Three New Species of *Begonia* Sect. *Platycentrum* from Nepal

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Abstract

Three new species of *Begonia* (Begoniaceae) are described from Nepal. All three species (*Begonia nuwakotensis* S. Rajbhandary, *Begonia panchtharensis* S. Rajbhandary and *Begonia taligera* S. Rajbhandary) belong to *Begonia* section *Platycentrum*, and they increase the number of *Begonia* species known from Nepal to 22. All are considered to belong to the IUCN threat category VUD2.

Introduction

Begonia inhabits moist, shady locations in humid lowland to upland forests. The greatest number of species is found in mid-elevations ranging between 1200-2500 m, growing in cloud forest habitats in rock crevices and on moist boulders and moss-covered tree trunks. *Begonia picta* Sm. and *Begonia dioica* Buch.-Ham. *ex* D. Don are the most common species in Nepal, found growing from 150-2700 m altitude. The genus was previously represented by 18 species in Nepal (Hara *et al*., 1978; Doorenbos *et al*., 1998; Press *et al*., 2000) and one new record (Rajbhandary and Shrestha, 2009) bringing this total to 19. These are placed within five different sections, *Diploclinium* (Lindl.) A.DC., *Monopteron* (A. DC.) Warb., *Platycentrum* (Klotzsch) A.DC, *Putzeysia* (Klotzsch) A.DC and *Sphenanthera* (Hassk.) Warb. (Smith *et. al*. 1986; Doorenbos *et al*. 1998). There are four endemic species, *Begonia tribenensis* C.R. Rao, *Begonia minicarpa* Hara, *Begonia flagellaris* Hara and *Begonia leptoptera* Hara.

Section *Platycentrum* (Klotzsch) A.DC. includes about 110 species from India through central China to Southeast Asia, and is one of the largest sections of the genus *Begonia* (Shui *et a*l., 2002; Ye *et al*., 2004). This section is comprised of relatively large and robust species, characterised by a large androecium on a distinct column, anthers with an extended connective, two highly convolute or spiralled styles and two-locular, drooping fruits with three unequal wings, one of which is considerably lengthened. During botanical expeditions from 2006–2008 to different parts of Nepal three new species of *Begonia* belonging to section *Platycentrum* were discovered, which are described and illustrated here, bringing the total number of *Begonia* species known from the country to 22.

Species descriptions

Begonia nuwakotensis S. Rajbhandary, *sp. nov*. [§ Platycentrum]
Begoniae palmatae *similis sed foliis basalibus longe petiolatis, laminae base cum lobis superpositis et in margine sine lobis vel dentibus longis curvatis, flore femineo tepalis exterioribus 4 similibus et tepalo interiore uno parvo, placentis trilamellatis et fructu cum ala laterali lata oblonga differt.* -**Type**: Central Nepal, Nuwakot, Kakani, Doman-4, 1700 m, 9 Aug 2007, *S. Rajbhandary, S. Ranjitkar, K. P. Thapa and S. R. Bista S31* (holotype, E; isotype, KATH).

Perennial, monoecious, rhizomatous, creeping **herb**, 14-30 cm tall. **Stems** rhizomatous at base, to 2 cm in diameter; erect portions semi-woody, reddish brown, becoming procumbent, tomentose, trichomes soft red. Stipules persistent, membranous, ovate, 16-21 × 8-10 mm, green to scarlet, with an abaxially prominent midrib forming a thin, long appendage at the apex, margin entire, outer surface sparsely hairy on the midrib, trichomes red, inner glabrous and glossy. **Leaves** cauline, petiole 6-24 cm long, green, villose, trichomes, red, multicellular up to 2 mm long; lamina asymmetric, broadly ovate or oblate-orbicular, 5-22 × 5-19 cm, base slightly oblique, cordate, with overlapping lobes 1.5-3 cm long, margin remotely and shallowly denticulate, distinctly divided into short 0.5-2 cm long lobes, apex acute to acuminate; upper surface green strigulose/sericeous, trichomes small and white, lower surface pale green, densely pilose, trichomes red and long; palmately veined, 7-8 veins. Inflorescences bisexual, axillary, cymose, few flowered, protandrous; peduncle 10-25 cm long, green, villose, trichomes red, multicellular. Bracts caducous, membranous, cymbiform, ovate, 12-15 × 8-11 mm, pale green to scarlet, glossy and pubescent, trichomes red, margin ciliate, apex acute. **Male flowers**: pedicel 1-2.3 cm, green, hairy, trichomes multicellular, red;

