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TWO NEW SPECIES OF ANDEAN *BEGONIA* (BEGONIACEAE)

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Two new species of *Begonia* (Begoniaceae) from Andean South America are described and illustrated. *Begonia heliantha* Tebbitt is classified in *B.* sect. *Eupetalum* and is known from the Puno Region of Peru and has also been tentatively identified from photographs taken in La Paz Department of Bolivia. *Begonia urubambensis* Tebbitt is affiliated with a group of species currently classified in *B.* sect. *Knesebeckia*. This group of species is informally named here the *B. acerifolia* group. *Begonia* sect. *Knesebeckia* is polyphyletic since the *B. acerifolia* group does not include the type species of the section. Ongoing research aims to recircumscribe this section. *Begonia urubambensis* is not assigned to a section given the changes needed to the sectional classification system. *Begonia urubambensis* is a narrow endemic of La Convención Province (Cusco Region) of Peru. *Begonia heliantha* is assigned the IUCN category of Data Deficient (DD), while *B. urubambensis* is assigned the IUCN category of Vulnerable (VU-D2).

Keywords. *Begonia chrysantha*, *Begonia erythrocarpa*, *Begonia pearcei*, *Begonia* sect. *Eupetalum*, *Begonia* sect. *Knesebeckia*, *Begonia serotina*, Bolivia, Peru, IUCN.

Introduction

The *Catalogue of the Flowering Plants and Gymnosperms of Peru* (Brako & Zarucchi, 1993) recognises 76 species of Peruvian *Begonia*, 38 of which are endemic. Since 1993 this number has grown slightly with the publication of two additional endemic species (Tebbitt, 2011, 2015a) and one range extension that newly includes Peru (Tebbitt *et al.*, 2015). Recent herbarium studies and fieldwork have identified two additional new species, one of which is also suspected to grow in Bolivia but apparently has not been collected there. *Begonia urubambensis* is endemic to southern Peru, being known only from the Cusco Region. *Begonia heliantha* has been collected in Sandia Province (Puno Region) in southern Peru, and has also tentatively been identified from photographs taken in Bolivia's Sud Yungas Province (La Paz Department).

Begonia heliantha is here classified in *B.* sect. *Eupetalum* (Lindl.) A.DC., which is composed of perennating herbs with perennial tubers or fleshy rhizomes and relatively large flowers restricted to the Andes (Doorenbos *et al.*, 1998; Tebbitt *et al.*, 2015). This species is notable among Andean *Begonia* in having yellow tepals, and is the first yellow-flowered *Begonia* known to occur in Peru. Only six yellow-flowered

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Andean *Begonia* species (out of an estimated c.150 total species [Tebbitt, unpublished]) have been described previously, all of which are currently classified in *B.* sect. *Eupetalum* (Tebbitt, 2015b). Little is currently known regarding the phylogenetic relationships of these species but it is suspected, based on the considerable morphological differences within this group, that yellow flowers originated in Andean *Begonia* on at least two separate occasions (Tebbitt, 2015b). *Begonia heliantha* is likely closely related to at least some of the yellow-flowered species from Bolivia and neighbouring northern Argentina, and is particularly similar in morphology to *B. pearcei* Hook.f. and *B. chrysantha* Tebbitt. *Begonia heliantha* shares with these two species vegetative parts with an indumentum of hairs, an upper leaf surface with very pale green main veins and intervenal lamina infused with bronze-green, and similar-shaped tepals in both the male and female flowers. All three species also occupy a distinct microhabitat on moist, shaded, moss-covered cliff faces.

Begonia urubambensis belongs to a group of 10 Andean species (also including: *B. acerifolia* Kunth, *B. arrogans* Irmsch., *B. erythrocarpa* A.DC., *B. leathermaniae* O'Reilly & Kareg., *B. ludwigii* Irmsch., *B. serotina* A.DC., *B. triramosa* Irmsch., *B. velata* L.B.Sm. & B.G.Schub., and *B. wollnyi* Herzog) that are currently classified in the polyphyletic *B.* sect. *Knesebeckia* (Klotzsch) A.DC. This group of 10 Andean species is herein referred to as the *B. acerifolia* group. Molecular data (Moonlight *et al.*, 2015) indicate that the *B. acerifolia* group (represented in Moonlight *et al.* [2015] by *B. ludwigii*) is only distantly related to the type species of *B.* sect. *Knesebeckia* – *B. incarnata* Link & Otto (a species native to Mexico) – and instead is closely related to *B.* sect. *Eupetalum*. *Begonia* sect. *Knesebeckia* as currently circumscribed in Doorenbos *et al.* (1998) is, therefore, polyphyletic. Ongoing molecular and morphological studies (Moonlight *et al.*, unpublished) aim to better circumscribe the *B. acerifolia* group and in particular determine how it can be distinguished from *B.* sect. *Eupetalum*.

