



## DIVERSITY AND DISTRIBUTION OF AGARICACEAE IN WESTERN PART OF INDIA WITH SPECIAL REFERENCE TO GUJARAT STATE

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Studies on lower groups have always been neglected in Gujarat; therefore, distribution and diversity of Agaricaceae in Gujarat state is investigated for the first time. Gujarat is known for its varying climates starting from moist deciduous forest (south Gujarat, a part of Western Ghat) to pure desert conditions (Great Rann of Kutchh). In spite of this, taxonomic exploration was carried out for the first time. The present study we reports 46 species from which four species are reported previously while rest of the 38 species are documented for the first time for the state. Highest numbers of species (39) are found in *Agaricus* while *Macrolepiota*, *Cystoagaricus* and *Podaxis* have single species each. Maximum diversity is observed in the districts like Dangs, Ahawa, Navsari, Narmada, Junagadh and Chhotaudepur while minimal diversity is observed in Rajkot, Kutchh and North Gujarat (Palanpur, Banaskantha, Sabarkantha). Among them *Agaricus bisporus*, *A. blazei*, *A. campestris*, *Chlorophyllum molybdites*, *Coprinellus micaceus*, *Cystoagaricus trisulphuratus*, *Leucoagaricus rubrotinctus*, *Leucocoprinus brebissonii*, *Podaxis pistillaris* are common while *Macrolepiota procera* is collected only from one locality. We expect much more species in Agaricaceae than reported in the present study and we suggest further studies to understand the diversity of Agaricaceae in the state.

**Key words:** *Agaricus*, *Chlorophyllum*, *Coprinus*, *Coprinellus*, *Leucoagaricus*, *Leucocoprinus*, Macrofungus, Mushroom, *Podaxis*

Gujarat state is located on the most western part of India and bounded by the Arabian Sea at the southwest and coordinated at 20°6' N 68° 10'E to 24° 42' N, 74° 28' E and possesses the largest seacoast among all the states (Tadvi 2013). The total geographical area of the state comprises of land mass of 1,96,204 km<sup>2</sup> (75,755 sq miles) from which a little or less than 20 lakh hector of land is under forest cover which is unevenly distributed but the major concentration is found on the eastern hilly Saurashtra region. The temperature of the state ranges from 1° C to 46° C. The extensive variation in geophysical and climatic conditions resulted into formation of different forest types. The state has elevated and plane land in addition to the desert at the northern part hence the rainfall received in the state varies from region to region. Gujarat has four major types of forests viz. Tropical moist Deciduous Forest; Tropical Dry Deciduous Forest; Northern Tropical Thorn Forest and Littoral and Swamp Forest (Champion and Seth 1968). Therefore, the state is gifted with great diversity of natural ecosystems ranging from evergreen to moist deciduous and dry deciduous to semiarid or pure dessert conditions (Tadvi 2013).

In spite of such variations in climatic conditions and forest types, fungal diversity of the state is poorly documented (Rajput *et al.* 2015). In 1996, Gujarat Ecological Commission documented the biodiversity of state and released first list of 164 fungi. Thereafter, few sporadic reports appeared on the fungal diversity of the state but majority of them are either concentrated around the human pathogens (Gajjar *et al.* 2011, Bhavsar *et al.* 2012, Nawal *et al.* 2012, Katara *et al.* 2013, Panchal *et al.* 2013, Nasit *et al.* 2013) or on plant pathogens (Arya *et al.* 2008; Maharshi and Thaker 2012, Nagdesi and Arya 2012a, b, 2013, Dhingani *et al.* 2013). When working on wood decay and fungal diseases in forest trees, we noticed that there is no much information on fungi occurring in the Gujarat. Therefore, on the basis of our study and available literature, a checklist of 339 fungal species is documented for the first time for the state (Rajput *et al.* 2015). Thus, the main aim of the present study is to enlist the diversity and distribution of family Agaricaceae in Gujarat state, western India.

## MATERIALS AND METHODS

*Sample collection:* Extensive field studies were carried out in 33 districts of Gujarat during 2013-2014. Fruiting bodies of mushrooms growing in different forests, sub urban areas, agricultural field and secondary forests were collected and packed in sterile polyethylene bags for further laboratory investigation. Prior to collection, morphological characteristic of fruiting bodies were recorded and photographed in their natural habitat with Cannon SLR 1200D digital camera. Collected mushroom specimens were identified on the basis of their macroscopic and microscopic characters.

*Isolation of fungal organism and microscopic studies:* For microscopic study, free hand sections mounted in lectophenol cotton blue and observed under Leica DME 2000D. To maintain the cultures of collected mushrooms for further studies, suitably trimmed fruiting bodies were surface sterilised by 0.1% HgCl<sub>2</sub> for 40-45 seconds, washed thoroughly with distilled water followed by 70 % ethanol for few seconds. Thereafter, these samples were inoculated on Potato Dextrose Agar (PDA) and Malt Extract Agar (MEA) media and incubated at 27°C. Pure cultures were established by serial transfer and stored at 4°C in refrigerator. All collections studied are also maintained at -20°C while rest of the specimens are maintained the Department of Botany, Faculty of Science, The Maharaja Sayajirao University of Baroda, Vadodara. After morpho-taxonomic identification, wherever doubt existed, such specimens were identified by molecular methods.

*Molecular Identification:* Genomic DNA was extracted (only for some samples where identity was ambiguous) using Plant/Fungi DNA isolation kit (Sigma Cat# E5038) and manually employing the procedure described by Plaza et al. (2004) from fresh fruiting bodies of mushrooms. PCR was carried out using 1x final concentration of Ready Mix™ Taq PCR Reaction Mix (Sigma) and, template DNA (50 ng/μl). Amplification of the DNA was

performed by using a Veriti® thermal cycler (Applied Biosystems, Foster City, CA, USA). The ITS region was amplified using the primers ITS 1 and ITS 4 as described by White et al. (1990). The amplified products were purified using Purelink™ Quick PCR Purification kit (Cat# K310001) and purified PCR products were sent for sequencing to Eurofins Genomics India Pvt. Ltd., Bangalore.

The generated sequences were used for BLAST search in the GenBank database (www.ncbi.nlm.nih.gov) for the identification of species. Identification was done by 99% base-pair match of the sequence obtained to the closest available reference sequences. After molecular identification, characteristics of the identified fungal species were compared with the literature for further confirmation of the identity of our isolate.

## RESULTS

Forty six species belonging to eleven genera of the Agaricaceae were collected during the survey in different geographical areas of the Gujarat. Maximal diversity was recorded from Ahwa, Dangs, Dharmpur, Navsari, Narmada, Junagadh and Chhotaudepur districts while arid regions such as Jessore, Kuchh, Taranga hills, Rajkot and Chotila region showed relatively poor diversity. From the collected species, *Agaricus* possessed maximum number of species while only one species of each is found in *Macrolepiota* Singer, *Cystoagaricus* Singer and *Podaxis* Desv. The morphological description of these species is as follows:

**1) *Agaricus augustus* Fr., Epicr. syst. mycol. (Upsaliae): 212 (1838) [1836-1838]**

Stipe 10-20 cm long, thick and enlarged at the base with partial veil also covered with brown scales. Pileus 10-25 cm broad, convex becoming flat at maturity, surface dry with yellow-brown to brown scales that are concentrically arranged on the cap surface. Gills free, close or nearly crowded, pale at first

and become dark brown at maturity. Flesh white, not bruising turns yellow with KOH. Cheilocystidia subglobose to more or less cylindrical; 30 x 10. Peleipellis cutis with yellow-brown to brown scales. Basidiospores are brown in colour, smooth, ellipsoid with a distinct apiculus; 7.5-10. x 5.5-6  $\mu\text{m}$ .

