Coprophilous and lignicolous dark-spored macrofungi of Mount Abu, Rajasthan, India

R. CHOUHAN AND C. PANWAR

J. Mycopathol. Res. 60(4) : *531-544, 2022;*
ISSN 0971-3719

Department of Botany,
University of Calcutta,
Kolkata 700 019, India

J. Mycopathol. Res. **60(4)** : 531-544, 2022; (ISSN 0971-3719)
doi :10.57023/JMycR.60.4.2022.531

Coprophilous and lignicolous dark-spored macrofungi of Mount Abu, Rajasthan, India

R. CHOUHAN [*1] AND C. PANWAR [2]
[1*]*Department of Botany, S.S Jain Subodh PG (Autonomous) College, Jaipur, Rajasthan, 302004.*
[2]*Jai Narain Vyas University, Jodhpur, Rajasthan 342005*

Received :16.08.2022 Accepted : 16.10.2022 Published : 26.12.2022

Dark spored species of macrofungi have been frequently found growing luxuriantly colonizing coprophilous and lignicolous habitats in Mount Abu and adjoining areas of the Aravalli Mountain range of Rajasthan, India after the monsoon rains. In the present communication, taxonomic description of *Agrocybe manihotis, Bolbitius titubans, Coprinus comatus, C. sterquilinus*, *Coprinopsis lagopides,Deconica coprophila, Homophron spadiceum, Panaeolus fimicola, Psathyrella patialensis, P. pygmaea, P. tiarella* and *P. magambica* has been given. These fungi are an addition to the yet unexplored rich mycoflora of the State. Most of these species have a noticeably short life span and some like *Coprinus* sp.are autodigesting and deliquescent.

Keywords: *Agrocybe, Bolbitius*, *Coprinus*, *Coprinopsis*, *Deconica, Homophron*, *Panaeolus*, *Psathyrella*

INTRODUCTION

The substrate utilization of saprobic fungi differentiates them into two broad categories, viz. coprophilous and lignicolous. Although both categories represent saprophytic mode of nutrition, coprophilous fungi grow on dung of herbivores animals and on manured soil, while lignicolous fungi grow on rotting twigs and logs of wood, utilizing the cellulose, hemicellulose, pectin,and lignin present in them. The niche provided by these habitats provide a conducive environment for the growth of macro-fungi with a short life cycle having enormous number of dark colored smooth spores (Schafer, 2010), fine mycelia etc. yet they are important biologically diverse species playing a role of decomposers of the terrestrial ecosystem.The microcosm reflects an adaptive fungal lifestyle and enriches the soil of its fertility by nutrient recycling.

The desert soils and high altitudinal soils are replenished of its nutrients as the excreta of herbivores and dead woods are decomposed by saprobes, hence these species are ecological balancers and ecosystem restorers.Research reveals that1100 species of *Psathyrella* have been reported worldwide(Larsson and Orstadius, 2008). Redhead *et al.*(2001) classified Psathyrellaceae as a separate family and included *Coprinopsis* genera which includes 228 species (www. indexfungorum.org, Gu Rao *et al.* 2021). Index fungorum (2017) has reported twenty-three species of *Coprinus* and ninety species of*Deconica*. According to Kirk *et al*. (2008), 25 species of *Bolbitius*,100 species of *Agrocybe* with 15 species of *Panaeolus* have been documented. In India, many researchers have made significant contributions in the study of several parameters of coprophilous and lignicolous fungi like taxonomy, ecology, edibility, and medicinal uses etc. (Manimohan *et al*. 2007; Atri *et al.* 2009; Kaur *et al*. 2013, 2020; Amandeep *et al*. 2015b).

Production of substantial number of dark colored spores and short life cycles have made possible to further group these diverse fungi under dark colored spore-producing fungi by many researchers (Örstadius *et al.* 2015).

The State of Rajasthan, India (27.0238° N, 74.2179° E) harboring the important landmarks like

*Correspondence :reenu.chouhan@gmail.com

the extremely dry Thar Desert and the Aravalli Mountain range is reported to show diverse gasteroid and agaricoid mushroom flora (Chouhan and Panwar 2021a,b,c; Chouhan *et al*. 2021), but has remained unexplored for the macrofungi preferring coprophilous and lignicolous habits. Therefore, with an aim to find the diversity of lignicolous and coprophilous fungi, mycofloristic surveys were conducted to collect macrofungi from Mount Abu in Sirohi district, Southwestern Rajasthan, India (24.5926° N, 72.7156° E). The explorations yielded important findings, of which, taxonomic descriptions of *Agrocybe manihotis, Bolbitius titubans, Coprinus comatus, C. sterquilinus*, *Coprinopsis lagopides, Deconica coprophila, Homophron spadiceum, Panaeolus fimicola, Psathyrella patialensis, P. pygmaea, P. tiarella* and *P. magambica* have been given in the present communication.

MATERIALS AND METHODS

Area of study

The State of Rajasthan, India, within latitudinal and longitudinal coordinates 27.0238°N, 74.2179°E experiences tropical climatic conditions with Mount Abu lying in the South-western part of Rajasthan, experiencing cooler climatic regimes (Meena 2013). Mushrooms grow well in South-western part of Rajasthan (Chouhan *et al.*2010; Chouhan *et al.* 2021) during the months of July to September. At the time of collection, characteristics like morphology, size, shape, color, and substrate of growth were noted at the collection site. Most of the macrofungi belonging to *Coprinus* are shaggy ink caps which have deliquescent gills so the time of collection and study of fresh specimens with the changes in fruiting body characteristics must be observed during early morning hours. Photographs were taken for all the mushrooms growing at the collection site. Preservation methods (Smith, 1949) and herbarium specimens 'preparation (Atri and Saini 2000)was followed, assigning a specimen number to each specimen .Identification was done by keys of Pegler (1977), Kits Van Waveren (1985,1995) and color terminology of Kornerup & Wanscher (1978) were used for description. Herbarium specimens have been deposited in the Department of Botany, Jai Narain Vyas University, Rajasthan (India). MycoBank numbers (www.mycobank.org) and Faces of fungi numbers were obtained (Jayasiri *et al.* 2015).

Taxonomic accounts

Key to the families:

I. Fruiting body morphology ranges from pileate to gasteroid or secotioid forms, spore print white, greenish, ochraceous, pink or sepia. In pileate species, gills are free, pileus is scurfy to smooth, convex, flat to umbonate.

Family Agaricaceae

i. Saprobic, coprophilous, ephemeral, mostly auto-digesting, ink caps with black spore print
Genus- *Coprinus*

a. Pileal surface covered with whitish or whitish-grey fibrils, flaking, Spores size range 5.0–12.0 × 4.0– 7.5 µm, olive green
Coprinus comatus

b. Fruiting body coprophilous, stipe base bulbous; germ pore central to slightly eccentric
Spores size 16.0 – 21.0 × 12.0 –14.0µm, black
C. terquilnus

I. Basidiocarps fragile, coprophilous, or lignicolous, caespitose, non- deliquescent with black, deep brown smooth spores

Family Psathyrellaceae

a. Coprophilous, cap ovoid, margin splitting, reflexed. barely auto-digesting, spores spindle shaped, smooth, 6.0 – 8.5 × 4.5 –7.0µm
Coprinopsis lagopides

b. Lignicolous, caespitose , pileus pale buff, broadly umbonate, veil absent , golden-brown spores, spores 7.5 – 10.0 × 4.0 –5.2µm, oblong to ellipsoid, cheilocystidia having a thick wall and crystalline encrusted mucronate apex
Homophron spadiceum

c. Lignicolous, caespitose, pileus brown, conical to campanulate, expanding, umbonate with a dark brown umbo, spores5.5 –7.0 × 3.3–4.0µm, Cheilocystidia are metuloidal,ventricose to lageniform *Psathyrella pygmaea*

d. Coprophilous, caespitose ,the pileus is distinctly pointed, conical, dirty white to greyish- brown with white to umber apex, spores 10.0 – 15.0 × 5.5 – 8.5µm, elongate-ellipsoid, cheilocystidia which are utriform to lageniform, with a broadly rounded apex
Psathyrella tiarella

e. Lignicolous, caespitose, pileus fuscous brown, covered with white loose, fibrillose velar

squamules, Spores 5.5 – 7.5 × 3.5 – 4.5µm, ovoid to ellipsoid, bean shaped, Cheilocystidia are ventricose, lageniform and hyaline

Psathyrella magambica

f. Lignicolous, pileus hazel brown with slightly darker radial streaks, spores 7.0 – 8.0 × 5.0 – 6.0µm, golden- brown, ovoid to broadly ellipsoid

