escorted by a lessening of the pulse rate and decrease of blood pressure to dangerous levels. This may cause death, depending on the size of the victim and the quantity eaten. **Habit**: found in *pinus sp*. forest. **Distribution**: Turkey (Alkan, 2010; Huffman et al., 2008), Australia and North America (Braaten et al., 2013).

2.1.18. *Inocybe fuscidula* Velen

Cap: 1-30 cm in dimeter, convex, subumbonate, surface smooth, satiny; margin yellowish to dark yellowish-brown; disk dark yellowish-brown. Lamellae adnexed, close, dark yellowish-brown with fimbriae, white to pale brown edges. **Stipe**: 2.5-3.5cm high and five cm thick, equal to a somewhat swollen base, solid; apex pruinose, lower portion striate and white. Context thin in pileus, white; white to very pale brown in stipe. Odor strong, fungoid. Taste not distinctive. Chemical reactions: Not examined. **Spores**: 7.0-10.5x4.5-6.5 μm, on average 9.5x5.8 μm, amygdaliform in side view, ellipsoid in frontal view, smooth, yellowish-brown to orange-brown. **Habit**: found in *pinus sp*. forest. **Distribution**: Japan (Kobayashi, 2005), Turkey (Alkan, 2010), Australia and North America (Braaten et al., 2013).

2.1.19. *Marasmius rotula* (Scop.) Fr.

Cap: 1.5-7 mm broad, rounded, with a central depression, distinctly folded; white; margin wavy, striate. Flesh very thin and white color. Gills not attached to stalk but to collar encircling stalk, distant and white color. **Stipe**: 1.5-8.5 cm long, 0.3-1 mm thick, equal; shiny black, tough, smooth and hollow. **Spores**: 6-10x3-4.5 μm, narrowly elliptical, tapered at one end, smooth; spore print white. **Habit**: some to many on twigs and leaves on the ground on bark or in woods on a lower trunk in a forest; Fall, Spring and Summer. (Huffman et al., 2008). **Distribution**: Germany, Denmark, USA (Antonín et al, 2014),

Cameroon (Kinge et al., 2013), Nigeria (Jonathan and Fasidi, 2001) and Philippines (Tadiosa et al., 2011).

2.1.20. *Armillaria mellea* (Vahl) P. Kumm

Cap: 3-15 cm in diameter, curved and smooth at first but becoming flattened with age, later becoming slightly dish-shaped. In addition, cap normally curved at maturity and the upper exterior is sticky when wet. The gills are the white color at first, sometimes becoming discolored or pinkish-yellow with time. **Stipe**: 10-20 cm long and 1.5-4 cm in diameter (Kuo and Methven, 2010). **Spores**: 7-9x6-7 μm; smooth; more or less elliptical; inamyloid; with a prominent apiculus. Basidia lacking basal clamps (URL21). **Habit**: black rhizomorphs form on the surface of colonized roots and under the bark of infected trees. Mycelial fans may also form beneath the bark of diseased roots and the root crown. Causes serious white rot of roots, especially in urban trees that have been over-watered. Thought to be the most virulent *Armillaria spp.* in California. Wood initially appears water-soaked, then becomes light colored and spongy with more advanced decay (Glaeser and Smith, 2010). *A. mellea* mushroom considered best edibles, while some individuals have reported "allergic" reactions that result in stomach upsets. Some authors suggest not collecting mushrooms from the wood of various trees, including hemlock, buckeye, eucalyptus, and locust. The mushrooms have a taste that has been described as slightly sweet and nutty, with a texture ranging from chewy to crunchy, depending on the method of preparation. Parboiling mushrooms before consuming removes the bitter taste present in some specimens, and may reduce the number of gastrointestinal irritants. Drying the mushrooms preserves and intensifies their flavor, although reconstituted mushrooms tend to be tough to eat. **Distribution**: it has been found in North America, Europe, North Asia and South Africa (Roberts and Evans, 2011).

2.1.21 *Pleurotus eryngii* (DC.) Quél.

Cap: 5-20 cm in diameter, firstly convex, then Flattene, funnel-shaped with involute margin. Color can vary from white to grey. The Flesh is white, solid with grate flavor and smell that reminds in some way hazelnuts. Gills: Crowded, decurrent .white-cream colored. **Stipe**: 3-10 cm solid, full, eccentric, often rooting, white-cream colored (URL6). **Spores**: 10-14x5-8 μm. Uses the mushroom has a good shelf life. An effective cultivation method was introduced to Japan around 1993 and has become popular there in a variety of dishes. It is now cultivated and sold commercially in Australia. Imported product is also commercially available in Australia and South Africa. It is also cultivated in

Taiwan, China, South Korea, Italy, and the United States. It has little flavor or aroma when raw. When cooked, it develops typical mushroom umami flavors with a texture similar to that of abalone. Pleurotus eryngii may naturally contain chemicals that stimulate the immune system. Dietary intake of Pleurotus eryngii may function as a natural cholesterol lowering dietary agent. **Distribution**: Israel (Lewinsohn et al., 2002), Turkey (Yildirim et al., 2012) and Philpines (Khan et al., 2011).

2.1.22. *Pleurotus ostreatus* (Jacq.) P. Kumm

Cap: 5–25 cm in diameter the color specimens range from white to gray or tan to dark-brown; the margin is inrolled when young, and is smooth and often somewhat lobed or wavy. The flesh is white, firm, and varies in thickness due to stipe arrangement. Gills of the mushroom are white to cream, and descend on the stalk if present. **Stipe**: it is off-center with a lateral attachment to wood. *Pleurotus ostreatus*, which is popular among cultivated oyster mushroom species are characterized by its white to lilac-gray spore print, and best viewed on a dark background. Its stipe is often nearly absent, and when present, it is short and thick (Teshome, 2016). **Spore**: 8-12x3.5-4.5 µm ellipitic and smooth. (Metzler and Metzler, 2010). **Habit**: it is often seen growing on dying hardwood trees; it only appears to be acting saprophytically, rather than parasitically. As the tree dies of other causes, *P. ostreatus* grows on the rapidly increasing mass of dead and dying wood (URL7). **Distribution**: Israel (Lewinsohn et al., 2002), Turkey (Yildirim et al., 2012) and Philipines (Khan et al., 2011).

2.1.23. *Volvariella gloiocephala* (DC.) Boekhout & Enderle

Cap: 5-6 cm broad, ovoid, expanding to convex or plane, more or less umbonate, viscid, glabrous, margin slightly striate, white to light avellaneous or light brownish gray, often darker on the disc, flesh moderately thick in the center, thin towards the margin, soft, white, maculose absent. Lamellae close to crowded, broad, free, becoming deep flesh color. **Stipe**: 5.7×0.4 cm in diameter, equal or enlarging to base, 0.5 cm thick, white to cream. **Spores**: 11–14×7–9 µm, oval to ovoid, occasionally obovoid. Basidia 35–38×15–16 µm, clavate, tetrasterigmatic, 4-spored. **Habit**: Growing mostly solitary upon cow dung admixtured decaying paddy straw or compost heaps. **Distribution**: India (Dutta et al, 2011) Korea (Seok et al., 2002), Yamane (Al-Fatimi et al, 2013) and Turkey (Kaya. and Bag 2010).

2.1.24. ***Coriolopsis trogii*** (Berk.) Domanski

Cap: not found, mushroom body up to 4 cm wide; an upper surface of body coarsely hispid, cream-buff to white-buff; margin sharp, pore surface white buff. **Pores**: angular to labyrinth form, 1-2 per mm; dissepiments thin and lacerate; tube layer continuous with lower layer of context, up to 9 mm deep; context cream-buff, duplex, darkening slightly with KOH reaction stronger in older basidiocarps, lower layer firm, up to 2 mm thick, and evenly integrated with the soft spongy and fibrous upper layer, up to 5 mm thick. **Habit**: found in dead hardwoods most common on *Populus* and *Salix* but also collected on *Acer, Betula, Fagus, Quercus,* and *Ulmus*. **Distribution**: widespread in warmer parts of Europe but rare in a Southern part of South Europe (Gilbertson and Ryvarden, 1993) and Poland (Wojewoda and Karasiński, 2010).

2.1.25. ***Lentinus tigrinus*** (Bull.) Fr.

Cap: 2-5 cm in diameter, 1-2 cm thick, deeply convex limb, very faintly, white then cream in the center, finally dingy yellowish with age. **Stipe**: 1.2-4 cm x 1.5-3.5 mm, central or eccentrics, cylindrical or attenuate downwards to the slightly thickened and abrupt base, or with several stems arising from a trunk white or cream. **Spores**: 5-7.5x2-3.5 µm white, smooth, subcylindric, inamyloid, with 1-2 minute guttural at the ends. Basidia 15-18x4-4.5 µm stigmata (URL8). **Habit**: Usually grows in small groups on woods, especially on buried parts of wood. (Razaq and Shahzad, 2015). **Distribution**: Turkey (Dursun et al., 2006), Thailand (Karunarathna et al., 2011) and Iran (Barzegar et al., 2013).

2.1.26. ***Polyporus arcularius*** (Batsch) Fr

Caps: 1-6 cm wide; Dark brown when young, becoming yellow-brown in age; dry; scaly; margin lined with conspicuous hairs. **Stipe**: 2-6 cm long and 1.5-4.5 mm thick, central, colored like the cap. **Pore**: White to pale yellow; pores polygonal to angular, radially arranged; 0.5-1 pore per mm. **Spores**: 6-8.5x2-3 µm, white, smooth, cylindric, often 2-guttulate, not amyloid. Basidia 16-21x4-5 µm; stigmata. **Habit**: it was found Individual or in groups on decaying deciduous wood or attached to buried wood (URL9). **Distribution**: it is found throughout the tropics, subtropics and the warmer parts of the temperate zone, in Africa collected from Sierra Leone to Kenya and Tanzania, and south to South Africa (URL10).

2.1.27. *Trametes gibbosa* (Pers.) Fr.

Cap: not found, Fruit bodies are 8–15 cm in diameter and semi-circular in shape. The upper surface is usually gray or white, but may be greenish in older specimens due to algal growth elongated. **Pores**: surface white to pale cream or straw-colored in old specimens, 1-2 pore per mm measured tangentially, 1-5 mm long measured radially; context white, dense, tough-fibrous, azonate, up to 3 cm thick at the base; tube layer concolorous with pore surface, up to 2 cm thick. **Spore**: size is 4-5x2-2.5 µm, cylindrical to oblong-ellipsoid, hyaline, smooth and negative in Melzer's reagent. **Habit**: that found on beech stumps and the dead wood of other hardwood species. It was recorded in other hardwoods including *Acer, Aesculus, Ailanthus, Alnus, Betula, Castanea, Corylus, Cratageus, Eucalyptus, Fraxinus, Juglans, Malus, Morus, Platanus, Populus, Prunus, Pyrus, Rhainnus, Quercus, Salix, Sorbus, Tilia* and *Ulmus.* **Distribution**: in Europe north to the southern part of Norway and Sweden and Widespread through Asia to Japan. (URL11, URL12).

2.1.28. *Psathyrella candolleana* (Fr.) Maire

Cap: 3-11 cm; rounded-conical or convex when young, expanding to broadly convex, broadly bell-shaped, or nearly flat; bald; often developing shallow radial wrinkles; dry; honey yellow when young, changing color markedly to pale brownish or nearly white as it dries out; the young margin adorned with hanging partial veil remnants; mature margin often splitting radially in places. Gills Attached to the stem or nearly free from it; whitish at first, becoming grayish and finally dark brown; close or crowded. **Stipe**: 4-13 cm long; 3-8 mm thick; equal; fragile; white; hollowing; bald or slightly lined and/or silky; almost always lacking a ring, but sometimes with loosely clinging partial veil remnants in a ring-like zone. Flesh very thin; fragile; brownish to whitish. **Spores**: 6.5-9.5x4-5 µm ellipsoid with a truncated end; smooth; dark brown in KOH. **Habit**: that grows alone or gregariously in lawns, pastures, and cultivated areas also in woods; typically near recently dead hardwood trees, their roots, and stumps and usually appearing in spring and early summer, but sometimes appearing in fall. **Distribution**: common in North America (URL12), Turkey (Kaya and Bag, 2010), Greek (Padamsee et al., 2008), Italy (Salerni and Perini, 2007) and Iran (Karim et al., 2012).

2.1.29. *Rhizopogon roseolus* (Corda) Th. Fr.

Cap: not found. Mushroom body 1.5-3-6 cm diameter subglobose to ellipsoid but usually irregularly so with an uneven outline, attached on the lower half by scanty, white to yellowish mycelial cords. Peridium thin, white or yellowish cream, discolouring rose-pink on exposure, finally reddish brown, with purplish black patches, finally tesselate-areolate, covered with appressed, white to yellowish or dark reddish fibrils. Gleba at first bright yellow then darkening from the centre to pale olive brown to yellowish brown. **Spores**: 7.5-10x2.5-4 µm, cylindrico-ellipsoid to fusoid, with a small basal scar but scarcely truncated, pale yellowish, slightly thick-walled, smooth. Basidia 22-28x7-8 µm, lageniform with a ventricose base, originating from brachybasidioles, developing a variable number of sterigmata, mostly four or six. **Habit**: it is always associated with Pinus, and is generally recognized by the whitish gasterocarps, when fresh, which soon become bruised pinkish to purplish on handling. The mycelial cords are less conspicuous than those of *R. luteolus*, and the less gelatinized gleba does not dry so hard and can be easily sectioned (Pegler et al., 1993). **Distribution:** North America (Zeller and Dodge, 1918), Turkey (Solak et al., 2006), East Asia and Japan (Yun and Hall, 2004).

2.1.30. *Schizophyllum commune* Fr.

Cap: 1-3.5 cm broad, fan-shaped bracket, frequently lobed or fused at the base with other brackets; upper surface densely hairy, light greyish-brown when moist, ashy grey to white when dry; lower surface light grey consisting of well-spaced, longitudinally split gills; stipe usually absent; flesh thin, light grey to brown, tough. The gills are pale reddish or gray, very narrow with a longitudinal split edge which becomes enrolled when wet; the only known fungus with split gills that is capable of retracting by movement. Fleshy mushrooms quickly rot in the hot humid. **Stipe**: it is very short and often not visible above the substrate surface; indeed, when underneath dead wood the fruitbodies is attached centrally via the infertile surface and without any stipe. **Spores**: 3-4x1-1.5 µm, cylindrical, smooth; spore print white. **Habit**: that found on hardwood logs and branches; fruiting after the fall rains, but can be found year-round. **Distribution**: European, Amrica, Mexico and India (Cooke, 1961; Lindsey & Gilbertson, 1978; Watling and Gregory, 1989; Desjardin et al., 2015).

2.1.31. ***Pisolithus arrhizus*** (Scop.) Rauscher

Cap: 5-10 cm across, but a very large one can be 20 cm across its largest. Often ellipsoidal or ovoid, especially when young, sometimes the fruitbodies develop a rudimentary stem as they mature, but unlike some puffballs, the entire contents of the eyeball consist of fertile spore-bearing material. Dimension and may weigh nearly 1kg. Initially, the inside of a *Pisolithus arrhizus* fruitbody comprises many separate compartments like those that rice grains or peas squashed together known as pseudoperidioles, within which the fungal spores develop. **Spores**: 7-11.5 µm diameter; ornamented with warty spines up to 2 µm tall. **Habit**: it is most often found with trees in a soft sandy soil, particularly in coastal pine. **Distribution**: Southern Europe, Britain, Ireland, USA and Portuga (URL14).

2.1.32. ***Stereum hirsutum*** (Willd.) Pers

Cap: not found, mushroom body 1-3.5 cm wide and up to 8 cm long when fused with adjacent shelves; upper surface hairy, undulate, lobed, banded orange-brown to yellow-brown, older tissue grey to grey-brown; lower fertile surface smooth, orange-buff to pale-buff, if zoned, less conspicuously than the upper surface; flesh 0.5-1.0 mm thick, pliant when young, tough in age; stalk absent. **Spores**: 5-7x3-4 µm, cylindrical, smooth d those found on the upper pileus surface. **Habit**: fruiting in tiers and overlapping shelves on dead hardwood stumps, branches, etc., occasionally on conifer wood; fruiting throughout the mushroom season (URL15). **Distribution**: widespread in both hemispheres in Mexico and Central America, Caribbean islands, and South America (Welden, 2010).

2.1.33. ***Agrocybe arvalis*** (Fr.) Heim & Romagn.

Cap: 2-7 cm in diameter, without olivaceous tinge. **Stipe**: 4-8 mm wide. **Spores**: 9-10.5×5.2–6 µm, elliptical and smooth. **Distribution**: Netherlands, (Nauta, 2003) Morocco, (Haimed et al., 2015) Austrian, (Hausknecht and Klofac, 2010) and Pakistan (Sultana et al., 2011).

2.1.34. ***Agrocybe pediades*** (Fr.) Fayod

Cap: 0.5-3.5 cm in diameter, hemispherical or slightly conical becoming broadly convex; the yellow to ochre-yellow surface is smooth and greasy; slightly hygrophanous, drying slightly paler; margin of young specimens hung with small white cottony veil fragments.The cap flesh is white, turning gradually ochre. Gills adnexed with a slight decurrent tooth; initially creamy beige turning grey-brown to rust-brown. **Stip**: 3-5 cm

long and 2-6 mm thickness; cylindrical, occasionally broadening slightly towards the base; whitish to pale ochre-yellow; pruinose; pale stem flesh, solid when young becoming hollow with age; usually without a stem ring or an obvious ring zone. Fine white rhizomorphs are often visible at the stem base. **Spores**: ellipsoidal, smooth, 9.5-15x7-9.5 µm, with a germ pore and a small hilar appendage.spore print dark brown. Basidia clavate, 30-33x11-13 µm, four-spored; with a basal clamp. **Habit**: normally fruits found in groups and is rarely solitary; it is saprobic and appears on lawns, in pastureland and in grassy parkland. **Distribution**: Britain, Ireland, Northern Europe and North America (URL16).

