

A Contribution to the Knowledge of *Amanita* (Amanitaceae, Agaricales) in Japan

Zhu-Liang Yang¹ and Yoshimichi Doi²

¹Kunming Institute of Botany, the Chinese Academy of Sciences,
Kunming 650204, P. R. China

²Department of Botany, National Science Museum,
4-1-1 Amakubo, Tsukuba, Ibaraki, 305-0005 Japan

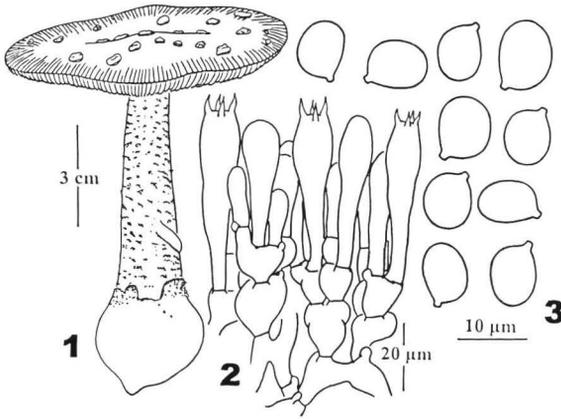
Abstract Specimens of the genus *Amanita* collected from Japan and deposited in the herbarium of the Department of Botany, National Science Museum, Tsukuba, Ibaraki, Japan (TNS) were studied. Eighteen taxa, including two species new to science and two taxa new to Japan are reported here. Brief notes on a few type specimens of the Amanitae described by T. Hongo are also included in the present account. The new species are *Amanita orientogemmata* and *A. oberwinklerana*, while the new records are *A. manginiana sensu* Chiu and *A. subjunquillea* var. *alba*. *Amanita sphaerobulbosa* is treated as a distinct species, independent of *A. abrupta*.

Key words: *Amanita*, *A. orientogemmata*, *A. oberwinklerana*, Japan, East Asia

The Amanitae in Japan are relatively well known thanks to the researches of several active mycologists (Bas, 1969; Bas & Hatanaka, 1984; Hongo, 1953–1983; Imai, 1933, 1938, 1939; Imazeki & Hongo, 1970, 1975, 1987; Imazeki & Toki, 1955; Imazeki *et al.*, 1988; Ito, 1959; Matsuda & Hongo 1955, 1956; Nagasawa & Hongo, 1984, 1985; Tulloss *et al.*, 1992 a, and many others). It is interesting to note that T. Hongo alone has described thirteen new taxa of *Amanita* from Japan (Doi, 1991), many of which are also found in China (Mao, 1991; Yang, 1994, 1997). During a cooperative research between China and Japan, we studied some specimens of the Amanitae collected from Japan by Y. Doi and his colleagues. In order to understand better the concept of some species described by T. Hongo, his type collections were also examined. Having studied type material as well as newly collected and well dried specimens, we add some new data to the Japanese *Amanita*-flora. Color codes of the form e.g., 3B4 are from Kornerup & Wanscher (1981); color names with first letters capitalized (e.g., Cream Color) are from Ridgway (1912).

Subgenus *Amanita* Section *Amanita*

1. *Amanita orientogemmata* Z. L. Yang & Y. Doi, sp. nov. Figs. 1–4
Name misapplied to the present species: *Amanita gemmata sensu* Nagasawa & Hongo in Mem. Natn. Sci. Mus., Tokyo 18: 73 (1985); non *Amanita gemmata*



Figs. 1–3. *Amanita orientogemmata* (TNS-F-198537, Holotype). 1. Basidiocarp; 2. Hymenium and subhymenium; 3. Basidiospores.

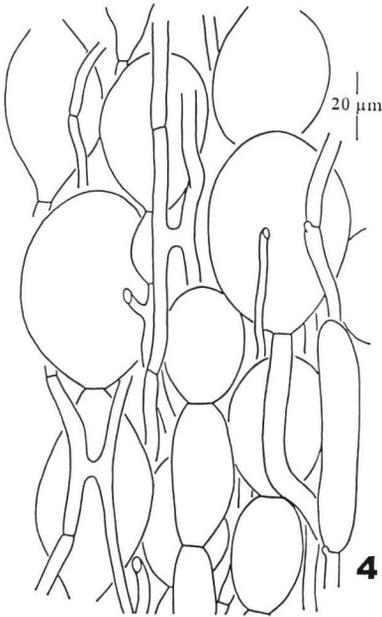


Fig. 4. Longitudinal section of volval remnant from pileus of *Amanita orientogemmata* (TNS-F-198537, Holotype).

(Fr.) Bertillon in DeChambre, Dict. Encycl. Sci. Medic. **1**(3): 496 (1866).

Selected Illustr.: Nagasawa & Hongo in Mem. Natn. Sci. Mus., Tokyo **18**: 74, fig. 1: 87, fig. 9 (1985).

Pileus 5–10 cm *latus*, *initio semiglobosus*, *deinde convexus vel plano-convexus*, *giseo-flavus vel pallide flavus*, *reliquiis volvae coactis, flocculosis, applanatis, tenuibus, sordide albidis ornatus, margine brevite striata, non appendiculata*. *Lamel-lae liberae, albae vel cremeae, confertae, lamellulis truncatis*. *Stipes* 5–11 × 1–1.5 cm, *sursum attenuatus, albus vel albidus, annulatus*. *Bulbus volvatus, subglobosus, sub-*

radicatus, 2–3 cm latus. *Volva breviter limbata*. *Annulus membranaceus, albus, inferior*. *Caro alba*. *Basidia 4-sporigera*. *Sporae* (7.5–) 8.0–10.0 (–11.0) × (6.0–) 6.5–7.5 (–8.0) μm , *lato-ellipsoideae vel ellipsoideae, non-amyloideae*. *Fibulae praesentes*. *Holotypus*: Ôchidani, Tottori City, Japan, 12. IX. 1979, E. & F. Nagasawa (TNS-F-198537).

Etymology: “*orientogemmata*” is named because of the similarity to *Amanita gemmata* from Europe.

Pileus 5–10 cm in diameter, at first hemispherical, then becoming convex to plano-convex, occasionally slightly depressed at the center, moderate greyish yellow (3-4B–C4-5) to light yellow (Apricot Yellow, Colonial Buff, Straw Yellow, 3A4–3A5), somewhat darker on disc, viscid when moist; volval remnants as felty, floccose patches or small subconical warts, 1–4 mm wide, up to 1.5 mm high (thick), whitish, becoming dirty white, yellowish or greyish when dried, randomly arranged, frequently densely placed over disc; margin short tuberculate-striate (0.15–0.25 R; R=radius), non-appendiculate; trama white. **Lamellae** free, whitish to pale creamy, crowded, with edge finely fimbriate and floccose; lamellulae truncate, plentiful, in 2–3 ranks. **Stipe** 5–11 × 1–1.5 cm, usually tapering upward, with apex slightly expanded, white to whitish, with cracked to appressed scaly belts above annulus and fibrillose below it or entirely more or less fibrillose; context white, loosely stuffed to hollow; basal bulb ovate to subglobose, subradicating, 2–3 cm wide, 3–4 cm high, white to pallid; volva short and appressed-limbate or as floccose patches or warts near apex of bulb, white to yellowish. **Annulus** present or torn from stipe during expansion of pileus, usually inferior when present, rarely median, white with occasional yellowish tinge. **Odor and taste** indistinct. **Color of spore print** not known.

Lamella trama bilateral. **Mediostratum** 30–50 μm wide, consisting of long ellipsoid to fusiform cells, 10–30 μm wide, mixed with abundant, branching hyphae, 2–5 (–8) μm wide; vascular hyphae rare. **Lateral stratum** consisting of long ellipsoid to fusiform cells, 10–20 μm wide, mixed with abundant hyphae, 3–7 μm wide, diverging at an angle of 30°–60° to the central stratum; septa often with clamps. **Subhymenium** 30–45 μm thick, with 2–3 (–4) layers of subglobose, ovoid to short ellipsoid, sometimes dolioform cells, 10–25 × 10–18 μm . **Basidia** 45–60 × 10–14 μm , clavate, 4-spored; sterigmata 4–6 μm long; basal septa often with clamps. **Basidiospores** [100/4/3] (= 100 spores from 4 basidiocarps of 3 collections measured in 5% KOH solution; Q is used to mean “length/width ratio” of a spore; **Q** means average Q of all specimens \pm sample standard deviation): (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 \pm 0.01], broadly ellipsoid to ellipsoid, rarely subglobose, inamyloid, colorless, hyaline, thin-walled, smooth, apiculus small. **Lamella edge** as sterile, somewhat gelatinized strip, 100–200 μm wide in side view, made up of clavate to broadly clavate (45–60 × 15–20 μm), to ovoid to subglobose (25–45 × 20–35 μm) or ellipsoid (30–40 × 15–25 μm) cells, 2–4 in chains, thin-walled, colorless or sometimes with yellowish contents, surface often

with fine granular substance, mixed with scattered to fairly abundant, filamentous hyphae, 2–5 μm wide, often clamped; elements embedded in yellowish amorphous matrix which gradually disappears in KOH. **Pileipellis** 80–150 μm thick; upper layer (60–90 μm thick) strongly gelatinized, made up of subradially arranged to somewhat interwoven hyphae, 1–5 μm wide, colorless to subcolorless, often with fine granular incrustations; lower layer (40–60 μm thick) made up of radially, subradially and compactly arranged hyphae, 3–8 μm wide, subcolorless or with yellowish to brownish vacuolar pigment; vascular hyphae rare, 2–7 μm wide. **Volval remnants** on pileus comprising \pm vertically, sometimes irregularly arranged elements: inflated cells fairly abundant to abundant, ellipsoid to subglobose cells, 25–90 \times 25–40 μm , often in short chains, thin-walled, colorless, or sometimes with brownish content; fairly abundant to locally abundant, filamentous hyphae, 3–5 (–8) μm wide, thin-walled, colorless or sometimes with yellowish to brownish content; septa often with clamps; vascular hyphae rare or locally abundant, 2–10 (–15) μm wide. Volval remnants on the stipe base and the upper bulb similar to those on the pileus, but elements irregularly arranged. **Stipe trama** dominantly consisting of longitudinally arranged, long clavate, terminal cells, 200–350 \times 18–40 μm , mixed with 2–8 μm wide hyphae scattered in interior, fairly abundant on stipe surface; vascular hyphae rare to locally fairly abundant, 2–8 μm wide. **Annulus** of abundant to locally very abundant, branching and interwoven hyphae, 3–5 (–8) μm wide, mixed with fairly abundant to abundant, subglobose to ellipsoid cells, 35–60 \times 20–35 μm .

