

P E R S O O N I A

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**SOME TROPICAL SPECIES OF GANODERMA (POLYPORACEAE)
WITH PALE CONTEXT**

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(With Plates 10-14)

Five species of *Ganoderma* Karsten are discussed, which are confined to the tropics and characterized by the presence of a light-colored context, but which are devoid of the laccate upper surface of the pileus typical of the species of the *Ganoderma lucidum*-group. *Ganoderma neurosporum* J. Furtado is proposed as a new species. Three of the five species—*Ganoderma amazonense* Weir, *G. coffeatum* (Berk.) J. Furtado, *comb. nov.*, and *G. neurosporum* J. Furtado—are from the neotropics. *Ganoderma lloydii* Pat. & Har. is known only from Africa, and *G. asperulatum* (Murrill) Bres. has been reported only from the Philippines and Borneo. Regardless of their geographical distribution, the five species under discussion are distinguished particularly by their basidiospore characteristics. In their morphological features they show several characteristics also found in some tropical species of *Amauroderma* Murrill.

Introduction

The genus *Ganoderma* Karsten, included in the subfamily Ganodermoideae, encompasses wood-rotting polypores commonly recognized by their reddish, yellowish or brownish woody basidiocarp showing a laccate appearance. The basidiospores are generally ovate, usually yellowish to pale brownish, and provided with a special duplex wall structure (Furtado, 1962, 1965; Heim, 1962) which recalls, in its general aspect, the U-thickening of the cells in the annulus of fern (Filicineae) sporangia. The laccate appearance has been given variable importance in the taxonomy of the ganodermoid polypores and the reader may be unaware that this single feature has been used to segregate the genus *Elfvigia* Karsten from *Ganoderma*. The evidences derived from a recent analysis of the microstructures of the basidiocarps and their value in the taxonomic treatment of the ganodermoid polypores indicate, however, that the laccate appearance plays no role in the segregation of genera in the subfamily Ganodermoideae (Furtado, 1965). Nevertheless, the analysis of a large sample of specimens revealed that, at the extremes of a range showing a complete series of intermediates regarding the laccate appearance, there is a group of species which always show a laccate appearance and another group that never exhibits any evidence of a laccate aspect. In both groups there are species with dark (brown, ferruginous, blackish, dark-grayish, etc.) context and others with pale (pale-brown, white, cream, pale yellowish, etc.) context.

This paper deals with five species of *Ganoderma* which never exhibit any evidence of a laccate appearance and have pale context. One species is proposed as new and two are being cited for the second time from new collections. They are known to occur only in tropical areas of the world, but there is no record that any one extends beyond its continent: three species are from the neotropics, one from Africa and another from the Phillipine Islands. Despite their distinct geographical distribution, these five species compose an interesting group, homogeneous in view of their general characteristics.

Materials and methods

The type specimen, or part of the type specimen, of each taxon referred to in this paper was examined. The specimens studied are cited in the herbaria indicated by the abbreviations proposed by Lanjouw & Stafleu (1964), as follows: Farlow Herbarium, Cambridge, Mass., U.S.A. (FH); Instituto de Botânica, São Paulo, S.P., Brazil (SP); Herbarium of the Royal Botanic Gardens, Kew, England (K); The National Fungus Collections, Plant Industry Station, Beltsville, Maryland, U.S.A. (BPI); and The New York Botanical Garden, New York, N.Y., U.S.A. (NY).

The techniques of sampling and mounting were based on those described by Teixeira (1962), summarized as follows: samples were taken from specific parts of the basidiocarp, teased apart and mounted in one drop of 1 per cent phloxin mixed with another drop of 3–4 percent KOH, covered with a cover slip and examined. Additional techniques involved semipermanent mounts with lactophenol cotton blue, permanent mounts with the water-soluble plastic ABOPON (Hrushovetz & Harder, 1962), and staining with 0.5 percent aqueous solution of toluidine blue. Phase contrast and dark field illuminations for microscopic observation gave the best results for the hyaline structures, especially the collapsing generative hyphae.

