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THE GENUS AMANITA IN SINGAPORE AND MALAYA

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(With 12 Plates and 56 Text-figures)

A rather extensive series of collections of the genus *Amanita* from Malaya and Singapore, provided the basis of 22 species described as new. The obscure species *Amanita eriophora* (Berk.) Gilb., *A. fritillaria* (Berk.) Sacc., *A. virginea* Mass., *Armillaria squamosa* Mass., and *Collybia elata* Mass. are redescribed and the last two transferred to *Amanita*. *Amanita similis* Boed. is reduced to the rank of a subspecies of *A. hemibapha* (Berk. & Br.) Sacc. and *A. hemibapha* sensu Boed. described as *A. hemibapha* subsp. *javanica*. *Amanita rubrovolvata* Imai is recorded for the first time from outside Japan.

During a period of about 15 years the senior author was in a position to collect fungi in the neighbourhood of Singapore and, to a lesser extent, also in Malaya. One of the genera found to be rather well represented in the area concerned, was the genus *Amanita*. Several decades of collections of this genus were gathered, preserved, extensively annotated, and many specimens depicted in colour. The collector was able to distinguish most of the species represented in his material already in the field, indicating these by means of numbers.

Later on, the collections and data were handed over to the junior author, who completed the microscopical descriptions, checked the literature of the genus *Amanita*, and studied types and additional material of related species as far as necessary.

The result of the combined efforts is, that in the present paper 22 new species are described and five previously published but incompletely known species are redescribed.

A rather detailed synonymy of the subgeneric and sectional names is given. This is done because several of these names could be used for entirely different subdivisions of the genus, depending on the types to be selected, since the original species formed heterogeneous lots. In these cases the application of these names is fixed by choosing suitable lectotypes.

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All the collections and drawings referred to in the present paper are deposited in the Rijksherbarium at Leiden, unless otherwise mentioned.

AMANITA Pers. ex Hook.

Amanita Pers., Tent. mycol. 65. 1797; *ex* Hook., Fl. scot. 19. May 1821. — *Agaricus* tribus *Amanita* (Pers.) *ex* Fr., Syst. mycol. **1** : 9, 12. 1821. — Lectotype (Clements & Shear, Gen. Fungi 348. 1931): *Agaricus muscarius* L.; cf. Donk *in* Beih. Nova Hedw. **5**: 22. 1962.

For a more complete enumeration of synonyms and a generic description one is referred to Singer (1951: 381; 1962: 422).

The more observations become available, the more one becomes convinced that the genus *Amanita* in a broad sense is a very natural taxon, and that none of the generic segregations is to be maintained. It even turns out to be rather difficult clearly to define as sections the groups distinguished by Gilbert (1940) and raised by him to generic rank.

For instance, *Amanitopsis* Roze and *Amanita* sensu Gilb. 1940 (= *Amanita* sect. *Caesareae* Sing.) cannot be separated on any character of importance. Therefore, they are united in the present paper into the single section *Vaginatae* (Fr.) Quél. There exists a long gradating series of intermediates between the exannulate, fragile *A. vaginata* (Bull. ex Fr.) Vitt. with globulose spores on one side and the annulate, fleshy *A. caesarea* (Scop. ex Fr.) Grev. with ellipsoid spores on the other. *Amanita princeps* Corner & Bas and *A. hemibapha* (Berk. & Br.) Sacc., both described in this paper, represent interesting members of this series. Huijsman (1959: 21) already provided some morphological evidence for the close relationship of *A. caesarea* with the *A. vaginata* group.

It seems hardly necessary to say that the two subgenera of *Amanita* with non-amyloid spores, viz. *Vaginaria* Forq. ex Quél. and *Pseudo-amanita* Sing. formerly distinguished by Singer (1951: 386) are indefensible in our opinion, as they separate the *A. vaginata* group from the *A. caesarea* group. We heartily agree with their recent union by Singer (1962: 426).

Gilbert (1940: 71) kept *A. farinosa* Schw. by itself in the monotypical genus *Amanitella* Earle. Singer (1951: 387) put this species into *Amanita* subg. *Vaginaria* sect. *Ovigerae* Sing. However, a very closely related species, *A. obsita* Corner & Bas, described in the present paper, is placed in section *Amanita* (syn., *Amanitaria* Gilb.; *Amanita* sect. *Muscariae* (Fr.) Quél. sensu Sing.).

As *A. farinosa* may have a distinctly bulbous base to the stipe (see Gilbert 1941:

pl. 26) and has a friable volva as well as ellipsoid spores, it certainly does not belong to section *Vaginatae*, even though an annulus is lacking. The cuticle of *A. farinosa* is well developed and has a gelatinous upper layer (observed in *Hesler 22331*). Its pulverulent appearance is due to the thin and very incoherent volva. Moreover, in the present paper, two new species, viz. *A. mira* and *A. sychnopyramis*, both also without an annulus, are placed in section *Amanita*, and the annulate *A. rubrovolvata* Imai with a volva very similar to that of *A. farinosa* appears to belong there too. Therefore, the incorporation of *Amanitella* Earle in *Amanita* sect. *Amanita* seems justified.

Singer's section *Ovigerae* (1951: 386; 1962: 427) is rather artificial and heterogeneous. At present it would seem preferable to keep the species resembling *A. vaginata* but possessing ellipsoid spores, in the same section as those with globulose spores.

The infrageneric classification of the genus *Amanita* adopted in the present paper may be learned from the following key.

KEY TO THE SUBGENERA AND SECTIONS

1. Spores not amyloid. Margin of pileus mostly (in Malaya and Singapore always) distinctly striate-sulcate. Short gills nearly always truncate . . . . . Subgenus *Amanita*
   2. Stipe with bulbous base. Volva mostly breaking up; if more or less membranous, then attached to greater part of bulb . . . . . Section *Amanita*, p. 283
   2. Stipe without bulbous base. Volva mostly deeply sheathing, sometimes breaking up . . . . . Section *Vaginatae*, p. 294
1. Spores amyloid. Margin of pileus mostly smooth (in Malaya and Singapore striate in some small species with small gills attenuate) . . . . . Subgenus *Lepidella*
   3. Volva sheathing, sometimes circumcised and leaving flat patches on pileus, in that case, however, bulb of stipe marginate and spores globulose; sometimes consisting of two layers, the inner one breaking up and covering pileus, the outer forming a sheathing volva or else a membranous calyptra on centre of pileus.
      4. Volva sheathing or circumcised. Margin of pileus neither exceeding gills nor appendiculate. Flesh seldom discolouring. Spores globulose to ellipsoid. Mostly rather slender species with white to coloured cuticle . . . . . Section *Phalloideae*, p. 277
      4. Volva sheathing, often consisting of a membranous outer layer and a friable inner one rendering the pileus micaceous, pulverulent, or squamulose. Margin sometimes exceeding gills and sometimes appendiculate. Flesh rather often rubescent. Spores broadly ellipsoid to subcylindrical. Mostly rather robust species with white to brown cuticle . . . . . Section *Amidella*, p. 275
   3. Volva breaking up, leaving base of stipe naked or covered with powdery, flocculose, warty, patch-like or ridges-forming remnants.
      5. Pileus with well defined, mostly coloured cuticle, not exceeding gills, never appendiculate. Remnants of volva on pileus easily washed off. Gills white to cream. Ring thin, membranous, rarely breaking up into fibrillose patches. Stipe with comparatively small bulb. Spores globulose to ellipsoid . . . . . Section *Validae*, p. 261
      5. Pileus with sometimes ill-defined, often white to pale cuticle, with margin mostly exceeding gills and appendiculate. Remnants of volva on pileus often more or less adnate. Gills white to deep ochraceous yellow, sometimes greenish-yellowish. Ring membranous, or thick and disrupting, or friable and rendering the stipe flocculose-pulverulent. Stipe sometimes rooting, often with large, sometimes marginate bulb. Spores globulose to subcylindrical . . Section *Lepidella*, p. 244

Subgenus LEPIDELLA (Gilb.) Vesely emend. [1]

Amanita [subgen.] *Euamanita* Lange *in* Dansk bot. Ark. **2**: 5, 7. 1915 (not valid; see Art. 21 and 32, of the 'Code' ed. 1961); *emend.* Sing. *in* Ann. mycol., Berl. **34**: 352. 1936; *in* Lilloa **22**: 387. 1951. — Lectotype (Sing. 1951): *A. phalloides* (Fr.) Link.

Lepidella Gilb. *in* Bull. Soc. mycol. France **41**: 303. 1925; not *Lepidella* Tiegh. *in* C. R. Acad. Sci., Paris **153**: 1198. 1911. — *Amanita* subgen. *Lepidella* (Gilb.) Vesely *in* Atl. Champ. Europe **1** (*Amanita*): 4, 54. 1934. — *Aspidella* Gilb. *in* Bres., Iconogr. mycol. **27** (1): 73, 79. 1940. (name change). — *Amanita* subgen. *Aspidella* (Gilb.) Gilb., Not. Amanites XXX [3]. 1941. — Type: *Amanita vittadinii* (Moretti) Vitt.

Amplariella Gilb. *in* Bres., Iconogr. mycol. **27** (1): 70, 76. 1940. — *Amanita* subgen. *Amplariella* (Gilb.) Gilb., Not. Amanites XXX [2]. 1941. — Type: *Amanita ampla* Pers. ex Larb. [= *A. excelsa* (Fr.) Gonn. & Rab.].

Amanitina Gilb. *in* Bres., Iconogr. mycol. **27** (1): 72, 78. 1940. — *Amanita* subgen. *Amanitina* (Gilb.) Gilb., Not. Amanites XXX [3]. 1941. — Type: *Amanita phalloides* (Fr.) Link.

Amidella Gilb. *in* Bres., Iconogr. mycol. **27** (1): 71, 77. 1940. — *Amanita* subgen. *Amidella* (Gilb.) Gilb., Not. Amanites XXX [3]. 1941. — Type: *Amanita volvata* Peck.

Lepidella is the oldest epithet available in subgeneric rank among those which have been typified with a species of *Amanita* with amyloid spores. Therefore, the subgen. *Lepidella* is emended here to cover all the species of *Amanita* with amyloid spores.

As a generic name, *Lepidella* Gilb. was illegitimate, it being an older homonym of *Lepidella* Tiegh. (Loranthaceae). It was changed into *Aspidella* Gilb. However, when adapted to the subgeneric level '*Lepidella*' became available again.

Section LEPIDELLA

Lepidella Gilb. — *Aspidella* Gilb. (see above).

Aspidella subgen. *Nitidella* Gilb. *in* Bres., Iconogr. mycol. **27** (1): 74. 1940 (not val. publ.). — *Amanita* sect. *Nitidella* (Gilb.) Konr. & Maubl., Agaricales 67. 1948 (not val. publ.). — Type: "*Amanita solitaria* Bull." [= *Amanita strobiliformis* (Paul. ex Vitt.) Gonn. & Rab.].

Amanita sect. *Strobiliformes* Sing. *in* Lilloa **22**: 388. 1951 (not val. publ.). — Type: *Amanita strobiliformis* (Paul. ex Vitt.) Gonn. & Rab.

Amanita sect. *Roanokensis* Sing. *in* Lilloa **22**: 388. 1951 (not val. publ.); *ex* Sing. *in* Sydowia **15**: 67. 1962. — Type: *Amanita roanokensis* Coker.

For the scope of this section, see the key to the subgenera and sections above.

KEY TO THE SPECIES OF SECTION *Lepidella*

1. Remnants of volva on pileus large, thick, pyramidal, angular or lumpish, dark brown warts. Pileus dingy pinkish. Stipe dingy vinaceous pink, squamulose, exannulate, with dark brown rim or large warts at base. Flesh turning vinaceous to purplish. Spores 10–11 μ, globulose . . . . . *A. sculpta*, p. 255
1. Remnants of volva on pileus a pulverulent layer, flat patches, or pyramidal warts gradually diminishing in size toward margin of pileus.
   2. Volva merely forming conical or pyramidal warts on pileus.
      3. Pileus entirely covered with large, white, pyramidal warts with ferruginous-brown tips. Stipe stout, pale with small brownish scales. Spores 7–10.5 × 7–9.5 μ, globulose to broadly ellipsoid . . . . . *A. perpasta*, p. 250

[1] In order to avoid the less desirable name *Amanita* subgen. *Peplophora* Quél., this subgeneric name has been typified by a species with non-amyloid spores (see p. 283).

3. Pileus entirely covered with small, conical, unicoloured warts.
   4. Fruit-body white. Stipe exannulate, with bulbous to broadly clavate base, entirely covered with small warts. Spores 7–9 × 6–7.5 μ, subglobulose to broadly ellipsoid . . . . . *A. virginea*, p. 248
   4. Fruit-body except gills flesh-coloured pink. Ring membranous, persistent. Stipe slenderly clavate, with small, narrow, transverse scales and scattered patches of volva at somewhat strobiliform base. Spores 7–10 × 6–8.5 μ, broadly ellipsoid to ellipsoid . . . . . *A. timida*, p. 245
2. Volva not merely forming conical or pyramidal warts on pileus.
   5. Pileus covered with a greyish umber to umber, flocculose, felted or micaceous layer sometimes breaking up into crusts, patches, warts or small particles.
      6. Fruit-body small, slender. Pileus greyish white, covered with small micaceous, umber particles. Stipe white at apex, brown at base, entirely flocculose. Bulb small, attenuated into a small, pointed root. Flesh white, unchanging. Spores 6.5–9 (–10) × 5–7.5 μ, broadly ellipsoid to elongated-ellipsoid *A. vestita*, p. 252
      6. Fruit-body tall. Pileus brown to yellowish, covered with a flocculose-felted, greyish umber, unequally thick layer, sometimes breaking up into patches and warts. Upper two thirds of stipe covered with greyish lilac or greyish violet felt. Bulb fusiform or marginate with more or less rooting base. Flesh white , slowly rufescent. Spores 8–12 × 7–10.5 μ, broadly ellipsoid . . *A. eriophora*, p. 253
   5. Pileus covered with white to yellowish-brownish, flat patches.
      7. Stipe below ring glabrous, without remnants of volva, with rhizoids at base. Gills becoming deep ochraceous. Pileus whitish, with whitish to yellowish-brownish, thin patches. Smell strong. Spores 5.5–7.5 × 5–6.5 μ, globulose to broadly ellipsoid . . . . . *A. gymnopus*, p. 259
      7. Stipe near base with patches or flocculose, without rhizoids, soon hollow. Gills white to cream. Pileus whitish, with very few, large, thick patches. Spores 7–8.5 × 5–7 μ, broadly ellipsoid to elongated-ellipsoid . . . . *A. centunculus*, p. 258

Amanita timida Corner & Bas, *sp. nov.* — Figs. 1, 2

Pileus 47–120 mm latus, initio globosus, dein convexus vel applanatus, margine appendiculatus neque striatus, siccus, albus vel incarnatus, verrucis conicis, minutis, duris, roseis vel incarnatis dense obsitus. Lamellae sub-confertae, albae vel cremeae. Stipes 65–160 mm longus, apice 6–16, basi 16–27 mm latus, clavatus vel subclavatus, substrobiliformis, solidus, annulatus, a summo albus, striatus, pruinosus, infra annulum subincarnatus, squarrulosus, volvae fragmentis dispersis, concoloribus, angulatis, planis vel recurvis. Annulus 10–15 mm latus, floccoso-membranaceus, supra striatus, albus, infra subincarnatus, margine verrucosus. Caro alba, rubescens, odore *Trigonellae foenum-graecum*. Sporae 7–10 × 6–8.5 μ, subellipsoideae vel ellipsoideae, amyloideae. Typus: *E. J. H. Corner s.n.*, 30 Oct. 1934, Singapore. Mac Ritchie Reservoir (L).

Etymology: timidus, timid (on account of the blushing context).

Pileus 47–120 mm wide, globose when young, convex to plane with age, without umbo, not striate at margin, dry, densely echinate with hard, micaceous, pale pink to flesh-coloured, small, pyramidal warts, 1.5–3 mm high and 1.5–2 mm wide over centre, smaller over limb, reduced to small, subfloccose, flesh pink points near margin, easily broken off over disc, becoming separated on expansion, displaying the white, pale pinkish or (when old or rained upon) flesh-coloured, subfloccose-felted flesh; margin often splitting on expansion, appendiculate with rather small membranous fragments of partial veil, sometimes with a few large angular warts similar to those on edge of annulus. Gills free, somewhat crowded, 45–56 primaries with 1–3(–7) attenuate shorter ones between each pair, rather thick, 6–13 mm wide,

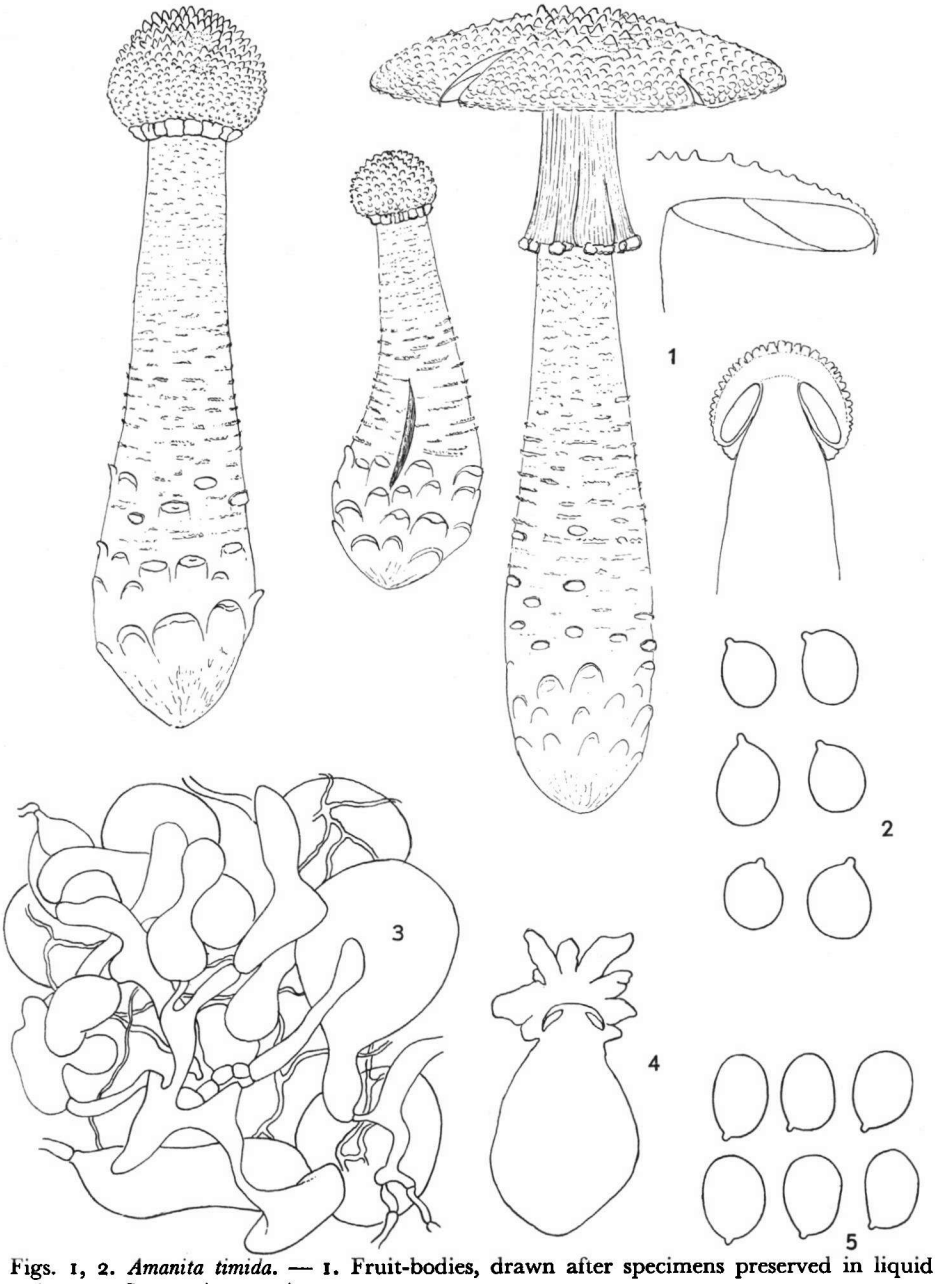
white then cream; edge micaceous-pruinose, irregularly serrulate. Stipe 65–160 mm long, 6–16 mm wide at apex, 16–27 mm at clavate to subclavate base, stout, solid, firm, straight or slightly curved, above ring finely longitudinally striate, pruinose and white; below ring pale pinkish flesh-coloured (except for white extreme base), with small, ascending, scarcely recurved, fibrillose, pale flesh-coloured, about 0.5–2 mm long scales and also with a few scattered, larger, hard, concolorous warts, 3–5 mm high and wide, as remnants of volva, more or less cubic in middle of stipe, flattened, with slightly recurved tips and more crowded at base of stipe (not in rings), making this part more or less strobiliform. Ring 15–30 mm below apex of stipe, 10–15 mm wide, pendant, floccose-membranous, thick, white and striate above, pinkish flesh-coloured beneath; round edge with big, hard, angular, pinkish flesh-coloured, 3–5.5 mm thick warts. Flesh 5–12 mm thick in centre, 3–6 mm half-way to margin, firm, persistently so in stipe, becoming spongy-felted in pileus, white, after an hour or more very slowly becoming pinkish in places on breaking. Whole fruit-body pinkish flesh-coloured when old or when rained upon; eventually pinkish rufescent at base of stipe. Smell faint, of fenugreek.

Spores (Fig. 2) 7.1–9.9 × 5.6–8.4 μ (fresh, 8–10 × 6.5–8 μ), broadly ellipsoid to ellipsoid, seldom subglobulose (length-breadth ratio 1.1–1.4, average 1.2–1.25), colourless, thin-walled, smooth, with a small to medium-large apiculus, with somewhat oleaginous granular contents, amyloid. Basidia 53–57 × 10–11 μ, remarkably long, slenderly clavate with long stalks, 4-spored, with clamps; sterigmata straight, up to 6 μ long. Marginal cells 20–55 × 12–35 μ, mostly pyriform, hyaline, smooth, rather numerous. Trama of gills rather irregelarly bilateral; central strand not clearly set off, composed of 3–14 μ wide, more or less longitudinal hyphae; divergent zones with elongate to short cylindrical, 5–15 (–20) μ wide cells, shorter and broader near subhymenium; subhymenium ramose to subcellular-ramose, with cells at base of basidia short cylindrical and rather narrow. Cuticle hardly differentiated, merely a denser part of trama of pileus with relatively more numerous hyphae, about 200 μ wide; without radial hyphae and without gelatinized hyphae; not separable from basal tissue of warts. Remnants of volva on pileus composed of very variable cells, more or less arranged in erect chains in apex of warts, with globulose to ellipsoid cells, up to 60 × 45 μ, and all kinds of transitional forms between those and cylindrical cells, e.g. citriform, fusiform, clavate and more irregularly shaped cells; base of warts consisting of 3–12 μ wide, interwoven hyphae with scattered, elongated cells and scattered, short, terminal rows of small inflated cells; oleiferous hyphae present. Remnants of volva on base of stipe nearly similar to those on pileus, but in their basal parts with some large, globulose cells with long peduncles. Trama of stipe with longitudinal, terminal broad, fusiform-clavate, up to 250 × 70 μ large cells, and strikingly numerous broad hyphae, mostly 5–8 μ wide, with narrower, more crowded hyphae near surface. Annulus made up of loosely interwoven, longitudinal, 3 μ and more wide hyphae, and elongate, up to 15 μ wide cells; upper side with numerous clavate cells. Clamps numerous.

HABITAT.—Terrestrial in jungle.

COLLECTIONS EXAMINED.—Singapore, Mac Ritchie Reservoir, 30 Oct. 1934 (type; several specimens; some dried and some in liquid); 7 Nov. 1934 (some dried specimens); both *E. J. H. Corner s.n.* (as *Amanita* 9).

There are no other species with small conical warts on the pileus, which have a pinkish colour and a slenderly clavate stipe in section *Lepidella*. The present species is rather similar to *A. virginea* Mass., which, however, is entirely white and has an exannulate, broadly clavate-bulbous stipe never strobiliform at the base.



Figs. 1, 2. *Amanita timida*. — 1. Fruit-bodies, drawn after specimens preserved in liquid (× 1). — 2. Spores (× 1250).

Figs. 3, 4. *Amanita sculpta*. — 3. Crushed remnants of veil from pileus (× 325). — 4. Anomalous bud (× $^1/_2$).

Fig. 5. *Amanita vestita*. — Spores (× 1250).

AMANITA VIRGINEA Mass.—Figs. 6–8

Amanita virginea Mass. *in* Kew Bull. **1908**: 1.
Amanita sumatrensis Boed. *in* Sydowia **5**: 326. 1951.

Pileus 100–155 mm wide, convex, then plane or slightly concave, not striate at margin, dry, white (to pale cream according to Boedijn), covered with a thin, soft, mealy, white layer, set with hard, conical, white, separable warts 2–3 mm high and wide (more slender in type; up to 4 mm long and 1—2 mm broad according to Boedijn), crowded over disc, smaller and softer and about 1 mm high and wide toward appendiculate margin; smooth and glabrous in old specimens after rain. Gills free, rather crowded, 86–121 primaries with 1–3 attenuate shorter ones between each pair, broad, 12–18 mm wide, white, with minutely floccose-micaceous, denticulate edge. Stipe 60–100 mm long, 20–50 mm wide at base, 15–25 mm at apex, solid (becoming hollow according to Massee, Boedijn), clavate-bulbous at base, more or less annulate, white, mealy, with small transverse scales up to apex, with 1–3 mm large, more or less conical warts derived from volva, often in transverse rows, where bulbous base passes into stipe, and with small flattened warts on bulb. Ring lifted up by expanding pileus, rather thick, covered with mealy small scales on underside, white, breaking and falling to pieces on expansion of pileus, leaving a narrow, irregular pendant collar, 3–5 mm wide, situated at extreme apex of stipe. Flesh 9–12 mm thick in centre of pileus, 2–3 mm half-way to margin, rather firm, white.

Spores (Fig. 8) fresh 8–9 × 6–6.5 μ (in type, 6.8–8.1 (–9.0) × 6.0–7.4 μ, length-breadth ratio 1.1–1.3, average 1.2) broadly ellipsoid, colourless, smooth, with cloudy granular contents, amyloid. Basidia 37–48 × 9–10.5 μ, 4-spored; sterigmata 3–4 μ long. Marginal cells ellipsoid to globulose (12–27 μ long according to Boedijn). Trama of gill composed of rather loose hyphae, consisting of 60–200 × 4–20 μ large cells; subhymenium compact, 2–3 cells thick; cells 15–25 × 12–20 μ. Remnants of volva on pileus and stipe made up of inflated, 20–60 × 12–40 μ large cells; narrow hyphae absent.

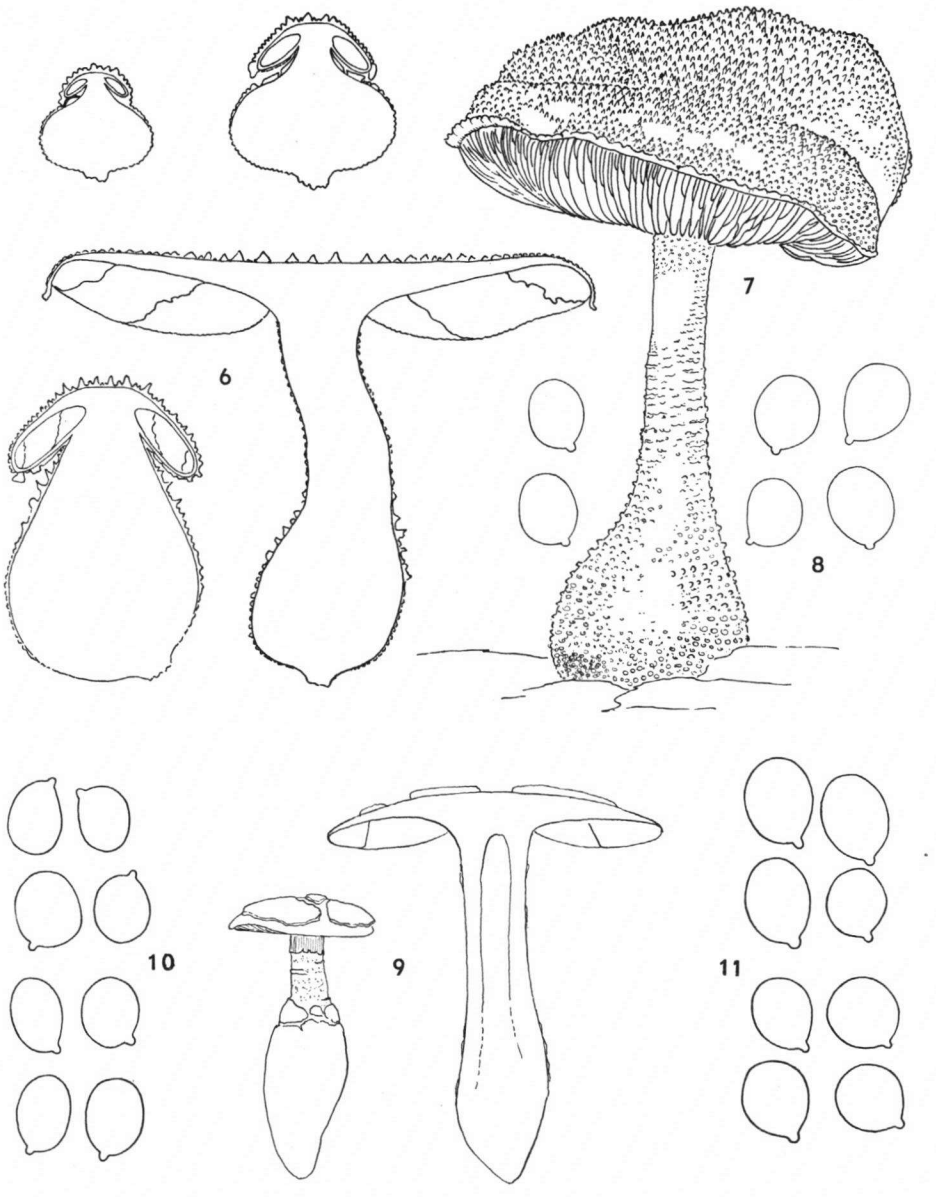
HABITAT.—Terrestrial in jungle. In Botanic Gardens in Singapore under *Quercus argentea*, appearing late in the rainy seasons, twice every year, about April and December.

DISTRIBUTION.—Singapore, Malaya (occasionally observed by Corner), Sumatra (Boedijn, l.c., as *A. sumatrensis* Boed.; original drawing in herb. Boedijn consulted) and Java (witness an excellent water-colour drawing with microscopical analyses by van Overeem, no. 1495, in Herb. bogoriense).

COLLECTIONS EXAMINED.—Singapore, Botanic Gardens, *Ridley 87 I* (type; 1 dried specimen; water-colour drawing; K); Gardens' Jungle, 1932 (many buds, in all stages, on liquid); 13 Dec. 1933 (several large pencil drawings), last two *E. J. H. Corner s.n.* (as *A. virginea*).

OBSERVATIONS.—The above description was made by the senior author from fresh material. All additions are bracketed. Because only buds were preserved, only the young tissues could be studied afterwards. An account of these observations follows.

