

RE-ESTABLISHMENT OF *BEGONIA*
CAVALLYENSIS A. CHEV. AND THE
ALTITUDINAL VICARIAD *BEGONIA*
FUSICARPA IRMSCH. (SECT.
TETRAPHILA A. DC.)

F. A. HAGMAN AND J. J. F. E. DE WILDE

Department of Plant Taxonomy
Wageningen Agricultural University, The Netherlands

Received 31-X-1983
Date of publication 5-III-1984

CONTENTS

Summary.	3
1. Introduction	3
2. <i>Begonia cavallyensis</i> A. Chev.	4
3. A chronological review of <i>Begonia</i> species and names (sect. <i>Tetraphila</i> A. DC.) formerly associated with <i>B. cavallyensis</i> A. Chev.	13
4. <i>Begonia fusicarpa</i> Irmsch.	15
5. Palynological observations (by R. G. VAN DEN BERG)	18
6. Acknowledgements	18
7. References	19

SUMMARY

Analysis of *B. cavallyensis* A. Chev. leads to the conclusion that this species was mistakenly placed into the synonymy of *B. eminii* Warb. The species is described anew and diagnostic characters are given. *Begonia* species and names at one time or another associated with *B. cavallyensis* are discussed. Among the African *Begonia* species known at present, *B. fusicarpa* Irmsch. is most closely related to *B. cavallyensis*. On morphological, distributional, ecological and palynological grounds the species are considered to be a pair of altitudinal vicariads.

1. INTRODUCTION

In the course of a taxonomic revision of the African *Begonias* belonging to section *Tetraphila* A. DC. our attention was drawn by a specimen originally collected in the Nimba Mountains in Liberia, and now growing in the greenhouse of the Agricultural University at Wageningen. Using the key in HUTCHINSON and DALZIEL's 2nd edition of the Flora of W. Trop. Africa (1954) the plant was identified as *B. eminii* Warb. This identification proved highly unsatisfactory as the plant differed in many characters from our concept of *B. eminii* and, more in particular, from the type material on which *B. eminii* is based. The plant, however, reasonably well fitted the description of *B. cavallyensis* A. Chev., a name which is considered to be a later, heterotypic synonym of *B. eminii* Warb. in HUTCH. and DALZ. (l.c., 1954).

In order to gain information about the variability of the species and its delimitation an analysis was made of all the living and dried material available of *B. cavallyensis*. This material, together with the results of our analysis and all available evidence was compared with that of related taxa and especially with that of all the names, which, at one time or another, have been placed into the synonymy of *B. eminii* Warb. The following validly published names, arranged in chronological order, are involved:

- B. eminii* Warb., July-Aug. 1895
- B. macrostyla* Warb., Nov. 1895
- B. poggei* Warb., Nov. 1895
- B. preussii* Warb., Nov. 1895
- B. warburgii* Gilg, 1904
- B. rubro-marginata* Gilg, 1904
- B. alepensis* A. Chev., 1912
- B. ealensis* Irmsch., 1921
- B. fusicarpa* Irmsch., 1954

Finally we have concluded that *B. cavallyensis* is a distinct species which is here re-described and delimited. At the same time we found that among all the names cited above only *B. fusicarpa* has many characters in common with *B.*

cavallyensis, and is, indeed, very closely related to it. After careful consideration it is maintained here as a vicariad beside *B. cavallyensis*.

2. *Begonia cavallyensis* A. Chev.

Fig. 1; Phot. 1 and 2; Map 1

Begonia cavallyensis Aug. Chevalier in Bull. Soc. Bot. France 58 (Mém. 8): 176. 1912; A. Chev., Expl. Bot. Afr. Occ. Franç. 1: 297. 1920; Hutch. and Dalz., Fl. W. Trop. Afr. 1st ed. 1(1): 188. 1927; F. R. Irvine, Plants of the Gold Coast: 52. 1930 (cited under the name *B. rubro-marginata* Gilg); R. Schnell, Vég. et Flore de la Rég. Mont. du Nimba in Mém. de l'Inst. Fr. Afr. Noire 22: 461. 1952 (cited under the name *B. rubro-marginata* Gilg); Hutch. and Dalz., Fl. W. Trop. Afr. 2nd ed. 1(1): 220. 1954 (in synonymy to *B. eminii* Warb.; among the material cited only Chevalier no. 21422 belongs to *B. cavallyensis*); Dalziel, Useful Pl. of W. Trop. Afr. 2nd reprint: 64. 1955 (cited under the name *B. rubro-marginata* Gilg); The Begonian 34: 170. 1967 (phot., as *B. eminii* Warb.); Adam, Fl. descriptive des Monts Nimba in Mém. Mus. Nat. Hist. Naturelle nouv. sér. B (Bot.) 20: 320, 322–324, pl. 76 and 77. 1971 (the name cited in synonymy to *B. eminii* Warb., the cited specimens belong to *B. cavallyensis*); Barkley in The Buxtonian 1, Suppl. 5, The Species of the Begoniaceae 1st ed.: 16, 28. 1972 (in syn. to *B. eminii*); Barkley and Golding, The Species of the Begoniaceae, 2nd ed.: 19, 34. 1974 (in syn. to *B. eminii*); Barkley in The Begonian 41: 151 (phot., as *B. rubro-marginata*). 1974; D. Johansson, Ecol. of Vasc. Epiphytes in W. Afr. rain forest in Acta Phytogeogr. Suecica 59: 41 (excl. the cited distribution in Cameroon), 52 (phot.), 54, 73, 75, 78, 81–82, 84 (phot.), 103, 106, 112, 118. 1974 (everywhere cited under the name *B. rubro-marginata* Gilg); M. L. Thompson in The Begonian 44: 295 (phot. only). 1977; M. L. Thompson and E. J. Thompson, Begonias, the complete ref. guide: 107, 109, 110, 295, colour phot. 12. 1981.

Misapplied name: *B. fusicarpa* auct. non Irmscher: Adam, loc. cit.: 322, pl. 77. 1971.

Type: Aug. Chevalier no. 21.422 (Ivory Coast: Dyola county in the basin of the upper Cavally River, on the summit of Mt. Dò, near Gouékangouiné, at 950 m alt., holotype and isotype in P).

