

## On Australasian species of *Lepiota* S. F. GRAY (Agaricales) with spurred spores

E. HORAK

Geobotanical Institute, ETHZ, CH-8092 Zürich, Switzerland

**Summary.** 10 new species of *Lepiota* S. F. GRAY with spurred spores are reported from Australasia, viz. *L. atrata*, *L. aurora*, *L. bichroma*, *L. crepusculata*, *L. disseminata*, *L. fraterna*, *L. infelix*, *L. insimulata*, *L. luteocastanea*, *L. squamatula*. 10 further (earlier described) taxa are recorded from various regions in Australasia: Australia (*L. exocarpi*), New Zealand (*L. adusta*, *L. alopochoa*, *L. aspera*, *L. calcarata*, *L. grangei*, *L. purpurata*) and Papua New Guinea (*L. aspera*, *L. castanea*, *L. erythrostickta*, *L. microspila*). All taxa are illustrated and a key to the Australasian representatives is presented.

### Introduction

Some years ago I validated the genus *Lepiotula* (MAIRE) LOCQUIN ex HORAK (1968) and accordingly I recognized its generic rank. *Lepiotula* is based on *Agaricus cristatus* FR. (1821) whose most significant features are as follows: cuticle of pileus hymeniform (composed of clavate cells with plasmatic pigment), lamellae free, annulus (ring) membranous, submobile, often dehiscent, spores spurred and dextrinoid.

According to this definition it must be expected that species belonging to *Lepiota* sect. *Cristatae* KÜHNER (1936) are friction-less absorbed by *Lepiotula* (MAIRE) with *L. cristata* as type species.

It is true that *L. lilacea* BRES., originally the second species included in this section, shares with *L. cristata* the hymeniform cuticle but its spores are ovoid(!). To resolve this obvious discrepancy KÜHNER shifted this species later to *Lepiota* sect. *Ovisporae* (LANGE) KÜHNER (1936) with the effect that its systematic position there appears now as unsettled as it was before. Finally KÜHNER relegated the "isolated" *L. cristata* (FR.) to *Lepiota* sect. *Stenosporae* (LANGE) KÜHNER.

Trying to propose a more "natural" classification within the genus *Lepiota* s. l. the crucial question is now: what is more important (on generic level): the spurred spores or the hymeniform cuticle of the pileus ?

When I introduced *Lepiotula* my generic concept followed partly only that of LOCQUIN (1944, 1945, 1951) and at the beginning I was convinced that all species related to *Lepiota pseudofjelina* LANGE (= *Lepiota* sect. *Stenosporae* (LANGE) KÜHNER) have to be transferred to *Lepiotula* (HORAK, 1980 b) accordingly.

After having scrutinized many collections of *Lepiota* both from Europe and from several localities overseas (South America, eastern Indomalaya and Australasia) I had to realize that my intended taxonomic concept regarding *Lepiotula* is fading away. Among the species described in this contribution just *Lepiota insimulata* and *L. fraternata* are fulfilling the proper requirements for *Lepiotula* s. str. Hence to my opinion all Ceylonese taxa listed by PEGLER (1972) in sect. *Cristatae* KÜHNER belong in fact not to *Lepiotula* s. str. for their spores are not spurred.

The systematic whereabouts of two other Australasian species mentioned in this paper is another difficult question. *Lepiota bichroma* and *L. aurora* possess spurred spores and the cuticle is actually composed of clavate cells but there is no ring-like annulus on the stipe. In fact the existing persistent veil remnants are (in distribution and shape) very much like those in taxa assembled in *Lepiota* sect. *Stenosporae* (LANGE) KÜHNER (cp. BON, 1976: 326: *L. cristata* f. *felinoides* ad. int.).

In the genus *Lepiota* s. l. the morphologic range of variation both of macroscopic and microscopic characters is unparalleled among all other genera of the Agaricales. At present about a dozen of infrageneric sections are proposed (PEGLER, 1972) to accommodate the majority of species described so far. Needless to say that spurred, dextrinoid spores occur also in at least two of these sections, viz. *Lepiota* sect. *Echinatae* FAYOD (1889) and sect. *Micaceae* LANGE (1935) (= *Cystolepiota* p. p. ss. SINGER). Following BON (1977) sect. *Echinatae* is now incorporated in *Cystolepiota* (KNUDSEN, 1978) but to my experience these two sections are not closely related at all. Among the presented Australasian taxa three species have to be classified as belonging either to sect. *Echinatae* (*L. aspera*, *L. microspila*) or sect. *Micaceae* (probably *L. disseminata*).

These few examples are enough to illustrate one of the many complex systematic situations within the genus *Lepiota*, i. e. if emphasis is given to one single character ("spurred spores") which by the way is restricted to *Lepiota*-like agarics.

If not otherwise stated the magnifications of the figures are: carpophores (nat. size), spores ( $\times 2000$ ), basidia and cystidia ( $\times 1000$ ) and cuticle (vertical section,  $\times 500$ ).

Type material of the new species is deposited in ZT.

### Acknowledgements

I am indebted to the Curators in the herbaria ADW, K and PDD for the loan of type material. The authorities of the Department of Forest, both in New Zealand and Papua New Guinea, offered logistic facilities to explore the mycoflora in these countries. I have to thank also the Swiss Society of Natural Sciences for the financial aid during my collecting trip to Australasia (1977).

Key to species

1. Lamellae adnate to emarginate; cuticle composed of cylindric interwoven hyphae, encrusted with pigment; pileus —8 mm, convex soon subumbilicate, white to pale brown, smooth; stipe —8×—0.5 mm, cylindric, pale brown, attached to spreading and interconnecting rhizomorphs; spores 7—9×2.5—3 μm, distinctly spurred; cheilocystidia polymorphic often with short, irregular excrescencies; on rotten wood. Papua New Guinea ..... *Morobia rhizomorpha* HORAK in Sydowia Beih. 8: 205. 1979
- 1\*. Lamellae free; cuticle not composed of cylindric hyphae (except *L. squamulata*); pileus never umbilicate but convex, campanulate or plane; spores distinctly spurred (except *L. microspila*, *L. aspera*, *L. disseminata*); interconnecting rhizomorphs absent; on soil, rarely on rotten wood ..... 2
2. Pileus covered with separable, distinct, conic, brown to tawny scales and spines, composed of globose or ovoid cells arranged in chains (loose sphaerocysts absent), membrane often thick-walled; cheilocystidia clavate; spores indistinctly spurred... 3
- 2\*. Pileus smooth, granular, tomentose, squamulose or scaly, subcutis often exposed by cracking, conic spines (if present) and squamules not separable, cuticle (veil) composed of interwoven, cylindric hyphae, loose sphaerocysts of palisadic layer of clavate to cylindric cells ..... 4
3. Spores 3.5—4.5×1.5—2 μm; pileus —30 mm; stipe —45×3.5 mm, cylindric, annulus fibrillose, evanescent; towards base with several brown, appressed, incomplete belts and warts of the veil; on soil in forest. Papua New Guinea; Sri Lanka (type) ..... 1. *L. microspila*
- 3\*. Spores 5—7×2—3 μm; pileus —70 mm; stipe —80×—12 mm, base often bulbous; annulus descendent, submembranous, margin covered with wart-like veil remnants; towards base with several, incomplete belts and warts of the veil; on soil in forests. Papua New Guinea, New Zealand; common in northern hemisphere ..... 2. *L. aspera*
4. Cuticle (veil) composed either of globose sphaerocysts or cylindric, interwoven hyphae ..... 5
- 4\*. Cuticle a palisade of clavate to cylindric cells ..... 6
5. Cuticle (universal veil) of globose to fusoid sphaerocysts (10—30 μm diam.) with brown, thick-walled membrane, smooth; pileus —7 mm, whitish cinnamon, covered with minute, brown, granular dots; stipe —15×—0.5 mm, cylindric, white, base with reddish tinge, pruinose, on white rhizomorphs; spores 3.5—4×1.5—2 μm, indistinctly spurred; cheilocystidia

- clavate to lageniform; on soil or on rotten wood in forests.  
 Papua New Guinea ..... 3. *L. disseminata*
- 5\*. Cuticle of interwoven, cylindrical hyphae ( $-10\ \mu\text{m}$  diam.) with yellow-brown, plasmatic pigment; pileus  $-40\ \text{mm}$ , orange-brown, densely squamulose; lamellae white; stipe  $-45 \times -3\ \text{mm}$ , below the white, fibrillose cortina with several, appressed, incomplete, orange-brown belts of veil; spores  $8-9 \times 2.5-3.5\ \mu\text{m}$ ; cheilocystidia clavate to subfusoid; on soil in fagaceous forests. Papua New Guinea ..... 4. *L. squamatula*
6. Cuticle a palisade of clavate cells (hymeniderm),  $-80\ (100) \times -20\ \mu\text{m}$  ..... 7
- 6\*. Cuticle a palisade of long-cylindric (to subfusoid) cells,  $>100 \times -15\ \mu\text{m}$  ..... 11
7. Annulus membranous, ascendent, persistent, submobile; disc of pileus smooth to tomentose-velutinous, towards margin breaking up into  $\pm$  concentrically arranged squamules; pigment encrusting membranes of hyphae ..... 8
- 7\*. Annulus absent (or if present: fibrillose and evanescent); disc of pileus velutinous, often entirely covered with minute to coarse squamules; pigment plasmatic or membranar. .... 9
8. Pileus  $-15\ \text{mm}$ , pale brown; lamellae cream to pale argillaceous; stipe  $-40 \times -2.5\ \text{mm}$ , white, annulus white with brown rim, other veil remnants absent; spores  $4.5-5 \times 2-2.5\ \mu\text{m}$ ; cheilocystidia clavate; among rotten debris of *Araucaria cunninghamii*. Papua New Guinea ..... 5. *L. insimulata*
- 8\*. Pileus  $-30\ \text{mm}$ , red-brown, context of subcutis white; lamellae white turning pale yellow; stipe  $-45 \times -3\ \text{mm}$ , pale yellow, pale red-brown towards base, annulus reddish brown, below several, concolorous, incomplete belts of veil; spores  $5.5-6.5 \times -2\ (-4.5)\ \mu\text{m}$ , with two conspicuous knobs (in dorso-ventral view); cheilocystidia clavate; on soil in fagaceous forests. Papua New Guinea ..... 6. *L. fraterna*
9. Pigment plasmatic; pileus  $-30\ \text{mm}$ , pale yellow-orange, disc and squamules deep lilac (pigment turns yellow in KOH); lamellae cream becoming pale orange with age; stipe  $-40 \times -2\ \text{mm}$ , orange, all over covered with lilac, short belts and warts; spores  $9-12 \times 3-4\ \mu\text{m}$ ; cheilocystidia subclavate; on soil in fagaceous forests. Papua New Guinea .... 7. *L. bichroma*
- 9\*. Pigment membranar; pileus orange, red-orange or red-brown (KOH-reaction negative); lamellae whitish to cinnamon; cheilocystidia subcylindric ..... 10
10. Pileus  $-20\ \text{mm}$ , orange to red-orange, minutely squamulose, margin devoid of veil remnants; stipe  $-25 \times -1.5\ \text{mm}$ , pale orange with small, rather inconspicuous, concolorous bands and squamules of veil; spores  $6-8.5 \times 3-4.5\ \mu\text{m}$ , with two