Trama of gills bilateral; central strand distinct and wide, with longitudinal hyphae; divergent zones rather narrow, with narrow hyphae perpendicular to subhymenium; subhymenium not yet distinct from divergent zones. Cuticle hard to distinguish, forming a thin hyaline layer over centre of pileus, between remnants of volva and context of pileus, composed of crowded, repent, narrow, slightly gelatinized hyphae. Remnants of volva on pileus pseudoparenchymatic, consisting of erect chains of inflated cells, 10–55 × 8–40 μ, mostly ellipsoid, sometimes glob-



Figs. 6–8. *Amanita virginea*. — 6. Fruit-bodies (× ½). — 7. Reproduction of type drawing (× ½). — 8. Spores of type (× 1250).

Figs. 9, 10. *Amanita centunculus*. — 9. Fruit-bodies, reconstructed from dried specimens and description (× 1). — 10. Spores (× 1250).

Fig. 11. *Amanita perpasta*. — Spores (× 1250).

ulose, ovoid, clavate and elongate to cylindrical; narrow hyphae absent and oleiferous hyphae scarce. Flat small warts on lower part of bulb composed of inflated cells, mixed with hyphae. Tissue between velum partiale and stipe similar to warts on pileus, but cells not exceeding 35 × 25 μ, mostly smaller. Annulus composed of loosely interwoven hyphae with short, rather broad, terminal, small, clavate cells. Clamps numerous.

A study of the type specimen and the type drawing left no doubt as to Corner's collections described above and *A. virginea* Mass. being conspecific. The microscopical structure of the type was hard to analyse. Especially clamps were difficult to find, but in the end some were observed in the trama of the gills.

Massee's description of the remnants of the volva on the base of the stipe is not clear, even when the type specimen and the type drawing are consulted. His account of the size of the spores is incorrect.

Among the white species of section *Lepidella* with conical warts on the pileus *A. virginea* is easy to characterize by its broadly clavate-bulbous, entirely squamulose stipe, the white gills and the thick, disrupting annulus. For a comparison with *A. timida*, see p. 246.

Amanita perpasta Corner & Bas, *sp. nov.*—Pl. 1*a*, Fig. 11

Pileus 40–170 mm latus, convexus, dein expansus, siccus, margine appendiculata, haud striata, verrucis multangulatis vel pyramidalibus, adnatis, albidis, apice subferruginosis omnino obtectus. Lamellae liberae, modice confertae, latae, albae vel cremeae. Stipes 50–140 mm altus, basi 30–55, apice 7–16 mm latus, clavato-bulbosus vel ventricosus, albus albidusve, annulatus, verrucis granulisve brunneolis ornatus; volvae reliquis nullis. Annulus superus, 2 mm crassus, 20–25 mm latus, albidus vel brunneolus, infra verrucosus. Caro alba, leviter flavescens. Sporae 7–10 × 6.5–9.5 μ, globulosae vel late ellipsoideae, amyloideae. Typus: *E. J. H. Corner s.n.*, 4 Sept. 1942, Singapore, Bukit Timah (L).

Etymology: perpastus, well-fed.

Pileus 40—170 mm across, convex then plane, not striate at margin, dry, entirely and regularly covered with adnate, 2–9 mm wide, 2–5 mm high conical or truncate-conical warts to polygonal small scales with conical, sometimes even recurved appendages changing into small erect crowded scales toward margin; firm conical tips or appendages of warts and scales subferriginous brown, basal parts whitish to pale brown, sometimes with radiating subferriginous fibrils on surface; narrow interstices between scales pallid-cream; hence whole pileus at first somewhat ferruginous brown and echinate, then pallid to brownish and sprinkled with distant hard upright subferruginous warts; margin ragged-appendiculate with pale brownish fragments of partial veil. Gills free, rather crowded, 66–79 primaries with 1–3 (–7) rounded obliquely truncate to attenuate shorter ones between each pair, thick, broad, 4–17 mm wide, cream-white. Stipe 50–140 mm long, 30–55 mm wide at base, 7–16 mm at apex, clavately bulbous or very ventricose with pointed base or short, attenuate root, hard, firm, white to pallid, subfloccose-pruinose above ring, more or less concentrically scaly with small, 1–2 mm wide flattened brownish scales or granules below ring; scales closer and smaller and in closer circles toward base. Ring pendant from extreme apex of stipe, 20–25 mm wide, about 2 mm thick, floccose-membranous, pallid and striate above, brownish and coarsely verrucose below with subconical warts. Flesh white (turning slightly yellowish according to drawing), rather dry and firm, rather thick, 8–17 mm wide in centre, 4–11 mm half-way to margin. Smell slight, not distinctive.

Spores (Fig. 11) 6.8–8.8 × 6.6–8.2 μ (fresh, 8–10.5 × 7.5–9.5 μ), globulose to broadly ellipsoid or obovoid (length-breadth ratio 1.0–1.25, average 1.1), colourless, thin-walled, smooth, with medium-large to large apiculus, with homogeneous opalescent contents, amyloid. Basidia 48–60 × 10–14 μ, subclavate to clavate, tapering into a long stalk, with four 4–5 μ long sterigmata; contents with oily drops, especially when young. Marginal cells numerous, 20–45 × 10–30 μ, globulose to clavate, thin-walled, colourless, forming a thick sterile margin, very soon collapsing. Trama of gills in type distinctly bilateral; central strand distinct, about 30 μ wide, dense, composed of 3–10 μ wide longitudinal hyphae; divergent zones about 175 μ wide, rather dense, made up of rather abruptly diverging 3–10 (–15) μ wide hyphae with rather short cells, in outer part nearly perpendicular to subhymenium; subhymenium ramose-subcellular, thin and hard to distinguish from divergent zones, with elongate to globulose up to 10 μ wide cells; in older specimen from Malaya trama of gills much looser and more irregular; central strand hardly distinguishable, all elements slightly wider, but truly inflated cells absent. Cuticle only distinguishable at base of warts on centre of pileus of young type specimen, thin, composed of very thin, about 2 μ wide, radial hyphae with conglomerations of numerous yellowish oleiferous hyphae just underneath, apparently very soon disappearing and then warts seemingly continuous with trama of pileus. Remnants of volva on pileus: subferruginous tips of warts consisting of small cells, up to 35 μ wide, globulose to broadly ellipsoid or ovoid, arranged in chains, brownish near surface, colourless in inner part, forming a dense, firm pseudoparenchyma, traversed by 3–5 μ wide, yellowish-brownish oleiferous hyphae, especially near surface; pale basal parts of warts composed of 5–15 μ wide interwoven colourless hyphae, with enormous radiating yellow-brown oleiferous elements on surface; with narrow transitional zone between tissues of tip and base. Upper layer of ring with 5–8 μ wide hyphae with short cylindrical cells, lower layer composed of 3–20 μ wide inflated cells forming a pseudoparenchyma. No clamps observed.

HABITAT.—Terrestrial, in humus in jungle.

COLLECTIONS EXAMINED.—Malaya, Negri Sembilan, Gunong Angsi, 500 m altitude, 4 July 1930 (sector of pileus and part of ring in liquid); Singapore, Bukit Timah, 4 Sept. 1942 (type; sector of pileus in liquid; water-colour drawing); both *E. J. H. Corner s.n.* (as *Amanita* 7).

OBSERVATIONS.—The velum universale consists of two layers: an outer brownish pseudoparenchymatic one and an inner one of rather broad interwoven hyphae, the latter layer apparently closely adhering to the cuticle. As the velum universale covers the whole pileus, the structure of the cuticle can be studied only in a cross-section of a wart. In the young type specimen one finds a thin layer of repent hyphae at the base of the warts on the centre of the pileus, accentuated by numerous yellowish-brownish oleiferous hyphae which are situated just beneath this layer. In a section of a wart from near the margin of the same pileus, the thin cuticle is not (longer?) discernable, but its probable place is indicated by the layer with numerous oleiferous hyphae. The warts of the older specimen from Malaya, seem to be continuous with the trama of the pileus. There, only the brown tips of the scales would appear to belong to the velum universale.

Amanita perpasta is well characterized by the fleshy pale cap, entirely covered with conical to polygonate warts with subferruginous brown tips, the thick brownish squamulose stipe without remnants of the volva and the globulose to broadly ellipsoid spores.

Amanita vestita Corner & Bas, *sp. nov.*—Pl. 1*b*, Fig. 5

Pileus 20–45 mm latus, plano-convexus vel applanatus, centro leviter depressus, margine appendiculatus neque striatus, siccus, pallide griseolus, pulvere umbrino obsitus. Lamellae subconfertae, albae. Stipes 40–80 mm longus, apice 3–7, basi 10 mm latus, subbulbosus, solidus, radicula acuta praeditus, pruinoso-flocculosus, a summo albus, deorsum brunneolus. Annulus raro praesens, albus, pruinoso-flocculosus. Caro alba. Sporae 6.5–9(–10) × 5–7.5 μ, subellipsoideae vel ellipsoideae, amyloideae. Typus: *E. J. H. Corner s.n.*, 23 March 1943, Singapore, Botanic Gardens (L).

Etymology: vestitus, coated.

Pileus 20–45 mm wide, plano-convex to plane with slightly depressed centre, slightly undulate, not striate at margin, dry, pale greyish white, covered with small micaceous umber particles, condensed to a soft, 1 mm thick layer over centre; margin appendiculate with soft white remnants of partial veil. Gills free or slightly adnexed, fairly crowded, 40–50 primaries with 1–3 obliquely truncate to attenuate shorter ones between each pair, 3–5 mm wide, rounded near margin of pileus, milk-white. Stipe 40–80 mm long, 3–7 mm wide at apex, 10 mm at subbulbous base, with short pointed root, solid; upper part white to whitish, mostly covered with minute white flocculose remnants of ring; lower part brownish, with umber mealy-flocculose remnants of friable volva. Ring sometimes incompletely present, white, flocculose-mealy. Flesh white, rather soft, 2–2.5 mm thick in centre of pileus.

Spores (Fig. 5) 7.3–9.3 × 5.6–6.8 μ (fresh, 6.5–9–10 × 5–7.5 μ), broadly ellipsoid to ellipsoid or obovoid, sometimes even elongate ellipsoid (length-breadth ratio 1.25–1.45 (–1.6), average 1.35–1.4), colourless, thin-walled, smooth, with small to medium-large apiculus, with cloudy contents, amyloid. Basidia 30–40 × 9–10 μ, 4-spored; sterigmata 4 μ long. Marginal cells scattered, 30–60 × 10–30 μ, globulose to clavate, colourless or with fuliginous-umber sap, thin-walled. Trama of gills thin, bilateral; central strand distinct, about 20 μ wide, composed of compacted 3–8 μ wide hyphae; divergent zones with cylindrical to elongate ellipsoid, 4–12 μ wide cells; subhymenium rather narrow, 20–30 μ wide, cellular, composed of ellipsoid to globulose, 8–18 μ long cells. Cuticle rather thin, not separable from inner part of remnants of volva, made up of (subradial?) loosely interwoven, 3–10 μ wide hyphae. Remnants of volva on pileus mainly consisting of cells 15–70 μ wide, globulose to ellipsoid, with fuliginous-umber contents, mostly arranged in loosely interwoven short chains, mixed with 2.5–6 μ wide hyphae and with some fusiform-inflated cells. Remnants of volva on base of stipe nearly similar, but globulose cells more rarely in rows and branching hyphae more numerous, with globose cells attached to them. Trama of stipe with mostly terminal longitudinal fusiform-clavate cells, up to 300 × 40 μ, similar near surface. No clamps observed.

HABITAT.—Terrestrial in jungle; solitary.

COLLECTIONS EXAMINED.—Singapore, Botanic Gardens, Gardens' Jungle 1929 (notes only); 23 March 1943 (type; one specimen in liquid; water-colour drawing); both *E. J. H. Corner s.n.* (as *Amanita* 2).

This species with its brownish, pulverulent volva, friable ring, rooting bulb, and ellipsoid spores, undoubtedly comes very close to *A. cinereoconia* Atk. (1909: 366) from North America. Especially the description of that species given by Bigelow (1959: 127) fits the Malayan material rather well; only the remnants of the veil on the cap of his specimens are more conical and his specimens tend to be larger (2.5–7–11 cm). However, the specimens on A. H. Smith's photograph, reproduced

by Gilbert (1941: pl. 66), are very robust with rather big bulbs and look quite different from the Malayan specimens described above.

In the original description of *A. cinereoconia*, Atkinson described the spores as subelliptical to suboblong, 8–12 × 4–6 μ; apparently the length-breadth ratio was about 2! Likewise, the spores of A. H. Smith's specimen depicted by Gilbert (1940: 197) measure 10–11.5 × 5–6 μ and their length-breadth ratio ranges between 1.7 and 2.1. Although according to the accounts of Coker (1917: 86) and Bigelow (1959: 86) the spores may be less elongate, their length-breadth ratio seems to vary from 1.5 to 2.1, which is considerably more than in *A. vestita*, where it varies from 1.3 to 1.5, exceptionally to 1.6.

Summarizing, one may say that *A. vestita* from the tropical rainforest in Singapore strongly resembles *A. cinereoconia* from North America, but that the latter species appears to have more slender spores, tends to form larger fruit-bodies, and grows in a totally different climate.

A. griseofarinosa from Japan, recently described by Hongo (1961: 39), is rather similar to the two species discussed above, both as to habit and colours. In this species, however, according to the drawings and the description, the spores seem to be still shorter than in *A. vestita*. Moreover, the spores of *A. griseofarinosa* are considerably larger, viz. 9.5–11.5 × 7.5–9.5 μ against 6.5–9 (–10) × 5–7.5 μ in *A. vestita*, and the subbulbous base of the stipe is not rooting.

AMANITA ERIOPHORA (Berk.) Gilb.—Figs. 12–15

Agaricus (*Amanita*) *eriophorus* Berk. *in* Hook. J. Bot. **2**: 43. 1850. — *Amanitopsis eriophora* (Berk.) Sacc., Syll. Fung. **5**: 26. 1887. — *Amanita eriophora* (Berk.) Gilb. *in* Bres., Iconogr. mycol. **27** (2): 230. 1941.

Pileus 90–220 mm wide, hemispherical at first, becoming convex with flattened centre, then plane or slightly concave, sometimes with umbo, not striate at margin, pale dingy brown to pale brownish or yellowish, slightly viscid (judging from microscopical structure of cuticle), at first entirely covered with subfloccose-felted greyish umber universal veil of unequal thickness, later on with greyish brown, subfloccose-felted, adnate large flat patches and scattered irregular more or less conical warts, 6–16 mm wide, 3–6 mm high, widely spaced toward margin, crowded over centre; margin more or less appendiculate with grey felted fragments of ring. Gills free, but with slight decurrent lines on apex of stipe, crowded, 140–165 primaries with 1–3 attenuate shorter ones between each pair, broad, 8–16 mm wide, white then cream; edge entire, often thinly felted or appendiculate with greyish lilac tissue of partial veil, especially near apex of stipe. Stipe 120–160 mm high (excluding rooting part), 15–22 mm wide at apex, 25–37 mm wide just above shortly cylindrical, subglobose, or napiform, sometimes strongly marginate, 30–70 mm long, and 35–55 mm wide, bulbous base tapering into a stout, 20–35 mm long, solid, firm, whitish to pallid root; upper two thirds thinly covered with greyish lilac felt of partial veil; lower third more or less smooth, often pale dull rufescent with age; bulb covered with adnate volva, sometimes with a thick, free, erect or recurved, entire or split, up to 20 mm high rim or with merely a slight ridge. Ring ill-defined, floccose-felted, greyish lilac, either forming a vague thickened felted girdle on stipe, about two thirds from apex, or fragments hanging down from margin of pileus.

Flesh 11–22 mm thick in centre of pileus, 5–8 mm thick half-way to margin, white, firm, very slowly but distinctly rufescent on bruising or cutting, pinkish with age. Smell, faint, slightly nutty.

Spores (Fig. 14–15) 9.1–10.9 × 7.3–9.3 μ (fresh, 9–10 × 7–8.5 μ), broadly ellipsoid, sometimes subglobulose (length-breadth ratio 1.1–1.25, average 1.2), colourless, thin-walled, smooth, with rather large apiculus, with cloudy-oleaginous contents, amyloid. Basidia 40–48 × 11–13 μ, 4-spored; sterigmata 4 μ long. Marginal cells 35–60 × 12–25 μ, clavate colourless, forming a sterile edge. Trama of gills seems to be composed of hardly inflated, sometimes up to 20 μ wide, hyphae; subhymenium apparently subcellular-ramose, with rather small cells. Cuticle rather thin, consisting of subradial, interwoven, 2.5–8 μ wide, brownish hyphae and some up to 20 μ wide oleiferous hyphae; gelatinized near surface. Remnants of volva on pileus made up of a mixture of variously shaped cells, easily breaking up on boiling or crushing, mainly consisting of brown, globulose to ellipsoid cells often in short chains and up to 60 μ, seldom 110 μ, long, mixed, however, with rather broad, 3–12 μ (mostly 5–8 μ) wide branching hyphae often forming very irregular elements, passing into inflated cells by gradually thicker and shorter cells; also some up to 20 μ wide oleiferous hyphae present. Trama of stipe with longitudinal, slenderly clavate, mostly terminal cells, up to 300 × 35 μ. Remnants of ring on stipe a mixture of hyphae and inflated cells. No clamps observed.

HABITAT.—Terrestrial in jungle; in small groups.

DISTRIBUTION.—India (Darjeeling), Singapore, Malaya.

COLLECTIONS EXAMINED.—Singapore, Reservoir Jungle, 26 March 1931 (several dried slices of at least two specimens) *E. J. H. Corner s.n.* (as *Amanita* 8); also observed by Corner in Malaya, Johore, Tebrau, 24 Sept. 1939.

OBSERVATIONS.—It seems unlikely that the thick fleshy rim on the bulb depicted in some of the specimens is formed only by the volva; most likely the trama of the bulb participates in its formation.

The type of *A. eriophora* (*J. D. Hooker 111*, Darjeeling), kindly put at our disposal by the director of the Herbarium at Kew, seems to represent an old specimen of the species described above. The habit, the colours, the spores and the microscopical structure of the remnants of the volva on the pileus are rather similar. As appears from Hooker's water-colour drawing, of which recently a copy was kindly presented to the Rijksherbarium at Leiden, the stipe of the type was nearly entirely pale greyish violet and floccose, and the bulb whitish, broadly fusiform and slightly rooting.

However, there are also some differences. The pileus of the type is covered entirely with a thin pruinose-subfloccose brown layer derived from the volva and, according to a note by Hooker on the drawing, gelatinous in the centre. However, Hooker added, ". . . I expect only from drenching rain." Moreover, the margin of the pileus of the specimen depicted is shortly striate.

All these differences are easy to explain, if one assumes the type to be an old specimen, collected after heavy rains, which caused the more wart-like remnants of the volva on the pileus to disappear. In the specimens from Singapore very thin powdery-flocculose remnants of the volva also occur, nearly everywhere on the pileus between the more patch-like remnants. This is clearly seen in the drawing (Fig. 12).

In the specimens from Singapore the flesh was slowly rufescent. Nothing alike is mentioned in the type description, but in the type drawing the flesh of the stipe is dingy greyish-brownish.

Berkeley incorrectly stated the gills to be adnate. In both Hooker's and Corner's drawing the more or less pointed gills just reach the apex of the stipe.

Some microscopical features of the type are: Spores 8.2–12.2 × 7.0–10.7, sub-

globulose to broadly ellipsoid, sometimes globulose (length-breadth ratio 1.0–1.25, average 1.1–1.15), with rather large apiculus, amyloid. Remnants of the volva on the pileus consisting mainly of ellipsoid, brown cells up to 70 × 40 μ arranged in short, easily disrupting chains, mixed with about 10 μ wide, irregular subcylindrical elements and rather thin, radial hyphae. Context of stipe showing *Amanita* structure. No clamps observed.

Because of the friable ring, the dark-coloured velum universale and the more or less rooting, bulbous base of the stipe, this very large and handsome species bears some resemblance to *A. cinereoconia* Atk. (1909: 366) from North America and *A. vestita* Corner & Bas from Singapore. It differs, however, from both by the blushing flesh, the different colours of cuticle and velum partiale, and the large size; in addition, from *A. cinereoconia* by the shorter spores.

Another species, comparable to *A. eriophora* is *A. borneensis* Boed. (1951: 324), placed, erroneously in our opinion, in subgenus *Amanitina* by its author. [2] Judging from the original pencil drawing, kindly placed at our disposal by Dr. K. B. Boedijn, this species has almost the same habit as *A. eriophora*, but the bulbous base of the stipe is more or less globose and not rooting. In addition, the cap and stipe are pinkish brown, the gills dingy pinkish and the spores globulose, (7.5–) 8–9 (–11) μ, which clearly distinguishes the species from *A. eriophora*. Nevertheless, these two species are rather closely related and seem to find their natural place somewhere near *A. cinereoconia* and *A. vestita*.

Amanita sculpta Corner & Bas, *sp. nov.*—Pl. 2, Figs. 3, 4

Pileus 100–240 mm latus, convexus, centro leviter depressus, dein applanatus, margine appendiculatus neque striatus, pallide roseo-brunneus vel pallide griseo-brunneo-vinosus, siccus, verrucis magnis crassisque, solidis, pyramidalibus vel irregularibus, purpureo-brunneis ornatus. Lamellae liberae, confertae, latae, modice crassae, albae vel cremeae. Stipes 120–240 mm longus, sursum attenuatus, apice 7–16 mm latus, basi bulbosus et 20–65 mm latus, plenus, annulatus, sordido-albidus vel sordido-vinosus, farinoso-floccosus vel floccoso-squamosus, ad basin margine purpureo-brunneo vel verrucis purpureo-brunneis ornatus. Annulus floccoso-submembranaceus vel friabilis, pallide sordido-vinaceus. Caro solida, alba, vinaceo-brunnescens vel purpurascens. Odore piri maturi. Sporae 10–11 μ, globulosae vel subglobulosae, amyloideae. Typus: *E. J. H. Corner s.n.*, 9 July 1940, Singapore, Bukit Timah (L).

Etymology: sculptus, sculptured.

Pileus 100–240 mm wide, convex, sometimes with depressed centre, then plane, not striate at margin, slightly exceeding gills, incurved at first, pale brownish pink to pale greyish madder brown, whitish or greyish pinkish toward margin, dry, set with distant, dark madder brown or chocolate brown, erect, firm, 3–16 mm high, 2–15 mm wide warts, slender conical to pyramidal over centre, more angular or

[2] Boedijn (1951: 323) emended *Amanitina* Gilb. (which he considered a subgenus), by describing the volva as "more or less strongly coalescent with bulbous base, often only present as rings," thus leaving out one of the most important features of this up till now rather natural taxon, namely the sheathing to circumcised volva. In this way '*Amanitina*' was thrown open to foreign elements. As a matter of fact Boedijn's first species, *A. borneensis*, belongs to '*Aspidella*' and the second, *A. neglecta*, to '*Amplariella*'. Only his *A. tjibodensis* appears to be a true member of '*Amanitina*'.

lumpish near margin, easily breaking off, attached by a pale, radiating base; finally whole pileus dingy madder brown; margin appendiculate with floccose-submembranous, pale dingy vinaceous remnants of partial veil. Gills free, crowded, 140–200 primaries with 0–1 obliquely truncate to rounded attenuate shorter ones between each pair, broad, 7–16 mm wide, rather thick, white to pale cream, often with edge pale dingy vinaceous powdery from remnants of partial veil. Stipe 120–240 mm long, 12–40 mm wide above, 20–65 mm at base, more or less thickened downward, with napiform or fusiform bulbous base, stout, solid, fibrous, dingy whitish, mealy-floccose to floccose-squamulose with pale dingy vinaceous remnants of partial veil, with coarser madder brown, sometimes recurved squamules toward base and some stout, firm, lumpish, madder brown warts or an abrupt margin around base; whole stipe becoming madder brown with age. Ring thick submembranous, floccose-arachnoid, disrupting, pale dingy vinaceous, leaving remnants at edge of pileus, at edges of gills, and on stipe. Flesh 11–20 mm thick in centre of pileus, 5–9 mm half-way to margin, firm, sappy, white, turning dull brownish vinaceous, dull vinaceous purplish or dull purplish on cutting or bruising. Smell faint, of ripe pears. All parts of young primordium white, but all outer parts colouring when volva starts disrupting.

Spores (fresh!) 10–11 μ, subglobulose, colourless, smooth, with cloudy-vacuolate contents (no spores in preserved specimens). Basidia 45–50 × 12–13 μ, clavate, 4-spored; sterigmata 5–6 μ long. Marginal cells numerous, forming a thick sterile margin along edges of gills, 18–40 × 16–30 μ, globulose to ellipsoid, terminal on 1.5–3 (–6) μ wide hyphae, often with pale madder brown walls. Pleurocystidia absent, but some brownish, basidium-like, distinctly pseudo-amyloid cells present, connected with similar hyphae in trama of gills. Trama of gills bilateral; central strand and divergent zones not set off from each other, composed of loose, slightly interwoven longitudinal to divergent, 3–15 μ wide hyphae with cells up to 80 μ long, slightly more crowded in central strand, sometimes up to 25 μ wide near subhymenium; some of these hyphae brownish, with wavy walls, turning brownish red in Melzer's solution; subhymenium narrow, about 20 μ wide (perhaps wider in mature specimens?), ramose-subcellular, with cells ellipsoid-sybcylindrical, 10–20 × 5–10 μ. Cuticle hardly differentiated, formed by a 400 μ wide layer denser than trama of pileus, composed of repent, interwoven, 2–10 (–15) μ wide hyphae, scattered elongate cells up to 20 μ wide, sometimes with slightly thickened walls, and some oleiferous hyphae, up to 20 μ wide; only the upper 10–30 μ wide layer consisting of more slender slightly gelatinized hyphae, 1.5–5 μ wide. Remnants of volva on pileus (Fig. 3) made up of a dense tissue of (i) ellipsoid to globulose, mostly terminal, cells up to 80 × 70 μ, (ii) 5–8 μ wide hyphae, passing into chains of very irregularly inflated elongate, often branching elements, and (iii) very thin branching hyphae, 1.5–2 μ wide; madder brown pigment in walls, not in sap. Remnants of volva on base of stipe similar, but inflated cells more ellipsoid, up to 90 × 50 μ. Trama of stipe with longitudinal, terminal, clavate, or mostly broadly clavate cells, up to 300 × 50 μ; floccose covering made up of shorter clavate cells, mixed with hyphae, some of which with refractive contents and slightly swelling

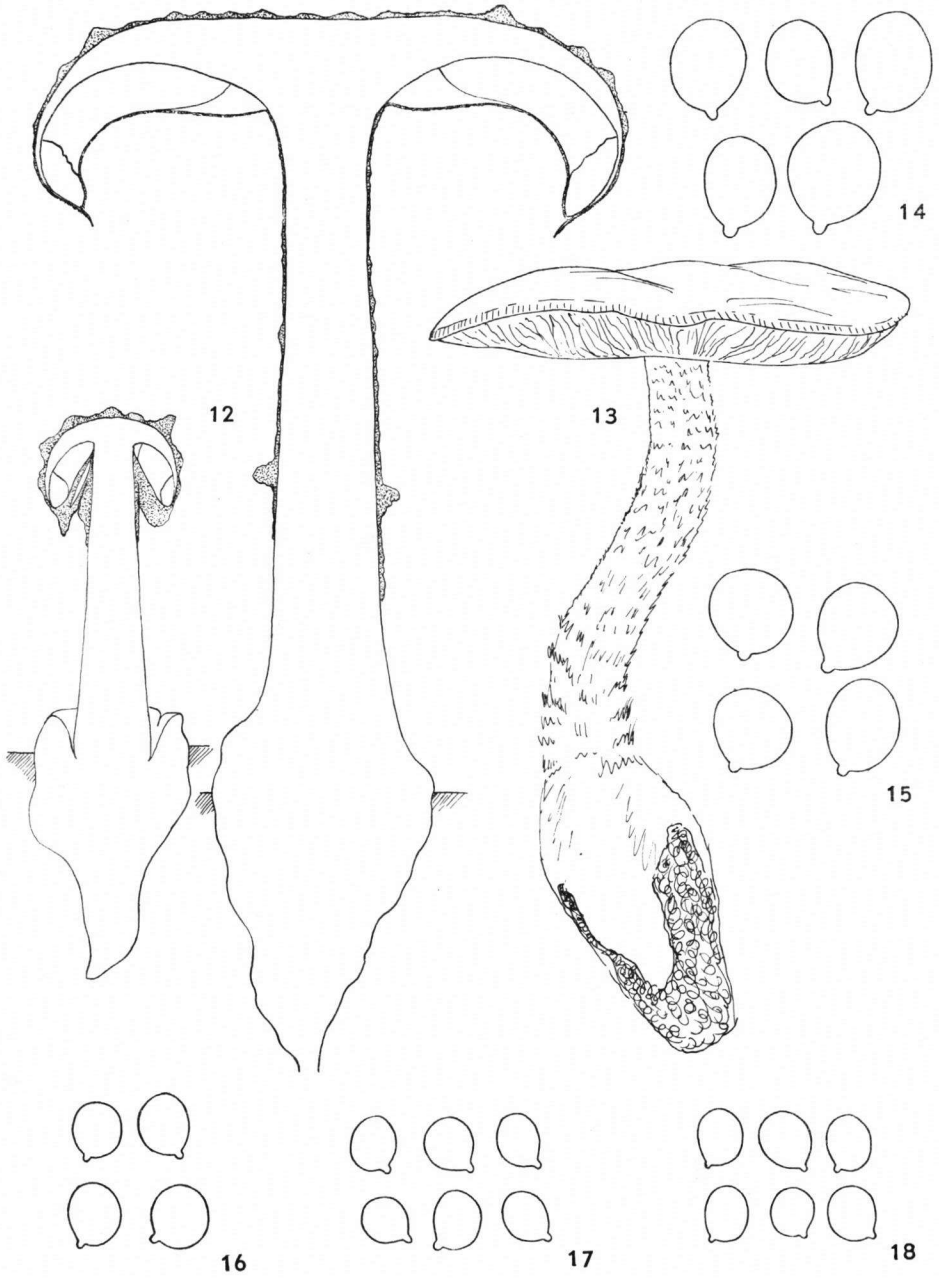
EXPLANATION OF FIGURES 12-18

Figs. 12–15. *Amanita eriophora*. — 12. Fruit-bodies (× 1/2). — 13. Reproduction of type drawing (× 1/2). — 14. Spores (× 1250). — 15. Spores of type (× 1250).

Fig. 16. *Amanita gymnopus*. — Spores (× 1250).

Fig. 17. *Amanita pausiaca*. — Spores (× 1250).

Fig. 18. *Amanita xanthomargaros*. — Spores (× 1250).



Figs. 12–18

in KOH and then here and there constricted by encrusting matter. No clamps observed.

HABITAT.—Terrestrial in forest; solitary.

COLLECTIONS EXAMINED.—Singapore, Bukit Timah, 15 Oct. 1939 (one bud in liquid); 9 July 1940 (type; one dried specimen without mature spores; water-colour drawing); 2 Sept. 1940 (water-colour drawing); all *E. J. H. Corner s.n.* (as *Amanita* 14); observed several other times on same spot, but never elsewhere in Singapore and Malaya.

OBSERVATIONS.—One quarter grown fruit-body (Fig. 4) was described separately on account of the naked stipe; the remnants of the volva being restricted to the pileus and forming there very high, irregular warts.

According to Corner's observations on fresh material, the discoloration of the volva is due to discoloration of the hyphal walls or granules on the outside of the hyphae.

Amanita sculpta stands rather isolated in section *Lepidella* on account of the strong purplish to vinaceous brown discoloration of the whole fruit-body except the gills, of the thick volva forming large conical to angular lumpish warts, and of the more or less globulose spores. The most closely related species seems to be *A. ochrophylla* (Cooke & Mass.) Clel. from Australia. The flesh of this species discolours to brick red and the spores are subglobulose, but the volva is much thinner and the ring well-shaped.

