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TWO NEW VARIETIES OF *BEGONIA HOOVERIANA* FROM SULAWESI

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ABSTRACT
ALVITASARI, D., CHIKMAWATI, T., DORLY, RUGAYAH & ARDI, W. H. 2024. Two new varieties of *Begonia hooveriana* from Sulawesi. *Reinwardtia* 23(2): 55–62. — Two new varieties of *Begonia hooveriana* Wiriad. from Sulawesi are described here, namely *Begonia hooveriana* var. *rubescens* Alvitasari and *Begonia hooveriana* var. *sepangensis* Alvitasari. They are distinguished based on several morphological characters: base, shape, and size of male flower tepals; peduncle length of female inflorescence; peduncle length, shape, and apex of fruits. A description of two new varieties, identification keys and its distributions are provided here.

Key words: Complex species, morphological characters, new varieties.

ABSTRAK
ALVITASARI, D., CHIKMAWATI, T., DORLY, RUGAYAH & ARDI, W. H. 2024. Dua varietas baru *Begonia hooveriana* dari Sulawesi. *Reinwardtia* 23(2): 55–62. — Dua varietas baru *Begonia hooveriana* Wiriad. dari Sulawesi sudah dipertelakan, yaitu *Begonia hooveriana* var. *rubescens* Alvitasari dan *Begonia hooveriana* var. *sepangensis* Alvitasari. Varietas tersebut dibedakan berdasarkan beberapa karakter morfologi: pangkal, bentuk, dan ukuran tepal bunga jantan; panjang gagang perbungaan betina; panjang gagang buah, bentuk, dan ujung buah. Deskripsi dan kunci ke dua varietas baru tersebut disajikan pada makalah ini.

Kata kunci: Karakteristik morfologi, jenis kompleks, varietas baru.

INTRODUCTION

Sulawesi Island has a high species diversity of *Begonia* (Wiriadinata, 2013). In the last decade, the number of known species increased, 93 % being endemic to the island (Ardi & Thomas, 2022; SBDP, 2023 continuously updated). Most begonias in Sulawesi are included in *Begonia* sect. *Petermannia* with 56 species (SBDP, 2023) recorded as native. Those species have protogynous inflorescences, two tepals in the male flowers, anthers with unilaterally positioned slits, five-tepals of female flowers, two-flowered female in each inflorescence, or solitary female flower, three-locular ovaries with axile placentation and bilamellate placentae, and fruits with equal or subequal wings (Doorenbos *et al.,* 1998; Moonlight *et al.,* 2018).

Most Sulawesi *Begonia* flowers are white, white tinged pink, or pink (Thomas *et al.,* 2013). How-

