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## New reports and illustrations of *Gymnopus* for Costa Rica and Panama

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Field trips to the Caribbean lowlands of Costa Rica and Panama over the last two decades have yielded several dozen collybioid collections. Morphological examination of those has resulted in the discovery of mushroom names not previously reported for this region of Central America. The distribution range for *Gymnopus luxurians*, initially described from southern United States and recently reported from the Dominican Republic, is extended into the Caribbean lowlands of Costa Rica and Panama. Similarly, *G. subpruinosis*, known from the Greater Antilles, is reported from Panama. Other new reports for Panama but previously recorded from Costa Rica are *G. neotropicus*, *G. omphalodes* and *G. luxurians* var. *copeyi*. *Gymnopus hondurensis* is proposed as a new record for Costa Rica and an updated morphological description is offered. *Marasmius cervinicolor* and *Marasmius coracicolor* are transferred to *Gymnopus*. Colored photos are provided for most taxa.

**Key words:** *Vestipedes*, morphology, taxonomy, neotropical fungi

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### Introduction

Application of the genus name *Gymnopus* (Agaricales, Tricholomataceae) has gained acceptance for many mushrooms originally placed in *Collybia* sections *Vestipedes*, *Levipedes*, and *Subfumosae* (Antonín *et al.*, 1997). *Gymnopus* is composed of delicate to semi-fleshy mushrooms commonly found on leaf and woody litter in tropical to temperate ecosystems, and therefore, are frequently collected wherever mycologists go. Ecologically, *Gymnopus* species are considered important in the recycling of nutrients (Singer, 1986).

Continuing collection efforts and careful examination regularly result in proposal of new morphological species across the globe almost every year (Mata *et al.*, 2004; Wilson *et al.*, 2004; Mata *et al.*, 2006; Polemis and Noordeloos, 2007). In addition, *Gymnopus* has been the subject of extensive and detailed monographic studies in North America (Halling, 1983; also see RE Halling's website <http://www.nybg.org/bsci/res/col/colintro.html>)

and Europe (Antonín and Noordeloos, 1997), but less is known for Costa Rica (Halling, 1996; Mata *et al.*, 2004). Mata (2002) reported 18 species in *Gymnopus* from the Talamanca Mountains in Costa Rica. No publications for *Gymnopus* can be found for the neighboring country of Panama. Pegler's (1983) work on *Gymnopus* (under *Collybia*) for the Lesser Antilles remains the best reference for taxa with a circum-Caribbean distribution.

While JL Mata has been involved with studies of collybioid specimens from the montane regions of Costa Rica, CL Ovrebo has been actively collecting and describing macrofungi in the Caribbean plains of northern Costa Rica and on Barro Colorado Island of the Panama Canal (Ovrebo, 1996; Desjardin and Ovrebo, 2006). Ovrebo's studies provide an opportunity to increase our knowledge about the presence and distribution of *Gymnopus* species in southern Central America and the circum-Caribbean region. In this paper, we report on the first records of *Gymnopus* sect. *Vestipedes* from Panama, provide new

information on species from Costa Rica, and propose new combinations under *Gymnopus* based on type specimen studies.

## Materials and methods

Sections of the pilei and stipes of dried specimens were first cut and then re-hydrated in an aqueous solution of 95% ethanol. Thin sections were cut and placed in 5% KOH on a glass slide for observation under bright light microscopy; Congo Red was used to increase contrast of structures. Melzer's reagent was used to test for dextrinoidity of basidiospores (Largent *et al.*, 1977). Notes were compared with previous type specimen studies and pertinent literature review (Mata, 2002; Mata and Petersen, 2004, Mata *et al.*, 2006). *In situ* color images by CL Ovrebo were also used to describe and confirm identity of specimens.

Color annotations in parentheses are from Kornerup and Wanscher (1978). Basidiospore measurements are as follow: n = total number of spores measured, x = arithmetic mean of spore length and spore width for all spores measured, Q = spore length divided by spore width, indicated as a range of spore variation in n spores measured.

Herbarium acronyms are taken from Holmgren and Holmgren (1998).

