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One neo- and four epitypifications for *Cantharellus* species from tropical African savannah woodlands

Bart BUYCK

Muséum national d'histoire naturelle, Département de Systématique et Évolution
Case Postale n° 39. UMR 7205, 57, rue de Cuvier, F- 75231 Paris cedex 05
email : buyck@mnhn.fr

Abstract – *Cantharellus addaiensis* is redescribed, illustrated and neotypified. Epitypes are introduced for *C. platyphyllus, C. symoensii, C. splendens* and *C. heinemannianus.*

***C. addaiensis* / *C. floridulus* / miombo woodland / nomenclature**

Résumé – *Cantharellus addaiensis* est redécrit, illustrée et néotypifié. Des épitypes sont introduites pour *C. platyphyllus, C. symoensii, C. splendens* et *C. heinemannianus.*

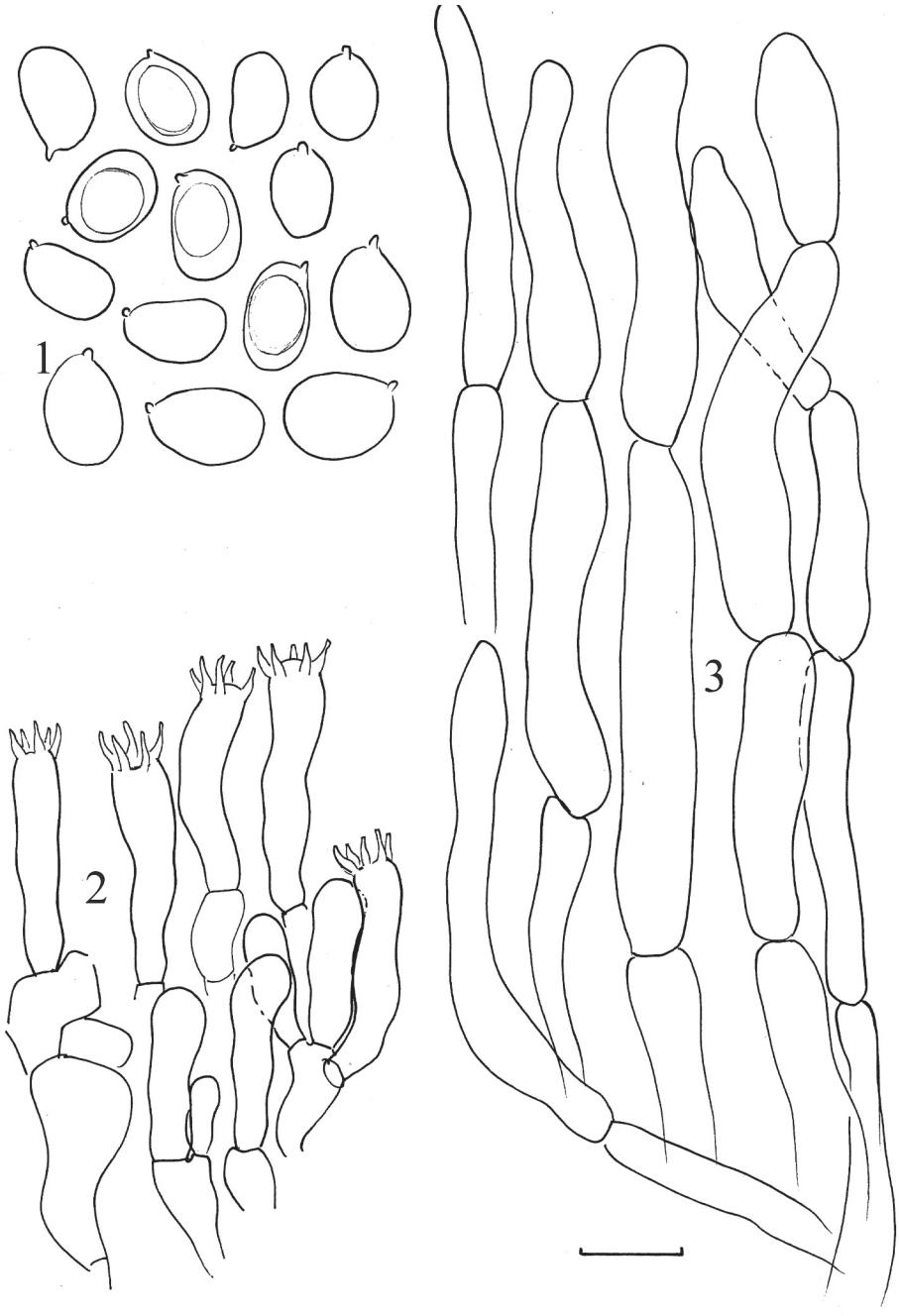
***C. addaiensis* / *C. floridulus* / miombo forêt claire / nomenclature**