Amanita centunculus Corner & Bas, *sp. nov.*—Figs. 9, 10

Pileus 50–60 mm latus, convexus, dein applanatus, margine haud striatus, albus, siccus, verrucis raris, magnis, planis, angulatis, albis vel brunneolis. Lamellae confertae, crassae, angustae, albae. Stipes 40–50 × 10–13 mm, subbulbosus, subradicatus, cavescens, albus, floccoso-pruinosus, subannulatus, basi initio verrucis planis, albis brunneolisve tectus, dein flocculosus. Annulus 6–10 mm latus, fragilis, totus appressus, albus, striatus, saepe laceratus. Caro alba. Sporae 7–8.5 × 5–6 μ, subellipsoideae vel longe ellipsoideae, amyloideae. Typus: *E. J. H. Corner s.n.*, 16 Aug. 1939, Singapore, Bukit Timah (L).

Etymology: centunculus, small blanket (on account of the large patches on the pileus).

Pileus 50–60 mm wide, convex then plane, not striate at margin, white, dry, with a few, sometimes only three, large, flat, angular, white then brownish, felted-membranous, 5–15 mm wide, 1–2 mm thick patches of volva, otherwise partly glabrous and smooth, partly thinly and finely felted to scurfy-pruinose. Gills free, crowded, about 100 primaries with 1(–3) truncate, obliquely truncate or (longer ones) attenuate lamellulae between each pair, rather thick and narrow, 3–4 mm wide, white, with a thickly micaceous-pruinose edge. Stipe 40–50 × 10–13 mm, slightly enlarged toward subbulbous, shortly rooting base, becoming widely hollow, white, wholly finely floccose-pruinose, more or less annulate; base at first with some white to brownish patches, later on obscurely and thinly peronate with fading remnants of volva, finally merely flocculose. Ring 6–10 mm wide, superior, pendant, but entirely attached to stipe, white, more or less split and lacerate, felted-floccose, striate on upper side. Flesh white, rather soft, thick, 5–6 mm in centre of pileus. Smell like in *A. strobiliformis*.

Spores (Fig. 10) 7.3–8.5 × 4.7–6.2(–7.8) μ (fresh, 7–8.5 × 5.5–6 μ), broadly ellipsoid, ellipsoid, or elongate ellipsoid, seldom subglobulose (length-breadth ratio (1.05–)1.2–1.6, average 1.35), colourless, thin-walled, smooth, with medium-large apiculus, with cloudy vitreous contents, amyloid. Basidia 30–38 × 9–11 μ,

4-spored, granular; sterigmata 4 μ long. Marginal cells 20–50(–70) × 10–30 μ, clavate to globulose, thin-walled, colourless, forming a thick sterile edge. Trama of gills bilateral, with rather large, elongate to clavate cells, up to 100 × 25 μ or 80 × 35 μ. Cuticle about 200–250 μ wide; upper part gelatinous, with irregularly interwoven, 1.5–3 μ wide hyphae; lower part with more crowded, up to 8 μ wide radial hyphae. Remnants of volva on pileus consisting of globulose, ellipsoid and piriform, probably terminal cells, up to 40 × 25 μ, mixed with many, 1.5–7 μ wide, branching hyphae and scarce, elongate cells. Remnants of volva on base of stipe as on pileus, but hyphae more numerous; inflated cells mostly directly on thin hyphae, sometimes, however, with some short cylindrical intervening cells. Trama of stipe with terminal, longitudinal, cylindrical-clavate, up to 250×45 μ large cells; without cortex. Floccose covering of stipe (derived from partial veil) consisting mainly of clavate cells, up to 60 × 30 μ, mixed with rather narrow hyphae. No clamps observed.

HABITAT.—Terrestrial in forest; solitary or in small groups.

COLLECTIONS EXAMINED.—Singapore, Bukit Timah, 16 Aug. 1939, *E. J. H. Corner s.n.* (type; dried fragments of 3 specimens) (as *Amanita* 11).

This entirely white species, with a bulbous and slightly rooting stipe, large, flat, and thick patches on the pileus, and an incoherent ring, resembles *A. strobiliformis* (Paul. ex Vitt.) Gonn. & Rab. from Europe. It is, however, easily distinguished by the small size, the relatively short stipe becoming widely hollow, and the considerably smaller spores, viz. 7.5–8.5 × 5.0–6.0(–7.5) μ against 10–13 × 7–10 μ in the latter species.

Another small species of section *Lepidella*, viz. *A. nana* Sing. (1941: 85) from Russia, differs by slightly pointed scales composed of hyphae on the pileus, and larger spores, viz. 10.5–13.5 × 7–10 μ. *Amanita silvicola* Kauffm. (1926: 123) from North America, which also has a relatively short stipe, is different on account of the thin velum universale and a different type of bulb.

The hollow stipe of *A. centunculus* is a very conspicuous feature within section *Lepidella*. To be sure, the stipe may become more or less hollow in some other species, such as *A. pulverulenta* Beeli, *A. lanosa* Beeli, and *A. boudieri* Barla forma *beillei* (Beauseigneur) Gilb., but in all these the character is not so pronounced as in the present species.

Amanita gymnopus Corner & Bas, *sp. nov.*—Pl. 4*a*, Fig. 16

Pileus 50–110 mm latus, convexus, dein applanatus vel concavus, saepe subumbonatus, margine haud striatus, initio albus, dein cremeus vel pallide brunneus, siccus, verrucis tenuibus, applanatis, 1–7 mm latis, albis vel pallide ochraceo-brunneis. Lamellae subconfertae, initio pallide ochraceo-cremeae, dein flavo-ochraceae. Stipes 60–140 mm longus, apice 7–11, basi 16–25 mm latus, clavato-bulbosus, solidus, durus, albus vel flaveolus, basi pallide roseo-brunnescens, subglaber, volvae fragmentis nullis, vulgo radiculis praeditus; apice pruinosus vel subsquamulosus. Annulus angustus, fragilis, albus vel flaveolus, striatus. Caro alba vel pallide flaveola, rubescens, odore forti. Sporae 5.5–7.5 × 5–6.5 μ, globosae vel ellipsoideae, in cumulo albae, amyloideae. Typus: *E. J. H. Corner s.n.*, 20 April 1941, Malaya, Johore, Gunong Panti (L).

Etymology: γυμνός, naked; πούς, foot.

Pileus 50–110 mm wide, convex, then plane or concave, often subumbonate, not striate at margin, slightly exceeding gills, white, becoming pale yellowish, cream or pale brownish, especially near edge, dry, minutely appressedly cottony-felted, set with small, thin, flat, floccose-membranous, white to pale brownish ochraceous patches from volva, 1–3 mm wide, larger and more distinctly patch-like, 4–7 mm wide over disc, washing off in wet weather. Gills free, rather crowded, 70–85 primaries with 1–7 rounded-attenuate shorter ones between each pair, pale cream-ochraceous, then deep ochraceous, thick, broad, 5–10 mm wide. Stipe 60–140 mm long, 7–11 mm wide above, 16–25 mm at clavate-bulbous base, tapering upward, with dilated apex 12–28 mm wide, solid, firm, fibrous, white, then pale yellowish or tinged pale pinkish brown especially at base, nearly smooth, minutely rimose, pruinose or even subsquamulose toward apex, glabrous below, without any trace of volva, mostly with some rhizomorphs. Ring narrow, 3–5 mm wide, pendant from upper part of stipe, whitish to pale yellowish, striate on upper side, smooth beneath, generally breaking up and falling off on expansion of pileus. Flesh 6–12 mm thick in centre of pileus, 2–5 mm half-way to margin, firm and sappy at first, rather dry and soft in old specimens, white to pale yellowish, especially in stipe, very slowly turning pale reddish brown on cutting or bruising. Smell strong, of burnt sugar and iodoform. Spore print white.

Spores (Fig. 16) 5.2–6.7 × 4.9–6.7 μ (fresh, 7–7.5 × 6–6.5 μ), globulose to broadly ellipsoid (length-breadth ratio 1.0–1.25, average 1.15), colourless, thin-walled, smooth, with medium-sized apiculus, with cloudy granular (slightly oily?) contents, sometimes with one small gutta, amyloid. Basidia 44–48 × 6.5–9 μ, conspicuously slender, 4-spored; sterigmata 4–5 μ long. Marginal cells in preserved specimen scarce, inflated, up to 30 μ wide. Trama of gills distinctly bilateral; central strand and divergent zones not set off from each other, composed of up to 12(–15) μ wide hyphae slightly constricted at septa, with up to 85 μ long cells; subhymenium about 40 μ wide, subramose-cellular, with cells ellipsoid and up to 25 μ long in inner parts and globulose, about 7–10 μ wide at base of basidia. Cuticle about 150 μ wide, composed of 3–10 μ wide, repent, colourless hyphae, interwoven but tending to a radial arrangement especially in lower part, not gelatinized near surface. Remnants of volva on pileus made up of 3–10 μ wide, interwoven, winding hyphae, often slightly constricted at septa, and scattered elongate to slender clavate (mostly terminal?), up to 20 μ wide cells (globulose and ellipsoid cells entirely lacking). Trama of stipe with terminal longitudinal, slenderly clavate to broadly clavate, up to 350 μ long, mostly up to 50 μ, sometimes even 75 μ wide cells; near surface covered by strands of 2–14(–20) μ wide, longitudinal hyphae. No clamps observed.

HABITAT.—Terrestrial in jungle; gregarious.

COLLECTIONS EXAMINED.—Malaya, Johore, Gunong Panti, 250–400 m altitude, 20 April 1941 (type; fragments of 3 specimens in liquid), *E. J. H. Corner s.n.* (as *Amanita* 19).

This remarkable species has several outstanding features: (i) there are no traces of the volva on the base of the stipe; (ii) the bulb of the stipe mostly bears one or more rhizomorphs; (iii) the gills become deep ochraceous; (iv) the species has a peculiar smell. Even in the preserved material the stipes are remarkably firm. The remnants of the volva on the pileus are more membranous than floccose, as they are easily detachable from the cuticle as thin membranous patches.

Amanita gymnopus seems to be related to *A. foetens* Singer (1953: 15) from Argentina, which also has a strongly reduced volva, yellow gills, a strong (although different)

smell and globulose or almost globulose spores, but differs by the farinaceous warts on the pileus, the unchangeable flesh, the rather thick non-striate annulus, and other features.

Section VALIDAE (Fr.) Quél.

Agaricus [sect.] *Validae* Fr., Monogr. Amanit. Sueciae 10. 1854. — *Amanita* [sect.] *Validae* (Fr.) Quél. *in* Mém. Soc. Emul. Montbéliard, ser. II, **5**: 69. 1872 (Champ. Jura **1**: 30); Sing. *in* Lilloa **22**: 388. 1951 ("sect"). — Lectotype (Sing., l.c.): *Amanita valida* (Fr.) Quél. [= *Amanita excelsa* (Fr.) Gonn. & Rab. s.l.].

Amanita [sect.] *Obliteratae* Quél., Fl. mycol. France 303. 1888. — Lectotype: *Amanita rubens* (Scop.) Quél. [= *Amanita rubescens* (Pers. ex Fr.) S. F. Gray].

Amanita [sect.] *Incompletae* J. Schroet. *in* Kryptog.-Fl. Schlesien **3** (1): 677. 1889; P. Henn. *in* Natürl. PflFam. **1** (1**): 273 ("sect"). 1898. — Lectotype: *Amanita spissa* (Fr.) Opiz [= *Amanita excelsa* (Fr.) Gonn. & Rab. s.l.].

Amplariella Gilb. *in* Bres., Iconogr. mycol. **27** (1): 73, 78. 1940. — *Amanita* subgen. *Amplariella* (Gilb.) Gilb., Not. Amanites XXX [4]. 1941. — *Amanita* sect. *Amplariella* (Gilb.) Konr. & Maubl., Agaricales 65. 1948. — Type: *Amanita ampla* Pers. ex Larb. [= *Amanita excelsa* (Fr.) Gonn. & Rab. s.l.].

For the scope of this section, see the key to the subgenera and sections on p. 243.

KEY TO THE SPECIES OF SECTION *Validae*

1. Small species with margin of pileus distinctly striate.
   2. Pileus yellow to pale yellow, set with brighter yellow, conical warts. Stipe white, with yellowish, floccose remnants of volva at subbulbous base. Ring white with yellowish edge. Spores 6.5–8(–9) × 5–7 μ, subglobulose to broadly ellipsoid *A. xanthella*, p. 274
   2. Pileus greyish brown or olivaceous brown.
      3. Pileus greyish umber to pale brownish grey, sprinkled with minute fuliginous particles. Stipe pale grey to whitish, with 1–3 faint greyish pruinose circles from volva at subbulbous base. Ring white with fuliginous edge, at or below middle of stipe. Spores 6.5–9.5 × 5–6.5 μ, broadly ellipsoid to ellipsoid . . . *A. demissa*, p. 272
      3. Pileus olivaceous brown. Stipe yellow-olivaceous, with yellowish apex 5
1. Small to large species with margin of pileus smooth or only shortly striate with age.
   4. Fruit-bodies in places with yellow and olivaceous tinges. Spores small, 4.5–7 × 4.5–6 μ.
      5. Pileus fuscous to olivaceous brown, yellowish near margin, with yellow-tipped, umber warts. Stipe pale greyish brown with yellowish apex and 2–3, partly fuscous, partly yellow, scurfy rings at base. Ring pale yellow with deep yellow edge. Spores 5.5–7 × 4.5–6 μ, subglobulose to broadly ellipsoid . . *A. xanthomargaros*. p. 270
      5. Pileus olivaceous brown, with small greyish patches. Stipe pale yellow-olivaceous with yellow apex and 2–3 rings of fuscous-olivaceous small warts at base. Ring white, with yellowish verruculose edge. Spores 5–6 × 4.5–5 μ, globulose to broadly ellipsoid . . . . . *A. pausiaca*, p. 271
   4. Fruit-bodies without olivaceous and yellow tinges. Spores > 6 μ, except in *A. tristis*.
      6. Remnants of volva on pileus blackish brown, darker than pileus.
         7. Pileus 50–100 mm across, umber to pale greyish umber, with small conical or truncate-conical warts, scurfy near margin, innately fibrillose, slightly viscid. Stipe appressedly fuscous-fibrillose in vague zones, with 2–4 rows of small fuscous-umber, scurfy warts at base. Ring brownish grey, often breaking into appressed patches. Cuticle consisting of narrow hyphae. Spores 6–8 × 5.5–7.5 μ, globulose to broadly ellipsoid . . . . . *A. fritillaria*, p. 265
         7. Pileus 25–70 mm across, umber to pale greyish brown, dry, innately and darkly

streaked, with powdery, subvillose remnants of volva, forming a thin covering or thin patches or irregular warts and sometimes small conical warts over centre. Stipe grey or greyish brown, with dark fibrillose innate streaks, with one to several, often incomplete, rows of dark, minute patches or with a dark pruinose-felted covering at base. Ring greyish fuliginous with dark edge. Cuticle with large elongate cells among hyphae. Spores 6–10 × 5–8 μ, subglobulose to broadly ellipsoid . . . . . *A. pilosella*, p. 267

6. Remnants of volva on pileus greyish, brownish, ochraceous or whitish, paler than pileus.
   8. Remnants of volva rendering base of stipe distinctly verrucose or squarrose.
      9. Base of stipe more or less turbinate, upper part covered with rings of white to greyish subangular warts. Pileus 65–80 mm, grey-fuscous, with greyish white, small conical warts. Stipe pale grey, flocculose-felted. Ring white, striate, with fuscous denticulate edge. Spores 5–6(–7) × 4–5 μ . . . . *A. tristis*, p. 264
      9. Base of stipe fusiform to slender-fusiform, entirely covered with irregularly disposed recurved scales. Pileus 25–65 mm, sepia, with small, pale brown, conical warts. Stipe pale sepia, subsquamulose below ring. Ring whitish, striate, with entire or denticulate brown edge. Spores 6.5–7.5 × 5.5–6.5 μ *A. squamosa*, p. 262
   8. Remnants of volva on base of stipe forming scurfy-pruinose rings or lacking.
      10. Pileus 60–80 mm, sepia, with moderately large, pale conical warts. Stipe cylindrical, pallid, smooth except floccose apex, with 1–2 rows of fuscous particles at base. Ring whitish with fuscous edge, striate. Spores 8–10 × 7.5–8.5 μ . . . . . *A. species* 1, p. 267
      10. Pileus 45–65 mm, fuscous brown, with large, flat, brown patches with white tips. Stipe 60–80 × 3–4 mm, with clavate base, white to pale brownish, minutely fibrillose, without remnants of volva. Ring white with brownish edge, not striate. Spores 7–7.5 × 6 μ . . . . . *A. species* 2, p. 269

Amanita squamosa (Mass.) Corner & Bas, *comb. nov.*—Figs. 19, 20

Armillaria squamosa Mass. *in* Kew Bull. **1908**: 3 (basionym).

Pileus 25–65 mm wide, convex to slightly concave, not striate at margin, sepia-fuscous over centre, paler toward margin, innately fibrillose, dry, rather closely set with small, pale brownish, more or less conical warts over centre, diminishing in size toward margin. Gills free, subdistant, rather wide, white to very pale ochraceous; short gills attenuate. Stipe 50–80 mm long, 4–6 mm wide at apex, 10–15 mm wide at fusiform, subbulbous base, solid, pale brownish, sometimes sepia-brown at base, apex entirely covered by ring, subglabrous, sometimes slightly and minutely dark-squamulose near base; fusiform base entirely and irregularly set with pale brown scales with slightly recurved tips. Ring rather wide, membranous, whitish, slightly striate on upper side, with brown, often more or less denticulate edge. Flesh white, slightly colouring ochraceous buff (?) on cutting.

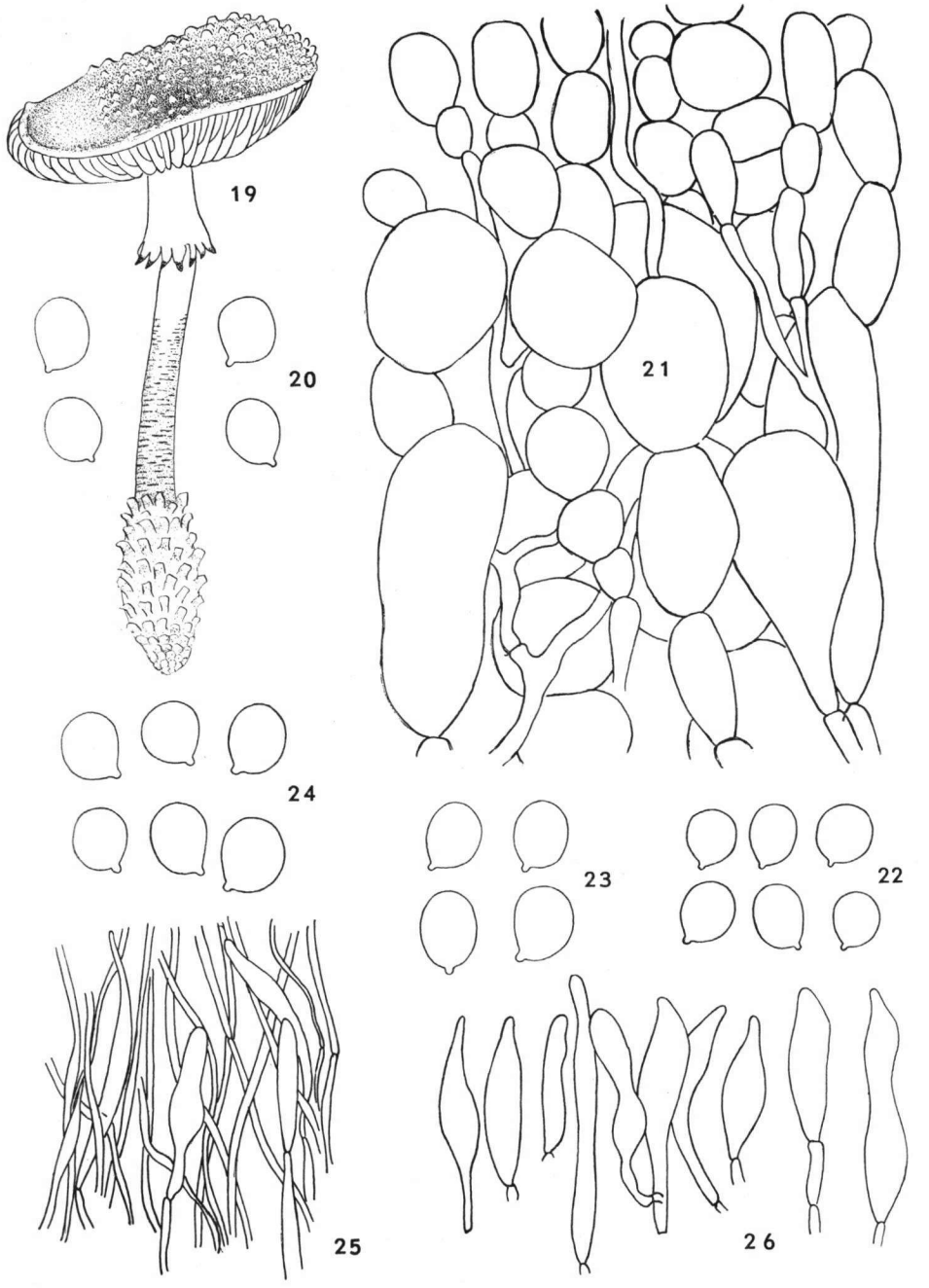
EXPLANATION OF FIGURES 19-26

Figs. 19, 20. *Amanita squamosa*. — 19. Reproduction of type drawing (× 1). — 20. Spores of type (× 1250).

Figs. 21, 22. *Amanita fritillaria* f. *malayensis*. — 21. Crushed conical wart from pileus (× 325). — 22. Spores (× 1250).

Fig. 23. *Amanita fritillaria*. — Spores of type (× 1250).

Figs. 24–26. *Amanita pilosella*. — 24. Spores (× 1250). — 25. Cuticle (× 140). — 26. Inflated cells from cuticle (× 140).



Figs. 19-26

Spores (Fig. 20) 6.5–7.5 × 5.5–6.5 μ (fresh presumably slightly larger), subglobulose to broadly ellipsoid (length-breadth ratio 1.1–1.3, average 1.15–1.2), with small apiculus, amyloid. Cuticle consisting of more or less radial, about 2–4 μ wide hyphae. Remnants of volva on pileus mainly consisting of globulose to ellipsoid, brownish cells, 25–55 × 20–50 μ, apparently mostly forming erect chains.

HABITAT.—Terrestrial in forest.

COLLECTIONS EXAMINED.—Singapore, *Ridley 61 I* (type; 1 dried specimen; water-colour drawing; K); Singapore, Botanic Gardens, 28 Nov. 1940, *E. J. H. Corner s.n.* (as *Amanita* 12 p.p.; water-colour drawing; no material preserved); *E. M. Burkill 273* (water-colour drawing without data).

OBSERVATIONS.—The above description is based on the drawings cited, on Massee's description, and on the type material. In the collection of the senior author there is only a drawing of this species, united with *A. tristis* (see p. 264) under '*Amanita* 12'.

Within section *Validae*, *A. squamosa* is very well characterized by the squarrose, fusiform base of the stipe. This feature reminds one of section *Lepidella*, where recurved scales on the base of the stipe occur in some species. In all other characters, however, *A. squamosa* very much resembles the species of section *Validae*. At first, the senior author even doubted whether *A. squamosa* really differed from *A. tristis* (see below). However, in that species the colours are more greyish, the scales on the base of the stipe restricted to the upper part of the bulb and not patent, the spores smaller, and the fruit-bodies larger.

Amanita tristis Corner & Bas, *sp. nov.*—Pl. 3*a*, Fig. 27

Pileus 60–80 mm latus, plano-convexus, centro leviter depressus, margine haud striatus, siccus vel subviscidus, centro fusco-griseus, margine griseolus, striis obscuris virgatus, verrucis minutis, conicis pustulatisve, griseolis indutus. Lamellae confertae, albae vel pallide ochraceae. Stipes 70–80 mm longus, apice 8–10, basi 20–22 mm latus, bulbosus, solidus, annulatus, pallide griseus, flocculoso-subcoactatus; bulbus turbinatus verrucis angulatis, griseolis vel albidis concentrice ornatus. Annulus amplus, 10–20 mm latus, albus, striatus, margine saepe verrucis griseis appendiculatus. Caro alba, pallide ochracescens. Sporae 5–6(–7) × 4–5 μ, subellipsoideae vel ellipsoideae, amyloideae. Typus: *E. J. H. Corner s.n.*, 24 Aug. 1939, Singapore, Botanic Gardens (L).

Etymology: tristis, sombre.

Pileus 60–80 mm wide, plano-convex with slightly depressed centre, not striate at margin, dry or slightly viscid, dark fuscous-grey over centre, paler toward margin, with darker fibrillose streaks, set with small, conical to wart-like, pale greyish remnants of volva diminishing in size toward margin. Gills free, crowded, intermixed with attenuate small ones, white to very pale ochraceous. Stipe 70–80 mm long, 8–10 mm wide at apex, 20–22 mm wide at bulbous base, solid, at apex entirely covered by ring, lower part pale grey, finely cottony-subvillose; upper part of the turbinate bulb set with 2–3 concentric circles of pale greyish to whitish, more or less angular, thick, flat, small warts. Ring large, ample, 10–20 mm wide, hanging from apex of stipe, white and striate on upper side, greyish cottony-flocculose beneath, often with grey warts at edge. Flesh white, tinged slightly pale ochraceous-buff on cutting, grey near surface.

Spores (Fig. 27) 4.9–6.1(–7.0) × 4.3–4.6 μ, broadly ellipsoid to ellipsoid, seldom subglobulose (length-breadth ratio (1.1–)1.25–1.45(–1.55), average 1.3–1.35), with

small apiculus, amyloid. Marginal cells present, globulose, up to 30 μ wide. Cuticle consisting of a gelatinous upper layer and a lower layer with radial, 1.5–8 μ wide, brown hyphae. Remnants of volva on pileus composed of globulose to ellipsoid, probably mostly terminal, up to 80 × 45 μ or 70 × 70 μ large, brownish cells and rather many 3–9 μ wide, branching hyphae. No clamps observed.

HABITAT.—Terrestrial in jungle.

COLLECTIONS EXAMINED.—Singapore, Botanic Gardens, Gardens' Jungle, 24 Aug. 1939 (type; dried fragment of 1 specimen); 28 Nov. 1940 (water-colour drawing); both *E. J. H. Corner s.n.* (as *Amanita* 12).

OBSERVATIONS.—The above description is based on the material of '*Amanita* 12' and on three of the four fruit-bodies depicted on the plate bearing the same number. The fourth fruit-body depicted appears to belong to *A. squamosa* (see above). As the description of '*Amanita* 12' contains a combination of the characters of *A. tristis* and *A. squamosa*, no data could be taken from it.

Of '*Amanita* 5', only a description is available and that seems to refer to large specimens of *A. tristis*. They differ from the specimens described above by (i) a larger pileus, viz. 100–150 mm wide, (ii) a taller stipe, viz. 120–150 mm long, which is white instead of grey and turns slightly brownish on handling, (iii) a white ring without a coloured edge, and (iv) persistently white flesh. All other characters, spore-size included, agree with *A. tristis*. However, as no material could be studied afterwards, the data mentioned above are not incorporated in the description of the present species.

On account of its volva characters, *A. tristis* reminds one of *A. sepiacea* Imai from Japan. In both species, the upper part of the bulb is set with rings of more or less angular, rather thick, flat warts. However, *A. sepiacea* has a more sepia coloured pileus and globulose to subglobulose, slightly larger spores. For comparison of *A. tristis* with *A. squamosa* (Mass.) Corner & Bas, see p. 264.

AMANITA FRITILLARIA (Berk.) Sacc.—Pl. 3*c*, Figs. 21–23

Agaricus (*Amanita*) *fritillarius* Berk. *in* Hook. J. Bot. **4**: 97. 1852. — *Amanitopsis fritillaria* (Berk.) Sacc., Syll. Fung. **5**: 26. 1887. — *Amanita fritillaria* (Berk.) Sacc., Syll. Fung. **9**: 2. 1891.

Pileus 50–100 mm wide, becoming plane or concave, with or without umbo, with smooth margin, dark umber to rather pale greyish umber, fuscous over centre, innately darker fibrillose, slightly viscid, thickly set with darker, small, soft, umber-fuscous remnants of volva as conical warts 1.5–2.5 mm wide and 1.5–2 mm high over disc, diminishing to scurfy flocks near margin. Gills free, crowded, about 100 primaries with 0–1–3 attenuate smaller ones between each pair, white, 6–9 mm wide. Stipe 90–110 mm long, 10–12 mm wide at apex, 15–20 mm at subglobose to slightly turbinate base, somewhat attenuate upward, solid, becoming more or less hollow, pale brownish or greyish brownish, whitish at apex, entirely finely and appressedly fuscous-fibrillose in vague peronate zones, marked with greyish brown patches of velum partiale in upper part when ring present or nearly down to base when no ring is formed; base set with 2–4 rows of small fuscous-umber scurfy warts 0.5–1 mm wide as remnants of volva. Ring present and pendant from middle of stipe or just above it, 8–10 mm wide, brownish grey with very small umber-fuscous warts on edge, floccose-membranous, or absent. Flesh white, becoming slightly ochraceous on cutting or bruising, 5–10 mm thick in centre of pileus.

Spores (Fig. 22) 6.0–7.6 × 5.4–6.6(–7.6) μ (fresh 7–8 × 6.5–7.5 μ), globulose to broadly ellipsoid (lenght-breadth ratio 1.0–1.25, average 1.1–1.15), smooth, thin-walled, colourless, with small apiculus, cloudy-granular, amyloid. Basidia

25–35 × 7–11 μ, 4-spored; sterigmata about 5 μ long. Marginal cells numerous, up to 45 μ, globose, ellipsoid or clavate. Trama of gills distinctly bilateral; central strand and divergent zones passing into each other (because all central elongated broad elements curve outward), with cells up to 200 μ long and 30 μ wide and slender cylindrical in centre, shorter and broader near subhymenium, mixed with narrow hyphae; subhymenium about 40 μ wide, cellular, not distinctly set off from trama, with cells about 25 μ wide in inner part and about 7 μ wide at base of basidia. Cuticle about 80 μ wide, composed of a gelatinized, 10–20 μ thick upper layer with distant, fading, brown hyphae and a lower layer with crowded, radially interwoven, brown hypahe, the latter 2.5–4.5 μ wide and with scattered slightly clavate darker tips of hyphae in upper part and up to 8 μ wide in lower part. Remnants of volva on pileus (Fig. 21) mainly consisting of chains of brown, inflated cells, globulose to ellipsoid, up to 100 μ wide, more rarely clavate to elongate, up to 180 × 45 μ, mixed with rather scarce hyphae; chains and hyphae in warts on disc all perpendicular to surface of pileus. Remnants of volva on base of stipe consisting of brown, polymorphous inflated cells, up to 40 μ wide, mixed with rather numerous 1.5–7 μ wide hyphae. Trama of stipe with longitudinal clavate cells, up to 350 μ long and 60 μ wide, mostly terminal, sometimes in short chains; near surface with brown hyphae and scattered, brown, clavate cells. No clamps observed.

HABITAT.—Terrestrial in forest; in small troops or solitary; frequent.

DISTRIBUTION.—India (Assam), Singapore.

