WAGENINGEN AGRICULTURAL UNIVERSITY PAPERS
89-4 (1989)

Series of revisions of Apocynaceae XXIX, XXX

AND

Tabernanthe: uses, phytochemistry, and pharmacology

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Date of publication 11-12-1989

Cip-data Koninklijke Bibliotheek, Den Haag

ISBN 90-6754-160-5
NUGI 835

Printed in the Netherlands by Drukkerij Veenman B.V., Wageningen

Contents

Part XXIX

A taxonomic revision of the genus Tabernanthe and a study of wood anatomy of T. iboga

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Summary

The taxonomy of the genus *Tabernanthe* (Apocynaceae) has been revised. Two species are recognised, *T. elliptica*and *T. iboga*. Both occur in Africa.

The secondary xylem of *Tabernanthe iboga* is described. A comparison has been made with a representative of the closely related genus *Tabernaemontana*. On wood anatomical grounds the relationship seems justified.

Introduction

The present publication is a revision of the genus *Tabernanthe* based on herbarium material and living plants grown in the greenhouse at Wageningen. The paragraph on wood anatomy (secondary xylem) is based on fresh material and specimens fixed in FAA and preserved in alcohol.

The second author contributed the text on *T. elliptica* and supervised the other taxonomical parts of the study.

The genus is exclusively African and counts two species. It is closely allied to *Tabernaemontana* from which it is distinguished mainly by presence of the disk and the in bud not inflexed corolla lobes.

History of the genus

Tabernanthe was described by H. Baillon in 1889 with a single species: *Tabernanthe iboga*. He undoubtedly named it after *Tabernaemontana* because of the relationship and similarity to that genus. The epithet *iboga* is a vernacular name in Gabon, near Cap Lopez, where M. Griffon du Bellay found the type specimen. Since 1889, six more taxa were described, all directly as species of *Tabernanthe*.

J. Braun & K. Schumann described another genus in the same year, i.e. *Iboga*, again named after the same vernacular name. Its only species, *Iboga vateriana*, was named after the Director of the Berlin Bot. Garden, W. Vater. In Engler & Prantl, Natürl. Pflanzenfam. 4(2) 1895, K. Schumann himself stated that Baillon and he indeed described the genus at the same time, but that his work was delayed and priority was for Baillon's publication.

Genus diagnosis

Tabernanthe Baill., Bull. Soc. Linn. Paris, 1: 782. 1889; Stapf in Fl. Trop. Afr. 4(1): 122. 1902; Leeuwenberg, Agric. Univ. Wageningen Papers 87-5: 1,13. 1988.

Type species: *Tabernanthe iboga* Baill.

Heterotypic synonyms: *Iboga* J. Br. & K. Schum., in Danckelmann, Mitth. Deutsch. Schutzgeb. 2: 172. 1889. Type species: *I. vateriana* J. Br. & K. Schum. (= *T. iboga* Baill.).

Daturicarpa Stapf, Kew Bull. 1921: 170, fig.2. 1921. Type species: *D. elliptica* Stapf (= *T. elliptica* (Stapf) Leeuwenberg).

Small tree or shrub with white latex; bark shallowly longitudinally fissured. Branches with concolourous lenticels, with conspicuous leaf scars, dichotomously branched and just above branching with two inflorescences; branchlets terete, often sulcate and angular when dried. *Leaves* opposite, petiolate or subsessile, those of a pair equal to unequal; petiole caniculate above, those of a pair connate into a short ocrea (not widened into intrapetiolar stipules); blade herbaceous when fresh, membranaceous when dried, entire. *Inflorescences* two together just above each ramification, pedunculate, irregularly corymbose; pedicels slender; bracts sepal-like. *Sepals* pale green, erect, imbricate in bud, entire. *Corolla* white, creamy or pale yellow, thin; tube not twisted; lobes in bud overlapping to the left, not inflexed, entire, spreading. *Stamens* included; anthers narrowly triangular, acuminate at the sterile apex, sagittate and fertile at the base, introrse, dehiscent throughout with longitudinal slits. *Pistil* glabrous; ovary abruptly narrowed into the style, composed of two carpels and surrounded by a disk; style cylindrical; pistil head composed of a basal ring, probably the receptive belt or stigma, a subglobose or obcampanulate central part with 5 lateral grooves, and two slender apical lobes; style and stigma persistent when the corolla is shed. *Fruit* pendulous, composed of two united or free carpels. Aril pulpy, white, enveloping the seed. *Seed* dark brown, obliquelly ellipsoid, with a deep groove to halfway at the hilar side, brain-like deeply indented all over, papillose, smooth; endosperm copious, starchy, ruminate, yellowish, enveloping the embryo; embryo almost straight, spathulate; cotyledons rounded at the apex.

Key to the species

Carpels fused; fruit smooth or bumpy; corolla tube usually with purple or violet dots in 5 groups in the throat; 7-20 pairs of secondary leaf veins, some sepals slightly spreading in dried flowers . . . . . 2. **Tabernanthe iboga**

Carpels almost free, only connected by the disk and the style; fruit of 2 separate mericarps bearing blunt soft prickles; 4-7 pairs of secondary leaf veins; sepals closely clasping the corolla base in dried flowers . . . 1. **Tabernanthe elliptica**

1. **Tabernanthe elliptica** (Stapf) Leeuwenberg, Agric. Univ. Wageningen Papers 87-5: 1,13. 1988. **Fig. 1; Map 1**

Basionym: *Daturicarpa elliptica* Stapf, Kew Bull. 1921: 170, fig. 2. 1921; Hürlimann, Ber. Schw. Bot. Ges. 67: 487-505. 1957.

Type: Zaïre: Orientale: between Lubutu and Kirundu, Bequaert 6843 (BR lecto-, designated here).

Heterotypic synonyms: *D. lanceolata* Stapf, l.c. and fig. 1. Type: Zaïre: Orientale: Kisangani, Tshopo R. bank, Bequaert 7058 (BR holo-).

D. firmula Stapf, l.c.. Type: Zaïre: Equateur: Moma, Jespersen Oct. 1910 (BR holo-).

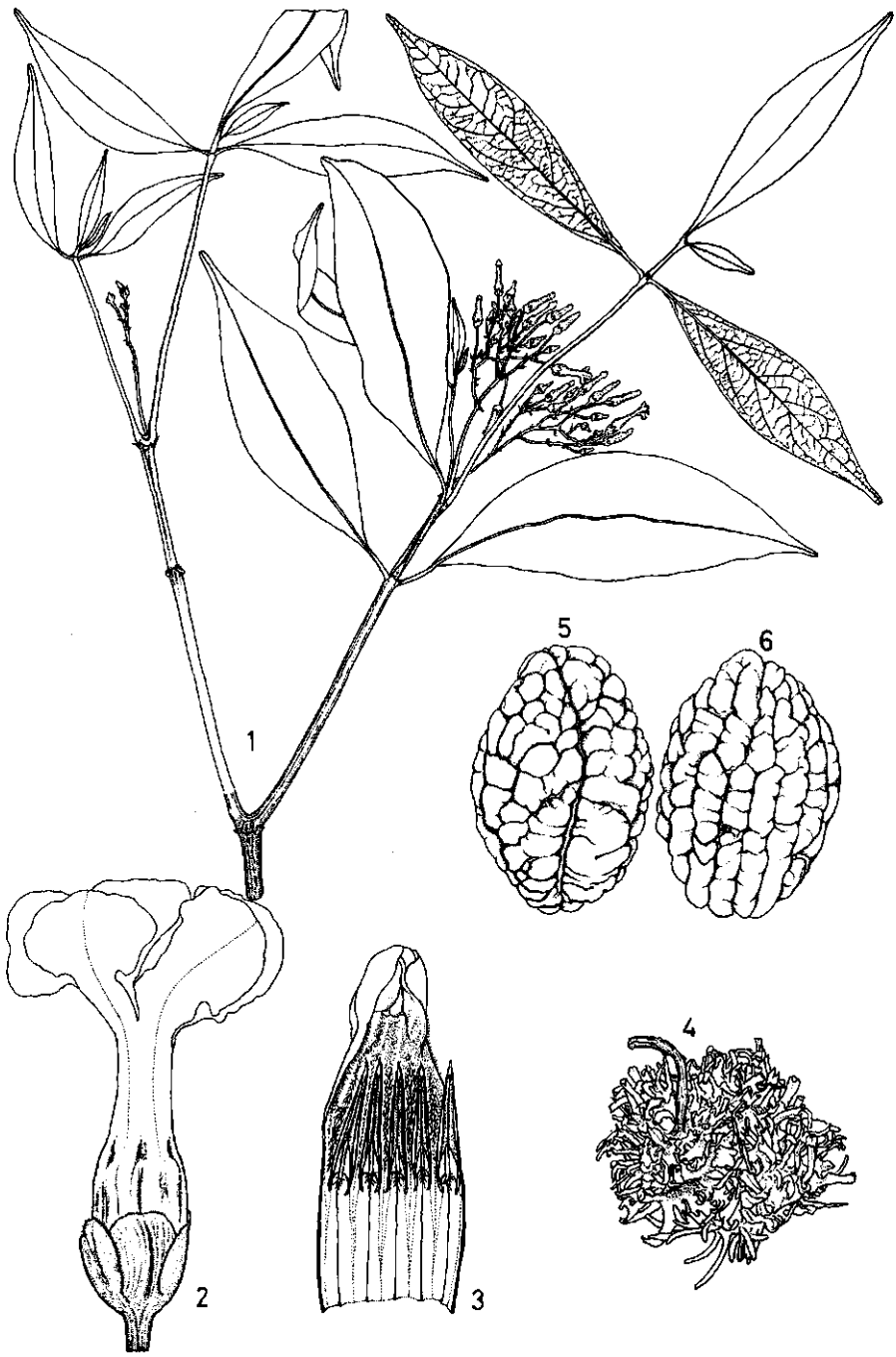
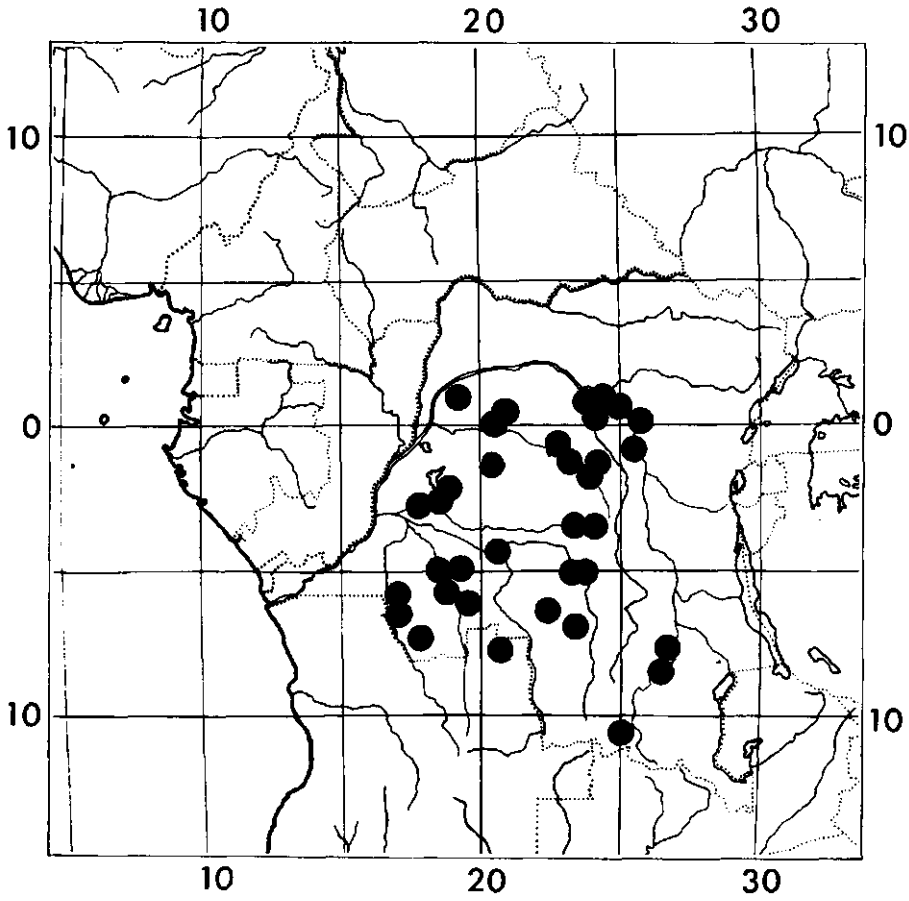


Figure 1. *Tabernanthe elliptica* 1, flowering branch (× 2/3); 2, flower (× 6); 3, opened corolla (× 6); 4, fruit (× 2/3); 5, seed, hilar side (× 4); 6, seed, back side (× 4). 1-3 from Lebrun 6254; 4 from Bamps 8199; 5-6 from Anonym. (1-3 herb. mat.; 4-6 alc. mat.).

Shrub 0.5-2 m high, with little latex. Trunk 1-3 cm in diameter; bark pale brown, lenticellate. Branches pale brown; branchlets glabrous. *Leaves* petiolate; petiole glabrous, 2-12 mm long, with 1-2 rows of colleters in the axils; blade elliptic or narrowly elliptic, 2-4 × as long as wide, 6-20 × 1.5-10 cm, acuminate or caudate at the apex, cuneate at the base or decurrent into the petiole, glabrous on both sides, sometimes with scattered small black dots beneath, with 4-7 pairs of upcurved distant secondary veins; tertiary venation rather inconspicuous, slightly reticulate. *Inflorescence* 1.5-5 × 1.5-3 cm, few-flowered, rather lax. Peduncle slender, glabrous, 5-15 mm long; pedicels glabrous, 2-12 mm long. Bracts deciduous. *Sepals* connate at the base for 0.3-0.5 mm, ovate or broadly ovate, 1-2 × as long as wide, (0.8)2-3(4) × 1-2 mm, acute to rounded or sometimes acuminate at the apex, glabrous or sometimes papillose on both sides, minutely ciliate, especially at the apex or not, inside with 2-6 colleters, usually in the middle, but sometimes only near the edges or in an interrupted row. *Corolla*: (tube orange, limb creamy, throat with 5 pink stripes at the base, teste Louis 14081), thin, in the mature bud forming a comparatively small ovoid head being about 1/3 of the whole length, head slightly wider than the tube apex, but narrower than the tube base (obtuse at apex), glabrous or minutely papillose on base of lobes outside, inside with densely pubescent 2 mm long stripes of hairs pointing downwards among the anthers; tube 2-5 × as long as the calyx, 1.2-2.5(3) × as long as the lobes, (3)5-8 mm long, almost ovoid, at the base 2-3 mm and below the mouth 1-1.5 mm wide; lobes obliquely obovate or nearly so, 0.5-0.8 × as long as the tube, 1.3-1.4 × as long as wide, 2.5-4 × 1.5-3 mm, not undulate. *Stamens* 0-1 mm included, inserted 0.2-0.5 of the length from the base of the corolla tube, (at 1-3 mm); anthers sessile, 2.5-3.2 × as long as wide, 3-3.2 × 1-1.2 mm, with apex for 0.1-0.2 mm sterile, glabrous. *Pistil* 3.5-5 mm long, with apex about halfway the anthers; ovary subglobose or broadly ovoid, 1-1.5 × 1-1.5 × 1-1.5 mm, composed of 2 separate carpels; disk entire, united with the distal sides of the ovary, up to half its length; style 1.5-2.5 mm long, not very thin, about 0.2 mm thick, cleft at the base or not; pistil head 0.7-1 × 0.6-0.7 mm, composed of a subglobose or obcampanulate head, often with 5 lateral grooves, 0.5-0.6 × 0.4-0.5 mm, with a stigmoid bilobed apex, 0.1 × 0.1 mm and a basal ring 0.6-0.7 × 0.1-0.3 mm. About 20-50 ovules in each carpel. *Fruit* of 2 separate mericarps; mericarps orange or yellow, soft, fleshy, ellipsoid, 20-50 × 20-45 × 15-40 mm, with soft blunt prickles 1-12 × 0.5-2 × 0.3-1 mm drying flat, among prickles smooth and not dotted, rounded at the apex and at the base, not recurved, not ridged, about 5-20-seeded; wall thick, 5-10 mm thick, of a thin orange outer and a thick more or less spongy white inner layer. *Seed* 9-11.5 × 4.5-7 × 4-6 mm; embryo 5-5.5 mm long; cotyledons elliptic, 1.3 × as long as wide, 2-2.8 × 1.5-2.1 mm, subcordate or rounded at the base; rootlet 2.8-3.2 × 0.5-0.7 mm.

Geographical distribution: Congo, Zaïre, Angola (Lunda).

Geographical selection of the about 80 specimens examined:



MAP 1. *Tabernanthe elliptica.*

CONGO: KOUILOU: Ngongo Region (fl. Mar.), Attims 181 (P); ibid., km 8 Ndindi Road (fl., imm. fr. May), Sita 3730 (P).

