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# New species of *Begonia* in Africa and their relevance to the study of glacial rain forest refuges

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## Summary

Eight new species in the closely related sections *Loasibegonia* and *Scutobegonia* are described one of which has two varieties. Data on the distribution of the species belonging to these sections in combination with their phylogeny are supposed to lead to a better understanding of the spectacular changes in the vegetation which took place during glacial periods. The group seems ideal for such a study.

**Keywords:** Africa, *Begonia*, biogeography, biodiversity, endemism, glacial, palaeoenvironment, rain forest refuges, speciation, vegetation

# 1 Glacial rain forest refuges in Africa

## 1.1 Introduction

During the last glacial (approximately 75,000-12,000 years B.P.) climatic conditions that prevailed in tropical Africa were markedly different from those today. The main elements which determine a tropical climate are temperature, humidity and length of the dry season. All three variables changed drastically during the last glacial period. Research on the change in temperature shows that it was 3-6 °C cooler, depending on the location (e.g. Diamond & Hamilton, 1980: 395-398; Hamilton, 1982: 244 ff.; Maley, 1987). The amount of precipitation decreased, in some locations more pronouncedly so than in others (e.g. Livingstone, 1982; Maley, 1987). Maley (1987) emphasized the increasing influence of cold seawater upwellings along the coast of Angola, Gabon and further west during the last glacial. These upwellings induced a major increase in stratiform cloud cover that was responsible for an extra cooling and desiccation of the adjacent coastal land areas. The length of the dry season increased in consequence of these effects.

Such major climatic changes must have had a profound impact on the tropical rain forest of that time. A general decrease in size of its area took place, and it receded from most of the areas where it is present today. The localities in which tropical rain forest survived can be looked upon as refuges for rain forest species. However, a clear distinction, which is not always made in literature on forest refuges, must be made between lowland and montane rain forest refuges. The changing in climatic circumstances had different influences on montane rain forests and on lowland ones. The decrease in temperature resulted in a descent of the montane rain forest belts. Thus, in places with sufficient humidity, the area of montane rain forest could actually increase and it has been shown that montane forest occurred at low altitudes (Elenga & Vincens, 1990; Maley et al., 1990). I am however not inclined to presume that in those days montane rain forest formed an almost continuous belt from the east African mountains through Angola towards western Cameroon as for example Hall & Moreau (1970: ix) suggest. The general decrease in precipitation will probably not have allowed for such a major extension. Data mentioned in e.g. Livingstone (1982) from the east African mountains do not confirm the idea of a major extension, moreover nowhere on these mountains proof of the existence of a forest vegetation during the last glacial was found. Several areas of montane rain forest will probably have existed under local, more favourable conditions in Angola and southern Zaire. These might have acted as stepping stones for migrating forest organisms which then resulted in the comparatively high floristic affinities encountered between montane regions in east Africa and Cameroon

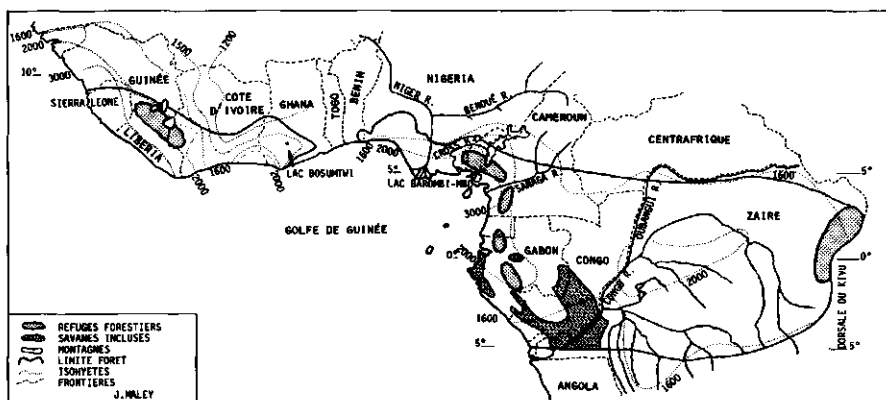


Fig. 1. Map with postulated refuge areas of tropical rain forest during the last Glacial. (from Maley, 1987: fig. 1. Used with permission of the author and publisher.)

(Hamilton, 1976, 1982).

Yet another cause of the disagreement between Hall & Moreau and myself might be that different authors are using different definitions of montane rain forest. Of course drier and wetter types do exist and the picture might be very different from the one outlined above when also drier types are taken into consideration.

In the few places in the lowland of central Africa where a forest vegetation during the last glacial was encountered (through palynological research) it appears that this vegetation contained certain montane elements. Therefore I think that true lowland forest species could survive only in a comparatively narrow altitudinal zone (of say 0-300 m) and that above this zone a narrow transition zone towards a montane rain forest vegetation was present.

In my opinion Maley's (1987) map (see fig. 1) represents the most accurate view. It shows that the main areas where rain forests in the general sense survived are situated in the regions Liberia/Ivory Coast, Cameroon/Gabon and eastern Zaire. Maley adjusted the location of the Cameroon-Gabon refuge outlined by e.g. Endler (1982) and proposed several smaller refuges. His adjustments are based on climatological data which were deduced from the research on cold upwellings along the western coasts of Africa (Maley, 1987, 1989). In view of the fact that nowhere in the east African mountains any trace of forest vegetation was encountered, it is my opinion that the E.-Zaire refuge should be adjusted as well. Because according to Livingstone (1982) and others there is no evidence for the occurrence of rain forest above roughly 1,000 m, areas situated above this altitude should be excluded from the refuge area proper.

In conclusion, lowland forest species could survive in the lower parts of the postulated refuge areas, while montane species could do so at the upper parts.

## 1.2 Evidence for refuges

The most convincing evidence that major vegetational changes did occur during the last glacial is provided by palynological analysis of sedimentary cores. From eastern tropical Africa comparatively many cores from the mountains have been studied. The cores all indicate more or less similar vegetational changes. Forests on these mountains were absent roughly from at least 35,000 years B.P. to 12,500-9,000 years B.P. depending on local conditions (Livingstone, 1982; Hamilton, 1988). Data from western tropical Africa are scarce, the most important being those of Maley (1987, 1989). He showed that in Ghana the rain forest was replaced by savanna during the last glacial. In western Cameroon at an altitude of 300 m Maley found a continuous sequence of pollen from forest species right through the coldest phase of the last glacial. With this result Maley was the first scientist who inferred the locality of a refuge area from palynological data.

Evidence for the geographic position of rain forest refuges can also be deduced from the distribution patterns of extant organisms. Assuming that at least part of the species which were 'captured' in refuges during the glacial were not capable of migrating out of these again when conditions improved, one may expect that at present there is a comparatively high degree of diversity and endemism in the area of the former refuges. Authors like Aubreville (1962) and Moreau (1969) tried to locate refuges by tracing centres with high degrees of endemism. However, recently scientists have started to combine distributional with geological and palynological information (e.g. Hamilton, 1976, 1988; Diamond & Hamilton, 1980; Maley, 1987). Their approach has undoubtedly led to a more solid base for the theory of rain forest refuges. Livingstone (1982: 531-532) recommended a very cautious use of biogeographical data. One may easily be trapped in circular arguing. Large diversity may, but certainly does not always, point to glacial refuges.

It is generally accepted that the establishment of lowland forest refuges in formerly more expanded forest areas can be looked upon as a vicariance event and is an ideal situation for speciation (Simpson, 1988 and several authors in Prance, 1982a). Widespread species become separated evolutionary units with their own evolutionary fate. The units might evolve into separate species and when the forest area increases once more, these species may either remain distinct or, when no sufficient isolation mechanism of any kind has been evolved, merge into one another. In the second case contact zones and/or geographical clines might result. In case the species remain distinct, we are dealing with closely related sister species occupying either vicariant or overlapping areas. Consequently information on the phylogeny of a group of organisms will be very conducive to the study of rain forest refuges. In case several examples are encountered of pairs of sister species showing the same kind of allopatric distribution, it is very likely that this distribution was caused by a single historical event viz. the falling apart of their ancestral area. Unfortunately only very few studies

involving cladistic biogeography have been published yet. Simpson (1988) also points to the need for this kind of studies.

### 1.3 Begonias and the study of refuge areas

The new species of *Begonia* described here belong to a group of plants which seems to be very promising for a study on forest refuges (see also Sosef, in prep.). They belong to the sections *Loasibegonia* and *Scutobegonia*. However, it is very doubtful whether these sections can be maintained (Sosef, 1991). The group, which comprises at present forty species, is most likely monophyletic because it is characterized by several apomorphic features which are rare or even unique within *Begoniaceae* (see Sosef, in prep.). Without exceptions these species inhabit wet or moist primary or rarely old secondary tropical rain forests, both lowland and montane, and they usually are narrow endemics. The seeds are not dispersed very far away from the plant. The fruits do not dehisce, as they do in many other *Begonia* species, but they remain attached to the plant and ultimately desintegrate. The seeds fall on the forest floor and may be dispersed by a thin layer of water running over the soil surface and/or with mud that clinges to the legs of forest animals. In several species the peduncles bend down towards the substrate and so deposit the fruit and seeds close to the plant base. Since such a dispersal mechanism is not very effective (in terms of dispersal ability) it is possible that their distribution areas still more or less coincide with the former refuge areas. It has been observed in glasshouse conditions that self-pollination rarely results in the production of fruits. For species with a self-incompatibility system it is even more difficult to migrate away from the original population. Two plants and thus beforehand not only one but two seeds are needed for reproduction.

The refuges formed during the last glacial existed some 25.000 years, which is evolutionary spoken a rather brief period. Thus, studying speciation caused by the development of lowland rain forest refuges demands the availability of species which are able to evolve comparatively quickly, for example species with a short life cycle. So, herbs, such as begonias, are particularly suitable. In other words, the group under consideration has several features which seems to make it ideal for the study which is being performed at present. The results are intended to be published in the near future.

In connection with this research I am most interested to become acquainted with well-elaborated phylogenetic trees from tropical African organisms, plants or animals, in order to compare them with my own data. Such a comparison would greatly strengthen any conclusions about rain forest refuges. Anyone working on the phylogeny of a group of species from the area, or having knowledge of published articles which contain such information, is strongly encouraged to contact the author.

It is hoped that this study will encourage others to review their own data in the light of the glacial rain forest refuge theory. The topic can also reveal

important information for future nature conservation since high degrees of endemism and diversity are expected at the location of former refuges as was already stressed by Myers (1982). In sharp contrast to the situation in S.-America, where e.g. Prance (1973, 1982b), Whitmore & Prance (1987) and Van der Hammen (1974) published extensively on the topic, it is not given much attention by taxonomists, especially botanists, working on African organisms.