## Results and Discussion

### New records of *Gymnopus* for Costa Rica or Panama

*Gymnopus hondurensis* (Murrill) J.L. Mata, Mycotaxon 86:313. 2003 (Fig. 1)

*Material examined*: BELIZE. 1906. coll. ME Peck HT (NY!). COSTA RICA, Provincia de Heredia, Cantón de Sarapiquí, Puerto Viejo, Estación Biológica La Selva, Camino Experimental Norte, on dicot twigs, 11 May 1991, Ovrebo 3014 (USJ); Camino Experimental Sur, on wood, solitary, 27 May 1991, Ovrebo 3201 (USJ); Sendero Suroeste, on twigs, scattered, 23 July 1986, Ovrebo 2259 (USJ).

*Gymnopus jamaicensis* Murrill, N. Amer. Fl. 9:373. 1915. JAMAICA, Castleton Gardens, on ants' nest, 28 Oct 1902, Earle 221, HT (NY!).

*Gymnopus coracicolor* (Berk. & M.A. Curtis) J.L. Mata **comb nov.** (Basionym: *Marasmius coracicolor* Berk. & M.A. Curtis, J. Linn. Soc. Bot. 10: 294. 1868.) CUBA. On logs in woods. C Wright 10, HT (K !)

*Pileus* 20-26(-45) mm wide, convex when young, in age broadly convex to plane, with a depressed disc; surface glabrous, moist, dull, shallowly sulcate and strongly translucent-striate to sulcate from edge of disc outwards; disc dark brown (7E/F5) or dull brown (6E4-6D4), drying dark buff, hygrophanous; margin wavy or not, incurved in some when partially expanded, straight to uplifted at maturity, color of striation troughs brown corresponding to that of pileus disc, and striation crests a combination of dull brown and light cinnamon buff to tan; context 1-2 mm thick near stipe, translucent brown; odor slight, nondescript; taste none. *Lamellae* adnexed to adnate, 1-4 mm wide, distant to subdistant, 1 mm between lamellae and lamellulae, grayish (5B3) to light fleshy cinnamon buff to pinkish grey (6B/C2), not discoloring; edge entire; lamellulae numerous but not in distinct tiers, not interveined but faintly rugulose especially with age. *Stipe* 14-30 x 1.5-3 mm, equal, terete or flattened with a longitudinal groove; surface thinly tomentose to hirsute overall, dull flesh brown, medium brown (7E5) to tan over most, or with apex fleshy buff; consistency fleshy fibrous, pliable; interior hollow. KOH: yellowish to olivaceous on pileus.

*Pileus epicutis* a simple cutis, composed of cylindrical hyphae, 4-8(-16)  $\mu\text{m}$  diam, radially oriented, interwoven, hyaline singly; terminal hyphae branching or flexing somewhat, diverticulate, pigmented slightly to heavily, band-incrustated, brown; wall thin to 1  $\mu\text{m}$  thick. *Pileus trama* interwoven; hyphae 4-8  $\mu\text{m}$  diam, hyaline; wall thin. Gleoplerous hyphae present, 4-6  $\mu\text{m}$  diam, occasional. *Basidia* 22-30 x 4-7  $\mu\text{m}$ , clavate, four-sterigmate, hyaline; wall thin. *Basidioles* 18-26 x 3-5  $\mu\text{m}$ , similarly shaped as basidia. *Pleurocystidia* absent. *Cheilocystidia* 25-40 x 8-10  $\mu\text{m}$ , prostrate, collapsed, arising from parallel hyphae, narrowly clavate to clavate, or broadly clavate to narrowly sphaero-pedunculate, some subfusoid to fusoid; apex obtuse, mucronate, diverticulate, or knobbed. *Stipe tissue* composed of hyphae (2-)4-12  $\mu\text{m}$  diam, parallel to slightly interwoven, hyaline singly; wall thin to 0.5  $\mu\text{m}$  thick. Gleoplerous hyphae, up to 6  $\mu\text{m}$  diam present, infrequent. *Caulocystidia* forming a vestiture throughout, 40-100 x 6-8  $\mu\text{m}$ ,



**Figs 1-4.** **Fig. 1** *Gymnopus hondurensis* (Ovrebø 2259). **Fig. 2.** *Gymnopus luxurians* (Ovrebø 3040). **Fig. 3.** *Gymnopus luxurians* var. *Copeyi* (Ovrebø 3769). **Fig. 4.** *Gymnopus neotropicus* (Ovrebø 3024). Scale bar = 10 mm.

cylindrical, mostly constricted, often flexed, singly or forming tufts, prostrate to erect, arising from parallel hyphae; apex obtuse or knobbed. All hyphae inamyloid and with clamp connections present. *Basidiospores* (6-)6.5-8(-9)  $\times$  (3-)4-4.5(-5)  $\mu\text{m}$  [ $n = 75$ ,  $x = 7.3 \times 4.0 \mu\text{m}$ ,  $Q = (1.50-1.84 (-2.25))$ ], ellipsoid to broadly ellipsoid in side view and profile, hyaline, inamyloid; wall thin, smooth.

