Full Length Research Paper

Studies on biodiversity of fleshy fungi in Navsari (South Gujarat), India

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Mushrooms have created great excitement because of their presence especially after the down pour during the monsoon season. So a detailed survey was made in and around Navsari, south Gujarat, from July to September, 2010, to understand the morphological variability in their population which has not been done earlier. The region is a habitat of well distributed micro flora and fauna. Navsari is located between the latitude 20.95° N. It has an average elevation of 9 m above the sea level. The average maximum and minimum temperatures are 40 and 18°C, respectively, with an average annual rainfall of 122 cm. Out of several mushroom collected, 17 species were identified belonging to 2 different classes namely, Gastromycetes - Daldinia concentrica [(Xylariaceae) (cramp ball)], Lycoperdon pyriforme [(Lycoperdaceae, edible) (wood or stump puff ball)], Scleroderma citrinum (Sclerodermataceae, edible); Hymenomycetes - Cantharellus umbonatus, Coriolus versicolor (Polyporaceae, inedible), Schizophyllum commune (Schizophyllaceae, inedible) (the split gill), Ganoderma lucidum (Ganodermataceae), Ganoderma applanatum (ganodermataceae), Laetiporus sulphureus (Polyporaceae, edible), Leptota organensis, Collybia butyacea, Lentinellus cochleatus (Aurisclpiaceae, edible), Galerina unicolor (Hymenogatraceae), Citocybe flaccida (Trichomataceae, edible), Oudemansiella radicata (Physalacriaceae, edible), Hygrophorus eburnes (Hygrophoraceae, edible) and Agaricus campestris (Agaricaceae, edible). The investigation proves that there exists a distinct biodiversity in mushroom population.

Key words: Navsari, south Gujarat, mushroom, population, flora, fauna.

INTRODUCTION

A mushroom is the fleshy spore bearing fruiting body of a fungus, typically produced above ground soil or on its food source. Some species of mushrooms are edible and poisonous. Mushrooms have been existing on earth even long time before man appeared on earth as it is evident from the fossil records of the lower cretaceous period. Although, biologically speaking, possibly man might have used mushroom as food gatherer and hunter on the chronology of cultural evolution, but their nutritive valve is untapped till now. Wild edible fungi have been collected and consumed by people for thousands of years. The geological records reveal that edible species associated with people living 13,000 years ago in Chile. Many mushrooms have been used as food and medicines. So they contribute towards diet, income and human health. Some mushrooms have been important source of revenue for rural communities in India and other developing countries (Wani et al., 2010). Navsari is located between 20° 51” N, 72° 55” E and about 9 m above the sea level. Minimum and maximum temperature is 18 and 40°C. The average annual rainfall is about 122 cm. The dominant tree species of this area are Subabul (Leucaena

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leucocephala), Garmalo (Cassia fistula), Ashoka (Saraca indica), Rain tree (Samanea saman), Peltophorum (Peltophorum inerme), Pink cassia (Cassia rainigera), Cordia (Cordia myxa) and Gulmohar (Delonix regia).

During rainy season, there is abundant growth of several kinds of mushroom. There is an urgent need to explore this area for mushroom emanating in different seasons under varying environment and conserve the biodiversity prevailing in this area. The present communication, as part of continuing investigations, describes some newly reported mushrooms from Navsari (south Gujarat), India.

Classification of mushrooms

Gasteromycetes

These are examples of the basidiomycetes commonly called the Gasteromycetes. It means “stomach fungus” and these fungi produce their spores inside the fruiting body, that at least initially enclosed within an outer skin. These fungi show considerable variation in both, the overall appearance and internal structure of the immature basidia-bearing fruiting bodies. The spores are shed by variety of interesting mechanisms. Young specimens of the more fleshy members are edible, but this group includes many small, dry, inedible species.

Hymenomycetes

One of the three major classes of Basidiomycota is Hymenomycetes, Urediniomycetes and Ustilagomycetes. About 98% of the species of the Hymenomycetes are in a clade called the Homobasidiomycetes, which includes mushrooms, bracket fungi, puffballs and others.

