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AMANITACEAE REPORTED FROM INDIA. A CRITICALLY ANNOTATED CHECKLIST

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Abstract

Since the appearance of *Amanitaceae of India* in 1990, there has been no publication addressing the current state of knowledge of the family in India. The present paper represents a step toward filling this gap and providing an updated list of those members of the Amanitaceae described, illustrated or listed from different parts of India to date. The list includes 53 names, of which 50 names are combined in *Amanita* and the rest in *Limacella*. Revision of collections determined originally as European or North American taxa has yielded fifteen new records for India: *A. avellaneosquamosa*, *A. caesareoides*, *A. clarisquamosa*, *A. concentrica*, *A. exitialis*, *A. liquii*, *A. oberwinklerana*, *A. orientigemmata*, *A. pantherina* var. *lutea*, *A. pseudoporphyria*, *A. pseudovaginata*, *A. rubrovolvata*, *A. subjunquillea* var. *subjunquillea*, *A. subjunquillea* var. *alba*, and *A. umbrinolutea*. It is projected that the number of *Amanita* taxa in India may exceed 100.

Keywords: China, Himalayan region, Japan

INTRODUCTION

Assemblages of ectomycorrhizal fungi associated with coniferous and oak-dominated forest communities in the Himalayan foothills of northwestern India and the mid-Appalachians of the eastern United States are the subject of an on-going study by the authors and a number of their colleagues. This paper, which presents an annotated checklist of the Indian Amanitaceae, is a step in documenting the distribution, ecology, and taxonomy of this group of agarics for the Indian region of interest. The foundation of the checklist is an extensive search of the literature. The extracted data has been critically reviewed based on relevant dried collections as well as new collections made during the current study.

Brief Comments on the Amanitaceae

The name "Amanitaceae" is often attributed to Roze (1876*a*, 1876*b*). However, he only named the family in French. Heim (1934) was the first to use the name "Amanitaceae";

however, he fixed no type genus and provided no Latin diagnosis. During the 1970's there was considerable debate as to whether to sanction vernacular (e.g., French and German) family names and then allow the Latin endings to be added as orthographic corrections. However, in 1975, this position was defeated at the XIIth Botanical Congress; and the 1978 Code (Stafleu *et al.*, 1978) made clear that the names with vernacular terminations were inadmissible. Following this change in the code, Pouzar (1983), whose summary of nomenclatural history we here summarize further, proposed *Amanita* to be the type of the Amanitaceae and provided a Latin diagnosis. Moreover, Pouzar specified included genera (*Amanita* and *Limacella*) and gave a list of excluded genera (*Rhodotus*, *Termitomyces*, *Volvariella*, *Pluteus*, and *Chamaeota*). He recognized Heim as having had a "concept of families of Agaricales [that seemed] to be the best for his time." Following Pouzar, the correct citation of the name is "Amanitaceae R. Heim *ex* Pouzar."

According to most modern authors, the family Amanitaceae remains as defined by Pouzar (e.g., Singer (1986)). Members of the family are characterized by the following features: pure white to vividly colored pilei; fleshy basidiomes having free to narrowly adnate, broad to narrow, thin to slightly thickened lamellae; a universal veil (present at least in early development of the basidiome) that may take the form of a glutinous sheath, a saccate or cupulate or limbate volva, a band along the margin of a marginate stipe bulb, or a sequence of floccons, warts, mealy matter, banded ring zones etc. on the lower stipe or stipe bulb (and in such cases often leaving volval patches, floccons, or warts on the surface of the pileus); in many taxa, a partial veil membranous and persistent to felted or flocculent and deciduous or ephemeral; lamella trama that are bilateral at least at some stage of development of the basidiome; context of the pileus and stipe that are monomitic, inamyloid, with or without clamp connections, often with some refractive or vascular hyphae; terminal hyphal cells that are often strongly inflated acrophysalides, with such cells longitudinally oriented in the stipe; basidia normally dominantly 4-spored in mature material, with less than a half-dozen notable exceptions in *Amanita* (one known from East Asia and the remainder from North and Central America), with or without basal clamp connections; cystidia lacking (with the possible exception of a very few species in *Amanita* in which vascular pseudocystidia protrude among the basidia and basidioles); vesiculose, deciduous cells on the edges of the lamellae in many species; spore color in mass white, cream, pale yellowish, pale sordid, or pale greenish; spores varying from globose (length/breadth ratio between 1.0 and 1.05) to bacilliform (length/breadth ratio greater than or equal to 3.0), mostly subglobose to broadly ellipsoid to ellipsoid (length/breadth ratio between 1.05 and 1.6), smooth, usually colorless, hyaline, usually thin-walled (with wall thickened in some taxa), with wall rarely reported to have minute punctation or "stippling" (particularly in *Limacella*), amyloid or inamyloid. Mostly occurring on earth or humus in wooded areas and, in *Amanita*, predominantly obligately ectotrophically mycorrhizal.

At present, the levels of knowledge of the two genera differ significantly, with our understanding of *Limacella* the much less advanced of the two. *Amanita* can be defined by three characters in combination: bilateral lamella trama, longitudinally acrophysalidic stipe tissue, and the schizohymenial type of development of the basidiomes (Bas, 1969: 294; Yang and Oberwinkler, 1999).

Singer (1986) listed 115 species in the family Amanitaceae, of which 100 species belongs to the genus *Amanita* and 15 to the genus *Limacella*. Gilbert (1918) in his com-

pilation of information on European species of *Amanita sensu lato* described 21 species of the genus *Amanita*, 3 of *Amanitopsis*, and 6 of *Limacella*. He also included a large number of infraspecific taxa. In his magnum opus on the Amanitaceae, Gilbert (1940-41) described and provided colored illustrations for many members of the family—including many from eastern Asia. Corner and Bas (1962) described 30 species of the genus *Amanita* from Singapore and Malaya. In the most important work on *Amanita* to date, Bas (1969) transformed the methodologies of study of the genus, provided keys to the subgenera and sections of *Amanita*, and described 93 species belonging to *Amanita* section *Lepidella* worldwide—including 16 new species. Jenkins (1986) compiled data on species of *Amanita* in North America and described in brief and illustrated 128 species. Tulloss (e.g., 1993, 1994; Tulloss *et al.*, 1992, 2001) expanded on the methodology of Bas and has concentrated on *Amanita*—treating over 70 species from around the world in detail. Zhu L. Yang also expanded on the methodology of Bas. In his work on the *Amanita* species of southwest China, Yang (1997) provided excellent illustrations and meticulously detailed descriptions of 47 taxa, most at species rank.

At this writing, the CABI Bioscience database of fungal names (Funindex) shows 1089 records under the genus *Amanita* and 48 records under the genus *Limacella* from the world over, however, a significant number of names included in the list are either synonyms or not validly published. According to C. Bas and Tulloss (unpub. data), the number of accepted names in *Amanita* is less than 600 at present; and this number is expected to include taxonomic synonyms. Bas (2000) and Tulloss (2000*a*) estimated the number of *Amanita* taxa in the world to be 900 to 1,000 species.

Overview of the Indian Literature

The Indian literature gives the impression that little attention has been paid to the agaric flora of this country although the Indian subcontinent with the mighty Himalayas in the north, is bestowed with a geographical area abounding in forest and possesses varied topography and a vast range of climates. Such a diversity of habitat is conducive to growth of a large variety of mushrooms, and there is an equally large opportunity to explore the mushroom flora of this country's various geographical regions.

From time to time, information about Indian Amanitaceae has been published in various checklists, research articles, books, and monographs. We have reviewed such publications ranging from Butler and Bisby (1931) to the present.

Butler and Bisby (1931) listed one species of *Amanita* and five species of *Amanitopsis* from the Khasi Hills, Assam and Darjeeling, West Bengal. Vasudeva (1960) revised the work of Butler and Bisby and repeated the records previously listed.

Bilgrami *et al.* (1979) listed two species of *Amanita* from the Khasi Hills, Assam; Solan, Himachal Pradesh; and Lucknow, Uttar Pradesh, and five species of *Amanitopsis* from the Khasi Hills, Assam and Darjeeling, West Bengal.

Sathe and Daniel (1980), Sathe and Deshpande (1980), and Sathe and Kulkarni (1980) described three species of *Amanita* from Poona, Maharashtra; Munnar, Kerala; and Sampaje, Karnataka and one species of *Limacella* from Quilon, Kerala. All four species were new to science.

Watling and Gregory (1980) listed three species of *Amanita* from Sonamarg, Gulmarg

and Sarband near Harwan, Kashmir.

Manjula (1983) listed nine species of *Amanita*. Purkayastha and Chandra (1985), in their *Manual of Indian Edible Mushrooms*, listed three species of *Amanita* from the Khasi Hills, Assam; Kerala; Solan, Himachal Pradesh; Lucknow, Uttar Pradesh and Sarband near Harwan, Kashmir, and two species of *Limacella* from Calcutta, West Bengal and Orissa.

Natarajan (1977), Natarajan and Purushothama (1987), Purushothama and Natarajan (1987) treated a total of three taxa from southern India.

Bhatt *et al.* (1988) described four species of *Amanita* in detail for the first time from the forests of Himachal Pradesh. Shajahan *et al.* (1988) described two species of *Amanita* and one species of *Amanitopsis* from Shella and Shillong, Khesi Hills (Meghalaya) along with a number of other macrofungi.

