

BEGONIA SECTION CRISTASEMEN
J. J. DE WILDE, SECT. NOV.

J. J. F. E. DE WILDE

*Department of Plant Taxonomy,
Wageningen Agricultural University, The Netherlands*

Received 01-X-1984
Date of publication 13-III-1985

CONTENTS

| | | |
|------|---|-----|
| 1. | INTRODUCTION | 115 |
| 2. | DESCRIPTION OF BEGONIA SECT. CRISTASEMEN J. J. DE WILDE, SECT. NOV. | 115 |
| 3. | BEGONIA THOMEANA C.DC. | 116 |
| 3.1. | Taxonomy. | 116 |
| 3.2. | Seed structure of <i>B. thomeana</i> C.DC. (by F. BOUMAN, Hugo de Vries Laboratory, University of Amsterdam) | 122 |
| 3.3. | Karyology | 124 |
| 4. | DISCUSSION | 125 |
| | SUMMARY | 128 |
| | ACKNOWLEDGEMENTS | 128 |
| | REFERENCES | 129 |

1. INTRODUCTION

In February 1983, during a botanical exploration in Gabon, *Begonia thomeana* C.DC., a species hitherto exclusively known from the island of São Tomé, was discovered and collected on the African continent for the very first time. In order to verify the identity of the newly collected material it was analysed, described and compared with the type. In the course of this work it became evident that *B. thomeana* shows a combination of characters which does not fit into any of the African sections hitherto known. A number of extra-African sections was screened as well, among others, *Begonia* section *Haagea* (Klotzsch) A.DC. from Asia. None of these, however, proved suitable to accommodate *B. thomeana*.

Unlike KERAUDREN-AYMONIN, AYMONIN AND BOSSER (1983) who found it most difficult and undesirable to follow a sectional treatment for the 52 species which they recognized on Madagascar and the Comores, we are of the opinion that a clear-cut classification into sections for the continental African *Begonia* species is well within reach. The existing classification into sections, lastly emended by IRMSCHER (1925), already provides a workable basis. This framework shows indeed some lapses but apart from comparatively few really essential modifications, it leads to a more or less natural key to the sections (in prep.). In this context we think it justified to erect the here described new monotypic section.

2. DESCRIPTION OF BEGONIA SECT. CRISTASEMEN J. J. DE WILDE, SECT. NOV.

Type species: *B. thomeana* C.DC.

Plantae perennes ramosae monoecae usque 10 m longae. Caules tenues multis radicibus brevibus adventivibus vestiti et tamquam *Hedera helix* in arboribus scandentibus et 3 vel pluribus metris supra solem florentes. Stipulae persistentes patentes. Folia symmetrica vel asymmetrica basi profunde cordata vel truncata, apice acuminata, margine grosse dentata, palminervia nervis 5–8 basalibus. Inflorescentia cymosa flores masculos et femineos ferens, protandra, pauciflora, usque 4 flores masculos et usque 3 flores femineos continens floribus masculis citius deciduis. Tepala 2 in flore masculo ut in flore femineo in vivo aurantiaco-flava. Androecium fasciculum asymmetricum applanatum a 10–16 staminibus formatum, filamentis basi breviter connatis antheris in unum latus convertentibus rimis longitudinalibus lateralibusque dehiscentibus. Flores feminei cum pedicellis post anthesim valde elongatis stylis 3 basi breviter connatis omnibus bis dichotomis (ergo brachii omnium stylorum quator) brachiis inaequalibus

duobus brevioribus abaxialibus duobus longioribus adaxialibus, apice brachiorum appanato hippocrepiforme margine stigmatosi. Pistillum ellipticum, triangulare, tripterum, ala una ceteris multo majore, triloculare, placentis indivisis, axillaribus. Infructescentia usque 15 cm longa, pendula, plerumque fructum unicum ferens. Fructus maturus capsulam alatum formans apice stylis desiccatis coronatus et rimis dehiscens. Semina basi et apice comosa coma cellis testae elongatis formata.

In São Tomé et Gabon supra 900 m crescens.

3. BEGONIA THOMEANA C.DC.

Fig. 1; Map 1

3.1. TAXONOMY

C. DE CANDOLLE in Bol. Soc. Brot. 10: 123. 1893; O. WARBURG in ENGL., Nat. Pflanzenf. 1st ed. 3(6a): 140, fig. 48 D. 1894 (in section *Loasibegonia* A.DC.); HENRIQUES in Bol. Soc. Brot. 27: 191. 1917 (in sect. *Loasibegonia*, erroneously printed: *Luasiobegonia*); ENGLER in ENGL. and DRUDE, Veg. der Erde 9, Die Pflanzenw. Afr. 3(2): 618. 1921 (in sect. *Loasibegonia*); IRMSCHER in ENGL., Nat. Pflanzenf. 2nd ed. 21: 574, fig. 261 D. 1925 (in sect. *Loasibegonia*); EXELL, Cat. Vasc. Pl. S. Tomé: 191. 1944; MONOD in Bull. I.F.A.N. sér. A 22(1): 50. 1960; FERREIRA in Garcia de Orta (Lisboa) 13(4): 533. 1965.

Type material and typification: *Quintas no. 5* (São Tomé, alt. 950–1450 m, May–July 1888, lectotype and two paratypes in G; isoparatypes: 3 sheets numbered *Quintas 178* at B, 1 sheet numbered *Quintas 1273* in both COI and BM); *Quintas no. 1339* (São Tomé: Rio Contador, alt. 1450 m, isoparatype, COI).