2.1.35. *Hypholoma subericaeum* (Fr.) Kühner

Cap: 1-4 cm wide, rounded, sometimes humped, without veil remnants, smooth, yellow-brown with slightly darker. **Stipe**: 2-8 cm high, cylindrical, without a ring. **Spores**: 12-15 µm. **Habit**: that is growing in meadows on wet fields or in acidic soils, on peat or moss. **Distribution**: Danmark (Vesterholt and Knudsen, 2008; Watling and Gregory, 1987) and UK (Hedger et al., 2006).

2.1.36. *Pholiota lucifera* (Lasch) Quél.

Cap: 3-6 cm in diameter, semi-globose to broadly umbonate, lemon yellow, bright yellow with red-brown scales, slightly viscid; margin at first coalescent with the stipe trough a yellow cortina. Gills notched, light yellow to rusty yellow. **Stipe**: 4-7 high, 0.5-1 cm thick, cylindrical, concolorous with the cap, red-brown ring in the upper part, scaly under the ring. Flesh light yellow, reddish at the base of the stipe. **Spores**: 7-8×4-5.5 µm, ellipsoid, light yellow, smooth. **Habit**: found on dead wood often buried into the soil, in deciduous forests. **Distribution**: Bulgaria (Stoichev and Dimcheva, 1987) Turkey (Servi et al., 2010) and Italy (Salerni and Perini, 2007).

2.1.37. *Pseudoclitocybe expallens* (Pers.) M.M. Moser

Cap: 3-5 cm in diameter, convex, then very infundibular, brown color to cream. **Stipe**: 3-4 cm high, 4 mm wide, also the stipe color is like the cap color. (Tabares and Rocabruna, 2008). **Spores**: 6-9x5-7 µm uniform to ovoid-ellipsoid, lacking a suprasellar depression. The amyloid wall is smooth at both light microscope and ultrastructural levels. **Habit**: unimproved grassland grassed by sheep, northeast oriented mountain slope, calcareous ground, mostly sunny, exposed to direct rain (Pegler and Young, 1973). **Distribution**: Italy (Vizzini et al, 2011), Turkey (Güngör et al, 2015) and Spain (Jiménez et al, 2000).

2.1.38. *Gymnopus dryophilus* (Bull.) Murrill

Cap: 1-5 cm broad, rounded, flattening with time; rusty to tawny brown to reddish brown, generally with a lighter band at margin; moist, drying silky, smooth; margin often incurved at first, becoming upturned, wavy. Flesh thin, white. Gills attached to notched, narrow, crowded; white, aging to buff. **Stipe**: 1-8 cm long, 2-5 mm thick, often swollen at the base and surrounded by a mat of white mycelium; it colors as a cap or paler; slightly flattened. **Spores**: 5-6.5x3-3.5 μm, elliptical, smooth; spore print white. **Habit**: clustered to numerous in leaf litter under hardwoods, on wood or sawdust piles, during Spring, Summer and Fall (Huffman et al, 2008). **Distribution**: Turkey (Yamaç et al, 2007), Mexico (Reverchon et al., 2010), Italy (Vizzini et al, 2008), China (Zhang et al, 2010), Spain (Ortega and Esteve-Raventós, 2005) and New Zealand (Cooper and Leonard, 2013).

2.1.39. *Gymnopus fusipes* (Bull.) Gray

Cap: 3-7 cm across Convex, flattening with an irregular incurved margin at least until fully mature brown, often with dark brown blotches. Gills of Gymnopus fusipes. Gills white, tinged tan-brown, developing rusty spots; annexed or free; very widely spaced. **Stipe**: 7-15 cm long and 0.8-1.5 cm diameter white near the apex, tan towards the base; spindle-shaped and usually grooved and sometimes lined longitudinally; the ring absence. **Spores**: 4-6x2-3 μm, spindleshanks ellipsoidal to pip-shaped, smooth, thin-walled, spore print white (URL17)**. Habit**: it is growing on old buried roots and branch and in remnant oak forests such as in the former parkland. **Distribution**: England (Watling, 2014), Italy (Angelini et al, 2012.), New Zealand (Cooper and Leonard, 2013), Denmark, France, United Kingdom, France, Austria (Hughes et al, 2010) and USA (Antonín et al, 2014).

2.1.40. *Lepista nuda* (Bull.) Cooke

Cap: 4-20 cm; convex with an inrolled margin when young, becoming broadly convex to nearly flat--or with an uplifted, wavy margin in age; surface smooth, slightly tacky when moist; sometimes finely cracked over the center; usually dull purple, or purplish with brown shades when fresh, fading to brownish, flesh-colored, tan, or paler but sometimes brown or buff from the beginning. Gills attached to the stem sometimes by a notch or beginning to run down it; close or crowded; pale lavender to lilac, fading to buff, pinkish-buff, or brownish. **Stipe**: 3-10 cm long; 1-3 cm thick at apex; equal, or enlarged at the base; dry; finely hairy, and/or mealy near the apex; pale purple or colored like the gills; becoming brownish in age; base often covered with lilac to buff mycelium. Flesh thick,

soft, purplish to lilac-buff or whitish. **Spores**: 5.5-8x3.5-5 µm ellipsoid; roughened or sometimes smooth; inamyloid. **Habit**: grows in groups in all kinds of debris: leaf and wood chip piles, decomposing organic matter in open places and thin woods; seems to prefer oak leaf dumps. **Distribution**: Europe and North America (URL 18; Russell, 2006).

2.1.41. ***Lepista sordida*** (Schumach.) Singer

Cap: 2-7 cm diameter, obtuse at first with an in rolled and in curved margin, becoming convex to plane with the margin slightly decurved, remaining narrowly in rolled and in curved for some time, pruinose-pubescent but soon appressed, disc becoming broadly but shallowly depressed, umbonate at times, margin finally up- lifted and spreading, often broadly undulate, sometimes lobed, faintly short pellucid- striate at times when moist but more often opaque, surface with a hoary sheen when very young, soon becoming innately fibrillose or glabrous, dull, hygrophanous, colo moist: various shades of violaceous to vinaceous brown, paler and opaque in age or when faded disc sometimes tinged darker, edges browning in age. Gills thin, firm, brittle, con with moist cap at first, soon fading to whitish with a vinaceous or pinkish cast, odor none or fungoid, taste mild. Lamellae adnexed to adnate or sometimes sinuate at first, becoming decurrent, close to subdistant, narrow to moderately broad (2-5.5 mm), often arched, not intervenose, separable from cap trama, color sordid pinkish or vinaceous, edges even, becoming eroded, somewhat undulate at times. **Stipe**: 2-8 cm length, 1.5-6 mm thick at apex, equal or the apex enlarged and tapering downward, solid, compressed at times, often curved and flexuous, at first covered by a thin whitish fibrillose coating, glabrescent or longitudinally striate, fibrils whitish, ground color like that of the moist cap, base often with small tuft of whitish or lilaceous tomentum, not connate. **Spores**: 6-8x3-5 µm, ellipsoid, sometimes some of them smooth, not amyloid, dingy "pinkish buff" or "pale pinkish buff" in mass. **Habit**: it is found on lawns, cultivated soil, pastures, old fields, etc. but also on compost piles, manure, or occasionally sawdust heaps. Rarely in the woods. It is found most frequently in late August to November out of doors, but occur in winter and spring in greenhouses. (Bigelow and Smith, 1969) **Distribution**: India (Pushpa and Purushothama, 2012), South Korea (Park, 1993), turkey (Doğan et al 2012), China (Dai et al, 2009), Italy (Doveri, 2010) and Greece (Zervakis et al, 2002.)

2.1.42. ***Melanoleuca stridula*** (Fr.) Singer

Cap: 2.7 cm wide, broadly conic-campanulas with incurved and finely grooved margin, smooth, viscid, shiny, evenly dark grey-brown. Gills slightly decurrently with a

tooth, fairly close, white. **Stipe**: 4x0.3 cm slightly attenuated upwards and bulbous at base smooth above, downwards fibrillose, pinkish brown, more grey-brown downwards. Flesh white, somewhat browning. **Spores**: 7-9x3-4 µm, ellipsoid, with amyloid warts. Basidia 4-spored. Cystidia absent. Clamps absent. Pigment zebra incrusting. **Habit**: grassy places in woods, roadsides, heathland etc. **Distribution**: Norway (Gulden, 2005), Turkey (Kaya, 2015), China (Fan and Yan, 2013) and Spain (Cristobo, 1934).

2.1.43. ***Omphalina galericolor*** (Romagn.) Bon

Cap: 1.3 cm, convex, with central papilla, smooth, shiny, warm yellow-brown to rusty-brown with darker center, radially striate. Lamellae decurrent, subdistant, with lamellulae in between, pale beige, white at an edge. **Stipe**: 20x1.5 mm, smooth, pale beige. Flesh pale brown in pileus and stipe; smell absent. **Spores**: 8.0-8.5x5.0-6.0 µm, broadly ellipsoid, blunt, inamyloid, smooth. Basidia 4-spored, 42x8.5 µm. Cystidia absent. Pileipellis of radially repent, elongate, 4-10 µm wide, yellow-brown zebra-incrusted hyphae; pileocystidia absent. Stipitepellis of 5-8 µm wide, cylindric, elongate hyphae, hyaline to pale brown; caulocystidia absent. Clamps at all septa (Gulden, 2005).

3. MATERIALS AND METHODS

3.1. General Description of the Duhok Province

3.1.1. The Geographical location of the survey area

3.1.1.1. Location

Duhok is a province located in the Northern part of Iraq, bordered by the Mosul provinces to the South Turkey to the North Syria to the West and Erbil provinces to the East (Figure 3.1.). It is located between latitudes 37° 20’ and 36° 10’ N and longitudes 44° 18’ and 42° 20’ E (Saddeeq, 2008).

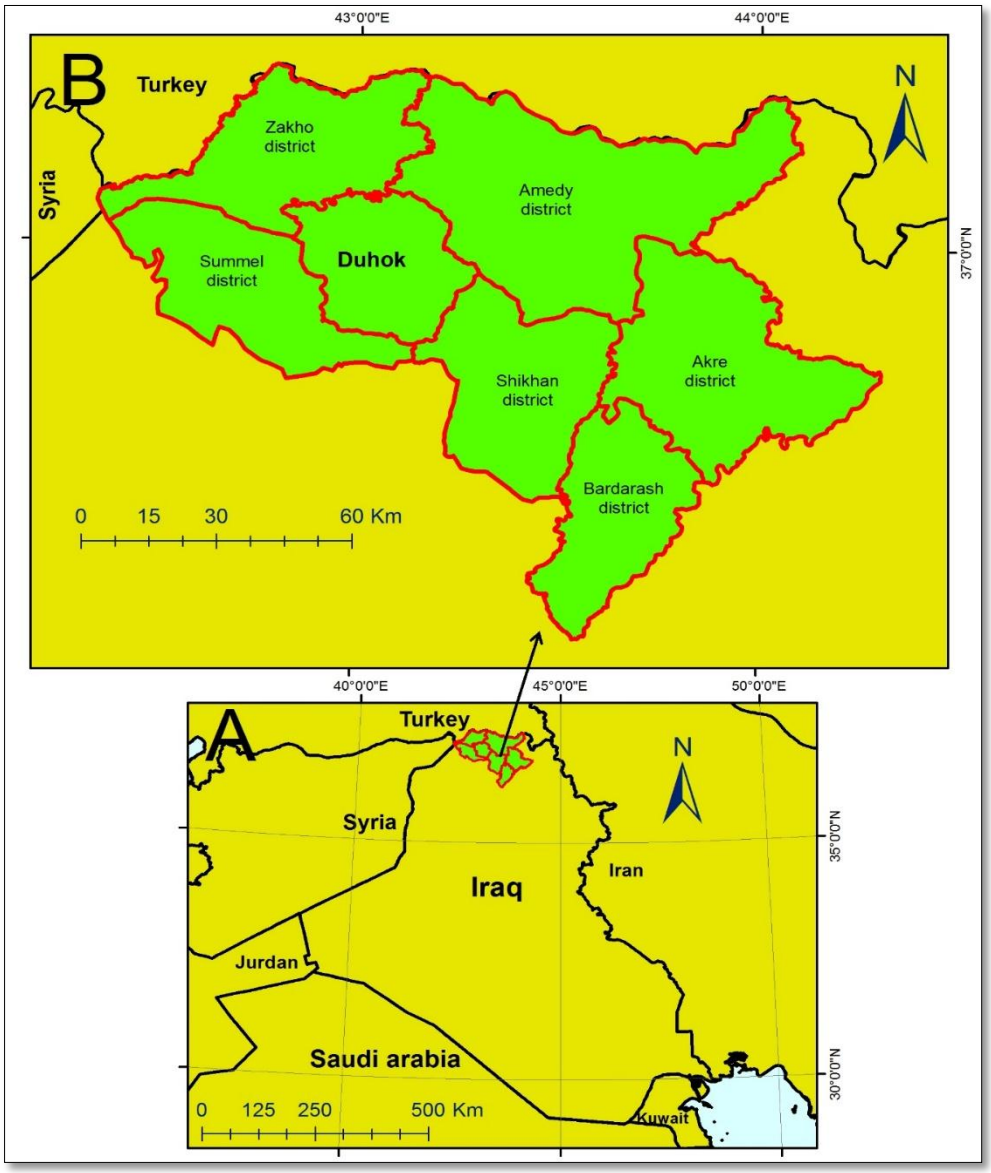

Figure 3.1: Iraq map (A), Duhok province map (B)

3.1.1.2. The geographical description

The details of the areas covered by the different terrains and landforms the altitude starting from 400 m and reach to 3500 m. Generally, the altitude increased when we go toward the North and Northeast. The mountains covered approximately 76.2% of Duhok province area (Saddeeq, 2008).

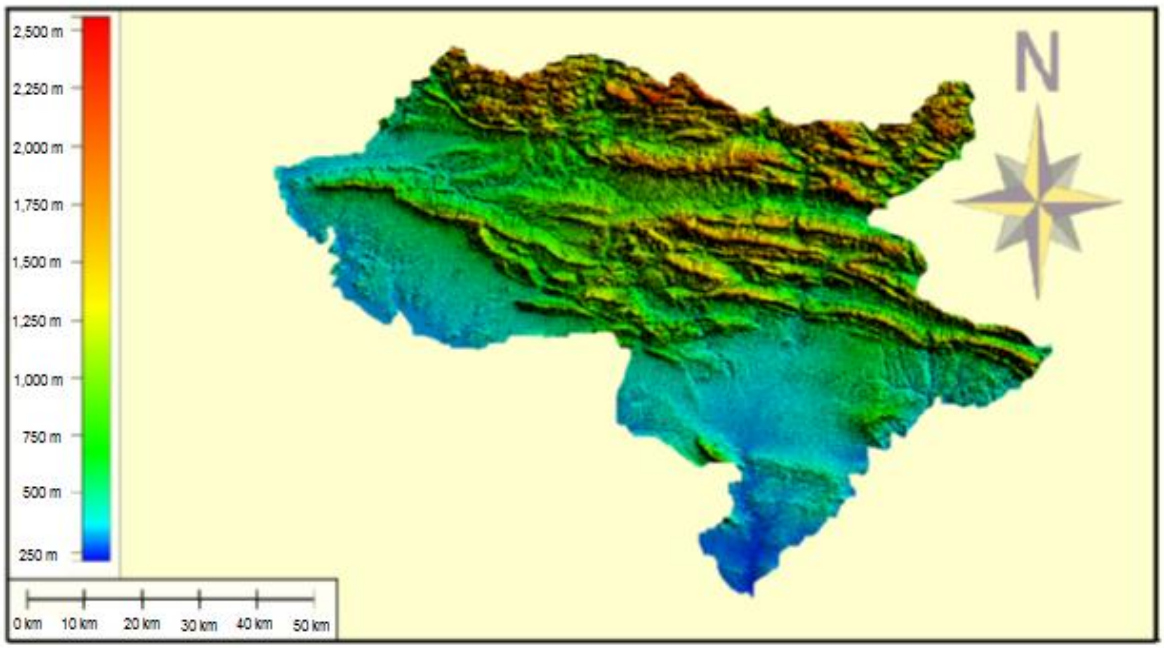

Figure 3.2 Tobografic of Duhok Province (Taha, 2013)

3.1.1.3. Soil properties

Most of the existing soils over the wide plains in Duhok region classified under fine textured group and exhibit medium to high swell-shrink potential upon soil moisture variation, this classification called vertisol. During the summer season, these soils shrink and the shrinkage manifested in form of deep, wide and extensive cracks. Documented evidence of the problems associated with vertisols is worldwide. Water and solutes flow rapidly through the cracks that formed in clay soils upon drying into the subsoil, thus bypassing the relatively dry root zone. This process leads to a nutrient shortage for crops and to pollution of subsoil and groundwater (Khursheed, 2003).

3.1.1.4. Geological structure

The Dohuk region is a part of Zagros orogenic belt near the North-eastern boundary of Arabian plate in the northern Iraq. The Zagros orogen is part of the Alpine-Himalayan orogenic belt (Stampfi and Borel, 2002) extending from the Atlantic Ocean to Western

Pacific. Jassim and Buday (2006) divided Iraq into three tectonically different areas, the Stable Shelf (unfolded zone), the Unstable Shelf (folded zone) and Zagros Suture Zone (thrust zone). In addition, they divided the Folded Zone into two parts: the High Mountain Belt (HMB) that is located northeastwards and the Foothill Belt (FHB), which is situated southwesterly. Stratigraphically, the Duhok area is a part of the folded zone and composed of several geologic formations ranging in time from Cretaceous to Miocene periods. These exposed formations from older to younger are described below:

1- The Bekhme Formation (Late Cretaceous) has basal conglomerates comprising fossiliferous limestones, reefal-detrital limestones and bituminous secondary dolomites.

2- The Shiranish Formation (Late Cretaceous) consists of upper division of blue marls, overlying lower division of thinly bedded marly limestone.

3- The Kolosh Fn. Formation (Paleocene - Early Eocene) is composed of shale, sandstone, fragments of green rocks, chert, carbonates and radiolarite.

4- Khurmala Formation: represents a yellowish to pale grey lenses of limestone on the upper part of Kolosh Formation.

5- The Gercus Formation (Middle Eocene) is composed of red and purple shales, mudstones and marls.

6- Avanah Formation: composed of limestone lenses.