ZAÏRE: BANDUNDU: Kingunda (fl.), Hürlimann s.n. 22 July 1955 (MO); Ipamu (fl., fr. Sept.), Vanderyst 12055 (BR); Imbela (fl. Sept.), Callens 4228 (BR, NY); Kikwit (fl. Jan.), Vanderyst 3044 (BR, paratype); Makamba (fl., fr.) Breyne 4054 (BR); Panzi (fl. Apr.), Callens 2693 (K, NY), Vanderyst 16915 (BR); Bokore (fl., fr. Oct.), Jans 599 (BR); Illongonga, Sapin s.n. Dec. 1907 (BR); Nioki (Oct.), Flamigni 6021 (BR); Bankaie (fl., imm. fr. June), Gilbert 14287 (BR). EQUATEUR: Wafania (bud, imm. fr.), Hulstaert 895 (BR); Bolongo (fr. June), Collart 97 (BR); Bomandja (fr. Oct.), Evrard 4981 (BR); Ikelemba River source (fr. June), Evrard 4211 (BR); Mondombe (fl., fr.), Jespersen s.n. Nov. 1907 (BR); Ikela, L. Dubois 838 (BR); Moma (bud, fr.), Jespersen s.n. Oct. 1910 (BR, type of *Daturicarpa firmula*). HAUT-ZAÏRE: Lifera, Opala (fr. Nov.), Lisowski 43473 (BR, K, POZG); Between Lubutu and Kirundu (bud, fr. Feb.), Bequaert 6843 (BR, lectotype); km 45 of road from Kisangani to Wanié-Rukula, Amunyala Falls (fr. Mar.), Lejoly 4831 (BR); km 23 Kisangani-Bengamisa Road (bud, fr. May), Bokdam 4154 (WAG); Yabahondo, Isangi (fr. Oct.), Germain 8134 (BR, M, P); Tshopo River bank (fl., fr. Mar.), Bequaert 7058 (BR, K, type of *Daturicarpa lanceolata*); Yalibwa (fr. Apr.), Germain 324 (BR); Weko, Isangi (fl. Mar.), Louis 14081 (BR, K, WAG). KASAI OCCIDENTAL: Sankuru River (fr.), E. Laurent s.n. Dec. 1895 (BR); ibid. (fl.),

Sapin s.n. Sept. 1906 (BR); Musoko, near Mutombo (fl. Aug.), Liben 3519 (BR). KASAI ORIENTAL: Lodja (fl. Sept.), Lebrun 6254 (BR); between Katakokombe and Lodja (fl. Sept.), Lebrun 6197 (BR); Kondue (fr. Nov.), E. & M. Laurent 17 (BR, paratype); Batempa (fr. Mar.), Lescrouwaet 353 (BR, paratype); Mwene-ditu (fl. July), Germain 7952 (P). KIVU: Kalima (bud Feb.), Kitembo 50 (BR); Pangi (fr. June), Michelson 45 (BR). SHABA: km 13 Kyamasumba-Kolwezi Road (fr. Jan.), Bamps & Malaisse 8199 (BR); km 6 Nasondoye-Kamina Road (fr. Apr.), Malaisse 12262 (BR); km 12 Nasondoye-Dilolo Road (fr. Jan.), Schmitz 6404 (BR).

ANGOLA: LUNDA NORTE: Dundo, Luachimo River (fl., fr. Nov.), Gossweiler 13930 (B, BM, K).

CULT.: ZAÏRE: Kisantu Bot. Garden (fl. Nov.), Tilquin 49 (BR).

2. **Tabernanthe iboga** Baill., Bull. Soc. Linn. Paris, 1: 782. 1889; D. Oliver in Hook. Icon. Pl. 24: pl. 2337. 1894; Stapf, Kew Bull. 1895: 37. 1895; K. Schumann in Engler & Prantl, Natürl. Pflanzenfam. 4(2): 146. 1895; Stapf in Fl. Trop. Afr. 4(1): 124. 1902.

Type: Gabon, Cap Lopez, Griffon du Bellay 327, (P holo-). **Fig. 2; Map 2**

Heterotypic synonyms: *T. albiflora* Stapf, Kew Bull. 1898: 305. 1898; De Wildeman, Ann. Mus. Congo-Bot. 2(I-1): 38. 1899; Ann. Mus. Congo-Bot. 1(I-4): 81, pl. 41. 1899. Type: Zaïre: VI: Mbandaka (syn. Coquilhatville), A. Dewèvre 684 (BR holo-).

T. tenuiflora Stapf, Kew Bull. 1898: 305. 1898; De Wildeman, Ann. Mus. Congo-Bot. 2(I-1): 38. 1899; Stapf in Fl. Trop. Afr. 4(1): 124. 1902. Type: Zaïre: A. Dewèvre 361 (BR holo-).

T. bocca Stapf, in Fl. Trop. Afr. 4(1): 122. 1902. Type: Congo: Müller s.n. (K holo-).

T. subsessilis Stapf in op. cit. 123. Type: Angola: Pungo Andongo, F. Welwitsch 5950 (BM lecto-, designated here, BM, COI, G, K, P isolecto-).

T. mannii Stapf, l.c.. Type: Gabon: Gabon River, G. Mann 943 (K holo-, P iso-).

T. pubescens Pichon, Bull. Mus. Nat. Hist. Nat. 25(2): 637. 1953, **syn. nov.** Type: Angola: Nordeste, J. Gossweiler 13672 (B holo-, BM, K, P iso-).

Iboga vateriana J. Br. & K. Schum. in Danckelmann, Mitt. Deutsch. Schutzgeb. 2: 172. 1889; Stapf in op. cit. 125. Type: Cameroun: Batanga, J. Braun 1054 (M lecto-, designated here, HBG isolecto-).

Small tree or shrub, 0.5-4 m high. Trunk terete, 3-10 cm in diameter; bark pale to dark grey, smooth. Branches with a pale to dark brown bark, with pale grey-brown lenticels; branchlets glabrous or pubescent. *Leaves* subsessile to distinctly petiolate; petiole glabrous or pubescent, 1-13 mm long, with three or more rows of colleters in the axils; blade bright to dark green above, paler beneath, elliptic, narrowly elliptic or narrowly obovate, sometimes ovate, 2-4.2 × as long as wide, (2.5)3.2-22 × (0.9)1.5-10 cm, acuminate at the apex and often also mucronate, subcordate or cuneate at the base or decurrent into the petiole (sometimes unequal-sided and then usually one side subcordate and the other cuneate), glabrous or pubescent on both sides (if hairy usually more so on the veins), secondary veins 7-20 on each side, curved, forming an angle of 50°-90° with the costa, anastomosing at the apex; tertiary venation reticulate. *Inflorescences* 3-7 × 2-4 cm, 2-5 × branched, few to many flowered, lax. Pedun-

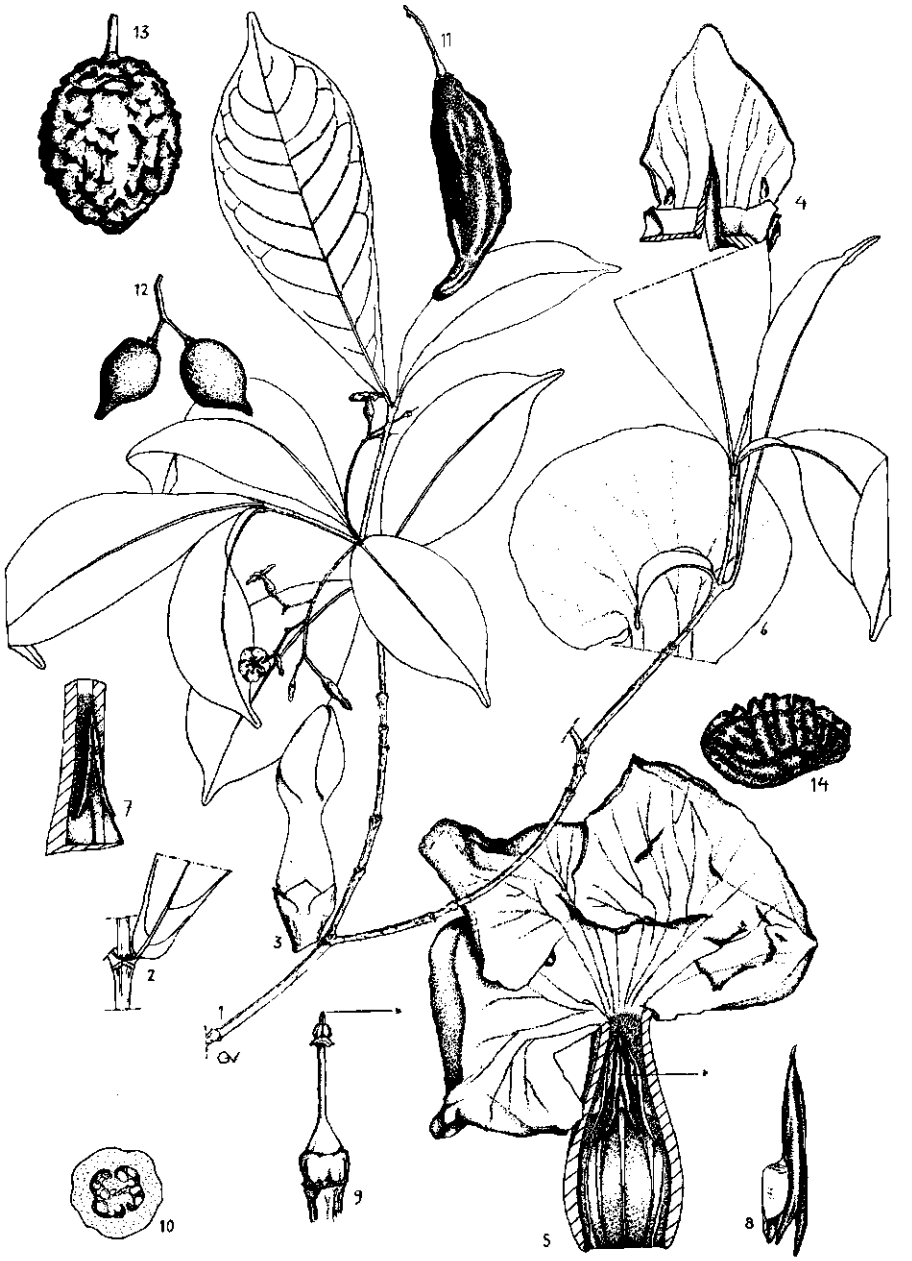
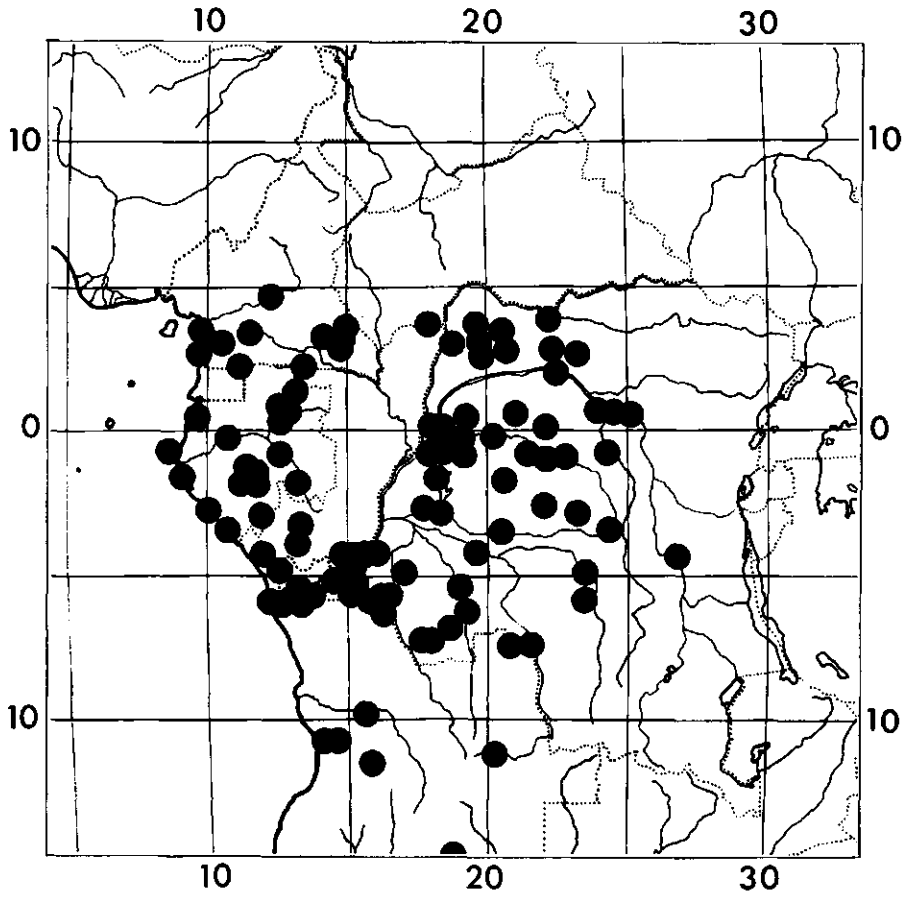


Figure 2. *Tabernanthe iboga* 1, flowering branch (× 1/2); 2, base of subsessile leaf (× 1); 3, mature bud (× 2 1/2); 4, partly torn calyx segment inside (× 10); 5, part of corolla inside (× 5); 6, spread corolla lobe inside (× 5); 7, stamen (× 5); 8, stamen (× 10); 9, pistil (× 5); 10, transverse section of ovary, just above disk (× 10); 11-13, fruit (× 1/2); 14, seed (× 2 1/2). 1 from Leeuwenberg 12544; 2 from Gillardin 617; 3-10 from Leeuwenberg 12400; 11 from Breteler & de Wilde 692/78; 12 and 14 from Bernardi 8222; 13 from Leeuwenberg 12542. (1, 2, 12, 14 herb. mat.; 3-11, 13 alc. mat.).



MAP 2. *Tabernanthe iboga*.

cle glabrous or pubescent, 0.5-4.5 cm long, fairly slender; pedicels glabrous or pubescent, 2-17 mm long, thickened at apex just below the calyx by which sepals seemingly connate at base. Bracts persistent, sparsely pubescent at the apex, about as long as the sepals, without colleters. *Flowers* fragrant. *Sepals* almost free, ovate, triangular or broadly so, 0.8-1.3(2) × as long as wide, 1.1-3 × 1-2.2 mm, glabrous or pubescent on both sides (less indumentum inside), minutely ciliate at least at apex, acute, obtuse or acuminate; colleters in 5 alternisepalous groups of 1-8 (in a single flower 7-28 colleters); calyx persistent, even under the fruit. *Corolla* usually with red to purple or violet dots or stripes in 5 groups in the throat, in the mature bud 6-12 mm long (the lobes are 42-69% of the length of the bud and 2-4.7 × 1.2-2.8 mm, in a conical or ovoid head), glabrous or above the calyx pubescent outside, inside pubescent from the insertion of the stamens to the mouth (density of indumentum decreasing towards mouth);

tube 2.8-7 × as long as the calyx, 1.2-3.2 × as long as the lobes, 5.5-8.7 mm long, almost cylindrical to urceolate, 1.5-3.5 mm wide, contracted at the base, 0.9-2 mm, fairly abruptly widened at the throat; lobes suborbicular or obliquely ovate, 0.3-0.9 × as long as the tube, 0.7-1.2 × as long as wide, 2.3-6 × 2.5-6.1 mm, obtuse or rounded at the apex, auriculate at the right side of the base, undulate and sometimes obscurely sinuate, spreading and recurved later. *Stamens* included for 1-2.5 mm, inserted 2.5-4 mm above the corolla base; anthers subsessile, 2.7-3.2 × 0.4-0.7 mm, at the apex for 0.1-0.3 mm sterile, glabrous or slightly pubescent inside, glabrous outside. *Pistil* 4.1-5.3 mm long; ovary subglobose, 1.2-1.8 × 0.8-1.8 × 0.8-1.8 mm, syncarpous, only basally 2-celled, placentas 2 parietal, much projecting, united at the base and less so at the apex; disk completely united with the ovary, entire or 5-lobed; style 1.7-2.5 × 0.1-0.3 mm (not thickened at apex); basal ring of pistil head 0.2-0.4 × 0.5-0.9 mm, central part 0.3-0.5 × 0.4-0.6 mm, apical lobes 0.2-0.6 mm long; apex of pistil about 0.9-1.6 mm below apices of anthers. On each placenta about 15-30 ovules (in 4-8 rows). *Fruit* glabrous (sometimes pubescent when immature), yellow to red, sometimes with lighter coloured, white or greyish-yellow spots, variable in shape (subglobose, ellipsoid or ovoid, not laterally compressed), rounded, obtuse, acute or acuminate at the apex, obtuse or rounded at the base, smooth or less often bumpy, 29-64 × 13-40 × 13-39 mm, many-seeded; wall 1.5-8 mm thick, white inside and on section. *Seed* dull, 7-10 × 4-6 × 3.5-5.5 mm; testa reticulate at the hilar side; embryo 4 mm long; cotyledons suborbicular, 1.7 × 1.7 mm, cordate at the base; rootlet 2.3 × 0.5 mm.

Geographical distribution: Tropical Africa, from Cameroun to Angola.