Note: QUINTAS made two collections of *B. thomeana* on São Tomé viz. *Quintas no. 1273* collected at Traz-os-Montes at 950 m altitude in May 1888 and *Quintas no. 1339* collected at Rio Contador at 1450 m altitude in July 1888. Both gatherings are at COI and are provided with the original tickets of the QUINTAS collection. There is no doubt about the identity of the material which is very homogeneous. In the protologue DE CANDOLLE only stated: 'In altitudine 950–1450 m (F. QUINTAS)'.

According to EXELL (l.c., 1944, page 383) HENRIQUES distributed duplicates of the QUINTAS collection under numbers different from the original numbers to various herbaria for identification by specialists. In this process he often added an indication to the original labels to show under what number the duplicates had been sent and to what place. The information on the labels going with these duplicates distributed by HENRIQUES was often a summary of the information given on the original tickets. The duplicates, moreover, were selected at random from the material available, often from several gatherings.

The Geneva herbarium contains three sheets of *B. thomeana* which belong

to the QUINTAS collection; all three bear a number 5. Among these one sheet has a label on which it is stated: 'Ins. St. Thomé (950–1450 m) and legit *F. Quintas*, 5–7, 1888'. On this particular sheet a hand-written diagnosis of the plant signed by CASIMIR DE CANDOLLE is added. Moreover, *Quintas no. 1273* in COI, bears a label on which it is annotated: 'DC. no. 5, B. 178, Kew 147'.

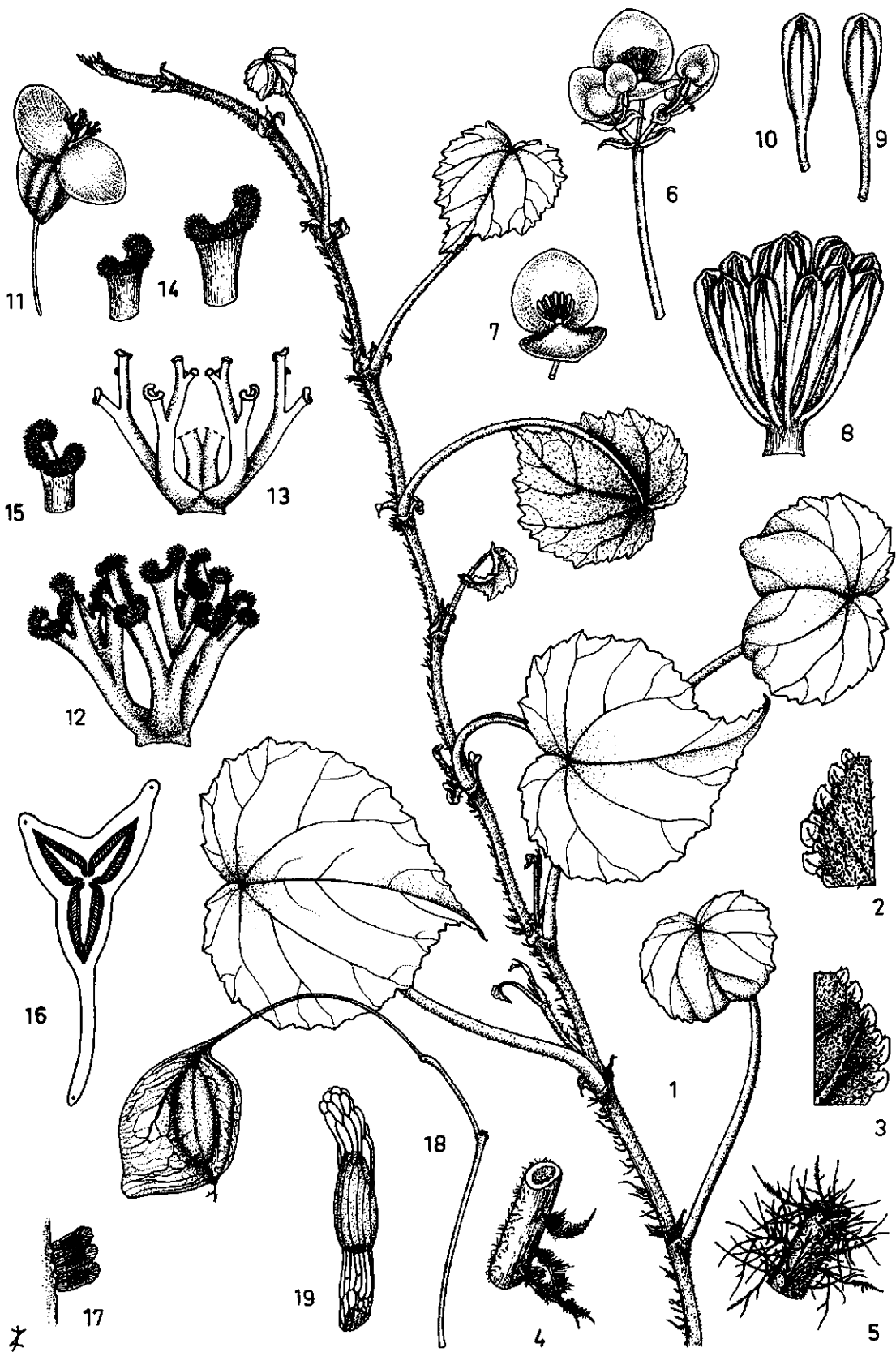
From this it is concluded that HENRIQUES sent duplicates of *Quintas no. 1273* (probably mixed with material of *Quintas no. 1339*) to DE CANDOLLE in Geneva under *no. 5* and to Berlin under *no. 178* (I have not seen this material at Kew). The eclectic label added to the Geneva duplicates gives a compilation of the information supplied by QUINTAS on the original labels of both his gatherings *nos 1273 and 1339*. It is not possible to decide whether the Geneva material is part of *Quintas no. 1273* or that it consists of a mixture of both QUINTAS' gatherings.