## 2. Descriptions

All species described below belong to the sections *Loasibegonia* and *Scutobegonia*. General characteristics of these sections are given by Sosef (1991).

The description of the shape of the ovary and fruit refers to the outline in side view.

### 2.1 *Begonia adpressa* Sosef spec. nov.

Fig. 2, Map 1

- TYPE: W.J. de Wilde & De Wilde-Duyfjes 2325 (WAG!, holo; BR!, EA, K!, MO!, P!, PRE, YA!, Z!): 'Cameroun, Bamena, ca 15 km W. of Banganté. Alt. 1200 m, 29-IV-1964.'

Diagnosis: *B. schaeferi* similis, a qua differt foliis marginibus non vel haud dentatis et venis densiter adpresse pilosis.

Plant 13-28 cm high. **Rhizome** rather stout and compact, sparsely hirsute especially around the leaf-axils or not and in addition usually sparsely scattered with minute glandular hairs; the top of the foliated part not or slightly ascending. **Stipules** very broadly triangular-ovate to triangular, acute to blunt, 3.1-9.1 mm long; margin entire, glabrous or with a few cilia at the top. **Leaves** peltate; **petioles** usually continuing into the main nerve with a distinct angle, inserted at 12-23 mm from the nearest margin, 6.0-27.0 cm long, juicy, reddish, hirsute or sparsely so with long, wavy and antrorsely appressed or somewhat curly and more or less patent hairs and in addition scattered with minute glandular hairs; **leaf blade** in more or less horizontal position, almost symmetric to asymmetric, elliptic-ovate to broadly ovate or broadly elliptic, usually distinctly acuminate in the upper 1/4 to 1/10, sometimes with a few coarse and shallow distant teeth in the apical half, (4.7-)7.5-15.4 × (2.7-)4.0-8.5 cm, juicy, with 8-10 palmate main nerves; margin entire or finely and distantly serrate towards the top, concolourous with the blade, glabrous or sparsely shortly ciliate; base rounded, top acute; upper surface medium to dark green, dull, smooth, scattered with minute glandular hairs, sometimes sparsely so; lower surface pale green and with a similar indumentum; **nerves**: the main and larger secondary nerves on the upper surface not prominent, on the lower not or slightly prominent, green, usually densely hirsute with rather short and antrorsely appressed hairs and in addition scattered with minute glandular hairs, smaller secondary nerves not prominent, distinct, tertiary nerves usually not or barely visible. **Inflorescence** containing 2-3 male flowers and 1 terminal female one; flowers positioned at about halfway up the

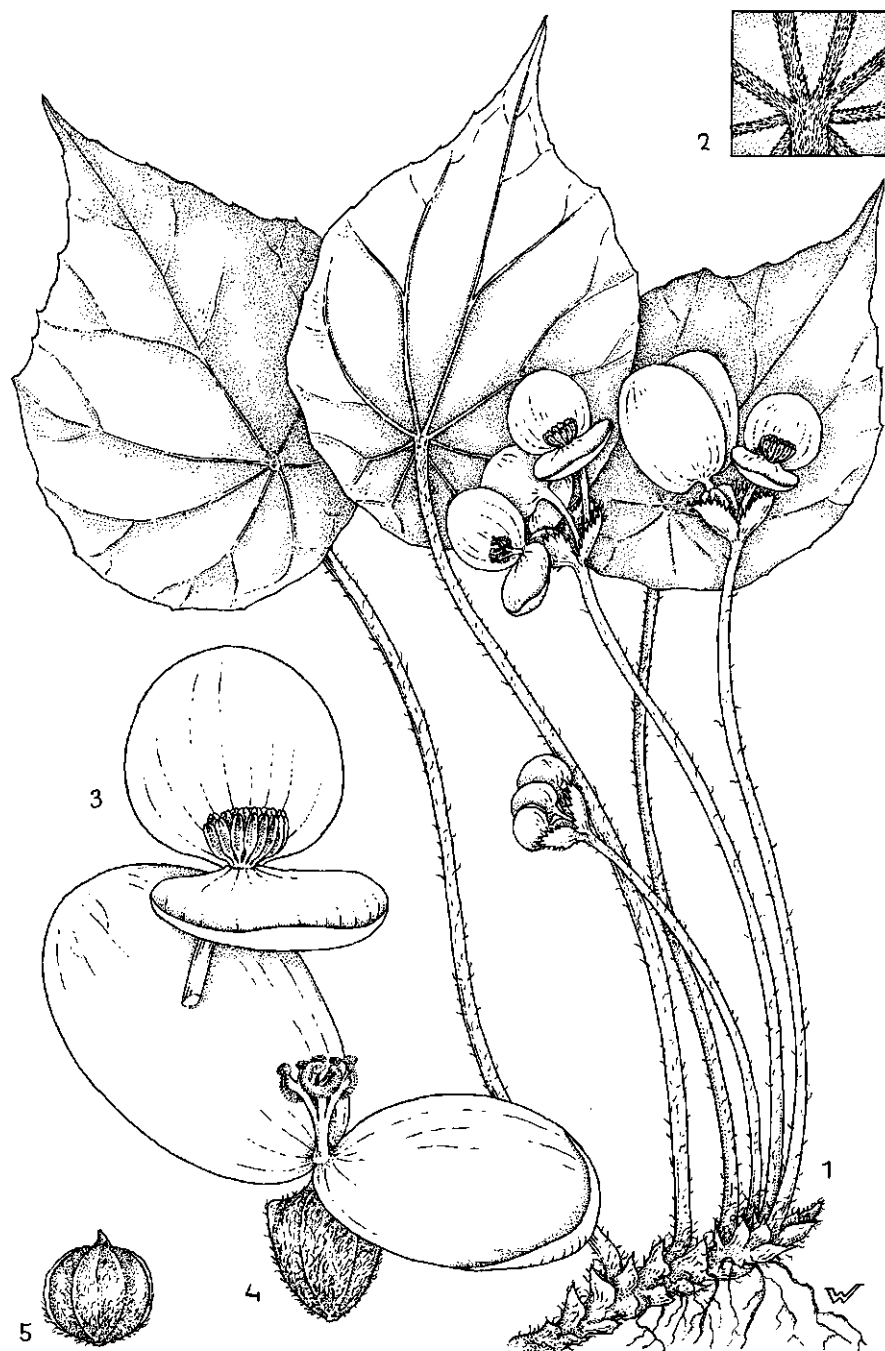


Fig. 2. *Begonia adpressa* Sosef. – 1: habitus (x2/3); 2: detail of lower leaf surface and nerves (x2); 3: male flower (x2); 4: female flower and ovary (x2); 5: fruit (x2). – 1-4: *Satabié* 263; 5: *W.J.J.O. de Wilde & de Wilde-Duyffjes* 2325.

petioles to at about the same level as the leaf blades; *peduncle* simple, (3.5-)5.5-18.5 cm long, usually sparsely hirsute with long, patent or appressed hairs, sometimes not hirsute, in addition scattered with minute glandular hairs; *bracts* (2-)3-4, very broadly ovate to circular, 6.0-10.9 mm long, red, scattered with minute glandular hairs, margin dentate, ciliate. **Male flower:** *pedicel* elongated at anthesis, up to 34 mm long, with or without a few long hairs and in addition scattered with minute glandular hairs; *perianth segments* broadly or very broadly ovate, sometimes broadly obovate, with a cuneate to slightly cordate base, (7.2-)9.0-21.0 x (7.0-)10.0-23.0 mm, outer side yellow with reddish nerves, scattered with minute glandular hairs, inner side yellow or bright pale yellow; *androecium* with 26-47 stamens; anthers (1.3-)1.6-2.3 mm long. **Female flower** similar to the male but *pedicel* short (often obscured by the large bracts), slightly elongated in fruit, 0.4-3.5 mm long; *perianth segments* broadly or very broadly ovate to circular, with a rounded to somewhat cordate base, 11.6-27.0 x 13.5-30.0 mm; *styles* 4, 4.5-8.5 mm long, fused in the lower 1/3, the top horse-shoe shaped or slightly elongated horse-shoe shaped, the arms 1.3-2.0 mm long and bearing a rather slender stigmatic band which is spirally twisted for ca. 1/2 a turn; *ovary* broadly obovate or circular to very broadly obtriangular-obovate, 4.0-7.9 x 4.3-6.9 mm, green, 4-locular, 4-winged in the upper half or only at the top, with a comb-like fringe of hairs in between the locules (sometimes only sparsely so) or densely hirsute all over and in addition scattered with minute glandular hairs, base rounded to broadly cuneate; beak present, 0.25-2.6 mm long; wings (sometimes absent on one or two sides of the ovary) patent to erectopate, distinctly widening upwards, broadly obovate to shallowly obtriangular-obovate, 0-3.6 mm wide, margin glabrous to ciliate. **Infructescence:** *peduncle* not recurved towards the substrate; *fruit* more or less erect, circular to very broadly obtriangular-obovate, 5.2-9.1 x 4.9-13.0 mm, dry, with a comparatively thick wall, green.

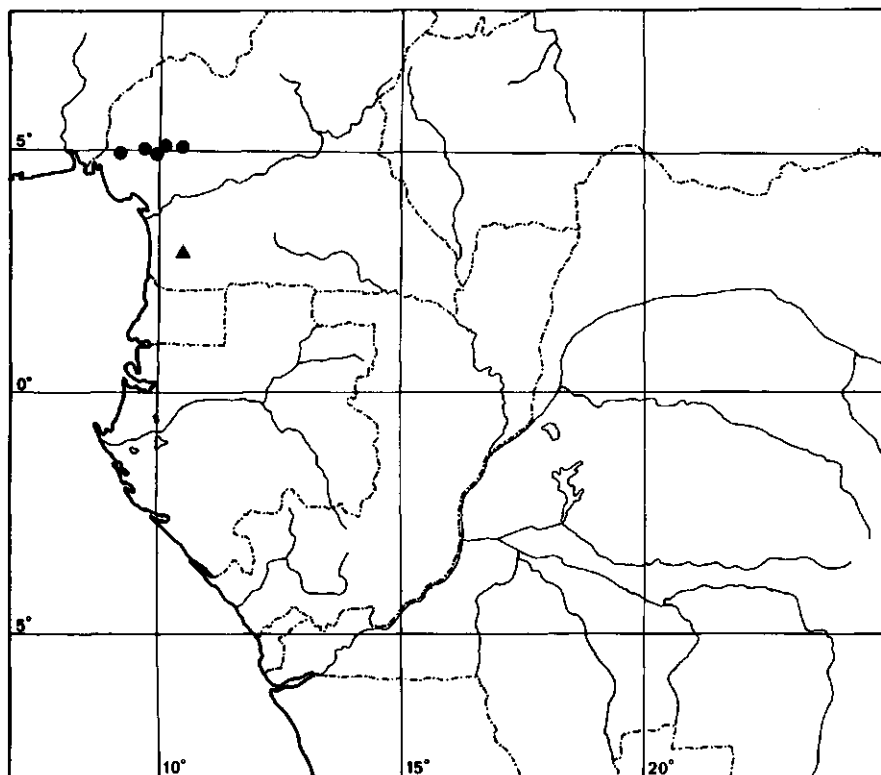
**Distribution:** CAMEROON: mountains in western Cameroon (8 coll.).

