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New species of *Amanita* from the eastern Himalaya and adjacent regions

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Abstract: Four new species of *Amanita,* Amanitaceae (Agaricales) are described from the eastern Himalaya and adjacent regions of southwestern China. *Amanita altipes* and *A. parvipantherina* are members of section *Amanita,* while *A. orientifulva* and *A. liquii* are representatives of section *Vaginatae.* They are compared with similar species and illustrated with line drawings.

Key words: Amanitaceae, Agaricales, Basidiomycetes, China, new taxa, systematics

INTRODUCTION

About 100 taxa of *Amanita* have been reported for China in the past hundred years (Yang 2000a). However, re-examinations of the voucher specimens demonstrated that many collections had been identified incorrectly and needed to be corrected (Yang 2000b, Yang et al 2001). We recently uncovered four undescribed amanitas from the eastern Himalaya and adjacent regions of southwestern China. They are described and illustrated herein.

MATERIALS AND METHODS

Methodology and notation follow those of Yang (1997). In descriptions of marginal striations of the pileus, the abbreviation *n*R is used, where *n* is the ratio of striation length to the radius of the pileus. The abbreviation (*n*/*m*/*p*) shall mean *n* basidiospores measured from *m* basidiocarps of *p* collections. Dimensions for basidiospores are given using notation of the form (*a*)*b*–*c*(*d*). The range *b*–*c* contains a minimum of 90% of the measured values. Extreme values, e.g., *a* or *d* are given in parentheses. Q is used to mean length/width ratio of a basidiospore in side view; **Q** means average Q of all basidiospores ± sample standard deviation. Color names with first letters capitalized are from Ridgway (1912); color codes of the form "3A4" that indicates the plate, row, and color block are from Kornerup and Wanscher (1981). Herbarium codes used follow Holmgren et al (1990) with one exception: HKAS = Herbarium of Cryptogams, Kunming Institute of Botany, Chinese Academy of Sciences, which is not listed in the Index Herbariorum or relative publications.

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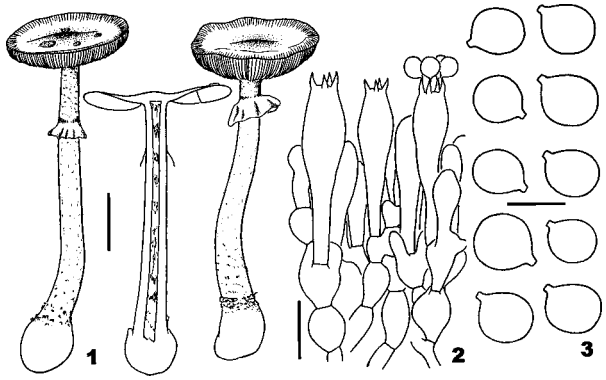
TAXONOMY

Amanita altipes Zhu L. Yang, M. Weiss et Oberw., sp. nov. FIGS. 1–4

Pileus 4–9 cm diametro, convexus vel plano-convexus, flavus vel luteus, saepe disco brunneoluteo, margine breviter striata (0.13–0.41R), flava, non appendiculata, reliquiis volvae coactis, flocculosis, applanatis, tenuibus, subflavis vel flavis ornatus. Lamellae liberae, confertae, albae ad albidae vel subflavae, margine flavida, lamellulis truncatis. Stipes 9–16 × 0.5–1.8 cm, subcylindricus vel sursum attenuatus, subflavus, sed albidus adversus bulbum, annulatus, bulbo subgloboso, 0.8–3.2 cm diametro, volvae reliquiis floccosis, flavis vel luteis obtecto, raro breviter limbato. Annulus membranaceus, cremeus vel flavidus, superior. Caro alba. Basidia 4-sporigera. Basidiosporae (7.5–)8.0–10.0(–11.5) × (7.0–)7.5–9.5(–10.0) μm, globosae vel subglobosae, non amyloideae. Fibulae absentes. Holotypus: Zhu L. Yang 2915 (HKAS 36609), 14 Aug 2000, Laojunshan, Lijiang, Yunnan, China.

Etymology: *altipes,* referring to the long stipe.

Basidiocarps (FIG. 1) small to medium-size. *Pileus* 4–9 cm diam, convex to plano-convex, broadly umbonate, yellowish to yellow (Apricot Yellow, Colonial Buff, Mustard Yellow, Straw Yellow, Warm Buff, 3A4–8), often with brownish tinge (Cinnamon-Buff, Orange-Cinnamon, 5C6–8, 5D6–8) over disk, viscid when wet; margin tuberculate-striate (0.13–0.41R), pale yellow (Pale Orange-Yellow, Light Orange-Yellow, 3A2–5), nonappendiculate; volval remnants as felty, floccose patches, 2–5 mm wide, up to 1 mm thick, yellowish to yellow to dirty yellow (Colonial Buff, Maize Yellow, Buff-Yellow, 3A2–5), randomly arranged, often washed away by rain or retained in the humus; trama white, unchanging. *Lamellae* free, crowded, white to cream-colored to yellowish (Cartridge Buff, Cream Color, Maize Yellow, 2A1–4), with yellowish to yellow edges; lamellulae truncate, plen-



FIGS. 1–3. *Amanita altipes* (from the holotype). 1. Basidiocarps. 2. Hymenium and subhymenium. 3. Basidiospores. Scale bars: 1 = 3 cm, 2 = 20 μm, 3 = 10 μm.

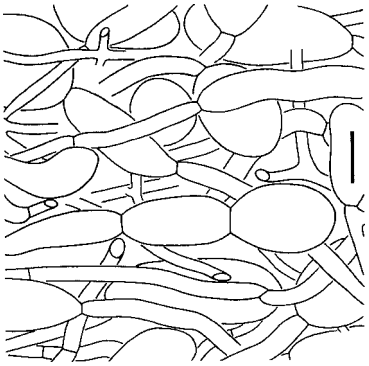


FIG. 4. Radial section of volval remnant from pileus of *Amanita altipes* (from the holotype). Scale bar = 20 μm.

tiful, evenly distributed. *Stipe* 9–16 × 0.5–1.8 cm, subcylindric or tapering upward, with apex slightly expanded, yellowish (Straw Yellow, Light Orange-Yellow, 2A2–4, 3A2–4), but becoming whitish toward stipe base, covered with yellow to yellowish (Apricot Yellow, Mustard Yellow, Straw Yellow, 3A4–8) squamules above annulus, with yellowish to whitish squamules or fibrils under annulus; context white, hollow in center; basal bulb subglobose to ovate, 0.8–3.2 cm diam, white to pallid; volval remnants as yellow to yellowish (Apricot Yellow, Mustard Yellow, Straw Yellow, 3A6–8) floccose patches or warts near apex of bulb, occasionally forming a short limb. *Annulus* persistent, pendant from attachment 1–3 cm below apex of stipe, upper surface cream-colored to yellowish (Cream Color, paler than Maize Yellow, 2A2–4), lower surface yellowish, with a yellow edge. *Odor* indistinct.