The species in the *B. acerifolia* group and in *B.* sect. *Eupetalum* are unusual among *Begonia* in typically being adapted to relatively high altitudes and seasonally dry environments. Morphologically the species in these two groups are relatively similar to one another compared with other Andean *Begonia* but the mechanism by which the species in the two groups survive seasonal dry periods and/or cold temperatures is, however, different. This suggests that they likely represent distinct but closely related evolutionary lineages. In members of *B.* sect. *Eupetalum* the above-ground parts die back during dry or cold periods and these species perennate via tubers or swollen rhizomes. In contrast, the members of the *B. acerifolia* group lack tubers or swollen rhizomes, have perennial above-ground stems that tend to be woodier and thicker than those of most *Begonia*, and temporarily lose their leaves during the dry season (Tebbitt, unpublished). Thus the members of the *B. acerifolia* group rely on energy reserves stored in their above-ground stems to survive periods of drought. *Begonia urubambensis* is morphologically more similar to the members of the *B. acerifolia* group than it is to the species classified in *B.* sect. *Eupetalum*. However, this new species differs from the rest of the *B. acerifolia* group by being acaulescent (members of *B.* sect. *Eupetalum* may be either acaulescent or caulescent). It is not known if the

leaves of *B. urubambensis* persist year-round or if they are deciduous. If the latter is the case then the species' rhizome likely acts as a perennating organ. If this is the case then the perennating rhizomes of *B. urubambensis* likely arose independently from similar perennating organs found in members of *B*. sect. *Eupetalum*, since *B. urubambensis* appears to be a relatively derived member of the *B. acerifolia* group.

Begonia urubambensis is most similar in terms of its overall appearance to *B. serotina* A.DC. This general resemblance is due in particular to their very similar leaf morphologies. In both species the leaves are peltate, of a similar size and shape, and are glabrous to puberulent. The distribution of *B. urubambensis* is, however, considerably disjunct from *B. serotina*, the closest populations of which occur over 1280 km to the northwest in the Tumbes Region of Peru. Given this large disjunction, and the fact that *B. urubambensis* shares even more characters (though less obvious ones) with the sympatrically distributed *B. erythrocarpa* A.DC., it appears that *B. urubambensis* is more closely related to *B. erythrocarpa* than it is to *B. serotina*. Characteristics shared by *B. urubambensis* and *B. erythrocarpa* but not other members of the *B. acerifolia* group include relatively few flowers per inflorescence (*B. urubambensis* and *B. erythrocarpa* have fewer than 15 flowers per inflorescence, while *B. serotina* has 20–50 flowers per inflorescence), globose anthers (*B. serotina* has obovoid anthers), tepals that do not persist in fruit (the tepals of *B. serotina* remain attached to the dehiscent fruit), and unequal fruit wings (*B. serotina* has subequal fruit wings). Furthermore, while the leaves of *Begonia erythrocarpa* usually differ from those of *B. urubambensis* and *B. serotina* by usually having lobed margins and a dense indumentum of hairs, its leaves, in common with *B. urubambensis* and *B. serotina*, are often peltate (a character state that is otherwise rare in Andean *Begonia*). However, while *Begonia urubambensis* and *B. serotina* always have peltate leaves, *B. erythrocarpa* individuals may have either peltate or basifixed leaves. *Begonia erythrocarpa* has a distribution that overlaps that of both *B. urubambensis* and *B. serotina* (although *B. erythrocarpa* has never been observed to co-occur with either of these species at the same site). Given this distribution pattern and the pattern of morphological variation found in these three taxa, it is suggested that the ancestor of *Begonia erythrocarpa* was perhaps the progenitor of both *B. serotina* and *B. urubambensis*. Ongoing molecular studies (Moonlight *et al.*, unpublished) aim to test this hypothesis. Because the members of the *B. acerifolia* group will require a future change to their sectional classification this new species is not herein assigned to a section.

