Taxonomic studies on *Begonia* (Begoniaceae) in Myanmar I: three new species and supplementary description of *Begonia rheophytica* from Northern Myanmar

Mya Bhone Maw\(^1\,^3\), Hong-Bo Ding\(^1\), Bin Yang\(^1\,^2\), Pyae Pyae Win\(^4\), Yun-Hong Tan\(^1\,^2\)

\(^1\) Southeast Asia Biodiversity Research Institute, Chinese Academy of Sciences & Center for Integrative Conservation, Xishuangbanna Tropical Botanical Garden, Chinese Academy of Sciences, Menglun, Mengla, Yunnan 666303, China \(^2\) Center of Conservation Biology, Core Botanical Gardens, Chinese Academy of Sciences, Menglun, Mengla, Yunnan 666303, China \(^3\) University of Chinese Academy of Sciences, Shijingshan District, Beijing 100049, China \(^4\) Forest Research Institute, Forest Department, Ministry of Environmental Conservation and Forestry, Yezin, Nay Pyi Taw 05282, Myanmar

Corresponding author: Yun-Hong Tan (tyh@xtbg.org.cn)

Citation: Maw MB, Ding H-B, Yang B, Win PP, Tan Y-H (2020) Taxonomic studies on *Begonia* (Begoniaceae) in Myanmar I: three new species and supplementary description of *Begonia rheophytica* from Northern Myanmar. In: Jin X-H, Xia N-H, Tan Y-H (Eds) Plant diversity of Southeast Asia-II. PhytoKeys 138: 203–217. https://doi.org/10.3897/phytokeys.138.38721

Abstract

Three new species of *Begonia* (*B. chenii*, *B. putaoensis* and *B. crassitepala*) belonging to *Begonia* section *Platycentrum* and a supplementary description of *B. rheophytica* with a detailed description of female flowers from Putao, Kachin State, Northern Myanmar, are described and illustrated. All the new species are endemic to Northern Myanmar and can be easily distinguished from other species among the section *Platycentrum*. A detailed description, photographs, habitat, distribution and a comparison with the most related allied species for all new species are provided.

Keywords

Kachin State, Sect. *Platycentrum*, Putao District, Sect. *Sphenanthera*
Introduction

*Begonia* Linnaeus (1753: 1056) (Begoniaceae) is one of the largest genera of angiosperm in the world, comprising more than 1900 species (Hughes et al. 2015), currently divided into 70 sections (Moonlight et al. 2018). The genus consists of herbs or lianas and is distributed throughout the tropical and subtropical regions of the world (Doorenbos et al. 1998; Moonlight et al. 2018). It has around 959 species and 19 recognized sections in Asia with the bulk occurring in Southeast Asia (Doorenbos et al. 1998; Shui et al. 2002; Ku et al. 2007; Hughes 2008; Moonlight et al. 2018). According to a recent updated checklist of *Begonia* from Myanmar by Hughes et al. (2019), 73 species of *Begonia* have been recorded from Myanmar.

During floristic surveys of northern Myanmar from 2016 to 2018, some interesting *Begonia* specimens were collected. After conducting a detailed examination of the morphological characteristics of the collected material, reviewing the type specimens and taxonomic publications, the authors have confirmed that the specimen of *Begonia* collected from northern Myanmar belong to species new to science, which are described and illustrated below.

Historically, based on the characters of axial placentation, 3 or 4-locular ovary, berry-like and wingless fruit, *Begonia chenii* should belong to *Begonia* sect. *Sphenanthera* (Hasskarl 1856: 139) Warburg (1894: 141). However, the recent molecular research result showed that *B. sect. Sphenanthera* was included in *B. sect. Platycentrum* (Klotzsch 1855: 243) A. DC. (1859: 134) (Moonlight et al. 2018). As the result, *Begonia chenii*, *B.putaoensis* and *B.crassitepala* belong to *B. sect. Platycentrum* in the present report.

Material and methods

Measurements and morphological character assessments of the new species have been examined based on fresh materials and dried specimens. They have been compared with morphologically similar species by affinities inferred using descriptions (Ku et al. 2007, Camfield and Hughes 2018) and type specimens in herbaria (BM, E, K, NYBG, KUN, PE, HITBC and RAF). Protologues and images of type specimens were gathered from JSTOR Global Plants (http://plants.jstor.org).

