Four newly recorded Amanita taxa from India

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Abstract. Singh Y, Kaur M. 2016. Four newly recorded Amanita taxa from India. Biodiversitas 17: 342-348. During the fungal forays in district Himachal Pradesh of North Western India, four unrecorded taxa of Amanita were collected. They are Amanita flavoconia var. flavoconia, A. flavoconia var. inquinata, A. pilosella f. pilosella and A. porphyria. A. flavoconia var. flavoconia is distinctive in having a brilliant yellow to yellow orange cap, with white lamellae and a stipe base turning light brownish on injury. Whereas. A. flavoconia var. inquinata possesses brownish yellow to orange yellow, superbicul pileus, having white to pastel yellow stipe, annulus grayish yellow, superior and volva forming broken rings of yellow patches around the bulb. A. pilosella f. pilosella unique in possessing grayish brown or brownish beige pileus having thick irregular warts and white lamellae edges. A. porphyria is represented by nonstriate pileus margin, off white stipe, decorated with grayish squamules, with violaceous tinge and has a marginate bulb, annulus is persistent, off white above and light grey below and volva is friable, as grey, cottony mass at the margin of the bulb.

Keywords: Amanitaceae, new record, India, taxonomy

INTRODUCTION

The genus Amanita belongs to the family Amanitaceae R. Heim ex. Pouzar. It comprises of both the edible as well as deadly poisonous species. It is known with 500 species worldwide (Kirk et al. 2008), but so far only 66 species are reported from India (Bhatt et al. 2003, Farook et al. 2013, Senwal et al. 2005, 2007, Vrinda et al. 2005). Very meager work has been done on the taxonomy of this genus in India. There are still many more species to be collected and identified. In this paper, four taxa viz. A. flavoconia var. flavoconia G. F. Atk., A. flavoconia var. inquinata Tulloss, Ovrebo & Halling, A. pilosella Corner & Bas and A. porphyria Alb. & Schwein.: Fr. belonging to subgenus Lepidella (E. J. Gilb.) Vesely emend. Corner & Bas and section Valideae (Fr.) QuéL, are included, which have amyloid basidiospores, none appendiculate pileus margin, lacking a membranous, limbate to saccate volva. All these taxa recorded for the first time from India.

MATERIALS AND METHODS

The specimens were collected from Himachal Pradesh in North Western India with an altitude ranging from 1500 to 3647 m in temperate zones. The morphological details were recorded from fresh sporophores. The field characters pertaining to gross morphology, shape, color and size of the pileus, stipe and lamellae, presence or absence of annulus and volva were noted down in the field following Atri et al. (2005) and Kornerup and Wanscher (1978). The specimens were hot air dried and packed in cellophane paper bags containing 1-4 dichlorobenzene. The microscopic details were studied under compound microscope (Olympus) on 100x and 40x by cutting free hand sections of revived part of the dried specimen and staining them in 1% cotton blue or 2% congo red. The spores were studied from the spore print as well as from the crushed mounts of the lamellae and amyloid reaction were checked in Melzer’s reagent. Statistics are based on 20-70 measured basidiospores. Abbreviations include Q’ = the length: width ratio range as determined from all measured basidiospores. The dried specimens are deposited in the Herbarium of Botany Department, Punjabi University, Patiala, Punjab, India under accession numbers given as PUN for further reference.

RESULTS AND DISCUSSION


Sporophores 8.5-11.8 cm in height. Pileus 3.2-6.0 cm broad, comanulate to convex; with or without an umbo; margin regular, none appendiculate, feebly striate; surface yellow (2A4), light orange (5A3), dark orange or deep orange (5A4) at centre, deep yellow (4A3) towards margins; covered with powdery, yellow volval remnants, more concentrated along margin; detersile; vicid; atomate; cuticle fully peeling; flesh white, unchanging, up to 0.1 cm thick; odor good like cucumber. Lamellae free to adnexed, subdistant to close, unequal, broad (up to 0.5 cm), yellowish white (1-3A3); gill edges serrate, yellowish; lamellulae attenuate. Stipe central, 7.0-10.8 cm long, up to
1.2 cm broad above, up to 1.5 cm broad from centre and up to 2.5 cm broad at bulb, distinctly bulbous; white (1A4) to pale yellow (2A3), to light yellow (4A4), with a whitish bulb; surface shiny, covered with pastel yellow (3A4) fibrillose scales; solid; annulate, annulus skirt like, striated, pastel yellow (3A4); volva in yellow concentric rings of floccose, cottony mass, detersile, easily lost while collecting; stipe base turns light brownish on injury.