Taxonomic Treatment

Begonia heliantha Tebbitt, **sp. nov.** Sect. *Eupetalum.* **Figs 1, 3.**

Begonia heliantha Tebbitt is closely allied to *B. pearcei* Hook.f. and *B. chrysantha* Tebbitt but differs from both these species by having an indumentum of glandular hairs on its stem, petioles and peduncles (*B. pearcei* and *B. chrysantha* have an indumentum of non-glandular hairs), by its paired bracteoles at the base of the ovaries

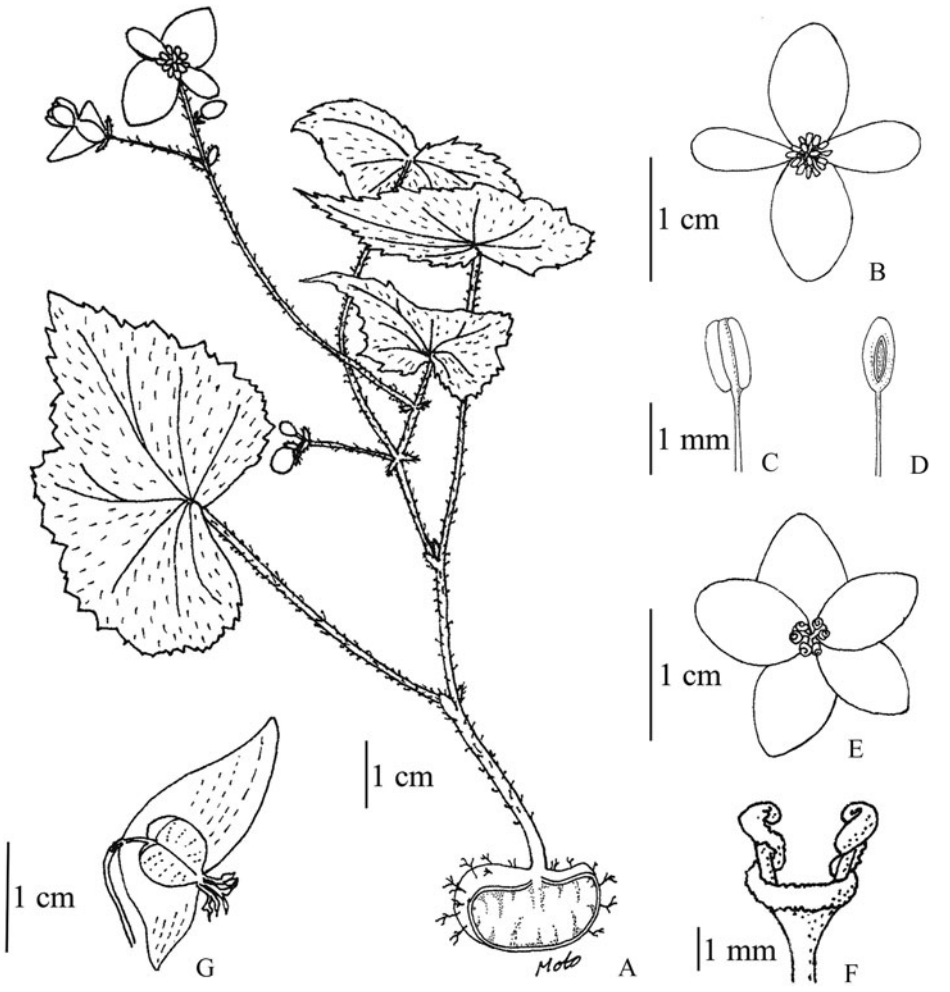

FIG. 1. *Begonia heliantha* Tebbitt. A, habit; B, male flower; C, stamen (front view); D, stamen (side view); E, female flower; F, style; G, mature fruit. A–E drawn from *Vargas* 16417-A (CUZ), F drawn from *Vargas* 16417-A (US).