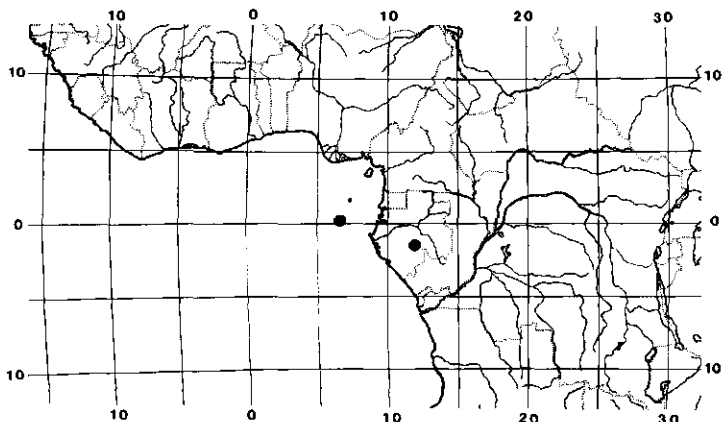
Under these circumstances the sheet bearing the annotations by DE CANDOLLE present in Geneva is selected as the lectotype. The other two sheets in G, beyond doubt also seen by DE CANDOLLE, are paratypes as it is not clear to which of the two QUINTAS gatherings they belong. All the relevant QUINTAS material present in other herbaria is indicated as isoparatypes.

Description: Monoecious creeper covering rocks on ground level but finally always climbing up trunks of trees; flowers only found three or more meters above the ground. The thin fleshy stems repeatedly branched, pale brown or reddish in vivo, terete, 1–3(–4) mm diam., up to 10 m long, profusely covered with short, adventitious roots on the side directed towards the substrata (like ivy, *Hedera helix* L.), otherwise loosely puberulous or rarely glabrescent; the indumentum composed of whitish simple hairs and minute pale brown trichomes. Internodes up to 5 cm long, usually shorter.

Stipules persistent, patent, in vivo pale green and with diaphanous often revolute edges, 6–11 mm long by 2–6 mm wide, triangular to broadly triangular, asymmetric and often somewhat sickle-shaped, outside and on the edge with a few white hairs especially near the base and loosely scattered with in vivo short brownish trichomes, inside glabrous but for a few trichomes.

Leaves long persistent, in vivo herbaceous, somewhat glossy bright green above, conspicuously glossy and paler green beneath; petioles flattened or slightly furrowed above, otherwise terete, 2–9(–10) cm long, in vivo often pale brownish-red, puberulous to glabrescent, the blade forming an almost right angle with the petiole. Blades almost symmetric to asymmetric, ovate to broadly ovate, (1,5)3–7,5(–8,5) cm, deeply cordate and with the leaf-edges slightly overlapping at the very base or the base truncate, acuminate at the apex; the margin coarsely dentate and in vivo somewhat undulating; both surfaces covered with an open sparse indumentum of short erect whitish hairs and loosely scattered with very minute brownish trichomes, the indumentum more pronounced on the upper surface; the leaves rarely almost glabrous; palmately 5–8-nerved, the nerves arising from the base, or the central ones from somewhat above the base, all nerves 1–3 times dichotomously branched, the branches reaching the margin and the tips ending in a tooth, prominent beneath, not or slightly prominent above;





MAP 1. Black dots on the island of São Tomé and in Gabon indicate localities from which *B. thomeana* C.DC. has been collected.

veins rather indistinct.

Inflorescence an axillary dichasial cyme, protandrous-androgynous, comparatively few-flowered, containing up to 4 male and 3 female flowers, exceeding the leaves at the time of flowering; one or both lateral branches (1st order) usually branched again, rarely a branch 2nd order also branched and in that case the branching monochasial. Axes first order up to 15 mm long, axes second order (if present) ca 5 mm long, glabrescent, loosely scattered with very minute brownish trichomes. Within the inflorescence each dichasial branching terminated by a male flower, the female flowers found on laterals from the ultimate dichasial cymelets; a cymelet usually consisting of a terminal male flower (see above) and a single lateral female flower, the axis opposite the female flower not developed or abortive, sometimes however both laterals developed, both bearing a female flower. Peduncle 3–6.5 cm long, at the apex with the two opposite bracts (subtending the axes 1st order); bracts 3–9 × 2–6 mm, ovate to obovate, more or less transparent, crenate and with a few minute brownish trichomes on the edge; bracts of subsequent dichasial branchings becoming

FIG. 1. *Begonia thomeana* C.DC. – 1: branch climbing with adventitious roots (× 3); 2: margin of developing leaf, upper side (× 4); 3: idem, underside (× 4); 4: section of young stem (× 2); 5: section of full-grown stem (× 1); 6: proterandrous-androgynous inflorescence (× 3); 7: ♂ fl. (× 3); 8: androecium (× 4); 9 and 10: different stamenshapes, frontal view (× 4); 11: ♀ fl. (× 3); 12: styles and stigmata (× 4); 13: idem, schematic; 14 and 15: different shapes of stigmata (× 6); 16: transverse section of ovary, ca in the middle (× 4); 17: part of ovuliferous placenta (× 20); 18: infructescence (× 3); 19: mature seed (× 26). – 1: living material introduced from São Tomé by *De Wilde, Arends and Groenendijk* (herb. no. 141) and *Van Veldhuizen* 882, spirit material from the same introduction; 2–4 and 7–17: *De Wilde c.s. 141*; 5, 18, 19: *De Wilde, Arends, Bouman, Karper and Louis* 521 from Gabon; 6: *Groenendijk* 138.

smaller, otherwise similar. Male flowers readily caducous and then the inflorescence seemingly female.

