

## The gasteral *Basidiomycetes* of Mascarenes and Seychelles 3. Some recent records

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**Abstract:** Recent collections of four gasteral *Basidiomycetes* from the Mascarenes and the Seychelles are recorded. The new species *Phallus flavidus* is described from Seychelles. Colour plates of three species and macro- and microscopical descriptions of two species are given. A key to 19 indusiate taxa of *Phallus* (“veiled ladies”) of the world is added.

**Zusammenfassung:** Aktuelle Funde von vier gasteralen Basidiomyceten von den Mascarenen und Seychellen werden mitgeteilt. Die neue Art *Phallus flavidus* von den Seychellen wird beschrieben. Drei Arten werden farbig abgebildet, zwei Arten werden makro- und mikroskopisch dokumentiert. Ein Schlüssel für 19 indusiate *Phallus*-Taxa („Schleierdamen“) der Welt ist angefügt.

Earlier collections of gasteral *Basidiomycetes* (*Basidiomycota*) of the second author on the islands Réunion, Mauritius, and Seychelles have been communicated in two earlier papers (KREISEL & HAUSKNECHT 2002, 2006). During two further stays (Mauritius 2008, Seychelles 2009) the second author collected a few additional species which will be presented here.

Specimens are deposited in the herbaria of Vienna University (WU) and H. KREISEL, Greifswald (Kr).

*Aseroë rubra* LABILL. 1806 s. str. (Fig. 2)

**Collection examined: Mauritius:** Savanne, Baie de Cap, in leaf litter, 21. I. 2008, leg. A. HAUSKNECHT (WU 28483).

The pantropical species *Aseroë rubra* s. l. is known in Africa from South Africa (in pine forests of Eastern Cape and southern Natal, DRING 1980, VAN DER WESTHUIZEN & EICKER 1994), Tanzania (DRING 1980), Congo (DEMOULIN & DRING 1975), and Mauritius (DRING 1980). The variability of this species with regard to paired or simple arms and length of stipe has been discussed by DRING (1980) where – still not drawing taxonomical consequences – DRING suggested that the frequently illustrated *A. rubra*

s. str. from Australia incl. Tasmania (type locality), New Zealand, South Africa, and Hawaii (GOOS 1970) has distinctly paired or forked (bifurcate) arms and a high stipe. A taxon with indistinctly paired or simple arms and relatively short stipe was described from Ceylon (Sri Lanka) as *Aseroë ceylanica* BERK. 1846, from Indonesia as *A. rubra* var. *junghuhnii* (SCHLECHT. 1847) BERNARD 1908, and from Brazil as *A. rubra* var. *brasiliensis* ULBR. 1929, and also recorded from Congo (Kivu) by DEMOULIN & DRING 1975, and from Japan; cf. illustrations in FISCHER (1933: 94, fig. 68 B), BOEDIJN (1934: figs. 1 and 2), DEMOULIN & DRING (1975: fig. 14) and IMAZEKI & al. (1988: 516). Regarded as a species for its own, that taxon with simple arms and more tropical distribution should be called *A. ceylanica* BERK.

Finally, another taxon with impaired, not bifurcate and not interconnected arms is known from warm-temperate areas in Japan (IMAZEKI & YOSHIMI in IMAZEKI & al. 1988: 517 "ad interim", KASUYA 2007: figs. 1-6). Its correct name is *Aseroë coccinea* IMAZEKI & YOSHIMI ex KASUYA 2007.

The 2008 collection from Mauritius has distinctly bifurcate arms and therefore belongs to *A. rubra* s. str.

### ***Calvatia gardneri* (BERK. 1873) LLOYD 1904 (Figs. 1 c, d; 3)**

#### **Characters:**

**Fruitbodies:** young pyriform, later turbinate with rather sharp edge and long stipe, 40-70 mm high, 30-70 mm broad, base with roundish ball of humose soil.

**Exoperidium:** whitish cream when young, later yellowish, after bruising soon discolouring yellow, orange yellow to orange, after drying clear ochraceous. Surface granulate to furfuraceous, on the stipe with fine short spines, smooth, after dehiscing alveolate.