- obvious knobs (in dorso-ventral view); on soil or on rotten wood in fagaceous forests. Papua New Guinea . . . . 8. *L. aurora*
- 10\*. Pileus —30 mm, red-orange to red-brown, squamulose, sub-persistent lumps of veil on margin; stipe —50 × —3 mm, white, pale reddish brown near base, with red-brown, incomplete belts and warts from veil; spores 8—9 × 2.5—3.5 μm; on soil in broad-leaved forests. New Zealand; Sri Lanka (type). . . . . 9. *L. alopochoera*
- 11 (6\*). Pileus purple, pink, wine red, red-brown or orange . . . . . 12
- 11\*. Pileus pale brown, fuscous or black . . . . . 16
12. Pileus purple, wine red or pink . . . . . 13
- 12\*. Pileus red-brown or orange; lamellae yellow . . . . . 14
13. Pileus —50 mm, purple (KOH-reaction?) fibrillose; lamellae pink; stipe —40 × —10 mm, swollen at base, whitish, fibrillose; spores 5.5—6 × 3.5—4 μm, indistinctly spurred; cheilocystidia ?; in forest litter. New Zealand . . . . . 10. *L. purpurata*
- 13\*. Pileus —25 mm, purple turning wine red or pink (pigment turns yellow or orange in KOH), minutely squamulose; lamellae white to cinnamon; stipe —40 × —2.5 mm, purplish or pale pink, covered with small, purple, incomplete belts and warts from veil; spores 6.5—9 × 2.5—4 μm; cheilocystidia vesiculose to subfusoid; pigment plasmatic; on soil in fagaceous forests. Papua New Guinea . . . . . 11. *L. erythrostricta*
14. Spores 10—13 × 3.5—4 μm; pileus —30 mm, red-orange to orange-brown (KOH-reaction negative), squamulose; stipe —50 × —4 mm, white, below the fibrillose, evanescent cortina with several orange-brown, incomplete belts or warts from veil; cheilocystidia clavate; pigment membranar; on soil under *Araucaria cunninghamii*. Papua New Guinea, northern hemisphere . . . . . 12. *L. castanea*
- 14\*. Spores smaller, 7.5—9 × 3—3.5 μm; context in stipe orange-yellow . . . . . 15
15. Pileus —35 mm, red-brown to fuscous turning orange with age minutely squamulose all over; stipe —55 × —3 mm, pale yellow above, orange-brown towards base, covered with brown to red-brown, short belts and warts from veil, cortina or annulus absent; cheilocystidia subcylindric; pigment membranar; on soil under fagaceous trees. Papua New Guinea . . . 13. *L. infelix*
- 15\*. Pileus —40 mm, disc and squamules red-brown to wine red on yellow background of subcutis; stipe —65 × —3 mm, yellow above, pale red-brown towards base; annulus ascendent, brown with red-brown margin, below with several short, red-brown belts and warts from veil; cheilocystidia clavate to lageniform; pigment plasmatic; on soil in fagaceous forests. Papua New Guinea . . . . . 14. *L. luteocastanea*

- 16 (11\*). Distinct green or olive tinge on pileus, lamellae, veil remnants or in context; pileus — 15 mm, disc velutinous disrupted into coarse squamules towards margin; lamellae white to cream; stipe — 40 × — 2.5 mm, covered with several, subannular, black belts and warts from veil, cortina or annulus absent; spores 10—14 × 3—4.5 μm; cheilocystidia fusoid to lageniform; on soil in forests. New Zealand; Europe (type), Argentina. . . . . 15. *L. grangei*
- 16\*. Green or olive colours absent . . . . . 17
17. Lamellae and apex of stipe orange or pale yellow; pigment membranar; margin of pileus with submembranous but evanescent veil remnants . . . . . 18
- 17\*. Lamellae and apex of stipe white, cream or cinnamon . . . . . 19
18. Pileus — 20 mm, disc and disrupted squamules dark brown; stipe — 60 × — 2 mm, annulus and cortina absent, with several, appressed, orange-brown, fibrillose zones from veil; spores 11—15 × 4—4.5 μm; cheilocystidia fusoid to lageniform; on rotting wood of *Nothofagus* sp. and on soil. New Zealand. . . . . 16. *L. calcarata*
- 18\*. Pileus — 45 mm, disc and concentrically arranged squamules grey-brown or (hazel)brown, KOH-reaction negative; stipe — 80 × — 5 mm, pale red-brown towards base, below the fibrillose, white, evanescent cortina with several, brown, subannular belts and warts from veil; spores 9—11.5 × 2.5—3.5 μm; cheilocystidia clavate to vesiculose; on soil under *Araucaria cunninghamii*. Papua New Guinea . . . . . 17. *L. crepusculata*
19. Pileus — 20 mm, velutinous disc and concentrically disrupted squamules black to fuliginous, KOH-reaction negative; stipe — 30 × — 2.5 mm, pale brown, covered with black warts; spores 7—8.5 × 2.5—3.5 μm; cheilocystidia clavate to vesiculose; on soil in mixed coastal forests. New Zealand. . . . . 18. *L. adusta*
- 19\*. Pileus densely covered with fuscous or black, small, conic spines or scales . . . . . 20
20. Pileus — 30 mm; stipe — 30 mm, reddish brown, below imperfect ring with black, scattered warts and scales; context reddish brown; spores 9.5—12 × 3.5—4.5 μm; cheilocystidia broadly fusoid; on soil in forests. Australia . . . . . 19. *L. exocarpi*
- 20\*. Pileus — 25 mm; stipe — 30 × — 2.5 mm, cream, annulus absent, towards base with scattered, small, black, subannular zones and warts from veil; yellow context beneath cuticle; spores 11—14 × 3.5—4.5 μm; cheilocystidia cylindric to subfusoid; on soil in *Nothofagus* forests. New Caledonia. . . . . 20. *L. atrata*

### Description of species

1. *Lepiota microspila* (BERKELEY) SACCARDO 1891 — Fig. 1

Syll. Fung. 9: 10.

Bas. *Agaricus microspilus* BERK. ap. COOKE 1888: Grevillea 16: 106.

Illustration. — PEGLER (1972: 158)

Description of Papua New Guinean material:

Pileus — 30 mm, hemispheric, convex or umbonate-expanded; pale brown to tawny; entirely covered with conic, pointed, up to 1.5 mm high, separable, concolorous or darker spines and scales; dry,

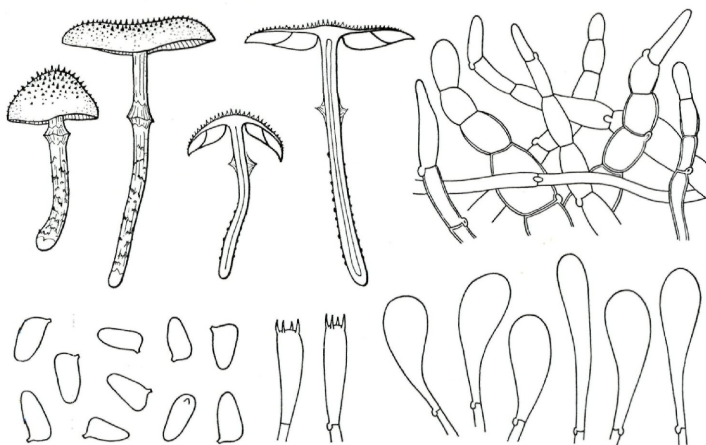


Fig. 1. *Lepiota microspila* (BERK.) SACC. (ZT 71/149): carpophores, spors, basidia, cheilocystidia, cuticle

margin not striate, persistent veil remnants absent. Lamellae very crowded, free, ventricose, up to 4 mm wide; white with pale pink tinge, turning pale orange-brown and finally brown, edge white, fimbriate. Stipe 25—45 × 2—3.5 mm, cylindric, slender, equal; white, pale brown towards base; below the white, fibrillose, evanescent cortina with several, brown, subannulate belts and warts from veil; dry, fibrillose, hollow, single in groups. Context white in pileus, pale brown in stipe. Odour and taste not distinctive. Chemical reactions unknown. Spore print white.

Spores 3.5—4.5 × 1.5—2 μm, indistinctly spurred, hyaline, dextrinoid, smooth, membrane thin-walled. Basidia 12—18 × 4—

5  $\mu\text{m}$ , 4-spored. Cheilocystidia 15—35  $\times$  4—8  $\mu\text{m}$ , clavate, hyaline, membrane thin-walled. Pleurocystidia absent. Cuticle composed of cylindrical, ovoid and globose cells (20—30  $\times$  6—20  $\mu\text{m}$  diam.) arranged in chains, membrane brown (KOH) and thick-walled, smooth. Clamp connections present.

Habitat. — On soil in forests (under *Castanopsis-Lithocarpus* in Papua New Guinea). — Papua New Guinea; Sri Lanka (type).

Material. — Papua New Guinea: Morobe district, Bulolo, Manki, 1250 m, 18. X. 1971, HORAK (ZT, 71/149).

Remarks. — This distinctive species obviously belongs to sect. *Echinatae* FAYOD (1889) and is readily recognized by the rather small and indistinctly spurred spores. The material collected in Papua New Guinea corresponds in all essential features with the type from Sri Lanka (PEGLER 1972: 157).

## 2. *Lepiota aspera* (FRIES) QUÉLET 1886 — Fig. 2

Enchiridion, 5

Bas. *Agaricus asperus* FRIES 1821: Syst. Myc. 1: 18.

Syn. *Cystolepiota aspera* (Fr.) BON 1977: Doc. Myc. 7: 11 (non. nud.).

*Cystolepiota aspera* (Fr.) KNUDSEN 1978: Bot. Tidsskr. 73: 129 (with list of further synonyms).

*Lepiota revocans* (COOKE & MASSEE) ABERDEEN 1962: Kew Bull. 16: 135 (s. n.).

Bas. *Agaricus* (*Schulzeria*) *revocans* COOKE & MASSEE 1889: Grevillea 18: 2.

Illustrations. — LANGE (1935: pl. 10, F). — KÜHNER (1936: 189). — KNUDSEN (1978: 132, 133).

Habitat. — On soil among litter in coniferous and broad-leaved forests. — Papua New Guinea, Australia (ABERDEEN, 1962: l. c.), New Zealand. — Common in the northern hemisphere: Eurasia including Japan (HONGO, 1959: 75) and eastern Siberia (VASSILIEVA, 1973: 177), also recorded from the southern hemisphere: Argentina (HORAK, 1980), Africa (MALENÇON & BERTAULT, 1970: 117; PEGLER, 1977: 352), Madagascar (PATOULLARD, 1927: 27).

Material. — Papua New Guinea: Morobe district, Bulolo, Heads Hump, 1200 m, 15. X. 1971, HORAK (ZT, 71/130); Western Highlands, Mt. Hagen, Baiyer River, Trauna Valley, 1400 m, 21. II. 1973, HORAK (ZT, 73/48). — New Zealand: North Island, Urewera National Park, Tawa Track, 24. VI. 1968, HORAK (ZT, 68/583).