*Habitat:* Saprobic, on leaf litter and humus rich soil, growing alone or gregarious. *Edibility:* Edible

*Material examined:* Gandhinagar, Dangs, Junagadh, collectors – Mr. AM Vasava, Dr. RD Koyani and Dr. KS Rajput, Code#: KSR0262

**2) *Agaricus bisporus*** (J.E. Lange) Imbach, Mitt. Naturf. Ges. Luzern 15: 15 (1946)

Pileus grey-white or brown to dirty white tint; hemispherical to convex or flat with the age, 6-11 cm. Surface dry smooth or scaly. Gills are crowded, free, narrow and pink in color which becomes red brown at maturity. Stipe is white more or less equal to slightly bulbous at base, 2-10 cm long, 1-4 cm broad, white to brown, scaly. Flesh white to light coloured, chocolaty brown; but does not stain yellow in KOH. Pileipellis with light brown, innate scales, Basidia generally 2-4 spored. Basidiospores brown, smooth, 3-8.5 x 4-6.4  $\mu\text{m}$  and elliptical.

*Habitat:* Saprobic, grows alone or gregariously on soil found in grassy areas, mostly in nutrient rich soil, rarely in forest and roadsides. *Edibility:* Edible.

*Material examined:* Baroda, Gandhinagar, Junagadh, Poloforest; collectors: Mr. AM Vasava, Dr. RD Koyani and Ms. HR Patel, Code#: KSR0109

**3) *Agaricus blazei*** Murrill, Q. Jl Fla Acad. Sci. 8(2): 193 (1945)

Pileus ivory white to greyish or dull reddish-brown, hemispherical, looks like buttons when comes out from ground and later become convex, reaching up to 30 cm in diameter. When young, surface appears silky, later it develops scales at maturity. Gills are compact, arranged closely and white in colour in the young age then turns pink to light reddish and

finally brown with spore maturation. Stipe is solid but become hollow with maturation. Flesh tastes similar to green nuts and smells like almond; turns yellow with KOH. Cheilocystidia abundant; inflated; 9-15  $\mu\text{m}$ . Peleipellis cutis with pinkish brown scales. Basidiospores brown, 5 x 4  $\mu\text{m}$  and almost oval in shape.

*Habitat:* Fruiting bodies grows singly or in clusters on leaf litter in humus/compost rich soil. *Edibility:* Edible having medicinal importance

*Material examined:* Anaaval, Dangs, Junagadh, Ratanmahal; Collectors: Dr. RD Koyani, Ms. HR Patel and Mr. AM Vasava, Code#: KSR0214

**4) *Agaricus bohusii*** Bon, Docums Mycol. 13(no. 49): 56 (1983)

A large edible mushroom, pileus 5-15 cm diameter, fruiting body initially hemispherical, subsequently becomes convex to flat-convex to umbonate, pale brown to dark brown in the centre. Stipe 7-18 cm, white long, fusiform, swollen in the middle, smooth to silky, white to brown with a membranous ring above. Flesh thick, white becomes reddish brown. Gills free, narrowing towards the margin of pileus, pink to dark brown. Peleipellis cutis with light brown scales. Basidiospores are small, brown and ovoid to ellipsoid, 5-6 x 6-8  $\mu\text{m}$ .

*Habitat:* Grows in small groups or solitary on decaying wood as well as on humus rich soil.

*Edibility:* Edible

*Material examined:* Dangs, Junagadh, Ratanmahal, Vadodara; collectors: Mr. AM Vasava, Dr. KS Rajput and Ms. HR Patel Code#: KSR0189

**5) *Agaricus bresadolanus*** Bohus [as 'bresadolianus'], Anns hist.-nat. Mus. Natn. Hung. 61: 154 (1969)

Pileus is around 100mm, convex or sometimes depressed in middle, at first creamy white cap surface without scales then turns light browning the centre. Gills are free, 10mm broad; pink becomes brown with the maturity.

Stipe is white, straight, approx. 8 x 2 cm in diameter, clavate to cylindrical in shape, more or less equal with a ring, fibrillose below ring. Base bit bulbous, yellowish to light brown. Basidia clavate, 2-4 spored. Cheilocystidia claviform cylindrical to spindle-shaped. Basidiospores are smooth, brown and ellipsoidal or sometimes oblong, without a germ pore, 5.5-7.5 x 4.0-5.0  $\mu\text{m}$ .

*Edibility:* Non-edible, Toxic

*Habitat:* Grows single or in small groups on grassy area or humus rich soil or in gardens.

*Material examined:* Girnar, Ratanmahal, Rajpipla, Vansda; collectors: Mr. RN Patel, Mr. AM Vasava and Dr. RD Koyani, Code#: KSR0068

**6) *Agaricus californicus*** Peck, Bull. Torrey bot. Club 22: 203 (1895)

Fruiting bodies grow scattered or clustered with shiny white to brownish cap. Pileus 5-10 cm, initially convex and becomes flat at maturity with a broad umbo, somewhat scaly, white or brownish over centre; turns yellow with KOH. Stipe 3-10 cm, thick, whitish but it becomes dark after handling, equal to slightly bulbous at the base. Gills are close, whitish at first, becomes pinkish brown at maturity. Basidiospores are elliptical, smooth, purple brown 3-6 x 4-7  $\mu\text{m}$  in size.

*Habitat:* Fruiting bodies scattered or cluster on soil and decaying wood logs. *Edibility:* Not edible, mildly toxic

*Material examined:* Ganhinagar, Rajpipla, Dediapada, Dangs, Sarkhadiya Hanuman; collectors: Mr. RN Patel, Mr. AM Vasava and Dr. RD Koyani, Code#: KSR0144

**7) *Agaricus campestris*** Linnaeus: Fries Syst. Mycol. 1: 281 (1821)

Sporophore stipate, pileus whitish, under surface slightly pink, convex to broadly convex, infrequently flat; 3-10 cm in diameter, smooth and glossy to fibrous to nearly woolly or scaly. Gills free from the stipe, crowded; dark pink gradually become brown and dark brown at maturity; covered with a thin white

partial veil when in the button stage. Stem thick, more or less parallel in diameter, occasionally tapering slightly to base. Flesh thick, white, not bruising, does not change colour with KOH. Basidiospores are elliptic, 3.5-5.5 x 5-9.6  $\mu\text{m}$ .

