

## THREE NEW SPECIES OF ENTOLOMA FROM KERALA STATE, INDIA

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Three new species of *Entoloma* s.l. from Kerala State, India are described, illustrated and discussed. *Entoloma haematinum*, a very small, bright red, omphalinoid species, reminiscent of *Hygrocybe cantharellus*, is unique because of its quadrate-cuboid spores; it fits well in subgenus *Omphaliopsis*. *Entoloma nubilum* and *E. carneum* are both characterised by their small, pleurotoid basidiocarps. The first is related to the species of subgenus *Leptonia*; the second fits better in subgenus *Claudopus*. Comments are given on the taxonomic position of the new species.

Following the publication of a preliminary account of the genus *Entoloma* s.l. from Kerala State, India (Manimohan et al., 1995), several interesting collections belonging to the genus have subsequently been made as part of a continuing study of the agaric mycota of this region. Based on some of these collections, three new species of *Entoloma* are described, illustrated and discussed below. Materials and methods adopted are the same as those given in the paper cited above. Colour names given in quotation marks and colour codes refer to Kornerup & Wanscher (1978). All collections cited are deposited in the Nationaal Herbarium Nederland, Leiden (L).

### *Entoloma haematinum* Manim., Leelav. & Noordel., *spec. nov.* — Figs. 1–3

Basidiocarpus parvus, omphalinoidus. Pileus 5–15 mm latus, convexus, haematinus, translucidus, primo pellucido-striatus, postea sulcato-striatus, glaber. Lamellae subdecurrentes vel decurrentes, aurantiae, subconfertae, lamellulis intermixtae, marginibus concoloratae et integrae. Stipes 10–20 × 0.5–1.5 mm, centralis, cylindricus, cavus, haematinus. Odor nullus. Sporae 6.5–8.5 × 6–8 µm, quadratae. Basidia 25–31 × 9–10 µm, clavata, 2- vel 4-sporigera. Acies lamellarum fertiles. Cheilocystidia et pleurocystidia nulla. Cuticula pilei ex hyphis repentibus, 7.5–20 µm latis composita. Fibulae nullae.

Holotypus: India, Kerala State, Malappuram District, Nilambur Teak Forest, 14 Nov. 1997, Manimohan M740a (L).

Etymology: haematinum (Latin), blood red.

Basidiocarps very small, omphalinoid, delicate, translucent, reminiscent of *Hygrocybe cantharellus*. Pileus 5–15 mm diam., hemispheric to convex, with or without a slight central depression; with straight margin, not hygrophanous, initially finely translucently striate, bright red or blood red (exact shade of red not available in Kornerup & Wanscher, 1978; nearest shade 9C8), smooth, glabrous, becoming finely radially sulcate with age. Lamellae well-developed, moderately crowded, without or with lamellulae of 1 or 2 lengths, subdecurrent to deeply decurrent, up to 2 mm broad, 'light orange' (8A4, 5A5, 6A4, 6A5) with entire, concolorous edge. Stipe 10–20 × 0.5–1.5 mm, central, terete, equal with slightly enlarged base, hollow, concolorous with pileus or slightly paler, smooth, glabrous, with scanty basal mycelium. Context 'light orange' (6A4, 6A5), less than 0.5 mm thick. Odour and taste not distinctive.

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Spores  $6.5\text{--}8.5 \times 6\text{--}8$  ( $7.6 \pm 0.65 \times 7.4 \pm 0.6$ )  $\mu\text{m}$ ,  $Q = 1.00\text{--}1.08$ ,  $Q_m = 1.03$ ,  $n = 20$ , cuboid, mostly quadrate in profile, rarely 5-sided, with slightly concave facets. Basidia  $25\text{--}31 \times 9\text{--}10$   $\mu\text{m}$ , clavate, 2- or 4-spored; sterigmata less than 5  $\mu\text{m}$  long. Lamella-edge fertile. Hymenial cystidia absent. Hymenophoral trama regular; hyphae made up of inflated, up to 16  $\mu\text{m}$  wide elements with hyaline, thin walls. Pileipellis a cutis of cylindrical hyphae, made up of short, inflated elements, 7.5–20  $\mu\text{m}$  wide, with clavate terminal elements, 20–60  $\times$  7.5–23  $\mu\text{m}$ , thin-walled, with a yellowish plasmatic pigment, without encrustations. Pileitrama interwoven; hyphae made up of inflated, 6–25  $\mu\text{m}$  wide, thin-walled elements, with yellowish plasmatic pigment. Stipitipellis a cutis of 3–15  $\mu\text{m}$  wide, thin-walled hyphae, with yellowish plasmatic pigment, without encrustations; frequently showing bundles of caulocystidia, 25–35  $\times$  11–14  $\mu\text{m}$ , inflated-clavate, with yellowish plasmatic pigment. Stipititrama made up of parallelly arranged hyphae; elements 60–90  $\times$  3–15  $\mu\text{m}$ , thin-walled, with a yellowish plasmatic pigment. Clamp-connections absent. Oleiferous hyphae rare.