COLLECTIONS EXAMINED.—Singapore, Botanic Gardens, Gardens' Jungle, 25 Nov. 1940 (fragments of 1 specimen in liquid; water-colour drawing); Bukit Timah 13 Dec. 1940 (water-colour drawing); both *E. J. H. Corner s.n.* (as *Amanita* 5[b]).

OBSERVATIONS.—Eaten with relish and immediately on sight by monkeys.

The director of the Kew Herbarium kindly enabled us to study the type specimen of *A. fritillaria* [Herb. Hook., *Agaricus* (*Amanita*) *fritillarius*, Khasia, Pomrang, Sept. 18, 1850, no. 35]. It is a dried, half specimen with many, small, blackish remnants of the volva on the brown pileus. These remnants are more or less conical over the centre of the pileus and pass via flattened conical warts into small patches near the margin. Warts and patches appear to consist of erect chains of mainly ellipsoid, dark brown cells, similar to those in the Malayan material described above, but somewhat smaller. There is no striking difference in structure of the volva between the Malayan and the Indian material.

The base of the stipe of the type is incomplete, and neither Berkeley's description nor J. D. Hooker's water-colour drawing (of which recently a copy was presented to the Rijksherbarium, Leiden) provide any information about the remnants of the volva at the base of the stipe.

The upper part of the cuticle of the type consists of gelatinized, thin, radial hyphae. The spores (Fig. 23) are amyloid and of about the same size as those of the collection from Singapore, but more ellipsoid, viz. 7.4–8.6 × 5.6–7.0 μ and broadly ellipsoid to ellipsoid (length-breadth ratio 1.2–1.5, average 1.3–1.35).

Judging from Hooker's drawing, the pileus of the type was rather pale grey, the stipe pale grey, and streaked with dark grey, and the ring grey and striate.

From the foregoing it is clear that the up till now insufficiently known *A. fritillaria* belongs to section *Validae* and is very similar to Corner's '*Amanita* 5b'. However, the Malayan material is here described as a new form of that species[3] to stress

[3] *Amanita fritillaria* forma **malayensis** Corner & Bas, *f. nov.* A typo differens sporis globulosis vel subellipsoideis. Type: *E. J. H. Corner s.n.*, 25 Nov. 1940, Singapore, Botanic Gardens (L).

the points of difference, viz. the more ellipsoid spores, the smaller cells in the remnants of the volva on the pileus, and the paler grey colour of the pileus of the type of *A. fritillaria*.

From *A. pilosella* Corner & Bas, the present species differs by the viscid cuticle without hair-like elements and the larger size.

Amanita spissacea Imai from Japan is very similar, but seems to have a more floccose stipe and flat and larger patches on the pileus. Moreover, the remnants of the volva on the base of the stipe are powdery.

Compare also the next species, *Amanita* species 1, which may be another form or variety of *A. fritillaria*.

AMANITA SPECIES 1—Pl. 5*b*
(allied to *A. fritillaria*)

Pileus 60–80 mm wide, becoming concave, subumbonate, with smooth or faintly striate margin, sepia, fuscous-umber in centre, with innate dark fibrillose streaks near margin, dry or slightly viscid, set with stout, firm, separable, conical, paler, greyish sepia warts, 2–4 mm wide and 1–2 mm high, but smaller near margin. Gills free, crowded, about 100 primaries with 1–3 shorter ones between each pair, 5–6 mm wide, cream-white, greyish toward base. Stipe 110 × 10–12 mm, subcylindrical, slightly tapering at apex, pale brownish or pallid-whitish and smooth below ring, greyish and slightly appressedly floccose with broken remnants of velum partiale above ring, at base set with 1–2 rows of slight, scurfy, greyish warts 0.5–1 mm wide. Ring pendant in upper part of stipe, spreading, pallid-whitish, striate, membranous-subfloccose, with fuscous scurfy particles on edge. Flesh firm, solid, white, turning slightly ochraceous on cutting, 8 mm thick in centre of pileus.

Spores (fresh) 8–10 × 7.5–8.5 μ, subglobose, colourless, cloudy-vacuolate or 1-guttate.

HABITAT.—Terrestrial in jungle; solitary.

COLLECTIONS EXAMINED.—Singapore, 16 Aug. 1940 (water-colour drawing; no material preserved), *E. J. H. Corner s.n.* (as *Amanita* 5[a]).

OBSERVATIONS.—The split base of the stipe of the specimen depicted is anomalous.

This species is close to *A. fritillaria*, of which it may be a form or variety. It differs by larger and paler warts on the pileus, by a pale smooth stipe and perhaps by slightly larger spores. As no material is preserved, a conclusion would be premature.

Amanita pilosella Corner & Bas, *sp. nov.*—Pl. 4*b*, Figs. 24–26

Pileus 25–70 mm latus, initio convexus, dein applanatus, interdum umbonatus, margine glaber vel leviter striatus, umbrinus, fuliginosus vel griseolo-brunneus, pallescens, striis obscuris virgatus, minute fibrilloso-coactatus, siccus, fragmentis volvae pruinoso-scabrosis vel verrucosis, umbrinis vel nigro-fuliginosis obsitus. Lamellae confertae, albae vel griseolae, margine albae vel fuliginosae. Stipes 40–110 mm longus, apice 3.5–6, basi 5–12 mm latus, subclavatus vel bulbosus, solidus, griseus vel fuscus, striis fibrillosis, innatis, obscuris virgatus, subfibrillosus vel subflocculosus, supra annulum fragmentis annuli griseolis indutus, basi fragmentis volvae nigro-fuligineis, pruinoso-coactatis vel verruculosis obsitus vel concentrice zonatus. Annulus angustus, submembranaceus, griseus, striatus, margine nigro-fuliginosus. Caro alba vel brunneola. Sporae 6.5–10 × 5–8 μ, subglobulosae vel subellipsoideae, amyloideae. Typus: *E. J. H. Corner s.n.*, 10 April 1941, Singapore, Reservoir Jungle (L).

Etymology: pilosellus, minutely hairy (on account of the cuticle which contains hair-like cells).

Pileus 25–70 mm wide, convex to plane or somewhat concave, sometimes slightly umbonate, smooth to faintly striate at margin, umber, fuliginous or greyish brown, paler on expansion, especially toward margin, with innate dark fibrillose streaks, minutely dark greyish brown fibrillose-subvillose, especially toward margin, dry (perhaps slightly viscid when old), with powdery-subvillose, umber, fuliginous or blackish remnants of volva, forming a thin scurfy-pruinose covering, especially near margin, or thin flat patches 1–2.5 mm wide, or irregular warts 1–3 mm wide, and sometimes, on centre of pileus, conicial warts, 0.5–1 mm high and wide. Gills free, crowded, 50–90 primaries with (0–)1–3 attenuate shorter ones between each pair, white or greyish white; edge white or fuliginous-umber. Stipe 40–110 mm long, 3.5–6 mm wide at apex, 5–12 mm wide at subclavate to bulbous base, attenuate upward, solid, entirely grey, fuscous-grey, greyish umber or fuscous, with dark fibrillose innate streaks, subfibrillose to subflocculose, with greyish patches above ring from shattered velum partiale; upper part of bulbous base with one to several mostly incomplete rows of fuliginous to blackish, minute, pruinose-felted patches, or entirely fuliginous pruinose-felted by volva. Ring rather narrow, pendant, floccose-membranous, dark to pale grey and striate at upper side, greyish and fuliginous pruinose or flocculose at underside, with slightly thickened, but entire, pruinose-flocculose, fuliginous to blackish edge, 15–30 mm below apex of stipe. Flesh white or slightly brownish, 1.5–4.5 mm thick in centre of pileus, thin over limb.

Spores (Fig. 24) (5.5–)6.4–7.9 × (4.3–)5.1–7.0 μ (fresh, 7–10 × 5.5–8 μ), subglobulose to broadly ellipsoid [length-breadth ratio 1.05–1.3(–1.4), average 1.15–1.2], cloudy-vacuolate to multiguttulate, with rather small apiculus, thin-walled, smooth, colourless, amyloid. Basidia 28–45 × 9–13(–14) μ, 4-, rarely 2-spored. Marginal cells 25–60 × 12–30 μ, a mixture of globose, ellipsoid and clavate cells and thin hyphae, sometimes with umber sap (hardly distinguishable in preserved material, thus contrasting with pigment in cells of volva); forming a broad sterile margin along edge of gills. Trama of gills distinctly bilateral; central strand with narrow and inflated hyphae, the latter with cells up to 100 μ long and up to 15(–25) μ wide; divergent zones with inflated cylindrical to ellipsoid or clavate cells, up to 60 × 25 μ, passing gradually into a thick cellular subhymenium, with globulose cells decreasing from 30 μ wide in inner part to 5 μ at base of basidia. Remnants of volva on cap consisting mainly of brown, globulose to ellipsoid cells, up to 100 μ wide, terminal or forming easily disintegrating chains, the latter in central conical warts perpendicular to surface of pileus, mixed with scarce to rather frequent, 3–7 μ wide, brown hyphae. Cuticle thin, composed of crowded, irregularly radial, 2–6 μ wide, brown hyphae, partly covered by rather distant, not or only slightly embedded, 3–12 μ wide brown hyphae, with scattered, slightly protruding, inflated elongate, mostly terminal cells (Fig. 25–26), up to 230 μ long and to 40 μ broad. Remnants of volva on base of stipe consisting of globose, ellipsoid, clavate or citriform, brown cells mixed with many hyphae. Trama of stipe with inflated, longitudinal, terminal clavate cells, up to 300 × 30 μ. Surface of stipe with brown narrow hyphae and scattered slenderly clavate brown cells. No clamps observed.

HABITAT.—Terrestrial in jungle; solitary; frequent every rainy season.

COLLECTIONS EXAMINED.—Singapore, Reservoir Jungle, 10 April 1941 (type; one specimen in liquid; water-colour drawing); 15 April 1941 (water-colour drawing); Botanic Garden, Garden's jungle, 30 Aug. 1944 (annotated, not preserved) Bukit Timah, 21 Aug. 1939 (one dried specimen); Singapore (without further information), 23 April 1940 (two specimens in liquid); all *E. J. H. Corner* (as *Amanita* 1[a] and 1[b]).

This small to medium-sized species evidently belongs to the difficult group of dark-coloured species within section *Validae*. It is, however, easy to distinguish by the dry cuticle with elongate, inflated, slightly protruding cells.

The remnants of the volva on the pileus vary considerably as to size and form, hence, the two forms here distinguished.

1. Forma PILOSELLA (Pl. 4*b*) Pileus 25–35 mm wide, with rather thick irregular warts, especially on the centre of the pileus, composed of large, mainly terminal, brown sphaerocysts, up to 100 μ wide, mixed with rather frequent hyphae. Edge of gills white. ('*Amanita* 1^{b}').

2. Forma **atroconica** Corner & Bas, *forma nov.*[4] Pileus 35–70 mm wide, with more regular patches of the volva on the limb of the pileus and conical warts on the centre, composed of rather scarce hyphae and slightly smaller and darker sphaerocysts up to 70 μ wide and mostly disposed in chains, the latter perpendicular to the pileus in the central warts. Edge of gills fuliginous, rarely white. The following collections of those enumerated above appears to belong to this forma: Singapore, 23 April 1940; Bukit Timah, 21 Aug. 1939 ('*Amanita* 1^{a}').

The senior author already separated both forms in his field-notes on account of the difference in colour of the edge of the gills. However, the material available being scanty, the taxonomical importance of these two forms is uncertain.

Amanita pilosella is undoubtedly closely related to *A. spissacea* Imai from Japan, which has the same dark brown pileus with darker greyish pulverulent patches from the volva, the same pulverulent grey remnants of the volva on the base of the stipe and the same spores. However, *A. spissacea* is larger and considerably more fleshy, has an umbonate pileus and a dark squamulose covering of the stipe below the ring; its cuticle seems to lack the streaky appearance of that of *A. pilosella*.

Amanita neglecta Boedijn (1951: 324) seems to be related, too. In that species, however, the colours are different, viz. the cap is dirty brown and the stipe is pinkish buff with appressed darker scales below the pale yellow ring.

AMANITA SPECIES 2—Pl. 1*c*
(allied to *A. pilosella*)

Pileus 45–65 mm wide, becoming plane, fuscous brown, paler toward margin, darker in centre, innately streaked, slightly viscid, set with large, 5–7.5 mm wide and 1 mm high, pale fuscous brown patches with whitish flat tops. Gills free, crowded, 50–60 primaries with 0–1 shorter ones between each pair, white, thin, 3–4 mm wide. Stipe 60–80 mm long, 3–4 mm wide at apex, 7–8 mm at base, attenuate upward, white to very pale brownish white, above ring surface breaking up into minute fibrillose patches and below ring into short fine fibrils; subbulbous base without any trace of volva. Ring pendant, 4–5 mm wide, floccose-felted membranous, white with a pale brownish edge, not striate, about 20 mm below apex of stipe. Flesh white, rather thin.

Spores (fresh) 7–7.5 × 6 μ, subglobose to broadly ellipsoid, colourless, 1-guttate. Remnants of volva on pileus composed of sphaerocysts.

HABITAT.—Terrestrial in forest.

[4] Pileus centro verrucis conicis. Lamellae margine saepe fuliginosae. Typus: *E. J. H. Corner s.n.*, 23 April 1940, Singapore (L).

COLLECTIONS EXAMINED.—Singapore, Reservoir Jungle, 10 April 1941 (water-colour drawing & notes; no material preserved), *E. J. H. Corner s.n.* (as *Amanita* 18).

This species reminds one of *A. pilosella* by the small size, the darkly streaked pileus, the brown-rimmed ring, and the small spores. However, it seems easy to distinguish by the large, flat, pale brown, white-topped patches on the pileus, the absence of remnants of the volva at the base of the stem, the much paler colours, and the viscid surface of the pileus.

Amanita xanthomargaros Corner & Bas, *sp. nov.*—Pl. 7*b*, Fig. 18

Pileus 45 mm latus, plano-convexus, margine haud striatus, fusco-brunneus vel olivaceo-brunneus, centro fuscus, margine flaveolus, striis obscuris virgatus, siccus, verrucis conicis, umbrinis, apicibus flavis tectus. Lamellae confertae, albae. Stipes 55 mm longus, apice 3 mm latus, basi 8 mm latus, clavatus et submarginatus, solidus, annulatus, pallide griseolo-brunneus, apice flaveolus, leviter pruinoso-flocculosus, basi fragmentis volvae flocculosis, flavis vel fuscis zonatus. Annulus membranaceus, pallide sordide flavus, margine flavus. Caro alba, pallide brunnescens vel griseo-brunnescens. Sporae 5.5–7 × 4.5–6 μ, subglobulosae vel subellipsoideae, amyloideae. Typus: *E. J. H. Corner s.n.*, 8 Nov. 1940, Singapore (L).

Etymology: ξανθός, golden yellow; μαργαρος, pearl.

Pileus 45 mm wide, plano-concave, with non-striate margin, fuscous-brown to olivaceous-brown, fuscous over disc, yellowish near margin, with innate, dark, radiating fibrils, dry, set with numerous, friable, soft, conical umber-brown warts with yellow tips, 1–1.5 mm high, 1–2 mm wide. Gills free, crowded, 66 primaries with 0–1 attenuate shorter ones between each pair, white, 5 mm wide, with white edge. Stipe 55 mm long, 3 mm wide at apex, 8 mm at clavate, submarginate base, attenuate upward, solid, pale greyish brown, yellowish at apex, wholly lightly pruinose-cottony above and below ring, at base with 2–3 powdery scurfy, incomplete circles, the upper one fuscous and yellow, the others light yellow. Ring pendant, spreading, 3 mm wide, membranous, pale dingy yellow, deeper yellow at entire, smooth edge. Flesh white, becoming pale brownish or greyish-brownish on cutting, especially in stipe, 3 mm thick in centre.

Spores (Fig. 18) 5.4–6.4 × 4.4–5.3 μ (fresh: 6–7 × 5–6 μ), subglobulose to broadly ellipsoid [length-breadth ratio (1.05–)1.1–1.3(–1.35), average 1.2–1.25], colourless, thin-walled, smooth, with small apiculus, 1-guttate, amyloid. Basidia 23–30 × 7.5–9 μ, 4-spored. Marginal cells vesiculose, colourless, in preserved material scarce and up to 30 μ wide. Trama of gills loose, irregularly bilateral, without distinct central strand, with elongate cells up to 135 × 30 μ in central part and more ellipsoid cells, up to 60 × 30 μ in outer part, mixed with hyphae; subhymenium 40–50 μ wide, cellular, with cells 10–25 μ wide, small near base of basidia, larger and more ellipsoid in inner part. Cuticle about 60–80 μ wide, made up of a gelatinized, 10–20 μ wide upper layer with 2–4 μ wide, irregularly disposed, distant, brown hyphae, and a lower layer with rather crowded, 4–10 μ wide, irregular to subradial, brown hyphae; near margin without gelatinized upper part and with elongate, hair-like, brown cells, up to 180 × 15 μ. Remnants of volva on pileus consisting of mainly sphaerocysts, 45–80 μ wide and brown in base of warts, 25–40 μ wide and yellow in tips of warts, sometimes disposed in short chains, but mostly abruptly terminal on 2–7 μ wide, rather numerous hyphae; chains and hyphae more or less perpendicular to surface of pileus, especially in tips of warts. Remnants of volva on base of stipe consisting of 20–50 μ wide sphaerocysts in chains or terminal, brown in upper ring, yellow in lower rings, mixed with 3–8 μ wide hyphae. Trama

of stipe with terminal, clavate, longitudinal cells, up to 330 μ long and 40 μ wide, with scattered thin, loose hyphae on brownish hyphae at surface. No clamps observed.

HABITAT.—Terrestrial in jungle; solitary.

COLLECTIONS EXAMINED.—Singapore, along Thomson Road, 8 Nov. 1940 (type; one specimen in liquid; water-colour drawing), *E. J. H. Corner s.n.* (as *Amanita* 16).

This species reminds one of the European *A. francheti* (Boud.) Fayod (= *A. aspera* ss. auct.), but the latter has a viscid, not fibrillosely streaked pileus, wholly yellowish warts, a whitish stipe, and larger spores, viz. 7.5–11 × 5.5–7 μ.

Amanita xanthomargaros is more closely related to *A. pausiaca*. These two species have in common (i) their habit, (ii) the olivaceous-brown, dry pileus, (iii) the yellow edge of the ring, (iv) the yellowish apex of the stipe, (v) the rows of small warts at the base of the stipe, and (vi) the small spores. However, in *A. pausiaca*, the remnants of the volva form greyish patches instead of yellow-tipped conical warts on the pileus, and fuscous-olivaceous warts at the base of the stipe instead of yellow ones. Moreover, the spores of *A. pausiaca* are slightly more globulose (average length-breadth ratio 1.1–1.15) than those of *A. xanthomargaros* (1.2–1.25). Nevertheless these two species may turn out to be conspecific, if more material becomes available.

Amanita pausiaca Corner & Bas, *sp. nov.*—Fig. 17

Pileus 60 mm latus, applanatus, centro depressus, margine minute striatus, fuligineo-olivaceus, centro fuscus, striis fibrillosis, obscuris virgatus, siccus, verrucis planis, minutis, griseolis tectus. Lamellae confertae, albae. Stipes 70 mm longus, apice 6, basi 13 mm latus, clavato-subbulbosus, solidus, pallide flavo-olivaceus, apice flavus, supra annulum pruinosus, infra annulum fibrillosus, basi fragmentis volvae fusco-olivaceis, verruculosis concentrice ornatus. Annulus membranaceus, 10 mm latus, albus, margine flaveolus et subverrucosus. Caro alba. Sporae 5–6 × 4.5–5.5 μ, globulosae vel subellipsoideae, amyloideae. Typus: *E. J. H. Corner s.n.*, 3 July 1930, Malaya, Negri Sembilan (L).

Etymology: pausiacus, olivaceous.

Pileus 60 mm wide, plane with slightly depressed centre, finely sulcate-striate at margin, bistre-olivaceous, darker and more fuscous in centre, innately streaked with darker fibrils, dry, more or less concentrically spotted with small greyish patches. Gills distantly free, crowded, 81 primaries with 1–3 attenuate shorter ones between each pair, white, 5–6 mm wide. Stipe 70 mm long, 6 mm wide at apex, 13 mm at subbulbous, clavate base, solid, pale yellow-olivaceous, clearer yellow near apex, fibrillose below ring, minutely pruinose above, at base with 2–3 rings of fuscous-olivaceous small warts of volva. Ring pendant, membranous, 10 mm wide, white with yellowish subverrucose edge. Flesh white, fuscous olive below surface of pileus, thin, 4 mm thick in centre of pileus.

Spores (Fig. 17) 5.1–6.1 × 4.4–5.8 μ, globulose to broadly ellipsoid (length-breadth ratio 1.0–1.2, average 1.1–1.15), smooth, colourless, with medium-large apiculus, amyloid. Cuticle rather thin, made up of 1.5–4.0 μ wide hyphae with brown contents, radial in inner part, irregular and gelatinized in upper part. Remnants of volva on base of stipe consisting mainly of globulose, seldom ellipsoid or fusiform, presumably mostly terminal cells, pale yellowish-brownish in NH_4OH, mixed with many 2.5–4 (–7) μ wide branching hyphae. Trama of stipe *Amanita* structure; clavate cells up to 200 × 30 μ and perhaps larger. No clamps observed.

HABITAT.—Terrestrial in forest.

COLLECTIONS EXAMINED.—Malaya, Negri Sembilan, Angsi Forest Reserve, 3 July 1930 (type; two dried slices), *E. J. H. Corner s.n.* (as *Amanita* spec.).

This species is characterized by colours like those of *A. phalloides* and a volva like that of *A. rubescens*. Moreover, the very small spores are distinctive. Compare *A. xanthomargaros* (p. 270).

Amanita demissa Corner & Bas, *sp. nov.*—Pl. 5*a*, 6*a*, Figs. 28, 29

Pileus 15–35 mm latus, initio campanulatus, dein plano-convexus vel applanatus, centro depressus vel subumbonatus, margine striatus, griseo-umbrinus, pallescens, flocculis volvae fuligineis centro verrucis conicis obsitus. Lamellae subdistantes, albae. Stipes 25–50 mm longus, apice 2–3, basi 3–6 mm latus, subbulbosus, cavus, annulatus, pallide griseolus vel albidus, basi fragmentis volvae griseis, pruinosis leviter zonatus. Annulus angustus, medius vel inferus, albus, margine fuliginosus. Caro alba. Sporae 6.5–9.5 × 5–6.5 μ, subellipsoideae vel ellipsoideae, amyloideae. Typus: *E. J. H. Corner s.n.*, 21 Aug. 1939, Singapore, Bukit Timah (L).

Etymology: demissus, lowered, let down (on account of the low annulus).

Pileus 15–35 mm wide, campanulate to plano-convex, becoming plane at last, sometimes slightly umbonate, sometimes slightly depressed in centre, $^1/_3$ striate from margin toward centre, greyish umber or umber-grey, paler toward margin, becoming pale brownish grey or grey in centre and whitish at margin, presumably slightly viscid, sprinkled with minute, soft, scurfy, fuliginous, easily separable particles, 0.5–1 mm wide and about 0.3 mm high, forming conical warts in centre. Gills free, not crowded, 34–43 primaries with 1–3 attenuate shorter ones between each pair, thin, 1.5–3 mm wide, white. Stipe 25–50 mm high, 2–3 mm wide at apex, 3–6 mm wide at subbulbous base, attenuate upward, hollow (cavity not drawn in all figures), brittle, annulate, pale greyish white with white apex or wholly pallid whitish, slightly fibrillose, remnants of volva at base as 1–3 faint uneven circles of fine greyish pruina. Ring narrow, pendant, at or below middle of stipe, not spreading, white with fuliginous scurfy particles on edge. Flesh 1.5–2.5 mm thick in centre of pileus, very thin over limb, soft, white. Smell slight, indistinct.

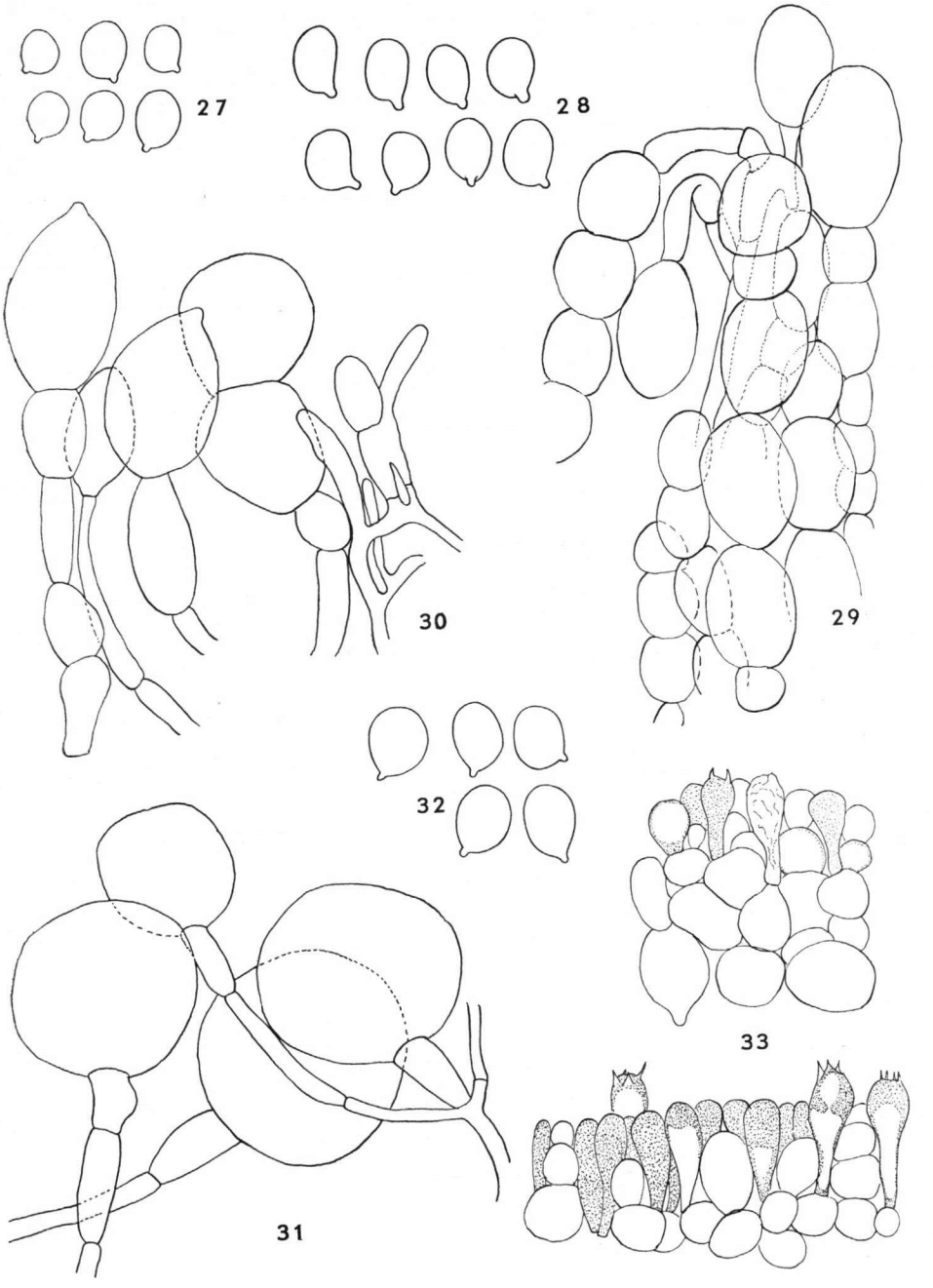
Spores (Fig. 28) 6.4–8.5 (–10.1) × 4.7–6.4 μ (fresh, 7–9.5 × 5–6.5 μ), broadly ellipsoid to ellipsoid [length-breadth ratio 1.1–1.5 (–1.6), average 1.3], often dorsally flattened, smooth, thin-walled, colourless, 1-guttate or merely cloudy-granular, amyloid. Basidia 28–40 × 9–10.5 μ, 4-spored, rarely 3- or 2-spored; sterigmata 3 μ long. Marginal cells scattered along gill-edge, 16–40 μ wide, vesiculose. Trama of gills impossible to analyse in dried material. Remnants of volva on pileus (Fig. 29) consisting mainly of 15–55 (–80) μ wide, thin-walled, smooth sphaerocysts with pale fuliginous sap, mostly arranged in long chains perpendicular to surface of pileus, sometimes terminal on rather scarce, 2.5–6 μ wide, hyphae. Cuticle made up of a thin gelatinous upper layer with 1.5–3 μ wide, very distant, irregularly disposed, brown hyphae, and a somewhat thicker lower layer of crowded, slightly

EXPLANATION OF FIGURES 27–33

Fig. 27. *Amanita tristis.* — Spores (× 1250).

Figs. 28, 29. *Amanita demissa.* — 28. Spores (× 1250). — 29. Crushed apex of wart from pileus (× 500).

Figs. 30, 33. *Amanita xanthella.* — 30. Crushed apex of wart from pileus (× 500). — 31. Crushed base of wart from pileus (× 500). — 32. Spores (× 1250). — 33. Hymenium with sterile cells (× 500).



Figs. 27–33

interwoven, radial, brown hyphae up to 8 μ wide. Remnants of volva on base of stipe made up of brown sphaerocysts and many loosely interwoven hyphae. Trama of stipe with longitudinal, cylindrical to cigar-shaped cells, terminal or in short chains, up to 420 × 45 μ. No clamps observed.

HABITAT.—Terrestrial in forest; occurring every rainy season (March-April, Aug.-Sept.); developing quickly; nearly always solitary and scarce.

COLLECTIONS EXAMINED.—Singapore, Bukit Timah, 21 Aug. 1939 (type; dried fragments of two specimens); 3 Sept. 1940 and Dec. 1940 (both water-colour drawings); Botanic Gardens 18 Aug. 1940 (water-colour drawing); also observed in Mandai Rd. forest; all *E. J. H. Corner s.n.* (as *Amanita* 1).

Amanita demissa seems to possess all the characters of a small species of section *Amanita*, viz. a hollow stipe, a striate margin of the pileus and a narrow non-striate annulus. However, the spores are amyloid and therefore the species has to be placed in section *Validae* where it does not find close allies.

Amanita xanthella Corner & Bas, *sp. nov.*—Pl. 7*a*, Figs. 30–33

Pileus 20–45 mm latus, subconcavus, margine striatus, luteus vel luteolus, siccus, verrucis conicis, minutis, luteis ornatus. Lamellae liberae, confertae, usque ad 6 mm latae, albae, acie luteola. Stipes 30–60 mm longus, apice 2–4, basi 6–12 mm latus, subbulbosus, e pleno cavus, albus, subfibrilloso-flocculosus, annulatus; basis fragmentis volvae flavis, flocculosis tecta. Annulus inferus, angustus, albus, acie luteola. Caro alba. Sporae 6.5–8 (–9) × 5–7 μ, subglobosae vel subellipsoideae, amyloideae. Typus: *E. J. H. Corner s.n.*, 27 March 1943, Singapore, Bukit Timah (L).

Etymology: xanthellus, latin diminutive of ξανθός, golden yellow.

Pileus 20–45 mm wide, shallow concave with flat margin, about $^1/_3$ tuberculate-striate from margin toward centre, pale yellow, deeper yellow in centre, dry, set with small, mealy, bright yellow, pyramidal warts, about 1–1.5 mm high and wide, crowded in centre, scattered and smaller toward margin. Gills free, crowded, thin, up to 6 mm broad, about 42 primaries with 0–1 (–3) attenuate shorter ones between each pair, white, with very pale yellow, entire edge. Stipe 30 –60 mm long, 2–4 mm wide at apex, 6–12 mm at subbulbous base, solid, becoming hollow, white, slightly fibrillose-floccose above and below ring; base set with small, 0.5 mm or less wide, yellow mealy flocks as remnants of volva. Ring narrow, pendant, white with edge set with yellow mealy particles, in lower third of stipe. Flesh white, firm.