*Notes:* *Gymnopus hondurensis* was previously known only from its type locality in Belize (British Honduras). Our field notes match very well with the original description by Murrill (1915). *Gymnopus hondurensis* is distinguished by a strongly striate-translucent, brown-colored, umbilicate pileus with distantly spaced, rugulose lamellae attaching to a grooved stipe. Micromorphological comparison to the type (Mata and Petersen, 2003) yielded very similar observations for pileipellis, basidia, and basidiospores. The only difference was in the apparent absence of cheilocystidia in the

type specimen, here attributed to extirpation due to age, and which in our collections from Costa Rica were collapsed on the lamellar margin.

Other species with similar morphological characteristics as *G. hondurensis* are *G. jamaicensis*, that presents broadly clavate cheilocystidia and larger spores (7.8  $\times$  4.5  $\mu\text{m}$ ,  $Q = 1.76$ ), and *G. coracicolor*, which has scattered hymenial pleurocystidia and shorter spores (6.1  $\times$  3.6  $\mu\text{m}$ ,  $Q = 1.70$ ).

Other similar *Gymnopus* species growing on twigs and woody debris are *G. neotropicus* (Singer) JL Mata (spores 7.2-9.6  $\times$  4-5.6  $\mu\text{m}$ ,  $Q = 1.77$ ) and *G. polygrammus* (Mont.) JL Mata (spores 7.8  $\times$  4.1  $\mu\text{m}$ ,  $Q = 1.93$ ) both with larger basidiomata and voluminous cheilocystidia. *Gymnopus lodgeae* (Singer) JL Mata can be recognized by the presence of conspicuous pleurocystidia (Mata and Petersen, 2003; Mata *et al.*, 2004).

***Gymnopus luxurians*** (Peck) Murrill, N. Amer. Fl. 9:362. 1916. (Fig. 2)

*Material examined:* COSTA RICA. Provincia de Heredia, Cantón de Sarapiquí, Puerto Viejo, Estación Biológica La Selva, Sendero El Surá, on decomposed log, 4 Jul 1986, Ovrebo 2101 (USJ); same location, on soil and very rotten wood including base of dead tree, 10 May 1991, Ovrebo 3001 (USJ); same location, caespitose in soil near base of living tree, 13 May 1991, Ovrebo 3040 (CSU, USJ). UNITED STATES. Alabama, Jul 1896, LM Underwood, 1787, HT (NYS!).

*Notes:* *Gymnopus luxurians* appears to be a widely distributed species. It is commonly collected on woody debris across continental United States (Alabama is the type locality) and has been reported from Hawaii (Desjardin *et al.*, 1999), Europe (Breitenbach & Kranzlin, 1991) and more recently Dominican Republic (Mata *et al.*, 2006). Mating studies have demonstrated that this is a well established biological species (Mata *et al.*, 2006).

***Gymnopus luxurians* var. *copeyi*** J.L. Mata & R.H. Petersen, Sydowia 58(2):287. 2006.

(Fig. 3)

*Material examined:* COSTA RICA. Provincia de San José, Cantón de Dota, road to Providencia, 28 Jun 2000, JL Mata *et al.*, TFB 11026, HT (TENN!). PANAMA. Provincia de Panamá, Gatún Lake, Barro Colorado Island, Barbour-Lathrop Trail, gregarious, one caespitose clump on log, 2 Aug 1999, Ovrebo 3698 (CSU, PMA); Fairchild Trail, scattered and gregarious on wood, 17 Aug 1999, Ovrebo 3769 (CSU, PMA).

*Notes:* *Gymnopus luxurians* var. *copeyi* is morphologically similar to *G. dichrous* (Berk. & M.A. Curtis) Halling because of lignicolous habit and the voluminous cheilocystidia, but its nrITS signal falls within the phylogenetic clade of *G. luxurians* (Mata *et al.*, 2006). Initially described from the Talamanca Mountains of southwestern Costa Rica, this species is now reported for Barro Colorado Island.

