

Neotropical Ganodermataceae (Basidiomycota): *Amauroderma sprucei* and *A. dubiopansum*

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Abstract – During the survey of wood-inhabiting fungi in Cuba, several specimens of an *Amauroderma* species with a brightly colored pore surface, viz. bright orange, were collected, and subsequently identified to *A. dubiopansum*. However, the status of the latter name, particularly its taxonomic relationship with *A. sprucei* remained uncertain. In order to confirm the identification, the type specimens of *A. dubiopansum* and *A. sprucei* were studied and compared to our various collections. We have concluded that *A. sprucei* and *A. dubiopansum* are synonyms, the former epithet having priority.

Cuba / Neotropics / *Polyporus pansus* / Taxonomy

INTRODUCTION

During several field surveys of polypores in western Cuba, more particularly in the Sierra del Rosario Biosphere Reserve, belonging to the homonymous western hills range, two *Amauroderma* species were encountered. The first species, and by far the commonest, was readily identified as *A. schomburgkii* (Mont. & Berk.) Torrend (Furtado, 1981; Ryvarden, 2004). However, the second species, found on only two occasions, was peculiar, having a brightly orange pores surface (Fig. 2), a feature unique within *Amauroderma*, and so far, known only in *Amauroderma dubiopansum* (Lloyd) Ryvarden (Corner 1983, Dennis 1970, Ryvarden 2004), a species originally described from Brazil (Lloyd 1912).

In addition to its bright orange pore surface, *A. dubiopansum* is mainly characterized by having dextrinoid vegetative hyphae (Corner, 1983; Ryvarden, 2004), and globose basidiospores, 8-10 µm in diam. (Corner, 1983; Dennis, 1970; Lloyd, 1912; Ryvarden, 2004).

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However, its taxonomic status, especially, its taxonomic relationships with *A. sprucei*, has been debated, and both names were either considered as synonyms (Furtado, 1981; Ryvarden, 1990; Moncalvo & Ryvarden, 1997) or encompassing two distinct species (Corner, 1983; Dennis, 1971; Ryvarden, 2004). The main feature then emphasized to differentiate *A. dubiopansum* from *A. sprucei* or other related species (of which *Polyporus pansus* Berk. (= *Amauroderma omphalodes* (Berk.) Torrend, Furtado, 1981) being the pore surface colour, respectively orange or whitish to creamy (Corner, 1983; Dennis, 1971; Lloyd, 1912; Ryvarden, 2004).

The type specimen of *A. sprucei*, *A. dubiopansum*, and *Pol. pansus* were revised, compared to one another and to our various Cuban collections and an additional specimen originating from French Guyana. From these studies, we have concluded that *A. dubiopansum* and *A. sprucei* should in fact be considered as synonyms, the latter epithet having the priority.

MATERIAL AND METHODS

The study is based on types or original specimens from the herbaria BPI, E, K, and MUCL (herbarium acronyms are from Holmgren *et al.*, 1990). Specimens were examined in Melzer's reagent, KOH 4% and Lactic acid Cotton blue. Colours are described according to Kornerup and Wanscher (1981). All microscopic measurements were carried out in Melzer's reagent. In presenting the range of the size of microscopic elements, 5% of the measurements were excluded from each end and are given in parentheses. The arithmetic means of different measurements are also provided.

TAXONOMY

***Amauroderma sprucei* (Pat.) Torrend, Brotéria Bot. 18: 121, 1920** Figs. 1-6

≡ *Ganoderma sprucei* Pat., Bull. Soc. Mycol. Fr. 10: 75, 1894.

= *Porotheium rugosum* Berk., J. Bot. & Kew Misc. 8: 237, 1856.

= *Polyporus dubiopansus* Lloyd, Lloyd Mycol Writ. 3: 125, 1912.

