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# Diversity of Fleshy Mushrooms of Solapur District Maharashtra, India

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**Abstract:** India is the agricultural country having always good environmental condition for culturing the various crops associate with them grow large number of macro and microfungal diversity. Mushroom are omnipresent in a group not well studied and documented by any researcher, Solapur district come under the western ghat belongs to the state of Maharashtra, India is one of the hotspots of diversity of mushrooms, people of this state aware about the mushroom as a delicious food and medicinal values. In this study area inventor servey, collected and identified near about 12 species from various places of tehsil in the district Solapur all are saprophytic in habitat in them 7 belongs to different group of families, 2 are Tricholomataceae and 3 are major group of family Agaricaceae were recorded, yet to be not studied any agencies and research student from this area in the month of July to September 2022.

**Key words**: Diversity, Mushroom, Taxonomy, Wild, Domestic, Macrofungi, Solapur.

**Introduction:** The fungi are the heterotrophic diverse group of organism and on the earth surface it is second largest biotic group after the insect (Bhandari and Jha, 2017; Choudhary et al., 2015; Panda et al., 2019) with this it is also consider as a diverse in mode of reproduction, form, size and physiology. In point of investigation the mushroom are the most important economically and ecologically with their medicinal properties, edibility value, mycorrhizal as well as parasitic association with the forest (Meena et al., 2020). The term macrofungi is derived as a fruiting body come under the class Ascomycetes and Basidiomycetes either it is Epigeous ro hypogeous, pick up this macrofungi by hand with our naked eyes (Chandrawati et al. 2014). Macrofungi are taxonomic group of organism bears a sporocarp which include birds nest, jelly fungi, bracket fungi, truffles, stink fungi, puffballs, coral and gilled fungi. Researcher studied near about 27000 species from India of them 1069 species of mushroom are studied as a edible to the human background and throughout the world number of inventor studied 2000 species from wild area whereas 283 edible species are reported from India (Choudhary et al., 2015). Total number of fungi carried out for the

 

scientifical study and with this many mycologists continue study to unknown fungal species, of them one third fungal diversity of the globe exist in India of this only 50 % fungal diversity characterized till today (Manoharachary et al. 2005). The main object of this study to collect maximum number of macrofungi from wild as well as domestic area scattered in different part of Solapur District as well as to study typical diversity of fungi, characterized it, to collect, preserved and evaluate either it is edible or poisonous, which were less explored the range and diversity of basidiomycetes fungi were found more in Solapur region, however uptill now no any researcher or any other agencies to take more efforts for the detailed study of fleshy mushroom from this region and nobody can carry the research in view of natural mushroom flora till today due to this aspect considered this study from this region.

**Material and Method**

During the month of May 2022 to October 2022, regular and systematic survey is carried out in the wild as well as domestic place of Solapur district and the collection of macrofungi is done by simply walking throughout the whole region of district and cover nearby 75% area under investigation, in this study sampling of macrofungi method like processs is consider (Mueller et al., 2004). Researcher collect fleshy mushroom from different part Solapur district specially from Jeur, Malsiras, Kusalamb and Kondi region respectively during month of July to September 2022. The sample were collected specially in the rainy season with the help of using forceps, digging tools, plough, hunting knife, scissor and its safely carry out in the polythene bags and plastic bottles to refer plastic basket. Proper photography is done in various angles in natural habitat on the above places for future study in the laboratory. Microscopic study is done by using compound microscope using 5xm 10x, 40x, 45x objectives, and 5x, 10x and 15x eyepiece and Stereoscope Trinocular Microscope SZ-PT Olympus, Japan Model SZ40 and Low Power of Research Trinocular Microscope KIC Olympus Model. A collected specimens labeled with give number, date of collection, substrate and locality. As per the Natrajan et. al. (1981), Van and Susan Metzler (1992) survey method and its techniques are adopted for the study of mushroom. At the time of collection standard method for collection, preservation, microscopic and macroscopic observation is done.