7- The Pila Spi Formation (Middle to Late Eocene) consists of bedded limestones, hard, massive and thickly bedded, chalky appearance, porous or vitreous, bituminous or white and partly fossiliferous. There is a fine to medium crystalline dolostone with chert near the top.

8- The Fat'ha (Lower Fars) Formation (Middle Miocene) consists of thinly bedded limestone, fossiliferous grey thinly bedded mudstone, thick beds of gypsum and siltstone.

9- The Injana (Upper Fars) Formation (Late Miocene) is composed of sub-continental and continental purple, red, brown and grey repeated sequences of siltstones, siltstones and sandstones (Jassim and Buday, 2006).

3.1.2. Climate

The climate of the Duhok province is like to the semi-Mediterranean weather conditions, with an effect of the comparatively high altitude of the near mountains. Depending to (Koeppe and De Long, 1959), the main characteristics of the Mediterranean weather are a modest quantity of precipitation during winter and dry summer. The summer period is low relative moisture and warm with bright sunlight. Greater relative humidity

and the correspondingly lesser amount of sunshine mark the winter period as compared with summer.

Depending on meteorological stations, the annual rainfall is around (570 mm –750 mm). The annual average temperature is 17.4 °C. However, an average more than 30.8 °C in Summer an average low than 5 °C in winter (Table 3.1). The annual evaporation is around 1891 mm/year (Habeeb, 2014). Moreover, the evaporation from 250 m^3 of forest area is (37.5-100 mm) in year depending on the forest type (Taha, 2013) Average annual humidity and average of precipitation of 10 years from the obtainable station in Duhok province, as shown in Tables 2.1 and 2.2, respectively.

Table 3.1. The monthly average temperature data (Celsius) in the Duhok city center during the period 2005 - 2015.

Years	Temperature (Celsius)											
	Months											
	Jan.	Feb.	Mar.	Apr.	May	Jun	July	Aug.	Sep.	Oct.	Nov.	Dec.
2005	8.05	8.30	13.2	19.6	24.2	29.5	34.0	33.3	27.8	16.9	14.2	12.9
2006	6.9	9.3	14.4	19.1	26.7	31.6	32.5	34.6	27.9	22.8	12.4	7.9
2007	6.6	9.2	12.2	15.4	20.7	30.5	34.0	33.4	29.6	23.9	14.7	8.8
2008	4.8	8.2	17.4	21.7	15.5	30.4	33.5	34.5	29.0	22.2	15.1	9.5
2009	7.5	10.9	12.4	17.0	24.1	30.6	32.6	31.5	26.4	23.1	14.2	11.2
2010	10.3	10.9	15.3	18.6	24.3	30.8	34.4	35.2	30.5	23.4	17.8	13.1
2011	8.2	8.6	13.3	17.5	23.1	19.8	33.8	33.3	28.3	20.9	11.1	9.8
2012	7.5	7.6	9.2	19.6	24.3	30.6	33.1	32.3	28.4	22.2	15.5	9.7
2013	7.1	9.8	13.5	18.6	23.7	29.2	32.1	32.2	27.1	20.7	15.2	7.4
2014	8.9	9.8	14.3	18.9	24.9	29.4	33.1	33.1	27.6	21.0	12.7	10.6
2015	7.8	9.7	12.8	17.2	24.5	28.9	33.9	33.0	30.0	22.9	13.5	8.5

Table 3.2. The monthly average relative humidity (%) in the Duhok city center during the period 2005 – 2015.

Years	Relative Humidity (%)											
	Months											
	Jan.	Feb.	Mar.	Apr.	May	Jun	July	Aug.	Sep.	Oct.	Nov.	Dec.
2005	63	64	61	52	39	32	27	27	31	31	44	50
2006	66	60	47	56	40	35	28	26	32	44	55	55
2007	61	65	56	57	43	33	31	29	30	40	59	59
2008	60	59	51	39	37	29	22	25	34	45	54	57
2009	56	57	58	47	33	24	24	23	32	38	68	73
2010	66	68	58	51	44	32	24	22	29	41	37	51
2011	69	65	49	52	48	30	24	25	31	41	60	55
2012	70	60	59	53	46	31	29	30	28	46	63	72
2013	76	74	56	51	46	29	25	27	31	31	65	66
2014	69	55	63	53	44	32	31	27	37	59	67	80
2015	71	71	69	66	45	29	23	26	32	54	69	70

Table 3.3. The monthly average rainfall (mm) in the Duhok city center during the period 2005 – 2015.

Years	Monthly Rainfall (mm)											
	Months											
	Jan.	Feb.	Mar.	Apr.	May	Jun	July	Aug.	Sep.	Oct.	Nov.	Dec.
2005	183.2	100.9	57.2	16.1	41.5	2.8	0.0	0.0	0.0	1.7	29.7	72.9
2006	209.3	188.6	35.9	142.6	8.2	0.0	0.0	0.0	0.0	100.4	48.9	71.4
2007	82.8	130.1	58.4	84.9	29.7	0.0	0.0	0.0	0.0	0.2	17.8	8.3
2008	96.3	51.0	40.2	2.2	0.2	0.0	0.0	0.0	3.3	18.6	76.6	81.7
2009	4.0	67.9	64.2	30.4	0.5	0.0	0.0	0.0	6.8	55.4	64.2	194.6
2010	110.1	68.1	28.7	26.9	41.8	2.7	0.0	0.0	0.0	1.2	0.0	58.4
2011	106.9	70.3	16.8	138.6	55.3	1.2	0.5	0.0	0.8	5.4	18.7	19.5
2012	101.9	80.7	110.8	8.5	2.7	0.6	1.4	0.0	0.0	19.1	54.6	169.0
2013	330.4	100.0	47.4	26.7	28.4	0.5	0.0	0.0	2.2	0.5	129.1	86.5
2014	168.2	8.2	134.5	22.1	15.9	6.1	0.0	0.3	2.5	111.9	153.5	75.9
2015	80.9	64.6	71.4	40.2	9.6	trs	0.0	trs	12.2	38.2	80.1	107.1

3.1.3. Vegetation

A larger part of the Duhok province area is involving of forest and land related with grasslands and herbs below or among trees. The cultivated area is generally around the villages. The total area of Duhok province is about 11000 km^2 (Directorate of Statistics, 2013) but around 28.4% percentage is a forests area (FAO, 2003). Nevertheless, there is no a certain data of the forest ratio of it at the local level.

In general the forest region of Duhok province includes the major tree are Oak trees with *Quercus infectoria*, *Qercus aegilops*. *Juniperus oxycedrus*, *Pistacia sp*. and *Crataegus azarolus* (Figure 3.3). The valleys and riverine forest involve other type of tree species like *Salix sp., Fraxinus syriaca*, *Platanus orientalis*, *Populus alba*, *Morus alba* and *Juglans nigra*. Nevertheless, *Pinus brutia* is heavily located around Zawita, Duhok center and small patches in deferent locations (Habeeb, 2014).

Figure 3.3 Forest in study area

3.2. Material

Macrofungi samples were collected from different localities of Duhok province in 2015 particularly in the April, October, November and December of spring and autumn. On the other hand, all the types of edible, inedible and poisonous mushrooms were

collected. Microscope was used to measure the spore and other part of mushrooms by micrometers. In addition, some chemical compound and relevant literature were employed.

3.3. Methods

3.3.1. Field work

Collected samples was depended on villager's information about the place of occurred of wild mushroom and pointed to plastic bags with writing the number of sample as same number of picture. The field studies generally conducted in spring and autumn, because of convenient climatic conditions for growth of fungi. During field study, digital color photographs were taken, and ecological feature were tested, flavor, shape and color were noted. The locations of each sample were fixed by GPS (Geographic Position System) device.

3.3.2. Laboratory work

The sample dried directly by drying device in 24 hours. From dried sample, small part took which contain spore for made microscopes slides. In addition, reagents 5% KOH and melzer reagent were used for the identification of macrofungus. For preparing 5% KOH 3g of KOH in 97 mL distilled water was dissolved. For preparing Melzer reagent 0.5 g iodine, 1.5 g Kl and 20 g chloral hydrate in 20 mL distilled water were dissolved.

All the mushrooms identified in Konya by Prof. Dr. Hasan Huseyin Dogan in University of Selcuk, Faculty of Science, Department of Biology. The samples were identified by referring to the following sources. (Basso, 1999), (Bernicchia, 2005), (Breitenbach and Kränzlin, 1984–2000), (Candusso, 1997), (Candusso and Lanzoni, 1990), (Cannon and Kirk 2007), (Eriksson et al, 1978–1984), (Eriksson and Ryvarden 1973–1978), (Hjortstam et al, 1987, 1988), (Horak, 2005), (Julich, 1984), (Kirk et al, 2008) (Medardi, 2006), (Moser, 1983), (Muñoz, 2005), (Neville and Poumarat,2004), (Parra, 2008), (Riva, 2003a), (Riva, 2003b), (Robich, 2007) and (Ryvarden and Gilbertson, 1993). Then, the obtained mushroom scientific name was compared with the scientific mushroom name mentioned in litreture (URL19) to know it the name was changed or not.

4. RESULTS AND DISCUSSIONS

4.1. Identification of Macrofungi

Habitations, date, distributions, location, elevations, collecting numbers and ediblety for each species was wrote, respectively. The scientific name of identify mushroom were checked in the mycobank website eight mushroom name changed and renewed.

4.2. Species Description

4.2.1. Divisio: Ascomycota

4.2.1.1. Family: Morchellaceae

4.2.1.1.1. *Morchella esculenta* (L.) Pers.

Common name: Morel

Local name: Unknown

On soil, under *Quercus aegilops*, 4/18/2015, Seydava village, 43°15'21.84"E 37°2'22.84"N, 909m, MRY110, edible (see Figure A1). *M. esculenta* was not consumed in whole Iraq even was not known as a mushroom.

4.2.1.2. Family: Helvellaceae

4.2.1.2.1. *Helvella acetabulum* (L.) Quél.

Common name: Vinegar Cup

Local name: Unknown

On soil, under *Quercus aegilops*, 4/18/2015, Alkishk village, 43°10'25.87"E 37°1'19.52"N, 850m, MRY109, inedible (see Figure A2).

4.2.1.2.2. *Helvella spadicea* Schaeff.

On soil, under apple, 4/16/2015, Ghlbish village, 43°12'21.99"E 37°5'42.59"N, 844m, MRY105, edible (see Figure A3). *H. spadicea* is not consum in Iraq.

4.2.1.3. Family: Terfeziaceae

4.2.1.3.1. *Terfezia claveryi* Chatin, La Truffe

Common name: Truffles

Local name: Dumbalan, Kamah

In soil, 18/4/2015, Batil village, 42°40'20.60"E 36°56'59.54"N, 594m, MRY112, edible (see Figure A4). *T. claveryi* is a commone type of mushroom in Iraq that use as food by cooking. In addition, use in local medicine by extraction water then using extraction for eyes diseases.

4.2.2. Divisio: Basidiomycota

4.2.2.1. Family: agaricaceae

4.2.2.1.1. *Leucoagaricus leucothites* (Vittad.) Wasser

Common name: White dapperling

Local name: unknown

Under pomegranate, 25/11/2015, Aloka village, 42°55'35.15"E 36°50'38.22"N, 709m, MRY142, edible (see Figure A5). *L. leucothites* is consumed by cooking.

4.2.2.1.2. *Panaeolus fimicola* (Fr.) Quél

Common name: Mower's mushroom or haymaker

Local name: unknown

On soil, 31/10/2015, Banda village, 43°10'59.35"E 37° 4'30.46"N, 828m, MRY120, inedible (see Figure A6).

4.2.2.2. Family: Amanitaceae

4.2.2.2.1. *Amanita ovoidea* (Bull.) Link

Common name: Amanita or European egg amidella

Local name: Dumblan spee

On soil, under *Quercus aegilops*, 4/12/2015, Ghlbish village, 43°11'25.72"E 37°6'10.00"N, 845m, MRY137, edible (see Figure A7). *A. ovoidea* is a commone type in nourth Iraq high amount ocure in spring and autumn but the test of spring *A. ovoidea* yammire than the autumn.

4.2.2.3. Family: Bolbitiaceae

4.2.2.3.1. *Conocybe semiglobata* Kühner ex Singer

Common name: Liberty cap

Local name: Unknown

On soil, under *Quercus aegilops*, 31/10/2015, Banda village, 43°10'56.67"E 37°4'30.26"N, 828m, MRY117, inedible (see Figure A8).

4.2.2.4. Family: Boletaceae

4.2.2.4.1. *Boletus impolitus* Fr.

Common name: Iodine bolete

Local name: Kivarka zar

On soil, under *Quercus aegilops*., 18/10/2015, Spindare village, 43°35′04.9″E 37°02′05.3″N, 1069m, MRY15, edible (see Figure A9). *B. impolitus* was rare consumed in Iraq.

4.2.2.4.2. *Chalciporus piperatus* (Bull.) Bataille

Common name: Peppery bolete

Local name: Unknown

In *pinus brutia* forest, 28/11/2015, Zawita village, 43° 8'46.76"E 36°53'53.28"N, 979m, MRY148, edible (see Figure A10). *C. piperatus* is inedible mushroom in Iraq.

4.2.2.5. Family: Coprinaceae

4.2.2.5.1. *Coprinellus disseminatus* (Pers.) J.E. Lange

Common name: Non-inky coprinus and little helmets

Local name: Unknown

Under *salix sp*. 25/11/2015, Aloka village, 42°55'35.62"E 36°50'38.92"N, 712m, MRY141, inedible (see Figure A11).

4.2.2.5.2. *Coprinellus micaceus* (Bull.) Vilgalys, Hopple & Jacq. Johnson

Common name: Mica cap

Local name: Unknown

On *Populus* sp., 16/4/2015 and 25/11/2015, Ghlbish village, Aloka village 43°12'24.99"E 37° 5'43.65"N and 42°55'34.66"E 36°50'38.67"N, 844m, 1049m, MRY107, MRY122, respectively. Also in soil under *Quercus aegilops*., 13/11/2015, Shilya village, 43°25'3.29"E 36°52'12.74"N, 711m, MRY139, inedible (see Figure A12).

4.2.2.5.3. *Parasola kuehneri* (Uljé & Bas) Redhead

On soil under *Quercus aegilops*, 13/11/2015, Shilya village, 43°25'7.75"E 36°52'12.45"N, 1052m, MRY123, and on soil under *Populus* sp., 25/11/2015 in Aloka village, 42°55'35.73"E 36°50'41.48"N, 715m, MRY140, inedible (see Figure A13).

4.2.2.6. Family: Gomphidiaceae

4.2.2.6.1. *Chroogomphus rutilus* (Schaeff.) O.K. Mill.

Common name: pine-spike and spike-cap

Local name: unknown

In *pinus brutia* forest, 28/11/2015, Zawita village, 43° 8'59.91"E 36°53'53.39"N, 987m, MRY149, edible (see Figure A14). *C. rutilus* was rare consumed in Iraq.

4.2.2.7. Family: Hymenochaetaceae

4.2.2.7.1. *Phellinus hartigii* (Allesch. & Schnabl) Pat.

On *Quercus aegilops*., 14/11/2015, Ghlbish village, 43°11'40.76"E 37° 5'23.87"N, 825m, MRY135, inedible (see Figure A15).

4.2.2.7.2. *Phellinus torulosus* (Pers.) Bourdot & Galzin

On *Quercus aegilops*, 16/4/2015, Gara Montain, 43° 9'25.00"E 37° 2'37.16"N, 1098m, MRY101, inedible (see Figure A16).

4.2.2.8. Family: Inocybaceae

4.2.2.8.1. *Inocybe ayeri* Furrer-Ziogas

In *Pinus brutia* Forest, 28/11/2015, Zawita village 43° 8'40.82"E 36°53'49.54"N, 971m, MRY147, poisonous (see Figure A17).

4.2.2.8.2. *Inocybe fuscidula* Velen.

In *Pinus brutia* forest 28/12/2015, Zawita village, 43° 8'42.86"E 36°53'53.31"N, 964m, MRY151, poisonous (see Figure A18).

4.2.2.9. Family: Marasmiaceae

4.2.2.9.1. *Marasmius rotula* (Scop.) Fr.

On soil, under *Quercus aegilops*, 31/10/2015, Banda village, 43°11'0.12"E 37° 4'29.72"N, 830m, MRY118, inedible (see Figure A19).

4.2.2.10. Family: Physalacriaceae

4.2.2.10.1. *Armillaria mellea* (Vahl) P. Kumm

Common name: Honey mushroom

Local name: Hajilok

On *Populus* sp., 12/11/2015, Ghlbish village, 43°12'25.27"E 37° 5'43.62"N, 850m, MRY121, edible (see Figure A20). *A. mellea* is a common mushroom eaten by cooking with oil.

4.2.2.11. Family: Pleurotaceae

4.2.2.11.1. ***Pleurotus eryngii*** (DC.) Quél.

Common name: King Oyster Mushroom

Local name: Kvarka Halizi

Near *Prangos ferulacea*, 17/4/2015, Gara mountain, 43°22'40.89"E 37° 1'46.00"N, 1247m, MRY108, edible (see Figure A21). *P. eryngii* is a very common mushroom in north Iraq that occurred in high mountain near Iraqi-turkey border, the mushroom cooked and eaten in breakfast in generally.

4.2.2.11.2. ***Pleurotus ostreatus*** (Jacq.) P. Kumm

Common name: Oyster Mushroom

Local name: Kvarka spindara

On *Populus* sp, 14/11/2015, Ghlbish village, 43°11'43.29"E 37° 5'22.22"N, 820m, MRY132, edible (see Figure A22). *P. ostreatus* is a common mushroom in north Iraq that occurred in valleys. It is edible.

4.2.2.12. Family: Pluteaceae

4.2.2.12.1. ***Volvariella gloiocephala*** (DC.) Boekhout & Enderle

On soil, 4/12/2015, Akre town, 43°52'1.65"E 36°44'12.56"N, 646m, MRY152, edible (see Figure A23). *V. gloiocephala* is an edible mushroom in Iraq.

