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Cantharellus solidus, a new species from Benin (West-Africa) with a smooth hymenium

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Abstract – This paper presents *Cantharellus solidus*, a new species from the Guineo-Sudanian part of Benin (West Africa). *C. solidus* is likely close to the *C. lateritius*-complex and occurs in forest galleries dominated by *Berlinia grandiflora* and *Uapaca togoensis*. Data from specimens collected in Bénin were compiled and compared with data available on a number of closely related taxa. Illustrations of macroscopy and microscopy are given, as well as information on its ecology.

Cantharellales / taxonomy / Bénin / savannah woodland / *Cantharellus lateritius* / *Goossensia*

Résumé — Cet article présente la description de *Cantharellus solidus,* une espèce nouvelle de la partie Guinéo-Soudanienne du Bénin. *C. solidus* est proche du complexe autour de *C. lateritius* et n'est connue que des forêts galeries dominées par *Berlinia grandiflora* et *Uapaca togoensis*. Les données des spécimens échantillonnées sont comparées à celles de quelques espèces proches. Des illustrations de la macro- et microscopie sont données, ainsi que quelques notes sur l'écologie.

Cantharellales / taxinomie / Bénin / savane boisée / forêt claire / *Cantharellus lateritius* / *Goossensia*

INTRODUCTION

The diversity of *Cantharellus* in the West African ectomycorrhizal forest ecosystems is very limited compared to the one from East Africa's miombo forests. In East Africa *Cantharellus* is mostly found under Caesalpiniaceae, especially *Brachystegia*, *Julbernardia* and *Isoberlinia*, as well as under trees belonging to *Uapaca* (Phyllantaceae). In the Sudanian open woodlands Caesalpiniaceae and *Uapaca* are well represented, although *Julbernardia* and *Brachystegia* are lacking (Thoen 1996). Especially the ectomycorrhizal genera *Isoberlinia*, *Berlinia*, *Burkea*, *Afzelia* and *Uapaca* are dominating the open sudanian woodlands and their forest galleries. The paucity of *Cantharellus* in West Africa is reflected in the literature surveys from Rammeloo & Walleyn (1993) and Walleyn & Rammeloo (1994). The complete lack of literature reporting the interest of West-African people in

Cantharellus, as a food resource, is striking compared to what *Cantharellus* means for local people in central and especially eastern Africa and Madagascar (Tibuhwa *et al.* 2008, Buyck 2008). Since the literature surveys from Rammeloo & Walleyn (l.c.), De Kesel *et al.* (2002) collected and reported the presence of *Cantharellus floridulus*, *C. congolensis*, *C. platyphyllus* and *C. rufopunctatus* in Benin. *Cantharellus conspicuus* Eyssart., Buyck & Verbeken is reported from Beninese forest galleries (Eyssartier *et al.* 2002), and in a plot survey including several types of open woodlands, Yorou *et al.* (2002) only found *Cantharellus floridulus*. Because of this feeble representation, *Cantharellus* is not known nor appreciated as a food resource in Benin and the entire region; even by those with a special interest and sound knowledge of edible species (De Kesel *et al.* 2002, 2008).

The objective of the present study is to describe and illustrate a large and conspicuous species that is restricted to forest galleries specifically dominated by *Berlinia grandiflora*.

MATERIALS AND METHODS

The specimens were collected in Bénin (Republic), Province of Donga, in the small forest reserve (Forêt Classée de Bassila, ca. 360m alt.s.m.) near Bassila (9° 0'8.53"N - 1°40'6.88"E). This forest is unique in Bénin and holds a forest gallery along the river Akoka. It has a Sudano-Guinean character, but lies within a vast area of moderately to heavily perturbated Sudanian open woodlands and savannahs. In certain areas of the gallery, especially where the new species occurs, the tree layer is dominated by *Berlinia grandiflora* (Vahl) Hutch. & Dalz. (Caesalpiniaceae) which is co-dominant with *Uapaca togoensis* Pax (Phyllanthaceae), *Lonchocarpus sericeus* (Poir.) Kunth, *Pterocarpus santalinoides* L'Herit. ex DC. (Fabaceae), *Elais guineensis* Jacq. and *Napoleonaea vogelii* Hook. & Planch. (Lecythidaceae). The herbaceous cover is very irregular and sometimes completely lacking. *Cyrtosperma senegalensis* (Schott) Engl. (Araceae) is common in areas with anthropogenic perturbation (for collecting of water). During heavy rains some parts of the gallery, including the site with *Cantharellus solidus*, become temporarily flooded. The soil is rich in iron, slightly hydromorphic and fine. The soil around nearby large termite hills (Macrotermitidae) is more clayey. The river bed is gravelly and strongly meandering. The slopes have much coarser soil and are rich in iron conglomerates. Very little light penetrates in the gallery.