Male flower supported by a 3.5–13 mm long 'pedicel', the length dependent on the place in the cyme. The 'pedicel' (the support of a single male flower) distinctly articulated near the base; the part above the articulation (the perianth-cylinder) 3–12 mm long, loosely scattered with minute brownish trichomes; the part below the articulation (the true pedicel) 0.5–1.0 mm long, with slightly denser indumentum and darker in colour, otherwise similar. Perianth-segments (tepals) two, opposite, in vivo orange-yellow, 12–20 mm in diameter, very broadly ovate, cordate at the base, glabrescent, the basal part on the outside scattered with minute trichomes. Androecium fasciculate, asymmetric; stamens 10–16, arranged in the way of a raceme of bananas. Filaments fused at the base over 0.5–1.5 mm, otherwise free; 1.5–3.5 mm long. Anthers all facing the same direction, 2.0–3.5 × 1 mm, narrowly oblong to obovate, truncate to obtuse at apex, opening more or less laterally, lengthwise; the actual slits widest near the apex.

Female flower long pedicellate; the pedicel (in fact an ultimate axis of the inflorescence) variable in length, 5–25 mm long but largely elongating in fruit, puberulous by minute trichomes. Perianth-segments (tepals) two, similar to the segments found in male flowers; the margins of both segments fused at the extreme base and the segments directly implanted on the top of the ovary. Styles 3, long persistent, fused at the base over ca 1 mm; each style forked twice, the first forking ca 1.5–2 mm above the fused part, a second forking into branches of uneven length (up to 4 mm and 2 mm long respectively) ca 1.5 mm higher, the forkings in two perpendicular planes, resulting in a 4-armed style, the two shorter arms abaxial. Apical part of each arm thickened, flattened and curved in the shape of a horseshoe, the rim densely papillose, the papillae glanduliferous (stigmatic tissue). Ovary 3-winged, in vivo green, trigonous, ellipsoid, up to ca 15 × 7 mm (wings excluded), scattered with minute brownish trichomes all over. The wings unequal in size, one wing much more developed as compared to the others; each wing starting as a sharp keel at the base of the ovary; the larger wing gradually expanding and reaching a width of 5–7 mm (ca 4 mm underneath the apex of the ovary) from where it narrows and from where the outline continues along a rather straight line towards the apex; the other wings widest in the basal part, reaching a width of up to 1.5 mm and gradually narrowing towards the apex. The ovary 3-locular with axile placentation. Placentas entire, flat, stretching deep into the locules, densely packed with ovules on both sides; the ovules side by side, perpendicular to the surface of the placenta (see also REITSMA, 1984).

Infructescences drooping, up to 15 cm long, usually containing one fruit, rarely more; the peduncle reaching a length of 6.5 cm, firm, brown, longitudinally finely furrowed; the axis first order up to 2.5 cm long, somewhat thinner and flattened; the fruiting pedicel up to 4.5 cm long, flattened and furrowed as well; the fruit hanging by the long pedicel. Mature fruit a dry, brown, trigonous, winged capsule, up to 3.5 cm long, still crowned by the persistent styles; the larger wing thick pergameneous, strongly veined, reaching a width of 2.2 cm;

the other two wings much narrower, up to 0.5 cm, otherwise similar. Dehiscence by slits formed by the pericarp breaking away from the wings but leaving the latter intact and, moreover, by longitudinal splitting of the septa; the process progressing from the base of the capsule towards above, not reaching the apical zone, however.

Mature seed glossy light brown, very characteristic as a result of the much enlarged testa cells found at the base and apex which give the seed a tufted appearance, 0.9–1.3 × 0.2–0.3 mm (the tufts included). For details, see 3.2.

Distribution: São Tomé, Gabon.

Distributional, ecological and biological notes: Until recently *B. thomeana* was only known as a narrow endemic species from the island of São Tomé. A reference to its occurrence in Cameroun by BARKLEY (1972, 1974) could not be substantiated. On São Tomé it is found in the mountain rain-forest that stretches from Lagôa Amelia to the Pico de São Tomé and in the corresponding range of what is called the mist-forest region by EXELL (l.c.: 21, 1944) at altitudes between 950 m and 1700 m. In February 1983, during a botanical expedition to Gabon the species was discovered for the very first time on the continent. It was collected in southern Gabon in the Massif du Chaillu, ca 15 km along the road Mimongo-Mbigou on the top of Mount Naguila in (sub-)montane forest at 880 m altitude (teste *J. J. de Wilde, Arends, Bouman, Karper and Louis no. 521, WAG*). In November 1983 a second expedition to the same area found *B. thomeana* in primary forest on neighbouring Mt Songou (1°37'S. × 11°46'E.) at ca 1020 m altitude (teste *A. M. Louis, Breteler and De Bruijn nos 982 and 983, WAG*). The physiognomy of this habitat of *B. thomeana* in Gabon, although somewhat lower in altitude, strikingly resembles that of where the species was found on São Tomé, where it was collected among others by *De Wilde, Arends and Groenendijk (no. 141, WAG)*. The trees do not reach such large dimensions as at lower altitudes and almost all are profusely covered with epiphytes, predominantly mosses and ferns. The rainfall is high and mist is a common feature.