**Peridium:** 0.5-0.8 mm thick, cream, later yellow, in exsiccatum brown, soon decomposing on the whole apex; on stipe persistent, scarcely decomposing.

**Gleba:** whitish, then clear yellow, finally brown, soon cottony, extending into the upper part of stipe. Smell of fresh material strong, unpleasant.

**Subgleba:** conspicuous, soft, tow-like, with large locules, olivaceous brown.

**Spore print:** umber-brown.

**Spores:** globose to subglobose, spinulose with scattered fine hyaline spinules about 0.5 µm distant, apedicellate, 3.8-4.2(-5.0) µm in diam., s. m. clear ochraceous.

**Capillitium:** of *Calvatia*-type, fragile, rather thin-walled, clear ochraceous, smooth, with scattered large circular pits (0.5-2.0 µm in diam.), septate, 4.0-6.0 µm thick.

**Collections examined: Mauritius:** Savanne, Baie du Cap, on ground under tropical broad-leaved trees, 21. 1. 2008, leg. A. HAUSKNECHT & S. D. BHUGLOO, det. H. KREISEL (WU 28470, Kr); - ibidem, 23. 1. 2008, leg. A. HAUSKNECHT (WU 28471).

**Australia:** Queensland, Millaa Millaa, Ellinjaa Falls, on ground in moist forest, 29. 3. 2003, leg. A. HAUSKNECHT (WU 24545, Kr.).

**India:** Sikkim, near Gangtok, 300-450 m s. m., on grassy ground, 23. 6. 2008, leg. K. DAS, det. H. KREISEL (Kr).

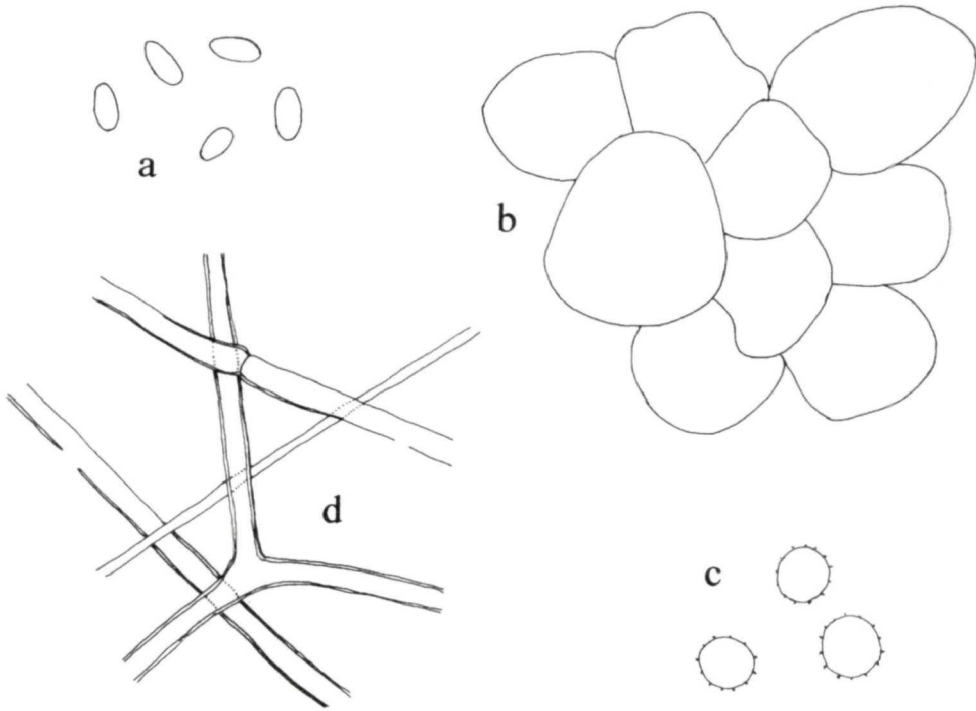


Fig. 1. *a, b. Phallus flavidus*. *a* spores,  $\times 2000$ , *b* cells of indusium,  $\times 800$ . *c, d. Calvatia gardneri*. *c* spores,  $\times 2000$ , *d* capillitium,  $\times 800$ .