Special attention was given to the pattern of septation of generative hyphae. As most of these hyphae were collapsed, the septa were studied in the generative hyphae that had undergone modification. Although the concept of modified and differentiated hyphae has been emphasized and repeated elsewhere (Furtado, 1965), it is opportune to insist upon the necessary distinction between these two types of hyphae, especially because of their implication in the analysis of the hyphal system as a taxonomic aid in classification. The process of hyphal modification involves any change of diameter, pigmentation, thickness of the walls, etc., without loss of the capacity for further cell division. Modification of the generative hyphae may affect terminal, intercalary or both kinds of cells. Hyphal differentiation is a phenomenon characterized by formation of functionally and morphologically distinct structures which have limited growth. This means that a differentiated structure usually does not show cell division: the cross-walls that may appear in differentiated hyphae are usually false septa.

The identification of the skeletal hyphae in the specimens examined was never difficult, despite their poor contrast, because of the hyaline or subhyaline nature of their walls. A distinction between the binding elements and the broken tapering

ends of the branched parts of the arboriform skeletal hyphae could be made by following the branching pattern of the two kinds of differentiated hyphae. The arboriform skeletal hyphae always show distinct direction of growth and, independently of the number of branches, they always show a main axis. The binding hyphae are usually multidirectional or, at least, bidirectional. The more serious problem in the study of the binding hyphae is the decidedly fragile nature of the binding elements.

The color of several parts of the basidiocarp was compared with the color charts of Maerz & Paul (1950). The colors are indicated by the initials MP followed by the corresponding plates, row and matched number.

The nomenclature of the structure of the pilear cover and other terminology related to the microstructures of the basidiocarp have been discussed elsewhere (Furtado, 1965).

Treatment of the species

The general features of the species under discussion are as follows:—

Basidiocarp stipitate, sessile or subsessile, woody to corky; pilear cover without a laccate appearance, zonate or azonate, wrinkled or smooth; context light-colored, almost pure white to pale yellowish, darkening with 3-4 percent KOH; basidiospore of the *Ganoderma*-type; tropical.

KEY TO THE SPECIES DISCUSSED

- 1. Mature basidiospores up to 12 μ long 2
- 1. Mature basidiospores more than 14 μ long 3
 - 2. Basidiospores plicate, rarely reticulate, 8-12 × 6-9 μ *G. coffeatum*
 - 2. Basidiospores punctate, 7-9 × 6-7 μ *G. amazonense*
 - 3. Basidiospores reticulate, 14-18 × 10-13 μ *G. lloydii*
 - 3. Basidiospores plicate or asperulate 4
 - 4. Context soft, almost cottony; basidiospores yellowish, asperulate or short-plicate, 17-24 × 10-14 μ *G. asperulatum*
 - 4. Context fibrous and formed of agglutinated hyphae; basidiospores hyaline to faintly yellowish, longitudinally plicate, 18-20 × 11-15 μ *G. neurosporum*

GANODERMA AMAZONENSE Weir—Pl. 10.

Ganoderma amazonense Weir in Bull. U.S. Dep. Agric. 1380: 93 pl. 6. 1926. — Type: Weir (BPI, Path. Coll. 62043). — Type locality: Cocal Grande, Pará State, Brazil; growing on several species of trees, especially on *Hevea brasiliensis*, either alive or as decayed stumps (Weir, 1926).

