Taxonomic Revision of Sinningia Nees (Gesneriaceae) IV: Six New Species from Brazil and a Long Overlooked Taxon

Authors: Chautems, Alain, Lopes, Thereza Cristina Costa, Peixoto, Mauro, and Rossini, Josiene

Source: Candollea, 65(2) : 241-266

Published By: The Conservatory and Botanical Garden of the City of Geneva (CJBG)

URL: https://doi.org/10.15553/c2010v652a6

Taxonomic revision of Sinningia Nees (Gesneriaceae) IV: six new species from Brazil and a long overlooked taxon

Alain Chautems, Thereza Cristina Costa Lopes, Mauro Peixoto & Josiene Rossini

Abstract

CHAUTEMS, A., T. C. COSTA LOPES, M. PEIXOTO & J. ROSSINI (2010). Taxonomic revision of Sinningia Nees (Gesneriaceae) IV: six new species from Brazil and a long overlooked taxon. *Candollea* 65: 241-266. In English, English and French abstracts.

Six new species of *Sinningia* Nees are described: *Sinningia bullata* Chautems & M. Peixoto, *Sinningia canastrensis* Chautems, *Sinningia gerdtiana* Chautems, *Sinningia globulosa* Chautems & M. Peixoto, *Sinningia helioana* Chautems & Rossini, and *Sinningia muscicola* Chautems, T. Lopes & M. Peixoto. An additional species, thought for some time to be undescribed, was recently identified as *Sinningia polyantha* (DC.) Wiehler. Comments on phylogenetic relationships within tribe *Sinningieae* Fritsch, as well as on ecology and conservation status, are also included. Each species is illustrated and a distribution map is provided.

Key-words

GESNERIACEAE – SINNINGIEAE – Sinningia – Brazilian Atlantic forest – Espírito Santo – Minas Gerais – Paraná – Rio de Janeiro – São Paulo – Santa Catarina – Brazil – Taxonomy – Conservation – IUCN Red List

Résumé

CHAUTEMS, A., T. C. COSTA LOPES, M. PEIXOTO & J. ROSSINI (2010). Révision taxonomique de Sinningia Nees (Gesneriaceae) IV: six espèces nouvelles du Brésil, ainsi qu'un taxon longtemps négligé. *Candollea* 65: 241-266. En anglais, résumés anglais et français.

Six espèces nouvelles du genre *Sinningia* Nees sont décrites: *Sinningia bullata* Chautems & M. Peixoto, *Sinningia canastrensis* Chautems, *Sinningia gerdtiana* Chautems, *Sinningia globulosa* Chautems & M. Peixoto, *Sinningia helioana* Chautems & Rossini et *Sinningia muscicola* Chautems, T. Lopes & M. Peixoto. Une espèce considérée tout d'abord comme inédite est identifiée comme *Sinningia polyantha* (DC.) Wiehler. Des commentaires sur les relations phylogénétiques au sein de la tribu des *Sinningieae* Fritsch, ainsi que sur l'écologie et le statut de conservation, sont également présentés. Chaque espèce est illustrée et sa répartition géographique est donnée.

Addresses of the authors: AC: Conservatoire et Jardin botaniques de la Ville de Genève, ch. de l'Impératrice 1, C. P. 60, 1292 Chambésy. Switzerland.
Email: **alain.chautems@ville-ge.ch**

TCCL: Dep. Botânica, Museu Nacional/UFRJ, Quinta da Boa Vista, São Cristóvão, 20949-040 Rio de Janeiro, RJ, Brazil.

MP: Caixa Postal 383, 08710-971 Mogi das Cruzes, SP, Brazil.

JR: Faculdade da Região Serrana, Santa Maria de Jetibá, ES, Brazil.

Submitted on January 11, 2010. Accepted on August 31, 2010. Edited by P. Bungener

ISSN: 0373-2967 *Candollea* 65(2): 241-266 (2010)

Following previous accounts on Brazilian *Gesneriaceae* (Chautems, 1988, 1990, 1991a, 1991b, 1995, 1997, 2002; Chautems & al., 2000, 2003; Rossini & Chautems, 2007) and in the course of preparing a treatment of the tribe *Sinningieae* Fritsch for "Flora Neotropica", six new taxa of *Sinningia* Nees need to be published. Some of them were included in previously produced phylogenetic studies as *Sinningia sp.* or *Sinningia sp. nov.* followed by a number (Perret & al., 2003, 2006, 2007); this paper gives now their proper identification. Descriptions are based in good part on observation of live material observed in the wild or in cultivation. All cited specimens have been seen by the authors. The contrasting morphological and ecological features of the species here described give a good idea of the extent of diversification that occurred in the *Sinningieae* within the Atlantic forest in Brazil (Perret & al., 2007). As currently circumscribed, the genus *Sinningia* includes 68 species.

1. *Sinningia bullata* Chautems & M. Peixoto, **spec. nova** (Fig. 1-2)

Typus: Brazil. Santa Catarina: Município de Florianópolis, Ilha de Santa Catarina, Alto Ribeirão, Testa do Macaco, ca 315 m, 6.III.2006, *A. Reis. & al. 5040* (holo-: HBR!; iso-: G!, HUMC!, US!).

Sinningia lineatae similis forma atque magnitudine corollarum, sed tubere basali numquam quiescenti tumores secundarios procreante, caule florifero cum indumento araneoso, foliis saepe 4-verticillatis, laminis foliorum superne bullatis, inflorescentia epedunculata differt.

Herb, arising from basal, often multi-lobed tuber, not going dormant, producing after several growing seasons a string of secondary tubers, irregularly shaped and reaching 2-8 cm in diam., new leafy and flowering shoots sprouting from distal as well as from older tubers. *Stems* of flowering shoots 15-30 cm long, 0.8-1 cm in diam., usually unbranched, covered by a woolly-araneose indument. *Leaves* decussate, often 4-verticillate, equal in a pair, petiole 1-1.5 cm long, light green; blade elliptic to obovate, 7-15 cm × 4-10 cm, chartaceous, apex obtuse to rounded, base acute to cuneate, vivid green, bullate and glabrous above, specially at young stage, covered with a white, woolly-araneose indument beneath at young stage, becoming looser and light brownish on older leaves, margin irregularly crenate, 5-7 pairs of veins. *Inflorescence* a frondose florescence with cymes of 1-4 flowers, in each axil of upper and newly produced leaves, peduncle absent, bracts 5-10 × 4-7 mm, green, often caducous. *Flowers* borne on pedicels, 4-5.5 cm long, reddish, araneose. *Calyx* narrowly campanulate, fused at base for ca. 0.5 cm, lobes 1.5 cm long, narrowly lanceolate, apex acute, base triangular, margin entire, pale green, woolly-araneose. *Corolla* tubular, erect in the calyx, 3.5-4 cm long, ca. 5 mm in diam. at base, tube 2.5-3 cm long, 4-6 mm wide, vermilion, bud light red, pubescent, limb nearly regular, lobes 8-10 × 10-12 mm, spreading and forming a right angle with the tube, the 2 dorsal ones narrower, up to 7-8 mm wide, tube inside light red with darker lines, extending over the lateral and ventral lobes. *Stamens* 4, included, filaments ca. 2 cm, white, glabrous, anthers coherent, star-shaped, pollen cream; nectary formed by two completely separate glands, violet brown, 2-3 × 1 mm; ovary greenish, style ca. 2.5 cm, white, glabrous. *Fruit* a capsule, conical, 12-15 × 9-10 mm; seeds narrowly ellipsoid, ca 0.8-0.9 mm long.

Etymology. – The epithet refers to the bullate leaf blade, a unique character within the genus *Sinningia.*

Phenology. – Observed in flowers from December to March in the wild; in cultivation in greenhouse conditions, new crowns bearing flowers are successively produced at the apex of the stem at least 2-3 times a year. A picture of a blooming specimen is visible at: http://mpeixoto.sites.uol.com.br/gesneriads/sinningia/floripa-leopold.html.

Distribution and ecology. – Sinningia bullata is known so far only from the type locality, growing on steep slopes and vertical granite outcrops at about 300-450 m alt., in semi-shady situations, in the south-western part of the island of Santa Catarina (Fig. 3). The plant is perennial and resprouts easily, sometimes forming strings of tubers, from which lateral shoots emerge, finally forming colonies of plants cascading down for up to three meters as observed at the base of a shady and humid rocky wall in the type locality (Fig. 2B). The growing pattern of this species was followed for some years in greenhouse conditions. New shoots were produced several times during the year, continuously elongating the portion of stem previously formed and no rest period was observed. This habit is contrasting with the new shoots produced once a year and emerging from the tuber, followed by flowering and then drying of the whole shoot that leads to a dormancy period with the plant reduced to its tuber, as it is found in most other species of *Sinningia.* Bullate leaves, which are usually considered as a means of increasing the light-absorbing surface, may indicate that the species is well adapted to low light intensity (Blanc, 2002).

Conservation status. – Critically Endangered (CR) B1ab, according to the International Union for Conservation of Nature and Natural Resources (IUCN) criteria (IUCN, 2001), based on the extent of occurrence estimated to be less than 100 km^2 and projected decline of extent and quality of habitat, because no protection measures of the natural resources exist so far in its area of occurrence. This species should also be added to the recently published list of rare plants in Brazil, based on area of occurrence covering less than 10'000 km^2 i.e. populations recorded in an area inferior to a 150 km extension (Chautems & Araujo, 2009).

Fig. 1. – *Sinningia bullata* Chautems & M. Peixoto. **A.** Habit; **B.** Leaf lamina, detail of adaxial view; **C.** Flower, side view; **D.** Base of corolla tube, side view; **E.** Base of corolla tube, bottom view; **F.** Corolla, front view; **G.** Corolla bud aestivation; **H.** Corolla opened to show stamens, dorsal view; **I.** Anthers detail, front view; **J.** Transversal section of ovary showing lateral placentation and the two dorsal nectary glands.

[Drawn from live material, accession number *AC-3101*] [Drawing Cyrille Chatelain]

Fig. 2. – *Sinningia bullata* Chautems & M. Peixoto. **A.** Plant in the wild, flowers and leaves; **B.** String of tubers cascading down a rocky outcrop.

[Photos: Alain Chautems]

Relationships. – Morphologically, *S. bullata* has corollas quite similar to *S. lineata* (Hjelmq.) Chautems in shape, size and color, but it is distinguished by the combination of growth habit apparently lacking dormancy period, perennial and branching stems with several tuberous swellings on old individuals instead of a unique tuberous base (in wild conditions), young stem portions and abaxial face of leaf lamina with cobwebby indument at flowering time, bullate leaf blades, and epedunculate inflorescence with long pedicels. The cobwebby indument is also present in *S. araneosa* Chautems, but in this species with the exception of the corolla, it covers the whole plant, including the abaxial and adaxial faces of leaf blade.

Prelimary phylogenetic analysis, based on molecular data, indicate that this species belongs to clade *Dircaea* together with other species also distributed in southern Brazil like *S. macrostachya* (Lindl.) Chautems*, S. lineata,* and *S. macropoda* (Sprague) H. E. Moore (M. Perret, *pers. comm.)*.

Formation of natural hybrids with *S. leopoldii* (Planch.) Chautems was observed in the lower slopes of the Alto Ribeirão in the Santa Catarina island. The latter species occurs on rocks near the sea level and at low elevation along the coast of the island and in the northern part of the continental coast of the Santa Catarina state.

Additional material examined. – **Brazil. Santa Catarina:** Florianópolis; Testa do Macaco, Alto Ribeirão, 400 m, 13.XII.1972, *A. Bresolin 661* (HBR); Florianópolis, Testa do Macaco, Alto Ribeirão, 450 m, 12.I.1973, *A. Bresolin 678* (HBR).