4.2.2.13. Family: Polyporaceae

4.2.2.13.1. ***Coriolopsis trogii*** (Berk.) Domanski

On *Populus* sp., 25/11/2015, Aloka village, 42°55'35.76"E 36°50'39.75"N, 705m, MRY145. also On *Populus* sp., 14/11/2015, Ghlbish village, 43°12'13.78"E 37° 5'37.05"N, 849m, MRY136, inedible (see Figure A24).

4.2.2.13.2. ***Lentinus tigrinus*** (Bull.) Fr.

Common name: Tiger sawgill

Local name: Kvarka chinara

On *Platanus orientalis*, 23/10/2015, 11/4/2015 Bava and Batel villages, 42°58'36.49"E 37° 7'8.35"N, 42°40'29.81"E 36°56'25.57"N, 577m, 543m, MRY116, MRY100, respectively, edible (see Figure A25). *L. tigrinus* is an edible mushroom in Iraq high amount found in the valleys.

4.2.2.13.3. *Polyporus arcularius* (Batsch) Fr

Common name: Light cap black-foot

Local name: Unknown

On *Quercus aegilops*, 19/4/2015 in Ghlbish village, 43°10'20.20"E 37° 5'29.13"N, 728m, MRY113, inedible (see Figure A26).

4.2.2.13.4. *Trametes gibbosa* (Pers.) Fr.

Common name: Lumpy bracket

Local name: Unknown

On *Quercus aegilops*, 4/16/2015, Ghlbish village, 43°12'25.56"E 37° 5'45.31"N, 852m, MRY103, inedible (see Figure A27).

4.2.2.14. Family: Psathyrellaceae

4.2.2.14.1. *Psathyrella candolleana* (Fr.) Maire

Common name: Suburban psathyrella

Local name: Unknown

On *Populus* sp, 25/11/2015, Aloka village, 42°55'32.52"E 36°50'37.99"N, 703m, MRY146, edible (see Figure A28).

4.2.2.15. Family: Rhizopogonaceae

4.2.2.15.1. *Rhizopogon roseolus* (Corda) Th. Fr.

Common name: Unknown

Local name: Dumblana buchik

In *pinus brutia* forest, 20/4/2015, 28/11/2015 Aloka and Zawita villages 42°55'10.45"E 36°50'49.83"N, 43° 8'48.04"E 36°53'53.17"N,734m, 972m, MRY114, MRY150, respectively, edible (see Figure A29). *R. roseolus* is edible mushroom, but not knowledge with people.

4.2.2.16. Family: Schizophyllaceae

4.2.2.16.1. *Schizophyllum commune* Fr.

Commone name: Split gill

Local name: Unknown

On apple tree, 16/4/2015, Ghlbish village, 43°12'24.68"E 37°5'45.12"N, 852m, MRY104 and on *Populus* sp, 25/11/2015, Aloka village, 42°55'34.57"E 36°50'38.58"N, 707m, MRY143, inedible (see Figure A30).

4.2.2.17. Family: Sclerodermataceae

4.2.2.17.1. *Pisolithus arrhizus* (Scop.) Rauscher

Commone name: Dog turds

Local name: kvarka jehrawi

On soil, under *Quercus aegilops*, 14/11/2015, Ghlbish village, 43°12'4.67"E 37°5'16.01"N, 846m, MRY134, inedible (see Figure A31).

4.2.2.18. Family: Stereaceae

4.2.2.18.1. *Stereum hirsutum* (Willd.) Pers.

Common Name: False tail

Local name: Unknown

On *Quercus aegilops*, 15/4/2015, 16/4/2015 and 19/12/2015, Gara mountain, Ghlbish and Alkishk village, 43°17'40.39"E 37° 0'10.67"N, 43°11'19.96"E 37° 4'52.63"N and 43°10'33.09"E 37°0'43.96"N, 1464m, 762m, 856m, MRY102, MRY106, MRY145, respectively, inedible (see Figure A32).

4.2.2.19. Family: Strophariaceae

4.2.2.19.1. *Agrocybe arvalis* (Fr.) Heim & Romagn.

Common Name: Common fieldcap

Local name: Unknown

Under *Populus* sp, 25/11/2015 in Aloka village 42°55'35.89"E 36°50'42.50"N, 717m, MRY144, inedible (see Figure A33).

4.2.2.19.2. *Agrocybe pediades* (Fr.) Fayod

On soil, under *Quercus aegilops*, 4/19/2015 in Seydava village 43°15'17.91"E 37° 2'15.38"N, 932m, MRY111, inedible (see Figure A34).

4.2.2.19.3. *Hypholoma subericaeum* (Fr.) Kühner

Between *Arundo Donax*، 14/11/2015, Ghlbish village, 43°12'14.91"E 37°5'37.81"N, 849m,MRY133, inedible (see Figure A35).

.4.2.2.19.4. *Pholiota lucifera* (Lasch) Quél.

Under *Populus* sp, 15/11/2015, Ghlbish village, 43°11'42.69"E 37° 5'21.92"N, 822m, MRY138, inedible (see Figure A36).

4.2.2.20. Family: Tricholomataceae

4.2.2.20.1. *Pseudoclitocybe expallens* (Pers.) M.M. Moser

On soil, under *Quercus aegilops*, 19/12/2015, Alkishk village, 43°10'36.09"E 37° 0'39.62"N, 857m, MRY153 and on soil 13/11/2015, Shilya village, 43°25'21.78"E 36°52'11.02"N,1071m, MRY126, inedible (see Figure A37).

4.2.2.20.2. *Gymnopus dryophilus* (Bull.) Murrill

On soil under *Quercus aegilops*, 14/11/2015, Ghlbish village, 43°12'8.61"E 37°5'16.72"N, 853m, MRY128, inedible (see Figure A38).

4.2.2.20.3. *Gymnopus fusipes* (Bull.) Gray

Commone name: Oak-loving collybia

Local name: Unknown

On *Quercus aegilops*, 14/11/2015, Ghlbish village, 43°11'31.79"E 37° 5'17.17"N, 800m, MRY130, inedible (see Figure A39).

4.2.2.20.4. *Lepista nuda* (Bull.) Cooke

Commone name: Blewit

Local name: kvarka mur

On soil, under *Quercus aegilops*, 13/11/2015, Shilya village 43°25'37.88"E 36°52'8.69"N, 1101m, MRY127, edible (see Figure A40). *L. nuda* is an edible in Iraq.

4.2.2.20.5. *Lepista sordida* (Schumach.) Singer

On soil, under *Quercus aegilops*,13 and 14/11/2015, Shilya villages, Ghlbish villages, 43°25'36.49"E 36°52'9.60"N and 43°11'29.53"E 37° 5'15.76"N, 1094m, 794m, MRY124, MRY129, respectively, inedible (see Figure A41).

4.2.2.20.6. *Melanoleuca stridula* (Fr.) Singer

On soil under *Quercus aegilops*, 31/10/2015 and 13/11/2015 in Banda and Shilya village 43°10'54.78"E 37° 4'30.50"N and 43°25'12.07"E 36°52'11.57"N, 824m, 1058m, MRY119, MRY125, respectively, edible (see Figure A42). *M. stridula* is an edible mushroom in Iraq.

4.2.2.20.7. *Omphalina galericolor* (Romagn.) Bon

On soil, 14/11/2015, Ghlbish village, 43°11'34.23"E 37° 5'17.32"N, 804mm, MRY131, inedible (see Figure A43).

4.3. New Record in Iraq

So far, no fungus flora has been founded in Iraq. Therefore, thirty-eight new mushroom species were recorded in this study (Table 4.1).

Table 4.1. The list of new records of mushrooms species in Iraq.

	Species Name
1	*Morchella esculenta* (L.)
2	*Helvella acetabulum* (L.)
3	*Helvella spadicea* Schaeff.
4	*Terfezia claveryi* Chatin
5	*Leucoagaricus leucothites* (Vittad.)
6	*Panaeolus fimicola* (Fr.)
7	*Amanita ovoidea* (Bull.)
8	*Conocybe semiglobata* Kühner ex Singerrer ex Singer
9	*Boletus impolitus* Fr.,
10	*Chalciporus piperatus* (Bull.)
11	*Coprinellus disseminatus* (Pers.)
12	*Parasola kuehneri* (Uljé & Bas) Redhead, Vilgalys & Hopple:
13	*Chroogomphus rutilus* (Schaeff.)
14	*Phellinus hartigii* (Allesch. & Schnabl)
15	*Phellinus torulosus* (Pers.)
16	*Inocybe ayeri* Furrer-Ziogas
17	*Inocybe fuscidula* Velen.
18	*Marasmius rotula* (Scop.)
19	*Armillaria mellea* (Vahl) P. Kumm
20	*Pleurotus eryngii* (DC.)
21	*Volvariella gloiocephala* (DC.)
22	*Coriolopsis trogii* (Berk.)
23	*Lentinus tigrinus* (Bull.)
24	*Polyporus arcularius* (Batsch) Fr
25	*Trametes gibbosa* (Pers.)
26	*Psathyrella candolleana* (Fr.)
27	*Rhizopogon roseolus* (Corda)
28	*Schizophyllum commune* Fr
29	*Pisolithus arrhizus* (Scop.)
30	*Agrocybe arvalis* (Fr.)
31	*Pseudoclitocybe expallens* (Pers.)
32	*Agrocybe pediades* (Fr.)
33	*Hypholoma subericaeum* (Fr.)
34	*Pholiota lucifera* (Lasch)
35	*Lepista nuda* (Bull.)
36	*Lepista sordida* (Schumach.)
37	*Melanoleuca stridula* (Fr.)
38	*Omphalina galericolor* (Romagn.)

Table 5.1 Classification of the identified mushrooms.

Kingdom	**Divisio**	**Sub divisio**	**Class**	**Sub class**	**Order**	**Family**	***Species***
Fungi	Ascomycota	Pezizomycotina	Pezizomycetes	Pezizomycetidae	Pezizales	Morchellaceae	*Morchella esculenta* (L.) Pers.
						Helvellaceae	*Helvella acetabulum* (L.) Quél
							Helvella spadicea Schaeff.
						Terfeziaceae,	*Terfezia claveryi* Chatin, La Truffe.
	Basidiomycota	Agaricomycotina	Agaricomycetes	Agaricomycetidae	Agaricales	Agaricaceae,	*Leucoagaricus leucothites* (Vittad.) Wasser
							Panaeolus fimicola (Fr.) Quél
						Amanitaceae,	*Amanita ovoidea* (Bull.) Link
					Boletales	Bolbitiaceae	*Conocybe semiglobata* Kühner ex Singer
						Boletaceae	*Boletus impolitus* Fr.
							Chalciporus piperatus (Bull.) Bataille
					Agaricales	Coprinaceae	*Coprinellus disseminatus* (Pers.) J.E. Lange
							Coprinellus micaceus (Bull.) Vilgalys, Hopple & Jacq. Johnson
							Parasola kuehneri (Uljé & Bas) Redhead
						Inocybaceae	*Inocybe ayeri* Furrer-Ziogas
							Inocybe fuscidula Velen.
					Boletales	Gomphidiaceae	*Chroogomphus rutilus* (Schaeff.) O.K. Mill.
					Hymenochaetales	Hymenochaetaceae	*Phellinus hartigii* (Allesch. & Schnabl) Pta.
							Phellinus torulosus (Pers.) Bourdot & Galzin
					Agaricales	Marasmiaceae	*Marasmius rotula* (Scop.) Fr.
						Physalacriaceae	*Armillaria mellea* (Vahl) P. Kumm

						Pleurotaceae	*Pleurotus eryngii* (DC.) Quél
							Pleurotus ostreatus (Jacq.) P. Kumm.
						Pluteaceae	*Volvariella gloiocephala* (DC.) Boekhout & Enderle
					Polyporale	Polyporacea	*Coriolopsis trogii* (Berk.) Domanski
							Lentinus tigrinus (Bull.) Fr.
							Polyporus arcularius (Batsch) Fr.
							Trametes gibbosa (Pers.) Fr.
					Agaricales	Psathyrellaceae	*Psathyrella candolleana* (Fr.) Maire
					Boletales	Rhizopogonaceae,	*Rhizopogon roseolus* (Corda) Th. Fr.
					Agaricales	Schizophyllaceae	*Schizophyllum commune* Fr.
					Boletales	Sclerodermataceae	*Pisolithus arrhizus* (Scop.) Rauscher
					Russulales	Stereaceae	*Stereum hirsutum* (Willd.) Pers.
					Agaricales	Strophariaceae	*Agrocybe arvalis* (Fr.) Heim & Romagn
							Agrocybe pediades (Fr.) Fayod
							Hypholoma subericaeum (Fr.) Kühner
							Pholiota lucifera (Lasch)
						Tricholomataceae	*Pseudoclitocybe expallens* (Pers.) M.M. Moser
							Gymnopus dryophilus (Bull.) Murrill
							Gymnopus fusipes (Bull.) Gray
							Lepista nuda (Bull.) Cooke
							Lepista sordida (Schumach.) Singer
							Melanoleuca stridula (Fr.) Singer
							Omphalina galericolor (Romagn.) Bon

5. CONCLUSIONS

In this study, 43 macrofungi taxa belonging to 23 families were identified. The taxa included 4 Ascomycota (2 Helvellaceae, 1 Morchellaceae and 1 Terfeziaceae) and 39 Basidiomycota (7 Tricholomataceae, 4 Polyporaceae, 4 Strophariaceae, 3 Coprinaceae, 2 Agaricaceae, 2 Inocybaceae, 2 Pleurotaceae, 2 Boletaceae, 2 Hymenochaetaceae, 1 Physalacriaceae, 1 Amanitaceae, 1 Bolbitiaceae, 1 Marasmiaceae, 1 Pluteaceae, 1 Psathyrellaceae, 1 Schizophyllaceae, 1 Sclerodermataceae, 1 Gomphidiaceae, 1 Rhizopogonaceae and 1 Stereaceae) as shown in Table 5.1 and Figure 5.1. Seventeen (56%) of the 43 taxa are edible, 24 (39%) are inedible, and 2 (5%) are poisonous (Figure 5.2).

As a result, the number of species reported from *Terfezia claveryi*, *Armillaria mellea*, *Amanita ovoidea*, *Leucoagaricus leucothites*, *Pleurotus eryngii*, *Pleurotus ostreatus*, *Volvariella gloiocephala*, *Psathyrella candolleana*, *Rhizopogon roseolu* and, *Lentinus tigrinus* are known as edible mushrooms by local residents. Although the *Morchella esculenta* is edible mushroom around the world while is not eaten in all Iraq. The distribution of identify mushroom in Duhok province are givens in Figure 5.3.

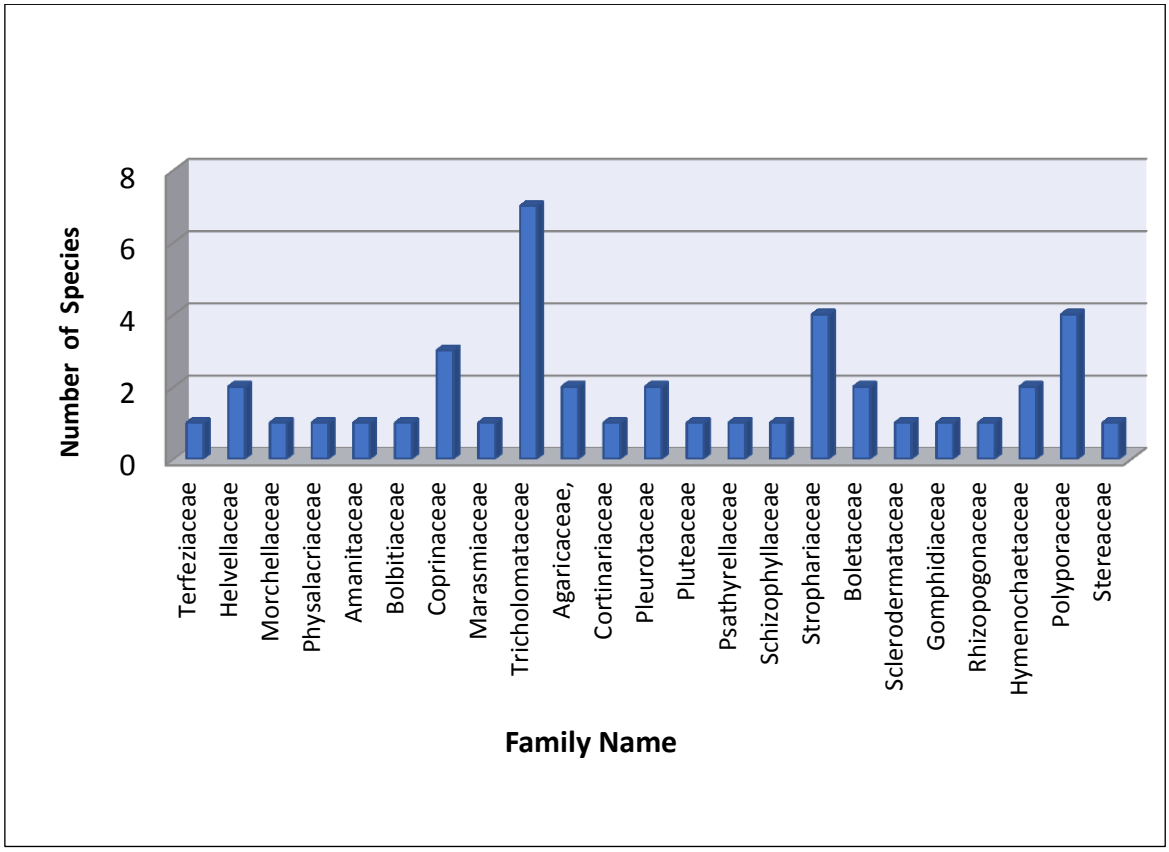

Figure 5.1. Family distribution of taxa as Families

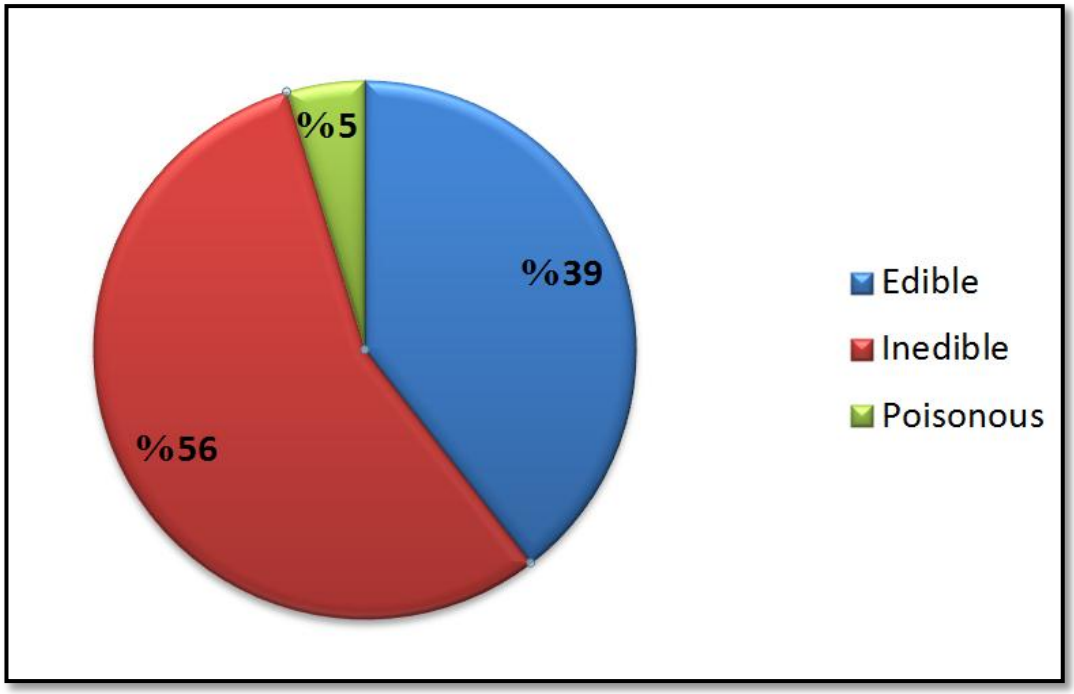

Figure 5.2. The percentages of edible, inedible, and poisonous mushroom in Duhok province