**Taxonomy of Mushroom**

Collected specimens preserved with distilled water and formalin (Hawksworth et. al. 1995) and Just cut off the cap of any mature mushrooms and lay it gills down on a piece of white paper covering it with a glass or bowl helps protect it from air currents. In 2-6 hours you will usually have a spore print. Mature mushrooms use for spore print. Mushroom can

 

preserve by simply drying them out, they shrink and fade in the process. Dried material can used for spore print, photograph is essential for future study. Drying is best accomplished on a rack or screen using a light bulb or hot plate as a heat source, after this in the laboratory taxonomical study were done based on fruiting body, cap, flesh, odor, gills, stalk, partial and universal veil, spores and edibility (Kumar et al. 2015). Lastly mushroom were identified with their relevant manual by Hard (2013), Swanton 2002; Lamaison and Polese 2005; Rai et al 2005), books Mushroom and their Habitat, American Publishers, (Augusto Rinaldi,Vassili Tyndalo, 1972); (Lincoff, Gary H, 1981), (Alexopoulos, C.J. & C.W. Mims. 1979), (Simon and Schuster's, 1980,1981 and 1989) and (Peter Jordan, 1995,1996, 2000) and poisonous and edibility was confirmed by interview with local and tribal people, who were familiar with them in particular study region.

**Study Area**

The geography of district Solapur lies between 17.10 to 18.32 degrees north latitude and 74.42 to 76.15 degrees east longitude, the whole district is located on the south east fringe of Maharashtra State, India and it lies between the Bhima and Seena rivers, the entire district is drain either by its tributories or Bhima river. The Solapur district covered on the north by Osmanabad and Ahmednagar districts, east by Gulbarga (Karnataka State) and Osmanabad districts, south by Bijapur (Karnataka State) and Sangli and west by Pune and Satara districts. In the whole district there is no important hill station, only in the north of Tehsil Barshi number of spurs of Balaghat range pass south for a few kilometers, in tehsil Malsiras, Madha and Karmala located few scattered hills, generally the district has undulating terrain or flat. In Madha and Karmala taluka has a low table land and small separate hills act as a Watershed between Sina and Bhima rivers. The geographical area of Solapur district occupies near about 14844.6 sq. kms cover with 4.82% of the total area of State of Maharashtra. Of them whole urban region of the Solapur district is 338.8 sq. kms (2.28%) and the remaining rural area is 14505.8 sq.kms. (97.72%), concern with the area other than taluka, Karmala taluka is largest covering an area of 1609.7 sq. kms and North Solapur is smallest covering an area of 736..3 sq. kms respectively. The researcher carried out their work in Solapur district in the month of June to September 2022, in the present investigation no any department or agencies is carried out this work on fleshy mushroom in the following Jeur, Kondi, Malsiras and Kusalamba region. All the various fleshy mushroom were recorded for the first time from this area hence the researcher taken into consideration to study of macrofungi.

 

**Results:**

Present study region scattered throughout the east, west, north and south part of the solapur district, the whole district lies between south east fringe of state of Maharashtra, India. The climate of the study area is is tropical**,** generally rainy season start from month of June to October and dry season recorded in this district is from November to May with average annual rainfall of 735 mm in 44 rainy days and overall mean temperature counted near about $23.4^0$ C ($74.2^0$F) during the month of December and in the month of May it require 32.8 °C (91.0 °F) respectively. During the collection and study time the relative humidity found to be 82% and after the survey researcher recorded like this humidity is good for fleshy mushroom for their life span in the district. In this study nearly 12 species were identified with genus and species level, all are belongs to the class Basidiomycetes, 12 identified macrofungi having in different group belonging to the different 9 families i.e. Lyophyllaceae, Physalacriaceae, Polyporaceae, Bolbitiaceae, Psathyrellaceae, Tricholomataceae, Agaricaceae, Strophariaceae and Cantharellaceae among these 7 belongs to different group of families, 2 are Tricholomataceae and 3 are major group of family Agaricaceae were recorded in this study region, mostly saprophytic in nature, grow on soil and when inventor communicate with tribal people which are familiar with mushroom states that all are the poisonous. However all this 12 identified species shown in the table No.1 was first time recorded from Solapur District Maharashtra.