Basidiospores [72/3/3] (5.6-) 6.4-9.6 (-10.4) \times 4.8-7.2 (-8.8) \mu m (L = 6.4-8.8 \mu m; L' = 7.8 \mu m; W = 5.6-6.4 \mu m; W' = 6.0 \mu m; Q = 1.14-1.43 (-1.67); Q' = 1.30); subglobule, broadly ellipsoid to ellipsoid, occasionally elongate; amyloid, thin walled, hyaline, smooth; apiculate, apiculus up to 1.6 \mu m long. Basidia 19.2-48.0 x 6.4-9.6 \mu m, clavate, without clamp connections, teterasterigmate; occasionally bisterigmate; sterrigmate up to 7.2 \mu m long. Lamellae edge cells 12.8-27.2 x 6.4-22.4 \mu m, clavate to balloon shaped, granular. Pileus cuticle hyphal, gelatinized, made up of sub-radially tangled, granular, septate 1.6-6.4 \mu m broad hyphae; pileus context made up of loosely interwoven, horizontally arranged, septate, granular, 3.2-12.8 \mu m broad hyphae; acrophysalides narrowly clavate, subglobule to ellipsoid, up to 64.0 \mu m broad. Hymenophoral trama bilateral divergent. Stipe cuticle made up of longitudinally and compactly arranged, thin walled, septate 1.6-8.0 \mu m broad hyphae; stipe context made up of loosely arranged, vertically intermingled, granular, 2.4-14.4 \mu m broad hyphae; acrophysalides thinn walled, septate 1.6 \mu m; volval context made up of loosely interwoven, horizontally arranged, septate, granular, 2.4-14.4 \mu m broad hyphae; acrophysalides thin walled, septate 1.6 \mu m; volva as yellow patches forming broken rings, around bulb, can easily lost while collecting.

Material examined. India, Himachal Pradesh, Narkanda, Hattu peak (2,800 m), growing solitary under Abies pindrow in mixed coniferous and broad leaved forest, Yadwinder Singh and Munruchi Kaur, PUN 3845, August 14, 2007; Shimla, Fagu (2,600 m), growing scattered on humicolous soil, in the coniferous forest, Munruchi Kaur and Yadwinder Singh. PUN 3847, August 12, 2007; Shimla, Chadwick fall (1,800 m), growing solitary, under Cedrus deodara in mixed coniferous forest, Yadwinder Singh, PUN 6433, August 13, 2009.

Distribution and Ecology. Amanita flavoconia var. flavoconia was found growing solitary to gregarious in hardwood forest, swampy area of mixed deciduous forest and Northern Hemlock-Hardwood forest constituting Quercus alba, Q. palustris, Acer, Fagus grandifolia, Liriodendron tulipifera, Tsuga canadensis, Betula allegheniensis, Carya ovata and Viburnum acerifolia from New Jersey at 780 m-1,760 m altitude (Tulloss 2013a). Presently examined collections have been found growing solitary to scattered on humicolous soil (PUN 3847), under Abies pindrow (PUN 3845) and under Cedrus deodara (PUN 6433), in mixed coniferous and broad leaved forest or mixed coniferous forest at an altitude varying from 1,800-2,800 m in Mid August.

Discussion. The above examined collections completely match with the description given for Amanita flavoconia var. flavoconia by Jenkins (1982) and Tulloss et al. (2001). It is distinctive in having a brilliant yellow to yellow orange cap, with white lamellae and a stipe base turning light brownish on injury. Bhatt et al. (1988) and Kumar et al. (1990a, b) reported A. flavoconia from different parts of Himachal Pradesh, while Abraham and Kachroo (1989) and Pandotra (1997) reported this species from Jammu and Kashmir. Later, on the revision of collections of Himachal Pradesh and Jammu and Kashmir by Tulloss et al. (2001), these were found to be falling under A. flavipes S. Imai and later Bhatt et al. (2003) recommended the transfer of Indian specimens know under A. flavoconia to A. flavipes. The present collections belong to A. flavoconia as they differ from A. flavipes in having less robust sporophores with cap color varying in shades of yellow to deep orange and having serrate gill edges, the bulb changing to light brown on injury. Amanita flavoconia var. flavoconia is the first report from India.