Spores (Fig. 32) 6.5–7.4 (–8.1) × 5.1–7.1 μ (fresh, 7–9 μ), subglobulose to broadly ellipsoid (length-breadth ratio 1.05–1.3), sometimes ovoid or obovoid, with rather narrow apiculus, colourless, thin-walled, with granular opalescent-vitreous contents, amyloid. Basidia 25–36 × 8–12 μ, with four sterigmata up to 5 μ long, in hymenium often interspaced by, up to 15 μ wide, isodiametric or broadly clavate hyaline cells (Fig. 33). Marginal cells rare, globulose, 17–24 μ wide; edge of gills partly fertile. Trama of gills subcellular, very indistinctly bilateral, made up of ellipsoid and globulose cells, up to 70 × 35 μ, mixed with hyphae; subhymenium consisting of large sphaerocysts (Fig. 33), not delimited from trama. Fragments of volva on pileus with terminal globulose cells, up to 70 μ across, with yellow sap, in base and with more or less erect chains of smaller inflated and cylindrical yellow cells in apex of warts (Fig. 30–31). Fragments of volva on base of stipe consisting of terminal yellow sphaerocysts, up to 60 μ wide, mixed with 3–10 μ wide hyphae. Cuticle 25–80 μ thick, composed of intermixed, distant, apparently imbedded, 2–5 μ wide hyphae with yellow vacuolar pigment. Hypoderm consisting of more

or less radial hyphae with inflated fusiform cells, not sharply delimited. Trama of stipe with cylindrical to clavate terminal cells, up to 225 × 45 μ, narrow hyphae and some twisting refractive hyphae up to 10 μ wide, scarcely septate; on bulbous base with large sphaerocysts and 5–10 μ wide hyphae. No clamps observed.

HABITAT.—Terrestrial in forest; solitary.

COLLECTIONS EXAMINED.—Singapore, Bukit Timah, 27 March 1943 (type; one fragmented specimen in liquid; water-colour drawing), *E. J. H. Corner s.n.* (as *Amanita* 20).

OBSERVATIONS.—The great difference between the results of the measurements of the spores of fresh and of preserved material, may be due to the fact that the mature spores got lost in the preservation liquid.

In a tentative arrangement of the material, this species was put into section *Muscariae* on account of its great resemblance to *A. mira* (see p. 290), although the attenuate short gills caused some doubt. Nevertheless, it was a bit of a surprise later on to find the spores to be amyloid. In this way the number of species in section *Validae*, characterized by bright colours and a striate margin of the pileus, is increased again after its reduction by the removal of *A. rubrovolvata* (see p. 287).

The only species more or less comparable with *A. xanthella* are the yellow *A. flavipes* Imai (1933: 428) and *A. bella* Imai apud Gilb. (1941: 364), both from Japan. However, neither of these has conical warts on the pileus and both have larger spores, viz. 7.5–10 × 5–6.5 μ.

Section AMIDELLA (Gilb.) Konr. & Maubl.

Amidella Gilb. *in* Bres., Iconogr. mycol. **27** (1): 71, 77. 1940.—*Amanita* subgen. *Amidella* (Gilb.) Gilb., Not. Amanites XXX[3]. 1941.—*Amanita* sect. *Amidella* (Gilb.) Konr. & Maubl., Agaricales 61. 1948.—Type: *Amanita volvata* Peck.

Amanita sect. *Baccatae* Sing. *in* Lilloa **22**: 387. 1951 (nom. prov.); Sing. *in* Rev. Mycol. **18**: 17. 1953 (not val. publ.).—Type: "*Amanita baccata* (Fr.) Quél." [= *Amanita agglutinata* (Berk. & Curt.) Sing.].

For the scope of this section, see the key to the subgenera and sections on p. 243.

Amanita duplex Corner & Bas, *sp. nov.*—Pl. 5*c*, Fig. 34

Pileus 40–100 mm latus, subconcavus, subumbonatus, margine haud striatus, pallide cinereo-brunneus vel pallide cinereo-bubalinus, siccus, volvae fragmentis pulverulento-coactatis, brunneo-griseis tectus, centro volvae laciniis membranaceis, albis, 10–25 mm latis ornatus. Lamellae confertae, albo-cremeae. Stipes 60–120 × 7–10 mm, basi subbulbosus, solidus, albus vel pallidus, exannulatus, apice pruinosus, brunneo-griseus, infra nunc verrucis minutis, recurvis, nunc volvae annulo appresso, membranaceo obsitus. Volva 25 mm alta, 12–25 mm lata, fere omnino adnata, alba, limbo 2–4 mm lato. Caro alba. Sporae 6.5–7.5 × 5–5.5 μ, subellipsoideae vel ellipsoideae, amyloideae. Typus: *E. J. H. Corner s.n.*, 4 Sept. 1942, Singapore, Bukit Timah (L).

Etymology: duplex, double (on account of the volva consisting of two layers).

Pileus 40–100 mm wide, shallowly saucer-shaped, somewhat umbonate, not striate at margin, pale greyish-brownish, pale greyish buff or pale greyish hazel, dry, innately fibrillose, at first covered with a slightly greyer, pruinose-felted, 0.2 mm thick layer, breaking up into granules, concentric crust-like patches, and rings, but in centre covered by a membranous, white (brownish ochre discoloured by

soil), smooth, 10–25 mm wide patch from top of volva. Gills free, crowded, about 130 primaries with 1(–3) rounded truncate shorter ones between each pair (mostly more truncate than in water-colour drawing), cream-white, 3–7 mm wide, with minutely eroded edge. Stipe 60–120 × 7–10 mm, tall, subcylindrical or slightly thickened downward, with hardly bulbous base, solid, whitish to pallid, exannulate, at least in upper two thirds covered with a pale brownish grey pruinose layer from ring, disrupted on elongation of stipe; on lower third with irregular small recurved squamules or with ring-like patch just above volva (as in specimen depicted). Volva at base of stipe up to 25 mm high, 12–25 mm wide, smooth, white, nearly entirely attached to base of stipe, with only a 2–4 mm wide free limb. Flesh 4–8 mm thick in centre, 1–1.5 mm half-way to margin, white, firm, then rather soft.

Spores (Fig. 34) 6.5–7.3 × 4.8–5.6 μ (fresh, 7–7.5 × 5.5 μ), ellipsoid to broadly ellipsoid (length-breadth ratio 1.25–1.45, average 1.35), colourless, thin-walled, smooth, with narrow, but sometimes rather long apiculus, with opalescent contents, amyloid. Basidia 4-spored, 32–36 × 9–11 μ; sterigmata about 4 μ long. Marginal cells numerous, small, 10–20(–30) μ wide, globulose to subglobulose. Trama of gills bilateral; central strand narrow, dense, made up of 5–10 μ wide hyphae and elongated cells up to 20 μ wide; divergent zones with elongate to ellipsoid or clavate cells up to 90 × 30 μ; subhymenium about 40 μ wide, composed of elongate to globulose cells, from 30 × 12 μ in inner part, to 8 × 8 μ at base of basidia. Cuticle about 200 μ wide, composed of a gelatinized, about 80 μ wide upper layer of radial 1.5–5 μ wide hyphae, and a lower layer of radial, up to 25 μ wide hyphae strongly constricted at septa, and forming chains of fusiform to ellipsoid cells. Remnants of volva on pileus: central patch absent in preserved fragment; crust-like patches composed of globulose, ellipsoid and piriform cells, with pale brown sap, often arranged in short chains, seemingly seated on a (more or less gelatinized?) thin layer of radial, 1.5–4 (–10) μ wide hyphae (difficult to make out whether this layer is inner layer of volva or belongs to cuticle; the first alternative seems more plausible). No clamps observed.

HABITAT.—Terrestrial in forest.

COLLECTIONS EXAMINED.—Singapore, Bukit Timah, 4 Sept. 1942 (type; one sector of pileus in liquid; water-colour drawing), *E. J. H. Corner s.n.* (as *Amanitopsis* 11).

OBSERVATIONS.—The universal veil of this species is composed of at least two distinct layers. Unfortunately the outer layer could not be studied as no parts of it were preserved. Most probably, however, it is composed of repent, interwoven hyphae and forms the central membranous patch over the centre of the pileus, the outer layer of the volva ring near the base of the stipe and the smooth covering of the base itself. The inner part of the universal veil consists of rather small inflated cells forming short chains and, therefore, is more liable to break up, thus forming crust-like patches all over the pileus. These pulverulent patches, however, are removable from the cuticle and rather coherent. As mentioned in the description, the chains of sphaerocysts seem to be seated on a thin layer of radial hyphae. This may be a third (innermost) layer of the universal veil.

Amanita duplex is rather difficult to place. It seems to take an intermediate position between sections *Lepidella* and *Amidella*. As a large part of the pileus is covered by pulverulent remnants of the universal veil one would be inclined to assign this species to section *Lepidella*. However, in this section one looks in vain for close allies and the slightly limbate volva in combination with the membranous patch on the centre of the pileus would be a peculiar feature there.

In section *Amidella*, however, several species occur which have a pulverulent or squamulose covering of the cuticle, besides a sheathing volva, for instance *A. fulvopulverulenta* Beeli, *A. goossensiae* Beeli, *A. agglutinata* (Berk. & Curt.) Sing., *A. lepiotoides* Barla, etc. It is very likely that in these species the pulverulent or fibrillose patches on the pileus are derived from a friable inner layer of the volva, as previously stated by Gilbert (1941: 309).

Therefore, although in *A. duplex* the volva is less sheathing than in the species enumerated above, its natural place seems to be in their vicinity. Form and size of the spores of *A. duplex* present no difficulties to that solution and, moreover, some of the species mentioned above have a friable ring, too.

Within section *Amidella*, *A. duplex* is easily distinguished on account of its very pale greyish-brownish pileus covered with numerous, slightly more greyish, crust-like patches, the friable ring, the unchanging flesh, and the relatively small spores.

Section PHALLOIDEAE (Fr.) Quél.

Agaricus [sect.] *Phalloideae* Fr., Monogr. Amanitarum Sueciae 3. 1854.—*Amanita* [sect.] *Phalloideae* (Fr.) Quél. *in* Mém. Soc. Emul. Montbéliard, ser II, **5**: 66. 1872 (Champ. Jura **1**: 28); Konr. & Maubl., Agaricales 63. 1948 ("sect.").—*Amanitina* [sect.] *Phalloideae* (Fr.) Gilb. *in* Bres., Iconogr. mycol. **27** (1): 72. 1940.—Lectotype (Sing. *in* Lilloa **22**: 387. 1951): *Agaricus phalloides* Fr.

Amanita [sect.] *Limbatae* Quél., Fl. mycol. France 307. 1888.—Lectotype: *Amanita phalloides* (Fr.) Link.

Amanita [sect.] *Volvati* J. Schroet. *in* Kryptog.-Fl. Schlesien **3** (1): 680. 1889; P. Henn. *in* Natürl. PflFam. **1** (1**): 275. 1889 ("*volvatae*"; "sect.").—Lectotype: "*Amanita bulbosa* Bull." [= *Amanita phalloides* (Fr.) Link].

Amanita [sect.] *Sphaerosporae* Lange *in* Dansk bot. Ark. **2** (3): 5, 7. 1915.—Lectotype: *Amanita mappa* (Batsch ex Fr.) Gonn. & Rab. [= *Amanita citrina* (Schaeff.) ex Roques].

Amanita [sect.] *Semilimbatae* Gilb., Genre Amanita 61, 172. 1918.—Lectotype: *Amanita citrina* (Schaeff.) ex Roques.

Amanita sect. *Volvoamanita* G. Beck *in* Pilz- u. Kräuterfreund **5**: 230, 235. 1922.—Lectotype: *Amanita phalloides* (Fr.) Link.

Amanitina [sect.] *Virosellae* Gilb. *in* Bres., Iconogr. mycol. **27** (1): 78. 1940.—Lectotype: *Amanita virosa* (Fr.) Quél.

Amanita [subsect.] *Mappae* Gilb., Genre Amanita 61, 172. 1918.—*Amanitina* [sect.] *Mappae* (Gilb.) Gilb. *in* Bres., Iconogr. mycol. **27** (1): 78. 1940.—*Amanita* [sect.] *Mappae* (Gilb.) Konr. & Maubl., Agaricales 64. 1948.—Lectotype: *Amanita citrina* (Schaeff.) ex Roques.

Amanitina Gilb. *in* Bres., Iconogr. mycol. **27** (1): 72, 78. 1940.—*Amanita* subgen. *Amanitina* (Gilb.) Gilb., Not. Amanites XXX [3]. 1941.—*Amanita* [sect.] *Amanitina* Kühn. & Romagn., Fl. anal. Champ. sup.: 431. 1953 (not val. publ.).—Type: *Amanita phalloides* (Fr.) Link.

For the scope of this section, see the key to the subgenera and sections on p. 243.

KEY TO THE SPECIES OF SECTION *Phalloideae*

1. Spores globulose to subglobulose, average length-breadth ratio < 1.15.
   2. Pileus umber, finely innately streaked near margin. Stipe white with small pale grey, flocculose-scurfy patches or fibrils. Ring and volva greyish. Spores 7.5–9 × 7–8.5 μ *A. privigna*, p. 281
   2. Pileus umber to mouse-coloured, rather conspicuously darkly streaked. Stipe white and smooth. Ring and volva white. Spores 7.5–11 × 6.5–10 μ . . . *A. alauda*, p. 282

1. Spores broadly ellipsoid to ellipsoid, sometimes subglobulose, average length-breadth ratio > 1.15.
   3. Gills broad and rather distant. Pileus 90–100 mm wide, with a thick cuticle, at first dark sepia, later one pale greyish sepia. Stipe with slightly pointed clavate-bulbous base, white, smooth, flocculose-squamulose near apex, annulate. Limb of volva without sphaerocysts. Spores 5.5–8 × 5–6 μ . . . . . *A. elephas*, p. 278
   3. Gills narrow and crowded. Pileus 40–60 mm wide, with a moderately thick to thin cuticle, grey or umber.
      4. Stipe up to 60 mm long, annulate, white. Pileus not streaked, umber to greyish mouse-coloured. Stipe pruinose to flocculose-pruinose, with globose, slightly radicating base. Volva fleshy-membranous; its limb with sphaerocysts. Spores 6–9 × 4.5–7 μ *A. modesta*, p. 279
      4. Stipe up to 160 mm long, exannulate, pale greyish below. Pileus with dark innate streaks, leaden grey. Stipe in lower two thirds finely fibrillose, in upper third subpruinose, with subbulbous-subradicating base. Spores 7–8.5 × 5.5–6.5 μ *A.* species 3, p. 280

Amanita elephas Corner & Bas, *sp. nov.*—Pl. 6*b*, Fig. 36

Pileus 90–100 mm latus, initio campanulatus, dein applanatus vel concavo-applanatus, subumbonatus, margine haud striatus, sepiaceus, dein sordide pallide sepiaceus, margine striis minutis, innatis, obscuris virgatus, nunc nudus, nunc verrucis paucis albis, magnis, tenuibus obtectus, siccus vel subviscidus. Lamellae liberae, subdistantes, pallide cremeae. Stipes 120 mm longus, apice 8 mm crassus, basi 20–25 mm crassus, clavato-bulbosus, solidus, albus, infra glaber, a summo floccoso-squamulosus, annulatus, volvatus. Annulus 12 mm latus, amplus, floccoso-membranaceus, laceratus, supra striatus. Volva semilibera, 28–35 mm alta, alba, membranacea, appressa. Caro alba, dein pallide ochracea. Sporae 5.5–8 × 5–6 μ, subglobulosae vel subellipsoideae, amyloideae. Typus: *E. J. H. Corner s.n.*, 16 Aug. 1940, Botanic Gardens, Singapore (L).

Etymology: elephas, elephant (on account of the thick cuticle).

Pileus 90–100 mm wide, campanulate when young, becoming subumbonate plane to plano-concave with age, not striate at margin, dark sepia at first, pale sepia or pale sepia-grey with paler spots later on, darker innately fibrillose in outer half of limb, smooth, glabrous or with a few large, irregular, thin, membranous, white patches from volva, dry to slightly viscid (presumably very viscid when wet). Gills free, not crowded, about 65 primaries with 1–3 rounded-attenuate shorter ones between each pair, broad, 9–10 mm wide, whitish cream. Stipe 120 mm long, 8 mm wide at apex, 13 mm near base, 20–25 mm at slightly pointed clavate-bulbous base, solid, firm, white, smooth below ring, somewhat floccose-scaly above ring. Volva 28–35 mm high, lower half attached to bulb of stipe, upper half forming a thin but tenacious, membranous limb, with even margin or split on one side, white, smooth, appressed. Ring 12 mm wide, pendant from 30 mm below apex of stipe, rather spreading, floccose-membranous, easily torn, white to cream, striate on upper side. Flesh white, turning slightly ochraceous when cut, thin over limb.

Spores (Fig. 36) 5.4–6.8 × 4.6–5.6 μ (fresh, 7–8 × 5.5–6 μ), subglobulose to broadly ellipsoid or obovoid (length-breadth ratio 1.05–1.25, average 1.15–1.2), colourless, thin-walled, smooth, with small apiculus, cloudy-vacuolate, amyloid. Basidia 32–38 × 7–11 μ, 4-spored; sterigmata up to 4 μ long. Marginal cells numerous, up to 45 × 35 μ, globulose, ellipsoid or clavate, colourless. Trama of gills distinctly bilateral; central strand and divergent zones passing into each other, consisting of 5–20 μ wide longitudinal to divergent hyphae with cylindrical to elongated ellipsoid, 30–100 μ long cells; subhymenium 40 to 60 μ wide, cellular,

with 8–20 μ wide cells. Cuticle about 400 μ wide (in bud even 800 μ), composed of a gelatinized, about 200 μ wide, upper layer with 3–5 μ wide, very distant hyphae, irregular near surface, subradial in lower part, and a dense, about 200 μ wide lower layer with, up to 15 μ wide, irregularly interwoven hyphae, slightly constricted at septa. Limb of volva composed of crowded, flexuosely interwoven, up to 10 (–18) μ wide, slightly thick-walled hyphae and some scattered elongated cells, up to 120 × 25 μ, on outside covered by irregular, densely interwoven, thin-walled, 2–4 μ wide hyphae and on inner side by slightly irregular to longitudinal, 3–8 μ wide hyphae with scattered elongated, ellipsoid and clavate cells; all with slightly thickened walls. Trama of stipe with clavate terminal longitudinal cells, up to 350 × 35 μ and narrow, longitudinal hyphae near surface. No clamps observed.

HABITAT.—Terrestrial in jungle.

COLLECTIONS EXAMINED.—Singapore, Botanic Gardens, Gardens' Jungle, 16 Aug. 1940 (type; a half specimen in liquid; water-colour drawing); Reservoir Jungle, 15 April 1941 (bud in liquid; water-colour drawing); both *E. J. H. Corner s.n.* (as *Amanita* 15).

Amanita elephas has much in common with *A. modesta* (see below); however, the different structure of the volva (no sphaerocysts), the thick cuticle, the broad, not crowded gills, and the large size demonstrate that it is different.

As *A. elephas* is close to *A. phalloides* (Fr.) Link it might well be poisonous.

Amanita modesta Corner & Bas, *sp. nov.*—Pl. 8*a*, Fig. 35

Pileus 40–50 mm latus, convexo-applanatus, interdum concavus, subumbonatus, margine haud vel breviter striatus, umbrinus vel griseo-murinus, nudus, viscidus. Lamellae confertae, angustae, albo-cremeae. Stipes 40–60 × 4–5 mm, bulbo globoso, acuto vel subradicato, 8–15 mm lato, solidus vel cavus, albus, pruinosus vel flocculosus, annulatus, volvatus. Annulus 5–7 mm latus, floccoso-membranaceus, saepe laceratus, supra striatus, albus. Volva semilibera, carnoso-membranacea, 15–22 mm alta, alba. Caro alba. Sporae 6–9 × 4.5–7 μ, subglobulosae vel ellipsoideae, amyloideae. Typus: *E. J. H. Corner s.n.*, 3 Dec. 1940, Singapore, Reservoir Jungle (L).

Etymology: modestus, modest.

Pileus 40–50 mm wide, plano-convex with depressed centre to concave, slightly umbonate, with margin smooth to shallowly and shortly sulcate-striate, umber to greyish mouse-coloured, with centre sometimes inclining to purplish umber, paler toward margin, glabrous, smooth, viscid to slightly viscid. Gills free, crowded, 76—100 primaries with 0–3 attenuate shorter ones between each pair, rather narrow, 3–4 mm wide, cream-white; edges often eroded, especially those of shorter gills. Stipe 40–60 × 4–5 mm, cylindrical, with globose, often pointed or even slightly radicating base, 8–15 mm wide, solid to hollow, white, wholly white pruinose or floccose-pruinose above and below ring. Volva fleshy-membranous, firm, sheathing, 15–22 mm high, 8–15 mm wide, mostly 2-lobed, white, smooth, lower half adnate to bulb. Ring 5–7 mm wide, pendant from apex of stipe, floccose-membranous, delicate, often torn, white, striate above, somewhat floccose-scurfy below; edge uneven. Flesh 2.5–3 mm thick in centre of pileus, thin over limb, white, soft.

Spores (Fig. 35) 5.9–7.8 × 4.1–6.2 μ (fresh, 7–9 × 5.5–7 μ), subglobulose to ellipsoid often slightly attenuate toward apiculus (length-breadth ratio 1.1–1.45, aver. 1.2–1.25), colourless, thin-walled, smooth, with small apiculus, with cloudy contents, amyloid. Basidia 4-spored, rarely 2- or 1-spored, 25–36 × 8–10 μ; sterig-

mata about 5 μ long. Marginal cells rather numerous, globulose, up to 30 (–50) μ wide. Trama of gills bilateral, loose; central strand with elongated cells up to 150 × 20 μ and ellipsoid to clavate cells up to 100 × 55 μ; divergent zones with elongated-ellipsoid to ellipsoid cells up to 85 × 30 μ; subhymenium about 40 μ wide, cellular, consisting of 10–25 μ wide, globulose to ellipsoid cells. Cuticle made up of a gelatinized upper layer, about 40 μ wide, with 2–5 μ wide, distant, interwoven-subradial hyphae and a lower layer, about 100 μ wide, of rather crowded (slightly embedded?), up to 20 μ wide hyphae constricted at septa and irregularly inflated especially at ends of cells; pigment intracellular, umber. Limb of volva with outer surface composed of irregular, densely interwoven 2.5–6 (–10) μ wide, multiseptate hyphae; the inner surface composed of more or less gelatinized narrow hyphae and scattered sphaerocysts; the inner part mainly of numerous inflated cells, mostly sphaerocysts, up to 60 μ wide. Trama of stipe with terminal, longitudinal, slenderly clavate cells, up to 300 × 30 μ; at surface with many oleiferous, slenderly clavate cells and patent ends of thin hyphae. No clamps observed.

HABITAT.—Terrestrial in jungle.

COLLECTIONS EXAMINED.—Singapore, Reservoir Jungle, 3 Dec. 1940 (type; several specimens in liquid; water-colour drawing); Malaya, Johore, Tebrau, 24 Sept. 1939 (one specimen in liquid); both *E. J. H. Corner s.n.* (as *Amanita* 13).

Among the dark-coloured species with ellipsoid spores of section *Phalloideae* only *A. pseudoporphyria* Hongo (1957: 141, fig. 2a–c) seems related and even bears a great resemblance to the present one. However, the Japanese species has more slender spores (1.3–1.6), a floccose-squamose stipe and is associated with conifers. Its spore-size was checked from a duplicate of the paratype, *Hongo 1219*, Otsu-city, 16 July 1955, preserved in the Rijksherbarium, Leiden.

A third collection originally attributed to the present species (*Amanita* 13, Singapore, Bukit Timah, 4 Oct. 1944; some fragments in liquid) has to be excluded. Its spores are larger (7.6–9.5 × 4.7–5.6 μ), more elongated (1.5–1.85) and ellipsoid-subreniform. The insufficiency of both data and material renders this collection unidentifiable.

AMANITA SPECIES 3

Pileus 60 mm wide, becoming concave and slightly umbonate, not striate at margin, leaden grey, darker over centre, with dark innate streaks, subviscid, smooth, without remnants of volva. Gills free, crowded, 130 primaries with 1–7 subtruncate to attenuate shorter ones between each pair, narrow, rather thick, 3 mm wide, white then cream. Stipe 160 mm long, 9 mm wide at apex, 15 mm at base (from dried specimen apparently subbulbous-subradicating), solid, rather stout and firm, pale greyish white and finely fibrillose, upper third white and slightly pruinose, exannulate. Volva 20 mm high, free as in *A. phalloides*, white. Flesh white, firm, 7 mm thick in centre, 2–2.5 mm half-way to margin. Smell faint, not unpleasant.

Spores 7.2–7.9 × 5.6–6.7 μ (fresh, 7–8.5 × 5.5–6.5 μ), subglobulose to broadly ellipsoid or obovoid (length-breadth ratio 1.1–1.3, average 1.2), thin-walled, colourless, smooth, with small apiculus, cloudy vacuolate, amyloid. Basidia 4-spored. Marginal cells numerous, inflated. Cuticle with 2–5 μ wide, distant irregular hyphae near surface and slightly wider, crowded, radial to subradial hyphae in lower part; hyphae with grey or umber sap. Trama of stipe *Amanita* type.

HABITAT.—Terrestrial.

COLLECTIONS EXAMINED.—Singapore, Bukit Timah, 21 Aug. 1939 (1 dried specimen), *E. J. H. Corner s.n.* (as *Amanitopsis* 6).

The specimen preserved was already in a bad condition before drying. It is impossible now to study the structure of the volva and the base of the stipe, while the description is rather vague on these points. Moreover, it is difficult to know from a single specimen whether the absence of an annulus is incidental or characteristic.

The present species seems to be most closely related to *A. modesta* Corner & Bas. It is similar in many respects, such as the colour of the pileus, the closeness of the narrow gills, the shape and size of the spores, and perhaps the shape of the base of the stipe. It seems to differ only in the very long, somewhat greyish stipe, the absence of an annulus, and the streaky pileus. From *A. elephas* Corner & Bas it differs in the crowded narrow gills and the exannulate stipe.

Amanita privigna Corner & Bas, *sp. nov.*

Pileus 50–60 mm latus, plano-convexus, margine haud striatus, griseo-umbrinus vel fuligineo-umbrinus, striis minutis, obscuris virgatus, subviscidus, glaber. Lamellae subconfertae, albae vel cremeae. Stipes 50–60 mm longus, apice 7–8, basi 10–12 mm latus, subbulbosus, albus, verrucis scabrosis fibrillosisve, griseolis ornatus. Volva 8–12 mm alta, carnoso-membranacea, quadripartita, griseola. Annulus membranaceus, griseus, minute striatus. Caro alba. Sporae 7.5–9 × 7–8.5 μ, globulosae vel subglobulosae, amyloideae. Typus: *E. J. H. Corner s.n.*, 16 Aug. 1939, Singapore, Bukit Timah (L).

Etymology: privigna, stepdaughter (the species being poorly endowed with characteristic features).

Pileus 50–60 mm wide, becoming subumbonately plano-convex, with smooth margin, livid umber, fuliginous umber in centre, paler and finely innately streaked toward margin, slightly viscid, smooth, glabrous. Gills free, rather crowded, 70 primaries with 1–3 obliquely truncate to attenuate shorter ones between each pair, narrow, 3–4 mm wide, white, becoming pale cream. Stipe 50–60 mm long, 10–12 mm wide at subbulbous base, 7–8 mm wide at apex, subequal, white with small, pale grey, floccose-scurfy patches or fibrils above and below ring, pure white at extreme apex. Volva 8–12 mm high, lower third attached to subbulbous base of stipe, upper two thirds forming a slightly spreading fleshy-membranous limb, split into 4 parts, pale grey, white at base, rather firm, in dried specimen constricted at joint with stipe. Ring 8–12 mm broad, pendant from about 10 mm below apex of stipe, membranous, grey, finely striate on upper side, smooth on underside, fairly firm and persistent. Flesh white, fairly firm, 4–5 mm thick in centre, gradually thinning toward margin.

Spores 7.4–9.0 × 6.7–8.5 μ (fresh, 8–9 × 7–8 μ), globulose to subglobulose, sometimes broadly ellipsoid (length-breadth ratio 1.0–1.2, average 1.05–1.1), colourless, thin-walled, smooth, with small apiculus, with cloudy vitreous contents, amyloid. Basidia 4-spored. Marginal cells 20–45 × 10–40 μ, clavate, piriform or globose, colourless, thin-walled, forming a sterile edge to the gill. Cuticle gelatinized near surface, with narrow, 2–6 μ wide, radial hyphae with pale brown intracellular pigment. Limb of volva composed of densely interwoven, mostly 3–8 μ wide hyphae and scattered elongated to slender clavate, seldom globose cells, e.g. 80 × 45 μ, 130 × 25 μ, 60 × 60 μ, etc.; outer surface covered by interwoven, up to 5 μ wide, irregular hyphae. No clamps observed.

HABITAT.—Terrestrial in forest; solitary.
COLLECTIONS EXAMINED.—Singapore, Bukit Timah, 16 Aug. 1939 (type; 1 dried specimen), *E. J. H. Corner s.n.* (as *Amanita* 10).

The present species belongs to the dark-coloured, volvate species with globulose spores of section *Phalloideae*.

Amanita fuliginea Hongo (1953: 69) from Japan is rather similar. However, an examination of authentic material of that species (*Hongo 711*, 4 Aug. 1953, Mii-dera, Otsu) kindly put at our disposal by Dr. T. Hongo, showed that the cuticle of that species is quite different, viz. only slightly gelatinized and with 5–8 (–18) μ wide, repent, subradial, dark brown hyphae. Moreover, the stipe of *A. fuliginea* is brownish squamulose-fibrillose, the volva is white and the ring turns brownish.

Amanita alauda Corner & Bas (see below) differs by the rather conspicuously streaked cuticle with 3–10 (–15) μ wide hyphae and the white stipe, ring, and volva.

Amanita alauda Corner & Bas, *sp. nov.*—Pl. 6*c*, Fig. 37

Pileus 30 mm latus, concavus, umbonatus, margine haud striatus, nudus, sepiaceus vel murinus, striis obscuris virgatus, viscidus. Lamellae confertae, 3 mm latae, albae, demum cremeae. Stipes 55 × 5 mm, subbulbosus, solidus, albus, glaber, annulatus, volvatus. Annulus 8 mm latus, membranaceus, albus, supra striatulus. Volva semilibera, sublobata, 10 mm alta, alba. Caro alba. Sporae 7–11 × 6.5–10 μ, globulosae vel subglobulosae, amyloideae. Typus: *E. J. H. Corner s.n.*, 4 Dec. 1940, Singapore, Botanic Gardens (L).
Etymology: alauda, lark (on account of the variegated brown pileus).

Pileus 30 mm wide, becoming umbonate concave, with non-striate margin, without remnants of volva, sepia or pale purplish umber to mouse-coloured, darker over disk, streaked by innate dark fibrils, especially near margin, smooth, viscid. Gills free, crowded, 66 primaries with 0–1 attenuate shorter ones between each pair, white then cream, 3 mm wide. Stipe 55 × 5 mm, cylindrical with subbulbous base, firm, solid, annulate, white, smooth. Ring about 8 mm wide, hanging down from apex of stipe, membranous, white, finely striate on upper side, soon collapsing. Volva 10 mm high, 8–9 mm wide, white; lower half connected with base of stipe; upper half forming an irregularly split membranous limb with indistinct lobes. Flesh white.