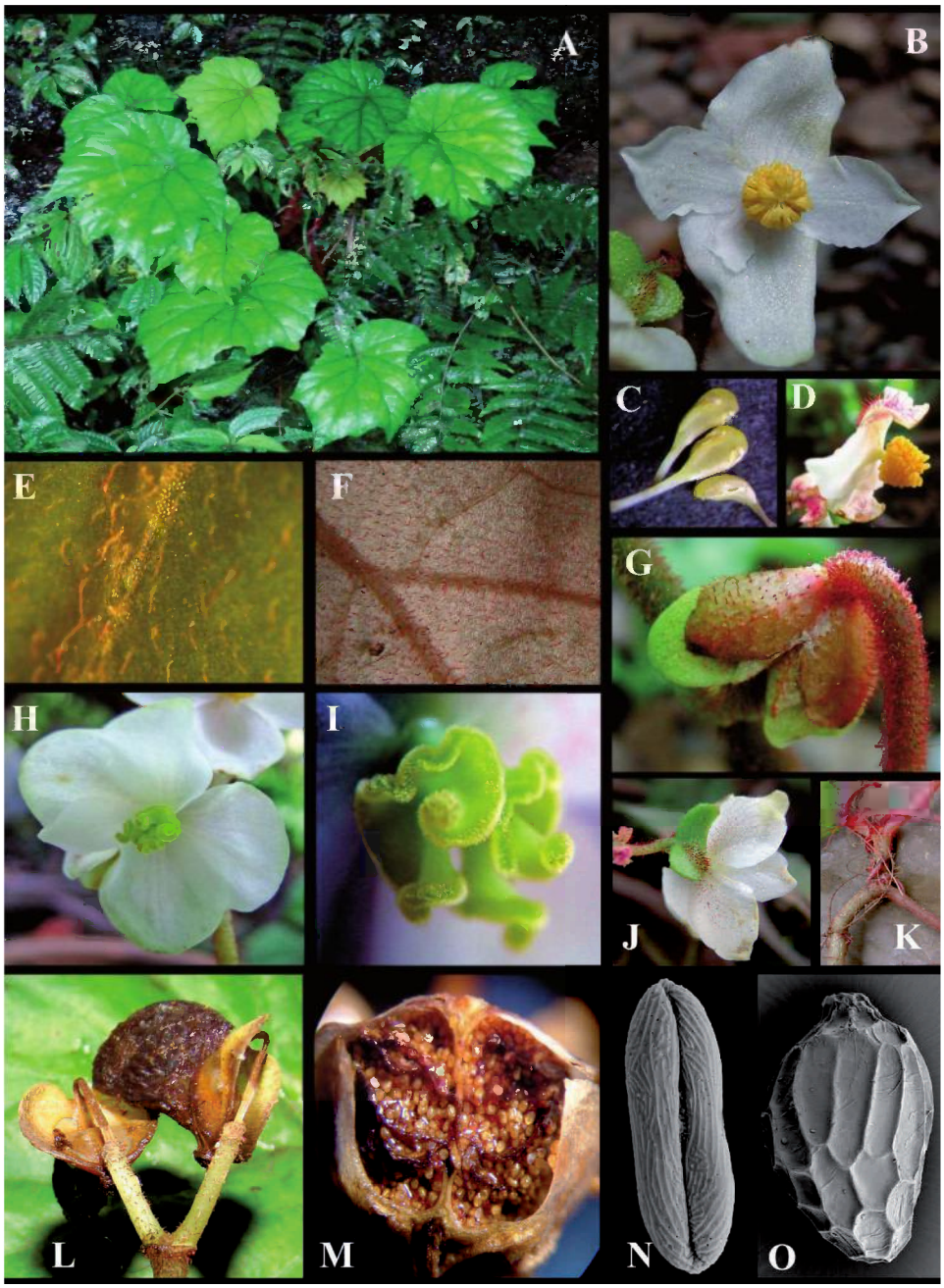
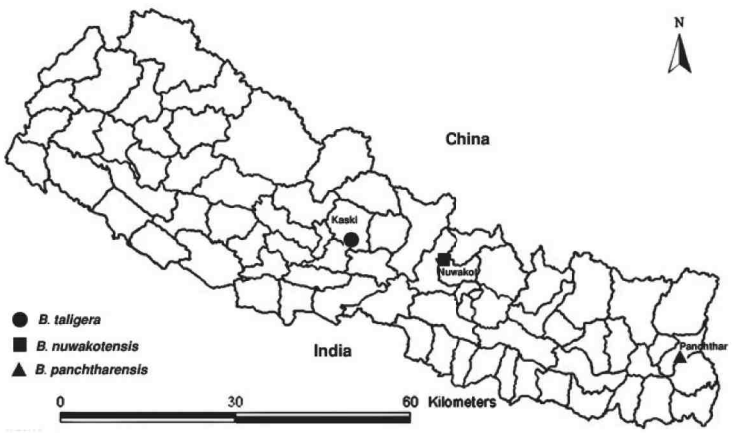