Dhancholia (1989) briefly described and illustrated seven species of *Amanita* out of a reported ten from Orissa. Further, Dhancholia *et al.* (1991) reported *Amanita phalloides* from the Almora Hills, Uttaranchal. Abraham and Kachroo (1989) listed 12 species of *Amanita* from Jammu and Kashmir. Kumar *et al.* (1990*b*) included 11 species in a listing of fungi recorded from a series of study areas near Narkanda in Himachal Pradesh.

The first book length contribution on the Indian Amanitaceae was made by Kumar *et al.* (1990*a*). They presented an account of 25 Indian taxa of *Amanita*.

In the recent edition of *Fungi of India*, Bilgrami (1991) listed five species of *Amanita*, five species of *Amanitopsis* and one species of *Limacella*. In another recent report, Sarbhoy *et al.* (1996) listed 12 species of *Amanita*.

Working on the mushroom flora of Garhwal Himalaya, Bhatt and Bhatt (1996) and Bhatt *et al.* (1999) described and illustrated seven species of *Amanita* new to the Indian mycota.

Doshi and Sharma (1997) listed two species of *Amanita* and one species of *Amanitopsis* from Rajasthan. Pandotra (1997) listed 12 species of the genus *Amanita* in his book on the fungi of north India. Kaur and Atri (2002) list two species from Punjab plains.

GOALS AND METHODS

This paper is a contribution towards one component of an international project with the objective of comparing the assemblages of ectomycorrhizal macrofungi that occur in certain forest ecosystems of the eastern United States and northwestern India that are montane in distribution and often dominated by members of the Pinaceae and Fagaceae. The project encompasses research in both mycology and forest ecology, and one group of fungi receiving particular interest is the Amanitaceae.

An important foundation for our study of this family in India was gathering and reviewing the relevant Indian literature. In order to evaluate the reports in the literature gathered, we began carrying out a revision of specimens that were at hand in BPI, GUH, HPUB, and the personal herbarium of Tulloss. Many of these were collected by the authors, their colleagues, and their students. Hence, we turned our critical eye first on the work of ourselves and close colleagues.

Recent information on Indian Amanitaceae is scattered in various journals and technical

publications that are not readily available to the scientific community. The present catalogue has the following goals: (1) assembling the available information on records of Indian Amanitaceae, (2) initiating a critical review of these records to suggest directions for the taxonomic component of our research and to improve the accuracy of the list, and (3) assembling an updated list of taxa reported for India.

To the extent possible, all taxa of the Amanitaceae recorded and published from India have been catalogued in the present communication. A total of 53 names (excluding synonyms) have been reported so far from India; 50 of these are epithets combined in *Amanita* and three in *Limacella*. The number of taxa represented is unclear, but this subject is discussed at the level of detail possible at an early stage of the project. At the end of this paper, a provisional revised list of Indian *Amanita* taxa is provided and an estimate of the potential number of *Amanita* taxa that may be found in India is given.

The list of taxa is given in alphabetical order for each genus. The taxa are listed by what we believe to be the correct name of each. When the correct name differs from that appearing in some of the reviewed publications, the other names are provided in remarks associated with each name's list entry. For each taxon, the following are provided: author citation and place of publication, nomenclatural status and status with regard to acceptance as a correct name for a taxon, references to the literature, localities where collections were made (following "**L**:"), and taxonomic remarks (following "**R**:") as required. Names accepted as correct are annotated by the phrase "Accepted name." Author citations conform to those provided by Kirk and Ansell (1992) with the exception of "E. J. Gilbert" (in which case we preserve the order of the author's initials used on the main body of his work, including his magnum opus—the order that has been used by the leading students of *Amanita* for the past 40 years and more).

Herbarium name codes follow Holmgren, Holmgren and Barnett (1992).

New Records

The total of *Amanita* taxa known for eastern and southern Asia exceeds 140. When their affinities are examined, the distribution of almost all taxa seems to be restricted to eastern and southern Asia, including peninsular southeast Asia. It is not a surprise then that, in most cases, it is determination of Indian material under an Australian, European, or Western Hemisphere name that has been found to be in error. In the past there has been limited monographic literature available for Asian species; however, this problem has been rectified to a great degree by the work of several authors in the last decades. In particular, the recent work of Z. L. Yang has made excellent, detailed species descriptions available. Most of his taxonomic work is now in English, but his thesis, in German (Yang, 1997), is very important to accurate determinations in southern and eastern Asia. In revising material for this project, we have found most useful the combination of Yang's publications, a number of recent publications from Japan including those of T. Oda and co-authors, the seminal work of Corner and Bas (1962) and, for section *Lepidella*, the monograph of Bas (1969). The time has come for these works to become major points of reference for Indian students of *Amanita*—replacing non-Asian field guides and technical works not treating Asian taxa, such as Jenkins' (1986) compendium of described *Amanita* taxa of North America.

It cannot be overemphasized, that collectors in southern Asia should look at unfamiliar

material as most likely to be endemic to Asia and, potentially, new. In any case, good field notes, carefully dried exsiccata (or material preserved in liquid), and drawings or photographs of fresh material are very important to progress in Asian *Amanita* taxonomy. There is considerable need for more information even on familiar taxa. When microscopic anatomy is reviewed, we strongly suggest that specimens be treated as "unknowns" and worked up thoroughly. We strongly recommend either of the methodologies followed by Tulloss (1998*b*, 2000*b*) or by Yang (1997). Macroscopic appearances can be deceptive in terms of determination. For example, it is not at all clear how many different taxa are reported as varieties of *A. gemmata* and *A. pantherina* in southern Asia. Yang lists several distinct taxa in his works and is in the process of publishing new taxa in the "*pantherina* group." Our experience to date suggests there may be still *other* members of the group in India and Pakistan.

In addition to finding that a number of names have been misapplied, new names proposed based on Indian material have proven to be taxonomic posterior synonyms, in a few cases.

In both cases, revision has resulted in identification of taxa, which are herein recorded for the first time from India. Publications treating these new records in detail will be forthcoming. For the time being, we simply record the names of these taxa under appropriate entries in the list of taxa that follows and in Table 1 at the conclusion of this paper.

CHECKLIST OF TAXA

Genus *Amanita* Pers.

Type species: *A. muscaria* (L.:Fr.) Pers. *Tentam. Disp. Meth. Fung.*: 67. 1794. [Conserved name]

1. *Amanita albocreata* (G. F. Atk.) E. J. Gilbert. *Iconogr. Mycol. (Milan)* 27, suppl. (2): 259. 1941. [Accepted name] **L**: Uttaranchal: Garhwal, Kandolia and Nagdev-Jhandidhar (Bhatt *et al.*, 1999). **R**: This species is known only from mixed forests in northeastern North America. Bhatt *et al.* (1999) reported it from Garhwal, Uttaranchal. Re-examination of this collection along with additional material obtained during subsequent years has shown that the taxon present in India matches very well the original description of *A. orientigemmata* Zhu L. Yang & Yoshim. Doi (1999), which was known from Japan and southwestern China prior to this preliminary report of its occurrence in India.

2. *Amanita alboflоccosa* A. V. Sathe & S. D. Deshp. *MACS Monograph* 1: 14. 1981. [Accepted name] **L**: Maharashtra: Poona (Sathe and Deshpande, 1980). **R**: This species was described originally from Poona, Maharashtra, India and, to our knowledge, is known only from the type locality.

3. *Amanita aporema* Boedijn. *Sydowia* 5: 319. 1951. [Accepted name] **L**: Orissa: Phulbani, Kalinga (Dhancholia, 1989). **R**: The description of the Orissa material conforms to what is known of Boedijn's species except for the statement that no clamp connections were found. Clamp connections were found to be common throughout the holotype of *A. aporema* by Yang et al. (to appear) leading the authors to believe that the species is "more closely related to *A. princeps* Corner & Bas [of *Amanita* stirps *Hemibapha*

(Tulloss, 1998*a*)] than to *A. fulva* and its allies." It would be valuable to re-examine the material of Dhancholia.

4. *Amanita aureofloccosa* Bas. *Persoonia* 5: 384, figs. 92-95. 1969. [Accepted name] **L**: Punjab: Sirhind, New Awadi (Kaur and Atri, 2002). **R**: *Amanita aureofloccosa* was described based on material from Congo. The entity described by Kaur and Atri differs from the central African species at least in having a distinct basal bulb on the stipe, a more robust habit, and thin-walled spores. Kaur and Atri do not describe the stipe's interior. The African species has a notably hollow stipe from early in development (Bas, 1969). Kaur and Atri's collection may represent the same species reported by Purushothama and Natarajan (1987) as *A. flavofloccosa* (see below). It would be valuable to revise the Punjabi material.

5. *Amanita berkeleyi* (Hook. f. *in* Berk.) Bas. *Persoonia* 5: 476. 1969. [Accepted name] **L**: West Bengal: Darjeeling (Berkeley, 1850: 43 as *Agaricus*); Jillapahar (Berkeley, 1850: 42 as *Agaricus regalis* Berk.). Himachal Pradesh: Shimla, Taradevi and Fagu (Bhatt *et al.*, 1988); Chadwick Fall and Narkanda (Kumar *et al.*, 1990*a*; 1990*b*). **R**: This species was described originally from India. Judging by the lack of recent collections, it is rare or, perhaps, restricted in its symbionts (e.g., associated only with dipterocarps). Bas (1969) knew it only from the holotypes of the two taxa whose names he placed in synonymy. More recently collected material determined as *A. berkeleyi* that has been revised by us has proven to be *A. fritillaria*. Any Indian material determined as *A. berkeleyi* in the past is worth revising, and new material is badly needed for study.