Material in cultivation. – Distributed among *Gesneriaceae* growers under the name *Sinningia sp.* "Florianópolis" through cuttings and seed produced from material of same origin as the type collection *Reis & al. 5040*. In the Geneva Botanical Garden greenhouses, this material is grown under accession number *AC-3101* (Fig. 1).

The ability to produce flowers several times a year adds to the ornamental qualities of this taxon. Propagation by seed (requiring manual pollination) or by cuttings is easy, as recently tested by some growers (WEH, Gesneriphiles discussion group, 29.8.2008).

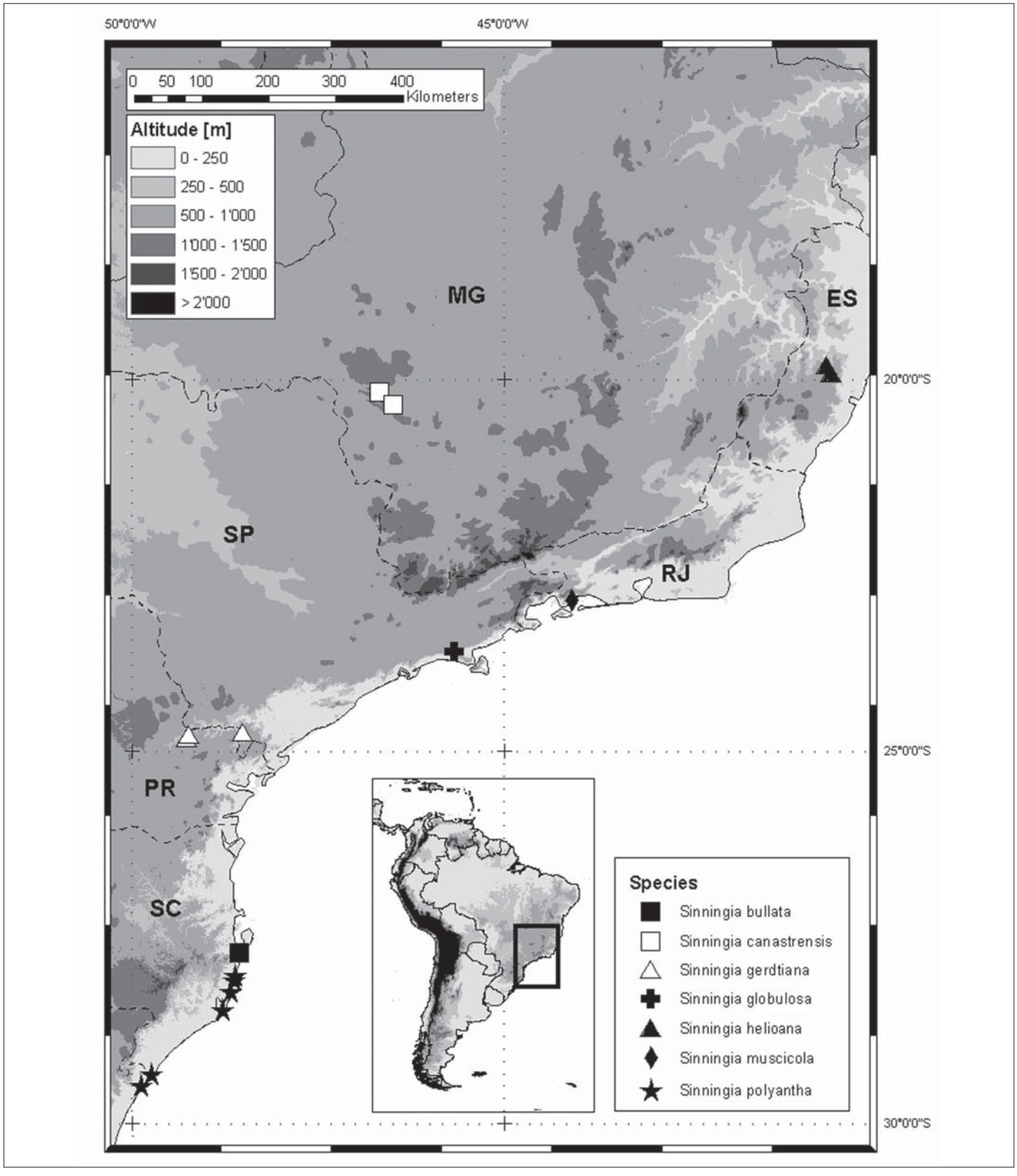

Fig. 3. – Distribution map of *Sinningia bullata* Chautems & M. Peixoto, *S. canastrensis* Chautems, *S. gerdtiana* Chautems, *S. globulosa* Chautems & M. Peixoto, *S. helioana* Chautems & Rossini, *S. muscicola* Chautems, T. Lopes & M. Peixoto, and *S. polyantha* (DC.) Wiehler. [ES = Espírito Santo, MG = Minas Gerais, PR = Paraná, SC = Santa Catarina, SP = São Paulo, RJ = Rio de Janeiro].

2. ***Sinningia canastrensis*** Chautems, **spec. nova** (Fig. 4-5)

Typus: Brazil. Minas Gerais: Município de São Roque de Minas, estrada São Roque-Sacramento, morro após o vale do Rio S. Francisco, 12.I.1996, *R. Romero, J. N. Nakajima, A. Chautems & M. Peixoto 3258* (holo-: HUFU!; iso-: G!).

Haec species caule evoluto lanatoque, foliis subsessilibus, pedicellis 0,8-2 cm, corolla tubuloso-campanulata 2,8-3,2 cm longa, violacea vel roseo-rubra ab omnibus congeneribus differt.

Herb, 20-40(-70) cm tall, arising from perennial globose tuber, 3-10 cm in diam., saxicolous. Stems 3-6 mm in diam., unbranched, covered by a whitish or reddish woolly indument. *Leaves* 2-4 pairs, decussate, sometimes nearly verticillate, equal or slightly anisophyllous, subsessile, blade obovate to elliptic, 5-10 cm long × 3-6 cm wide, apex obtuse, base truncate to attenuate, green and pubescent above, much paler or reddish beneath with tomentose to woolly indument, margin crenate, 6-8 pairs of veins. *Inflorescence* a (frondo-)bracteose florescence with cymes of 1-4 flowers, arranged in opposite pairs along a 10-30 cm axis at the axils of leaves or bracts diminishing from 4 to 0,5 cm long from base to top. *Flowers* borne on pedicels, 0.8-2 cm, ascending. *Calyx* campanulate, fused at base for 2-3 mm, lobes 5-6 mm long, acute at apex, triangular at base, margin entire, green to reddish towards the margin, villous. *Corolla* tubular-campanulate, oblique in the calyx, 2.8-3.2 cm long, 0.5-0.6 cm at base in diam., tube 1.2-1.4 cm wide, dorsal side arcuate in the proximal part, ventral side gibbous in the distal part, violet or pinkish red to bright red, pubescent, lobes 8-11 × 6-9 mm the 2 dorsal ones slightly smaller, patent to slightly revolute, tube inside/throat cream to light violet with darker lines or cream with pink dots. *Stamens* 4, included, filaments 1.9-2.4 cm, white, glabrous, anthers coherent in a square, pollen cream, nectary formed of 5 glands, the 2 dorsal ones fused at base; ovary greenish, style included, 2-2.7 cm, white, puberulous. *Fruit* a capsule, 12-15 × 8-10 mm; seeds ellipsoid, 0.6-0.8 mm long.

Etymology. – The epithet is derived from the locality "Serra da Canastra" where the species was first encountered.

Distribution and ecology. – Restricted to the Serra da Canastra and Serra da Babilônia area in the western part of Minas Gerais state (Fig. 3), where it grows in soil cracks between rocks, among "campo rupestre" vegetation. The Serra da Canastra area, an important water divide of two drainage basins, the Rio São Francisco (whose spring lies in the Serra da Canastra National park) and the Rio Paraná, is well known for its high number of endemic taxa (Romero & Nakajima, 1999).

Two forms with variation in leaf arrangement, corolla and indument coloration were identified. One has dark violet corollas, 3 pairs of decussate leaves with white indument and seems restricted to the Serra da Canastra, the other possesses pink-red corollas, 2-3 pairs of leaves condensed in a pseudo-verticillate and covered with reddish indument. The pink-red flowered form was observed in a small population *(Romero & al. 1744)* within the Serra da Canastra and in the nearby Serra da Babilônia *(Simão Bianchini & Bianchini 1202)*. This pink-red form was observed and photographed in 1996 in the Serra da Canastra, but has not been seen subsequently, after some fires burned the area (M. Peixoto, *pers. comm.)*.

Observations of pollinators on the violet form of *S. canastrensis* registered pollination by large Euglossini *(Eufriesea violascens)* and Megachilini *(Megachile sp.)* bees (Sanmartin-Gajardo & Sazima, 2004).

Phenology. – Flowering in December-January.

Conservation status. – Endangered (EN) B2ab, according to the IUCN criteria (IUCN, 2001), based on the area of occupancy estimated to be less than 500 km^2 and observed decline of one of the two color forms. It could be added to Mendonça & Lins (2000) and to the recently published list of rare plants in Brazil, based on area of occurrence estimated to be less than 10 000 km^2 i.e. populations recorded in an area inferior to a 150 km extension (Chautems & Araujo, 2009).

Relationships. – Based on the phylogenetic data from Perret & al. (2003, 2006, 2007, cited as *Sinningia indet.* 1 or *Sinningia sp. nov.* 1), *S. canastrensis* belongs to clade *Corytholoma* as a sister species of a clade including *S. elatior* (Kunth) Chautems, *S. incarnata* (Aubl.) D. L. Denham, and *S. sceptrum* (Mart.) Wiehler. Morphologically, *S. canastrensis* stands well apart from the latter species based on its large campanulate corollas.

Additional material examined. – **Brazil. Minas Gerais:** São Roque de Minas, Parque Nacional da Serra da Canastra, Estrada S. Roque de Minas-Sacramento, 3 km da sede administrativa, 10.XII.1996, *J. N. Nakajima & André 2481* (UEC); São Roque de Minas, Parque Nacional da Serra da Canastra, topo de morro após nascente do Rio São Francisco, 11.I.1995, *R. Romero & al. 1709* (G); São Roque de Minas, após a entrada para a cachoeira da Casca d'Anta, estrada para Sacramento, Parna Serra da Canastra, 12.I.1995, *R. Romero & al. 1744* (G); José do Barreiro, estrada para Babilônia, 3.I.1998, *R. Simão Bianchini & S. Bianchini 1202* (SP).

Material in cultivation. – Seeds distributed among *Gesneriaceae* growers germinate, but none of them was able to keep the plant alive afterwards. Therefore, survival of this species depends only on "in situ" conservation, whereas most other *Sinninga* species can benefit from "ex situ" cultivation for their conservation.