Lamellar trama bilateral. Mediostratum 50–70 μm wide, composed of abundant fusiform to subellipsoid inflated cells (70–90 × 15–30 μm), mixed with abundant, 2–6(–8) μm wide filamentous hyphae, vascular hyphae rare. Lateral stratum composed of abundant clavate to subellipsoid inflated cells (50–90 × 10–25 μm), diverging at an angle of ca 30–45° to the mediostratum; filamentous hyphae abundant, 3–7 μm wide; septa without clamps. *Subhymenium* (FIG. 2) 20–40 μm thick, with 2–3 layers of ovoid to subellipsoid to irregularly formed cells, 9–25 × 8–20 μm. *Basidia* (FIG. 2) (35–)40–60(–75) × 10–16 μm, clavate, 4-spored, rarely 2-spored; sterigmata 3–6(–8) μm long; basal septa without clamps. *Basidiospores* (FIG. 3) (363/16/7) (7.5–)8.0–10.0(–11.5) × (7.0–)7.5–9.5(–10.0) μm (Q = 1.0–1.14[–1.20], **Q** = 1.07 ± 0.04), globose to subglobose, rarely broadly ellipsoid, inamyloid, colorless, hyaline, thin-walled, smooth; apiculus small. *Lamellar edge* appearing as sterile, somewhat gelatinized strip 100–150 μm wide in side view, composed of numerous clavate to broadly clavate (30–40 × 10–20 μm) or ovoid to subglobose (18–25 × 14–20 μm) to ellipsoid (18–25 × 8–15 μm) inflated cells, single and terminal or in chains of 2–3, thin-walled, colorless, hyaline or with yellowish contents; filamentous hyphae abundant, 2–5 μm wide, thin-walled, hyaline or with yellowish vacuolar pigments, ± running parallel to the lamellar edge. *Pileipellis* 100–150 μm thick; upper layer (30–100 μm thick) strongly gelatinized, composed of subradially arranged, 2–3(–5) μm wide, thin-walled, colorless to subcolorless, filamentous hyphae, often with fine granular incrustations; lower layer (50–70 μm thick) composed of radially and compactly arranged, 3–5 μm wide hyphae, subcolorless or with yellowish vacuolar pigments; vascular hyphae rare, 3–7 μm wide. *Volval remnants* on pileus (FIG. 4) composed of ± radially to somewhat irregularly arranged elements; filamentous hyphae fairly abundant to abundant, becoming more abundant toward the pileal surface, 2–7 μm wide, thin-walled, colorless, hyaline, branching, interwoven, sometimes anastomosing; inflated cells abundant to very abundant, ovoid to subglobose (35–60 × 30–55 μm) to broadly ellipsoid (40–65 × 25–35 μm) to long ellipsoid (45–90 × 15–35 μm), sometimes broadly clavate (60–70 × 28–35 μm), single and terminal or in chains of 2–3 and then terminal, thin- to slightly thick-walled (up to 1 μm thick), colorless to subcolorless; vascular hyphae rare. Outer surface of volval remnants a layer of 10–30 μm thick composed of gelatinized and collapsed yellowish to brownish filamentous hyphae, mixed with collapsed or uncollapsed inflated cells similar to those in the interior. Volval remnants on the stipe base composed of ± irregularly arranged elements; filamentous hyphae abundant to very abundant to locally nearly dominant, 2–7(–15) μm wide, thin- to slightly thick-walled (ca 0.5 μm thick), colorless, hyaline, sometimes with yellowish vacuolar pigments; inflated cells abundant to locally very abundant,

subglobose to ovoid (20–60 × 15–50 μm) to ellipsoid (30–90 × 12–35 μm), single and terminal or in chains of 2–3 and then terminal, colorless, hyaline, occasionally with yellowish vacuolar pigments, thin- to slightly thick-walled (up to 1 μm thick); vascular hyphae rare. *Stipe trama* composed primarily of longitudinally arranged, long clavate, terminal cells, 260–450 × 25–40 μm; filamentous hyphae scattered (in interior) to fairly abundant (on stipe surface), 2–7(–12) μm wide; vascular hyphae rare, 3–10 μm wide. *Annulus* composed of loosely and subradially arranged, 2–5(–8) μm wide, thin-walled, anastomosing, filamentous hyphae; inflated cells scattered to locally fairly abundant, clavate to broadly clavate to ellipsoid (35–70 × 10–25 μm), thin-walled, hyaline, usually single and terminal; vascular hyphae rare. Upper surface of annulus gelatinized, elements often with yellow to yellowish vacuolar pigments and incrustations.

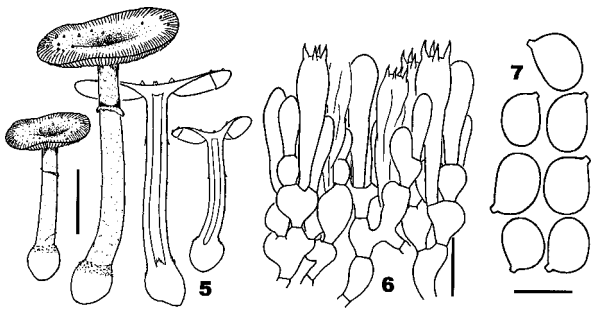
Habit, habitat and distribution. Solitary to scattered on soil under *Abies, Picea, Quercus, Betula* and/or *Salix*; fruiting from August to September in southwestern China at 2700–4000 m elevation.

Specimens examined. CHINA. SICHUAN PROVINCE: Hongyuan County, Kangle, altitude 3400 m, 11 Aug 1998, *M. S. Yuan 3263* (HKAS 33847). Luding County, Moxi, altitude 3200 m, 23 Aug 1997, *D. S. Hibbett 97-183* (FH). XIZANG AUTONOMOUS PREFECTURE (TIBET): Bomi County, Guxiang, altitude 2700 m, 12 Sep 1982, *X. L. Mao 419* (HMAS 52601, as *A. citrina* in Mao 1990). YUNNAN PROVINCE: Lijiang County, Laojunshan, altitude 3800 m, 14 Aug 2000, *Zhu L. Yang 2915* (HKAS 36609, HOLOTYPE). Zhongdian County, Daxueshan, altitude 4000 m, 23 Aug 2000, *Zhu L. Yang 2992* (HKAS 36596); same locality, 24 Aug 2000, *Zhu L. Yang 3007* (HKAS 36606). Zhongdian County, Tianchi, altitude 3900 m, 20 Aug 2000, *Zhu L. Yang 2951* (HKAS 36590).

Commentary. *Amanita altipes,* belonging in *Amanita* subgenus *Amanita* section *Amanita* (Yang 1997), resembles *A. orientigemmata* Zhu L. Yang et Yoshim. Doi and *A. pantherina* var. *lutea* W. F. Chiu, both originally described from East Asia. However, *A. altipes* differs from *A. orientigemmata* by its more slender basidiocarps with a superior annulus, wider basidiospores and radially to somewhat irregularly arranged elements with rare vascular hyphae in the volval remnants on the pileus, and absence of clamps (Yang and Doi 1999). The basidiospores of *A. orientigemmata* are (7.5–)8.0–10.0(–11.0) × (6.0–)6.5–7.5(–8.0) μm (Q = [1.07]1.15–1.46[–1.59], **Q** = 1.30 ± 0.01) (Yang and Doi 1999). *Amanita pantherina* var. *lutea* is distinguished from *A. altipes* by its whitish to grayish warts on the pileus, paler-colored gills, and proportionately narrower basidiospores with higher Q ratio. Chiu (1948) described the basidiospores of *A. pantherina* var. *lutea* as (8)9–10 × 6–7 μm, and Yang (1997) reported the basidiospores are (8.0)8.5–11.5(12.5) × (6.0)7.0–8.5(9.5) μm (Q = [1.06]1.13–1.47[–1.53], and **Q** = 1.29 ± 0.11). Furthermore, the warts on the pileus of *A. pantherina* var. *lutea* are composed of more or less vertically arranged filamentous hyphae and inflated cells (Yang 1997).