≡ *Amauroderma dubiopansum* (Lloyd) Ryvarden, Neotropical Polypores, Synop. Fung. 19: 52, 2004. (Not *Amauroderma dubiopansum* (Lloyd) Dennis, Fung. Fl. Venezuela: 117, 1970, invalid combination, Greuter *et al.* 2000, art. 33.3).

Other description can be found in Corner (1983) and Ryvarden (2004), the former especially for a complete description of the hyphal system.

Basidiocarp stipitate, pleuro- or mesopodal. Stipe short, thin to thick, more or less round in section or slightly ellipsoid, 31-40 mm long × 3.5-22 mm wide at the occasionally slightly bulbous base, down to 5-14 mm at the apex, smooth, glabrous, covered by a hard, horny crust, brown to dark brown (mainly chocolate brown, 6E6 but up to 6F6). Pileus laterally, centrally or eccentrically attached to the stipe, spatulate, flabelliform, semicircular to dimidiate, up to 20-60 mm long, 30-90 mm wide, or circular, slightly ellipsoid, to irregular in shape, and up to (28)36-135 mm diam., applanate, horizontal, to somewhat campanulate in section,



Figs. 1-6. *Amauroderma sprucei*. 1-2. Specimens MUCL 44084 (scale bar = 20 mm); 3-4. Type specimen of *A. sprucei* (scale bar = 40 mm); 5-6. Type specimen of *A. dubiopsun*. Note that pileus surface is in part covered by a basidiospores print, making its color, lighter than unusual (scale bar = 70 mm).

occasionally slightly umbonate at the centre, 9-15 mm thick at the base/centre, down to 1-2 mm thick at the margin. Pileus surface slightly to distinctly concentric sulcate and radially wrinkled, dull, glabrous, covered by a crust, homogeneously brown all over the surface (chocolate brown (6E5-6), cocoa brown), greyish chocolate brown, up to dark brown (toward 6F6), or commonly with

narrow to medium size, concentric, darker bands, dark brown up to blackish brown (6F5-6) to blackish, larger and darker near the base or at the centre, rarely with a tint of reddish (7F6), occasionally paler, pale corky (4B3, 5B4, greyish orange) near the margin. Margin sharp to abruptly bent, creamy, pale corky, or concolorous with the pileus, chocolate brown. Pore surface in variable orange tint when fresh, from very pale orange, almost white, to bright orange, cadmium orange (5A8, to more commonly deep orange, carrot red, orange peel (6AB7-8), drying paler, whitish, pale orange white (6A3), greyish orange (5B4-5), or darker, near brick red or dirty brownish orange (6BC5-6, 6D5-7). Pores round, even, small, (6)7-8/mm, (85)95-147(170) μm diam. (\bar{x} = 114 μm diam.). Dissepiments thick, smooth or with a slightly pruinose aspect. Trama of the stipe usually homogeneous, with a corky consistency, a fibrous texture when fresh, or heterogeneous, with the centre slightly hollowed or having a looser consistency, which is more obvious near the base, then shrinking on drying, white, whitish, and drying whitish, pale creamy, faintly pale greyish brown near the surface (the crust). Trama of the pileus 3-14 mm thick at the centre or base down to 1-3 mm thick at the margin, homogeneous, with a hard corky consistency, a fibrous texture, white, whitish, and drying whitish, pale creamy, faintly pale greyish brown near the crust. Tube layer single, 2-9 mm thick, white to pale orange when fresh, drying off-white, pale creamy, greyish orange (5B4, 6B4), light brown (6CD6-7), reddish golden, light brown), with a harder consistency, up to hard resinaceous, and a denser fibrous texture. Crust on the stipe and pileus, hard, horny, dark brown to blackish brown, 50-200 μm thick. Hyphal system di-trimitic in the context and the trama of the tubes. Generative hyphae thin-walled, clamped. Vegetative hyphae in all part of the basidiome hyaline, strongly dextrinoid, cyanophilous. Stipe and Context of a similar composition. Trama of the tubes dimitic with generative and hyaline arboriform skeletal hyphae. Mature basidia not seen. Basidiospores subglobose to globose, double-walled, the endospore thick-walled, faintly yellowish, slightly dextrinoid, cyanophilous, with conspicuous fine, cylindrical endosporic projections, the exospore hyaline, thin, negative in Melzer's reagent not cyanophilous, the endo-exosporic space 0.5-0.8 μm thick, (6.8)7.5-9.8(10.3) \times (6.5)7.0-9.0(9.5) μm , $R = (1.0)1.1-1.2(1.2)$ ($\bar{x} = 8.6 \times 7.8 \mu\text{m}$, $\bar{x} = 1.1$). Chlamydospores absent. Substrate. On soil, or wood (buried wood?). Type of rot. A white rot (positive reaction with ABTS in pure culture). Sexuality. Unknown.