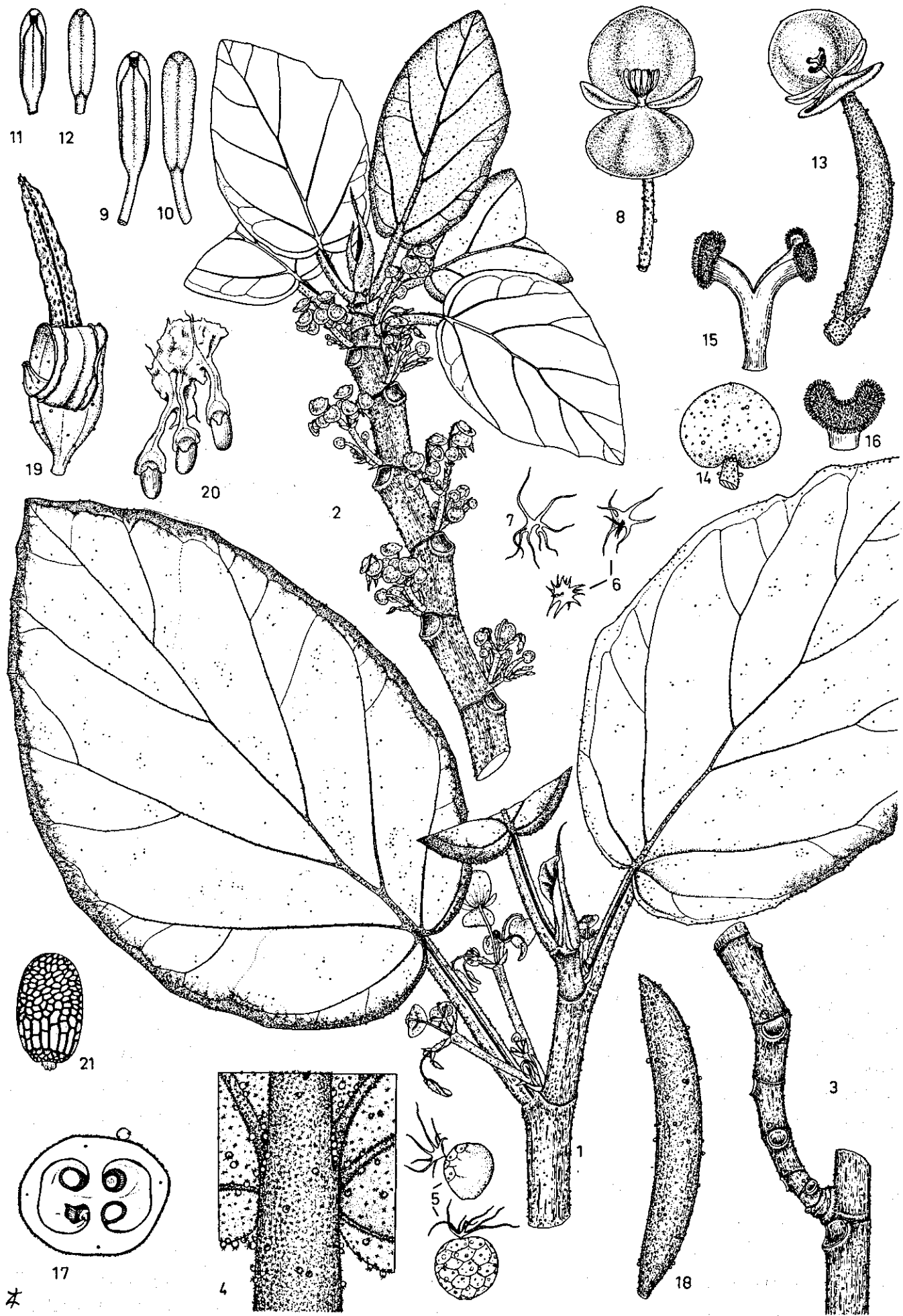
Diagnostic and differential characters: Monoecious epiphytic erect stem-succulent up to 90 cm tall, confined to the Upper Guinea subdivision of the Guineo-Congolian Region between elevations of ca 500 and 1500 m. Stems thick and with conspicuous scars left by the readily caducous leaves; the internodes usually short, 0.5–3 cm long. Petioles relatively long and thick, (1–)2–7(–15) × 0.2–0.5 cm. Blades ovate, obliquely cordate or obtuse at the base, acute to obtuse at the apex, 4–16(–24) × 2–10(–15) cm; in vivo provided with an up to 4 mm broad contrasting, dark red, almost entire margin. All parts of the living plant scattered with conspicuous whitish, spherical, multicellular

trichomes. Inflorescences unisexual, more rarely androgynous. Male inflorescence a (2–)4–15-flowered dichasial cyme; the peduncle 1.5–45(–55) mm long. Female inflorescence a 2–3-flowered cyme; the peduncle very short, 1.5–5.5 mm long. Bracts early caducous. Perianth segments (tepals) 4 (viz. 2 + 2) in flowers of both sexes, the inner pair sometimes missing; the outer pair of tepals pink, the inner pair almost white. Androecium fasciculate, asymmetric; stamens 11–19. Styles 2(3), about half as long as the inner tepals, fused over 0.5–1.5 mm at the base. Stigmas crescent-shaped, the stigmatic tissue on the outer surface continuous from one arm of the crescent to the other. Ovary fusiform, terete in transverse section, 2(3)-celled. Mature fruit 20–50 × 2–5 mm, opening by a single lateral slit. Seeds proportionally big, 1.1–1.5 × 0.6–0.8 mm, the hilar part embedded into a cup-shaped aril-like structure.

Description: Monoecious sturdy epiphyte growing on forest trees. The stems thick, grey-green to dark red-brown, usually branched, erect, occasionally rooting at the nodes, up to ca 90 cm high, more or less terete, in sicco deeply wrinkled lengthwise, the more woody basal parts of the stem 5–16 mm in diam., the juvenile upper parts densely covered with an indumentum of lepidote-stellate, irregularly shaped, brown transparent hairs. The nodes with marked stipular scars. The internodes short, 4–30 mm, but up to 85 mm in cultivated plants. Axillary buds long, 12–40 mm, acute, red and covered with an indumentum of lepidote-stellate brownish hairs. In vivo the whole plant scattered with conspicuous, sessile, white-transparent, glandular, spherical multicellular trichomes. The trichomes ca 0.2 mm diam., mostly bearing a lepidote-stellate hair on top or lateral. These trichomes are easily rubbed off and eventually disappear in herbarium material.

Stipules large, boat-shaped, (15–)27–43 × (4–)13–15 mm, narrowly oblong to narrowly triangular, acuminate to almost cuspidate at the apex, early caducous, red but often colourless-transparent towards the margins (in vivo), membranous, outside scattered with lepidote-stellate hairs, inside glabrous.

Leaves readily caducous and usually confined to the upper parts of the stem, papery, greenish-brown to red-brown in sicco; in vivo rather thick and somewhat fleshy, green and with a conspicuous up to 4 mm broad dark purplish-red margin and red nerves above, the lower surface pale green to reddish-brown and with red nerves. Petioles relatively long and thick, 8–70(–150) × 2–5 mm, furrowed above, otherwise terete, in vivo entirely red or red on the light exposed upper side and green below, covered with indumentum and glandular spherical trichomes, leaving conspicuous big hooflike or transversely broadly elliptic scars on the stem, the scars 2–7 × 2.5–10 mm. Blades more or less asymmetric, ovate, 40–160 (–240) × 20–100(–150) mm, obliquely cordate or obtuse at the base, acute to obtuse at the apex; margin almost entire, undulate; blade in cross-section slightly V-shaped. Older blades with some scattered hairs and glandular trichomes on both sides; younger blades with an indumentum of brownish hairs, especially on the nerves on both sides and with easily caducous glandular trichomes. Nerves wine-red and very prominent on the lower surface, 4–5 on each