Table No.1 Showing the diversity of Mushroom of Solapur District, Maharashtra State, India.

| Family | Scientific Name | Locality | Mode of Nutrition | Total Specimen | Host | Importance |
|---|---|---|---|---|---|---|
| Strophariaceae | Pholiota squarrosoides | Kusalamb | Saprophyte | 1 | Soil | Poisonous |
| Polyporaceae | Lentinus crinitus | Kondi | Saprophyte | 1 | Soil | Poisonous |
| Agaricaceae | Lepiota brunneoincarnata | Jeur | Saprophyte | 1 | Soil | Poisonous |
| Cantharellaceae | Cantharellus concinnus | Kusalamb | Saprophyte | 1 | Soil | Poisonous |
| Lyophyllaceae | Termitomyces microcarpus | Kondi | Saprophyte | 1 | Soil | Poisonous |
| Psathyrellaceae | Coprinus niveus | Akluj | Saprophyte | 1 | Soil | Poisonous |
| Agaricaceae | Xanthagaricus luteolosporus | Kusalamb | Saprophyte | 1 | Soil | Poisonous |

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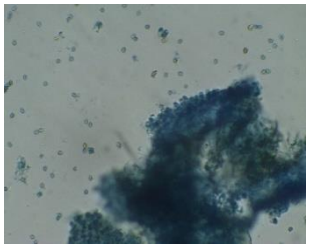
| | | | | | | |
|---|---|---|---|---|---|---|
| Bolbitiaceae | Panaeolus campanulatus | Akluj | Saprophyte | 1 | Soil | Poisonous |
| Physalacriaceae | Cyptotrama asparata | Kondi | Saprophyte | 1 | Soil | Poisonous |
| Agaricaceae | Agaricus bitorquis | Jeur | Saprophyte | 1 | Soil | Poisonous |
| Tricholomataceae | Tricholoma vaccinum | Kusalamb | Saprophyte | 1 | Soil | Poisonous |
| Tricholomatacee | Collybia cookie | Jeur | Saprophyte | 1 | Soil | Poisonous |

**Description:**

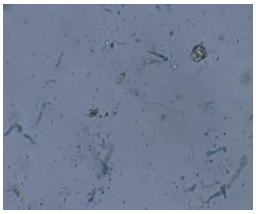
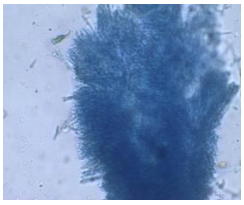
1. ***Pholiota squarrosoides*** (Peck) Sacc.

a b

***Pholiota squarrosoides*** (Peck) Sacc. Fig.-1: a-Habit b-Spores, Basidia and Basidiospores

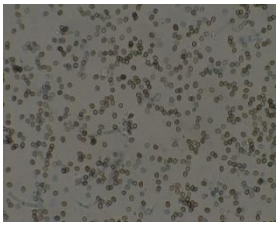
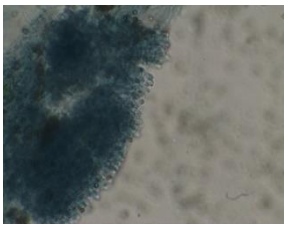
2. *Lentinus crinitus* (L.) Fr. (1825)

a b c

*Lentinus crinitus* (L.) Fr. (1825) Fig.-2: a-Habit b-Spores c- and Basidia and Basidiospores

3. ***Lepiota brunneoincarnata*** Chodat & C. Martín (1889)