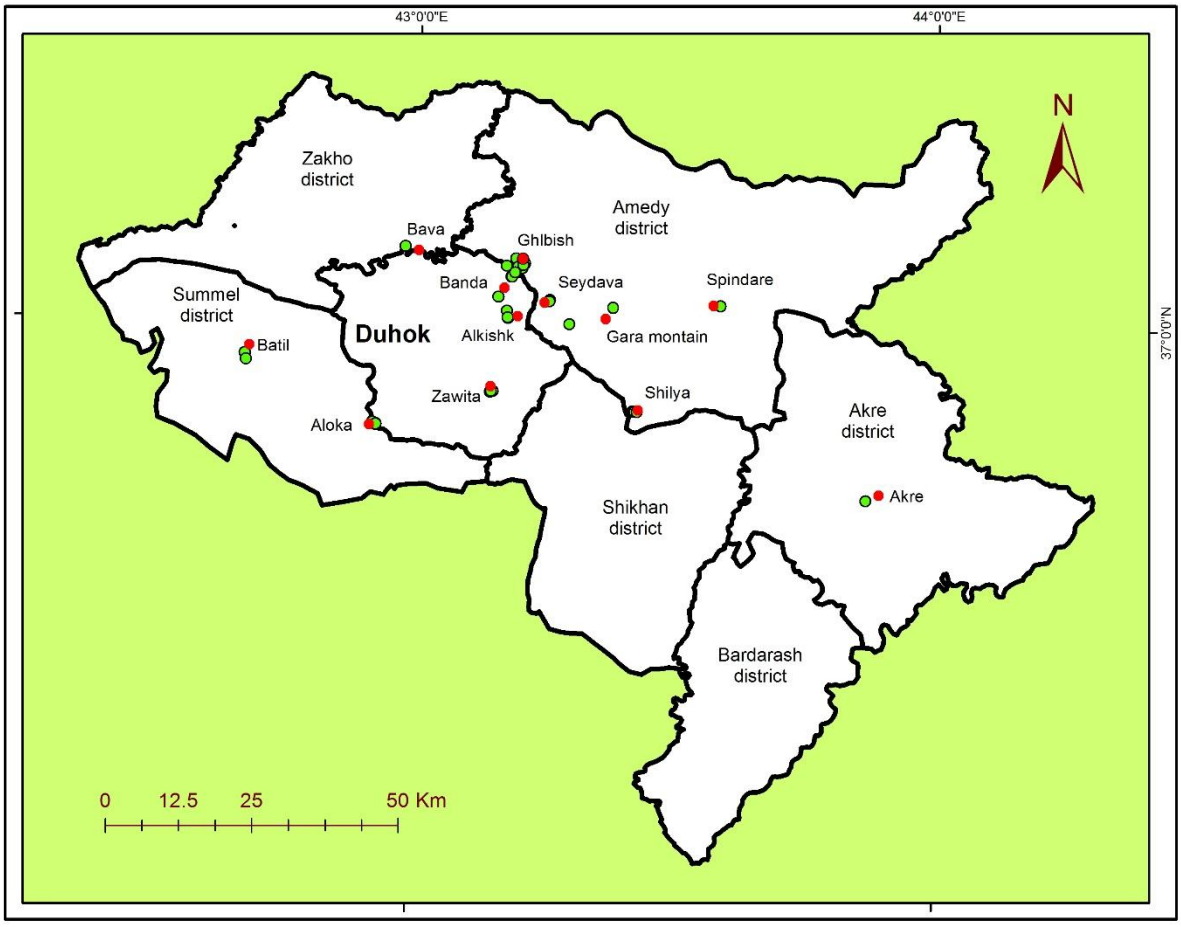

Figure 5.3. The distribution of identify mushrooms as in a Duhok province

Among them, the most popular are *Terfezia claveryi*, *Pleurotus eryngii* and *Pleurotus ostreatus* collected and consumed during spring. However, the *Amanita ovoidea* is available in both autumn and spring; the villager says the spring *A. ovoidea* have biter test than the Aautumn.

The common habitats for collected mushroom are highland areas that are temperate to semi-temperate in pine forests. In addition, oak forest, most of the mushrooms grow up as Parasitical with *Quercus aegilops*, *Populus* sp. and other trees.in generally on dead tissue of tree or plant. These are *Quercus aegilops* with 26 samples, *Populus sp*. with 11 samples, *Pinus brutia* with 5 samples, *Platanas orentalis*, with 2 samples, apple with 2 samples, Pomegranate with one sample, *Salix sp*. with one sample and *Prangos ferulacea* with one sample, respectively. The other 5 samples are in soil (Figure 5.3)

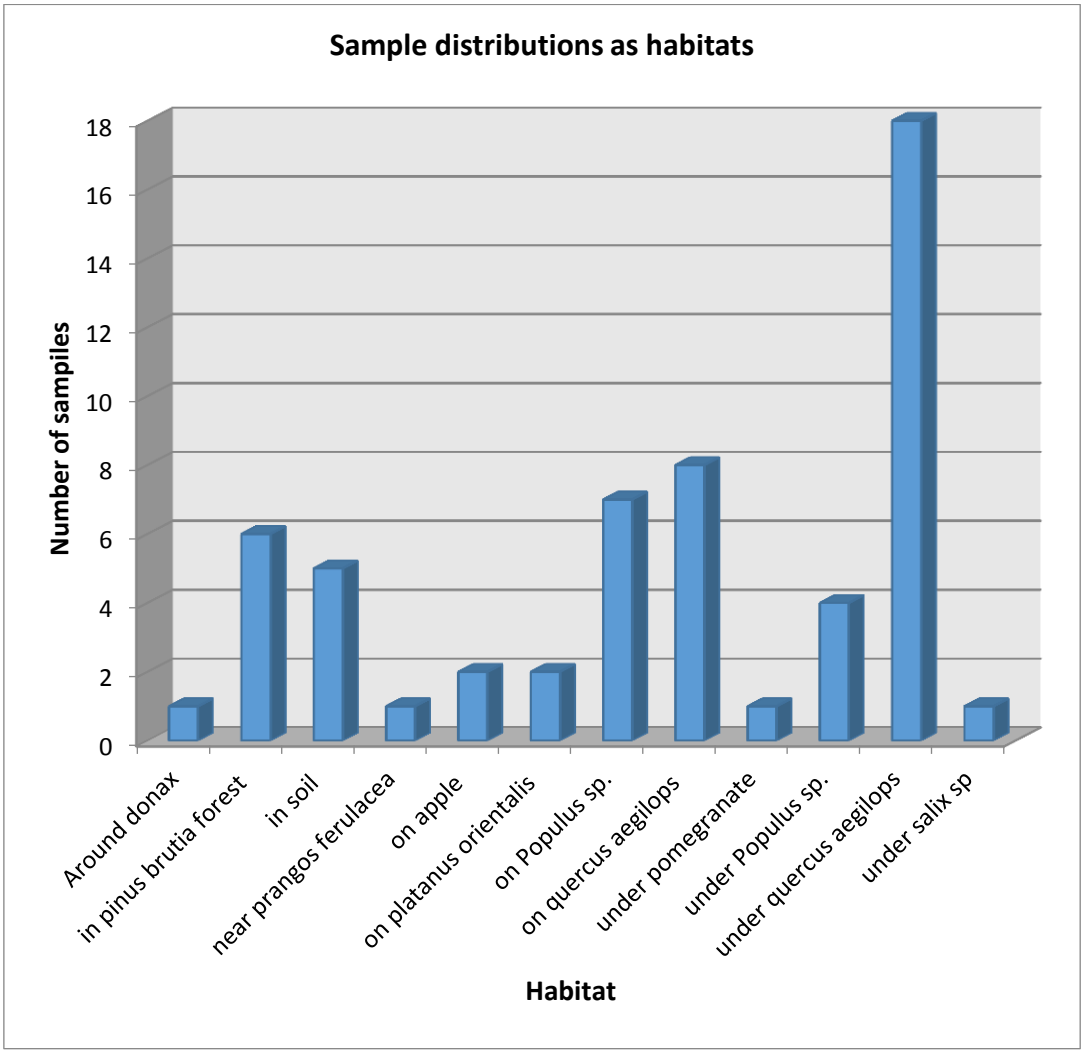

Figure 5.2. Samples distributions as function of habitats.

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URL18 http://www.mushroomexpert.com/clitocybe_nuda.html.

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APPENDIX

Figure A1. *Morchella esculenta* (L.) Pers.

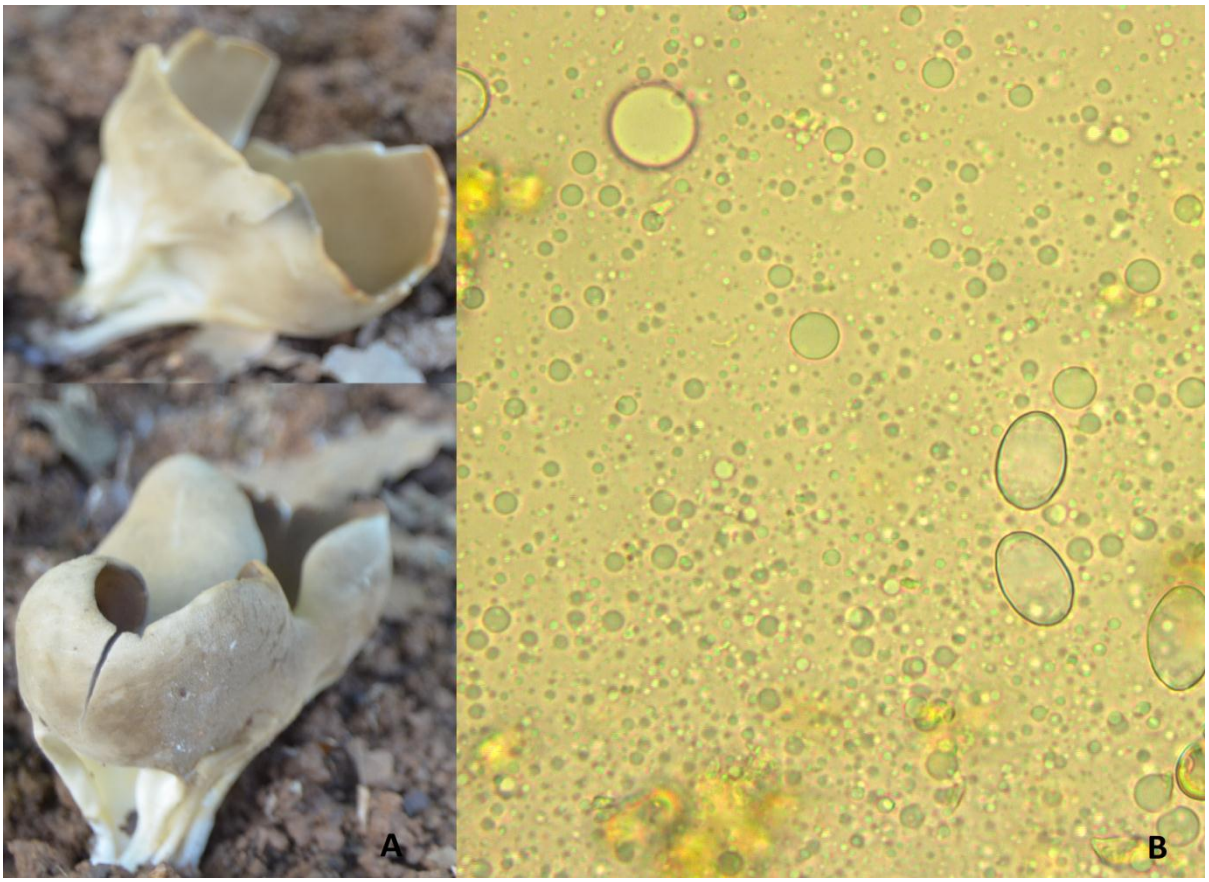

Figure A2. *Helvella acetabulum* (L.) Quél. (A: Body, B: Spor).

Figure A3. *Helvella spadicea* Schaeff.

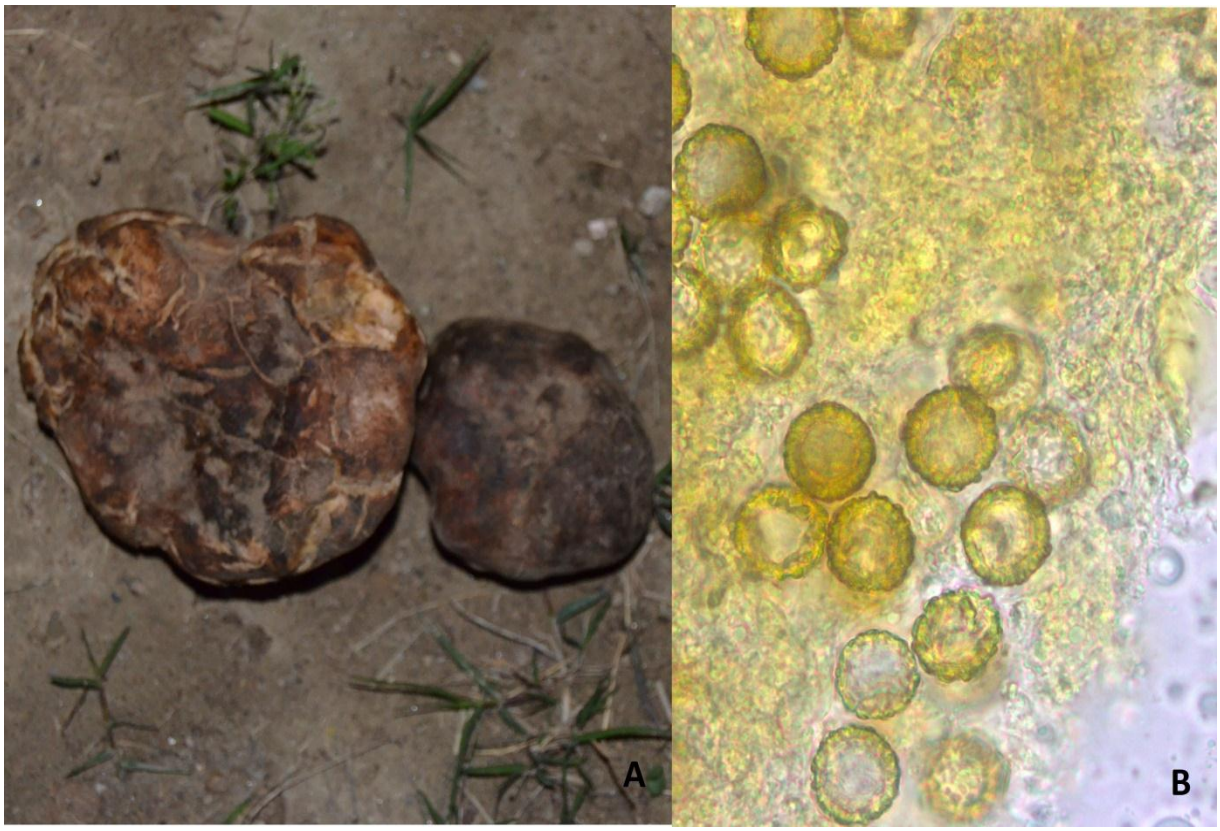

Figure A4. *Terfezia claveryi* Chatin, La Truffe (A: Body, B: Spor).

Figure A5. *Leucoagaricus leucothites* (Vittad.) Wasser (A: Body, B: Spor).