Collection of specimens, field notes and photographs were taken during several expeditions between 2000 and 2004. Colour codes (between square brackets) and names for colours correspond to the Methuen Handbook of Colour (Kornerup & Wanscher 1983). The microscopic structures were observed in Melzer's reagent as well as in Congo-red ammonia. Measurements were performed using an Olympus BX51 light microscope, with digital camera and AnalySIS® Five imaging software (Soft Imaging System GmbH). Mean values (in italics) ± 1.96 × standard deviations, and minimum-maximum values (between brackets) are given for all microstructures and derived parameters (length/width ratios). For the statistical data the number N of basidiospores that were measured is given (between braces). The collections are deposited at the National Botanic Garden of Belgium's herbarium 'BR' (abbreviation following Holmgren *et al.* 1990).

TAXONOMY

Cantharellus solidus De Kesel, Yorou & Buyck sp. nov.
Mycobank : MB 561703

Carpophorus solidus, Cantharello lateritio affinis sed caro singulariter callosa (cartilaginosa, fibrosa). Pileus infundibuliformis, albo aurantiacus vel laete sufflavus ochraceus ad pallido armeniacus. Hymenium teres vix rugulosum, albidum deinde rosaceo-griseum. Stipes validus, radicatus, saepe conjunctus in terram ad lignum defunctum, ad apicem cum tenuis squamulis ochraceo-flavis tectus. Caro languidius flavo-brunnescens, ocissimus in pellis et hymenium. Basidia elongata, plerumque bisterigmata. Basidiosporae albidae, ellipsoideae vel subglobosae. (8.3-)8.4-10.2-12(-12.5) × (6.3-)6.6-8.1-9.5(-9.6) µm; Q = (1.05-)1.1-1.26-1.42(-1.47) Cystidia desunt. Fibulae conspicuae.

Holotypus: Benin, Prov. Donga, Bassila, ad terram, continens fluvius (Akoka) in silvae clarioris (A. De Kesel 3476, in herbario BR conservatus)

Etymology: the name refers to the compact and remarkably solid nature of the context.

Fruitbodies gregarious or in tufts. **Pileus** 3-9 cm wide, convex, becoming infundibu-liform, often irregular, sometimes with subimbricate lobes, dry, glabrous to subtomentose, then minutely floccose in the centre, at first pale yellow to yellowish white (4A4-4A3(2)), becoming orange white (5A2) to pale yellowish ochre (5B3-4) or apricot (5B6), sometimes slightly zonate, particularly along the margin; margin acute, thin, strongly incurved, then incurved to deflexed. **Stipe** (2) 3-8 x 0.8-1.6 cm, cylindric, tapering downwards and rooting 2-7cm deep, fleshy, solid and very compact, sometimes stuffed in its upper part, concolorous or paler than the pileus (4A2), slightly darker towards the base (4A3), glabrous to subtomentose in the lower part, beset with minute pale yellowish ochre (5B4) to apricot (5B6) squamules in the upper part, slowly turning pale yellowish ochre to brownish when bruised. **Hymenophore** smooth, sometimes becoming subrugulose to radially rugulose, whitish cream then pinkish white (5A2) to reddish grey (7A2-7B2-8B5), bruising yellowish ochre to brownish, often forming a very irregular demarcation line over the stipe. **Context** white, yellow in the base of the stipe, turning slightly pale yellowish ochre on exposure, 1-2 mm thick in the pileus, 2-5 mm in the centre, becoming compact and tough towards the base of the stipe. **Basal mycelium** scanty, ochraceous. **Odour** and **taste** as in *Cantharellus cibarius*, fruity.