Spores (Fig. 37) 7.1–8.4 (–9.2) × 6.3–8.3 μ (fresh, 9–11 × 8–10 μ), globulose to subglobulose (length-breadth ratio 1.0–1.15, average 1.05–1.1), colourless, thin-walled, smooth, with small apiculus, with cloudy opalescent contents, amyloid. Basidia 35–45 × 10–13 μ, 4-spored, with about 5 μ long sterigmata. Marginal cells scattered, clavate to ellipsoid, up to 30 × 20 μ in preserved specimen. Trama of gills bilateral; the very distinct central strand with clavate to cylindrical, often terminal cells up to 120 × 25 μ; the rather indistinct and narrow divergent zones with scattered ellipsoid to subcylindrical cells up to 60 × 30 μ; the subhymenium about 40 μ wide, cellular-subramose, with cells 10–20 μ wide, the innermost cells hardly larger than those at base of basidia. Cuticle about 200 μ thick, irregular with slight radial tendency, composed of brown, 3–10 (–15) μ wide hyphae, constricted at septa, with many darker brown, non-inflated tips of hyphae; the upper part (75–100 μ wide) with distant hyphae, embedded in gelatinous matter. Limb of volva mainly consisting of 3–15 (–25) μ wide, interwoven, sublongitudinal hyphae, with some scarce sphaerocysts up to 100 μ wide in inner part. Trama of stipe with cylindrical to clavate, longitudinal, up to 370 × 50 μ cells terminal or

in short chains. Surface of stipe consisting of 3–6 μ wide longitudinal hyphae. No clamps observed.

HABITAT.—Terrestrial in jungle; solitary.

COLLECTIONS EXAMINED.—Singapore, Botanic Garden, Garden's Jungle, 4 Dec. 1940 (type; two half specimens in liquid; water-colour drawing), *E. J. H. Corner s.n.* (as *Amanita* 17).

Among the dark-coloured species with globulose spores of section *Phalloideae*, particularly *A. murinacea* Pat. (1928: 29) from Madagascar and *A. fuliginea* Hongo (1953: 69, fig. 1; coloured plate in Imazeki & Hongo, 1957: pl. 18 fig. 103) from Japan seem to be comparable to the present species. The former is insufficiently described. It is not clear whether its mouse grey cap is streaked or not. However, it seems to be different on account of the strongly bulbous base of the stipe, the dry, silky pileus, and the larger size. *Amanita fuliginea* differs by the ring turning brownish, the brownish squamulose-fibrillose stipe and the less streaky, subviscid to dry pileus.

A remarkable feature of *A. alauda* is the viscid cuticle giving a strong impression of being fibrillose, which is caused by the rather wide, dark brown hyphae embedded in the gelatinous matter of the upper layer.

Subgenus AMANITA

Amanita subgen. *Vaginaria* Forq., Champ. sup. 45. 1888 (not val. publ.); *ex* Quél., Fl. mycol. France 302. 1888.—Lectotype (Sing. *in* Lilloa **22**: 386. 1951): *Amanita vaginata* (Bull. ex Fr.) Vitt.

Amanita [subgen.] *Peplophora* Quél., Fl. mycol. France 303. 1888; Quél. & Bat., Fl. monogr. Amanites Lépiotes 22. 1902 ("subgen.").—Lectotype: *Amanita muscaria* (L. ex Fr.) Hook.

Amanitopsis Roze *in* Bull. Soc. bot. France **23**: 50, 51. 1876.—*Amanita* subgen. *Amanitopsis* (Roze) Lange *in* Dansk bot. Ark. **2** (3): 6. 1915.—Lectotype (fixed by conservation): *Agaricus vaginatus* Bull. ex Fr.

Amanitaria Gilb. *in* Bres., Iconogr. mycol. **27** (1): 70, 76. 1940.—*Amanita* subgen. *Amanitaria* (Gilb.) Gilb., Not. Amanites XXX [2]. 1941.—Type: *Amanita pantherina* (DC. ex Fr.) Schummel.

Amanita subgen. *Pseudoamanita* Sing. *in* Ann. mycol., Berl. **34**: 336, 352. 1936 (not val. publ.); *ex* Sing. *in* Acta Inst. bot. Acad. Sci URSS (ser. II, Plant. crypt.) **6**: 389. 1951.—Lectotype (Sing. *in* Lilloa **22**: 385. 1951): *Amanita muscaria* (L. ex Fr.) Hook.

Spores non-amyloid.

Section AMANITA

Agaricus [sect.] *Muscariae* Fr., Monogr. Amanitarum Sueciae 6. 1854.—*Amanita* [sect.] *Muscariae* (Fr.) Quél. *in* Mém. Soc. Emul. Montbéliard, ser. II, **5**: 67. 1872 (Champ. Jura etc. **1**: 29); Sing. *in* Lilloa **22**: 386. 1951 ("sect.").—Lectotype (Gilb. *in* Bull. Soc. mycol. France **46**: 173. 1931): *Agaricus muscarius* L. ex Fr.

Amanita [sect.] *Circumscissae* Quél., Fl. mycol. France 304. 1888; *emend.* Sing. *in* Ann. mycol., Berl. **41**: 162. 1943.—Lectotype: *Amanita muscaria* (L. ex Fr.) Hook.

Amanita [sect.] *Marginatae* J. Schroet. *in* Kryptog.-Fl. Schlesien **3** (1): 679. 1889; P. Henn. *in* Natürl. PflFam. **1** (1**): 275. 1898 ("sect.").—Lectotype: *Amanita muscaria* (L. ex Fr.) Hook.

Amanita [sect.] *Ovisporae* Lange *in* Dansk bot. Ark. **2** (3): 5, 8. 1915.—Lectotype: *Amanita muscaria* (L. ex Fr.) Hook.

Amanita [sect.] *Floccosae* Gilb., Genre Amanita 81, 172. 1918.—Lectotype: *Amanita muscaria* (L. ex Fr.) Hook.

Amanitella Earle *in* Bull. N.Y. bot. Gard. **18**: 449. 1909.—*Amanita* [sect.] *Amanitellae* Gilb., Genre Amanita 156, 173. 1918 (name change).—Type: *Amanita farinosa* Schw.

Amanitopsis sect. *Pulveratae* Imai *in* Bot. Mag., Tokyo **47**: 430. 1933.—Type: *Amanitopsis farinosa* (Schw.) Atk.

Amanitaria Gilb. *in* Bres., Iconogr. mycol. **27** (1): 70, 76. 1940.—*Amanita* subgen. *Amanitaria* (Gilb.) Gilb., Not. Amanites XXX [2]. 1941.—*Amanita* sect. *Amanitaria* (Gilb.) Konr. & Maubl. Agaricales 59. 1948.—Type: *Amanita pantherina* (DC. ex Fr.) Schummel.

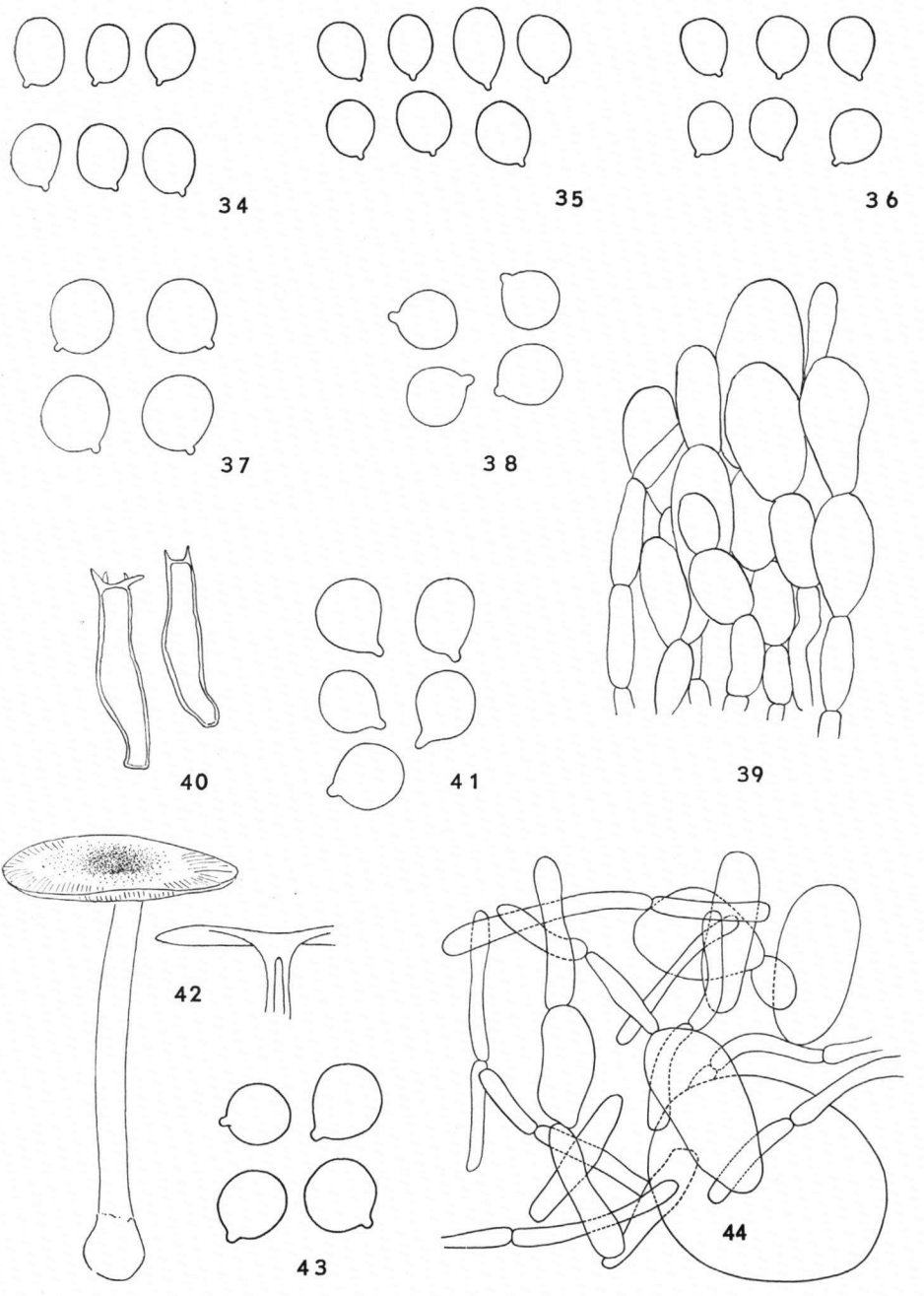
For the scope of this section, see the key to the subgenera and sections on p. 243.

KEY TO THE SPECIES OF SECTION *Amanita*

1. Volva forming a narrow membranous rim or ridge around top of bulbous base of stipe and membranous, flat patches on pileus. Pileus pale ochraceous buff to dingy buff, with darker centre and whitish patches. Stipe white to dingy cream, exannulate, but often with volva ring. Spores 7–9.5 × 6–8.5 μ, globulose to subglobulose . . *A. elata*, p. 286
1. Volva forming small conical warts or powdery to felted remnants on bulbous base of stipe and conical warts or a powdery-felted layer, breaking up into minute warts on pileus.
   2. Pileus covered with conical warts.
      3. Pileus dark brown to brown, with greyish white to greyish brown warts. Stipe whitish, with greyish or brownish white, scurfy remnants of volva round top of bulbous base, exannulate. Spores 6.5–8 μ, globulose to subglobulose. *A. sychnopyramis*, p. 291
      3. Pileus clear-coloured, red, orange, yellow or pale yellow, with yellow to yellowish warts.
         4. Pileus red to orange in centre. Stipe mostly exannulate. Shorter gills truncate. Spores 6.5–8.5 × 6–7.5 μ, globulose to subglobulose. . . . . *A. mira*, p. 290
         4. Pileus yellow to pale yellow in centre. Stipe mostly (?) annulate. Shorter gills attenuate. Spores 6.5–8 × 5–7 μ, subglobulose to broadly ellipsoid (see *A. xanthella*, p. 274)
   2. Pileus covered with powdery-felted layer, breaking up into minute warts.
      5. Pileus orange-scarlet with reddish to orange remnants of volva. Stipe yellow, with reddish orange powdery zones at base. Ring yellow with orange margin. Spores 7.5–10 (–11) μ, globulose . . . . . *A. rubrovolvata*, p. 287
      5. Pileus pallid with greyish umber remnants of volva. Stipe white, flocculose-pruinose, fuliginous pruinose or with fuliginous felted ridge at base, exannulate. Spores 6–8.5 × 5.5–7.5 μ, globulose to broadly ellipsoid . . . . . *A. obsita*, p. 292

EXPLANATION OF FIGURES 34–44

Fig. 34. *Amanita duplex*. — Spores (× 1250).
Fig. 35. *Amanita modesta*. — Spores (× 1250).
Fig. 36. *Amanita elephas*. — Spores (× 1250).
Fig. 37. *Amanita alauda*. — Spores (× 1250).
Figs. 38, 39. *Amanita sychnopyramis*. — 38. Spores (× 1250). — 39. Crushed wart from pileus (× 500).
Figs. 40–44. *Amanita elata*. — 40. Thick-walled basidia (× 500). — 41. Spores (× 1250). — 42. Reproduction of type drawing (× ½). — 43. Spores of type (× 1250). — 44. Crushed patch of veil from pileus of type (× 500).



Figs. 34–44

Amanita elata (Mass.) Corner & Bas, *comb. nov.*—Pl. 9*a*, Figs. 40–44

Collybia elata Mass. *in* Kew Bull. **1914**: 73 (basionym).

Pileus 35–90 mm wide, campanulate to convex when young, becoming plano-convex with depressed centre or concave with flat margin with age, $^1/_4$ to $^1/_3$ tuberculate-striate from margin toward centre, pale dingy ochraceous buff or dingy buff with very faint sulphur yellow tinge, more or less umber or fuliginous in centre, pallid whitish toward margin, glutinous-viscid, then smeary, glabrous or with some small, scattered, irregularly shaped, dingy white, rather thick, floccose-membranous, flat patches, easily washed off by rain. Gills free, crowded, 72–125 primaries, with 0–1 (–3) truncate shorter ones between each pair, 3–6 mm wide, white to cream, slightly transversely veined at base near margin of cap; edge presumably minutely flocculose. Stipe 50–130 × 4–15 mm, equal or attenuate upward, with globose or subglobose, seldom slightly turbinate, marginate, 8–19 mm wide, bulbous base, solid, becoming hollow, white to cream or slightly greyed, somewhat floccose-scabrid below, whitish pruinose above with narrow, 2–6 mm high rim of volva round top of bulb, without ring derived from partial veil but often somewhere with a spurious, irregularly shaped, dingy white or pale dingy ochraceous, ascending ring, derived from volva. Flesh white, firm, 2–4 mm thick in centre of pileus, thin over limb. Smell unpleasant, as in *A. phalloides* (Fr.) Link.

Spores (Fig. 41, 43) 7.0–8.5 × (6.0–) 6.8–7.7 μ (fresh, 7–9.5 × 6–8.5 μ), globulose to subglobulose, seldom broadly ellipsoid [length-breadth ratio 1.0–1.1 (–1.2)], with rather large apiculus, colourless, thin-walled, smooth, with one medium-large gutta or several small ones, sometimes non-guttate, non-amyloid. Basidia 38–47 × 10–12 μ, with four, up to 5 μ long sterigmata; in collection of 18 March 1931 many with thickened walls, (Fig. 40), especially near edge of gill. Marginal cells forming a broad sterile margin along edge of gill consisting of branching hyphae 3 μ and more wide, cylindrical cells about 8–12 μ wide, with rounded ends, sometimes forming short chains; and inflated cells, up to 25 μ across, often with oily contents. Trama of gills rather distinctly bilateral, composed of a central strand with elongated inflated cells e.g. 60–200 × 20–40 μ and narrow hyphae, bordered by zones with diverging hyphae and inflated ellipsoid cells e.g. 50–70 × 25–40 μ which gradually pass into a broad cellular subhymenium of cells, diminishing in size from 20 (–35) μ to 5–10 μ at base of basidia. Trama of rim of volva on top of bulb consisting of numerous, 3–12 μ wide branching hyphae, often constricted at septa, some hyphae with oily contents and inflated cells up to 60 × 40 μ, but mostly about 40–50 × 25–35 μ, often terminal but sometimes forming short chains. Cuticle with 10–40 μ thick hyaline upper layer, composed of 1.5–4.5 μ wide, irregularly arranged, distant hyphae, apparently slightly embedded, but not dissolved, and with 20–40 μ thick lower layer of more or less radially arranged, very crowded, narrow, coloured hyphae with intracellular pigment. Trama of stipe with a firmer outer part, composed of terminal clavate cells up to 220 × 36 μ, and 2–5 μ wide hyphae, and a softer inner part composed of 4–10 μ wide hyphae, rather small, ellipsoid, constricted, terminal, inflated cells, and many 6–14 μ wide hyphae with oily contents. No clamps observed.

HABITAT.—Terrestrial in forest in Singapore: Botanic Gardens' Jungle, Bukit Timah Forest and other remnants of forest. Common every rainy season and often very abundant.

COLLECTIONS EXAMINED.—Singapore, Botanic Gardens, Gardens' Jungle, 22 Sept. 1913. *E. M. Burkill 150* (type; several dried specimens; water-colour drawing; K); Botanic Gardens, Aug. 1929 & 18 March 1934 (both dried); Reservoir Jungle, 4 Nov. 1940 & 26 Sept. 1943 (both water-colour drawings, the second also specimens in liquid); except type, all *E. J. H. Corner s.n.* (as *Amanitopsis* 3).

OBSERVATIONS.—The fresh pileus being described by the senior author as glutinous-viscid, it is somewhat amazing to find the cuticle of the preserved specimens with only a thin hyaline upper layer with non-dissolving hyphae. However, it may be that the specimens had already lost a more glutinous outer layer. As a matter of fact all specimens preserved by the senior author had also lost the remnants of the volva on the pileus.

Amanita elata greatly resembles *A. gemmata* (Fr.) Gillet and is undoubtedly closely related to that species. However, *A. gemmata* differs by (i) a thinner, more paper-like volva, (ii) as a rule larger and more ellipsoid spores [according to 100 measurements of the junior author on 10 Dutch collections, 8–11 (–12) × (6.0–) 7–8.5 μ, the average length-breadth ratio per find ranging from 1.1–1.4], (iii) a golden yellow to ochraceous yellow pileus, becoming brownish only in centre, (iv) the absence of a smell, (v) the occasional presence of a true ring derived from the partial veil and the very rare presence of a spurious ring derived from the volva, only just above the bulb, as in *A. pantherina* (DC. ex Fr.) Schummel.

It is even more difficult to separate the present species from *A. diemii* Sing. (1954: 120) from Patagonia. However, this species differs from *A. elata* by (i) a golden yellow to orange ochre yellow pileus turning brown with age from centre toward margin, (ii) the margin of the cap often set with white denticules of the volva, (iii) the entirely coarsely floccose-granular stipe, (iv) the short ellipsoid, slightly larger spores, (viz. 8.2–10 × 7.5–9 μ), (v) the absence of a smell, (vi) the presence of clamps in the trama of the gills. Dr. R. Singer, Buenos Aires, who studied colour-slides of the water-colour drawings and the description of the present species, also looks upon *A. elata* and *A. diemii* as different species (in litt.).

It was somewhat surprising to find this typical species of *Amanita* described as a species of *Collybia*. The type is well preserved and it is not difficult to recognize in it the species depicted by Corner.

The pileus of the type (Fig. 42) has a sulcate-striate margin and bears some patches derived from the volva. However, these may easily escape attention, as some of the pilei are almost completely covered with paper, on account of the glutinous surface of the fresh pileus. The exannulate stipe has a more or less globose bulbous base on which the margin of the volva is easy to distinguish. The spores are non-amyloid and globulose; their size is 6.8–8.4 × 6.7–7.9 μ and their length-breadth ratio 1.00–1.05. The trama of the stipe has *Amanita* structure.

AMANITA RUBROVOLVATA Imai.—Figs. 45–47

Amanita rubrovolvata Imai *in* Bot. Mag., Tokyo **53**: 392. 1939.—*Amplariella rubrovolvata* (Imai) Gilb. *in* Bresadola, Iconogr. mycol. **27** (1): 79. 1940.

DESCRIPTIONS & ILLUSTRATIONS.—Imai apud Gilb. *in* Bresadola, Iconogr. mycol. **27** (3): pl. 56. 1941; Hongo *in* J. Jap. Bot. **30**: 216, fig. 1 (4–6). 1955; Imazeki & Hongo, Colour. Ill. Fungi Japan 46, pl. 19 fig. 107. 1957.

Pileus 35–40 mm wide, becoming plane, tuberculate-striate half-way from margin toward centre, orange scarlet, paler toward margin, subviscid, covered with a powdery micaceous, reddish orange to orange, separable down, the latter sometimes

breaking up with age in scattered, thin, crust-like patches. Gills free, crowded, up to 4 mm wide, 58–82 primaries with 0–1 truncate shorter ones between each pair, white. Stipe 35–75 × 6–7 mm, subequal, with subglobose, 8–13 mm wide bulbous base, hollow in mature specimens, yellow to pale yellow, sometimes deeper yellow either toward base or toward apex, minutely pruinose-floccose above ring, minutely pruinose-fibrillose below; remnants of volva forming two powdery flocculose reddish orange zones, one on upper part of basal bulb and the other, 2 to 7 mm higher up on stipe. Ring in the middle or in the upper fourth of stipe, 2–6 mm wide, pendant, floccose-membranous, thin, white above, pale yellow below, with powdery orange margin. Flesh 2–2.5 mm thick in centre of pileus, membranous over limb, pale yellowish, orange beneath cuticle of pileus, deeper yellow near surface of stipe.

Spores (Fig. 47) 7.5–9.9 (–11.3) × 7.4–9.9 μ (in alcohol-formalin material 6.8–7.9 μ across), globulose to subglobulose [length-breadth ratio 1.0–1.1 (–1.13)], with rather broad apiculus, colourless, thin-walled, with one medium-large gutta or several small ones, non-amyloid. Basidia 35–40 (–45) × 9–11 μ, with 4 about 5 μ long sterigmata. Some rare, up to 35 μ wide, globulose marginal cells observed. Edge of gills for the greater part fertile. Trama of gills rather distinctly bilateral, with a rather broad central strand of 2.5–6 μ wide hyphae mixed with cylindrical cells up to 50 × 12 μ; on both sides bordered by a zone with slightly diverging hyphae and cylindrical or inflated cells, passing gradually in the about 25 μ thick ramose-subcellular subhymenium with 6–10 μ wide globulose cells just beneath the hymenium. Fragments of volva on pileus (Fig. 45) composed of irregularly arranged, loosely interwoven, short chains of globulose to shortly ellipsoid, 15–55 × 13–35 μ large cells mixed with 2–5 μ wide hyphae; fragments of volva on base of stipe (Fig. 46) mainly consisting of loosely interwoven long chains of short cylindrical to ellipsoid, 18–40 × 6–20 μ large cells, the bigger ones often slightly constricted in the middle. Cuticle a 25–40 μ thick layer of crowded, subradial, 2–5 μ wide hyphae, covered by a hyaline, at least 25 μ thick layer with irregularly arranged, very distant, thin, gelatinizing hyphae. Trama of stipe composed of clavate terminal up to 220 × 60 μ large cells and short chains of sausage-shaped and ellipsoid cells, mixed with 4–8 μ wide hyphae. No clamps observed.

HABITAT.—Near oak in highlands (1500 m alt.); solitary.

DISTRIBUTION.—Japan, Malaya.

COLLECTIONS EXAMINED.—Malaya, Pahang, Cameron's Highlands, 31 July 1934 (dried), 1 Aug. 1934 (dried and in alcohol-formalin), both *E. J. H. Corner s.n.* (as *Amanita* 21).

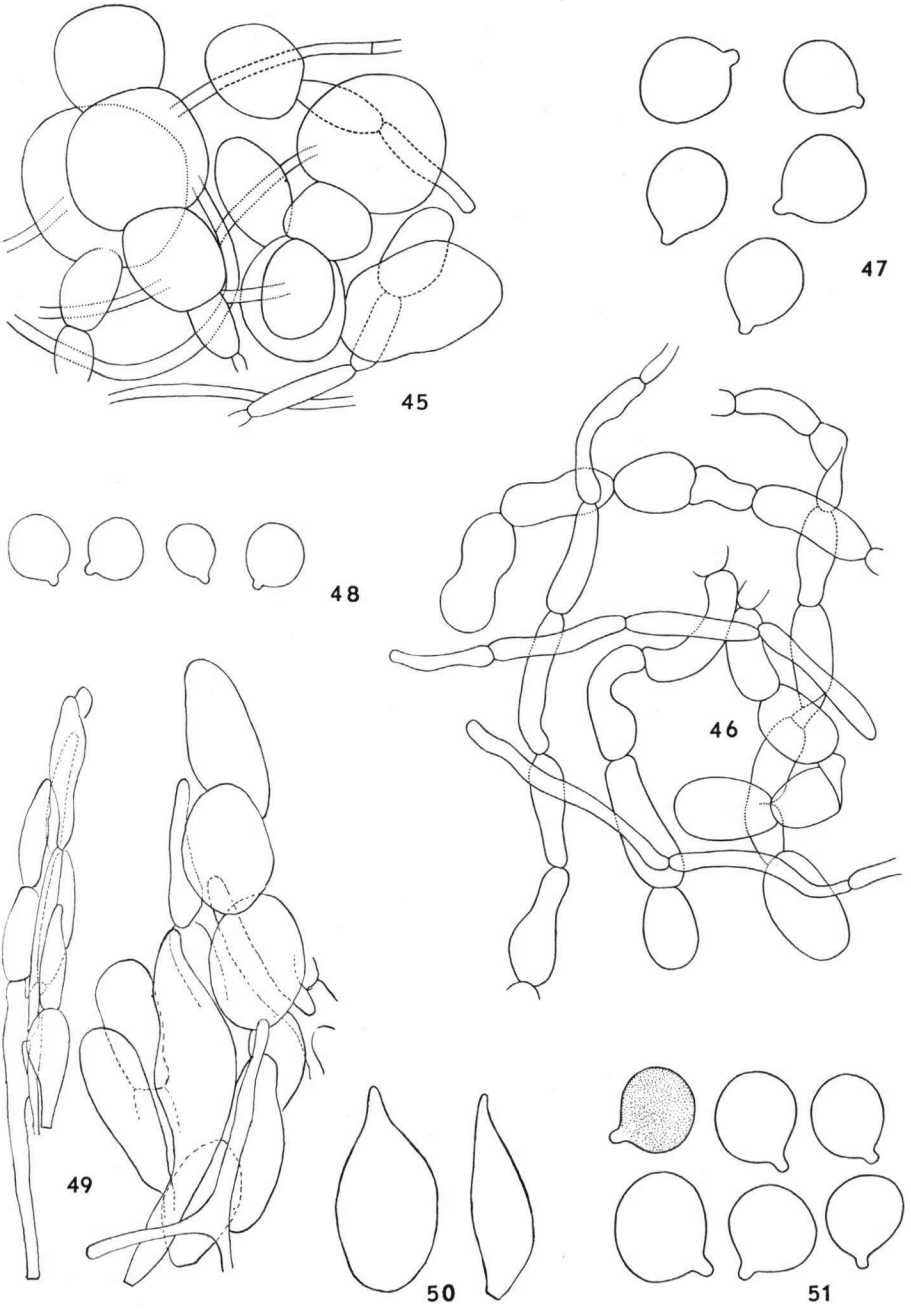
OBSERVATIONS.—On the dried specimen of 31 July 1934 the remnants of the volva on the bulb seem to comprise more than the orange reddish zone on the upper part of the bulb, described above. The bulb bears at its sides a pale thin layer of wadding, closely adherent to, but easily distinguished from, the more solid tissue of the bulb and forming a very narrow free limb in its upper part. It seems that only the outermost layer of the basal part of the volva is coloured a reddish orange. In the specimens depicted by Imai (l.c.) this outer layer is still undisturbed and covering the greater

EXPLANATION OF FIGURES 45–51

Figs. 45–47. *Amanita rubrovolvata.* — 45. Crushed remnants of veil from pileus (× 500). — 46. Crushed remnants of veil from base of stipe (× 500). — 47. Spores (× 1250).

Figs. 48–50. *Amanita mira.* — 48. Spores (× 1250). — 49. Crushed warts from pileus (× 500). — 50. Apical cells of chains in warts from pileus (× 500).

Fig. 51. *Amanita princeps.* — Spores (× 1250).



Figs. 45-51

part of the bulb. In those depicted by Imazeki & Hongo (l.c.) this outer layer was nearly completely lost and the bulb almost entirely pale-coloured. In the present specimens this coloured outer layer is preserved only at the upper part of the bulb and at the volva ring at the base of the stem.

Through the kindness of Dr. S. Imai (Yokohama) a specimen of the type-collection (Japan, prov. Mutsu, Towada-mura, 27 Sept. 1935, coll. *S. Imai s.n.*) could be studied. Here the structure of the volva at the base of the stipe is exactly the same as in the Malayan specimen described above.

In a young specimen (*Hongo 936*) of the present species kindly sent by Dr. T. Hongo (Otsu), inflated cells were present on the edge of the gills.

Gilbert placed *A. rubrovolvata* in *Amplariella* (= sect. *Validae*) on account of its amyloid spores. Imai did not mention this character in the original description. However, Hongo stated that the spores were non-amyloid. Our experience of the type and the collections described above, affirms Hongo's statement. Apparently *A. rubrovolvata* has to be placed in section *Amanita*, where it also fits better in view of the strongly striate margin of the pileus, the bright colours and the globulose spores.

The present record is the first from outside Japan.

Amanita mira Corner & Bas, *sp. nov.*—Pl. 9*c*, Figs. 48–50

Pileus 40–90 mm latus, campanulatus, dein applanatus, centro depressus, margine fortiter striatus, aurantio-ruber, aurantius vel flavo-aurantius, subviscidus, verrucis minutis, cuspidatis, flavis, dein albescentibus ornatus. Lamellae confertae, 4–10 mm latae, albae. Stipes 50–110 mm longus, 5–9 mm crassus, basi subbulbosus et 8–15 mm latus, e pleno cavus, albus, subfibrillosus. Volva adnata, flava, concentrice squamoso-diffracta. Annulus vulgo evanidus. Caro alba. Sporae 6.5–8.5 × 6–8 μ, globulosae vel subglobulosae, non-amyloideae. Typus: *E. J. H. Corner s.n.*, 16 Aug. 1939, Singapore, Bukit Timah (L).

Etymology: mirus, wonderful.

Pileus 40–90 mm wide, campanulate to plane with depressed centre, finely tuberculate-striate half-way from margin toward centre, orange-red to pale clear orange in centre, yellow orange, ochre-yellow, or bright yellow toward pale margin, generally becoming dingy fuliginous olive or bistre from centre outward to margin with age, subviscid, sprinkled with small firm yellowish to whitish pyramidal warts about 1 mm high and 1–2 mm wide, but often glabrous after rain. Gills free, crowded, thin, 4–10 mm wide, white, 80–100 primaries with 0–1 truncate shorter ones between each pair; edge entire. Stipe 50–110 × 5–9 mm, equal or tapering upward, with 8–15 mm broad subbulbous base, solid, becoming hollow, white or slightly greyish, finely appressed fibrillose, with 2–3 more or less complete rings of small subfloccose yellow warts at the base (as on pileus) or with a yellow floccose-felted, slightly warty, coating of the base, mostly exannulate, only once seen with a distinct pendant collapsed ring at apex of stem. Flesh white, yellowish below cuticle of pileus, 3–5 mm thick in centre of pileus, membranous over limb.