**Altitude:** 1000-1750 m.

**Ecology:** Moist primary montane forest, in shade, on rocks or on the forest floor.

**Notes:** Nerves with appressed hairs are rare in this section of *Begonia*, hence the name.

Easily distinguished from its relatives (*Begonia schaeferi* Engler and others) by the often almost entire leaf-margin and nerves with appressed hairs.



Map 1. Distribution of *B. adpressa* Sosef (circles) and *B. mbangaensis* Sosef (triangle).

## 2.2 *Begonia duncan-thomasi* Sosef spec. nov.

Fig. 3, Map 2

- TYPE: D.W. Thomas & H.L. McLeod 5492 (WAG!, holo; BR!, MO): 'Cameroon, Southwest Province, forest on the west side of Mount Kupé, 4°48'N, 9°42'E, Elev. 1800 m, 1 Feb. 1986.'

Diagnosis: *B. schaeferi* similis, a qua differt foliis bullatis et pedunculis plerumque ramosis.

Plant up to 25 cm high. **Rhizome** rather stout, sparsely hirsute and in addition usually sparsely scattered with minute glandular hairs, the top of the foliated part horizontal to slightly ascending. **Stipules** triangular-ovate to ovate or broadly ovate, not or slightly acuminate, 2.6-13.0 mm long, pale bronze-green, sometimes partly brownish red tinged; margin entire or the apical part dentate, sometimes dentate all along, ciliate. **Leaves** peltate; *petiole* continuing into the main nerve with a distinct angle, inserted at 11-35 mm from the nearest margin, 3.0-21.0 cm long, firm, fleshy, pale green at first, later on becoming rather dark

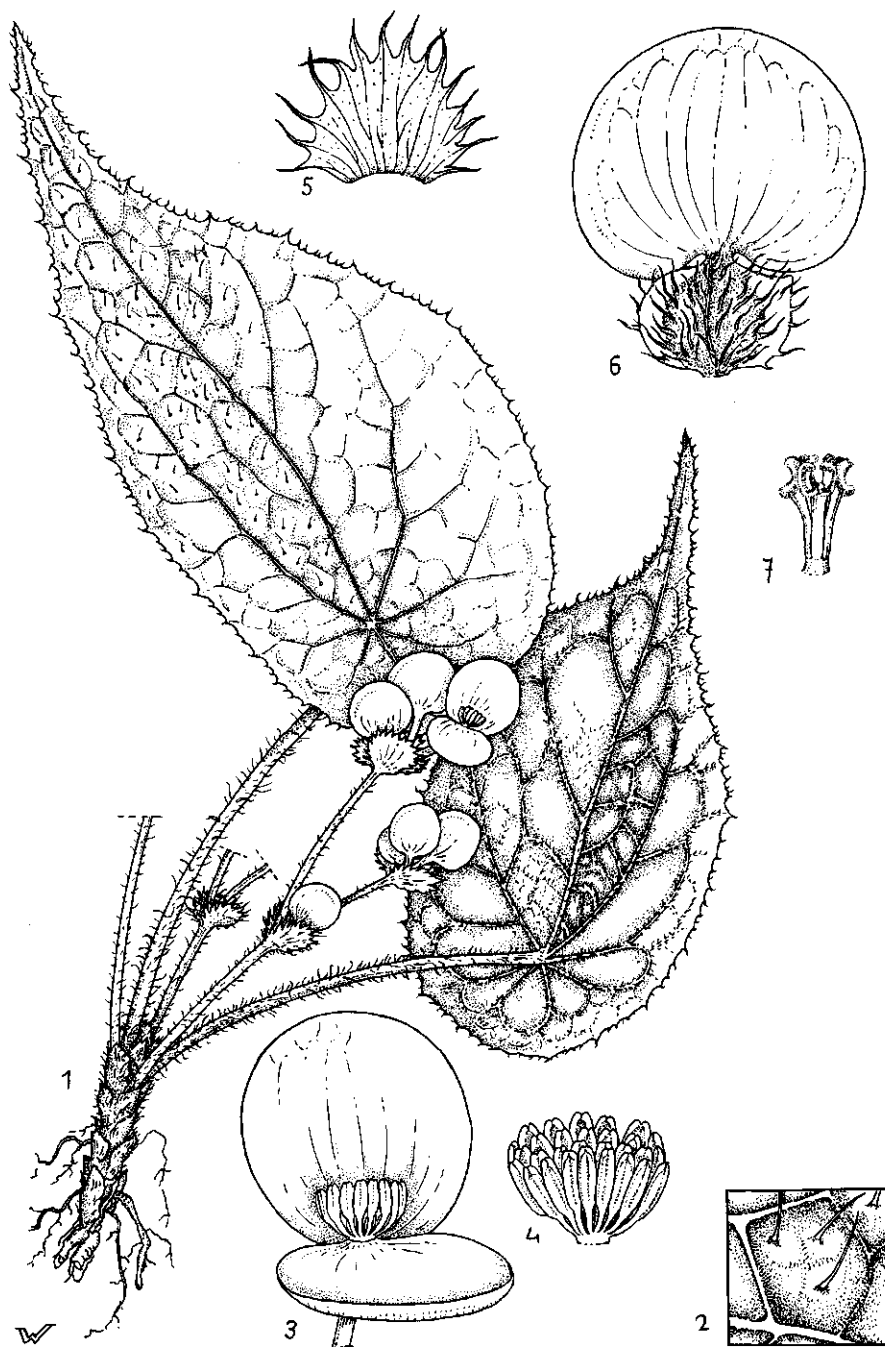


Fig. 3. *Begonia duncan-thomasi* Sosef. – 1: habitus (x2/3); 2: detail of upper leaf surface (x4); 3: male flower (x2); 4: androecium (x4); 5: bract (x2); 6: female flower and ovary (x2); 7: styles (x2). – 1-7: living coll. at WAG, voucher *Thomas & McLeod* 5492.

brownish red towards the base, in sicco often rugose due to small knobs, hirsute with long, patent, wavy, white hairs and in addition scattered with minute glandular hairs; *leaf blade* in more or less horizontal position or the apex drooping, usually slightly asymmetric, ovate to elliptic-ovate, sometimes narrowly so, acuminate in the apical 1/3 to more or less gradually tapering towards the top, sometimes with a few coarse and elongated teeth in the apical part, 9.1-20.6 × 4.3-11.3 cm, rather thin but brittle and juicy, on both surfaces scattered with minute glandular hairs, with 6-8 palmate main nerves; margin dentate, often distinctly so with elongated teeth, concolorous with the blade, ciliate; base rounded, top acute; upper surface light to medium green, sometimes reddish tinged, shiny, rugulose-bullate with solitary bullae, each bulla topped with a stiff erect white hair; lower surface light to pale green, without any long hairs in between the nerves; *nerves*: the main and larger secondary nerves sunken on the upper surface, on the lower prominent, pale green to pale bronze-green, hirsute with patent white hairs and in addition scattered with minute glandular hairs, in sicco rugose due to small knobs, the smaller secondary nerves distinct, tertiary nerves fairly indistinct. **Inflorescence** containing 2 male flowers and 1 terminal female one; flowers positioned slightly below or at the same level as the leaf blades; *peduncle* usually branched 1 or 2 times, red-brown to pale red-brown turning bronze-green with age, sparsely scattered with minute glandular hairs and in addition the primary branches sparsely hirsute with white hairs or not, the upper branches with or without a few hairs; primary branches 0.5-4.0 cm long, secondary ones 0.2-8.5 cm long, tertiary ones 0.5-4.0 cm long; *bracts* 2 on every branching point, similar to the 3-4 below the actual flowers, more or less enveloping the young flowers, very broadly ovate to ovate or elliptic ovate, 2.6-11.7 mm long, pale green to bronze-green, scattered with minute glandular hairs; margin dentate, ciliate. **Male flower**: *pedicel* elongated at anthesis up to 17 mm, yellowish green, sparsely scattered with minute glandular hairs, otherwise glabrous; *perianth segments* broadly ovate to very broadly so, with a rounded to cordate base, 7.8-16.0 × 6.7-18.0 mm, the outer side sparsely scattered with minute glandular hairs; the upper segment yellow with a large orange-brown-red spot which reaches up to 3/4 of the length of the segment turning more diffusely orange-yellow with age on the outer side, the inner side yellow, the lower segment light yellow turning yellow with age on the outer side, yellow on the inner side; *androecium* with 15-32 stamens; anthers 0.9-2.0 mm long. **Female flower** similar to the male but almost sessile, the pedicel 0.1-0.4 mm long; *perianth segments* with a cordate base, 7.1-18.0 × 9.2-19.0 mm; *styles* 4, 2.0-4.0 mm long, fused in the lower half, the top split into a rounded and rather compact U-shape, the arms 0.25-0.4 mm long and bearing a broad and non-twisted stigmatic band; *ovary* very broadly obovate, 2.3-5.3 × 2.9-6.9 mm, green, 4-locular, 4-winged in the apical half to all along, sometimes hirsute with long white hairs and in addition scattered with minute glandular hairs, with a rounded to slightly cordate base; beak present, 0.65-1.3 mm long; wings patent to slightly erectopatent and then the upper margin curved upwards, distinctly widening upwards, obovate to broadly obtriangular-obovate, 0.5-2.6 mm wide, the margin entire