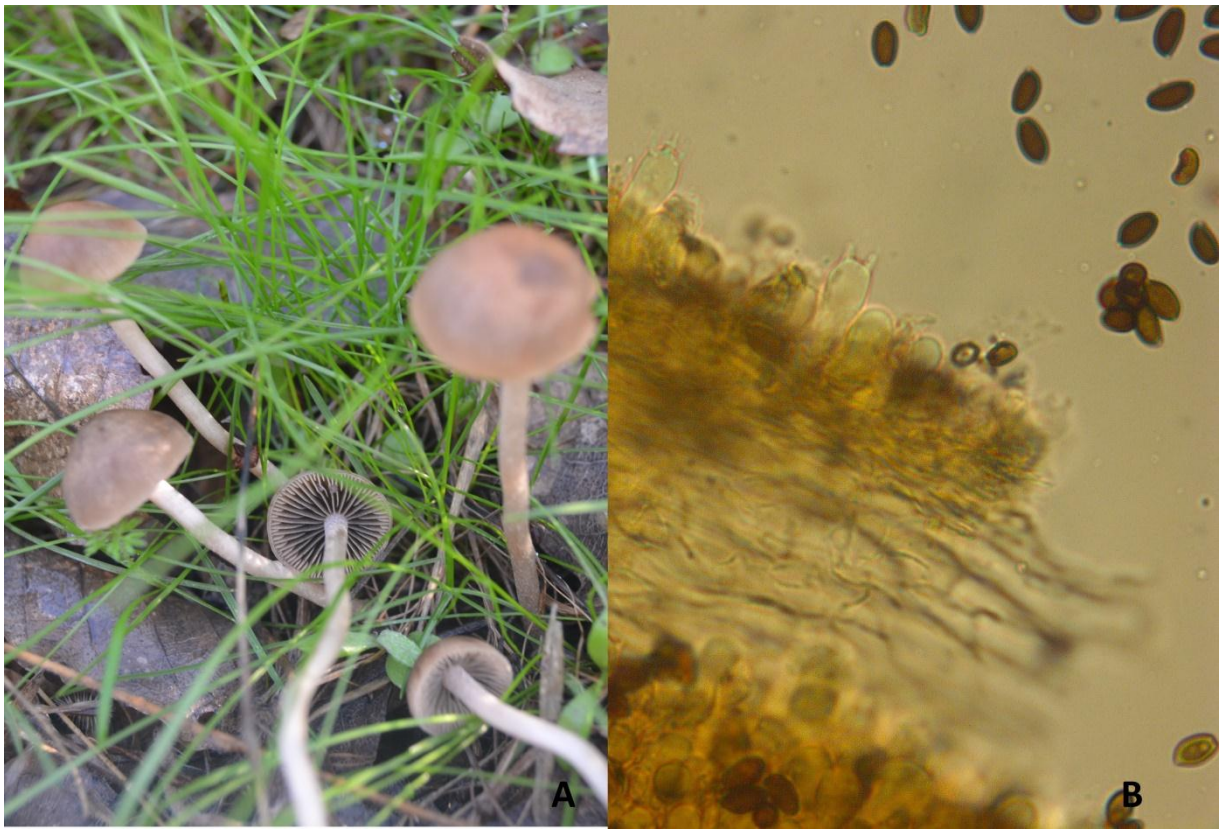

Figure A6. *Panaeolus fimicola* (Fr.) Quél (A: Body, B: Spor).

Figure A7. *Amanita ovoidea* (Bull.) Link.

Figure A8. *Conocybe semiglobata* Kühner ex Singer (A: Body, B: Spor).

Figure A9. *Boletus impolitus* Fr (A: Body, B: Spor).

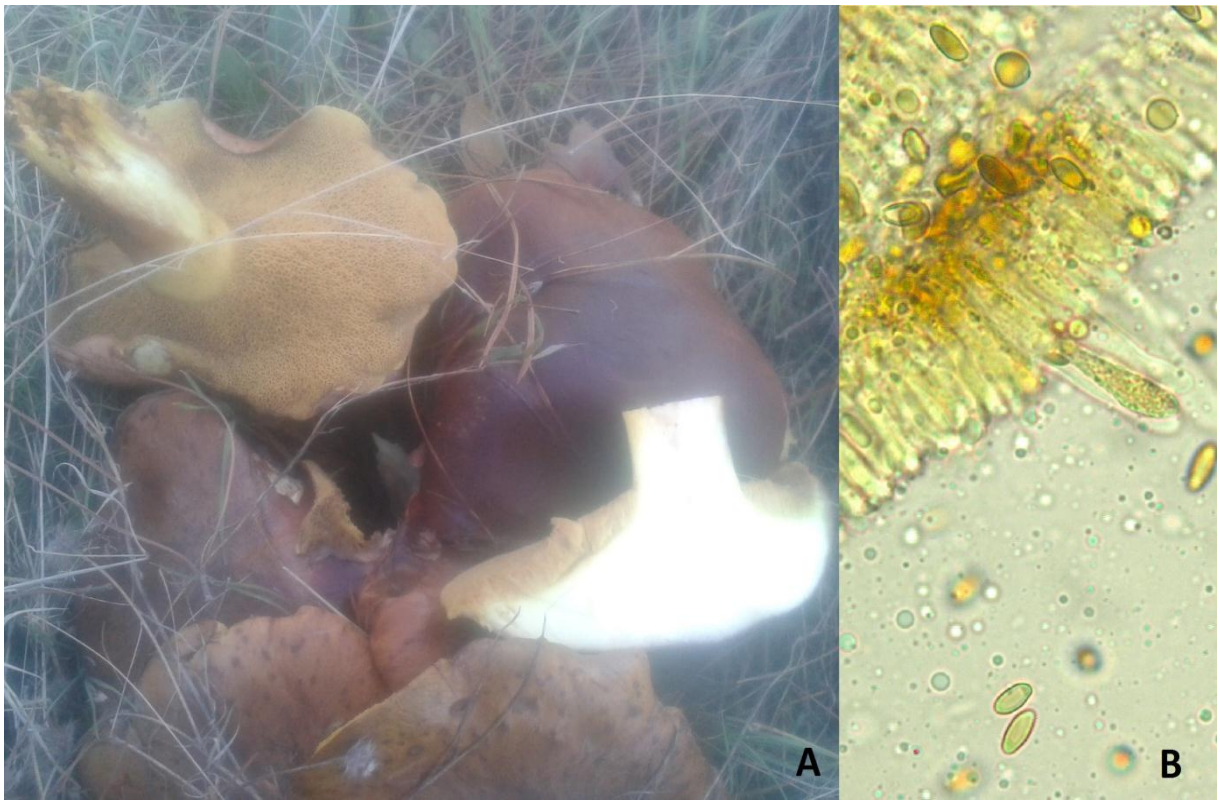

Figure A10. *Chalciporus piperatus* (Bull.) Bataille (A: Body, B: Spor).

Figure A11. *Coprinellus disseminatus* (Pers.) J.E. Lange (A: Body, B: Spor).

Figure A12. *Coprinellus micaceus* (Bull.) Vilgalys, Hopple & Jacq. Johnson (A: Body, B: Spor).

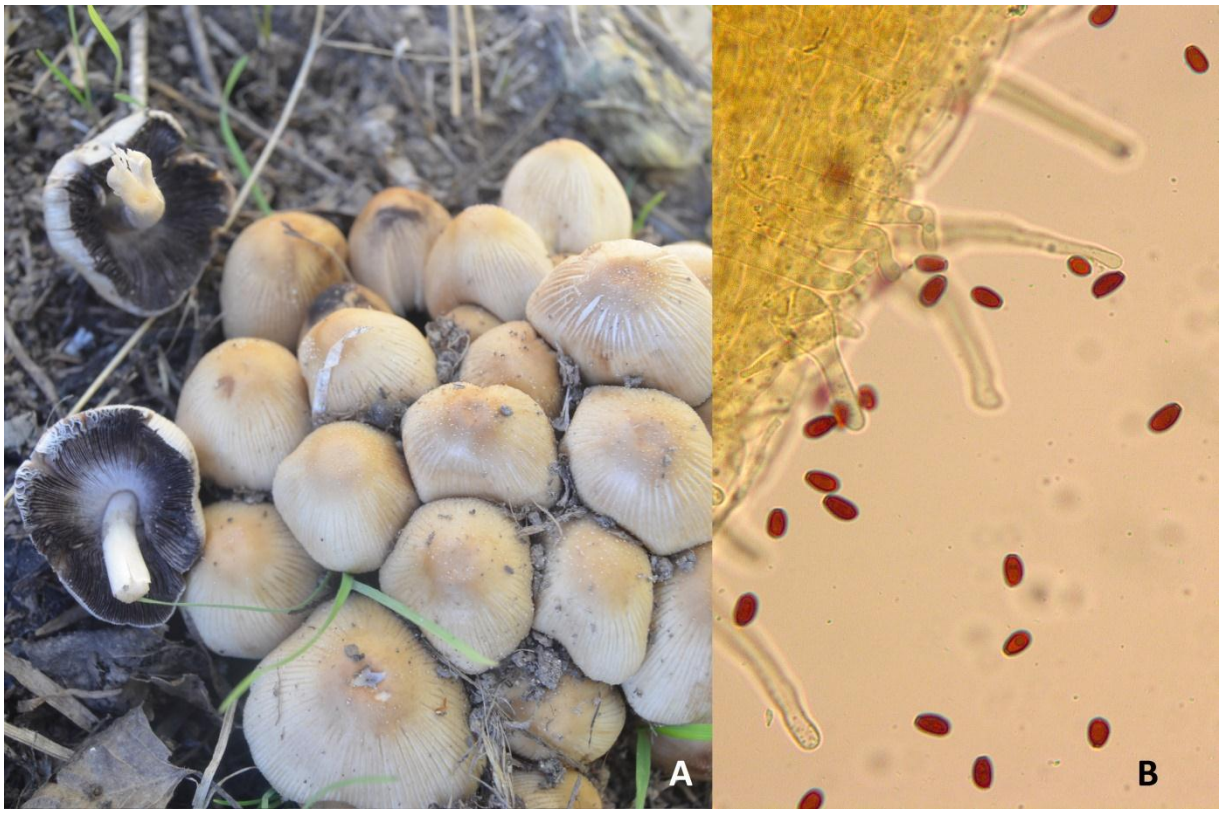

Figure A13. *Parasola kuehneri* (Uljé & Bas) Redhead (A: Body, B: Spor).

Figure A14. *Chroogomphus rutilus* (Schaeff.) O.K. Mill.

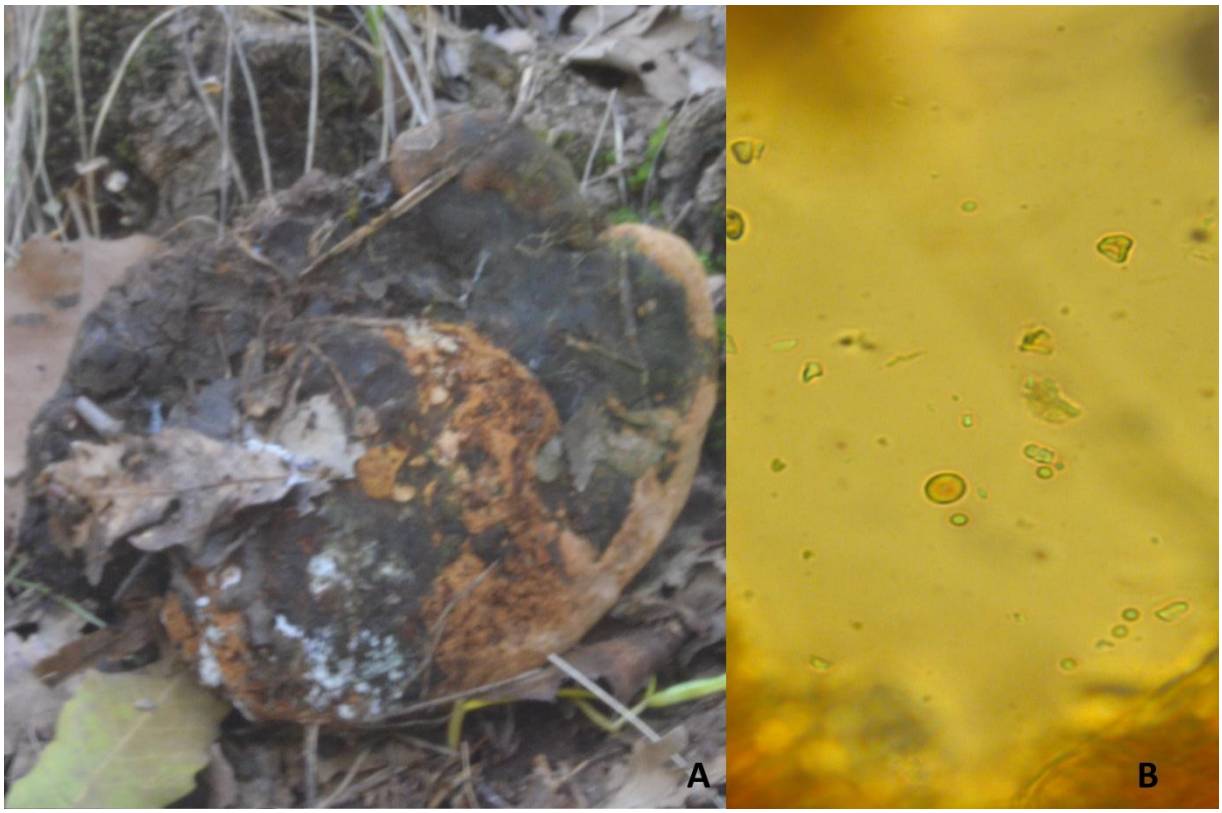

Figure A15. *Phellinus hartigii* (Allesch. & Schnabl) Pat. (A: Body, B: Spor).

Figure A16. *Phellinus torulosus* (Pers.) Bourdot & Galzin.

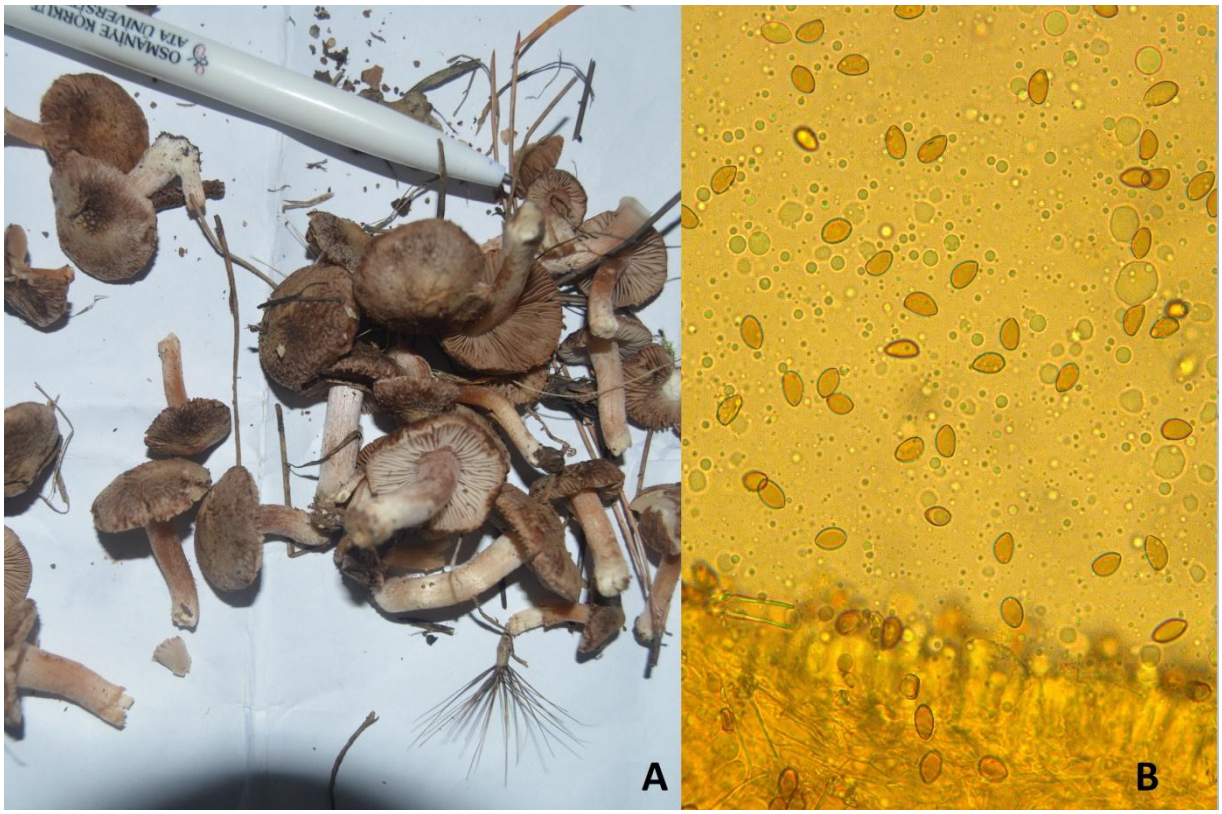

Figure A17. *Inocybe ayeri* Furrer-Ziogas (A: Body, B: Spor).

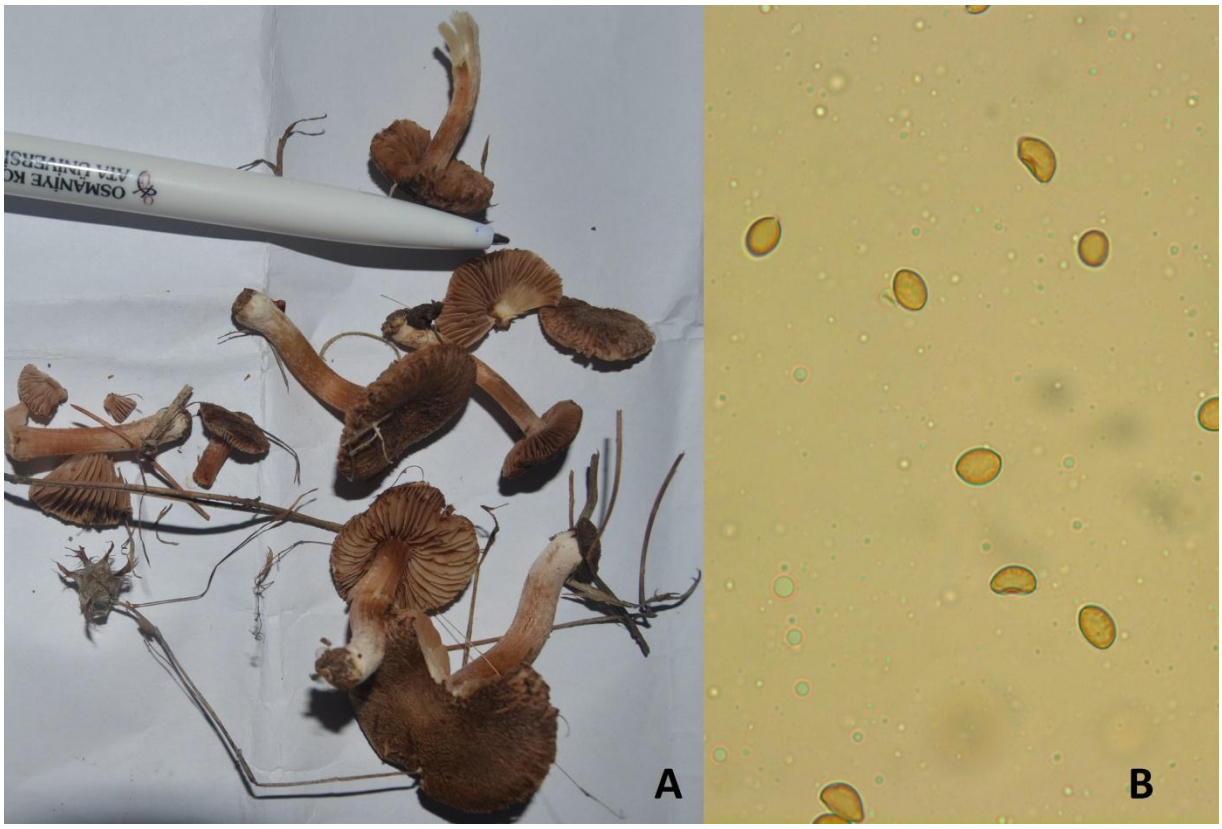

Figure A18. *Inocybe fuscidula* Velen (A: Body, B: Spor).