***Gymnopus neotropicus*** (Singer) J.L. Mata, Mycotaxon 86:313. 2003. (Fig. 4)

*Material examined:* BOLIVIA. La Paz, Nor Yungas, Coroico, 15 Feb 1956, R Singer, B 1173, HT (LIL !). COSTA RICA. Provincia de Heredia, Cantón de Sarapiquí, Puerto Viejo, Estación Biológica La Selva, station grounds, on soil, 11 May 1991, Ovrebo 3018 (USJ); Sendero Holdridge, on soil, 12 May 1991, Ovrebo 3024 (USJ). PANAMA. Provincia de Panamá, Gatún Lake, Barro Colorado Island, Fairchild Trail, scattered beneath on small logs, 11 Aug 1999, Ovrebo 3737 (PMA); Fausto Trail, caespitose group of 3 + 1, 12 Aug 1999, Ovrebo 3743 (CSU, PMA) & scattered on large sticks and small logs, 11 Aug 1999, Ovrebo 3736

(PMA); Balboa Trail, scattered, attached to base of logs and woody debris, 13 Aug 1999, Ovrebo 3747 (CSU, PMA).

*Notes:* *Gymnopus neotropicus* has its type locality in South America and has been reported from the northern plains (Ovrebo, 1996) and Talamanca Mountains, Costa Rica (Mata, 2002). It has distantly spaced lamellae and a deeply sulcate-translucent pileus with a long, pubescent stipe. This species appears to be quite common on leafy and woody litter based on the number of collections made.

***Gymnopus omphalodes*** (Berk.) Halling & J.L. Mata, Fungal Diversity 16:122. 2004. (Fig. 5)

*Material examined:* PANAMA. Provincia de Panamá, Gatún Lake, Barro Colorado Island, Miller Trail, scattered on leaf litter, 13 Aug 1997, Ovrebo 3624 (CSU, PMA).

*Notes:* We have not seen the type of *G. omphalodes*, so our observations rely on comparisons to type specimen studies and descriptions by Dennis (1951), Singer (1973) and Pegler (1983). *Gymnopus omphalodes* was originally described from South America but has been reported from the Lesser Antilles (Pegler, 1983) and now we record it as new to Panama. In Costa Rica it has been collected from the lowlands to mountains and microscopically it can be distinguished by its huge pleurocystidia, a character shared by *G. lodgeae* and *G. pseudolodgeae* JL Mata in sect. *Vestipedes* (Mata *et al.*, 2004).

***Gymnopus subpruinus*** (Murrill) Desjardin, Halling & Hemmes, Mycologia 91(1):171. 1999. (Fig. 6)

*Material examined:* PANAMA. Provincia de Panamá, Gatún Lake, Barro Colorado Island, Van Tyne Trail, at the base of "Big Tree", scattered on partially buried wood debris, 26 May 1997, Ovrebo 3534 (CSU, PMA); Barbour-Lathrop Trail, on wood debris and twigs, 16 May 2000, Ovrebo 3823 (CSU, PMA); Lake Trail, scattered on wood debris and mulch, 13 Aug 2001, Ovrebo 4083 (CSU, PMA).

*Notes:* We have not studied the type specimen of *G. subpruinus*, but our Panamanian specimens match previous descriptions for this species and type species studies (Desjardin *et al.*, 1999). *Gymnopus subpruinus* appears to have a broad distribution, from Hawaii and western United States, to Jamaica (Desjardin *et al.*, 1999). In Costa Rica, it was reported by Ovrebo (1996). Mushrooms in this taxon have a translucent- striate pileus with pale colors,



**Figs 5-9.** **Fig. 5.** *Gymnopus omphalodes* (Ovrebo 3624). **Fig. 6.** *Gymnopus subpruinus* (Ovrebo 3534). **Fig. 7.** *Gymnopus collybioides* (Ovrebo 2250). **Fig. 8.** *Gymnopus pseudoomphalodes* (Ovrebo 2061). **Fig 9.** *Gymnopus subcyathiformis* (Ovrebo 3048). Scale bar = 10 mm.

subdistant buff-colored lamellae, and a grayish vestured stipe.

#### New records from the Costa Rican Caribbean lowlands

*Gymnopus collybioides* (Speg.) Desjardin, Halling & Hemmes, *Mycologia* 91(1):175. 1999. (Fig. 7)

*Material examined:* BRAZIL. Apiaty, Apr 1888, J Puiggari, no. 2893, HT (LPS!). COSTA RICA.