*Calvatia gardneri* was originally described from Ceylon (Sri Lanka). It was sometimes regarded as a synonym of *C. pyriformis* (LÉV.) KREISEL (e.g., KREISEL 1992, 2001). Both species have cellular subgleba, capillitium with scattered very large pits, habitat in forests or at least under trees. Recent collections show that they must be separated by spore form (globose in *C. gardneri*, markedly ellipsoid to long-ellipsoid in *C. pyriformis*).

Consequently, the earlier sample of *C. pyriformis* from Mauritius (KREISEL 1992, 2001) belongs to *C. gardneri* as already stated by DRING & RAYNER (1967).

*Calvatia pyriformis* (LÉV. 1846) KREISEL 1992 was first described as *Hippoperdon pyriforme* LÉV. from Java, Indonesia. The first author has studied the type (PC), moreover collections from tropical sites in India (Maharashtra) and Togo.

#### ***Disciseda candida* (SCHWEIN. 1822) G. CUNN. 1927**

**Collection examined: Mauritius :** Rodrigues island, La Ferme, Montagne du Sable, in dry grassland, 5. 2. 2008, leg. A. HAUSKNECHT, det. H. KREISEL (WU 29472, Kr).

This species, fruiting in sand dunes and dry grasslands, is known from the Subarctic to the Mediterranean zone, Cape Verde islands, Middle East, and North America

(ECKBLAD & BROCHMANN 1988, KREISEL 2001). The record from Rodrigues is the first one of a *Disciseda* species on Mascarenes.

***Phallus flavidus* KREISEL & HAUSKN., spec. nova** (Figs. 1 a, b; 4)

Mycobank MB 515507

**Diagnosis latina:** Basidioma phalloideum, 50-80 mm altum, stipite 8-12 mm crasso, pileo reticulato-costato, coloribus cremeis ad pallide aurantiacis, indusio citrino pendente, extenso  $\frac{1}{2}$  ad  $\frac{2}{3}$  longitudinis stipitis, solum non contingente. Odor glebae ingratus, tamen non foetidus. Sporae cylindricae, glabrae, pallide lutescentes, 2,8-3,6  $\times$  1,5-1,8  $\mu\text{m}$ . Habitat ad terram graminosam.

**Holotypus:** Seychelles, Mahé, Jardin du Roi, 12. 2. 2009, leg. A. HAUSKNECHT (WU 29607).

**Characters:**

**Fruitbody:** 50-80 mm high, emerging from a globose "egg" of 20 mm in diam., surface light grey with orange flush.

**Pileus:** glebiferous conical-truncate, pallid orange, surface reticulate with sharp costae, 18-25 mm high, 15-20 mm broad; apex truncate, perforate, white.

**Stipe:** cylindric, somewhat tapering above, 8-12 mm in diam., cream to yellowish, clear orange towards the tip, spongy, hollow.

**Indusium:** up to 50 mm long, hanging down about  $\frac{1}{2}$  to  $\frac{2}{3}$  of the stipe length (not reaching the soil), cream to yellow, with wide polygonal meshes.

**Gleba:** olivaceous brown, smell unpleasant but not fetid, remembering sperma or raw potatoes.

**Spores:** cylindric, smooth, yellowish, 2.8-3.6  $\times$  1.5-1.8  $\mu\text{m}$ .

**Habitat:** terricolous, in high grass on somewhat ruderal site.

**Collection examined:** Seychelles: Mahé, Jardin du Roi, 12. 2. 2009, leg. A. HAUSKNECHT (WU 29607, holotypus; isotypus in herbario H. KREISEL = Kr).

By its yellowish indusium and orange pileus, this taxon comes close to a group of tropical and subtropical species of "veiled ladies" with yellow, orange, or red indusium and pileus. Of these, *P. indusiatus* f. *citrinus* K. DAS & al. from tropical India is most similar by its colour pattern, but is different by its larger size (fruitbody 75-100 mm high, stipe 11-22 mm in diam., indusium 90-95 mm long) and somewhat larger spores (3.0-4.4  $\times$  1.2-2.0  $\mu\text{m}$ ).

*Phallus luteus* (LIU & L. HWANG) T. KASUYA from Japan is very similar to this, but still larger (fruitbody 85-240 mm high, stipe 26-38 mm in diam.) and with a long indusium hanging down to the soil surface.