Figure 1. *Begonia nuwakotensis* S. Rajbhandary. A. habit; B. Male flower; C. Stamens: D. Androecium; E. Upper leaf surface; F. Lower leaf surface; G. Bracts; H. Female flower; I. Stigma; J. Ovary; K. Prostrate stem; L. Fruits; M. Transverse section of fruit; N. Pollen; O. seed.

tepals 4-5, white, outer 2 tepal orbicular, 13-15 × 13-20 mm, abaxially pilose, trichomes red, base cordate, margin ciliate, apex rounded to acute; inner 2-3 tepals obovate, 12-17 × 8-12 mm, smallest innermost 10-12 × 5-6 mm, white, glabrous, base cuneate, apex acute or sometimes rounded; androecium globose, on a small column, 6-10 mm diameter, yellow, symmetrical, receptacle flat, free filaments almost equal, but slightly longer in the middle of the androecium, stamens *ca* 100, filaments 1-2 mm; anthers narrowly obovoid, 1.2-1.5 mm long, anthers towards the outside are longer than the filaments and those at the centre are shorter than the filaments, dehiscing through unilateral slits as long as the anther, connective slightly extended. **Female flowers**: pedicel 1-2 cm, hairy, trichomes red, multicellular; tepals 5, white, unequal, four outer tepals are orbicular, 20-22 × 18-22 mm, innermost tepal smallest, ovate, 13-15 × 7-8 mm, except for the innermost all the tepals are abaxially pubescent, margin entire, base rounded, apex rounded, acute in the innermost tepal; styles 2, deciduous, 3-6 mm long, fused at the base and ends into a broad wide apex, yellowish green; stigma green, a papillose band, strongly spiralled over the broad apex of the style and twisted at two ends; ovary green, pubescent, trichomes red, 2 locular; placentation axile, trilamellate. **Fruits** with pedicel 15-25 mm long, glabrous; 17-25 × 10-12 mm, nodding or pendulous, unequally 3-winged, with one larger wing and two narrow wings, larger wing oblong, 12-20 mm; lateral wings much smaller, 5-6 mm, small wings recurved; capsule obovoid, *ca* 10-12 × 6-10 mm, green and hairy when young and dark brown when mature, glabrous; drying dark brown, dehiscing along the sutures between the two smaller wings.

SEM studies: **Pollen**: large, perprolate with slightly concave sides and slightly pointed poles, irregular striate ornamentation with few scattered pores, P 22-22.5 μm, E 7.6-8.4 μm, P/E 2.6-2.9, the endoporus elliptical with costae, margo distinct, narrow. **Seeds** ellipsoidal to obovoid, mean size 325 × 240 μm; collar cells elongated, testa cells polygonal with straight or slightly curved anticlinal walls; anticlinal walls of testa cells thin and slightly raised; operculum short, flat and nipple-shaped; cuticular pattern consisting mainly of short linear zigzag striate ornamentation.