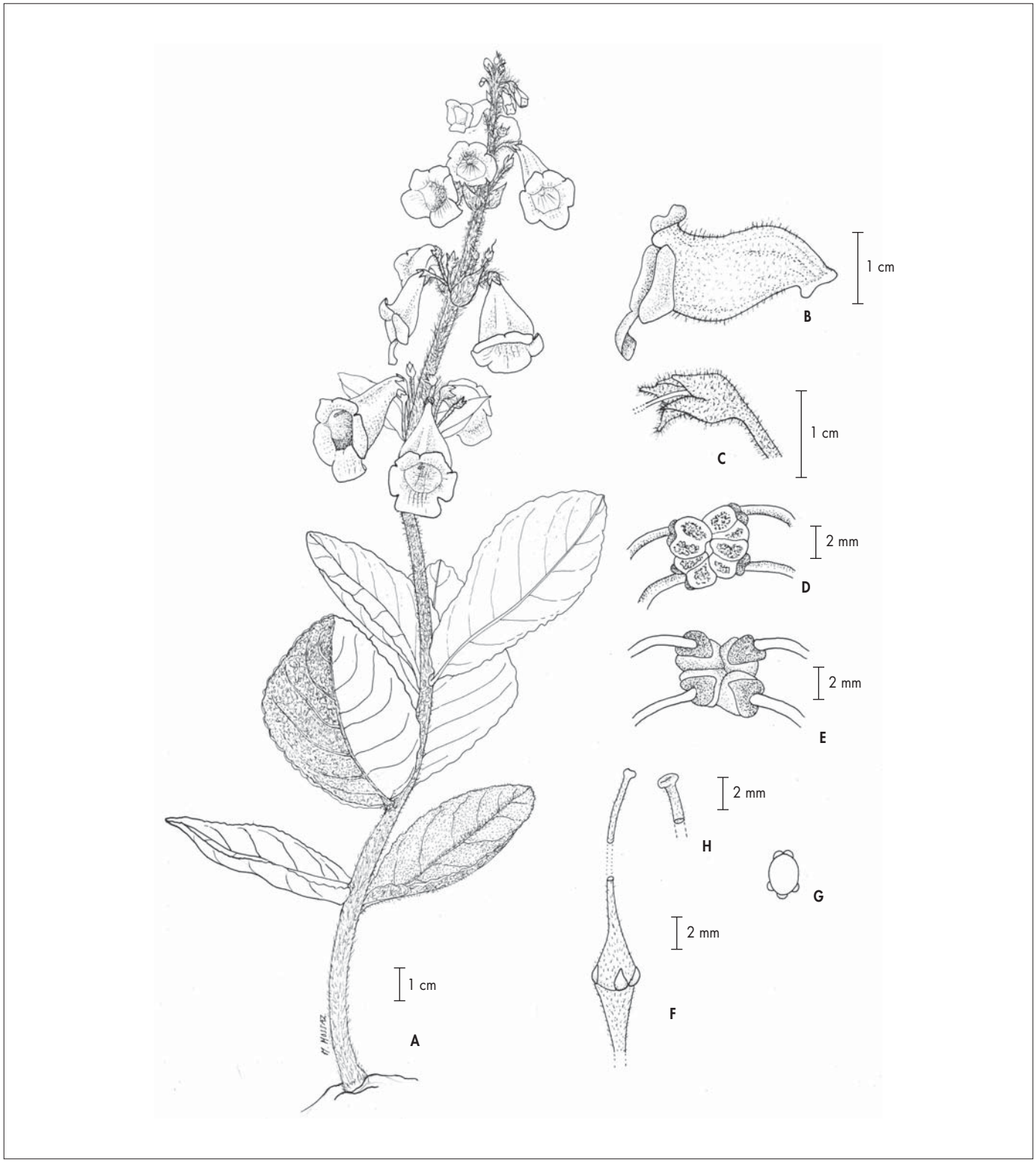

Fig. 4. – *Sinningia canastrensis* Chautems. **A.** Habit; **B.** Corolla, side view; **C.** Calyx (corolla removed), side view; **D.** Anthers detail, front view; **E.** Anthers detail, dorsal view. **F.** Ovary; **G.** Nectary glands arrangement around ovary; **H.** Stigma detail.

[**A:** *Romero & al. 1709, G*; **B-H:** based on spirit-fixed flowers from material cultivated by M. Peixoto, same origin as holotype *Romero & al. 3258*]
[Drawing: Maya Mossaz]

Fig. 5. – *Sinningia canastrensis* Chautems. **A.** Violet flowered form in the wild; **B.** Pink-red flowered form in the wild.
[Photos: Alain Chautems]

3. ***Sinningia gerdtiana*** Chautems, **spec. nova** (Fig. 6-7)

Typus: Brazil. Paraná: Município de Cerro Azul, Barra Rio Bom Sucesso, 20.III.1974, *G. Hatschbach 33846* (holo-: MBM!; iso-: Z!).

Juxta S. schiffneri, sed habito plerumque repenti caulis facile repullulantis copiose ramificantisque, foliis minoribus, corollis maioribus, capsula dorsaliter omnino secedenta differt.

Herb saxicolous with perennial somewhat fleshy stem, tuber absent. Stems creeping at base, erect on terminal branches, 30-80 cm tall, 3-8 mm in diam., freely branching or resprouting, puberulous when young, internodes 2-4 cm, sometimes reduced to 1-5 mm on side shoots. *Leaves* decussate, slightly anisophyllous, petiole 3-20(-45) mm long, pale green; blade ovate, 2-8(-11) cm long × 1.2-4.5(-5.5) cm wide, apex acute to acuminate, base obtuse, slightly asymmetric, above green, green to reddish beneath, margin broadly serrate, teeth 1.5-2.5 long × 1.5-3 mm wide, 4-7 pairs of veins, adaxial face pubescent, abaxial face puberulous. *Inflorescences* 1-flowered, in uppermost leaf axils, epedunculate, bractless. *Flowers* borne on pedicels, 5-12 mm long, greenish, calyx campanulate, fused at base for 5-6 mm and canescent, lobes subequal, 8-11 mm long, 3.5-4.5 mm wide at base, spreading, light green, pubescent, apex subulate, margin entire. *Corolla* tubular, obliquely inserted at an angle of nearly 90° in the calyx, 4-5 cm long, tube narrow at base for ca. 1.5 cm × 4 mm in diam., then briefly constricted and expanding to 9-10 mm in diam., evenly gibbous ventrally, with two grooves along a lengthwise bulge

dorsally, cream and puberulous on the outside, throat glabrous, white with fine parallel violet lines, lobes subequal, 7-9 mm long × 9-11 mm wide, ventral lobe erect, lateral and dorsal ones spreading, glabrous, white with violet netlike veins on the inside. *Stamens* 4, included, filaments 2 cm long, white, glabrous or minutely puberulous at base, anthers coherent in a narrow rectangle, 3.5 × 1.5 mm, pollen cream; nectary composed of 5 equal glands, 1,5-2 mm long × 0.5 mm wide, white; ovary semi-inferior, whitish, style 2-2.5 cm long, white, puberulous. *Fruit* a globose capsule, 8-10 mm long × 8-9 mm in diam., dehiscing by two apical valves (2 slits) with one of the slits continuing to the base of hypanthium, while still somewhat green and fleshy with acrescent calyx; seeds irregularly subglobose, 0.5-0.6 mm.

Etymology. – This species is named in honour of Dr Gerdt Guenter Hatschbach who first collected material of it and guided some of us to the original locality without any hesitation some 25 years after the first collection. This is an example of his exceptional skills and deep knowledge of the Brazilian flora. The senior author is very grateful to him for his help during the several visits to the MBML herbarium in Curitiba and the many gifts of material sent to G.

Phenology. – Inferred from the only two known collections, flowers are produced around February-March. This late summer period is matched in cultivation in the Geneva greenhouses with flowers regularly observed around August.

Distribution and ecology. – To our present knowledge, the species is endemic to a limited area in Brazil in the upstream portion of Rio Ribeira basin, across Paraná and São Paulo states (Fig. 3). It grows in forest along river or nearby, creeping on the ground covered by leaf litter or on margin of humid rocky walls. This species is an addition to the "Flora Fanerogãmica do Estado de São Paulo" (Chautems & Matsuoka, 2003).

The fruit dehiscence with one slit on one side of the capsule, including the hypanthium, is unique so far in tribe *Sinningieae.* It was first described by Wiehler (1983: Fig. 391) and later found in several members of tribe *Gloxinieae* Fritsch, i.e. some species of the genera *Diastema* Benth., *Monopyle* Benth., and *Gloxinella* (H. E. Moore) Roalson & Boggan (Weber, 2004). It is suggested that in perpetually wet forests, these fruits represent a special form of rain-wash or rain-splash capsules where the seeds are washed away by rain drops or water dripping from the tree cover. As observed by Kvist & Skog (1996) for some genera of *Gloxinieae,* the irregularly subglobose or broadly-elliptic type of seeds found in *Sinningia gerdtiana* is shared with other ground-dwelling and sciaphilous species (like *S. barbata* (Nees & Mart.) G. Nicholson*, S. eumorpha* H. E. Moore*, S. speciosa* (Lodd.) Hiern), in contrast with the ellipsoid seed present in most other *Sinningia* species that grow in more open and wind exposed habitat (Beaufort-Murphy, 1983).

Conservation status. – Endangered (EN) B2ab, according to the IUCN criteria, based on its area of occupancy in the high valley of Rio Ribeira is not exceeding 500 km^2 and projected decline of extent and quality of habitat, because no protection measures of the natural resources exist so far in its area of occurrence (IUCN, 2001). This species should be added to the recently published list of rare plants in Brazil, based on its area of occurrence covering less than 10 000 km^2 i.e. populations recorded in an area inferior to a 150 km extension (Chautems & Araujo, 2009). No protection measures of the natural resources exist so far in its area of occurrence. Hatschbach *(pers. comm.)* mentioned that the site of collection would be flooded by the construction of a dam. This project, named "Tijuco Alto" is still the object of controversial discussions (see http://www.socioambiental.org/inst/camp/RibeiraEn/tijuco).

Relationships. – Based on phylogenetic data, *S. gerdtiana* is sister to *S. schiffneri* Fritsch (Perret & al., 2003, 2006, 2007, cited as *Sinningia indet.* 4 or *Sinningia sp. nov.* 4). Unless other *Sinningia*, these two species do not rely on a basal tuber for perennial growth, but possess a perennial, somewhat fleshy stem. *Sinningia gerdtiana* differs from *S. schiffneri* by several characters listed in Table 1.

Table 1. – Comparisons of morphological characters for *Sinningia gerdtiana* Chautems and the related species *S. schiffneri* Fritsch.

	S. gerdtiana	***S. schiffneri***
habit	creeping	erect
stem	freely branching	mostly unbranched
stem diameter [mm]	3-8	4-12
leaf blade length [cm]	2-8	5-20
blade margin and teeth length [mm]	broadly serrate, teeth 1.5-2.5	finely serrate, teeth 1-1.5
calyx lobes size [mm]	8-11 × 3.5-4.5	5-10 × 2-3
corolla tube width [mm]	9-10	5-6
corolla length [cm]	4-5	2-3
corolla throat	violet veined	violet dotted
abaxial face of corolla lobes	violet veined	white
fruit dehiscence	two slits, one apical, the other dehiscing up to the base of hypanthium	two apical slits