Taxonomic treatments

*Begonia chenii* Y.H. Tan, M.B. Maw & H.B. Ding, sp. nov.

urn:lsid:ipni.org:names:77204214-1

Figure 1

**Diagnosis.** *Begonia chenii* Y.H. Tan, M.B. Maw & H.B. Ding is mostly similar to *B. mariachristinae* Wahlste (2018: 1) in lanceolate-ovate leaves with silver patches or
Figure 1. *Begonia chenii* Y.H. Tan, M.B. Maw & H.B. Ding, sp. nov. (photographed by H.B. Ding and Y.H. Tan) A habitat B leaves (back view) C inflorescence D staminate flower showing 6 tepals E pistillate flower F infructescence showing monoecious G infructescence showing stigmas H staminate flower showing variation of 4, 5, 6 tepals I tepals of staminate flower J androecium K tepals of pistillate flower L ovary and stigma M ovary (3-winged) N ovary (4-winged) O–P serial cross section of ovary (locules 4) Q serial cross section of ovary (locules 4 and wingless) R serial cross section of ovary (locules 3).
dots on the upper surface, but significantly differs by stipules slightly pilose (vs. glabrous), petiole densely reddish pilose (vs. sparsely puberulous), 6 (rarely 4 or 7) tepals of female flower (vs. 4 tepals) and red, 3 or 4 locular ovary (vs. green, 2 locular).

**Type.** MYANMAR. Kachin State: Putao District, on the way from Putao to Upper Shankhaung, in tropical rain forest, 27°25′36.87″N, 97°16′13.56″E, 512 m, 4 May 2017, Y.H. Tan, B. Yang, H.B. Ding, X.D. Zeng, M.B. Maw & T.S. Tin M1378 (holotype: HITBC!; isotypes: RAF!).

**Description.** Perennial herb, dioecious or rarely monoecious, lacking rhizome or tuber. Stem erect, 40–60 cm tall, reddish brown, densely white pilose, internode 2–11 cm long, branching. Stipule persistent, ovate, 1–15 × 3–5 mm, papery, keeled, apex cuspidate (1–4 mm), margin entire, slightly pilose. Leaf alternate, petiole 1.5–3 cm long, reddish-brown, densely reddish pilose; blade asymmetric, lanceolate-ovate, 8–11 × 2.5–4 cm, apex attenuate, base oblique, margin serrate and with reddish hispid, venation palmate-pinnate, 5–6 pairs of veins; upper surface green or dark green with white patches and dots between the veins, bright green shot with metallic blue depending on the angle of the light, especially on young leaves, sparsely reddish hispid, especially along the midrib and lateral veins; lower surface deep red or deep red with light green areas both margin linings, scattered reddish hispid and densely along the midrib and lateral veins. Inflorescence axillary, flower solitary or in a simple cyme, pendulous; bract persistent, ovate to narrow lanceolate, 4–8 × 2–3 mm. Staminate flower: pedicel 0.8–1.1 cm, reddish, glabrous or sparsely pilose; tepals 4 (rarely 5 or 6), reddish with white margins, unequal, inner 2 (rarely 3), ovate, 7–1 × 6–1 mm, glabrous, outer 2 (rarely 3), ovate, 7–9 × 7–1 mm, reddish or whitish pilose on the outer surface, margin entire; androecium actinomorphic, stamens numerous, filament free, anther oblong, golden yellow. Pistillate flower: pedicel 0.6–0.8 cm, tepals 6 (rarely 4 or 7), unequal, inner 3, elliptic, 8–10 × 3–4 mm, pink to white, glabrous, outer 3, ovate or elliptic, 7–11 × 5–7 mm, reddish or whitish pilose on outer surface; ovary red, slightly or densely pilose on the surface, triangular or rhomboid winged, 3–5 × 2–5 mm, placenta axillary, locules 3 or 4, placenta 2 per locale; styles 3, fused at base, stigma bifid with twisted bands, highly convolute, yellow or golden yellow. Fruit berry-like, red, reddish or whitish pilose, triangular, rhomboid (8–15 × 6–9 mm) or suboblate (8–15 mm in diam.), 3 or 4 horned, rarely wingless.

**Phenology.** Flowering from April to May; fruiting from May to June.

**Distribution.** The species is only known from the type locality, Putao District, Kachin State, Northern Myanmar.

**Ecology.** The species grows in the moist shaded environment of tropical rain forest, elevation about 512 m.

**Etymology.** The species epithet “chenii” is named after Professor Chen Jin, the director of Southeast Asia Biodiversity Research Institute, Chinese Academy of Sciences, who gave us the opportunity to study the Myanmar flora, which led to the discovery of this new species.