Habitat — Saprotrophic, on the ground, amongst decaying leaf litter, scattered. November – December.

*Specimens examined.* INDIA: Kerala State, Malappuram District, Nilambur Teak Forest, 14 Nov. 1997, Manimohan M740a (holotype, L); 18 Nov. 1997, Manimohan M740b; 31 Dec. 1997, Manimohan M740c.

*Entoloma haematinum* is a rather unusual species with its very small, bright red, omphalinoïd basidiocarps. In addition, some microscopical features, such as cuboid spores, absence of both clamp-connections and pigment encrustations, plasmatic pigment and presence of inflated-clavate caulocystidia are characteristics of this species. Red basidiocarps are extremely rare in *Entoloma* and according to Horak (1980), the Indian species *Entoloma nanum* (Masse) E. Horak is the only one known to show this colour amongst the entire range of Indomalayan and Australasian species of *Entoloma* studied by him. *Entoloma nanum* is easily distinguished by its wine-red to ochre-red, conico-complanate pileus, adnato-adnexed lamellae, smaller, isodiametric-polygonal spores and cheilocystidia. Extensive searches in the literature revealed no comparable species from other geographical regions. The taxonomic position of this species is also interesting. We place it in the subgenus *Omphaliopsis* Noordel. since it does not fit in subgenus *Claudopus* (A. Gillet) Noordel. because of the colours and pigments. Cuboid spores are rare in subgenus *Omphaliopsis*, but do occur in some African species (Romagnesi & Gilles, 1979). As most species of subgenus *Paraleptonia* Romagn. ex Noordel. have clamp-connections and faint encrustations in the pileipellis, it is difficult to place the new species in that subgenus.