Distribution: Known only from the type locality.



Ecology: Growing on wet shady slopes by the side of waterfalls, at *ca* 1700 m.

Notes: This species is similar to *Begonia palmata* but differs in lacking long and curved lobes or teeth in the leaf margin. It also differs in having female flowers with 4 similar outer tepals and one small inner tepal, trilamellate placentae, and a fruit with a broad oblong wing. It is known only from the type locality and so it is named after the place of its collection. The population at the moment is healthy and reproducing well. However, as the single locality is not under protection and the capability of the species to cope with less shade and moisture is not likely to be good, we consider it to belong to the IUCN threat category VUD2.

Begonia panchtharensis S. Rajbhandary, *sp. nov*. [§ Platycentrum]
Begoniae sikkimensi *similis sed foliis solum basalibus praesentis eis magnis suborbicularibus profunde lobatis longe petiolatis et fere glabris, floribus femineis 6-tepalis et fructu cum ala laterali lata falcata differt*. -**Type**: Cultivated plant grown from Eastern Nepal, Panchthar, Tinubote, Sisire, Prangbung, VDC, 2240–2300 m, 2 x 2007, *U. Thamsuhang s.n.*, vouchered as *S. Rajbhandary S74* (holotype, E, isotype, KATH).

Perennial, monoecious, rhizomatous **herb**, 50-60 cm tall. **Stem** rhizomatous, 8-12 cm long, 20-30 mm in diameter, covered with long roots. Stipules caducous, membranous, cymbiform, broadly ovate, 18-25 × 8-10 mm, pink with a light green tinge, glabrous with red spots on the abaxial surface, margin entire, apex acuminate**. Leaves** several, arising from the rhizome, petiole 33-46 cm long, succulent, glabrous, grooved, yellowish green with red linear dots; lamina slightly asymmetric, suborbicular and deeply lobed, 24-

