

## A new *Lactarius* species from Togo with an isolated phylogenetic position

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**Abstract** – *Lactarius cocosmus* Van de Putte & De Kesel sp. nov. is described from *Uapaca* woodlands in Togo. The species has a remarkable coconut-smell, which is typical for some European and North American *Lactarius* species but is observed here for the first time in a milkcap from Africa. Unpublished molecular data show that the species represents a new phylogenetic group for the African continent.

***Lactarius* / taxonomy / tropical Africa / ectomycorrhizal fungi / *Uapaca* woodlands**

**Résumé** – *Lactarius cocosmus* Van de Putte & De Kesel sp. nov. est décrit des forêts à *Uapaca* du Togo. L'espèce produit une odeur forte de noix de coco. Cette odeur typique de certaines espèces d'Europe et d'Amérique du Nord est constatée ici pour la première fois chez une espèce africaine. Les données moléculaires indiquent que cette espèce constitue un nouveau groupe phylogénétique pour le continent africain.

***Lactarius* / taxonomie / Afrique tropicale / ectomycorhize / forêt à *Uapaca***

### INTRODUCTION

The diversity of the ectomycorrhizal genus *Lactarius* Pers. in tropical Africa is high and new species continue to be described (Verbeken *et al.*, 2008). A new monograph treats 96 species (Verbeken & Walley, 2009) but the real number of species is estimated to be at least 125 (Verbeken & Buyck, 2001). Records from Togo are still rather scarce. Eighteen *Lactarius* species are known from the country, including *L. foetens* Verbeken & Van Rooij, *L. afroscrobiculatus* Verbeken & Van Rooij and *L. miniatescens* Verbeken & Van Rooij, all described from Benin. The country is poorly explored and so far no new species were described from Togo.

The species mentioned here were found by the second author in the national park of Fazao-Malfakassa. This reserve of 192000 ha is situated in

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the Atacora mountains and, although within the Guineo-soudanian transition zone, it benefits from a slightly cooler and wetter climate. The park hosts the largest intact vegetations of Togo and most of its surface is covered by a mosaic of woodlands and savanna woodlands. Besides the forest galleries, dominated by *Dialium guineensis* Willd., *Antiaris africana* Engl. and *Berlinia grandiflora* (Vahl) Hutch. & Dalz., two more types of woodland were screened. Representatives of *Lactarius* were found in an open type of woodland, dominated by *Afzelia africana* Sm. (Caesalpiniaceae), *Anogeissus leiocarpa* (DC.) Guill. & Perr. and *Isoberlinia doka* Craib & Stapf (Caesalpiniaceae). The new species was found in a slightly denser type of woodland, dominated by *Monotes kerstingii* Gilg and *Uapaca togoensis* Pax (Euphorbiaceae).

Preliminary molecular data show that the species has an isolated position within the traditional concept of the genus *Lactarius* and is most closely related to *Lactarius* subgenus *Lactariopsis*. More sequencing is needed to confirm its position within the newly circumscribed *Lactarius* clades in Buyck *et al.* (2008).

## MATERIAL AND METHODS

Macroscopic characters are all based on fresh material. Microscopic features were studied from dried material mainly in Congo-red in L4. Spore ornamentation is described and illustrated as observed in Melzer's reagent. For details on terminology we refer to Verbeken (1998) and Verbeken & Walley (2009). Line-drawings were made by A. Verbeken with the aid of a drawing tube at original magnifications 6000 × for spores, 1000 × for individual elements and sections. Basidia length excludes sterigmata length. Spores were measured in side view in Melzer's reagent, excluding the ornamentation, and measurements are given as  $[AVa-2*SD] - AVa - [AVa + 2*SD]$  in which AVa = mean value for the measured collection and SD = standard deviation. Q stands for "quotient length/width" and is given as  $MINQ - AvQ - MAXQ$  in which AvQ stands for the mean quotient for the measured spores.

Colour codes refer to Kornerup & Wanscher (1978).