*Habitat:* Saprobic, gregarious or growing alone in humus rich soil. *Edibility:* Edible

*Material examined:* Ratanmahal, Girnaar, Waghai, Narmada, Madhi; collectors Mr. RN Patel, Mr. AM Vasava and Dr. KS Rajput, Code#: KSR0081

**8) *Agaricus diminutivus*** Peck, Ann. Rep. Reg. N.Y. St. Mus. 54: 184 (1902)

Pileus convex to plano-convex, smooth to slightly fibrillose with pinkish-brown fibrils on cap surface, 2-4 cm across; turns yellow with KOH. Gills free close, dull pink then become blackish-brown at maturity. Stipe 3-6 cm long, white, bruising yellowish, equal, often with basal bulb; smooth to slightly fibrillose below the ring. Flesh thin, white. Basidia 4-spored; cheilocystidia 7-20 x 6-8  $\mu\text{m}$ , short-clavate. Basidiospores ellipsoidal, 3.3-5.8 x 3.3-5  $\mu\text{m}$ , brown and smooth.

*Habitat:* Grows solitary or in small groups on leaf litter. *Edibility:* Not known

*Material examined:* Junagadh, Dediapada, Rajpipla, Sagai; collectors: Dr. KS Rajput, Mr. AM Vasava, Mr. AD Gondaliya and Dr. Pramod S. Code#: KSR0202

**9) *Agaricus dulcidulus*** Schulzer, in Kalchbrenner, Icon. Sel. Hymenomyc. Hung.: 29 (1874)

Pileus light grayish purple in centre and gradually become light purple towards margin; convex often with inflexed margins and becoming flat with maturity; cap surface covered with purple-brown to pinkish dense fibrils. Flesh turns slightly yellow with KOH. The stipe cylindrical, bulbous or clavated at the base, 4-5 cm long, white, somewhat darkening toward the base. Basidiospores elliptical and brown, small, 3.5-4 x 4-3-6  $\mu\text{m}$ .

*Habitat:* Grows on leaf litter with humid soil.



*Edibility*: Not known

*Material examined*: Girnaar, Mahal, Poloforest, Rajpipla; collectors: Dr. KS Rajput, Mr. AM Vasava and Dr. Pramod S. Code#: KSR0303

**10) *Agaricus goossensiae*** Heinem., Bull. Jard. Bot. État Brux. 26(1): 42 (1956)

Pileus hemispherical to convex, 2.5 to 6 cm in diameter, white but turns yellow with maturation, smooth first and turn scaly with age. Gills arranged closely, free, pink when young and purple at age. Stipe cylindrical, white and turns yellow with age, 2-5 x 0.2-1 cm size. Spores are ovate without germ spores, brown, smooth and 5-7.5 x 4-6  $\mu\text{m}$ .

*Habitat*: Grows solitary on humus rich soil.

*Edibility*: Not known

*Material examined*: Ratanmahal, Dangs, Gandhinagar, Kheralu; collectors: Mr. AM Vasava, Dr. RD Koyani, Ms. HR Patel and Dr. Pramod S., Code#: KSR0224

**11) *Agaricus hondensis*** Murrill, Mycologia 4(6): 296 (1912)

Stipe 8-15 cm long while 1-2 cm thick, wider at the base and somewhat tapered toward apex. Pileus convex, grey to brown with pale fibers on the cap that becomes brownish with age and turns yellow with KOH. Flesh thick, become yellowish if injured. Gills crowded, free from the stipe; whitish at first gradually become pink, lilac-gray, and finally brownish as the spores mature. Cheliocystidia not observed. Spores are elliptical, smooth and brown, 3-4 x 4.4-6  $\mu\text{m}$ .

*Habitat*: Saprophyte, grows scattered or in small groups in mixed type of forests. *Edibility*: Non edible, Toxic

*Material examined*: Waghai, Pavagadh, Junagadh; collectors: Dr. KS Rajput, Dr. RD Koyani, and Mr. AM Vasava, Code#: KSR0127

**12) *Agaricus langei*** (F.H. Møller) F.H. Møller, Friesia 4(3): 203 (1952)

Pileus 5-12 cm, convex densely covered with

reddish-brown to rusty brown scales that are more dense towards the middle of the cap. The stipe is more or less parallel sided with a swollen or bulbous base; whitish with pink tinge. Gills are free, crowded, pinkish grey subsequently become darker with age. Cheilocystidia numerous, thin-walled, ovate to m-clavate, hyaline, 20-50 x 9-30  $\mu\text{m}$ . Spores are large, ovoid and brown in colour.

*Habitat*: Grows on ground, leaf litter. *Edibility*: Edible

*Material examined*: Gandhinagar, Dharampur, Ratanmahal; collectors: Mr. AM Vasava, Dr. RD Koyani and Dr. KS Rajput. Code#: KSR0158

**13) *Agaricus moelleri*** Wasser, Nov. sist. Niz. Rast. 13: 77 (1976)

Commonly called as inky mushroom, stipe 5-12 cm long, 12-18 mm thick, bruising yellow at base, stem smooth bulbous towards base with persistent ring. Pileus broadly convex that becomes eventually flat at maturity. Cap creamy white covered with grey-brown scales, densest and darkest towards the centre; turns yellow with KOH. Gills free from stipe, crowded, free, pink when young and become brown as the fruiting body reaches maturity. Cheilocystidia globose, thin-walled and hyaline. Spores are brown, smooth and elliptic to ellipsoidal measuring 4-5 x 5-7  $\mu\text{m}$ .

*Habitat*: Grows on leaf litter and humus rich soil. *Edibility*: Non edible, Pisonous

*Material examined*: Waghai, Junagadh, Madhi, Dharampur, Waghahi; collectors: Mr. AM Vasava and Ms. HR Patel, Code#: KSR0248

**14) *Agaricus pocillator*** Murrill, Mycologia 33(4): 446 (1941)

Pileus is convex, 3-19 cm, which becomes flat at the maturity with grayish to brownish scales towards the centre on the cap surface. Stipe is 5-8 cm long, more or less equal with a small bulbous base and typical persistent ring. Gills are free from the stem, close, and white, become pinkish followed by brown at the maturity. Cap and Flesh turns yellow with

KOH. *Chileocystidia* not observed. Basidiospores are brown, elliptical, 3-4 x 4.7-6.1  $\mu\text{m}$ .

*Habitat:* Grows on leaf litter. *Edibility:* Non edible

*Material examined:* Dharampur, Vansda, Poloforest, Junagadh; collectors: Mr. AM Vasava, Dr. RD Koyani and Ms. HR Patel, Code#: KSR0241

**15) *Agaricus porphyrizon*** P.D. Orton, Trans. Br. Mycol. Soc. 43(2): 174 (1960)

Pileus 4-10 cm across, convex, shield shaped, smooth, whitish with purplish lilac scales, darker at centre and gradually lighter towards margin, fruiting body reaching up to 5-12 cm and cap stains yellow with KOH. Stipe white and smooth, turns yellow when touched. Partial veil forms complete ring. After cutting the flesh become discoloured. *Cheilocystidia* ovoid to globose, 14-28 x 7-18  $\mu\text{m}$ . Basidiospore ovoid, purplish to black 3.2-3.8 x 4.5-5.5  $\mu\text{m}$ .