Remarks. — *Lepiota aspera* (likely to be conspecific with *L. acutesquamosa* (Fr.) from which it is not convincingly separated, cp. Knudsen, 1978: l. c.) is a common saprophytic agaric probably with worldwide distribution in the temperate and tropic-subtropic regions. The material examined represents the first confirmed records of *L. aspera* in Australasia. In the Indomalayan area the occurrence of this taxon is not reported yet, however, I suspect that *Lepiota*



*leontoderes* (B. & BR.) SACC. (cp. PEGLER, 1972: 165) is a further synonym to *L. aspera* or a very closely related species at least.

Due to the similar micromorphology of the veil remnants (= conic spines and warts) on the pileal surface BON (1977) and subsequently KNUDSEN (1978) proposed to shift all taxa belonging to *Lepiota* sect.

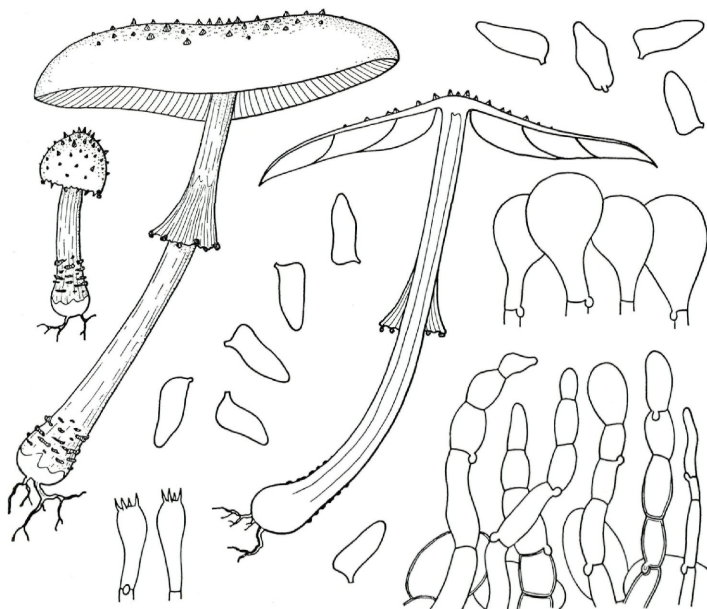


Fig. 2. *Lepiota aspera* (FR.) QUÉL. (ZT 73/48): carpophores, spores, basidia, cheilocystidia, cuticle

*Echinatae* FAYOD (1889) to *Cystolepiota* Singer (1951). After examining many collections of „*Lepiota*“ I can not accept this concept for there are so many species with intermediate or overlapping characters (e. g. spurred spores!) that the conclusive delimitation of subgenera or sections is premature at best. However, I have to emphasize that, among the many species of *Lepiota*, the echinate species related to *L. aspera* (FR.) and the typical members of *Cystolepiota* are well defined and independent units indeed which both merit generic rank.

3. *Lepiota disseminata* HORAK, spec. nov. — Fig. 3

Pileo —7 mm, convexo dein subcampanulato, pallido, pruinato granulis brunneis minutisve. Lamellis liberis, albidoargillaceis. Stipite —15 × —0,5 mm, cylindraceo, albido, basim versus rosaceo, subpruinoso, rhizoideis albis instructo. Sporis 3.5—4 × 1.5—2 μm, subcalcaratis. Cheilocystidiis clavatis vel lageniformibus. Hyphis fibulatis. Ad terram vel lignum putridum. Nova Guinea. Typus, ZT, 71/141.

Pileus —7 mm, hemispheric or convex becoming subcampanulate or umbonate-expanded; whitish or cinnamon, densely covered with (concentrically arranged) minute, brown, granular dots from universal

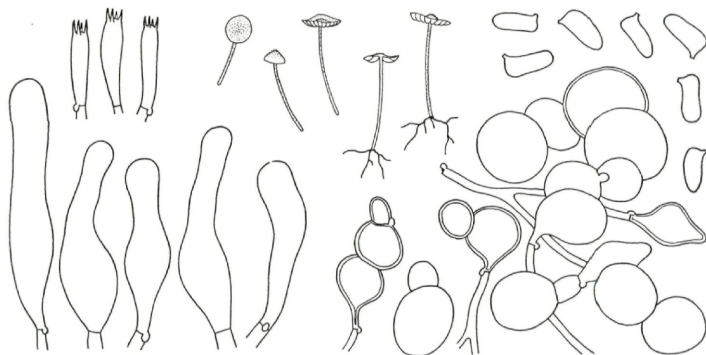


Fig. 3: *Lepiota disseminata* HORAK (type): carpophores, spores, basidia, cheilocystidia, cuticle (veil remnants)

veil; dry, margin not striate, fragile, any persistent veil remnants on margin absent. Lamellae (L 8—12, —5) crowded, free, ventricose, up to 1.5 mm wide; white turning pale argillaceous, white edge fimbriate. Stipe 10—15 × —0.5 mm, cylindric, equal, slender; whitish at apex, pale red-brown towards base, conspicuously pruinose, veil remnants absent; dry, solid, with white branched rhizomorphs occasionally interconnected, single, rarely cespitose, but always in dense groups. Context thin, whitish. Odour and taste not distinctive. Chemical reactions unknown. Spore print white.

Spores 3.5—4 × 1.5—2 μm, indistinctly spurred, subcylindric, hyaline, weakly dextrinoid, smooth, membrane thin-walled. Basidia 12—16 × 3—4 μm, 4-spored. Cheilocystidia 25—45 × 5—10 μm, subclavate to lageniform, hyaline, membrane thin-walled. Pleurocystidia absent. Caulocystidia polymorphic, cylindric, subclavate or subfusoid, often with brown (KOH) membranes, 20—70 ×

5–14  $\mu\text{m}$ , rather scattered. Cuticle (universal veil) composed of globose, subglobose or fusoid inflated cells (10–30  $\mu\text{m}$  diam.) with brown, thick-walled membrane, smooth. Clamp connections numerous.

Habitat. — On soil among litter or on rotten wood in fagaceous forests. — Papua New Guinea.

Material. — Papua New Guinea: Morobe district, Bulolo, Heads Hump, 1200 m, 18. X. 1971, HORAK (ZT, 71/141, holotype).

Remarks. — This species is related to *Lepiota hetieri* BOUDIER (1902) which also has the same small, spurred spores. However, the two taxa are well separated by several macroscopic characters.

The granular veil remnants on the pileal surface of this striking *Lepiota* consist of loose or connected sphaerozysts with brown and often thick-walled membranes and therefore this species traditionally has to key out in sect. Micaceae LANGE (1935) or in sect. Echinatae FAYOD (1889). Supposed in a taxonomic concept of *Lepiota* preference is given to the shape of the spores thus *L. disseminata* evidently belongs to sect. Stenosporae (LANGE) KÜHNER (1936). If the combination of several characters, however, is taken into consideration then this species can not be successfully referred to one of the described infra-generic sections or genera related to *Lepiota*.

As a rule carpophores of *Lepiota* are found single or in small groups at most. *Lepiota disseminata*, as its specific name already says, occurs in dense herds of numerous specimens. In the field, therefore, this species can be taken for *Morobia rhizomorphica* HORAK (1979: 205). The two agarics do not only resemble concerning shape, size and colours of the carpophores but share also the same biotop in fagaceous forests of Papua New Guinea.

Owing to the microscopic data reported for *Lepiota lentiginosa* PEGLER (1977: 361) from Uganda (Africa) this species could be expected to have a rather close relationship to *L. disseminata*. The two fungi, however, are distinctly separated by the shape and size of the carpophores.

#### 4. *Lepiota squamatula* HORAK, spec. nov. — Fig. 4

Pileo — 40 mm, campanulato vel umbonato-plano, dilute aurantiobrunneo, squamulis concoloribus vel obscurioribus densissime instructo. Lamellis liberis, albis. Stipite — 45 × 3 mm, cylindrico, albo, infra cortina fibrillosa albaque zonis et squamis aurantiobrunneis irregulariter oblecto. Sporibus 8–9 × 2.5–3.5  $\mu\text{m}$ , calcaratis. Cheilocystidiis clavatis. Epicute ex hyphis cylindraceutis trichodermium formantibus, pigmento plasmatice impletis, fibulatis. Ad terram in silvis. Nova Guinea. Typus, ZT, 62/692.

Pileus 20–40 mm, convex soon becoming broadly umbonate or campanulate; pale orange-brown, entirely covered with small, appressed concolorous or darker, floccose squamules and fibrils, fibrillose towards margin in aged specimens; dry, margin not striate, with fibrillose,

white, subsistent patches and lumps from the veil. Lamellae very crowded, free, up to 4 mm wide; white, concolorous edge even. Stipe 30–45 × 2–3 mm, cylindric, equal, slender; white; innately fibrillose at apex, fibrillose to submembranaceous; white, persistent cortina, towards base with several orange-brown, appressed, fibrillose zones and subannular belts of the veil; dry, with white branched

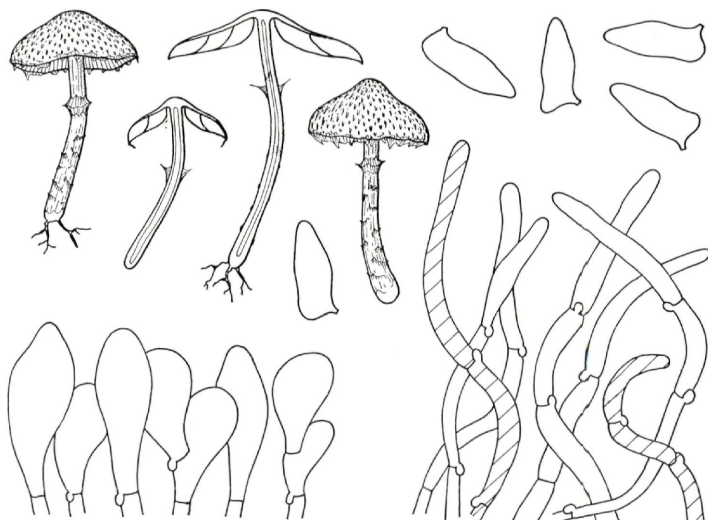


Fig. 4. *Lepiota squamatula* HORÁK (type): carpophores, spores, cheilocystidia, cuticle

rhizomorphs, fistulose or hollow, single, in groups. Context white in pileus, orange-brown in base of stipe. Odour sourish, like squashed grass. Spore print white.

Spores 8–9 × 2.5–3.5 μm, spurred, hyaline, dextrinoid, membrane thin-walled. Basidia 17–22 × 6–7 μm, 4-spored. Cheilocystidia 15–30 × 7–11 μm, clavate to subfusoid, hyaline, membrane thin-walled, forming dense seam on edge. Pleuro- and caulocystidia none. Cuticle of erect, cylindric hyphae (6–10 μm diam.), not forming a palisade, with yellow or brown, plasmatic pigment. Clamp connections present.