RESULTS

During survey, several numbers of mushrooms were collected and identified. At present, we could be able to identify 18 genera belonging to 12 families and two classes. They are individually described (Figures 1 and 2).

Gasteromycetes

Daldinia concentrica

Family: Xylariaceae
Common name: Cramp balls
Cap colour: Jamun colour later becoming black.
Cap shape: Hemispherical with slightly incurved base.
Cap diameter: 2.5 to 6.0 cm.
Spore print: Black.
Spore colour: Black.
Spore size: 4.74 to 5.54 × 4.07 to 4.88 µ
Spore shape: Spindle shaped
Edibility: Not known (Figure 1).

Lycoperdon pyriforme

Family: Lycoperdaceae
Common name: Wood or stump puff ball
Cap colour: Yellowish brown
Cap shape: Pear shaped with hump at center
Cap surface: Smooth
Cap diameter: 2 to 7 cm
Strip length: 0.5 to 3.5 cm
Spore colour: Golden yellow
Spore size: 4.44 to 5.48 × 3.07 to 4.94 µ
Spore shape: Round
Edibility: Edible

Scleroderma citrinum

Family: Sclerodermataceae
Cap colour: Dirty olive-yellow

Mushrooms demystified

A comprehensive guide to the fleshy fungi given by Arora (1986) and the Agaricales in modern taxonomy Singer (1986).

MATERIALS AND METHODS

Collection of mushroom samples

Detailed survey was carried out in and around Navsari from July to September, 2010 to understand the morphological variability in the mushrooms population. The collection was made by method given by Hailing (1996). Collection site is Navsari agricultural university campus, college farm, residential area and nearby villages of Navsari. Spotted mushrooms were minutely inspected in their natural habitats and brought to laboratory for detailed study. Photographs were taken by means of a Canon Camera with power of 12 megapixels.

Identification and classification of mushroom samples

We were using the following parameters for identification of mushrooms specimens: Cap colour, cap surface, cap margin, cap diameter, stipe length, gill attachment, gill spacing and spore print. Spore prints were taken according to guidelines given by Michelo (2004). Individual spore characteristics like shape, size and colour were recorded. For this purpose, we used scale, Petri plate, black-white paper for spore print, microscope with camera and measuring scale. We were measuring 6 samples of each mushroom for collecting information. Final identification and classification were done by comparing recorded characteristics of mushrooms with the colour dictionary of mushroom given by Dickinson and John (1982), the mushroom guide and identifier by Jorden (2000) and the mushroom identifier by Pegler and Spooner (1997).
Figure 1. a = *Daldinia concentrica*; b = *Lycoperdon pyriforme*; c = *Scleroderma citrinum*; d = *Cantharellus umbonatus*; e = *Coriolus versicolor*; f = *Schizophyllum commune*; g = *Ganoderma lucidum*; h = *Ganoderma applanatum*.

Cap shape: Rounded or pumpkin shaped
Cap surface: Rough
Cap diameter: 4 to 6 cm
Spore colour: Blackish brown
Spore size: 9.5 µ in diameter
Spore shape: Spherical
Edibility: Edible.

**Hymenomycetes**

**Cantharellus umbonatus**

Family: Tricholomataceae
Cap colour: Brown
Cap shape: Convex, centrally depressed
Cap surface: Smooth, floculose silky.
Cap diameter: 6 cm
Cap margin: Wavy
Gill colour: White
Gill spacing: Distant
Gill attachment: More or less decurrent
Stipe length: 1 to 5 cm
Stipe colour: White
Spore print: Yellow
Spore colour: White
Spore size: 0.32 to 0.56 × 0.32 to 0.51 μ
Spore shape: Oblong
Edibility: Edible (Figure 1).

*Coriolus versicolor*

**Family: Polyporaceae**
Cap colour: Grey brown with white border at the edge of each cap.
Cap shape: Flat
Cap diameter: 2.5 cm
Pores: Quite fine and white or cream like the flesh.
Habitat: Decaying timber
Edibility: Inedible.