a b c

***Lepiota brunneoincarnata*** Chodat & C. Martín (1889) Fig.-3: a-Habit, b-Spores, c-Basidia and Basidiospores

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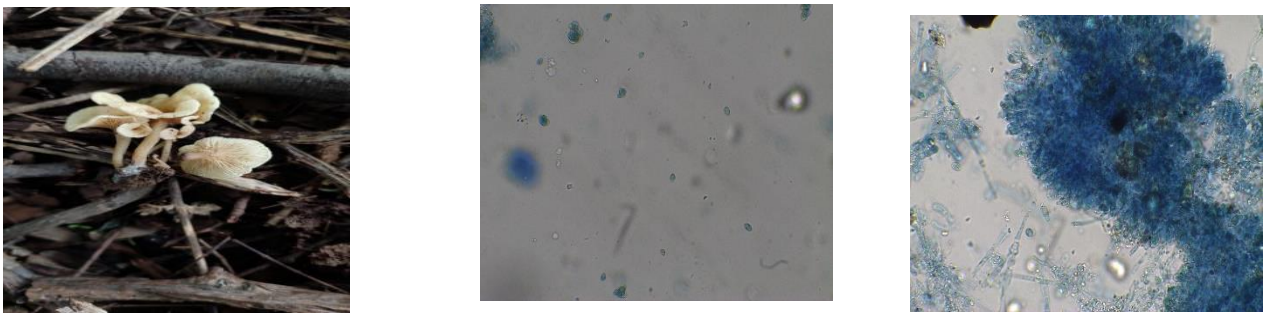
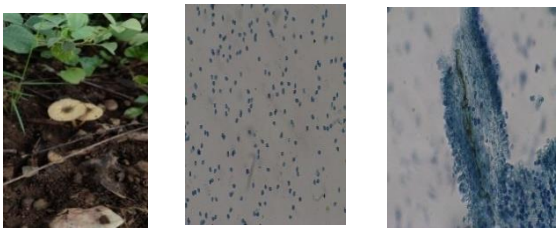
4. *Cantharellus concinnus* Berk. (1878).



a b

*Cantharellus concinnus* Berk. (1878). Fig.-4: a-Habit b-Spores c-Basidia and Basidiospores

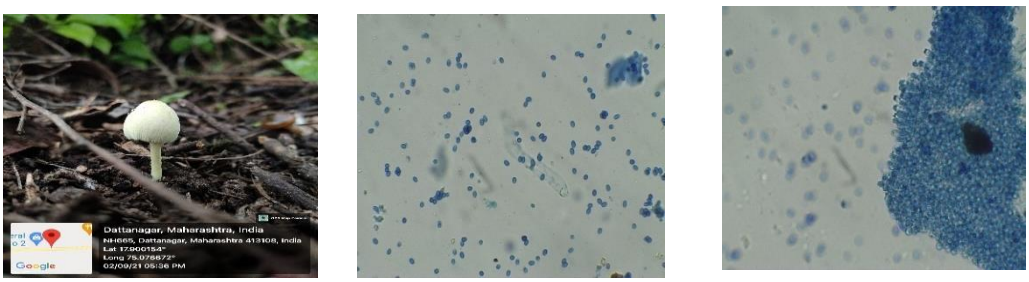
**5. *Termitomyces microcarpus*** (Berk. & Broome) R. Heim (1942)



a b c

***Termitomyces microcarpus*** (Berk. & Broome) R. Heim (1942) Fig.-5: a-Habit b-Spores c-Basidia and Basidiospores

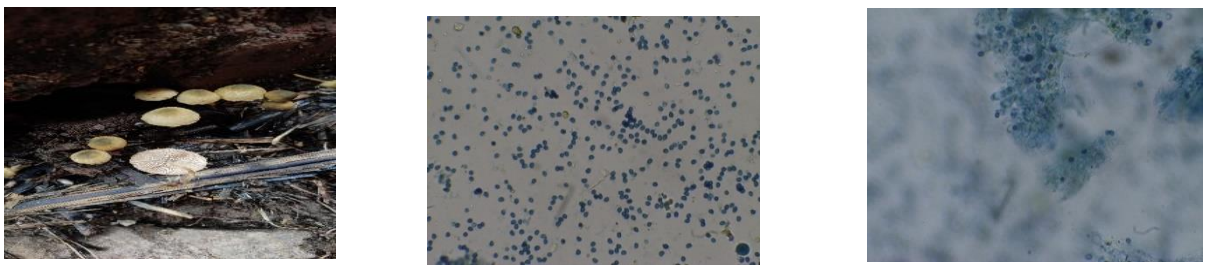
**6. *Coprinus niveus*** (Pers.) Redhead, Vilgalys & Moncalvo (2001)