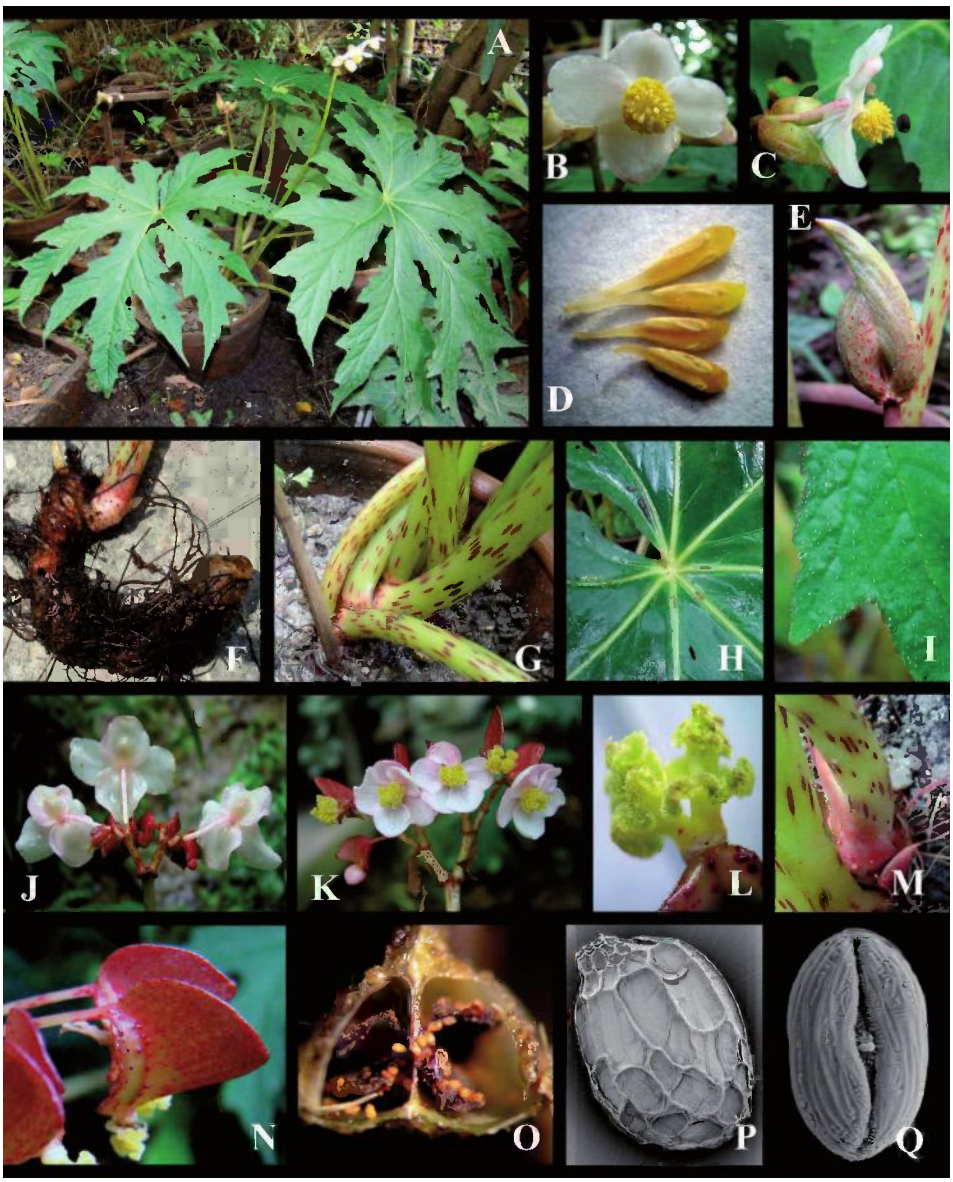


Figure 3. *Begonia panchtharensis* S. Rajbhandary. A. Habit; B. Male flower; C. Androecium; D. Stamens; E. Bracts: F. Rhizome; G. Petioles; H. Leaf venation; I. Leaf surface; J. & K. Inflorescence; L. Style and stigma; M. Stipule; N. Fruits; O. Transverse section of fruit; P. Seed; Q. Pollen.

40 × 36-48 cm, base deeply cordate; margin irregularly serrulate or deeply dentate, distinctly divided to 2/3 of leaf length; lobes 6-8, apex acuminate, dark green above and pale green below, adaxially sparsely hirsute more so on the periphery, trichomes small, multi-cellular, crimson or whitish transparent, abaxially glabrous except for sparse hairs on the veins near

the periphery, palmately veined, 6-8 veins. **Inflorescences** bisexual, axillary, cymose, dichotomously branched, protandrous; peduncle 42-50cm long, glabrous, grooved, sub-woody, yellowish green with red linear dots. Bracts caducous, in unequal pairs, membranous, cymbiform, elliptic to broadly elliptic, 25-30 × 15-18 mm, green, narrowly ridged abaxially and with linear or circular red granules, papery, margin entire, apex acuminate. **Male flowers**: pedicel 1-8 cm, light pink with linear red spots, glabrous; tepals 4, white to pink; outer 2 tepals broadly ovate, 1.2-1.8 × 0.9-1.2 cm, abaxially glabrous, with a pink tinge near the tip and the margin, base truncate, margin entire, apex acute; inner 2 tepals oval to narrowly oval, 1.5-1.8 × 0.8-1.3 cm; white, glabrous, base cuneate, apex retuse; androecium globose, on a small column, 9-12 mm long, yellow, symmetrical, receptacle slightly raised; stamens 125-141, filaments 0.5-2.5 mm long; anthers oblong, 1-1.5 mm, anthers towards the outside are longer than the filaments and those at the centre are shorter than the filaments, dehiscence through long straight slits which are slightly curved at the tip, connectives extended, acute. **Female flowers**: pedicel 1.5-2 cm, glabrous; tepals 6–8, outermost tepals pink, innermost white, symmetrical, oval 9-11 × 8-11 mm, glabrous, base rounded, margin entire, apex acute; styles 2, persistent, 2.5-6 mm long, fused at the base, greenish yellow, stigmatic surface spirally convolute, papillose; ovary oblong and slightly curved, locular part 10-13 × 3-4 mm, glabrous with red circular or linear granules, with three unequal wings; largest wing oblong with a rounded tip and two smaller more or less equal rim-like blunt wings; 2-locular, placentae axile, bilamellate. **Fruits:** pedicel 2.5-3 cm, glabrous; 10-25 × 10-15 mm, nodding or pendant, falcate, unequally 3-winged; longer wing obovoid–oblong, 9-25 × 10-15 mm, lateral wings smaller, 1 mm long, wings red, capsule oblong, 10-15 × 2-4 mm, light greenish yellow when young becoming brownish green when mature, glabrous; drying dark brown with green tinge, dehiscing along the sutures between the two smaller wings.