Provincia de Heredia, Cantón de Sarapiquí, Puerto Viejo, Estación Biológica La Selva, near new air-conditioned building, scattered, 22 Jul 1986, Ovrebo 2250 (USJ); Camino Experimental El Surá, on soil and soil-wood debris, 11 May 1991, Ovrebo 3012 (USJ).

*Gymnopus cervinicolor* (Murrill) J.L. Mata, **comb nov.** (Basionym: *Marasmius cervinicolor* Murrill, N. Amer. Fl. 9:265. 1915.) JAMAICA. Castleton Gardens, on fallen decayed leaves, 28 Oct 1902, Earle 223, HT (NY!)

*Notes:* *Gymnopus collybioides* is similar to *G. subcyathiformis* (Murrill) Desjardin *et al.*

and *G. biformis* (Peck) Halling but it differs from the previous in that it has a more pruinose stipe, a sharply umbilicate pileus, and flexuous, more nodulose cheilocystidia than in *G. subcyathiformis* and *G. biformis*. *Collybia cervinicolor* (Murrill) Pegler also has similarly sized and shaped cystidia and basidiospores, but its basidiomata develop a pseudocollarium when dried. Pegler (1983) mentions the presence of wiry rhizomorphs, but none were observed in the type specimen.

***Gymnopus lodgeae*** (Singer) J.L. Mata, Mycotaxon 86:313. 2003.

*Material examined:* COSTA RICA. Provincia de Heredia, Cantón de Sarapiquí, Puerto Viejo, Estación Biológica La Selva, Camino Experimental Norte, on soil, 11 May 1991, Ovrebo 3017 (USJ); same location, Research Trail, 23 Dec 1979, Lodge 294, HT (F!).

*Notes:* Distribution of *Gymnopus lodgeae* species remains limited to a few localities in Costa Rica. To our knowledge it has only been collected in its type locality – the Caribbean lowlands of northern Costa Rica –and in a few oak-dominated forest patches in the Talamanca mountain range. Key characters to distinguish this species are its umbonate-sulcate pileus and distant lamellae, with a combination of conspicuous pleurocystidia and cheilocystidia.

***Gymnopus pseudoomphalodes*** (Dennis) J.L. Mata, Sydowia 58(2):289. 2006. (Fig. 8)

*Material examined:* COSTA RICA. Provincia de Heredia, Cantón de Sarapiquí, Puerto Viejo, Estación Biológica La Selva, Sendero EL Surá, on dead standing tree, gregarious and some caespitose, 29 Jun 1986, Ovrebo 2061 (USJ).

*Notes:* We have not studied the type specimen for *G. pseudoomphalodes* so our observations of Costa Rican specimens were compared to type species descriptions and studies (Dennis, 1961; Pegler, 1983). *Gymnopus pseudoomphalodes* was originally described from Venezuela and has been reported from the Lesser Antilles (Pegler, 1983) and in the Pacific slopes of the Talamanca Mountains of Costa Rica (Mata, 2002). This species is distinguished by the pilei that are conical in the early stages, by the twisted stipes and by the occurrence on lignicolous substrates

***Gymnopus subcyathiformis*** (Murrill) Desjardin, Halling & Hemmes, Mycologia 91(1):175. 1999. (Fig. 9)

*Material examined:* COSTA RICA. Provincia de Heredia, Cantón de Sarapiquí, Puerto Viejo, Estación Biológica La Selva, Sendero Occidental, near base of standing dead snag, gregarious, 1 Jul 1986, Ovrebo 2078 (USJ); on station grounds, on soil, 13 May 1991, Ovrebo 3048 (USJ).

*Notes:* *Gymnopus subcyathiformis* is reported for the Caribbean lowlands of Costa Rica, but was collected previously on the Pacific slope of the Talamanca Mountain range (Mata *et al.*, 2006). Basidiomata exhibit a flat to depressed pileus with brown-violet colors, in combination with pallid lamellae and pruinose stipe. It is different from *G. menehune* Desjardin *et al.*, described first from Hawaii (Desjardin *et al.*, 1999) but also reported from Indonesia (Wilson *et al.*, 2005), which has deeply pellucid-striate pilei, orange-colored lamellae and densely tomentose stipes. Basidiomata of *G. biformis*, a species described from New York, are associated more with a pine-oak substrate. Fruiting bodies of *G. johnstonii* (Murrill) AW Wilson *et al.* are much smaller and have a garlic-like odor.

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