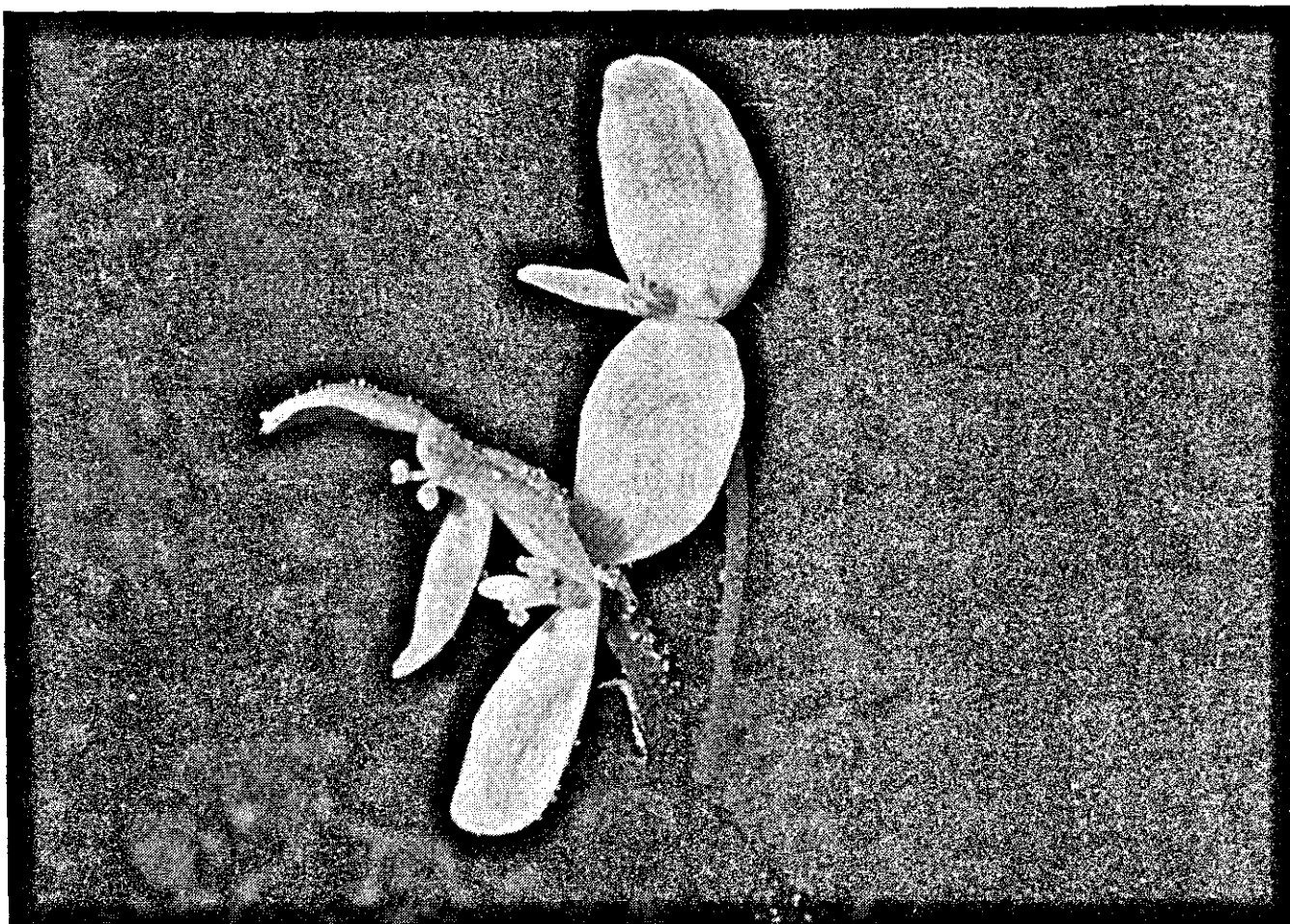
side of the midrib.

Inflorescences found in the axils of the leaves or above the scars left by fallen leaves, up to 3 in one axil, most often unisexual, sometimes androgynous, the shed peduncles eventually leaving almost circular scars of 1–2.5 mm diameter in the leaf axils.

Male inflorescence a dichasial cyme, (2–)3–15-flowered; peduncle 1.5–45 (–55) mm long and 0.75–2.5 mm in diam., terete, in vivo red and covered with lepidote-stellate hairs and some glandular trichomes, bearing at the top two opposite membranous, early caducous, brownish bracts (subtending the primary dichasial branches), the bracts 3–5(–10) × 2–3.5 mm, ovate with an acute apex, outside with indumentum, inside glabrous; the peduncle branched in two lateral axes; axes (1st order) 1–8(–20) mm long, otherwise similar to the peduncle but with smaller apical bracts; the primary lateral axes usually branched again and the axes of the second order 1–3 mm long with small (1–3.5 × 0.5–3 mm) bracts at the top. All axes terminated by a flower and in this way the inflorescence usually (3–)7-flowered. Sometimes the branches 2nd order dichasially branched again, resulting in a potentially 15-flowered inflorescence. The axis 3rd order short, ca 1 mm, with very small bracts. In two cases inflorescences were found with axes 4th and 5th order, which would result in a potentially 31–63-flowered inflorescence. However, in these cases some axes and/or flowers were reduced and not developing thereby not resulting in the many flowered dichasium as indicated above (teste *Aylmer 49* and *Scott Elliot 5721*). The terminal flower of the dichasial cyme opening first, followed by the flowers terminating the lateral branches of the first order, etc. The flowers of the axes lower order usually early caducous, while those of higher order are developing. On plants in cultivation occasionally a male inflorescence was found to bear one or two female flowers thus becoming androgynous. These female flowers are always found on laterals of a dichasium of which the top flower is male (see *PHOT. 1*).

Male flower supported by a 2–17(–25) mm long 'pedicel' the length of which varies with its place in the cyme. The 'pedicel' (the support of a single male flower) distinctly articulated 0.5–1 mm above the base; the part above the articulation (the perianth-cylinder) 1.5–17(–25) mm long, slender, in vivo pinkish-white, scattered with a few lepidote-stellate hairs and spherical trichomes; the short part below the articulation (the true pedicel) dark pink, otherwise ditto. Flower after anthesis falling in one piece from the articulation, the true pedicel