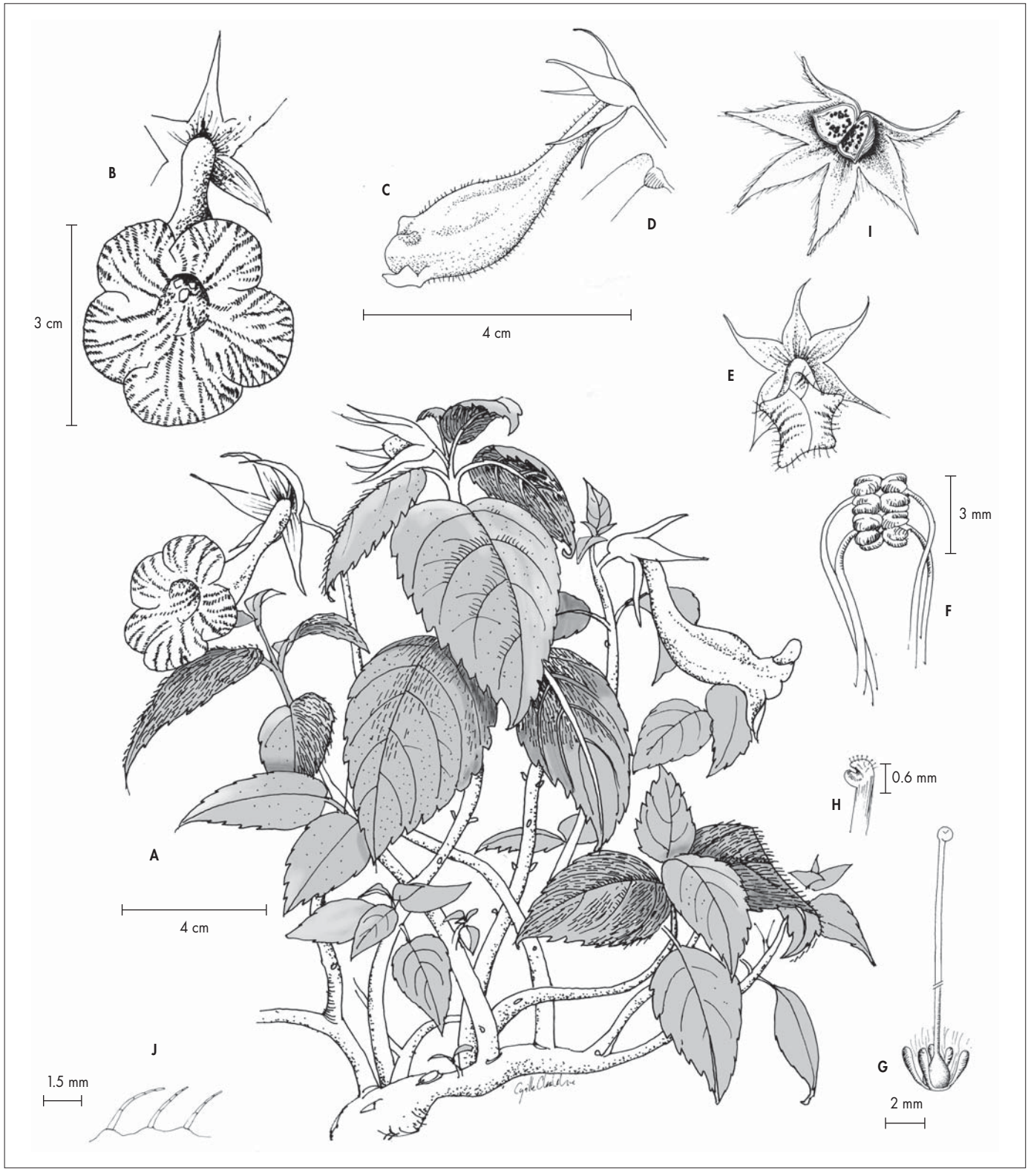

Fig. 6. – *Sinningia gerdtiana* Chautems. **A.** Habit ; **B.** Flower, front view ; **C.** Flower, side view ; **D.** Insertion of the corolla on the receptacle (calyx removed) ; **E.** Corolla bud aestivation ; **F.** Anthers detail, dorsal view ; **G.** Ovary and nectary glands ; **H.** Stigma detail ; **I.** Fruit ; **J.** Multicellular trichomes on adaxial leaf lamina.

[Drawn from live material, accession number *AC-2328*] [Drawing : Cyrille Chatelain]

Fig. 7. – *Sinningia gerdtiana* Chautems **A.** Cultivated specimen; **B.** Fruit showing dehiscence of hypanthium.

[Photos: Alain Chautems]

Additional material examined. – **Brazil. Paraná:** Cerro Azul, Barra do Rio Ribeira, ca. 1 km rio abaixo, depois do Rio Bom Sucesso, 24°47'00"S 49°13'04"W, 300 m, 26.XI.98 (steril), *G. Hatschbach & al. 71920* (MBM); Same material, flowered in cultivation in the greenhouses of the "Conservatoire et Jardin botaniques de la Ville de Genève", 22.VIII.2000, *A. Chautems s.n.* (G [AC-2328]). **São Paulo:** Município Barra do Turvo, Cachoeira Dito Salu, beira de paredão úmido, 27.II.1994 (fl.), *E. Barbosa & al. 884* (G, MBM).

Material in cultivation. – Distributed among *Gesneriaceae* growers under the name *Sinningia sp.* "Gertiana" through seed produced from material of same origin as the collection *Hatschbach 71920.* In the Geneva Botanical Garden greenhouses, this material is grown under accession number *AC-2328* (Fig. 6).

4. ***Sinningia globulosa*** Chautems & M. Peixoto, **spec. nova** (Fig. 8-9)

Typus: Brazil. São Paulo: Município de Caraguatatuba, Parque Estadual da Serra do Mar, Núcleo Caraguatatuba, Estrada intermediária, ca. km 41, ca. 1220 m, 23°38'44"S 45°40'21"W, coletado por J. P. Souza em 2000, floreceu em cultivo na coleção de Mauro Peixoto no sítio Primavera, Biritiba Ussú, perto de Mogi das Cruzes, 18.I.2009, *M. Peixoto 25* (holo-: HUMC!).

Floribus S. magnificae magnitudine similis, *sed pedunculo diminuto (1-3 mm), calyce campanulato-globoso indumento lanato miniato-aurantiaco omnino obtecto, sepalis plerumque connatis, gemmis fructibusque globosis differt.*

Herb, arising from perennial globose tuber, 4-9 cm in diam., brown to reddish, saxicolous. *Stems* 25-70 cm tall, 5-10 mm in diam., usually unbranched, densely covered by a white and lanate indument. *Leaves* decussate, equal or subequal in each pair, petiole 0.5-5 cm long, pale green and lanate-tomentose; blade ovate, 8-15 cm × 4.5-9 cm, apex acute, base attenuate to cordate, above green and pubescent, beneath white and lanate-tomentose, margin irregularly crenate to serrate, 5-7 pairs of veins. *Inflorescence* composed of 1-4 frondo-bracteose cymes in the stem apex, each bearing 2-8 flowers, peduncle reduced (1-3 mm). *Flowers* borne on pedicels, 1.5-2.5 cm, reddish, tomentose. *Calyx* campanulate-globose, lanate-tomentose, indument red orange, lobes fused at base for 4-5 mm, free for 2,5-3 mm, triangular, apex acute, margin entire,. *Corolla* tubular bilabiate, erect in the calyx, bright red, 4-4.5 cm long, 6-7 mm in diam. at base, tube 2.5 cm long, 9-10 mm wide below the throat, reddish pubescent, dorsal lobes 14-16 × 7-8 mm, fused for almost their entire length, lateral lobes 2-2.5 × 5-7 mm, spreading to reflexed, ventral lobe 2-3 × 5-6 mm, reflexed, with a wine red mark at base, inside of throat cream to rose. *Stamens* 4, included, filaments 3-3.5 cm, pale red, puberulous, anthers coherent, star-shaped, connective brown red, pollen yellow; nectary formed of 2 dorsal separate glands; ovary whitish pubescent, style reddish, puberulous, *Fruit* a globose capsule, mostly covered by accrescent calyx covered by an orange-red lanate-tomentose indument, capsule 8-10 × 8-10 mm; seeds narrowly ellipsoid, ca. 1 mm.

Etymology. – The specific epithet refers to the fuzzy ball observed at bud or fruiting stages, where calyx lobes completely hide the corolla "primordium" or maturing capsule.

Phenology. – Flowering from January to April, based on material in cultivation in Brazil.

Distribution and ecology. – Only known so far from the type locality in the Serra do Mar in São Paulo (Fig. 3), where it appears restricted to open vegetation on top of mountain or "campo de topo de morro" as described by Garcia & Pirani (2003). This species is an addition to Chautems & Matsuoka (2003).

Conservation status. – Critically Endangered (CR) B1ab, according to the IUCN criteria, based on the extent of occurrence not exceeding 100 km^2 with plants known in a single location and projected decline of extent and quality of habitat (IUCN, 2001). This species should be added to the recently published list of rare plants in Brazil, based on its area of occurrence covering less than 10 000 km^2 i.e. populations recorded in an area inferior to a 150 km extension (Chautems & Araujo, 2009).

Relationships. – Based on preliminary phylogenetic data, *S. globulosa* belongs to clade *Dircaea* (M. Perret, *pers. comm.).* This species is morphologically related to *S. cooperi* (Paxton) Wiehler, *S. hatschbachii* Chautems, and *S. magnifica* (Otto & A. Dietr.) Wiehler. Table 2 shows the main distinguishing features between the four species.

Additional material examined. – **Brazil. São Paulo:** Mogi das Cruzes, distrito de Biritiba Ussú, cultivated by Mauro Peixoto in sítio Primavera, 23°43'S 46°08'W, from horticultural source of unknown wild origin, 15.I.1994, *Chautems 421* (G); Caraguatatuba, Parque Estadual da Serra do Mar, Núcleo Caraguatatuba, Estrada intermediária, ca. km 41. Campo de altitude com dominância de *Eremanthus,* ca. 1220 m, 23°38'44"S 45°40'21"W, erva com rizoma desenvolvido, sobre encosta rochosa; frutos castanhos passados, 25.IV.2000, *J. P. Souza & al. 3518* (ESA 79060).

Material in cultivation. – Distributed through "the Gesneriad Society" for several years by means of a seed-list published in its journal "Gesneriads" under the name *Sinningia sp.* "Globulosa", same origin as *Souza & al. 3518.* A previous introduction grown in Brazil in Mauro Peixoto's collection in the 1980's and 1990's was used as the source of the line drawing (Fig. 8) and voucher *Chautems 421.*

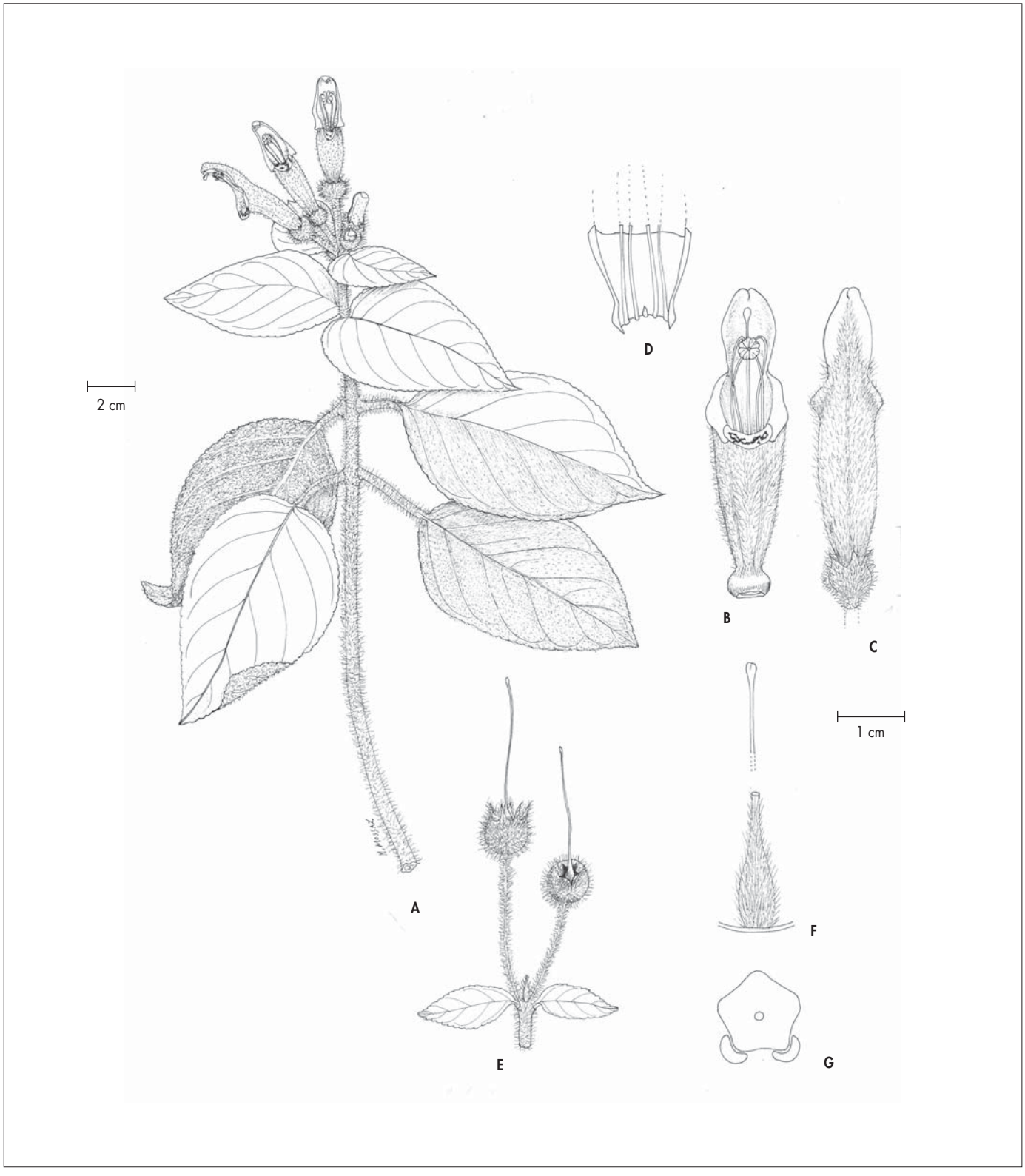

Fig. 8. – *Sinningia globulosa* Chautems & M. Peixoto. **A.** Habit; **B.** Corolla, ventral view; **C.** Corolla, dorsal view; **D.** Open corolla showing insertion of stamens and staminode; **E.** Immature fruits enclosed in accrescent calyces; **F.** Ovary; **G.** Nectary glands arrangement around ovary.