Sporophore up to 10.5 cm in height. Pileus up to 3.9 cm broad, flattened depressed; lacking umbo; margin regular, splitting at maturity; surface brownish orange (6C4,5) at centre and yellowish orange to orange yellow (5B2,5) towards margin, washed out due to rain; subvulcic; glabrous; cuticle fully peeling; flesh white, unchanging, up to 0.2 cm thick; odor radish like. Lamellae free, subdistant, moderately broad (up to 0.4 cm), unequal, yellowish white (4A4); gill edges serrate, yellowish white; lamellae truncate. Stipe central, up to 9.5 cm long, up to 0.7 cm broad above, and up to 1.7 cm broad at base, with subglobule bulb at base, pastel yellow (3A4) above, white at bulb, covered with yellowish scales; hollow; annulate, annulus superior, single, skirt like, membranous, collapsing on the stipe, hanging, grayish yellow (4B4), striated above, smooth below; volva as yellow patches forming broken rings, around bulb, can easily lost while collecting.

Basidiospores [35/1/1] (5.6-) 6.4-9.6 (-11.2) \times (4.8-) 5.6-7.2 (-8.0) \mu m (L = 6.4-8.0 \mu m; L' = 8.0 \mu m; W = 5.6-7.2 \mu m; W' = 6.4 \mu m; Q = (1.0-) 1.11-1.42 (-1.67); Q' = 1.27); subglobule to broadly ellipsoid to ellipsoid, infrequently globose, rarely elongated; amyloid, thin-walled, smooth, hyaline; apiculate, apiculus up to 1.6 \mu m long. Basidia 24.0-45 x 8.0-9.6 \mu m, clavate, inamyloid, without clamp connections; teterasterigmate; sterrigmate up to 6.4 \mu m. Pileus cuticle hyphal, made up of subradially intermingled, granular, septate 2.4-6.4 \mu m broad hyphae; pileus context made up of loosely interwoven, subradially to loosely interwoven, septate, granular, 3.2-11.2 \mu m broad hyphae; acrophysalides clavate to narrowly clavate, ellipsoid, up to 40.0 \mu m broad. Hymenophoral trama bilateral divergent. Stipe cuticle made up of longitudinally and compactly arranged, thin walled, septate 1.6-8.0 \mu m broad hyphae; stipe context made up of loosely interwoven, thin walled, septate 1.6-8.0 \mu m broad hyphae; acrophysalides abundant, narrowly clavate, up to 32.0 \mu m broad. Volval
elements composed of thin walled, smooth, branched, septate, 2.0-6.1 µm broad hyphae, intermixed with subglobose, broadly ellipsoid to ellipsoid, clavate, elongated, subpyriform, 20.4-98.0 x 12.3-82.0 µm inflated cells arranged in chains. Clamp connections absent throughout.

Material examined. India, Himachal Pradesh, Narkanda, Hattu peak (2,800 m), growing solitary, on humicolous soil, in mixed coniferous forest, under Picea smithiana, Munruchi Kaur and Yadwinder Singh, PUN 6434, August 14, 2007.

Distribution and Ecology. Tulloss et al. (1992) reported Amanita flavoconia var. inquinata growing solitary to gregarious in loamy soil, under different species of Quercus in Colombia and Costa Rica at an altitude varying from 1,675-3,000 m, from México they collected this species from a mixed forest including Pinus patula, Abies religiosa, Quercus sp., Arbutus xalapensis, and Baccharis conferta at an altitude of 2,800 m. The present collection was found growing solitary, under Picea smithiana in mixed coniferous forest during mid August.