6. *Amanita bharatensis* A. V. Sathe & Jeys. Daniel. *MACS Monograph* 1: 75. 1981. [Tentatively accepted name] **L**: Kerala: Munnar (Sathe and Daniel, 1980). **R**: This species was described originally from India. The original published description contains some conflicting elements and assignment to section is problematic. A review of the type and collection of new material is desirable. See *A. muscaria* subsp. *muscaria*, below.

7. *Amanita calyptratoides* Peck. *Bull. Torr. Bot. Club* 36: 329. 1909. [Accepted name] **L**: Orissa: Phulbani, Daringbadi (Dhancholia, 1989). **R**: This species is known only from a limited range in the Western Hemisphere [from southern California, USA to the neovolcanic zone of central Mexico (Tulloss, unpub. data)]. It is very unlikely to be found in India. Dhancholia's description of the Indian material conflicts with that of *A. calyptratoides* at least in having an ochraceous pileus and spores 7.8 - 10 × 5.6 - 7 µm. The North American species has a lead (gray-brown) pileus with spores (9.4-) 9.8 - 13.2 (-15.0) × (6.0-) 6.8 - 8.9 (-9.9) µm (Tulloss, unpub. data). Because the mushroom is described and illustrated as though it had a bulbous base, it might belong in *Amanita* section *Phalloideae* (Fr.) Quél. Unfortunately, the reaction of spores to Melzer's reagent was not reported. Indian material determined as *A. calyptratoides* in the past should be revised.

8. *Amanita ceciliae* (Berk. & Broome) Bas. *Persoonia* 12: 192. 1984. [Accepted name] **L**: Uttar Pradesh: Allahabad, (as *Amanita inaurata*, Singh and Mehrotra, 1974). Himachal Pradesh: Kullu, Jaloripass, Sojha, Pulga, Rahla Fall; Shimla, Narkanda (Kumar *et*

al., 1990*a*; 1990*b*). Jammu and Kashmir: Kashmir, Gulmarg (Abraham and Kachroo, 1989; Pandotra, 1997). **R**: *Amanita inaurata* Secr. *nom. inval.* is a synonym that commonly appears in the literature. The species seems to be limited to Europe and adjacent western Asia. It has never been demonstrated to be exportable with symbionts. Recently, Z. L. Yang (pers. corresp.) has found that the species commonly determined as *A. ceciliae* in southern China is a distinct species soon to be published as *A. liquii* Zhu L. Yang, M. Weiss & Oberw. (to appear). Abraham and Kachroo (1989) describe a pileus for their "*ceciliae*" that is "pale indigo to grayish ... blue" and, hence, not the yellowish to brown European taxon. They describe a second species as "*inanurata*" [sic] that seems very similar to the new taxon of Zhu L. Yang *et al.* From incomplete revisions of Indian material similar to *A. ceciliae*, we believe that there are additional taxa that have been recorded under this name. We have revised some material of *A. ceciliae sensu* A. Kumar *et al.* and find that the material examined is assignable to *A. umbrinolutea* (Secr. *ex* Gillet) Bataille. For taxonomic details on the latter species, see Tulloss *et al.* (2001).

9. *Amanita citrina* (Schaeff.) Pers. *Tentam. Disp. Meth. Fung.*: 66. [Invalid combination] **L**: Jammu and Kashmir: Kashmir, Pahalgam (Abraham and Kachroo, 1989; Pandotra, 1997). **R**: This species is reported from around the world; but, in point of fact, seems limited to Europe and adjacent western Asia. Reports of its exportation with a symbiont have been disproved to date. Recently, *A. sinocitrina* Zhu L. Yang, Z. H. Chen & Z. G. Zhang (Chen *et al.*, 2001) has been described from eastern Asia. Indian material previously determined as *A. citrina* should be compared to the Chinese species. Note: Unfortunately, *Agaricus citrinus* Schaeff. is a posterior homonym. The currently accepted name for the European taxon is *A. bulbosa* var. *citrina* (Schaeff.) Gillet.

10. *Amanita cokeri* (E. J. Gilbert & Kühner) E. J. Gilbert. *Iconogr. Mycol. (Milan)* 27 suppl. (2): 372. 1941. [Accepted name] **L**: Uttaranchal: Garhwal, Dandapani (Bhatt and Bhatt, 1996). **R**: This species is known only from eastern North America. Although reported from Garhwal, Uttaranchal by Bhatt and Bhatt (1996), it probably does not occur in India. Revision of Indian material previously determined as *A. cokeri* is currently underway by us. This material may comprise more than one species. One of the species involved is *A. concentrica* T. Oda, C. Tanaka & Tsuda (2002) described recently from Japan. In many ways, this species is deceptively like *A. cokeri* macroscopically; however, it is a species of *Amanita* section *Amanita* with inamyloid spores. Other material determined as *A. cokeri* might be *A. eijii* Zhu L. Yang (2002).

11. *Amanita craseoderma* Bas. *Persoonia* 10: 20. 1978. [Accepted name] **L**: Karnataka: Bentamale Forest, near Guthigar and Mannagundi, South Kahara (Natarajan and Purushothama, 1987). **R**: This species is known only from specialized tropical environments in South America. The material from Karnataka differs from the Amazonian species in having a different colored pileus, shorter striations on the pileus margin, a different colored stipe, a universal veil that appears to be submembranous rather than pulverulent, larger spores, etc. It is very unlikely that *A. craseoderma* would be found in India. Material determined as this species should be revised.

12. *Amanita elata* (Massee) Corner & Bas. *Persoonia* 2 (3): 286. 1962. [Accepted name] **L**: Orissa: Phulbani, Daringbadi (Dhancholia, 1989). **R**: *Amanita elata* is a species of *Amanita* section *Amanita*. The species described and illustrated by Dhancholia appears to belong in either *Amanita* section *Phalloideae* or *Amanita* section *Vaginatae* (Fr.) Quél. The material should be revised.

13. *Amanita emilii* Riel. *Bull. Trimestriel Soc. Mycol. France* 23: 1. 1907. [Name status unclear] **L**: Himachal Pradesh: Shimla, Glen (Bhatt *et al.*, 1988); Glen, Chadwick Fall, Taradevi, Charabara and Baghi (Kumar *et al.*, 1990*a*). **R**: This name is treated by many European authors as a posterior synonym of *A. regalis* (see, below). What little information exists on *A. emilii* would place it among the clamp-bearing taxa in the "*A. muscaria* group." However, the fact that the Indian material is reported to lack clamp connections suggests an affinity with *A. gemmata* or *A. pantherina*. Possibly, the material is assignable to *A. subglobosa* Zhu L. Yang (1997). We are proceeding with revision of the Indian material.

14. *Amanita eriophora* (Berk.) E. J. Gilbert. *Iconogr. Mycol. (Milan)* 27 suppl. (2): 230. 1941. [Accepted name] **L**: Punjab: Sirhind, Village Sheikhpura (Kaur and Atri, 2002). West Bengal: Darjeeling (Berkeley, 1850 as *Agaricus*). **R**: This species was described originally from India. To our knowledge, it is known in India only from the type locality. The material reported from Punjab differs greatly from *A. eriophora*—lacking a strongly marginate deeply rooting bulb, having a strong odor, lacking a thick layer of violet-tinted volval material over the upper two-thirds or more of the stipe, having larger more elongate spores, etc. From the lack of recent collections, *A. eriophora* may be rare or limited in its possible symbionts. Corner and Bas (1962) reported the species from Singapore.

15. *Amanita excelsa* (Fr.:Fr.) Bertillon *in* Dechambre. *Dict. Encycl. Sci. Med.* 1 (3): 499. 1866. [Accepted name] **L**: Jammu and Kashmir: Kashmir, Pahalgam (Abraham and Kachroo, 1989; Pandotra, 1997). **R**: This species is not known to be exported from its native Europe and adjacent western Asia with symbionts. There are several taxa known from eastern Asia that may have been confused with this species. Material from India determined as this species should be revised.

16. *Amanita farinosa* Schwein. *Schr. Nat. Ges. Leipzig* 1: 79. 1822. [Accepted name] **L**: Rajasthan: Udaipur (Doshi and Sharma, 1997). **R**: This taxon is reported from eastern Asia and western North America as well as from Eastern North America, from which it was described. In general, many determinations of material collected outside eastern North America are in need of critical revision.

17. *Amanita flavoconia* G. F. Atk. *J. Mycol.* 8: 110. 1902. [Accepted name] **L**: Himachal Pradesh: Shimla, Glen and Taradevi (Bhatt *et al.*, 1988); Shimla, Glen, Baghi, Chajpur, Chopal, Charabara, Narkanda; Kullu, Manali, Pulga; Chamba, Kala Top and Khajjiyar (Kumar *et al.*, 1990*a*; 1990*b*). Jammu and Kashmir: Kashmir, Gulmarg (Abraham and Kachroo, 1989; Pandotra, 1997). **R**: Nearly all material from India that was determined as this species and has been revised has proven to be *A. flavipes* S. Imai (Tulloss *et al.*, 2001). *Amanita flavipes* appears to be common in northern India.