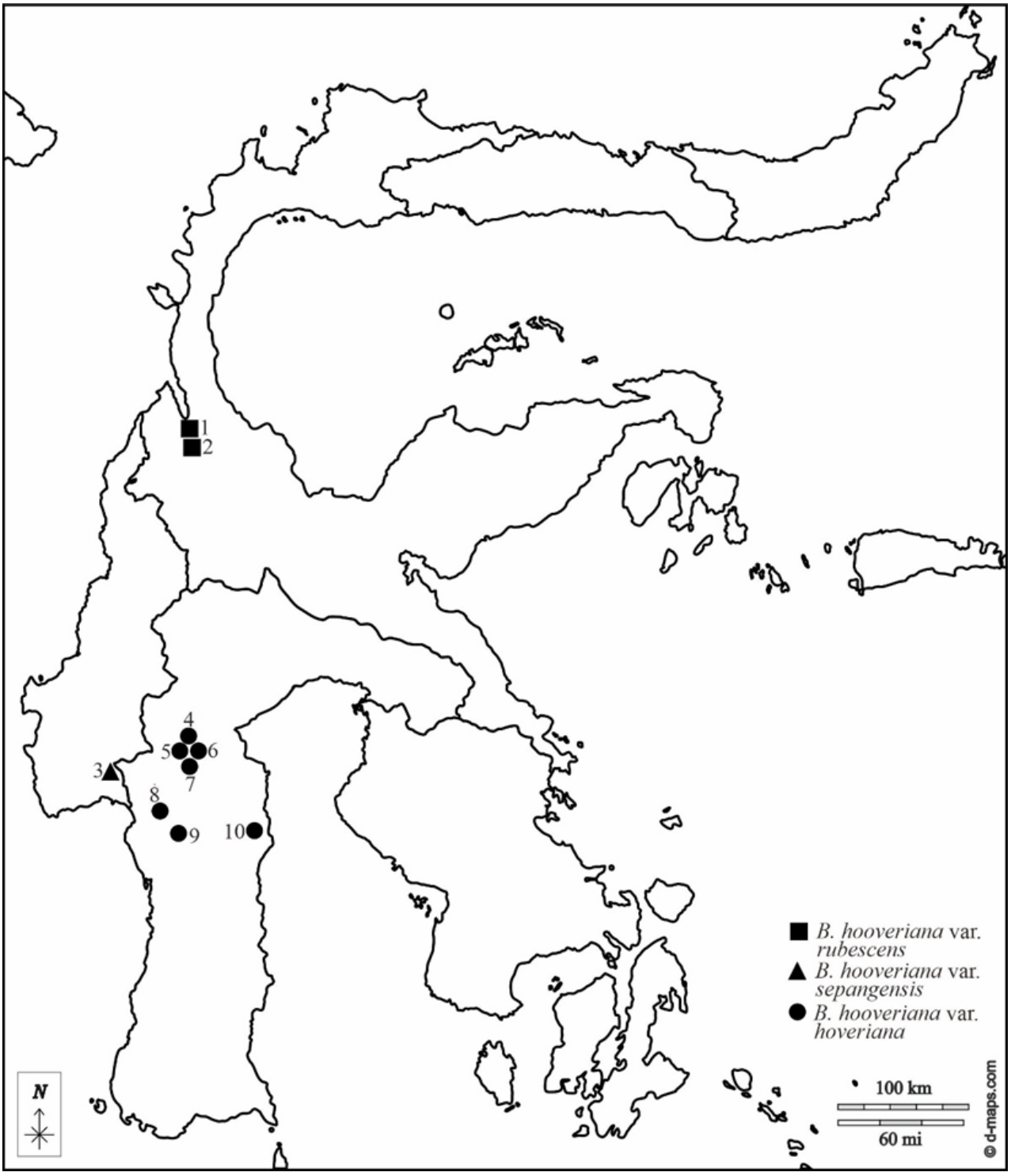

Fig. 1. Geographical distribution of *B. hooveriana* on Sulawesi Island. Central Sulawesi: (1) Wera and (2) Saluki, West Sulawesi: (3) Sepang, South Sulawesi: (4) Londa (5) Tilangga (6) Gandangbatu (7) Makale (8) Baroko (9) Bambapuang (10) Kebun Raya Enrekang.

ever, some conspicuous exceptions exist, such as the orange-red flowers of *Begonia ignita* (Lin *et al.,* 2017) or the considerable variation in flower colour of *Begonia stevei* ranging from pale green and white to coral pink (Hughes, 2006). The androecium symmetry in all Sulawesi species is actinomorphic. Most Sulawesi begonias have dry capsules with equal or subequal wings. All species in Sulawesi show three locules, and all species have bilamellate placentae, except for the three species of section Jackia, which have unilamellate placentae. Placentae are an essential characters in *Begonia* classification, and can be assessed by making a cross-section in the middle part of the ovary (Doorenbos *et al.,* 1998).

Members of this genus are found in various habitat types, namely karst hills, tropical rain forests, lowlands, and mountains with an altitude of 2,400 m (Munawaroh & Hartutiningsih, 2018). The wide distribution results in a wide variety and range of morphological characters, causing complex species boundaries. Consequently, this genus is found in a species complex, *i.e.* a group of closely related species that appear so similar that the species boundaries between them are often unclear.

