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## Okoubaka Pellegrin & Normand is really a genus of Santalaceae

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**Résumé**: *Okoubaka*, publié comme genre à tort dans les *Octoknemaceae* en 1944, a été placé correctement dans les *Santalaceae* par STAUFFER en 1957. Or, 30 années après cette mise au point capitale, l'erreur continue à persister dans des Flores récentes et dans de grands herbiers. Au rappel historique, l'auteur ajoute une iconographie originale détaillée de l'espèce ouest-africaine: fleurs  $\sigma$  et  $\varphi$ , pollen, fruit et noix; cette dernière est comparée à quelques autres noix de *Santalaceae* et *d'Olacaceae*.

**Summary**: Okoubaka, wrongly ascribed to Octoknemaceae in 1944, was rightfully placed in Santalaceae by STAUFFER in 1957. However, after 30 years, the error is persisting in recent Floras and in Herbaria. A historie survey is followed by new detailed drawings of the western Africa species:  $\sigma$  and  $\varphi$  flowers, pollen, fruit and nut; the latter is compared with some nuts of Santalaceae and Olacaceae.

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... we were born for the prejudices, much more than for the truth; even the truth is obstinate only when it becomes prejudged... The new, weak ideas because they are being born, do not have the force to penetrate... Sylvain BAILLY, 5<sup>e</sup> Lettre.

The purpose of this note is to point out the work of STAUFFER, which has remained ignored, and to make a historical summary of the vicissitudes of the *Okoubaka* genus. The occasion is found to contribute our iconographic share on the morphology of some nuts as a marginal note in our revision of Santalaceae of New Caledonia.

In 1936, A. AUBRÉVILLE, in the Forest Flora of Ivory Coast, gives, like Olacaceae which is imperfectly known, an incomplete description of a large very rare tree of the Ivory Coast of which he had three collections. The drupe is described as globulous, with a diameter of 4 cm (sic), and the nut, of 2.5 X 1.4 cm, would have a thick very hard wall of 3.3 mm; this according to only one fruit-bearing collection, its No 1788 (2 fruits and a sawn nut). The diameters indicated are underestimated a little having been measured dry. The local name in agni, okoubaka, has the literal meaning of "that which makes the other trees die". This last character, so precisely observed, and confirmed by fetishistic uses, is really typical of Santalaceae that parasitize the roots of other plants to the point of weakening or killing them. Such a character could have directed research, but nothing was done about it.

In 1937, AUBRÉVILLE & PELLEGRIN validly describe the species within Octoknemaceae (sic nomen conservandum) under the name of *Octoknema okoubaka*, misled by a certain similarity of the description of the placenta made by PIERRE for his *Octoknema klaineana*. The authors draw attention to the size of the fruit, that is to say 9 X 5 cm (probably according to new field notes: fruit in September according to Yapo) without a new sample for support. The figure shows the contour of the fruit, a badly cleaned nut, and a very approximate layout of the seed.

In 1944, D. NORMAN discovers by the anatomical study of wood does not agree with *Octoknema* and also, a vital find, that the species is closely connected to Santalaceae. With PELLEGRIN a new genus is proposed and even in the absence of a diagnosis, new name, *Okoubaka aubrevillei*, is validated (article 42). Having not reconsidered placentation, the new genus remains within Octoknemaceae.

In 1946, NORMAN & PELLEGRIN, in NORMAN & PELLEGRIN, with a Latin resumption of *Okoubaka aubrevillei*, and always in the same family, makes known new collections from Ghana (Gold Coast) where the species would be gregarious [growing in clusters] (W St Clearly-Thompson 4368, 22.2.1937, P ex K!).

In December 1947, J LÉONARD discovers conspecific plants at Yangambi, Zaire. He describes a new variety, *glabrescentifolia*. The fruit measured 15-16 X 9-10 cm and the seed 7 X 4.5 cm. The deterioration which the species causes to nearby plants is confirmed; it acted the same in cultural trials with *Milletia laurentii*; *Okoubaka* is, however,still not suspected of parasitism!

In 1948, J LOUIS & J LÉONARD place the genus, the species and the new variety in Octoknemaceae in the Flora of Belgian Congo. In same volume, ROBYNS & LAWALRÉE, count in Santalaceae only the genera *Osyris* and *Thesium*.

In June 1950, J LÉONARD & TROUPIN specify the placentation of the genus, and, without recognizing it as being Santalaceae, describe a second species with a glabrous disc, *Okoubaka michelsonii*. The drupe of 4 X 2.5 cm is pedunculate; the seed 2.4 X 1.5 cm. The yellowish color and the glutinous texture of the mesocarp are specified (we observed the same characters in the rehydrated fruit of *O. aubrevillei*).

At at the end of 1950, NORMAN recalls, in his Atlas of the Wood of the Ivory Coast, the affinity of *Okoubaka* with Santalaceae. There is even information this year in METCALFE & CHALK.