(*B. pearcei* and *B. chrysantha* lack bracteoles), and by its bright yellow tepals (*B. pearcei* has pale yellow tepals, while *B. chrysantha* has golden yellow tepals). – Type: Peru, Puno Region, Prov. Sandia, entre Sandia y Tambopata, *Vargas* 16417-A (holo US; iso CUZ [2]).

Caulescent, tuberous herb. *Tuber* ellipsoid, 1.1–2.5 cm in diameter. *Stem* erect, 4.5–10 cm tall, unbranched, internodes 1.5–3.1 cm long, sparsely glandular pubescent. *Stipules* persistent, ovate, 1–3.5 × 0.5–2 mm, apex acute ending in a 1.5–2.5 mm long hair, margin fimbriate. *Leaves*: 3 to 6, alternate, basifixed; petiole joining blade at an angle, 1.7–5 cm long, densely glandular pubescent, hairs c.0.75–1 mm long; blade

asymmetric, ovate, 2.5–5.1 × 1.6–3.5(–4.1) cm, apex long acute, base cordate, basal lobes spreading and not overlapping, sinus 0.5–1 cm deep, margin shortly lobed, lobes triangular-crenate, lobes themselves dentate, lobes 2–5 mm deep, teeth 0.25–1 mm long, upper surface green with pale whitish green veins, intervenal lamina usually with patches of bronze-green, lower surface paler green, upper surface moderately pubescent, hairs non-glandular, 0.5–2 mm long, lower surface veins densely pubescent, intervenal lamina moderately pubescent, hair morphology as on upper surface, veins palmate, 7 to 9. *Inflorescences* 1 to 3, axillary, erect, cymes, up to twice-branched, few-flowered, male flowers opening first but soon female flowers also opening so that both present concurrently; peduncle 5–8 cm long, moderately pubescent, hairs glandular as in petioles but up to 1 mm long; pedicels of male flowers 0.3–1.3 cm long, moderately pubescent, hairs c.0.5 mm long, glandular; pedicels of female flowers 1–1.4 cm long, moderately pubescent, hairs c.0.5 mm long, glandular; bracts persistent, lower pair obovate or ovate, 1.25–3.5 × 0.5–2 mm, apex rounded, margin ciliate with glandular hairs, hairs 0.25–0.5 mm long, surfaces glabrous; upper bracts ovate, 1.5–2 × 0.75–1 mm, apex acute, margin ciliate, hair morphology as in lower pair of bracts, surfaces glabrous. *Male flowers*: tepals 4, spreading, bright yellow, outer pair elliptic to ovate, 0.8–1.4 × 0.5–1.1 cm, apex obtuse, margin entire, surfaces glabrous; inner pair narrowly obovate, 0.8–1.1 × 0.3–0.5 cm, apex obtuse, margin entire, surfaces glabrous; stamens c.25 to 35, attached along the length of a c.1 mm tall torus, filaments 1–2 mm long, anthers symmetrically basifixed, cuboid, c.1 mm long, dehiscing via lateral slits along each locule, connectives not projecting. *Female flowers*: bracteoles paired at base of ovary, deciduous, lanceolate to lanceolate-ovate, c.2 × 1 mm, apex acute, margin ciliate, surfaces moderately pubescent, hairs non-glandular; tepals not persisting in fruit, 5, spreading, bright yellow, ovate, elliptic or ovate-elliptic, subequal, 0.6–1.2 × 0.4–0.5 cm, apex obtuse, margin entire, surfaces glabrous; ovary body ellipsoid to almost spherical, 3–9 × 3–5 mm, glabrous, unequally 3-winged, longest wing triangular, apex acute to obtuse, 0.5–1 × 0.3–1.2 cm, shorter 2 wings triangular, apex acute, 3–5 × 3–5 mm; 3-locular, placentas not observed; styles 3, free to base, c.4 mm tall, bifid, branches erect, stigmatic papillae in a spiral band. *Fruiting pedicel* c.3 cm long. Mature dehiscent *fruit* subnutant, body broadly ellipsoid, to 9 × 5 mm, longest wing triangular, to 1.3 × 0.7 mm, shorter two wings triangular, to 7 × 7 mm.

Phenology. Flowering and fruiting from February to August.