Basidiospores ellipsoid to subglobose, (8.3-)8.4-10.2-12(-12.5) × (6.3-)6.6-8.1-9.5 (-9.6) µm; Q = (1.05-)1.1-1.26-1.42(-1.47) {N=55}, pale pinkish in the mass. **Basidia** very long 110-125 × 5.8-6.6(7) µm and narrowly clavate, hyaline; (1)2-spored; sterigmata 4-5.2µm long. **Basidioles** 45-65 × 4.2-6.9(7.3) µm, easily collapsed. **Hymenium** up to 250-310 µm thick near stipe. **Cystidia** absent. **Subhymenium** of hyaline hyphae, 4.5-6.8 µm wide, with clamp connections. **Pileipellis** a poorly defined cutis of radially parallel to intertwined hyphae, the latter thin walled, 3.3-5.3 (7.4) µm wide, similar to those of the underlying context. **Stipitipellis** similar to the pileipellis, a very thin layer (40-65µm) of loosely interwoven hyphae; squamules composed of thin-walled elements, 4-4.7 µm wide, with yellowish intracellular pigment. Hyphae of the context of the central and lower part of the stipe densely packed, parallel, somewhat flattened, short, 9-21 × 1.4-2.7 (3.5) µm, sometimes with 0.6-1.2 µm thick walls, in the lowermost part of the stipe even shorter. **Clamps** abundant in all tissues.

Habitat and ecology: Only in old forest galleries dominated by *Berlinia grandiflora* and *Uapaca togoensis*; locally abundant. Fruitbodies can be found

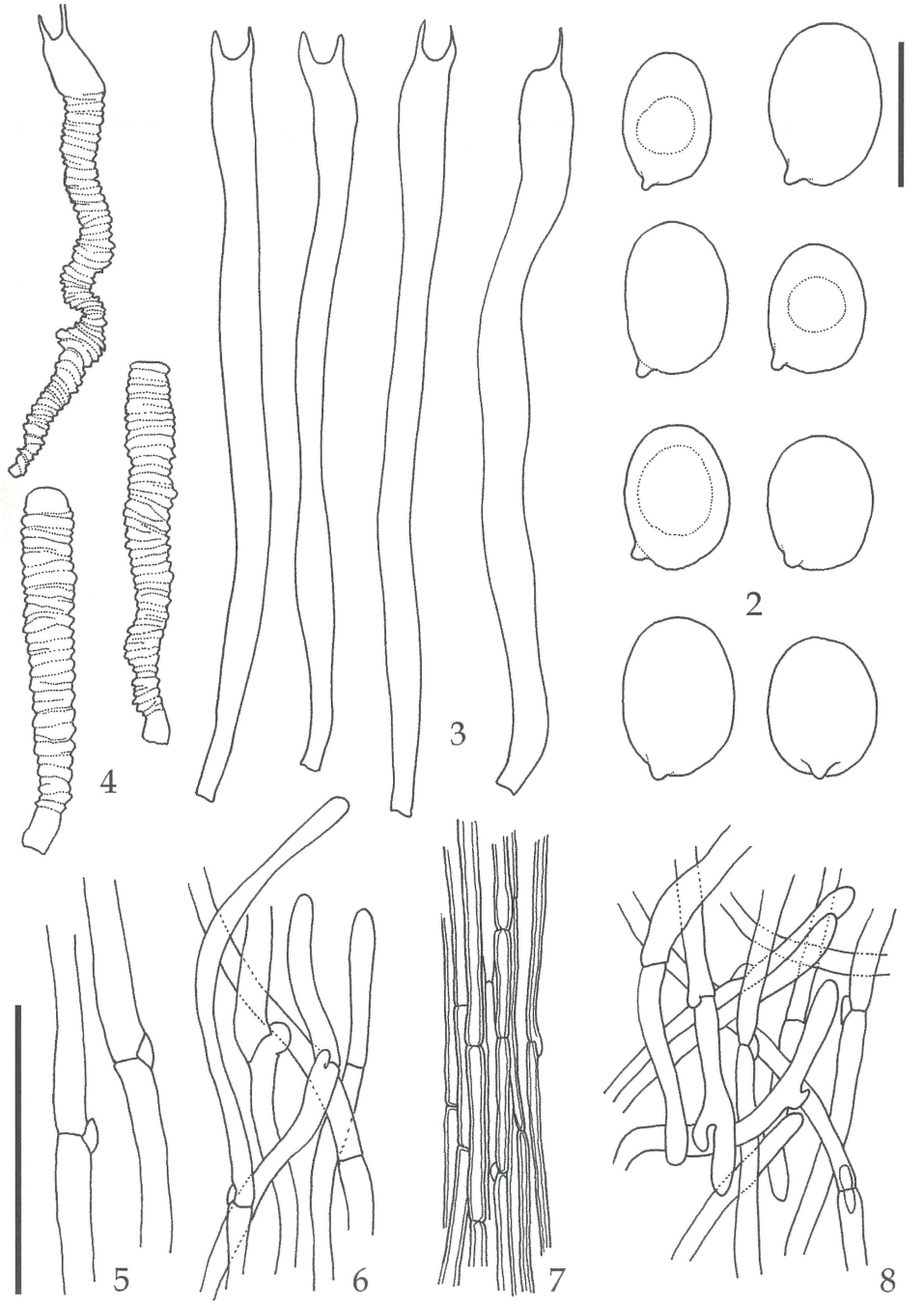
Fig. 1. *Cantharellus solidus*. Fruitbodies at different stages of development (De Kesel 3476).