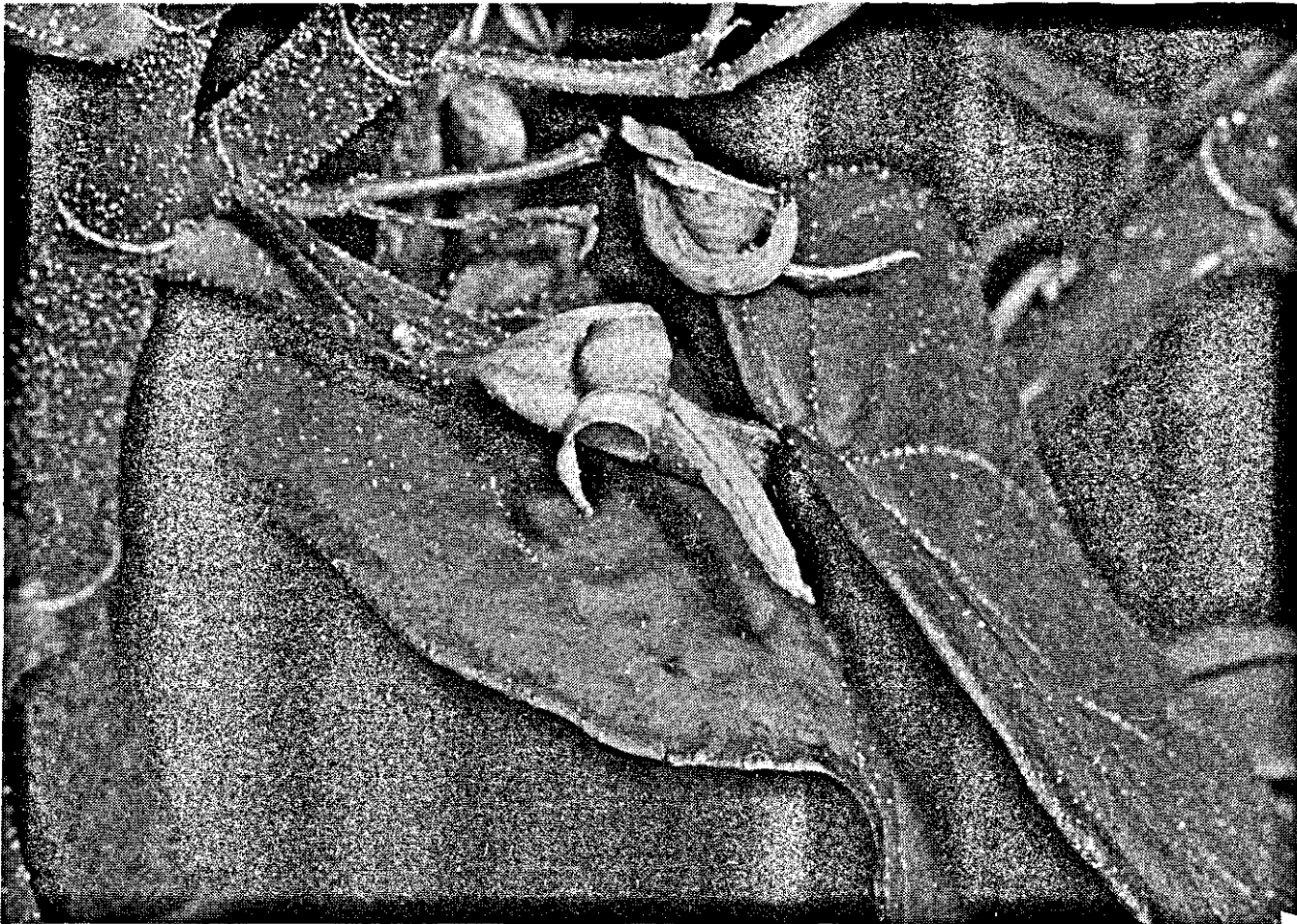
FIG. 1. *Begonia cavallyensis* A. Chev. – 1: branch with male inflorescences (× ½); 2: idem, with male and female inflorescences (× ½); 3: idem, the nodes showing characteristic scars of fallen leaves and stipules (× ½); 4: leaf base, underside, with indumentum and spherical trichomes (× 2); 5: trichomes bearing a lepidote-stellate hair (× 20); 6: hairs of a leaf (× 20); 7: trichome-hair (× 20); 8: ♂ fl. (× 2); 9: large stamen, frontal view (× 10); 10: idem, dorsal view (× 10); 11: small stamen, frontal view (× 10); 12: idem, dorsal view (× 10); 13: ♀ fl. (× 2); 14: tepal, ♀ fl., outer side (× 2); 15: styles and stigmata, lateral view (× 10); 16: stigma, abaxial side (× 10); 17: transverse sect. of ovary, ca in the middle (× 8); 18: young fruit (× 2); 19: dehiscent fruit (× 1); 20: placenta tissue bearing mature seeds (× 5); 21: mature seed (× 15). – 1, 4–17: living material (*J. J. de Wilde 3397*); 2: *J. J. de Wilde 7395*; 3: *Leeuwenberg 2957*; 18: *Leeuwenberg 3870*; 19–21: *J. J. de Wilde 8789*, spirit material.



PHOT. 1. *Begonia cavallyensis* A. Chev. showing an occasional androgynous inflorescence with a male top flower and two female lateral flowers (J. J. F. E. de Wilde 7395; PHOT. J. W. MUGGE).

staying behind. Perianth-segments (tepals) (2)4; the two bigger outer tepals opposite, 3.5–10(–14) × 3–8(–11) mm, convex, broadly ovate to broadly elliptic, obtuse at apex, outside with a few hairs and glandular trichomes, inside glabrous, pinkish-white with pink veins; the pair of inner tepals alternate with the outer ones, much smaller, 4–7.5 × 0.7–2.5 mm, boat-shaped, narrowly obovate, obtuse at apex, glabrous both sides, white, sometimes missing. Androecium fasciculate, asymmetric, stamens 11–19, filaments fused at the base to form a column of ca 0.5–1 mm long, otherwise free, the longest free filaments of the bundle up to 1.2 mm long, the shortest stamens with almost sessile anthers, filaments in vivo pale pink. Anthers yellow, 1–2(–2.2) × 0.2–0.5(–0.8) mm, narrowly obovate, obtuse at the apex, opening more or less laterally, lengthwise, the slits directed towards the centre of the bundle.

Female inflorescence usually a 2–3 flowered dichasial cyme in which the lateral flowers are always subtended by a pair of bracts 2nd order indicating that these flowers are in fact laterals of an otherwise reduced dichasium 2nd order; peduncle short, 1.5–5.5 mm long, in vivo wine-red and with an indumentum of lepidote-stellate hairs and some spherical trichomes, at the top with two opposite bracts (bracts 1st order); the bracts similar to those in the male inflorescence or somewhat smaller; the lateral axes (1st order) 1.5–2.5 mm long, with smaller bracts at the top. Androgynous inflorescence described above under the male ones.



PHOT. 2. *Begonia cavallyensis* A. Chev.: infructescence with dehiscent fruits. All parts scattered with multicellular trichomes (J. J. F. E. de Wilde 8789; PHOT. J. W. MUGGE).

Female flowers sessile. Perianth-segments (tepals) 4 or 2, in the latter case the pair of inner tepals missing; outer tepals convex, (3-)5-8(-9.5) × 3-8 mm, broadly ovate to broadly elliptic; inner tepals (if present) 2-5.5 × 1-2 mm, narrowly obovate to obovate; the tepals otherwise similar to the corresponding male flowers. Styles 2(3), often about half as long as the inner tepals, in vivo bright yellow, fused over 1-1.5 mm, otherwise free and spreading. The free parts 0.5-1.5 mm long, glabrous, horseshoe-shaped forked thereupon, the arms of the horseshoe widely spreading, 0.3-1 mm long, on the abaxial (outer) surface densely papillose and this stigmatic glanduliferous tissue forming a continuous band from one arm to the other giving the horseshoe a rather crescent-shaped appearance, the style-arms otherwise glabrous.

Ovary fusiform, tapering towards both sides but especially towards the apex, terete, often somewhat curved. (6-)10-22(-28) × 2-3 mm (the total length of the ovary measured as the part above the subtending bracts), in vivo brownish-green to brown-red, covered with a rather dense indumentum of brownish lepidote-stellate hairs and scattered with a few glandular trichomes, the indumentum often more or less disappeared in dried material. Perianth-segments and styles early caducous. The ovary 2(3)-locular, corresponding with the number of the styles. Placentation topographically axile, though morphologically the placentas arise from the ovary-walls, fuse in the centre of the ovary and finally are branched left and right with one branch in each of the 2 locules

(Fig. 1, 17). See also REITSMA, this issue.