From a taxonomic (and phylogenetic) point of view close relatives of *B. thomeana* do not occur on São Tomé. However, on the continent and in particular in the Lower Guinea subdivision of the Guineo-Congolian Region, *Begonia* clearly shows a centre of variation as testified by the occurrence of about 50 species in Gabon only (out of ca 125 species on the continent). None the less in Gabon *B. thomeana* seems to occupy an isolated taxonomic position as well. The fact that populations of the species on São Tomé and in Gabon resemble each other so closely and in the course of evolution remained unchanged, combined with the observation that variability and species segregation among African *Begonia* taxa is a common and wide-spread feature, once again points into the direction of the here adopted status of *B. thomeana* as a section by itself.

At maturity the dry winged fruits are pendulous and dehiscence with slits. This in combination with the special structure of the seed which is equipped with a

pair of 'flying tufts', indicates dispersal by wind (see also BOUMAN and DE LANGE (1983), and the following paragraph).

In cultivation *B. thomeana* is difficult to grow owing to its high requirements as regards shade and humidity of the air.

Specimens examined:

SÃO TOMÉ: between Monte Café and the Pico, *Chevalier 14539* (P); between Lagôa Amelia and Calvario, *J. J. de Wilde, Arends and Groenendijk 141* (WAG); near Vanhulst (Macambarará), *Exell 419* (BM, BR, COI, MO); between Lagôa Amelia and Calvario, *Groenendijk 138* (WAG); Lagôa Amelia, *Monod 11782* (BM, COI); Calvario, *Monod 11844* (BM, COI); slopes N.W. of the Pico, *Monod 12253* (BM, COI); Ins. St. Thomé (950–1450 m), legit *F. Quintas, 5–7, 1888, Quintas 5* (G, 3 sheets, lectotype and two paratypes); sin. loc., *Quintas 178* (B, 3 sheets, isoparatypes); Traz-os-Montes, *Quintas 1273* (BM, COI, isoparatypes); Rio Contador, *Quintas 1339* (COI, isoparatype).

GABON: Massif du Chaillu, Mt. Naguila, ca 15 km on the road Mimongo-Mbigou, ca 4 km S.E. of Mouyanama, *J. J. de Wilde c.s. 521, 1983* (WAG, Libreville-LIBRV-); Massif du Chaillu, Mt. Songou between Dibandi and Mouyanama, ca 20 km E. of Mimongo, *A. M. Louis, Breteler and De Bruijn 982* (WAG, LIBRV); *ibid.*, 1°37'S. × 11°46'E., *A.M. Louis c.s. 983* (WAG, LIBRV).

CULTA: Agricultural University Wageningen, The Netherlands; from living material originally introduced by *De Wilde, Arends and Groenendijk* from São Tomé, *Van Veldhuizen 882* (WAG).

3.2. SEED STRUCTURE OF *B. THOMEANA* C.DC.

(BY F. BOUMAN, HUGO DE VRIES LABORATORY, UNIVERSITY OF AMSTERDAM)

Shape and size:

Seeds narrowly elliptic to narrowly oblong in outline, one or both of its sides sometimes curved and rendering the seeds J-, or slightly S-shaped (Figs. 2a and b). Micropylar and chalazal ends of the seeds composed of blown-up, air-filled cells (Figs. 2c and d). The central part, covered by the collar cells, contains the embryo. Micropylar, central and chalazal part each take up about one third of the seed.

Seeds of *B. thomeana* from Gabon (*De Wilde c.s. 521*) vary in length from 11.0 to 12.9 × 10⁻⁴ m, in width from 2.1 to 2.6 × 10⁻⁴ m; mean 12.0 × 2.4 × 10⁻⁴ m. Length: width ratio 5. Central part: seed length ratio 3.5.

Seeds of *B. thomeana* from São Tomé (*Quintas 5*, lectotype, G) slightly differ in dimensions: variation in length from 9.4 to 11.8 × 10⁻⁴ m; in width from 2.3 to 2.6 × 10⁻⁴ m; mean 10.0 × 2.4 × 10⁻⁴ m. Length: width ratio 4.2. Central part varying in length from 3.4. to 3.9 × 10⁻⁴ m; mean 3.6 × 10⁻⁴ m. Central part: seed length ratio 2.8.



FIGS. 2a - e *Begonia thomeana* C.DC. SEM photomicrographs. a: mature seed (*Quintas 5*, São Tomé, lectotype); b: mature seed (*De Wilde c.s. 521*, Gabon); c: micropylar part; d: detail of blown-up chalazal cells with striate cuticle; e: detail of collar cells with collapsed outer walls, reflecting pits; FIG. 2f *Begonia glabra* Aublet var. *cordifolia* (C.DC.) Barkley, seed.

Primary sculpture:

Collar cells strongly elongated, regular; the anticlinal cell walls between the collar cells straight. Border line with the micropylar part sharp, that with the chalazal part more indented. Outer periclinal walls thin, collapsing in the mature seed and reflecting the pitted structure of the inner periclinal wall (Fig. 2e).