It is in November 1957 that STAUFFER, having revised the floral characters of *Okoubaka*, confirms expressly that it is indeed Santalaceae. He announces its affinity with *Scleropyrum*, an Indomalaysian genus with several species.

In March 1958, in the FWTA (Flora West Tropical Africa) of HUTCHINSON & DALZIEL revised by KEAY, *Okoubaka* is in Octoknemaceae. In June of the same year the work of STAUFFER is clearly mentioned in the AETFAT-index.

In 1959, AUBRÉVILLE publishes the second revised edition of the Forest Flora of Ivory Coast. *Okoubaka* remained in Octoknemaceae, like, with the same date, [it is] in Families of Flowering Plants of HUTCHINSON.

Until 1973, date of the 8th edition of the WILLIS dictionary (p. 811), it seems that botanists no longer recognized the membership of the genus *Okoubaka* in Santalaceae; it is thus of LEMEE, 1959; LETOUZEY, 1960, with the discovery of *Okoubaka* in Cameroun; IRVINE, with three collections quoted for Ghana in 1961; BOLD in Niger, 1963; SAMAI in Sierra Leone (herb. n° 358, P ex K) and G. DE LA MENSBRUGE in Ivory Coast, 1966; F HALLÉ & OLDEMAN in Ivory Coast, 1970; LAw ALRÉE in the Flora of Cameroun n° 14, 1972; VILLIERS in the Flora of Cameroun n° 15 and Gabon n° 20 (the genus is still to be found in Gabon), 1973.

In spite of the good reference, Santalaceae, of WILLIS in 1973, *Okoubaka* continues to persist as alleged Octoknemaceae; thus in F. HALLÉ et al., 1978; in the Index DE FARR, LEUSSINK & STAFLEU, 1979; in the guide ROLLEAU, 1981; LOBREAU-CALLEN in 1982 (the author described and shows the pollen of *Okoubaka* by approving the conclusions of STAUFFER but, under the influence of the errors accepted by routine, the bad position is maintained); in the Index of BAMPS, LEBRUN & STORK, 1984... The good work of STAUFFER, deceased in 1965, did not deserve such a lapse of memory due to some bibliographic negligences. In his 1987dictionary MABBERLEY takes the fortunate result of WILLIS.



Fig. 1. - Short-styled σ or φ flower of **Okoubaka aubrevillei** Pellegrin & Norman: **1**, tetramerous bud, diam. 3 mm; **2**, pentamerous bud, diam. 3.5 mm; **3**, partly cut flower, diam. 4 mm; **4**, tepal of 2 mm seen by the internal face; **5**, young anther, width 0.8 mm; **6**-9, anther 0.7 mm long and 0.5 mm broad; **10**, disc, diam. 3.5 mm (note the edge of the disc which embraces the base of the filaments), 1.2 mm broad; **11**, young disc still glabrous and marked by the small cavities of compression of pollen thecae, diam. 2 mm; **12**, **13**, stigma, 0.8 mm diam.; **14**, section of the style showing the 1.5 mm long channel; **15**, placenta seen from above, 0.25 mm diam. (*Letouzey* 2991, Koukou river, W MT Sangembam, Cameroun, 1960).

It now seems useful for us to give new figures of *Okoubaka aubrevillei* Pellegrin & Normand:  $\sigma$  flower (fig. 1), pollen (fig. 2),  $\varphi$  flower (fig. 3), fruit (fig. 4) and nut (fig. 5, details 1 to 4). For the nut it was interesting to be able to compare it with those of some other species of the same family with large inferior fruits, examples taken from the genera *Santalum* and *Scleropyrum* (fig. 5, details 5-12). The comparison can still be made with nuts of some Olacaceae of the genera *Octoknema* and *Strombosiopsis* (fig. 6). The distinctive characters given in the form of a key do not leave any more doubt: STAUFFER must be followed, *Okoubaka* is well within Santalaceae.



Fig. 2. - Pollen of **Okoubaka aubrevillei** Pellegrin & Norman: **1**, **2**, oblique view; 3, 4, side view; **5**, **6**, polar view; equatorial diameter 24-26  $\mu$ m. - NOTE 1: the ornamentation is too fine to be interpreted in more detail (optical immersion 100/1.25 on acetolysis mount Monique CHALOPIN 6.10.1987). Letouzey 299 Cameroun. - NOTE 2: this figure is to be reconciled with the excellent photographic views of M.E.B. per D. LOBREAU-CALLEN, 1982, p. 397.

Let us note finally that it is still necessary to follow STAUFFER who specified that Octoknemaceae be reduced to only the genus *Octoknema*, [and which] must rejoin the center of Olacaceae. This point of view is followed since the origin (PIERRE, 1897), in spite of VAN TIEGHEM (1905), by many authors and by the Kew Index and all its supplements, although it is missing in Olacaceae, under [this] family close to Anacolosoideae should accomodate this genus.