*Habitat:* on ground in deep forest. *Edibility:* Edible

*Material examined:* Girnar, Ratanmahal, Dediapada; Collectors: Mr. AM Vasava, Ms. HR Patel and Dr. KS Rajput, Code#: KSR0219

**16) *Agaricus rotalis*** K.R. Peterson, Desjardin & Hemmes, Sydowia 91(1): 244 (1999)

Pileus convex to plano-convex with a broad umbo that is occasionally slightly depressed. Cap 7-10 cm across, surface contains grey to brownish-grey fissure on the surface that exposes the white context, bruising dull yellow. Stipe 5-10 long, brownish-grey above and below the annulus with a bulbous base that often contains significant white rhizomorphs attached to the substrate. Gills are free, crowded, with occasional lamellulae, pinkish red when young, becoming dark brown at the maturity. Basidia club shaped. *Cheilocystidia* club shaped 8-16  $\mu\text{m}$ . Basidiospores 3.2-3.9 x 4.5-5.6  $\mu\text{m}$

*Habitat:* Grows on leaf litter and humus rich soil. *Edibility:* Not known

*Material examined:* Dharampur, Mahal, Junagadh, Narmada; Collectors: Dr. RD Koyani and Dr. KS Rajput, Code#: KSR0324

**17) *Agaricus subrutilescens*** (Kauffman) Hotson & D.E. Stuntz, Mycologia 30(2): 219 (1938)

Fruiting body reaching up to 9-15 cm, 10-20 mm thick with skirt like ring. Pileus 5-18 cm across, convex at first and becomes nearly flat, covered with brown to reddish brown or purple-brown scales on the cap surface. Gills free, close, whitish pink at young stage, becomes brown to blackish brown at the maturity and cap stains light green with KOH. *Cheilocystidia* clavate to globose; up to 40 x 18  $\mu\text{m}$ . Basidiospores brown, small, ellipsoidal, 3-4 x 4-6.5  $\mu\text{m}$ .

*Habitat:* Grows on leaf litter and humus rich soil. *Edibility:* Edible

*Material examined:* Baroda, Rajpipala, Junagadh, Narmada; Collectors: Mr. AM Vasava, Ms. HR Patel and Dr. KS Rajput, Code#: KSR0271

**18) *Agaricus sylvicola*** (Vittad.) Peck, Ann. Rep. Reg. N. Y. St. Mus. 23: 97 (1872) [1870]

Fruiting bodies occur in small groups or scattered, reaching up to 15 cm, base swollen, smooth or with fine fibres with persistent large ring. Pileus white, 7-16 cm, smooth, spherical initially and become flattened at the maturity, bruising yellow particularly at margin. Cap surface stains yellow with KOH Basidiospores are smooth and ellipsoidal to ovoid, 3.5-4.5 x 5-7.5  $\mu\text{m}$ .

*Habitat:* Saprophyte on leaf litter and decaying woods in moist deciduous forest. *Edibility:* Edible

*Material examined:* Ahmedabad, Junagadh, Baroda; Collectors: Mr. AM Vasava, Ms. HR Patel and Dr. RD Koyani, Code#: KSR0343

**19) *Agaricus sylvaticus*** Schaeff., Fung. bavar. palat. nasc. (Ratisbonae) 4: 62 (1774)

The cap is greyish white, 5-10 cm across, convex initially but flattens at centre with maturity, scaly and does not stain with KOH.

Stem is bulbous at the base, brown, 5-8 x 1-2 cm in size, sometimes white scales below the ring. Gills are grey in colour which turns dark brown with age. Peleipellis cutis with reddish-brown to brown scales. Flash is white initially, turns dark red to brown with maturity. Cheilocystidia thin-walled, clavate. Basidiospores oval, purple brown to dark brown, 4-6 x 2-4  $\mu\text{m}$  in size.

*Habitat:* In deciduous forests on decaying wood debris or grassy land. *Edibility:* Edible

*Material examined:* Ahwa, Baroda, Junagadh, Vansda; Collectors: Mr. AM Vasava, Dr. KS Rajput and Dr. RD Koyani, Code#: KSR0315

**20) *Agaricus xanthodermus*** Genev., Bull. Soc. bot. Fr. 23: 28 (1876)

Pileus white or whitish brown coloration, initially globose, become broadly convex to nearly flat with the age, if rubbed or injured bruising yellow initially and becomes dark after some times. Cap surface stains yellow with KOH. Flesh white and thick, yellowing after crushing. Stipe is white, 7-15 cm long with a bulbous base, sometimes bulbous at base, bruising yellow. Gills free white to close pink at young become brown at maturity. cheilocystidia are club-shaped. Basidiospores ellipsoidal, brown 3-4.5 x 4.5-5.9  $\mu\text{m}$ .

*Habitat:* Grows on leaf litter and humus rich soil. *Edibility:* Non edible, Toxic

*Material examined:* Girnaar, Sarkhadiaya, Rajpipla, Dangs; Collectors: Mr. AM Vasava, Dr. KS Rajput and Ms. HR Patel, Code#: KSR0133

**21) *Chlorophyllum hortense*** (Murrill) Vellinga, Mycotaxon 83: 416 (2002)

Pileus is 5-8 cm broad, initially ovoid to convex and distinctly umbonate, creamy white with pale ochreous to yellowish brown scales on the cap surface. Stipe is sub-cylindrical, fibrillose, base bulbous, surface whitish, smooth and glabrous with persistent annulus. Gills free, crowded, whitish, becoming darker with the age. Cheilocystidia are cylindrical. Basidia 2 spored. Basidiospores 7-

8.3 x 9.5-12  $\mu\text{m}$ , ellipsoid to ovoid, thick walled, smooth and without germ pore.

*Habitat:* Grows on leaf litter and humus rich soil. *Edibility:* Non edible

*Material examined:* Anaaval, Rajpipala, Junagadh, Dang; Collectors: Mr. AM Vasava and Dr. KS Rajput Code#: KSR0312

**22) *Chlorophyllum molybdites*** (G. Mey.) Masee, Bull. Misc. Inf., Kew: 136 (1898)

Fruiting body reaching up to 20 cm, stipe white, long, tapered slightly to apex, and somewhat enlarged toward base; finely fibrillose. Pileus convex to spherical when young, becoming broadly convex or nearly with the maturity of fruiting body with brownish scales on the cap surface. Cap does not stain with KOH. Flesh white, thick and no bruising after injury or after slicing. Gills are free from the stem, crowded; white when young, becoming grayish green to brownish green as the spores mature. Peleipellis a trichoderm or cutis with whitish, fibrillose surface. Cheilocystidia densely packed, clavate, smooth, thin-walled, hyaline. Basidia, 4-spored, clavate. Basidiospores smooth, ellipsoid with slightly truncated end, 6-9 x 8.12.9  $\mu\text{m}$ .