Testa cells of the chalazal part irregularly arranged, elongated, especially those adjacent to the collar cells. Outer periclinal walls bulging towards the chalazal apex. Anticlinal walls straight or slightly curved.

Operculum massive. Exostome rim oblique, the longer side often cristate. Hilum sunken, hidden by the exostomal rim. Appearance of the cells resembling that of the chalazal ones.

Micromorphology:

Collar cells with sunken anticlinal boundaries. Due to the bulging outer walls, this character is not so conspicuous in the other parts of the seed. Surface of the testa cells with a striate cuticular ornamentation. Striae varying in length and density, sometimes locally with slight undulations. Testa cells sometimes with one or more patches lacking any sculpture. Cuticular pattern most prominent on the chalazal part and almost absent on the collar cells, the latter often with (mainly transverse) folds on the collapsed outer wall.

Sectional relationships:

The seed morphology of *Begonia thomeana* is highly aberrant from all African *Begonia* species thus far studied. The micropylar and chalazal ends of the seed consisting of air-filled cells are supposed to function as balloons, thus promoting wind dispersal. Although the majority of the *Begonias* have wind-dispersed seeds, a specialized construction as balloon cells is but rarely encountered. A comparable structure has been found in some American species, by the author in *B. glabra* Aublet var. *cordifolia* (C.DC.) Barkley (Section *Pritzelia*, Fig. 2f) and had already been described by SEITNER (1972) in *B. odorata* Willd. (Section *Begonia*) and *B. lobata* Schott (Section *Ewaldia*).

In IRMSCHER'S classification *B. thomeana* is placed in section *Loasibegonia*, but the seeds of this section are very different from those of *B. thomeana*. They are characterized by their small size (mostly under 0.3 mm), curved anticlinal walls and a thick cuticle with a much pronounced ornamentation (DE LANGE & BOUMAN, 1985). The seeds of section *Loasibegonia* closely resemble those of section *Scutobegonia*. Hydro/ombrochory and epizoochory are probably the most important forms of dispersal.

The morphological seed characters support the establishment of a separate section *Cristasemen* for *B. thomeana*.

3.3. KARYOLOGY

Ir. J. C. ARENDS (pers. comm.) informs us that the somatic chromosome

number of the cultivated specimen of *B. thomeana* (greenhouse accession number T1268, voucher herbarium *De Wilde, Arends & Groenendijk no. 141, WAG*) is $2n = 38$. Its karyotype is similar to that of several species of the section *Scutobegonia* such as *B. ciliobracteata* Warb. The total chromosome length of the somatic complement is about 25 μm .

4. DISCUSSION

Originally WARBURG (1894) accommodated *B. thomeana* in section *Loasibegonia* A.DC. (1864: 389). This section, in its original circumscription by ALPHONSE DE CANDOLLE, is characterized by two yellow perianth-segments in both male and female flowers and a 4-locular elongated prismatic 4-ribbed ovary crowned by 4 styles which are connate in the lower part and which bear reniform stigmas at their apices. Furthermore there are 4 entire placentas, one in each locule. At the time DE CANDOLLE only knew *B. prismatocarpa* Hook., which thus automatically fixes the type species. Mature fruits were not known to DE CANDOLLE.

WARBURG (1894: 140) added 4 species to this section and among these mentioned only *B. thomeana* and *B. quadrialata* Warb. specifically. On this occasion the circumscription of section *Loasibegonia* was altered. By now 3 or 4 styles were admitted and these might even be branched manifold (as found in *B. thomeana*). Most remarkably, the placentas were now unequivocally indicated as bifid, a condition not found in any of the species cited by WARBURG (see also REITSMA, 1984).

ENGLER (1921: 618), following WARBURG's opinion that the placentas in section *Loasibegonia* are bifid, excluded *B. quadrialata* from the section (this species is transferred to section *Scutobegonia* Warb.). Next to *B. prismatocarpa* and *B. thomeana* he admitted 4 other species into the section, viz. *B. scutifolia* Hook.f., *B. scapigera* Hook.f., *B. dusenii* Warb. and *B. schäferi* Engl. The main criterion used by ENGLER to incorporate these 4 species into section *Loasibegonia* is probably found in the condition that the ovaries and fruits of these species are almost devoid of wings.

IRMSCHER (1925: 574) repeated the description of section *Loasibegonia* supplied by WARBURG almost verbatim, stating again: 'Samenleisten 2 spaltig. Frucht prismatisch, manchmal sehr lang, mit 3-4 meist schmalen, zuweilen nur angedeuteten Flügeln'. He admits 6 species, probably following ENGLER (see above).

NICOLAS HALLÉ (1967: 507), in a discussion on the sections *Loasibegonia* and *Scutobegonia* cited a number of species that at one time were accommodated in section *Loasibegonia* and at another time in *Scutobegonia* and vice versa. From this he concluded that the characters used in separating both sections are inconsistent and that in his opinion both sections should be merged into one taxon

for which he supplied a circumscription. In HALLÉ's new concept both entire and bifid placentas are admitted and the fruits are dry and winged or not winged. The inflorescence, more in particular, is described as a monoecious, proterandrous, 'pseudo-umbel' terminated by one (rarely two) female flower(s) flanked by usually 2, and more rarely 3–5, male flowers.