Psathyrella patialensis

III. Coprophilous , small, deliquescent basidiocarps, pileus covering of balloon-shaped cells, brown-spored

Family Bolbitiaceae

a. Coprophilous, pileus yellowish white, surface viscid, fragile, with striate margin, flesh thin, spores brown, 10.0 – 12.0 × 6.0 – 8.0µm, ovoid to ellipsoid

Bolbitius titubans

b. Coprophilous, pileus sepia, flesh moderately thick, coarse, and fibrous, spores dark greyish-brown, lenticular, spindle shaped, 11.5 – 15.0 × 8.5 – 10.0µm

Panaeolus fimicola

IV. Agarics with rust-brown to dark brown smooth spores, with a cutis-type pileipelli

Family Strophariaceae

a. Coprophilous, pileus light buff, changing to brown when bruised shining, slimy,
spores 10.0 –14.0 × 7.5 – 9.5µm, ovoid to broadly ellipsoid, rust brown

Agrocybe manihotis

b. Coprophilous, pileus dark- brown to orange brown, umbonate, annulus absent, spores purplish- brown, smooth, ellipsoid to hexagonal , 10.0 – 12.0 × 5.0 – 8.0µm

Deconica coprophila

Coprinus sterquilinus (Fr.) Fr., Epicrisis Systematis Mycologici: 242 (1838)
MycoBank number: MB160771
Faces of Fungi number: FoF 10767

Basionym: *Agaricus sterquilinus* Fr., Systema Mycologicum 1: 308 (1821)

Synonym: *Onchopus sterquilinus* (Fr.) P. Karst., Bidrag till Kännedom av Finlands Natur och Folk 32: 527 (1879)

Pileus 2.0 – 6.0 cm in diameter, greyish white with blackening gills, at first sub-globose to ovoid, later broadly conical to campanulate, finally revolute at margins, cap covered with small white, fibrillose scales remnants of the universal veil. *Stipe length* 3.0– 7.0cm × 0.2– 1.6 cm in diameter, equal, easily separable from the pileus, cylindric with napiform base, hollow, white, shining, glabrous, fibrous. *Lamellae* white, free, crowded, at first pinkish- grey, soon black, and deliquescent. *Spores* 16.0 – 21.0 × 12.0 –14.0µm, black, broadly ellipsoid, thick walled, sometimes depressed on the adaxial side and an apical germ pore. Basidia 4-spored, swollen, clavate to cylindric in shape (Fig.1).

Ecology and distribution

Keirle *et al.* (2004) have reported *C. sterquilinus* to be coprophilous on horse dung from Hawaiian Islands and Swapna et al. 2008 reported *C. sterquilinus* from Karnataka, India.

Specimens Examined – Herbarium no. – JNV/Mycl/1023/2018

Collector's name–Reenu Chouhan
Coordinates and Area of collection – 72.71217°E, 24°53'18.17"N72°50'52.58"E Sirohi Mount Abu 72.7083°E 24.5925°N, Arbuda Devi temple, 24.60107°N .

Coprinopsis lagopides (P. Karst.) Redhead, Vilgalys & Moncalvo, Taxon 50 (1): 229 (2001).

Current Name: *Coprinopsis lagopides* (P. Karst.) Redhead, Vilgalys & Moncalvo, Taxon 50 (1): 229 (2001)

Basionym: *Coprinus lagopides* P. Karst., Meddelanden af Societas pro Fauna et Flora Fennica 5: 37 (1879)

Myco Bank number: MB474613
Faces of Fungi number: FoF 10768

Pileus 2.0 – 6.0 cm in diameter,greyish, scales silvery gray, appressed fibrillose, cap ovoid to cylindrical, becoming convex to later flattened, finely sulcate- striate to the center, margin splitting and finally reflexed. Flesh thin, fragile, barely auto-digesting. Velar hyphae ending in long cell like chains. *Stipe length* 3.0– 11.0cm × 0.3– 1.2 cm in diameter, equal, white, at first minutely downy then

smooth, white wooly at the base. Flesh hollow and fragile, fibrous. *Lamellae* at first white, rapidly becoming dark vinaceous, then black, adnexed to free, crowded. *Spores* brownish- black with vinaceous tints, ellipsoid or spindle shaped, smooth, 6.0 – 8.5 × 4.5 –7. 0µm.*Basidia* 4-spored. *Cystidia* not distinctive (Fig. 2).

Ecology and distribution: *Coprinopsis lagopides* have been reported growing on dung from Punjab State of India by Amandeep *et al*. (2014).In the present surveys, it is found solitary or in groups on dung and on manured soil amongst grass.

Specimens Examined –Herbarium no. – JNV/Mycl/1024/2018
Collector's name–Reenu Chouhan
Coordinates and Area of collection –24.6653° N, 72.7819° E Guru Shikhar area and Sunset Point, Mount Abu.

Coprinus comatus(O.F. Müll.) Pers., Tentamen dispositionis methodicae Fungorum: 62 (1797)
MycoBank number: MB 148667
Faces of Fungi number: FoF 04984
Basionym:*Agaricus comatus* O.F. Müll., Fl. dan.: t. 834 (1780)

Synonyms: *Agaricus cylindricus* Schaeff., Fungorum qui in Bavaria et Palatinatu circa Ratisbonam nascuntur Icones 4: 5, t. 8 (1774)
Agaricus vaillantii J.F. Gmel., Systema Naturae 2 (2): 1427 (1792)

Pileus 5.0 – 6.0 cm in diameter, greyish, surface covered with whitish or whitish-grey fibrils, which are flaking , cap ovoid to cylindrical, becoming convex to later flattened, finely sulcate- striate almost to the center, margin splitting and finally reflexed, fragile, with soon blackening gills, auto-digesting, pileus and appendiculate margins covered with small white, fibrillose scales remnants of the universal veil. *Stipe length* 5.0– 10.0cm × 0.5 – 2.0 cm in diameter, equal, easily separable from the pileus, cylindric with a napiform base, hollow, white, shining, glabrous, fibrous. *Lamellae* white, free, crowded, at first pinkish- grey, soon black, and deliquescent. *Spores* 5.5–12.0 × 4.5–7.5 µm, ellipsoidal, olive green to brown and thick-walled. *Basidia* 4-spored, swollen, clavate to cylindric in shape (Fig. 3).

Ecology and distribution–Dorjey (2019) reported *Coprinus comatus* growing solitary in marshy areas with mosses in cold desert of Ladakh. Varghese *et al*. (2010) and Mohanan (2011) reported *C.comatus* from Kerala, India.

Specimens Examined – Herbarium no. – JNV/Mycl/1021/2018
Collector's name– Charu Panwar
Coordinates and Area of collection –72.7083°E 24.5925°N Toad rock, Mount Abu , and 24°53'18.17"N72°50'52.58"E Sirohi.

Note –*C.comatus* is commonly called lawyer's wig due to its appearance at maturity. The young basidiocarps of this species are edible as the mature ones are autolyzed. It has been reported to be an endoparasitizing nematode-destroying fungus (Luo *et al.* 2004) and also as anantioxidant (Li *et al*. 2010) and antidiabetic (Zhou and Han, 2008) with many other medicinal properties .

Homophron spadiceum (P. Kumm.) Örstadius & E. Larss., Mycological Progress 14 (5/25): 35 (2015)
MycoBank number: MB811631
Faces of Fungi number: FoF 10771
Current name: *Homophron spadiceum* (P. Kumm.) Örstadius & E. Larss., Mycological Progress 14 (5/25): 35 (2015)

Basionym: *Psilocybe spadicea* P. Kumm., Der Führer in die Pilzkunde: 71 (1871)

Taxon Synonyms: *Agaricus spadiceus* Schaeff., Fungorum qui in Bavaria et Palatinatu circa Ratisbonam nascuntur Icones 4: 27, t. 60 (1774)
Psathyrella spadicea (Schaeff.) Singer, Lilloa 22: 468 (1951)
Drosophila spadicea (Schaeff.) Quél., Enchiridion Fungorum in Europa media et praesertim in Gallia Vigentium: 116 (1886)

Pratella spadicea (Schaeff.) J. Schröt., Kryptogamen-Flora von Schlesien 3.1 (33-40): 568 (1889)

Agaricus stipatus Pers., Synopsis methodica fungorum: 423 (1801)

Agaricus fuscescens Batsch, Elenchus fungorum: 77 (1783)

Psilocybe spadicea var. spadicea (?) [MB#419905]
Pilosace spadiceus (Schaeff.) Kuntze: 504 (1898)

Pileus 3.0 – 8.0 cm in diameter, pale buff to brown, globose, convex then plane to broadly umbonate, surface hygrophanous, glabrous, thin- fleshed. *Stipe length* 4.0 – 8.0 cm × 0.5 – 1.0 cm in diameter, off-white to dull brown in color, sometimes concolorous, cylindrical, slightly curved, fibrous-fleshy, fistulose, with a white mycelial base, veil absent. *Lamellae* white to pinkish, finally purplish-brown, adnate-sinuate, edge white, pruinose. Spores 7.5 – 10.0 × 4.0 – 5.2µm, ellipsoid, golden brown, with a thin smooth wall. *Basidia* 4-spored, clavate in shape. *Lamellae* edge sterile with crowded cheilocystidia having a thick wall and crystalline encrusted mucronate apex. *Pleurocystidia* ventricose, fusoid, mucronate, apically encrusted, hyaline with a thickened wall, particularly towards the apex (Fig.4).