Ecology: Forest understorey or gallery forests, sometimes riverine or swamp forests or relatively wet savanas. Alt. 0-1500 m. Flowering and fruiting throughout the year.

Geographical selection of the about 650 specimens examined:

CAMEROUN: Bissaga, Letouzey 1456 (P); between Bange-mouth and Yokadouma, Mildbraed 4592 (HBG); 16 km EES of Mouangko, Asongani 682 (WAG); Yokadouma, Hedin 523 (P); 5 km S of M'Balmayo, W. de Wilde 1806 (P, WAG); between Mang and Asip, Letouzey 5558 (BR, HBG, K, P, WAG); km 18 Yokadouma-Lomie, Letouzey 5370 (P); near Zokadiba, Letouzey 12156 (K, P, WAG); Grand Batanga, Dinklage 931 (HBG); Mékoassi, Raynal 9964 (P); near Alati, Biholong 269 (P).

CENTRAL AFRICAN REPUBLIC: Boukoko, Tisserant 2141 (BM, BR, P).

GABON: Libreville, Klaine 428 (K, P); Cap Lopez, Griffon du Bellay 327 (P, holotype); Mondorobé, Pobequin 53 (P); Gamba, Breteler & van Raalte 5629 (WAG); near Ndjolé, N. Hallé 1750 (BR, P); Bélinga, Breteler & de Wilde 555/78 (WAG); ibid., N. Hallé 3766 (P); Simintang, Leeuwenberg 11567 (WAG); km 15 Mékombo-Makokou, Hladik 2602 (P); near Lastoursville, Breteler & de Wilde 797/78 (WAG); km 23 Mouanda-Franceville, Breteler 6257 (WAG); Divindé, le Testu 5905 (P); Etéké, Aubreville 184 bis (P); 20 km E of Mimongo, A.M. Louis et al. 988 (WAG); km 10 Mimongo-Mbigou, J. de Wilde et al. 374/83 (WAG); km 40 Mouila-Yeno, Breteler et al. 8131 (WAG); 20 km S of Mayumba, J. de Wilde et al. 671/83 (WAG).

CONGO: Kouilou, Farron 5042 (P); Ngokamina II, Bouquet & Sita 2221 (P); near Oyabi, Bou-

quet & Sita 2263 (P); 25 km W of Sibiti, C. Farron 4232 (P); Tchisséka, Bouquet 1965 (P); near Brazzaville, Sita 1962 (P); near Kinkala, Koechlin 5255 (P).

ZAÏRE: BAS-ZAÏRE: between Malemba and Matambama Kanzi, Wagemans 2218 (WAG); Moanda (= Muanda), Nsimundele 112 (BR); Luki, Toussaint 2213 (B, BR, FHO, K, P); Sandanda, Donis 142 (BR); Bingila, Dupuis s.n. (BR); Matomba (= Matombe), Wagemans 1363 (BR, MO, UC); Sanga, Compère 1743 (BR); Kisantu, Callens s.n. (F); Kingana (= Kinganga), Pauwels 728 (BR); Kingemba Kinga, Pauwels 1889 (BR); Kimvula, Callens 4783 (BR, WAG). KINSHASA: Sabuka, E. et M. Laurent s.n. (BR); Kimuenza, Robyns 4304 (BR, K, MO); Kinshasa, Bequaert 845 (BR); Lemba, Cabra 29 (BR); between Kinshasa and Ndjili, Dubois 1547 (BR, K, M); Ndjili, Pauwels 5262 (BR, WAG); Kinkole, Breyne 4146 (BR); Kimpoko, Okitolembo 12 (BR, WAG); Menkao, Breyne 2973 (BR); Bombo River, Breyne 33 (BR). BANDUNDU: Kole, Lebrun 6337 (BR, WAG); Mongandjale (= Mogandjale), Flamigny 10289 (BR); Bokoro, Jans 627 (BR); Kenge, Devred 2645 (BR, K, L); Ipamu, Vanderyst 9386 (BR); between Dekese and Bumbuli, Lebrun 6492 (BR, WAG); Popokabaka, L. Dubois 1577 (BR); Kiyaka, Devred 2776 (BR, K, P, WAG); Kidima, Callens 3493 (BR, NY); Kisangi (= Kisandji), Renier 81 (BR); Panzi, Callens 2713 (BR). EQUATEUR: Bas-Uele, Dewulf 790 (BR); Bombura, Evrard 908 (BR); Bobutu, Evrard 474 (BR); Boketa, Evrard 625 (BR); Ekuta, Sapin s.n. (BR); Guluma, Brimeyer 34 (BR); near Likimi, Malchair 290 (BR); Dundusana, Mortehan 509 (BR); Upoto, E. Laurent s.n. (BR); Coquilhatville (= Mbandaka), Dewèvre 684 (BR, type of *T. albiflora*); Eala, Leemans 103 (BR, K, MO, P, WAG); Mongo, Louis

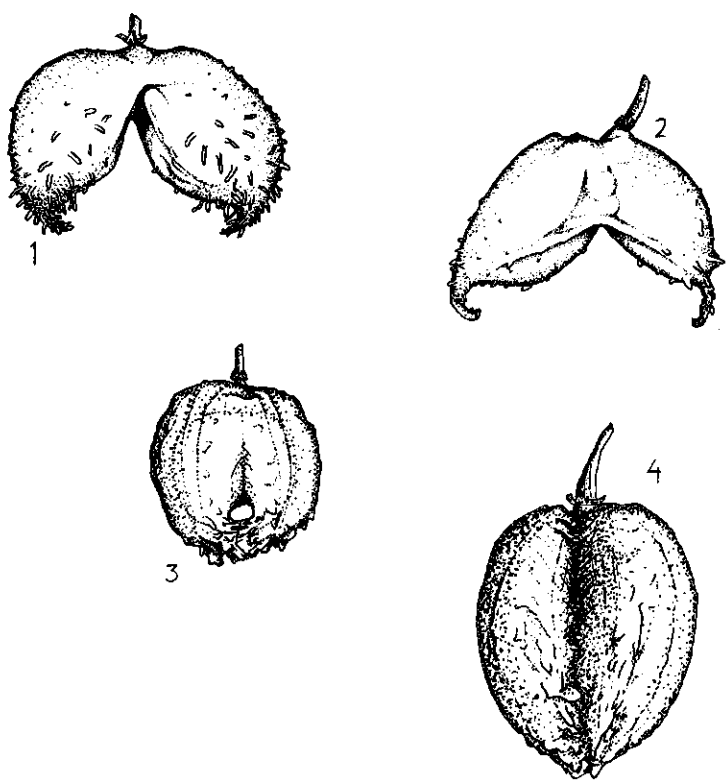


Figure 3. *Tabernanthe elliptica* × *T. iboga* 1-4, fruit (× 1). 1 from Breyne 4421; 2 from Szafranski 1260; 3 from Breyne 3237; 4 from Anonym. 1 ('Mebange', P). (1-4 herb. mat.).

151 (BR, C, K, LISC, MO, P, WAG); Mondjo, Ikelemba River, J. Léonard 542 (BR, F); Tolongote, Evrard 4172 (BR, K); between Mompono and Befori, Evrard 5717 (BR); Wendji, Lebrun 1157 (BR, C, LISC, MO, UPS, WAG); Lake Tumba, J. Léonard 643 (BR, COI, M); Bobanda, Evrard 3847 (BR, K); between Flandria (= Boteka) and Makako, Evrard 6050 (BR); Flandria (= Boteka), Hulstaert 112 (BR); Bolengambi, Evrard 6110 (BR, K); Bokote, Hulstaert 996 (BR); Bokondji (= Bokonji), De Wanckel 128 (BR); Lolia Buma, L. Dubois 680 (BR); Mondombe, Jespersen 40 (BR); Monkoto, L. Dubois 102 (BR, WAG). HAUT-ZAÏRE: Mobwasa, Reygaert 1118 (BR); Yandjali, Germain 8091 (BR, P); Yangambi, J. Louis 9226 (BR, C, K, LISC, MO, P, UPS, WAG, Z); Kisangani, Lubini 3218 (WAG); near Osuke, Lisowski 43259 (BR). KASAI OCCIDENTAL: Badibanga, Liben 1753 (BR, COI, LISC). KASAI ORIENTAL: near Booke, Robin 107 (BR); Mukumari, Gillardin 583 (BR); Katako Kombe, Lebrun 6129 (BR, K, WAG); Sangaie, Gillardin 617 (BR). KIVU: Mutambo, A. Léonard 5669 (BR).

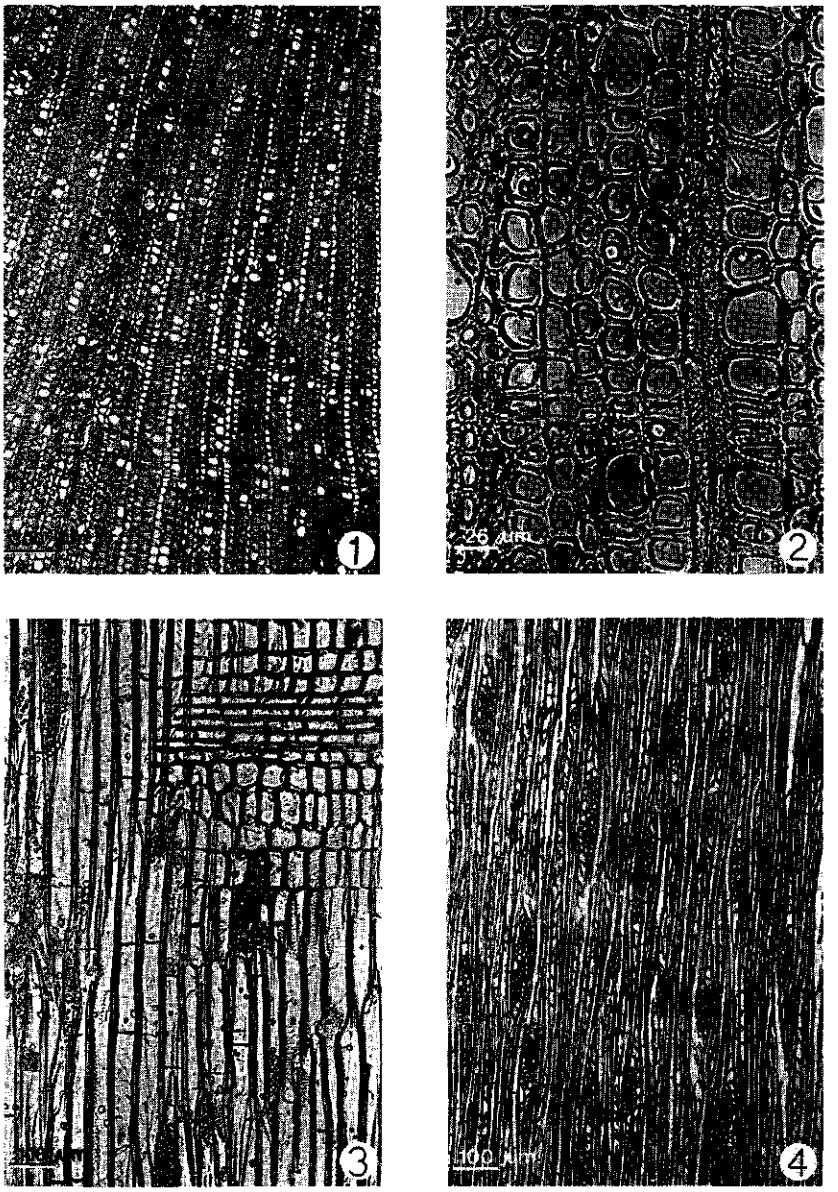
ANGOLA: MAIOMBE: Buco Zau, Gossweiler 6949 (BM). UIGE: Entre, Raimundo et C. Matos e Maia 883 (LISC). LUNDA: near Dundo, Martins 65 (P); Nordeste, Gossweiler 13672 (B, BM, K, P, type of *T. pubescens*); Dala, Exell & Mendonça 1109 (BM). CUANZA SUL: Amboim, Gossweiler 9974 (COI); Gabela, Teixeira et al. 11202 (LISC). BIÉ-CUANDO-CUBANGO: between Chitembo and Chingueia, Teixeira et al. 10716 (LISC); near Longa, Mendes 3170 (LISC). MULANYE: Pungo Andongo, Welwitsch 5950 (BM, COI, G, K, P, type of *T. subsessilis*).

CULT.: IVORY COAST: km 17 Abidjan-Dabou, Leeuwenberg 12024 (WAG). GABON: Akoga, Leeuwenberg 12542 (WAG); ibid., Leeuwenberg 12543 (WAG); ibid., Leeuwenberg 12544 (WAG).

NOTE: After a detailed study of all the herbarium material, we found that hybridisation occurs between the two species *T. iboga* and *T. elliptica*, and that more than one transition-form exist. H. Breyne, for example, made a few artificial hybrids in the botanical garden of Kisantu, Zaïre, and also some hybrids were found in the wild.

T. iboga has a fruit consisting of two fully united, smooth carpels; the fruit of *T. elliptica* consists of two free carpels with blunt soft prickles. When hybridisation occurs, forms can arise which resemble *T. elliptica* the most, e.g. the two carpels connate only at the base and there smooth, but free in the upper part and with prickles (see fig. 3-1; H. Breyne 4421); other forms are intermediate between the two species, resembling both species to the same extent, e.g. the two carpels connate and smooth in the lower half and free and prickly in the upper half (see fig. 3-2; Szafranski 1260); also forms resembling *T. iboga* more may occur, e.g. the two carpels (almost) fully connate, smooth, sometimes with only some small prickles at the apex. (see fig. 3-3, 3-4; H. Breyne 3237, Anonym. 1 ('Mebange', P)).

Consequently, only fruiting plants can be safely recognised as hybrids.



Phot. 1-4. Secondary xylem of *T. iboga* -1: Transverse section showing vessels, regularly distributed, within a ground tissue of radially arranged libriform fibres. Note the wood-rays and the growth-ring boundaries. -2: Transverse section, enlargement of a part of fig. 1, showing a 2-seriate wood-ray crossing a growth-ring boundary. -3: Radial section showing a wood-ray composed of procumbent, square and upright cells. Note vessels with simple perforation plates (lower right-hand side corner), and septated libriform fibres with regularly distributed small bordered pits. -4: Tangential section showing uniseriate and multiseriate wood-rays mainly with tails of more than 4 marginal rows. Note the septated libriform fibres without pits in the tangential walls.

Wood anatomy of Tabernanthe iboga Baill.

Materials and methods

The collected *T. iboga* is a shrub of 1.20 m high, with a stem diameter of 2 cm. The sample, from which sections were made, was taken from a cultivated shrub, grown at ORSTOM, 17 km west of Abidjan on the road to Dabou, (5.19 N; 4.08 W), Ivory Coast, West Africa, planted by A. Bouquet (ca 1948). Altitude 30 m above sea level. Fresh stem samples were fixed in FAA; they are preserved at the Department of Plant Taxonomy, Wageningen, the Netherlands with the accompanying herbarium voucher (Lg 12024). Other wood-sections of the same species were made from fresh material (shrubs of 0.80 m tall with a stem diameter of 1-1.5 cm), which was collected as seed in Gabon (1982) and raised in the greenhouses of the Agricultural University, Wageningen (Lg 12542; Lg 12543; Lg 12544).

Transverse, radial and tangential sections of the wood samples were made with a sledge microtome, varying in thickness from 15-20 µm. All sections were embedded in Kaiser's gelatin-glycerin (Johansen, 1940). Means and ranges of the number of wood rays per mm in tangential direction, ray height and width, radial vessel diameter and vessel-member length are based on at least fifty measurements. The vessel-member length was measured including the tails. Vessel frequency was determined by counting vessels in radial sections, because in cross-sections vessels were not always distinguishable from libriform fibres. The countings were converted to number of vessels per square mm in cross sections. For all quantitative data, mean values are given, preceded and followed by extreme values between brackets. The author has used the definition of libriform fibres given by Reinders (1935) and Janssonius (1940). Wood ray types are classified according to a modified system of Kribs (1959).

Results

The secondary xylem of the investigated *T. iboga*-samples shows the following characters (see also Table 1):

Growth rings fairly distinct, marked by gradually decreasing radial diameters of the cells followed by an abrupt increase. *Vessels* solitary, in radial multiples of 3(-6), sometimes in clusters, regularly distributed; round to slightly oval or flattened where in contact with each other; average number (112-)135(-162) per square mm; radial diameter (15-)30(-50) µm, thin-walled (3-5 µm). Vessel-member length (110-)770(-1210) µm. Perforations simple in very oblique end walls. Inter-vessel pits alternate, bordered, with a horizontal diameter of 3-5

μm, sometimes with coalescent apertures. Vessel-ray pits half-bordered, with a horizontal diameter of 3-5 μm. Vessels in contact with libriform-fibres and/or wood rays. *Fibres* libriform, thin-walled, (2.5-)5(-9) μm, septate, with mainly small bordered pits with slit-like inner apertures, confined to the radial walls (regularly distributed); length (425-)1010(-1575) μm. *Parenchyma* absent. *Rays* (1-)2 to 3(-4)-seriate; uniseriate rays composed of upright cells, but sometimes also square cells are present; multiseriate rays composed of upright cells in the tails and mainly procumbent-, together with square cells in the centre; tails of multiseriate rays sometimes short, usually with more than 4 marginal rows (with an average number of 6, up to 20); height (125-)695(-3500) μm; (10-)13(-17) per tangential mm. *Crystals* regularly present, not abundant, only in ray cells and then almost always in square and/or upright cells, mainly rhomboidal, sometimes together with sand, seldom together with a druse.