**Conservation status.** Data Deficient (DD). Begonia chenii was collected along the path on the way from Putao to Upper Shankhaung where any signs of major anthropogenic disturbance were noticed in the type locality. However, further explorations...
Taxonomic studies on *Begonia* (Begoniaceae) in Myanmar I

Are needed for a proper assessment of conservation due to insufficient information on its distribution and population status. Therefore, the species has been preliminarily assigned to Data Deficient (DD) category according to The Guidelines for Using The IUCN Red List Categories and Criteria (IUCN 2017).

**Additional specimens examined (paratypes).** Myanmar. Kachin State: Putao District, Upper Shankhaung, in tropical montane forest, 27°25’36.87”N, 97°16’13.56”E, 512 m, 4 May 2017, Y.H. Tan, B. Yang, H.B. Ding, X.D. Zeng, M.B. Maw & T.S. Tin M1379 (HITBC!); Kachin State: Putao District, Upper Shankhaung, 27°25’35”N, 97°16’14”E, 500 m, 29 April 2016, Y.H. Tan & S.S. Zhou M201627 (HITBC!); Kachin State: Putao District, Upper Shankhaung, 27°25’34”N, 97°16’13”E, 520 m, 7 May 2017, S.S. Zhou & X.D. Zeng M2030 (HITBC!; RAF!)

**Affinities.** *Begonia chenii* is morphologically similar to *B. mariachristinae*. But it can be easily distinguished in having 3 or 4 locules (vs. 2 locules). See Table 1 for detailed comparison of *B. chenii* with morphologically allied species.

**Begonia putaoensis** Y.H. Tan, M.B. Maw & H.B. Ding, sp. nov.

*urn:lsid:ipni.org:names:77204216-1*

Figures 2–3

**Diagnosis.** *Begonia putaoensis* Y.H. Tan, M.B. Maw & H.B. Ding is morphologically similar to *B. scintillans* Dunn (1920: 111) in rhizomatous creeping habit and dark green ovate leaves with silver or white area on the upper surface, but it can be easily distinguished by the following characters: sparsely pubescent adaxially leaf (vs. densely strigose) and glabrous capsule (vs. red villose).

**Type.** Myanmar. Kachin State: Putao District, on the way from Camp 2 to Camp 3 along Putao to Madwel, on moist rocky slope in tropical rain forest, 27°39’35”N, 97°22’30”E, 505 m, 29 November 2017, Y.H. Tan, B. Yang, H.B. Ding, X.D. Zeng, M.B. Maw & P.K. Linn M2923 (holotype: HITBC!; isotypes: RAF!)

**Description.** Perennial herb, monoeious, 10–25 cm tall. Rhizome creeping with adventitious roots, sometimes branched, 3–30 cm long, 5–12 mm thick, reddish brown, densely pubescent or rusty villous, internode short, 3–8 mm long. Stipule