Specimens examined: Japan: Ōchidani, Tottori City, Tottori Pref., 12. IX. 1979, E. & F. Nagasawa *s.n.* (= *sine numero*) (TNS-F-198537, Holotype!); ditto, 8. IX. 1979, E. & F. Nagasawa *s.n.* (TNS-F-198540); ditto, 9. IX. 1979, E. & F. Nagasawa *s.n.* (TNS-F-198546).

Habitat and distribution: Solitary or gregarious on ground in forest of *Abies-Castanopsis*. Only known from Japan.

Observations: In the above description the color and size of the basidiocarps are mainly based on the descriptions of Nagasawa and Hongo (1985). Other data are from observations on the collections by the present authors.

Amanita orientogemmata is characterized by its greyish yellow to light yellow pileus with whitish, felted volval patches or warts, inferior and fugacious annulus, limbate volva, inamyloid, broadly ellipsoid to ellipsoid spores, and presence of clamps. It differs from *A. gemmata* (Fr.) Bertillon in the rather common presence of clamps, smaller and proportionately narrower spores, and different structure of volval remnants on pileus. The volval remnants on pileus of *Amanita gemmata* from Europe [Netherlands: Friesland, 23. X. 1994, C. Bas 8942 (L); Schoorl, 26. XI. 1994, C. Bas 8949 (L)] dominantly consist of irregularly to subradially arranged, filamentous hyphae, mixed with scattered to locally fairly abundant inflated cells (Yang, 1997: 51). The spores of *A. gemmata* from the two European collections listed above are [120/6/2] (9.0–) 9.5–12.0 (13.0) \times (6.0–) 6.5–8.5 (–9.0) μm [Q=(1.17–) 1.25–1.62

(-1.77), $Q=1.42\pm 0.13$].

Nagasawa & Hongo (1985) indicated that this species may be closely related to *Amanita pantherina* var. *velatipes* (Atk.) Jenkins ($\equiv A. velatipes$ Atk.) from North America. However, *A. velatipes* has a persistent annulus, an ocreate volva on the bulb, and narrower spores (Jenkins, 1977, 1982, 1986; Tulloss *et al.*, 1995).

Species in the section *Amanita* having yellow to yellowish pilei and exhibiting some morphological similarities to *A. orientogemmata* are *A. pantherina* var. *lutea* Chiu from China., *A. elata* (Mass.) Corner & Bas from Southeast Asia, *A. crenulata* Peck from North America, *A. xylinovolve* Tulloss, Overbo & Halling from Colombia, and *A. diemii* Singer from Argentina. *Amanita pantherina* var. *lutea* differs from the present species by its bulbs with an ocreate collar, a superior annulus, and absence of clamps (Yang, 1997). *Amanita elata* differs by its more detachable volval remnants on pileus, smaller, globose to subglobose spores, and absence of clamps (Corner & Bas, 1962). *Amanita crenulata* differs from this species in its sordid yellowish tan to somewhat sordid pale tan pileus with pulverulent, champagne-colored volval remnants, superior annulus with few inflated cells, absence of clamps, and rounder spores (Tulloss, 1990). *Amanita xylinovolve* has longer marginal striations on the pileus, no clamps, and wider spores (Tulloss *et al.*, 1992 b). *Amanita diemii*, occurring under *Nothofagus*, differs from *A. orientogemmata* by its golden yellow to orange ochre yellow pileus becoming brown with age, lacking annulus, and rounder spores (Singer, 1954).

2. *Amanita melleiceps* Hongo in J. Jpn. Bot. **41**: 165 (1966).

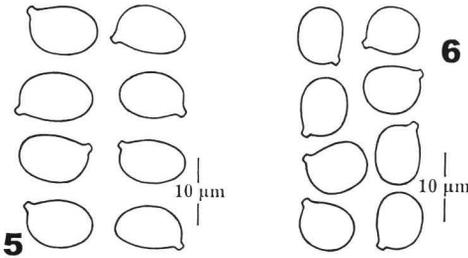
Fig. 5

Basidia 32–40 \times 10–13 μm , clavate, 4-spored; basal septa without clamps. **Basidiospores** [50/2/1] (7.5–) 8.5–11.0 (–12.0) \times 6.0–7.0 (–8.0) μm [$Q=(1.25\text{--})$ 1.29–1.64 (–1.83), $Q=1.47\pm 0.11$], mostly ellipsoid, inamyloid, colorless, hyaline, thin-walled, smooth; apiculus small. **Volval remnants** on pileus made up of \pm vertically arranged elements; inflated cells abundant to very abundant, subglobose to ovoid (25–35 \times 20–25 μm), to ellipsoid (30–45 \times 15–30 μm), probably in short chains, thin-walled, colourless, hyaline to subhyaline; filamentous hyphae fairly abundant, 2–5 μm wide, branching, thin-walled, hyaline to subhyaline; septa without clamps; vascular hyphae rare.

Specimen examined: Japan: Senjô, Ôtsu, 22. VI. 1965, T. Hongo *s.n.* (Hongo Herb. 3070, TNS-F-237279, Holotype).

Habitat and distribution: In forest of *Pinus densiflora*, mixed with young *Quercus serrata*. Also known from South Korea and China (Kim, *et al.*, 1993; Mao, 1991).

Observations: Having studied the holotype, we know that this species has no clamps and the volval remnants on pileus are made up of vertically arranged elements.



Figs. 5–6. Basidiospores. 5. *Amanita melleiceps* (TNS-F-237279, Holotype); 6. *Amanita pseudogemmata* (TNS-F-237280, Holotype).

3. *Amanita pseudogemmata* Hongo in Travaux mycologiques dédiés à R. Kuhner, Bull. Soc. Linn. Lyon, no. spéc.: 189 (1974). Fig. 6

Basidiospores [30/1/1] (7.0–) 7.5–9.5 (–10.0) × (6.0–) 6.5–7.5 (–8.0) μm [Q = (1.07–) 1.1–1.28 (–1.31), Q = 1.20 ± 0.06], subglobose to broadly ellipsoid, inamyloid, colorless, hyaline, thin-walled, smooth, apiculus small. **Volval remnants** on pileus made up of \pm vertical elements: inflated cells fairly abundant to abundant, subglobose to ovoid to ellipsoid (50–75 × 25–50 μm), thin-walled, hyaline or often with yellowish vacuolar pigment; filamentous hyphae fairly abundant to scattered, 3–5 μm wide; vascular hyphae plentiful, 2.5–8 μm wide.

Specimen examined: Japan: Ginkakuji, Sakyo-Ku, Kyoto, 9. VIII. 1970, H. Noro *s.n.* (Hongo Herb. 4201, TNS-F-237280, Holotype).

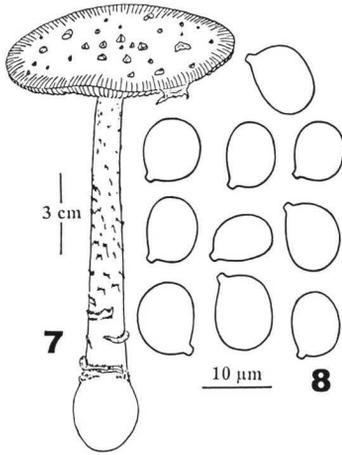
Habitat and Distribution: In forest of *Castanopsis cuspidata*. Only known from Japan.

Observations: The holotype is poorly rehydrating. Basal septa of basidia probably have no clamps. Vascular hyphae in the volval remnants on pileus are quite conspicuous.

4. *Amanita* cf. *pantherina*. Figs. 7–9

Pileus 5.5–8.5 cm in diameter, convex to planate, yellowish-greyish, darker at the center; volval remnants felt-like to subconical, 1–4 mm wide, up to 3 mm high, dirty white, randomly arranged, frequently denser at the center; margin short tuberculate-striate (0.1–0.2 R), often with remnants of annulus; trama white. **Lamellae** free, white to whitish, crowded; lamellulae truncate, plentiful. **Stipe** 9–11 × 0.5–1 cm, slightly attenuate upward, white to whitish, lower part with somewhat reflexed scales; basal bulb ovate to subglobose, ca. 1.5–2.5 cm wide, 2–3 cm high, white to pallid; volva an ocreate ring. **Annulus** present but often torn from stipe during expansion of pileus, and then hanging on margin of pileus. **Odor and taste** unknown. **Color of spore print** unknown.

Basidia 45–55 × 11–12 μm , clavate, 4-spored; sterigmata 3–5 μm long; basal septa often with clamps. **Basidiospores** [30/1/1] (8.5–) 9.0–11.0 × (6.5–) 7.0–8.5 (–9.0) μm [Q = (1.10–) 1.19–1.38 (–1.40), Q = 1.29 ± 0.07], broadly ellipsoid to ellipsoid, inamyloid, colorless, hyaline, thin-walled, smooth, apiculus small. **Volval rem-**



Figs. 7–8. *Amanita cf. pantherina* (TNS-F-182971). 7. Basidiocarp; 8. Basidiospores.