Table 1. Secondary xylem characters of the investigated *Tabernanthe iboga*.

	Lg 12024	Lg 12542	Lg 12543	Lg 12544
presence of growth rings	+	+	+	+
vessels				
mean radial diameter (μm)	30	30	30	30
(min-max)	(20-45)	(15-50)	(20-50)	(15-40)
average number per mm	160	132	134	112
perforation	simple	do.	do.	do.
inter-vessel pits (μm)	3-5	3-5	3-5	3-5
average member length (μm)	720	890	625	835
fibres				
type	libriform septate	do.	do.	do.
rays				
average height (μm)	785	640	660	690
(max)	(3500)	(2475)	(2650)	(2700)
average width (cells)	2	2-3	2	2
type	HoIII/ HeI(II)	do.	do.	do.
predominant cell type	p;u	p;u	p;u	p;u
number per tangential mm	12	12	15	13

Symbols and abbreviations used:
I: uniseriate rays and multiseriate rays with long uniseriate tails; II: uniseriate rays and multiseriate rays with short uniseriate tails; III: only uniseriate rays present; He: heterogeneous wood ray; Ho: homogeneous wood ray; p: procumbent wood ray cell; u: upright wood ray cell.

Discussion

Although this anatomical study was not intended to make a full comparison between genera of the *Tabernaemontaneae*, one species of *Tabernaemontana* can be compared with *Tabernanthe iboga* described earlier.

Only few and incomplete wood characteristics of *Tabernaemontana* species are known from literature, *T. sphaerocarpa* Bl. being the only complete one (Janssonius 1920).

The wood of *T. sphaerocarpa* shows as many similarities with the wood of *T. iboga*. In *T. sphaerocarpa* the vessels are small (radial diameter 30-100 μm), regularly distributed, solitary and in clusters; round to oval, flattened where in contact with each other; about 30 per square mm; member length 150-1000 μm; perforations simple in almost straight to very oblique end walls; inter-vessel pits bordered, diameter 3-4 μm; vessel-ray pits half-bordered. Fibres libriform, thin-walled, 3-5 μm, septate, with small bordered pits, mainly confined to the radial walls; length 900-1350 μm. Parenchyma very rare, paratracheal. Rays 1 to 3(-6)-seriate; uniseriate rays composed of upright cells; multiseriate rays composed of upright cells in the tails and procumbent cells in the centre. Crystals regularly present, only in ray cells and then in upright cells, less in procumbent cells, one or more per cell.

In conclusion, the wood anatomy of *Tabernanthe iboga* justifies a close relationship to at least one species of *Tabernaemontana*.

Acknowledgements

The authors are sincerely grateful to Dr Ir R.W. den Outer and ing. W.L.H. van Veenendaal (Department of Plant Cytology and Morphology) for their assistance with the work on anatomy and to J.W. Mugge who printed all the photographs.

They are greatly indebted to the Directors and Curators of the herbaria cited for putting the material at their disposal:

B, BM, BOL, BR, C, COI, F, FHO, HBG, K, L, LISC, LISJC, M, MO, NY, P, UC, UPS, WAG, Z.

They are also very grateful to Miss Yuen Fang Tan for preparing the fine drawing (*T. elliptica*), and to Prof. Dr Ir L.J.G. van der Maesen for correcting the text.

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Index of Scientific names

Synonyms are in *italics*. Page number of principal entries are in **bold face**, those of figures in *italics*.

Tabernanthe: uses, phytochemistry, and pharmacology

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Uses

Tabernanthe iboga enjoys a wide reputation in West Central and Central Africa for a variety of purposes: It is used in fetish ceremonies and in sorcery. In the *Bwiti* cult of Gabon and the Congo it is employed as a hallucinogen in a magico-religious context, including the initiation rites of passage. Its function is to seek information from ancestors and the spirit world – hence, 'a coming to terms with death'. It seems that originally it was the leaves that were taken by the coastal peoples of Gabon; but later, immigrants taught the use of the roots. See further, Khuong-Huu *et al.* (1976), Schultes and Hofmann (1979), and Mandrile and Bongiorno de Pfirter (1985).

Iboga root in high doses greatly stimulates the central nervous system, causing hallucinations and stupefaction; in excess it may bring about death. It is much used to prevent fatigue and sleep when prolonged physical effort is required. The root also has anaesthetic properties and is employed as a febrifuge. The latex finds use as an anthelmintic and the warmed leaves are rubbed on the gums in toothache (references in: Bisset, 1958: 135). The latex of the bark is mixed with *Parquetina* and/or *Strophanthus* to give an arrow poison (Angenot, 1978).

At one time, attempts were made to introduce the root into western medicine, particularly in France, where it was recommended as a stimulant for the central nervous system and in small doses for strengthening the heart and stimulating the appetite. Its reputation suffered because false *ibogas*, some of which had quite different properties, were also put on the market (references in: Bisset, 1958: 135).

Phytochemistry

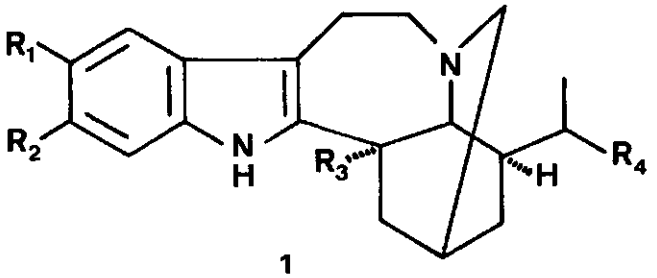
T. (Daturicarpa) elliptica

Of the total alkaloids in the root bark (5.6%) and stem bark (2.4%), about 80% is ibogaine (**1c**); it is accompanied by the related compounds iboxygaine (**1d**) and voacangine (**1e**), as well as ibogaline (**1g**) and ibophyllidine (**2**) (Bruneton *et al.*, 1976). The leaves, on the other hand, contain coronaridine (**1b**), tabersonine (**3a**), vincadifformine (**3b**), and also pandoline (**4a**) and *epi*-pandoline (**4b**). The seeds are rich in alkaloid (ca. 7%) and voacangine (**1e**) has been shown to be present in them (Delaude *et al.*, 1984).

T. iboga (including *T. mannii, T. subsessilis*)

The alkaloids of this species have been extensively investigated and more than 20 different compounds have been obtained, but several of them appear to be artefacts arising in the course of the isolation procedures. For summaries of the earlier work, see Bisset (1958, 1961), Taylor (1965), Caignault and Delourme-Houdé (1977), and Mandrile and Bongiorno de Pfirter (1985). Only more recent work is discussed below.

As with the previous species, ibogaine (**1c**) predominates in the alkaloid-rich



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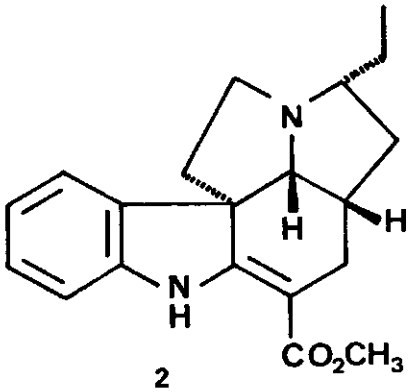

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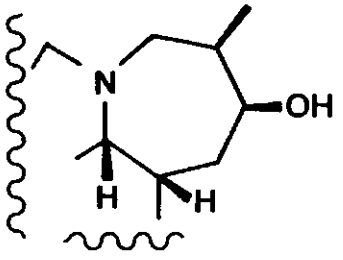
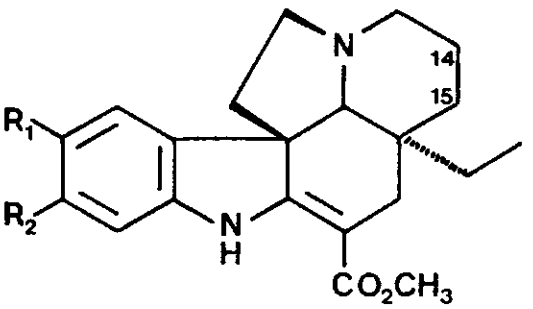


6

1a Ibogamine $R_1 = R_2 = R_3 = R_4 = H$
1b Coronaridine $R_1 = R_2 = R_4 = H$, $R_3 = CO_2CH_3$
1c Ibogaine $R_1 = OCH_3$, $R_2 = R_3 = R_4 = H$
1d Iboxygaine $R_1 = OCH_3$, $R_2 = R_3 = H$, $R_4 = OH$
1e Voacangine $R_1 = OCH_3$, $R_2 = R_4 = H$, $R_3 = CO_2CH_3$
1f Voacristine $R_1 = OCH_3$, $R_2 = H$, $R_3 = CO_2CH_3$, $R_4 = OH$
1g Ibogaline $R_1 = R_2 = OCH_3$, $R_3 = R_4 = H$

2 Ibophyllidine

6 Iboxyphylline



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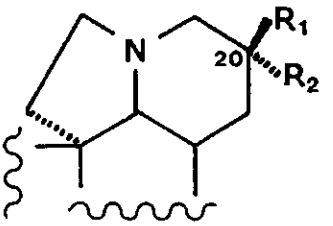

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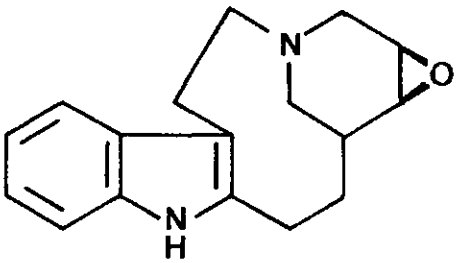

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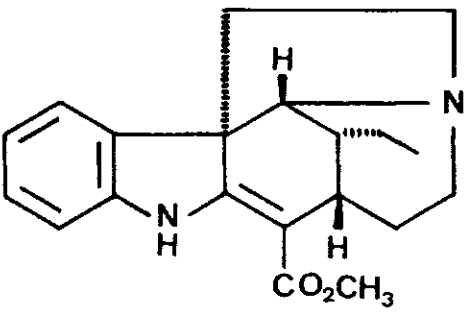

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3a Tabersonine $R_1 = R_2 = H$, $\Delta^{14(15)}$
3b Vincadifformine $R_1 = R_2 = H$
3c 10-Hydroxy-11-methoxytabersonine $R_1 = OH$, $R_2 = OCH_3$, $\Delta^{14(15)}$
4a Pandoline $R_1 = C_2H_5$, $R_2 = OH$
4b *epi*-Pandoline $R_1 = OH$, $R_2 = C_2H_5$
5 Voaphylline
7 Tubotaiwine

root bark (up to ca. 5.5% total alkaloid). It is accompanied by ibogamine (**1a**) voacangine (**1e**), voacristine (**1f**), and a variety of minor bases. In the trunk bark (ca. 2% total alkaloid), ibogaine (**1c**) is again the major base, occurring along with ibogamine (**1a**), iboxygaine (**1d**), ibogaline (**1g**), etc. (Mulamba *et al.*, 1981).

The alkaloids of the leaves (up to ca. 0.8%) are very different from those present in the stem bark and root bark. Those of *T. pubescens* from Zaïre contained mainly voaphylline (**5**), together with several other bases (Mulamba *et al.*, 1981). In *T. subsessilis* leaves from Gabon the chief alkaloid was ibophyllidine (**2**), but ibogamine (**1a**) was also present (Khuong-Huu *et al.*, 1976). The alkaloids of *T. iboga* leaves from Gabon and Zaïre were ibogamine (**1a**), together with ibophyllidine (**2**) and iboxyphylline (**6**) which are probably derived from pandoline (**4a**) (cf. *T. elliptica*, above) (Khuong-Huu *et al.*, 1976; Delaude *et al.*, 1984).

In the seeds (fruits) of *T. iboga* (and *T. pubescens*) from Zaïre, with 0.6–0.8% total alkaloids, coronaridine (**1b**) was the principal alkaloidal constituent, but voaphylline (**5**) and other bases were also present (Mulamba *et al.*, 1981; Delaude *et al.*, 1984).

Suspension cultures of *T. iboga* have yielded tubotaiwine (**7**) and voaphylline (conoflorine) (**5**); the former base has not otherwise been found in the plant (Pawelka and Stöckigt, 1983).

The alkaloid composition of *Tabernanthe* species places them firmly in the Tabernaemontaneae group of genera, but the preponderance of ibogan bases gives the plants a chemotaxonomic character of their own.

The Kisantu hybrid

This is an intergeneric hybrid which has arisen spontaneously in the Jardin de Kisantu, Zaïre. It was described by Hürlimann (1957) as *Daturicarpa elliptica* × *Tabernanthe iboga*, a view which Leeuwenberg (1987) shares. Studies by Delaude *et al.* (1984) have yielded somewhat contradictory findings: the morphology of the F_1 and F_2 fruits suggested rather *Daturicarpa elliptica* × *Tabernaemontana (Pterotaberna) inconspicua*, while comparison of the alkaloids from the seeds and leaves of the hybrid and of the putative parents agreed better with the parentage originally suggested. A more recent examination of the alkaloids from the leaves of *T. (P.) inconspicua* by Massiot *et al.* (1988), in which a dimeric *ar*-oxygenated tabersonine derivative (cf. **3**) was found, is interpreted as favouring the parentage *D. elliptica* × *T. (P.) inconspicua*, since the hybrid is known to contain 10-hydroxy-11-methoxytabersonine (**3c**).

There is no doubt that one parent is *D. elliptica*, but whether *Tabernanthe iboga* or *Tabernaemontana inconspicua*, both of which grow nearby, is the other one, is still not clear. The last word on this interesting problem has yet to be written.

Pharmacology

Ibogaine (**1c**), the main alkaloid of the roots, is responsible for their effects.

Its pharmacology is discussed in Bisset (1985) and is considered in greater detail by Caignault and Delourme-Houdé (1977). The compound has psychotomimetic properties and greatly affects the central nervous system; it prevents the oxidation (and hence causes an increase in the available amount) of serotonin and catalyses that of catecholamines. The anticholinesterase activity of the alkaloid contributes to its anti-fatigue properties; this results in an increased sensitivity to adrenaline, bringing about a transient hypersympathicotonic state. Tinctures of the roots may have anticholinesterase activity up to 100 times greater than that of the alkaloid. Ibogaine is also hypotensive, hyperthermic, and diuretic.

About the pharmacology of ibogamine, iboxygaine, coronaridine, voacangine, etc., see Caignault and Delourme-Houdé (1977), Bisset (1985), and Van Beek and Van Gessel (1988).

While the pharmacological actions of ibogaine largely explain the effects of *iboga* root, leaf extracts are known to have greater activity than root extracts. The basis of this increased activity remains unexplained – for ibogaine is absent from the leaves and the alkaloids that have been isolated from them so far do not share the same properties as ibogaine.

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PART XXX

A taxonomic revision of the genus Orthopichonia

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Summary

The present publication is a monographic revision of the genus *Orthopichonia*, based on the examination of herbarium material and spirit collections.

The genus is exclusively African and counts six species. It belongs to the Landolphiinae to which a key will be published later.

History of the genus

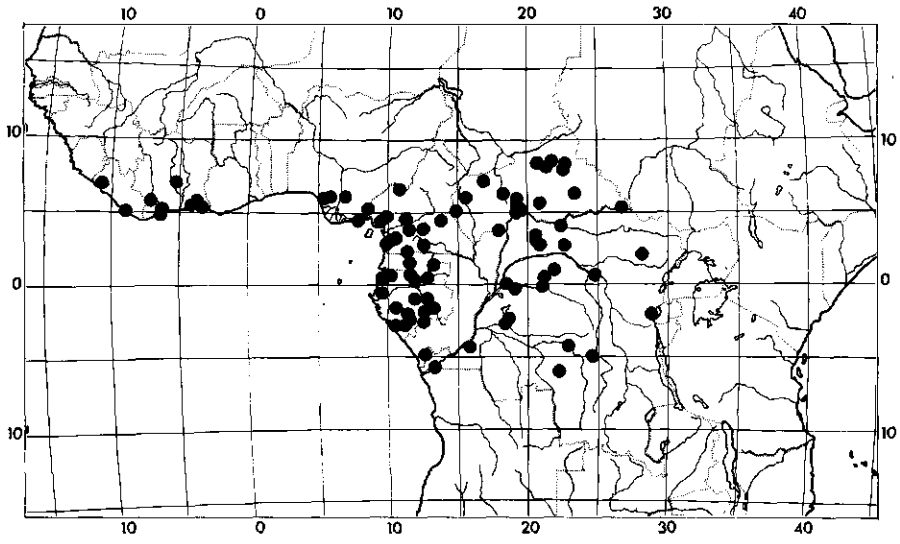
The genus was first considered as sect. *Orthandra*, a section of *Clitandra* by Pichon (1948) who raised it later to the rank of genus, without realising that the name *Orthandra* was already used by Burret (1940) for a Tiliaceae genus. Pichon's error was corrected by Huber (1962) who rebaptised it *Orthopichonia*.