*Habitat:* Grows on humus rich soil. *Edibility:* Non edible, Toxic

*Material examined:* Girnar, Pavagadh, Mahal, Sagai, Waghai; Collectors: Mr. AM Vasava and Dr. KS Rajput, Code#: KSR0337

**23) *Coprinellus aureogranulatus*** (Uljé & Aptroot) Redhead, Vilgalys & Moncalvo 2001

Fruiting body is bright golden yellow-orange, ellipsoid to sub-globose. Pileus 50 mm at maturation, translucently striate when young and the surface become radially striate after expanding, globose when young which turns oval with age, yellow- brown to orange-brown. Lamellae free, crowded, white when young and become grayish to black, with a very finely fimbriate edge. Stipe slender, fistulose, equal, or tapering towards the base, silky white, and

10 x 0.1-0.3 cm in size. basidiospores are ellipsoid, brown, flat base, 6- 8 x 3-5 µm.

*Habitat:* Dead wood branches, sometimes in soil or gardens. *Edibility:* Not known

*Material examined:* Girnar, Rajpipla, Junagadh, Poloforest, Narmada; Collectors: Mr. AM Vasava, Dr. RD Koyani and Dr. KS Rajput, Code#: KSR0183

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

Pileus 2-8 cm, oval at young condition, expanding to bell shaped rarely margin curled up, light brown and subsequently become amber or pale coloured, especially towards the margin and cap surface does not stain with KOH. Button is covered with mica like granules. Gills attached or free from stem, they are pale coloured, gradually become brown and subsequently become black. Stem hollow, 3-6 cm long, smooth to finely hairy and fibrous. Cheilocystidia elliptical to ovoid. Basidia 4-spored. Basidiopores are black, smooth with central pore, sub-elliptical, 3.9-6.8 x 6.8-10-7 µm.

*Habitat:* on wood debris and branches buried under soil thus appearing like terrestrial. *Edibility:* Edible

*Material examined:* Dangs, Junagadh, Ratanmahal, Rajpipla, Dediapada, Sagai; collectors: Mr. RN Patel, Mr. AM Vasava and Dr. KS Rajput, Code#: KSR0123

**25) *Coprinopsis atramentaria*** (Bull.) Redhead, Vilgalys & Moncalvo, in Redhead, Vilgalys, Moncalvo, Johnson & Hopple, Taxon 50(1): 226 (2001)

Pileus 2-11 cm, oval to rounded-cylindrical during young stage, gradually becoming to bell-shaped with a uplifting of margin. At maturity the fruiting body is turning to black with a brownish centre. Stalk white, smooth and hollow; 5-18 cm long and 1-2 cm thick, tapering at the apex. Gills free from the stem; crowded, white gradually become pink and then turn black. Basidiospores are 7-9 x 4-5 µm, elliptical and smooth with a central to

slightly eccentric pore. Basidia 4-spored.

*Habitat:* Grows on ground soil along road side mostly.

*Material examined:* Dangs, Junagadh, Poloforest, Dediapada, Sagai; collectors: Dr. RD Koyani, Mr. AM Vasava and Dr. KS Rajput, Code#: KSR0051

**26) *Coprinus silvaticus*** Peck, Ann. Rep. N.Y. St. Mus. 24: 71 (1872)[1871]

Pileus 1-4 cm in diameter, ovoid expanding to conical-convex, seldom entirely flat with a deeply striate margin grooved to the centre. Gills narrowly adnate; crowded, white slowly become umber coloured and dark brown at the maturity. Stem fragile, 4-8 cm long, white. Basidiospores ovoid, ornamented with rows of warts, 8-10 x 10-14.5 µm.

*Habitat:* Grows on leaf litter and humus rich soil. *Edibility:* Not known

*Material examined:* Junagadh, Ratanmahal, Jambughoda, Hathni Mata, Baroda; Collectors: Mr. AM Vasava, Ms. HR Patel, Dr. RD Koyani and Dr. KS Rajput Code#: KSR0236

**27) *Cystoagaricus trisulphuratus*** (Berk.) Singer, Mycologia 39(1): 87 (1947)

Pileus furfuraceous, separable, dark orange, bell shaped at young age and turns convex at maturity, 2-6 cm in size. Lamella ventricose, crowded and chocolate brown coloured at maturity. Stem is cylindrical, 4-6 cm long, furfuraceous and orange in colour. Spores angular, irregular, dark brown.

*Habitat:* Grows on leaf litter and humus rich soil or sandy soil.

*Material examined:* Ahwa, Baroda, Sagai, Vadodara, Vansda; collectors: Dr. KS Rajput, Mr. AM Vasava, Mr. AD Gondaliya and Dr. Pramod S., Code#: KSR0033

**28) *Cystolepiota oregonensis*** (H.V. Sm.) Vellinga, Mycotaxon 98: 228 (2006)

Pileus smooth, pale yellow towards periphery and darker in the centre, 4-5 cm across and convex. Gills closed, adnexed, crowded, white



at young age turns brown with maturity. Stipe is bulbous at the base, 3-5 cm in length. Spores ellipsoid, golden brown in colour, 1-2 x 0.5-1 µm in size.

*Habitat:* Nutrient rich soil or leaf litter in thick forests with plant debris.

*Material examined:* Anaval, Gir, Junagadh, Dangs, Madhi, Vyara, Ratanmahal, Rajpipla; collectors: Mr. AM Vasava, Mr. AD Gondaliya, Dr. RD. Koyani and Dr. KS Rajput, Code#: KSR0332.

**29) *Lepiota flammeotincta*** Kauffman, Pap. Mich. Acad. Sci. 4: 331 (1925) [1924]

Fruiting body stipate, pileus 4-6 cm across, convex becoming flat with uplifted at the margin or occasionally umbonate; scales on the cap surface brown, reddish-brown, purplish-brown. Flesh white, staining pink or red if bruised. Stipe slender, relatively thicker at the base, 5-9 cm long, hairy like pileus, partial veil forming like sleeve on the middle. Gills free, close and brown, spores smooth, ellipsoidal 4-4.5 x 6-8.5 µm.

*Habitat:* Grows on leaf litter and humus rich soil

*Material examined:* Ahwa, Rajpipla, Junagadh, Narmada, Sarkhadiya Hanuman; collectors: Mr. AM Vasava, Dr. RD. Koyani and Dr. KS Rajput, Code#: KSR0351

**30) *Lepiota atrodisca*** Zeller, Mycologia 30(4): 473 (1938)

Pileus 1-4 cm in diameter, convex, becoming plane, slightly umbonate; cap surface dry, tomentose at the disc with fine blackish scales, less dense toward the margin. Stalk 2-7 cm long, 1-4 mm thick; more or less equal; hollow; glabrous at the apex. Gills free, white, close, crowded. Cheilocystidia clavate; pileipellis a cutis. Basidiospores, ellipsoid, smooth, thick-walled, 5.5-7.8 x 3.5-4.5 µm. Spore print white.

*Habitat:* Grows on soil and dead wood.  
*Edibility:* Non edible, Poisonous

*Material examined:* Ahwa, Dangs, Junagadh, Dediapada, Sagai; collector: AM Vasava, Code#: KSR0200

**31) *Lepiota phaeosticta*** Morgan, J. Mycol. 12(6): 248 (1906)

Pileus fleshy, sub-ovoid with blunt apex, dark gray, 2-4 cm across, broadly convex to almost flat with age, umbo prominent, dark gray or blackish scales present on the cap surface, flesh white. Stipe white, smooth and hollow, cylindrical, tapering upward from the clavate base, with persistent partial veil. Gills white, close. Spores ovoid smooth, obliquely apiculate, hyaline, 3-3.5 x 5-6 µm.