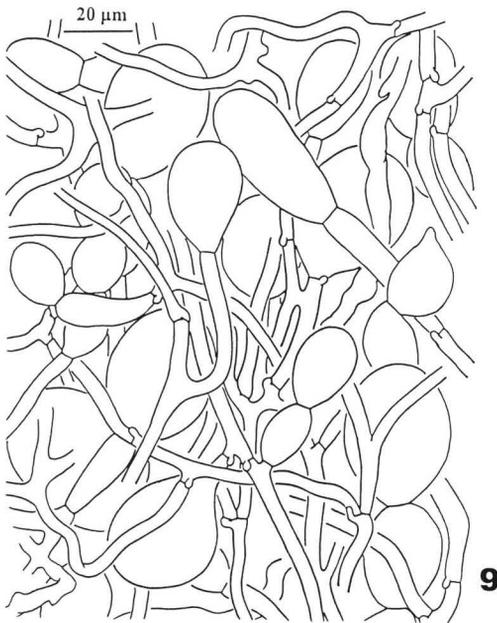


Fig. 9. Longitudinal section of volval remnant from pileus of *Amanita cf. pantherina* (TNS-F-182971).

nants on pileus made up of \pm vertically arranged elements: inflated cells abundant to very abundant, subglobose, ovoid to short ellipsoid, $20\text{--}45 \times 15\text{--}35 \mu\text{m}$, sometimes long ellipsoid to subfusiform, $55\text{--}60 \times 20\text{--}25 \mu\text{m}$, single and terminal, or 2–3 (–4) in chains, thin-walled, colorless, hyaline, sometimes with brownish vacuolar pigment; fairly abundant to abundant hyphae, $2\text{--}7$ (–10) μm wide, thin-walled, colorless, hyaline; septa often with clamps; many hyphae vascular, i.e. with yellowish-brownish, reflective, vacuolar pigment (content).

Specimen examined: Japan: Tsukuba Botanical Garden, Tsukuba, Ibaraki Pref., I. X. 1997, Y. Doi *s.n.* (TNS-F-182971).

Habitat and Distribution: On ground under trees of *Castanea*.

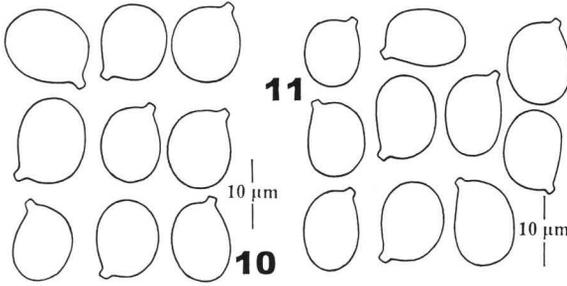
Observations: This species probably has been regarded as *Amanita pantherina* (DC.: Fr.) Krombh. in the past. It differs, however, from the latter in, among other features, its presence of clamps. It is probably an undescribed taxon. Since we do not understand this species well, it will need to be studied further when more collections are available.

Subgenus *Amanita* Section *Caesareae* Singer ex Singer

5. *Amanita longistriata* Imai in J. Facul. Agr. Hokkaido Imp. Univ. **43**: 11 (1938).
Fig. 10

Pileus 3–9 cm in diameter, at first hemispherical, then convex to plano-convex, with or without small umbo, slightly greyish buff, sometimes with very slightly pinkish tinge, greyish, sometimes greyish brown to slightly brownish at disc, subviscid, glabrous and usually without volval remnants; margin usually long sulcate [0.3–0.5 R], occasionally short striate [0.2–0.25 R], non-appendiculate; context white. **Lamellae** free, or even remote from stipe, (sub) distant, rather broad (up to 11 mm broad), already when very young beautifully pale but clear pink, later paler pink, with edge minutely white flocculose, subdenticulate; lamellulae obliquely truncate. **Stipe** 9–18×0.5–1.5 cm, subcylindrical or slightly tapering upward, at first pinkish white, later white, with proportionately broad central cylinder, base lacking bulb; volva saccate, 2–3 (–4)×1–2 cm, ca. 0.5–1.5 mm thick, membranous, white to whitish, with *limbus internus* placed on inside of volval limb, slightly above point of juncture of stipe and limb. **Annulus** present, superior to almost median, membranous, thin, whitish. **Taste** mild; **Odor** indistinct. **Color of spore print** not known.

Subhymenium 30–40 μm thick, with 2–3 layers of subglobose, ovoid to ellipsoid cells, 10–23×8–15 μm . **Basidia** 34–48×11–13 μm , clavate, 4-spored; sterigmata 3–5 μm long; basal septa often with clamps. **Basidiospores** [175/8/5] (8.0–) 9.0–12.0 (–13.5)×(7.5–) 8.0–10.0 (–11.0) μm [Q=(1.02–) 1.06–1.33 (–1.53), Q=1.19±0.08], dominantly broadly ellipsoid, sometimes ellipsoid or subglobose, inamyloid, colorless, hyaline, thin-walled, smooth, apiculus small. **Volval remnants** on stipe base made up of irregularly to somewhat longitudinally arranged elements: filamentous hyphae dominant, 2–7 (–12) μm wide, hyaline, thin-walled, branching, interwoven, with clamps; inflated cells scarce to scattered to locally fairly abundant, subglobose to ovoid, 50–70×35–50 μm , sometimes ellipsoid to fusiform, 50–120×20–50 μm , colourless hyaline, thin-walled; vascular hyphae rare. Outer surface of volva consisting of \pm irregularly arranged filamentous hyphae, 2–5 (–7) μm wide, hyaline, thin-walled; inflated cells rare. Inner surface of volva gelatinized, with filamentous hyphae, 1–3 μm wide. Volval remnants on pileus not seen. **Annulus** dominantly con-



Figs. 10–11. Basidiospores. 10. *Amanita longistriata* (C. Bas 9040, in L); 11. *Amanita pseudovaginata* (TNS-F-237282, Holotype)

sisting of subradially to irregularly arranged, filamentous hyphae, 2–6 μm wide, mixed with usually rare but locally abundant, clavate to broadly clavate, inflated cells, 20–30 \times 8–12 μm , colorless, hyaline, thin-walled; clamps very common; vascular hyphae rare.

Specimens examined: Japan: Along hiking course, left-side ridge of Kurosawa-gawa River, Kurosawa 3-Chôme, Oume City, Tokyo, 16. VII. 1997, Y. Doi & K. Miyazaki *s.n.* (TNS-F-182475; ditto, TNS-F-182478); Along hiking course, left-side ridge of Kurosawa-gawa River, Kurosawa 3-Chôme, Oume City, Tokyo, 5. X. 1997, Y. Doi *s.n.* (TNS-F-237593); In garden of Fukiage-Gosho Imperial Palace; Chiyoda-ku, Tokyo, 12. VII. 1995, T. Tobishima *s.n.* (TNS-F-180370); Mt. Fuji, Yoshida-guchi, Yamanashi Pref., 6. IX. 1983, C. Bas 9040 (L).

Habitat and distribution: Solitary or gregarious on ground in forests (e.g., of *Abies*). Also known from South Korea, and China (Kim *et al.*, 1993; Mao, 1991; Yang, 1997).

Observations: The colour of the fruitbody is mainly based on the field notes of C. Bas 9040. This species is somewhat similar to *A. spreata* (Peck) Sacc., originally described from North America. The latter has, however, considerably shorter marginal striations, smaller volva on stipe base, and significantly narrower spores. *Amanita longistriata* is close to *A. incarnatifolia* Z. L. Yang (a new name for *A. rhodophylla* Imazeki & Toki, see Yang 1997: 52). It differs from the latter in its somewhat larger basidiocarps, longer striations on the pileus margin, and wider basidiospores (Yang, 1997).

Subgenus *Amanita* Section *Vaginatae* (Fr.) Quél.

6. *Amanita pseudovaginata* Hongo in Mem. Shiga. Univ., Nat. Sci., **33**: 108 (1983).

Fig. 11

Basidiospores [50/2/1] (9.5–) 10.5–13.0 \times 8.0–9.0 (–9.5) μm [Q=(1.20–) 1.25–1.51 (–1.54), Q=1.37 \pm 0.08], broadly ellipsoid to ellipsoid, inamyloid, colorless, hyaline, thin-walled, smooth, apiculus small. **Volval remnants** on pileus made up of \pm irregularly or sometimes subvertically arranged elements: inflated cells very abun-

dant, subglobose to ovoid to ellipsoid ($20\text{--}50 \times 15\text{--}40 \mu\text{m}$), thin-walled, hyaline or often with brownish vacuolar pigment, single and terminal or in short chains; filamentous hyphae fairly abundant to locally abundant, $2\text{--}7$ (-10) μm wide, often with brown vacuolar pigment; vascular hyphae rare. On the outer surface of the volval remnants there are more abundant \pm radially arranged, filamentous hyphae.

Specimen examined: Japan: Along road-cuts, Ikeno-o, Uji-City, Aug. 4, 1981, T Hongo *s.n.* (Hongo Herb. 6134, TNS-F-237282, Holotype).

Habitat and distribution: In *Pinus-Quercus* forest. Also known from China (Yang, 1997).

Observations: The holotype specimen is poorly rehydrating. From our observations of bases of basidia, their basal septa probably have no clamps.

Subgenus *Lepidella* Section *Amidella* (E. J. Gilb.) Konr. & Maubl.

7. *Amanita avellaneosquamosa* (Imai) Imai in Ito, Mycol. Fl. Jpn. 2(5): 250 (1959).

Pileus ca. 5 cm in diameter, convex to plano-convex to planate, dirty white to brownish, subviscid, occasionally with whitish volval remnants; margin short striate (0.15–0.2 R). **Lamellae** free, crowded; lamellulae 0–2, truncate.

Basidiospores [20/1/1] $8.5\text{--}10.5$ (-11.0) \times (4.5--) $5.0\text{--}5.5$ (-6.0) μm [$Q=(1.55\text{--})$ $1.66\text{--}2.09$ (-2.20), $Q=1.87 \pm 0.16$], long elongate to subcylindrical, amyloid, colorless, hyaline, thin-walled, smooth, apiculus small.

Specimen examined: Japan: Along right-side ridge of Kurosawa-gawa River, Kurosawa 3-Chôme, Oume City, Tokyo, 25. IX. 1997, Y. Doi *s.n.* (TNS-F-237935).