## RESULTS

### ***Lactarius cocosmus* Van de Putte & De Kesel sp. nov.**

Etymology: Contraction of "cocos osmus": with the smell of cocos (*Cocos nucifera*)

*Pileus* 100-120 mm diam., *aplanatus*, *firmus*, *crassus*, *siccus*, *rugulosus*, *brunneoaurantiacus*, *griseoaurantiacus ad pallide brunneum*. *Lamellae adnatae ad subdecurrentes*, *distantes*, *aurantioalbae*. *Stipes* 100 mm longus, 30 mm *crassus*, *cylindratus*, *teres*, *brunneoaurantiacus ad pallide brunneum*. *Latex albus*, *cyanovirescens*. *Contextus albus*, *immutabilis*, *gustu acrisimus*, *odore cocos similis*. *Sporae late ellipsoideae*,  $6.4-7.2-8.0 \times 5.5-6.3-7.1 \mu\text{m}$  ( $Q = 1.06-1.15-1.29$ ), *indistincte ornatae*, *macula non amyloidea*. *Basidia*  $50-70 \times 9-10 \mu\text{m}$ , *4-sporae*, *longa*, *anguste*

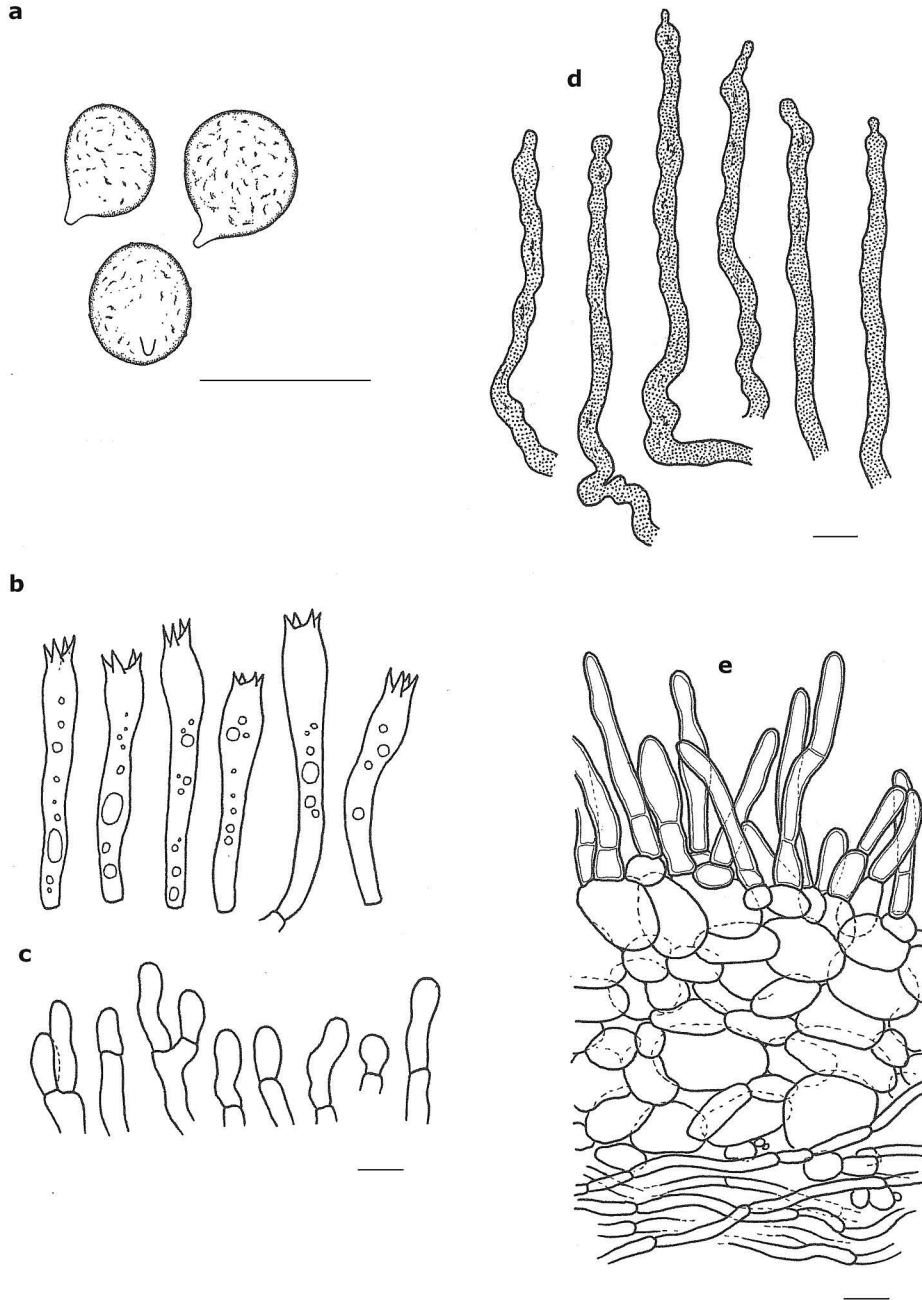


Fig. 1. *Lactarius cocosmus*: a. Spores, b. Basidia, c. Marginal cells, d. Pleuropseudocystidia, e. Section through the stiptipellis (all from holotype, scale bar = 10  $\mu$ m).