---

**Table 1.** Comparison of key morphological characters of *Begonia chenii* and *B. mariachristinae*.

| Attributes          | *B. chenii*                              | *B. mariachristinae*               |
|---------------------|------------------------------------------|-----------------------------------|
| Stem                | 40–60 cm tall, reddish brown densely white pilose | 40–60 cm tall dark red to maroon, hairs |
| Stipules            | persistent, slightly pilose              | persistent, glabrous              |
| Petiole             | 1.5–3 cm long, densely reddish pilose    | 1–5 cm long, sparsely puberulous  |
| Leaves              | lanceolate-ovate, 8–11 × 2.5–4 cm        | lanceolate-ovate 6–11.5 × 2.5–4.5 cm |
| Upper surface       | sparsely reddish hispid especially along the midrib and lateral veins | slightly reddish hispid |
| Lower surface       | scattered reddish hispid and densely along the midrib and lateral veins | slightly hairy along midrib |
| Male flower         | tepals 4 (rarely 5 or 6) reddish with white linings | tepals 4 pink or white |
| Female flower       | tepals 6 (rarely 4 or 7) pink to white   | tepals 4 pink or white |
| Ovary               | locules 3 or 4 red, slightly or densely pilose | locules 2 green, hispid |
| Style               | 3                                        | 2 (or 3)                          |
Figure 2. *Begonia putaoensis* Y.H. Tan, M.B. Maw & H.B. Ding, sp. nov. (wild, photographed by H.B. Ding) **A–B** habitat **C** rhizome **D** inflorescence **E** stipule on stem **F–H** single leaf (front and back view) **I** flowers (front view) **J** flowers (back view) **K** outer tepals of male flower (back view) **L** inner tepals of male flower (back view) **M** androecium with pedicel.
angular, 6–12 × 5–6 mm, apex cuspidate (3–5 mm), margin entire, rusty colored, densely rusty tomentose on both surfaces, persistent; petiole scarlet red to crimson, cylindrical, 3–15 cm long, densely rusty tomentose. Blade ovate to widely ovate, 6.5–15 cm long, 6–11 cm wide, asymmetric, adaxially dark green with gray or light-green areas, slightly pubescent, abaxially light-green, deep red along veins, rarely entirely dark red or red with light-green areas, slightly pubescent, rusty villous on the veins; base cordate, apex acuminate to attenuate, margin sinuate, with sparse hairs; venation palmate, 7–9 veined, adaxial slightly impressed, abaxial distinctly prominent. Inflorescence axillary, sub-corymb, erect, branching 2–3 times, 7–19 cm long. Primary peduncle 5.5–14.5 cm long, densely rusty tomentose, dark red, secondary 0.6–1.5 cm long; bract ovate to lanceolate or obovate, 8–13 × 3–7 mm, glabrous, apex acute, margin entire, sometimes with ciliate, 2–10 flowers per inflorescence, male flowers open earlier at the same node. Staminate flower: pedicel white or pink, glabrous, 0.9–3.7 cm long, tepals 4, rarely 6, outer 2 (or 3) larger, pink, ovate to suborbicular, 1.3–1.8 × 1.1–2.1 cm, glabrous or abaxially strigose; inner 2 (rarely 3), smaller, white-pinkish, ovate or obovate, 9–17 × 7–11 mm., glabrous; androecium 4–6 mm long, 5–7 mm in diameter; stamens numerous, filaments ca. 1.7 mm long, anthers yellow, obovate, nearly 1.2 mm long, apex obtuse. Pistillate flower: pedicel dark red, glabrous, 2.6–3.3 cm long, tepals 5, rarely 6, outer 3, larger, pink, ovate, 14–16 × 1–13 mm, inner 2 (rarely 3), smaller, white-pinkish, ovate to suborbicular, 12–16 × 8–11 mm; ovary glabrous, 2-loculed, placentae axillary, placentae 2 per locule, styles 2 or 3, fused at base, stigma bifid with twisted bands, highly convolute, yellow or golden yellow. Capsule nodding, ovoid, glabrous, unequally 3-winged; abaxial wing nearly round-rectangular, 13–17 mm broad, lateral wings shorter, 2.5–3.0 mm broad.

Phenology. Flowering from November to December; fruiting from December to February.

Distribution. The species is known from the single locality in Putao District, Kachin State, Northern Myanmar.

Ecology. The species grows on moist rocky slopes of tropical montane forest, elevation 500–900 m.

Etymology. The species epithet refers to the type locality of the species, Putao District, Kachin State, Northern Myanmar.

Conservation status. Data Deficient (DD). The species might not confront strong human pressures because of the remoteness of its type locality. But we cannot assess the species' risk of extinction due to lack of data. Therefore, the species is temporarily assigned a status Data Deficient (DD) according to The Guidelines for Using The IUCN Red List Categories and Criteria (IUCN 2017).

Affinities. Begonia putaoensis is mostly similar in morphological characters to B. scintillans and B. annulata K. Koch (1857: 76) under the sect. Platycentrum. But it can be easily distinguished from B. scintillans in having shorter internode 0.3–0.8 cm long (vs. 3–5 cm long), sparsely pubescent leaf lamina (vs. densely hairy) and
Figure 3. *Begonia putaoensis* Y.H. Tan, M.B. Maw & H.B. Ding, sp. nov. (cultivated plants, photographed by H.B. Ding) A habit B staminate flower showing 4 tepals C staminate flower showing 6 tepals D pistillate flower showing 6 tepals and 3 styles E pistillate flower showing 5 tepals and 2 styles F rhizome G stipule (back view) H stipule (front view) I bract J uppermost bract K stigma (3, front view) L stigma (2, side view) M androecium (front view) N fruit with unequal wings O serial cross section of ovary.
glabrous capsule (vs. red villose). It differs from *B. annulata* through having the following characteristics: rhizomatous creeping (vs. rhizomatous erect) and dark green with silver or light green area on upper surface of leaf (vs. dark green with white/silver bands). See Table 2 for detailed comparison of *B. putaoensis* with morphologically allied species.