Habitat. — On soil in forests, dominated by fagaceous trees (*Lithocarpus* spp.). — Papua New Guinea.

Material. — Papua New Guinea: Eastern Highlands, Kassem Pass, 1900 m, 5. XII. 1972, HORAK (ZT, 72/692, holotype).

Remarks. — The most distinctive character of this species is the peculiar structure of the pileocutis which is composed of cylindric, interwoven hyphae forming a cutis or trichoderm. Differentiated terminal cells are absent.



Fig. 5. *Lepiota insimulata* HORAK (type): carpophores, spores, basidia, cheilocystidia, cuticle

5. *Lepiota insimulata* HORAK, spec. nov. — Fig. 5

Pileo — 15 mm, papillato dein umbonato-plano, pallide brunneo, squamulis concoloribus concentric obiecto. Lamellis liberis, cremis vel dilute argillaceis. Stipite — 40 × 2.5 mm, cylindrico, saepe attenuato apicem versus, albido, cortina membranosa albaque subsistententer instructo. Sporis 4,5–5 × 2–2,5 μm, calcaratis. Cheilocystidiis clavato-versiculosis. Epicute ex cellulis clavatis epithelium formantibus, inerustatis, fibulatis. Ad frustula Araucariae. Nova Guinea. Typus, ZT, 71/295.

Pileus 10–15 mm, conic becoming convex or umbonate-expanded; pale brown in smooth to minutely tomentose centre, towards margin with concolorous, ± concentrically arranged, small squamules and fibrils, whitish near not striate margin; dry, veil remnants none. Lamellae (L 18–26, –3) crowded, free, up to 2 mm wide; white turning pale cinnamon or argillaceous in mature specimens, white edge even. Stipe 20–40 × 1.5–2.5 mm, cylindric, equal or

slightly subclavate, slender; white, with pale brown tinge in aged carpophores; fibrillose, annulus membranous, subpersistent, submobile, white with brown margin, often deteriorated or attached to the margin of the pileus; dry, fistulose, rhizomorphs absent, single in groups. Context white. Odour not distinctive or sourish. Spore print white.

Spores  $4.5-5 \times 2-2.5 \mu\text{m}$ , spurred, hyaline, weakly dextrinoid, smooth, membrane thin-walled. Basidia  $18-21 \times 5 \mu\text{m}$ , 4-spored. Cheilocystidia  $18-32 \times 8-12 \mu\text{m}$ , clavate to vesiculose, hyaline, membrane thin-walled, pigment none. Pleurocystidia absent. Cuticle an epithelium of clavate to vesiculose cells ( $20-40 \times 10-18 \mu\text{m}$ ), membrane thin-walled, hyaline, encrusted with pale brown (KOH) pigment. Clamp connections present.

Habitat. — On soil among litter of *Araucaria cunninghamii*. — Papua New Guinea.

Material. — Papua New Guinea: Morobe district, Bulolo, Manki, 1200 m, 15. XI. 1971, HORAK (ZT, 71/295, holotype).

Remarks. — Undoubtedly *L. insimulata* is a close relative of *L. cristata* (FR.) QUÉLET, a very common fungus in Eurasia and North America. The two Australian records of *L. cristata* are either erroneous (ABERDEEN, 1962: 131) or still need critical re-examination (CLELAND, 1934: 55).

#### 6. *Lepiota fraterna* HORAK, spec. nov. — Fig. 6

Pileo — 30 mm, convexo dein umbonato-plano, marginem versus concentric squamuloso, rufo-brunneo vel castaneo. Lamellis liberis, albis dein apricosis, fimbriatis. Stipite —  $45 \times 3$  mm, cylindrico vel subclavato, apricoso, ad basim carneo-brunnescenti, anulo membranaceo rufo-brunneo instructo, infra squamis zonisque castaneis partim obtecto. Sporis  $5.5-6.5 \times 2-4.5 \mu\text{m}$ , calcaratis vel irregulariter rhomboideis. Cheilocystidiis vesiculosis. Epicute ex cellulis clavatis epithelium formantibus, incrustatis, fibulatis. Ad humum in silvis. Nova Guinea. Typus, ZT, 72/659.

Pileus 15–30 mm, hemispheric to convex at first, becoming campanulate or plane with obtuse umbo; surface red-brown to chest nut brown, disc remaining smooth or minutely tomentose but towards white, fibrillose-subrimose margin disrupting into red-brown, concentrically arranged, coarse squamules becoming smaller and more fibrillose near margin; dry, margin often striate-plicate in aged carpophores, veil remnants absent. Lamellae crowded, free, ventricose, up to 3 mm wide; white turning pale apricot in mature specimens, white edge fimbriate. Stipe 25–45 × 2–3 mm, cylindric, equal or attenuated towards apex, slender; pale orange at apex, towards base with distinct, pale red-brown tinge; innately fibrillose above persistent, membranous, ascendent, reddish brown annulus, fibrillose below ring and beset with several appressed, fibrillose or squamulose, reddish brown patches or subannular zones; dry, fragile, fistulose,

often with white, branched rhizomorphs, single in groups. Context white. Odour sourish. Spore print white.

Spores  $5.5-6.5 \times 2 \mu\text{m}$  (in lateral view),  $-4.5 \mu\text{m}$  (in dorso-ventral view), spurred, in dorso-ventral view with two additional knobs, hyaline, subdextrinoid, smooth, membrane thin-walled. Basidia  $16-20 \times 5-7 \mu\text{m}$ , 4-spored. Cheilocystidia  $12-25 \times 8-12 \mu\text{m}$ , clavate to vesiculose, hyaline, membrane thin-walled, pigment absent. Pleurocystidia none. Cuticle a palisade of clavate

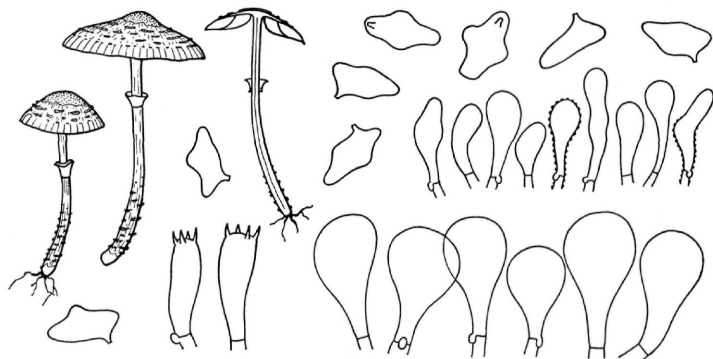


Fig. 6. *Lepiota fraterna* HORAK (type): carpophores, spores, basidia, cheilocystidia, cuticle

cells ( $18-40 \times 6-10 \mu\text{m}$ ), membrane thin-walled, encrusted with brown (KOH) pigment. Clamp connections numerous.

Habitat. — On soil in (rain) forests, dominated by *Castanopsis acuminatissima* and *Lithocarpus* spp. (Fagaceae). — Papua New Guinea.

Material. — Papua New Guinea: Morobe district, Bulolo, Watut, 1000 m, 21. XI. 1972, HORAK (ZT, 72/659, holotype).

Remarks. — The red-brown colour of the pileus and the membranous, subsistent annulus of the present species are recalling both *L. insimulata* and *L. cristata* but *L. fraterna* is readily separated by the peculiar shape of the spores (compare also *L. aurora*).

7. *Lepiota bichroma* HORAK, spec. nov. — Fig. 7

Pileo  $-30 \text{ mm}$ , campanulato vel umbonato-plano, pallide aurantioflavo, squamis velutinis violaceis dense instructo. Lamellis liberis, pallide aurantioflavis. Stipite  $-40 \times -2 \text{ mm}$ , cylindrico, aurantiaco, squamis vel zonis violaceis irregulariter obtecto, cortina nulla. Sporibus  $9-12 \times 3-4 \mu\text{m}$ , calcaratis. Cheilo-

cystidiis clavato-vesiculososis. Epicute ex cellulis clavato-lageniformibus palisadam formantibus, pigmento plasmatico impletis, fibulatis. Ad terram in silvis. Nova Guinea. Typus, ZT, 73/146.

Pileus 20–30 mm, hemispheric or convex at first becoming broadly campanulate or obtusely umbonate-expanded, umbonate centre also depressed in aged carpophores; pale yellow-orange, disc

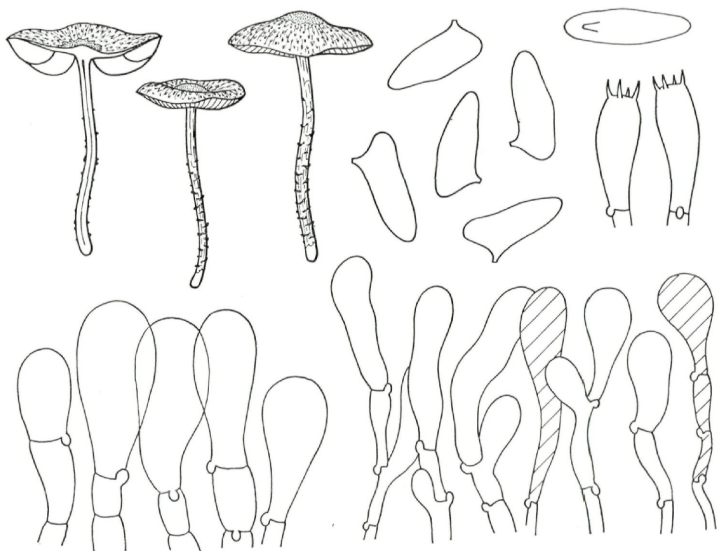


Fig. 7. *Lepiota bichroma* HORÁK (type): carpophores, spores, basidia, cheilocystidia, cuticle

deep lilac, minutely tomentose or velutinous, towards margin entirely covered with lilac, minute, appressed squamules and fibrils; dry, margin not striate, veil remnants absent. *Lamellae* crowded, free, ventricose, up to 4 mm wide; cream to pale yellow turning pale orange with age, concolorous edge even. *Stipe* 20–40 × 1.5–2 mm, cylindric, equal, slender; pallid or pale orange; almost completely beset with lilac, wart-like or subannular, fibrillose, persistent squamules or zones, cortina absent; dry, fistulose, with white branched rhizoids at base, single in groups. *Context* white in pileus, orange-brown in cortex of



stipe. Odour sourish. Chemical reactions on pileus: KOH — yellow (green). Spore print white.

Spores  $9-12 \times 3-4 \mu\text{m}$ , spurred, hyaline, dextrinoid, smooth, membrane thin-walled. Basidia  $18-22 \times 7-8 \mu\text{m}$ , 4-spored. Cheilocystidia  $15-45 \times 10-20 \mu\text{m}$ , clavate to vesiculose, membrane hyaline, thin-walled, pigment absent. Pleurocystidia none. Cuticle a palisade of clavate to subfusoid cells ( $30-80 \times 5-16 \mu\text{m}$ ), membrane thin-walled, hyaline, pale brown (KOH) encrusting and plasmatic pigment present. Clamp connections numerous.

Habitat. — On soil in (rain) forests dominated by *Castanopsis acuminatissima* and *Lithocarpus* spp. (Fagaceae). — Papua New Guinea.