**A b c**

***Coprinusniveus***(Pers.) Redhead, Vilgalys & Moncalvo (2001) Fig.-6: a-Habit b-Spores c-Basidia and Basidiospores

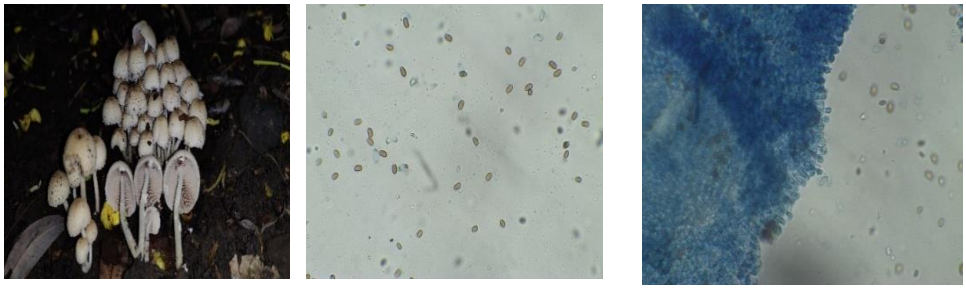
7. ***Xanthagaricus luteolosporus*** (Heinem. & Little Flower)



**a b c**

***Xanthagaricusluteolosporus*** (Heinem. & Little Flower). Fig.-7: a-Habit b-Spores c-Basidia and Basidiospores

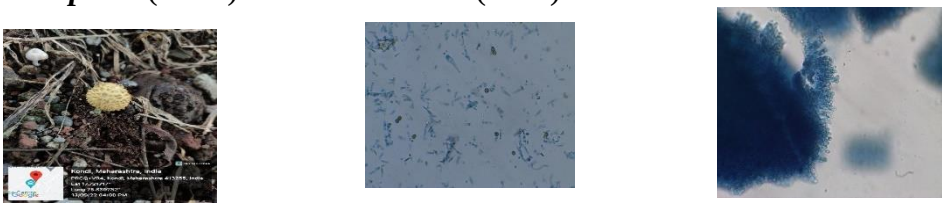
8. ***Panaeolus companulatus*** (Bull. ex Fries) Quélet



a b c

***Panaeolus companulatus*** (Bull. ex Fries) QuéletFig.-8: a-Habit b-Spores c-Basidia and Basidiospores

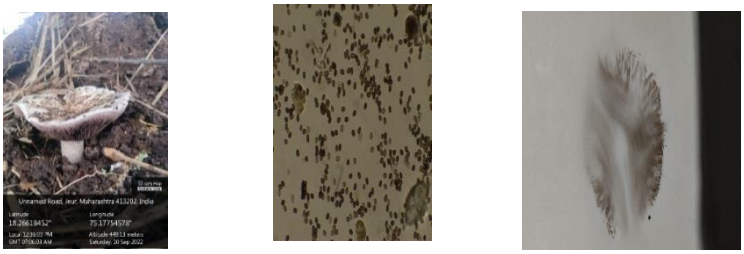
9. ***Cyptotrama asprata*** (Berk.) Redhead &Ginns (1980)



**a** **b** **c**

*Cyptotrama asprata* (Berk.) Redhead & Ginns (1980). Fig.-9: a-Habit b-Spores c-Basidia and Basidiospores

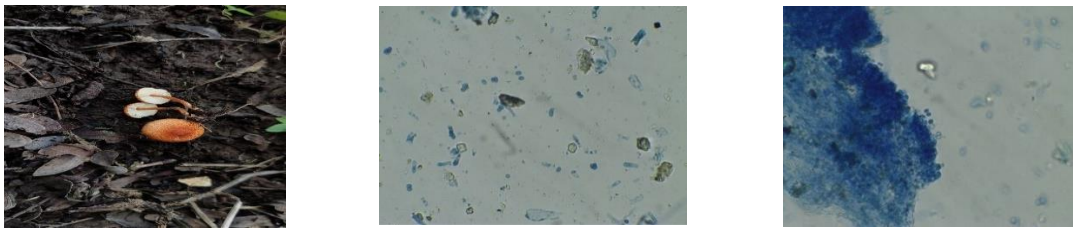
10. ***Agaricus bitorquis*** (Quél.) Sacc. (1887)