Species in the section *Amanita* having yellow to yellowish pilei and exhibiting some morphological similarities to *A. altipes* are *A. elata* (Massee) Corner et Bas, *A. gemmata* (Fr.) Bertillon, *A. russuloides* (Peck) Sacc., *A. xylinivolva* Tulloss, Ovrebo et Halling. However, *A. elata,* originally described from Singapore, differs from *A. altipes* by its more or less umber or fuliginous pileal disk, exannulate stipe, an unpleasant odor and smaller basidiospores (Corner and Bas 1962). The basidiospores of *A. elata* are 7.0–8.5 × (6.0)6.8–7.7 μm (Q = 1.0–1.1[–1.2]) (Corner and Bas 1962). *Amanita gemmata,* originally described from Europe, differs from *A. altipes* by its relatively shorter stipe, white volval remnants with fewer inflated cells and basidiospores with higher Q ratio. Breitenbach and Kränzlin (1995) reported the basidiospores of *A. gemmata* are 8.9–10.8 × 6.8–8.7 μm (Q = 1.1–1.4). Yang and Doi (1999) reported the spores of *A. gemmata* are (9.0–)9.5–12.0(–13.0) × (6.0–)6.5–8.5(–9.0) μm (Q = [1.17]1.25–1.62[–1.77], **Q** = 1.42 ± 0.13). *Amanita russuloides* (Peck) Sacc., originally described from North America, differs from *A. altipes* by its white, warty volval remnants on the pileus, white stipe and narrower basidiospores (Jenkins 1977, Tulloss et al 1995). The basidiospores of *A. russuloides* are 8.7–10.2 × 6.3–7.0 μm according to Jenkins (1977). Tulloss et al (1995) reported the basidiospores of *A. russuloides* are (8.7)9.8–10.5(10.8) × 6.6–7.7 μm. *Amanita xylinivolva,* originally described from Colombia, has fruit bodies without a pileal umbo, white to off-white to dingy gray volval remnants, whitish buff lamellae and marked to abrupt bulb (Tulloss et al 1992).

In China *A. altipes* probably was regarded as *A. pantherina* (DC. : Fr.) Krombh. originally described from Europe. But the latter is distinguished from the former by its brownish to brown pileus with white verrucous to subconical volval remnants, a proportionately shorter stipe and broadly ellipsoid to ellipsoid basidiospores. Breitenbach and Kränzlin (1995) reported the basidiospores of *A. pantherina* are 8.9–11.5 × 7.0–8.4 μm (Q = 1.2–1.5). In addition, in *A. pantherina* the volval remnants on the pileus are composed of vertically arranged elements (unpublished data of Yang studying material from the Netherlands, *Bas 7474* [L]). HMAS 52601 was regarded incorrectly as *A. citrina* (Schaeff.) Pers. by Mao (1990), but the European *A. citrina* has, among other features, a nonstriate pileus, a subtruncate bulb on the stipe



FIGS. 5–7. *Amanita parvipantherina* (from the holotype). 5. Basidiocarps. 6. Hymenium and subhymenium. 7. Basidiospores. Scale bars: 5 = 3 cm. 6 = 20 μm. 7 = 10 μm.

base and amyloid basidiospores (Breitenbach and Kränzlin 1995).

Amanita parvipantherina Zhu L. Yang, M. Weiss et Oberw., sp. nov. FIGS. 5–8

Pileus 3.5–6 cm diametro, convexus vel plano-convexus, griseus vel ochraceus, disco brunneo vel pallide brunneo, margine striata (0.27–0.4R), non appendiculata; reliquiis volvae conicis vel subconicis vel granulatis, sordide albis, griseis vel subflavis ornatus. Lamellae liberae, albae, confertae, lamellulis truncatis. Stipes 4–9 × 0.5–1 cm, subcylindricus vel sursum attenuatus, albus, annulatus, bulbo 1–2 cm diametro, subgloboso vel rapiformi, volvato. Volva granulata, alba vel subfulva vel grisea. Annulus membranaceus, albus, superior. Caro alba. Basidia 4-sporigera. Basidiosporae (8.0–)8.5–11.5(–13.5) × (6.0–)6.5–8.5(–9.0) μm, lato-ellipsoideae vel ellipsoideae, non amyloideae. Fibulae absentes. Holotypus: Zhu L. Yang 2490 (HKAS 32492), 24 Jul 1998, Huangping, Heqing, Yunnan, China.

Etymology: *parvipantherina,* a smaller mushroom similar to *A. pantherina.*

Basidiocarps (FIG. 5) small to medium-size. *Pileus* 3.5–6 cm diam, convex to plano-convex, often slightly depressed at center, grayish to ochraceous (Light Drab, Buffy Brown, 5B2–3, 5C4–6), becoming brown to brownish (Snuff Brown, Cinnamon-Brown, 5D4–6, 5E6–7) over disk, viscid when moist; margin tuberculate-striate (0.27–0.4R), nonappendiculate; volval remnants as conical, subconical to granular, small warts, up to 2 mm high, dirty white, grayish to yellowish (Cream Color, Pale Smoke Gray, Cream Buff, 2A1–3, 5B2), randomly arranged, frequently densely placed over disk; trama white, unchanging. *Lamellae* free, white (1A1), crowded, with finely fimbriate and floccose edges; lamellulae truncate, plentiful, in 2–3 ranks. *Stipe* 4–9 × 0.5–1 cm, subcylindric or slightly tapering upward, with apex slightly expanded, white (1A1), fibrillose to subglabrous; context white, loosely stuffed to hollow in center; basal bulb 1–2 cm diam, subglobose to napiform, white to pallid, with upper part covered with floccose to granular, dirty white to yellowish or grayish (Cream Color, Pale Smoke Gray, Cream Buff, 2A1–3, 5B2) volval remnants. *Annulus* present, superior, pendant from attachment 1.5–2.5 cm below apex of stipe, white (1A1), thin, membranous. *Odor* indistinct.

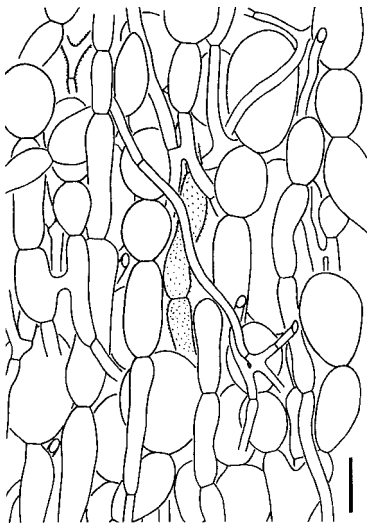


FIG. 8. Longitudinal section of volval remnant from pileus of *Amanita parvipantherina* (from the holotype). Scale bar = 20 μm.