*Habitat:* Grows on Leaf litter and humus rich soil. *Edibility:* Not known

*Material examined:* Baroda, Dangs, Jambughoda, Hathni Mata, Junagadh, Ratanmahal, Sarkhadiya Hanuman; collectors: AM Vasava, Dr. RD Koyani, Dr. KS Rajput, Code#: KSR0276

**32) *Lepiota subclypeolaria*** (Berk. & M.A. Curtis) Sacc., Syll. fung. (Abellini) 5: 67 (1887) [1886]

Fruiting body stipate, pileus about 4 cm, ovoid to plane, thin, umbonate, broad; white, surface radiate-striate, fuscous on the umbo. Stipe 4-6 cm long, cylindrical, hollow, base bulbous narrowing upwards and annulus membranous. Gills free, moderately crowded, remote, distant; spores broadly ellipsoid, smooth, hyaline, 3-4.3 x 4-6 µm; stipe 3-4 cm long, sub-equal, glabrous, white, annulus median.

*Habitat:* Grows on leaf litter and humus rich soil. *Edibility:* Not known

*Material examined:* Anaaval, Dangs, Baroda, Junagadh, Dediapada; Mr. AM Vasava, Dr. RD. Koyani and Dr. KS Rajput, Code#: KSR0235

**33) *Leucoagaricus americanus*** (Peck) Vellinga, Mycotaxon 76: 433 (2000)

Fruiting body stipate, pileus 4-12 cm across, convex at first, subsequently becomes flat,

covered with brown to reddish brown scales on the cap surface, bald in button stage but soon become scaly overall and stains red with KOH. The stipe 5-12 cm long, bald or finely silky; enlarged at in the middle and tapering toward the base, whitish in the beginning but reddish brown. Gills free, crowded white when young and becoming reddish brown with the age. Flesh white, staining slowly yellow. Cheilocystidia clavate, thin walled. Pileipellis a cutis. Pleurocystidia absent. Spore smooth, white with tiny pore, 5-7 x 9-10  $\mu\text{m}$ .

*Habitat:* Grows on woods, on stumps or around deadwood. *Edibility:* Not known

*Material examined:* Baroda, Rajpipla, Junagadh, Girnar, Sagai, Vansda; Collectors: Dr. KS Rajput, Mr. AM Vasava, and Dr. RD Koyani, Code#: KSR0207.

**34) *Leucoagaricus leucothites*** (Vittad.) Wasser, Ukr. bot. Zh. 34(3): 308 (1977)

Pileus 4-9 cm wide, white, hemispherical, initially convex, expanding to become flat with smooth and silky cap surface, margin curved. Flesh white, thick, soft, not bruising when cut. Cap surface does not stain with KOH. Stipe 5-10 cm long, white, surface smooth to silky, cylindrical, enlarged to sub-bulbous, base smooth, longitudinally fibrillose below. Gills free, crowded pure white at first, eventually becoming pale flesh-color with age. Cheilocystidia subcylindric to subclavate, subutriform; thin-walled. Basidiospores broadly elliptic, smooth, thin walled with apical pore, 4.5-5.5 x 7-9  $\mu\text{m}$ .

*Habitat:* Grows on Leaf litter and humus rich soil. *Edibility:* Not Known

*Material examined:* Dharampur, Dediapada, Dang, Poloforest, Rajpipla, Sagai; Collectors: Mr. AM Vasava, Ms HR Patel and Dr. RD. Koyani, Code#: KSR0162.

**35) *Leucoagaricus littoralis*** (Menier) Bon & Boiffard, Docums Mycol. 6(no. 24): 44 (1976)

Fruiting body stipate, pileus creamy white, initially convex becomes broadly convex to nearly flat with the age. Flesh thick, soft, stipe

white, long, tapering towards apex with bulbous base. Gills white at young stage, becoming brown at maturity, free and close. Cheilocystidia cylindrical, narrowly clavate. Basidia 4 spored; basidiospores ellipsoidal, brown, 4-5.5 x 8-10  $\mu\text{m}$ .

*Habitat:* Grows on humus rich soil as well as dry deciduous. *Edibility:* Not known

*Material examined:* Ambaji, Balasinor, Junagadh, Ranason, Poloforest, Sagai; Collectors: Mr. AM Vasava, Dr. KS Rajput and Dr. RD Koyani, Code#: KSR0171.

**36) *Leucoagaricus rubrotinctus*** (Peck) Singer, Sydowia 2(1-6): 36 (1948)

Fruiting body stipate, initially egg-shaped, pileus 4-7 cm across, orange-brown, slightly umbonate with radial fissures and scales on the cap surface and stains light green with KOH. Stipe is more or less equal, 5-10 cm long, thick or with a club-shaped base with white ring on upper surface. Flesh white, not bruising. Gills free from stipe; close white at young; become brown at the maturity. Cheilocystidia numerous; subfusiform or subclavate; 31-48 x 5-9  $\mu\text{m}$ ; thin-walled. Basidiospores ellipsoid to somewhat irregular, smooth, 4-5 x 6-9  $\mu\text{m}$ .

*Habitat:* Growing alone or gregarious on leaf litter and humus rich soil

*Material examined:* Ahwa, Balasinor, Gandhingar, Junagadh, Girnaar, Rajpipla, Ratanmahal; Collectors: Mr. AM Vasava and Dr. KS Rajput, Code#: KSR0180.

**37) *Leucoagaricus vassiljevae*** E. F. Malysheva, T.Yu. Svetasheva & E.M. Bulakh, Mikol. Fitopatol. 47(3): 176 (2013)

Pileus bell shaped at early age which turns flat with maturity, red-brown or fibrillose to squamulose surface, 1-5 cm in size. Stipe is white, slender more or less equal, wide at base, hollow, annulus present at upper part of stipe, and 4-14 cm in length. Gill free; crowded; pale pink. Cheilocystidia numerous, narrowly clavate, cylindrical, hyaline, thin-walled; 20-48 x 5.5-15  $\mu\text{m}$ . Basidia 4-spored; basidiospores ellipsoid to ovoid without germ pore, smooth

and hyaline, thick-walled, 6-13 x 4-6  $\mu\text{m}$  in size.

*Habitat:* Grows solitary, deciduous forest, on leaf litter and humus rich soil. *Edibility:* Not known

*Material examined:* Ahmedabad, Junagadh, Jambughoda, Kaprada, Rajpipla, Poloforest, Sagai; Collectors: Mr. AM Vasava, Dr. KS Rajput and Dr. RD Koyani, Code#: KSR0253.

**38) *Leucocoprinus birnbaumii*** (Corda) Singer, Sydowia 15(1-6): 67 (1962) [1961]

Pileus 2-6 cm across; cap oval at young stage, become conical to convex or bell-shaped at maturity. Gills are free from the stem, crowded and yellow to pale yellow. Stalk 3-9 cm long and 2-5 mm thick, more or less equal with slightly swollen base. Cheilocystidia lageniform; 50 x 16  $\mu\text{m}$ . Basidiospores are ellipsoid, smooth, thick-walled, with a small pore.