Begonia hooveriana is one of the endemic begonias, a complex species on the island of Sulawesi, and is found in lowlands and hilly areas (Wiriadinata, 2013). The species is widespread in Sulawesi distributed in Central Sulawesi, West Sulawesi, and South Sulawesi (Thomas & Ardi, 2020) and blooms throughout the year from January to December (Hartutiningsih *et al.,* 2007). *Begonia hooveriana* displays variability in leaf laminas. It is something succulent and relatively small and thick, while others are larger and thinner. Male partial inflorescences may be nearly sessile in some cases, although most are supported by pe-duncles measuring up to 4 cm long. The ovary also exhibits variation; in the type locality, some specimens have elongated ovaries with a cylin-drical seed-bearing section, with the wing attach-ment positioned notably below the base of the seed-bearing part and compact stigma branches. In contrast, other collections feature shorter, ellipsoid ovaries, with the wing attachment situated just below the seed-bearing part, and more elongated stylodia (Thomas & Ardi, 2020).

This species has a relatively high morphological variation, so it is interesting to be studied further, and it is necessary to review its taxonomic status. To understand this variation better and determine if it could be taxonomically recognized, we undertook morphological studies of *B. hooveriana* across its range.

MATERIALS AND METHODS

This study was based on collections from the wild in Sulawesi (Wera, Saluki, Sepang, Londa, Tilangga, Gandangbatu, Makale, Baroko, Bambapuang, and Kebun Raya Enrekang (Fig. 1) in a greenhouse of the Bogor Botanical Garden and herbarium specimens from Herbarium Bogoriense (BO), Herbarium Hortus Botanicus Bogoriensis (BOHB), Singapore Botanic Gardens (SING), Herbarium Leiden (L), and Royal Botanic Garden Edinburgh (E).

RESULT AND DISCUSSION

Begonia hooveriana in Sulawesi shows variations of morphological characters. The total variations of species include vegetative and generative characters. Morphological variations include leaf shape, colour lamina, male flower tepals size and shape, length of female inflorescence, and fruit shape. Variations in vegetative characters are leaf shape broadly ovate to elliptic and abaxial lamina, different in colour, and sometimes variegated with white bands between the veins. The important generative characters, such as female flowers, have five tepals, white, white-tinged pink, or greenish whitish color, large tepals with ovate to elliptic shape, smallest tepals with obovate or elliptic shape, rounded base, and rounded to truncate apex. Male flowers have two tepals and anthers dehiscing through unilaterally positioned slits that are *ca.* ½ as long as the anthers.

Begonia hooveriana from Sulawesi shows a high morphological variation. Variations in leaf vegetative characters can differentiate *B. hooveriana* into three: broadly ovate, ovate, and elliptic. The presence of variation in this species is striking and can be distinguished without significant geographical or ecological isolation, so the appropriate category used is variety (Duistermaat, 1987). Thus, it was grouped into three groups based on nine morphological characters: the shape and colour of the abaxial lamina, shape, size, and base shape of male flower tepals, the length of female inflorescence, the length of fruit, and fruit shape, and apex (Table 1).

Thus, based on morphological characters, *Begonia hooveriana* in Sulawesi consisted of three varieties, namely *B. hooveriana* var. *hooveriana, B. hooveriana* var. *rubescens,* and *B. hooveriana* var. *sepangensis.* The last two varieties are new varieties determined in this study.

TAXONOMIC TREATMENT

Begonia hooveriana Wiriadinata, Reinwardtia. 13: 445. 2013; Thomas D.C. & Ardi W.H., Phytotaxa. 437:73. 2020. — Type: INDONESIA. Sulawesi, South Sulawesi, Tanah Toraja, Central Park Makele, alt. 900 m, 9 Mar. 1998, *W.S. Hoover 889* (BO [1454234], lectotype designated here; isolec-

Table 1. List of the key characters for the different *Begonia hooveriana* varieties.