In pure culture, the species produce on malt agar a bright orange mycelium, up to brick red with age.

Holotype: Brazil, Amazonas State, Panur , Spruce 44, BPI (Type of *Porothelium rugosum* Berk.).

Additional specimens examined: Brazil, Minas Gerais State, Serra do Fraz o, Ouro Preto, L. Dalmazio, BPI, Lloyd Herbarium 36121 (Holotype of *Polyporus dubiopianus* Lloyd); Brazil, Mato Grosso, North of Chavantina, R.S. and R.G.S. Base camp, 30 Jan. 1968,  .J.H. Corner, E. Cuba, Prov. Pinar del R o, San Andr s, in the transition zone between a dry *Quercus cubana* forest and a humid, riparian, secondary forest, near a small tributary, on soil, Sep. 2002, C. Decock and S. Herrera Figueroa CU-02/89 = MUCL 44082, HAC; CU-02/93 = MUCL 44083 = MUCL 44107, HAC; CU-02/91 = MUCL 44084, HAC; CU-02/85 = MUCL 44095, HAC; CU-02/96 = MUCL 44096, HAC (cultures ex-specimens MUCL 44096 = CRGF 12, MUCL 44107 = CRGF 13); French Guyana, Kourou valley, on the hill above the cabin of L. Collado (*Association Canop e*), 4  53' 182  N- 52  47' 849 W, on a dead fallen trunk of unidentified angiosperm, 04 Jul. 2002, C. Decock & G. Castillo, FG-02/71, MUCL 43926.

DISCUSSION

Amauroderma sprucei is characterized by a mainly stipitate, occasionally subsessile basidiocarp, a dull, mainly brown (chocolate brown) pileus (Figs. 1, 3, 5), a pale (whitish orange) to bright orange pore surface when fresh (Fig. 2), discolored when older and weathered, or in dried conditions, then whitish, pale orange white, greyish orange (Figs. 4, 6), or darker, near brick red or dirty brownish orange, 7-8 pores/mm (\bar{x} = 112 μ m in diam.), a whitish context when fresh, drying whitish to pale creamy, whitish to greyish orange tube layer, strongly dextrinoid vegetative hyphae, both in the context (including the stipe) and the hymenophoral trama, and subglobose basidiospores, (7.5)8.0-10.0(10.3) \times (7.0)7.0-9.0(9.5) μ m, (\bar{x} = 8.8 \times 7.9 μ m) with numerous, narrow, cylindrical inter-wall pillar, the inter-wall space ranging from 0.5 to 0.8 μ m wide.

The comparison of the type specimens of *A. sprucei* [= *Porothelium rugosum* Berk.³] and *A. dubiopansum* did not allow to evidence any consistent differences that would support the recognition of two distinct species. Corner (1983), Dennis (1971), and Ryvarden (2004) emphasized the pore surface colour to distinguish both taxa. However, this character does not hold after a careful comparison of the diagnosis of both species, revision of their type, and comparison with fresh specimens.