*Habitat:* Grows on leaf litter with rich humous soil and dead wood. *Edibility:* Non edible, toxic

*Material examined:* Pavagadh, Junagadh, Mahal, Narmada, Ratanmahal; Collectors: Mr. AM Vasava, Ms. HR Patel and Dr. RD Koyani, Code#: KSR0339

**39) *Leucocoprinus brebissonii*** (Godey) Locq., Bull. Mens. Soc. Linn. Soc. Bot. Lyon 12: 95 (1943)

Pileus 2-3 cm in diameter, white; delicate almost transparent, conical when young then becoming flat with age; with dark grey-brown scales becoming more dispersed towards the margin. Margin plicate-sulcate half way or more to the disk. Stipe 4-8 cm long, cylindrical, white, hollow, slightly thickened towards the base; with a partial veil. Gills free, white, sub-crowded with lamellae with two lengths. Basidiospores are white, elliptic or ovoid, with a germ-pore, 5.5-7 x 9-12  $\mu\text{m}$ .

*Habitat:* Grows on the soil, on woods with deciduous trees. *Edibility:* Not known

*Material examined:* Baroda, Pavagadh,

Junagadh, Jambughoda, Ratanmahal, Waghai; Collectors: Mr. AM Vasava and Ms. HR Patel, Code#: KSR0117

**40) *Leucocoprinus cepistipes*** (Sowerby) Pat. [as 'cepaestipes'], J. Bot., Paris 3: 336 (1889)

Pileus is 2-9 cm in diameter. When young, cap is oval in shape, gradually become broadly convex with whitish scales and granules on the cap surface and does not stain with KOH. Gills are free from the stem, close, white, in colour and become brownish with age. Stalk is 3-9 cm long and 4-9 mm thick, more or less equal with swollen base. Cheilocystidia clavate to mucronate 60 x 26  $\mu\text{m}$ ; thin-walled; pleurocystidia absent. Basidiospores are smooth; thick-walled and ellipsoid, with a small pore; 8-10 x 5-6  $\mu\text{m}$  in length and width.

*Habitat:* common in several forests and grows on ground soil rich with humas. *Edibility:* Not known

*Material examined:* Baroda, Junagadh, Dang, Madhi, Narmada, Sagai; Collectors: Mr. AM Vasava, Ms. HR Patel and Dr. KS Rajput, Code#: KSR0195

**41) *Leucocoprinus cretaceus*** (Bull.) Locq., Bull. mens. Soc. linn. Soc. Bot. Lyon 14: 93 (1945)

Fruiting body stipate, pileus white, 3-8 cm in diameter, initially ovoid, gradually become convex to broadly conical, umbonate at maturity, covered with granular floccose, white squamules. Stem 5-9 cm long, slender, cylindrical, white, glabrescent, annulus attaché to the upper part of the stipe. Gills free, white, crowded, margin entire, basidiospores ellipsoid to hyaline, thick walled, smooth, 5-6.5 x 7-10  $\mu\text{m}$ .

*Habitat:* Grows on dead wood and hard wood tree. *Edibility:* Not known

*Material examined:* Baroda, Coba, Jambughoda, Junagadh, Shivrajpur, Ratanmahal; Collectors: Mr. AM Vasava and Dr. KS Rajput, Code#: KSR0175



**42) *Leucocoprinus fragilissimus*** (Ravenel ex Berk. & M.A. Curtis) Pat., Essai Tax. Hyménomyc. (Lons-le-Saunier): 171 (1900)

Fruiting body 5-10 cm long, cap deeply grooved, fragile, pale yellow and gradually fading to white, pileus 1.5 to 4.5 cm across, bell-shaped, when young and becoming convex and nearly flat with maturity; with a small central bump; deeply grooved from the margin to the centre. Pileipellis hymeniform. Stipe fragile, light yellow, 6-10 cm long, equal with scattered yellow squamules, annulus small, white and membranous. Gills free from the stipe, pale yellow. Pleurocystidia absent. Cheilocystidia clavate. Basidiospores are ellipsoid to sub-globose, thick walled, smooth, and hyaline, 8-12 x 7-8  $\mu\text{m}$  in size.

*Habitat:* Saprobic, growing on decaying plant



**Figure 1: Fruiting bodies of *Agaricus*.** A: *Agaricus porphyrizon* (surface), B: *Agaricus porphyrizon* (side view), C: *Agaricus rotalis* (surface), D: *Agaricus rotalis* (gill surface), E: *Agaricus subrutilescens* (surface), F: *Agaricus subrutilescens* (gill surface). Scale bar: A, B = 5mm; C, D = 11mm; E, F = 10mm

matter (humus or compost), growing alone or scattered. *Edibility:* Not known

*Material examined:* Bordevi, Jambughoda, Rajpipla, Ratanmahal, Shivrajpur, Vansda; Mr. AM Vasava, Ms. HR Patel and Dr. RD Koyani, Code#: KSR0308

**43) *Lycoperdon dermoxanthum*** Vittad., Monogr. Lycoperd.: 178 (1843)

Fruiting bodies (gasterocarp) are 12–37 mm in diameter, 10–40 mm in height, globose to sub-globose, with somewhat plicate base, tapering to a single, thin and minute rhizomorph. Ostiole medium-sized, orbicular, exoperidium initially white to off-white, gradually become yellowish white or pale yellow, verruculose to slightly verruculose, fragile, sub-flocculent and raised. Endoperidium pale yellow or dull yellow, glabrous, papery and persistent. Gleba is greyish-yellow and cottony. Basidiospores



**Figure 2: Fruiting bodies of *Coprinus* and *Leucoagaricus*.** A: *Coprinus atramentarius* (Fruiting body), B: *Coprinus atramentarius* (Gill surface), C: *Leucoagaricus rubrotinctus* (Fruiting body), D: *Leucoagaricus rubrotinctus* (Gill surface). Scale Bar: A-D = 10 mm



are globose, hyaline, 4.0–4.8  $\mu\text{m}$  in diameter.

*Habitat:* terrestrial and found growing on soil rich with leaf litter. *Edibility:* Not known

*Material examined:* Dharampur, Junagadh, Kaprada, Polo forest, Vavar; Collector: Mr. AM Vasava, Code#: KSR0252

**44) *Macrolepiota procera* (Scop.) Singer, Pap. Mich. Acad. Sci. 32: 141 (1948) [1946]**

Pileus ovate and egg shaped when un-opened becomes bell shaped and become flat when completely opened, cap diameter 10-20 cm. Fruiting body reaching up to 30 cm, scaly with brownish cap, stipe very long bulbous at the base with brown scales, the partial veil becomes a ring which is movable and slides up and down the stem. Gills are white, broad, rough edged, flesh thin, soft, white and moderately thick and non-bruising. Basidiospores 10-16 x 9-12  $\mu\text{m}$ , ovate-

ellipsoidal, smooth walled, with small germ pore

*Habitat:* In moist forest, grassland, rare. *Edibility:* Non edible

*Material examined:* Junagadh, Dharampur, Narmada, Pavagadh, Sagai, Shivrajpur; collectors: Dr. RD Koyani and Dr. KS Rajput, Code#: KSR0173