almost throughout the entire rainy season, i.e. from June till October. It often grows near dead wood; several specimens (*De Kesel* 3641) rooted directly on buried dead wood.

Material examined: **BÉNIN**. Donga prov., Bassila, Forêt Classée de Bassila, 8°59.883'N 1°38.748'E, 03/10/2000, *A. De Kesel* 2983 ; 9°00'04,4"N 1°38'47,8"E, 21/09/2001, *A. De Kesel* 3259 ; 8°59.685'N 1°38.606'E, 27/06/2002, *A. De Kesel* 3476 (holotype; BR MYCO 152164-68); 8°59.874'N 1°38.728'E, 28/06/2002, *A. De Kesel* 3493 ; 8°59,001'N 1°38,631E, 07/10/2002, *A. De Kesel* 3529; 9°00'03,9"N 1°38'53,4"E, 16/06/2004, *A. De Kesel* 3641.

DISCUSSION

Cantharellus solidus may be confused with other yellowish chanterelles that have a poorly differentiated to smooth hymenophore. First of all with the badly known *Goossensia cibarioides* Heinem. described from Central Africa (Heinemann 1958). The latter species shares the smooth hymenophore and also the ochraceous yellow mycelium, but is recognized by a very watery context and smaller, ellipsoid spores. We re-examined one of the specimens (Goossens-Fontana 995) of this taxon and found spores of (6.1-)6.2-7.9-9.5(-9.5) × (3.6-)3.7-4.5-5.4(-5.7) µm. Q = (1.32-)1.3-1.73-2.16(-2.1) {N=27}, and basidia with four to six sterigmata. The ecology mentioned in Heinemann (1959) and Corner (1966), i.e. on the ground and on rotten wood, corresponds. We share the opinion of Corner (l.c.) that *Goossensia cibarioides* strongly recalls *Cantharellus lateritius* (Berk.)



Figs 2-8. *Cantharellus solidus*. 2. Basidiospores (scale bar = 10µm). 3. Basidia with one or two sterigmata. 4. Basidioles. 5. Hyphae from the pileal trama. 6. hyphae from the pileipellis. 7. Hyphae from the context of the stipe base. 8. Hyphae from the stipitipellis (all from De Kesel 3476). Scale bar 3-8 = 50µm.

Singer *(ut C. odoratus)* and possesses extremely similar features. *Goossensia* may well be a synonym of *Cantharellus*, but new collections are needed.

Cantharellus lateritius is a North American species that is recognized by a weakly veined to nearly smooth hymenophore and clamped hyphae with irregularly undulating extremities at the cap surface (Buyck & Hofstetter 2011). This species has been subject to much confusion and misinterpretation, in particular in relation to two other American species: *Craterellus odoratus* (= *Cantharellus odoratus*) and the widely used *Cantharellus confluens* (Berk. & M.A. Curtis) R.H. Petersen nom. inval. The species concept of *C. lateritius* suffered also from contradictions between protologue and more recent descriptions, but has now been epitypified with a sequenced specimen from the southeastern United States that should make future work on this complex more easy (see Buyck & Hofstetter 2011). A variety *colombianus* has been described from South America (Petersen and Mueller 1992) *(syn.: C. cibarius* var. *cantharellus* Heim described from Guatemala – fide Eyssartier 2001) and a very similar but probably distinct species was recently reported from Malaysia (Eyssartier *et al.* 2009).

Within this complex group of yellowish *Cantharellus* with a smooth to slightly rugulose hymenium, *Cantharellus solidus* is unambiguously separated by its tough, rooting stipe and fairly large, subglobose to shortly ellipsoid spores that are produced by bi-sterigmate basidia. Although exceptions to the rule have recently been described (Buyck *et al.* 2010), the thick-walled hyphae in its context and surface tissues would place it in subgenus *Cantharellus* as redefined by Eyssartier & Buyck (2001).

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