Discussion. In its macroscopic and microscopic details present collection matches well with Amanita flavoconia var. inquinata Tulloss, Ovrebo & Halling (Tulloss et al., 1992). In the field this variant is confusing with A. flavoconia var. flavoconia. A. flavoconia var. flavoconia differs from the present specimen in possessing brilliant yellow to yellow orange cap, with white lamellae and basidiospores broadly ellipsoid to ellipsoid, infrequently subglobose. The present collection is characterized in possessing brownish orange to yellowish orange to orange yellow, subvicid pileus, having white to pastel yellow stipe, with bulb at base, annulus grayish yellow, superior, collapsing on the stipe, while volva forming broken rings of yellow patches around the bulb, which are easily lost while collecting. Amanita flavoconia var. inquinata is the first report from India.
Figure 2. Internal details of *A. flavoconia* var. *flavoconia*

Figure 3. Internal details of *A. flavoconia* var. *inquinata*

Figure 4. Internal details of *A. pilosella* f. *Pilosella*

Figure 5. Internal details of *A. porphyria*

Sporophore up to 15.8 cm high. Pileus up to 5.0 cm wide, convex; lacking umbo; margin regular, very feebly striate along margins, surface greyish brown or brownish beige (6E₃), covered entirely, with grey to light grayish, fibrilllose, squarros, flat, powdery, irregular warts; cuticle fully peeling; flesh white, unchanging, up to 0.3 cm thick; odor mild. Lamellae sinuate, close, broad (up to 0.5 cm); yellowish white (2A₃), unchanging; gill edges smooth; lamellulae attenuate. Stipe central, up to 15.0 cm long, up to 1.0 cm broad up above, up to 1.8 cm broad at base, distinctly bulbous, surface white (3A₁), covered with grayish brown (6F₃), fibrilllose to flocculose scales, unchanging; annulate, annulus single, grayish white (1B₃), superior, skirt like, pendulous, striated, light grey above and grey below; hollow; volva as few incomplete rings of grey powdery fibrilllose scales at the margin of the bulb.

Basidiospores [25/11/1] 6.4-8.0 x (4.8) 5.6-6.4 μm (L = 6.4-8.0 μm; L¹ = 7.5 μm; W = 5.6-6.4 μm; W¹ = 5.9 μm; Q = (1.12-) 1.14-1.33 (-1.43); Q¹ = 1.27); broadly ellipsoid, infrequently ellipsoid, rarely subglobos, amyloid, hyaline, thin walled; guttulate; smooth; apiculate, apiculus up to 1.6 μm long. Basidia 33.6-45 x 8.0-11.2 μm, clavate, without any clamp connections, tetrasterigmate; sterigmata up to 6.4 μm long. Pileus cuticle hypal, gelatinized, made up of horizontally septate hyphae giving rise a turf of thin walled, septate 1.6-4.0 μm broad granular hyphae, with brownish pigment; pilocystidia absent; pileus context composed of loosely interwoven, septate, thin walled, 3.2-9.6 μm broad hyphae; acrophysalides subpyriform to broadly clavate to clavate, up to 38.4 μm broad. Hymenophoral trama bilateral divergent. Stipe cuticle hypal, made up of longitudinally and compactly tangle, septate, 1.6-6.4 μm broad hyphae; stipe context composed of loosely arranged, septate, thin walled, 3.2-12.8 μm broad hyphae; acrophysalides thinned walled, abundant, up to 32.0 μm broad. Volval remnants composed of globose, ellipsoid, clavate, pyriform to subpyriform 16.0-70.4 x 11.2-37.0 μm broad inflated cells, abundant, single or terminal or in rows, intermixed with branched, thin walled, with brownish pigment, septate, 3.2-9.6 μm broad hyphae. Clamp connection absent throughout.

Material examined. India, Himachal Pradesh, Narkanda, Circuit house (2,900 m), growing solitary, in coniferous forest, among mosses and Frageria, under Abies pindrow, Yadwinder Singh and Munruchi Kaur, PUN 3846, August 13, 2007.

Distribution and Ecology. Corner and Bas (1962) collected *Amanita pilosella f. pilosella* growing solitary in Singapore and reported it to be very common in every rainy season. Yang (1997) found this species from China growing solitary or in small groups in a broad-leaved forest with dominant species of Lithocarpus and Castanopsis, at 1,000-2,000 m height.