MACROSCOPIC CHARACTERISTICS.—*Pileus* (Figs. 1, 2) sessile, imbricate or not, often developing pileoli on the surface or in the growing margin, also stipitate, solitary, pleuropodal or mesopodal; woody to soft woody, occasionally corky; applanate when sessile, centrally depressed in some specimens, regular or not in outline when stipitate; margin sterile below. *Pilear cover* opaque, pale-brown (MP 14 E 8), dark-brown (MP 8 H 10), or reddish-brown (MP 8 H 3), yellowish-white toward the margin, zonate or azonate, rugose or smooth, radially wrinkled or not. *Context*

light-colored, yellowish-cream (MP 11 D 5), darkening with KOH, variously thickened, about 5 mm thick towards the stipe, 1 mm thick near the growing margin. *Tubes* darker (MP 12 D 6) than the context or concolorous, variously developed, 4–10 mm long. *Pores* whitish-yellow (MP 10 B 2) to concolorous with the context, rounded to pentagonal, 4–6 per mm, edges entire. *Stipe* mesopodal or pleuropodal, concolorous with the pilear cover or darker.

MICROSCOPIC CHARACTERISTICS.—*Pilear cover* a typical crust 100–200 μ thick, derived from an indeterminate derm. *Hyphal system* trimitic: generative hyphae bearing clamp-connections (Fig. 3), thin-walled, collapsed, 2–4 μ diam.; skeletal hyphae (Figs. 4, 5) both aciculiform and arboriform, hyaline to subhyaline, thick-walled to subsolid, 3–7 μ diam.; binding hyphae (Fig. 4a) thick-walled to subsolid, 2–3 μ diam. *Hymenium* collapsed; basidiospore (Fig. 6) short-ovoid, hyaline to faintly yellowish, truncate or rounded at the apex, 7–9 \times 6–7 μ , with a punctate appearance in the tangential optical section; in the specimens examined the basidia appeared as a honeycomb-like structure.

DISTRIBUTION AND MATERIAL EXAMINED.—

Brazil: Mato Grosso State, Rio Ouro Preto, *Weir 30534* (BPI); Pará State, *Weir 20538* (BPI); Amazonas State, Tacoatiari, *Weir 30534* (BPI), Colônia Pedro Borges, *Weir 30537* (BPI).

British Honduras: Peck, 1906 (NY).

Grenada Island: Broadway, IX-1905 (NY).

Puerto Rico: Rio Piedras, *Johnston 437* and *589* (NY). *Nelson*, 29-VI-1919 (NY); Sierra Naguabo, vicinity of La Florida, *Shafer 3390* (NY).

Jamaica: Port Antonio, *coll. unknown 589* (NY).

Ganoderma amazonense is well represented by Weir's collections from Brazil in BPI, but the species has not been reported since it was described (Weir, 1926). Because of its stipitate form, *G. amazonense* could be mistaken for *G. coffeatum*. The distinction between these two neotropical species is provided by the features of the basidiospores: in *G. amazonense* the basidiospores are hyaline to faintly yellowish, with a punctate appearance, and 7–9 \times 6–7 μ (Fig. 6), whereas in *G. coffeatum* the basidiospores are yellowish, with a plicate or irregularly reticulate appearance, and 8–12 \times 6–9 μ (Figs. 17–18).

The basidiospores of *Ganoderma amazonense* were described by Weir (1926) as brown, but it is likely that the color of these structures was misinterpreted because of the bubbles filling them and blocking light transmission.

GANODERMA ASPERULATUM (Murrill) Bres.—Pl. 11.

Amauroderma asperulatum Murrill in Bull. Torrey bot. Club 35: 407. 1908. — *Ganoderma asperulatum* (Murrill) Bres. in Anns mycol. 9: 549. 1911. — *Ganoderma asperulatum* (Murrill) Sacc. & Trott. in Sacc., Syll. Fung. 21: 307. 1912. — *Polyporus asperulatus* (Murrill) Lloyd, Mycol. Writ. 6: 1063. 1921. — Type: Copeland, 1904 (NY and BPI, merotypes). — Type locality: Lamao, Bataan Province, Luzon Island, Philippines.