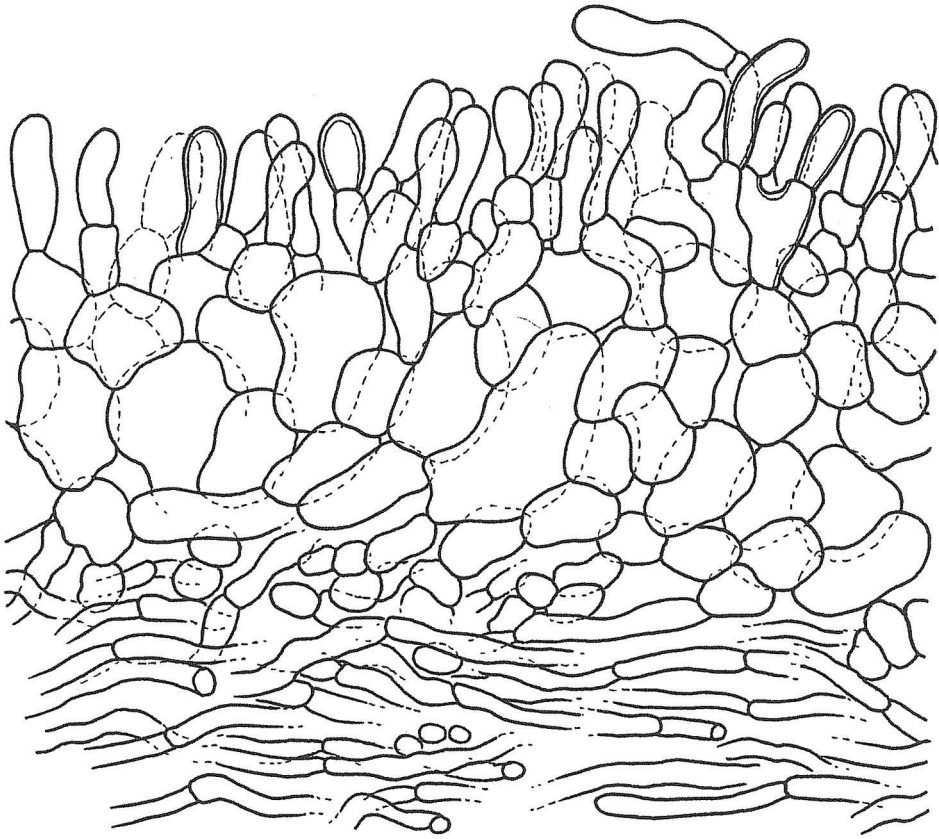


Fig. 2. *Lactarius cocosmus*: Section through the pileipellis (holotype, scale bar = 10  $\mu$ m).

*clavata*. *Macropleurocystidia* absentia. *Pleuropseudocystidia* abundantia, leviter emergentia, 3-5(6)  $\mu$ m diam., leviter tortuosa, capitata. *Pileipellis* bistrata, cellulae terminalis cylindrata ad subclavatae, 10-25  $\times$  6-9  $\mu$ m, interdum pariete leviter incrassato.

*Holotypus*: Togo, Central Prov., Fazao National Park, N08°43,145' E0°46,332', alt. 556 m, in woodland dominated by *Uapaca togoensis*, on gravelly soil, 20 July 2007, De Kesel 4462 (*Holotypus*, BR).

**Pileus** 100-120 mm diam., firm, moderately thick, regular, aplanate, with shallow central depression; margin sharp, probably inflexed when young, moderately to strongly rugulose, even or slightly undulate; pellis adnate, not dehiscent, mat, dry, smooth in the centre, radially wrinkled at mid radius, rugulose to concentrically rugulose towards the margin, almost unicolorous, scarcely fissured near the margin, brownish orange to light brown (6C8-6D6) in the centre and greyish orange to (5B4-5C3) towards the margin. **Lamellae** adnate to subdecurrent, unequal with numerous lamellulae (5-7/L) of different lengths,

rarely forked, very distant 6-7(8)/cm, up to 5mm high, orange white (5A2) to cream colour near the margin; edge entire, sharp, concolorous. **Stipe** 100 × 30 mm, cylindrical, central, terete, tapering near the base, mat, dry, smooth to subtomentose, brownish orange to light brown (6C8-6D6) near the base, gradually paler greyish orange (5B4-5C3) towards the apex, firm, solid, bruising light brown (7D6). **Context** firm, white, unchanging; smell like fresh cocos, strong; taste very acrid. **Latex** not abundant, white, very slowly becoming greyish turquoise (24C4). **Spore-deposit** probably white to pale cream coloured.