Although we do not have detailed information on all the species belonging to both sections, we analysed and studied a number of them and concluded that the fruits remain more or less fleshy and do not dehisce as maturity, as opposed to the dry dehiscent fruits of sect. *Cristasemen* (see also our opinion about a necessary transfer of section *Scutobegonia* series *Longicaules* Engl. to section *Filicibegonia* A.DC. on page 127). As regards the structure of the inflorescence in the sections *Loasibegonia* and *Scutobegonia* we disagree with HALLÉ. In our opinion the female flower represents a lateral of a contracted monochasial cyme. This however, applies also to the situation found in section *Cristasemen*. HALLÉ attributed both sections to WARBURG as the publishing author, ignoring DE CANDOLLE. Using A. DE CANDOLLE's original diagnosis of section *Loasibegonia* as a basis it might, in our opinion, still be possible to keep it apart from section *Scutobegonia*. Our current knowledge does not allow us to solve the problem. Whatever the outcome may be we feel that *B. thomeana* does not fit in either section nor in any of the other sections known at present. This view is based on the observation of the following characters which we consider to be of primary importance for a sectional arrangement:

1. the habit of the plants;
2. the number of perianth-segments in both male and female flowers;
3. the placentas;
4. the fruit;
5. the seeds.

These characters are discussed hereafter for section *Cristasemen* and in relation to the above-mentioned sectional arrangement of the continental African species often placed in a wider context.

– 1. In section *Cristasemen* the plants are climbing on trees by means of numerous short adventitious roots. This habit represents a unique growth-form as far as African *Begonia* species are concerned. It is, however, also found in some extra-African sections but then always associated with very different character combinations.

– 2. Section *Cristasemen* shows 2 perianth-segments in both male and female flowers. This is a common feature in a number of African sections viz. in *Baccabegonia*, *Filicibegonia*, *Loasibegonia*, *Mezierea*, *Scutobegonia* and *Squamibegonia*. This character is very constant and holds for all species belonging to these sections. To our knowledge it only breaks down for section *Mezierea*, where *B. meyeri-johannis* Engl. shows 4 tepals in the male flowers and 2 in the female flowers. The stability and value of this flower character on a sectional level is further emphasized by the outcome of IRMSCHER's (1961: 106) monographic revision of the African sections *Augustia* (Klotzsch) A.DC. and *Rostrobegonia* Warb. comprising 29 species in all. Among these he found 7 species characterized

by male flowers showing 2 perianth-segments (the other species have 4) whereas none of these 29 species showed 2 perianth-segments in the female flowers (the number is here 3, 4, 5 or rarely 6). In sect. *Tetraphila* A.DC. recently defined by DE WILDE & ARENDS (1979: 357) all ca 35 species have 4 perianth-segments in both male and female flowers though there is a tendency towards suppression of the innermost perianth-whorl in flowers of both sexes as demonstrated by HAGMAN & DE WILDE (1984) in *B. cavallyensis* A. Chev.

– 3. REITSMA (1984) studied the placentation in African *Begonia* species and came to a division into two main groups based on the criterion of the nature of the septa which are either true or partly false. He subdivided these main groups into subgroups using exclusively the characters of the placentas and finally arrived at species groups in which the species share a number of placentation characters. According to this findings *B. thomeana* C.DC. is characterized by completely true septa and by a single axile entire placenta in each of the three locules of the triangular ovary. The ovules are regularly arranged in a single layer around the placentas. A similar character combination he found in six other species at present accommodated in the sections *Scutobegonia* (1 species), *Rostrobegonia* (1 species) and *Augustia* (4 species). With regard to the latter two sections we found that two perianth-segments in the female flower, as in *B. thomeana*, are inadmissible (see above). The single species (traditionally accommodated in section *Scutobegonia* viz. *B. sciaphila* Gilg ex Engl.) analysed and admitted to this species group by REITSMA, belongs, in our opinion, to section *Filicibegonia*. The same holds for *B. sessilifolia* Hook.f., *B. elatostemmoides* Hook.f. and *B. macrocarpa* Warb., placed by REITSMA in a different but closely related species group and traditionally also placed in section *Scutobegonia*.

Summarizing it may be stated that the placentation found in *B. thomeana* excludes it from the sections *Baccabegonia*, *Mezierea*, *Squamibegonia* and *Tetraphila* and that it shows similarities with the placentation found in the remaining continental African sections. At the same time it is concluded that placentation characters alone are insufficient to arrive at a sectional arrangement.

– 4. The characters of the fruit as shown in *B. thomeana*, viz. a dry winged capsule opening with slits, are similar to those found in the sections *Augustia*, *Rostrobegonia*, *Sexalaria* A.DC. and *Filicibegonia*. Among these the first three sections never show 2 perianth-segments in the female flowers (see also above). Section *Filicibegonia*, in our concept comprising besides *B. asplenifolia* Hook.f. also section *Scutobegonia* series *Longicaules* Engler (1921: 616), forms a homogeneous taxon of white or pinkish flowering, rather low terrestrial branched herbs showing 2 perianth-segments in both male and female flowers. Despite of the signalized similarities in the characters of flowers, placentation and fruits we strongly feel that it is not warranted to place *B. thomeana* in section *Filicibegonia*, taking into account its climbing growth-form, the unique seed morphology and as additional segregating characters the singular forkings of the styles and the yellow colour of the flowers.