Fig. 3. - Long-styled  $\varphi$  or  $\varphi$  flower of **Okoubaka aubrevillei** Pellegrin & Norman: **1**, bud, diam. 3.5 mm; **2**, flower seen from above, 4 mm diam.; **3**, section of flower (note the 3.5 mm long channel), 6 X 4 mm; **4**, tepal seen by the internal face, 1.7 X 2 mm; **5**, anthers (sterile), internal face, 1 mm high; **6**, anthers in oblique view (note the arched and fleshy base of the filament); **7**, detail of the disc, 3 mm diam., and androecium (anthers sterile); **8**, style 1.3 mm high, stigma 0.9 mm broad; **9**, side view of two ovuliferous placentas, and placenta seen from above, 0.3 mm broad (Aubréville 603, Ivory Coast, 1936, type of the species).

## KEY TO NUTS OF OKOUBAKA COMPARED WITH NUTS OF SOME OLACACEAE AND SANTALACEAE.(SPECIES WITH INFERIOR FRUITS)

1. Seed deprived of a testa (Santalaceae); endosperm not ruminate; endocarp with incomplete or irregular external crests; base of the endocarpic dipples with small porose cavities (fiber passages); no internal pulpy crests. - Fig. 5.

2. Nut twice as long as broad; endocarp with strong and irregular longitudinal crests; very thick endocarp of approximately 3-4 mm; oblong and deep longitudinal small cavities; very small and numerous pores; apical cupule with deeply crowned denticules [teeth]. *Okoubaka* 

2'. Nut ovoid or globular; sometimes with incomplete longitudinal crests; endocarp only 1-3 mm thick; surface  $\pm$  vertuculose and subechinate with quite apparent pores; apical crest at the base plane or conical, or with a convex top without a deep cupule.



Fig. 4. - Fruit of **Okoubaka aubrevillei** Pellegrin & Nonnand: **1**, according to a sketch of Samai 358, Sierra Leone, 6.8.1966, length approximately 80-100 mm; **2**, according to Aubréville 1788, Ivory Coast, 8.1933, rehydrated dry fruit of 65 X 55mm (before the preparation of nut, see fig. 5, details 1-4); **3**, according to the Forest Flora of Ivory Coast, fruit of 90 X 50 mm. - NOTE: taking into account the imperfection of the data, these drawings are interpretations or "identikits" [composite images] to some extent; the extreme paucity of collections of this very rare species justifies the use of such a process.

<ul> <li>3. Endocarpic pores rather fine and numerous; sessile fruit or with short stalk, of approximately 5 mm.</li> <li>3'. Endocarpic pores coarse and very few; fruit with stalk of approximately 10 mm.</li> </ul>	
'. Seed equipped with a testa (Olacaceae) Fig. 6.	
4. Ruminate endosperm; endocarp with blurred but regular meridian external crests	
and joining the two ends of nut: intermediate spaces folded slightly and not porose:	
internal crests of a pulpy origin, not ossified	a
4' Endosperm not ruminate: endocarp ovoid without peaks nor pores, but with a	
In gitudinally marked surface of fine tangential strictions: internal creats not of a	
indigenerations intervention of the tangential strations, internal crests not of a	
pulpy origin	<i>.</i>

TECHNICAL NOTE. - the cleaning of nuts must be made with the greatest care: choose quite ripe fruits; prolonged boiling of the herbarium material; pulp removed in two times separated by one second boiling; careful scraping with a hard tool but not an edge; very fine and very careful scraping of anfractuosities [sinuous depressions] and pores with ablation of fibers under a binocular scope (approximately 8X); brushing; drying. For study of the endocarp section, sawing and very fine sandpapering; possibly a new boiling allows good rehydration of the internal parts.



Fig. 5. - Nuts of Santalaceae: **1-4**, **Okoubaka aubrevillei** Pellegrin & Norman, 32 X 16 mm, Aubréville 1788, Ivory Coast; **5,6**, **Scleropyrum wallichianum** Arn., 19 X 18.5 mm, Harmand 638, Cochinchine; **7, 8**, **Santalum insulare** Bertero, 20 X 16.5 mm, Nadeau 328 (or 32 G?), Tahiti; **9,10**, same species, 19.5 X 13.5, Florence 6548, Rapa; **11**, **12**, **Santalum marchionense** Skottsberg, 23 X 23 mm, Gillett 2216, Nukuhiva. -1, 5, 7, 9, 11, side view; 2, 6, 8, 10, 12, seen apical view; 3, view of the lower part; 4, transverse section.



Fig. 6. - Nuts of Olacaceae: **1-3**, **Octoknema klaineana** Pierre, 17 X 15 mm, Klaine s.n., 25.2.1899, Gabon; **4-6**, **Octoknema affinis** Pierre, 12 X 9 mm, Klaine 2920, Gabon; **7-9**, **Strombosiopsis tetrandra** Engler, 24 X 20 mm, Tisserant 1815, Central Africa. - 1, 4, 7, side view; 2, 5, 8, apical view; 3, 6, 9, transverse sections of sectors of the endocarp (respectively 0.8, 1, 1.6 mm thick), with the pulpy sub-endocarpic debris on the internal concave face.

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