18. *Amanita flavofloccosa* Nagas. & Hongo. *Trans. Mycol. Soc. Japan* 25: 367. 1984. [Accepted name] **L**: Tamil Nadu: Madras (Purushothama and Natarajan, 1987). **R**: This species is a yellow one belonging in stirps *Nauseosa* of *Amanita* subsection *Vittadiniae* Bas (1969). The Tamil Nadu material is probably assignable to the same stirps. However, the protologue of *A. flavofloccosa* describes an entity with a differently colored pileus surface and gills, somewhat different habit (more elongate and lepiotoid) and notably larger spores than the entity described and illustrated by Purushothama and Natarajan. Revision of the Indian material would be worthwhile. Also, see *A. aureofloccosa*, above.

19. *Amanita franchetii* (Boud.) Fayod. *Ann. Sci. Nat. (Bot.)*, 7° Sér. 9: 316. 1889. [Accepted name] **L**: Jammu and Kashmir: Kashmir, Gulmarg (Abraham and Kachroo, 1989; Pandotra, 1997). **R**: This name is very widely misapplied in the Western Hemisphere to taxa of very different habits and pigmentations. In particular, North American literature is unreliable with regard to this species. The pileus of the European taxon is greenish yellow according to the protologue; however, the name is also applied in Europe to an entity with a gray-brown, virgate pileus and sulfur yellow warts. Indian material previously determined as this species should be revised.

20. *Amanita fritillaria* (Berk.) Sacc. *Syll. Fung.* 9: 2. 1891. [Accepted name] **L**: Assam: Khasi Hills (Berkeley1852 as *Agaricus*). Uttaranchal: Dehradun, FRI (Bakshi, 1974). Jammu and Kashmir: Kashmir, Gulmarg (Abraham and Kachroo, 1989; Pandotra, 1997). **R**: This species is a very distinctive one with a very dark universal veil. The center of the pileus is brown and notably virgate, while the pileus margin may be quite pale in some specimens.

21. *Amanita fulva* (Schaeff.) Fr. *Obs. Mycol.* 1: 2. 1815. [Accepted name] **L**: Himachal Pradesh: Shimla, Glen, Taradevi, Jakhoo and Fagu (Bhatt and Lakhanpal, 1988); Kullu, Rahla Fall, Manali, Pulga; Shimla, Narkanda (Kumar *et al.*, 1990*a*; 1990*b*). Orissa: Mayurbhanj, Joshipur (Das and Sinha, 1990). **R**: *Amanita fulva* is a name applied very loosely around the world to diverse taxa of *Amanita* section *Vaginatae* that lack an annulus and have brownish pilei. Western Hemisphere material treated under this name can be segregated into a number of indigenous taxa. Z. L. Yang (pers. corresp.) has recently found that Chinese and Japanese material treated as *A. fulva* in the past represents a distinct taxon indigenous to eastern Asia—*Amanita orientifulva* Zhu L. Yang, M. Weiss & Oberw. (to appear). Since *A. aporema* is in this checklist and since it was described in its protologue as strongly suggesting the European *A. fulva*, *A. aporema* should be considered as a possible determination for Indian material formerly classified as *A. fulva*. *Amanita fulva* is not known to be exportable from its native Europe and adjacent western Asia with symbionts. It is very unlikely that it would be found in India. All Indian material determined as *A. fulva* should be revised.

22. *Amanita fulvaurantia* R. P. Bhatt, Locq. and T. N. Lakh. *in* Kumar et al. *Amanitaceae India*: 68. 1990. [Accepted name?] **L**: Himachal Pradesh: Shimla, Taradevi (Kumar *et al*, 1990*a*). **R**: We hesitate to declare this name accepted because more taxonomic data on this and related species are needed.

23. *Amanita gemmata* (Fr.) Bertillon *in* Dechambre. *Dict. Encycl. Sci. Medic.* 1 (3): 496. 1866. [Accepted name] **L**: Himachal Pradesh: Shimla, Summer Hill and Glen (Bhatt *et al.*, 1988); Taradevi, Baghi, Jubbal and Chopal (Kumar *et al.*, 1990*a*; 1990*b*). **R**: This European species is not known to be exportable with symbionts. The name is applied loosely to white, tan, yellow-orange and yellowish species of *Amanita* section *Amanita* around the world. One entity commonly called *A. gemmata* in eastern Asia has recently been recognized as a distinct species [*A. orientigemmata*], and its original description is a very good match to the description of "*A. gemmata*" by Kumar *et al.* (1990*a*). We propose that the new name is the correct one for the material described by Kumar *et al.* It now seems unlikely that *A. gemmata* would occur in India. Indian material previously determined as this species should be revised. See the discussion of *A. albocreata*, above.

24. *Amanita hemibapha* (Berk. & Broome.) Sacc. *Syll. Fung.* **5**: 13. 1887. [Accepted name] **L**: Assam: Khasi Hills (Berkeley, 1852 as *Agaricus caesareus* Scop.). Uttaranchal: Dehradun (Bakshi, 1974). Himachal Pradesh: Shimla, Shillaroo, Narkanda, Baghi, Khadrala; Kullu, Pulga, Manali; Chamba and Khajjiyar (Kumar *et al.*, 1990*a* and 1990*b* as *Amanita caesarea* (Scop.:Fr.) Pers. **R**: The name *A. caesarea sensu auct.* has often been applied to this taxon. But that name has also been applied to numerous other taxa of *Amanita* stirps *Hemibapha* (Tulloss, 1998a). Therefore, one cannot simply make a substitution of "*hemibapha*" for "*caesarea*" when reviewing the literature. Southern and southeast Asia apparently comprise a center of speciation for the taxa of stirps *Hemibapha*, with a variety of spore shapes and sizes, habits and colors of the basidiome, and bruising reactions of the basidiome combining to identify taxa that apparently do not intergrade. These are interpreted by some authors as distinct species, by others as subspecies of *A. hemibapha*, and by others as varieties of *A. hemibapha*. Among the taxa to which the names "*A. caesarea*" and "*A. hemibapha*" may be misapplied are *A. caesareoides*, *A. chepangiana* Tulloss & Bhandary, *A. javanica* (below), *A. pakistanica* Tulloss, S. H. Iqbal & A. N. Khalid, *A. hemibapha* var. *ochracea* Zhu L. Yang, *A. similis* Boedijn, and *A. simlensis* (below)—as well as possibly new taxa. *Amanita caesareoides* conforms very well to the description of *A. caesarea* by Kumar et al. (1990*a*) as suggested by Tulloss (1998*a*).

25. *Amanita indica* R. P. Bhatt, Locq. & T. N. Lakh. *in* Kumar et al. *Amanitaceae India*: 71. 1990. [Not accepted, posterior synonym] **L**: Himachal Pradesh: Shimla, Taradevi, Jakhoo, Baghi (Kumar *et al.*, 1990*a*). **R**: According to our revisions, this name is a posterior taxonomic synonym of *A. pseudoporphyria* Hongo.

26. *Amanita javanica* (Corner & Bas) T. Oda, C. Tanaka & Tsuda. *Mycoscience* 40: 64. 1999. [Accepted name] **L**: Orissa: Phulbani, Daringbadi (Dhancholia, 1989); Keonjhar, Kiriburu (Das and Sinha, 1990). **R**: The more familiar combination is *A. hemibapha* subsp. *javanica* Corner & Bas (1962). See the entry regarding *A. hemibapha*, above. The species described by Dhancholia and by Das and Sinha has a yellow rather than orange-buff annulus, and neither paper mentions orange fibrils or felted fragments on the stipe, which are present in *A. javanica*.

27. *Amanita konkanensis* A. V. Sathe & S. M. Kulk. *in* S. M. Kulk. *Biovigyanam* 18 (1): 56-58. 1992. [Accepted name] **L**: Maharashtra: Sawantwadi (Kulkarni, 1992). **R**: This species was described originally from Maharashtra State and is apparently known only from the type locality.

28. *Amanita multisquamosa* Peck. *Rep. (Annual) Regents Univ. State New York New York State Mus. Nat. Hist.* 53: 840, pl. B, figs. 1-7. 1900. [Accepted name] **L**: Himachal Pradesh: Sirmour, Pacchad, Mohan (Saini and Atri, 1993). **R**: This species is known only from eastern North America. It is very unlikely to occur in India. Indian collections of this taxon should be revised. Jenkins (1977) created the combination *Amanita pantherina* var. *multisquamosa* (Peck) Dav. T. Jenkins. A posterior synonym of the present name that is commonly seen in the literature is *A. cothurnata* G. F. Atk.

29. *Amanita muscaria* subsp. *muscaria* [Conserved name] **L**: Tamil Nadu: Kodaikanal (Sathe and Sasangan, 1977); Kodaikanal, Guntur (Natarajan, 1977). Jammu and Kashmir: Kashmir, Sonamarg (Watling and Gregory, 1980). **R**: Indian material determined as this species (especially from southern India) should be revised because of the similarity of the species to *A. bharatensis* (above).