Material. — Papua New Guinea: Morobe district, Bulolo, Watut, 1250 m, 3. IV. 1973, HORAK (ZT, 73/146, holotype); Bulolo, Watut, 1200 m, 20. III. 1972, HORAK (ZT, 72/253).

Remarks. — According to PEGLER (1972) there is only one Ceylonese *Lepiota* viz. *L. erythrosticta* (BERK. & BR.) SACC. which appears to be related to this striking agaric. The two species, however, are well distinguished by several macroscopic and microscopic characters such as size and shape of the spores and the cuticular cells.

The specific features of *L. subcitrifhylla* HONGO (1956: 146) indicate also a rather close relationship to *L. bichroma* HORAK. The Japanese agaric, however, differs in the absence of lilac squamules and veil remnants on pileus and stipe and smaller spores. According to HONGO (1956: l. c.) the context and the lamellae stain immediately blue upon bruising. No such remarkable discoloration is known yet from any other species of *Lepiota* with spurred spores.

#### 8. *Lepiota aurora* HORAK, spec. nov. — Fig. 8

Pileo — 20 mm, conico-convexo dein umbonato-plano, aurantiaco vel vulpino, squamis minutis dense obtecto. Lamellis liberis, cremeis. Stipite —  $25 \times 1.5$  mm, cylindrico, pileo concolori vel pallidiori, zonis vel squamis concoloribus irregulariter instructo, cortina nulla. Sporis  $6-8.5 \times 3-4.5 \mu\text{m}$ , calcaratis. Cheilocystidiis cylindraceo-subclavatis. Epicute ex cellulis clavatis epithelium formantibus, interdum membrana incrassata instructis, fibulatis. Ad lignum putridum et ad terram in silvis. Nova Guinea. Typus, ZT, 72/223.

Pileus 10–20 mm, hemispheric or convex becoming plane with obtuse umbo or subcampanulate; conspicuously orange or red-orange; entirely covered with small, concolorous, appressed squamules and fibrils, towards not striate margin  $\pm$  concentrically arranged; dry, veil remnants absent. Lamellae crowded, free, ventricose, up to 3 mm wide; whitish to cream or very pale argillaceous, edge even, concolorous. Stipe  $15-25 \times 1-1.5$  mm, cylindric, equal, slender; pale orange; innately fibrillose, towards base with few, scattered, red-orange, appressed squamules or short annular zones, cortina absent;

dry, fistulose, with branched, white rhizoids at base, single in groups. Context white in pileus, pale orange-brown in stipe. Odour sourish. Chemical reactions on pileus: KOH — negative. Spore print white.

Spores  $6-8.5 \times 3-4.5 \mu\text{m}$ , spurred, in dorsal-ventral view with two additional obtuse knobs, hyaline, dextrinoid, smooth, membrane thin-walled. Basidia  $15-20 \times 5-7 \mu\text{m}$ , 4-spored. Cheilocystidia  $25-45 \times 4-7 \mu\text{m}$ , cylindric to subclavate, hyaline, membrane thin-walled, pigment absent, forming dense seam on edge. Pleurocystidia

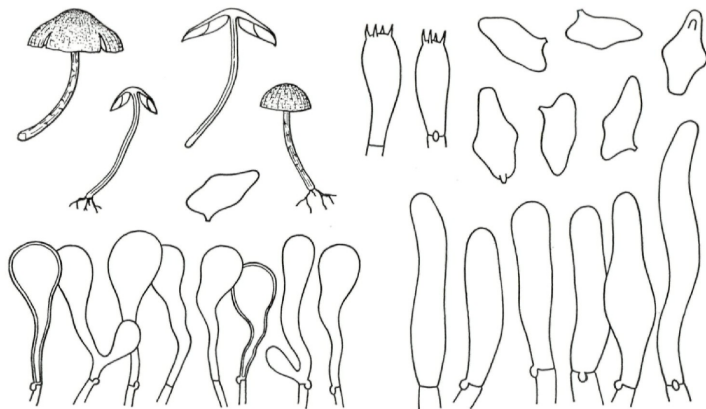


Fig. 8. *Lepiota aurora* HORAK (type): carpophores, spores, basidia, cheilocystidia, cuticle

absent. Cuticle a palisade of erect, clavate cells ( $30-80 \times 8-20 \mu\text{m}$ ), membrane yellowish (KOH), thin- or distinctly thick-walled (up to  $1 \mu\text{m}$  diam.). Clamp connections present.

Habitat. — On rotten wood or on soil among litter, in forests under fagaceous trees (*Castanopsis* spp., *Lithocarpus* spp.). — Papua New Guinea.

Material. — Papua New Guinea: Morobe district, Bulolo, Manki, 1300 m, 15. III. 1972, HORAK (ZT, 72/223, holotype); Bulolo, Heads Hump, 1200 m, 15. X. 1971, HORAK (ZT, 71/126).

Remarks. — This delicate, orange to red-orange species is characterized not only by the conspicuous colour but also by its pileocutis (composed of clavate cells with slightly thickened membranes) and the peculiar spurred spores with two additional knobs when observed in dorso-ventral position. These features put *L. aurora* in

close relationship to *L. pyrhaes* (BERK. & BR.) SACC. reported from Sri Lanka (PEGLER, 1972: 167).

9. *Lepiota alopochroa* (BERKELEY & BROOME) SACCARDO

— Fig. 15, E

Syll. Fung. 5: 63

Bas. *Agaricus alopochrous* BERK. & BR. 1871: J. Linn. Soc., Bot. 11: 510.

Syn. *Lepiotula alopochroa* (BERK. & BR.) HORAK 1980b: New Zealand J.

Bot. 18: 185.

Habitat. — On soil in coastal, broad-leaved forests. — New Zealand.

Material. — New Zealand: South Island: Nelson: Kaihoka Reserve, 11. V. 1968, HORAK (PDD, 27139, holotype); Same locality, 10. V. 1968, HORAK (ZT, 68/419).

Remarks. — The type material of this Ceylonese *Lepiota* was reexamined by PEGLER (1972: 168) and the New Zealand collections agree sufficiently well to be considered the same species.

*L. alopochroa* is characterized by the brilliant red-orange or ferruginous colours on pileus and stipe. It has these features in common with three other representatives of *Lepiota* viz. *L. fulvella* REA (1918), *L. castanea* QUÉL. (1880) and *L. infelix* HORAK. However, *L. alopochroa* is well separated from these taxa either by smaller spores or different structure and pigmentation of the pileal cuticle (cp. BABOS, 1964: 69).

Macroscopically *L. alopochroa* is also similar to *L. pyrhaes* (BERK. & BR.) SACC. (1887) but the spores of the latter species are distinctly smaller (PEGLER, 1972: 167).

10. *Lepiota purpurata* (STEVENSON) HORAK, comb. nov.

— Fig. 15, F

Bas. *Pluteus purpuratus* STEVENSON 1962: Kew Bull. 16: 73.

Syn. *Lepiotula purpurata* (STEVENSON) HORAK 1971: New Zealand J. Bot.

9: 448.

Illustrations. — STEVENSON (1962: l. c.); HORAK (1971; 1980b).

Habitat. — On soil among litter in forests. — New Zealand.

Material. — New Zealand: Maungatua, 18. IV. 1953, STEVENSON-CONE, 881 (K, holotype).

Remarks. — The pink and free lamellae are probably the reason why STEVENSON identified this species as a member of *Pluteus* FR. The spores are, however, distinctly dextrinoid and slightly spurred. The basidia are 4-spored, 16–20 × 4–5 μm. The type material is in rather bad condition and therefore the structure of the cuticle could not be fully revived. By all means cellular elements are absent, and the cylindrical hyphae observed are encrusted with grey (KOH) pigment. Clamp connections not observed.

11. *Lepiota erythrostickta* (BERKELEY & BROOME) SACCARDO 1887  
— Fig. 9A, B

Syll. Fung. 5: 62

Bas. *Agaricus erythrosticktus* BERKELEY & BROOME 1871: J. Linn. Soc., Bot.

11: 508.

Illustration. — PEGLER (1972: 166).

Description of the Papua New Guinean material:

Pileus 15—25 mm, hemispheric to convex becoming obtusely umbonate or plane and expanded; deep purple or wine red turning pink with age; disc minutely tomentose or velutinous, disrupting into very small, appressed, fibrillose squamules towards not striate, white margin; dry, conspicuous veil remnants along margin absent.

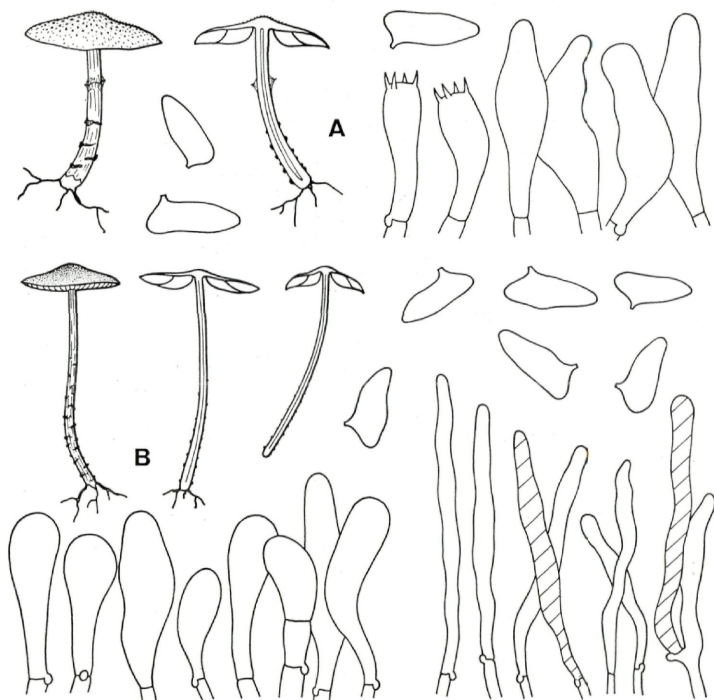


Fig. 9. *Lepiota erythrostickta* (BERK. & BR.) SACC.: A (ZT 73/144): carpophores, spores, basidia, cheilocystidia. — B (ZT 73/71): carpophores, spores, cheilocystidia, cuticle



Lamellae (L 12—16, —3) crowded, free, ventricose, up to 3 mm wide; white, cream to cinnamon, occasionally with pink tinge, white edge fimbriate. Stipe 20—40×1.5—2.5 mm, cylindric, equal, slender; white with distinct pink or purple tint; fibrillose, sometimes with fugaceous, fibrillose, white cortina in very young specimens, towards base with purple, wart-like squamules or scattered, subannular belts from the veil; dry, fistulose, villous base white, often with white, branched rhizomorphs, single in groups. Context pale purple or pink in pileus and stipe. Odour sourish. Chemical reactions on pileus: KOH — yellow to orange. Spore print white.