Mature fruit in vivo pale red, fusiform, $20-50 \times 2-5$ mm, in sicco attenuated or almost beaked at the apex over 1–3 mm and at the very apex with a disciform scar at the place where the styles and perianth-segments were attached; finally opening by a single lateral slit. The pericarp after dehiscence flattening out and rolling backwards in one piece, fleshy, pale red inside and with two (opposite) longitudinal ridges at the places where the placentas broke away. The seed-bearing placenta tissue bright yellow, forming a fusiform mass and coming loose from the pericarp except for the very base which is devoid of seed-bearing placenta tissue (see PHOT. 2). Both pericarp and placenta tissue very transitory.

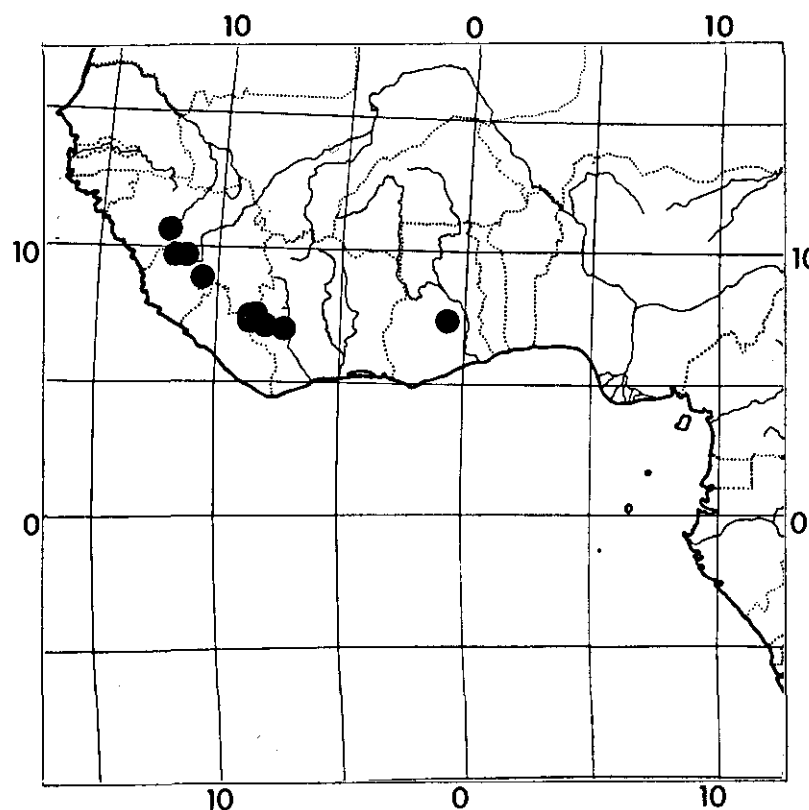
Mature seeds glossy light brown, ovoid, obovoid or cylindric with obtuse base and apex, $1.1-1.5 \times 0.6-0.8$ mm; the brittle testa with a conspicuous cellular pattern; the hilar part composed of three transverse rings of very small alveolate cells; the collar cells (sensu BOUMAN and DE LANGE, 1982) much bigger, elongated in longitudinal direction, tetragonal; the remaining testa cells small and in a longitudinal pattern, this pattern becoming more irregular – and the cells smaller – towards the apex. The hilar part of the seed surrounded by a cup-formed aril-like structure and connected to the placenta via an up to 1,5 mm long and 0,5 mm broad, flattened funicle.

Notes. 1. In cultivated (clonal) individuals present in the living collection at Wageningen, adventitious roots at the nodes were never observed. However, among the examined herbarium specimens some collections show these roots (e.g. *Adam no. 20851*, *D. Johansson no. 733*, both in UPS) and others do not. In our opinion, the presence or absence of these roots might depend upon habitat-factors, i.e. a poor food supply and high dynamics in microclimate might lead to the development of aerial roots whereas better nutrition and a steady microclimate (as in the greenhouse) do not induce this development. As such, the occurrence of roots at the nodes has no diagnostic value in this species.

2. A. CHEVALIER (l.c., 1912) in his description of male flowers of *B. cavallyensis* stated: 'sepala 2 suborbicularia; petala 0'. The female flowers are described as having 2 sepals and here the petals are ignored. Individuals in cultivation at Wageningen showed flowers of both sexes having either 2 or 4 perianth-segments even in flowers belonging to a single inflorescence.

Distribution: Guinea, Sierra Leone, Liberia, Ivory Coast, Ghana.

Ecological, biological and distributional notes. In Guinea *B. cavallyensis* was collected in the Fouta-Djallon highlands, in the upper course of the Konkouré River. Although no altitude is stated on the labels, these highlands reach in places over 1400 m. The available collectors' notes mention it to be uncommon and growing as an epiphyte on trees along the rivers (teste *Chevalier no. 25836*, *Pobéguin nos 1482* and *1651*, all in P). A second locality in Guinea where the species was found are the Nimba Mountains. Here, SCHNELL collected it several times on the south-western ridge at an altitude of ca 1500 m.



MAP 1. Spot distribution map giving localities where *B. cavallyensis* A. Chev. was collected.

In Sierra Leone it was collected in the northern and south-eastern provinces. No altitudes are given, but the collecting-localities all point to heights above 500 m. DEIGHTON (no. 709, K) stated: 'Epiphytic, 1–2 ft high, roots at the nodes and forms large clumps'. MORTON and GLEDHILL (no. SL 1966-a, K) found it in the Tingi Mountains as an epiphyte in the forest.

All collections made in Liberia, at least as far as the localities could be traced, originate from the Nimba Mountains. Collectors' notes mention altitudes ranging between 650 and 1300 m and often state that it was found growing as an epiphyte. The living plants of *B. cavallyensis* in cultivation at Wageningen are cloned from a specimen originally collected by H. C. D. DE WIT on Mt Nimba in Liberia in 1960–'61.

From Ivory Coast we examined the type (*Chevalier* no. 21.422, P) and two collections made by LEEUWENBERG (nos 2957 and 3870) from the same individual growing on Mt Tonkouï at 1180 m altitude. The latter collector stated that he found it growing as an epiphyte on a branch 2 m above groundlevel in an edge of montane rain-forest. The distribution in Ivory Coast seems confined to the Man-region at altitudes above 900 m.

Finally, from Ghana, only two specimens came to our attention. A specimen distributed by W. H. JOHNSON (no. 129, K) and dated 19-2-1899 only bears the annotation: 'Gold Coast, plant 3 ft high, found in the crutch of huge cotton-tree which had fallen down'. MORTON (no. A 716, GC) collected the species in 1954 at the foot of the Mpraeso Scarp as an epiphyte on the high branches of a tree. No altitude was given. On maps the elevation of this area is indicated to be above 500 m.

Summarizing, the collections of *B. cavallyensis* presently at hand show a re-

stricted, i.e. endemic distribution in the Upper Guinea subdivision of the Guineo-Congolian Region. Within this area the species is confined to elevations between ca 500 and 1500 m where it grows as an epiphyte in (sub)montane rain-forest.