**45) *Parasola plicatilis* (Curtis) Redhead, Vilgalys & Hopple, in Redhead, Vilgalys, Moncalvo, Johnson & Hopple, Taxon 50(1): 235 (2001)**

Cap 1-3 cm wide, ovoid at first, becoming convex or bell-shaped and subsequently become flat; deeply grooved from the margin nearly to the centre, yellow to orange brown when young become grey in the grooves and finally complete. Gills free from the stipe, close or nearly distant; whitish at first slowly become dark grey and eventually black. Stem



**Figure 3: Fruiting bodies of *Macrolepiota* and *Leucocoprinus*.** A: *Macrolepiota procera* (Fruiting body), B: *Leucocoprinus cepaestipes* (Fruiting body), C: *Leucocoprinus brebissonii* (Fruiting body), D: *Agaricus augustus* (Fruiting body), E: *Leucocoprinus birnbaumii* (Fruiting body). Scale Bar: A = 30mm, B = 15mm, C = 10mm, D - E = 5mm



**Figure 4: Fruiting bodies of *Lepiota* and *Agaricus*.** A: *Lepiota atrodisca* (Fruiting body), B: *Lepiota lutea* (Fruiting body), C: *Agaricus californicus* (Fruiting body), D: *Agaricus diminutivus* (Fruiting body), E: *Agaricus bohusii* Scale bar : A, B, D = 8mm; C, E = 15mm.

3-7 cm long, hollow, fragile, equal above and slightly swollen at base, very finely silky white and without ring. Spores ellipsoid, lentiform, 8.4-10.5 x 10-12.8 µm.

*Habitat*: on open forest floors, lawns, humus rich soil, grass lands. *Edibility*: Non edible, Poisonous

*Material examined*: Ahwa, Dangs, Dharampur, Gandhinagar, Jambughoda, Ratanmahal, Wilson Hills; collector: Ms. HR Patel, Mr. AM Vasava and Dr. RD Koyani, Code#: KSR0198

**46) *Podaxis pistillaris* (L.) Fr.** [as 'Podaxon'], Syst. mycol. (Lundae) 3(1): 63 (1829)

Basidiomata narrowly ellipsoid to obovate reaching up to 15 cm in height, 2-4 cm in diam. Stipe white to yellow-brown, straight, bulbous at the base, possessing a fibrous to woody texture, become hollow in the centre at maturity. Pileus initially whitish becoming yellowish to rusty-brown in color at maturity, not opening like other mushrooms and is covered with flattened, tan coloured scales when young. Peridium non-dehiscent and remains fused with the stipe. Peridium cracks or splits after drying to release spores. Gills are replaced by gleba, which is pink in color when young and become reddish to brown at maturity. Basidiospores globose to subglobose (10-14 µm in diameter) Young spores purple gradually become reddish to dark brown or looking like black powdery mass at maturity, thick and smooth walled.

*Habitat*: On road sides, forests, suburban areas, grows in soil. *Edibility*: Edible

*Material examined*: Dharampur, Dangs, Junagadh, Ratanmahal, Vansda; collectors: Ms. HR Patel, Mr. AM Vasava, Dr. RD Koyani and Dr. KS Rajput, Code#: KSR0297

## DISCUSSION

Ecological, biological and biotechnological importance of Agaricaceae members paved the way towards intensifying research on their distribution. The optimum numbers of reports about the record of Agaricaceae members from India have been published in last five years but

the knowledge of the same from Gujarat state is scarce. There are periodic reports available on the occurrence of new species or pathogenic fungus related with agricultural crops or as a human pathogen in Gujarat (GEC 1996, Singh and Beena 2003, Arya *et al.* 2008, Saxena *et al.* 2009, Gajjar *et al.* 2011, Kumar *et al.* 2011, Bhavsar *et al.* 2012, Nagadesi and Arya 2012, Nawal *et al.* 2012, Maharshi and Thaker 2012, Assudani *et al.* 2013, Korat *et al.* 2013, Dhingani *et al.* 2013, Katara *et al.* 2013, Khan *et al.* 2013, Khokhar *et al.* 2013, Nasit *et al.* 2013, Panchal *et al.* 2013, Shah *et al.* 2013, Yadav *et al.* 2013) whereas no special efforts are made to document the fungal diversity of the state. From all the forty six species described in the present study, only seven species i.e. *Agaricus bisporus*, *A. blazei*, *A. campestris*, *A. goossensiae*, *Leucoagaricus vassiljevae*, *Lepiota organensis* and *Podaxis pistillaris* have been reported by the earlier workers (Modi *et al.* 2014, Korat *et al.* 2013, Rajput *et al.* 2015) while other 39 species are fresh report to the Gujarat state. From these, nineteen species have also been reported previously from different states of India. Sathe and Rahalkar (1976) have documented *Agaricus sylvicola* whereas *Agaricus xanthodermus* and *Leucoagaricus americanus* were found in 1982 by Sathe and Deshpande for the first time. Vrinda *et al.* (1999) has also contributed by introducing *Chlorophyllum hortense* and *Agaricus caribaeus*. Karwa and Rai (2010) reported *Agaricus augustus* whereas Kumar *et al.* (2013) reported *A. langei*. Other species like *A. sylvaticus* and *Leucocoprinus brebissonii* were reported by Pushpa and Purushothama in year 2012. In year 2014, Ghate *et al.* and Senthilarasu (2014) have also documented *Cystoagaricus trisulphuratus*, *Leucocoprinus fragilissimus* and *Leucoagaricus rubrotinctus* respectively in addition to *Cyathus stercoreus* and *Macrolepiota procera* given by Usha & Janardhana (2014). Very recent contribution of Gogoi & Vipin (2015) for *Cyathus striatus* and Amandeep *et al.* (2015) for *Chlorophyllum molybdites*, *Coprinellus micaceus*, *Coprinus*

*plicatilis*, *Leucoagaricus leucothites* and their distribution in India played essential role for the literature build up. From Gujarat state, *Agaricus goossensiae*, *Leucoagaricus vassiljevae* and *Podaxis pistillaris* have been reported earlier by Korat *et al.* (2013), Modi *et al.* (2014) and Rajput *et al.* (2015). As per our knowledge, *Agaricus bohusii*, *Agaricus bresadolanus*, *Agaricus californicus*, *Agaricus diminutivus*, *Agaricus dulcidulus*, *Agaricus hondensis*, *Agaricus moelleri*, *Agaricus pocillator*, *Agaricus porphyrizon*, *Agaricus rotalis*, *Agaricus subrutilescens*, *Coprinellus aureogramulatus*, *Coprinus silvaticus*, *Lepiota flammeotincta*, *Lepiota phaeosticta*, *Lepiota subclypeolaria*, *Leucoagaricus littoralis* and *Lycoperdon deroxanthum* are the novel addition of seventeen species of Agaricaceae to the country. Decisively, preliminary but successful efforts of reporting Agaricaceae members demand for further study to enrich the mycodiversity documentation record of the state and country which can extensively be useful for their biotechnological or pharmaceutical applications.

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