### Additional specimens examined (paratypes).
**MYANMAR.** Kachin State: Putao District, near around Camp 5, along Putao to Madwel, on moist rocky slopes in tropical rain forest, 27°43’59.51”N, 97°22’52.27”E, 873 m, 3 December 2017, Y.H. Tan, B. Yang, H.B. Ding, X.D. Zeng, M.B. Maw & P.K. Linn M3168 (HITBC!; RAF!); MYANMAR. Kachin State: Putao District. Voucher from the cultivated plant in the Xishuangbanna Tropical Botanical Garden, Chinese Academy of Sciences, 12 November 2018, H.B. Ding XTBG-0050 (HITBC!).

### Table 2. Comparison of key morphological characters of *Begonia putaoensis*, *B. scintillans* and *B. annulata*.

| Attributes | *B. putaoensis* | *B. scintillans* | *B. annulata* |
|------------|-----------------|-----------------|---------------|
| Habit      | rhizomatous, creeping 15–25 cm tall | rhizomatous, creeping 7–15 cm tall | rhizomatous, erect 15–30 cm tall |
| Internode  | short, 0.3–0.8 cm long | 3–5 cm long | 0.7–1.5 cm long |
| Stipule    | triangular, 6–12 × 5–6 mm densely rust tomentose on both surfaces | lanceolate, 6–11 × 4–6 mm villose on outer surface | lanceolate, 4–13 × 2–6 mm tomentose on outer surface |
| Leaf       | ovate to widely ovate 6.5–15 × 6–11 cm | ovate-orbicular 4.5–10 × 3.5–7 cm | ovate 9–15 × 5–10 cm |
| Upper surface | dark green with silver or light green areas sparsely pubescent | dark green with small silver spots, densely strigose | dark green with white/silver bands slightly tomentose or strigose |
| Lower surface | light green, deep red along veins entire dark-red or red with light green area slightly pubescent, rusty villous on the veins | red, densely red tomentose | red and green, strigose |
| Stamine flower | tepals 4 (rarely 6), pink or white-pinkish | tepals 4, coral pink | tepals 4, white to pink |
| Pistillate flower | tepals 5 (rarely 6), glabrous pink or white-pinkish | tepals 4–5, coral pink, pilose on outer surface | tepals 4–5, white to pale pink, puberulous on outer surface to glabrous |
| Style      | 2 or 3 | 3 | 2 |
| Capsule    | ovoid, glabrous, 3-winged longest one round-rectangular 13–17 mm broad | obovoid, red villose, 3-winged longest one rounded oblong 4–6 mm broad | ellipsoid, tomentose, 3-winged longest one rounded oblong 5–9 mm broad |

*Begonia crassitepala* Y.H.Tan & M.B.Maw, sp. nov.

urn:lsid:ipni.org:names:77204217-1

Figure 4

**Diagnosis.** *Begonia crassitepala* Y.H. Tan & M.B. Maw is morphologically similar to *B. dryadis* Irmscher (1951: 41) in ovate to broadly ovate leaf, but it can be distinguished by its stem and petiole having white prickles (vs. puberulous), adaxially leaf having densely pinkish or grey hirsute (vs. subglabrous), abaxially outer 2 tepals of pistillate flower and ovary having reddish or whitish succulent strigose and tuberculate (vs. puberulous).
Figure 4. *Begonia crassitepala* Y.H. Tan & M.B. Maw, sp. nov. (photographed by H.B. Ding) A habit B inflorescence C stipule and stem (showing the whitish soft spine-like hairs) D rhizome E single leaf (front view) F single leaf (back view) G hirsute leaf margins H flowers (front view staminate flower) I staminate flower (back view) J dried fruits K pistillate flower (front view) M staminate flower showing 4 tepals N pistillate flower (side view) L capsule and cross section of ovary.
Type. **Myanmar**, Kachin State, Putao District, on the way from Ratbaw to Alanga, 27°17′13.73″N, 97°44′24.28″E, 836 m, 15 June 2018, Y.H. Tan, B. Yang, H.B. Ding, X.D. Zeng, M.B. Maw & H.L. Naing M4495 (holotype: HITBC!; isotypes: RAF!).