Genus diagnosis

Orthopichonia H. Huber in Kew Bull. 15: 437 (1962); Compère in Bull. Jard. Bot. Brux. 32: 206 (1962); H. Huber in Fl. W. Trop. Afr. 2(2): 57 (1963).

Map 1A

Basionym: *Clitandra* sect. *Orthandra* Pichon, Mém. Mus. Nat. Hist. Nat. 24: 148 (1948).



MAP 1A. Distribution of the genus *Orthopichonia*.

Liana, up to at least 12 m long. Trunk up to 15 cm in diameter. *Branches* pale brown to dark brown with small lenticels, smooth; branchlets often densely pubescent at the nodes. *Leaves*: petiole 7-14 mm long, glabrous or only at the base sparsely pubescent; blade papery or subcoriaceous when dried, glossy, elliptic or oblong, rarely ovate, 1.7-3 × as long as wide, 4-15.1 × 1.7-7.2 cm, acumen 5-15 mm long, with a rounded or truncate, sometimes obtuse point at the apex, cuneate at the base, glabrous on both sides, with 30-50 pairs of conspicuous secondary veins alternated by less conspicuous ones; tertiary venation inconspicuous above, reticulate beneath. *Inflorescences* axillary, often seemingly terminal, 1-4 together, sometimes rather lax, more often densely congested into a cluster of about 10-80 flowers, 12-35 × 12-35 mm. Peduncle 0.5-3 mm long; peduncle and main axis pubescent or sometimes glabrous. Pedicels 0.5-3 mm long, pubescent or glabrous. Bracts triangular, 0.7-1 × 0.7-1.3 mm, pubescent or glabrous on both sides, ciliate; colleters 1-2, 0.1-0.2 mm long. *Sepals* up to 0.3 mm connate at the base, triangular or ovate, sometimes suborbicular or elliptic, 0.8-1.6 × as long as wide, 0.7-1.3 × 0.6-1.2 mm, obtuse, acute or truncate, sometimes rounded at the apex, outside glabrous or sometimes minutely pubescent, more or less ciliate, inside glabrous. *Corolla* often with a green tube (sometimes tinged with pink), at lobes white, in the mature bud 7.5-13 mm long, forming an oblong head 0.35-0.51 of the bud-length, glabrous outside; tube 4.8-8 × as long as the sepals, 1-3.1 × as long as the lobes, 4.5-6.8 mm long, contracted at the base and there 0.5-0.8 mm, widened above and widest 1.9-2.9 mm above the base (0.32-0.56 of the tube) and there 0.7-1.4 mm, again contracted just above the anthers and there 0.3-0.7 mm wide, fairly abruptly widened at the throat, inside with a pilose belt from 0.8-1.7 mm above the base to the base of the lobes; lobes oblong or narrowly so, 0.3-1 × as long as the tube, 1.6-3.6 × as long as wide, 1.7-5.5 × 0.8-2.5 mm, rounded at the apex, often slightly involute at the left side, outside glabrous, more or less ciliate, inside sometimes sparsely pilose at the base. *Stamens* 2-4 mm included (0.44-0.57 of the tube-length), inserted 1.2-2.3 mm from the base of the tube (the base of the anthers being 1.8-2.8 mm above the base of the tube); filaments glabrous on both sides, 0.3-0.7 mm long; anthers 1-2.7 × as long as the filaments, narrowly triangular, narrowly ovate or narrowly elliptic, 2.5-4.5 × as long as wide, 0.5-0.9 × 0.2 mm, acuminate or acute, sometimes apiculate with an up to 0.15 mm long sterile apex. *Pistil* 1.4-2.3 mm long; ovary superior to inferior for one quarter, sub-globose, sometimes obovoid, 0.5-0.9 × 0.5-0.8 × 0.5-0.8 mm, glabrous, unilocular, abruptly narrowed into the style; style 0.5-1 × 0.1-0.2 mm; pistil head ovoid, sometimes cylindrical, 0.3-0.8 × 0.2-0.3 mm, split at the apex for 0.2 mm; apex of pistil 0.6-1.8 mm below apices of anthers. Placentas often much protruding, each with 10-40 ovules. *Fruits* with mango odour, yellow or orange, pear-shaped, sometimes globose, sometimes truncate at the apex, often bumpy, the surface minutely shallowly grooved, glabrous, with many lenticels, often subtended by the persistent calyx, 18-87 × 20-60 mm; pulp edible, acid. *Seeds* light to dark brown when dried, irregularly ellipsoid to bean-shaped, 10-16 × 8-13 × 6-10 mm; embryo 1 × 1 mm; cotyledons ovate to elliptic, up to 14 mm long, cordate to slightly cuneate at the base.

Geographical distribution: Tropical Africa from Ivory Coast to Zaïre.

Ecology: Tropical rain forests. Alt. 220-650 m. Flowering and fruiting throughout the year, flowering especially in the months June – February.

Geographical selection of the about 250 specimens examined:

IVORY COAST: Taî forest, de Namur 1427 (WAG); National Park Banco Forest, de Koning 4558 (WAG); Abidjan – Aboisso, 43 km after Comoe Bridge, Breteler 5909 (WAG).

NIGERIA: BENDEL: Bénin, Chevalier 15133 (P); Sapoba, Kennedy 2322 (K, P); Asaba, Unwin 15 (K).

CAMEROUN: Bertoua, Breteler 2225 (BR, K, LISC, M, P, WAG); Ayos, de Wit 8126/104 (K, P, WAG); Bitye, Bates 1935 (BM, BR, MO, NY); Djoum, Letouzey 8358 (BR, K, P, WAG).

CENTRAL AFRICAN REPUBLIC: Boukoko, Tisserant 284 (BM, P, WAG).

GABON: Oveng, Louis et al. 523/83 (WAG); near Koumameyong, Reitsma et al. 3455/87 (WAG); near Makokou, Gentry 33311 (MO); 100 km S of Libreville, de Wilde et al. 858/83 (WAG); Minguembé, le Testu 8055 (BM, BR, LISC, P, WAG).

ZAÏRE: EQUATEUR: Likimi, de Giorgi 1505 (BR); Dundusana, Mortehan 487 (BR); Bodala, Coulon 5 (BR); Eala, Staner 1437 (BR, C, K, MO, P, US); Befale, Dubois 773 (BR); Ingende, Evrard 6117 (BR); Bongoy (=Bongoie), Evrard 3192 (BR). HAUT-ZAÏRE: Yangambi, Louis 12678 (BR, C, E, L, M, MO, NY, P, WAG); Itia, Jespersen 67 (BR). BAS-ZAÏRE: Luki, Toussaint 309 (BR, K, P); Gimbi, Toussaint 498 (BR). KINSHASA: Menkao, Breyne 2974 (BR). BANDUNDU: Ganda, Body s.n. (BR); Bankaie, Gilbert 14115 (BR); Bikoro (=Bokoro), Anonym. s.n. (BR). KASAI-OCCIDENTAL: Tchimbumbang (=Tshimbambange), Sapin s.n. (BR). KASAI-ORIENTAL: Bena-Dibele, Flamigni 5 (BR); Lubefu, Anonym. s.n. (BR).

2. **Orthopichonia cirrhosa** (Radlk.) H. Huber in Kew Bull. 15: 437 (1962).

Fig. 1A; Map 3A

Basionym: *Clitandra cirrhosa* Radlk. in Abh. Nat. Ver. Bremen 8: 400 (1883); Stapf in Fl. Trop. Afr. 4(1): 67 (1902); Hutchinson & Dalziel, Fl. W. Trop. Afr. 1(2): 34 (1931).

Type: Gabon, H. Soyaux 183 (M lecto-, designated here, BP, C, K, W isolecto-).

Homotypic synonym: *Orthandra cirrhosa* (Radlk.) Pichon, Mém. I.F.A.N. 35: 227 (1953).

Heterotypic synonyms: *Clitandra batesii* Wernh. in Journ. of Bot. 54: 227 (1916), **syn. nov.** Type: Cameroun, Bitye, G.L. Bates 701 (BM holo-, MO, Z iso-). Homotypic synonyms: *Orthandra batesii* (Wernh.) Pichon, op. cit. 224; *Orthopichonia batesii* (Wernh.) H. Huber, l.c.

Orthandra nigeriana Pichon, op. cit. 226, **syn. nov.** Type: Nigeria, Oban, P.A. Talbot 1351 (K holo-, BM, BR, K, P, Z iso-). Homotypic synonym: *Orthopichonia nigeriana* (Pichon) H. Huber, l.c.; in Fl. W. Trop. Afr. 2(2): 58 (1963).

Liana up to 35 m high climbing in trees. *Branches* grey-brown to purple, with small lenticels, smooth, minutely pubescent at the nodes; branchlets smooth. *Leaves*: petiole 4-14 mm long, glabrous, rarely pubescent above, glabrous or pubescent beneath; blade coriaceous when dried, smooth, elliptic or oblong, sometimes ovate or obovate, 1.6-3 × as long as wide, 5.4-18.2 × 2.4-8.9 cm, acumen 6-17 mm long, with a rounded or truncate point at the apex, cuneate at the base, glabrous on both sides, with midrib pale yellowish above, pale yel-

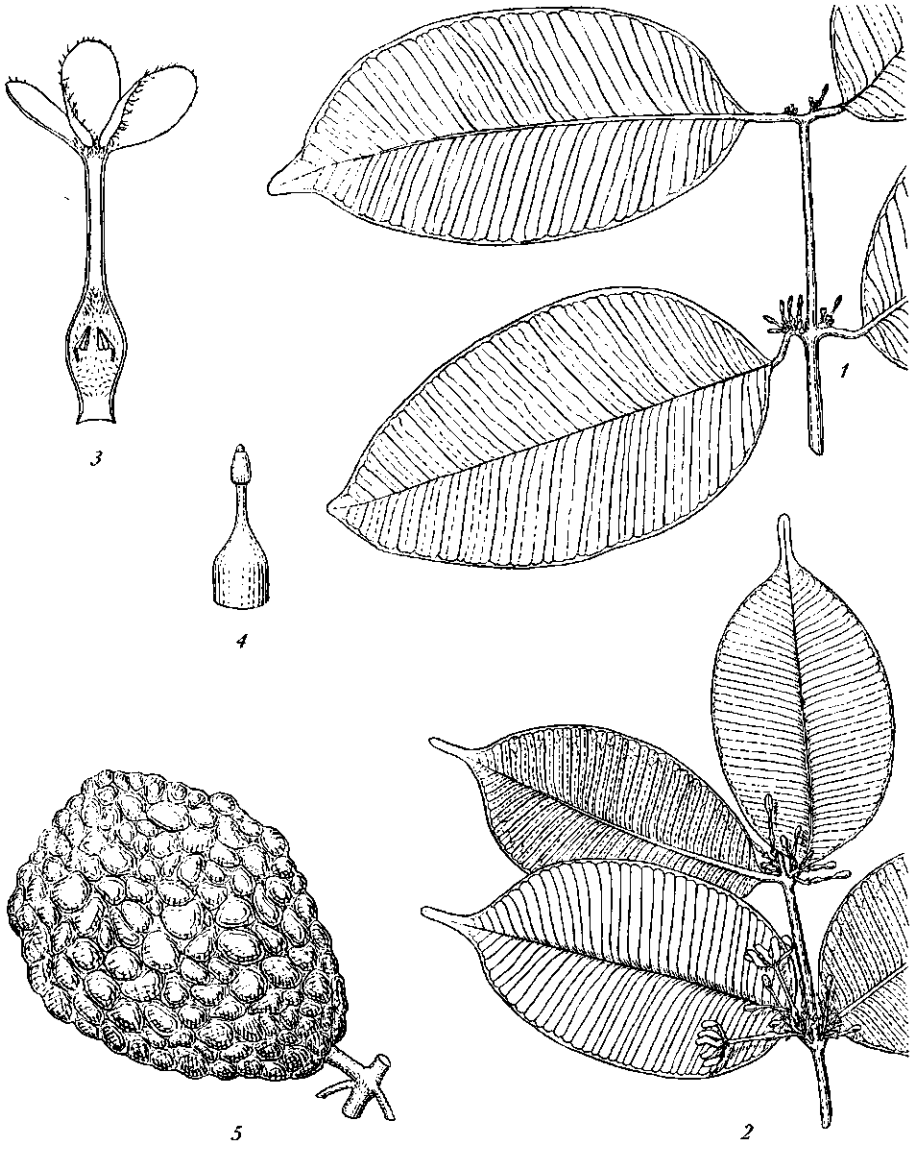
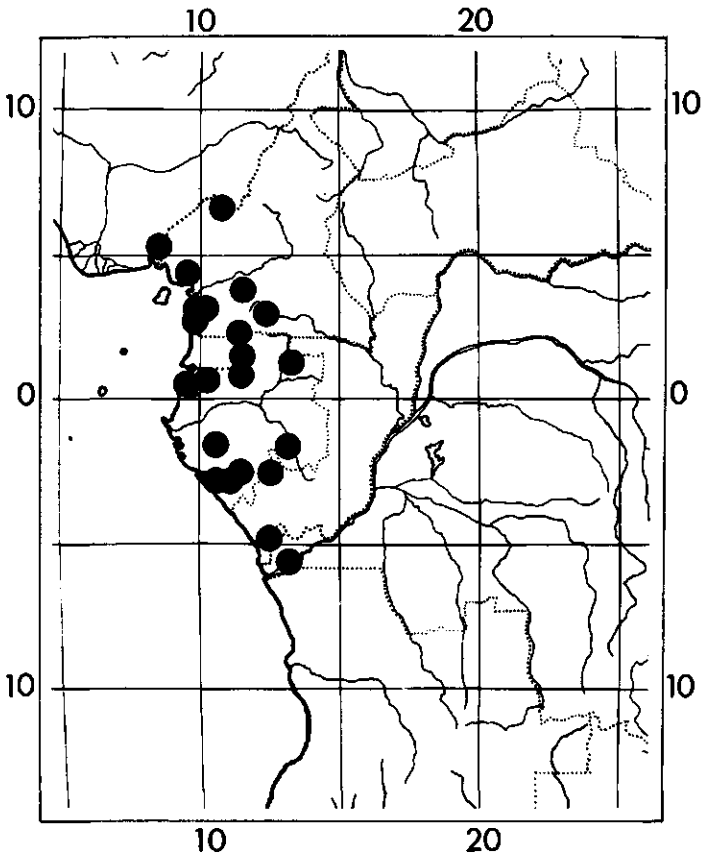


Figure 1A. (after Pichon) *Orthopichonia barteri* 1, flowering branch (× 2/3). *O. cirrhosa* 2, flowering branch (× 2/3); 3, part of corolla inside (× 4); 4, pistil (× 10); 5, fruit (× 2/3). 1 from Chevalier 15133; 2-4 from Zenker 1628; 5 from Klaine 373 bis.