Spores 6.5—9×2.5—4  $\mu\text{m}$ , spurred, hyaline, dextrinoid, smooth, membrane thin-walled. Basidia 18—27×6—7  $\mu\text{m}$ , 4-spored. Cheilocystidia 15—40×6—14  $\mu\text{m}$ , vesiculose, clavate or subfusoid, membrane hyaline, thin-walled, pigment absent. Pleurocystidia none. Cuticle a palisade of erect, cylindric to subfusoid cells (40—120×5—12  $\mu\text{m}$ ), membrane thin-walled, hyaline, with yellow to brown (KOH) plasmatic pigment. Clamp connections present.

Habitat. — On soil in fagaceous forests, dominated by *Castanopsis acuminatissima* and *Lithocarpus* spp. — Papua New Guinea.

Material. — Papua New Guinea: Western Highlands, Mt. Hagen, Baiyer River, Trauna Valley, 1400 m, HORAK (ZT, 73/71); Morobe district, Bulolo, Susu, 1100 m, 15. X. 1971, HORAK (ZT, 71/125); Bulolo, Susu, 1100 m, 16. III. 1972, HORAK (ZT, 72/230); Bulolo, Manki, 1200 m, 24. III. 1972, HORAK (ZT, 72/294); Bulolo, Watut, 1250 m, 3. IV. 1973, HORAK (ZT, 73/144).

Remarks. — In Papua New Guinea four collections of this beautiful species have been gathered. The very well developed and young material ZT 73/144 (fig. 9A) corresponds well with the illustrations of the Ceylonese type collection (PEGLER, 1972: 166).

In addition to PEGLER's analysis *Lepiota erythrosticta* is characterized by several hitherto unnoticed features: (1) the purple to wine red colour on pileus and stipe changes (with age and/or drying) to a vivid pink; (2) the purple or red cuticle and the concolorous veil remnants on the stipe turn yellow with KOH; (3) the white to pale pink, fibrillose cortina is observed only on young carpophores and is collapsed in aged material; (4) the shape of the cheilocystidia varies from vesiculose to subfusoid; and (5) clamp connections are present on septa of the hyphae.

DENNIS (1952: 485) and subsequently PEGLER (1972: 168) report the occurrence of *L. erythrosticta* (BERK. & BR.) from Trinidad, West Indies. To my opinion the description and the illustrations of this record do not fit *L. erythrosticta* proper; under these circumstances the area of distribution of this Ceylonese species does not extend to the Caribbean region but is restricted to Indomalayan and Australasian provinces.

12. *Lepiota castanea* QUÉLET 1880 — Fig. 10

Ass. franc. Avancem. Sci., 1

Illustrations. — QUÉLET (1880: l. c.); KÜHNER (1937: Bull. Soc. Myc. France 53: Atl. 74, 2).

Description of the Papua New Guinean material:

Pileus 20—30 mm, convex to broadly campanulate becoming umbonate-expanded; surface conspicuously red-orange or orange-

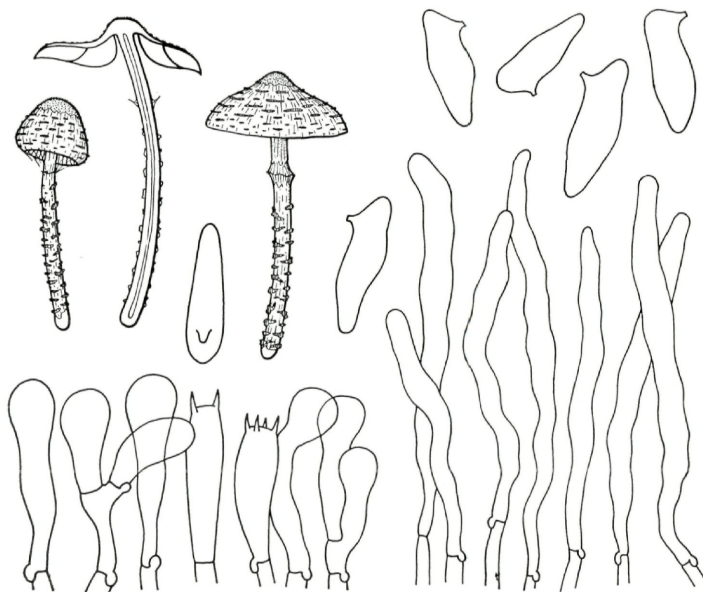


Fig. 10. *Lepiota castanea* (FR.) QUÉL. (ZT 71/452): carpophores, spores, basidia, cheilocystidia, cuticle

brown; centre smooth, minutely tomentose or subsquamulose, towards margin breaking up in concolorous, concentric, small squamules or fibrils; dry, margin not striate, veil remnants absent. Lamellae crowded, free, ventricose, up to 4 mm wide; white to cream at first turning pale argillaceous with yellow tint, white edge fimbriate. Stipe 30—50 × 3—4 mm, cylindric, equal, slender; white; fibrillose, in young specimens with distinct but evanescent, white, fibrillose cortina, below with numerous, red-orange or orange-brown, irregular,

subannular zones and squamules (especially near base); dry, fistulose, rhizomorphs absent, single in groups. Context white, orange-brown beneath cuticle of pileus. Odour sourish. Chemical reactions on pileus: KOH, HCl and  $\text{NH}_3$  — negative. Spore print white.

Spores  $10-13 \times 3.5-4 \mu\text{m}$ , spurred, hyaline, dextrinoid, smooth, membrane thin-walled. Basidia  $17-26 \times 7-8 \mu\text{m}$ , 4-spored. Cheilocystidia  $20-35 \times 6-10 \mu\text{m}$ , clavate, hyaline, pigment absent, membrane thin-walled, forming dense seam on edge. Pleuro- and caulocystidia none. Cuticle a palisade of erect, cylindric to subfusoid cells ( $40-140 \times 6-12 \mu\text{m}$ ), membrane thin-walled, brown (KOH). Clamp connections present.

Habitat. — On soil among litter in forests (pure stand of *Arucaria cunninghamii*). — Papua New Guinea; northern hemisphere.

Material. — Papua New Guinea: Morobe district, Bulolo, Manki, 1300 m, 20. XII. 1971, HORAK (ZT, 71/452). — Italy: Trentino, in herbidis al Castellar, IX. 1888, BRESADOLA (S, holotype of *Lepiota ignicolor* BRES.).

Remarks. — The material from Papua New Guinea agrees in all details with collections of European origin (type locality: France). *Lepiota castanea* QUÉL. is a rather common species whose area of distribution reaches also the Far East of Eurasia (Eastern Siberia: VASSILIEVA [1973: 177]; Japan [HONGO, 1959: 76]).

The orange to ferruginous colour of the pileus and the concolorous veil remnants on the stipe varies very much according to the age of the fungus and the ecologic condition of the locality where it was gathered from. However, even weathered specimens are readily identified by the virtue of the following characters; size and shape of spores, cheilocystidia and cuticular cells and localisation of the pigment.

After examining the type of *Lepiota ignicolor* BRESADOLA (1927: 39, 2) it is obvious that KÜHNER & ROMAGNESI's (1953: 398) interpretation of this species is erroneous. *L. ignicolor* BRES. is a well defined species characterized by much smaller spores ( $6.5-8.5 \times 3-4 \mu\text{m}$ ). Compare remarks under *L. infelix* HORAK.

### 13. *Lepiota infelix* HORAK, spec. nov. — Fig. 11

Pileo — 35 mm, conico-convexo dein umbonato-plano, flavido, squamulis minutis fulvis castaneisve dense obtecto. Lamellis liberis, luteis, albo-fimbriatis. Stipite —  $55 \times 3$  mm, cylindrico, flavido, basim versus squamis zonisque brunneis irregulariter obtecto, cortina nulla. Sporis  $7.5-9 \times 3-3.5 \mu\text{m}$ , calcaratis. Cheilocystidiis clavato-cylindraceis. Epicute ex cellulis fusoido-cylindraceis palisadam formantibus, fibulatis, raro defibulatis. Ad teram in silvis. Nova Guinea. Typus, ZT, 73/157.

Pileus 20—35 mm, hemispheric or convex becoming campanulate or obtusely umbonate-expanded; orange or red-brown in velutinous or minutely squamulose centre, towards pale yellow margin breaking

up in very small, appressed, irregularly distributed squamules and fibrils, turning orange upon bruising; dry margin not striate, in young specimens with brown subappendiculate veil remnants. Lamellae very crowded, free, ventricose, up to 4 mm wide; yellow turning ochre-orange with age, orange upon bruising; white edge fimbriate. Stipe 30–55 × 2–3 mm, cylindrical, equal, slender; pale yellow in upper portion, towards base pale orange-brown; innately fibrillose,

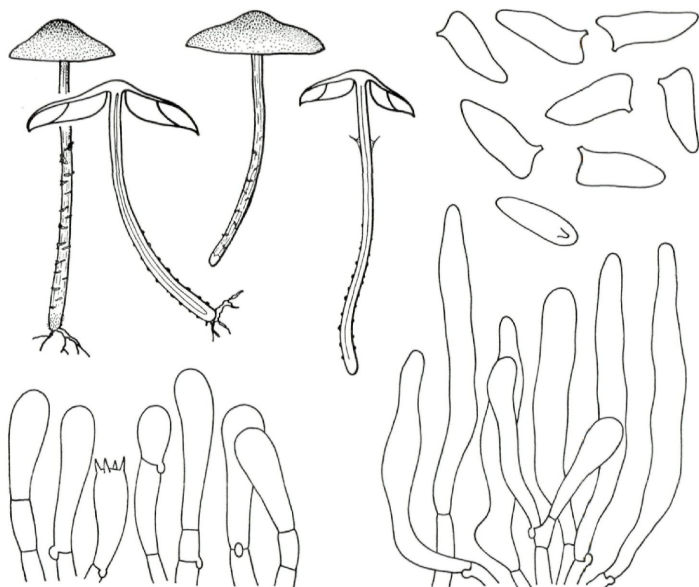


Fig. 11. *Lepiota infelix* HORAK (type): carpophores, spores, basidium, cheilocystidia, cuticle

distinct fibrillose cortina absent, towards base with brown to red-brown, wart-like squamules or subannular irregular zones from the veil; dry, hollow to fistulose, fragile, with white to pale brown, branched rhizomorphs, single in groups. Context orange (brown) in cortex of stipe. Odour sourish. Chemical reactions on pileus: KOH — yellow. Spore print white.

Spores 7.5–9 × 3–3.5 μm, spurred, hyaline, dextrinoid, smooth, membrane thin-walled. Basidia 18–23 × 6–7 μm, 4-spored. Cheilo-



cystidia 15—35×4—8  $\mu\text{m}$ , cylindric to subclavate, hyaline, membrane thin-walled, inconspicuous. Pleurocystidia none. Cuticle a palisade of erect, cylindric to subfusoid cells (40—140×6—15  $\mu\text{m}$ ), membrane brown (KOH), thin-walled. Clamp connections numerous.

Habitat. — On soil in (rain) forests under *Castanopsis acuminatissima* and *Lithocarpus* spp. (Fagaceae). — Papua New Guinea.

Material. — Papua New Guinea: Morobe district, Bulolo, Heads Hump, 1200 m, 29. II. 1972, HORÁK (ZT, 72/157, holotype).