[**A-D, F-G:** *Chautems 421*, G; **E:** based on photos from material cultivated by M. Peixoto, same origin as *Chautems 421*] [Drawing: Maya Mossaz]

Fig. 9. – *Sinningia globulosa* Chautems & M. Peixoto. **A.** Flowering specimen; **B.** Globose fruits with brilliant red-orange indument.
[Photos: Alain Chautems]

Table 2. – Comparisons of morphological characters for *Sinningia globulosa* Chautems & M. Peixoto and the related species *S. cooperi* (Paxton) Wiehler, *S. hatchbachii* Chautems, and *S. magnifica* (Otto & A. Dietr.) Wiehler.

	S. globulosa	***S. cooperi***	***S. hatschbachii***	***S. magnifica***
stem indument	dense lanate, always white	pubescent	velutino-lanate, always white	tomentose, white or reddish
inflorescence	erect	pendent	erect	erect or pendent
peduncle length [mm]	1-3	5-25 mm	absent	5-60
calyx shape	campanulate-globose	briefly campanulate	campanulate	briefly campanulate
calyx indument	lanate-tomentose, red orange	puberulous	sericeous, white	pubescent to tomentose, white or reddish
calyx lobes	fused for most of their length	free for most of their length, linear-lanceolate	free for most of their length, long lanceolate	free for most of their length, triangular-lanceolate
flower bud	globose, corolla hidden by calyx lobes	obovoid, corolla not hidden by calyx lobes	obovoid, corolla not hidden by calyx lobes	obovoid, corolla not hidden by calyx lobes
corolla length [cm]	4-4.5	5-7	6-7	3.5–5.5
capsule	globose, mostly covered by accrescent calyx lobes	conical, not covered by calyx lobes	conical, not covered by calyx lobes	conical, not covered by calyx lobes

5. ***Sinningia helioana*** Chautems & Rossini, **spec. nova** (Fig. 10-11)

Typus: Brazil. Espírito Santo: Município de Santa Teresa, base da Pedra da Onça, próx. de Várzea Alegre e da Penha, propriedade de Waldir Erler, ca. 800 m, mata de encosta com muitos matações de rocha, na base de uma escarpa, 4.VI.1998, *H. Boudet Fernandes, L. Kollmann, E. Bausen, A. Chiarelo & W. Pizziolo 3237* (holo-: MBML 7906!).

Species valde peculiaris cum foliis aut floribus deinceps evolutis, caule e tubero emisso, petioliformi, plerumque unifoliato, petiolo carenti, lamina 10-15-nervata, corola tubulosa ad tubi basam apicemque constricta.

Herb, arising from perennial tuber, often ellipsoid-flattened, 4-12 cm in diam., saxicolous, leaves and inflorescences produced separately and successively,1-2 stems obliquely arising from the tuber upper surface (rarely 3-6 stems on several years old tubers), petiole-like, 4-8(-12) cm long, 2-3 mm in diam., brown red, pubescent, blade attachment swollen abaxially (looking like a pulvinus). *Leaves* forming an angle of nearly 90° with the petiole-like stem, usually reduced to one blade (a second and small one (1-5 mm long) is sometimes produced in opposite position), ovate (3-)9-24(-36) cm long × (1-)4-11(-18) cm wide, apex acute-acuminate, base shortly attenuate to truncate, green above, green or reddish beneath, finely puberulous-velutinous, margin slightly crenate, 10-15 pairs of veins. *Inflorescences* organized in well developed pair-flowered cymes, 4-10 flowers borne on peduncle, 5-8 cm, 1-2 mm in diam., reddish, emerging from 1-several points of the tuber upper surface, bracts linear, 1-2 mm long. *Flowers* nodding, borne on pedicels, 2-2.5 cm long, greenish, puberulous. *Calyx* campanulate, sepals fused at base for 2 mm, narrowly triangular, 3-4 × 1-1.5 mm wide at base, greenish to violet brown, margin entire, puberulous. *Corolla* slightly oblique in the calyx, tubular, 2.5-3 cm long, constricted above nectary chamber and below limb, 2 mm wide at base, tube enlarged then towards the middle reaching 5-6 mm in diam., greenish in bud, brilliant red at anthesis, puberulous, lobes 4.7-5.3 mm × 5-6.3 mm wide, ventral lobes slightly larger than dorsal lobes, spreading, throat cream inside. *Stamens* 4, included, filaments ca. 15 mm, white, glabrous, anthers coherent by their apex and side, forming a rectangle, pollen white, staminode reduced to a ca. 1 mm point, nectary formed by 2 fused dorsal glands and 3 smaller ones in ventral and lateral position; ovary 3-4 mm, greenish, style,16-20 mm, white. *Fruit* a capsule, borne on erect pedicel, ca. 7-9 mm long × 4-5 mm wide, terminated by a curved beak at the apex; seeds ellipsoid, 0.5-0.6 mm, striate.

Etymology. – This species is dedicated to our friend and colleague Helio de Queiroz Boudet Fernandes, director of the Mello Leitão Museum in Santa Teresa (MBML) who collected this very interesting plant, suspecting it could be an undiscovered species. He kindly sent to Geneva pictures and observations, based on material kept in cultivation at the Museu Mello Leitão, allowing us to recognize the unique features characterizing this new taxon.

Distribution and ecology. – The species is so far endemic from the Santa Teresa Municipality, known in only two localities (Fig. 3). In the wild, tubers were observed growing in shady and humid situations on steep, or vertical surfaces with leaf apex oriented downwards, leaf blade being therefore more or less parallel to the rock surface.

At first sight, this species looks like a stem-less plant with one or a few leaves with a well developed petiole emerging directly from the tuber. Seedlings were observed and followed for several growing seasons. After germination, the first pairs of tiny leaves are opposite-decussate as in any other *Sinningia* species. Following formation of a small tuber, a pair of strongly anisophyllous leaves appears and eventually a single leaf of large size develops. A very small foliar bud in opposite position often remains, that occasionally grows and forms a leaf reaching a few centimeters. These observations allowed us to understand that what appears like a petiole is in reality a stem, bearing a leaf blade without petiole and forming a right angle with the stem axis. This species has a growth cycle similar to *S. defoliata* (Malme) Chautems, alternating phases of production of leaves and flowers that emerge directly from the tuber and not from a well formed stem, like in most other species in the genus. Another species, *S. tuberosa* (Mart.) H. E. Moore does not produce stem or has a very reduced one and leaves and flowers are borne separately on the tuber. Table 3 includes the main characters that allow discrimination between the three acaulescent species.

Phenology. – Flowering between May and August with inflorescences usually emerging from bare tuber or sometimes with wilting leaves.

Conservation status. – Critically Endangered (CR) B1ab, according to the IUCN criteria, based on the extent of occurrence not exceeding 100 km^2 as well as projected decline of extent and quality of habitat, because no protection measures of the natural resources exist so far in its area of occurrence (IUCN, 2001). This species should be added to the recently published list of rare plants in Brazil, based on its area of occurrence covering less than 10 000 km^2 i.e. populations recorded in an area inferior to a 150 km extension (Chautems & Araujo, 2009). No protection measures of the natural resources exist so far in its area of occurrence.

Relationships. – Phylogenetic data show that the three acaulescent species are not closely related. *Sinningia helioana* is placed close to *S. aghensis* Chautems within a clade that also includes three micro-miniature species, i.e. *S. pusilla* (Mart.) Baill., *S. muscicola,* and *S. concinna* (Hook. f.) G. Nicholson

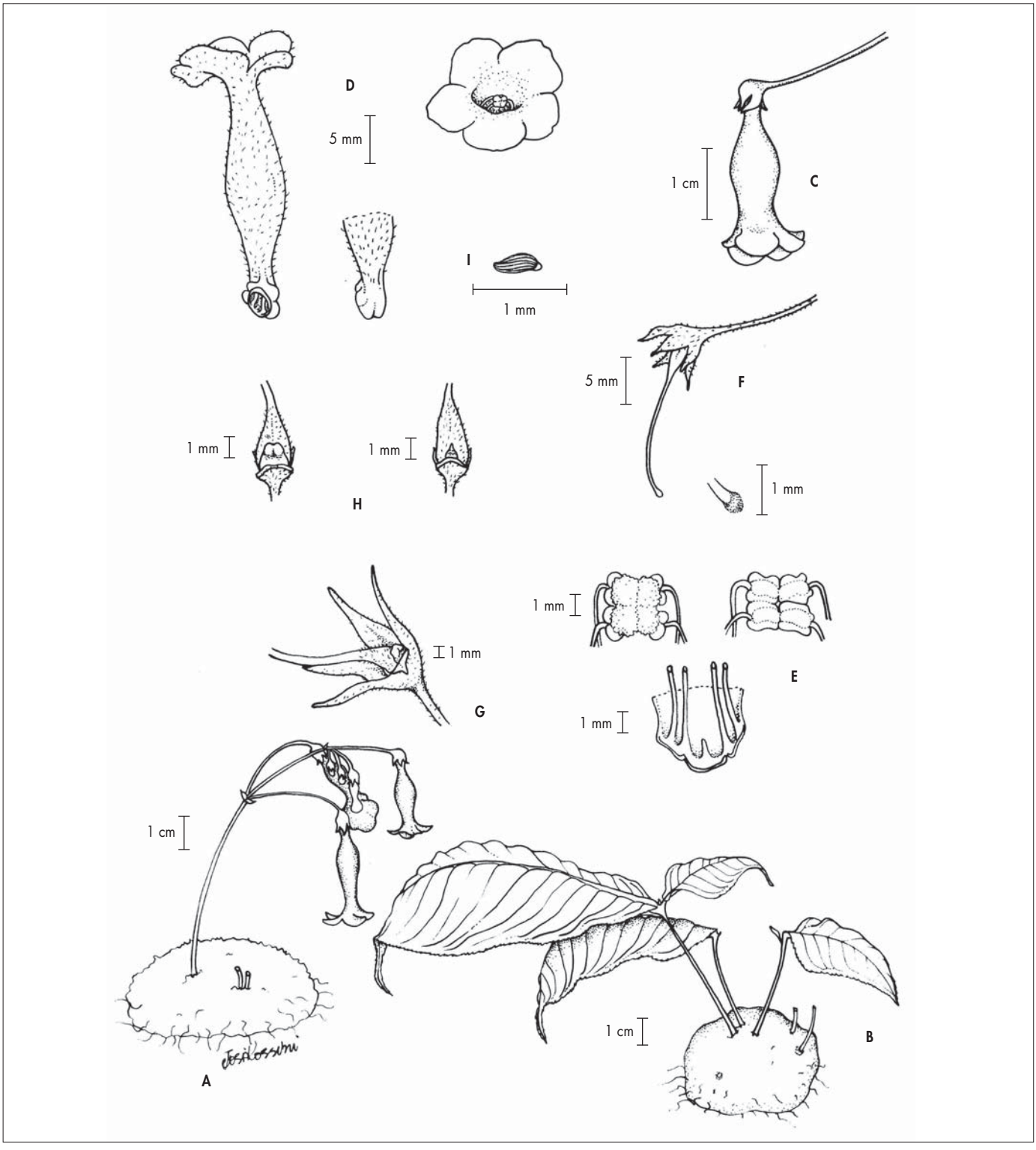

Fig. 10. – *Sinningia helioana* Chautems & Rossini. **A.** Habit at flowering stage; **B.** Habit at leaf stage; **C.** Corolla, side view; **D.** Corolla ventral view with details of basal portion, lateral view and corolla opening, front view; **E.** Anthers details with front view, dorsal view and open corolla showing insertion of stamens and staminode; **F.** Calyx and ovary, side view and detail of stigma; **G.** Calyx open to show ovary and dorsal nectary; **H.** Nectary glands and ovary, dorsal view and front view; **I.** Seed.