MACROSCOPIC CHARACTERISTICS.—*Pileus* (Figs. 7–8) stipitate, solitary, woody to corky, convex-concave, regular or not in outline; margin acute to subacute, deflexed, regular to undulate, fertile or sterile below. *Pilear cover* opaque, dark-brown (MP 15 A 6) to blackish-brown (MP 8 A 9), zonate or azonate, rugulose or smooth. *Context* light-colored, whitish-cream (MP 9 E 3) or paler (MP 9 C 2), darkening with KOH, variously thickened, usually thinner than the length of the tubes.

Tubes usually darker than the context (MP 14 B 7), up to 15 mm long. *Pores* whitish to grayish, round to pentagonal, 3–6 per mm, edges entire. *Stipe* pleuropodal, single, concolorous or darker than the pilear cover, cylindrical, solid or tubular.

MICROSCOPIC CHARACTERISTICS.—*Pilear cover* a typical crust 70–100 μ thick, derived from an indeterminate derm. *Hyphal system* trimitic: generative hyphae bearing clamp-connections, hyaline, thin-walled, collapsed, 2–4 μ diam., also modified, thickened to subsolid, hyaline to subhyaline, 2–5 μ diam.; skeletal hyphae (Fig. 9) usually aciculiform but also sparingly branched-arboriform, thickened to subsolid, hyaline to subhyaline, thick-walled, 3–5(–7) μ diam.; binding hyphae very delicate, easily broken, hyaline to subhyaline, thick-walled to subsolid, 1–3 μ diam. *Hymenium* collapsed; basidiospore (Figs. 10–11) large, ovoid, truncate or rounded at the apex, distinctly yellowish, thick-walled, 17–24 \times 10–14 μ , with an asperulate to shortly plicate appearance in the tangential optical section.

DISTRIBUTION AND MATERIAL EXAMINED.—

Philippines: Luzon Island, Mount Maquiling, *Reinking* (BPI, Lloyd Coll. 26868 and ex-Reinking 9931), *Ferrer* (BPI, Lloyd Coll. 26876, 55744, and ex-Phill. Isl. College Agric. 9767).

Borneo: (not seen; Bresadola, 1911).

In its gross morphology, *Ganoderma asperulatum* resembles a common species of *Amauroderma* found in the Philippine Islands which is usually identified as "*Amauroderma rugosum* (Blume & Nees) Pat."

***Ganoderma coffeatum* (Berk.) J. Furtado, *comb. nov.*—Pl. 12.**

Polyporus coffeatus Berk. in Ann. Mag. nat. Hist. 3: 385. 1839 (basionym). — *Fomes coffeatus* (Berk.) Sacc., Syll. Fung. 6: 163. 1888. — *Amauroderma coffeatum* (Berk.) Murrill in Bull. Torrey bot. Club 32: 367. 1905. — Type: Guilding (K). — Type locality: Saint Vincent, West Indies.

Polyporus opacus Berk. & Mont. in Anns Sci. nat. (Bot.), sér. 3, 11: 236. 1849. — *Fomes opacus* (Berk. & Mont.) Cke. in Grevillea 13: 118. 1885. — *Ganoderma opacum* (Berk. & Mont.) Pat. in Bull. Soc. mycol. Fr. 5: 67. 1889.

Polyporus angustus Berk. in Hook. J. Bot. 8: 143. 1856. — *Fomes angustus* (Berk.) Cke. in Grevillea 13: 117. 1885. — *Amauroderma angustum* (Berk.) Torrend in Broteria (Bot.) 18: 137. 1920.

Polyporus hemibaphus Berk. in Hook. J. Bot. 8: 193. 1856.

Amauroderma flaviporum Murrill in North Amer. Flora 9: 116. 1908. — *Ganoderma flaviporum* (Murrill) Sacc. & Trott. in Sacc., Syll. Fung. 21: 304. 1912.

Polyporus infulgens Lloyd, Mycol. Writ. 5: 656. 1917. — *Amauroderma infulgens* (Lloyd) Torrend in Broteria (Bot.) 18: 134. 1920. — *Ganoderma infulgens* (Lloyd) Sacc. & Trott. in Sacc., Syll. Fung. 23: 407. 1925.