Ecology and distribution- *Homophron spadiceum* were found growing caespitose around both dead and living deciduous and conifer trees by Örstadius *et al.*(2015). The habit and substrate colonization of the species reported herein are in complete agreement to Örstadius *et al*. (2015) from Europe.

Specimens Examined – Herbarium no. – JNV/ Mycl/ 1029/2018
Collector's name–Reenu Chouhan
Coordinates and Area of collection – 24° 31' 53.2020'' N and 72° 44' 0.0960'' E Mount Abu, 24°53'18.17"N and 72°50'52.58"E Sirohi.

Note: Singer (1951) considered *Homophron* as a subgenus of *Psathyrella* but Örstadius *et al.* (2015) have raised the subgenus *Homophron* to species level according to molecular phylogenetics and taxonomy studies.

Psathyrella pygmaea (Bull.) Singer, Lilloa 22: 467 (1951)
MycoBank number: MB282858
Faces of Fungi number: FoF 10773
Basionym: *Agaricus pygmaeus* Bull., Herbier de la France 11: t. 525:2 (1791)

Synonyms: *Drosophila pygmaea* (Bull.) Quél., Enchiridion Fungorum in Europa media et praesertim in Gallia Vigentium: 117 (1886)

Naucoria pygmaea (Bull.) Gillet, Les Hyménomycètes ou Description de tous les Champignons qui Croissent en France: 544 (1876)

Psathyra pygmaea (Bull.) Quél., Comptes Rendus de l´Association Française pour l´Avancement des Sciences 9: 664 (1881)

Phaeomarasmius pygmaeus (Bull.) Singer, Lilloa 22: 577 (1951)

Pileus 0.6 – 1.7 cm in diameter, surface brown, conical to campanulate, expanding, umbonate with a deep brown umbo, cap translucent with striate margin, flesh thin, smooth. *Stipe length*1.0 – 3.0 cm × 0.1 – 0.5 cm in diameter, white, glabrous, cylindric with a sub-bulbous base, fistulose, veil absent. *Lamellae* pale pink to dark- brown, adnexo-adnate, broad, very crowded, edge white. Spores 5.5 – 7.0 × 3.3 – 4.0µm, ellipsoid, with an apical germ pore, brown, smooth, with a moderately thick wall. *Basidia* 4-spored, clavate in shape. Lamellae edge heteromorphous with numerous cheilocystidia which are metuloidal, ventricose to lageniform, with a short neck and an obtusely rounded apex, frequently crystalline encrusted. *Pleurocystidia* abundant, metuloidal, fusoid to lageniform with a thickened apex, hyaline to yellowish with an apical crystalline encrustation (Fig.5).

Ecology and distribution – *Psathyrella pygmaea* have been reported by Pegler (1977) from East Africa, growing on fallen trunk of trees and by Yan &Bau (2018) from Northeast China. Herein, this species has been reported from Mount Abu, Rajasthan , caespitose on humus rich soil amongst leaf litter, widespread after rainfall.

Specimens Examined – Herbarium no. – JNV/Mycl/ 1031
Collector's name–Reenu Chouhan
Coordinates and Area of collection – Mount Abu72.7083°E 24.5925°N, Sunset Point, 24.5995° N 72.6978° E elevation: 1108m.
Note – The chief distinguishing feature of *Psathyrella pygmaea* are pleurocystidia with an apical crystalline encrustation as also described by Yan and Bau (2018).

Psathyrella tiarella (Berk. & Broome) Sacc., Sylloge Fungorum 5: 1135 (1887)
MycoBank number: MB 186308
Faces of Fungi number: FoF 10772
Basionym: Agaricus tiarella Berk. & Broome, Botanical Journal of the Linnean Society 11: 557 (1871) [MB#506938]

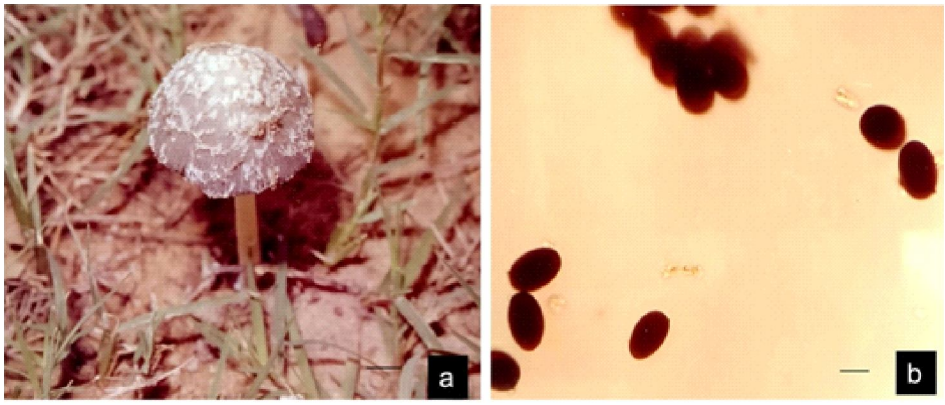

Fig.1 (a) : Coprophilous habit of *Coprinus sterquilinus* on manured soil amongst grass (b) Spores. Scale bar =10 µm

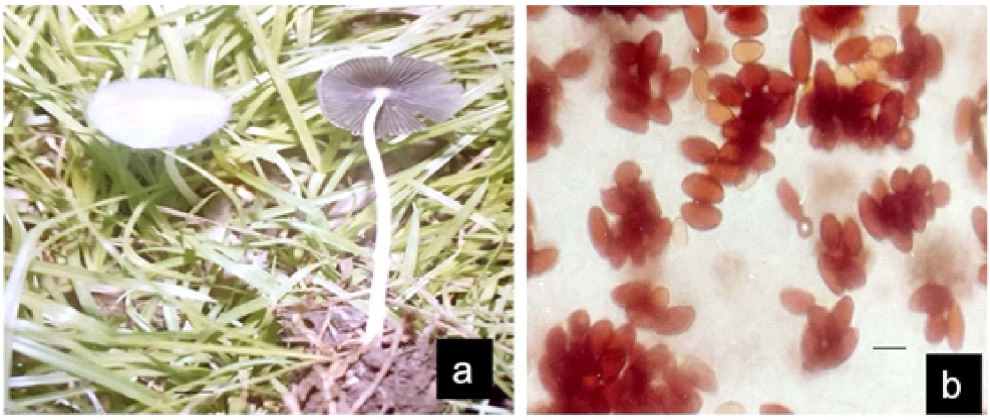

Fig.2(a) *Coprinopsis lagopides* showing coprophilous habit (b)Spores. Scale bar =10 µm

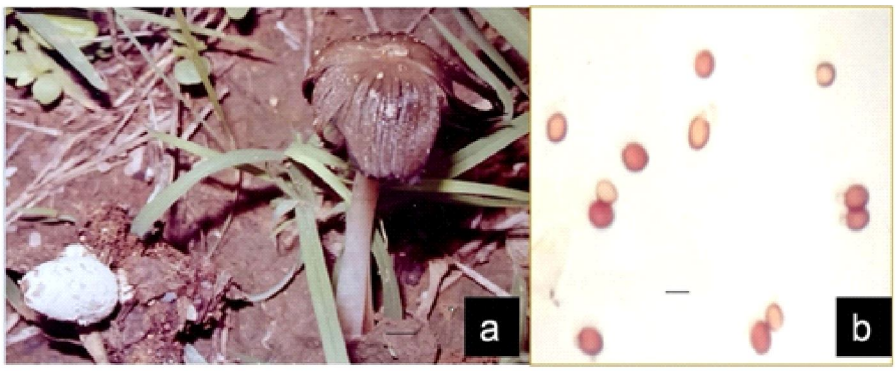

Fig.3(a) Young and mature fruiting bodies of *Coprinus comatus* growing on dung (b) Spores. Scale bar = 10 µm