Lamellar trama bilateral. Mediostratum 30–40 μm wide, composed of long ellipsoid to subfusiform, inflated cells, 90–130 × 10–30 μm; filamentous hyphae fairly abundant, 2–7 μm wide; vascular hyphae rare. Lateral stratum composed of long ellipsoid to fusiform inflated cells, 55–100 × 20–30 μm, diverging at an angle of 30–45° to the mediostratum; filamentous hyphae fairly abundant, 3–7 μm wide; septa without clamps. *Subhymenium* (FIG. 6) 30–40 μm thick, with 2–3(–4) layers of subglobose, ovoid to barrel-shaped cells, 10–20 × 8–17 μm. *Basidia* (FIG. 6) 38–55 × 10–13 μm, clavate, 4-spored; sterigmata 3–5 μm long; basal septa without clamps. *Basidiospores* (FIG. 7) (360/14/7) (8.0–)8.5–11.5(–13.5) × (6.0–)6.5–8.5 (–9.0) μm (Q = [1.13–]1.22–1.54[–1.62], **Q** = 1.38 ± 0.10), broadly ellipsoid to ellipsoid, rarely subglobose or elongate, inamyloid, colorless, hyaline, thin-walled, smooth; apiculus small. *Lamellar edge* appearing as sterile strip up to 100 μm wide in side view, composed of clavate to broadly clavate to sphaeropedunculate cells (25–40 × 10–22 μm), single and terminal or in terminal chains of 2–3, thin-walled, colorless, hyaline; filamentous hyphae very abundant, 2–5 μm wide, gelatinized, irregularly arranged or ± running parallel to the lamellar edge. *Pileipellis* 100–150 μm thick; upper layer (60–80 μm thick) strongly gelatinized, composed of subradially arranged to somewhat interwoven 3–5 μm wide, colorless to sub-

colorless, moderately gelatinized, filamentous hyphae; lower layer (40–70 μm thick) composed of radially and compactly arranged, 3–6 μm wide filamentous hyphae, sometimes with intercalary segments inflated to 8–10(–12) μm wide, often with brownish vacuolar pigments; vascular hyphae rare, 3–6 μm wide. *Volval remnants* on pileus (FIG. 8) composed of ± vertically, at wart base subvertically, arranged elements; inflated cells abundant to nearly dominant, subglobose, ovoid to short ellipsoid (20–65 × 10–40 μm) or ellipsoid to subfusiform (35–60 × 15–30 μm), often in chains of 2–4, thin-walled to slightly thick-walled (ca 0.5 μm thick), colorless, hyaline to subhyaline, sometimes with fine incrustations; filamentous hyphae fairly abundant, 2–8 μm wide, thin-walled, colorless, hyaline to subhyaline; vascular hyphae rare or locally conspicuous, 2–7 μm wide. Volval remnants on stipe base and upper bulb with structure similar to those on pileus, but elements irregularly arranged and filamentous hyphae more abundant. *Stipe trama* composed primarily of longitudinally arranged, long clavate, terminal cells, 200–410 × 25–45 μm; filamentous hyphae 2–7(–10) μm wide, scattered to fairly abundant in interior, abundant on stipe surface; vascular hyphae rare. *Annulus* composed primarily of filamentous, 2–7 μm wide hyphae, somewhat loosely and subradially arranged, frequently branching, anastomosing, interwoven, thin-walled, colorless, hyaline; inflated cells fairly abundant to locally abundant, clavate to long ellipsoid (35–130 × 10–30 μm), occasionally subglobose to ovoid (20–45 × 15–30 μm), usually single and terminal, rarely 2–3 in chains; vascular hyphae rare.

Habit, habitat and distribution. Solitary to scattered on soil in mixed forests with *Pinus yunnanensis*; fruiting from July to August in Yunnan, southwestern China at 1200–2500 m elevation.

Specimens examined. CHINA. YUNNAN PROVINCE: Binchuan County, Jizushan, 9 Aug 1985, *G. P. Xiao 529* (HKAS 17032). Heqing County, Huangping, altitude 2500 m, 24 Jul 1998, *Zhu L. Yang 2490* (HKAS 32492, HOLOTYPE). Menghai County, Mangao Nature Reserve, altitude 1200 m, 14 Aug 1991, *Zhu L. Yang 1519* (HKAS 24180). Simao County, Zhala Yakou, altitude 1730 m, 1 Aug 1991, *Zhu L. Yang 1338* (HKAS 24202). Tengchong County, Mingguang, 2 Aug 1980, *M. Zang 6301* (HKAS 6301). Wuding County, Sishan, 27 Jul 1988, *L. S. Wang 9 and 10* (HKAS 20886 and 20887 respectively).

Commentary. *Amanita parvipantherina* is a member of *Amanita* subgenus *Amanita* section *Amanita* (Yang 1997). A few collections cited above were regarded incorrectly as *A. pantherina* (DC. : Fr.) Krombh., but the latter has more robust basidiocarps with shorter striations on the pileal margin, a short limbate collar on the stipe base and more abundant filamentous hyphae in the white volval remnants on the pileus (Breitenbach and Kränzlin 1995; Yang 1997, unpublished data of Yang studying material from the Netherlands (THE NETHERLANDS. ZÜID-HOLLAND: Wassenaar, 2 Sep 1979, *C. Bas 7474* [L]). *Amanita parvipantherina* is similar to *A. sychnopyramis* f. *subannulata* Hongo (Hongo 1971) but differs from the latter by its somewhat smaller basidiocarps with a superior annulus and larger, broadly ellipsoid to ellipsoid basidiospores. The basidiospores of *A. sychnopyramis* f. *subannulata* are mostly globose to subglobose, (6.0–)6.5–8.5(–9.5) × 6.0–8.0(–9.0) μm (Q = [1.0]1.03–1.14[–1.19], **Q** = 1.07 ± 0.04) (Yang 1997). In addition, the warts on the pileus of *A. parvipantherina* are composed of more abundant filamentous hyphae than those of *A. sychnopyramis* f. *subannulata*. *Amanita parvipantherina* also resembles *A. sychnopyramis* Corner et Bas f. *sychnopyramis* but differs from the latter by the presence of an annulus, longer basidia, and larger, broadly ellipsoid to ellipsoid basidiospores. The basidia of *A. sychnopyramis* f. *sychnopyramis* are 26–32 × 10–11 μm, and the basidiospores of this taxon are globose to subglobose, 6.3–8.1 μm, Q = 1.0–1.1 (Corner and Bas 1962).

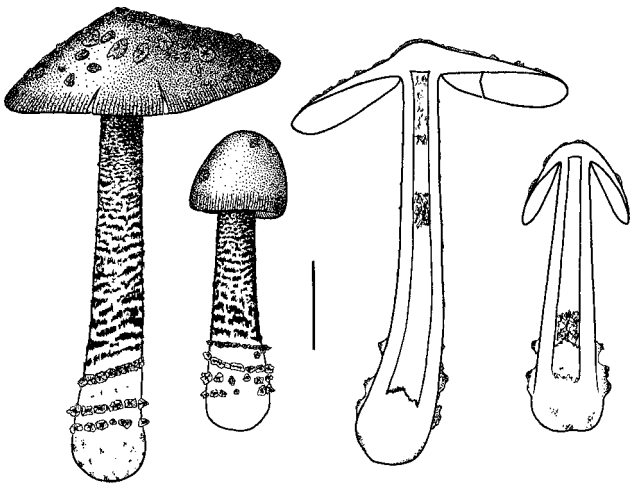
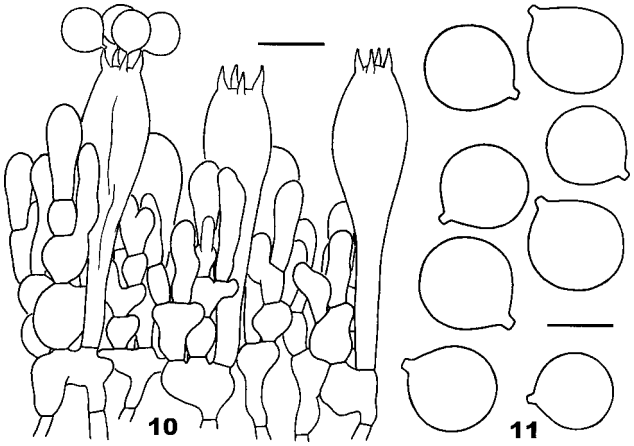


FIG. 9. Basidiocarps of *Amanita liquii* (from the holotype). Scale bar: 9 = 4 cm.