MACROSCOPIC CHARACTERISTICS.—*Pileus* (Figs. 12, 13) stipitate, single, woody, also coriaceous-woody, applanate to central-depressed, irregular or orbicular in outline; margin acute to obtuse, sometimes deflexed, regular to undulate, fertile or sterile below. *Pilear cover* opaque, brown (MP 14 K 9), yellowish-brown (MP 12 D 5), reddish-brown (MP 8 H 14) or grayish to blackish-brown (MP 8 C 8); regularly concentrically zonate or not, zones usually darker than the rest of the pilear cover, reddish-brown; rugose or smooth, variously radially plicate or concentrically wrinkled. *Context* light-colored, cream (MP 9 G 4), darkening with KOH, variously thickened. *Tubes* concolorous or darker than the context (MP 13 E 8), up to 10 mm long. *Pores* yellowish to whitish, rounded or pentagonal, 4–8 per mm,

edges entire. *Stipe* mesopodal or pleuropodal, single, dark-brown, cylindrical or flattened, variously thickened, tubular or solid.

MICROSCOPIC CHARACTERISTICS.—*Pilear cover* a typical crust 200–300 μ thick, derived from an indeterminate derm. *Hyphal system* trimitic: generative hyphae bearing clamp-connections (Fig. 16), thin-walled, hyaline, often collapsed 2–3 μ diam., or modified, thick-walled to subsolid, up to 5 μ diam.; skeletal hyphae (Fig. 14) aciculiform and sparingly branched-arboriform, hyaline to subhyaline, thick-walled to subsolid (2–)4–6(–8) μ diam.; binding hyphae (Fig. 15) very fragile, hyaline, slender, thick-walled to subsolid, branched, 1.5–2.5 μ diam. *Hymenium* collapsed; basidiospore (Figs. 17–18) short-ovate, thick-walled, yellowish, 8–12 \times 6–9 μ with a plicate to irregularly reticulate appearance in the tangential section.

DISTRIBUTION AND MATERIAL EXAMINED.—

Brazil: Rio Grande do Sul State, *Rick* (BPI, ex-Weir Herb. 30567, 30568, and 30569); São Paulo State (SP 7396); “Horto Florestal do Inst. Agro. Campinas”, Ubatuba, *J. S. Furtado*, 21-IV-1966 (SP 95408); Guanabara State, Rio de Janeiro (not seen; Lloyd, 1920); Bahia State, *Blanchet* (K and BPI, as type specimen of *Polyporus opacus*), *Torrend*, 1923 (BPI, Lloyd Coll. 23406, as type specimen of *Polyporus infulgens*); Amazonas State, Panuré, *Spruce 211* (K and BPI, as type specimen of *Polyporus angustus*).

Peru: Dept. Loreto, *Killip & Smith 28731* (BPI); Navarro-Chipurana, *Stakman 21b* (BPI).

Colombia: Puerto Lopes, *Little 10028* (BPI).

Trinidad: *Rorer*, 1912 (NY).

Panamá: Canal Zone, Barro Colorado, *Woodworth*, 25-VII-1925 (BPI).

Costa Rica: San Antonio de Nicoya, *Valerio 97* (BPI); *Carpenter*, 16-XI-1950 (BPI).

Haiti: near Jean Raper, *Leonard & Leonard 12783* (BPI).

Jamaica: Hope Mine, *Earle 105* (NY, as type specimen of *Amauroderma flaviporum*).

Puerto Rico: *Seaver & Chardon 944* (NY); Santa Isabel, *Johnston*, 10-I-1912 (NY).

Cuba: Pinar del Rio, Guane and vicinity, *Shafer*, 30-XII-1911, and 11271 (NY); Soledad, Harvard Botanical Garden, *Weir*, 16-XI-1924 (BPI); Guantanamo, *Dumas*, XII-1918 (BPI); Santiago de Cuba, Alto Cedro, *Earle & Merrill*, 19-20-III-1905 (NY); *Weir*, 5-XII-1924 (BPI).