SEM studies: **Pollen:** large**,** perprolate with smooth convex sides and rounded poles, faint striate ornamentation with pores, P 16.8-21 µm, E 8-10 µm, P/E 2.1, the endoporus elliptical with costae, margo present, the grains not syncopate. **Seeds:** ellipsoidal, 325-345 × 215-240 µm; collar cells elongated with straight and slightly curved anticlinal walls; testa cells polygonal with straight anticlinal walls; operculum long nipple-shaped with layers of cells; anticlinal boundaries broad and flat; the cuticle on the testa consisting mostly of patches without orientation while in the collar and operculum the cuticule has a long linear loose striate ornamentation.

Distribution: Known only from the type locality (Fig. 2).
Ecology: Growing on shady river banks and edge of the forest near rivers at ca. 2240–2300 m.

Notes: This distinct species is somewhat similar to *Begonia sikkimensis* A. DC. in leaf shape but differs in having only basal, large and almost glabrous leaves, female flowers with six tepals, and broad falcate winged fruit. As it is known only from the type locality, the species is named after the place of its collection. As the single locality is not under protection and the capability of the species to cope with less shade and moisture is not likely to be good, we consider it to belong to the IUCN threat category VUD2.

Begonia taligera S. Rajbhandary, *sp. nov*. [§ Platycentrum]
Begoniae hatacoa affinis sed folii margine subintegro usque remote triangulari-serrulato dentibus interdum attenuatis, floribus haud lineatis, stigmate spiraliter torto, fructu cum ala laterali longa lataque apice rotundato et in petiolis radicibus ubi e planta separatis effractisve crescentibus recedit. -**Type**: Central Nepal, Kaski, Bharat Pokhari, near Pokhara 700-740 m, 5 Sep 2007, *S. Rajbhandary and S Adhikari S52* (holotype, E; isotype, KATH).

Perennial, monoecious, caulescent **herb**, 30-70 cm tall. **Stem** rhizomatous at base**,** subwoody, 3.5 cm in diameter, covered with long roots; erect portions terete, 17-32 cm long, dark brownish red, branched, hairy. Stipules persistent, membranous, lanceolate, 6-11 × 7-13 mm, cymbiform, greenish white, transparent, abaxially glabrous, glossy, apex acuminate. **Leaves** cauline, petiole 6-10 (-32) cm long, succulent, densely covered with brown scales or multicellular two-armed short stalked trichomes, dark reddish brown at the base becoming ruby red adaxially near the top, readily forming adventitious roots when detached or broken; lamina asymmetric, cordate, ovate-lanceolate to elliptic-lanceolate, 10.5-23 × 5.5-18 cm, base slightly asymmetric, rounded or shallowly cordate, margin entire to attenuate-dentate, apex long-acuminate to attenuate, deep green adaxially, glossy, glabrous, yellowish-green abaxially, hairy with veins being covered densely with brown multicellular two-armed stalked trichomes, palmately veined, 5-7 veins. **Inflorescences** bisexual, axillary, branched cymose, protandrous, peduncle glabrous 6-20 cm long, red, bearing few terminal flowers. Bracts: caducous, in unequal pairs, membranous, cymbiform, long elliptic to lanceolate, 5-8 × 1.5-3.5 mm, light green, transparent, apex acuminate, margin entire, glabrous, glossy. **Male flowers**: pedicel 1.5-3.5 cm, white to brownish green, glabrous; tepals 4, outer 2 tepals broadly oval, 9-17 × 7-12 mm, abaxially glabrous and glossy with a green or pinkish tinge more on the upper tepal, base rounded, margin entire, apex acute; inner 2 tepals