Distribution. Southern Andean Peru (Puno Region) and probably northern Andean Bolivia (La Paz Department).

Habitat. Moist south-facing slopes below overhanging rocks at an elevation of 1600 to 2200 m.

IUCN conservation category. *Begonia heliantha* has been collected from a short stretch of roadside cliff NE of the town of Sandia (Puno Region) in southern Andean Peru.

I have also examined photographs of what appears to be this species taken 275 km to the SE near the town of Chulumani (Sud Yungas Province, La Paz Department), Bolivia. I have not had the opportunity to observe *Begonia heliantha* in the wild, being unable to relocate this species when I visited its known location in Sandia Province in January 2015. Accordingly I assess *Begonia heliantha* as Data Deficient (DD), according to IUCN criteria (IUCN Standards and Petitions Subcommittee, 2014).

Etymology. *Begonia heliantha* is named for the species' bright yellow sun-like flowers.

Additional specimens examined. Peru. **Puno**: Sandia Province, c.17 km on road below Sandia, 14°13′S, 69°24′W, *R.T. Pennington, T.D. Pennington & A. Daza* 1113 (E, K).

Notes. *Begonia heliantha* is similar to *B. pearcei* and *B. chrysantha* but differs from both these species by having an indumentum of glandular hairs on its stem, petioles and peduncles (*B. pearcei* and *B. chrysantha* have an indumentum of non-glandular hairs), by its paired bracteoles at the base of the ovaries (*B. pearcei* and *B. chrysantha* lack bracteoles), and by its bright yellow tepals (*B. pearcei* has pale yellow tepals, while *B. chrysantha* has golden yellow tepals). In addition *Begonia heliantha* differs from *B. pearcei* in its denser indumentum of hairs, its cuboid anthers (*B. pearcei* has obovoid anthers), its unbranched stem (*B. pearcei* has a few-branched stem), its stipules with fimbriate margins (*B. pearcei* has entire stipule margins), and its smaller parts (e.g. the leaf blades of *B. heliantha* are 2.5–5.1 × 1.6–4.1 cm, while those of *B. pearcei* are 6–10.5 × 3.5–8 cm). In addition *Begonia heliantha* differs from *B. chrysantha* in the colour of its hairs (*B. heliantha* has white hairs, while those of *B. chrysantha* are either white in their upper half and red in their lower half or red throughout), its smaller stipules (1–3.5 mm long in *B. heliantha* vs. 5–10 mm long in *B. chrysantha*), and its green leaf undersurfaces (*B. chrysantha* has purple leaf undersurfaces).

Begonia urubambensis Tebbitt, **sp. nov.** Sect. unassigned. **Figs 2, 3.**

Begonia urubambensis Tebbitt is similar to *Begonia erythrocarpa* A.DC. and *B. serotina* A.DC. but differs from both these species by lacking an aerial stem, by its more asymmetrical inflorescences, and by its inner pair of male tepals being elliptic. – Type: Peru, Cuzco Region, La Convencion, Distrito Echarate, Kiteni y alrededores del margen izquierda del río Alto Urubamba, 12°47′S, 72°40′W, *P. Núñez, M. Palma & J. Arque* 10092 (holo CUZ; iso MO, US).

Acaulescent herb, with a short fleshy rhizome 1–4 cm long. *Stipules* deciduous, narrowly lanceolate to lanceolate, 3–5 × 1.5–2 mm, apex acute, margin entire. *Leaves* c.4, alternate, peltate; petioles 10–30 cm long, glabrous; blade ovate-orbicular, 7–18 × 13–17 cm, apex acuminate, margin minutely crenate toothed, upper surface mid-green, lower surface greyish-green, veins same colour as lamina or sometimes pink tinged, raised below, upper surface with a moderate cover of minute short stiff hairs, lower surface glabrous, veins 7 to 9. *Inflorescence* 1 or 2, an asymmetric cyme, erect, up to 4-branched, majority of flowers male, male and female flowers open concurrently;