Much more detailed ecological information concerning *B. cavallyensis* is found in D. JOHANSSON (l.c., 1974), who extensively studied the epiphytic flora of the Nimba area, including parts of the Nimba Mts in Liberia. In his publication this information is found under the name *Begonia rubro-marginata* Gilg. Judging from the accompanying photographs and the material cited (Johansson no. 733, UPS) this material, without any doubt, belongs to *B. cavallyensis* A. Chev.

According to JOHANSSON the species is common in this area. It grows preferably on the basal and middle parts of the large branches of the phorophyte (i.e. the 'host tree' of the epiphyte), where it is found on humus deposits in open shade to full sun. Among the phorophytes occurring in the Nimba area he records 28 different high forest tree species on which it was observed. Outside the high forest it was found on *Cola nitida*. Several epiphyte communities, rich in epiphytic orchids and ferns with which *B. cavallyensis* is associated, are listed. In the dry season most, if not all, leaves are shed, which is illustrated by Fig. 65 in JOHANSSON's work, and corroborated by herbarium specimens e.g. *Leeuwenberg* no. 3870 (WAG) and *Schnell* no. 1198 (P). This certainly leads towards reduction of evaporation. JOHANSSON refers to it as a drought tolerant stem succulent in which the thick fleshy stems are suitable for water storage.

Vernacular name and uses: DEIGHTON (no. 709, K) states in his collectors' notes that in Sierra Leone, amongst the Mende tribe, the plant is called 'Gongui', and that the juice is put on wounds, presumably as an antiseptic. This information is cited in DALZIEL, l.c., 1955.

Specimens examined:

GUINEA: Fouta Djallon, between Dalaba and Kouloupa, *Chevalier* 25836 (P); Konkouré River, *Pobéguin* 1482 (P); *ibid.*, *Pobéguin* 1651 (P); Nimba Mountains, *Schnell* 1036 (P); *ibid.*, south-western ridge, *Schnell* 1198 (P); *ibid.*, *Schnell* 1490 (P).

SIERRA LEONE: Falaba, *Aylmer* 49 (K); *sin. loc.*, *Deighton* 709 (K); south eastern Prov., Kono Distr., Tingi Mts, above Koyema, *Morton and Gledhill* SL 1966-a (K); northern Prov., near Makunde, Limba, *Scott Elliot* 5721 (BM, K).

LIBERIA: *sin. loc.*, *Adam* 7445 and 7502 (P); Nimba Mts, *Adam* 20124-bis (P); *ibid.*, *Adam* 20851 (K, UPS); *ibid.*, *Adam* 21496 (K, UPS); *ibid.*, Yéképa, *Adam* 27744 (MO); Mt Barclay, *Bunting* 27 (BM); Nimba Mts, Sanniquelle Distr., *Johansson* 733 (UPS); *sin. loc.*, *Linder* 59 (K).

IVORY COAST: Upper course of the Cavally R., Dyola country, Mt Do, near Gouékangouiné, *Chevalier* 21422 (P, 2 sheets, holotype and isotype); Mt. Tonkoui, N.W. of Man, *Leeuwenberg* 2957 (WAG); *ibid.*, *Leeuwenberg* 3870 (WAG).

GHANA: *sin. loc.*, *comm.* *W. H. Johnson* 129 (B, K); *Morton* A-716 (GC).

CULTA: Agricultural University Wageningen, The Netherlands; from living material originally introduced by H. C. D. de Wit from Mt Nimba, Liberia, *J. J. F. E. de Wilde* 3397 (WAG); *ibid.*, *J. J. F. E. de Wilde* 7395 (WAG); *ibid.*, *J. J. F. E. de Wilde* 8789 (WAG); *ibid.*, *van Veldhuizen* 502 (WAG).

3. A CHRONOLOGICAL REVIEW OF BEGONIA SPECIES AND NAMES (SECT. TETRAPHILA A. DC.) FORMERLY ASSOCIATED WITH *B. cavallyensis* A. CHEV.

Begonia eminii was published by O. WARBURG in ENGLER, Pflanzenwelt Ost-Afr., C (2-3): 282. July-Aug. 1895. It is based on three syntypes, viz. *Stuhlmann nos 1453, 1454 and 3828* (all in B). STUHLMANN's specimens are all from Bukoba in Tanzania and remarkably uniform. Since then the species has become known from a large number of African countries. Widespread in the forests of tropical Africa its distribution ranges from Liberia to Kenya, radiating south into Angola and Tanzania, and from sea level up to ca 2200 m altitude.

In HUTCHINSON and DALZIEL's 2nd edition of the Flora of W. Trop. Africa (l.c., 1954) *B. cavallyensis* was placed into the synonymy of *B. eminii* Warb. This was followed by a number of subsequent authors e.g. ADAM (l.c., 1971) and BARKLEY (l.c., 1972).

B. eminii Warb. is characterized by and differentiated from *B. cavallyensis* by a number of characters, among which relatively thin stems and long internodes; leaves acute to acuminate at the apex; the leaf-margin coarsely dentate to sinuate, not red; styles 3(2), forked in a sharp angle at the top, the stigmatic tissue slightly spiralled; fruits red and seeds less than 1 mm long. The distributions of both species overlap and there is also an overlap in their altitudinal ranges.

B. macrostyla Warb. was validly published in ENGL., Bot. Jahrb. 22(1): 37. Nov. 1895. The holotype, *Preuss no. 960* (B), was collected in Cameroon, in a forest at Buea at 970 m altitude. The name is cited in synonymy to *B. eminii* Warb. in HUTCHINSON and DALZIEL (l.c., 1954), which was followed by later authors e.g. by BARKLEY (l.c., 1972). *Preuss no. 960*, the type, shows all characters mentioned above for *B. eminii* Warb.; mature seeds, however, are not available. A final decision about the status of the name *B. macrostyla* Warb. awaits further research; but certainly *B. cavallyensis* A. Chev. does not belong to it.

B. poggei Warb. was published simultaneously with the above mentioned *B. macrostyla* Warb. (op cit.: 35. Nov. 1895). It is based on two syntypes, viz. *Pogge no 962* (B) from Zaire and *Zenker and Staudt no. 538* (B) from near Yaoundé in Cameroon. WARBURG, the publishing author, already stated in the protologue that it is very closely related to *B. eminii*: 'von der sie nur durch geringe Unterschiede in der Behaarung, Blattform und Blattgröße getrennt erscheint'. Subsequent authors unanimously place it in synonymy to *B. eminii* Warb. The present authors share this opinion.

B. preussii, published by WARBURG in a single publication together with *B. macrostyla* and *B. poggei* (op.cit.: 36. Nov. 1895), is based on *Preuss nos 111 and 333* (both in B). Both these syntypes are from Barombi-station in Cameroon (4° 40' N.-9° 23' E.). *Preuss no. 111* is designated here as the lectotype.

Although the name is cited in synonymy to *B. eminii* Warb. in HUTCHINSON and DALZIEL (l.c., 1954), which was followed by later authors, we are of the

opinion that it represents a distinct taxon. Details on female flowers are unknown. The seeds measure 0.8×0.4 mm. The available evidence, type material and protologue, excludes it from being conspecific with *B. cavallyensis*.