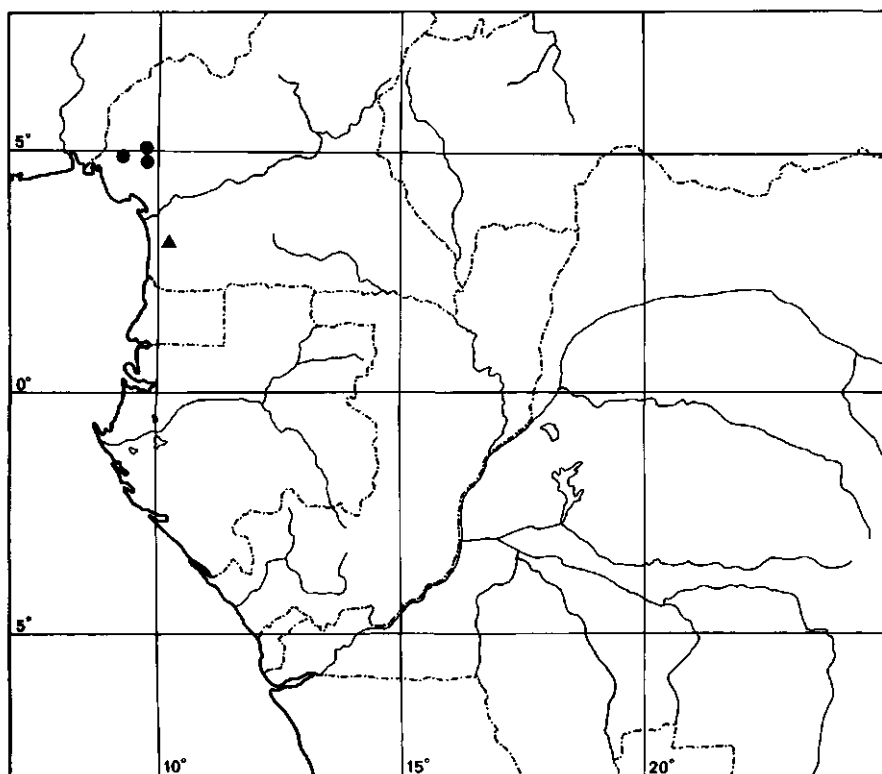
to shallowly dentate, glabrous or scattered with long hairs. **Infructescence:** its peduncle not recurved towards the substrate; *fruit* erect, very broadly obtriangular-obovate,  $9.0 \times 7.5$  mm, dry, with a comparatively thin wall, pale brown.

**Distribution:** CAMEROON: western Cameroon mountains (4 coll.).

**Altitude:** 1550-2000 m.

**Ecology:** On (wet) rocks and soil, on hillsides, in shaded conditions in understorey of montane forest.

**Notes:** The species is named in honour of Duncan Thomas who collected three of the four specimens known at present. Moreover he sent a live specimen to Kew. A cutting from this plant was kindly put at my disposal by dr Martin Sands, and it flowered at Wageningen in June 1990.



Map 2. Distribution of *B. duncan-thomasi* Sosef (circles) and *B. minuta* Sosef (triangle).

### 2.3 *Begonia mbangaensis* Sosef spec. nov.

Fig. 4, Map 1

- TYPE: Letouzey 9460 (P!, holo; YA!): 'Cameroun, colline Nkolesesan près Mbanga (km 81 route Kribi-Ebolowa près sous préfecture Akom II) feuille IGN 1/200.000 Nyabessan. 26 Avril 1968.'

Diagnosis: *B. laporteifolia* similis, a qua differt floribus luteis, foliis magis orbiculatis, et ovario anguste triangulariter alato.

Plant up to 10 cm high. **Rhizome** rather stout and compact or with short runners in between the tufts of leaves, sparsely hirsute and the younger parts in addition scattered with minute glandular hairs, the top of the foliated part ascending. **Stipules** broadly ovate or broadly triangular to triangular-ovate, acute to blunt, 2.3-6.2 mm long, the outer side sparsely hirsute or not and in addition scattered with minute glandular hairs; margin dentate, ciliate. **Leaves** peltate; *petiole* continuing into the main nerve with a distinct angle, inserted at 9-24 mm from the nearest margin, 2.5-11.0 cm long, rather firm and fleshy, densely hirsute with long, patent, wavy, red hairs and in addition scattered with minute glandular hairs; *leaf blade* in more or less horizontal position, symmetric to slightly asymmetric, circular or broadly elliptic to elliptic-ovate, with a rounded apical part, 4.8-10.4 × 3.5-8.8 cm, rather firm, with 7-9 palmate main nerves; margin crenate, concolorous with the blade, ciliate, often with two or three cilia together in between the teeth; base and top rounded; upper surface dark green, scattered with long, straight, erect, red hairs in a regular pattern but glabrescent and in addition densely scattered with minute glandular hairs; lower surface paler, with densely scattered minute glandular hairs in between the nerves; *nerves*: the main and larger secondary nerves not prominent on the upper surface, on the lower distinctly prominent, hirsute or densely so with appressed or sometimes erecto-patent hairs and in addition scattered with minute glandular hairs, the smaller secondary nerves distinct and prominent, tertiary nerves distinct, slightly prominent and creating a reticulated pattern. **Inflorescence** containing 2 male flowers and 1 terminal female one; flowers positioned below the leaf blades; *peduncle* simple, 3.5-4.5 cm long, hirsute with red hairs and in addition scattered with minute glandular hairs; *bracts* 3, circular to elliptic or ovate, 2.5-4.0 mm long, the outer side sparsely hirsute and in addition scattered with minute glandular hairs, the dentate margin ciliate. **Male flower**: *pedicel* elongated up to 10.5 mm at anthesis, hirsute and in addition scattered with minute glandular hairs; *perianth segments* broadly elliptic, with a rounded base, 9.7 × 8.5 mm, the outer side hirsute with red hairs and in addition scattered with minute glandular hairs, glabrous on the inner side; the upper segment yellow on the outer side and yellow with a few red nerves at base on the inner side, the lower yellow; *androecium* with 23 stamens; anthers 1.4-1.7 mm long. **Female flower** similar to the male but shortly pedicellate, the pedicel 0.4-1.0 mm long, *perianth segments* broadly elliptic-ovate, with a rounded base, 10.9-15.0 × 1.1-13.0 mm; *styles* 3, 4.3-4.8 mm long, fused in the lower half, the top split and horse-shoe shaped, the arms



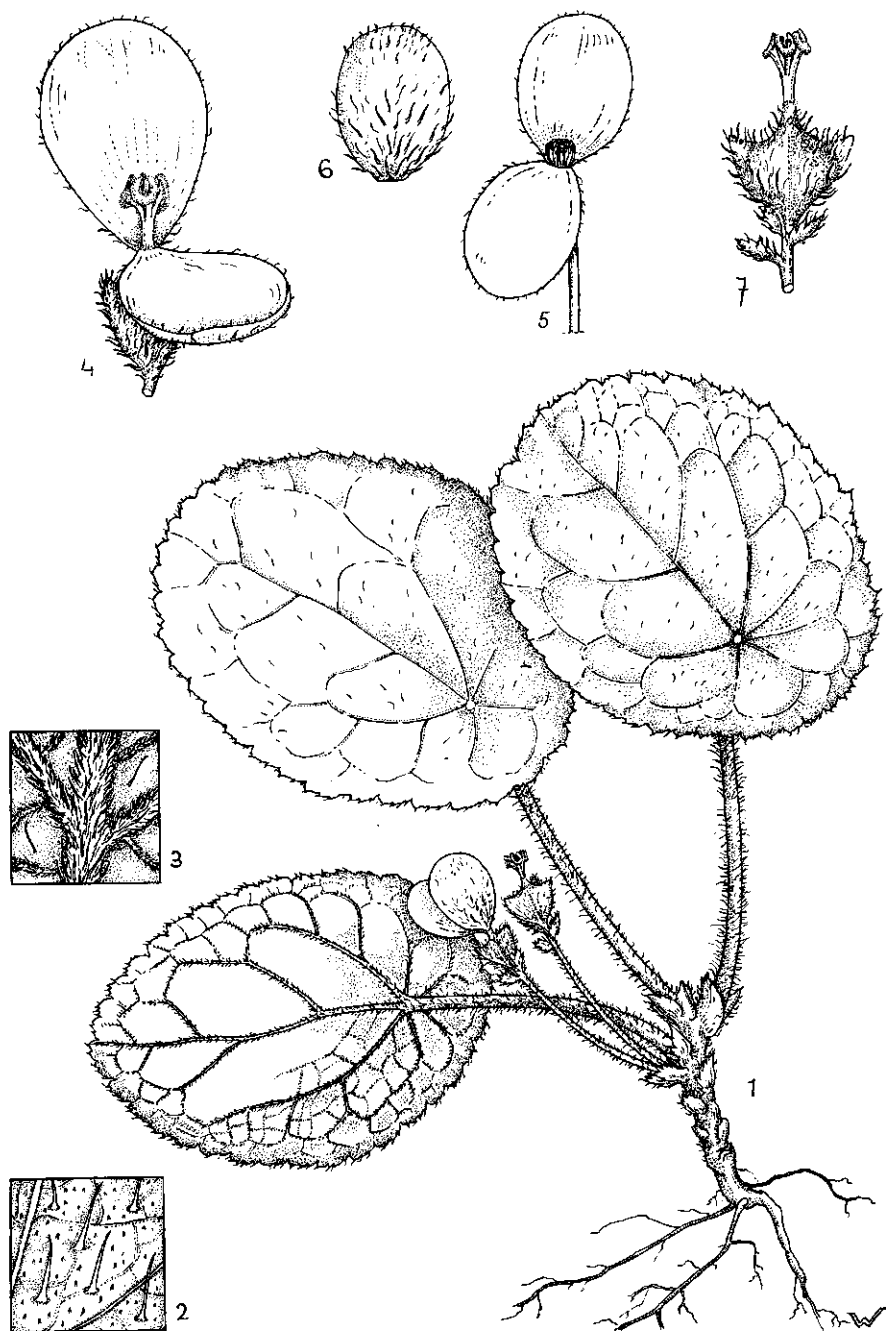


Fig. 4. *Begonia mbangaensis* Sosef. – 1: habitus (x2/3); 2: detail of upper leaf surface (x4); 3: detail of lower leaf surface and nerves (x4); 4: female flower (x2); 5: male flower (x2); 6: outer surface of perianth segment of male flower (x2); 7: fruit with styles attached (x2). – 1-4, 7: Letouzey 9460, 5-6: Bates 297.

0.8-1.2 mm long and bearing a rather compact stigmatic band which is spirally twisted for up to 1/2 a turn; *ovary* transversely broadly obtriangular, 3.5-4.8 × 7.2-9.2 mm, 3-locular, 3-winged in the apical half to 2/3, hirsute with red hairs and in addition scattered with minute glandular hairs, cuneate at base; beak conspicuous, 2.3-3.1 mm long; wings slightly erecto-patent, distinctly widening upwards, very broadly obtriangular to very shallowly obtriangular, 1.3-2.6 mm wide, the margin hirsute. **Infructescence** not seen; peduncle most likely recurved towards the substrate and the fruit pendulous.