Description. Perennial herb, monoecious, rhizomatous. Stem erect, 40–60 cm tall, reddish, densely rusty wooly tomentose, and sparsely covered by whitish soft spine-like hairs, internodes 1–2 cm long. **Stipule** lanceolate, 1–1.3 × 0.3–0.5 cm, slightly or densely rusty tomentose, deciduous. **Leaf** petiole 4.5–15 cm, densely rusty tomentose, slightly whitish stiff hairs; **blade** ovate to broadly ovate, base cordate with overlapping lobes, 12–20 × 15–19.5 cm, asymmetric, adaxially green, densely pinkish or grey hirsute, abaxially green, rusty puberulous, venation palmate-pinnate, densely rusty wooly tomentose along midrib and veins, margin denticulate, reddish hirsute along the margin, apex acuminate. **Inflorescence** nearly terminal, cymose, peduncle 4.4–6.0 cm long, reddish, slightly rusty wooly tomentose and whitish soft spine-like hairs. **Staminate flower:** pedicel 1.8–2.5 cm long, whitish villose, tepals 4, unequal, outer 2, ovate, 2.2–2.7 × 2.6–2.8 cm, whitish or pinkish with pink lining, thick, ca. 2 mm, inner 2, smaller, 1.7 × 2.1 cm, whitish or pinkish (sometimes with pinkish lining), densely whitish villose on the outer surface; stamen numerous, ca. 200; filaments ca. 2 mm long, fused at base; anther oblong to elliptic, 1–2 mm long. **Pistillate flower:** pedicel 2.2–2.5 cm, densely whitish or rusty villose, bracteoles absent; tepals 5, equal, obovate, outer 2, 2.0–2.9 × 1.8–2.0 cm, pure white or sometimes with pink lining, densely pinkish or whitish strigose on outer surface, margin entire, inner 3, similar to outer ones but smaller, 1.8–2.1 × 1.6–1.8 cm, ovary 2-locular, placentation axillary, placentae 2 per locule, densely reddish or whitish succulent strigose and tuberculate, styles 2, fused at base, stigma bifid with twisted bands, highly convolute, yellow or golden yellow. **Fruit** berry-like, elliptic, pale green to pink, 3 wings, unequal, with whitish or reddish succulent strigose and tuberculate (especially on wings).

Phenology. Flowering from June–July; fruiting from July–August.

Distribution. Endemic to the type locality, Putao District, Kachin State, Northern Myanmar.

Etymology. The species epithet refers to its thick tepals.

Ecology. In the tropical montane forest up to about 577 m elevation, on the moist soil slope.

Conservation status. Data Deficient (DD). *Begonia crassitepala* have been collected along the roadside from Langsa to Gawlaw village where no signs of major anthropogenic disturbance were noticed. Further exploration is required to access the current range of the species (IUCN 2017).

Additional specimens examined (paratypes). **Myanmar**, Kachin State: Putao District, along Langsa to Gawlei, tropical montane forest, 27°32′28.94″N, 97°56′36.09″E, 577 m, 2 June 2018, *Myanmar Exped. M3952* (HITBC!; RAF!); Kachin State, Putao District, Gathu to Tongwang Cave, 27°29′53.48″N, 97°58′30.84″E, 664 m, 4 June 2018, *Myanmar Exped. M4008* (HITBC!; RAF!); Kachin State, Putao District, Gathu to Tangsa, 27°28′41.17″N, 97°56′46.40″E, 550 m, 31 May 2018, *Myanmar Exped.*
Begonia crassitepala is the most distinct species in the section Platycentrum thanks to its thickened tepals and succulent strigose and tuberculate ovary. The new species shares similar characteristics with B. dryadis in ovate to broadly ovate leaf and 4 tepals of staminate flower. However, it can be easily distinguished by its stem and petiole having rusty tomentose and whitish soft spine-like hairs (vs. puberulous), adaxially leaf having densely pinkish or grey hirsute (vs. subglabrous), adaxially outer 2 tepals of pistillate flower having densely pinkish or whitish strigose (vs. puberulous), ovary having densely reddish or whitish succulent strigose and tuberculate (vs. puberulous).

Begonia rheophytica M. Hughes, Edinb. J. Bot. 76(2): 2. 2019

Figure 5

Type. Myanmar. Hills east of the Mali Hka, 2000–3000 ft, xii 1930, Kingdon-Ward 9067 (holotype: BM000896328; isotypes: BM000896327, NY02652766).