a b c

***Agaricus bitorquis*** (Quél.) Sacc. (1887) Fig.-10: a-Habit b-Spores and Basidia and Basidiospores, c-Spore Print

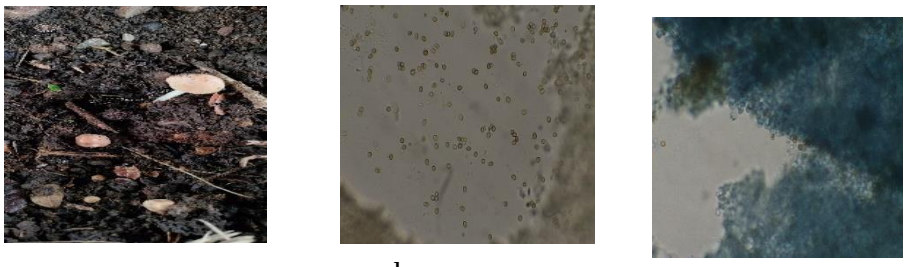
11. *Tricholoma vaccinum* (Schaeff.) P. Kumm. (1871).



a b c

*Tricholoma vaccinum* (Schaeff.) P.Kumm. (1871). Fig.-11: a-Habit b-Spores c-Basidia and Basidiospores

12. . ***Collybia cookie*** (Bres.) J.D.Arnold (1935)



a b c

***Collybia cookie*** (Bres.) J.D.Arnold (1935). Fig.-12: a-Habit b-Spores c-Basidia and Basidiospores

1. ***Pholiota squarrosoides*** (Peck) Sacc. **Family:** Strophariaceae

**Occurrence:** Solapur District ( Kusalamb)

Fruiting body scattered to gregarious, Cap glutinous, hygrophonous, Flesh blackish white, Odor mild, flavour pleasant; Gills crowded, Stalk 4.0 5.5 cm long, 0.5- 0.7 cm broad, brownish white in color, Partial veil absent, Universal veil absent, Spores globose, Edibility poisonous.

2. ***Lentinus crinitus*** (L.) Fr. (1825) **Family:** Polyporaceae

Fruiting body growing on decaying wood, Cap hygrophonous, Flesh brown, Odor mild, flavour pleasant, Gills brown in color, Stalk club shape, Partial veil absent, Universal veil absent; Spores blackish to yellowish brown, Edibility poisonous.

3. ***Lepiota brunneoincarnata*** Chodat & C. Martín (1889) **Family:** Agaricaceae

Fruiting body solitary, growing on soil, Cap rounded, 0.7 –0.9 cm in length, 1.3-2.8 cm across, Flesh whitish brown, Odor mushroom have distinctive taste, flavour pleasant; Gills crowded, Stalk dark white in color, Universal veil absent; Spores; globose are 3.32-6.64µ in size and oval are 3.32-6.64 µ in length and 3.32-4.98 µ in width; Edibility poisonous.

4. ***Cantharellus concinnus*** Berk. (1878). **Family:** Cantharellaceae

Fruiting body growing on soil, Cap depressed, Flesh white, Odor mild, flavour pleasant; Gills decurrent, Stalk bent, Partial veil absent; Universal veil absent; Spores globose are 4.98-9.96µ in size, Edibility poisonous.

5. ***Termitomyces microcarpus*** (Berk. & Broome) R.Heim (1942), **Family:** Lyophyllaceae

Fruiting body total height 2.2-3.4 cm, Cap 0.1-0.4 cm in length, 0.9- 1.8 cm across, Flesh yellowish white texture smooth, Odor mild, flavor pleasant; Gills crowded, Partial veil absent, Universal veil absent; Spores blackish white in color, Edibility poisonous.

6. ***Coprinus niveus*** (Pers.) Redhead, Vilgalys & Moncalvo (2001) **Family:** Psathyrellaceae

Fruiting body solitary, Cap bell shaped, 0.1 – 1.1 cm in length, 2.7- 4.1 cm wide, Flesh dark white, odor mild, Gills adnate, Stalk rhizoidal, Partial veil present, Universal veil absent; Spores cylindrical, Edibility poisonous.