*Phallus multicolor* (BERK. & BROOME) LLOYD from Australia, Indonesia, eastern China, Hawaii, Ecuador, and Tobago is a rather variable species with regard to its colour pattern (pileus bright yellow to orange-yellow, bright orange or apricot, stipe cream to pale orange, indusium deep lemon-yellow to orange or salmon), indusium mostly short (hanging down about  $\frac{1}{3}$  to  $\frac{2}{3}$  of stipe length, only in rare cases reaching the soil). *Phallus multicolor* is a species of moderate size (fruitbody 95-190 mm high, stipe 13-30 mm in diam.).



Fig. 2. *Aseroë rubra* (WU 28483). – Fig. 3. *Calvatia gardneri* (WU 28470). – Fig. 4. *Phallus flavidus* (WU 29607, holotype). – Phot. I. HAUSKNECHT.

Finally, *Phallus cinnabarinus* (LEE) KREISEL from Taiwan is different by its bright cinnabar red indusium and pileus, the indusium hanging down up to 100 mm from a fruitbody 70-130 mm high.

Within the old world, *Phallus flavidus* from Mahé is the most western representative of this aggregate, and different from all taxa mentioned by its small and delicate fruitbodies and more pallid colour pattern. The primordium (“egg”) lacks pink to purplish pigments, which are rather common in the other taxa mentioned here.

All the taxa mentioned above are terricolous – in contrast to *Phallus flavocostatus* KREISEL 1996 (*Ithyphallus costatus* PENZIG 1899, non *Phallus costatus* VENT. 1798) and a few related species, all of them without indusium, rather small to dwarfish and growing on rotten wood.

*Phallus flavidus* is the smallest of the indusiate species of *Phallus*, while *P. rubrovolvatus* (M. ZANG, JI & LIOU) KREISEL from Yunnan, up to 330 mm high, is the largest of the “veiled ladies”. Within the not indusiate species of *Phallus*, *P. pygmaeus* BASEIA & al. from Brazil, only 5-10 mm high, is the smallest stinkhorn (BASEIA & al. 2003), while *P. favosus* (PENZIG) E. FISCH. from mountains of Indonesia reaches up to 350 mm height (BOEDIJN 1932) and is the biggest species of the genus.

### Key to the indusiate species of the genus *Phallus* s. l. (“veiled ladies, maiden veil fungi, bridal veil fungi”)

1	Indusium (veil) white, cream, pinkish	2
1*	Indusium (veil) yellow, orange, salmon, red	14
2	Indusium ascendent from the volva, white. Gleba fetid. Basidiome 100-120 mm high. Laurel forests (laurisilva); Madeira <i>P. maderensis</i> CALONGE in CALONGE & al. 2008	
2*	Indusium pendent from the tip of stipe	3
3	Indusium rudimentary, hidden under the pileus, white. Gleba fetid. Temperate forests, parks; Europe, North Africa (Morocco) <i>P. impudicus</i> var. <i>obliteratus</i> (MALENÇON 1957) KREISEL 1996 = <i>P. impudicus</i> f. <i>subindusiatus</i> PILÁT 1958	
3*	Indusium visible beneath the pileus of mature basidiomes	4
4	Pileus orange or pink. Volva with reddish-violet mycelial strands. Subtropical forests; southern Brazil, Australia (Queensland) <i>P. callichrous</i> (MÖLLER 1895) LLOYD 1907 = <i>Dictyophora callichroa</i> MÖLLER 1895	
4*	Pileus white, cream, yellowish	5
5	Indusium, in full development, hanging down to the soil surface; with wide polygonal meshes	6
5*	Indusium hanging down $\frac{1}{3}$ to $\frac{2}{3}$ of the stipe length	10