B. warburgii was published by GILG in ENGL., Bot. Jahrb. 34(1): 94. 1904. It is based on *Preuss no. 111* (holotype, B), a specimen which, simultaneously, represents one of the syntypes on which WARBURG based *B. preussii* (see above). In our opinion, and in accordance with our lectotypification, the name *B. warburgii* Gilg constitutes a later homotypic synonym of *B. preussii* Warb.

B. rubro-marginata Gilg in ENGL., Bot. Jahrb. 34(1): 95. 1904 is based on *Conrau no. 80* (holotype, B), collected at Bangwa in Cameroon. Together with for instance *B. mannii* Hook. and *B. komoënsis* Irmsch. it belongs to a group of species which, within section *Tetraphila*, is characterized by simple, subuliform styles. This, in combination with other characters, e.g. short, 5–9 mm long petioles and small leaves devoid of a red margin, does not fit into the circumscription of *B. cavallyensis*.

Doubtless, GILG, in coining the specific epithet 'rubro-marginata' did so to denote the outer pair of perianth-segments which, in the collector's note, are indicated as: 'weisz mit rotem Rande'. The fact that JOHANSSON (l.c., 1974) and others misidentified specimens of *B. cavallyensis* (characterized by distinct red leaf margins) as *B. rubro-marginata* is certainly due to this last specific epithet. The distributions of *B. rubro-marginata* and *B. cavallyensis* do not overlap.

B. alepensis was published by AUG. CHEVALIER in Bull. Soc. Bot. France 58 (Mém. 8): 174. 1912. It is based on *Chevalier no. 17482* (holotype and isotype in P), collected near Alépé in Ivory Coast. According to the protologue the fruits are trigonous, equal-sided in transverse section and ivory-white at maturity. The stigmatic parts of the 3 styles are forked, similar to the situation found in *B. eminii* Warb. Even when fruits are present these fruit characters are often difficult to ascertain on dried herbarium specimens. None the less, in the field they are clear-cut and diagnostic in discriminating between this species and the otherwise closely related *B. eminii* which is characterized by terete fruits (from personal observation by the second author, who collected *B. alepensis* several times in Cameroon, teste *J. J. de Wilde nos 7499, 7573-A, 7725 and 7864*, all in WAG). Trigonous fruits are also known from a few other species in section *Tetraphila* e.g. *B. ebolowensis* Engl., and probably *B. epiphytica* Hook. f. and *B. fusialata* Warb. The taxonomy of *B. epiphytica* (1871), *B. fusialata* (1895) and *B. alepensis* (1912) is, as yet, not clear; possibly only one taxon is involved. *B. ebolowensis* Engl. stands apart as a distinct species.

From this it is clear that *B. alepensis* A. Chev. was erroneously placed in synonymy to *B. eminii* Warb. by KEAY in HUTCHINSON and DALZIEL (l.c., 1954), and that, moreover, it is well distinguishable from the terete-fruited *B. cavallyensis* A. Chev. There might be an overlap in distributions.

B. ealensis was published by IRMSCHER in ENGL., Bot. Jahrb. 57(2): 241. 1921. It is based on two syntypes, viz. *Aug. Chevalier nos 28043 and 28046* (P), both collected in Zaire at the Botanic Gardens at Eala in August, 1912. On the collectors' labels it was explicitly marked 'spontané'. According to WILCZEK, in his

treatment of the *Begoniaceae* in the Flore du Congo, du Rwanda et du Burundi: 27, 31. 1969, *Chevalier no. 28043* consists of a mixture of *B. eminii* Warb. and *B. alepensis* Chev. In the Paris Herbarium *Chevalier no. 28046* is indicated as the (lecto)type, which is followed here. Accordingly we tentatively agree to WILCZEK's opinion that the name *B. ealensis* Irmsch. is a later heterotypic synonym of *B. eminii* Warb. The difficulties in discriminating between *B. eminii* and *B. alepensis* from dried herbarium specimens are outlined above. Any specific resemblance to *B. cavallyensis* is missing.

Finally *B. fusicarpa* Irmsch., to our knowledge, was never brought into synonymy. Despite this, this taxon is, in our opinion, exactly the one which, among all the above-mentioned species and names, is most closely related to *B. cavallyensis*. After careful consideration, and handicapped by the fact that it was collected only once, it is maintained here as a distinct taxon. For full details see under the species.

4. *Begonia fusicarpa* Irmsch.

Fig. 2; Map 2

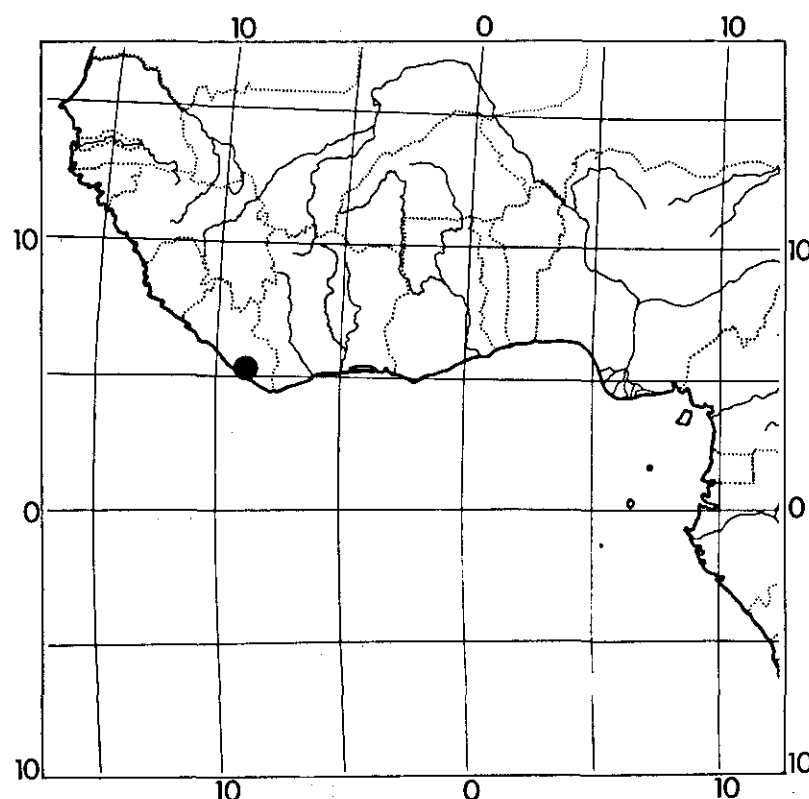
Begonia fusicarpa Irmsch. in Engl., Bot. Jahrb. 76(2): 212. 1954; Hutch. and Dalz., Fl. W. Trop. Afr. 2nd ed. 1(1): 220. 1954 (erroneously cited as *B. fissicarpa*); Adam, Fl. descriptive des Monts Nimba in Mém. Mus. Nat. Hist. Naturelle nouv. sér. B (Bot.) 20: 322, 324, pl. 77. 1971 (only the name; description, cited material and plate belong to *B. cavallyensis* A. Chev.); Barkley, The Species of the Begoniaceae: 36. 1972 in The Buxtonian 1, suppl. 5; Barkley and Golding, The Species of the Begoniaceae, 2nd ed.: 43. 1974.