The holotype of *Ganoderma coffeatum* is represented by a single collection from the West Indies which is almost completely destroyed. Nevertheless, the distinguishing features of this species—the peculiar basidiospore wall appearance, the light color of the context, and the structure of the pilear cover—are still detectable in the remaining fragments. The adult structure of the pilear surface is a typical crust derived from an indeterminate derm. In young specimens the surface is formed by a loose, short trichoderm which undergoes incrustation and interweaving as the specimen ages. At certain stages of development of the basidiocarp, the typical crust is usually completely formed, but the hyphal tips of the juvenile trichoderm are still free. This condition gives a velutinous aspect to the surface when it is examined with a hand lens. The basidiospore (Figs. 17–18) is the principal distinguishing characteristic of *G. coffeatum*. The small difference between the largest and the smallest diameters of the spore may cause some difficulty for the detection

of the correct shape of the basidiospores. The short-plicate or irregularly reticulate appearance of the wall in the tangential optical section observed in the basidiospores of *G. coffeatum* is seen also in the basidiospores of *G. asperulatum*. The latter species, however, has much larger basidiospores, which are $17-24 \times 10-14 \mu$, and has not been found yet in the area of the neotropical flora. The woody form of *G. coffeatum* could be mistaken for the stipitate, woody specimens of *G. amazonense*. The distinction between these two neotropical species is discussed under the latter species.

The difficulty in observing the correct shape of the basidiospores of *Ganoderma coffeatum* led various authors to place this species (under its various disguises) sometimes in *Amauroderma*, at other times in *Ganoderma*.

GANODERMA LLOYDII Pat. & Har.—Pl. 13.

Ganoderma lloydii Pat. & Har. in Bull. Soc. mycol. Fr. 28: 281 pl. 14, fig. 3. 1912. — Type: coll. unknown (FH, merotype; also in the Museum of Natural History, Paris, according to Heim, 1962). — Type locality: West Africa.

MACROSCOPIC CHARACTERISTICS.—*Pileus* (Figs. 19–20) stipitate, single, woody, convex, regular or irregular; margin subacute, deflexed, regular or undulate, sterile below. *Pilear cover* opaque, brown (MP 15 A 7) to grayish-brown, zonate, rugose, radially wrinkled. *Context* light-colored, yellowish-cream (MP 11 E 5), darkening with KOH, 1–4 mm thick. *Tubes* concolorous with the context, 3–6 mm long. *Pores* yellowish to grayish-yellow, rounded to pentagonal, 4–6 per mm, edges entire. *Stipe* mesopodal, single or multiple, concolorous with the pilear cover, solid.

MICROSCOPIC CHARACTERISTICS.—*Pilear cover* a typical crust 160–200 μ thick, derived from an indeterminate derm. *Hyphal system* trimitic: generative hyphae bearing clamp-connections (Fig. 22), hyaline, thin-walled, collapsed, 2–3 μ diam. or modified, thickened to subsolid, hyaline to subhyaline, 2–5 μ diam.; skeletal hyphae (Fig. 21) aciculiform and arboriform, hyaline to subhyaline, thickened to subsolid, 3–6(–8) μ diam.; binding hyphae delicate, slender, thickened to subsolid, hyaline to subhyaline, easily broken, 1.5–2.5 μ diam. *Hymenium* collapsed; basidiospore (Figs. 23–24) large, ovate, truncate but also rounded at the apex, hyaline to faintly yellowish, $14-18 \times 10-13 \mu$, with a peculiar reticulate appearance in the tangential optical section.

DISTRIBUTION AND MATERIAL EXAMINED.—

Congo, Trotter (BPI, Lloyd Coll. 23433, det. as *Polyporus fasciculatus*).