– 5. BOUMAN and DE LANGE (1982, 1983) demonstrated that micromorphological characters of the seeds are of great taxonomic value in *Begonia*. Recent re-

search by these authors (DE LANGE and BOUMAN, 1985) points, more in particular, to the diagnostic value of these characters with regard to the delimitation of sections, at least as far as the African taxa are concerned. In this context it can be put forward that the seeds of *B. thomeana* show a morphology which stands completely apart from the rest of the *Begonia* species on the African continent. For details, see paragraph 3.2.

Weighing the evidence and data discussed above it is concluded that *B. thomeana* occupies an isolated position within the African species and that it is justified to give this taxon a sectional status.

SUMMARY

In 1983 botanical exploration in Gabon revealed the occurrence of *B. thomeana* on the African continent. This species was hitherto considered to be a narrow endemic confined to the island of São Tomé. Subsequent analysis of the collected plants and of all living material and herbarium specimens available leads to the conclusion that the circumscription of none of the known sections in *Begonia* permits the inclusion of a combination of characters as shown by *B. thomeana*. As a consequence of this a new section *Cristasemen* is proposed and circumscribed and its place among the continental African sections is discussed. The type species, *B. thomeana*, is lectotypified and its distribution, ecology and karyology are given. Dr. F. BOUMAN contributed a description of the micromorphology of the very characteristic seed which shows a specialization functional to wind-dispersal.

ACKNOWLEDGEMENTS

The author is grateful for the cooperation of the Directors and Curators of the herbaria cited in the text, who willingly sent herbarium material on loan. He wants to express his gratitude to Mrs. Dr. G. J. H. AMSHOFF who latinized the diagnosis of the new section. Professor J. DOORENBOS of the Department of Horticulture, several members of the Department of Plant Taxonomy and in particular Drs. R. G. VAN DEN BERG contributed to and commented upon the manuscript; they are gratefully acknowledged. Miss IKE ZEWARD prepared the fine drawing. Mrs. J. M. VAN MEDENBACH DE ROOY-RONKEL corrected the English text. The expedition to Gabon in January-March 1983, during which *B. thomeana* was collected, was partly financed by the STANLEY SMITH Horticultural Trust, Dunbar, Scotland. The members of the expedition are grateful to its Director, SIR GEORGE TAYLOR and the Trustees for their generous support.

The Netherlands Foundation for the Advancement of Tropical Research (WOTRO) participated in the funding of this expedition as well. In Gabon the Centre National de la Recherche Scientifique et Technologique (CENAREST) under the directorship of Dr. CHARLES MEFANE spared pains nor expenses to facilitate our work.

REFERENCES

- BARKLEY, F. A., 1972. The species of the *Begoniaceae*. The Buxtonian, **1**, Suppl. 5: 1-120.
- BARKLEY, F. A. & J. GOLDING, 1974. The species of the *Begoniaceae*, 2nd revised edition.
- BOUMAN, F. & A. DE LANGE, 1982. Micromorphology of the seed coats in *Begonia* sect. *Squamibegonia* Warb. Acta Bot. Neerl. **31**(4): 297-305.
- BOUMAN, F. & A. DE LANGE, 1983. Structure, micromorphology of *Begonia* seeds. The Begonian, **50**: 70-78.
- DE CANDOLLE, A., 1864. Prodrômus systematis naturalis regni vegetabilis **15**. Paris.
- DE LANGE, A. & F. BOUMAN, 1985. The importance of seed morphology for the classification of African *Begonia* sections. Acta Bot. Neerl. **34** (in pres).
- DE WILDE, J. J. F. E. and J. C. ARENDS, 1979. *Begonia loranthoides* Hook.f. (sect. *Tetraphila* A.DC.). Acta Bot. Neerl. **28**(4-5): 357-374.
- ENGLER, A., 1921. Die Pflanzenwelt Afrikas 3(2). Die Vegetation der Erde 9. Leipzig.
- FERREIRA, J. H. PEREIRA DE BARROS, 1965. *Begoniaceas* de S. Tomé e Príncipe. Garcia de Orta (Lisboa) **13**(4): 525-544.
- HAGMAN, F. A. & J. J. F. E. DE WILDE, 1984. Re-establishment of *Begonia cavallyensis* A. Chev. etc. Meded. Landbouwhogeschool Wageningen 83-9: 1-19.
- Hallé, N., 1967. Deux *Begonia* du Gabon analysés sur le vif. Adansonia sér. **2**, 7(4): 507-512.
- IRMSCHER, E., 1925. *Begoniaceae* in: ENGLER & PRANTL, Die natürlichen Pflanzenfamilien 2nd ed. **21** Leipzig.
- IRMSCHER, E., 1961. Monographische Revision der *Begoniaceen* Afrikas I. Sekt. *Augustia* und *Rostrobegonia* in: ENGLER, Bot. Jahrb. **81**(1-2): 108-188.
- KERAUDREN-AYMONIN, M., G. G. AYMONIN & J. BOSSER, 1983. *Begoniaceae* in: Flore de Madagascar et des Comores.
- LANGE see DE LANGE
- MONOD, Th., 1960. Notes botaniques sur les îles de São Tomé et de Príncipe. Bull. I.F.A.N. sér. A, **22**(1): 19-94.
- REITSMA, J. M. 1984. Placentation in *Begonias* from the African continent. Meded. Landbouwhogeschool Wageningen 83-9: 21-53.
- SEITNER, P. G., 1972. Some observations on *Begonia* seeds. The Begonian **39**: 47-55.
- WARBURG, O., 1894. *Begoniaceae* in: ENGLER & PRANTL, Die natürlichen Pflanzenfamilien 3(6a). Leipzig.
- WILDE see DE WILDE.