INTRODUCTION

As discussed elsewhere (Buyck *et al.* 2010), morphological characters in *Cantharellus* are few, but include for example the unfortunately quite variable field aspect of a species which requires a lot of experience for correct interpretation. In the past, this difficulty has resulted in numerous misapplications of species' names through the use of 'simplified' species concepts that lump together several taxa sharing a similar general morphology or a single outstanding character, e.g. *C. cinnabarinus* (Schwein.) Schwein. for all small, red chanterelles in the northern hemisphere (Buyck *et al.* 2011) or *C. cibarius* Fr.:Fr. for nearly all medium-sized, yellow chanterelles worldwide (Buyck & Hofstetter 2011). We have to conclude that molecular data are indispensable for an unambiguous delimitation of natural taxa in *Cantharellus*, but these may only promote nomenclatural and taxonomic stability when related also to type specimens or authentic material.

Several recently collected specimens for all taxa discussed in this paper have been sequenced for a number of ribosomal and protein coding genes in preparation of a forthcoming multigene phylogeny of worldwide *Cantharellus* (Buyck & Hofstetter 2008). The purpose of this paper is to settle some nomenclatural issues to promote taxonomic stability by introducing epitypes for some *Cantharellus* occurring in the African savannah woodlands, some of them described more than 50 years ago by Heinemann (1966). We also proceed to a neotypification of *C. addaiensis* Henning 1898 for which no original material exists.

We choose to epitypify only a selected number of *Cantharellus* species that we collected in these African savannah woodlands: i.e. only those that were originally described from the Zambezian woodlands and for which sequencing of



Figs 1-3. *Cantharellus addaiensis* (neotype). **1.** Spores. **2.** Basidia, basidiola and cells of the subhymenium. **3.** Hyphal extremities of the pileipellis. Scale bar = 10 µm (drawings B. Buyck).

Fig. 4. *Cantharellus addaiensis* (neotype). Scale bar = 2 cm (photo B. Buyck).

Fig. 5. *Cantharellus addaiensis in situ* (photo B. Buyck).

the type was unsuccessful. Our forthcoming phylogeny, however, comprises several more *Cantharellus* collected in these woodlands, but some of these species were originally described from the Guineo-congolian rain forest area (Heinemann 1958, 1959), but were only later reported from the surrounding savannah woodlands (Heinemann 1966), in many cases involving slight morphological differences between collections of rain forest and savannah for a given species. In our long-standing experience with ectomycorrhizal fungi in tropical Africa, the differences in climate and ecology between the two floristic regions in Africa are generally responsible for the differentiation of different taxa. This seems confirmed by recent publications on rain forest *Cantharellus* (De Kesel *et al.* 2011, Eyi Ndong *et al.* 2011). Therefore, chanterelles that were originally described from the Guineo-congolian rain forest area should preferably be epitypified with sequenced specimens that were collected in this particular vegetation type, as savannah collections may involve misapplications of these species names for morphologically very similar taxa. The confusion, commented below, between *C. floridulus* and *C. addaiensis*, two small, red chanterelles, illustrates very well the need to compare between specimens collected in both floristic regions. In the absence of sequenced rain forest collections for species that were originally described from the Guineo-congolian rain forest, we thus refrained from epitypification, although we do provisionally apply these names to our morphologically similar woodland specimens until these can be compared molecularly with collections from the rain forest. Examples of such cases include, amongst others, *Cantharellus densifolius* Heinem., *C. congolensis* or *C. cyanoxanthus*, all originally described from the rain forest (Heinemann 1958), but later reported from the surrounding woodlands.

MATERIALS AND METHODS

The microscopical observations have been made using an ammonia-Congo red solution, after a short pre-treatment in 10% potassium hydroxide solution. Spores length, width and length/width ratio (Q) have been established for "n" measured spores and are given as (min) min-SD – *AV* – max-SD (max), in which min = lowest measured value, max = highest value, AV = arithmetic average and SD = standard deviation. All collections are conserved at the national mycological herbarium of the Natural History Museum in Paris (PC), unless otherwise cited. Color coding refers to Kornerup & Wanscher (1978).