**Distribution:** CAMEROON: Centre-Sud Prov. (3 coll., from the same locality).

**Ecology:** Hygrophilous coastal evergreen forest ('forêt biafréenne') with *Caesalpinioideae*.

**Notes:** The species is closely related to *B. laportefolia* Warb. and *B. lacunosa* Warb. It is clearly distinct from the first because of the yellow flowers and the more roundish shape of the leaf blade and from the second by its non-bullate leaf blade with crenate margins.

#### 2.4 *Begonia minuta* Sosef spec. nov.

Fig. 5, Map 2

– TYPE: Letouzey 12709 (P!, holo, iso; WAG!, YA!): 'Cameroun, colline Nkol Tsia, 488 m (18 km NW Bipindi près Gouap) feuille IGN 1/200.000 Edea.'

**Diagnosis:** *B. scutifolia* similis, a qua differt foliis fere aequilateribus, apice saepe longiter acuminato et elongato, margine glabra et venis lateralibus marginem versus perspicue incrassatis.

Plant up to 6 cm high, scattered all over with minute glandular hairs with a globose head which turn dark purplish when dry. **Rhizome** slender, rather compact, glabrous. **Stipules** broadly or very broadly triangular-ovate to almost circular, sometimes elliptic, 0.65-1.7 mm long, green; margin dentate, ciliate. **Leaves** peltate; *petiole* making a distinct angle with the main nerve, inserted at 1-4 mm from the nearest margin, 1.5-5.5 cm long, juicy, green, glabrous; *leaf blade* in more or less horizontal position, symmetric to slightly asymmetric, ovate, sometimes narrowly so, usually broadly caudate in the upper 1/2 to 1/3, sometimes terminating abruptly into a short tail-like appendage or gradually tapering towards the top, 1.2-3.9 × 0.5-1.5 cm, slightly juicy, with 4-8 palmate main nerves; margin usually very shallowly sinuate-dentate, glabrous, concolourous with the blade; base rounded, very apex blunt; upper surface light green, dull, smooth, glabrous; lower surface pale green, glabrous in between the nerves; *nerves*: the main nerves not prominent, green, glabrous and concolourous with the blade on both surfaces, markedly widening in the marginal zone, secondary nerves indistinct (visible only with the aid of transmitted light), tertiary nerves



Fig. 5. *Begonia minuta* Sosef. – 1: habitus (x1); 2: male flower (x2); 3: female flower (x2); 4: styles (x4); 5: fruit (x2). – 1-5: Letouzey 12709.

not visible. **Inflorescence** containing 1 male flower and 1 terminal female one; flowers positioned at about the same level as or extending beyond the leaves; **peduncle** simple, up to 5.5 cm long, green, glabrous; **bracts** 2, often small or even practically absent, narrowly elliptic to elliptic, 0.25-1.3 mm long, green, entire, glabrous. **Male flower**: **pedicel** elongated at anthesis, up to 24 mm long, glabrous; **perianth segments** broadly elliptic to broadly elliptic-ovate, with a rounded to cuneate base,  $7.0-8.5 \times 5.2-8.2$  mm, glabrous, yellow on both surfaces; **androecium** with 8-14 stamens; anthers 0.8-1.2 mm long. **Female flower**: similar to the male but shortly pedicellate, the pedicel however elongated in fruit up to 3.3 mm; **perianth segments** broadly elliptic to almost circular,  $6.8-10.8 \times 4.7-6.9$  mm; **styles** 4, 2.0-3.0 mm long, fused in the lower  $1/4$  to  $1/2$ , the top split to form a compact half circle, the arms 0.4-0.5 mm long and covered with a broad non-twisted stigmatic band; **ovary** narrowly elliptic,  $5.9-10.1 \times 0.8-1.7$  mm, green 4-locular, 4-winged all along, glabrous, cuneate at base; beak present, 0.65-2.3 mm long; wings ribbon shaped, 0.1-0.4 mm wide. **Infructescence**: peduncle not recurved towards the substrate; **fruit** narrowly elliptic to narrowly obovate,  $7.9-13.0 \times 1.2-3.0$  mm, dry, thin-walled.

**Distribution**: CAMEROON: Centre-Sud Prov. (4 coll., from the same locality).

**Altitude:** at c. 500 m.

**Ecology:** Forming a mat on vertical very wet rockfaces otherwise covered with mosses; under trees and bushes.

**Notes:** The new species is readily distinguished by its small habit (hence the name) in combination with the absence of a-glandular hairs, the presence on every part of the plant of minute glandular hairs with a short stalk and a globose head which in sicco turn dark purplish and the typical elongated shape of the leaves.

## 2.5 *Begonia pulcherrima* Sosef spec. nov.

Fig. 6, Map 3

*Begonia scapigera* auct. non Hook.f.: R. Wilczek, Fl. Congo, Rwanda et Burundi (1969) 33; Lewalle, Bull. Jard. Bot. Nat. Belg. 42 (1972) 179; Troupin, Fl. Rwanda – Spermatoph. II (1983) 450, f. 142.1.

– TYPE: Bamps 2805 (BR!, holo; GENT!, LG!): 'Rwanda, Rwankuba, Préfect. Cyangugu, E 29°08' S 2°30', alt. 1950 m, forêt de montagne, sous-bois sur sol humide, 18-12-71.'

**Diagnosis:** *B. gentilii* similis, a qua differt aliis ovariae apicem versus non dilatatis, venis secundariis tertiariisque subtus sparsim pilosis et stylo diverso.

Plant up to 25(-35) cm high. **Rhizome** rather stout and usually distinctly elongated, often markedly brown-red when dry, glabrous to sparsely hirsute and densely hirsute around the leaf-axils with long, wavy hairs; the top of the foliated part not or slightly ascending and sometimes forming a short stem of up to 5 cm long. **Stipules** elliptic to ovate or triangular-ovate, with a rounded to acute top, (3.2-)4.0-11.7 mm long, bronze-green; margin dentate, ciliate. **Leaves** pettate; *petioles* making a right angle with the main nerve, inserted at (5-)10-32 mm from the nearest margin, (4-)8-27 cm long, juicy, sparsely hirsute with long wavy, hairs and in addition scattered with minute glandular hairs; *leaf blade* in more or less horizontal position or drooping, symmetric, ovate to elliptic or broadly elliptic, acuminate at the top, (4.2-)6.0-14.0 × (2.6-)4.0-9.8 cm, slightly juicy, scattered with minute glandular hairs on both surfaces, with 9-11(-12) palmate main nerves; margin shallowly and remotely dentate in the upper 2/3-1/2, rarely indistinctly so, sparsely shortly ciliate; base rounded, top acute; upper surface medium green, dull, smooth, sparsely hirsute with short, straight, hairs usually in a ± regular pattern to almost glabrous; lower surface paler; *nerves*: the main and larger secondary nerves sunken on the upper surface, on the lower slightly prominent, green and sparsely hirsute with patent hairs the smaller secondary nerves distinct, tertiary nerves usually distinct but not prominent. **Inflorescence** containing 2 male flowers and 1 terminal female one;

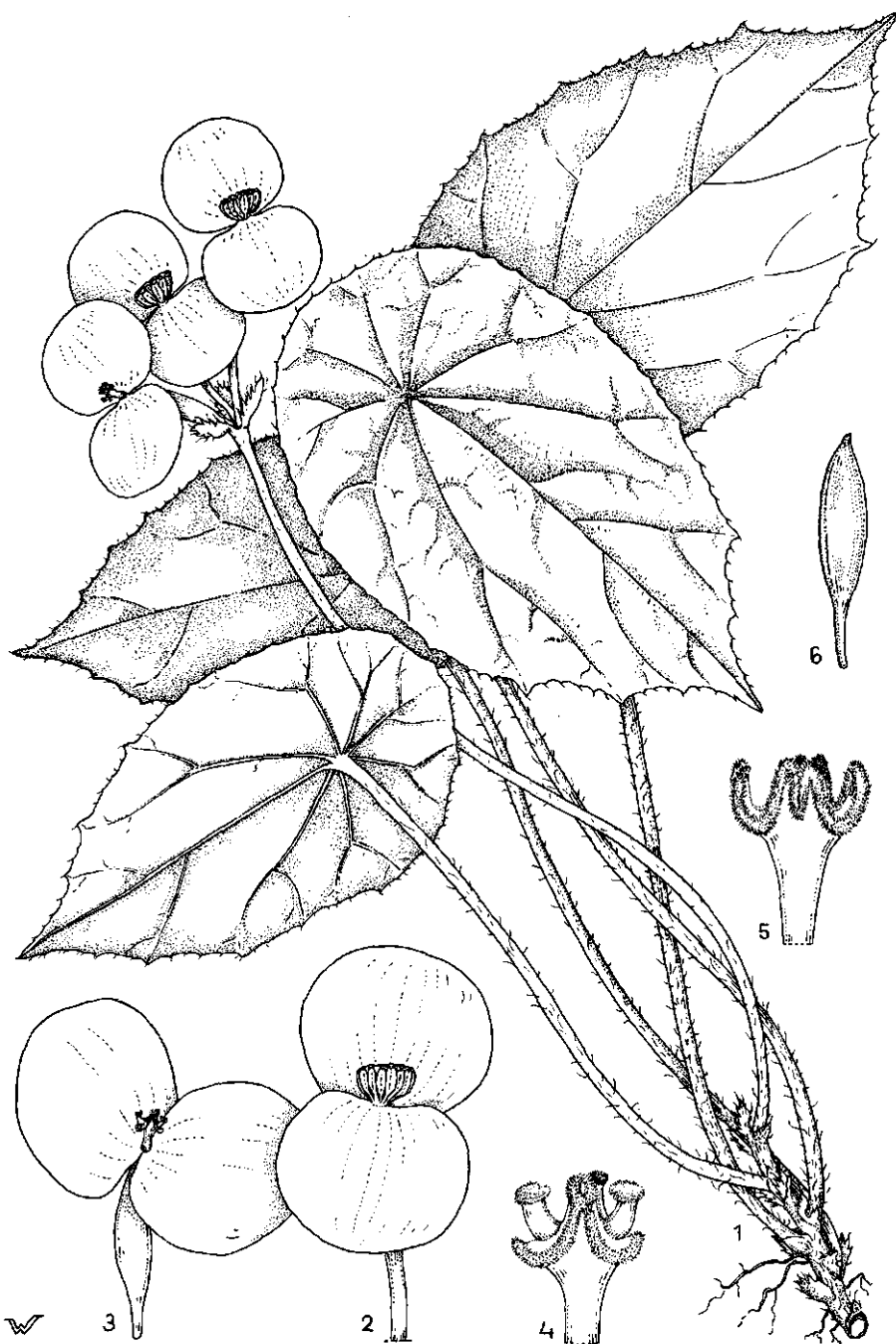


Fig. 6. *Begonia pulcherrima* Sosef. – 1: habitus (x2/3); 2: male flower (x1); 3: female flower (x1); 4-5: two types of styles (x4); 6: fruit (x1). – 1-3: *Bamps* 2805, 4: *Bouxin* 267, 5: *Bouxin* 1013, 6: *Christiaensen* 1511.