Habitat and distribution: Solitary on ground in *Quercus*-forests. Also known from China (Yang, 1997).

Observations: *Amanita avellaneosquamosa* was usually regarded as a synonym of *A. volvata* (Peck) Lloyd, originally named and described for a North American mushroom. Recent studies show that they should be treated as distinct taxa (Yang, 1997; Weiß *et al.*, 1998).

Subgenus *Lepidella* Section *Lepidella*

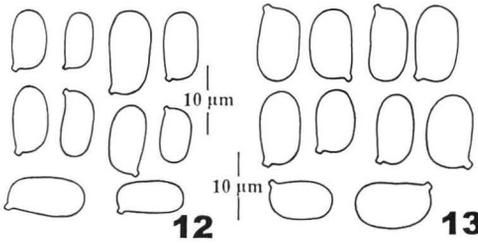
8. *Amanita alboflavescens* Hongo in Mem. Shiga Univ., Nat. Sci. 20: 50 (1970).

Fig. 12

Basidia $36\text{--}40 \times 8\text{--}11 \mu\text{m}$, dominantly 4-spored, sometimes 2-spored. **Basidiospores** [30/1/1] $8.0\text{--}11.0$ (-13.0) \times (4.0--) $4.5\text{--}5.5$ (-6.5) μm [$Q=(1.63\text{--})$ $1.67\text{--}2.09$ (-2.12), $Q=1.88 \pm 0.16$], elongate, colorless, hyaline, thin-walled, smooth, apiculus small.

Specimen examined: Japan: Dô, Ôtsu, Shiga Pref., 18. IX. 1969, T. Hongo *s.n.* (Hongo Herb. 4014, TNS-F-237274, Holotype).

Habitat and Distribution: In forest under *Quercus acutissima*, *Q. glauca*, etc. Also known from South Korea and China (Kim *et al.*, 1993; Yang, 1997).



Figs. 12–13. Basidiospores. 12. *Amanita alboflavescens* (TNS-F-237274, Holotype); 13. *Amanita castanopsis* (TNS-F-237275, Holotype).

Observations: Yang (1997) noted that it is unknown whether *A. alboflavescens* possesses clamps or not. Unfortunately, the holotype is not well rehydrating and hence, the question is still open.

9. *Amanita castanopsis* Hongo in Travaux mycologiques dédiés à R. Kühner, Bull. Soc. Linn. Soc. Lyon, no. spéc.: 192 (1974). Fig. 13

Basidia 40–55×9.0–11 μm clavate, 4-spored; sterigmata 3–5 μm long; basal septa with clamps. **Basidiospores** [50/2/1] (8.5–) 9.0 (–11.0)×5.0–6.5 μm [Q=(1.55–) 1.58–1.91 (–2.06), Q=1.75±0.11], dominantly elongate, rarely ellipsoid or subcylindrical, amyloid, colorless, hyaline, thin-walled, smooth, apiculus small. **Volval remnants** on pileus made up of vertically arranged elements: inflated cells abundant to dominant, subglobose, ovoid to ellipsoid, 35–75×25–50 μm, single and terminal, or 2–3 (–4) in chains, thin-walled, colorless, hyaline to subhyaline; mixed with scattered to locally fairly abundant, filamentous hyphae, 3–5 μm wide, thin-walled, colorless, hyaline; septa often with clamps; vascular hyphae rare.

Specimen examined: Japan: Kokubu, Ôtsu, 18. IX. 1972, T. Hongo *s.n.* (Hongo Herb. 4753, TNS-F-237275, Holotype).

Habitat and distribution: In forest of *Castanopsis*. Also known from South Korea and China (Kim *et al.*, 1993; Yang, 1997).

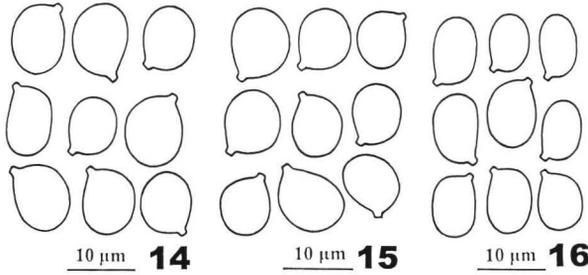
Observations: *Amanita castanopsis* is close to *A. virgineoides* Bas. The latter differs, however, from the present species in the broadly ellipsoid to ellipsoid spores (Hongo, 1974 b). In addition, the volval remnants on the pileus of *A. virgineoides* are usually smaller, and made up of smaller inflated cells mixed with usually scattered but conspicuous vascular hyphae (cf. Bas, 1969; Yang, 1997).

10. *Amanita griseofarinosa* Hongo in Mem. Shiga Univ., Nat. Sci. **11**: 39 (1961).

Fig. 14

Pileus ca. 2–5 cm in diameter, convex to applanate, greyish to paler, covered with greyish, grey to dark grey, tomentose to farinose, volval remnants, sometimes with subconical paler volval warts; margin appendiculate. **Stipe** ca. 6–7×0.5–1 cm, attenuate upwards to subcylindrical; bulbous clavate, subglobose, covered with grey, farinose volval remnants. **Annulus** fugacious.

Basidia 45–75×12–15 μm, 4-spored, probably without clamps. **Basidiospores**



Figs. 14–16. Basidiospores. 14. *Amanita griseofarinosa* (TNS-F-237277, Holotype); 15. *Amanita hongoi*, (TNS-F-237946); 16. *Amanita lutescens* (TNS-F-237278, Holotype).

[101/4/2] (8.5–) 9.0–11.0 (–12.0) × (6.0–) 6.5–8.5 (–10.0) μm [$Q=(1.1-)$ 1.18–1.47 (–1.54), $Q=1.31 \pm 0.09$], broadly ellipsoid to ellipsoid, amyloid, colorless, hyaline, thin-walled, smooth, apiculus small.

Specimens examined: Japan: Kurozu, Ôtsu, 1. IX. 1959, T. Hongo *s.n.* (Hongo Herb. 2011, TNS-F-237277, Holotype); ditto, 16. VII. 1964, T. Hongo *s.n.* (Hongo Herb. 2887, TNS-F).

Habitat and distribution: Gregarious among mosses in woods. Also known from China (Mao, 1991; Yang, 1997).

Observations: Spores from the holotype of *A. griseofarinosa* are [71/3/1] (8.0–) 9.0–11.0 (–12.0) × (6.0–) 6.5–8.5 (–10.0) μm [$Q=(1.1-)$ 1.18–1.47 (–1.54), $Q=1.29 \pm 0.09$]. Both studied collections are poorly rehydrating. Based on observable basidia, there are probably no clamps.

11. *Amanita hongoi* Bas in *Persoonia* **5**: 410 (1969).

Fig. 15

Pileus ca. 8 cm in diameter, convex to planate, whitish, covered with conical to subconical, brownish to whitish volval remnants, 1–1.5 mm high. **Stipe** ca. 12 × 1–1.5 cm, base subfusiform; **annulus** fugacious.

Basidiospores [30/1/1] (7.5–) 8.0–10.0 × (6.5–) 7.0–8.5 (9.0) μm [$Q=1.10-1.21$ (–1.29), $Q=1.16 \pm 0.05$], subglobose to broadly ellipsoid, amyloid, colorless, hyaline, thin-walled, smooth, apiculus small. Clamps absent.

Specimen examined: Japan: Right-side ridge of Kurosawa-gawa River, Kurosawa 3-Chôme, Oume City, Tokyo, 25. IX. 1997, Y. Doi *s.n.* (TNS-F-237946).

Habitat and distribution: Solitary on ground in *Quercus*-forests. Also known from South Korea (Kim *et al.*, 1993).

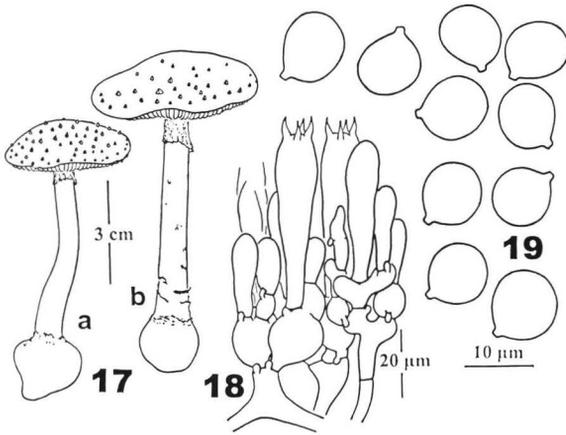
Observations: *Amanita hongoi* is closely related to *A. perpasta* Corner & Bas. A detailed comparison of these two species is given in Bas (1969: 412).

12. *Amanita lutescens* Hongo in *J. Jpn. Bot.* **33**: 347 (1958).

Fig. 16

Basidiospores [60/2/1] (7.5–) 8.0–10.0(10.5) × (5.0–) 5.5–7.0 (7.5) μm [$Q=(1.25-)$ 1.31–1.73 (–1.87), $Q=1.48 \pm 0.14$], ellipsoid to elongate, amyloid, colorless, hyaline, thin-walled, smooth, apiculus small.

Specimen examined: Japan: Hie-Shrine, Ôtsu, 20. IX. 1956, T. Hongo *s.n.*



Figs. 17–19. *Amanita sphaerobulbosa*.
 17. Basidiocarps (a. TNS-F-237770; b. TNS-F-237569); 18. Hymenium and subhymenium (TNS-F-237569); 19. Basidiospores (TNS-F-237569).

(Hongo Herb. 1529, TNS-F-237278, Holotype).

Habitat and distribution: Gregarious on the ground under frondose trees. Only known from Japan.

Observations: The holotype specimen is poorly rehydrating. We do not know whether there are any clamps on septa of hyphae in this mushroom.