MAP 3A. *Orthopichonia cirrhosa.*

lowish-green or white below, with 21-44 pairs of conspicuous secondary veins alternated by less conspicuous ones (of the latter sometimes 2 between two conspicuous veins); tertiary venation reticulate. *Inflorescences* axillary, often seemingly terminal, 1 or 2 together, rather lax to rather congested, 5-14-flowered, up to 34 mm long, sometimes terminal and then more or less tendril-like, rather lax, 4-8- flowered, up to 29 mm long. Peduncle when inflorescences axillary up to 5 mm long, when terminal up to 14 mm long; peduncle and main axis glabrous or pubescent. Pedicels 1-5 mm long, glabrous or minutely pubescent. Bracts triangular, 0.5-1.1 × 0.6-1 mm, outside glabrous or minutely pubescent, at least near the base, ciliate, inside pubescent, rarely glabrous, colleters 1-2, 0.1-0.2 mm long. *Sepals* pale green to dark purple and then with white to green margins, up to 0.3 mm connate at the base, triangular to obovate, 0.8-1.7 × as long as wide, 0.9-1.7 × 0.6-1.3 mm, acute to truncate or sometimes slightly apiculate at the apex, glabrous on both sides, more or less ciliate. *Corolla* at lobes white, sometimes pink, and at tube reddish or yellowish-green with a pale green base;

in the mature bud 13.7-19 mm long forming an oblong head 0.26-0.37 of the bud-length, outside glabrous or sometimes minutely pubescent at wide part of tube; tube 8.5-15 × as long as the sepals, 1.7-3.3 × as long as the lobes, 9-15 mm long, contracted at the base and there 0.5-0.8 mm, widened above and widest 2.5-3.8 mm above the base (0.21-0.33 of the tube) and there 1.2-1.8 mm, again contracted just above the anthers and there 0.4-1 mm wide, fairly abruptly widened at the throat, inside with a pilose belt from 1.2-2 mm to 4.3-6.4 mm above the base of the tube, throat glabrous or almost glabrous; lobes oblong or elliptic, 0.3-0.6 × as long as the tube, 1.4-4.5 × as long as wide, 3.2-7.4 × 1.5-3 mm, rounded at the apex, sometimes slightly auriculate at the left side of the base, often slightly involute at the left side, entire or sometimes slightly undulate, outside glabrous, more or less ciliate, more so at the base, inside glabrous or minutely pilose at the base. *Stamens* 6-10.3 mm included (0.62-0.74 of the tube-length), inserted 2-3.2 mm from the base of the tube (the base of the anthers being 2.7-4 mm above the base of the tube); filaments glabrous on both sides, 0.5-1 mm long; anthers 0.7-1.8 × as long as the filaments, narrowly triangular or oblong, sometimes ovate or elliptic, 2.3-4 × as long as wide, 0.7-0.9 × 0.2-0.3 mm, acuminate, sometimes acute, with an up to 0.05 mm sterile apex. *Pistil* 1.8-2.9 mm long; ovary superior to hemi-inferior, obovoid, 0.4-1.1 × 0.5-0.9 × 0.5-0.9 mm, glabrous, sometimes unilocular, more often imperfectly 2-celled, abruptly narrowed into the style; style 0.7-1.4 × 0.1-0.2 mm; pistil head ovoid, 0.5-0.8 × 0.2-0.4 mm, split at the apex for 0.2 mm; apex of pistil 1-2.4 mm below apices of anthers. Placentas often protruding, sometimes only slightly so, each with 15-23 ovules. *Fruits* whitish-green or dull dark green, pear-shaped to subglobose, attenuate at the base, truncate at the apex, verrucose, glabrous, with lenticels, subtended by the persistent calyx, 24-46 × 23-36 mm. *Seeds* light brown when dried, irregularly ellipsoid to bean-shaped, 11-16 × 8-15 × 6-10 mm; embryo 1 × 1 mm; cotyledons ovate, 11 mm long, slightly cuneate at the base.

Geographical distribution: Nigeria, Cameroun, Gabon, Congo, Zaïre.

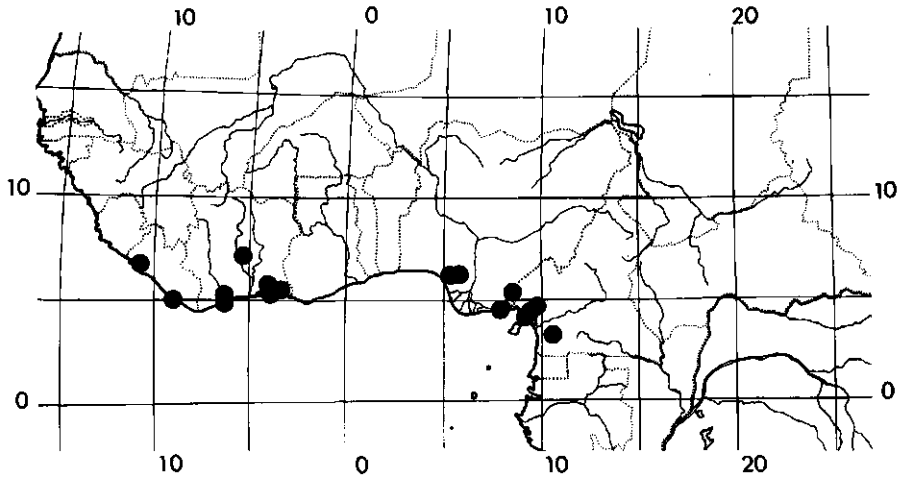
Ecology: Tropical rain forests. Alt. 0-700 m. Flowering throughout the year, especially in the months September – March. Fruits can be found all year round.

Geographical selection of the about 230 specimens examined:

NIGERIA: CROSS RIVER: Oban, Talbot 1351 (BM, BR, K, P, Z, type of *Orthandra nigeriana*).

CAMEROUN: Balangi (=Mbalange), Binuyo & Daramola FHI 35089 (B, K, P); 25 km S of Yaoundé, Breteler et al. 2467 (BR, K, LISC, M, P, WAG); Bipindi, Zenker 1628 (B, BM, BP, BR, COI, E, G, HBG, K, L, M, P, S, W, WAG, WU, Z); between Longii and Songkwari, Bos 6088 (WAG); 8 km N of Kribi, Bos 4762 (BR, M, P, WAG); near Grand Batanga, Bos 3752 (P, WAG); Bitye, Bates 977 (BM, BR, MO, Z); near Ambam, Letouzey 10025 (BR, K, P, WAG).

GABON: Oyem, le Testu 9290 (B, BM, BR, LISC, P, WAG); Bélinga, Caballé 152 (WAG); Libreville, Klaine 3079 (K, P); Mont Mvélakéné, Hallé & Villiers 5138 (P); Oveng, Louis et al. 381/83 (WAG); Agouma, le Testu 5822 (BM, BR, LISC, P, WAG); between Pagha and Moutéti, le Testu 5110 (BM, BR, LISC, P, WAG); Guidouma, le Testu 5068 (B, BM, BR, LISC, MO, P, WAG);



MAP 4A. *Orthopichonia indeniensis*.

km 11 Moanda-Mbinda, Breteler 6483 (WAG); Mayumba, le Testu 1408 (BM, BR, LISC, P); Tchibanga, le Testu 2137 (BM, BR, K, LISC, P); 53 km SW of Doussala, de Wilde et al. 8963 (WAG).

CONGO: near Kouyi, Sita 3965 (WAG).

ZAÏRE: BAS-ZAÏRE: Luki, Donis 2141 (BR, MO).

ANGOLA: Buco Zau, Gossweiler s.n. (LISJC).

3. **Orthopichonia indeniensis** (A. Chev.) H. Huber in Kew Bull. 15: 437 (1962); in Fl. W. Trop. Afr. 2(2): 58 (1963). **Fig. 2A; Map 4A**

Basionym: *Clitandra indeniensis* A. Chev., Mém. Soc. Bot. Fr. 8: 43 (1908).

Type: Ivory Coast, Aboisso, Chevalier 17751 (P lecto-, designated here, B, K, P, WAG isolecto-). Homotypic synonym: *Orthandra indeniensis* (A. Chev.) Pichon, Mém. I.F.A.N. 35: 218 (1953).

Heterotypic synonyms: *Clitandra longituba* Wernham, Cat. Pl. Talb. Oban Distr. S. Nig.: 60 (1913); Hutchinson & Dalziel, Fl. W. Trop. Afr. 1(2): 34 (1931), **syn. nov**. Type: S. Nigeria, Oban, P.A. Talbot 1577 (BM holo-, BM, K, Z iso-). Homotypic synonyms: *Orthandra longituba* (Wernh.) Pichon, op. cit. 216; *Orthopichonia longituba* (Wernh.) H. Huber in Kew Bull. 15: 437 (1962); in Fl. W. Trop. Afr. 2(2): 58 (1963).

Clitandra ivorensis A. Chev. ex Hutch. et Dalz., Fl. W. Trop. Afr. 1(2): 34 (1931); in Kew Bull. 1937: 336 (1937). Type: Ivory Coast, Abidjan, Chevalier 15183 (P lecto-, designated here, B, BR, G, K, L, WAG isolecto-).

Large *liana* at least 20 m high climbing in trees. *Branches* rough, dark red to dark brown, sometimes pale grey, with few lenticels, glabrous; branchlets glabrous. *Leaves*: petiole 6-10 mm long, glabrous; blade coriaceous, sometimes papery or leathery when dried, elliptic or oblong, 1.9-2.9 × as long as wide, 8-13.2 × 3-5.3 cm, acumen 4-14 mm long, with a rounded, sometimes slightly obtuse, point at the apex, cuneate at the base, glabrous on both sides, with 17-52 pairs of conspicuous secondary veins alternated by less conspicuous ones (of

the latter sometimes 2 between two conspicuous veins); tertiary venation more or less reticulate. *Inflorescences* axillary, 1-2 together, rather congested, 5-15-flowered, up to 35 mm long, sometimes terminal and then more or less tendril-like, lax, up to 10-flowered, up to 150 mm long. Peduncle when inflorescences axillary up to 2.5 mm long, when terminal 75 mm long; peduncle and main axis glabrous or minutely pubescent. Bracts triangular, 0.7-1 × 0.6-1 mm, glabrous or pubescent on both sides, ciliate, colleters 1-2, 0.1 mm long. *Sepals* 0.2-0.4 mm connate at the base, triangular, 0.8-1.7 × as long as wide, 1-1.7 × 0.7-1.3 mm, acute to truncate at the apex, almost glabrous outside, ciliate, glabrous inside. *Corolla* often with an at least at base pale green tube, at the lobes white, in the mature bud 12.9-22.8 mm long forming an attenuate head 0.33-0.6 of the bud-length, outside glabrous or with a pilose belt from 2-3 mm above the base of the tube to the base of the lobes (indumentum somewhat less dense at narrow part of tube); tube 7.6-12 × as long as the sepals, 1.5-2.7 × as long as the lobes, 12.5-14.4 mm long, contracted at the base and there 0.6-0.8 mm, widened above and widest 2.8-3.7 mm above the base (0.2-0.28 of the tube) and there 1.1-1.5 mm, again contracted just above the anthers and there 0.7-1 mm wide, fairly abruptly widened at the throat, inside with a pilose belt from 1.2-1.7 mm to 5.8-7.5 mm above the base of the tube or to the base of the lobes (indumentum less dense or absent in narrow part of tube above anthers), in the throat somewhat less dense; lobes narrowly triangular, 0.4-0.7 × as long as the tube, 2.8-5.8 × as long as wide, 5.1-10 × 1.3-2 mm, obtuse at the apex, sometimes slightly auriculate at the left side of the base, more or less involute at the left side, outside glabrous or pilose, only so at the base, more or less ciliate, more at the base, inside sometimes glabrous, more often pilose at the base. *Stamens* 9-12 mm included (0.68-0.86 of the tube-length), inserted 2.3-2.8 mm from the base of the tube (the base of the anthers being 2.7-3.3 mm above the base of the tube); filaments inside glabrous or pilose, only so at the base, outside glabrous, 0.5-0.9 mm long; anthers 1.1-2.2 × as long as the filaments, oblong or narrowly elliptic, 3.3-5 × as long as wide, 0.8-1.1 × 0.2-0.3 mm, acute or acuminate with an up to 0.1 mm sterile apex, sometimes obtuse and then without sterile apex. *Pistil* 1.9-2.3 mm long; ovary inferior for one third, cylindrical or obovoid 0.4-0.7 × 0.6-0.8 × 0.6-0.8 mm, densely hirto-pubescent from 0.2-0.4 mm above the base, up to the apex of the ovary, unilocular or imperfectly 2-celled, abruptly narrowed into the style; style 0.6-0.8 × 0.2 mm; pistil head ovoid, 0.7-1 × 0.3 mm, split at the apex for 0.2 mm; apex of pistil 1.6-2.2 mm below apices of anthers. Placentas more or less protruding, each with 10-17 ovules. *Fruits* orange, sometimes dark green, with white longitudinally arranged spots, at least near apex, ellipsoid, sometimes subglobose or pear-shaped, cuneate, sometimes rounded at the base, obtuse or acuminate with an obtuse point at the apex, smooth (sometimes slightly rough when young), lenticellate, minutely hirto-pubescent at the apex when young, subtended by the persistent calyx, 24-76 × 18-60 mm. *Seeds* beige-ochre with a lighter coloured stripe where the two parts of endosperm are connate, irregularly shaped (to the space available), 13-22 × 18-19 × 13-14 mm; embryo 1 × 2 mm; cotyledons ovate, 18 mm long, cordate at the base.

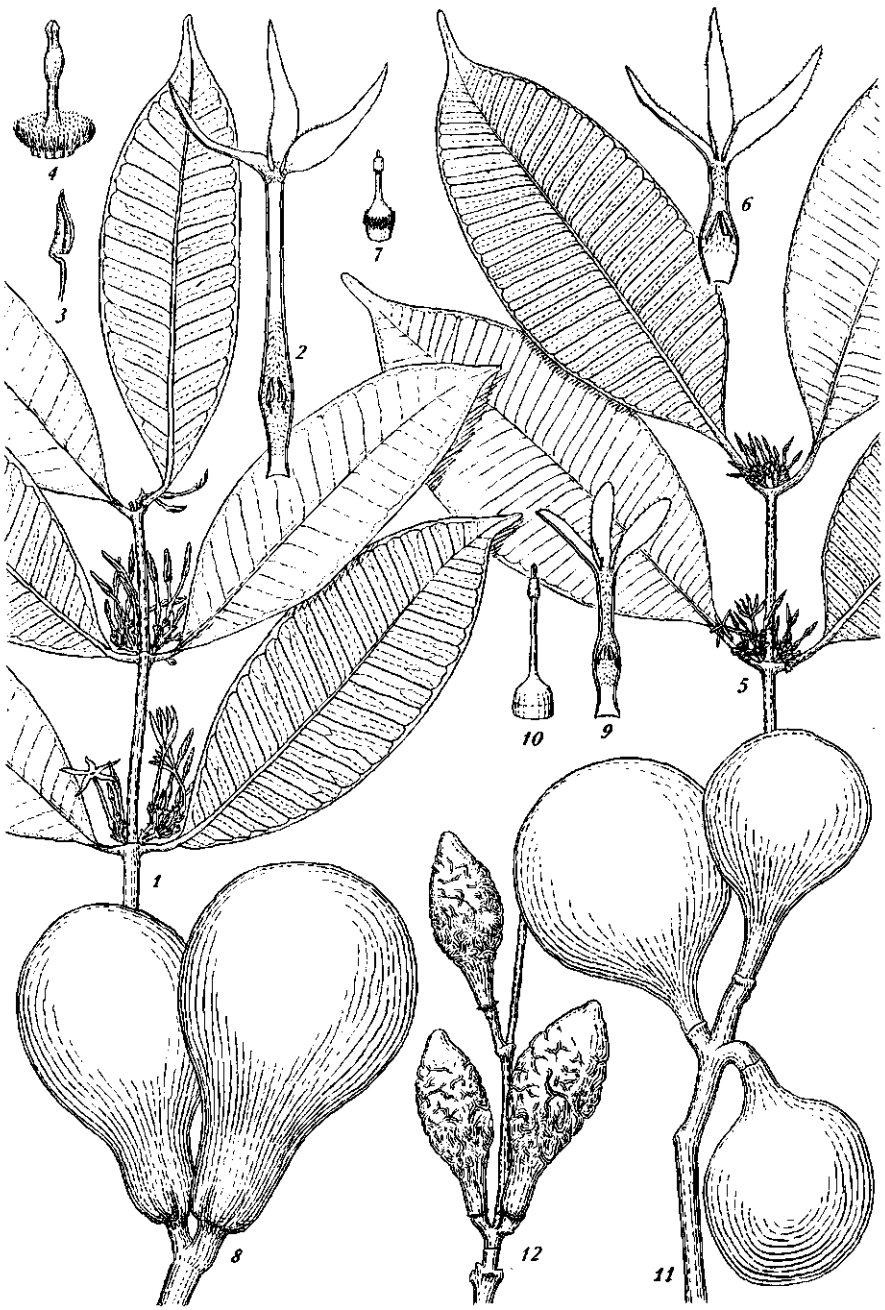


Figure 2A. *Orthopichonia indeniensis* 1, flowering branch (× 2/3); 2, part of corolla inside (× 3); 3, stamen (× 10); 4, pistil (× 10). *O. seretii* 5, flowering branch (× 2/3); 6, part of corolla inside (× 4); 7 (emend.), pistil (× 10); 8, fruits (× 2/3). *O. barteri* 9, part of corolla inside (× 4); 10, pistil (× 10); 11, 12, fruits (× 2/3). 1-4 from Talbot 1577; 5-7 from Zenker 550; 8 from Jespersen s.n.; 9-10 from Rosselet 5; 11 from Sapin s.n.; 12 from Unwin 15.

Geographical distribution: West tropical Africa from Liberia to Cameroun.

Ecology: Tropical rain forests. Alt. 0-1500 m. Flowering especially in the months February – May. Fruits can be found throughout the year. Rare.

Geographical selection of the about 100 specimens examined:

LIBERIA: Bomi Hills, Jansen 1476 (WAG); Sinoe R., Whyte 4 (BM, K).

IVORY COAST: 3 km N of Abé, de Koning 40 (WAG); km 34 Sassandra-San Pedro, Leeuwenberg 12104 (WAG); km 27 Monogaga-Sassandra, Leeuwenberg 12148 (WAG); km 54 Sassandra-Gagnoa, Breteler 6011 (WAG); Yapo forest, Leeuwenberg 12276 (WAG); Abidjan, Chevalier 15183 (B, BR, G, K, L, P, WAG, lectotype of *Clitandra ivorensis*, para-); km 12 Yakassé Mé-Kodiousou, Leeuwenberg 8018 (WAG); Aboisso, Chevalier 17751 (B, K, P, WAG, lectotype).