**Basidiospores** broadly ellipsoid, 6.4-7.2-8.0 × 5.5-6.3-7.1 μm (Q = 1.06-1.15-1.29); ornamentation amyloid, but very weak, composed of small warts and very low ridges; plage inamyloid, but rarely an amyloid plage was observed. **Basidia** 50-70 × 9-10 μm, long and slender, narrowly clavate, 4-spored. True pleurocystidia absent. **Pleuroseuodocystidia** very abundant, slightly emergent, 3-5(6) μm diam., slightly tortuose, often capitate. **Lamellae-edge** sterile; marginal cells 10-25 × 4-6 μm, cylindric to subclavate, thin-walled, hyaline. **Hymenophoral trama** cellular, with abundant lactifers. **Pileipellis** a palisade to trichopalisade, 70-100 μm thick; terminal elements cylindrical to subclavate, 10-25 × 6-9 μm, thin-walled or sometimes with slightly thickened wall, some with a distinct granular content; subpellis composed of mostly rounded cells, 10-30 μm diam. **Stipitipellis** a palisade to trichopalisade, 70-150 μm thick; terminal elements cylindrical to subclavate, sometimes slightly capitate or somewhat irregularly shaped, 11-70 × 5-8 μm; subpellis composed of rounded to slightly elongated or irregularly shaped cells (10-32 × 5-15 μm).

Studied material:

Togo, Central Prov., Fazao National Park, N08°43,145' E0°46,332', alt. 556 m, in woodland dominated by *Uapaca togoensis*, on gravelly soil, 20 July 2007, De Kesel 4462 (Holotypus, BR).

## DISCUSSION

*L. cocosmus* can be easily recognised in the field, showing a striking combination of characters: large, orange brown and firm fruitbodies with distant and broad gills, a strong smell of fresh cocos, an acrid taste and latex which turns slowly turquoise. Up to now, latex which changes bluish green is only observed in one African species: *L. cyanovirescens* Verbeken, belonging to *L.* subg. *Russulopsis*, a completely different taxonomical group.

Macroscopically, *L. cocosmus* reminds of a representative of *L.* subgenus *Lactiflui*, chiefly because of its orange colours, velvety surface and distant gills. The structure of its pileipellis, although not a pure palisade (with some aspects of a trichopalisade), also fits in this group. The spores on the other hand, are very deviating since they are extremely low ornamented. Preliminary molecular results (based on LSU and rpb2 sequences, data to be published soon) show that *L. cocosmus* has a rather isolated position being possibly most closely related to *Lactarius* subgenus *Lactariopsis* and to the *Lactarius vellereus*-clade.

*L.* subgenus *Lactariopsis* is well represented in tropical Africa, but the known African species so far form a separate clade from the *L. vellereus*-clade (although *L. vellereus* was before included in this subgenus, see Verbeken, 1998; Heilmann-Clausen *et al.*, 1998) and evidently also excludes *L. cocosmus*.

Morphologically, both the abundant and emergent pseudopleurocystidia and the palisade to trichopalisade structure with some scattered thick-walled elements are fitting well in the African *Lactariopsis* group.

We hope to discover other African species related to *L. cocosmus* in order to find out more about the precise relationships of *L. cocosmus* and the potential presence of a new infrageneric clade in tropical Africa.

The cocos-smell is a surprising character, since it is present in European and North American species but was up to now absent in tropical species. *Lactarius* is a genus which shows a large variation of smells, often very characteristic for a species or a group of species. Some odours that are commonly found in temperate species are remarkably absent in tropical African species, such as the smell of bugs (*L. quietus* (Fr.: Fr.) Fr.), the sweet apple-like smell (*L. evosmus* Kühner & Romagn.), *Pelargonium* smell (*L. decipiens* Quéél.), smell of *Cossus cossus* caterpillar (*L. hysginus* (Fr.: Fr.) Fr.), spicy smell (*L. camphoratus* (Bull.: Fr.) Fr.). And although some odours are only known from African species, e.g. the distinct soap-smell of *L. saponaceus*, the range of different odours found in African *Lactarius* are mainly fish-like, sperm-like or sweetish and fruity.

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