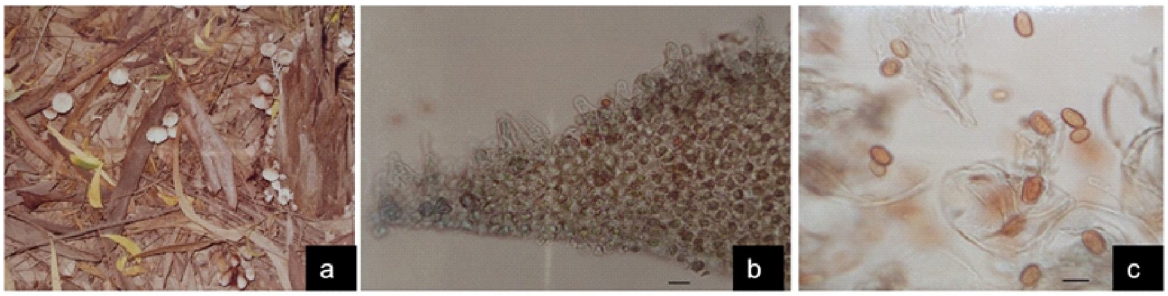

Fig.4 (a.) Lignicolous habit of *Homophron spadiceum* (b) Hymenium layer showing distinct cheilocystidia (c) Spores. Scale bar b =10 µm, c =10 µm

Pileus 0.5 – 1.4 cm diameter, dull white to pale brownish grey at maturity, sometimes with brown tints at the apex, which is pointed conical to campanulate, prominently umbonate with white umbo which is distinguishable from the rest of the pileus by its white color on greyish- brown background, flesh thin with copious veil. *Stipe length*1.5 – 7.0 cm × 0.1– 0.2 cm in diameter, white, covered with white furfuraceous squamules, stipe flexous, cylindric, equal, fistulose. *Lamellae* pale pink to dark- brown, adnexed, ascendant, grey then purplish fuscous, moderately crowded, edge white. *Spores* 10.0 – 15.0 × 5.5 – 8.5µm, elongate-ellipsoid, often with a suprahilar depression, thick-walled, smooth. *Basidia* 4-spored, clavate in shape. Abundant cheilocystidia present, which are utriform, hyaline, and thin walled making the lamella edge sterile. *Pleurocystidia* absent (Fig.6).

Ecology and distribution- *Psathyrella tiarella* have been reported by Pegler (1977) from Kenya growing under *Hyphaene* palm and from Tanzania growing on rotting herbaceous stems on forest floor.

Specimens Examined – Herbarium no. – JNV/ Mycl/ 1030/2018
Collector's name–Reenu Chouhan
Coordinates and Area of collection – 24°53'18.17"N72°50'52.58"E Sirohi, 72.7083°E 24.5925°N Toad rock area, Mount Abu.

Note: *Psathyrella tiarella* has been reported by Pegler(1977) from East Africa. Kits van Waveren(1985) has published a monograph on the genus *Psathyrella* in Western Europe and reexamined the type species from Kew Herbarium reported as *P. tiarella* by Berkeley & Broome (Kits van Waveren 1995) and confirmed the status of the species further. According to him, the characters of the species reported by both Berkeley & Broome 1861 and by Pegler (1977) report distinctly conical pileus, ascending and adnexed lamellae and elongate spores of the species as has also been found in the present findings.

Psathyrella magambica Pegler, Kew Bulletin Additional Series 6: 427 (1977)
MycoBank number: MB 321251
Faces of Fungi number: FoF 10769
Basionym: *Psathyrella magambica* Pegler, Kew Bulletin Additional Series 6: 427 (1977)

Pileus 2.0 – 4.0 cm diameter, fuscous brown, convex-campanulate to broadly umbonate, covered with numerous white loose, fibrillose velar squamules and appendiculate margin. *Stipe length* 4.0– 6.0cm × 0.5– 1.0 cm in diameter, creamish-white, cylindric, equal, hollow, surface covered with minute, fibrillose- floccose squamules which are remnants of the veil on the pileal surface and stipe. *Lamellae* adnate, creamish- white later dark fuscous brown, moderately spaced, edge white, pruinose. *Spores* 5.5 – 7.5 × 3.5 –4.5 µm, ovoid to ellipsoid, slightly bean shaped, with a central germ pore, light brown and a moderate thick wall. *Basidia* clavate in shape, 4-spored .*Cheilocystidia* abundant, making the lamella edge sterile, ventricose, lageniform, hyaline andthin-walled. *Pleurocystidia* abundant, lageniform, hyaline and thin-walled (Fig.7).

Ecology and distribution – Pegler (1977) reported this species from Tanzania, East Africa, growing amongst leaf litter. According to him, the distinguishing feature of the species is abundant velar squamules which are persistent on the pileus and stipe at maturity. In the present communication also, *P. magambica* is found to be lignicolous, found in tufts on wood and has a pileus with distinguishable bright velar squamules as has been reported by Pegler (1977).

Specimens Examined –Herbarium no. – JNV/Mycl/ 1028/2018
Collector's name–Reenu Chouhan
Coordinates and Area of collection – 24°53'18.17"N72°50'52.58"E Sirohi, 72.7083°E 24.5925°N Toad rock area, Mount Abu.

Psathyrella patialensis Harw. Kaur & M. Kaur, Mushroom Research 29 (1): 15 (2020)
MycoBank number: MB 815268
Faces of Fungi number: FoF 10770
Basionym: *Psathyrella patialensis* Harw. Kaur & M. Kaur, Mushroom Research 29 (1): 15 (2020)

Pileus 4.0 – 12.0 cm in diameter, sepia, hazel or umber-brown with slightly darker radial streaks, convex to campanulate with umbo, later becoming plane with an expanding umbo, uplifted at maturity, smooth, surface dry, viscid in wet conditions, cap fragile, with striate margin, flesh thin and smooth.

Stipe length 7.0 – 12.0 cm × 1.0 – 1.5 cm in diameter, central, white, bruising to reddish-brown

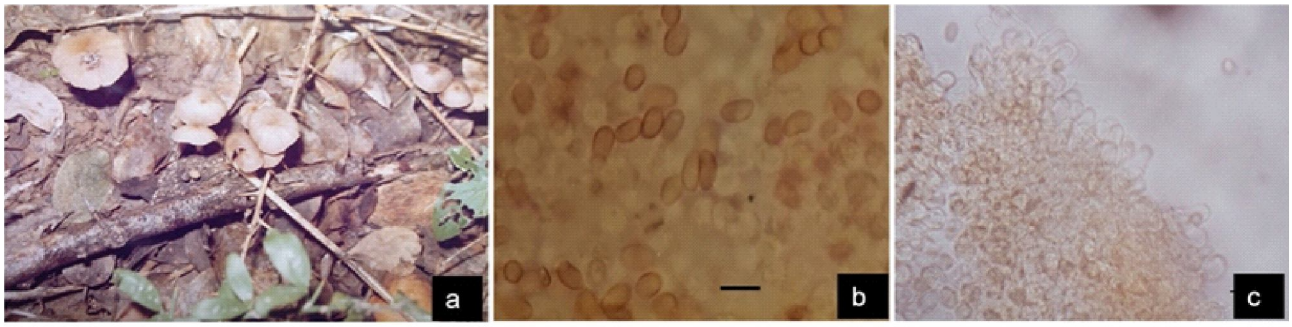

Fig.5(a)*Psathyrella pygmaea* growing on humus rich soil on twigs amongst leaf litter (b) Spores. (c) Hymenium layer with cheilocystidia and pleurocystidia. Scale bar: b = 20 µm, c = 15 µm

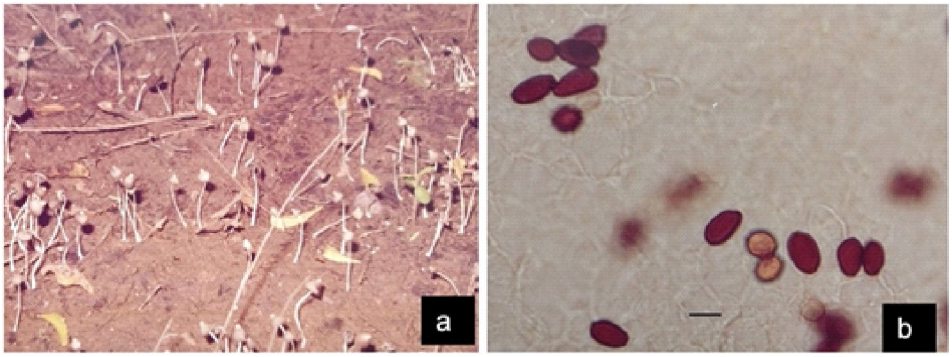

Fig.6 (a) Coprophilous habit of *Psathyrella tiarella* (b)Spores. Scale bar =10 µm.