RESULTS

C. addaiensis Henn., *Hedwigia* 37: 286. 1898 Figs 1-5

Original diagnosis: "Pusillus; pileo carnoso, infundibuliformi, levi, glabro, margine substriato 5-10 mm diametro, coccineo; stipite centrali, subtereti, levi, substriato, farcto, concolori 5-7 mm longo, 1-1,5 mm crasso; lamellis pliciformibus, dichotomis, decurrentibus, confertis, flexuosis, coccineis; sporis ellipsoideis 6,5-7,5 × 4-5 µm hyalinis, 1 guttulatis."

= *C. floridulus* sensu Eyssart. 2001, Buyck *et al.* 2000, Eyssartier & Buyck 1998, De Kesel *et al.* 2002, Harkonen *et al.* 1995, 2003, non sensu Heinem. 1966.

= *C. miniatescens* sensu Ryvarden *et al.* 1994.

Cap rarely exceding 20 mm diam., dry, fibrillose, at maturity often with a perforated center and infundibuliform, margin mostly regular and smooth when wet, becoming strongly plicate-striate, often undulate when drying out, reminiscent of a bright red-orange *Laccaria tortilis*, of a magnificent, intense blood red (8AB8, 9AB8) color when fresh, sometimes darker in the center, turning rapidly orange pink (7A6-8, 8A6-7) when starting to dry out. **Hymenophore** decurrent, with well-developed but thin, densely arranged gill folds, 1-2 mm high, unequal, some forked, of a soft peachy orange pink. **Stipe** longer or equal to the cap diam. in length, 1-4 mm broad, often bent in the lower part, subcylindrical with the extreme base often slightly widened, slightly paler than the cap, especially toward the base which in some specimens may be almost off-white, stuffed or becoming sometimes narrowly fistulose. **Context** pink. **Taste** mild or slightly acrid. **Smell** fruity and typical. **Spore print** not obtained.

Spores shortly ellipsoid to ellipsoid, (5.6)6.1-*6.7*-7.3(8.1) × (4.0)4.2-*4.8*-5.3(5.8) µm, Q = 1.3-*1.4*-1.5(1.6), smooth. **Basidia** 26-34(40) × 6-7.5 µm subcylindrical or only slightly widening towards the apex, (4)5-spored with short but plump sterigmata. **Subhymenium** composed of inflated cells (e.g. up to 15 µm), not filamentous. Pileipellis composed of intermixed hyphal ends, mostly 6-11 µm diam., thin-walled or with hardly thickened, refringent walls; the terminal cell measuring mostly (25)50-70 µm long, subcylindrical, subfusiform or slightly constricted in the middle or somewhat narrowing toward the apex. **Clamp connections** absent.

Neotypus hic designatus: TANZANIA. Dar-es-salaam. University campus, in degraded *Brachystegia* woodland on loamy clay soils, 350-400 m alt., 27 April 1998, Buyck 98.033 (PC0084717)

Commentary: Miombo collections of this species were generally misidentified as *C. floridulus* in the literature (Eyssart. 2001, Buyck *et al.* 2000, Eyssartier & Buyck 1998, De Kesel *et al.* 2002, Harkonen *et al.* 1995, 2003). The latter is an orange-red rain forest taxon with contrasting, whitish gills that was recently discussed and illustrated by Eyi Ndong *et al*. (2011) based on new collections from Gabon. The type specimen for *C. floridulus* was already reexamined by Eyssartier & Buyck (1998) and hardly differs from *C. addaiensis* under the microscope. *C. floridulus* has thus not yet been found in savannah vegetation, whereas *C. addaiensis* is one of the most common species in savannah woodlands, typically growing in large groups.

Following Eyi Ndong *et al*. in their interpretation of *C. floridulus*, the very similar taxon with nearly concolorous gills that abundantly fruits in the surrounding miombo woodlands corresponds perfectly to Henning's diagnosis of *C. addaiensis*, which is here proposed as current name to designate this species. As there exists no original material for *C. addaiensis*, we designate here as neotype the sequenced collection "Buyck 98.033" from Tanzania, described above.

Both Index Fungorum and Mycobank cite *C. addaiensis* erroneously as a synonym of the brownish, northern hemisphere *Arrhenia auriscalpium* (Fr.) Fr.

C. heinemannianus Eyssart. & Buyck, *Belgian Journal of Botany* 131(2): 148. 1998

Holotypus : ZAMBIA, Copperbelt province, near Chibouli, on wet sandy soil of the Brachystegia woodland, 1 February 1996, Buyck & Eyssartier 96.071

Epitypus hic designatus: ZAMBIA, Copperbelt province, Bought along road from Lusaka to Kapiri Mposhi, 4 February 1996, Buyck & Eyssartier 96.307 (PC0084720)

Commentary: We refer to the detailed and illustrated original description for the features of this taxon, which is apparently a very rare species that remains only known from a few Zambian miombo collections. We were unfortunately unable to sequence the type collection.