Type: *Baldwin no. 11417* (Liberia: Sinoe county, Kulo, on a fallen tree, holotype in K; isotypes: MO, WAG).

Short description (see also remark no. 1): Monoecious epiphyte, to our present knowledge confined to lowland in Liberia under 500 m altitude. Stems probably erect or somewhat bent, 3–6 mm in diam.; internodes 2–4.5 cm long. Leaves rather long persistent, finally falling off and leaving smaller and less conspicuous scars as compared to *B. cavallyensis*. Petioles 3–6 cm long. Blades narrowly obovate to narrowly elliptic, obtuse and almost symmetric at the base, broadly acute to obtuse at the apex, 13–21 × 4–6.5 cm; the margin entire or somewhat sinuate and in the upper half often with a few coarse blunt teeth. The characteristic red margin sometimes faintly visible even on dried specimens of *B. cavallyensis* and diagnostic for that taxon presumably missing in *B. fusicarpa*. Multicellular spherical trichomes probably absent. Inflorescences unisexual, axillary. Male inflorescences found in the axils of the terminal leaves, slender, few-flowered, cymose; the peduncle 20–25 mm long. Female inflorescence a 2–5-flowered dichasial cyme; the peduncle very short, up to 4 mm long. The female inflorescences found lower down the stem and sometimes two (or more?) in the axil of a single leaf. Bracts rather early caducous. Perianth-segments



FIG. 2. *Begonia fusicarpa* Irmsch. — 1: fruiting banch ($\times \frac{1}{2}$); 2: hairs of a leaf ($\times 20$); 3: ♂ fl., partly reconstructed ($\times 3$); 4: stamen, frontal view ($\times 20$); 5: idem, dorsal view ($\times 20$); 6: androecium, schematic (magnified); 7: ♀ fl., partly reconstructed ($\times 2$); 8: outer tepal, ♀ fl., outer side ($\times 4$); 9: inner tepal, ♀ fl., outer side ($\times 4$); 10: stigmata of a single flower, abaxial side ($\times 10$); 11: transverse section of ovary, ca in the middle, partly reconstructed ($\times 8$); 12: mature fruit ($\times 1$); 13: surface of pericarp ($\times 10$); 14: hairs of pericarp ($\times 20$); 15: part of the placenta bearing a mature seed ($\times 5$); 16: mature seed ($\times 15$). — 1-16: Baldwin 11417.



MAP 2. The only hitherto known station where *B. fusicarpa* Irmsch. was collected.

(tepals) 4 in flowers of both sexes.

Male flower supported by a 2–3 mm long pedicel. The two bigger outer tepals 4×5 mm, broadly ovate; the pair of inner tepals smaller and shorter, 3×2 mm, oblong. Androecium fasciculate, asymmetric; stamens 12–18. Anthers opening lengthwise by means of two more or less lateral slits; the anthers of the outer whorl facing the centre of the bundle, the remaining anthers also directed towards the centre of the bundle (Fig. 2, 6).

Female flower almost sessile. The outer tepals 4.5–5 mm in diam., broadly ovate, the inner tepals smaller, $2.5-3 \times 1-1.3$ mm, oblong. Styles 2, slender, 2.5–3 mm long, about as long as the inner tepals, fused over 1–1.5 mm at the base, above it free and only slightly spreading; the stigmas forked (not crescent-shaped as in *B. cavallyensis*) and the stigmatic tissue not continuous from one arm of the fork to the other. Ovary fusiform, terete in transverse section, 2-celled, $14-18 \times 1-1.5$ mm. Placentation similar to *B. cavallyensis*. Perianth-segments and styles early caducous.

Mature fruit erect, supported by a 1–1.5 mm long pedicel, straight or curved, 3.5–6 cm long by 2–2.5 mm diam.

Mature seeds a bit more slender than those of *B. cavallyensis*, cylindric or obovoid, $1.2-1.5 \times 0.5-0.7$ mm, otherwise almost similar.

Remarks: 1. Our description given above is merely an abstract and translation of the elaborate latin diagnosis produced by IRMSCHER to which we refer. In it differential characters as compared to *B. cavallyensis* are stressed. Since the time that IRMSCHER (1954) published *B. fusicarpa* no additional material or information has become available. This implies that nothing is known about the variability of the species. Dr. F. BOUMAN informed us that he found a minor

difference between *B. cavallyensis* and *B. fusicarpa* in a micromorphological character of the seed coat (verbal comm.).

2. Mr. R. G. VAN DEN BERG analysed the pollen of *Begonia* sect. *Tetraphila*, and reports on the two species here under discussion in the following section. His study points to similarities in pollen of *B. cavallyensis* and *B. fusicarpa* and endorses the separation of *B. cavallyensis*/*B. fusicarpa* from the *B. eminii*-group.

3. The strong similarities in micro- and macromorphology, the allopatric distribution and the altitudinal separation lead us to the conclusion that *B. cavallyensis* and *B. fusicarpa* are to be considered as altitudinal vicariads.

5. PALYNOLOGICAL OBSERVATIONS (BY R. G. VAN DEN BERG)

Within the section *Tetraphila* a number of pollen types is present. Two of these, which are easily distinguished from each other, are characteristic for a large number of species. The 'cavallyensis-type' is a large (28–30 μ), perprolate grain with a large endoporus bordered by rather heavy costae; a striking character is the presence of a margo: a ca 2 μ wide band along the colpi where the striate ornamentation is replaced by an irregular sculpture. This type of pollen is characteristic for: *B. cavallyensis*, *B. fusicarpa*, *B. ebolowensis*, *B. polygonoides*, *B. oxyanthera*, *B. jussiaeicarpa*, *B. sanjeensis*, *B. capillipes* and *B. preussii* (syn.: *B. warburgii*).

The 'eminii-type' is a smaller grain (20–24 μ), prolate-perprolate, with a small endoaperture with narrow costae and never in possession of a margo. The following species names show this pollen-type: *B. eminii*, *B. alepensis*, *B. epiphytica*, *B. fusialata*, *B. macrostyla*, *B. mannii*, *B. ndongensis*, *B. ealensis*, *B. subalpestris*, *B. poggei* and *B. tatoniana*.

6. ACKNOWLEDGMENTS

Thanks are due to the Directors and Curators of the herbaria cited in the text, who generously sent herbarium material on loan. The drawings, which are among the best parts of this study, have been made by Miss IKE ZEWARD. We are indebted to Professor J. DOORENBOS of the Department of Horticulture of this University for his valuable comments on the manuscript and to Mr. J. J. KAPER of the same department for taking care of the cultivation of living plant material. Mrs. J. M. VAN MEDENBACH DE ROOY-RONKEL corrected the English text and typed the manuscript. The first author received a grant from the Wageningen Agricultural University Fund for a visit to the herbarium of Paris.

7. REFERENCES

- BOUMAN, F. & A. DE LANGE. 1982. Micromorphology of the seed coats in *Begonia* Sect. *Squamibegonia* Warb. in: Acta Bot. Neerl. 31(4): 297–305.
- REITSMA, J. 1984. Placentation in *Begonias* from the African continent: this issue.