Fig. 7 :(a) Lignicolous habit and caespitose growth of *Psathyrella magambica* (b) Spores. Scale bar, b= 10 µm

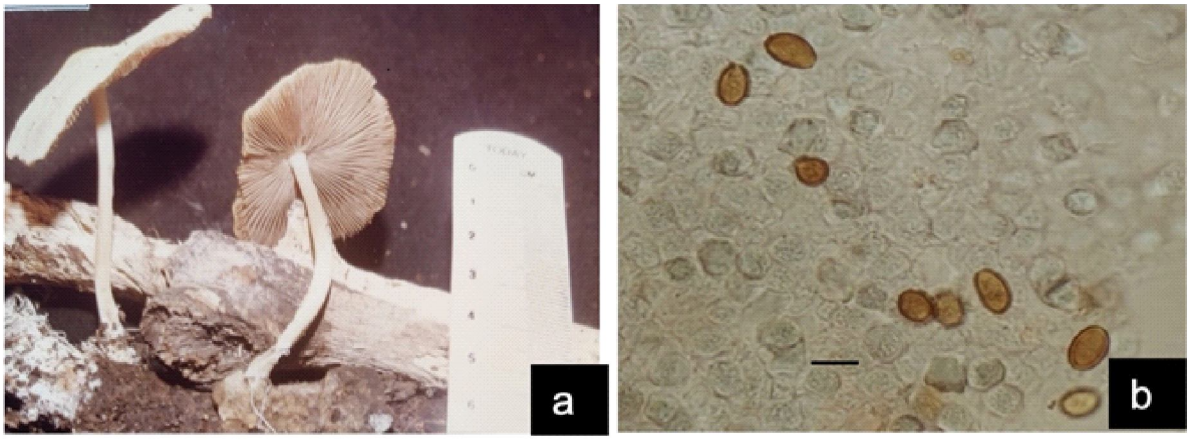

Fig. 8 : (a) *Psathyrella patialensis* showing lignicolous habit (b)Spores. Scale bar b =10 µm.

when handled, cylindrical, fibrillose, equal but swollen at the base with basal mycelial strands, annulus, and volva absent. *Lamellae* white becoming dull pink to light brown, lamellulae three tiered, free, thin, crowded, edge wavy and white. *Spores* 7.0 – 8.0 × 5.0 – 6.0µm, broadly ellipsoid, brown in color with a smooth but moderately thick wall. *Basidia* clavate 4-spored. *Lamellae* edge heteromorphous with numerous cheilocystidia which are thin walled, apically encrusted. *Pleurocystidia* absent (Fig.8).

Ecology and distribution – The specimens described here is *Psathyrella patialensis*.This species has been described by Kaur &Kaur (2020) from Punjab (Kaur *et al.* 2020),but it is the new report to Rajasthan, North India.Herein, *P. patialensis* has been found growing on dead log showing lignicolous habit.

Specimens Examined – Herbarium no. – JNV/Mycl/1029/2018
Collector's name–Reenu Chouhan.
Coordinates and Area of collection – 24° 31' 53.2020'' N and 72° 44' 0.0960'' E Mount Abu, 24°53'18.17"N and 72°50'52.58"E Sirohi, elevation: 321 m (1,053 ft.).

Bolbitius titubans (Bull.) Fr., Epicrisis Systematis Mycologici: 254 (1838)
MycoBank number: MB175350
Faces of Fungi number: FoF 10774
Obligate synonyms–*Bolbitius vitellinus* var. *titubans* (Bull.) M.M. Moser ex Bon, Documents Mycologiques 18 (70-71): 37 (1987)
Prunulus titubans (Bull.) Gray, A natural arrangement of British plants 1: 632 (1821)
Pluteolus titubans (Bull.) Quél., Enchiridion Fungorum in Europa media et praesertimin Gallia Vigentium: 105 (1886)
Bolbitius vitellinus subsp. *titubans* (Bull.) Konrad & Maubl., Icones Selectae Fungorum Fasc. 4: pl. (1928)
Pluteolus titubans var. *titubans* (Bull.) Quél.: 83 (1888)
Basionym – *Agaricus vitellinus* Pers. in Synopsis Methodica Fungorum p. 402, 1801.
Synonyms –*Pluteolus vitellinus* (Pers.) Quél. in Flore Mycol. de France p. 83, 1888.
Cortinariusvitellinus (Fr.) Bigeard & H. Guill. in La Flore, des Champignons supérieur de France, 1: 255, 1909.
Bolbitius vitellinus subsp. fragilis (Fr.) Konr. & Maubl. in Icon. Sel. Fung. 2: 171, 1930.
Bolbitius titubans var. *vitellinus* (Pers.) Courtec. in Doc. Mycol. 34(135–136): 49, 2008

Pileus 2.0 – 6.0 cm in diameter, conico-campanulate then expanding to plane, surface yellowish- brown, umbonate with a broad umbo, golden- yellow at the disk, paling towards the margin, surface viscid, cap fragile, with striate margin, flesh thin and smooth. *Stipe length* 4.0 – 11.0 cm × 0.2 – 0.5 cm in diameter, central, cylindric elongated, or slightly attenuated towards the apex, fistulose, cartilaginous and brittle, white to straw colored, glabrescent below but villose at the base, often with basal mycelial strands. *Lamellae* brown to ochraceous- brown, bruising to dark- brown, free, thin, moderately crowded, edge wavy and white. *Spores*10.0 – 12.0 × 6.0 – 8.0µm, ovoid to ellipsoid, with a distinct apical germ pore, ochre brown to rust brown, possessing a smooth wall.Basidia 4-spored, clavate in shape. Lamellae edge heteromorphous with numerous cheilocystidia which are clavate, hyaline, thin- walled and granular at the tips. Pleurocystidia are lageniform (Fig.9).

Ecology and distribution- *Bolbitius titubans,* a coprophilous macrofungi with world-wide distribution, has been reported as *B. vitellinus* by Pegler (1977) from East Africa, To´th et al. (2013) from Hungary and by *El Kholfy* et al. (2021) from Mamora forests in Morocco. From India, it has been reported by various researchers like Atri *et al*. (2009) and Amandeep *et al.*(2013) growing on dung heaps from Punjab State of North India. During the present surveys, this species is found growing on dung and manured soil in open forests.

Specimens Examined – Herbarium no. – JNV/Mycl/1032/2018

Collector's name–Reenu Chouhan

Coordinates and Area of collection – 24°53'18.17"N72°50'52.58"E Sirohi, 72.7083°E 24.5925°N Toad rock area, Mount Abu.

Panaeolus fimicola (Fr.) Quél., Mémoires de la Société d'Émulation de Montbéliard 5: 257 (1872)
MycoBank number: MB158646
Faces of Fungi number: FoF 03434
Basionym: *Agaricus fimicola* Fr., Systema Mycologicum 1: 301 (1821)
Synonym: *Coprinarius fimicola* (Fr.) P. Kumm., Der Führer in die Pilzkunde: 69 (1871)

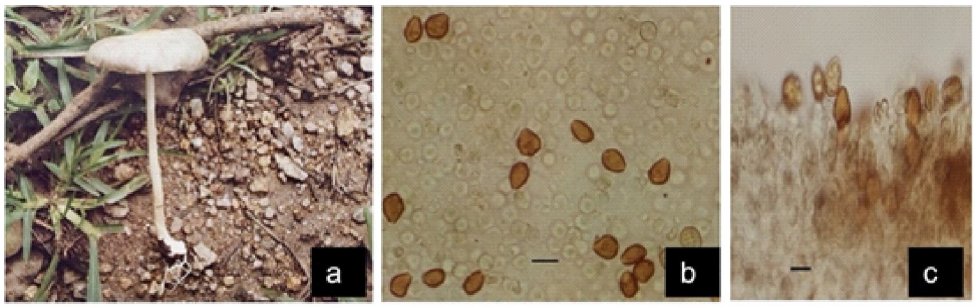

Fig.9 : a Fruiting body of *Bolbitius titubans*. b Spores. c. Hymenium layer with basidia and spores. Scale bar: b = 10 µm, c = 15 µm