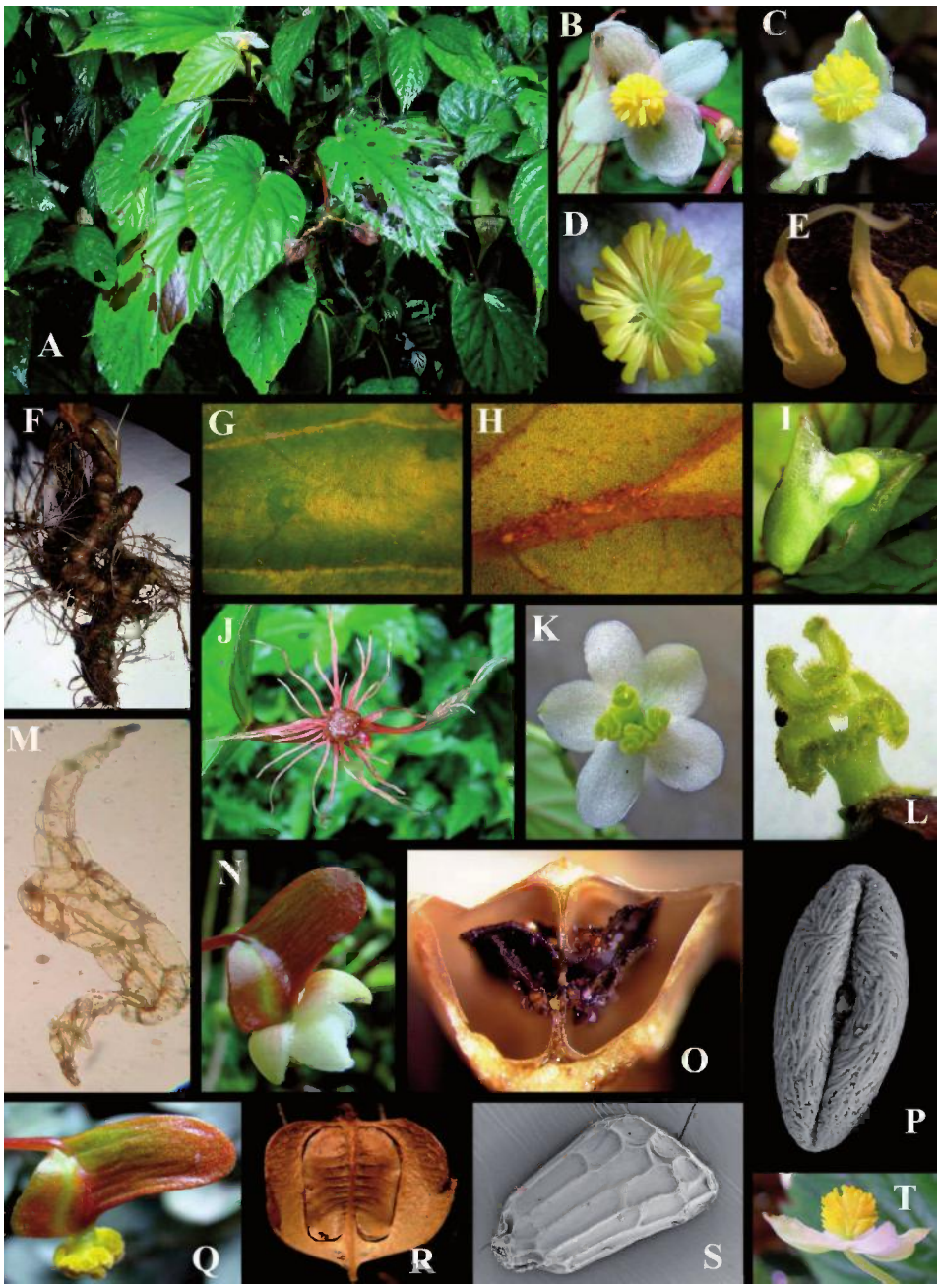


Figure 4. *Begonia taligera* S. Rajbhandary. A. habit; B. Male flower; C. & D. Androecium; E. Stamens: F. Rhizome; G. Upper leaf surface; H. Lower leaf surface; I. Bracts; J. Broken petiole with adventitious roots; K. Female flower; L. Style and stigma; M. Two-armed trichome; N. Ovary; O. Transverse section of fruit; P. Pollen; Q. Fruit; R. Recurved small wings of the fruit; S. Seed; T. Androecium.

oval, 9-18 × 7-10 mm, white, glabrous, base rounded, apex obtuse or retuse; androecium a loose sessile globose cluster, 7-9 mm long, golden yellow, symmetrical, receptacle slightly raised; stamens 90-95, filaments 1-2 mm long and free; anthers narrowly obovate, 2-2.5 mm, longer than the filaments, dehiscence through long straight slits, connectives extended, round or acute. **Female flowers**: pedicel 1-2 cm, glabrous; tepals 5, white, outer 2 tepals broadly ovate, 1-13 × 1-12 mm, glabrous, glossy, base rounded, margin entire, apex obtuse or rounded, the inner 3 oblong or lanceolate, 1.5-2 × 6-7 mm, apex obtuse to acute, but sometimes all the tepals are either broadly ovate or all oblong; styles 2, sometimes 3-4, persistent, 0.4-0.5 mm long, free, each style ending into a broad apex and connate at the base, green when young and becoming more yellow when mature; stigmas bifid, spirally tortuous and papillose all over; ovary oblong, 9-12 mm long, glabrous and glossy, unequally 3-winged, 2-locular, placentae axile, bilamellate. **Fruits**: pedicels 1.2-2 cm long, glabrous; 19-25 × 9-15 mm, pendulous, with 3 unequal wings, the largest wing broadly falcate, 15-25 × 9-14 mm, apex rounded, the other 2 wings smaller and narrow, *ca* 4-5 mm long with rounded tips, capsule oblong, 10-15 x 3-4 mm, reddish brown when young and pale brown when mature, glabrous; drying pale brown, dehiscing along the sutures between the two smaller wings.