Amanita liquii Zhu. L. Yang, M. Weiss et Oberw., sp. nov. FIGS. 9–12

Pileus 10–14 cm diametro, convexus vel applanatus, obscure umbonatus, atrofuscus, ad marginem atrobrunneo, margine sulcata (0.15–0.25R), non appendiculata, reliquiis volvae coactis, flocculosis vel verrucosis, atrogriseis vel nigricantibus ornatus. Lamellae liberae, griseolae, confertae; lamellulae truncatae. Stipes 13–17 × 1.5–3 cm, subcylindricus vel sursum attenuatus, haud bulbosus, albidus vel brunneolus, cavus, squamellis atrogriseis ad nigricantibus, exannulatus, volvatus. Volva grisea vel atrogrisea, interdum



FIGS. 10–11. *Amanita liquii* (from the holotype). 10. Hymenium and subhymenium. 11. Basidiospores. Scale bars: 10 = 20 μm. 11 = 10 μm.

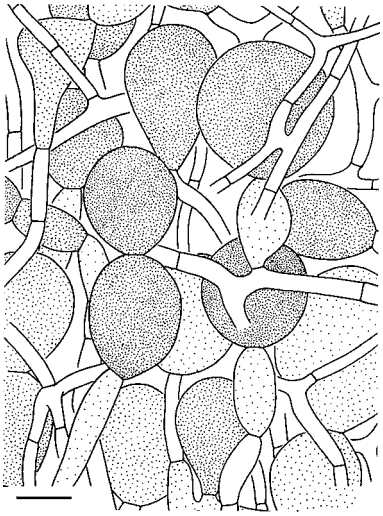


FIG. 12. Longitudinal section of upper part of a verrucous volval remnant from pileus of *Amanita liquii* (from the holotype). Vacuolar pigments are indicated by shades of gray. Scale bar = 20 μm.

brunneola, verrucosa. Caro albida. Basidia 4-sporigera. Basidiosporae (11.0–)11.5–15.0(–24.0) × (9.5–)11.0–14.5(–20.0) μm, globosae vel subglobosae, non amyloideae. Fibulae absentes. Holotypus: Zhu L. Yang 2916 (HKAS 36611), 14 Aug 2000, Laojunshan, Lijiang, Yunnan, China.

Etymology: *A. liquii* is named for Li Qui (Li Kui), a historic Chinese hero, said to have a dark face.

Basidiocarps (FIG. 9) large. Pileus 10–14 cm diam, at first nearly hemispherical, then convex to planoconvex, center often slightly umbonate, sepia to blackish (Warm Sepia, Clove Brown, Fuscous to Fuscous-Black, 6F3–7), becoming blackish brown to dark brown (Brussels Brown, Raw Umber, Medal Bronze, Cinnamon-Brown, Natal Brown, 6D3–5, 6E3–7) toward margin, lacking any yellow tint at all stages of development; margin tuberculate-striate (0.15–0.25R), nonappendiculate; volval remnants dark gray to sepia, sometimes gray (Warm Sepia, Medal Bronze, 6D2–3, 6E2–4, 6F3–5), felty to irregularly formed to verrucous, 2–10 mm diam, 1–3 mm thick (high); trama white, but grayish to gray just beneath pileipellis, unchanging. *Lamellae* free, crowded, white to cream-colored (Cream Color, 1A1–2) when young, grayish (much paler than Pale Smoke Gray, paler than 3B2) when mature, becoming brownish gray, dark gray to fuscous (paler than Fuscous, 5C3–5, 5D3–5, 5E3–5) when dried; lamellar edges blackish to dark brown (Medal Bronze, Natal Brown, 6E3–5, 6F5–7); lamellulae truncate to subtruncate, plentiful, evenly distributed. *Stipe* 13–17 × 1.5–3 cm, subcylindric or slightly tapering upward, with apex slightly expanded, whitish to brownish, densely covered with dark gray to blackish (Warm Sepia, Medal Bronze, Raw Umber, 6E3–6, 6F4–7) squamules often in belts; context white but at very base often grayish, sometimes brownish to light rusty brown, hollow in center; basal bulb lacking; volval remnants verrucous to subconical to granular, gray to dark gray to brownish (Smoky Gray, Drab, Mouse Gray, 5C1–4) in apical parts, becoming paler toward base of remnants, arranged in incomplete belts at stipe base. *Annulus* lacking. *Odor* indistinct.

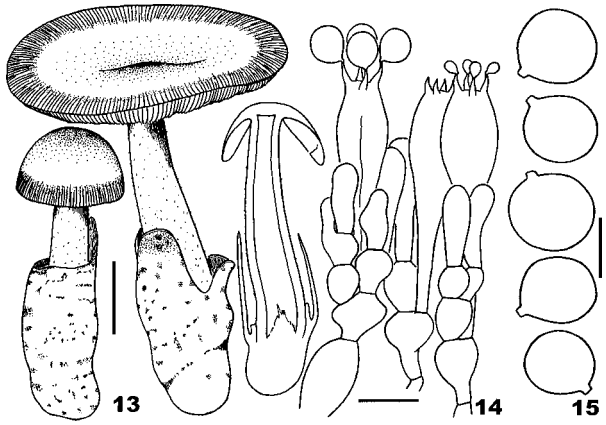
Lamellar trama bilateral. Mediostratum 30–50 μm wide, composed of fairly abundant, long ellipsoid to subfusiform inflated cells (30–90 × 10–25 μm) and abundant interwoven, often anastomosing, 2–7 μm wide filamentous hyphae; vascular hyphae rare. Lateral stratum composed of fairly abundant, long ellipsoid to subfusiform (55–70 × 20–28 μm), sometimes to ellipsoid (55–70 × 20–28 μm) inflated cells, diverging at an angle of ca. 30–45° to mediostratum; filamentous hyphae abundant, 2–6 μm wide, frequently branching, interwoven, sometimes anastomosing; vascular hyphae rare, 3–7 μm wide. *Subhymenium* (FIG. 10) 40–60(–70) μm thick, with (2)3–4 layers of subglobose to ovoid or irregularly shaped cells 12–30 × 10–25 μm, sometimes mixed with a few hardly inflated cells 5–7 μm wide. *Basidia* (FIG. 10) 55–95 × 16–25 μm, clavate, 4-spored, rarely 1- or 2-spored; sterigmata 6–10 μm long; basal septa without clamps. *Basidiospores* (Fig. 11) (220/9/7) (11.0–)11.5–15.0(–24.0) × (9.5–)11.0–14.5(–20.0) μm (Q = 1.0–1.09[–1.21], **Q** = 1.05 ± 0.04), globose to subglobose, rarely broadly ellipsoid, inamyloid, colorless, hyaline, thin-walled, smooth; apiculus small. *Lamellar edge* appearing as sterile, gray-brown to dark brown strip up to 250 μm wide in side view, predominantly composed of inflated cells, ovoid to subglobose or short ellipsoid (20–60 × 15–50 μm), often in chains of 2–3, sometimes sphaeropedunculate to