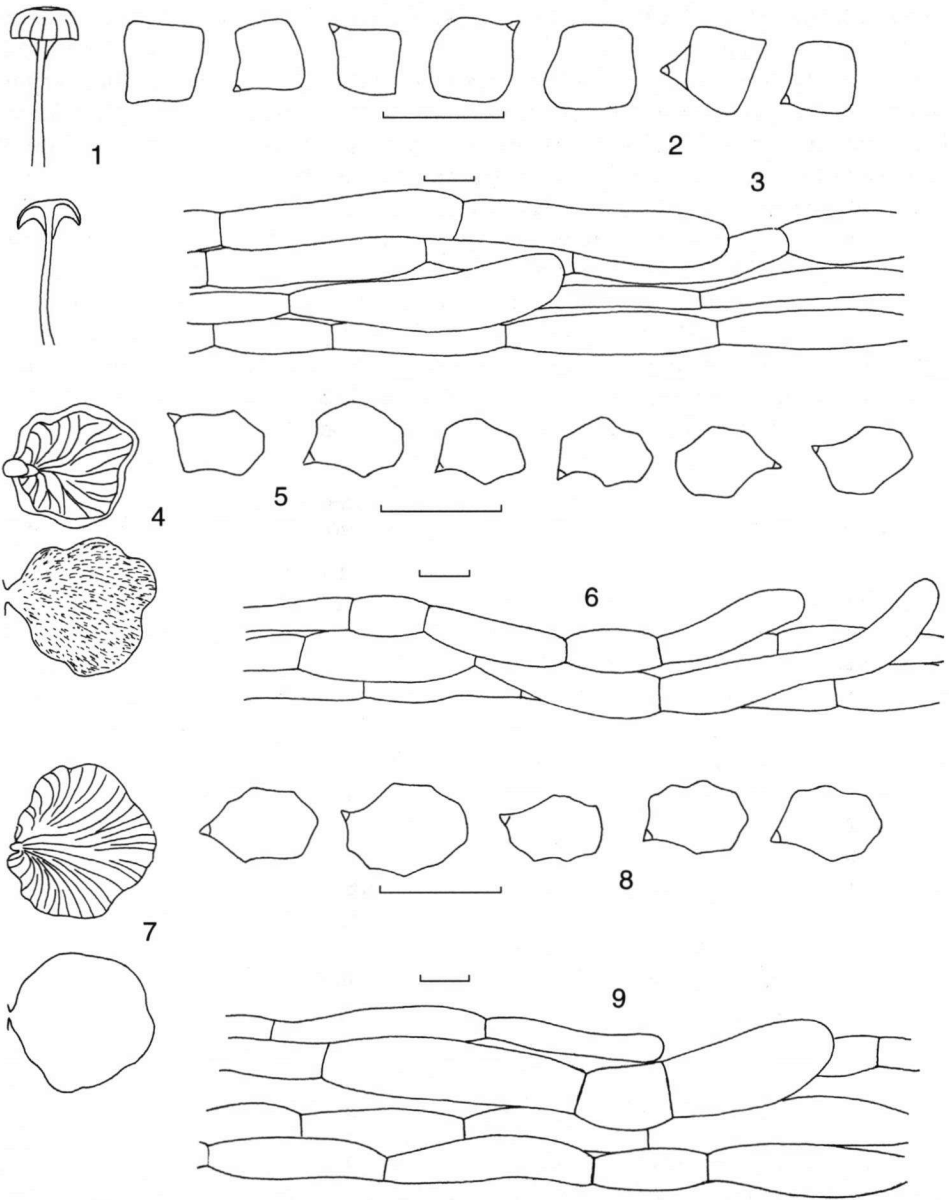
### ***Entoloma nubilum* Manim., Leelav. & Noordel., spec. nov. — Figs. 4–6**

Basidiocarpus parvus, pleurotoidus. Pileus 4–8 mm latus, cupulato reniformis vel subflabelliformis, lividus, estriatus, glaber. Lamellae adnexae, primo caesiae, postea aurantio-griseae, subremotae, lamellulis intermixtae, marginibus concoloratae et integrae. Stipes brevissimus, lateralis. Odor nullus. Sporae  $7.5\text{--}9 \times 5\text{--}6$   $\mu\text{m}$ , heterodiametrico-ovatae, 6–7 angulatae. Basidia  $30\text{--}40 \times 8.5\text{--}10$   $\mu\text{m}$ , clavata, 4-sporigera. Acies lamellarum fertilis. Cheilocystidia et pleurocystidia nulla. Cuticula pilei ex hyphis repentibus, 5–12.5  $\mu\text{m}$  latis composita. Fibulae nullae.

Holotypus: India, Kerala State, Malappuram District, Nilambur Teak Forest, 14 Nov. 1997, Manimohan M739a (L).

Etymology: nubilum (Latin), greyish blue.

Basidiocarps small, pleurotoid. Pileus 4–8 mm, cupulate-reniform to subflabelliform to almost unguulate with incurved entire margin which becomes lobate and fissurate with



Figs. 1–3. *Entoloma haematinum*. 1. Basidiocarp; 2. spores; 3. elements of pileipellis. — Figs. 4–6. *Entoloma nubilum*. 4. Basidiocarp; 5. spores; 6. elements of pileipellis. — Figs. 7–9. *Entoloma carneum*. 7. Basidiocarp; 8. spores; 9. elements of pileipellis. — Scale bars = 10  $\mu$ m.

age; not hygrophanous, not translucently striate, 'ink blue' (20F4), finely appressed hairy to almost smooth. Lamellae with lamellulae of 2–5 lengths, subdistant, adnexed, up to 2 mm wide, initially 'bluish grey' (20C2), becoming 'orange grey' (6B2) with age, with entire, concolorous slightly bluish edge. Stipe strongly reduced to almost absent, lateral, knob-like, with dimensions less than 1 × 1 mm; surface concolorous with the pileus, densely pruinose to tomentose. Context thin, white, less than 1 mm thick. Odour and taste not distinctive. Dried specimens retaining the blue colour.