flowers positioned at about the same level as or extending beyond the leaf blades; *peduncle* simple, up to 22 cm long, with few long, patent, white hairs and in addition scattered with minute glandular hairs; *bracts* 3, elliptic to almost circular, 4.9-11.1 mm long, bronze-green, scattered with minute glandular hairs, otherwise glabrous except for the cilia on the teeth of the denticulate margin; the top rounded. **Male flower:** *pedicel* elongated at anthesis up to 41 mm, with or without few hairs and in addition sparsely scattered with minute glandular hairs; *perianth segments* very broadly ovate to very broadly obovate, with a rounded to cordate base, 10.9-20.5 x 11.7-26.5 mm, the outer side with or without a few hairs in the basal part and in addition sparsely scattered with minute glandular hairs; both segments golden yellow on both sides; *androecium* with (13-)20-31 stamens; anthers 1.3-2.5 mm long. **Female flower:** like the male flower, *pedicel* elongated in fruit and 2.0-12.4 mm long; *perianth segments* circular to very broadly obovate, 10.1-22.0 x 11.0-27.0 mm; *styles* 3 or 4, broadening upwards, 3.9-6.5 mm long, very variable in shape, completely fused into a trumpet-shaped structure with the margin strongly undulating and either with 4 deep and wide incisions alternating with 4 less deep and narrower ones or with 2 very wide U-shaped parts with only a small part of the tips free, the margin covered with either a continuous stigmatic band or this band broken into 4 loose adnate U-shaped parts, or the styles with 2 additional pillar-like structures placed inside the margin of the fused parts, the margin then covered with a stigmatic band which is fused just below the top, the pillar-like structures covered with a heart-shaped stigmatic band (see fig. 5); *ovary* elliptic to narrowly so or narrowly elliptic-ovate, 6.5-17.0 x 1.8-6.4 mm, green, 3- or 4-locular, narrowly 3- or 4-winged all along, scattered with minute glandular hairs, otherwise glabrous, cuneate at base; beak present, up to 4.5 mm long; wings ribbon shaped, 0.1-1.0 mm wide, glabrous. **Infructescence:** peduncle not recurved towards the substrate; *fruit* narrowly elliptic-ovate to narrowly elliptic-obovate, 19-24 x 3.4-9.1 mm, dry, comparatively thin-walled.

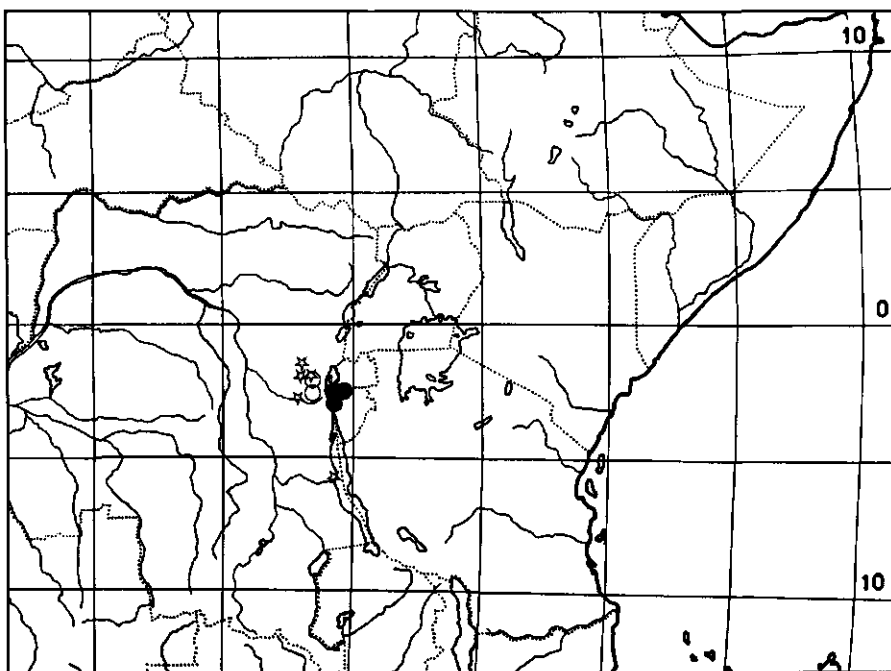
**Distribution:** RWANDA: Préfect. Cyangugu (10 coll.); BURUNDI: Territ. Bubanza (2 coll.).

**Altitude:** 1650-2000 m.

**Ecology:** Montane forest (with *Syzygium*, *Pentadesma* and *Carapa*); on slopes, along rivers or on wet or moist places; in shade.

**Notes:** The new species is closely related to *B. gentilii* De Wild. from Zaire. *B. pulcherrima* differs from the latter by its ribbon-like wings on the ovaries (not widening upwards), the complicated structure of the styles, the completely yellow flowers, the sparsely hirsute nerves on the lower leaf surface and the usually much longer peduncles. The two species might well represent vicariants.

Van den Berg (1985: 15) remarks that the material identified as *B. schaeferi* may consist of several taxa. Three of the presently described new species (*B.*



Map 3. Distribution of *B. pulcherrima* Sosef (solid circles), *B. zairensis* Sosef var. *zairensis* (stars) and *B. zairensis* Sosef var. *montana* (open circles).

*pulcherrima*, *B. adpressa* and *B. ramosa*) are affiliated to *B. schaeferi* and were found among the material studied by Van den Berg, confirming the latter author's surmise.

The gracefully shaped leaves and the large showy flowers with their conspicuous styles make this species the most beautiful treasure of the group I studied, hence the name.

## 2.6 *Begonia ramosa* Sosef spec. nov.

Fig. 7, Map 4

– TYPE: Satabié 163 (WAG!, holo; BR!, K!, P!, YA!): 'Cameroun, Mts Bamboutos, 25 km W MBounda, 10°0' Long E, 5°40' Lat N, Alt. 2000 m, 29 novembre 1974.'

Diagnosis: *B. schaeferi* similis, a qua differt pedunculis ramosis, inflorescentiis solum floribus masculis vel floribus masculis et femineis.

Plant 15-22 cm high. **Rhizome** rather stout and fairly compact, glabrous or sparsely scattered with minute glandular hairs; the top of the foliated part often

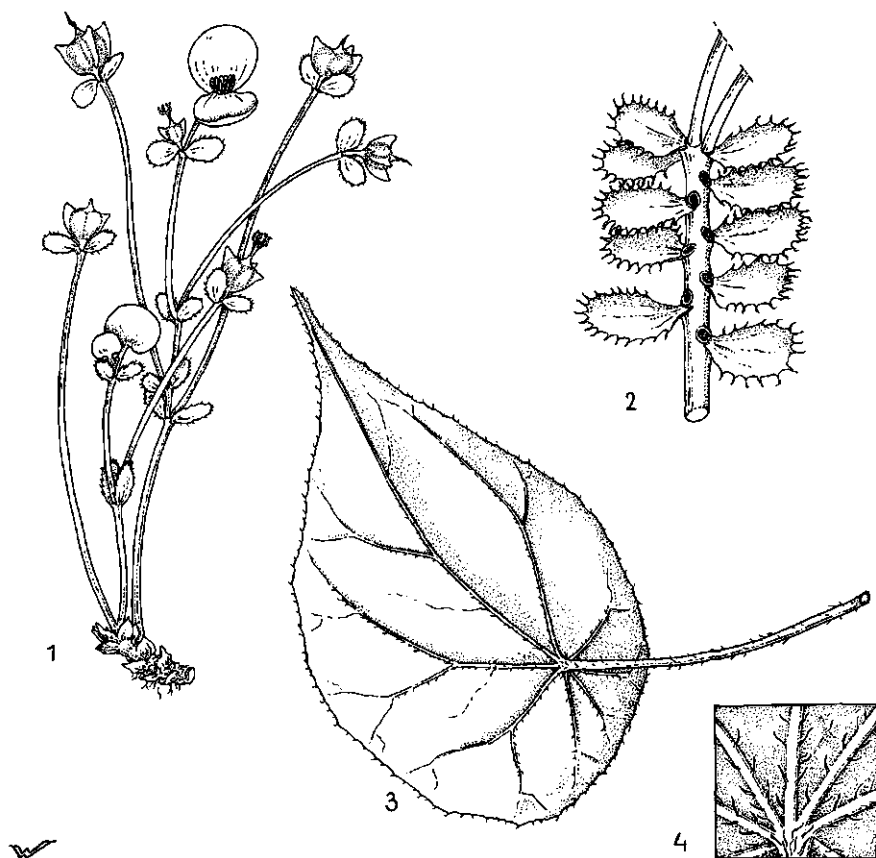


Fig. 7. *Begonia ramosa* Sosef. – 1: bisexual inflorescence (x 2/3); 2: detail of male inflorescence (x2); 3: leaf, lower surface (x2/3); 4: detail lower leaf surface and nerves (x2). – 1-4: Satabié 163.