pyriform (35–65 × 20–35 μm), then single and terminal, with brownish to brown to gray-brown vacuolar pigments, occasionally nearly colorless and hyaline; filamentous hyphae fairly abundant to scattered, 2–7 μm wide, with brownish vacuolar pigments or nearly colorless. *Pileipellis* 100–180 μm thick; upper layer (20–70 μm thick) slightly to moderately gelatinized, composed of ± radially and moderately compactly arranged, 2–5 μm wide, thin-walled, colorless to nearly colorless, slightly to moderately gelatinized filamentous hyphae; lower layer (80–120 μm thick) composed of radially and compactly arranged, 3–7 μm wide filamentous hyphae, sometimes with intercalary segments inflated to 15 μm wide, usually with dark yellowish brown, vacuolar pigments; terminal cells present, 5–12 μm wide, hardly inflated; vascular hyphae rare to locally scattered, 3–10 μm wide. *Volval remnants* on pileus: the verrucous remnants (FIG. 12) composed of ± vertically, at volval base irregularly, arranged elements; felty remnants composed of ± irregularly arranged elements. Inflated cells very abundant (to dominant), subglobose (25–80 × 20–70 μm) or ovoid to broadly clavate (30–50 × 25–38 μm), becoming larger toward the pileipellis, single and terminal, or in chains of 2–3(–4) and then terminal, thin- to slightly thick-walled (up to 1.0 μm thick), usually with brown to dark brown, vacuolar pigments, occasionally colorless and hyaline; filamentous hyphae fairly abundant, not becoming more abundant toward the pileipellis, 3–8 μm wide, frequently branching, often anastomosing, thin-walled, colorless, hyaline or with brownish vacuolar pigments; vascular hyphae rare, 2–8 μm wide. Volval remnants on stipe base similar to those on the pileus, but inflated cells and filamentous hyphae irregularly arranged, and the vacuolar pigments locally much paler. *Stipe trama* composed primarily of longitudinally arranged, clavate to long clavate, terminal cells, 70–400 × 16–50 μm; filamentous hyphae 2–7 μm wide, scattered (in interior) or fairly abundant to abundant (on stipe surface), colorless and hyaline (in interior), or with brown to dark brown vacuolar pigments (on stipe surface); vascular hyphae 3–15 μm wide, rare to locally conspicuous.

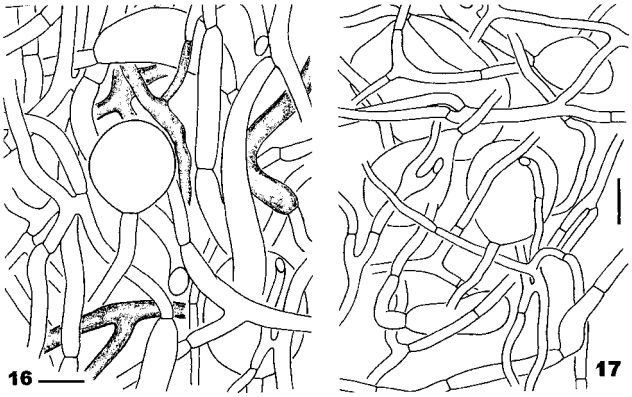
Habit, habitat and distribution. Scattered on soil under *Abies* and/or *Picea*; fruiting from July to September in southwestern China at 2900–4000 m elevation.

Specimens examined. CHINA. SICHUAN PROVINCE: Yanyuan County, Beilingshan, altitude 3820 m, 9 Aug 1983, *K. K. Chen 541* (HKAS 14096, as *A. ceciliae* in Yang 1997). YUNNAN PROVINCE: Dali Municipality, Huadianba, altitude 2900 m, 10 Jul 1984, *J. X. Xi 569* (HKAS 378, as *A. ceciliae* in Yang 1997). Deqin County, Baimaxueshan, altitude 3700 m, 11 Jul 1981, *J. W. Chen 34* (HKAS 8575, as *A. ceciliae* in Yang 1997). Lijiang County, Laojunshan, altitude 3900 m, 14 Aug 2000, *Zhu L. Yang 2916* (HKAS 36611, HOLOTYPE). Lijiang County, Laojunshan, altitude 4000 m, 25. Sep 2000, *M. Zang 13712* (HKAS 37052). Zhongdiang County, Xiaozhongdian, altitude 3900 m, 24 Aug 1984, *K. K. Chen & Y. Xuan 19* (HKAS 14242, as *A. ceciliae* in Yang 1997). XIZANG AUTONOMOUS PREFECTURE (TIBET): Chayu, Ridong, altitude 3500 m, 18 Sep 1982, *M. Zang 1005* (HKAS 11254, as *A. ceciliae* in Yang 1997).

Commentary. *Amanita liquii* is characterized by its dark-colored, robust fruit body with grayish lamellae, dark-colored volval remnants on the pileus, verrucous volval remnants in belts at the nonbulbous stipe base, and globose to subglobose, inamyloid basidiospores. Several collections cited above were regarded as *A. ceciliae* by Yang (1997). *Amanita liquii* is similar to *A. ceciliae* (Berk. et Broome) Bas, *A. beckeri* Huijsman ex Huijsman, *A. cinctipes* Corner et Bas, and *A. sororcula* Tulloss, Ovrebo et Halling. Actually, several Chinese amanitas of this group have been determined as *A. ceciliae,* originally described from Europe (Teng 1936 and 1996 as *Amanitopsis strangulata* [Fr.] Roze; Mao 1990 as *A. inaurata* Secr. ex Gillet; Yang 1997). However, the European *A. ceciliae* differs from *A. liquii* by its yellow-brown, reddish-brown to gray-brown or olive-brown pileus covered with lighter-colored (grayish to brownish) volval remnants, white lamellae with white edge, much paler-colored squamules on the stipe and somewhat smaller basidiospores. The basidiospores of *A. ceciliae* are 10.4–14.1 × 9.7–14.0 μm (Breitenbach and Kränzlin 1995). Furthermore, the volval remnants at the base of the stipe of *A. ceciliae* often form a ring-zone above a strangulate region and a floccose, nearly cupulate structure at the very base of the stipe (Phillips 1990, Breitenbach and Kränzlin 1995). The vacuolar pigments in the cells of the sterile strip along lamellar edge and volval remnants on the pileus of *A. liquii* are much darker than those of European *A. ceciliae* (FRANCE. JURA: near Noga, 2 Oct 1992, *C. Bas 9341* [L]). *Amanita beckeri,* originally described from Europe, differs from *A. liquii* by its differently colored pileus, lighter-colored volval remnants and smaller basidiospores (Huijsman 1962a, b, Tulloss 1994). The basidiospores of *A. beckeri* are (8.8)9.8–11.8(13.0) × (7.2)9.0–11.0(12.2) μm (Tulloss 1994). *Amanita cinctipes,* originally described from Southeast Asia, is distinguished from *A. liquii* by its slender fruit body lacking an umbo on the pileus, smaller basidia and smaller basidiospores (Corner and Bas 1962). Basidia and the basidiospores of *A. cinctipes* are 40–50 × 15–15 μm and 8.2–11.1 × 7.8–10.1 μm respectively (Corner and Bas 1962). *Amanita sororcula,* originally described from Colombia, differs from *A. liquii* by its smaller and more slender fruit



FIGS. 13–15. *Amanita orientifulva* (from the holotype). 13. Basidiocarps. 14. Hymenium and subhymenium. 15. Basidiospores. Scale bars: 13 = 3 cm. 14 = 20 μm. 15 = 10 μm.