	var. *hooveriana*	var. *rubescens*	var. *sepangensis*
Distribution	South Sulawesi: Londa, Tilangga, Gandangbatu, Makale, Baroko, Bambapuang, and Kebun Raya Enrekang	Central Sulawesi: Saluki and Pakuli.	West Sulawesi: Sepang
Leaf shape	Broadly ovate	Ovate	Ovate to elliptic
Colour of abaxial lamina	Pale green or reddish green, iridescent with pale green veins or something variegated with white bands between the veins, lustrous glossy	Reddish-greenish or maroon in the central part of the leaves	Green
Male flower tepals shape	Suborbicular	Ovate	Broadly ovate to suborbicular
Size of male flower tepals (mm)	19.4–25 × 20.1–26	8–13.6 × 8–14	13.7–19.3 × 14.1–20
Base shape of male flower tepals	Cordate	Truncate	Slightly cordate to truncate,
Peduncle length of female inflorescences (mm)	47−62	17–31	32–46
Fruits peduncle size (mm)	61−84	15–31	38–60
Fruit shape	Ovoid to ellipsoid	Ovoid	Ellipsoid
Fruit apex	Rounded to truncate	Truncate	Rounded

totype BO [5 sheets: BO1454232; BO1454233; BO1454235; BO1454236; BO1454237]).

Description. *Perennial*, erect, monoecious herb to *ca.* 140 cm tall. *Stem* branched; internodes 5–17 cm long, slightly swollen at the nodes, pale green, reddish-green or red, with white spots, glabrous. *Leaves* alternate; stipules semi-persistent, 1.0–4.3 × 0.6–2.6 cm, ovate or broadly ovate, with an abaxially prominent midrib, margin green or red translucent, keeled, apex narrowed into bristle green or red up to 5 mm long, glabrous, green or reddish-green; petioles 4–28 cm long, concolourous with the stem, glabrous or trichome; lamina basifixed, 7.5–31 × 4–25 cm, ovate, elliptic, broadly ovate, asymmetric, base cordate and lobes not overlapping to overlapping, apex acuminate, margin broadly dentate, denticulate, denticulate between the larger teeth sundulate, biserrate, teeth bristle pointed, adaxial surface green, reddish-green, green with variegated, green with green maroon in the central part of the leaves, green or reddish with white between the veins, glabrous, smooth and glossy or matte; abaxial surface pale green, green, reddish green, reddish-greenish or maroon in the central part of the leaves, iridescent with pale green veins or something variegated with white bands between the veins, lustrous glossy or not lustrous glossy, glabrous or very sparsely hairy with bristly hairs on the veins; venation palmate pinnate, primary veins (5–)7–8, actinodromous, secondary veins craspedodromous. *Inflorescences* protogynous; female inflorescences 2-flowered, 1–4 female inflorescences basal to male inflorescence part, peduncles (5–)15–62 mm long, pale green, reddish-green, or red, bracts caducous, 8–20 × 4–13 mm ovate to broadly ovate, pale green, reddish-green, glabrous; male inflo-rescences paniculate-cymose, composed of up to 7 subumbellate partial inflorescences, each with up to 12 flowers, peduncle of male inflorescence 1−51 mm long, pale green, reddish-green, red, glabrous, bracts caducous, 9–19 × 8–19 mm, broadly ovate to suborbicular, pale green or reddish-green, glabrous. *Male flowers.* Pedicels (5–)13–53 mm long, concolourous with the peduncle, glabrous; tepals 2, white, white tinged pink, or greenish-whitish, 8–25 × 8–26 mm, ovate, suborbicular, broadly ovate to suborbicular, base truncate, cordate, slightly

Taxonomic key to the variety of *Begonia hooveriana*

1 a. Broadly ovate stipules, glossy adaxial leaf surface, male flower tepals 19.4–25 × 20.1–26 mm, peduncle of female inflorescences 47−62 mm long ..... *B. hooveriana* var. *hooveriana*
b. Ovate stipules, matte adaxial leaf surface, male flower tepals 8–19.3 × 8–20 mm, peduncle of female inflorescences 17−46 mm long 2
2 a. Ovate male flower tepals, truncate base of male flower tepals, peduncle of fruits 15–31 mm long, ovoid fruits, truncate apex ..... *B. hooveriana* var. *rubescens*
b. Broadly ovate to suborbicular male flower tepals, slightly cordate to truncate base of male flower tepals, peduncle of fruits 38–60 mm long, ellipsoid fruits, rounded apex ..... *B. hooveriana* var. *sepangensis*