Spores (Fig. 48) 6.4–7.9 × 6.2–7.7 μ (fresh, 7.0–8.5 × 6.5–7.5 μ), globulose to subglobulose (length-breadth ratio 1.0–1.1), colourless, thin-walled, with one large gutta or several small ones, non-amyloid. Basidia 30–40 × 10–13 μ, with four, about 4 μ long sterigmata. Marginal cells 15–35 × 5–15 μ, cylindric, clavate or piriform, colourless, thin-walled, smooth, forming a sterile edge to the gill. Trama of gills (hardly analyzable in dried material) with many large inflated cells e.g. 65 × 35, 80 × 50, 125 × 50 μ. Fragments of volva on pileus composed of more or less erect chains of narrow to wide cylindric, ellipsoid and clavate cells, 27–72 ×

7–40 μ, the apical ones often more or less acuminate, mixed with 4–8 μ wide hyphae (Fig. 49–50). Remnants of volva on base of stipe consisting of ellipsoid, ovoid and clavate cells up to 40 × 30 μ, mixed with 4–6 μ wide hyphae. Cuticle about 150 μ thick, made up of 3–7 μ wide, repent, agglutinated hyphae, intermixed in centre of cap, wavy-radially near margin, with vacuolar yellow to umber pigment, with scattered repent, rounded terminal members of hyphae (without hyaline gelatinous upper layer). Trama of stipe (hardly analyzable in dried material) with terminal clavate cells up to 40 μ wide and apparently up to 150 μ and longer, with many twisting refractive hardly septate hyphae up to 25 μ wide. No clamps observed.

HABITAT.—Terrestrial in forest; common every rainy season.

COLLECTIONS EXAMINED.—Singapore, Bukit Timah, 16 Aug. 1939 (type) & 21 Aug. 1939 (both dried); Singapore, Botanical Garden, 28 Nov. 1940 (water-colour drawing), and Singapore, Reservoir Jungle, 15 Sept. 1940 (water-colour drawing); all *E. J. H. Corner s.n.* (as *Amanitopsis* 4).

OBERVATIONS.—Eaten by two monkeys without discomfort.

This species bears a certain resemblance to *Amanita muscaria* (L. ex Fr.) Hook., but is easily distinguished by the smaller and globulose spores, by the different structure of the remnants of the volva on the pileus which results in small firm pyramidal warts, and by the generally lacking annulus. *Amanita muscaria* has never been observed in Malaya.

Amanita sychnopyramis Corner & Bas, *sp. nov.*—Pl. 8*c*, 9*b*, Figs. 38, 39

Pileus 20–75 mm latus, e convexo applanatus vel concavus, margine striatus, brunneo fuscus vel griseo-umbrinus, striis obscuris virgatus, subviscidus, verrucis conicis, minutis, griseolis vel brunneo-griseis tectus. Lamellae liberae, confertae, 3–9 mm latae, albae. Stipes 40–80 mm longus, apice 5–11, basi 8–15 mm latus, subbulbosus, demum cavus, albus, basi brunneo-griseolus, exannulatus. Volva adnata, griseola vel brunneola, concentrice squamuloso-diffracta. Caro alba. Sporae 6.3–8.1 μ, globulosae vel subglobulosae, non-amyloideae. Typus: *E. J. H. Corner s.n.*, 21 Aug. 1939, Singapore, Bukit Timah (L).

Etymology: συχνός, many; πυραμις, pyramid.

Pileus 20–75 mm wide, convex to plane with depressed centre, finally even concave, $^1/_3$ tuberculate-striate but often faintly from margin toward centre, fuscous fawn or greyish brown, umber or fuscous bay over centre, streaked by innate darker fibrils, paler toward margin, slightly viscid, slightly viscose-papillose over centre, set with pale greyish white, grey or greyish-brownish small floccose pyramidal warts 0.5–2 mm wide, 0.3–1.5 mm high (eventually washing off with rain). Gills free, crowded, 3–9 mm wide, thin, white, 80–100 primaries with 1–3 truncate shorter ones between each pair. Stipe 40–80 mm long, 5–11 mm wide at apex, 8–15 mm wide at swollen, slightly pointed base, tapering upward, becoming hollow, white, greyish-brownish near base, the upper part of the swollen base set with pale greyish or brownish white, very small, scurfy particles, 0.2–0.5 mm wide, arranged in several irregular circles, exannulate. Flesh white, soft, brittle in stem, 2.5–3.5 mm thick in centre of pileus.

Spores (Fig. 38) 6.3–8.1 μ, globulose to subglobulose (length-breadth ratio 1.0–1.1), colourless, thin-walled, with one large gutta or many small ones, with rather large apiculus, non-amyloid. Basidia 26–32 × 10–11 μ, with four, 3.5 μ long sterigmata; contents finely granular. Marginal cells 20–50 × 10–25 μ, clavate, piriform or subglobose, hyaline, colourless, thin-walled, forming a sterile edge to the gill. Remnants of volva on pileus (Fig. 39) composed of more or less erect chains

of inflated, ellipsoid, broadly clavate or broadly cylindrical, 25–40 × 18–27 μ cells with fuliginous-umber sap, mixed with 3.5–7 μ broad hyphae. Remnants of volva on base of stipe consisting of hyphae and ellipsoid, clavate and cylindrical cells. Cuticle thin, made up of 1.5–4 μ broad repent hyphae, wavily radially arranged, with scattered, sometimes slightly broader terminal members of hyphae, slightly gelatinized near surface; pigment brown, vacuolar. Tissue of stipe with large, terminal, clavate cells, e.g. 200 × 35 μ. No clamps observed.

HABITAT.—Terrestrial in forest.

COLLECTIONS EXAMINED.—Singapore, Bukit Timah, 21 Aug. 1939 (type; dried fragments of at least 2 specimens); 16 Aug. 1939 (dried fragments of 2 specimens); 23 Aug. 1940 (water-colour drawing) and 7 April 1941 (water-colour drawing); all *E. J. H. Corner* s.n. (as *Amanitopsis* 5).

Amanita sychnopyramis stands rather by itself because of the conical warts on the brown pileus, the small globulose spores, and the lack of the annulus. It reminds one somewhat of the species with conical warts in section *Validae*. However, the non-amyloid spores, truncate short gills and striate margin of the pileus leave no doubt about its place in section *Amanita*, where it is most closely related to *A. mira* (see p. 290).

Amanita obsita Corner & Bas, *sp. nov.*—Pl. 8*b*, Figs. 52, 53

Pileus 20–45 mm latus, convexus, dein applanatus, centro depressus vel concavus, margine fortiter striatus, albidus vel pallidus, interdum centro pallide fuscus, siccus, volvae fragmentis pulverulentis griseo-umbrinis obsitus. Lamellae liberae, subdistantes, albae dein cremeae. Stipes 26–70 mm longus, apice 2–5, basi 4–8 mm latus, subbulbosus, cavus, albus, floccoso-pruinosus, exannulatus. Volva adnata, fuliginosa, subfloccoso-marginata vel pulverulento-diffracta. Caro alba. Sporae 6–8 × 5–7 μ, globulosae vel ellipsoideae, non-amyloideae. Typus: *E. J. H. Corner s.n.*, 15 Oct. 1939, Singapore, Bukit Timah (L).

Etymology: obsitus, entirely covered.

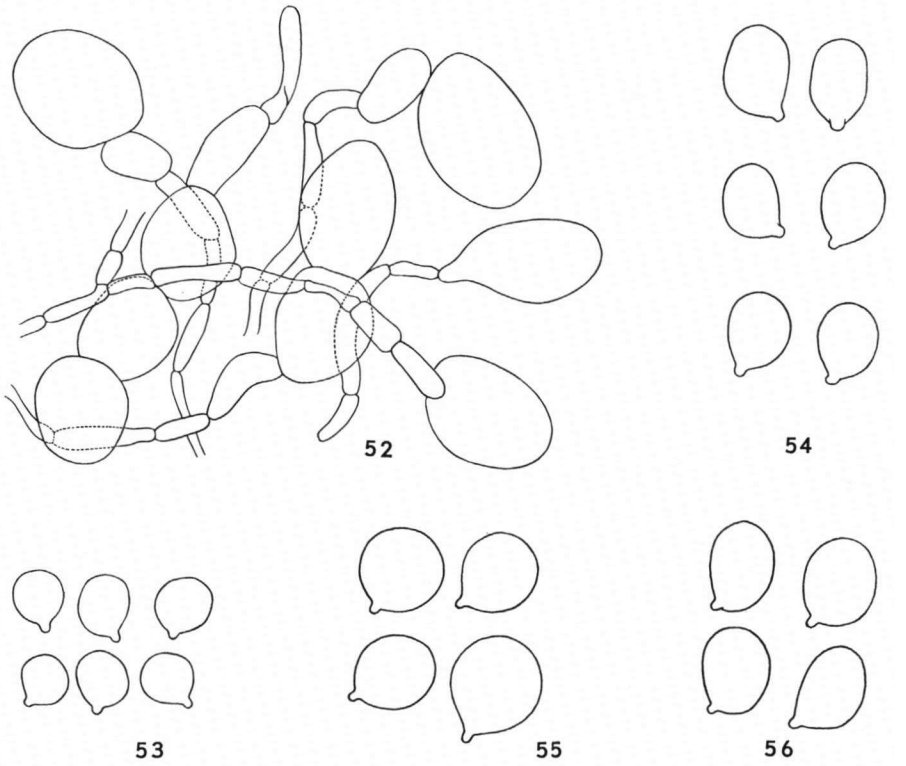
Pileus 20–45 mm wide, convex, becoming plane with slightly depressed centre or concave, sulcate-striate almost to centre, pallid-whitish, sometimes pale fuscous in centre, sprinkled with fine greyish umber powder, dense over disk, or covering powdery layer breaking up into minute warts, up to 0.5 mm wide, dry. Gills free, subdistant, 40–75 primaries with 0–1 truncate shorter ones between each pair, occasionally forked, 2–4 mm wide, white then pale cream. Stipe 26–70 mm long, 4–8 mm wide at base, 2–5 mm at apex, cylindrical or attenuate upward, with slightly bulbous base, hollow (not drawn in figures), rather fragile, white, wholly finely cottony pruinose, at base finely fuliginous pruinose or merely finely felted with pale greyish umber cottony substance forming an abrupt but slight ridge, without warts, exannulate. Flesh 1.5–2.5 mm thick in centre, very thin over limb, soft, fragile, white.

Spores (Fig. 53) 5.8–6.7 × 5.2–6.1 μ [fresh, 6.5–7.5 (–8) × 6–7 (–7.5) μ], globulose to broadly ellipsoid (length-breadth ratio 1.0–1.15, average 1.1), colourless, thin-walled, smooth, 1-guttate, sometimes cloudy vacuolate, with small to medium-large apiculus, non-amyloid. Basidia 32–40 × 10–12 μ, with 4, about 4 μ long, sterigmata. Marginal cells 13–26 × 7–15 μ, clavate to subcylindrical, thin-walled, colourless, forming sterile edge to gill. Trama of gills hard to analyse in dried material, containing large ellipsoid cells up to e.g. 60 × 40 μ and sphaerocysts up to 40 μ wide. Remnants of volva on pileus (Fig. 52) consisting of loosely interwoven, 2.5–6 μ wide hyaline hyphae and 15–45 μ wide sphaerocysts terminal or

in short chains and with umber sap. Cuticle impossible to analyse in dried specimen. No clamps observed.

HABITAT.—Terrestrial in jungle; solitary.

COLLECTIONS EXAMINED.—Singapore, Bukit Timah, 15 Oct. 1939 (type; one fragmented pileus) and 30 April 1940 (water-colour drawing); Botanic Gardens, Gardens' Jungle, 13 Aug. 1940 (water-colour drawing); all *E. J. H. Corner s.n.* (as *Amanitopsis* 7).



Figs. 52–53. *Amanita obsita.* — 52. Crushed remnants of veil from pileus (× 500). — 53. Spores (× 1250).

Fig. 54. *Amanita hemibapha* subsp. *similis.* — Spores (× 1250).

Fig. 55. *Amanita cinctipes.* — Spores (× 1250).

Fig. 56. *Amanita species* 4. — Spores (× 1250).

This species is very similar to *A. farinosa* Schw. from southern North America and Japan. However, it has a pale cap covered by darker brown powdery remnants of the volva, whereas *A. farinosa* has a brown cap covered with "drab" powdery remnants. Comparing the Malayan specimen with collections of *A. farinosa* from North America (*Hesler 22331*, North Carolina) and Japan (*Hongo 2018*) the

sphaerocysts in *A. obsita* appear to be of a much darker brown than those of *A. farinosa*. Although several authors state the spores of *A. farinosa* to be globulose, they are broadly ellipsoid to ellipsoid in the collections mentioned above (length-breadth ratio 1.25–1.4, average 1.3 in the first one and 1.1–1.35, average 1.2 in the second), which is more or less in accordance with figures of the spores of that species as published by Gilbert (1941: 125, 199). Thus it seems justified to consider the Malayan material to represent an autonomous tropical ally of *A. farinosa*.

Undoubtedly, *A. farinosa* and *A. obsita* are closely related to *A. subvaginata* (Clel. & Cheel) Gilb. from Australia, New S. Wales, placed in *Amanitopsis* by Gilbert (1941: 75). This exannulate species has the same small size, the same striate pileus, covered with greyish powder of the volva, and small globulose spores (7.5–9 μ wide). The basal part of the volva, however, is more coherent and forms a slightly marginate greyish coating of the bulbous base of the stipe.

Section VAGINATAE (Fr.) Quél.

Agaricus [sect.] *Vaginatae* Fr., Monogr. Amanit. Sueciae 2. 1854.—*Amanita* [sect.] *Vaginatae* (Fr.) Quél. *in* Mém. Soc. Emul. Montbéliard, ser. II, **5**: 64. 1872 (Champ. Jura **1**: 27); Sing. *in* Lilloa **22**: 386. 1951 ("sect.").—Lectotype (Sing. l.c.): *Agaricus vaginatus* Bull. ex Fr.

Amanitopsis sect. *Volvatae* Imai *in* Bot. Mag., Tokyo **47**: 428. 1933 (presumably an unintentional name change of *Vaginatae* Fr.).—Lectotype: *Amanitopsis vaginata* (Bull. ex Fr.) Roze.

Amanitopsis Roze *in* Bull. Soc. bot. France **23**: 50, 51. 1876.—*Amanita* subgen. *Amanitopsis* (Roze) Lange *in* Dansk bot. Ark. **2** (3): 6.—*Amanita* sect. *Amanitopsis* (Roze) Konr. & Maubl., Agaricales 58. 1948.—Lectotype (fixed by conservation): *Agaricus vaginatus* Bull. ex Fr.

Amanita sect. *Caesareae* Sing. *in* Ann. mycol., Berl. **41**: 162. 1943 (not val. publ.); *ex* Sing. *in* Acta Inst. bot. Acad. Sci. URSS (ser. II, Plant. cryptog.) **6**: 389. 1950.—Lectotype (Sing. *in* Lilloa **22**: 385. 1951): *Amanita caesarea* (Scop. ex Fr.) Grev.

Amanita sect. *Ovigerae* Sing. *in* Lilloa **22**: 386. 1951 (not val. publ.); *ex* Sing. *in* Sydowia **15**: 67. 1962.—Type: *Amanita biovigera* Sing.

For the scope of this section, see the key to the subgenera and sections on p. 243.

KEY TO THE SPECIES OF SECTION *Vaginatae*

1. Annulate species with sheathing volva.
   2. Spores broadly ellipsoid to ellipsoid, 8–12 × 6–9 μ. Colours extremely variable. Pileus red, orange, yellow, olivaceous or greyish brown, mostly lighter and pinkish, yellowish or melleous at margin, glabrous. Stipe yellow with concolorous, orange, or red, fibrillose scales. Gills whitish to pale yellow, with pinkish to yellow edge. Ring orange, yellow or greyish. Volva white to greyish . . . . . *A. hemibapha*, p. 295
   2. Spores globulose to subglobulose, 9–13 × 8–12 μ. Very large species. Pileus pale dingy buff. Gills white to cream. Stipe white to pale buff. Volva large, fleshy with membranous limb, white, with pale buff patches. Ring present but fragile *A. princeps*, p. 297

1. Exannulate species with sheathing or friable volva.
   3. Volva friable, forming at base of stipe 2–4 greyish brown floccose rings, often broken into warts. Pileus mouse grey to pale greyish brown, with dark centre and greyish brown floccose patches or warts of volva. Stipe greyish brown, with dark fibrillose scales. Spores 8–11 × 8–10 μ, globulose to subglobulose . . . . . *A. cinctipes*, p. 299
   3. Volva sheathing.

4. Spores broadly ellipsoid to ellipsoid.
   5. Spores 9–11.5 × 7–8.5 μ. Pileus $^1/_2$ striate, leaden grey, glabrous. Gills white. Stipe whitish, minutely cottony. Volva wide-sheathing, membranous-subcarnous, white . . . . . *A.* species 4, p. 301
   5. Spores 11–13 × 9.5–11 μ. Pileus greyish brown, glabrous. Gills white to pale brownish. Stipe pale brownish drab to whitish. Volva whitish buff, split on one side *A.* species 5, p. 301
4. Spores globulose to subglobulose.
   6. Very large species with pale dingy buff pileus 2
   6. Medium-large to small species with grey to greyish brown pileus.
      7. Spores 11–13 (–15) μ. Pileus 25–80 mm wide, $^1/_2$ striate-tuberculate, grey to greyish brown, glabrous. Gills subdistant, up to 7 mm broad, white; short gills lacking. Stipe white to pale brownish, slightly fibrillose-floccose. Volva more or less cylindrical, deeply sheathing, white . . *A. angustilamellata*, p. 302
      7. Spores 8–11 × 7–10 μ. Pileus 20–40 mm, mouse grey, with large flat grey patches. Gills crowded, white. Stipe pale silvery grey, minutely fibrillose. Volva cyathiform, closely fitting, with narrow free margin, grey *A.* species 6, p. 302

AMANITA HEMIBAPHA (Berk. & Br.) Sacc.
subsp. **similis** (Boed.) Corner & Bas, *comb. nov.*—Pl. 11, Fig. 54.

Amanita similis Boedijn *in* Sydowia **5**: 322. 1951 (basionym).

Pileus 60–130 mm wide, cylindric-campanulate at first, becoming plane to slightly concave and subumbonate, $^1/_3$–$^1/_2$ sulcate-striate from margin toward centre, fuliginous-bistre, fuscous-olivaceous or olivaceous-umber at first with outer striate part varying from vinaceous pink, rufescent orange to pale orange or yellowish, wholly olivaceous-umber with age, innately streaked, glabrous, viscid at first. Gills free, crowded, 90–100 primaries with 0–3 (–7) truncate, obliquely truncate or sometimes attenuate shorter ones between each pair, 5–10 mm wide, pale yellow or yellowish white with deep yellow, orange or pinkish orange, micaceous-floccose edge. Stipe 100–180 mm long, 6–13 mm wide at apex and 7–17 mm wide near base, extreme base slightly attenuate, firm, hollow, but sometimes with floccose, pithy septa, canary yellow, pale yellow orange or pale yellow, marked with zig-zag transverse orange, pinkish orange or concolorous, fibrillose to floccose-fibrillose zones below ring, bright orange, pinkish orange or pale orange-yellow, striate, fibrillose above ring, annulate, with sheathing volva. Volva 25–50 × 10–30 mm, white, sometimes dingy brownish stained, rather thick, floccose-firm, with irregularly lobed edge, attached at very base of stipe, with indistinct limbus internus inserted in inner side of volva some millimeters above joint with stipe. Ring pendant at 25–30 mm from apex of stipe, thin, membranous, 12–17 mm wide, pinkish orange, pale orange or orange-yellow, slightly striate above, more yellowish, subfloccose below, scarcely spreading, soon collapsed. Flesh soft, pale yellowish to yellowish white, deeper yellow below surface, 4–8 mm thick in centre of pileus, thin over limb.

Spores (Fig. 54) 7.0–9.9 × (5.4–) 6.1–8.6 μ (fresh, 8–11 × 7–9 μ, sometimes 7–9 × 5.5–7.5 μ), broadly ellipsoid to ellipsoid, sometimes subglobulose (length-breadth ratio 1.05–1.4, average 1.2), with rather broad apiculus, colourless, thin-walled, smooth, cloudy-vacuolate, multiguttulate or 1-guttate, non-amyloid. Basidia 35–50 × 10–13 μ and 25–35 × 7–9 μ, dimorphic, 4-spored; sterigmata about 4 μ long. Marginal cells 20–90 × 10–30 μ, clavate, piriform or ellipsoid, with yellow sap, mixed with numerous thin hyphae, forming a rather broad sterile margin along edge of gills. Trama of gills impossible to analyse in dried material.

Volva with outer layer consisting of more or less longitudinal, 1.5–6 μ wide hyphae and inner layer composed of up to 90 μ wide inflated cells, mixed with thin hyphae. Cuticle 40–80 μ thick, consisting of a, 20–40 μ wide, hyaline, gelatinized upper layer with very scattered, thin, fading hyphae and a 20–40 μ thick lower layer of crowded radial, 2–5 μ wide hyphae with orange-yellow to fuliginous sap. Trama of stipe consisting of longitudinal, clavate to cylindrical cells, up to 225 × 55 μ, mixed with thin hyphae. Clamps observed on coloured hyphae of cuticle.

HABITAT.—Terrestrial in forest; solitary or gregarious, coming up soon after rains (March and August in Singapore).

DISTRIBUTION.—Java (type-locality); Malaya & Singapore, frequent throughout the country; Borneo, once a large troop observed by the senior author in 1961 near the Mesilau River, on Mt. Kinabalu at about 1700 m alt. in oak-forest.

COLLECTIONS EXAMINED.—Malaya, Johore, Gunong Panti, Aug. 1929 (dried); Negri Sembilan, Angsi Forest Reserve, 750 m alt., 3 July 1930 (dried); Singapore, Bukit Timah, 16 Aug. 1939 (dried), 18 Dec. 1940 & 16 Febr. 1943 (last two water-colour drawings); all *E. J. H. Corner s.n.* (as *Amanita* 3).

Amanita hemibapha, extremely variable as to the colours of the pileus, is recognizable by (i) the yellow stipe with sometimes concolorous, but mostly brighter coloured appressed fibrillose scales, (ii) the yellow to yellowish gills with brighter coloured edge, (iii) the attenuate base of the stipe, (iv) the white to greyish deeply sheathing, rather fleshy volva, attached only to the extreme point of the base of the stipe, and (v) the tropical distribution.

The red and orange forms very much resemble *A. caesarea* from the northern temperate zones, but in these forms the orange to red fibrillose-scaly zones on the stipe are distinctive.

Amanita hemibapha was first described from Ceylon (Berkeley & Broome 1871: 149, pl. 33 fig. A) from preserved material and a water-colour drawing sent to England by Thwaites (no. 700). The pileus was described and depicted as scarlet with a yellow margin, the stipe described as yellow and depicted as white; but both the description and the reproduced drawing are rather poor. This was also the opinion held by Petch (1910: 373), who published a description of the same species based on two of his own collections from Ceylon which he found in good accordance with Thwaites' original drawings consulted by him. Petch described the pileus as deep crimson with a broad, bright yellow margin, the stipe as yellow, covered with thin, appressed, reddish patches and the ring as yellow.

Boedijn (1951: 320) published a description of *A. hemibapha* based on material from Java. He gave the pileus of this species as orange-yellow to ochre yellow, sometimes with a brown tinge, paler toward the margin and the stipe as yellow with orange buff scales and the ring orange buff.

Two unpublished plates, kindly put at our disposal, illustrate this form very well. One of them (herb. Boedijn) is a coloured pencil drawing by Dr. K. B. Boedijn from his collection from the Poentjak pass, 18 Oct. 1941. In this rather pale figure no scales on the stipe are discernable. The other plate (Herb. bogoriense) is an excellent water-colour drawing by van Overeem (no. 1464, under the unpublished name *A. aureo-annulosa* Overeem) without data, but undoubtedly drawn from

specimens from Java, as van Overeem never collected in the tropics outside Java.

Undoubtedly, the material from Java, described by Boedijn, belongs to *A. hemibapha*. However, it is quite remarkable that the deep red colour of the pileus, which seems to be constant on Ceylon, is lacking in the material from Java.

In the collections from Singapore and Malaya (Pl. 11), described above, the colour of the pileus ranges from fuliginous-bistre to brownish olivaceous with a pinkish to yellowish tinged margin, the stipe is bright to pale yellow with pinkish orange to concolorous fibrillose scales, and the ring pinkish to orange-yellow.

From the written accounts there would seem to exist considerable differences in colour between the material from Java and that from Malaya. Comparing, however, Corner's most pronouncedly olive-coloured drawing (Pl. 11*a*) with van Overeem's plate, one finds a very great resemblance. In the former the yellow of the pileus is mixed with olivaceous-brown, in the latter with reddish brown.

Amanita similis Boedijn (1951: 322) seems to represent an extreme of the series of colour forms of *A. hemibapha*. Its pileus is described as greyish brown to pale brownish olive with a melleous to chamois margin, its stipe as greyish yellow with brighter yellow base and apex, with concolorous fibrils, and the ring as greyish. Only the greyish tinge of the ring, the middle of the stipe and the volva would differentiate *A. similis* from the specimens collected by the senior author in which the fibrils on the stipe were sometimes concolorous, too. Therefore, it seems reasonable to consider the Malayan material identical with *A. similis*. However, if this is accepted, then the gap between *A. similis* and *A. hemibapha* is considerably narrowed.

One would be inclined to put together into one very variable species all the above mentioned colour forms. However, since the variability would seem to be linked up with the geographical distribution, the best solution of the problem at present is to divide *A. hemibapha* into three subspecies:

Subspecies HEMIBAPHA: Pileus crimson red, with yellow margin. Stipe yellow with reddish scales. Ring yellow. Distribution: Ceylon.

Subspecies JAVANICA Corner & Bas [5]: Pileus orange-yellow to ochre yellow, sometimes with reddish brown tinge, with yellow margin. Stipe yellow with orange scales. Ring orange buff. Distribution: Java.

Subspecies SIMILIS (Boed.) Corner & Bas: Pileus fuliginous-bistre to brownish olivaceous, with pinkish, yellowish or melleous margin. Stipe bright yellow to pale dingy yellow, with pinkish orange to concolorous scales or fibrils. Ring pinkish orange to greyish. Distribution: Java, Borneo, Singapore, and Malaya.

Amanita princeps Corner & Bas, *sp. nov.*—Pl. 10, Fig. 51

Pileus 100–200 mm latus, initio ovoideus vel convexus, dein concavo-applanatus, subumbonatus, margine sulcato-striatus, pallide ochraceo-isabellinus, vulgo nudus, interdum verrucis albis, applanatis, tenuibus ornatus, subviscidus. Lamellae liberae, confertae, albae, dein cremeae. Stipes 160–240 mm altus, apice 9–15, basi 13–25 mm latus, initio solidus, dein

[5] AMANITA HEMIBAPHA subspecies **javanica** Corner & Bas, *subsp. nov.* (*A. hemibapha* sensu Boedijn *in* Sydowia 5: 320. 1951). A typo differens pileo aurantiaco flavo brunneove. Typus: *K. B. Boedijn s.n.*, 18 Oct. 1941, Java, Poentjak pass (BO).

celeriter cavus, albus vel pallide bubalinus, infra subflocculosus, a summo pruinosus, annulatus vel exannulatus, volvatus. Annulus amplus, albus, tenuis, submembranaceus, evanidus. Volva 50–80 × 25–40 mm, sacciformis, crassa, alba, verrucis tenuibus, pallide bubalinis obtecta. Caro alba. Sporae 9–13 × 8–12 μ, globulosae vel subglobulosae, subtiliter verruculosae, non-amyloideae. Typus: *E. J. H. Corner s.n.*, Sept. 1930, Singapore, Bukit Timah (L).

Etymology: princeps, prominent.

Pileus 100–200 mm wide, ovoid to convex when young, plane or slightly concave to almost cyathiform with age, subumbonate, 1/4 sulcate-striate from margin toward centre (already distinctly striate when emerging from volva), light biscuit colour or pale, slightly greyed, brownish ochraceous, slightly darker toward disk, paler toward white or pallid margin, glabrous or occasionally with few thin white fugacious patches of volva, slightly viscid at first. Gills free, distant from apex of stipe, crowded, 134–150 primaries, 0 (–1) truncate shorter ones between each pair, 10–17 mm wide, thin, white, then cream, with flocculose-denticulate edge. Stipe 160–240 mm long, 13–25 mm wide at base and 9–15 mm wide at apex, stout, brittle, fibrous, becoming hollow, still solid in 40 mm high bud, already hollow in specimen just emerging from volva, white or very pale buff, somewhat floccose below, pruinose-pulverulent above, annulate or exannulate, with sheathing volva. Volva 50–80 × 25–40 mm, white, thick, fleshy with membranous limb, outer layer cracking and peeling in thin, very pale buff patches, often with a narrow 1–1.5 mm high limbus internus; attached only to the very base of stipe. Ring ample, pendulous, thin, floccose-membranous, easily torn, usually dropping off in bits from underside of pileus on expansion, or splitting radially in strips, white or pale ochraceous buff, faintly striate above, subfloccose below, attached at the very apex of stipe. Flesh white, cream in base of stipe, rather soft, very putrescent, 6–9 mm thick in centre of pileus, about 1 mm thick half-way to margin. Smell faint, like that of *A. phalloides* (Fr.) Link.

Spores (Fig. 51) 8.7–11.5 × 7.9–10.1 μ (fresh, 10–13 × 9–12 μ), globulose to subglobulose (length-breadth ratio 1.0–1.15, average 1.1), colourless, very slightly thick-walled?, densely and minutely verruculose, with 1-guttate or multiguttulate contents, with large, prominent apiculus, non-amyloid. Basidia 4-spored, 45–65 × 14–16 μ, perhaps dimorphic (not intermixed with pseudoparaphyses). Marginal cells very abundant in young specimen, forming a broad margin along edge of gill, globulose, mostly 20–30 μ wide, sometimes up to 40 μ. Trama of gills very distinctly bilateral; central strand and adjacent zones with divergent hyphae composed of ellipsoid and cylindrical cells up to 110 × 25 μ, mixed with 2 μ and more wide hyphae, the outermost cells perpendicular to subhymenium; subhymenium about 15–25 μ wide, densely ramose-subcellular, with cells up to 10 μ across. Outermost peeling layer of volva consisting of very crowded, slightly coloured 2.5–5 μ wide hyphae. Membranous limb of volva on outer side with 2.5–5 μ wide interwoven or sublongitudinal hyphae and scattered oleiferous hyphae up to 12 μ wide; inner side nearly similar, but with very scattered sphaerocysts up to 110 μ wide. Young fleshy volva, up to 4 mm thick, still covering pileus in bud (about 35 mm high) composed of numerous large sphaerocysts mixed with thin hyphae. Cuticle about 150 μ thick in young specimen, consisting of a hyaline gelatinous upper layer with very distant, thin, nearly faded hyphae and many superficial oleiferous hyphae up to 12 μ wide, passing gradually into a lower layer of 3–7 μ wide and more crowded hyphae; hyphae of both layers interwoven near centre, radial over limb. Trama of stipe with large terminal clavate cells. Clamps abundant on thin hyphae of volva and cuticle.