FIGS. 16–17. Longitudinal section of the outer layer of the interior of the volval limb at stipe base. Vascular hyphae are shaded. 16. *Amanita orientifulva* (from the holotype). 17. *Amanita fulva* (from N. Arnold box II). Scale bar = 20 μm.

body with longer marginal striations on the pileus, volval remnants tending to darken considerably with age and smaller basidiospores (Tulloss et al 1992, Tulloss pers comm). The basidiospores of *A. sororcula* are (8.8)9.7–12.8(16.8) × (8)8.8–12(15.5) μm (Tulloss et al 1992).

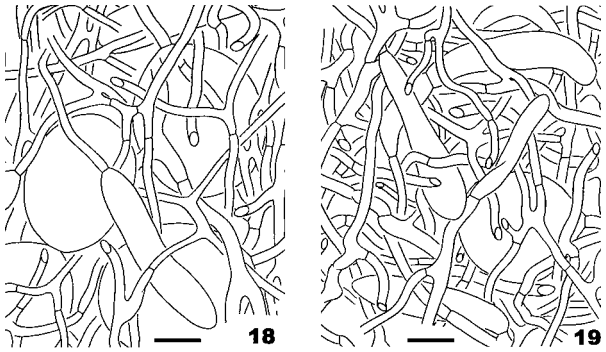
Amanita orientifulva Zhu L. Yang, M. Weiss et Oberw., sp. nov. FIGS. 13–16, 18

Pileus 5–14 cm diametro, convexus vel applanatus, obscure umbonatus, ochraceus, fulvus, brunneus, disco fulvo, brunneo vel atrobrunneo, margine sulcata (0.2–0.35R, raro ad 0.5R), non appendiculata. Lamellae liberae, albae vel cremeae, confertae; lamellulae truncatae. Stipes 8–15 × 0.5–3 cm, sursum attenuatus, haud bulbosus, cavus, squamellis brunneis vel fulvis, exannulatus, volvatus. Volva saccata, membranacea, alba, margine brunnescente. Caro albida vel cremea. Basidia 4-sporigera. Basidiosporae (8.5–)10.0–14.0(–17.0) × (8.0–)9.5–13.0(–16.5) μm, globosae vel subglobosae, non amyloideae. Fibulae absentes. Holotypus: Zhu L. Yang 2461 (HKAS 32522), 26 Jul 1998, Dongwang, Zhongdiang, Yunnan, China.

Etymology: *orientifulva* is proposed because of the eastern Asian mushroom's similarity to *A. fulva*.

Basidiocarps (FIG. 13) medium-size to large. *Pileus* 5–14 cm diam, at first hemispherical, then convex to plano-convex, obtusely umbonate, fulvous to brown or dark brown (Raw Umber, Antique Brown, Cinnamon-Brown, Orange-Cinnamon, 5C6, 5D6–7) over disk, becoming ochreous, yellowish brown to fulvous (Ochraceous-Tawny to Ochraceous-Orange, 5B5–6, 5C6, 4A4–5) toward margin, often with an indistinctly darker-colored ring-like zone at the proximal end of the marginal striation, glabrous; margin tuberculate-striate (0.2–0.35R, rarely up to 0.5R), nonappendiculate; trama white to dirty white to cream-colored, unchanging. *Lamellae* free, crowded, white to cream-colored (Cream Color, 1A1–2), with brown to brownish edges; lamellulae truncate, plentiful, evenly distributed. *Stipe* 8–15(–20) × 0.5–3 cm, usually tapering upward, with apex slightly expanded, dirty white to brownish (1A1, much paler than 5B4), covered with brown to fulvous or grayish brown (5B3–5) squamules; context white, hollow in center; basal bulb lacking; volva saccate, (2–)4–6(–9) × (1–)1.5–5 cm, membranous, outer surface white (1A1), often with rusty (6C5–6) spots, upper margin often brownish, inner surface pale brown (paler than 5B4), 1–3 mm thick, with *limbus internus* placed rather high on inside of volval limb or at point of attachment between stipe and volval limb. *Annulus* lacking. *Odor* indistinct.

Lamellar trama bilateral. Mediostratum 40–50 μm wide, composed of fairly abundant subfusiform to ellipsoid or clavate, inflated cells (45–100 × 15–25 μm); filamentous hyphae abundant, 3–7 μm wide; vascular hyphae rare. Lateral stratum composed of



FIGS. 18–19. Longitudinal section of the inner layer of the interior of the volval limb at stipe base. 18. *Amanita orientifulva* (from the holotype). 19. *Amanita fulva* (from N. Arnold box II). Scale bar = 20 μm.

abundant clavate to subfusiform, inflated cells (55–100 × 20–30 μm), diverging at an angle of 30–45° to mediostratum; filamentous hyphae abundant, 2–7(–12) μm wide. *Subhymenium* (FIG. 14) 30–50 μm thick, with 2–3(–4) layers of subglobose to ovoid or short ellipsoid cells, 10–25(–30) × 10–20(–25) μm. *Basidia* (FIG. 14) 50–85(–95) × 15–20(–22) μm, clavate, 4-spored; sterigmata 5–8 μm long; basal septa without clamps. *Basidiospores* (FIG. 15) (585/27/17) (8.5–)10.0–14.0(–17.0) × (8.0–)9.5–13.0(–16.5) μm (Q = 1.0–1.12[–1.23], **Q** = 1.06 ± 0.04), globose to subglobose, rare broadly ellipsoid, inamyloid, colorless, hyaline, thin-walled, smooth; apiculus small. *Lamellar edge* microscopically appearing as a sterile, somewhat gelatinized, yellowish strip 100–200 μm wide in side view, composed of very abundant, ovoid to subglobose or sphaeropedunculate, thin-walled, colorless, inflated cells (25–70 × 20–40 μm), sometimes showing yellowish contents and appearing single and terminal or in terminal chains of 2–3; filamentous hyphae abundant, 2–5(–8) μm wide, gelatinized, colorless, hyaline or yellowish, ± running parallel to the lamellar edge. *Pileipellis* 60–100 μm thick; upper layer (30–50 μm thick) strongly gelatinized, composed of ± radially arranged, 1–3 μm wide filamentous hyphae, thin-walled, colorless to subcolorless; lower layer (30–50 μm thick) composed of radially and compactly arranged, 3–8(–12) μm wide filamentous hyphae, often with brownish to brown, vacuolar pigments; vascular hyphae rare (to scattered), 3–12 μm wide. Interior of volval limb on stipe base composed of two layers intergrading into each other. Outer layer (FIG. 16) composed of longitudinally to irregularly arranged elements: filamentous hyphae dominant, (2–)4–10(–12) μm wide, colorless, hyaline or sometimes with brownish to brown contents, slightly thick-walled (ca 0.5 μm thick), branching, anastomosing; inflated cells scattered to fairly abundant, subglobose to ovoid (40–70 × 30–55 μm) to long ellipsoid to subfusiform (80–90 × 30–35 μm), colorless, hyaline or with brownish contents, slightly thick-walled (ca 0.5 μm thick), usually single and terminal, sometimes in chains of 2; vascular hyphae scattered to locally conspicuous, 3–10 μm wide. Inner layer (FIG. 18) composed of very abundant 2–8 μm wide, colorless, hyaline, slightly thick-walled filamentous hyphae (up to 0.5 μm thick); inflated cells fairly abundant to locally abundant, subglobose to ovoid (35–100 × 30–85 μm), long ellipsoid to subfusiform (55–120 × 15–40 μm), single and terminal or intercalary, or in chains of 2–3, colorless, hyaline to subhyaline, thin- to slightly thick-walled (ca 0.5 μm thick); vascular hyphae rare, 3–10 μm wide. Outer surface of the volval limb similar to the interior of the outer layer but often with more abundant, somewhat gelatinized filamentous hyphae; inner surface strongly gelatinized, composed of 1.5–3 μm wide filamentous hyphae. Volval remnants on pileus lacking. *Stipe trama* composed primarily of longitudinally arranged, long clavate, terminal cells, 200–350 × 30–40 μm; filamentous hyphae 2–8 μm wide, scattered (in interior) to abundant (on stipe surface), colorless, hyaline (in interior) or with yellowish, vacuolar pigments (on stipe surface); vascular hyphae rare, 2–15 μm wide.