cordate to truncate, apex rounded, outer surface glabrous; androecium of 26–101 stamens, yellow, filaments up to *ca.* 3.4 mm long, slightly fused at the very base, anthers up to *ca.* 3.2 mm long, obovate, dehiscing through unilaterally positioned slits that are *ca.* ½ as long as the anthers. *Female flowers.* Pedicels 9−33 mm long, concolourous with the peduncle, glabrous; tepals 5(−6), white, white tinged pink, or greenish-whitish, unequal, larger 10–34 × 8–23 mm, ovate, broadly ovate, elliptic, smallest one 7−28 × 3−18 mm, obovate to elliptic, outer surface glabrous; ovary 8–26 × 4–10 mm, cylindrical or ellipsoid, wings 3, subequal, base rounded, apex rounded to truncate, widest point up to 12 mm (apically or subapically), glabrous, locules 3, placentation axile, placentae bilamellate; style *ca.* 6.5 mm long, basally fused, 3 –branched, each stylodium bifurcate in the stigmatic region, stigmatic surface a spirally twisted papillose band, orange. *Fruit.* dry capsule; peduncles 15−84 mm long; pedicels 10–47 mm long, pale green, green, or reddish, glabrous; seed-bearing part 11−30 × 4−14 mm (excluding the wings), ovoid to ellipsoid, apex rounded to truncate, pale green, reddish-green, reddish, glabrous. *Seeds.* barrel-shaped, *ca.* 0.5 mm long.

Distribution. Indonesia, endemic to Sulawesi: South Sulawesi, Central Sulawesi, and West Sulawesi.

Taxonomic Notes. *Begonia hooveriana* shows a high morphological variation. It is indicated that a grouping at the infraspecies level is needed. Thus, based on morphological characters *B. hooveriana* in Sulawesi consisted of three varieties, namely *B. hooveriana* var. *hooveriana*, *B. hooveriana* var. *rubescens,* and *B. hooveriana* var. *sepangensis*. The last two varieties are new varieties determined in this study.

B. hooveriana* var. *hooveriana

SULAWESI. South Sulawesi, Tanah Toraja, Central Park Makele, alt. 900 m, 9 Mar. 1998, *W.S. Hoover 889* (BO[1454234], lectotype: designated here; isolectotype: BO[5 sheets: BO1454232; BO1454233; BO1454235; BO1454236; BO 1454237]) (Fig. 2).

Diagnosis. *Begonia hoveriana* var. *hooveriana* is characterized by stipules broadly ovate, margin of stipules green translucent, pale green or reddish -green petioles, broadly ovate leaf shape, abaxial pale green or reddish green, iridescent with pale green veins or something variegated with white bands between the veins, lustrous glossy, peduncle of female inflorescences 47–62 mm long, tepals of male flower suborbicular, 19.4–25 × 20.1–26 mm, base cordate, fruits peduncle 61.1–84 mm long, fruits ovoid to ellipsoid, apex rounded to truncate.

Distribution. Endemic to South Sulawesi: Londa, Tilangga, Gandangbatu, Makale, Baroko, Bambapuang, and Kebun Raya Enrekang.

Ecology. Lowland to hill rain forest; growing in crevices of limestone rock, terrestrially at the base of limestone cliffs and hills, or on mossy granite rocks; partially shaded to open areas at *ca.* 200–1,109 m asl.

Taxonomic notes. The female petals of this variety, especially those found at the Makale location, are partially curled, and the male petals are half-closed. Crosses between individuals have been carried out several times. However, there are still no results because the female flowers ripen first, and the ovules fall before maturing. This variety has leaves, flowers, fruit, and seeds that are relatively larger and longer on its peduncles, pedicels of the female flower, and pedicels of fruit compared to other varieties.