13. *Amanita sphaerobulbosa* Hongo in J. Jpn. Bot. **44**: 230 (1969). Figs. 17–19

Pileus ca. 2–4 cm in diameter, convex to planate, white to cream-colored, covered with white, conical to subconical, small volval remnants, ca. 1 mm high; margin appendiculate. **Stipe** 5–8×0.5–0.8 cm, attenuate upwards to subcylindrical; bulb subglobose to napiform, often submarginate, upper part of bulb and stipe base covered with whitish, small volval remnants. **Annulus** pendant from ca. 1–1.5 cm below apex of stipe, finely radially striate above.

Basidia 45–60×12–15 µm, clavate, 4-spored, rarely 2-spored; sterigmata 3–5 µm long; basal septa often with clamps. **Basidiospores** [105/5/5] (7.0–) 8.0–10.5 (–11.5)×(6.5–) 7.0–9.5 (–10.0) µm [Q=(1.0–) 1.02–1.18 (–1.25), Q=1.1±0.05], globose, subglobose to broadly ellipsoid, amyloid, colorless, hyaline, thin-walled, smooth, apiculus small. **Volval remnants** on pileus made up of ±vertically arranged elements: inflated cells very abundant to dominant, subglobose to ovoid to ellipsoid, 15–40 (–60)×12–25 (–35) µm, usually longer in base of wart, thin-walled, sometimes slightly thick-walled (≤0.5 µm thick), often hyaline, 2–5 in chains, sometimes anastomosing; filamentous hyphae scattered, in base of wart fairly abundant, 2–7 (–10) µm wide, branching, anastomosing and interwoven, thin-walled, hyaline to subhyaline, vascular hyphae rarely scattered, 2–8 µm wide but in upper part of volval wart often with conspicuous vascular hyphae and inflated cells; clamps rare. **Annulus** made up of abundant to very abundant inflated cells, broadly clavate, ellipsoid, sometimes fusiform, 35–80×20–30 µm, mixed with fairly abundant filamentous hyphae,

2–5 μm wide, hyaline, thin-walled; vascular hyphae rare.

Specimens examined: Japan: Mt. Watamuki, Shiga Pref., 17.IX.1967, T. Hongo *s.n.* (Hongo Herb. 3504, TNS-F-244377, Holotype); Along hiking course, Nagayama-Kyûryô Hills, Kurosawa 3-Chôme, Oume City, Tokyo, 5.X.1997, Y. Doi *s.n.* (TNS-F-237770); In *Quercus* forests, right side of Kurosawa-gawa River, Kurosawa 3-Chôme, Oume City, Tokyo, 25.IX.1997, Y. Doi *s.n.* (TNS-F-237949); ditto, 2.VIII.1997, Y. Doi & K. Miyazaki *s.n.* (TNS-F-182502); Along hiking course, left-side of Kurosawa-gawa River, Nagayama-Kyûryô Hills, Kurosawa 3-Chôme, Oume City, Tokyo, 5.X.1997, Y. Doi & K. Miyazaki *s.n.* (TNS-F-237569).

Habitat and distribution: In forests, Only known from Japan.

Observations: Spores of the holotype are $[30/1/1]$ (7.0–) 8.0–10.0 \times (7.0–) 7.5–9.0 (–9.5) μm [Q=(1.0–) 1.03–1.18 (–1.20), Q=1.10 \pm 0.05]. Although the holotype is poorly rehydrating, we have observed clamps on bases of basidia in preparations from the holotype. *Amanita sphaerobulbosa* has recently been regarded as a synonym of *A. abrupta* Peck from North America (e.g., Hongo, 1982; Imazeki & Hongo, 1987). Undoubtedly they are very closely related to each other. However, the spores of *A. abrupta* are narrower (Bas, 1969; Jenkins, 1986; Tulloss *et al.*, 1995). Further, in *A. sphaerobulbosa* many hyphae and inflated cells, especially in the upper part of volval remnants on pileus, are vascular (oleiferous); this is not the case in *A. abrupta* (Bas, 1969: 434). For the time being, we prefer to treat them separately.

Subgenus *Lepidella* Section *Phalloideae* (Fr.) Quél.

14. *Amanita oberwinklerana* Z. L. Yang & Y. Doi, sp. nov. Figs. 20–25

Pileus 3–8 cm *latus*, *initio semiglobosus, deinde convexus, plano-convexus vel planus, albus, albidus, cremeus vel subflavidus, reliquiis volvae magnis, coactis, membranaceis, applanatis, tenuibus, albis ornatus, margine nonstriata, non appendiculata. Lamellae liberae, albae vel cremeae, confertae, lamellis attenuatis. Stipes* 5–12 \times 0.5–1 cm, *sursum attenuatus, albus vel albidus, annulatus; bulbis volvatus, napiformis, subglobosus vel clavatus, 1–2 cm latus. Volva breviter limbata, sed saepe marginata vel subnulla. Annulus membranaceus, albus, superior. Caro alba. Basidia 4-sporigera, interdum 2- vel 3-sporigera. Sporae* (7.5–) 8.0–10.5 (–12.5) \times (5.5–) 6.5–8.0 (–8.5) μm , *lato-ellipsoideae vel ellipsoideae, amyloideae. Fibulae absentes. Holotypus:* Y. Doi *s.n.* (TNS-F-237722), 5.X.1997, Nagayama-Kyûryô, Kurosawa, Oume, Tokyo, Japan.

Etymology: “*oberwinklerana*” is named in honour of Prof. Dr. F. Oberwinkler on the occasion of his 60th birthday.

Pileus 3–8 cm in diameter, at first hemispherical, then becoming convex to plano-convex to almost applanate, white, whitish, sometimes creamy to pale yellowish [Cream Color, Pale Chalcedony Yellow, Light Chalcedony Yellow, 1A1, 2A2, 2A3, 3A2, 3A3], slightly deeper on disc, viscid when moist; volval remnants white to

whitish [1A1, 1A2], often in 1–3 large pieces (1–2.5×1–2.5 cm) on pileus, felt-like, submembranous, up to 1 (–2) mm thick, randomly arranged, sometimes glabrous and without volval remnants, then the volval remnants usually retained at the base of stipe as limbate volva; margin smooth, occasionally finely striate [0.1–0.2 (–0.3) R], non-appendiculate; trama white. **Lamellae** free, white, whitish to pale creamy, crowded, edge finely fimbriate and floccose; lamellulae attenuate to subattenuate, plentiful, in 2–3 ranks. **Stipe** 5–12×0.5–1 cm, usually tapering upward, with apex slightly expanded, white to whitish, subglabrous, finely fibrillose or sometimes with reflexed scales; context white; basal bulb napiform, subglobose to clavate, 1–2 cm wide, 1.5–2 cm high, white to pallid; volva short limbate to limbate, membranous, white to whitish, but often with few volval remnants on stipe base, and then bulb marginate. **Annulus** present, superior, pendant from ca. 1–1.5 cm below apex of stipe, membranous, white to whitish, above fine radially striate. **Odor and taste** not known. **Color of spore print** not known. Dried basidiocarps not giving yellow reaction to KOH solution (5%–10%).

Lamella trama bilateral. **Mediostratum** ca. 30 μm wide, distinct, consisting of long ellipsoid, subfusiform to sometimes subcylindrical, inflated cells, 50–90×10–30 μm wide, mixed with abundant, branching hyphae, 2.5–7 μm wide; vascular hyphae rare. **Lateral stratum** consisting of long ellipsoid to fusiform, inflated cells, 40–70×15–20 μm , mixed with fairly abundant filamentous hyphae, 3–5 μm wide, diverging at an angle of 30°–45° to the central stratum; septa without clamps. **Subhy-menium** 25–40 (–50) μm thick, with 2–3 layers of subglobose, ovoid to short ellipsoid cells, 10–20 (–28)×9–18 μm . **Basidia** 33–55×9–12 (–14) μm , clavate, 4-spored, sometimes 2- or 3-spored, rarely 1-spored; sterigmata 3–5 (–7) μm long; basal septa without clamps. **Basidiospores** [155/7/6] (7.5–) 8.0–10.5 (–12.5)×(5.5–) 6.5–8.0 (–8.5) μm [Q=(1.13–) 1.19–1.50 (–1.71), Q=1.34±0.10], broadly ellipsoid to ellipsoid, amyloid, colorless, hyaline, thin-walled, smooth, apiculus small. **Lamella edge** a sterile, somewhat gelatinized strip, 20–80 μm wide in side view, made up of abundant, subglobose, ovoid, clavate to sphaeropedunculate cells (20–40×12–25 μm), single and terminal or 2–3 in chains, thin-walled, colorless, hyaline, often somewhat gelatinized, mixed with fairly abundant (to abundant), filamentous hyphae, 2–5 μm wide, irregularly arranged or \pm running parallel to the lamella edge. **Pileipellis** 90–160 μm thick: the upper layer (60–100 μm thick) strongly gelatinized, made up of radially arranged, filamentous hyphae, 1–5 μm wide, colorless, hyaline; vascular hyphae rare; the lower layer 30–50 μm thick, made up of radially, subradially and compactly arranged, filamentous hyphae, 3–7 (–12) μm wide, colorless, usually hyaline, sometimes subhyaline. **Volval remnants** on pileus made up of irregularly arranged elements: filamentous hyphae abundant to locally (towards the surface of pileus) very abundant, 3–7 (–12) μm wide, branching, interwoven, loosely arranged, hyaline, thin-walled; inflated cells abundant, subglobose, ovoid, 25–75×25–55 μm , single and terminal, sometimes 2–3 in chains, colorless, thin-walled, sometimes slightly thick-

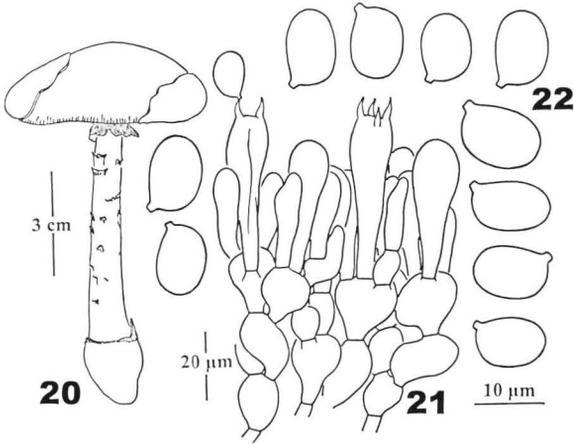
walled ($\leq 0.5 \mu\text{m}$); vascular hyphae rare. Volval remnants on the stipe base and upper bulb similar to those on the pileus, but filamentous hyphae somewhat more abundant, especially towards the somewhat gelatinized inner surface. **Stipe trama** dominantly consisting of longitudinally arranged, long clavate, terminal cells, $180\text{--}350 \times 17\text{--}40 \mu\text{m}$, mixed with $2\text{--}7$ (-12) μm wide hyphae scattered interior, fairly abundant on stipe surface; vascular hyphae rare. **Annulus** consisting of \pm radially arranged, abundant to very abundant, filamentous hyphae, $2\text{--}5$ (-8) μm wide, thin-walled, branching and anastomosing, mixed with fairly abundant (on upper surface) to very abundant (on edge of annulus), clavate, broadly clavate, subglobose to sphaeropedunculate, inflated cells, $20\text{--}45 \times 10\text{--}20 \mu\text{m}$, colorless hyaline, thin-walled, usually single and terminal; vascular hyphae rare.