Fig.10 (a) Habit of *Panaeolus fimicola* on manured soil amongst grass (b) Fruiting bodies showing lamellae (c)Spores Scale bar =10 µm

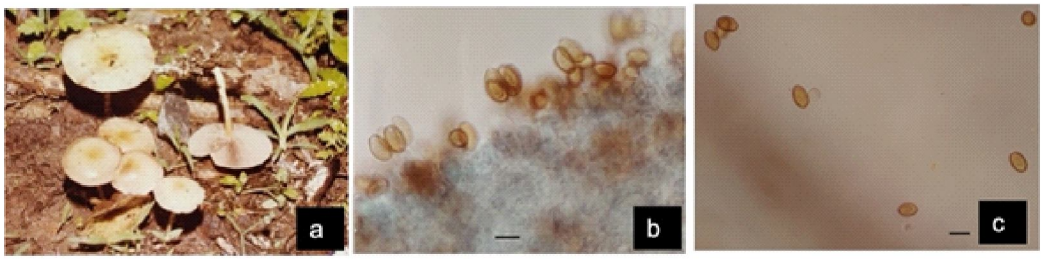

Fig.11(a) Basidiocarps of *Agrocybe manihotis* (b) Hymenium layer with basidia and spores. (c) Spores. Scale bar: b = 15 µm, c= 10 µm

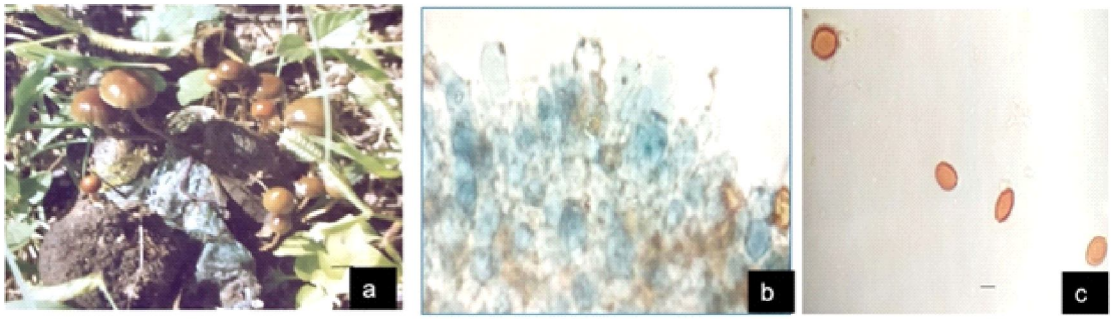

Fig.12: (a)*Deconica coprophila* growing on dung of herbivorous animals (b) Internal structure of gills with hymenium layer, basidia and cystidia (c) Spores. Scale bar b=15 µm, c= 10 µm

*Pileus*1.5 – 3.0 cm in diameter, hemispherical ,dome shaped, surface dry, sepia to brown with a darker marginal zone, striate when moist. Flesh moderately thick, coarse, and fibrous. *Stipe length* 3.0 – 6.0 cm × 0.1 – 0.5 cm diameter, thin, cylindrical to flattened with a bulbous base, fistulose, pale- brownish to fuscous, finely striate, equal. *Lamellae* broadly adnate, grey, soon black, moderately spaced. *Spores* dark greyish- brown to brownish- black, lenticular, ovate- elliptic,

ellipsoid or spindle shaped, smooth, 11.5 – 15.0 × 8.5 – 10.0µm, translucent to opaque. Basidia shape clavate, 4-spored. *Cheilocystidia* abundant making the lamella edge sterile. *Pleurocystidia* absent (Fig.10).

Ecology and distribution- *Panaeolus fimicola* have been reported by Karun & Sridhar (2015) growing on elephant dung in Makutta Reserve Forest in Karnataka (South India) and by Vrinda and Pradeep (2011) from Kerala State of South India.

Specimens Examined – Herbarium no. – JNV/Mycl /1026/2018
Collector's name– Charu Panwar
Coordinates and Area of collection – 24° 31' 53.2020'' N and 72° 44' 0.0960'' E Mount Abu, 24°53'18.17"N and 72°50'52.58"E Sirohi.

Agrocybe manihotis Pegler, Kew Bulletin 21 (3): 508 (1968)
MycoBank number: MB325925
Faces of Fungi number: FoF 10791

Pileus 3.0 – 6.0 cm in diameter, light buff, shining, slimy, deeply pigmented at the disc, sub globose to convex becoming applanate, sub- umbonate, smooth, slightly striate at the margin. Flesh moderately thick, pale, changing to brown when bruised. *Stipe* length 0.7 – 3.0cm × 0.2– 0.8 cm in diameter, concolorous, equal or attenuated towards the apex, hollow, longitudinally striate, pruinose over the entire length, arising from a bulbous base with mycelial strands, veil absent. *Lamellae* free to adnexed, ferruginous, darkening to umbrinous, crowded, edge white, pruinose. *Spores*10.0 – 14.0 × 7.5 – 9.5µm, ovoid to broadly ellipsoid, translucent, rust brown, smooth walled with a distinct germ pore, containing one to several guttules. Basidia inflated clavate, 4-spored. *Cheilocystidia* cylindrical, thin-walled, hyaline forming a heteromorphous gill- edge, clavate to cylindric. *Pleurocystidia* abundant (Fig.11).

Ecology and distribution- *Agrocybe manihotis*have been documented earlier by Natarajan and Raaman 1983 from South India, Kumaresan *et al*. (2021) have reported this species growing solitary on ground amongst grass from Puducherry, India. Pegler (1977) reported it from East Africa, growing on dead trunk of trees. Presently, it has been reported for the first time to be from Mount Abu, Rajasthan, growing gregariously on dung in grazing pasturelands.

Specimens Examined – Herbarium no. – JNV/Mycl/ 1033/2018
Collector's name–Reenu Chouhan
Coordinates and Area of collection – 24°53'18.17"N72°50'52.58"E Sirohi, 72.7083°E 24.5925°N Toad rock area, Mount Abu.

Deconica coprophila (Bull.) P. Karst., Rysslands, Finlands och den Skandinaviska Halföns. Hattsvampar: 515 (1821)
Faces of Fungi number: FoF 10775
MycoBank number: MB 178700
Basionym: *Agaricus coprophilus* Bull., Histoire des champignons de la France, 2 2: 423, t. 566:3 (1793)

Pileus 0.5 – 1.5 cm in diameter, dark- brown to orange brown, domed, hemispherical, sometimes with barely defined blunt umbo, slimy, viscid when damp, otherwise smooth, shiny, finely sulcate-striate to the center, context thin , margin splitting and finally reflexed. Flesh pallid, delicate, and thin. *Stipe length* 3.5 – 5.0 cm × 0.2– 0.3 cm in diameter, pallid ochraceous to dark brown to almost white at the apex, central, very slender, cylindrical, smooth, equal. Stipe with ring zone, which is whitish, superior, and ephemeral. *Lamellae* at first pallid-clay, becoming purple- brown at maturity, adnate to sub decurrent, crowded. *Spores* purplish-brown, smooth, ellipsoid, to sometimes appearing hexagonal, 10.0 – 12.0 × 5.0 – 8.0µm with a distinct germ pore, yellowish- brown, wall smooth , thick but thin at the regions of germ pores. Basidia hyaline and subclavate. *Lamellae* edge cystidia abundant, clavate to lageniform but gill face cystidia fusiform with a short or long tubular neck. Pileipellis composed of prostrate hyphae and hypodermium hyphae encrusted with golden yellow pigment. Hymenophoral trama regular. Clamp connections present.

Ecology and distribution: *Deconica coprophila* have been reported worldwide in distribution (Guzmán 1983). It has been reported by Cortez *et al*. (2004) and Silva *et al*.(2012, 2014) from biosphere reserves in Brazil, Noordeloos (2009) from Europe, Guzman and Kasuya (2004) from Nepal, Kaur and Kaur (2015) from Punjab, India. Herein, it is being reported as a new addition to

the mycoflora of Rajasthan and is found growing in troops on droppings of herbivorous animals particularly donkeys, in open pasturelands.

Specimens Examined – Herbarium no. – JNV/ Mycl / 1025/2019
Collector's name– Reenu Chouhan.
Coordinates and Area of collection – 24° 31' 53.2020'' N and 72° 44' 0.0960'' EMount Abu, 25.07°N 73.88°E547 m (1,795 ft.) Parshuram Mahadev temple, Rajsamand District.