Discussion. Corner and Bas (1962) proposed two forms of *Amanita pilosella* i.e. forma *pilosella* Corner & Bas and forma *atroconica* Corner & Bas based on size and form of volval remnants on cap surface and the color of lamellae edges. In forma *pilosella* pileus has thick irregular warts and white lamellae edges. While, in forma *atroconica* the cap has conical warts in the centre with regular patches along the margin, further in forma *atroconica* the gill edges are dark brown. *Amanita pilosella f. pilosella* is the first time report from India.
Sporophore up to 10.5 cm high. Pileus up to 6.0 cm wide, plano-convex, with depressed centre; lacking umbo; margin regular; nonappendiculate; splitting at maturity; surface dark brown (7F4) at centre and light brown (6D3) to brownish grey along margin; moist; atomate; glabrous; cuticle fully peeling; flesh up to 0.2 cm thick, white, unchanging; odor mild. Lamellae free, with a fine decurrent line on stipe; close; broad (up to 0.6 cm); creamy white, unchanging; gill edges smooth; lamellulae attenuate. Stipe central, up to 9.5 cm long, up to 0.8 cm broad above and up to 1.0 cm broad in middle, up to 1.1 cm broad near base, distinctly bulbous with marginate bulb up to 2.2 cm broad, off white background, decorated with grayish colored scales, with violaceous tinge; hollow; annulate; annulus single, attached, skirt like, off white above and light grey below; volva friable, present as grey, broken rings at the margin of the bulb.

Basidiospores (7.2-) 8.0-9.6 (-10.4) x 7.2-9.6 µm (L = 8.0-9.6 µm; L' = 8.4 µm; W = 7.2-8.0 µm; W' = 7.6 µm; Q = 1.0-1.11 (-1.30); Q' = 1.10); globose to subglobose, rarely broadly ellipsoid; amyloid, hyaline, thin walled; apiculate, apiculus up to 0.8 µm long. Basidia 24.0-32.0 x 7.2-9.6 µm, granular, inamyloid, clavate, without clamp connections, tetrasterigmate; sterigmata up to 4.0 µm long. Pileus cuticle hyphal, gelatimized, made up of sub-radially tangled, thin walled, granular, septate, 2.0-6.1 µm broad hyphae, pilocystidia absent; pileus context composed of radially to irregularly interwoven, septate, thin walled, 4.1-12.3 µm broad hyphae; acrophysoides thin walled, narrowly clavate to clavate, ellipsoid up to 41.0 µm broad. Hymenophoral trama bilateral divergent. Stipe cuticle hyphal, made up of longitudinally and compactly arranged, septate, 2.0-8.2 µm broad hyphae; stipe context made up of longitudinally and loosely arranged, septate, 4.1-16.4 µm broad hyphae; acrophysoides thin walled, abundant, up to 37.0 µm broad. Volval remnants on stipe base composed of irregularly arranged elements, inflated cells abundant, globose, subglobose, broadly ellipsoid to ellipsoid to elongated, 20.4-45.0 x 12.3-37.0 µm, thin walled, single, terminal or sometimes in rows of 2-3, intermixed with branched, thin walled, septate, abundant, 2.0-8.2 µm broad hyphae. Clamp connection absent throughout.

Material examined. India, Uttarakhand, Pigla Pani (2,500 m), growing solitary on soil in mixed broad leaved and coniferous forest, under Pinus roxburghii, Yadwinder Singh, PUN 6438, August 20, 2010.

Distribution and Ecology. Amanita porphyria was found growing solitary to subgregarious in Pinus sylvestris forest and in sand with Arctocephalys, Castanopsis, Pinus, Quercus, Tsuga canadensis, T. heterophylla, F. grandifolia, and Acer sp. from Norway, Switzerland, California, Vermont and Washington (Tulloss 2013b). According to A. porphyria is very common in the tree line forests of northern Europe.

Discussion. Macroscopic and microscopic details of the examined specimen matches with description of Amanita porphyria Alb. & Schwein.: Fr. provided by Tulloss (2013b). This species is characterized in possessing a distinctive nonstriate pileus margin, off white stipe, decorated with grayish squamules, with violaceous tinge and has a marginate bulb, annulus is persistent, skirt like, off white above and light grey below, whereas the volva is friable, present as grey, cottony mass at the margin of the bulb. In India, Adlikari and Bora (1989) reported A. porphyria from Uttarakhand, but according to Bhatt et al. (2003) Indian material may be misidentified and is possibly A. pseudoporphyria Hongo. The present collection was also compared with A. pseudoporphyria, but in A. pseudoporphyria the stipe is white and is covered with white fibrillose squamules and has a limbate volva with free limbs and basidiospores are broadly ellipsoid to ellipsoid. Amanita porphyria is the first time report from India.

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