Spores 7.5–9 × 5–6 ( $8 \pm 0.4 \times 5.2 \pm 0.34$ )  $\mu\text{m}$ ,  $Q = 1.33\text{--}1.8$ ,  $Q_m = 1.54$ ,  $n = 20$ , heterodiametric-ovate with 6 or 7 concave sides in profile. Basidia 30–40 × 8.5–10  $\mu\text{m}$  clavate, 4-spored; sterigmata up to 5  $\mu\text{m}$  long. Lamella-edge fertile. Cheilocystidia and pleurocystidia absent. Hymenophoral trama regular; hyphae 3.5–15  $\mu\text{m}$  wide, thin-walled, hyaline. Pileipellis a cutis of repent hyphae, 5–12.5  $\mu\text{m}$  wide, often constricted at septa, thin-walled, with dark blue plasmatic pigment, without encrustations. Pileitrama parallel-interwoven; hyphae 3.5–18.5  $\mu\text{m}$  wide, thin-walled, hyaline. Clamp-connections and oleiferous hyphae absent.

Habitat — Saprotrophic, on decaying leaves partially buried in soil or directly on humus-rich soil, scattered, November.

*Specimens examined.* INDIA: Kerala State, Malappuram District, Nilambur Teak Forest, 14 Nov. 1997, Manimohan M739a (holotype, L); 18 Nov. 1997, Manimohan M739b.

*Entoloma nubilum* is characterised by the combination of small, pleurotoid basidiocarps, dark blue, non-striate pileus, lateral, rudimentary stipe, heterodiametric-ovate spores with 6 or 7 concave facets in profile, cutis-type pileipellis with plasmatic pigment and absence of both pigment encrustations and clamp-connections. *Claudopus cyanomelaenus* Boedijn is the only blue *Claudopus* reported so far from Indomalaya and Australasia (Horak, 1980). Not much is known about its variability, however, since the species has only been recorded once from the type locality in Sumatra. Horak (1980) could not trace the type material. It is nonetheless clear that *Entoloma nubilum*, though similar to *C. cyanomelaenus* in overall morphology, differs in certain features. According to Horak (1980), the pileus of *C. cyanomelaenus* turns red in KOH, whereas the pileus of the present collections does not. The spores of *E. nubilum* are also distinctly smaller than those of *C. cyanomelaenus*. These features, along with the geographical difference, have led us to describe the collections from Kerala State as a new species. *Entoloma cyaneum* (Murrill) Hesler, another blue pleurotoid species described from Florida, is somewhat similar to the present collections. However, it is a lignicolous species with adnate lamellae, a well-developed, white stipe, slightly larger, 5 or 6 sided spores and colourless pileipellis hyphae.

The taxonomic position of *Entoloma nubilum* and *Claudopus cyanomelaenus* is intriguing. They certainly do not fit in the current concept of *Claudopus* (treated as either a 'genus' or a 'subgenus') because of the blue plasmatic pigment and the total lack of pigment encrustations. It is probably better to consider them as reduced forms in subgen. *Leptonia*, sect. *Cyanula*. As in other agaric genera (e.g. *Marasmius*, *Marasmiellus*, *Psilocybe*) pleurotoid basidiocarps are found in different parts of the infrageneric classification system and are by no means unique. For this reason we strongly believe that the pleurotoid habit in *Entoloma* is likewise polyphyletic, and may have occurred several times in the course of evolution of that genus. *Claudopus* in the sense of Horak (1980) is therefore an unnatural, heterogeneous assemblage of non-related species. For that reason, the following new combination is made here.

**Entoloma cyaneomelaenus** (Boedijn) Manim., Leelav. & Noordel., *comb. nov.*

Basionym: *Claudopus cyaneomelaenus* Boedijn, Rec. Trav. bot. Neerl. 26 (1929) 419.

**Entoloma carneum** Manim., Leelav. & Noordel., *spec. nov.* — Figs. 7–9

Basidiocarpus parvus, pleurotoidus. Pileus 5–35 mm latus, subflabelliformis, primo albidus, postea incarnatus, estriatus, glaber. Lamellae liberae, incarnatae, subconfertae, lamellulis intermixtae, marginibus concoloratae et integrae. Stepes brevissimus, lateralis vel excentricus, solidus. Odour nullus. Sporae 7.5–10 × 5–7 µm, heterodiametrico-ovatae, noduloso-angulatae. Basidia 30–39 × 9–11.25 µm, clavata, 4-sporigera. Acies lamellarum fertilliss; cheilocystidia et pleurocystidia nulla. Cuticula pilei ex hyphis repentibus 3–21 µm latis composita. Hyphae fibulatae.