NIGERIA: BENDEL: Okomu, Onochie 38311 (K, WAG); Nikrowa, Ross 118 (BM); Benin, Unwin 51 (K); Sapoba, Emwiogbon 45339 (K). CROSS RIVER: Oban, Talbot 1577 (BM, K, Z, type of *Clitandra longituba*); Eket, Talbot s.n. (BM, K, P).

CAMEROUN: km 4 Eboné-Ekomtolo, Leeuwenberg 8175 (WAG); near Banga, Brenan 9498 (BM, BR, CGE, COI, K, P); Mafanja (=Mapanja), Maitland s.n. (B, K); near Buea, Maitland 405 (B, K); 65 km SSW of Eséka, de Wilde & de Wilde-Duyfjes 2734 (P, WAG).

4. **Orthopichonia schweinfurthii** (Stapf) H. Huber in Kew Bull. 15: 437 (1962); in Fl. W. Trop. Afr. 2(2): 58 (1963). **Phot. 1A; Map 5A**

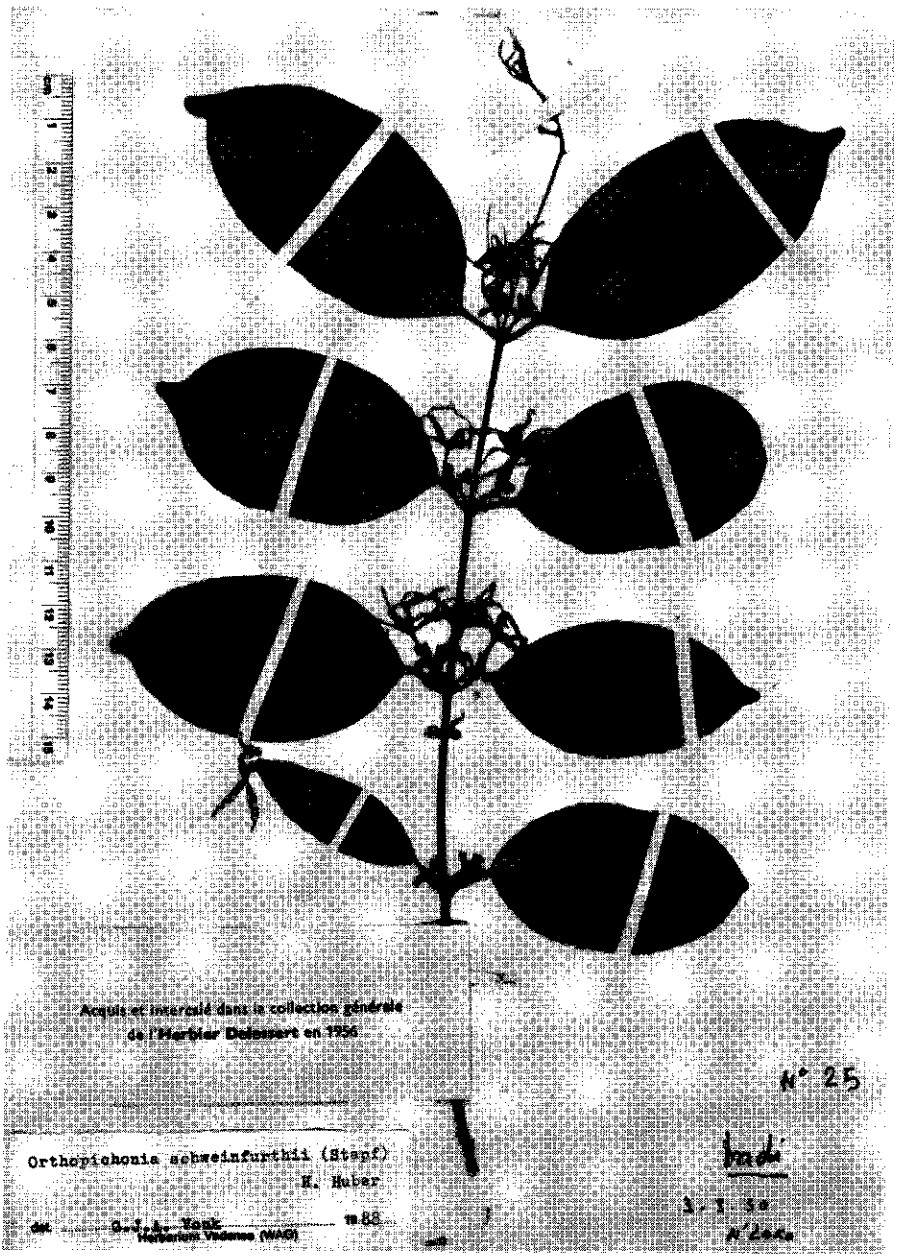
Basionym: *Clitandra schweinfurthii* Stapf, Kew Bull. 1894: 20 (1894); in Fl. Trop. Afr. 4(1): 68 (1902).

Type: Central African Republic, G. Schweinfurth III-68 (K holo-, P iso-).

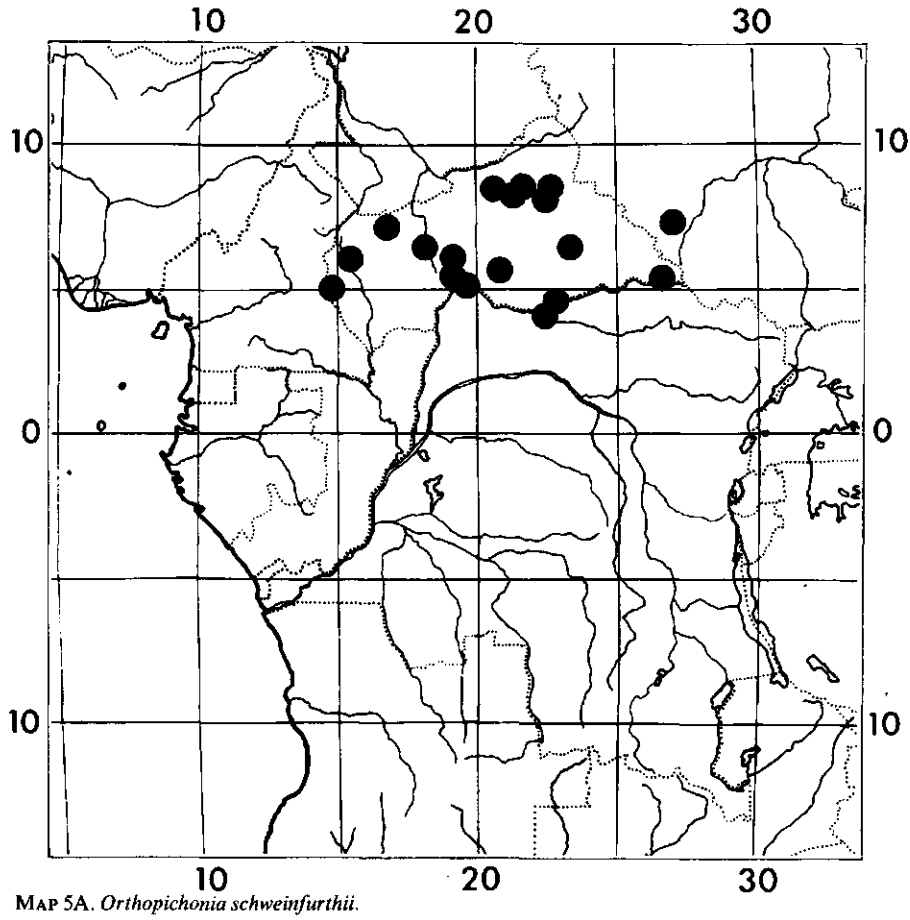
Homotypic synonym: *Orthandra schweinfurthii* (Stapf) Pichon, Mém. I.F.A.N. 35: 213 (1953).

Heterotypic synonym: *Clitandra mildbraedii* Mgf. in Notitzbl. Bot. Gart. Mus. Berlin 9: 55 (1924). Type: Cameroun, Mildbraed 9454 (K lecto-, designated here, BM, K, WAG isolecto-).

Liana. Branches dark brown or light yellowish brown to grey-brown, smooth, with lenticels; branchlets smooth, glabrous. *Leaves*: petiole 6-15 mm long, glabrous; blade leathery when dried, shiny above, oblong or elliptic, sometimes ovate, 1.7-2.8 × as long as wide, 5.5-12.6 × 2.5-5.7 cm, short-acuminate with an obtuse or rounded point at the apex (the acumen being up to 6 mm long), cuneate at the base, glabrous on both sides with 25-53 pairs of conspicuous secondary veins alternated by less conspicuous ones; tertiary venation more or less inconspicuous or reticulate. *Inflorescences* axillary, 1-2 together, rather congested, 5-8-flowered, up to 30 mm long, often also terminal and then more or less tendril-like, lax, 4-6-flowered, up to 75 mm long. Peduncle when inflorescences axillary 0.8-5 mm long, when terminal 9-44 mm long; peduncle and main axis glabrous or pubescent. Pedicels 1-2.3 mm long, glabrous or pubescent. Bracts narrowly triangular, 1.3-2 × 0.7-1 mm, glabrous or pubescent outside, ciliate, pubescent inside, at least near apex; colleter 1, 0.2 mm long. *Sepals* up to 0.2 mm connate at the base, narrowly triangular or ovate, 1.1-2.4 × as long as wide, 1-2.1 × 0.7-1.4 mm, obtuse or acute, sometimes truncate at the apex, glabrous on both sides, ciliate. *Corolla* with a pale yellow tube, at lobes white



Phot. 1. *Orthopichonia schweinfurthii* (Pittard 25, phot. van der Maesen).



MAP 5A. *Orthopichonia schweinfurthii.*

to yellowish white, in the mature bud 12-18.3 mm long, forming an attenuate head 0.54-0.63 of the bud-length, glabrous outside; tube 3.5-7.2 × as long as the sepals, 0.4-0.8 × as long as the lobes, 6.5-9 mm long, contracted at the base and there 0.6-0.9 mm, widened above and widest at 2.3-3 mm above the base (0.33-0.37 of the tube) and there 0.8-1.5 mm, again contracted just above the anthers and there 0.3-0.7 mm wide, fairly abruptly widened at the throat, inside with a pilose belt from 1.3-2 mm above the base to the base of the lobes, in the throat sometimes more dense; lobes narrowly ovate to narrowly triangular, 1.3-2.8 × as long as the tube, 4.8-11.8 × as long as wide, 8.5-20 × 1-2 mm, obtuse at the apex, sometimes slightly auriculate at the left side of the base, sometimes slightly involute at the left side, outside glabrous, minutely ciliate, inside sometimes slightly pilose at the left side of the base, more often entirely glabrous. *Stamens* 3.1-5.2 mm included (0.47-0.68 of the tube-length), inserted 1.8-2.2 mm from the base of the tube (the base of the anthers being 2.2-2.7 mm above the base of the tube); filaments pilose inside or almost glabrous, glabrous

outside, 0.4-0.5 mm long; anthers 2.2-3 × as long as the filaments, narrowly triangular, 3.7-6 × as long as wide, 0.9-1.2 × 0.2-0.3 mm, acute or acuminate at the for 0.05-0.1 mm sterile apex or sometimes obtuse and then without sterile apex. *Pistil* 1.7-2.2 mm long; ovary inferior for one quarter, subglobose, 0.5-0.9 × 0.4-0.8 × 0.4-0.8 mm, glabrous, unilocular, sometimes imperfectly 2-celled, more or less gradually narrowed into the style; style 0.6-0.8 × 0.2 mm; pistil head ovoid, ellipsoid or cylindrical, 0.5-0.6 × 0.3 mm, 0.1 mm split at the apex; apex of pistil 1.1-1.7 mm below apices of anthers. Placentas more or less protruding, each with 12-18 ovules. *Fruits* yellow, edible, with pulp very acid, globose, smooth, with few lenticels, glabrous, subtended by the persistent calyx, 19-35 mm in diameter; wall 1 mm thick. *Seeds* brown when dried, irregularly ellipsoid, 11-12 × 8-10 × 6-7 mm; embryo 1 × 1 mm; cotyledons ovate to elliptic, 10 mm long, slightly cuneate to cordate at the base.

Geographical distribution: Central African Republic, Northern Zaïre, Sudan, Eastern Cameroun.

Ecology: Tropical rain forests or rather humid savanas. Alt. 500-1000 m. Flowering especially in the months December – May. Fruits can be found throughout the year. Common.

Geographical selection of the about 75 specimens examined:

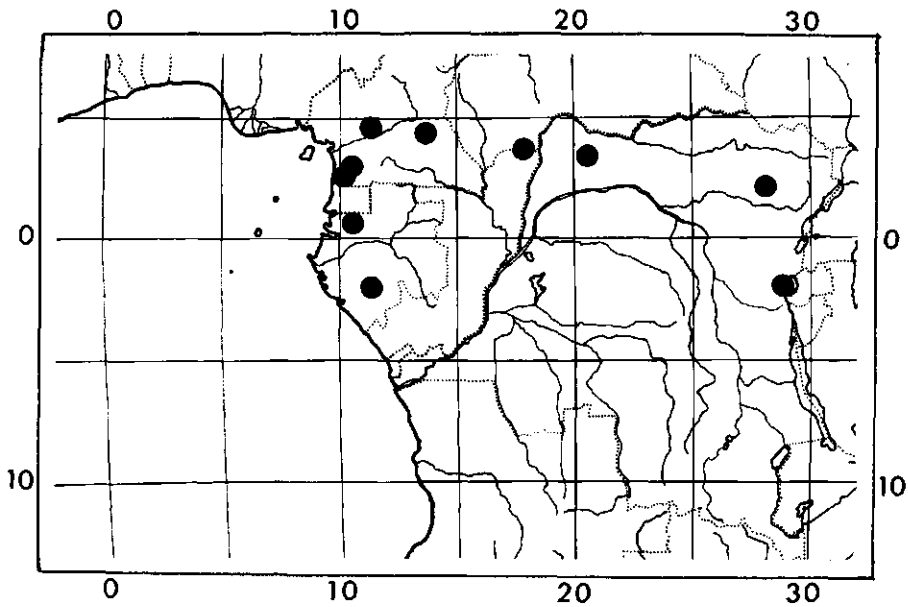
CAMEROUN: Buar, Mildbraed 9487 (K, paratype of *Clitandra mildbraedii*).
CENTRAL AFRICAN REPUBLIC: Ndélé, Chevalier 7902 (BR, K, P); 68 km E of Ndélé, Guigonis 3367 (BR); 4 km W of Pende, Fay 4313 (K); Sakala R., Fay 4298 (K); between Ouadda and Ouanda-Djalé, le Testu 3781 (BM, P); Boguila Region, Fay et al. 5137 (K); 100 km SW of Bouar, Haxaire 1422 (WAG); near Bouar, Descoings 10208 (P); Lado R., Cartwright 13 (K); between Nana and Fort Sibut, Chevalier 10738 (P); between Fort de Possel and Fort Sibut, Chevalier 5384 (P); Mission de la Sainte Famille, Chevalier 5317 (P); near Bambari, Tisserant 1748? (BR, P); N'Zako, Pittard 25 (G); Yalinga, le Testu 2492 (B, BM, LISC, P, WAG); near Obo, Descoings 11978 (P).
SUDAN: between R. Pongo and R. Getti, Schweinfurth III-68 (K, holotype, P, iso-).
ZAÏRE: EQUATEUR: Bas-Uele, Dewulf 632 (BR).

5. **Orthopichonia seretii** (De Wild.) Vonk **comb. nov.**

Fig. 2A; Map 6A

Basionym: *Clitandra seretii* De Wild., Not. Pl. Ut. Int. Congo, 2: 226 (1908). (as *sereti*).
Type: Zaïre, F. Seret 731 (BR holo-).