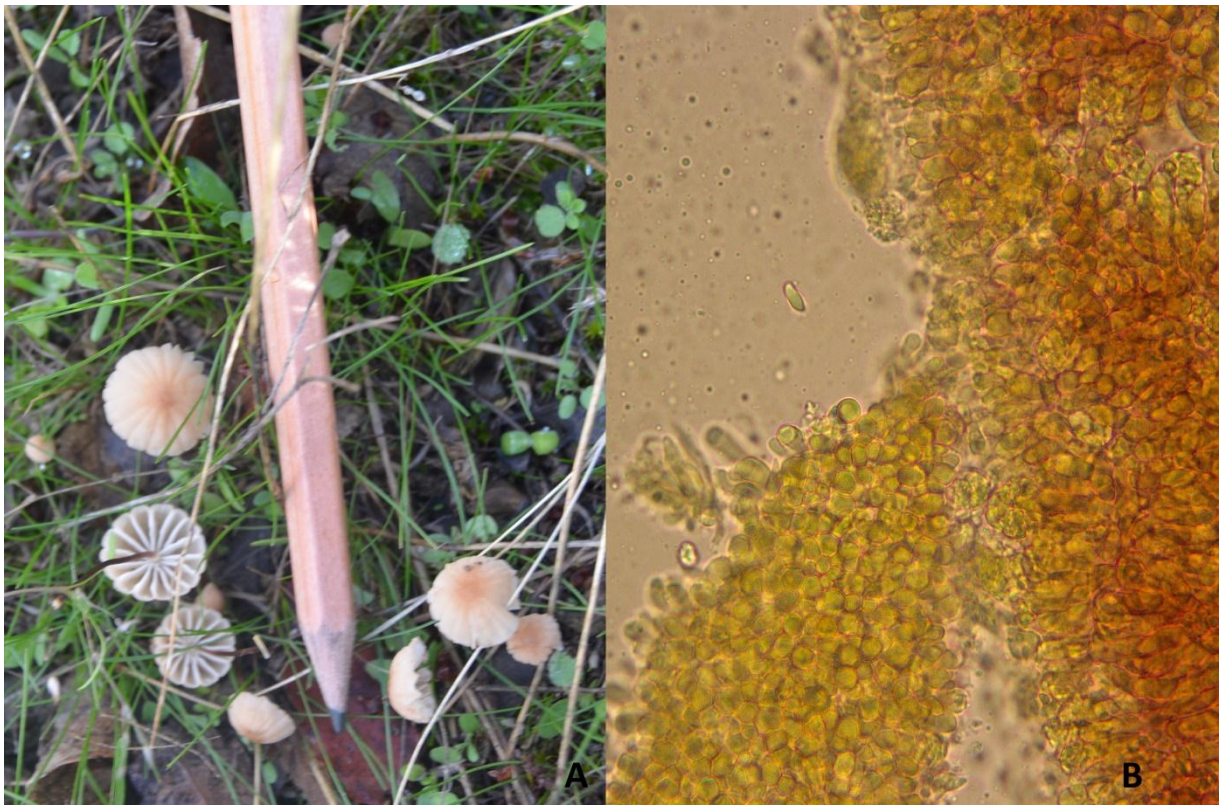

Figure A19. *Marasmius rotula* (Scop.) Fr. (A: Body, B: Spor).

Figure A20. *Armillaria mellea* (Vahl) P. Kumm.

Figure A21. *Pleurotus eryngii* (DC.) Quél.

Figure A22. *Pleurotus ostreatus* (Jacq.) P. Kumm.

Figure A23. *Volvariella gloiocephala* (DC.) Boekhout & Enderle (A: Body, B: Spor).

Figure A24. *Coriolopsis trogii* (Berk.) Domanski (A: Body, B: Spor).

Figure A25. *Lentinus tigrinus* (Bull.) Fr.

Figure A26. *Polyporus arcularius* (Batsch) Fr (A: Body, B: Spor).

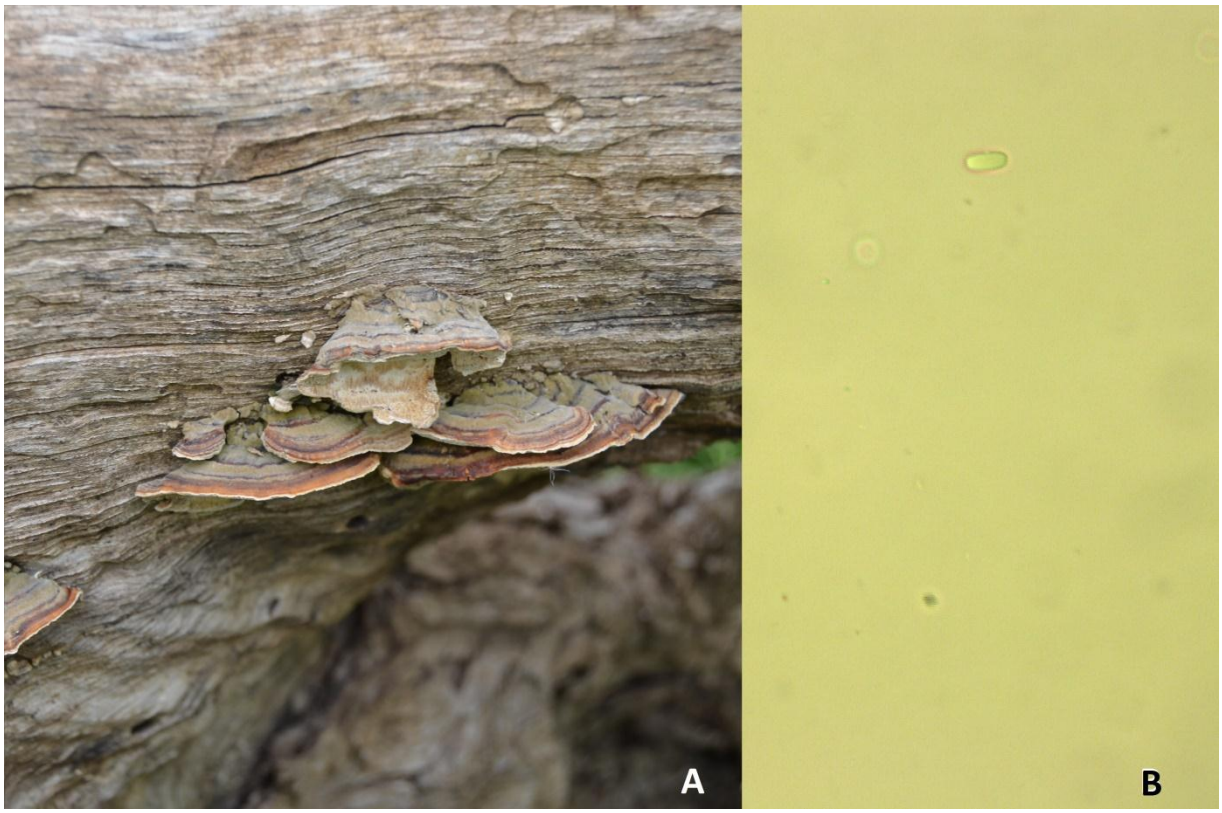

Figure A27. *Trametes gibbosa* (Pers.) Fr. (A: Body, B: Spor).

Figure A28. *Psathyrella candolleana* (Fr.) Maire (A: Body, B: Spor).

Figure A29. *Rhizopogon roseolus* (Corda) Th. Fr.

Figure A30. *Schizophyllum commune* Fr. (A: Body, B: Spor).

Figure A31. *Pisolithus arrhizus* (Scop.) Rauscher.

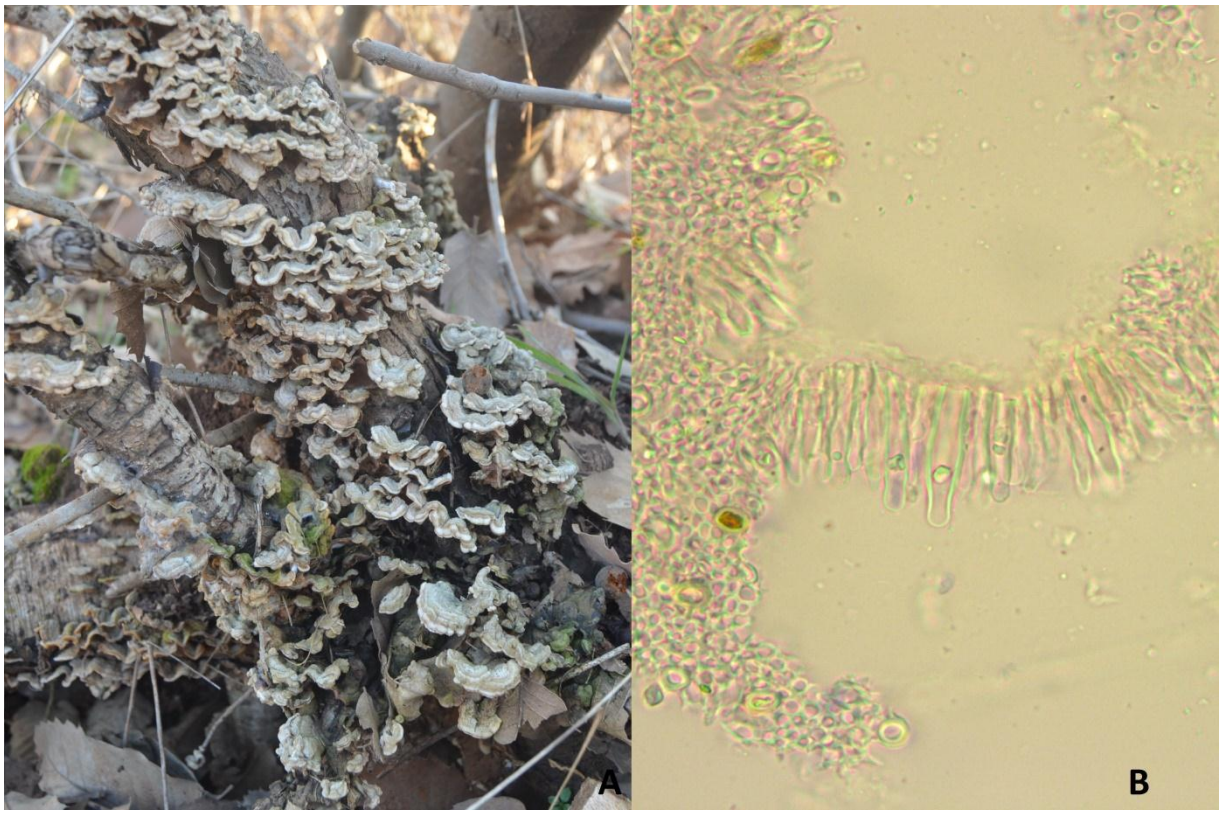

Figure A32. *Stereum hirsutum* (Willd.) Pers. (A: Body, B: Spor).

Figure A33. *Agrocybe arvalis* (Fr.) Heim & Romagn. (A: Body, B: Spor).

Figure A34. *Agrocybe pediades* (Fr.) Fayod (A: Body, B: Spor).

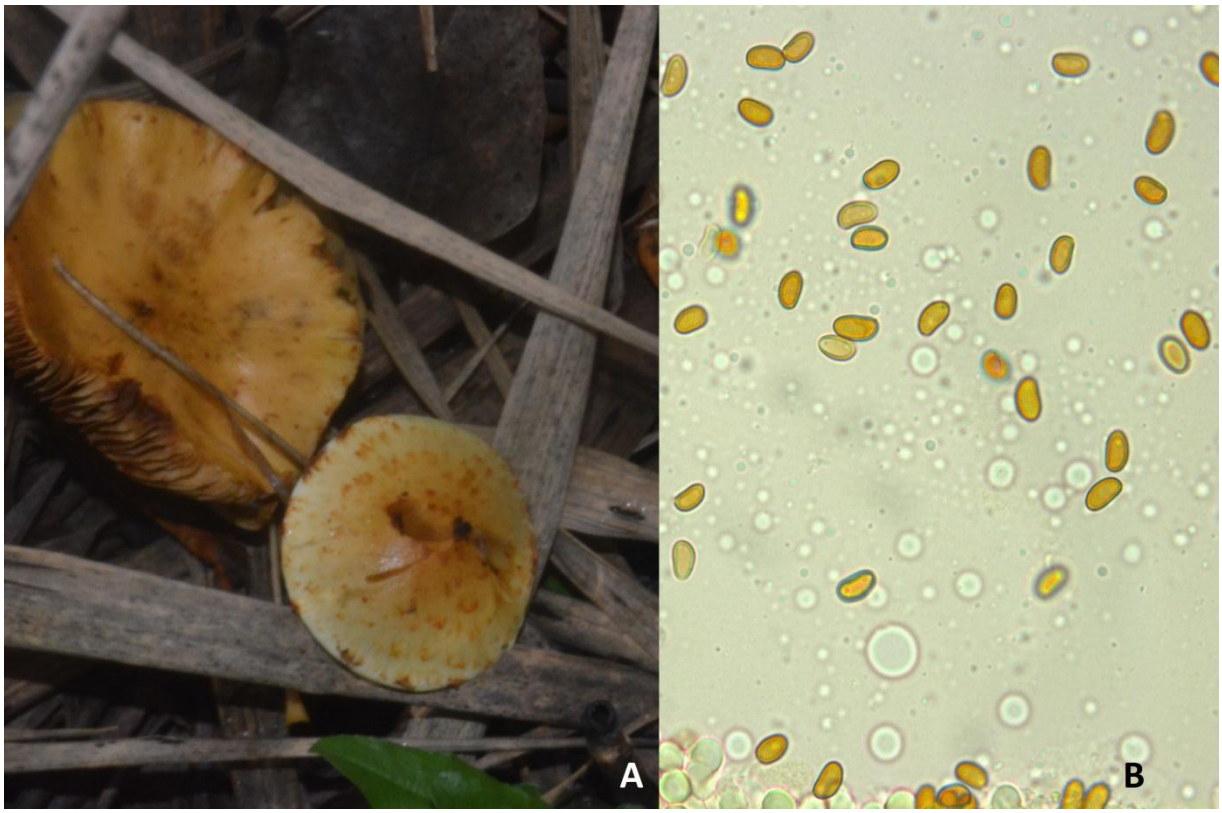

Figure A35. *Hypholoma subericaeum* (Fr.) Kühner (A: Body, B: Spor).

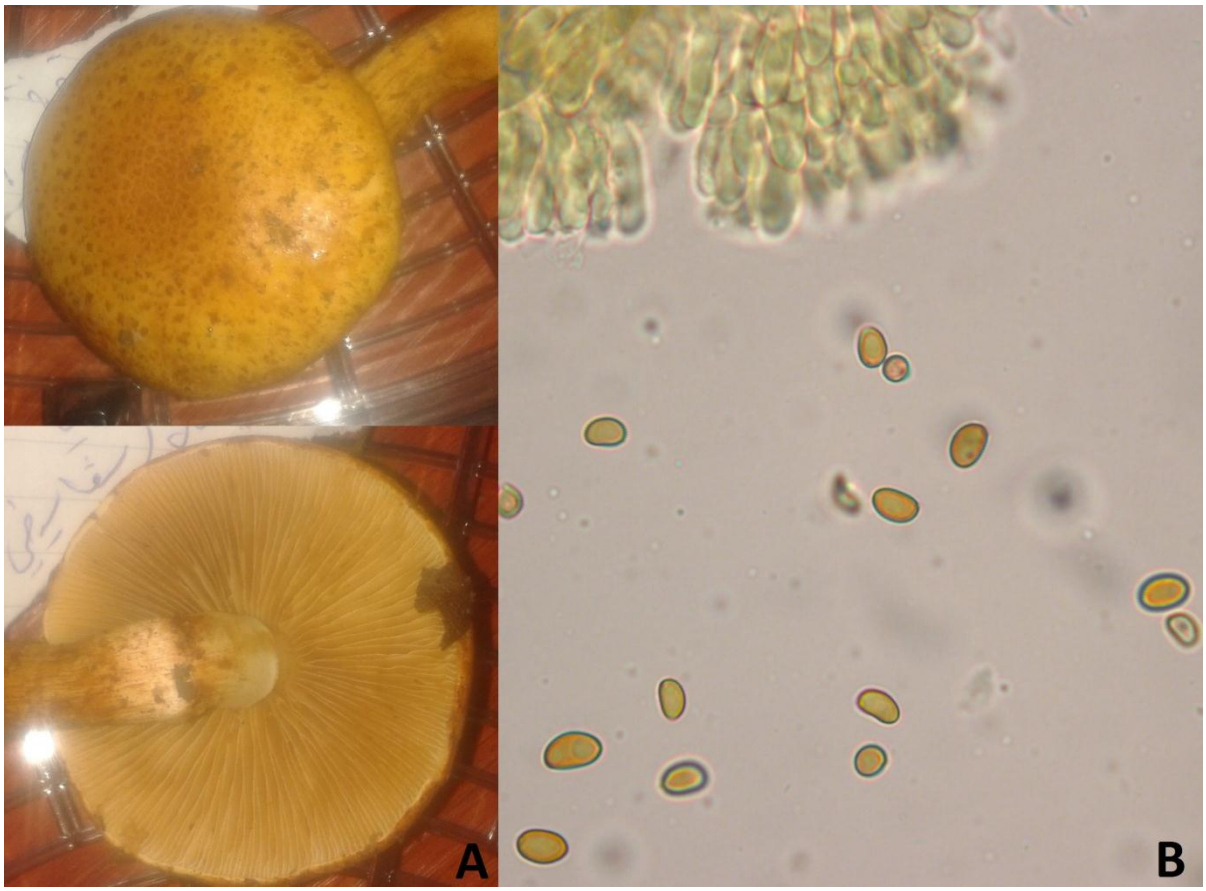

Figure A36. *Pholiota lucifera* (Lasch) Quél. (A: Body, B: Spor).