30. *Amanita muscaria* subsp. *flavivolvata* Singer. *Sydowia* 11: 374. 1958. [Accepted name] **L**: Himachal Pradesh: Shimla, Narkanda, Hatoo Peak (Kumar *et al.*, 1990*a*; 1990*b*). **R**: This is a common species in North and Central America, but (unless exported with a mesoamerican *Quercus* or a North American conifer) it is unlikely to be found in India. It is often identified using the combination *A. muscaria* var. *flavivolvata* (Singer) Dav. T. Jenkins. To date, all the Indian material determined as this subspecies revised by us has proven to be *A. rubrovolvata* S. Imai, which is reported herein for the first time from India. Revision of additional collections is continuing.

31. *Amanita orsonii* A. Kumar & T. N. Lakh. *in* Kumar et al. *Amanitaceae India*:. 75. 1990. [Accepted name] **L**: Himachal Pradesh: Kullu, Manali, Pulga; Chamba, Kala Top (Kumar *et al.*, 1990*a*); Shimla, Baghi (Tulloss *et al.*, 2001). Uttaranchal: Chamoli, Bhatwari Garhwal (Tulloss *et al.*, 2001). **R**: This species appears to be the "*A. rubescens*" of Pakistan, northern India, and Japan (Tulloss *et al.*, 2001). (See *A. rubescens*, below.)

32. *Amanita ovalispora* Boedijn. *Sydowia* 5: 320. 1951. [Accepted name] **L**: Orissa: Phulbani, Daringbadi (Dhancholia, 1989); Koraput, Nawrangpura (Das and Sinha, 1990). **R**: Dhancholia's material differs from *A. ovalispora* in the color of the pileus, a friable rather than membranous universal veil, and spores that are apparently more broadly ellipsoid than ellipsoid. The material described by Das and Sinha also differs from *A. ovalispora* in pileus color. It is also odd that their reported lower limit of spore width is reported as equal to what appears to be the average spore width; in turn, this contributes to a high value of average Q for the material (1.5). Z. L. Yang (1997) reported the spores from Boedijn's type were (8.0-) 8.5 - 10.0 (-10.5) × (6.0-) 6.5 - 7.5 (-8.0) µm, (Q = (1.19-) 1.25 - 1.42 (-1.47); **Q'** = 1.32±0.06). Revision of the material of Dhancholia and Das and Sinha would be valuable.

33. *Amanita pachycolea* Stuntz *in* Thiers & Ammirati. *Mycotaxon* 15: 158-161. 1982. [Accepted name] **L**: Uttaranchal: Garhwal, Khirsu (Bhatt *et al.*, 1999). **R**: This species is known from the Pacific Coast of the United States (California, Oregon and Washington) its occurrence in India is problematic. Material from India previously determined as this species should be re-examined. Based on (Tulloss *et al.*, 2001), it is possible that such material could belong in *A. umbrinolutea* (Secr. *ex* Gillet) Bataille. Indeed, we have recently revised material from Himachal Pradesh that proved to be *A. umbrinolutea*.

34. *Amanita pantherina* (DC.:Fr.) Krombh. *Naturgetreue Abbild. Essbar. Schädl. Undverd. Schwäm.* 4: 24, pl. 29. 1836. [Accepted name] **L**: Tamil Nadu: Kodaikanal (Sathe and Sasangan, 1977). Jammu and Kashmir: Kashmir, Gulmarg (Watling and Gregory, 1980), Pahalgam (Abraham and Kachroo, 1989). Himachal Pradesh: Shimla, Narkanda, Charabara, Shillaroo, Baghi, Jubbal, Khara Pathar, Chopal and Churdhar; Kullu, Pulga and Manali; Chamba, Kala Top and Khajjiyar (Kumar *et al.*, 1990*a*). Meghalaya: Khasi Hills, Shella, and Shillong, (Shajahan *et al.*, 1988). **R**: There is no confirmed case of this European and western Asian species being exported with a symbiont. Z. L. Yang has reported and described several pantherinoid taxa from China and Japan including, e.g., *A. pantherina* var. *lutea*, *A. pseudopantherina* Zhu L. Yang *nom. prov.*, and *A. subglobosa*. Indian material previously determined as *A. pantherina* should be revised.

35. *Amanita peckiana* Kauffman *in* Peck. *Mycologia* 5: 67. 1913. [Accepted name] **L**: Uttaranchal: Garhwal, Danadapani (Bhatt *et al.*, 1999). **R**: This species is known only from eastern North America. Additional study of the Indian material determined originally as this species has indicated that it should be referred to *Amanita clarisquamosa* (S. Imai) E. J. Gilbert.

36. *Amanita phalloides* (Fr.:Fr.) Link. *Handb. Erkenn. nutzb. hänfigst. Gewächse* 3: 272. [Accepted name] **L**: Uttaranchal: Almora (Dhancholia, *et al.*, 1991); Garhwal, Kuinkaleshwar, Nagdev-Jhandidhar (Bhatt *et al.*, 1999). Meghalaya: West Khasi Hills (Rao *et al.*, 1997). **R**: Like *A. muscaria*, there are instances in which this species has been exported along with a variety of symbionts, which would make its occurrence in India possible. Unfortunately, Dhancholia, *et al.* (1991) provided no taxonomic data regarding their collection. Some Uttaranchal material determined originally as this species was revised by us and proved to be *A. subjunquillea* S. Imai var. *subjunquillea*.

37. *Amanita porphyria* (Alb. & Schwein.: Fr.) Alb. & Schwein. *Consp. Fung.*: 142, taf. 11 (fig. 1). 1815. [Accepted name] **L**: Uttaranchal: Pithoragarh, Thal Kedar (Adhikari and Bora, 1989). **R**: This species apparently is one of the few amanitas that has a circumboreal distribution; however, there may be more than one species to which the name is commonly given in North America and Europe. The presence of *A. pseudoporphyria* (see *A. indica*, above) in India raises the possibility that at least some Indian material determined as *A. porphyria* may be misdetermined. We regard the occurrence of *A. porphyria* in India as requiring further study.

38. *Amanita regalis* (Fr.:Fr.) Michael. 1903. *Führer Pilzfreunde*, 4th ed. 1: pl. 56. [Accepted name] **L**: Uttaranchal: Garhwal, Jaiharikhal (Bhatt *et al.*, 1999). **R**: This species is treated as *A. muscaria* var. *regalis* (Fr.:Fr.) E. J. Gilbert by some authors, but this

assignment of rank is becoming uncommon in Europe. In countries in which the species is well known (e.g., in Scandinavia), species rank is apparently universally accepted. (See *A. emilii*, above.)

39. *Amanita rubescens* (Pers.:Fr.) Pers. *Tentam. Disp. Meth. Fung.*: 67. 1794. [Accepted name] **L**: Meghalaya: Khasi Hills, Shella, and Shillong, (Shajahan *et al.*, 1988). Himachal Pradesh: Shimla, Summer Hill, Taradevi and Jakhoo (Bhatt and Lakhanpal, 1989); Shimla, Baghi, Charabara, Narkanda and Kullu, Pulga (Kumar *et al.*, 1990*a*; 1990*b*). Jammu and Kashmir: Kashmir, Gulmarg (Abraham and Kachroo, 1989; Pandotra, 1997). **R**: This species has been found to be exported in association with symbionts (Tulloss, unpub. data); however, Indian material determined originally as *A. rubescens* that has been revised by Tulloss has proven to be *A. orsonii* (Tulloss *et al.*, 2001) except for a single case in which the material proved to be *A. fritillaria*. The report of Shajahan *et al.* (1988) describes something with extremely small spores that may not be an *Amanita*.

40. *Amanita sampajensis* A. V. Sathe & S. M. Kulk. *MACS Monograph* 1: 44. 1980. [Accepted name] **L**: Maharashtra: Sampaje (Sathe and Kulkarni, 1980). **R**: This species was described originally from India and is apparently known only from its type locality.

41. *Amanita simlensis* R. P. Bhatt, Locq. & T. N. Lakh. *in* Kumar et al. *Amanitaceae India*: 85. 1990. [Accepted name.] **L**: Himachal Pradesh: Shimla, Hatoo Peak (Kumar *et al.*, 1990*a*). **R**: This species was described originally from India. It has only been reported from its type locality.

42. *Amanita solitaria* (Bull.:Fr.) Mérat. 1836. *Nouv. Fl. Envir. Paris*, 4^{me} ed. 1: 121. [Accepted name] **L**: Rajasthan: Udaipur (Doshi and Sharma, 1997 as *A. echinocephala* (Vitt.) Quél., a synonym *per* Bas (1969)). Kerala: (Devi and Nair, 1983, as cited in Purkayastha and Chandra, 1985). **R**: This species has been reported from many places outside of Europe and adjacent western Asia; but, to date, the relevant collections eventually have been found to be indigenous taxa (e.g., by Bas (1969)). It is unlikely that the species would be found in India.

43. *Amanita subvaginata* (Cleland & Cheel) E. J. Gilbert. *Iconogr. Mycol. (Milan)* 27 suppl. (2): 206. 1941. [Accepted name] **L**: Orissa: Phulbani, Kalinga (Dhancholia, 1989). **R**: The numerous species Cleland described from South Australia are unusual in their relative phenetic isolation from other taxa of *Amanita*. It seems unlikely that one of these species would have a disjunct distribution outside of Australia. Moreover, the Australian species is assignable to *Amanita* section *Amanita* and is somewhat similar to *A. farinosa* of North America, whereas Dhancholia describes and illustrates a species of *Amanita* section *Vaginatae* with a saccate universal veil. The macroscopic description of this species suggests *A. pseudovaginata*; however, the spore size and shape is too round and too small. This difference could be explained by the spores not having been measured in strictly lateral view. Indian material determined as *A. subvaginata* should be revised.