SEM studies: **Pollen:** large, perprolate, pollen grain with smooth convex sides, rounded poles, compact irregular striate ornamentation with pores in-between, P 17.4-20 μm, E 8 μm, P/E 2.1-2.5, elliptical endoporus with costae, margo present around the endoporus, the grains are not syncolpate. **Seeds:** ellipsoidal, mean size 392 × 228 μm; collar cells elongated with straight anticlinal walls; testa cells polygonal with straight and slightly curved anticlinal walls; operculum very short, flat nipple-shaped with a layer of flat elongated cells; anticlinal boundaries thin and slightly elevated; the cuticule with long linear striate ornamentation.

Distribution: Known only from the type locality (Fig. 2).

Ecology: Growing on moist shady rock ledges near streams at ca. 700-740 m.

Notes: Allied to *Begonia hatacoa* Buch.-Ham. ex D. Don but differs in having an entire to attenuate-dentate leaf margin, while in *B. hatacoa* the leaf margin is usually always entire or only slightly dentate. *Begonia taligera* also lacks striped flowers, the stigma is spirally tortuous, the lateral long wing of the fruit is more broad with a rounded tip, and in the pollen the ornamentation of the testa cells is compact with irregular striate with pores in-between and margo present. One of the characteristic features of this species is the development of roots when a petiole is broken or detached

from the main stem. The epithet *taligera* is derived from the Latin *talea*, and means producing cuttings for propagation. The population is currently healthy and reproducing well. However, as the species is restricted to a single locality, which is not under formal protection, and the capability of the species to cope with less shade and moisture is not likely to be good, we consider it to belong to the IUCN threat category VUD2.

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