C. platyphyllus Heinem., *Bulletin du Jardin Botanique de l'État* 36: 342. 1966

Original diagnosis: "C. cibario affinis. Pileus carnosus, sature rubeolus. Stipes solidus, aurantiaco-rubeolus. Lamellae distantes, latae, luteo-aurantiacae. Sporae (7.9) 8.3-9.6 (10.1) × 6.4-7.5 µm. Fibulae dubiae."

Modern examination of the holotype (Eyssartier 2001): **Spores** shortly ellipsoid, 7.5-*9*-11 × 6-*6.73*-7.5 µm, Q = 1.2-*1.34*-1.67, smooth. **Basides** 4-5 (6)-spored, (50)60-70 × 8-10 µm, narrowly clavate. **Cystides** non observées. **Pileipellis** of thin-walled hyphae, some with distinct parietal pigment. **Clamp connections** absent.

Holotypus: DEMOCRATIC REPUBLIC OF CONGO (Congo belge, ex-Zaire), province of Shaba, Lubumbashi, February 1932, de Loose 31 (BR)

Epitypus hic designatus: TANZANIA. Vigama, near Kazimzumbwi forest, ca 10 km from Kisarawe, 12 May 1998, Buyck 98.126 (PC0084723)

Commentary: This species has been discussed and illustrated in detail in Eyssartier & Buyck (1998) and Buyck (1994). It has never been reported from the Guineo-congolian rain forest.

C. splendens Buyck, *Ubwoba : les champignons comestibles de l'Ouest du Burundi*, p. 112. 1994

Holotypus: BURUNDI. forest of Nyamirambo, near Rumonge, forêt claire sous *Brachystegia,* 28 janvier 1994, Buyck 5518 (BR)

Epitypus hic designatus: ZAMBIA. Bought along road from Lusaka to Kapiri Mposhi, 4 February 1996, Buyck & Eyssartier 96.306 (PC0084731)

Commentary: We refer to Buyck's original description and illustrations of this taxon, but we were unfortunately unsuccessful in our efforts to sequence the type. A later re-examination of the type supplied some precisions for microscopic features (Eyssartier 2001): Spores 8-*9.5*-11 × 5-*5.25*-6 µm. Q = 1.5-*1.82*-2.2. Basidia 4-5(6)-spored (not 2-4 spores as mentioned in the original description), 70-80(90) × 8-10(12) µm. Pileipellis hyphae 5-7 (8) µm diam.

This is apparently a very rare taxon known from a handful of collections from eastern Africa (Zambia, Burundi and Tanzania). It has never been reported from the Guineo-congolian rain forest.

C. symoensii Heinem., *Bulletin du Jardin Botanique de l'État* 36: 343. 1966

Pileus carnulosus, levis, ruber, sulcatus. Stipes aurantiacus. Lamellae aurantiacae, latiusculae, distantes, decurrentes, ramosae, intervenatae. Caro luteola, odore C. cibarii. Sporae (8,5) 9,7-11,3 × 5,3-6,3 (7) µm, ellipsoideae. Basidiae (2) 4-6 sporae. Fibulae absunt.

Modern examination of the holotype (Eyssartier 2001): **Spores** elongate ellipsoid, 8-9.04-10 × 4.5-5.09-5.5 µm. Q = 1.6-1.78-2, slightly reniform or pea-nut shaped, smooth. **Basidia** (4)5-6 spored, (50)60-70 × 8-10 µm, *narrowly* clavate. **Cystidia** not observed. **Pileipellis** a trichocutis composed of hyphae measuring

(3)5-10(12) µm diam. without observable pigment (the type is conserved in alcohol). **Clamp connections** absent.

Holotypus: DEMOCRATIC REPUBLIC OF CONGO (Congo belge, ex-Zaire), province of Shaba, Kasumbalesa, alt. 1350 m, miombo woodland, December 1958, J.J. Symoens 6037 (BR)

Epitypus hic designatus: TANZANIA. Dar-es-salaam, bought on local market, 12 May 1998, Buyck 98.113 (PC0084756)

Commentary: This species has been discussed and illustrated in detail in Eyssartier & Buyck (1998) and Buyck (1994). It has never been reported from the Guineo-congolian rain forest.

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