- 6 Indusium light pink. Tropical forests; tropical Mexico and South America, Congo, Cameroon, Japan  
*P. indusiatus* var. *roseus* LLOYD 1909
- 6\* Indusium white 7
- 7 Volva spiny by mycelioid projections, whitish to pallid brown. Warm temperate forests; southern China  
*P. echinolvatus* (ZANG & al. 1988) KREISEL 1996  
= *Dictyophora echinolvata* ZANG, ZHENG & HU 1988
- 7\* Volva smooth 8
- 8 Pileus somewhat rugose, nearly smooth. Tropical forests; Ecuador  
*P. spec.*, LÆSSØE & PETERSEN (2008) as *P. cf. merulinus*
- 8\* Pileus reticulate-alveolate 9
- 9 Volva light pinkish, with pinkish to violet mycelial cords. Indusium hanging down from the tip of stipe. Smell of gleba not fetid, but spicy, like certain pastries (similar to that of *P. hadriani*). Tropical and subtropical forests, bamboo thickets; Caribbean, tropical South America, Australia, Japan, China (north to Hebei prov.), India, Sri Lanka, tropical Africa  
*P. indusiatus* (VENT. 1798) PERS. 1801  
= *Dictyophora indusiata* (VENT. 1798: PERS. 1801) DESV. 1809  
= *Dictyophora phalloidea* DESV. 1809  
Numerous synonyms, see e. g., LIU (1984)
- 9\* Volva white to brownish, with white mycelial cords. Indusium inserted distinctly beneath the tip of stipe. Smell of gleba fetid. Tropical and subtropical forests. Brazil, tropical Africa, China  
*P. moelleri* LLOYD 1909  
= *Dictyophora phalloidea* DESV. 1809 sensu MÖLLER 1895 p. p. (Taf. 1)
- This species is not generally recognized and frequently merged with *P. indusiatus*.
- 10 (5) Volva black or red 11
- 10\* Volva white to pallid brownish 12
- 11 Volva black. Gleba greenish, not fetid, with sweetish-aromatic smell. Indusium 30-50 mm long. Basidiome 40-100 mm high. On wood chips in tropical grassland; Costa Rica  
*P. atrovolvatus* KREISEL & CALONGE in CALONGE & al. 2005
- 11\* Volva red. Indusium to 70 mm long, with wide roundish to polygonal meshes. Basidiome 200-330 mm high. Bamboo thickets; southern China (Yunnan)  
*P. rubrovolvatus* (M. ZANG, JI & LIU 1976) KREISEL 1996  
= *Dictyophora rubrovolvata* M. ZANG, JI & LIU 1976

- 12 (10) Pileus rugose to meruloid. Indusium white, with smaller and larger roundish meshes. Smell of gleba not offensive, remembering decaying fruits. Gardens, bamboo thickets; pantropical: Pakistan, China (Guangdong), tropical India, Sri Lanka, Thailand, Singapore, Philippines, Indonesia, Australia, Tobago, Guyana

*P. merulinus* (BERK. 1866) LLOYD 1909

= *P. irpicinus* (PAT. 1898) LLOYD 1907

= *Dictyophora merulina* BERK. 1866

= *Clautriavia merulina* (BERK. 1866) LLOYD 1909

- 12\* Pileus reticulate-alveolate. Smell of gleba fetid. Species of temperate climates

13

- 13 Indusium cream to pinkish, with wider meshes above and smaller meshes more down, with entire and often imperforate margin. Basidiome (50-)120-170 mm high. Broad-leaved forests, gardens, lawns; North America (eastern and central USA, Mexico), Japan, China (prov. Hebei to Yunnan), Mauritius, West and South Africa, ?Spain

*P. duplicatus* BOSC 1811

= *Dictyophora duplicata* (BOSC 1811) E. FISCH. 1886

= *P. togatus* (KALCHBR. 1884) FARLOW 1885

= *P. impudicus* L.: PERS. var. *togatus* (KALCHBR. 1884)

COSTANTIN & DUFOUR 1895

= *P. mauritanus* LLOYD 1909

- 13\* Indusium pure white, with wide polygonal meshes, inferior margin often torn. Coniferous and broad-leaved forests, parks; Europe, North Africa (Morocco), ?temperate Asia

*P. impudicus* L.: PERS. var. *pseudoduplicatus* O. ANDERSSON 1989

= *P. subuculatus* MONT. 1842

= *P. duplicatus* BOSC sensu ULBRICH 1932 ff. & auct. Europ. plur.