[Drawn from live material in the Mello Leitão Museum] [Drawing: Josiene Rossini]

Fig. 11. – *Sinningia helioana* Chautems & Rossini. **A.** Habit at flowering stage; **B.** Habit at leaf stage showing young opposite leaves on young plant and very reduced leaf blades at later stage.

[Photos: Alain Chautems]

Table 3. – Comparisons of morphological characters for *Sinningia helioana* Chautems & Rossini and the related species *S. defoliata* (Malme) Chautems and *S. tuberosa* (Mart.) H. E. Moore.

	S. helioana	*S. defoliata*	*S. tuberosa*
growth cycle	leaves and flowers produced successively in separate stage	leaves and flowers produced successively in separate stage	leaves and flowers produced at same stage
leaves	sessile, borne on petiole-like stem	nearly sessile, borne on tuber	petiolate and peltate
blade apex	acute-acuminate	obtuse	obtuse
flowers	nodding	obliquely erect	horizontal
corolla length [cm]	2.5-3	4-4.5	3-3.5
corolla constrictions	2, above nectary chamber and below limb	1, above nectary chamber	1, above nectary chamber

(M. Perret, *pers. comm.). Sinningia tuberosa* belongs to clade *Sinningia* and *S. defoliata* fits into clade *Corytholoma*, but in a different subclade than *Sinningia helioana* (Perret & al., 2003).

Additional material examined. – **Espírito Santo:** Santa Teresa, São João Petrópolis, cachoeira do Struts, subida da cachoeira, lado direito do riacho, 3.VIII.2000 (fl), *V. Demuner & al. 1334* (MBML); Santa Teresa, Varzea Alegre, Cachoeira do Strutz, 24.VII.2009 (fl), *J. Rossini & L. C. Rossini 697* (VIC [32.259]).

Material in cultivation. – This species has been made available to the *Gesneriaceae* growers under the name *Sinningia sp.* "Santa Teresa". In Brazil, it is grown in the "Casa das epífitas" at the Museu Mello Leitão in Santa Teresa-Espírito Santo since its introduction by Dr. Helio Boudet Fernandes in 1998 from material of same origin as the type collection *Boudet Fernandes & al. 3237* (Fig. 10). At the "Conservatoire et Jardin botaniques de la Ville de Genève", this material is registered under accession number *AC-2601* in the collection greenhouse, the source material being *Demuner & al. 1334.*

6. *Sinningia muscicola* Chautems, T. Lopes & M. Peixoto, **spec. nova** (Fig. 12-13)

Typus: Brazil. Rio de Janeiro: Município de Mangaratiba, Reserva Rio das Pedras, (RPPN-IBAMA), proximidades da Toca da Aranha, ca. 400 m, 24.XI.1998, *J. M. Braga & M. G. Bovini 5095* (holo-: RUSU!).

Sinningia pusillae proxima, sed laminis foliorum maioribus et profunde crenatis, superficie adaxiale circa costam nervosque atro-puprurea, pedicelis longioribus, corolla sine calcari differt.

Herb, small, 5-6 cm in height, 4-8 cm in diam., arising from perennial globose tuber, 0.7-1 cm in diam., saxicolous, sciaphilous. *Stems* 1-13 mm tall, 1-2 mm in diam., unbranched, puberulous. *Leaves* rosulate, petiole 0.1-2.1 cm, green; blade ovate, 0.7-4.4 × 0.3-1.9 cm, apex acute, base obtuse, above green with broad violet-black streaks extending beyond midrib and veins, pubescent, reddish beneath, margin deeply crenate, 5-7 pairs of veins. *Inflorescence* reduced to solitary flower, axillary, lacking peduncle. *Flowers* borne on pedicels, 3.7-6 cm, green, pubescent with glandular trichomes. *Calyx* minute, fused at base for 0.25 mm, lobes, spreading towards the apex, 3 mm, linear, subulate at the apex, narrowly lanceolate at base, margin entire, green, pubescent with glandular trichomes. *Corolla* tubular-funnel-shape, obliquely inserted in the calyx, 1.3-1.5 cm long, ca. 2 mm in diam. at base, with a swelling on the dorsal side, tube 2.4-2.6 mm wide, yellowish to light purple in bud, pale purple at anthesis, pubescent with glandular trichomes, lobes spreading, unequal, upper two 3-3.5 × 3-3.5 mm; 2 lateral 4.5-5 × 3.5-3.8 mm, lower one 5-5.5 × 4.2-4.5 mm, tube inside white with some pale lavender lines. *Stamens* 4, included, filaments 6-7 mm, white, glabrous, anthers coherent, forming a rectangle, pollen white; nectary 2 dorsal separate glands; ovary pubescent, style 5-6 mm, white, stigma bilobed. *Fruit* a capsule, 7-8 × 5-6 mm; seeds ellipsoid, 0.4-0.5 mm.

Etymology. – The epithet is based on "muscus", Latin for moss and "cola", Latin for dweller in reference to the way populations of this tiny species grow among mosses covering vertical faces of rocks.

Distribution and ecology. – The species is so far only known from the Rio das Pedras Preservation area (near Mangaratiba, Rio de Janeiro) where it was found at two locations along a path between 250 and 450 m (Fig. 3). The plants were observed growing in colonies among mosses and lichens on nearly vertical faces of big boulders within dense and humid forest. In these conditions, leaves in the rosettes are strongly unequal with 1-3 leaves hanging towards the ground much larger that the remaining leaves pointing to the sky. In cultivation, plants when grown on flat surfaces tend to produce larger leaves of equal size all around the rosette. The variegated leaves with violet-black streaks along the veins are typical for low-growing prostrate herbs thriving in shady forest understory. This kind of leaf coloration may be an adaptation for plants that grow in variable levels of light intensity, in an environment where there is reduced competition (Blanc, 2002).

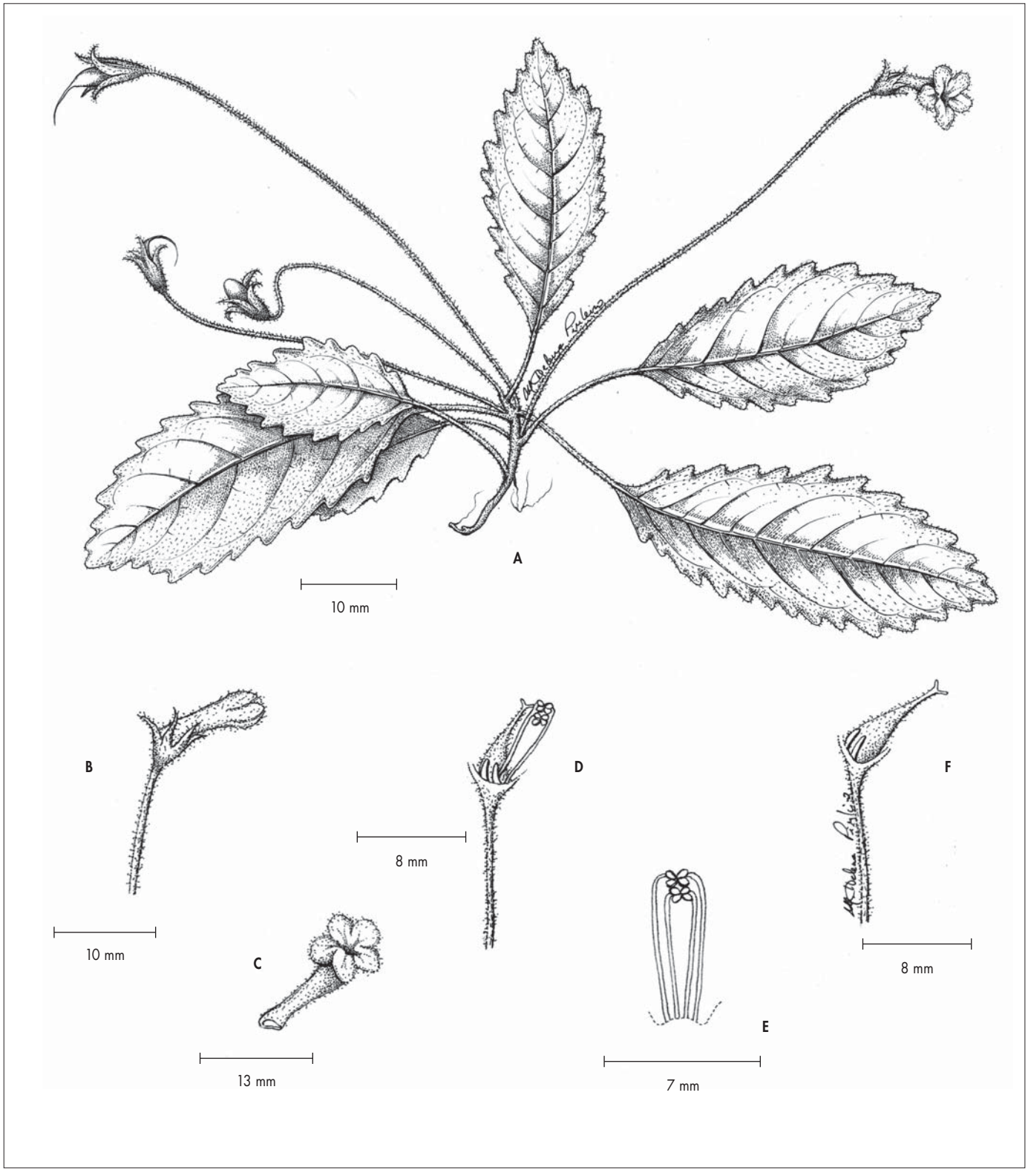

Fig. 12. – *Sinningia muscicola* Chautems, T. Lopes & M. Peixoto. **A.** Habit; **B.** Flower in bud; **C.** Corolla, side view **D.** Anthers and ovary; **E.** Anthers, front view; **F.** Nectary and ovary.

[*Lopes & al. 18,* RUSU] [Drawing: Maria Helena Pinheiro]

Fig. 13. – *Sinningia muscicola* Chautems, T. Lopes & M. Peixoto. **A.** Flowers and immature fruit capsule; **B.** Flower in close-up.
[Photos: Alain Chautems]

Phenology. – Collected in bloom in October-November, also observed some flowers in January. In cultivation, fruit capsules are produced through self-pollination and seed germinate and can produce flowers in less than 6 months. Blanc (2002) commented that it is frequent for low-growing herbs growing on slopes or rocks to produce flowers and fruits at any season, because of their reduced investment in producing reproductive structures.