Description. Herb, rhizomatous, firmly rooted to rock. Rhizome 2.5–4.0 cm long and 0.5–1.0 cm in diam., internode 0.2–0.7 cm long. Stipule reddish brown, eventually deciduous, narrowly triangular, 0.7–1.0 × 0.3–0.5 cm, keeled, margin entire, glabrous. Leaf petiole deep red or deep red to green, turns to brown in mature leaves, sparsely or densely white pilose, 4–17 cm in length, deeply grooved above; blade symmetric, narrowly lanceolate, 13.4–18.2(–21) × 2.2–4.0 cm, base attenuate, sometimes unequal, margin red, toothed, teeth tipped by a short ciliate, sometimes undulate, apex elongate; adaxially dark green, glabrous; abaxially pale green, veins densely or sparsely white pubescent; venation pinnate, 5–7 pairs of veins, reddish green in young leaves, red in mature leaves. Inflorescence axillary, cymose, peduncle erect, 14–20 cm long, reddish green or pale reddish brown, sparsely hairy; bract caducous, broadly ovate–triangular (or ovate–lanceolate), 6–8 × 3–5 mm, purplish red to dark yellow-green, margin entire, hairless. Staminate flower: pedicel 1.9–2.1 cm, pale pink (or) pinkish white, sparsely hairy; bracteoles ca. 3 mm, narrowly ovate, dark yellow green, margin entire, hairless, soon falling, tepals 4, unequal, inner 2, elliptic, 1.4–1.7 × 0.8–1.0 cm, pure white to pinkish, margin entire, outer tepals 2, broadly ovate, 1.1–1.8 × 1.1–1.5 cm, pure white or pinkish, tip rounded, margin entire; androecium actinomorphic; stamens numerous, filaments fused at base; anther golden yellow, narrowly oblong, apex rounded. Pistillate flower: pedicels 2–3 cm, reddish or purplish red, hairless; bracteole narrowly ovate 6–8 × 3–5 mm, dark yellow green
Figure 5. *Begonia rheophytica* M. Hughes (photographed by H.B. Ding and Y.H. Tan) A habitat B staminate flower (front view) C pistillate flowers D inflorescences E staminate flowers (front and back view) F single leaf (back view) G single leaf (front view) H pistillate flower I ovary with gynoecium, pedicel and bracts J ovary with gynoecium K bracts L pedicel M androecium with pedicel N tepals of staminate flower O tepals of pistillate flower P capsule Q–R cross section of ovary.
(sometimes crystal white), soon falling; **tepals** 5–6, unequal, outer 2, equal, broadly ovate, tip rounded, 0.7–1.2 × 0.8–1.2 cm, pure white or white to rosy pink, inner 3 or 4, unequal, 3 larger, 0.8–1.2 × 0.7–1.0 cm, elliptic, pure white or pinkish, tip rounded, 1 smaller, ca. 0.8 × 0.3 cm, pure white, crescent, styles 2, free, stigma bifid with twisted bands, greenish yellow, 4–5 mm long, ovary purplish red, ca. 9–15 mm long, 2–4 mm in diam., wings 3, unequal, placentation axial, locules 2, placentae 2 per locule. **Capsule** nodding, 3-winged, unequal, major wing 8–12 mm long, lateral wings 2–3 mm long.

**Distribution.** Only found in Putao District, Kachin State, Northern Myanmar.

**Additional specimens examined.** **Myanmar,** Kachin State, Putao District, Camp 1 to Namti (Camp 2), understory herbs in tropical rain forest, 27°24’36.80”N, 97°39’24.38”E, 801 m, 12 December 2018, *Myanmar Exped. M3427* (HITBC!; RAF!); Kachin State, Putao District, near around Camp 1, understory herbs in tropical rain forest, 27°24’18.70”N, 97°36’24.18”E, 850 m, 11 December 2018, *Myanmar Exped. M3334* (HITBC!; RAF!); Kachin State, Putao District, humid rocks near streams or near caves by waterfall of tropical montane forest, 27°24’46.31”N, 93°39’36.28”E, 808 m, 16 December 2017, *Myanmar Exped. M3747* (HITBC!, RAF!).

**Note.** This species was originally described by Hughes et al. (2019) from the male flowering plant only. Here, we provide a supplementary description of *B. rheophytica* with a detailed monograph of female flowers from Putao, Kachin State, Northern Myanmar.

**Acknowledgements**

The authors would like to express their gratitude to the Forest Research Institute of Myanmar for permission to conduct this study in the Northern Myanmar, and for their support and collaboration. We are grateful to Xiao-Dong Zeng, Kyaw Swar and Myint Zaw for their kind help in fieldwork. This work was financially supported by a grant from the National Natural Science Foundation of China (Grant no. 31970223) awarded to Yun-Hong Tan, a project of the Lancang-Mekong Cooperation (LMC) Special Fund (Biodiversity Monitoring and Network Construction along Lancang-Mekong River Basin project), CAS “the Belt and Road” Master Fellowship Program and CAS President’s International Fellowship Initiative (PIFI) and the Southeast Asia Biodiversity Research Institute, Chinese Academy of Sciences (Y4ZK111B01) and the CAS 135 program (No. 2017XTBG-F03).