44. *Amanita vaginata* (Bull.:Fr.) Lam. *Encycl. Méthod. Bot.* 1: 109. 1783 ["1784"]. [Accepted name] **L**: Assam: Khasi Hills (Berkeley, 1852 as *Agaricus*). Himachal

Pradesh: Solan (Sohi *et al.*, 1964 and Tilak and Rao, 1968); Shimla, Chadwick Fall, Potters Hill, Glen, Narkanda, Baghi, Khara Pathar, Kullu, Manali, Chamba and Kala Top (Kumar *et al.*, 1990*a*; 1990*b*). Maharashtra: Nagpur (Trivedi, 1972). Uttar Pradesh: Lucknow (Ghosh *et al.*, 1974); Allahabad (Singh and Mehrotra, 1974). West Bengal: Bankura (Ray and Samajpati, 1979). Jammu and Kashmir: Kashmir, Pahalgam (Abraham and Kachroo, 1989), Sarband near Harwan (Watling and Gregory, 1980). Meghalaya: Khasi Hills, Shella and Shillong (Shajahan *et al.*, 1988 [as *Amanitopsis vaginata*]. **R**: The name "*vaginata*" has been applied very loosely all over the world. It is most often applied in cases of a species with a gray to grayish brown or brownish gray pileus; however, the name has been applied to many other exannulate taxa of *Amanita* section *Vaginatae*. At least two taxa have been distinguished in the process of revising Indian material determined originally as *A. vaginata* (Tulloss *et al.*, 2001): *A. pseudovaginata* Hongo and an apparently undescribed species also treated as *A. vaginata* by Kumar *et al.* (1990*a*). Occasionally, the two taxa are found mixed in a single collection. Critical revision of Indian material determined as *A. vaginata* is needed.

45. *Amanita velatipes* G. F. Atk. *Studies Amer. Fung.*: 63, figs. 64-67. 1900. [Accepted name] **L**: Himachal Pradesh: Shimla, Chajpur (Kumar *et al.*, 1990*a*). **R**: This species may be found in some literature under the combination *A. pantherina* var. *velatipes* (G. F. Atk.) Dav. T. Jenkins. It is a species known only from eastern North America and is unlikely to be collected in India. Indian material determined as this species that has been revised by us proved to be *A. pantherina* var. *lutea* W. F. Chiu previously known only from Yunnan Prov., China, and recently provided with a detailed modern description by Yang (1997).

46. *Amanita verna* (Bull.:Fr.) Lam. *Encycl. Méthod. Bot.* 1 (1): 113. 1783. [Accepted name] **L**: Maharashtra: Nagpur (Trivedi, 1972). Uttaranchal: Dehradun, Asarori, Jadhiwala and Jhagra, FRI (Bakshi, 1974). Orissa: Phulbani, Kalinga (Dhancholia, 1989). Rajasthan: Udaipur (Doshi and Sharma, 1997). **R**: There is some difficulty regarding the taxonomy of this species, even in Europe. It is often reported that the species is nonreactive with KOH solution in contrast to *A. virosa*; however, a concerted effort to find nonreactive "*verna*" in southern Europe has produced only reactive (yellowing) basidiomes (F. Massart, pers. corresp.). At any rate, there is no evidence that *A. verna* can be exported from Europe and western Asia with symbionts. A more likely determination of a white Indian species in *Amanita* section *Phalloideae* bearing ellipsoid spores might be *Amanita oberwinklerana* Zhu L. Yang & Yoshim. Doi (1999) [see also (Yang, Li and Wu, 2001)]; and, indeed, we found an Indian collection of this species during our process of revision. Dhancholia's material assigned to *A. verna* has two-spored basidia, and his description strongly suggests *A. exitialis* Zhu L. Yang & T. H. Li (2001). Indian material previously determined as *A. verna* should be revised.

47. *Amanita virosa* (Fr.) Bertillon *in* Dechambre. *Dict. Encycl. Sci. Medic.* 1 (3): 497. 1866. [Accepted name] **L**: Uttaranchal: Garhwal, Kuinkaleshwar (Bhatt *et al.*, 1999). **R**: Material from Uttaranchal that was determined originally as *A. virosa* was revised by us and proved to be *Amanita subjunquillea* var. *alba* Zhu L. Yang (1997). In the future,

if material is collected with globose to subglobose spores between 9.5 and 12 µm long (as *is* to be found in material deposited in GUH), then a determination as *A. exitialis* should be considered.

48. *Amanita vittadinii* (Moretti) Vitt. *Tent. Mycol. Amanita* 3: 31, pl. I. 1826. [Accepted name] **L**: Jammu and Kashmir: Kashmir, Gulmarg (Abraham and Kachroo, 1989; Pandotra, 1997). **R**: Despite claims to the contrary, we know of no evidence that this white to whitish species occurs outside of Europe and adjacent western Asia. In their report of this species, Abraham and Kachroo (1989) describe a yellow species with spores much larger than those of any known macroscopically similar southern or eastern Asian species of *Amanita* subsection *Vittadiniae* Bas. Their illustrations of spores from their material are unusual for *Amanita* spores. The single collection is in need of revision.

49. *Amanita volvata* (Peck) Lloyd. *Mycol. Writings I (Volvae)*. **9**: 15. 1898. [Accepted name] **L**: Himachal Pradesh: Shimla, Narkanda, Hatoo Peak (Kumar *et al.*, 1990*a*; 1990*b*). **R**: The Indian material determined as *A. volvata* that has been revised by us to date is assignable to *A. avellaneosquamosa* (S. Imai) S. Imai.

50. *Amanita watlingii* A. Kumar & T. N. Lakh. *in* Kumar et al. *Amanitaceae India*: 92. 1990. [Not accepted, posterior synonym] **L**: Himachal Pradesh: Kullu, Pulga; Shimla, Chopal (Kumar *et al.*, 1990*a*). **R**: As proposed by Tulloss *et al.* (2001), this name is a posterior synonym of *A. flavipes*. (See *A. flavoconia*, above.)

Genus: *Limacella* Earle. *Bull. N. Y. Bot. Gard.* 5: 447. 1909.
Type species: *Agaricus delicatus* Pers.:Fr. 1821. *Syst. Mycol.* 1: 27.

51. *Limacella quilonensis* A. V. Sathe & Jeys. Daniel. *MACS Monograph 1*: 85. 1980. [Accepted name?] **L**: Kerala: Quilonia (Sathe and Daniel, 1980). **R**: This species was described originally from India.

52. *Limacella guttata* (Pers.:Fr.) Konrad & Maubl. *Icon. Sel. Fung.* 1: pl. 9. 1924. [Accepted name] **L**: West Bengal: Calcutta (Roy and Samajpati, 1978).

53. *Limacella sp.* **L**: Orissa: (Rath, 1978).

DISCUSSION

Our review indicates that many names in the list have been or may have been misapplied. We suggest possible alternate determinations in the case of about 60% of the *Amanita* names in the list.

The 22 names that we have demonstrated to be at least occasionally misapplied (or that are posterior synonyms) and their correlated corrections based on our redeterminations are provided in Table 1. We caution that it cannot be assumed that all applications of a given misapplied name correlate to the same Indian taxon. An "n" superscript on a name in Table 1 indicates a new record for India. An equal sign in parentheses in Table 1 indicates the name is a posterior taxonomic synonym of the corresponding name in the column to the immediate right. There are 22 taxa listed in Table 1 as redeterminations. We believe there is at least one unnamed candidate to consider when revising material determined in the past as *A. ceciliae*, *A. cokeri*, *A. hemibapha*, or *A. vaginata*. *Amanita berkeleyi* is listed among the names correctly applied in the region of study. Hence, there is a

minimum of 25 distinct taxa belonging solely to the group represented in Table 1.

Name in List	Redetermination(s)	Name in List	Redetermination(s)
albocreata	*orientigemmata*^{n}	*pachycolea*	*umbrinolutea*^{n}
berkeleyi	*berkeleyi* & *fritillaria*	*pantherina* var. *velatipes*	*pantherina* var. *lutea*^{n}
caesarea	Diverse spp. of *Amanita* stirps *Hemibapha* including *caesareoides*^{n}, *hemibapha*, *javanica*, *similis*, *simlensis*, etc.	*peckiana*	*clarisquamosa*^{n}
calyptratoides	Sp. of sect. *Vaginatae* or sect. *Phalloideae*	*phalloides*	*subjunquillea* var. *subjunquillea*^{n}
ceciliae	Spp. of sect. *Vaginatae* (at least 3) including *liquii*^{n} and *umbrinolutea*^{n}	*rubescens*	*orsonii* and, infrequently, *fritillaria*
cokeri	Spp. of sects. *Amanita* and *Lepidella* including *concentrica*^{n}	*subvaginata*	Sp. of sect. *Vaginatae*, possibly *pseudovaginata*
elata	Sp. of sect. *Phalloideae* or sect. *Vaginatae*	*vaginata*	Several spp. including *pseudovaginata*^{n}
flavoconia	*flavipes*	*verna*	At least two spp. including *exitialis*^{n} & *oberwinklerana*^{n}
gemmata	*orientigemmata*^{n}	*virosa*	At least two spp. including *exitialis*^{n} & *subjunquillea var. alba*^{n}
indica (=)	*pseudoporphyria*^{n}	*volvata*	*avellaneosquamosa*^{n}
muscaria subsp. *flavivolvata*	*rubrovolvata*^{n}	*watlingii* (=)	*flavipes*

Table 1: Names known to have been misapplied to Indian species of *Amanita* with proposed correct determinations *and* names of posterior synonyms (indicated by "(=)") applied to Indian species of *Amanita* with accepted correct names for the taxa.