erect to form a short stem of up to 2 cm. **Stipules** broadly triangular-ovate to triangular or triangular-ovate, acute, 3.1-7.3 mm long, glabrous or sparsely scattered with minute glandular hairs; margin entire or shallowly dentate at the often ciliate apex. **Leaves** peltate; *petiole* usually making a distinct angle with the main nerve, inserted at 10-18 mm from the nearest margin, 7.0-21.5 cm long, juicy, red, hirsute or sparsely so with long, patent, wavy, hairs and in addition more or less densely scattered with minute glandular hairs; *leaf blade* in more or less horizontal position, variously asymmetric, usually elliptic or elliptic-ovate, sometimes broadly elliptic or broadly elliptic-ovate, usually distinctly acuminate to acuminate-caudate in the upper 1/8 to 1/5, 7.7-13.8 × 4.3-7.2 cm, somewhat juicy, with 7-10 palmate main nerves; margin denticulate or finely serrate in the apical part, concolorous with the blade, ciliate; base rounded, top acute; upper surface bright green, dull, smooth, sparsely hirsute with evenly distributed medium-sized hairs and in addition sparsely scattered with minute glan-



dular hairs; lower surface paler green, scattered with minute glandular hairs in between the nerves; *nerves*: the main and larger secondary nerves not prominent on the upper surface, on the lower not or slightly prominent, red, sparsely hirsute with medium-sized patent hairs and in addition scattered with minute glandular hairs, the smaller secondary nerves not prominent, distinct to indistinct, tertiary nerves indistinct to not visible. **Inflorescence** of two different types, one exclusively male, the other bisexual; flowers positioned at about 2/3 of the length of the petioles; *peduncle* branched up to 3 times, rarely simple, sparsely hirsute below each branching point and in addition usually sparsely scattered with minute glandular hairs, primary axes 4.0-10.5 cm long, secondary axes 1.0-7.0 cm long, tertiary axes 4.0-11.5 cm long, each ramification with two opposite bracts similar to those beneath the flowers but narrower; *male inflorescence* containing 4-8 male flowers and 4-8 bracts, *bisexual inflorescence* containing 1-2 male flowers, 1-2 terminal female one(s) and 2-3 bracts; *bracts* circular to broadly elliptic, 5.2-8.8 mm long, bronze-green, usually sparsely scattered with minute glandular hairs, margin dentate, ciliate. **Male flower**: *pedicel* elongated at anthesis, up to 24 mm long, sparsely scattered with minute glandular hairs; *perianth segments* circular to very broadly ovate, rounded at base, 7.2-14.5 × 9.4-15.0 mm, the outer side with or without a few long hairs and in addition sparsely scattered with minute glandular hairs, yellow, the inner side glabrous, yellow; *androecium* with 22-26 stamens; anthers 1.2-2.1 mm long. **Female flower** similar to the male one, *pedicel* usually distinct and elongated in fruit, 1.2-5.2 mm long; *perianth segments* very broadly ovate, slightly cordate at base, 7.9-12.0 × 8.2-15.5 mm; *styles* 4, 3.1-5.1 mm long, fused in the lower half, the top broadly and more or less compressed horse-shoe shaped, the arms 0.8-1.6 mm long and bearing a rather compact stigmatic band which is spirally twisted for up to 1/2 a turn; *ovary* broadly obtriangular-obovate to very broadly so, 4.3-5.7 × 5.1-7.0 mm, green, sparsely scattered with minute glandular hairs, rounded at base, 4-locular, 4-winged in the apical half; beak present and usually distinct, 0.8-2.3 mm long; wings patent or slightly erecto-patent, broadly obtriangular-obovate to very broadly so, widening upwards, 0.9-2.6 mm wide, margin glabrous. **Infructescence**: *peduncle* not recurved towards the substrate; *fruit* erect, broadly obtriangular-obovate to very broadly so, 5.2-8.8 × 5.9-10.5 mm, dry, with a relatively thin wall.

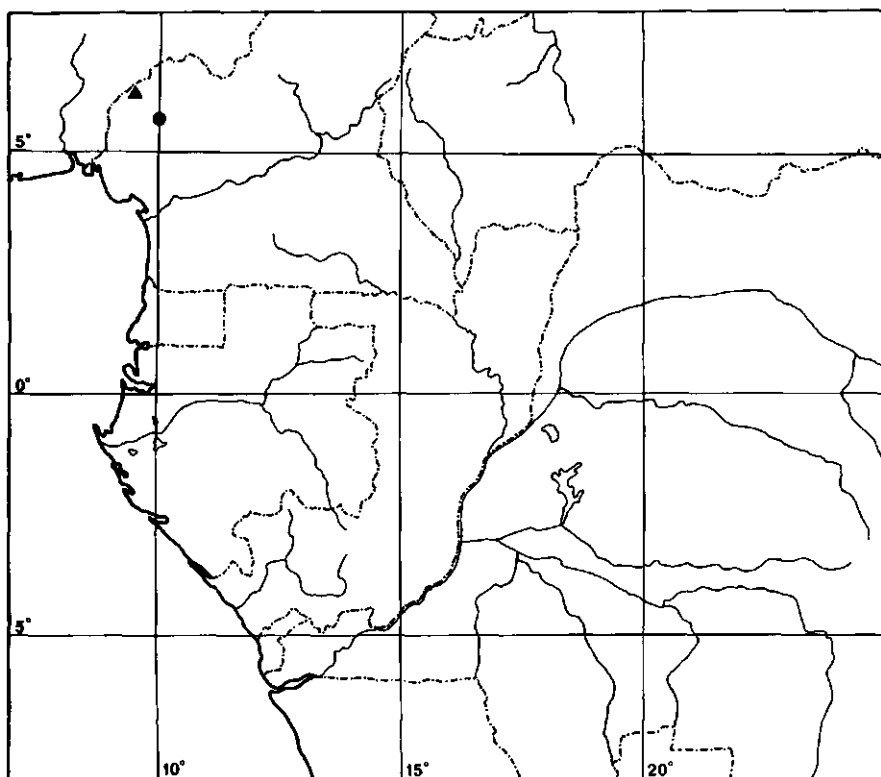
**Distribution**: CAMEROON: mountains in western Cameroon (3 coll.).

**Altitude**: 1900-2300 m.

**Ecology**: Montane forest, trees 6-12 m high or light montane shrubbery; on rocks, in shade, on moist or dry places.

**Notes**: One of the few species within the section with branched peduncles, hence the name.

The two types of inflorescences are remarkable and not noted elsewhere in



Map 4. Distribution of *B. ramosa* Sosef (circle) and *B. stellata* Sosef (triangle).

the section. This feature and the distinctly winged ovaries and fruits which lack long hairs make it rather easy to distinguish it from *Begonia schaeferi* Engl. and other closely related species.

## 2.7 *Begonia stellata* Sosef spec. nov.

Fig. 8, Map 4

- TYPE: Thomas, Fay & Doumenge 7437 (WAG!, holo; MO): 'Cameroon, Prov. South-West, forested ridges above Mbilishe Village, canopy low (5-10 m), some trees to 30 m, numerous small trees, sparse undergrowth, lots of epiphytes, 06°13'N 09°28'E, 1000-1200 m, 7 May 1987.'

Diagnosis: *B. salisburyana* similis, sed differt squamis stellatis, foliis fere aequilateralibus, siccis tenuiter membranaceis, margine manifeste dentatis et floribus roseis.

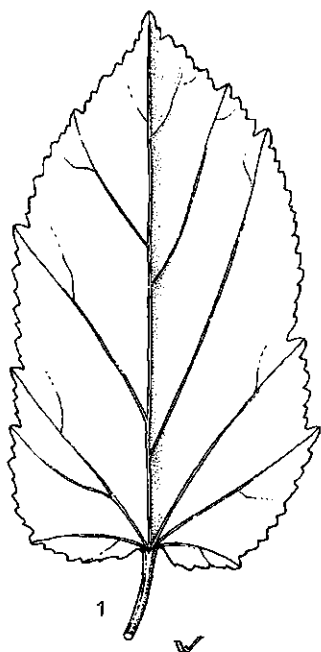


Fig. 8. Leafblade of *Begonia stellata* Sosef (x2/3) (reconstructed from the only mature but damaged leaf available): Thomas, Fay & Doumenge 7437.

Plant up to 9 cm high. **Rhizome** rather slender, fairly compact, scattered with minute glandular hairs and in addition the younger parts scattered with stellate scales; the top of the foliated part not or slightly ascending. **Stipules** often imbricate, very broadly triangular-ovate to triangular, 1.0-4.0 mm long, glabrous or sparsely scattered with minute glandular hairs, top acute to acuminate; margin entire, glabrous. **Leaves** not peltate; *petiole* continuing into the main nerve without a distinct angle or with a more or less distinct angle when young, 1.5-3.0 cm long, slender, green, scattered with minute glandular hairs and in addition sparsely scattered with stellate scales; *leaf blade* probably in more or less horizontal position, symmetric, ovate, rounded to slightly acuminate at the top, 4.0-10.5 × 2.7-6.1 cm, herbaceous, palmately-pinnately nerved with 5 main nerves; margin distinctly irregularly dentate or slightly serrate, the teeth slightly elongated and rounded to very broadly triangular and acute, concolorous with the blade, glabrous; base shallowly cordate to cordate, top rounded to acute; upper surface bright green, smooth, scattered with minute glandular hairs; lower surface paler, scattered with minute glandular hairs and besides sparsely scattered with stellate scales especially towards the margin; *nerves*: the main and larger secondary nerves on the upper surface not prominent, on the lower not or slightly prominent, concolorous with the blade and sparsely scattered with minute glandular hairs, smaller secondary nerves indistinct but visible, tertiary nerves indistinct.

**Inflorescence** containing 3-4 male flowers, female flowers not seen (see notes); *peduncle* simple, 3.0-3.5 cm long, scattered with minute glandular hairs, otherwise glabrous; *bracts* 4-5, broadly elliptic to broadly obovate, 1.8-2.5 mm long, pale green, scattered with minute glandular hairs and in addition sparsely scattered with a few stellate scales or not; margin entire, glabrous. **Male flower:** *pedicel* elongated at anthesis up to 4.5 mm, sparsely scattered with minute glandular hairs; *perianth segments* broadly elliptic to broadly elliptic-ovate, rounded to cordate at base, 3.9-6.6 × 3.3-4.0 mm, pink, the outer side scattered with minute glandular hairs and in addition with a few stellate scales, the inner side glabrous; *androecium* with 7 stamens; anthers 1.2-1.3 mm long. **Female flower** not seen. **Infructescence** not seen.

**Distribution:** CAMEROON: Sud-Ouest Prov. (1 coll.).

**Altitude:** 1000-1200 m.

**Ecology:** Forested ridges with low canopy (5-10 m), some trees up to 30 m, with numerous small trees, sparse undergrowth, lots of epiphytes, growing on damp mossy rocks.

**Notes:** Only known from the type specimen.

The aberrant shape of the leaf margins, the white flowers and the symmetric leaf blade distinguish it from *B. salisburyana* Irmsch. and *B. prismatocarpa* W.J. Hooker which are probably its closest relatives.

It could not be deduced whether the inflorescences are unisexual or that the female flowers were not yet developed, as all available inflorescences were very young with the lowest male flower opening barely or being no more than a small bud.

## 2.8 *Begonia zairensis* Sosef spec. nov.

a. var. *zairensis*

Fig. 9, Map 3

*Begonia clypeifolia* Wilczek non Hook.f., Fl. Congo, Rwanda et Burundi (1969) 37.

*Begonia quadrialata* Wilczek non Warb. p.p., Fl. Congo, Rwanda et Burundi (1969) 38.

– TYPE: Van der Veken 9723 (GENT!, holo; BR!, WAG!): 'Zaire, Kivoe, Irangi, IRSAC-domein bij de Luhoho. 800-850 m, 11.3.1972.'

**Diagnosis:** *B. mildbraedii* similis, a qua differt stigmatibus elongatis lobis angulatis acutius formantibus, foliis plerumque longe petiolatis et pedunculis vulgo longioribus.