The basidiospores are the most distinctive characteristic of *Ganoderma lloydii*. They appear reticulate in tangential optical section (Figs. 23–24). In certain specimens of *G. coffeatum* (a species restricted to the American tropics), the basidiospores may have an irregular reticulate appearance. These basidiospores, however, are $8-12 \times 6-9 \mu$, whereas those of *G. lloydii* are $14-18 \times 10-13 \mu$.

Ganoderma lloydii was theoretically 'discovered' by Lloyd (1912) who mentioned an unnamed specimen of *Ganoderma* that he found in Paris. The species was described in Lloyd's honor but, despite the conspicuous and large *Ganoderma*-type basidiospores, Patouillard & Hariot (1912) placed this species in Patouillard's (1889) section *Amauroderma*. *Ganoderma lloydii* appears not to have been reported since its original description, except in studies dealing with its type specimen (Heim, 1962). I identified a specimen collected by Trotter in the Congo (identified by Lloyd as *Polyporus*

fasciculatus, which is a species of *Amauroderma*) as *G. lloydii*. This is, perhaps, the second collection ever known of this species. It is represented by an excellent specimen.

***Ganoderma neurosporum* J. Furtado, *sp. nov.*—Pl. 14.**

Pileus stipite instructus, lignosus, applanatus, leviter umbonatus; pilei superficies opaca, concentric zonata, rugosa, radialiter rugulosa, distincte crustosa, fusco-brunnea; superficies hymenialis porosa: pori rotundi, parvi, circiter 200 μ diam., 4–5 per mm; tubi 1.5 cm longi; basidia non visa; sporae magnae, hyalinae, pallide flavescentes, ovoideae, longitudinaliter costatae, 18–20 \times 11–15 μ .

TYPE: *Myer*, 18-VII-1945 (BPI and SP, merotypes). — Type locality: Buenos Aires, Panama.

PARATYPES:

Brazil, Mato Grosso State, Santa Ana da Chapada, Buriti, *Malme*, 15-VI-1894 (BPI).

Venezuela, Amazonas Territory, Tributary of Rio Conucunuma, Playa Alta, *B. Maguire, R. S. Cowan, & J. J. Wurdack 29390* (NY and SP).

Costa Rica, Limon Province, tributary of Rio Siquirres, *Dodge & al. 5668* (BPI).

MACROSCOPIC CHARACTERISTICS.—*Pileus* (Figs. 25–26) stipitate, subsessile or sessile; applanate; with an irregular umbo between two concrescent parts (holotype) or symmetrical; convex; margin obtuse, regular to undulate, sterile below. *Pilear cover* opaque, brown (MP 15 E 9) with reddish-brown concentric zones, rugose, radially wrinkled. *Context* light-colored, creamish (MP 9 C 2) or brownish-cream in older specimens, darkening with KOH, typically fibrous, 2–5 mm thick. *Tubes* darker than the context, tending to a grayish-brown (MP 14 E 7), 1–1.5 cm long. *Pores* creamish or grayish, small, about 200 μ diam., rounded, 4–5 per mm. *Stipe* pleuropodal, when present, irregularly compressed, short, thick and solid (in the holotype).

MICROSCOPIC CHARACTERISTICS.—*Pilear cover* a typical crust 400–500 μ thick, derived from an indeterminate derm. *Hyphal system* trimitic: generative hyphae bearing clamp-connections (Fig. 28–29), thin-walled, hyaline, collapsed, or modified, hyaline to subhyaline, thickened to subsolid, 3–5 μ diam.; skeletal hyphae (Fig. 27) mostly aciculiform but also sparingly branched-arboriform, thick-walled to subsolid, hyaline to subhyaline, 3–7 μ diam.; binding hyphae (Fig. 30) very slender, delicate, much branched, twisting prominently, thick-walled to subsolid, 1–2.5 μ diam. *Hymenium* collapsed; basidiospore (Figs. 31–32) ovate, hyaline to faintly yellowish, 18–20 \times 11–15 μ , with a distinctive longitudinally plicate appearance in the tangential optical section.