Names possibly misapplied with corresponding possible corrections to determination suggested for further research are presented in Table 2. The columns headed "Possible Redetermination(s)" include names that have not been demonstrated to be correctly applied to any material determined originally under the name in the column immediately to the left, but might prove to be correct redeterminations. There are 11 checklist names that are treated in Table 2. We believe that they have been applied to as many as 15 or more taxa of which 6 are distinct from those whose application is not questioned in this paper (*A. eriophora* is not questioned as its type collection is from India.) and those listed in Table 1.

The number of names in the list that are both accepted as correct and are possibly or certainly correctly applied to Indian material is 15. Two pairs of these names may be synonyms; therefore, conservatively, the list of correctly or possibly correctly applied names includes 13 taxa. Hence, our brief and preliminary analysis suggests that the number of

Amanita taxa in India is at least (25+11+13) 49—accounting for known misapplication and known synonymy. Because of the lack of names available for taxa in *Amanita* section *Vaginatae* alone, we believe that the eventual number of Indian amanitas recorded will certainly be greater.

Given the limited work on Indian agarics cited at the outset of this paper, the increasing number of taxa from northern India that were originally described from China and Japan (with a total of over 80 *Amanita* taxa known between them), the diversity of habitat presented by the Indian subcontinent, and the number of potentially novel taxa in our respective herbaria, it is possible that the number of species of *Amanita* in India will be in the range of 80 to 100, or even greater.

Name in Checklist	Possible Redetermination(s)	Name in Checklist	Possible Redetermination(s)
citrina	*sinocitrina*	*fulva*	Spp. of *Amanita* sect. *Vaginatae* including *orientifulva*
craseoderma	?	*multisquamosa*	?
emilii	*subglobosa*	*pantherina*	*subglobosa*
eriophora	*eriophora* & ?	*porphyria*	*pseudoporphyria*, *sinocitrina*
excelsa	Spp. of *Amanita* sect. *Validae* (Fr.) Quél. including *fritillaria*, *orsonii*, & *sepiacea*	*solitaria*	?
farinosa	*sinensis* var. *sinensis*, *sinensis* var. *subglobispora*, *farinosa sensu auct. Asia orient.*	*vittadinii*	?
franchetii	?		

Table 2: Names from the checklist that are possibly misapplied to Indian taxa with possible lists of correct names for those taxa.

Our tentative revision of the list of amanitas in India (including 39 taxa) follows—organized alphabetically by section:

- section *Amanita* (7 or 8 taxa): *bharatensis* (instead, could be in section *Validae*), *concentrica*, *emilii sensu* A. Kumar *et al.*, *farinosa sensu auct. Asia orient.*, *muscaria* var. *muscaria*, *orientigemmata*, *pantherina sensu* Abraham and Kachroo, *pantherina* var. *lutea*
- section *Vaginatae* (14 taxa): *aporema*, *caesareoides*, *ceciliae sensu* Abraham and Kachroo, *fulva sensu* A. Kumar *et al.*, *hemibapha*, *hemibapha sensu* Zhu L. Yang, *javanica*, *liquii*, *ovalispora sensu* Zhu L. Yang, *pseudovaginata*, *sampajensis*, *simlensis*, *vaginata sensu* A. Kumar *et al.* (excluding *A. pseudovaginata*), *umbrinolutea*
- section *Amidella* (2 taxa): *avellaneosquamosa*, *clarisquamosa*
- section *Lepidella* (5 taxa): *alboflоccosa*, *berkeleyi*, *eriophora*, *flavoflоccosa sensu* Purushothama and Natarajan, *konkanensis*
- section *Phalloideae* (5 taxa): *exitialis*, *oberwinklerana*, *pseudoporphyria*, *subjunquillea* var. *alba*, *subjunquillea* var. *subjunquillea*

- section *Validae* (5 or 6 taxa): *bharatensis* (instead, could be in section *Amanita*), *flavipes*, *fritillaria*, *fritillaria sensu* A. Kumar *et al.*, *fulvaurantia*, *orsonii*.

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LITERATURE CITED

Abraham, S. P. and J. L. Kachroo. 1989. Larger fungi from Kashmir, India, VI. The genus *Amanita*. *Micol. Neotrop. Apl.* 2: 41-51.

Adhikari, R. S. and S. S. Bora. 1989. *Amanita porphyria*—A new record for India. *Curr. Sci.* 58: 90-91.

Bakshi, B. K. 1974. *Mycorrhiza and its role in forestry.* Forest Research Institute, Dehra Dun.

Bas, C. 1969. Morphology and subdivision of *Amanita* and a monograph of its section *Lepidella*. *Persoonia* 5: 285-579.

Bas, C. 1984. On the correct name of "*Amanita inaurata* Secr." *Persoonia* 12: 192-193.

Bas, C. 2000. Una visione più ampia sulle *Amanita*. *Boll. Gruppo Micol. G. Bresadola* 43(2): 9-12.

Berkeley, M. J. 1850. Decades XXV to XXX. Sikkim-Himalayan fungi, collected by Dr. J. D. Hooker. *Hooker J. Bot. Kew Gard. Misc.* 2: 42-51, 76-88.

Berkeley, M. J. 1852. Decades XXXIX, XL. Sikkim and Khassya fungi. *Hooker J. Bot. Kew Gard. Misc.* 4: 130-142.

Bhatt, R. P. and V. K. Bhatt 1996. *Amanita cokeri* (Gilb. & Kühner) Gilbert—An addition to Indian Agarics. *Indian J. Mycol. Pl. Pathol.* 26(1): 113-114.

Bhatt, R. P., A. Kumar and T. N. Lakhanpal. 1988. Fleshy fungi of North-Western Himalayas—VII. *Indian J. Mycol. Pl. Pathol.* 18: 143-148.

Bhatt, R. P. and T. N. Lakhanpal. 1988. *Amanita fulva* (Schaeff. ex Pers.)—an edible mushroom new to India. *Curr. Sci.* 57: 1126-1127.

Bhatt, R. P. and T. N. Lakhanpal. 1989. A new record of edible *Amanita* from India. *Curr. Sci.* 58: 627-628.

Bhatt, V. K., R. P. Bhatt, R. D. Gaur and M. P. Singh. 1999. Mushrooms of Garhwal Himalaya: The genus *Amanita* Pers. ex Hooker. *Mushr. Res.* 8(2): 1-8.

Bilgrami, K. S., S. Jamaluddin and M. A. Rizwi. 1979. *Fungi of India. Part-I: List and References*. Today and Tomorrow's Printers and Publishers, New Delhi.

Bilgrami, K. S. 1991. *Fungi of India List and References*. Today and Tomorrow's Printers and Publishers, New Delhi.

Butler, E. J. and G. R. Bisby. 1931. Fungi of India. *Sci. Monogr. Imp. Council Agric. Res. India* 1: i-xviii, 1-237.

Chen, Z. H., Z. L. Yang and Z. G. Zhang. 2001. Three noteworthy *Amanitae* of subgenus *Lepidella* from China. *Mycotaxon* 79: 275-284.

Corner, E. J. H. and C. Bas. 1962. The genus *Amanita* in Singapore & Malaya. *Persoonia* 2: 241-304.

Das, M. K. and M. P. Sinha. 1990. Agaricales of Eastern India—I. *Indian Phytopath.* 43(2): 150-155.

Dhancholia, S. 1989. Noteworthy records of the genus *Amanita* from Orissa (India). *Acta Bot. Indica* 17: 279-282.

Dhancholia, S., J. C. Bhatt and S. K. Pant. 1991. Studies of some Himalayan Agarics. *Acta Bot. Indica* 19(1): 104-109.

Doshi, A. and S. S. Sharma. (1997). Wild Mushrooms of Rajasthan, *in*: Rai R. D., B. L. Dhar and R. N. Verma, eds. *Advances in Mushroom Biology and Production*. (Mushroom Society of India, National Research Center for Mushrooms, Chambaghat, Solan): 105-127.

Ghosh, R. N., N. C. Pathak and B. P. Singh. 1974. Studies on Indian Agaricales II. *Proc. Nat. Acad. Sci. India* 44:125-128.

Gilbert, E. J. 1918. *Le genre Amanita Pers.* (Lons-le Saunier). 186 pp.

Gilbert, E. J. 1940-41. Amanitaceae. *Iconogr. Mycol. (Milan)* 27 suppl. (1-3): i-xx, 1-427, pl. 1-73.

Heim, R. 1934. Fungi Iberici I. Observations sur la flore mycologique catalane. *Treb. Mus. Ciénc. Natur. Barcelona* 15(3): 1-146.

Holmgren, P. K., N. H. Holmgren and L. C. Barnett. 1990. Index herbariorum. Part I. The herbaria of the world, 8th ed. *Regnum Veg.* 120: 1-693.