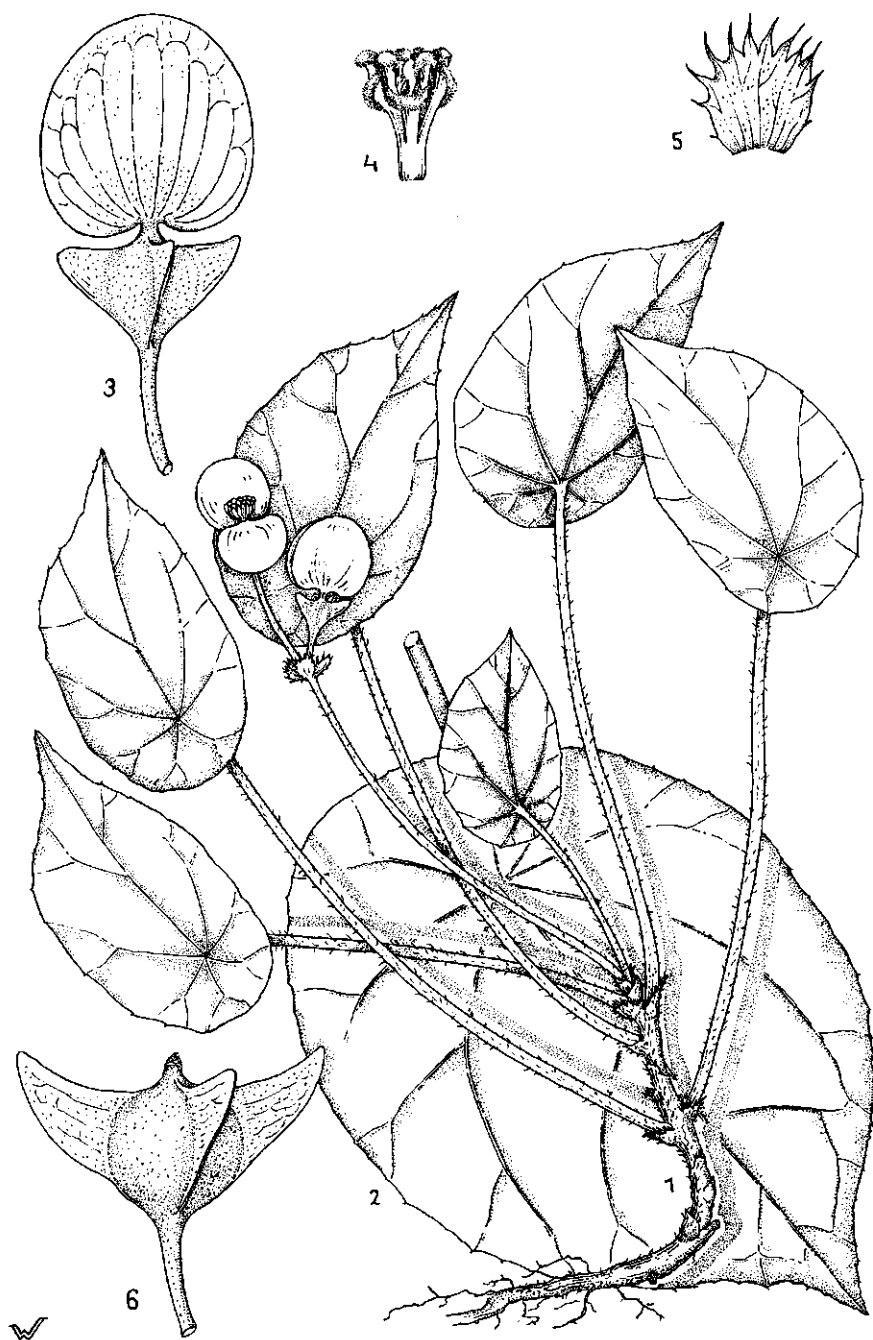


Fig. 9. *Begonia zairensis* Sosef var. *zairensis*. – 1: habitus (x2/3); 2: comparatively large leaf blade (x2/3); 3: female flower and ovary (x2); 4: styles (x4); 5: bract (x4); 6: fruit (x2). – 1, 5: Christiaensen 185, 2: Christiaensen 398, 3-4: Christiaensen 986, 6: Van der Veken 9723.

Plant (5-)7-25(-32) cm high. **Rhizome** rather stout, fairly compact to elongated, scattered with minute glandular hairs and sometimes (especially the younger parts) in addition sparsely hirsute; the top of the foliated part usually erect to form a short stem of up to 7 cm long. **Stipules** very broadly triangular-ovate to elliptic, acute to slightly acuminate, 2.3-9.0(-13.0) mm long; margin more or less entire to dentate, ciliate. **Leaves** peltate; *petiole* continuing into the main nerve with or without a distinct angle, inserted at (8-)11-30(-40) mm from the nearest margin, (3.5-)6.0-25.0(-31.0) cm long, firm, fleshy, red, hirsute to sparsely so with long, patent, wavy hairs and in addition scattered with minute glandular hairs; *leaf blade* in more or less horizontal position, asymmetric to almost symmetric, usually elliptic to elliptic-ovate, sometimes broadly so, often slightly acuminate or gradually tapering towards the apex in the apical 1/4 to 1/6, (4.5-)7.0-14.5(-20.5) × (2.9-)3.5-9.5(-13.5) cm, somewhat fleshy, palmately-pinnately nerved with 7-10 main nerves; margin almost entire to finely serrate towards the top, usually with a few coarse shallow teeth in the apical half especially in that of the larger right or left half of the blade, almost glabrous to ciliate; base rounded or rarely slightly cordate, top acute; upper surface medium to dark green, smooth, sparsely scattered with minute glandular hairs or not and rarely in addition sparsely hirsute with relatively short hairs; lower surface pale green to reddish, scattered with minute glandular hairs in between the nerves or only sparsely so; *nerves*: the main and larger secondary nerves not prominent on the upper surface, on the lower slightly prominent, reddish to green, densely scattered with minute glandular hairs and in addition sparsely hirsute with patent hairs or not, rarely hirsute with appressed hairs, the smaller secondary nerves distinct, not prominent, tertiary nerves indistinct but usually visible, rarely slightly prominent. **Inflorescence** containing 2(-3) male flowers and 1 terminal female one; flowers positioned from halfway up the petioles to at about the same level as the leaf blades; *peduncle* simple, (2.0-)3.0-9.5 cm long, scattered with minute glandular hairs, sometimes sparsely so and in addition sparsely to very sparsely hirsute, sometimes lacking these longer hairs; *bracts* 3-4, very broadly ovate or almost circular to elliptic, (2.3-)3.0-5.9 mm long, bronze-green, scattered with minute glandular hairs; margin dentate, ciliate. **Male flower**: *pedicel* elongated at anthesis, up to 30(-43) mm long, usually sparsely scattered with minute glandular hairs and in addition sparsely hirsute or not; *perianth segments* usually broadly or very broadly ovate to circular, rarely ovate, slightly cuneate to slightly cordate at base, (5.9-)7.2-13.0 × (4.4-)5.1-13.0 mm; the outer side yellow to orange, sparsely scattered with minute glandular hairs, glabrous on the inner side; the upper segment yellow with a red patch and nerves on the inner side; the lower yellow on the inner side; *androecium* with (13-)19-28 stamens; anthers (1.0-)1.2-2.1 mm long. **Female flower** similar to the male, shortly to long and distinctly pedicellate, pedicel elongated in fruit, 0.5-10.0(-22.0) mm long; *perianth segments* with a rounded to cordate base, (5.9-)7.0-17.0 × (5.1-)7.3-17.0 mm; *styles* 3-4, (2.7-)3.1-5.1 mm long, fused in the lower 1/2 to 1/5, the top split into an elongated V-shape, the arms (0.9-)1.2-2.2 mm long and covered with a slender stigmatic band which is spirally twisted for half a

to one turn; *ovary* usually very broadly to shallowly obtriangular-obovate, rarely only broadly so, (4.4-)5.3-8.3 x (3.3-)5.2-15.0 mm, green, 3-4-locular, 3-4-winged all along or only in the apical half, scattered with minute glandular hairs; beak present but usually short, 0.25-1.3 mm long; wings patent to distinctly curved upwards, usually distinctly widening upwards, broadly obovate to shallowly obtriangular, (0.65-)1.8-7.9 mm wide, usually one wing somewhat larger than the others, margin glabrous or rarely with a few hairs. **Infructescence:** peduncle not recurved towards the substrate; *fruit* more or less erect, broadly elliptic to shallowly obtriangular-obovate, 7.5-11.2 x 5.1-19.0 mm, dry, with a thick wall.

**Distribution:** ZAIRE: Kivu Prov. (16 coll.); Shaba Prov. (1 coll.).

**Altitude:** 460-1250 m.

**Ecology:** Primary rain forest (with *Cynometra*, *Julbernardia* and *Staudtia*); along roadsides, near rivers; once on a small log; in shade.

**Notes:** Van Meel 118 (BR) was collected much further south than the other specimens. It is aberrant due to the rather narrow and comparatively short-petioled leaves which show a fairly prominent tertiairy nervation. The plant is therefore somewhat intermediate between *B. hirsutula* Hook.f. and this species.

**b. var. montana** Sosef var. nov.

**Map 3**

*Begonia scutulum* Wilczek non Hook.f., Fl. Congo, Rwanda et Burundi (1969) 36.

– TYPE: J. Lebrun 5542 (BR!, holo): 'Mushwere (Env. Ngweohe) (Kivu), Alt. 2000 m, Juin 1932, Forêt de montagne; ravin.'

**Diagnosis:** A varietate typica differt venis densius pilosis et floribus interdum majoribus.

Differs from the typical variety by:

Main and larger secondary nerves on the lower leaf surface hirsute with patent hairs, smaller secondary and tertiairy nerves sparsely hirsute. Peduncle 8-12.5 cm long. Bracts 3.3-7.8 mm long. Male flower: perianth segments up to 22 x 19 mm. Female flower: perianth segments up to 19 x 22 mm.

**Distribution:** ZAIRE: Kivu Prov. (3 coll.).

**Altitude:** 1000-2000 m.

**Ecology:** Primary forest (with *Cyathea*, *Julbernardia* and *Staudtia*); ravine.

**Notes:** The variety was collected at relatively high altitudes, hence the name. It differs mainly in the hirsuteness of the nerves. Whether there is an actual tendency to possess larger bracts and perianth segments and longer peduncles or whether this is due to chance cannot be concluded from observations on the 3 collections now at hand.

Two distinct types are present within the species. No distinct correlation between the amount of hair on the nerves and the altitude was observed. This feature therefore seems to be more than just a phenotypic expression induced by an ecological variable viz. altitude (temperature and/or moisture) and seems to justify the recognition of a distinct taxon.

### 3. Acknowledgements

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