Specimens examined. SULAWESI. South Sulawesi: Pasoei, 17 June 1929. *G.K. Kjellberg 1396* (BO); near Central Park Makele, 3 September 1998, *W.S. Hoover et al. 889* (BO[6 sheets]); Buntu area, Kpg Lokkok, 15 November 2003, *J. Vermeulen 2299* (L, SING); Tana Toraja, Makale, 29 April 2009, *D.C. Thomas & W.H. Ardi 09-100* (BO, E); Tana Toraja, Makale, 29 April 2009, *D.C. Thomas & W.H. Ardi 09–101* (BO, E); Bam-

Fig. 2. *Begonia hooveriana* var. *hooveriana.* A. Habit. B. Stipule. C. Male inflorescences. D. Male flower. E. Female inflorescence. F. Female flower. G & H. Fruit. (Scale=1 cm). Photos by Devi Alvitasari.

bapuang Karst, 3 November 2018, *W.H. Ardi 323* (BO, KRB, SING); Bambapuang Karst, 3 November 2018, *W.H. Ardi 325* (BO, KRB, SING); Karst Baroko, Enrekang, 5 November 2018, *W.H. Ardi 337* (BO, KRB, SING); Karst Benteng Alla, Enrekang, 5 November 2018, *W.H. Ardi 338* (BO, KRB, SING); Gandangbatu, Toraja, 5 November 2018, *W.H. Ardi 339* (BO, KRB, SING); Pemandian Tilanga, 8 November 2018, *W.H. Ardi 348* (BO, KRB, SING); Londa, Torajan Tomb, 8 November 2018, *W.H. Ardi 350* (BO, KRB, SING).

Begonia hooveriana* var. *rubescens* Alvitasari, *var. nov. Fig. 3. — TYPE: INDONESIA. Sulawesi, Central Sulawesi, Tanah Toraja, Saluki, Maleo nesting ground, 29 July 2018, *W.H. Ardi et al. WI 249* (holotype: BO!; isotype: KRB!).

Diagnosis. *Begonia hoveriana* var. *rubescens* characterized by stipules ovate, margin of stipules red translucent, red petioles, ovate leaf shape, abaxial reddish-greenish or maroon in the central part of the leaves, matte, peduncles of female inflorescence 17–31 cm long, tepals of male flower ovate, 8–13.6 × 8–14 mm, base truncate, fruits peduncle 15–31 mm long, fruits ovoid, apex truncate.

Distribution. Endemic to Indonesia, Sulawesi, Central Sulawesi: Saluki and Pakuli.

Habitat and ecology. Lowland to hill rain forest; grow in the shady cliff entire shade areas at *ca.* 600 –1,047 m asl.

Etymology. Latin, rubra = red, referring to its red petioles and red translucent of stipule margin.

Taxonomic Notes. This variety has relatively smaller leaves, flowers, fruit, and shorter female inflorescence peduncles than *B. hooveriana* var. *hooveriana* and *B. hooveriana* var. *sepangensis.*

Specimens examined. SULAWESI. Central Sulawesi: Pakuli, Biromaru, Donggala, 25 May 2002, *Ramadanil et al. RP 805* (CEB); Pakuli, Maleo nesting ground, near Gumbasa River, 11 May 2007, *Ramadanil Pitopang & Sylva PC UNTAD, RP 2046* (CEB); Wera Waterfall, near Parampadende, 1 June 1979, *M.M.J. van Balgooy 3619* (A, K); Saluki, Maleo nesting ground, 29 July 2018, *W.H. Ardi et al. WI 249* (BO, SING, KRB); Sigi, Wera waterfall, 10 August 2018, *W.H. Ardi et al.*

Fig. 3. *Begonia hooveriana* var. *rubescens*. A. Habit. B. Stipule. C. Male inflorescences. D. Male flower. E. Female inflorescence. F. Female flower. G & H. Fruit. (Scale = 1 cm). Photos by Devi Alvitasari.

WI 317 (BO, FIPIA, KRB, SING).

Begonia hooveriana* var. *sepangensis* Alvitasari *var. nov. Fig. 4. — TYPE: INDONESIA. Sulawesi, West Sulawesi, Mamasa, Messawa, Sepang, 24 Nov. 2018, *W.H. Ardi WI 565* (holotype: BO!; isotype: KRB!).