Remarks. — Dried material of this species is readily recognized by the fact that the yellow colour on stipe and pileus is changing to a conspicuous green-olive.

*Lepiota infelix* HORÁK is undoubtedly closely related to *L. ignicolor* BRESADOLA, recorded only once near Trento, Italy. The two taxa are separated by features such as size and shape of the carpophores, paler colours and more slender spores in the Papua New Guinean species. The type material of *L. ignicolor* BRES. (cp. remarks under *L. castanea* QUÉL., nr. 12) is in fragmentary condition and therefore it was impossible to revive basidia, cheilocystidia and cuticular cells whose morphology must be known for the delimitation of the species.

*L. infelix* HORÁK is also close to *L. alopochroa* (BERK. & BR.) SACC. [recorded from Sri Lanka (type) and New Zealand (cp. nr. 9)] and the rare European *L. fulvella* REA.

#### 14. *Lepiota luteocastanea* HORÁK spec. nov. — Fig. 12

Pileo — 40 mm, campanulato vel umbonato-plano, castaneo vel vinoso, squamis concentricis concoloribus marginem flavam versus obtecto. Lamellis liberis, aureis dein pallide luteoargillaceis. Stipite — 65×—3 mm, cylindraceo, apicaliter luteo, basim versus castaneo, annulo submembranaceo rubrobrunneo instructo, infra zonis concoloribus inconspicuis irregulariter ornato. Sporis 7—9.5×3—3.5  $\mu\text{m}$ , calcaratis. Cheilocystidiis lageniformibus. Epicute ex cellulis subcylindraceis palisadam formantibus, pigmento plasmaticeo impletis, fibulatis. Ad terram in silvis mixtis. Nova Guinea. Typus, ZT, 72/447.

Pileus 20—40 mm convex becoming broadly campanulate to umbonate-expanded; red-brown to wine brown (with distinct purple tinge): disc velutinous or minutely tomentose-floccose towards the conspicuously yellow margin disrupted into  $\pm$  concentric concolorous, fibrillose, small bands or squamules; dry, white, fibrillose veil remnants along margin in very young specimens. Lamellae (L 20—30, —3) very crowded, free, ventricose, up to 4 mm wide; golden yellow, turning yellow or pale yellow-brown with age, white edge fimbriate. Stipe 30—65×2—3 mm, cylindric, equal, slender; yellow at apex, changing to pale red-brown downwards; annulus ascendent, persistent, fibrillose to membranous, brown, with red-brown to wine brown margin, below with several, appressed, brown to red-brown, rather indistinct subannular zones and squamules; dry, fibrillose, often with



white, branched rhizoids, fistulose, single in groups. Context yellow in pileus, orange (brown) in cortex of stipe. Odour sourish or unpleasant, like raw potato. Chemical reactions on pileus: KOH — yellow. Spore print white.

Spores  $7-9.5 \times 3-3.5 \mu\text{m}$ , spurred, hyaline, dextrinoid, smooth, membrane thin-walled. Basidia  $20-25 \times 6-7 \mu\text{m}$ , 4-spored. Cheilo-

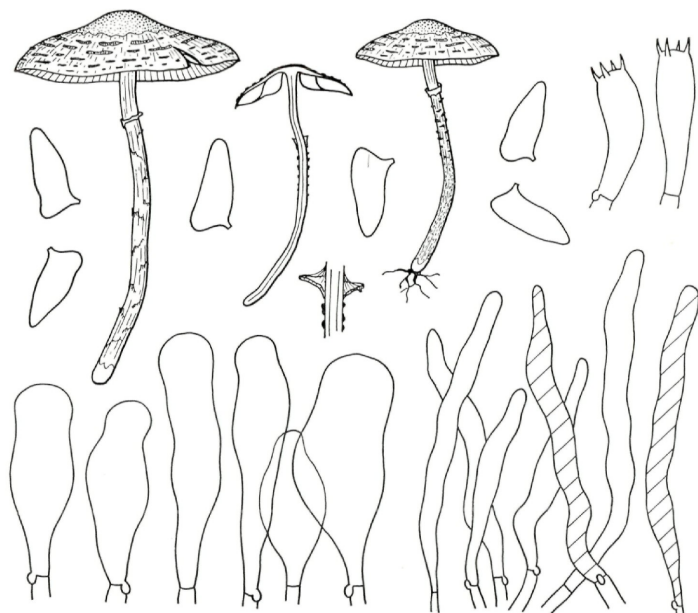


Fig. 12. *Lepiota luteocastanea* HORAK (type): carpophores, spores, basidia, cheilocystidia, cuticle

cystidia  $15-45 \times 6-15 \mu\text{m}$ , fusoid to lageniform, sometimes broadly capitate, membrane hyaline, thin-walled, pigment absent. Pleurocystidia none. Cuticle a palisade of erect cylindrical to subfusoid cells ( $40-140 \times 6-12 \mu\text{m}$ ), membrane thin-walled, hyaline, with yellow-brown (KOH) plasmatic pigment. Clamp connections present.

Habitat. — On soil in forests under broad-leaved trees (*Castanopsis acuminatissima* and *Lithocarpus* spp. — Fagaceae) and conifers (*Araucaria hunsteiniana*). — Papua New Guinea.

Material. — Papua New Guinea: Morobe district, Bulolo, Manki, 1300 m, 9. V. 1972, HORAK (ZT, 72/447, holotype); Bulolo, Manki, 1250 m, 22. X. 1971, HORAK (ZT, 71/198); Bulolo, Watut, 1200 m, 13. III. 1973, HORAK (ZT, 73/94); Wau, McAdam Memorial Park, 1300 m, 18. I. 1973, HORAK (ZT, 73/8).

Remarks. — The yellow colour on lamellae and stipe of *L. luteo-castanea* is recalling the Ceylonese *L. citrophylla* (B. & BR.) SACC. (1887). Based upon PEGLER's (1972: 165) redescription of the latter species the two taxa are readily distinguished both by the colour of pileus and the size of the fusoid-cylindric elements in the palisadic cuticle.

15. *Lepiota grangei* (EYRE) LANGE 1935 — Fig. 15, B

Fl. Agar. Danica 1: 30

Bas. *Schulzeria grangei* EYRE ap. SMITH & REA 1902: Trans. Brit. Myc. Soc. 2: 37.

Illustrations. — LANGE (1935: pl. 10, A), KÜHNER (1936: 197).

Habitat. — On soil in forests. — Eurasia, Argentina, New Zealand.

Material. — England: Swarraton, Alresford, 4. XI. 1903, W. G. SMITH (K, topotypic material). — New Zealand: North Island: Mt. Egmont National Park, Kaitake Rge., Lucy's Valley, 14. VI. 1968, HORAK (ZT, 68/541); South Island: Fjordland, Mt. Luxmore, 27. III. 1969, HORAK (ZT, 69/168). — Argentina: Tierra del Fuego, Lapataia, 14. III. 1975, HORAK (ZT, 75/102).

Remarks. — The peculiar green-black colour on pileus and stipe and the rather large, spurred spores are distinctive characters of *L. grangei* (EYRE). The material gathered in the two New Zealand localities agrees in all details with topotypic specimens from England. *Lepiota griseovirens* MAIRE (1928), another species with green-olive colours, is separated from *L. grangei* by its distinctly smaller spores.

According to HONGO (1959: 76) *L. ossaeiformispora* IMAI (1933: 43) is probably conspecific to *L. grangei* which means its area of distribution probably covers the whole Eurasian region (VASSILIEVA, 1973: 180).

The above mentioned records from New Zealand and Argentina indicate that *L. grangei* also occurs in the more temperate zones of the southern hemisphere.

16. *Lepiota calcarata* (HORAK) HORAK, comb. nov. — Fig. 15, C

Bas. *Lepiotula calcarata* HORAK 1980b: New Zealand J. Bot. 18: 186.

Illustrations. — HORAK (1980b).

Habitat. — On soil or on rotten wood in *Nothofagus* forest. — New Zealand.

Material. — New Zealand: South Island: Westcoast, S of Lake Hochstetter, 29. III. 1968, HORAK (PDD, 27141, holotype).

Remarks. — The most significant features of this species are the large, spurred spores, the fusoid-lageniform cheilocystidia and the dark brown colour on the carpophores. The combination of these three characters definitely exclude the speculation that *L. calcarata* represents a discoloured form of *L. alopochroa* (B. & BR.), *L. infelix* HORAK or some other species belonging to the complex around *L. castanea* QUÉL. For further discussion see HORAK (1980b).

*L. calcarata* shares the dark brown colour of pileus and veil remnants with the Papua New Guinean *L. crepusculata* HORAK whose microscopic data, however, are distinctly separating these two Australasian taxa.

#### 17. *Lepiota crepusculata* HORAK, spec. nov. — Fig. 13

Pileo — 45 mm, conico-convexo dein umbonato-plano, griseo-brunneo vel avellano, zonis squamisque concoloribus fibrillosis densissime obtecto. Lamellis liberis, aurantiacis dein isabellinis, albofimbriatis. Stipite — 80 × 5 mm, cylindrico, supra apricoso, infra cortina subfibrillosa zonis et squamis rubro-brunneis irregulariter obtecto. Sporis 9—11.5 × 2.5—3.5 μm, calcaratis. Cheilocystidiis clavatis. Epicute ex cellulis fusoido-cylindraceis palisadam formantibus, fibulatis. Ad terram in silvis. Nova Guinea. Typus, ZT, 71/451.

Pileus 20—45 mm, convex becoming broadly campanulate or obtusely umbonate-expanded; grey-brown to (hazel) brown; disc tomentose or velutinous, towards margin disrupting into ± concentric, fibrillose, concolorous squamules and fibrils, margin not striate, white; dry, veil remnants absent. Lamellae very crowded, free, ventricose, up to 4 mm wide; cinnamon to pale orange turning pale orange-brown with age, white edge fimbriate. Stipe 45—80 × 3.5—5 mm, cylindric, equal, slender; pale orange at apex, reddish brown towards base; entirely fibrillose, in young specimens with distinct but evanescent, white fibrillose cortina, below beset with numerous brown, wart-like squamules or subannular zones from the veil; dry, hollow, fragile, with white, branched rhizomorphs, single in groups. Context white. Odour not distinctive. Chemical reactions on pileus: KOH, HCl and NH<sub>3</sub> — negative. Spore print white.

Spores 9—11.5 × 2.5—3.5 μm, spurred, hyaline, dextrinoid, smooth membrane thin-walled. Basidia 20—24 × 7—8 μm, 4- and 2-spored. Cheilocystidia 24—40 × 10—16 μm, clavate to vesiculose, membrane hyaline, thin-walled, pigment none. Pleurocystidia absent. Cuticle a palisade of erect cylindric to subfusoid cells (50—180 × 6—14 μm), membrane pale brown (KOH), thin-walled. Clamp connections present.

Habitat. — On soil among litter in forests, dominated by *Araucaria cunninghamii*. — Papua New Guinea.

Material. — Papua New Guinea: Morobe district, Bulolo, Manki, 1400 m, 21. XII. 1971, HORAK (ZT, 71/451, holotype). — Bulolo, Watut, 1200 m, 3. IV. 1973, HORAK (ZT, 73/147).