**References**

Camfield R, Hughes M (2018) A revision and one new species of *Begonia* L. (Begoniaceae, Cucurbitales) in northeast India. European Journal of Taxonomy 369: 1–116. https://doi.org/10.5852/ejt.2018.396

De Candolle A (1859) Mémoire sur la famille des Bégoniacées. Annales des Science Naturelles. Botanique 4(11): 92–149.
Doorenbos J, Sosef MSM, De Wilde JJFE (1998) The sections of Begonia including descriptions, keys and species lists. Studies in Begoniaceae VI. Wageningen Agricultural University Papers 98(2): 1–266.

Dunn ST (1920) Decades Kewensis: Plantarum Novarum in Herbario Horti Regii Conservatarum. Decas XCVI. Bulletin of Miscellaneous Information, Kew, 108–111. https://doi.org/10.2307/4120224

Hasskarl JC (1856) Brief van den heer Hasskarl, aan den secretaris der natuurkundige afdeeling van de Koninklijke Akademie van Wetenschappen te Amsterdam. Verslagen en mededelingen der Koninklijke Akademie van Wetenschappen 4: 135–141.

Hughes M (2008) An Annotated Checklist of Southeast Asian Begonia. Royal Botanic Garden Edinburgh, Edinburgh, 1–164.

Hughes M, Moonlight PW, Jara-Muñoz A, Tebbitt MC, Wilson H, Pullan M (2015–Present) Begonia Resource Centre. http://padme.rbge.org.uk/begonia/ [accessed 17 July 2019]

Hughes M, Aung M, Armstrong K (2019). An updated checklist and a new species of Begonia (B. rheophytica) from Myanmar. Edinburgh Journal of Botany 76(2): 1–11. https://doi.org/10.1017/S0960428619000052

Irmscher E (1951) Some new Chinese species of Begonia. Notes from the Royal Botanic Garden Edinburgh 21(1): 35–45.

Klotzsch JF (1855) Begoniaceae-Gattungen und Arten. Abhandlugen der Koniglichen Akademie der Wissenschaften zu Berlin, 121–255.

Koch K (1857) Drei neue Schieflblatter oder Begonien. Berliner Allgemeine Gartenzeitung 25(10): 1–76.

Ku TC, Peng C-I, Turland NJ (2007) Begoniaceae. In: Wu ZY, Raven PH (Eds) Flora of China (Vol. 13). Science Press, Beijing; Missouri Botanical Garden Press, St. Louis, 153–207.

Linnaeus C (1753) Species Plantarum, Exhibentes Plantas Rite Cognitas ad Genera Relatas, cum Differentiis Specificis, Nominibus Trivialibus, Synonymis Selectis, Locis Natalibus, Secundum Systema Sexuale Digestas. Impensis Laurentii Salvii, Homiae, 1056 pp. https://doi.org/10.5962/bhl.title.669

Moonlight PW, Ardi WH, Padilla LA, Chung KA, Fuller D, Girmansyah D, Hollands R, Jara-Muñoz A, Kiew R, Leong WC, Liu Y, Madhavika A, Marasinghe LDK, O’Connor M, Peng CI, Pérez AJ, Phutthai T, Pullan M, Rajbhandary S, Reynel C, Rubite RR, Sang J, Scherberich D, Shui YM, Tebbitt MC, Thomas DC, Wilson HP, Zaini NH, Hughes M (2018) Dividing and conquering the fastest-growing genus: Towards a natural sectional classification of the mega-diverse genus Begonia (Begoniaceae). Taxon 67(2): 267–323. https://doi.org/10.12705/672.3

Shui YM, Peng CI, Wu CY (2002) Synopsis of the Chinese species of Begonia (Begoniaceae), with a reappraisal of sectional delimitation. Botanical Bulletin of Academia Sinica 43(4): 313–327.

IUCN, Petitions Subcommittee (2017) Guidelines for using the IUCN red list categories and criteria. version 13. Prepared by the Standards and Petitions Subcommittee. http://www.iucnredlist.org/documents/RedListGuidelines.pdf

Wahlsteen E (2018) Begonia mariachristinae (Begoniaceae), a new species from Northern Myanmar. Edinburgh Journal of Botany 75(2): 161–166. https://doi.org/10.1017/S0960428618000021

Warburg O (1894) Begoniaceae. In: Engler A, Prantl K (Eds) Die Natürlichen Pflanzenfamilien, 3(6a). Wilhelm Engelmann, Leipzig, 121–150.