Diagnosis. *Begonia hoveriana* var. *sepangensis* characterized by stipules ovate, margin of stipules green translucent, pale green or reddish-green petioles, ovate to elliptic leaf shape, abaxial green, matte, peduncles of female inflorescence 32–46 cm long, tepals of male flowers broadly ovate to suborbicular, 13.7–19.3 × 14.1–20 mm, base slightly cordate to truncate, fruits peduncle 3.8–60 mm long, fruits ellipsoid, apex rounded.

Distribution. Endemic to Indonesia, Sulawesi, West Sulawesi: Sepang.

Habitat and ecology. Lowland to hill rain forest; grow in the open cliff, full open areas, a heavily disturbed limestone habitat at 700–900 m asl.

Etymology. The epithet refers to the name of Sepang, the village where this species was found.

Specimens examined. SULAWESI. West Sulawesi, Mamasa, Messawa, Sepang, 24 Nov. 2018, *W.H. Ardi WI 565* (BO, KRB).

Taxonomy notes. This varieties has medium size on leaves, flower, fruit, and has medium long female inflorescence peduncles compared to *B. hooveriana* var. *hooveriana* and *B. hooveriana* var. *rubescens.*

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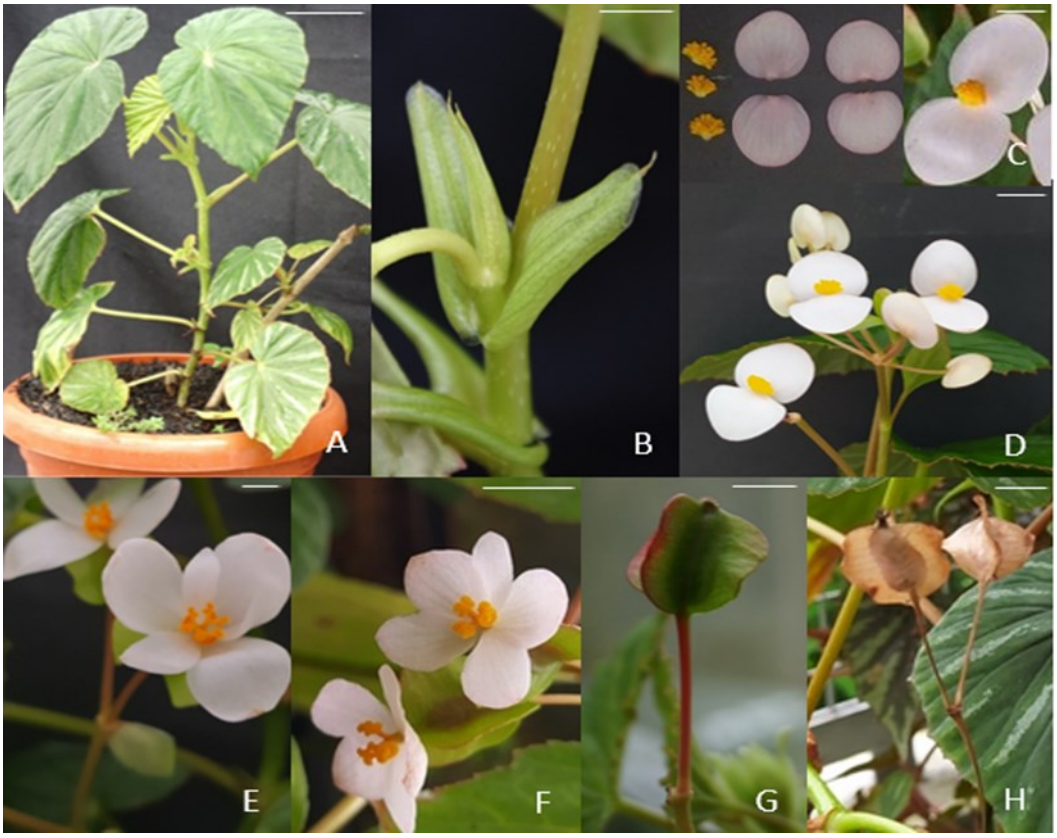

Fig. 4. *Begonia hooveriana* var. *sepangensis*. A. Habit. B. Stipule. C. Male inflorescences. D. Male flower. E. Female inflorescence. F. Female flower. G & H. Fruit. (Scale = 1 cm). Photos by Devi Alvitasari.

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