Indeed, and importantly, it cannot be excluded from Berkeley's (1854) original diagnosis that the pore surface of the *A. sprucei* type specimen had, originally, an orange tint, even if currently the specimen is no longer of that colour. In his original description, Berkeley (1856) did mention the orange colour of the pore surface. Although in the Latin diagnosis, he characterized the hymenium [pore surface] as "*lutuelo*" [yellowish], in the subsequent English description, he specified, significantly for us, "... yellowish, inclining to orange" (Berkeley 1856), a fact that subsequent authors (Corner 1983, Furtado 1981, Ryvarden 2004) seem to have overlooked.

The range of colour variation in mature and freshly collected orange-tinted specimens is largely unknown, or at least was not specified, as it may change on ageing or weathering. Most fresh specimens of *A. dubiopansum sensu* Corner (1983), Dennis (1971) and Ryvarden (2004) encountered in Cuba had an orange-tinted pore surface, bright orange (Fig. 2), or in some, perhaps still immature or apparently older basidiomes, darker, more brick red to brownish orange, or lighter, pale orange to almost white on place. A specimen collected in French Guyana also had an orange tint, although already (probably) weathered and discolored, brownish orange to light brown.

The colour variation can be greater still and the color can drastically change when the specimens are (badly) dried or stored, or after long-term storage in herbaria. Corner's specimen is no longer orange as stated in his description ["brilliant orange" (Corner, 1983)] but pale to grayish, up to brownish, orange. This might have happen with the type of *A. sprucei*.

3. The species was in fact first described as *Porothelium rugosum* Berk. Patouillard (1894) first recognized the affinities of the species with *Ganoderma* Karst. but could not recombine "rugosum" in the latter genus, the binomial *G. rugosum* being already occupied by *G. rugosum* (Bl. & Nees: Fr.) Pat. (1889). He then proposed *Ganoderma sprucei* Pat. for this species. The binomial *Amauroderma rugosum* (Bl. & Nees: Fr.) Torr. being also occupied, the combination in *Amauroderma* is also *A. sprucei* (see also Furtado 1964 for the nomenclature status of this name).

Table 1.

<i>Specimens</i>	<i>Locality</i>	<i>Spore range</i>	<i>Spore range</i>
<i>A. sprucei</i>			
Type	Brazil	(6.8)7.0-9.0(9.0) × (6.5)6.5-8.2(9.0)	8.1 × 7.4
Type (<i>P. dubiopsanus</i>)*	Brazil	(8.5)8.5-10.3(10.3) × (7.3)7.8-9.0(9.5)	9.5 × 8.6
Corner (E)	Brazil	(7.5)7.9-9.5(9.5) × (7.0)7.0-8.6(8.7)	8.6 × 7.8
MUCL 43926	French Guyana	(8.0)8.1-9.0(9.0) × (7.0)7.2-8.1(8.3)	8.6 × 7.7
MUCL 44082	Cuba	(8.0)8.0-10.0(10.0) × (7.0)7.0-8.8(8.8)	8.6 × 7.6
MUCL 44083	Cuba	(8.0)8.0-9.1(9.5) × (7.0)7.1-8.5(8.5)	8.6 × 7.8
MUCL 44084	Cuba	(8.0)8.0-9.5(10.2) × (7.0)7.0-8.5(9.0)	8.8 × 7.9
<i>Polyporus pansus</i>			
Type	Brazil	(8.5)8.7-10.0(10.5) × (8.0)8.0-9.2(9.2)	9.3 × 8.6

* Measurements taken from a basidiospores print. Interestingly, a basidiospores print is present on the surface of the pileus of the type specimen, making it lighter than usual.

Furthermore, the influence of the environmental conditions on the pore surface colour is not known.

There are other examples of wide colour variation of the pore surface in polypores species, as for instance *Pycnoporus sanguineus* (Fr.) Murrill, the color of which ranges from deep red to almost white (Ryvarden and Johansen 1980). *Perenniporia aurantiaca* (David & Rajchenb.) Decock & Ryvarden, also orange to brick red when fresh and actively growing, can also fade considerably on weathering or bad drying.