*Schizophyllum commune*

Family: Schizophyllaceae
Common name: The split gills
Cap colour: Whitish grey
Cap shape: Kidney shaped
Cap surface: Velvety
Cap diameter: 1 to 4 cm
Cap margin: Incurved somewhat lobbed
Gill colour: Grey or violet
Gill spacing: Distant
Spore print: White
Spore colour: White
Spore size: 5.0 × 1.3 μ
Spore shape: Cylindrical
Edibility: Inedible.

*Ganoderma lucidum*

Family: Ganodermataceae
Cap colour: Brick red with white margin
Cap shape: Flatted dish shape
Cap surface: Smooth
Cap diameter: 4 to 5 cm
Cap margin: 4 to 5 cm
Gill colour: White with incurved
Stipe length: 2 to 3 cm
Spore colour: Brown
Spore size: 10.3 × 6.3 μ
Edibility: Poisonous.

*Laetiporus sulphurus*

Family: Polyporaceae
Cap colour: Orange yellow
Cap shape: Bracket shaped
Cap surface: Smooth
Cap diameter: 25 to 35 cm
Cap margin: Wavy
Spore colour: Yellow
Spore size: 6.4 × 4.5 μ
Spore shape: Rounded
Edibility: Edible (Figure 2).

*Leptiot a oregonensis*

**Family: Agaricaceae**
Cap colour: Pale yellow depressed darker at center
Cap shape: Knobbed
Cap surface: Smooth
Cap diameter: 4.4 cm
Cap margin: Enrolled to uplifted
Gill colour: Brown to milky white
Gill spacing: Crowded
Gill attachment: Adnexed
Stipe length: 4 cm
Stipe colour: Stipe is bulbous swollen at the base.
Spore print: White
Spore colour: Golden brown
Spore size: 1.30 to 1.45 × 0.63 to 0.89 μ
Spore shape: Ellipsoidal
Edibility: Inedible.

*Collybia butyracea*

**Family: Tricholomataceae**
Cap colour: Whitish with brown center
Cap shape: Convex
Cap surface: Smooth
Cap diameter: 1.5 to 3.5 cm
Cap margin: Incurved
Gill colour: White
Gill spacing: Crowded
Gill attachment: Adnexed
Stipe length: 1.5 to 3.0 cm
Stipe colour: Creamy white
Spore print: Brownish
Spore color: Hyaline
Spore size: 0.42 to 0.58 × 0.42 to 0.51 μ
Figure 2. a = Laetiporus sulphurus; b = Lepiota oregonensis; c = Collybia butyracea; d = Lentinellus cochleatus; e = Galerina unicolor; f = Citocybe flassida; g = Oudemansiella redicata; h = Hygrophorus eburnes; i = Agaricus campestris.

Spore shape: Globose
Edibility: Inedible.

*Lentinellus cochleatus*

Family: Aurisclpinaceae

Cap shape: Irregular funnel
Cap surface: Smooth
Cap diameter: 7.5 cm
Cap margin: Wavy
Gill colour: Watery pale brown
Gill spacing: Close
Gill attachment: Decurrent
Stipe length: 2 cm

Cap colour: Red brown
Stipe colour: Flash at the top, reddish brown towards base
Spore print: Pinkish brown
Spore size: 5.93 × 5.56 μ
Spore shape: Round
Edibility: Edible.

Galerina unicolor

Family: Hymenogastraceae
Cap colour: Brown
Cap shape: Completely convex, initially bell shaped
Cap surface: Smooth/slimy/shiny
Cap diameter: 3 to 4 cm
Cap margin: Extending beyond gills
Gill colour: White
Gill spacing: Distant
Stipe colour: Dark brown, with white cottony mycelia at base
Spore print: Dark brown to blackish
Spore colour: Brown
Spore size: 4.87 × 3.70 μ
Spore shape: Spherical to oval
Edibility: Inedible.