DISCUSSION

In the present communication, twelve species of mushrooms belonging to four families viz. Agaricaceae, Psathyrellaceae, Bolbitiaceae and Strophariaceae have been identified and described. During the present mycofloristic surveys, the coprophilous fungi described herein are *Agrocybe manihotis, Bolbitius titubans, Coprinus comatus, C. sterquilinus*, *Coprinopsis lagopides, Panaeolus fimicola, Psathyrella tiarella* and *Deconica coprophila* while*Homophron spadiceum, Psathyrella patialensis, Psathyrella magambica* and *Psathyrella pygmaea* exhibit lignicolous habit. Different species of*Agrocybe, Bolbitius, Coprinus, Coprinopsis*, *Panaeolus*, *Psathyrella* and *Deconica* have been reported from other parts of India but some species of macrofungi described herein have been documented for the first time from Rajasthan. A checklist of coprophilous agarics of India and taxonomic studies on coprophilous agarics has been done by Amandeep *et al*. (2015a and 2015d).

Many researchers have studied the diversity of *Psathyrella* spp. from Punjab State of North India. Kaur *et al*. (2013) have described the genus *Psathyrella* and Kaur *et al*. (2020) have discussed the diversity of genus *Psathyrella.* Amandeep *et al*. (2015c) have also described the coprophilous habit of many *Psathyrella* species. Out of the *Psathyrella* species described herein, *P. tiarella*, *P. pygmaea* and *Homophron spadiceum* have been reported as new species from Rajasthan.Ecology of *Coprinus* has been described byAmandeep *et al*.(2015b) and *Coprinopsis* has been described from Punjab State (Amandeep *et al*. 2014b).
In the present communication, *Bolbitius* and *Panaeolus* have been placed in a single family Bolbitiaceae. According to To´th *et al*. (2013) the genera *Bolbitius, Conocybe* and *Agrocybe* with *Panaeolus, Panaeolina* etc. have been traditionally placed in the family Bolbitiaceae in addition to gasteroid species like *Gastrocybe, Galeropsis, Agrogaster*, etc. but molecular phylogenetic studies excluded most of the species from core family Bolbitiaceae and suggested a polyphyletic origin with exception of the genus *Agrocybe* . According to him, *Panaeolus* is included in a related group of the family Bolbitiaceae owing to some common taxonomic features with the genera *Bolbitius, Conocybe* and *Pholiotina* of the family. According to Singer (1986), features like spore wall structure, pileus covering, and ecological characteristics are common in *Panaeolus* and *Bolbitius* but some characteristics like reddish-brown to black color of the spores of *Panaeolus* distinguishes them from yellowish- brown spores of *Bolbitius*.

Kumaresan *et al*. (2021) have reported this species from Puducherry, India. Although Amandeep *et al.* 2014a have described two species of *Agrocybe* from Punjab State but *Agrocybe manihotis* described herein, is a new report of species to North India.

Diversity of the genus *Bolbitius* has been documented by Amandeep *et al.*(2013 b) from Punjab, India but *Bolbitius titubans* has been described for the first time from Rajasthan, India. *Panaeolus* has been described from Punjab State in India by Kaur *et al*. (2014) with *P. fimicola* reported herein forming part of new report from this region. Although there are reports of this genus from Kerala and Karnataka in South India (Karun and Sridhar, 2015) but interestingly, it is a new report to North India.

Deconica coprophila, earlier reported by Natarajan and Raaman (1983) as *Psilocybe coprophila* and by Thomas *et al*. (2002) from Kerala in South India, has not been reported earlier from Rajasthan, hence it is a new addition to the list of macrofungi from the State of Rajasthan, North India.

Psathyrella patialensis is a rarely found mushroom in this part of the country due to requirement of dead wet rotting logs favoring its growth but intense myco-explorations in the dense forest areas of Mount Abu after monsoon rains have yielded important findings and this species finds a place in the new report of *Psathyrella* species from Rajasthan State.

Another important aspect of the species favoring coprophilous and lignicolous habit is the production of dark-coloured smooth spores out of which some species like *Coprinus comatus* and *Coprinus sterquilinus* are auto-digesting and are commonly called ink- caps.

Taxonomic description of the above studied species has added to the rich mycoflora of the State,(Chouhan *et al*. 2010; Chouhan *et al*. 2021a; Chouhan and Panwar, 2021 b) reflecting the rich mycobiodiversity, despite the prevalence of arid climatic conditions of Thar Desert in most of the parts of the State.

The significant outcome of this research lies in the fact that many species of coprophilous and lignicolous mushrooms have been explored, reported, and taxonomically described from the yet less explored regions of the State of Rajasthan, indicating their vast potential for colonizing a variety of substrates in varied agro- climatic zones and forming part of a homogenous group with dark-coloured spores, are important findings.

ACKNOWLEDGEMENTS

The authors thank Dr. Swarnjeet Kaur for her guidance.

REFERENCES

Amandeep, K., Atri, N.S., Munruchi, K.2013 a . Two new coprophilous varieties of *Panaeolus* (Psathyrellaceae, Agaricales) from Punjab, India. *Mycosphere***4**: 616-625.

Amandeep, K., Atri, N.S., Munruchi, K.2013b. Diversity of species of the genus *Bolbitius* (Bolbitiaceae, Agaricales) collected on dung from Punjab, India. *Mycosphere***4**: 1053-1064.

Amandeep, K., Atri, N.S., Munruchi, K.2014 a.Taxonomic study on species of *Agrocybe* (Strophariaceae, Agaricales) collected on dung from Punjab, India. *Kavaka***43**: 46-49.

Amandeep, K., Atri, N.S., Munruchi, K.2014 b.Taxonomic study on coprophilous species of *Coprinopsis* (Psathyrellaceae, Agaricales) from Punjab, India. *Mycosphere***5**: 1-25.

Amandeep, K., Atri, N.S., Munruchi, K.2015 a.A Checklist of Coprophilous Agarics of India. *Curr. Res. Environ. Appl. Mycol.***5**: 322-348.

Amandeep, K., Atri, N.S., Munruchi, K.2015 b. Ecology, Distribution Perspective, Economic Utility and Conservation of Coprophilous Agarics (Agaricales, Basidiomycota) Occurring in Punjab, India. *Curr. Res. Environ. Appl. Mycol.***5**: 213-247.

Amandeep, K., Atri, N.S., Munruchi, K.2015c. *Psathyrella* (Psathyrellaceae, Agaricales) species collected on dung from Punjab, India. *Curr. Res. Environ. Appl. Mycol.***5**: 128-137.

Amandeep, K., Atri, N.S., Munruchi, K.2015d. Taxonomic study on the coprophilous mushrooms from Punjab, India: new records of family Agaricaceae. *Curr. Res. Environ. Appl. Mycol.***5**: 27-45.

Atri, N.S., Saini, S.S. 2000. Collection and study of Agarics- An introduction. *Indian J. Mush.***18**:1-5.

Atri, N.S., Kaur, A., Kaur, M. 2009. Three new records of coprophilous mushrooms of family Bolbitiaceae from India. *Mushroom Res.***18**: 51-56.

Berkeley, M.J., Broome, C.E. 1861. Notices of British fungi (901-951). *Ann. Magaz. of Natur. History* **7**: 373-382.

Chouhan ,R., Kaur, S., Gehlot, P.2010. Some new records of mushroom from India. *J. Mycol.PlantPathol.* **40**: 550-554.

Chouhan, R., Panwar, C., Kaur, S. 2021. Taxonomic Study on Some Agaricales of Rajasthan, India - New Reports. *Int. J. Curr. Microbiol. App. Sci.***10**: 816-825.

Chouhan, R., Panwar, C. 2021a. Diversity of Gasteromycetes in Rajasthan, India-I. *Studies in Fungi* **6**:175-187.

Chouhan, R., Panwar, C. 2021b. Diversity of Gasteromycetes in Rajasthan, India-II. *Studies in Fungi* **6** 352-364.

Chouhan, R., Panwar, C. 2021c. The genus *Volvariella* from Mount Abu, Rajasthan, India. *J.Mycopathol. Res.* **59**: 63-66

Cortez V , Coelho G. 2004. The Stropharioideae (Strophariaceae, Agaricales) from Santa Maria, Rio Grande do Sul, Brazil. *Mycotaxon***89**:355-378.