Specimens examined: Japan: Along hiking course, left-side ridge of Kurosawagawa River, Kurosawa 3-Chôme, Oume City, Tokyo, 16. VII. 1997, Y. Doi & K. Miyazaki *s.n.* (TNS-F-182594); ditto, 25. IX. 1997, Y. Doi *s.n.* (TNS-F-237780); Along hiking course, Nagayama-Kyûryô Hills, Kurosawa 3-Chôme, Oume City, Tokyo, 5. X. 1997, Y. Doi *s.n.* (TNS-F-237572; TNS-F-237722=Holotype!; TNS-F-237727; & TNS-F-237750).

Habitat and distribution: Solitary or gregarious on ground in forests. Presently only known from Japan.

Observations: *Amanita oberwinklerana* was probably regarded in East Asia as *A. verna* (Bull.: Fr.) Lamarck or *A. virosa* Bertillon for its white, off-white fruitbodies with a membranous annulus and white volva, and for its amyloid spores. It differs, however, from *A. verna* in its weak volval remnants with abundant inflated cells, and in its smaller spores. Two specimens of *A. verna* collected from North Africa [Morocco: Maroliko, Tanger, 20. IV. 1971, C. Bas 5523 (L); Larache, 22. IV. 1971, C. Bas 5536 (L)] have been studied. The spores are $[170/7/2]$ (8.5--) $9.5\text{--}12.0$ (-14.5) \times (6.0--) $6.5\text{--}8.0$ (-10.5) μm [$Q=(1.19\text{--})$ $1.30\text{--}1.67$ (-1.79), $Q=1.47 \pm 0.11$]. The volva is dominantly made up of filamentous hyphae $2\text{--}8 \mu\text{m}$ wide, mixed with scattered to locally fairly abundant, inflated cells, $70\text{--}80 \times 25\text{--}60 \mu\text{m}$, often single. *Amanita virosa* possesses an irregularly formed, conical to campanulate pileus, and globose to subglobose spores. We have studied a collection of *A. virosa* from Europe [Poland: Biolowiesza virgin forest, 5. IX. 1966, C. Bas 4697 (L)]. The spores are $[30/1/1/]$ (8.0--) $9.0\text{--}11.0$ (-12.5) \times $8.0\text{--}10.0$ (-11.0) μm [$Q=(1.01\text{--})$ $1.03\text{--}1.16$ (-1.21), $Q=1.09 \pm 0.05$]. The volva is dominantly made up of filamentous hyphae $3\text{--}10 \mu\text{m}$ wide, mixed with rare to scattered to locally fairly abundant, inflated cells, $100\text{--}175 \times 40\text{--}70 \mu\text{m}$, often single.

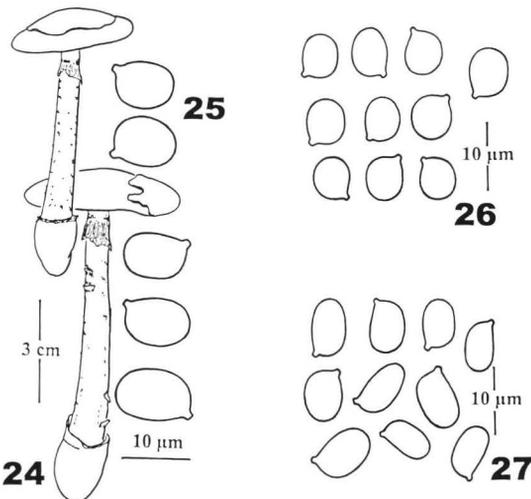
Amanita oberwinklerana is somewhat similar to *A. bisporigera* Atk. and *A. magnivelaris* Peck (*A. elliptosperma* Atk.) from North America, and *A. eburnea* Tulloss from Belize and Honduras. However, *A. bisporigera* usually has a limbate volva with dominantly filamentous hyphae, predominantly 2-spored basidia, and broader spores (Jenkins, 1986; Tulloss *et al.*, 1995). *Amanita magnivelaris* possesses larger basidio-



Figs. 20–22. *Amanita oberwinklerana* (TNS-F-237722, Holotype). 20. Basidiocarp; 21. Hymenium and subhymenium; 22. Basidiospores.



Fig. 23. Crushed volval remnant from pileus of *Amanita oberwinklerana* (TNS-F-237722, Holotype).



Figs. 24–27. Basidiocarps and basidiospores. 24–25. *Amanita oberwinklerana* (TNS-F-237750); 26. *Amanita manginiana sensu Chiu* (TNS-F-182476); 27. *Amanita pseudoporphyria* (TNS-F-237281, Holotype).

carps with a limbate volva, and pinkish lamellae (Coker, 1917; Tulloss *et al.*, 1995). In addition, *A. magnivelaris* has no or fewer inflated cells in its annulus (cf. Jenkins, 1978, 1982). *Amanita eburnea* differs from *A. oberwinklerana* by its often darker colored pileus, more abundant inflated cells in the annulus, and narrower spores (cf. Tulloss, 1989). The volva of *Amanita eburnea* seems usually to be retained at the stipe base.

15. *Amanita manginiana sensu* Chiu in Sci. Rept. Natl. Tsing Hua Univ., ser. B. Biol. & Psychol. Sci. **3**(3): 166 (1948). Fig. 26
 ?=*Amanita manginiana* Hariot & Pat. in Bull. Mus. Hist. Nat. (Paris) **20**(3): 155 (1914).

Pileus 7–9 cm in diameter, convex to plano-convex to aplanate, brownish-gray, with darker, radial, innate fibrils, subviscid, usually glabrous, occasionally with white, whitish membranous volval remnants; margin smooth, often with remnants of annulus. **Lamellae** free, crowded; lamellulae 0–2, attenuate. **Stipe** 10–15 × 1–2.5 cm, subcylindrical or slightly tapering upward, white to whitish, smooth or with white fibrils or scales; volva limbate, 3–5 × 1.5–3 cm, membranous, white, upper 1/3 free, lower part adnate to indistinctly enlarged base. **Annulus** present, subapical, white, membranous, fragile.

Basidiospores [80/4/3] (5.5–) 6.0–7.5 (–8.0) × (4.5–) 5.0–6.0 μm [Q=(1.0–) 1.08–1.40 (–1.46), Q=1.24 ± 0.10], subglobose to broadly ellipsoid, sometimes ellipsoid, amyloid, colourless, hyaline, thin-walled, smooth, apiculus small. **Volval remnants** on stipe base made up of ± irregularly arranged elements; filamentous hyphae dominant, 2–7 (–10) μm wide, hyaline, thin- to slightly thick-walled (<0.5 μm), branching, interwoven, without clamps; inflated cells scattered to locally fairly abundant, subglobose, ovoid, ellipsoid to long ellipsoid, 40–90 × 25–40 μm, colorless, hyaline, thin- to slightly thick-walled (<0.5 μm), single and terminal or intercalary; vascular hyphae rare. Outer surface of volva consisting of filamentous hyphae. Inner surface of volva strongly gelatinized.

Specimens examined: Japan: Along hiking course, left-side ridge of Kurosawagawa River, Kurosawa 3-Chôme, Oume City, Tokyo, 16. VII. 1997, Y. Doi & K. Miyazaki *s.n.* (TNS-F-182476, TNS-F-182482 & TNS-F-182492).

Habitat and distribution: Solitary or gregarious on the ground in forests. *Amanita manginiana sensu* Chiu is quite common in China, and is new to Japan.

Observations: *Amanita manginiana* Hariot & Pat. is not a well known species. The type specimen was bought in a market in Hue, Viet Nam, and is now not in good condition (Yang, 1997: 167). According to the protologue (Hariot & Patouillard, 1914), and the description and the coloured illustration published by Gilbert (1940; 1941), there are some differences between *Amanita manginiana* Hariot & Pat. and *A. manginiana sensu* Chiu (Yang, 1997), the latter is an edible mushroom often sold at free market in summer in Southwest China. In Japan it was probably regarded as *A.*

pseudoporphyria Hongo, the edibility of which is not known. For comparison of these two species, see the observations under *A. pseudoporphyria*.

It is interesting to note that the outward appearance of *A. manginiana sensu* Chiu and *A. pseudoporphyria* is somewhat similar to that of the famous, fatally poisonous mushroom *A. phalloides* (Fr.) Link, originally described from Europe. However, the former two seem to have no close phylogenetic relationships with the latter according to molecular data (Weiß *et al.*, 1998).