= *P. togatus* (KALCHBR.) FARLOW sensu PEGLER & al. (1995)

= *P. impudicus* var. *togatus* (KALCHBR.) COSTANTIN & DUFOUR  
sensu SARASINI (2005)

- 14 (1) Indusium, in full development, hanging down to soil surface, with wide meshes. Smell of gleba fetid

15

- 14\* Indusium hanging down only  $\frac{1}{3}$  to  $\frac{3}{4}$  of stipe length, not reaching the soil

16

- 15 Indusium cinnabar or salmon. Pileus cinnabar, reticulate. Volva greyish white to brownish, with pinkish mycelial cords. Smell of gleba less aggressive. Basidiome 70-130 mm high. Grassland and under bamboo; Taiwan, Hawaii

*P. cinnabarinus* (LEE 1957) KREISEL 1996

= *Dictyophora cinnabarina* LEE 1957



- 15\* Indusium chrome yellow, orange-yellow. Pileus orange, pallescent yellowish white. Volva becoming vinaceous to chestnut brown. Smell of gleba fetid. Basidiome 65-240 mm high. Evergreen forests, bamboo thickets, grassland and cultivated areas; Japan, Korea, China, Mexico

*P. luteus* (LIU & L. HWANG 1936) T. KASUYA 2008  
= *Dictyophora lutea* LIU & L. HWANG 1936

- 16 (14) Pileus cepiform or campanulate (similar to that of *Phallus impudicus*), with irregular, narrow-meshed reticulum with blunt ribs. Basidiome 100-190 mm high, stipe 13-30 mm in diam. 17

- 16\* Pileus conical-truncate, with wider reticulum formed by strong, sharp costae. Basidiome 50-110 mm high 18

- 17 Indusium rudimentary or  $\frac{1}{3}$  to  $\frac{1}{2}$  of stipe length, cream, pallid orange, egg-yellow or pinkish. Volva and mycelial cords purplish. Stipe white to cream. Gleba with weak fetid smell. Tropical forests, parks, gardens; Australia (Victoria to Queensland), Madagascar

*P. multicolor* (BERK. & BROOME 1883) LLOYD 1907 **var. multicolor**  
= *Dictyophora multicolor* BERK. & BROOME 1883

- 17\* Indusium  $\frac{1}{2}$  to  $\frac{3}{4}$  of stipe length, orange, fulvous, or chrome yellow. Stipe yellowish to clear orange. Volva purplish, dark brown or nearly black. Mycelial cords becoming pink to deep violet. Smell of gleba spirituous-spermatoc, not fetid. Tropical forests, parks, bamboo thickets; Australia (Northern Territory), Indonesia, New Guinea, Molucces, Hawaii, Malaysia, eastern China (north to Jiangsu prov.), Taiwan, Sri Lanka, Tobago, ?Ecuador

*P. multicolor* **var. laeticolor** D. A. REID 1976

Specimens with a dark volva with short, soft spines have been observed in Indonesia (BOEDIJN 1932, REID 1976).

- 18 (16) Basidiome 75-110 mm high. Stipe white, 11-22 mm in diam. Pileus pallid orange to orange, pallescent yellowish white. Volva whitish, becoming vinaceous, dark vinaceous, chestnut-brown. Smell of gleba not reported. Grassland with *Acacia*; tropical India (Maharashtra)

*P. indusiatus* **f. citrinus** K. DAS, S. K. SINGH & CALONGE 2007

This taxon probably deserves the rank of a species, if not conspecific with *P. flavidus*. In contrary to KASUYA (2008) we do not regard it conspecific with *P. luteus*.

- 18\* Basidiome 50-80 mm high. Stipe yellowish white to clear orange, 8-12 mm in diam. Pileus deep orange-yellow. Volva light grey, light orange-grey. Smell of gleba not fetid but unpleasant, spermatoc or potato-like. Grassland, somewhat ruderal site; Seychelles (Mahé)

*P. flavidus* KREISEL & HAUSKN. 2009, spec. nova

Closer information on several species included in the key above can be found in ANDERSSON (1989), CALONGE (2005), CALONGE & al. (2005, 2008), DAS & al. (2007), GOOS (1970), KASUYA (2008), KREISEL (1996), LIU (1984), MÖLLER (1895), PEGLER & al. (1995), REID (1976), SARASINI (2005).

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