Holotypus: India, Kerala State, Kannur District, Pulikurumba, 23 Sept. 1997, *Manimohan M729a* (L.).

Etymology: *carneum* (Latin), flesh-coloured.

Basidiocarps small to medium-sized, pleurotoid. Pileus 5–35 mm diam., convex, subflabelliform with lateral or excentric attachment; with initially straight, entire, with age upturned, irregularly lobate, fissile margin, not hygrophanous, not translucently striate, not zonate, whitish, becoming flesh-coloured (6B3, 6B2) with age, glabrous, with a silky sheen. Lamellae with lamellulae of several lengths, moderately crowded to crowded, free to remote, up to 3 mm wide, initially flesh-coloured (6B3, 6B2), becoming 'red-haired' (6C4), with entire, concolorous edge. Stipe up to 2 × 1 mm, rudimentary, excentric to lateral, terete, solid; concolorous with pileus, finely pruinose under a lens; with well-developed basal mycelium, and with mycelial cords. Context thin, flesh-colored (6B2). Odour and taste not distinctive.

Spores 7.5–10 × 5–7 (8.6 ± 0.86 × 6.1 ± 0.55) µm, Q = 1.25–1.55, Qm = 1.4, n = 20, heterodiametric-ovate to almost heterodiametric-elliptic, irregularly nodulose-angular in side-view. Basidia 30–39 × 9–11.25 µm, broadly clavate, 4-spored; sterigmata up to 4.5 µm long. Lamella-edge fertile. Cheilocystidia and pleurocystidia absent. Hymenophoral trama regular, made up of 3.5–25 µm wide, short-celled, thin-walled, hyaline hyphae. Pileipellis an undifferentiated cutis of repent hyphae, 3–21 µm wide, short-celled, thin-walled, hyaline, without encrustations. Pileitrama parallel-interwoven; hyphae 4.5–20 µm wide, made up of short, hyaline, thin-walled elements. Stipititrama composed of frequently rather inflated, up to 40 µm wide, thin-walled, hyaline hyphae. Stipitipellis an undifferentiated cutis with recurved cylindrical hyphal tips frequently projecting out. Clamp-connections and oleiferous hyphae rarely observed in the hymenophoral trama.

Habitat — Saprotrophic, on decaying stem of palm (*Corypha umbraculifera* L.) in dense imbricate clusters, September.

*Specimens examined.* INDIA: Kerala State, Kannur District, Pulikurumba, 23 Sept. 1997, *Manimohan M729a* (holotype, L.); 29 Sept. 1997, *Manimohan M729b*.

*Entoloma carneum* is characterised by its palmicolous, pleurotoid basidiocarps which appear in dense imbricate clusters and have a whitish to flesh-coloured, glabrous pileus, free to remote lamellae, a rudimentary, lateral to excentric stipe, spores that are irregularly-nodulose in profile, no cystidia of any kind, a cutis-type pileipellis without encrusting or membranous pigment, and clamp-connections. In the size and shape of spores, in the absence of cystidia, and in the presence of clamp-connections, it is very similar to *Entoloma byssi-sedum* (Pers.: Fr.) Donk, a species widely distributed in temperate and boreal regions. The latter species, however, differs in having a darker, more grey-brown pileus, adnate to decur-

rent lamellae, farinaceous odour and membranous and encrusting pigments in the pileipellis and pileitrama. The palmicolous habitat and growth-form in dense, imbricate clusters are also distinctive for *E. carneum*. *Entoloma depluens* (Batsch: Fr.) Hesler also seems to be very similar, but differs in having silvery-white hairs on pileus and abundant cheilocystidia. For the time being, it seems best to include *Entoloma carneum* in subgenus *Claudopus*, despite the lack of encrusting pigments, although the considerations in the discussion under *E. nubilum* should be taken into account with regard to the taxonomic status of species with a pleurotoid habit.

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