HABITAT AND DISTRIBUTION.—Terrestrial in forest in Singapore; one large troop

every rainy season in fern-valley in Bukit Timah Forest; occasionally also in the Reservoir Jungle; not seen anywhere else in Malaya. A denizen of the deep forest.

COLLECTIONS EXAMINED.—Singapore, Bukit Timah, Sept. 1930 (buds in liquid); March 1931 (type; two specimens, just emerged from volva, with inner veil still closed, in liquid); Reservoir Jungle, 29 Nov. 1940 (water-colour drawing); a spore print without data; all *E. J. H. Corner s.n.* (as *Amanita* 4).

OBSERVATIONS.—Monkeys refused to eat this species.

Although the very finely and densely verruculose spores of *A. princeps* are unique within the genus *Amanita*, there is no doubt that the species should be classed in this genus.

A remarkable feature of *A. princeps* is the fact that the part of the young volva covering the pileus mainly consists of sphaerocysts, while the limb of the volva and consequently remnants of the volva on the pileus derived from it consist nearly entirely of hyphae. The last phase of the growth of the upper part of the volva is apparently entirely the result of hyphal growth, so that the originally rather crowded sphaerocysts become widely scattered.

Amanita cinctipes Corner & Bas, *sp. nov.*—Pl. 12*b*, *c*, Fig. 55

Pileus 45–120 mm latus, convexo-applanatus, centro depressus, margine sulcato-striatus, murinus vel pallide griseolo-brunneus, centro obscuro, verrucis applanatis vel conicis, floccosis obtectus. Lamellae confertae, albae vel griseolae, acie concolore vel griseo-brunnea. Stipes 90–200 mm altus, apice 6–13, basi 10–17 mm crassus, haud bulbosus, cavus, fragilis, griseolus vel griseo-brunneus, fibrillosus squamosusve, exannulatus. Volva adnata, floccosa, friabilis, annulos griseo-brunneo relinquens. Caro alba. Sporae 8–11 × 8–10 μ, globulosae vel subglobulosae, non-amyloideae. Typus: *E. J. H. Corner s.n.*, 19 March 1931, Singapore, Botanic Gardens, Gardens' Jungle (L).

Etymology: cinctus, girdle; pes, foot.

Pileus 45–120 mm wide, becoming plano-convex with depressed centre, $^1/_3$–$^1/_4$ sulcate-striate from margin toward centre, mouse grey to pale greyish brown, darker, greyish brown to fuliginous umber at centre, subviscid, set with scattered, grey to greyish brown remnants of volva, varying from floccose patches, 4–10 mm wide, to floccose, erect, pyramidal warts 1–2.5 mm high. Gills free, crowded, 65–127 primaries with 0–1 (–3) truncate shorter ones between each pair, 3–11 mm wide, white to greyish, with or without grey-brown edge. Stipe 90–200 mm high, 10–17 mm wide at base, 6–13 mm wide at apex, hollow, rather fragile, entirely pale or dark greyish to greyish brown, paler near apex, with darker, appressed, fibrillose scales, often forming incomplete transverse zones, especially in lower part, at base with 2–4 dark greyish brown, floccose, volva rings, often broken into warts or scales, exannulate. Flesh 3–4 mm thick in centre of pileus, thin over limb, white.

Spores (Fig. 55) 8.2–11.1 × 7.8–10.1 μ (fresh, 9–11 μ), globulose to subglobulose (length-breadth ratio 1.0–1.1, average 1.05), with rather small apiculus, colourless, thin-walled, smooth, hyaline, 1-guttate or multiguttulate, non-amyloid. Basidia 40–50 × 12–15 μ, with 4 sterigmata, 5 μ long. Marginal cells none. Trama of gills hard to analyse in dried material, subhymenium rather thin, densely ramose with irregular small cells, without globose cells. Remnants of volva on pileus consisting of globose to ellipsoid terminal cells up to 60 μ wide and with umber sap and 2–5 μ wide hyphae. Remnants of volva on base of stipe as those on pileus, but sphaerocysts sometimes in short chains; deeper parts less coloured and with more

hyphae. Cuticle composed of an entirely gelatinized upper layer about 25 μ thick and a lower layer about 25 μ thick consisting of crowded radial hyphae, thin in upper part, quickly increasing in diameter downward. Trama of stipe with clavate, terminal, longitudinal cells up to 250 × 45 μ and oleiferous hyphae up to 18 μ wide and especially present near inner surface. No clamps observed.

HABITAT.—Terrestrial in jungle. Probably common in lowland forest in Malaya and Singapore.

COLLECTIONS EXAMINED.—Singapore, Botanic Gardens, Gardens' Jungle, 19 March 1931 (type; several dried specimens); Aug. 1939 (dried); 16 Aug. 1940 (water-colour drawing); Mandai Road Forest, 20 Aug. 1939 (dried); Reservoir Jungle, 6 Dec. 1940 (water-colour drawing); also observed in Bukit Timah Forest Reserve and in Malaya, Johore, Gunong Panti; all collected or noticed, *E. J. H. Corner s.n.* (as Amanitopsis 1).

OBERVATIONS.—Monkeys were observed to eat this species without discomfort.

This species is very close, perhaps too close to *A. inaurata* Secr. from Europe. However, at present it seems preferable to keep it apart on account of (i) the smaller spores and basidia (8–11 × 8–10 μ and 40–50 × 12–15 μ against those of *A. inaurata* (10–) 11–13 (–22) × 10–12.5 (–21) μ and 60–80 × 16–18 μ; the occurrence of very large spores in *A. inaurata* is due to 2-spored and 1-spored basidia), (ii) the absence of an umbo on the pileus, (iii) a more delicate habit, (iv) a tendency of the volva to form small pyramidal warts on the pileus, and (v) a slightly different colour of the pileus; the beautiful yellowish brown tints in older specimens of *A. inaurata* seem to lack entirely in the more greyish *A. cinctipes*.

In all of the many Dutch collections of *A. inaurata* studied, the fruit-bodies appear to be considerably stouter than those of *A. cinctipes*. This cannot be said of the American specimens of *A. inaurata* depicted by Peck (1900: pl. 44 fig. 1–10, as *Amanitopsis strangulata*) and the Japanese ones by Imazeki & Hongo (1957: pl. 18 fig. 100), but it still has to be proved that these specimens are conspecific with the European *A. inaurata*, especially those of Peck. However, all authors consulted, agree that the size of the spores of *A. inaurata* is larger than 10 μ and usually exceeds 11 μ, which is in accordance with our observations.

Judging from the water-colour drawings, *A. cinctipes* varies considerably. The type collection is most similar to Pl. 12*c*. Especially in this case it is a pity that the specimens depicted have not been preserved, so that one has to rely on the senior author's observations in the field for the conclusion that both forms depicted are really conspecific.

AMANITA VAGINATA (Bull. ex Fr.) Vitt. *sensu lato*

A. vaginata and its close allies appear to have a world-wide distribution and the number of forms, varieties and 'small' species within this group is undoubtedly considerable. However, since the classification of the European representatives of this group is still highly unsatisfactory, it is understandable that our knowledge of the extra-European forms is still more scanty and confused.

Thus far the differences in colour were stressed too much, while the characters of the spores (form) and of the volva (form, attachment to the stipe, microscopical

structure and the presence and insertion of a limbus internus) were neglected too much.

When using the size of the spores as a differentiating character, it should be kept in mind that in several members of the *A. vaginata* group, 1-, 2-, and 4-spored basidia may occur in the same fruit-body.

As no material was preserved of most of the finds of this group in Malaya and Singapore, very little can be contributed in this paper to the knowledge of the tropical allies of *A. vaginata*. The few identifications in the following enumeration are done with reservation.

AMANITA SPECIES 4—Fig. 56

? *Amanita ovalispora* Boed. *in* Sydowia **5**: 320. 1951.

Pileus 60 mm wide, becoming plane with depressed centre, $^1/_2$ striate-sulcate from margin toward centre, leaden grey, darker in centre, slightly viscid, glabrous. Gills free, crowded, 74 primaries with 0–1 shorter ones between each pair, white, 5.5 mm wide, thin. Stipe 125 mm long, 5 mm wide above, 9 mm wide below, hollow, pallid-whitish, minutely cottony, almost smooth, exannulate, with sheathing volva. Volva 20 mm high and wide, sheathing, attached only at very base of stipe, membranous-subcarnous, with edge not lobed, white, with rather narrow limbus internus inserted in innerside of volva, some millimetres above connection with stipe. Flesh white, soft, 3 mm thick in centre, 0.5 mm halfway to margin.

Spores (Fig. 56) 9.0–11.0 × 7.1–8.7 μ (fresh, 9–11.5 × 7–8.5 μ), broadly ellipsoid (length-breadth ratio 1.1–1.4, average 1.25–1.3), with medium-large apiculus, colourless, mostly 1-guttate, thin-walled, smooth, non-amyloid. Volva on inner and outer surface with interwoven sublongitudinal, 3–5 (–8) μ wide hyphae; the interior consisting mainly of hyphae and some very scattered inflated cells. Cuticle rather thin, consisting of a gelatinized upper layer and a lower one of interwoven, subradial, 1.5–3 μ wide hyphae with brown contents. Trama of stipe with large, clavate, terminal, longitudinal cells, up to 420 × 60 μ, and rather numerous oleiferous hyphae, up to 18 μ wide. No clamps observed.

HABITAT.—Terrestrial in jungle.

COLLECTIONS EXAMINED.—Malay, Pahang, Tembeling Estate, 8 Nov. 1930 (1 dried sp.), *E. J. H. Corner s.n.* (as *Amanitopsis* 2 pr.p.)

The Malayan specimen described above differs from *A. ovalispora* Boed. from Java (of which we were unable to study material) by (i) the grey cap lacking brown, (ii) the wider volva and (iii) the broader spores, viz. 9–11 × 7–8.7 against 8–11 × 6–7 μ. The spores depicted by Boedijn have a length-breadth ratio between 1.4 and 1.6, those of the Malayan specimen 1.1–1.4. Nevertheless both collections may be conspecific.

AMANITA SPECIES 5

Pileus 65 mm wide, plane, with sulcate-striate margin, greyish brown, glabrous, subviscid. Gills free, crowded, white or pale brownish near base. Stipe 90 × 8 mm, stout, cylindrical, hollow, pale brownish drab to whitish, exannulate, with sheathing volva. Volva 35 mm high, 12 mm wide at base, firm, floccose-felted, buff-white, split on one side, embedded in soil. Flesh white.

Spores 11–13 × 9.5–11 μ, broadly ellipsoid, multiguttulate.

HABITAT.—Terrestrial in forest.

COLLECTIONS EXAMINED.—Singapore, Bukit Timah, 19 Nov. 1939 (no material preserved), *E. J. H. Corner s.n.* (as *Amanitopsis* 8).
OBSERVATIONS.—A monkey did eat this species without discomfort.

This species resembles *A. ovalispora* Boed. but has considerably larger spores. It differs from *A. vaginata* and allied species by the ellipsoid spores.

AMANITA ANGUSTILAMELLATA (Höhn.) Boed.—Pl. 12*a*

Amanitopsis vaginata var. *angustilamellata* Höhn. *in* S. B. Akad. Wiss. Wien (Math.-Nat. Kl., Abt. I) **123**: 74. 1914.—*Amanita angustilamellata* (Höhn.) Boed. *in* Sydowia **5**: 318. 1951.

Pileus 25–80 mm, becoming plane with depressed centre, $^1/_2$ tuberculate-striate from margin toward centre, greyish brown to brownish grey, darker over disk, glabrous. Gills subdistant, without short ones, up to 7 mm broad, white. Stipe 50–160 × 4–12 mm, slightly attenuate upward, hollow, white to pale brownish or pale fawn, slightly fibrillose-floccose, exannulate, with sheathing volva. Volva 13–30 mm high, more or less cylindrical, deeply sheathing, often split on one side, white.
Spores 11–13 (–15) μ, globulose, 1-guttate.
HABITAT.—Terrestrial in forest.
COLLECTIONS EXAMINED.—Singapore, Bukit Timah Forest, 28 Nov. 1940 (water-colour drawing; no material preserved), *E. J. H. Corner s.n.* (as *Amanitopsis* 2a).
OBSERVATIONS.—Eaten by monkeys.

Boedijn's description of the present species fits the material from Singapore rather well. From the grey European *A. vaginata* sensu stricto this species seems to be different by the longer striation of the margin of the pileus and by a different type of volva.

From *Amanitopsis endochorda* (Berk. & Br.) Petch sensu Petch from Ceylon it differs according to Petch's (1910: 374) description by the non-umbonate pileus and the pale, less ornamented stipe. The colour of the pileus of *Amanitopsis endochorda* seems to vary considerably; normally the horizontal margin is brown or blackish brown, the depressed area light brown and the umbo dark brown, but sometimes the pileus is purple grey or 'French grey'. So it is possible that Petch's description covers more than one taxon.

Petch (1924: 121) finally concluded that the true *Agaricus* (*Collybia*) *endochordus* Berk. & Br., which he had rediscovered, really was a species of *Collybia* and transferred it accordingly. So the species which he previously described under the name *Amanitopsis endochorda* (Berk. & Br.) Petch is still without a name. There is, however, no merit in renaming it before it has become better known.

It is unlikely that the narrow gills of *Amanita angustilamellata* are a reliable distinctive feature, as narrow gills occur in several European forms of the *A. vaginata* group.

AMANITA SPECIES 6

Pileus 20–40 mm wide, becoming plane, sulcate-striate at margin, greyish mouse-colour, covered with large flat grey patches of volva, dry. Gills free, crowded, white, 4 mm wide. Stipe 50–80 × 5 mm, equal, hollow, pale silvery grey, minutely fibrillose, not squamulose, exannulate, with sheathing volva. Volva 10 mm high and broad, cyathiform, with narrow free margin, closely fitting, grey. Flesh, white, soft.

Spores 8–9 × 7–8.5 μ or 8–11 × 7–10 μ, 1-guttate. Basidia 47–60 × 10–13 μ and 30–45 × 10–13 μ, dimorphic.

COLLECTIONS EXAMINED.—Singapore, Botanic Gardens, Garden's Jungle and Reservoir Jungle (no material preserved), *E. J. H. Corner* (as *Amanitopsis* 2).

It is not certain that this species is related to *A. vaginata*. Apparently, the grey volva falls apart rather easily and is its lower part adherent to the base of the stipe. Moreover, the spores being comparatively small, it is still possible that the present species belongs to the group of *A. farinosa*.

However, two water-colour drawings (no. 2b) by Ridley's artist originally referred to the present species by the senior author, show very slender specimens, which have a small, nearly naked, striate pileus with a depressed centre, are entirely grey, except the whitish volva, and have an exannulate stipe. Unfortunately the volva and the base of the stipe are rather vague in these drawings. They strongly remind one of a very slender form of typical *A. vaginata*. They may also represent the grey forms included by Petch (1910: 347) in his *Amanitopsis endochorda* (see discussion under *A. angustilamellata*).

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EXPLANATION OF THE PLATES

PLATE 1

Fig. a. *Amanita perpasta* (× 1). — Fig. b. *Amanita vestita* (× 1). — Fig. c. *Amanita* species 2 (× 1).

PLATE 2

Amanita sculpta (× 1/2).

PLATE 3

Fig. a. *Amanita tristis* (× 1/2). — Fig. b. *Amanita squamosa* (× 1/2). — Fig. c. *Amanita fritillaria* forma *malayensis* (× 1/2).

PLATE 4

Fig. a. *Amanita gymnopus* (× 1/2). — Fig. b. *Amanita pilosella* forma *pilosella* (× 1).

PLATE 5

Fig. a. *Amanita demissa* (× 1). — Fig. b. *Amanita* species 1 (× 1/2). — Fig. c. *Amanita duplex* (× 1/2).

PLATE 6

Fig. a. *Amanita demissa* (× 2). — Fig. b. *Amanita elephas* (× 1/2). — Fig. c. *Amanita alauda* (× 1).

PLATE 7

Fig. a. *Amanita xanthella* (× 1). — Fig. b. *Amanita xanthomargaros* (× 1).

PLATE 8

Fig. a. *Amanita modesta* (× 1). — Fig. b. *Amanita obsita* (× 1). — Fig. c. *Amanita sychnopyramis* (× 1).

PLATE 9

Fig. a. *Amanita elata* (× 1/2). — Fig. b. *Amanita sychnopyramis* (× 1/2). — Fig. c. *Amanita mira* (× 1/2).

PLATE 10

Amanita princeps (× 1/2).

PLATE 11

Fig. a-b. *Amanita hemibapha* subspecies *similis* (× 1/2).

PLATE 12

Fig. a. *Amanita angustilamellata* (× 1/2). — Fig. b-c. *Amanita cinctipes* (× 1/2).


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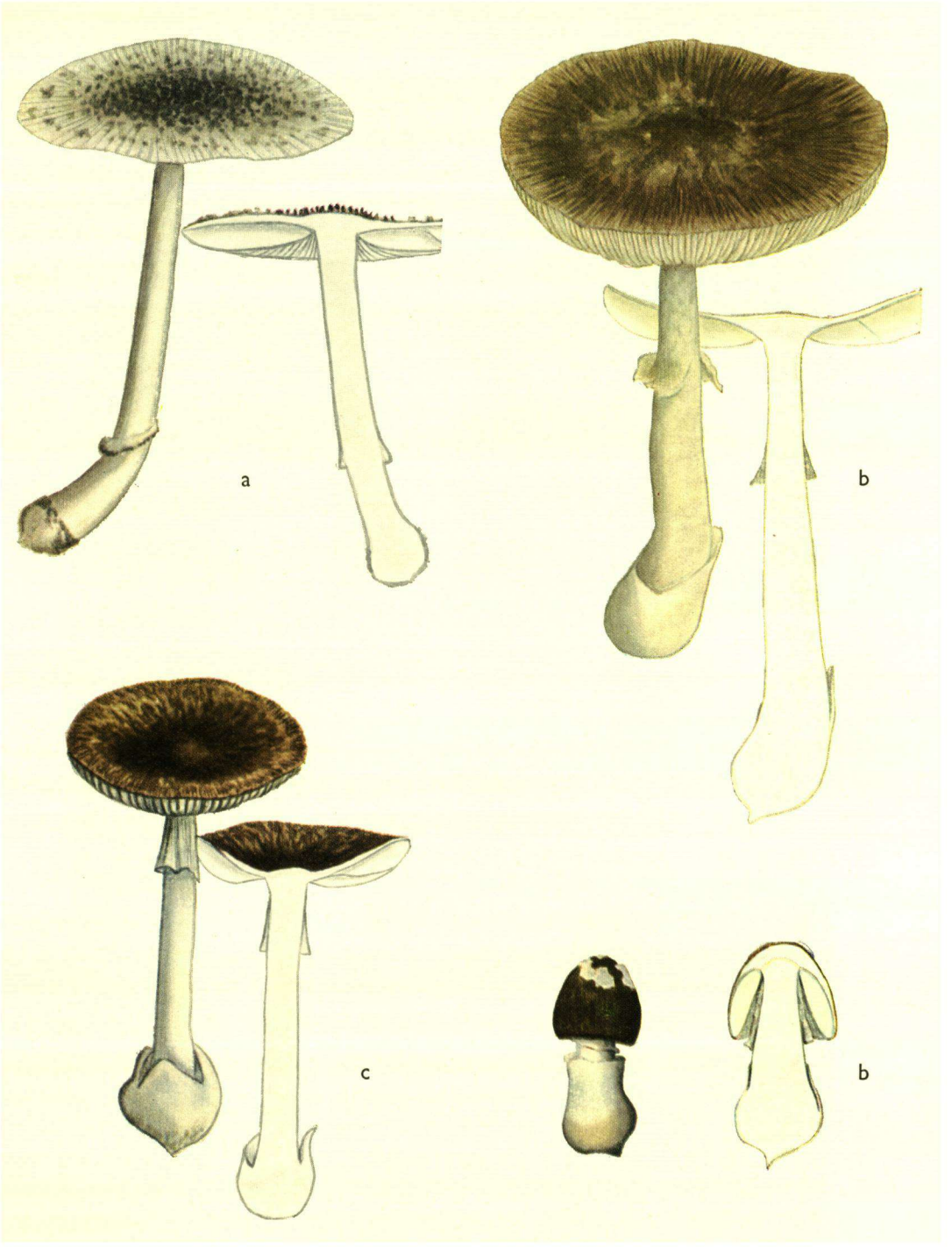
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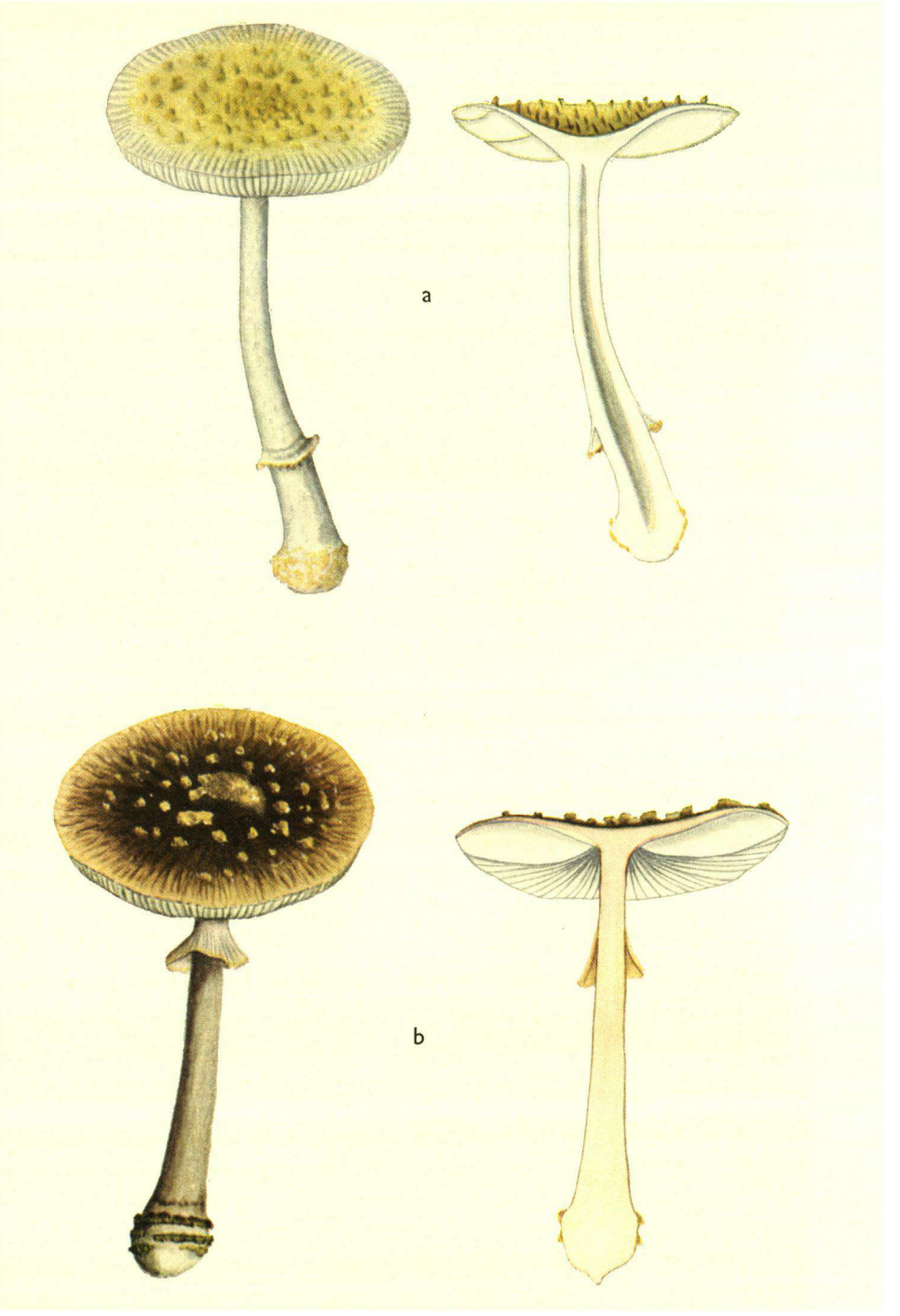
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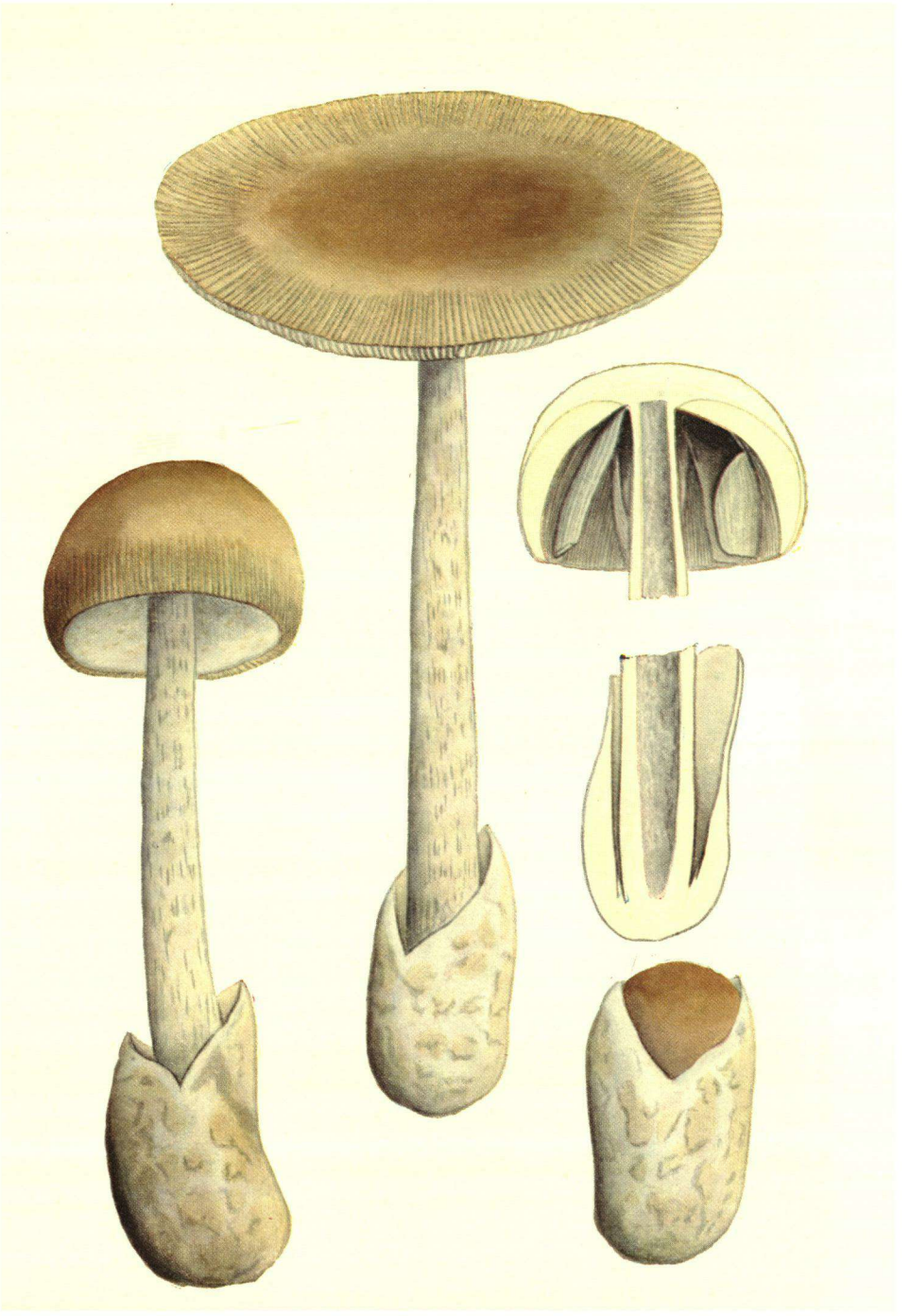


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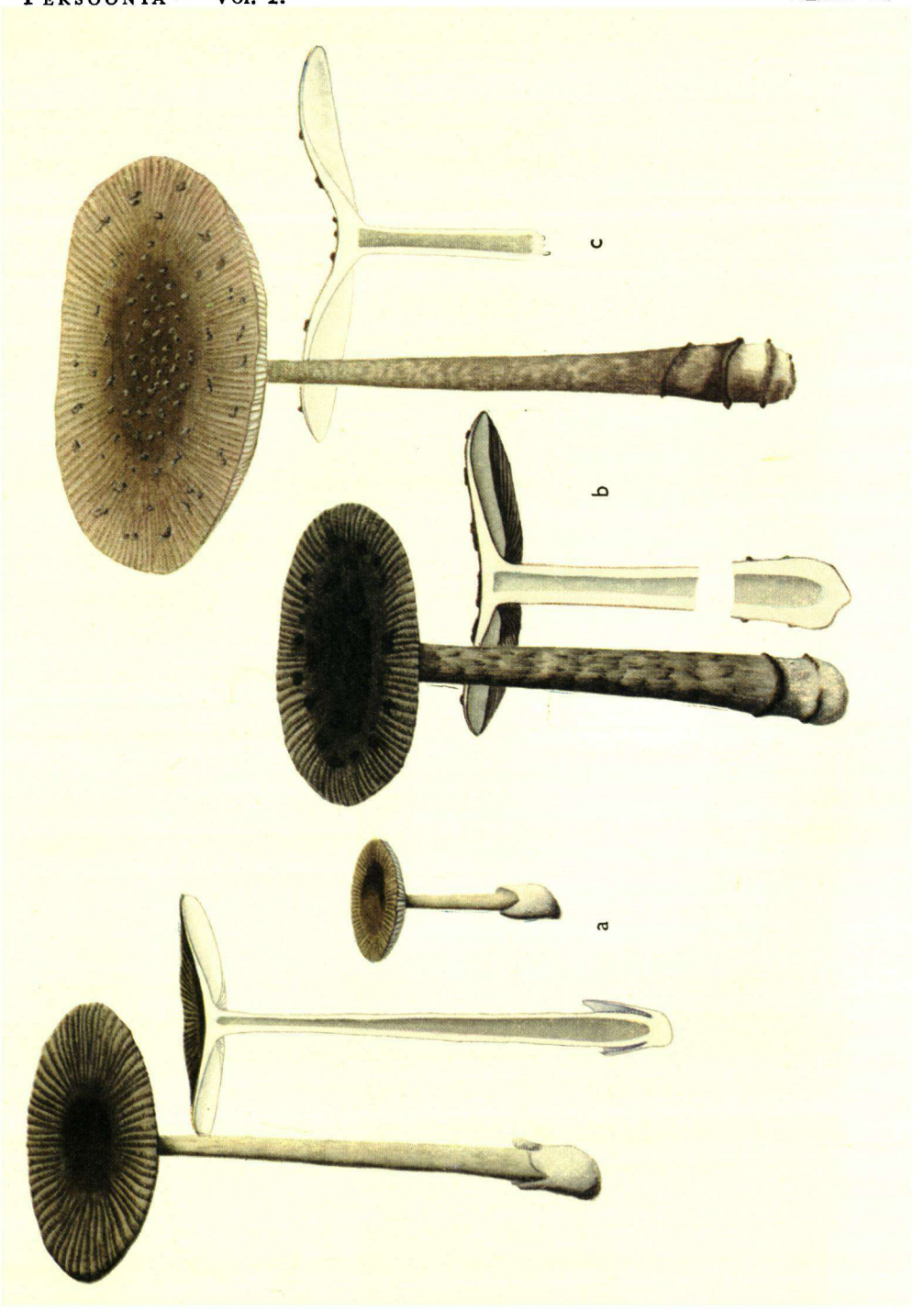
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