Jenkins, D. T. 1986. *Amanita of North America*. (Mad River Press, Inc. Eureka). 198 pp.

Kaur, A. and N. S. Atri. 2002. Some interesting mushrooms from Punjab plains. *Mushr. Res.* 11(1): 1-5.

Kirk, P. M. and A. E. Ansell. 1992. Authors of fungal names. *Index Fung., Suppl.*: i-viii, 1-95.

Kulkarni, S. M. 1992. *Amanita konkanensis*: a new species of Agaricales. *Biovigyanam* 18(1): 56-58.

Kumar, A., R. P. Bhatt, and T. N. Lakhanpal. 1990*a*. *The Amanitaceae of India*. (Bishen Singh Mehendra Pal Singh Publication, Dehra Dun). 160 pp.

Kumar, A., T. N. Lakhanpal, and S. L. Stephenson. 1990*b*. Ecological studies of some macrofungi in the northwestern Himalayas. *Nova Hedwigia* 50: 535-547.

Manjula, B. 1983. A revised list of the agaricoid and boletoid basidiomycetes from India and Nepal. *Proc. Indian Acad. Sci. (Plant Sci.)* 92: 81-231.

Nagasawa, E. and T. Hongo. 1984. New taxa of *Amanita*: Three new species and one new form from western Japan. *Trans. Mycol. Soc. Japan* 25: 367-376.

Natarajan, K. 1977. South Indian Agaricales. III. *Kavaka* 5: 35-39.

Natarajan, K. and K. B. Purushothama. 1987. South Indian Agaricales. XXIII. *Kavaka* 15: 75-86.

Oda, T., C. Tanaka and M. Tsuda. 1999. Molecular phylogeny of Japanese *Amanita* species based on nucleotide sequences of the internal transcribed spacer region of nuclear ribosomal DNA. *Mycoscience* 40: 57-64.

Oda, T., C. Tanaka and M. Tsuda. 2002 *Amanita concentrica*: a new species in *Amanita* section *Amanita* in Japan. *Mycoscience* 43: 81-83.

Pandotra, V. R. 1997. *Illustrated fungi of north India with special reference to J. and K. State*. International Book Distributors, Dehra Dun.

Pouzar, Z. 1983. Taxonomic and nomenclatural notes on some families of larger fungi. *Česká Mykol.* 37: 172-176.

Purkayastha, R. P. and A. Chandra. 1985. *Manual of Indian Edible Mushrooms*. Today and Tomorrow's Printers and Publishers, New Delhi.

Purushothama, K. B. and K. Natarajan. 1987. *Amanita flavofloccosa*—an addition to Indian agaric flora. *Curr. Sci.* 56:1073-1074.

Rao, C. S., G. D. Sharma and A. K. Shukla. 1997. Distribution of mycorrhizal fungi in pure stands of different age groups of *Pinus kesiya*. *Canad. J. Microbiol.* 43: 85-91.

Rath, G. C. 1978. Mushroom cultivation in Orissa. *Indian Mushr. Sci.* 1: 41-48.

Ray, S. and N. Samajpati. 1979. Agaricales of West Bengal IV. *Indian J. Mycol. Res.* 17: 65-69.

Roy, A. and N. Samajpati. 1978. Agaricales of West Bengal II. *Indian J. Mushr.* 4(2): 17-23.

Roze, E. 1876*a*. Essai d'une nouvelle classification des Agaricinées. *Bull. Soc. Bot. France* 23: 45-52.

Roze, E. 1876*b*. Catalogue des Agaricinées observées aux environs de Paris. *Bull. Soc. Bot. France* 23: 108-115.

Saini, S. S. and N. S. Atri. 1993. North Indian Agaricales—IV. *Indian J. Mycol. Pl. Pathol.* 23(3): 250-254.

Sarbhoy, A. K., J. L. Varshney and D. K. Agarwal. 1996. Fungi of India, 7th supplement (1982-1992). (CBS Publishers and Distributors, New Delhi).

Sathe, A. V. and J. Daniel. 1980. Agaricales (Mushrooms) of Kerala State *in Agaricales of south west India*. A. V. Sathe, S. Deshpande, S. M. Kulkarni and J. Daniel, eds. (Maharashtra Assoc. for the Cultivation of Science, Pune): 75-108.

Sathe, A. V. and S. D Deshpande. 1980. Agaricales (Mushrooms) of Maharashtra State *in Agaricales of south west India*. A. V. Sathe, S. Deshpande, S. M. Kulkarni and J. Daniel, eds. (Maharashtra Assoc. for the Cultivation of Science, Pune): 9-42.

Sathe, A. V. and S. M. Kulkarni. 1980. Agaricales (Mushrooms) of Karnataka State *in Agaricales of south west India*. A. V. Sathe, S. Deshpande, S. M. Kulkarni and J. Daniel, eds. (Maharashtra Assoc. for the Cultivation of Science, Pune): 43-73.

Sathe, A. V. and K. C. Sasangan. 1977. Agaricales from south-west India—III. *Biovigyanam* 3: 119-121.

Shajahan, Md., N. Roy Choudhury, A. K. Saha and N. Samajpati. 1988. Mushroom flora of Khasi (Meghalaya), India. *Indian J. Mycol. Res.* 26: 75-85.

Singer, R. 1986. *The Agaricales in Modern Taxonomy*, 4th ed. (Koeltz, Koenigstein). i-viii, 1-981, pl. 1-88.

Singh, J. and B. S. Mehrotra. 1974. A survey of the gilled mushrooms in India I. *Nova Hedwigia* 47: 511-529.

Sohi, H. S., S. Kumar and P. K. Seth. 1964. Some interesting fleshy fungi from Himachal Pradesh. *Indian Phytopath.* 17: 217-222.

Stafleu, F. A. *et al.* 1978. International code of botanical nomenclature. *Regnum Veg.* 97: 1-457.

Tilak, S. T. and R. Rao. 1968. *Second supplement to the fungi of India* (1962-67). (Marathawada Univ., Marathawada).

Trivedi, T. K. 1972. Agaricales of Nagpur—I. *Botanique (Nagpur)* 3: 53-59.

Tulloss, R. E. 1993. *Amanita pachysperma, Amanita subvirginiana*, and *Amanita virginiana* (taxonomy and distribution) with notes on the description of lamella trama in *Amanita*. *Mycotaxon* 49: 449-475.

Tulloss, R. E. 1994. Type studies in *Amanita* section *Vaginatae* I: Some taxa described in this Century (studies 1-23) with notes on description of spores and refractive hyphae in *Amanita*. *Mycotaxon* 52: 305-396.

Tulloss, R. E. 1998*a* ["1997"]. Provisional world key to species closely related to *Amanita hemibapha* with notes on the slender Caesar's mushrooms of eastern North America. *McIlvainea* 13(1): 46-53.

Tulloss, R. E. 1998*b*. *Syllabus for a seminar on Amanita*. (N. Amer. Mycol. Assoc. & Mycol. Soc. San Francisco). vi+184+ii pp.

Tulloss, R. E. 2000*a*. Le *Amanita* nel mondo: bellezza, pericolo e diversità. *Boll. Gruppo Micol. G. Bresadola* 43(2): 13-21

Tulloss, R. E. 2000*b*. Note sulla metodologia per lo studio del genere *Amanita* (Agaricales). *Boll. Gruppo Micol. G. Bresadola* 43(2): 41-59.

Tulloss, R. E, S. H. Iqbal, A. N. Khalid, R. P. Bhatt and V. K. Bhatt. 2001. Studies in *Amanita* (Amanitaceae) from southern Asia. I. Some species of Pakistan's Northwest Frontier Province. *Mycotaxon* 77: 455-490.

Tulloss, R. E, C. L. Ovrebo and R. E. Halling. 1992. Studies on *Amanita* (Amanitaceae) from Andean Colombia. *Mem. New York Bot. Gard.* 66: 1-46.

Vasudeva, R. S. 1960. *The fungi of India (revised)*. (ICAR, New Delhi).

Watling, R. and N. M. Gregory. 1980. Larger fungi from Kashmir. *Nova Hedwigia* 32: 493- 564.

Yang, Z. L. 1997. Die *Amanita*-Arten von Südwestchina. *Biblioth. Mycol.* 170: 1-240.

Yang, Z. L. 2002. *Amanita eijii*—a new name for *Amanita cokeri* f. *roseotincta*. *J. Jilin Agric. Univ.* 24(2): 32-34.

Yang, Z. L. and Y. Doi. 1999. A contribution to the knowledge of *Amanita* (Amanitaceae, Agaricales) in Japan. *Bull. Nat. Sci. Mus., Tokyo, Ser. B* 25(3): 107-130.

Yang, Z. L. and T. H. Li. 2001. Notes on three white *Amanitae* of section *Phalloideae* (Amanitaceae) from China. *Mycotaxon* 78: 439-448.

Yang, Z. L., T. H. Li and Z. L. Wu. 2001. Revision of *Amanita* collections made from Hainan, southern China. *Fung. Diversity* 6: 149-165.

Yang, Z. L. and F. Oberwinkler. 1999. Die Fruchtkörperentwicklung von *Amanita muscaria* (Basidiomycetes). *Nova Hedwigia* 68(3-4): 441-468.

Yang, Z. L., M. Weiss and F. Oberwinkler. to appear. New species of *Amanita* from eastern Himalayas and adjacent regions. *Mycologia*.