Habit, habitat, and distribution. Solitary or scattered on soil under *Abies, Quercus* and/or *Salix,* sometimes under *Castanopsis*; fruiting from June to September in southwestern China at 1300–4200 m elevation.

Specimens examined. CHINA. GUIZHOU PROVINCE: Suiyang County, Kuankuoshui, altitude 1300 m, 17 Jun 2000, *X. L. Wu 819* (HKAS 35989). SICHUAN PROVINCE: Daocheng County, altitude 3800 m, 4 Jul 1998, *Zhu L. Yang 1984* (HKAS 32531). Jiulong County, Jichoushan, altitude 3500 m, 11 Sep 1996, *M. S. Yuan 2682* (HKAS 31133). Kangding County, Gonggashan, 14 Jul 1984, *J. J. Su & H. A. Wen 1129* (HMAS 50987, as *Amanita fulva* in Ying et al 1994). Luding County, Moxi, altitude 3000 m, 12 Aug 1997, *P. Q. Sun 2906* (HKAS 31360). Xiangcheng County, Daxueshan, altitude 4060 m, 24 Jul 1998, *Zhu L. Yang 2423* (HKAS 32530); same locality, altitude 4000 m, 27 Jul 1998, *Zhu L. Yang 2474* (HKAS 32470). Xiangcheng County, Reda, altitude 3450 m, 15 Jul 1998, *Zhu L. Yang 2333* (HKAS 32483); same locality, altitude 3600 m, 16 Jul 1998, *Zhu L. Yang 2344* (HKAS 32457). Xiangcheng County, Wumingshan, altitude 4100 m, 12 Jul 1998, *Zhu L. Yang 2290* (HKAS 32478). YUNNAN PROVINCE: Deqin County, Meilishi, altitude 4200 m, 29 Aug 2000, *Zhu L. Yang 3017* (HKAS 36604). Lijiang County, Laojunshan, altitude 3850 m, 13 Aug 2000, *Zhu L. Yang* 2911 (HKAS 36586). Yiliang County, Mugan, altitude 1800 m, 20 Sep 2000, *Zhu L. Yang 2519* (HKAS 32664). Zhongdiang County, Daxueshan, altitude 3800 m, 24 Aug 2000, *Zhu L. Yang 3016* (HKAS 36603). Zhongdiang County, Dongwang, altitude 3800 m, 26 Jul 1998, *Zhu L. Yang 2461* (HKAS 32522, HOLOTYPE); same locality, altitude 3800 m, 26 Jul 1998, *Zhu L. Yang 2459* (HKAS 32464).

Commentary. Amanita orientifulva, belonging in *Amanita* subgenus *Amanita* section *Vaginatae* (Fr.) Quél. in the sense of Yang (1997), is rather common and widely distributed in China. This species is very similar to *A. fulva* (Schaeff.) Fr., originally described from Europe. In fact, *A. orientifulva* usually was regarded as *A. fulva* in China (Ying et al 1994). However, there are a few features separating *A. orientifulva* from *A. fulva.* The main morphological or anatomical difference between *A. orientifulva* and *A. fulva* might be the volval structure. The interior of the volval limb of *A. fulva* (GERMANY. BAVARIA: Bayerisches Wald, 18 Oct 1987, *N. Arnold box II* [L]) can be distinguished into two layers: The outer layer is

composed of loosely and irregularly arranged, fairly abundant to abundant filamentous hyphae and fairly abundant to abundant inflated cells; the inner layer is composed predominantly of irregularly arranged filamentous hyphae, mixed with scattered to locally fairly abundant inflated cells (FIGS. 17, 19). Hyphae on the outer surface of the volva in *A. fulva* usually are broken during fruit body development. On the contrary, the outer layer of the volva of *A. orientifulva* is primarily composed of much more compactly and more or less longitudinally arranged, filamentous hyphae mixed with fewer inflated cells and scattered to locally conspicuous vascular hyphae, and the inner layer consists of more inflated cells (FIGS. 16, 18). Hyphae on the outer surface of the volva in *A. orientifulva* do not break during fruit body development. Furthermore, *A. orientifulva* is distinguished from *A. fulva* by its generally larger basidiocarps often with a somewhat darker-colored ring-like zone at the proximal end of the marginal striations of the pileus and somewhat larger basidiospores (Tulloss 2000). The basidiospores of *A. fulva* are (9.0–)10.0–12.5(–19.3) × (8.2–)9.3–12.0(–15.5) μm (Tulloss 2000).

Amanita orientifulva is phenetically somewhat similar to *A. sampajensis* Sathe et Kulkarni, *A. fuligineodisca* Tulloss, Ovrebo et Halling and *A. humboldtii* Singer. *Amanita sampajensis,* known from India, has an isabelline to hazel pileus, dark olivaceous brown stipe, white volva and a pileipellis with wavy hyphae with olivaceous contents (Sathe et al 1980, Tulloss et al 1992). *Amanita fuligineodisca* and *A. humboldtii,* both originally described from Colombia, have smaller fruit bodies, usually with longer marginal striations on the darker pileus and thinner pileipellis. Furthermore, there is no pronounced division of structure within the interior of the volval limb of *A. fuligineodisca* and *A. humbolditii* (Tulloss et al 1992, Tulloss pers comm).

In the protologue of *A. aporema* Boedijn, a poorly known species described from Indonesia, it was supposed that *A. aporema* might be confused with *A. fulva* (Boedijn 1951:320). We have studied the only specimen cited by Boedijn under *A. aporema* (INDONESIA. SUMATRA: Batang Paleopoeh, exact day unknown, Jul 1924, *E. Jacobson s.n.* [HOLOTYPE, BO]). It reveals that the basidiospores are inamyloid, (35/1/1) (9.0–)9.5–11.0(–12.5) × (8.0–)8.5–10.5 (–12.0) μm (Q = [1.0–]1.02–1.11[–1.15], **Q** = 1.08 ± 0.04) and clamps are common in all parts of the fruit body. These data indicate that *A. aporema* is more closely related to *A. princeps* Corner et Bas than to *A. fulva* and its allies. Based on the original description and examination of the poorly preserved holotype, it appears that *A. aporema* differs from *A. orientifulva* at least by its dirty white, smooth stipe, somewhat smaller basidiospores and the presence of clamps.

ACKNOWLEDGMENTS

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