Conservation status. – Critically Endangered (CR) B1ab, according to the IUCN criteria, based on the extent of occurrence not exceeding 100 km^2, known to exist at a single location and projected decline of extent and quality of habitat (IUCN, 2001). This species should be added to the recently published list of rare plants in Brazil, based on its area of occurrence covering less than 10 000 km^2 i.e. populations recorded in an area inferior to a 150 km extension (Chautems & Araujo, 2009).

Relationships. – This species is related to but quite distinct from *S. pusilla* (Biggs, 2004). Preliminary phylogenetic data place this species in clade *Corytholoma*, along with two other micro-miniature species, *S. pusilla* and *S. concinna* (M. Perret, *pers. comm.).* Table 4 summarizes the characters that allow to distinguish these three species.

Additional material examined. – **Brazil. Rio de Janeiro:** Mangaratiba; Reserva Rio das Pedras, Trilha para a Toca da Aranha, 26.X.2001, *T. C. C. Lopes & al. 18* (RUSU); *ibidem*, Trilha para a Toca da Aranha, 26.X.2001, *T. C. C. Lopes & al. 21* (RUSU); *ibidem,* 15.X.2003, *T. C. C. Lopes & al. 58* (RUSU); *ibidem,* 15.X.2003, *T. C. C. Lopes & al. 59* (RUSU); *ibidem,* 15.X.2003, *T. C. C. Lopes & al. 60* (RUSU); *ibidem,* 13.XI.2004, *T. C. C. Lopes & A. Giupponi 93* (RUSU); *ibidem,* 13.XI.2004, *T. C. C. Lopes & A. Giupponi 95* (RUSU).

Material in cultivation. – This species was introduced among *Gesneriaceae* growers in 2002 under the name *Sinningia sp. nov.* "Rio das Pedras" (Peixoto, 2003). Quite some variation was observed in the more or less dark leaves and light to plain purple corollas. This species appears to hybridize fairly readily with a number of other species, like *S. concinna* and *S. conspicua* (Seem.) G. Nicholson. The micro-miniatures *Sinningia* species are quite popular among *Gesneriaceae* growers, due to their very small size and ability to grow in terrarium conditions. Hybrids with other species are already registered, see for example *Sinningia* 'Brazilian Dollbaby', a cross of *S. eumorpha* H. E. Moore cv. "Saltão" with *S. muscicola* (as *Sinningia* "Rio das Pedras": http://www.dollyyeh.idv.tw/Sinn_Brazilian_Dollbaby_2006aggs.jpg) or *Sinningia* 'Li'l Georgie', a cross of *S. muscicola* with *S. concinna* (http://www.burwur.net/sinns/4x_georg.htm).

Table 4. – Comparisons of morphological characters for *Sinningia muscicola* Chautems, T. Lopes & M. Peixoto and the related species *S. concinna* (Hook. f.) G. Nicholson and *S. pusilla* (Mart.) Baill.

	S. muscicola	***S. concinna***	***S. pusilla***
plant height [cm]	4-8	6-10	3-5
rosette diameter [cm]	5-9	4-7	3-6
petiole lengt [mm]h	3-6	5-10	2.5-8
petiole /blade ratio	shorter than the blade	often longer than the blade	shorter than the blade
blade size [mm]	7-44 × 3-19	8-15 × 9-15	3-13 × 2.1-8
blade shape	ovate	suborbicular	ovate to elliptic
blade margin	deeply crenate	moderately crenate	moderately crenate
adaxial blade midrib and veins	dark violet	reddish	tinged reddish
adaxial blade coloration	dark violet or blackish around the veins, dark green towards the margin	dark green	dark green
abaxial blade coloration	reddish	reddish	pale green
pedicel length [mm]	15-35	25-30	25-35
pedicel indument	glandular trichomes	glabrous (fine hairs visible only under binocular)	glandular trichomes
calyx lobes shape	linear lanceolate	narrowly lanceolate	narrowly lanceolate
calyx lobes size [mm]	2.8-3.3 × 0.7-0.9	2-2.5 × 1.3-1.6	2.2-2.8 × 1.2, dorsal lobe 1.8-2 × 1
corolla tube length [mm]	10-12	12-15	11-13
corolla tube color	white flushed with lilac on dorsal side	white with a dark purple band on dorsal side	white flushed with lilac on dorsal side
corolla base	not spurred	not spurred	spurred, spur 2-2.5 mm
tube width [mm]	2.4-2.6	3.2-3.6	1.3-1.5
tube height [mm]	2.2-2.4	3.4-3.8	1.7-1.9
throat in ventral part	inconspicuously 3-sulcate	distinctly bisulcate	inconspicuously 3-sulcate
throat pigmentation	cream, not dotted	purple dotted	cream and purple, not dotted
corolla opening diameter [mm]	1.8-2.2	3-4	1.8-2
corolla lobes shape	obovate	obovate-orbicular	obovate-oblong
corolla lobes size [mm]	upper two 3-3.5 × 3-3.5, 2 lateral 4.5-5 × 3.5-3.8, lower one 5-5.5 × 4.2-4.5	upper two 3-4 × 3.5-4.5, 2 lateral 5.6-6.8 × 6.2-6.4, lower one 5-5.2 × 6.2-6.4	upper two 4.5-5 × 2.8-3, 2, lateral 4.5-5 × 3, lower one 5-5.5 × 3.5-4
nectary glands	2 dorsal, separate	5 glands	2 dorsal separate, 3 other ones vestigial
stigma	bilobed	stomatomorphic	bilobed

7. *Sinningia polyantha* (DC.) Wiehler in Selbyana 5: 383. 1981 (Fig. 14-15).

≡ *Gesneria polyantha* DC., Prodr. 7: 528. 1839.

Typus: Brazil. Santa Catarina: "Ste Catherine", 1832, *Gaudichaud 182* (holo-: G-DC!; iso-: G!, P!).

Herb, arising from perennial tuber, globose 3-10 cm in diam. Stems 30-80 cm tall, 3-8 mm in diam., unbranched, reddish, villous. *Leaves* arranged in 3-4 nodes, decussate or 3-whorled, equal in a whorl, petiole 0,2-3 cm long, green; blade ovate, 5-14 × 3-8 cm, apex acute, base obtuse to truncate or slightly cordiform, above green, sericeous, beneath pale green to canescent, tomentose, margin irregularly serrate to serrulate, 5-6 pairs of veins, opposite or alternate. *Inflorescence* 10-30 or more flowers, pseudo-umbellate, in one or two whorls in the upper stem, peduncle 1-5 mm, bracts 5-15 × 3-5 mm. *Flowers* borne on pedicels, 1.5-3 cm long, densely pubescent. *Calyx* campanulate, fused at base for 2-3 mm, lobes linear-lanceolate, 3-4 mm long, apex acute, margin entire, green to reddish, pubescent. *Corolla* tubular, erect in the calyx, 3.1-3.4 cm long, 3-4 mm in diam. at base, nectary chamber formed of 5 gibbosities, 5.5-6 mm wide, tube 2.8-3 cm long, 5-7 mm wide, yellowish-pink in bud, bright pink with wine red streaks in the upper half at anthesis, pubescent, ventral and lateral lobes 3-4 × 4-5 mm, the two dorsal ones 3-4 × 3-4 mm, overlapping at the apex, erect to slightly spreading, throat pink with wine red streaks extending on the inner lobes. *Stamens* 4, included, filaments white, anthers coherent forming a rectangle, pollen white; nectary consisting of two dorsal glands, ca 3 mm long, separate, only touching in their basal portion; ovary reddish, style ca. 2.5 cm, pink. *Fruit* held on erect pedicel, capsules ovoid, apex acute, 12-15 × 4-6 mm; seeds narrowly ellipsoid, ca 1 mm long.

Etymology. – The epithet is based on the Greek roots "poly", numerous and "anthos", flowers.

Phenology. – Flowers were registered between October and December, whereas seed capsules were observed between November and January.

Distribution and ecology. – This species is usually found in "restinga" areas in southern Santa Catarina and northern Rio Grande do Sul (Fig. 3), growing in sand or occasionally on rocks or trees in the transition zone between beach vegetation and coastal forest. The whole formation of coastal vegetation growing on sandy substrate is commonly called "restinga" along the Atlantic coast in Brazil. This species is the only one in the genus growing in sandy substrate (see Fig. 15), with tubers which can be totally buried in sand.

Conservation status. – Endangered (EN) B1ab, according to the IUCN criteria, based on the extent of occurrence estimated to be less than 5000 km^2 with only 4-5 localities or "municipios" known so far and threatened habitat, due to urban development along the attractive sandy beaches of this part of southern Brazil (IUCN, 2001).

Relationships. – Based on phylogenetic data, *S. polyantha* belongs to clade *Dircaea*, in sister position to *S. nivalis* Chautems and within a subclade including other whorled-leaved *Sinningia* (Perret & al., 2003, 2006, 2007, cited as *Sinningia indet.* 7 or *Sinningia sp. nov.* 7). Morphologically, *S. polyantha* is related to *S. douglasii* (Lindl.) Chautems and *S. nivalis,* which both occur in southern Brazil. The main discriminating morphological characters are listed in Table 5. Candolle in its description, in an infrageneric arrangement of the species belonging to *Gesneria* L. (now all included in *Sinningia),* had properly put his *Gesneria polyantha* in a group of species with opposite leaves while *G. douglasii* Lindl. was placed in a group comprising species with whorled leaves.

Chautems (1990) placed *Sinningia polyantha* in synonymy with *S. douglasii,* but this position must be corrected, now that live material and several collections other than the original Gaudichaud material were found and proved morphologically distinct.

Material examined. – **Brazil. Santa Catarina:** Município de Garopaba, Praia da Ferrugem, margem da restinga, 28°04'49"S 48°37'52"W, XI.1998, *A. Cervi & al. AC-484* (G [fl.]); G [fr.]); Município de Laguna, restinga, X.1971, *G. Hatschbach & al. 27241* (MBM, BH, NY, UC); Município de Imbituba, Praia Boa Esperança, 3-5 m; terrícola, dunas fixas, flor vermelho-carmim, 13.XII.2000, *G. Hatschbach & al. 71883* (MBM); Garopaba, 10 m alt., rupestre, 21.X.1970, *R. M. Klein & A. Bresolin 8820* (HBR); Garopaba, Praia da Ferrugem, 3.X.1989, *L. H. Paukowskii 115* (HAS). **Rio Grande do Sul:** Município de Arroio do Sal, Parque Tupancy, mata de restinga, interior e beira de mata, algumas vezes crescendo em areia; epífita ou erva terrestre, flores roséo-avermelhadas, 28-16.X.2004, *L. F. P. Lima s.n.* (ICN 135518); Município de Torres, Rondinha Velha, num capão distante cerca de 400 m do mar, na beira da mata, 29-27.X.1987, *C. Mondin & V. Manfroi s.n.* (HAS); Arroio do Sal, Baln. Rondinha Velha, 11.XI.1990, *M. G. Rossoni 570* (ICN); *ibid.,* 11.XI.1990, *M. G. Rossoni 571* (ICN); *ibid.,* mata de restinga em solo arenoso, crescendo no interior da mata e nas clareiras, 11.XI.1990, *M. G. Rossoni 573* (CEPEC); Torres, Arroio do Sal, 13.IX. 1985, *N. Silveira & al. 3531* (HAS); Arroio do Sal, Praia de Rondinha, sobre a duna ao sol, epifítico, 21.III.1991, *N. Silveira 8824* (G, HAS); Torres, Praia Itapeva, epífito, em capão de dunas também, XI.1979, *J. Waechter 1455* (ICN); Torres, Praia Itapeva, epífito, em mata de dunas, XII.1987, *J. Waechter 2282* (ICN).