Citocybe flassida

Family: Tricholomataceae
Cap colour: Reddish leather brown
Cap shape: First convex than turn funnel shaped
Cap surface: Smooth and shiny
Cap diameter: 3.5 cm
Cap margin: Expanded downward often wavy
Gill colour: White
Gill spacing: Crowded
Gill attachment: Free
Stipe length: 3 cm
Stipe colour: Leather brown
Spore print: White
Spore colour: Sparse hyaline
Spore shape: Sub globose
Edibility: Edible.

Oudemansiella redicata

Family: Physalacriaceae
Cap colour: Pale brown, grey to dark olive brown
Cap shape: Bell shaped finally flat with slight hump
Cap surface: Slimy and slightly wrinkled
Cap diameter: 3 to 9 cm
Cap margin: Wavy
Gill colour: Clear white
Gill spacing: Distant
Gill attachment: Adnexed
Stipe length: 10 to 20 cm tappres toward the top with long taproot
Stipe colour: Whitish brown
Spore print: White
Spore colour: Hyaline white
Spore size: 2.59 × 1.89 μ
Edibility: Edible

Hygrophorus eburnes

Family: Hygrophoraceae
Cap colour: White, bicid
Cap shape: Convex to nearly plane
Cap diameter: 3.5 cm
Gill colour: White
Gill spacing: Distant
Gill attachment: Decurrent
Stipe length: 3 cm narrow at base
Stipe colour: White
Spore print: Yellowish
Spore colour: Yellowish
Spore size: 2.25 to 2.59 × 2.22 to 2.99 μ
Edibility: Edible.

Agaricus campestris

Family: Agariaceae
Cap colour: White
Cap shape: Hemispherical
Cap surface: Smooth
Cap diameter: 5 to 10 cm
Cap margin: Incurved
Gill colour: Bright pink when young
Gill spacing: Dense
Gill attachment: Free
Stipe length: 6 to 7 cm
Stipe colour: White
Spore colour: Brown
Spore size: 7 to 8 to 4 to 5 μ
Spore shape: Ovate
Edibility: Edible.

DISCUSSION

Mushrooms have been objects of much curiosity and speculation since time immortal. They are an important component of the ecosystem. Their edibility, poisonous nature, psychotropic properties, mycorrhizal and parasitic association with the trees makes them economically important and interesting to study. Mushrooms are of ancient lineage, omnipresent, remarkably beautiful and diverse in their form, in their interaction with biota. The occurrence of such familiar substrate as wood, litter and soil, implies a role for them in these micro habitats (Lakhanpal, 1996). Fleshy fungi tend to appear seasonally, the most productive months are those of rainy days (July to October), starting after summer season. Mushrooms are cosmopolitan and are found almost everywhere; such as pastures, forested areas. Many of them are found in only one kind of habitat such as bog, a forest, gardens, roadsides, deserts etc. They actually
emerge from substrates such as peat, along or soil, humus, dung, saw dust, charcoal heaps etc. (Sharma and Samota, 2006). Mushrooms grow wild in almost all types of soils, on decaying organic matter, wooden stumps etc. They appear in all seasons; however, rains favor rapid growth when organic matter or its decomposition products are easily available (Manoharachary et al., 2005).

Singer (1989) had reported 1320 species belonging to 129 genera under Agaricales. Mushrooms alone are represented by about 41,000 species, of which approximately 850 species are recorded from India (Deshmukh, 2004). Besides extensive surveys of the Himalayan region are compiled by Lakhanpal (1997). Atri et al. (2000) had done taxonomic studies of Agarics from Punjab plains. Pradeep et al. (1998) worked on the diversity of mushrooms from Western Ghats.

Conclusion

Mostly, mushrooms are found in forest area, in field area, on branches of trees, and some time in west land area. The possible reason for the growth and survival of various kinds of naturally occurring mushrooms can be the prevailing climatic condition with different vegetation which provided the favorable environment. Through this study we are reporting the existing biodiversity of mushroom in this region for the first time.

REFERENCES