Liana, up to at least 50 m long. *Branches* greyish-brown with few lenticels; branchlets greyish-brown, pubescent, hairs curved. *Leaves*: petiole 11-22 mm long, glabrous or pubescent above, less hairy beneath, hairs curved; blade papery when dried, oblong or elliptic, 2-3.2 × as long as wide, 6.1-12.1 × 2.8-4.9 cm, acumen 4-14 mm long, with a rounded, sometimes slightly obtuse point at the apex, cuneate at the base, glabrous on both sides or on midrib slightly pubescent at the base, with 28-53 pairs of conspicuous secondary veins alternated by less



MAP 6A. *Orthopichonia seretii.*

conspicuous ones; tertiary venation inconspicuous to slightly reticulate. *Inflorescences* axillary, 1-3 together, congested, (5-)7-9-flowered, 15-20 mm long, with peduncle up to 2 mm long, rarely terminal, and then somewhat tendril-like, rather congested, 2-4-flowered, up to 20 mm long, with peduncle 3.2-6 mm long; peduncle and main axis densely pubescent, hairs curved. Pedicels 1-3 mm long, densely pubescent, hairs curved. Bracts triangular, 1.3-1.8 × 1-1.1 mm, pubescent on both sides, hairs curved, ciliate; colleters 0.2 mm long. *Sepals* 0.2-0.4 mm connate at the base, triangular or ovate, 0.9-1.3 × as long as wide, 0.9-1.4 × 0.9-1.3 mm, retuse to acute, sometimes apiculate at the apex, densely pubescent outside, at least near midrib and at base, hairs curved, ciliate, usually pubescent inside, hairs curved. *Corolla* often with a pale green tube and white lobes, in the mature bud 7.5-13 mm long forming an attenuate head (the lobes 0.47-0.54 of the bud-length), outside glabrous or sometimes with a pubescent belt from about half of the tube upwards to the base of the lobes; tube 4.2-5.5 × as long as the sepals, 0.7-1.2 × as long as the lobes, 4.7-6 mm long, contracted at the base and there 0.6-1 mm, widened above and widest at or just below the middle and there 1.2-1.4 mm, again contracted just above the anthers and there 0.5-0.7 mm wide, fairly abruptly widened at the throat, inside with a pilose belt from 1.4-2 mm to the apex of the anthers or the base of the lobes (indumentum less dense or absent in narrow part of the tube above anthers), in the throat somewhat more dense; lobes narrowly triangular, 0.8-1.4 × as long as the tube, 2.9-5 × as long as wide, 3.8-8.2 × 1.2-1.9 mm, obtuse at the apex, slightly auriculate at the left side of the base, more or less involute at the left side, outside glabrous

sometimes pubescent at the base, hairs curved, more or less ciliate, inside pilose, only so at the auricle or sometimes entirely glabrous. *Stamens* 1.8-3 mm included (being 0.38-0.5 of the tube-length), inserted 1.8-2.4 mm from the base of the tube (the base of the anthers being 2-3.1 mm above the base of the tube); filaments 0.3-0.7 mm long, pilose inside, glabrous outside; anthers 1.4-2.7 × as long as the filaments, narrowly triangular or oblong, 3-6 × as long as wide, 0.8-1.2 × 0.2-0.4 mm, acuminate at the for 0.05-0.1 mm sterile apex or sometimes obtuse and then without sterile apex. *Pistil* 1.4-2 mm long; ovary inferior for one quarter to hemi-inferior, subglobose to obovoid, 0.5-0.9 × 0.7-1 × 0.7-1 mm, widest above the middle, almost entirely or at least apically densely pubescent (hairs short and curved, sometimes the hairs on the lower half of the ovary not curved), unilocular, abruptly narrowed into the style; style 0.6-1 × 0.2 mm; pistil head ovoid, ellipsoid or cylindrical, 0.3-0.6 × 0.2-0.3 mm, up to 0.2 mm split at the apex; apex of pistil 1.2-2 mm below apices of anthers. Placentas much protruding, each with 15-40 ovules. *Fruits* globose or obovoid, up to 7 cm in diameter, slightly bumpy, more or less lenticellate, glabrous, subtended by the persistent calyx, 2-celled; wall up to 2 cm thick. *Seeds* light green or brown when dried, bean-shaped to ellipsoid, 12-18 × 10-12 × 6-9 mm, covered by a greyish slimy layer when fresh; embryo 1 × 2 mm; cotyledons elliptic, 11 mm long, cordate at the base.

Geographical distribution: Cameroun, Central African Republic, Gabon, Zaïre.

Ecology: Tropical rain forests. Alt. up to 900 m. Flowering throughout the year, especially in the months June – November.

Geographical selection of the about 70 specimens examined:

CAMEROUN: near Bafia, Benoît 376 (P); Bertoua, Breteler 1671 (BR, K, LISC, M, P, WAG); Nye'ete, de Kruif 1060 (WAG); Bipindi, Zenker 550 (B, BR, C, G, GH, LD, MO, NY, P, UC, WAG).

CENTRAL AFRICAN REPUBLIC: Boukoko, Tisserant 428 (B, BM, LISC, P, WAG).

GABON: between Assok and Tchimbélé, de Wilde et al. 137/83 (WAG); Bilengué, le Testu 5487 (BM, LISC, P, WAG).

ZAÏRE: EQUATEUR: Boyasegeze, Evrard 1508 (BR). HAUT-ZAÏRE: between Wamba and Gombari, Lebrun 3310 (A, BR, UC). KIVU: near Irangi, Troupin 3416 (BR, K).

Note: When Schumann described *Clitandra visciflua* (1900), he based it on four syntypes. Out of these four, Staudt 860 was used by Stapf to create *C. staudtii* (1902). The name was maintained in the revision of *Orthandra* by Pichon (1953).

The present author, however, does not consider Staudt 860 as distinct, and names this specimen *O. visciflua*. Therefore the other specimens identified by Stapf, several followers and Pichon as *C. staudtii* or *O. staudtii* needed an other name: *O. seretii*.

6. **Orthopichonia visciflua** (K. Schum. ex Hall.) Vonk **comb. nov.**

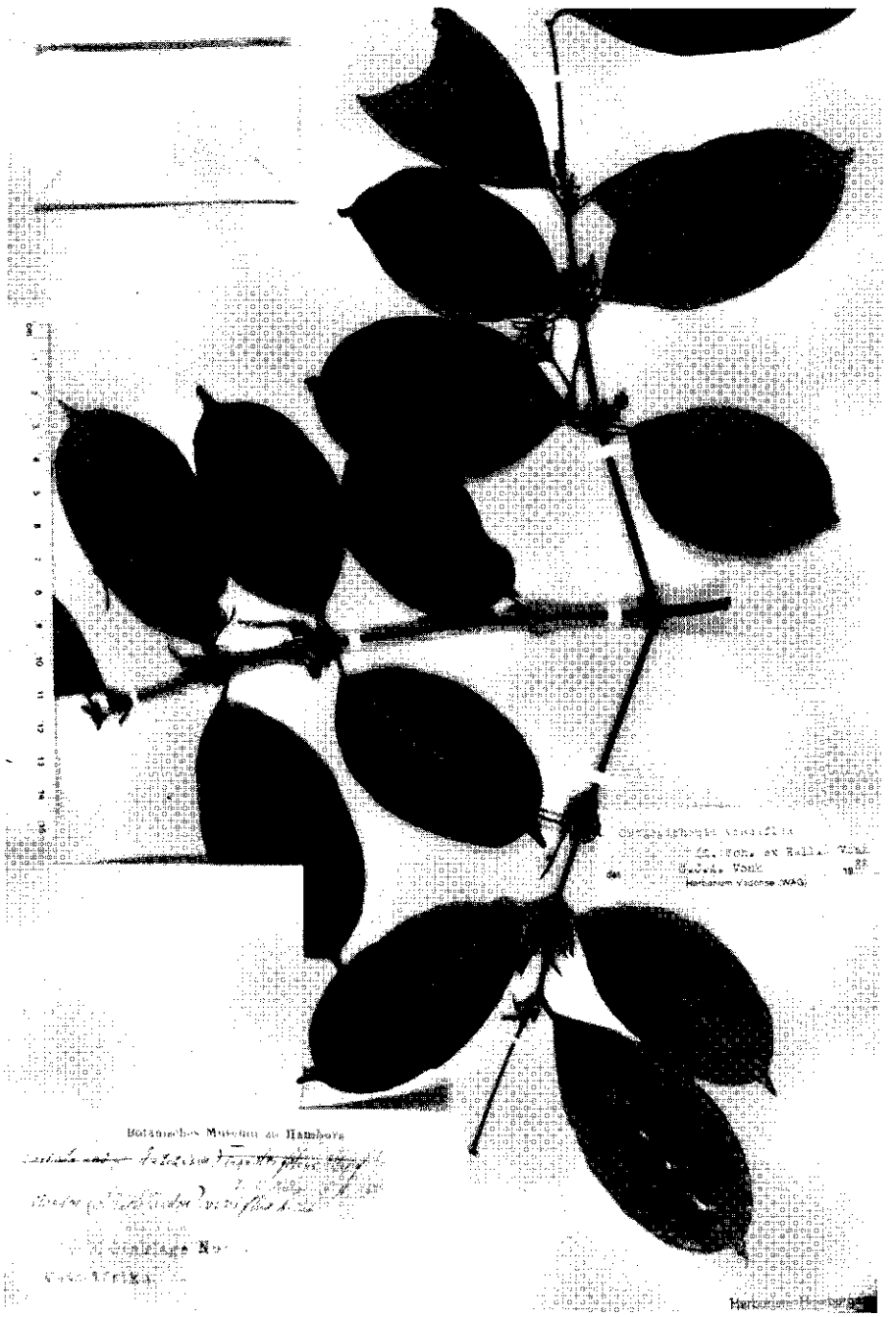
Phot. 2A; Map 7A

Basionym: *Clitandra visciflua* K. Sch. ex Hall. in Jahrb. Hamb. Wiss. Anst. 17(3): 127 (1900); Stapf in Fl. Trop. Afr. 4(1): 66 (1902); Hutchinson & Dalziel, Fl. W. Trop. Afr. 1(2): 34 (1931).

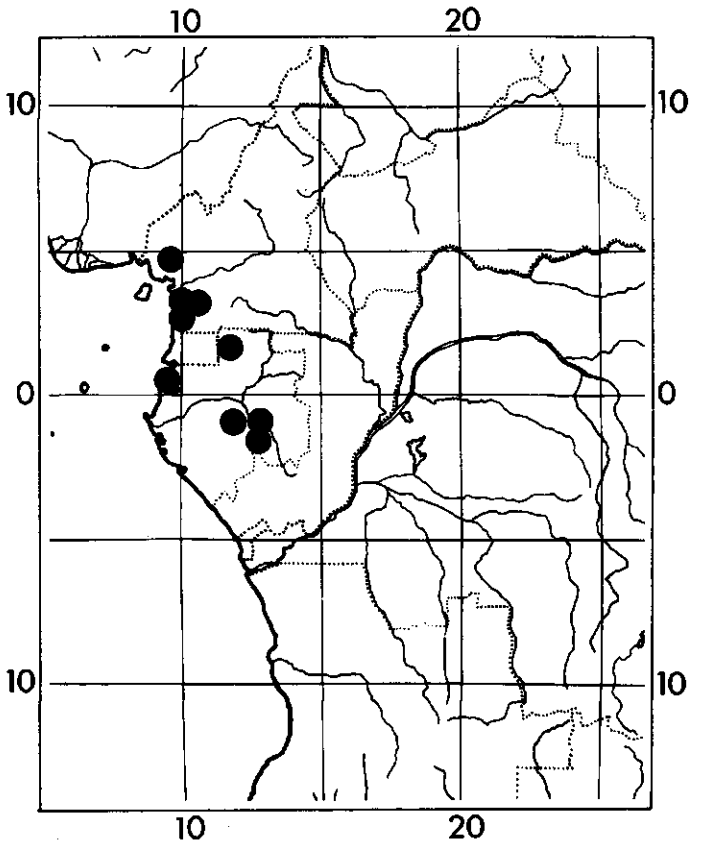
Type: Cameroun, Bipindi, G. Zenker 1606 (HBG lecto-, designated here, B, BM, BP, BR, COI, E, G, K, L, M, MO, NY, P, S, W, WAG, Z isolecto-).

Heterotypic synonym: *Clitandra staudtii* Stapf in op. cit. 67; Hutchinson & Dalziel, l.c., **syn. nov.**. Type: Cameroun, Kumba, Staudt 860 (K holo-, BM, GH iso-). Homotypic synonyms: *Orthandra staudtii* (Stapf) Pichon, Mém. I.F.A.N. 35: 219 (1953); *Orthopichonia staudtii* (Stapf) H. Huber in Kew Bull. 15: 437 (1962); in Fl. W. Trop. Afr. 2(2): 58 (1963).

Liana, slender. Branches grey-brown to dark brown, smooth, with lenticels; branchlets glabrous. *Leaves*: petiole 5-12 mm long, glabrous; blade thinly leathery when dried, elliptic or obovate, sometimes oblong, 1.7-3.6 × as long as wide, 7.3-15.8 × 3.3-6.8 cm, acumen 6-14 mm long, with a rounded point at the apex, cuneate at the base, glabrous on both sides, with 18-30 pairs of conspicuous secondary veins alternated by less conspicuous ones (of the latter sometimes 2 between two conspicuous veins); tertiary venation more or less reticulate, sometimes inconspicuous. *Inflorescences* axillary, often seemingly terminal, 1-3 together, rather congested, 5-9-flowered, 13-33 mm long, peduncle up to 4 mm long; peduncle and main axis glabrous, sometimes sparsely pubescent. Pedicels pale green, 1-4 mm long, glabrous. Bracts triangular, obtuse, sometimes truncate at the apex, 0.7-1.2 × 0.6-1 mm, glabrous on both sides, sometimes minutely pubescent on both sides, then at least near apex, ciliate, colleters one, sometimes two, 0.1-0.2 mm long. *Sepals* up to 0.4 mm connate at the base, triangular or ovate, 0.7-1.6 × as long as wide, 0.7-1.3 × 0.7-1.5 mm, obtuse or acute, sometimes truncate or apiculate at the apex, glabrous or almost glabrous on both sides, ciliate. *Corolla* at tube pale green or yellowish-green, sometimes with a cream top, at lobes white, in the mature bud 12.7-22 mm long, forming an attenuate head 0.48-0.53 of the bud-length, glabrous outside; tube 8.5-13.3 × as long as the sepals, 0.8-1.2 × as long as the lobes, 7.7-12.4 mm long, contracted at the base and there 0.6-1.1 mm, widened above and widest at 2-2.8 mm above the base (0.17-0.26 of the tube) and there 1-1.5 mm, again contracted just above the anthers and there 0.5-0.8 mm wide, fairly abruptly widened at the throat, inside with a pilose belt from 1-2 mm above the base to about 3 mm above the apices of the anthers or the base of the lobes (indumentum less dense or absent in narrow part of the tube above the anthers and most densely just above the anthers), in the throat somewhat more dense; lobes narrowly ovate to narrowly triangular, 0.9-1.3 × as long as the tube, 4.7-8.5 × as long as wide, 7-16.2 × 1.3-2.7 mm, obtuse at the apex, often slightly involute, outside glabrous, more or less ciliate, inside sometimes slightly pilose at the left side of the base, more often entirely glabrous. *Stamens* 5.3-9.5 mm included (0.68-0.79 of the tube-length), inserted 1.6-2.4 mm from the base of the tube (the base



Phot. 2. *Orthopichonia visciflua* (Dinklage 1161, phot. van der Maesen).



MAP 7A. *Orthopichonia visciflua.*

of the anthers being 2.3-3.1 mm above the base of the tube); filaments pilose inside, glabrous outside, 0.5-1 mm long; anthers 0.8-1.4 × as long as the filaments, narrowly triangular or oblong, 3.5-4.5 × as long as wide, 0.7-0.9 × 0.2 mm, acute or acuminate with an up to 0.1 mm long sterile apex. *Pistil* 1.5-2.4 m long; ovary inferior for one quarter to one third, subglobose to obovoid, 0.5-0.9 × 0.6-0.7 × 0.6-0.7 mm, glabrous or with a hirto-pubescent belt from about 0.2 mm above the base to the apex of the ovary, unilocular, sometimes imperfectly 2-celled, abruptly narrowed into the style; style 0.3-0.9 × 0.1-0.2 mm; pistil head ovoid, ellipsoid or cylindrical, 0.6-1 × 0.2-0.3 mm, up to 0.3 mm split at the apex; apex of pistil 1.4-1.8 mm below apices of anthers. Placentas more or less protruding, each with 8-15 ovules. *Fruits* unknown.

Geographical distribution: Cameroun, Gabon.

Ecology: Tropical rain forests. Flowering especially in the months February – May and September – December.

Geographical selection of the about 200 specimens examined:

CAMEROUN: Johann-Albrechtshöhe (= Kumba), Staudt 860 (BM, GH, K, type of *Clitandra staudtii*, para-); near Kribi, Bos 4166 (BR, L, LD, M, P, WAG); Bipindi, Zenker 1606 (B, BM, BP, BR, COI, E, G, HBG, K, L, M, MO, NY, P, S, W, WAG, Z lectotype); Grand Batanga, Dinklage 840 (HBG paratype); ibid., M. Dinklage 1161 (HBG, K, WAG paratype).

GABON: Oyem, le Testu 9513 (BM, P); near Libreville, Klaine 2849 (BR, P, UC); Iméno Poubi, le Testu 8600 (BM, P, WAG); Liyanga, le Testu 7707 (BM, P, WAG); Liyembo, le Testu 8784 (B, BM, LISC, P, WAG).

Note: see note under *O. seretii*.

Acknowledgements

I am greatly indebted to the Directors and Curators of the herbaria cited for putting the material at my disposal: A, B, BM, BP, BR, C, CGE, COI, E, F, G, GB, GH, HBG, K, L, LD, LISC, LISJC, M, MO, NY, P, S, UC, US, W, WAG, WU, Z.

I am also very greatful to Prof. Dr Ir L.J.G. van der Maesen for correcting the text and for the photographs, and especially to Dr A.J.M. Leeuwenberg for his supervision and critical remarks.

Special thanks are due to the Director of the Laboratoire de Phanérogamie at Paris for permission to use the Pichon's original drawings for this publication.

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Index of Scientific names

Synonyms are in *italics*. Page number of principal entries are in **bold face**, those of figures or photographs in *italics*.