Material in cultivation. – Distributed through the Gesneriad Society for several years by means of a seed-list published in its journal "Gesneriads" under the name *Sinningia sp.* "Waechter" or *Sinningia sp.* "arenicola". In G, it is registered under accession number *AC-2330* (for some time labelled as *Sinningia "dunensis"*), same origin as collection *Cervi & al. AC-484* (Fig. 14).

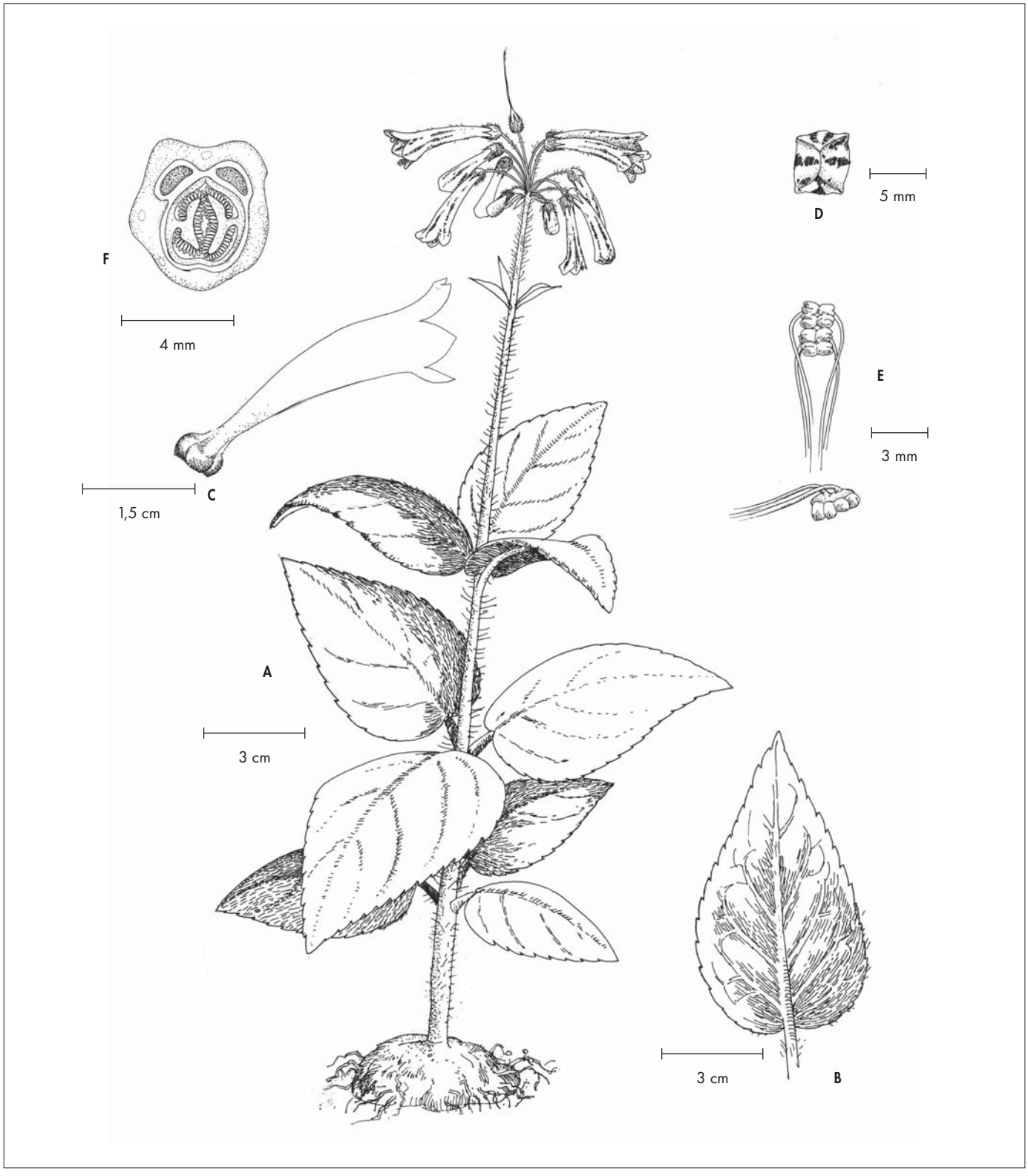

Fig. 14. – *Sinningia polyantha* (DC.) Wiehler. **A.** Habit; **B.** Leaf, abaxial view; **C.** Corolla, side view; **D.** Corolla bud aestivation; **E.** Stamens, front and side view; **F.** Transversal section of ovary showing lateral placentation and the two dorsal nectary glands.

[Drawn from live material, accession number *AC-2330*] [Drawing: Cyrille Chatelain]

Fig. 15. – *Sinningia polyantha* (DC.) Wiehler. Plant in the wild collected as *Cervi & al. AC-484.*

[Photo: Alain Chautems]

Table 5. – Comparisons of morphological characters for *Sinningia polyantha* (DC.) Wiehler and the related species *S. douglasii* (Lindl.) Chautems and *S. nivalis* Chautems.

	S. polyantha	***S. douglasii***	***S. nivalis***
number of nodes	3-4	1-2	1-2
leaves arrangement	opposite or 3 whorled	6-whorled	6-whorled
leaf blade indument abaxial face	tomentose	pubescent	tomentose
petiole length [cm]	0.2-3	2.5-6	0.3-2.5
pedicel indument	tomentose	puberulent	hirsute
pedicel length [cm]	1.5-3	2-5	1.5-4
calyx lobes [mm]	3-4	2-3	5-7
corolla length [cm]	3-3.5	3.5-5	2.8-3.3
corolla lobes length [mm]	3-4	6-7	6
nectary glands	2 dorsal united basally	2 dorsal separate	2 dorsal separate
ecology	restinga	slopes of Mata atlântica	high campos
habitat	sandy soil, rarely rupicolous or epiphytic	epiphytic, rarely rupicolous	rupicolous

Acknowledgments

We are grateful to M. Perret for discussing his preliminary phylogenetic analyses based on unpublished molecular data, N. Nakajima and R. Romero for sending material to Geneva and later guiding the senior author in the Canastra area, to Dr. Jorge Waechter from the Federal University of Rio Grande do Sul in Porto Alegre who first drew our attention to material of *S. polyantha* he had collected and cultivated, to the greenhouse team at the Conservatoire et Jardin botaniques de la Ville de Genève (CJBG) for keeping the live *Gesneriaceae* collection, to Alan Lavergne for a careful reading of a previous version of this manuscript and for all the information attractively organized in his "Sinningia and friends" website (http://www.burwur.net/sinns/sinns.htm).

References

Biggs, N. (2004). 502. Sinningia pusilla. Gesneriaceae. *Bot. Mag.* 21: 193-196.

Blanc, P. (2002). *Etre plante à l'ombre des forêts tropicales.* Nathan/VUEF.

Beaufort-Murphy, H. T. (1983). The seed surface morphology of the Gesneriaceae utilizing the scanning electron microscope and a new system for diagnosing seed morphology. *Selbyana* 6: 220-422.

Chautems, A. (1988). Révision taxonomique et possibilités d'hybridations de Nematanthus Schrader (Gesneriaceae), genre endémique de la forêt côtière brésilienne. *Diss. Bot.* 112.

Chautems, A. (1990). Taxonomic revision of Sinningia Nees: nomenclatural changes and new synonymies. *Candollea* 45: 381-388.

Chautems, A. (1991a). A familia Gesneriaceae na região cacaueira da Bahia, Brasil. *Revista Brasil. Bot.* 14: 51-59.

Chautems, A. (1991b). Taxonomic revision of Sinningia Nees (Gesneriaceae) II: new species from Brazil. *Candollea* 46: 411-425.

Chautems, A. (1995). Taxonomic revision of Sinningia Nees (Gesneriaceae) III: new species from Brazil and new combinations. *Gesneriana* 1: 8-14.

Chautems, A. (1997). New Gesneriaceae from São Paulo, Brazil. *Candollea* 52: 159-169.

Chautems, A. (2002). New Gesneriaceae from Minas Gerais, Brazil. *Candollea* 56: 261-279.

Chautems, A. & A. O. Araujo (2009). Gesneriaceae. *In:* Giulietti, A. M., A. Rapini, M. J. G. Andrade, L. P. Queiroz & J. M. C. Silva (ed.), *Plantas Raras do Brasil:* 187-190. Conservação Internacional – Brasil & Universidade Estadula de Feira de Santana, Belo Horizonte

Chautems, A., G. S. Baracho & J. A. Siqueira Filho (2000). A new species of Sinningia (Gesneriaceae) from northeastern Brazil. *Brittonia* 52: 49-53.

Chautems, A. & C. Y. K. Matsuoka (2003). Gesneriaceae. *In:* Wanderley, M. G. L., G. J. Shepherd, A. M. Giuletti & T. S. Melhem (ed.), *Fl. Phanerog. Estado São Paulo* 3: 75-103.

Garcia, R. J. F. & R. Pirani (2003). Revisão sobre o diagnóstico e caracterização da vegetação campestre junto à crista de serras, no Parque Estadual da Serra do Mar, São Paulo, SP, Brasil. *Hoehnea* 30: 217-241.

IUCN (2001). *IUCN Red List Categories and Criteria: Version 3.1.* IUCN Species Survival Commission. IUCN.

Kvist, L. P. & L. E. Skog (1996). Revision of Pearcea (Gesneriaceae). *Smithsonian Contr. Bot.* 84.

Mendonça, M. P. & L. V. Lins (ed.) (2000). *Lista vermelha das espécies ameaçadas de extinção da flora de Minas Gerais.* Fundação Biodiversitas, Fundação Zoo-Botânica de Belo Horizonte, Belo Horizonte.

Peixoto, M. (2003). Sinningia sp. “Rio das Pedras”. *Gloxinian* 53: 35-37.

Perret, M., A. Chautems & R. Spichiger (2006). Dispersal-Vicariance Analyses in the Tribe Sinningieae (Gesneriaceae): A Clue to Understanding Biogeographical History of the Brazilian Atlantic Forest. *Ann. Missouri Bot. Gard.* 93: 340-358.

Perret, M., A. Chautems, R. Spichiger, T. G. Barraclough & V. Savolainen (2007). The geographical pattern of speciation and floral diversification in the Neotropics: the tribe Sinningieae (Gesneriaceae) as a case study**.** *Evolution* 61: 1641-1660.

Perret, M., A. Chautems, R. Spichiger, G. Kite & V. Savolainen (2003) Systematics and evolution of tribe Sinningieae (Gesneriaceae): evidence from phylogenetic analyses of six plastid DNA regions and nuclear ncpGS. *Amer. J. Bot.* 90: 445-460.

Romero, R. & J. N. Nakajima (1999). Especies endêmicas do Parque Nacional da Serra da Canastra, Minas Gerais. *Revista Brasil. Bot.* 22, suppl.: 259-265.

Rossini, J. & A. Chautems (2007). Codonanthe gibbosa Rossini & Chautems, a new species of Gesneriaceae from the State of Espírito Santo, Brazil. *Candollea* 62: 215-220.

Sanmartin-Gajardo, I. & M. Sazima (2004). Non-Euglossine bees also function as pollinators of Sinningia species (Gesneriaceae) in southeastern Brazil. *Pl. Biol. (Stuttgart)* 6: 506-512.

Weber, A. (2004). Gesneriaceae. *In:* Kubitzki, K. & W. Kadereit (ed.), *The families and genera of vascular plants, 7, Flowering plants, Dicotyledons: ‘Lamiales’ (except ‘Acanthaceae’ including ‘Avicenniaceae’):* 63-158. Springer.

Wiehler, H. (1983). A synopsis of the neotropical Gesneriaceae. *Selbyana* 6: 1-219.