Remarks. — This species recalls *L. tomentella* LANGE (1923: 48) a rather rare species (described from Denmark) with smaller carpophores and spores. An excellent illustration of this fungus is found in LANGE (1935: 14, D).

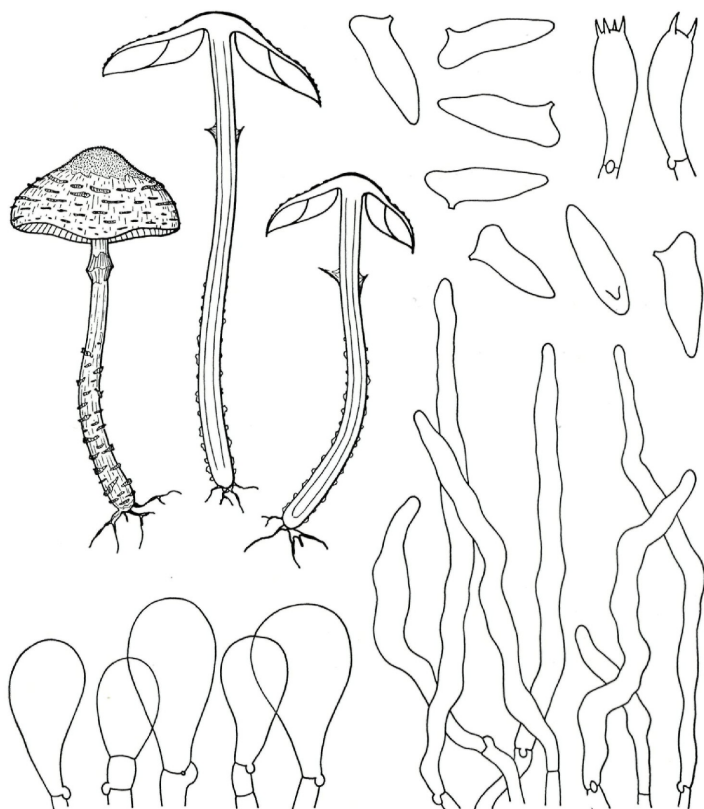


Fig. 13. *Lepiota crepusculata* HORAK (type): carpophores, spores, basidia, cheilocystidia, cuticle

18. *Lepiota adusta* (HORAK) HORAK, comb. nov. — Fig. 15, D  
Bas. *Lepiotula adusta* HORAK 1980b: New Zealand J. Bot. 18: 186.

Illustration. — HORAK (1980b: l. c.).

Habitat. — On soil among litter in coastal, mixed forests. — New Zealand.

Material. — New Zealand: South Island: Nelson, Whanganui Inlet, Mangarakau, 16. V. 1968, HORAK (PDD, 27140, holotype).

Remarks. — As pointed out in the key *L. adusta* comes macroscopically close to two other Australasian species of *Lepiota*, viz. *L. atrata* HORAK (New Caledonia) and *L. exocarpi* CLEL. (Australia). These three species are, however, well separated by their specific microscopic characters (shape-size of spores and cheilocystidia).

For further discussion compare HORAK (1980b).

19. *Lepiota exocarpi* CLELAND 1934 — Fig. 15, A

Toadstools and Mushrooms ... South Australia, 54

Illustration. — CLELAND (l. c.: 55).

Nothing can be added to the macroscopic characters.

Spores  $9.5-12 \times 3.5-4.5 \mu\text{m}$ , distinctly spurred, hyaline, dextrinoid, smooth, membrane thin-walled. Basidia  $24-30 \times 8-9 \mu\text{m}$ , 4-spored. Cheilocystidia  $30-55 \times 16-24 \mu\text{m}$ , broadly fusoid to lageniform, hyaline, membrane thin-walled. Pleurocystidia absent. Cuticle a palisade of erect cylindric-subfusoid cells, with yellow-brown (KOH) plasmatic pigment. Clamp connections not observed.

Habitat. — On soil among litter (under *Exocarpus cupressiformis*). — Australia.

Material. — Australia: South Australia: Mt. Lofty, 27. VI. 1921, CLELAND (ADW, 9552, holotype).

Remarks. — This imperfectly known species is recognized by the dark brown to black, spiny squamules both on the disc of the pileus and on the stipe below the "imperfect, distant" (?) annulus. The lamellae are cream and the colour of the context is orange beneath the cuticle and reddish brown in the stipe.

The occurrence of *Lepiota exocarpi* CLEL. is also reported from Queensland (ABERDEEN, pers. comm.).

20. *Lepiota atrata* HORAK, spec. nov. — Fig. 14

Pileo — 25 mm, campanulato dein umbonato-plano, albidulo, squamis conicis minutis atrisque dense oblecto, marginem versus fibrillis lanatis nigris instructo. Lamellis liberis, cremeis. Stipite —  $30 \times -2.5 \text{ mm}$ , cylindrico, cremeo, zonis vel squamis atris irregulariter ornato, cortina nulla. Sporis  $11-14 \times 3.5-4.5 \mu\text{m}$ , calcaratis. Cheilocystidiis subfusoidis. Epicute ex cellulis cylindraceis palisadam formantibus, pigmento plasmatico impletis, fibulatis. Ad terram in silvis. Nova Caledonia. Typus, ZT, 77/149.



Pileus 15–25 mm, hemispheric or convex soon becoming expanded with low, obtuse umbo; cream, disc densely covered with conic, spinose, black squamules, breaking up into smaller, black squamules and fibrils towards not striate margin; dry, veil remnants none. Lamellae crowded, free, up to 3 mm wide, ventricose; cream, concolorous edge subfimbriate. Stipe 15–30 × 2–2.5 mm, cylindric,

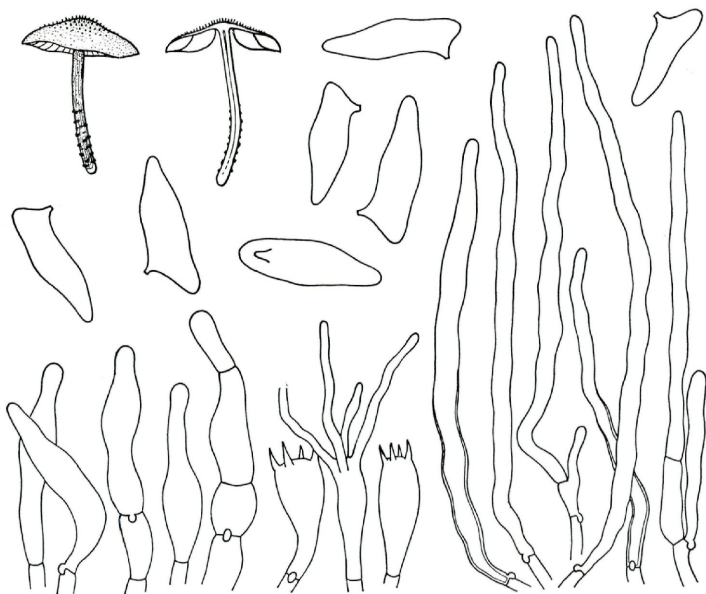


Fig. 14. *Lepiota atrata* HORÁK (type): carpophores, spores, basidia, cheilocystidia, cuticle

equal or slightly attenuated towards apex; cream, towards base with black, appressed, fibrillose squamules and short, irregular, subannular zones, dry, fibrillose, cortina absent, fistulose, rhizoids at base absent, single in groups. Context pale yellow beneath cuticle of pileus. Odour sourish. Chemical reactions on pileus: KOH — pale yellow. Spore print white.

Spores 11–14 × 3.5–4.5  $\mu\text{m}$ , spurred, hyaline, dextrinoid, smooth, membrane thin-walled. Basidia 20–25 × 7–8  $\mu\text{m}$ , 4- and 2-spored, sterigmata often transformed into long (up to 45 × 2  $\mu\text{m}$ ),

cylindric projections. Cheilocystidia 25—40×5—7 μm, polymorphic, cylindric to subfusoid, hyaline, membrane thin-walled, rather scattered on edge. Pleurocystidia none. Cuticle a palisade of cylindric to subfusoid cells (30—200×6—10 μm), membrane hyaline, thin-walled, but near base occasionally thickened (—1 μm diam.), with plasmatic, pale brown (KOH) pigment. Clamp connections present.

Habitat. — On soil in forests, dominated by *Nothofagus* spp. (Fagaceae). — New Caledonia.

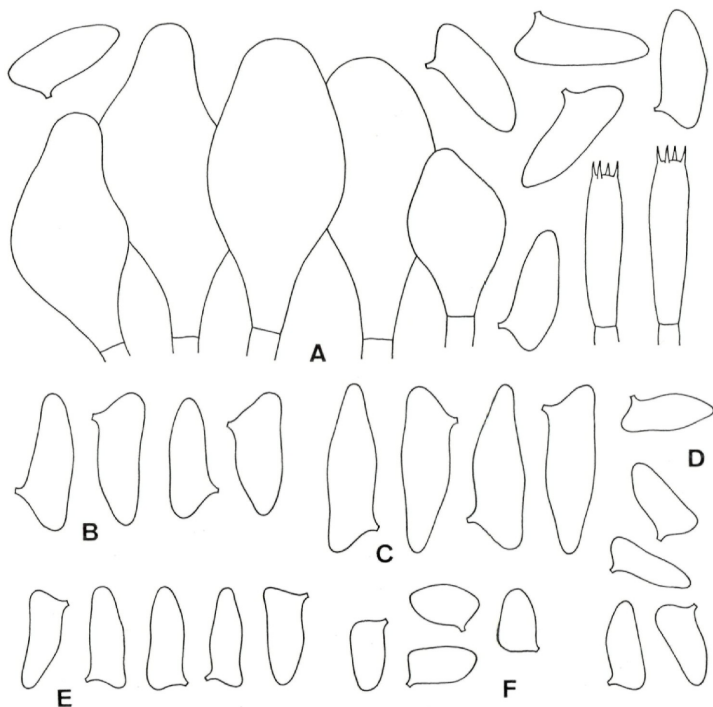


Fig. 15. A. *Lepiota exocarpi* CLELAND (type): spores, basidia, cheilocystidia. — B. *Lepiota grangei* (EYRE) LANGE (ZT 69/168): spores. — C. *Lepiota calcarata* (HORAK) (type): spores. — D. *Lepiota adusta* (HORAK) (type): spores. — E. *Lepiota alopochroa* (BERK. & BR.) SACC. (ZT 68/418): spores. — F. *Lepiota purpurata* (STEVENSON) HORAK (type): spores

Material. — New Caledonia: Paita, Mt. Mou, 1250 m, 20. II. 1977, HORAK (ZT, 77/149, holotype).

Remarks. — This species is recognized by the black spinulose pileus, black subannular belts on the lower portion of the stipe and spores measuring about  $11-14 \times 3.5-4.5 \mu\text{m}$ . Supposed only macroscopic characters are taken into consideration then *L. atrata* keys out near the European *L. pseudofelina* LANGE whose spores, however, are distinctly smaller.

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