16. *Amanita pseudoporphyria* Hongo in J. Jpn. Bot. **32**: 141 (1957). Fig. 27

Pileus 3–10 cm in diameter, convex to plano-convex to applanate, greyish-brown, brownish, darker at center, with darker innate fibrils, subviscid, glabrous or bearing white, whitish, creamy or grayish, membranous volval remnants; margin smooth, often with white remnants of annulus, context white. **Lamellae** free, crowded; lamellulae 0–2, attenuate. **Stipe** 3–11×0.3–2 cm, subcylindrical or slightly tapering upward, white to whitish, smooth or with white fibrils or scales; volva limbate, 1–3×0.5–2.5 cm, membranous, white to whitish, sometimes with greyish tinge especially towards upper rim of limb, upper 1/3 free, lower part adnate to indistinctly enlarged or almost uninflated, sometimes rooting base. **Annulus** present, apical to subapical, white, membranous, fragile.

Basidiospores [110/6/3] (6.0–) 6.5–8.5 (–11.5)×(4.0–) 4.5–5.5 (–6.5) μm [Q=(1.18–) 1.30–1.78 (–2.17), Q=1.53±0.17], ellipsoid to elongate, rarely subcylindrical, amyloid, colorless, hyaline, thin-walled, smooth, apiculus small. **Volval remnants** on stipe base made up of ±irregularly arranged elements: filamentous hyphae abundant to very abundant, 2–7 (–12) μm wide, hyaline, thin- to slightly thick-walled (<0.5 μm), branching, interwoven, without clamps; inflated cells fairly abundant to (locally) abundant, ovoid, ellipsoid to long ellipsoid, sometimes subglobose, 40–120×25–60 μm , colourless hyaline, thin-walled, single and terminal, sometimes intercalary, occasionally in short chains, vascular hyphae rare. Outer surface of volva consisting of more abundant filamentous hyphae. Inner surface of volva strongly gelatinized.

Specimens examined: Japan: Ishiyama-Hiratsu-chô, Ôtsu, 23. VII. 1956, T. Hongo *s.n.* (Hongo Herb. 1506, TNS-F-237281, Holotype); Right-side ridge of Kurosawa-gawa River, Kurosawa 3-Chôme, Oume City, Tokyo, 2. VIII. 1997, Y. Doi & K. Miyazaki *s.n.* (TNS-F-182564); Along hiking course, left-side ridge of Kurosawa-gawa River, Kurosawa 3-Chôme, Oume City, Tokyo, 16. VII. 1997, Y. Doi & K. Miyazaki *s.n.* (TNS-F-182479).

Habitat and distribution: Gregarious on ground in forests (e.g., of *Pinus*). Also known from South Korea and China (Kim *et al.*, 1993; Yang, 1997).

Observations: Spores of the holotype of *A. pseudoporphyria* are [60/3/1] 7.0–9.0 (–11.5)×(4.0–) 4.5–5.5 (–6.5) μm [Q=(1.36–) 1.43–1.83 (–2.17), Q=1.63±0.14], ellipsoid to long ellipsoid, rarely subcylindrical, amyloid, colorless, hyaline,

thin-walled, smooth, apiculus small. *Amanita manginiana sensu* Chiu is very similar to this species, but differs from the latter in its shorter and wider spores, and in the volva with fewer inflated cells. Furthermore, the stipe base of *A. pseudoporphyria* is often rooting (Yang, 1997: 168).

17. *Amanita subjunquillea* Imai in Bot. Mag. (Tokyo) **47**: 424 (1933). Figs. 28–29

Pileus 3–5 cm in diameter, at first hemispherical, then convex to plano-convex, brownish yellow, citrin-yellow at disc, yellowish towards margin, sometimes yellowish with carneous tinge, subviscid, glabrous and usually without volval remnants; margin smooth or finely striate, non-appendiculate; context white or whitish. **Lamellae** free, crowded, lamellulae 0–2, attenuate. **Stipe** 5–11×0.5–1 cm, subcylindrical or slightly tapering upward, whitish to yellowish, with yellow to yellowish fibrils or scales; base with a bulb; volva limbate, 2–3×1–2 cm, ca. 0.5–1 cm thick, membranous, white to whitish. **Annulus** present, pendant from ca. 1.5 cm below apex of stipe, membranous, white.

Subhymenium 20–30 μm thick, with 2–3 layers of subglobose, ovoid to ellipsoid cells, 8–18×6–15 μm . **Basidia** 28–40×8–12 μm , clavate, 4-spored; sterigmata 3–4 μm long; basal septa without clamps. **Basidiospores** [50/3/3] (6.0–) 6.5–8.0 (–8.5)×(5.0–) 6.0–7.5 (8.0) μm [Q=1.0–1.17 (–1.2), Q=1.09±0.05], globose to subglobose, rarely broadly ellipsoid, amyloid, colorless, hyaline, thin-walled, smooth, apiculus small. **Annulus** dominantly consisting of subradially arranged, filamentous hyphae, 2–7 μm wide, mixed with scattered to fairly abundant, broadly clavate, sometimes ovoid to subglobose, inflated cells, 20–50×15–30 μm , colorless, hyaline, thin-walled, usually single and terminal, rarely 2–3 in chains; vascular hyphae rare.

Specimens examined: Japan: Along hiking course, left-side ridge of Kurosawagawa River, Kurosawa 3-Chôme, Oume City, Tokyo, 16. VII. 1997, Y. Doi & K. Miyazaki *s.n.* (TNS-F-182483); Right-side ridge of Kurosawagawa River, Kurosawa 3-Chôme, Oume City, Tokyo, 25. IX. 1997, Y. Doi *s.n.* (TNS-F-237829); Along hiking course, Nagayama-Kyûryô Hills, Kurosawa 3-Chôme, Oume City, Tokyo, 5. X. 1997, Y. Doi *s.n.* (TNS-F-237728).

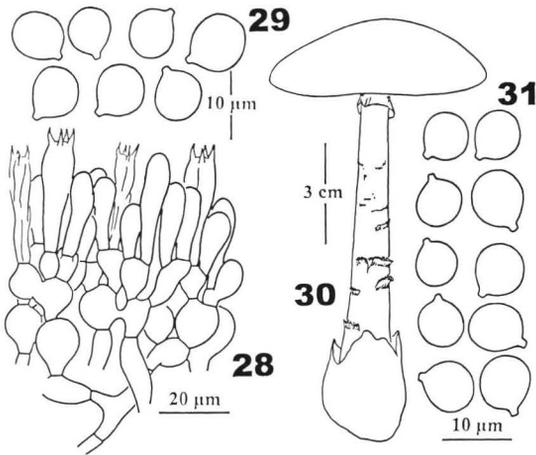
Habitat and distribution: Solitary or gregarious on ground in forests. Also known from China (Mao, 1991).

Observations: This species is characterized by its small, globose to subglobose, amyloid spores. A white variety of this taxon also occurs in Japan (see below).

18. *Amanita subjunquillea* var. *alba* Z. L. Yang in Biblioth. Mycol. **170**: 174 (1997).

Figs. 30–31

Pileus 3–5 cm in diameter, at first hemispherical, then convex to plano-convex, white to whitish, sometimes creamy to pale yellowish at disc, subviscid, glabrous and usually without volval remnants; margin smooth or finely striate, non-appendiculate; context white, whitish. **Lamellae** free, crowded; lamellulae 0–2, attenuate. **Stipe**



Figs. 28–31. Basidiocarps, hymenium, subhymenium and basidiospores. 28–29. *Amanita subjunquillea* (TNS-F-182483); 30–31. *Amanita subjunquillea* var. *alba* (Basidiocarp: TNS-F-237599; Basidiospores: TNS-F-194890).

5–11×0.3–1 cm, subcylindrical or slightly tapering upward, white to whitish, smooth or with white fibrils or scales; base bulbous; volva limbate, 2–3×1–2 cm, membranous, white to whitish. **Annulus** present, 1–2 cm below apex of stipe, white, membranous. Pilei of dried basidiocarps often give yellow reaction to KOH solution (5%).

Basidia 30–45×9–11 µm, clavate, 4-spored, rarely 1-spored, sterigmata 3–5 µm long, basal septa without clamps. **Basidiospores** [124/10/6] (6.0–) 6.5–8.0 (–9.0)×(5.0–) 6.0–7.5 (–8.5) µm [Q=1.0–1.15 (–1.3), Q=1.07±0.05], globose to subglobose, rarely broadly ellipsoid, amyloid, colorless, hyaline, thin-walled, smooth, apiculus small.

Specimens examined: Japan: Along hiking course, left-side ridge of Nagayama-Kyûryô Hills, Kurosawa 3-Chôme, Oume City, Tokyo, 5. X. 1997, Y. Doi *s.n.* (TNS-F-237599, TNS-F-237594, & TNS-F-237748); Right-side ridge of Kurosawagawa River, Kurosawa 3-Chôme, Oume City, Tokyo, 25. IX. 1997, Y. Doi *s.n.* (TNS-F-237846); Do-zawa, Fudagou, Kiyosumi, Chiba Pref., 14. VII. 1983, Y. Doi *s.n.* (TNS-F-174870); Kyoto Univ. Forest in Ahiu, Kyoto, 24. VII. 1964, Y. Doi *s.n.* (TNS-F-194890).

Habitat and distribution: Solitary or gregarious on ground in forests. *Amanita subjunquillea* var. *alba* was described from China, and is new to Japan.

Observations: *Amanita subjunquillea* var. *alba* differs from *A. subjunquillea* var. *subjunquillea* in its white pileus and stipe. This taxon was probably often treated as *A. virosa*, a species originally described from Europe. The latter possesses, however, irregularly formed, conical to campanulate pileus, thin and fragile annulus, and distinctly larger basidiospores (Yang, 1997: 177).

Acknowledgements

The first author is very grateful to Dr. C. Bas, Leiden, for discussions with him on the systematics of *Amanita*, and for providing him working space for the study of some collection of *Amanita* deposited there and to Dr. R. E. Tulloss, New Jersey, for his valuable published and unpublished data of *Amanita*, and for his many informative discussions and correspondence, and for critically reviewing the manuscript. He expresses his sincere thanks to Prof. Dr. F. Oberwinkler, Tübingen, for his guidance. He thanks his colleagues in Japan for their organizations, hospitality and support during his visit to Japan. The authors extend thanks to Dr. T. Hongo for his kind help.