In its morphological features, *Ganoderma neurosporum* may resemble old specimens of *G. coffeatum*, but the latter has smaller basidiospores.

One of the paratype specimens is a fragment of the basidiocarp collected in Brazil by Malme in 1894 whose hymenomycete collections were studied by Romell (1901). The cited specimen was unknown to Romell and probably also to Bresadola who, according to Romell (1901), received specimens for identification. The annotation slip attached to the basidiocarp fragment at BPI indicates that Romell, suspecting a new species, used an unpublished name.

RESUMO

Cinco espécies de *Ganoderma* Karsten restritas às regiões tropicais do globo e caracterizadas pela presença de contexto de coloração clara e ausência do aspecto lacado da cobertura pilear, que é típica para as espécies do grupo *Ganoderma lucidum*, foram discutidas. Uma delas, *Ganoderma neurosporum* J. Furtado, é proposta como nova.

Tres das cinco espécies—*Ganoderma amazonense* Weir, *Ganoderma coffeatum* (Berk.) J. Furtado, comb. nov., e *Ganoderma neurosporum* J. Furtado—são encontradas nos trópicos americanos. *Ganoderma lloydii* Pat. & Har. é conhecida apenas para a Africa, e *Ganoderma asperulatum* (Murrill) Bres. tem sido reportada unicamente para as Filipinas e Borneo.

Apesar da distinta distribuição geográfica, as cinco espécies discutidas distinguem-se das demais do gênero *Ganoderma* pela coloração clara do contexto. Pelas características gerais do basidiocarpo, as mesmas espécies podem ser confundidas com algumas espécies do gênero *Amauroderma* Murrill. A distinção entre as cinco espécies de *Ganoderma* discutidas é feita fundamentalmente pelo exame dos basidiosporos.

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EXPLANATION OF PLATES 10-14

PLATE 10

Figs. 1-6. *Ganoderma amazonense*. — 1. Stipitate basidiocarp. — 2. Pileoli in the growing margin. — 3. Originally penultimate segment of generative hypha showing broken part of the clamp-connection ($\times 600$). — 4. Skeletal and (a) binding hyphae ($\times 200$). — 5. Branched arboriform skeletal hypha ($\times 200$). — 6. Basidiospores in distinct optical section ($\times 2800$).

PLATE 11

Figs. 7-11. *Ganoderma asperulatum*. — 7, 8. Basidiocarps. — 8. Holotype. — 9. Arboriform skeletal hypha ($\times 220$). — 10, 11. Basidiospores, in median and tangential optical sections ($\times 1350$).

PLATE 12

Figs. 12-18. *Ganoderma coffeatum*. — 12, 13. Basidiocarps. — 12. Type specimen of *Polyporus opacus*. — 13. Type specimen of *Amauroderma flaviporum*. — 14. Aciculiform skeletal hyphae ($\times 200$). — 15. Broken pieces of binding hyphae ($\times 200$). — 16. Clamp-connection of generative hypha ($\times 1500$). — 17, 18. Basidiospores, in tangential and median optical sections ($\times 1500$).

PLATE 13

Figs. 19-24. *Ganoderma lloydii*. — 19, 20. Basidiocarp col. Trotter, Congo. — 21. Arboriform skeletal hypha ($\times 200$). — 22. Modified generative hypha showing clamp-connection at superior level ($\times 350$). — 23, 24. Basidiospores in tangential and median optical sections ($\times 1400$).

PLATE 14

Figs. 25-32. *Ganoderma neurosporum*. — 25, 26. Holotype. — 27. Skeletal hypha ($\times 500$). — 28, 29. Part of clamp-connection in broken hyphae ($\times 1400$). — 30. Binding hypha ($\times 600$). — 31, 32. Basidiospores in median and tangential optical sections ($\times 2250$).