Dorjey K.2019. Morpho Taxonomical and Ecological Studies of Macrofungi of Trans Himalayan Ladakh. *Envi.s Bull. Himalayan Ecol*. **27**: 7-19.

El Kholfy, S., Nmichi, A., Bouchar, A., Ouabbou, A., Belahbib, N., Ouazzani T., Douira, A.2021. Study of three species of Basidiomycetes of the genus *Bolbitius*, two news for the fungal diversity of Morocco: *Bolbitius grandiusculus* and *Bolbitius lacteus*. *Plant Cell Biotechnol. Mol. Biol.***22**: 62-68.

Guzmán, G. 1983. The genus *Psilocybe*. A systematic revision of the known species including the history, distribution, and chemistry of the hallucinogenic species. *Beihefte zur Nova Hedwigia* **74**: 1–439

Guzmán, G., Kasuya, T. 2004. The known species of *Psilocybe* (Basidiomycotina, Agaricales, Strophariaceae) in Nepal. *Mycoscience* **45**: 295–297.

Index Fungorum 2017. http://www.indexfungorum.org/Names/Names.asp (accessed on March 21, 2017).

Jayasiri, S.C., Hyde, K.D., Ariyawansa, H.A., Bhat, J. et al. 2015. The faces of fungi database: fungal names linked with morphology, phylogeny, and human impacts. *Fungal Divers.***74**: 3-18

Karun, N.C., Sridhar, K.R. 2015. Elephant dung-inhabiting macrofungi in the Western Ghats. *Curr. Res. Environ. Appl. Mycol.***5**: 60-69.

Kaur, A., Atri, N.S., Kaur, M. 2014. Diversity of coprophilous species of *Panaeolus* (Psathyrellaceae, Agaricales) from Punjab, India. *Biodiversitas* **15**: 115-130

Kaur, H., Kaur,M., Atri, N.S., Kaur, A. 2013. The Genus *Psathyrella* (Fr.) Quél. from India: New Records. *J. New Biologic. Rep.***2**: 55-63

Kaur,H , Kaur,M. 2015. Psilocybe (Fr.) P. Kumm. from Punjab, India. *Inter. J. Adv. Multidiscipl. Res*. **2**: 86-97.

Kaur, H., Nazir, M., Munruchi, K. 2020. Diversity of genus *Psathyrella* (Psathyrellaceae, Agaricales) from Punjab, India. *Mushroom Res.***29**: 9-20

Keirle, M.R, Hemmes, D.E., Desjardin, D.E. 2004. Agaricales of the Hawaiian Islands. 8. Agaricaceae: *Coprinus* and *Podaxis*; Psathyrellaceae: *Coprinopsis, Coprinellus* and *Parasola*. *Fungal Divers*.**15**: 33-124.

Kirk, P.M., Cannon, P.F., Winter, D.W., Stalpers, J.A.2008.*Dictionary of the Fungi.* 10th ed. Wallingford, CABI.

Kits van Waveren, E. 1985. The Dutch, French, and British species of *Psathyrella*. *Persoonia* **2** (Suppl.): 1-300.

Kits van Waveren, E. 1995. The Berkeley & Broome Species of *Psathyrella* in the Kew Herbarium. *Kew Bull.***50**: 307-325.

Kornerup, A, Wanscher, J.H.1978. *Methuen Handbook of Colour*, 3rd ed, Eyre Methuen, London.

Kumaresan, V., Sariha, C., Murali, T.S., Senthilarasu, G .2021. Occurrence of gilled fungi in Puducherry, India. *J. Threatened Taxa* **13**: 18878-18887.

Larsson, E., Orstadius, L. 2008. Fourteen coprophilous species of *Psathyrella* identified in the Nordic countries using morphology and nuclear rDNA sequence data. *Mycol. Res*. **112**:1165-1185

Li B, Lu F, Suo X., Nan, H., Li, B. 2010. Antioxidant properties of cap and stipe from *Coprinus comatus*. *Molecules* **15**: 1473- 1486.

Luo, H., Mo, M., Huang, X.,Li, X., Zhang, K. 2004. *Coprinus comatus*: A basidiomycete fungus forms novel spiny structures and infects nematode. *Mycologia* **96**: 1218-1224.

Meena, K.L.2013. Some New Records to the Flora of Rajasthan, India. *The J. Biodivers. Photon.***112**: 233-240.

Manimohan, P.K., Thomas, A., Nisha ,V.S. 2007. Agarics on elephant dung in Kerala State, India. *Mycotaxon* **99**: 147-157.

Mohanan, C. 2011. Macrofungi of Kerala. KFRI Handbook No. 27, Kerala Forest Research Institute, Peechi, Kerala, India.

Natarajan, K., Raaman, N. 1983. South Indian Agaricales. *Bibliotheca Mycologica* **89**: 1-203.

Noordeloos, M.E. 2009. The genus Deconica (W.G. Sm.) P. Karst. in Europe - new combinations. *Österrische Zur Pilzkunde* **18**: 207-210.

Örstadius, L., Ryberg, M., Larsson, E.2015. Molecular phylogenetics and taxonomy in Psathyrellaceae (Agaricales) with focus on psathyrelloid species: introduction of three new genera and 18 new species. *Mycol. Progress* **14**:25

Pegler, D.N.1977. A preliminary agaric flora of East Africa. *Kew Bull*. Add., Ser.**6**. Pp. 615.

Pegler, D.N. 1983. Agaric flora of the lesser Antitles. *Kew Bull*.**9**: 1-668

Rao, G., Dai, D., Zhao, H-N., Liang, Y., Li, Y., Zhang, B. 2021.Two new psathyrelloid species of *Coprinopsis* (Agaricales, Psathyrellaceae) from China. *MycoKeys***83**: 85-103.

Redhead, S.A., Vilgalys, R., Moncalvo, J.M., Johnson, J., Hopple ,J .S., Jr. 2001. *Coprinus*Pers., and the disposition of *Coprinus* species *sensu lato*. *Taxon***50**: 203-241.

Schafer, D.J.2010. Keys to sections of *Parasola*, Coprinellus, *Coprinopsis* and *Coprinus* in Britain. *Field Mycol*. **11**: 44-51.

Silva, P.S., Cortez, V.G., Silveira, R.M.B. 2012. Synopsis of the Strophariaceae (Basidiomycota, Agaricales) from Floresta Nacional de São Francisco de Paula, Rio Grande do Sul State, Brazil. *Hoehnea* **39**: 479-487.

Silva, P.S., Silveira, R.M.B., Cortez, V.G. 2014 . Notes on Deconica and Psilocybe (Agaricales) from the southern border of Atlantic forest and Pampa biomes of Brazil. *Sydowia* **66**: 217–228.

Singer, R .1986. *The Agaricales in modern taxonomy,* 4th edition. Koeltz Scientific Books, Koenigstein, Germany.

Singer, R. 1951. The “Agaricales” (Mushrooms) in modern taxonomy. *Lilloa* **22**:1-830

Smith, A. H.1949. .*Mushrooms in their Natural Habitats.* Hafner Press, New York, 626 pp.

Swapna, S., Abrar, S., Krishnappa, M. 2008. Diversity of Macrofungi in Semi-Evergreen and Moist Deciduous Forest of Shimoga District-Karnataka, India. *J. Mycol. Plant Pathol.***38**: 21-26.

To´th, A., Hausknecht, A., Krisai-Greilhuber, I., Papp, T., Va´gvo¨lgyi, C., Nagy, L.G. 2013. Iteratively Refined Guide Trees Help Improving Alignment and Phylogenetic Inference in the Mushroom Family Bolbitiaceae. *PLoS ONE* **8**: e56143.

Thomas, K.A. ,Manimohan, P., Guzmán, G. , Tapia, F., Ramirez-Guillen, F. 2002. The genus Psilocybe in Kerala State, India. *Mycotaxon* **83**: 195-207.

Varghese, S.P., Pradeep, C.K., Vrinda, K.B. 2010. Mushrooms of tribal importance in Wayanad area of Kerala. *J. Mycopathol. Res.***48**: 311-320.

Vrinda,K.B., Pradeep, C.K.2011. Toxic, and hallucinogenic mushrooms of Kerala. *J. Mycopathol. Res.* **49**: 231-246.

Yan, J-Q., Bau, T.2018. The Northeast Chinese species of *Psathyrella* (Agaricales, Psathyrellaceae). *MycoKeys* **33**: 85-102.

Zhou, G., Han, C. 2008. The co-effect of vanadium and fermented mushroom of *Coprinus comatus* on glycaemic metabolism. *Biol. Trace Element Res.* **124**: 20- 27.