7. ***Xanthagaricus luteolosporus*** (Heinem. & Little Flower) Little Flower, Hosag. &T.K. Abraham. **Family:**Agaricaceae

Fruiting body rough, Cap viscid, Flesh dull blackish brown, Odor mild, flavour pleasant; Gills adnate, Stalk club shaped, Partial veil absent, Universal veil absent; Spore yellowish to blackish white in color, Edibility poisonous.

8. ***Panaeolus companulatus*** (Bull. ex Fries) Quélet**Family:**Bolbitiaceae

Fruiting body white, Cap bell shaped, Flesh white, Odor mild, flavour pleasant; Gills ash in color, Partial veil absent; Universal veil absent; Spores yellowish dark brown in color, Edibility poisonous.

9. ***Cyptotrama asprata*** (Berk.) Redhead &Ginns (1980), **Family:** Physalacriaceae

Fruiting body total height 2.9 cm, Cap aculeate, Flesh white, Odor mushroom have distinctive taste, mild, flavour pleasant; Gills adnate, Stalk equal, Partial ring absent; Universal veil absent; Spores globose, Edibility poisonous.

10. ***Agaricus bitorquis*** (Quél.) Sacc. (1887) **Family**: Agaricaceae

Fruiting body growing on soil, total height 9.7 cm, Cap convex, depressed, 2.1 cm in length, 9.8 cm across, Flesh white, Odor mild, flavour pleasant; Gills sinuate, Stalk oblong, Partial veil absent; Universal veil present, cup shaped, Spores globose are 3.32-6.64µ in size and oval are 4.98-9.96 µ in length and 3.32-6.64 µ in width, Edibility poisonous.

11. ***Tricholoma vaccinum*** (Schaeff.) P. Kumm. (1871).

**Family:** Tricholomataceae

**Occurrence:** Solapur District ( Kusalamb)

Fruiting body laterally fused, Cap 0.1 – 1.1 cm in length, 2.7- 4.1 cm width, Flesh brown, odor mild, Gills crowded, Stalk long, Partial veil absent; Universal veil absent, Spores 4.98-6.64µ in size and cylindrical are 6.64-9.96µ in length and 4.98-6.64µ in width; Edibility poisonous.

12. ***Collybia cookie*** (Bres.) J.D.Arnold (1935) **Family:** Tricholomataceae

Fruiting body growing on soil and dung, Cap knot like, conical, 0.4–0.5 cm in length, 0.6 – 2.7 cm across, Flesh whitish brown, Odor mushroom have distinctive taste, mild flavour

pleasant, Gills adnate, Stalk bulbous, Partial veil absent; Universal veil absent, Spores globose, spherical, Edibility poisonous.

**Discussion:** In the Solapur region near about 12 genus and species studied by author from the different parts of the study area belongs to the division Basidiomycotina of them 3 belongs to the family Agaricaceae. 2 are Tricholomataceae and others are belongs to the different families named as Lyophyllaceae, Physalacriaceae, Polyporaceae, Bolbitiaceae, Psathyrellaceae, Strophariaceae and Cantharellaceae respectiviely. The R.T. Moore (1980) described the fungi belongs to the 16 class, 52 orders, 177 families, 1589 genera and 31515 species of division Basidiomycotina and class basidiomycetes, 3 subphyla and 6 unasigned classes. The diagnostic character of this phylum is the presence of a basidium bearing basidiospores and Kirk et. al. (2001) described 37% species of true fungi out of 30,000 species. The macro and micro fungi plays a significant role in biotechnological industries, biofertilizers, agriculture and antibiotics also the fungi plays a major role in the bioremediation, textiles, medicine and food industry (Danielson et al.1989). Number of macrofungi complete their life cycle to depend on aquatic as well as terrestrial in habitat which are either parasitic and saprophytic mode of nutrition consume by the fungi.

**Conclusion:** Wild macrofungi diversity is the floristic study carried out by inventor in the region of Solapur district, Maharashtra. Invented wild fleshy mushroom study will be reference database of this state of Maharashtra and surely it will help to the coming researcher in the future for the study of research work, also the macrofungi plays a very crucial role in the maintaining of ecosystem about the mushroom diversity with recycling the organic and inorganic content and it help in biodegradation, fleshy mushroom have highly nutritious and medicinal value, also the people are utilized for food and commercial culture is the gaining character for society.

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