This study was supported partially by the Grant-in-Aid for Scientific Research, Ministry of Education, Science, Sports and Culture, Japan (no. 10041186 in 1998), and by the National Natural Science Foundation of China under the project no. 39800007 for the first author. The field works by the second author in the forest area of Oume City, Tokyo, Japan in 1997 were financially supported by the Grant-in-Aid from the World Wide Fund for Nature, Japan (WWF Japan).

References

- Bas, C., 1969. Morphology and subdivision of *Amanita* and a monograph of its section *Lepidella*. *Persoonia*, **5**: 285–579.
- Bas, C. & S-I. Hatanaka, 1984. An undescribed species of *Amanita* section *Lepidella* from Japan. *Persoonia*, **12**: 321–325.
- Chiu, W. F., 1948. The Amanitaceae of Yunnan. *Sci. Rept. Nation. Tsing Hua Univ. ser. B*, **3**(3): 165–178.
- Coker, W. C., 1917. The Amanitas of the eastern United States. *J. Elisha Mitchel Sci. Soc.*, **33**: 1–88.
- Corner, E. J. H. & C. Bas, 1962. The genus *Amanita* in Singapore and Malaya. *Persoonia*, **2**: 241–304.
- Doi, Y., 1991. Type collection in the Herbarium of National Science Museum, Tokyo (TNS), Agaricales named by Dr. Tsuguo Hongo (1). *Bull. Natn. Sci. Mus. Tokyo, ser. B*, **17**(2): 49–58.
- Gilbert, E. J., 1940. Amanitaceae. In J. Bresadola: *Iconographia Mycologica*, **27**, Suppl., **1**(1): 1–200. Mediolani.
- Gilbert, E. J., 1941. Amanitaceae. In J. Bresadola: *Iconographia Mycologica*, **27**, Suppl., **1**(2-3): 201–427, 73 pls., Mediolani.
- Hariot, P. & N. Patouillard, 1914. Champignons recueillis dans l'Annam par M. Eberhardt. *Bull. Mus. Nat. d'Hist. Natur. Paris*, **20**: 151–156.
- Hongo, T., 1953. Larger fungi of the provinces of Omi & Yamashiro (4). *J. Jpn. Bot.*, **28**: 69–75.
- Hongo, T., 1955. Notes on Japanese larger fungi (6). *J. Jpn. Bot.*, **30**: 73–79.
- Hongo, T., 1957. Notes on Japanese larger fungi (10). *J. Jpn. Bot.*, **32**: 141–146.
- Hongo, T., 1958 a. Notes on Japanese larger fungi (13). *J. Jpn. Bot.*, **33**: 344–350.
- Hongo, T., 1958 b. Studies on the Agaricales of Japan (2). The genus *Amanita* in the prefectures of Shiga and Kyoto. *Mem. Shiga Univ., Nat. Sci.*, **8**: 35–41.
- Hongo, T., 1959. The Agaricales of Japan (1). *Mem. Shiga Univ., Nat. Sci.*, **9**: 47–94.
- Hongo, T., 1961. On some agarics of Japan. *Mem. Shiga Univ., Nat. Sci.*, **11**: 39–42.
- Hongo, T., 1966. Notes on Japanese larger fungi (18). *J. Jpn. Bot.*, **41**: 165–172.
- Hongo, T., 1967. Notulae mycologicae (6). *Mem. Shiga Univ., Nat. Sci.*, **17**: 89–95.

- Hongo, T., 1969. Notes on Japanese larger fungi (20). *J. Jpn. Bot.*, **44**: 230–238.
- Hongo, T., 1970. Notulae mycologicae (9). *Mem. Shiga Univ., Nat. Sci.*, **20**: 49–54.
- Hongo, T., 1971. Notulae mycologicae (10). *Mem. Shiga Univ., Nat. Sci.*, **21**: 62–68.
- Hongo, T., 1974 a. Notulae mycologicae (13). *Mem. Shiga Univ., Nat. Sci.*, **24**: 44–51.
- Hongo, T., 1974 b. Two new species of *Amanita* from *Castanopsis* forests in Japan. Travaux mycologiques dédiés à R. Kühner. *Bull. Soc. Linn. Lyon, no. spéc.*: 189–193.
- Hongo, T., 1975. Notulae mycologicae (14). *Mem. Shiga Univ., Nat. Sci.*, **25**: 56–63.
- Hongo, T., 1977. Notulae mycologicae (15). *Mem. Shiga Univ., Nat. Sci.*, **27**: 20–25.
- Hongo, T., 1982. The Amanitas of Japan. *Acta Phytotax. Geobot.*, **33**: 116–126 (in Japanese).
- Hongo, T., 1983. Notulae mycologicae (18). *Mem. Shiga Univ., Nat. Sci.*, **33**: 37–41.
- Imai, S., 1933. Studies on the Agaricaceae of Japan I. Volvate agarics in Hokkaido. *Bot. Mag. (Tokyo)*, **47**: 423–432.
- Imai, S., 1938. Studies on the Agaricaceae of Hokkaido I. *Journ. Facul. Agr. Hokkaido Imp. Univ. Sapporo*, **43**: 1–178.
- Imai, S., 1939. Studia agaricacearum Japonicum. I. *Bot. Mag. (Tokyo)*, **53**: 392–399.
- Imazeki, R. & T. Hongo, 1970. Coloured Illustrations of Fungi of Japan. vol. 1., 265 pp., Hoikusha Publishing Co., Ltd. (Osaka) (in Japanese).
- Imazeki, R. & T. Hongo, 1975. Coloured Illustrations of Fungi of Japan. vol. 2., 312 pp., Hoikusha Publishing Co., Ltd. (Osaka) (in Japanese).
- Imazeki, R. & T. Hongo, 1987. Colored Illustrations of Mushrooms of Japan. vol. 1., 325 pp., Hoikusha Publishing Co., Ltd. (Osaka) (in Japanese).
- Imazeki, R., Y. Otani & T. Hongo, 1988. Fungi of Japan., 623 pp., Yama-kei Publishers Co., Ltd., Tokyo (in Japanese).
- Imazeki, R. & S. Toki, 1955. Contribution to the knowledge of Japanese Agaricales I. *Bull. Governm. For. Exp. Stat., Meguro*, **79**: 1–12.
- Ito, S., 1959. Mycological flora of Japan. vol. II. 467 pp., Yokendo Ltd., Tokyo (in Japanese).
- Jenkins, D. T., 1977. A taxonomic and nomenclatural study of the genus *Amanita* sect. *Amanita* for North America. *Biblioth. Mycol.*, **57**: 1–126.
- Jenkins, D. T., 1978. A study of *Amanita* types I. Taxa described by C. H. Peck. *Mycotaxon*, **7**: 23–44.
- Jenkins, D. T., 1982. A study of *Amanita* types IV. Taxa described by G. F. Atkinson *Mycotaxon*, **14**: 237–246.
- Jenkins, D. T., 1986. *Amanita* of North America. 198 pp., Mad River Press, Eureka, California.
- Kim, Y.-S., S.-J. Suck, Y.-H. Park & D. Y. Cha, 1993. *Amanita* in Korea. In Proceedings of the First Korea-China Joint Seminar for Mycology, Dec. 2–5, 1993, Seoul, Korea, published by the Korean Society of Mycology, pp. 114–127.
- Kornerup, A. & J. H. Wanscher, 1981. Taschenlexikon der Farben. 3 Aufl., 242 Seiten., Muster-Schmidt Verlag, Zürich, Göttingen.
- Mao, X. L., 1991. Poisonous mushrooms of Amanitaceae from China and their poisons (*Chinese*) *Microbiol. Bull.*, **18**: 160–165 (in Chinese).
- Matsuda, I. & T. Hongo, 1955. Larger fungi from the sand dunes in Niigata Prefecture (1). *J. Jpn. Bot.*, **30**: 148–153.
- Matsuda, I. & T. Hongo, 1956. Larger fungi from the sand dunes in Niigata Prefecture (3). *J. Jpn. Bot.*, **31**: 197–200.
- Nagasawa, E. & T. Hongo, 1984. New taxa of *Amanita*: three new species and one new form from western Japan. *Trans. Mycol. Soc. Japan*, **25**: 367–376.
- Nagasawa, E. & T. Hongo, 1985. Some agarics from the San-in District, Japan. *Mem. Natn. Sci. Mus. Tokyo*, **18**: 73–88.
- Ridgway, R., 1912. Color standards and nomenclature. 53 pp.+53 pl., Publ. by the author, Washington,

D.C.

- Singer, R., 1954. Agaricales von Nahuel Huapi. *Sydowia*, **8**: 100–157.
- Tulloss, R. E., 1989. *Amanita eburnea*—a new species from Central America. *Mycotaxon*, **36**: 1–7.
- Tulloss, R. E., 1990. *Amanita crenulata*—history, taxonomy, distribution and poisonings. *Mycotaxon*, **39**: 393–405.
- Tulloss, R. E., T. Hongo & H. R. Bhandary, 1992 a. *Amanita neoovoidea*—taxonomy and distribution. *Mycotaxon*, **44**: 235–242.
- Tulloss, R. E., C. L. Ovrebo & H. R. Halling, 1992 b. *Amanita* (Amanitaceae) from Andean Colombia. *Mem. New York Bot. Gard.*, **66**: 1–46.
- Tulloss, R. E., S. L. Stephenson, R. P. Bhatt & A. Kumar, 1995. Studies on *Amanita* (Amanitaceae) in West Virginia and adjacent areas of the mid-Appalachians. Preliminary results. *Mycotaxon*, **56**: 243–293.
- Weiß, M., Z. L. Yang & F. Oberwinkler, 1998. Molecular phylogenetic studies in the genus *Amanita*. *Can. J. Bot.*, **76**: 1170–1179.
- Yang, Z. L., 1994. Studies of the genus *Amanita* from southwestern China (I). *Mycotaxon*, **51**: 459–470.
- Yang, Z. L., 1997. Die *Amanita*-Arten von Südwestchina. *Biblioth. Mycol.*, **170**: 1–240.