The micro-morphology of both type specimens is similar, and similar to our collections: the important features are the strongly dextrinoid vegetative hyphae present in all part of the basidiomes and the globose basidiospores, the average ranging from 8.1-9.5 × 7.4-8.6 µm (Tab. 1). The basidiospores are slightly smaller in the type of *A. sprucei* (Tab. 1) but not outside the range reported here for other specimens with a bright orange pore surface.

In conclusions, as it can not be excluded from the original diagnosis that the pore surface of the type specimen of *A. sprucei* had, by the time Berkeley (1854) studied it, an orange tint, and all other macro- and microscopical features being in concordance, we would consider that *A. dubiopsanus* is a synonym of *A. sprucei*, the latter epithet having priority.

Lloyd (1912) related *Polyporus dubiopsanus* to *Polyporus pansus* Berk., noting that both species were indistinguishable but by the orange pore surface of the former. The study of the type specimen of *Polyporus pansus* [Brazil, Panure, Spruce # 205, K (K(M): 108633)] gave us the following data: pores: 7-8 / mm, 83-125 µm diam. (\bar{x} = 101 µm); basidiospores (8.5)8.7-10.0(10.5) × (8.0)8.0-9.2(9.2), \bar{x} = 9.3 × 8.6 µm. The vegetative hyphae are typical of *Amauroderma* (Corner 1983) and not or variably dextrinoid, the reaction being weak in the hymenophoral trama and more pronounced in the context.

The basidiospores of *P. pansus* are, as regards their size, similar to those of *A. sprucei*. However, they differ in their ornamentation that is denser but less

pronounced in *P. pansus*, and in the endo-exospore space, which is narrower in *P. pansus* than in *A. sprucei*. The reaction of the vegetative hyphae in Melzer's reagent also differentiates both taxa: the vegetative hyphae in *A. sprucei* are immediately and strongly dextrinoid while the reaction is absent or weak in *P. pansus*.

Furtado (1981) reduced *P. pansus* to synonymy with *A. omphalodes* (Berk.) Torrend. However, he noted basidiospores $11-13 \times 9-11$ for *A. omphalodes* and $8.0-9.5 \times 7.5-8.0$ for the type of *P. pansus* ($8.7-10.0 \times 8.0-9.2$ μm , pers. obs.) but considered the latter to be "at the lowest extreme of the variation found [in *A. omphalodes*]" (Furtado 1981). Furthermore, Furtado (1981) noted 4-6 pores/mm in *A. omphalodes* while in *P. pansus*, it is 7-8 / mm (pers. obs.). The differences observed lead us to question the synonymy of the two names. This will be discussed in detail elsewhere.

Steyaert (1972) considered *A. sprucei* as a synonym of *A. rugosum* (Bl. & Nees: Fr.) Torr. The latter was originally described from Southeast Asia, and later reported throughout the tropics. However, the type seems to have been lost (Moncalvo and Ryvar den 1987), making any taxonomic conclusions about this species impossible. Taking into consideration that *A. sprucei*, in its present circumscription, is, in all probability, endemic to the Neotropics, the synonymy with *A. rugosum* would be dubious.

The species concept of *A. sprucei* as we understand it here would thus correspond to *A. dubiopianum sensu* Corner (1983), Dennis (1971), and Ryvar den (2004). *Amauroderma sprucei sensu* Furtado (1981), Moncalvo and Ryvar den (1987), and Ryvar den (2004), and as already noted by Moncalvo and Ryvar den (1987), might represent a complex of taxa, and should be carefully revised.

The species, in the restricted sense adopted here, only occurs in the neotropics and is currently known from Brazil (Corner, 1983; Lloyd, 1912), Venezuela (Ryvar den, 2004), French Guyana (pers. obs.), Costa Rica (Ryvar den, 2004), Belize (Ryvar den, 2004), and Cuba (pers. obs.), the latter probably representing the species Northern limit of distribution.

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