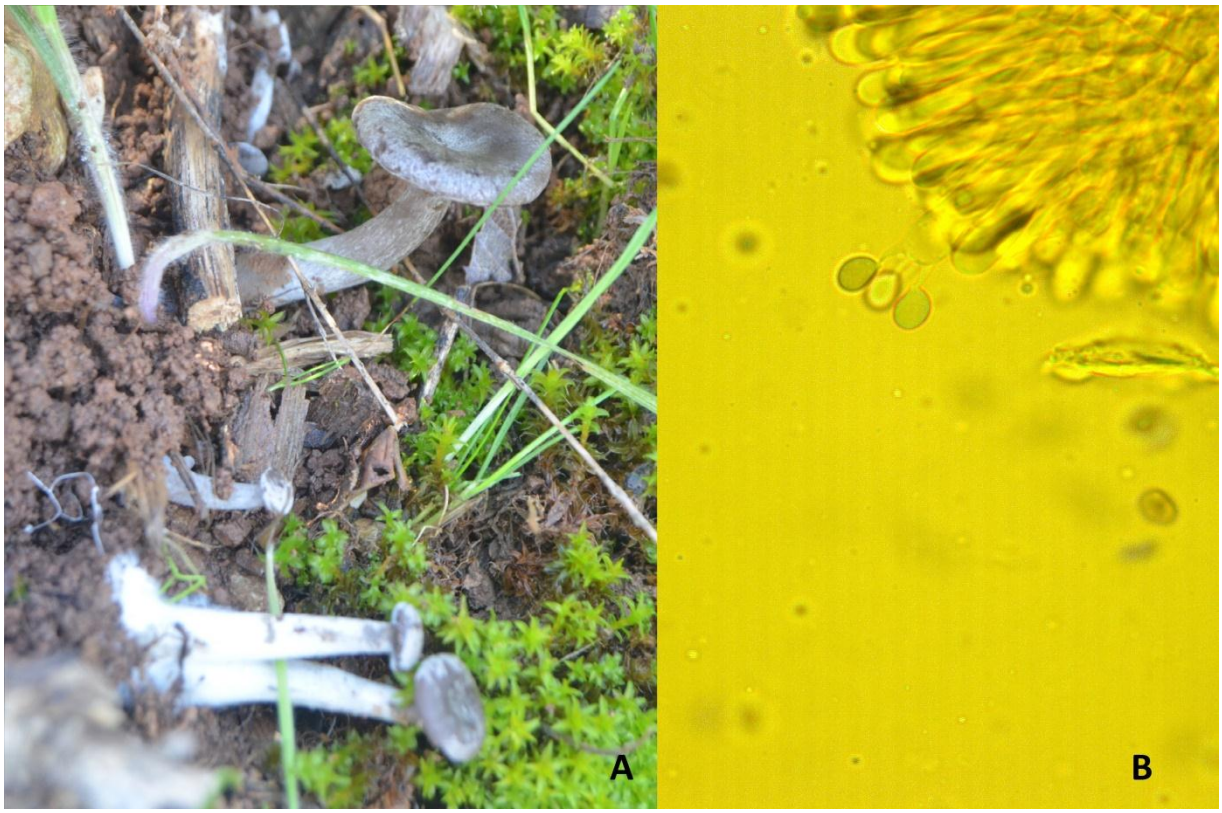

Figure A37. *Pseudoclitocybe expallens* (Pers.) M.M. Moser (A: Body, B: Spor).

Figure A38 *Gymnopus dryophilus* (Bull.) Murrill (A: Body, B: Spor).

Figure A39. *Gymnopus fusipes* (Bull.) Gray.

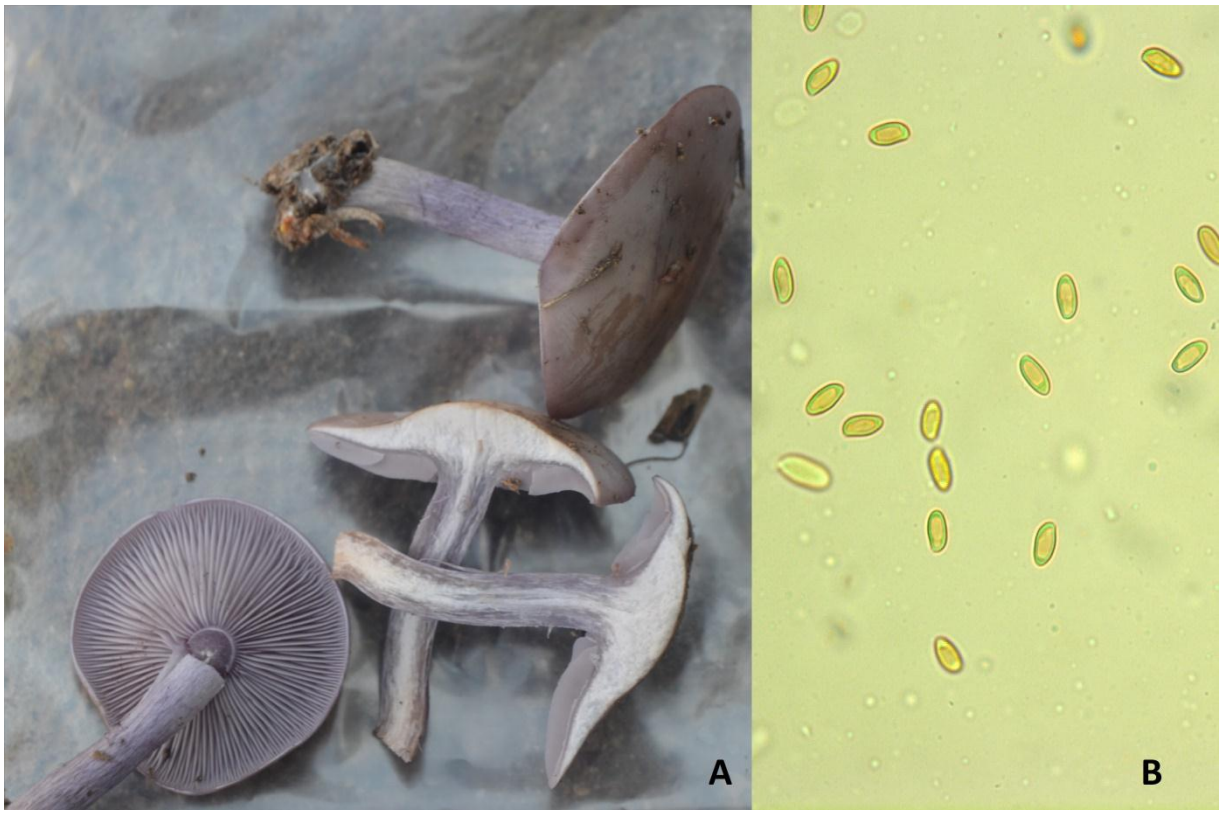

Figure A 40. *Lepista nuda* (Bull.) Cooke (A: Body, B: Spor).

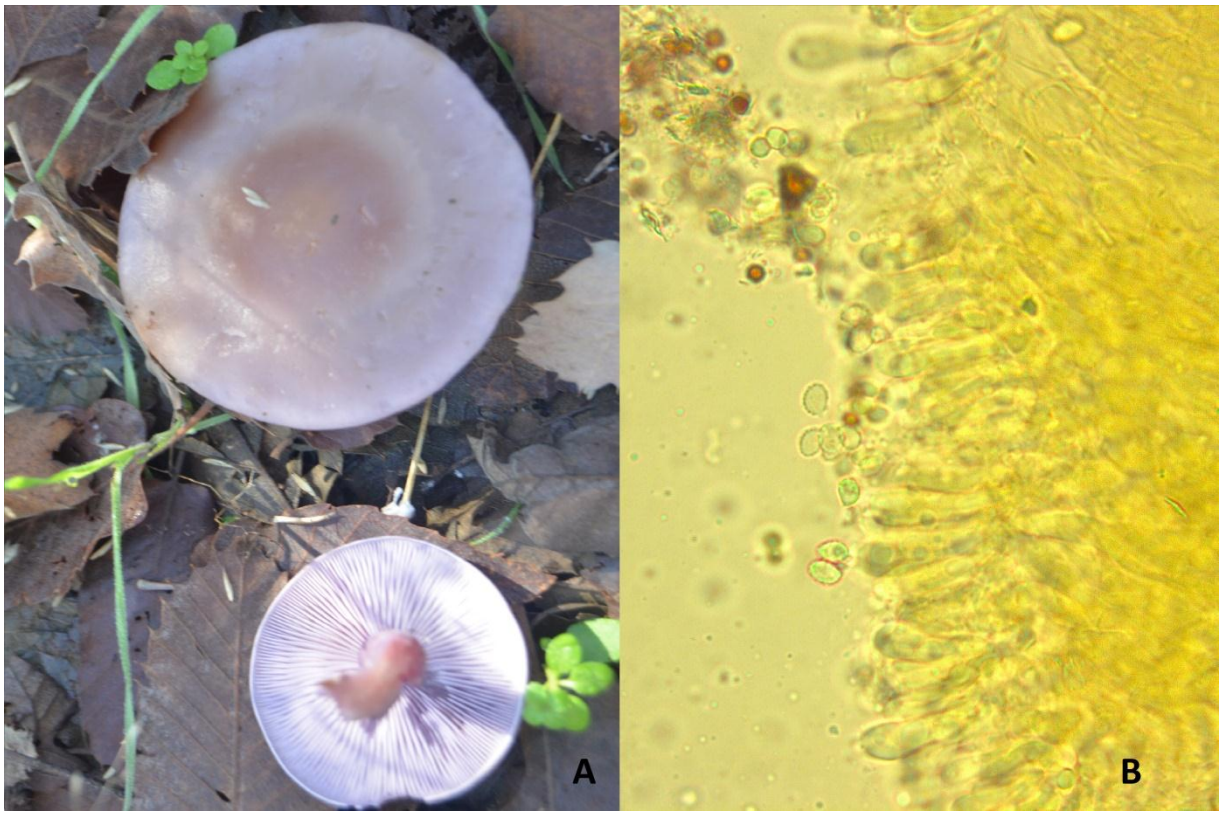

Figure A41. *Lepista sordida* (Schumach.) Singer (A: Body, B: Spor).

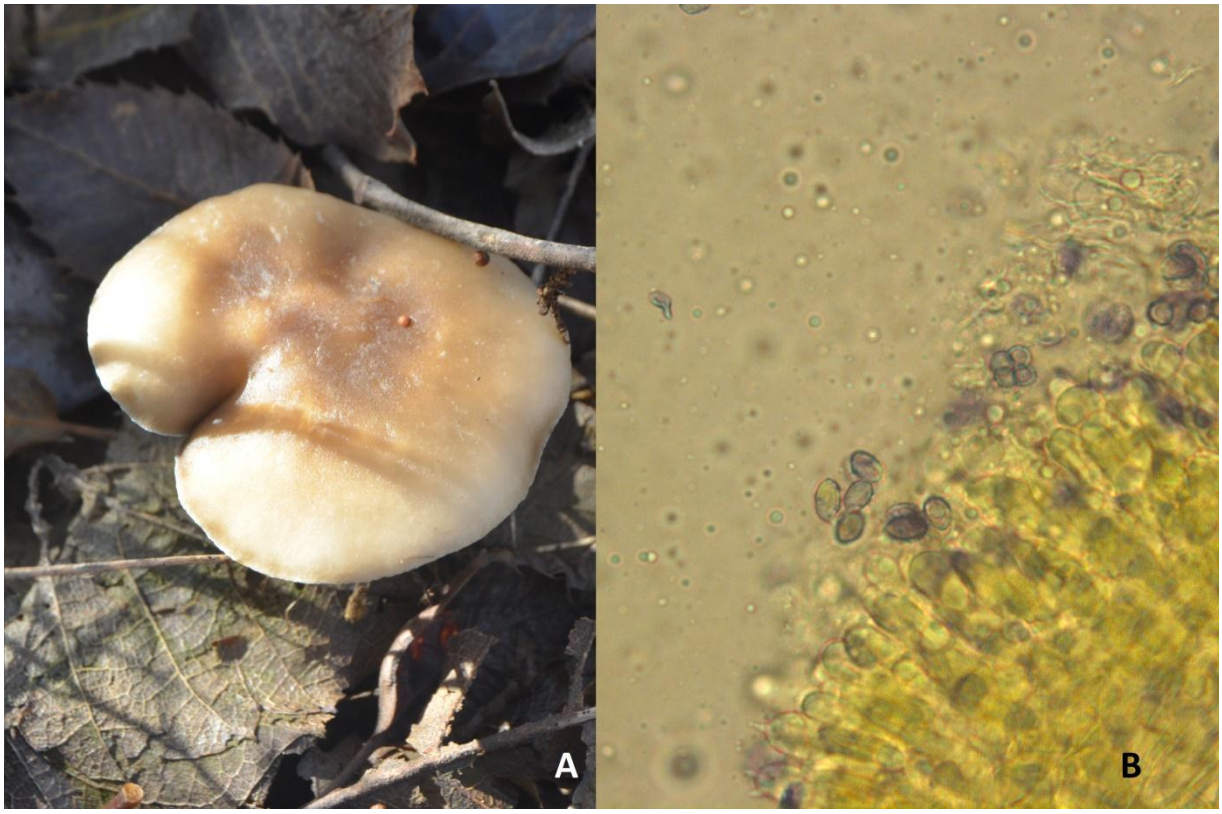

Figure A42. *Melanoleuca stridula* (Fr.) Singer (A: Body, B: Spor).

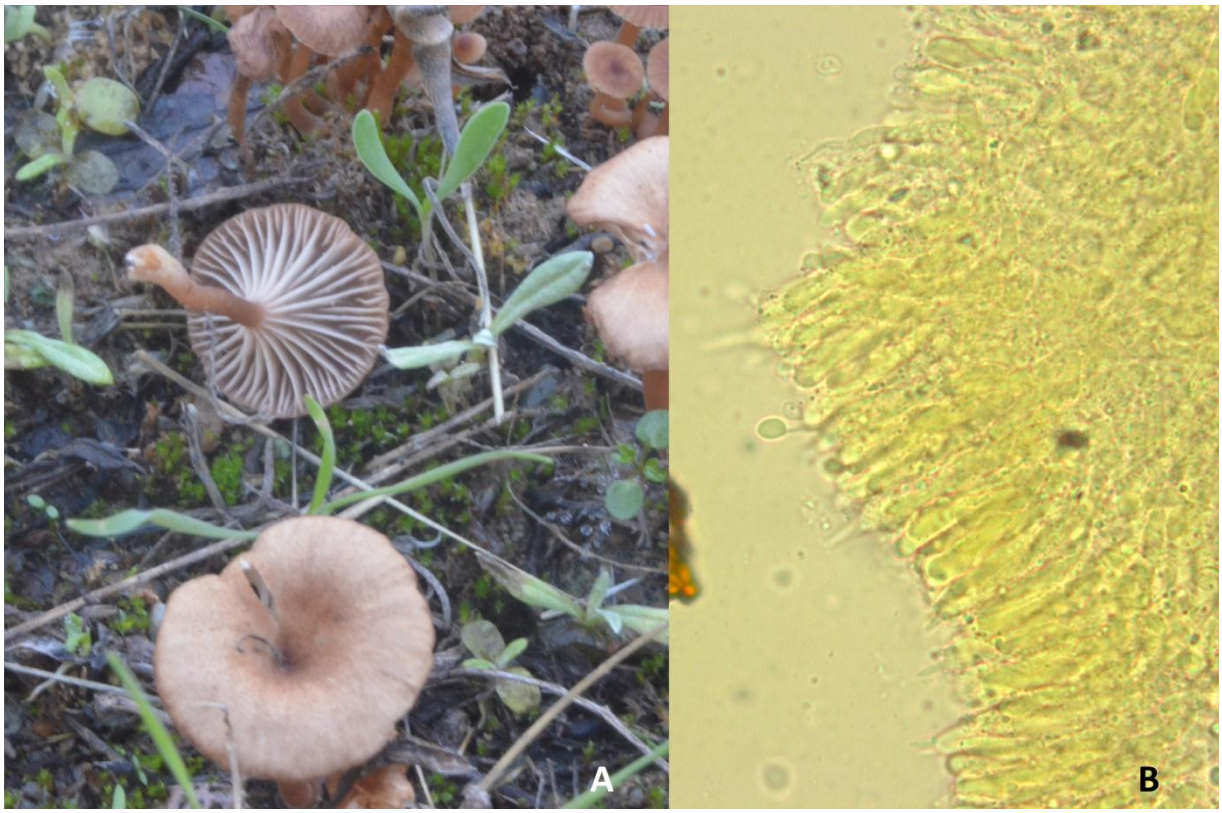

Figure A43. *Omphalina galericolor* (Romagn.) Bon (A: Body, B: Spor).

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