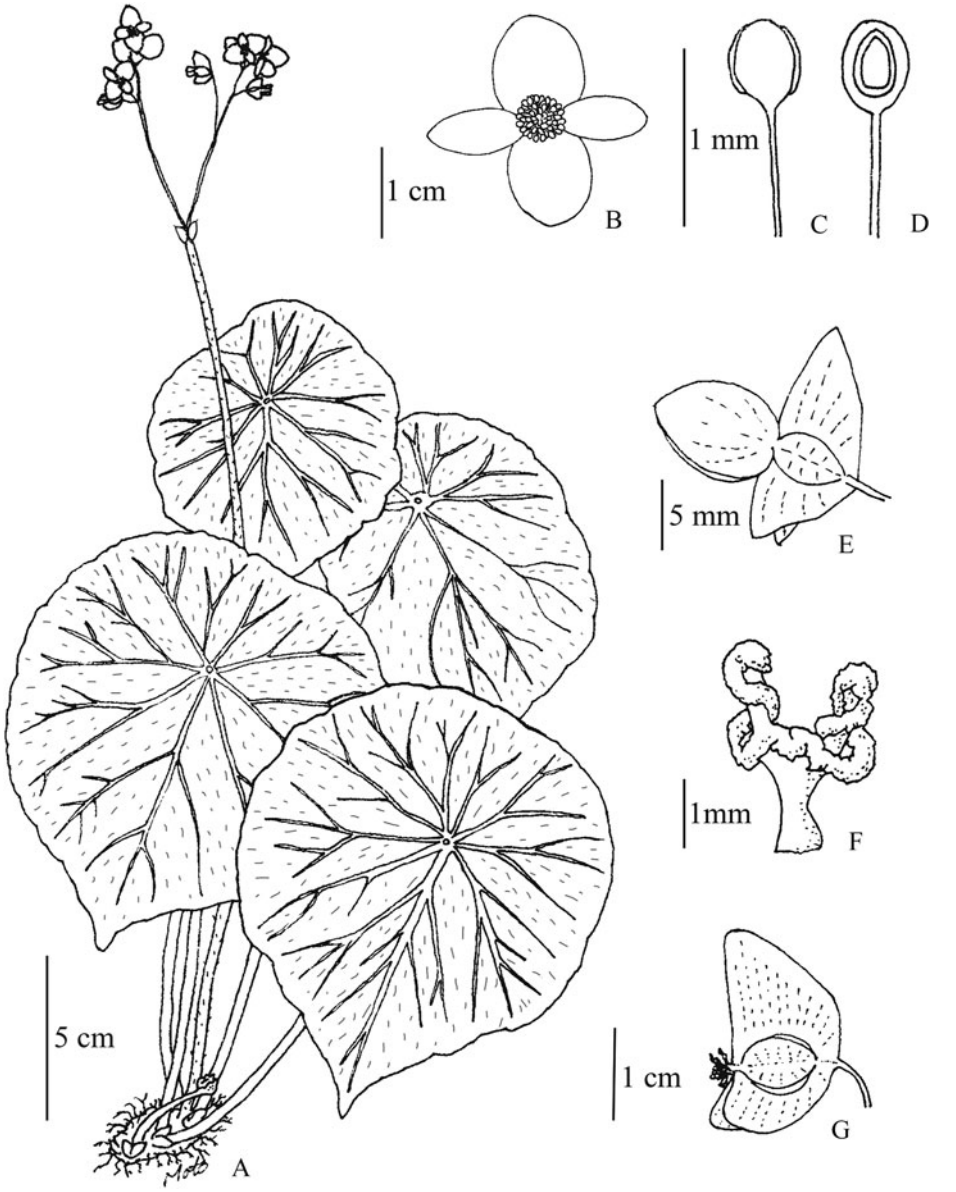

FIG. 2. *Begonia urubambensis* Tebbitt. A, habit; B, male flower; C, stamen (front view); D, stamen (side view); E, female flower (side view); F, style; G, mature fruit. Drawn from *Valenzuela et al*. 6652 (US, USM).

peduncle 30–40 cm long, sparsely pubescent, hairs simple, c.0.5 mm long; pedicels of male flowers 0.3–1.5 cm long, glabrous; pedicels of female flowers c.1.5 cm long, glabrous; bracts deciduous, lower bracts oblong-elliptic, 5–8 × c.2 mm, apex acute and shortly apiculate, margin entire, upper bracts not observed. *Male flowers*: tepals 4,

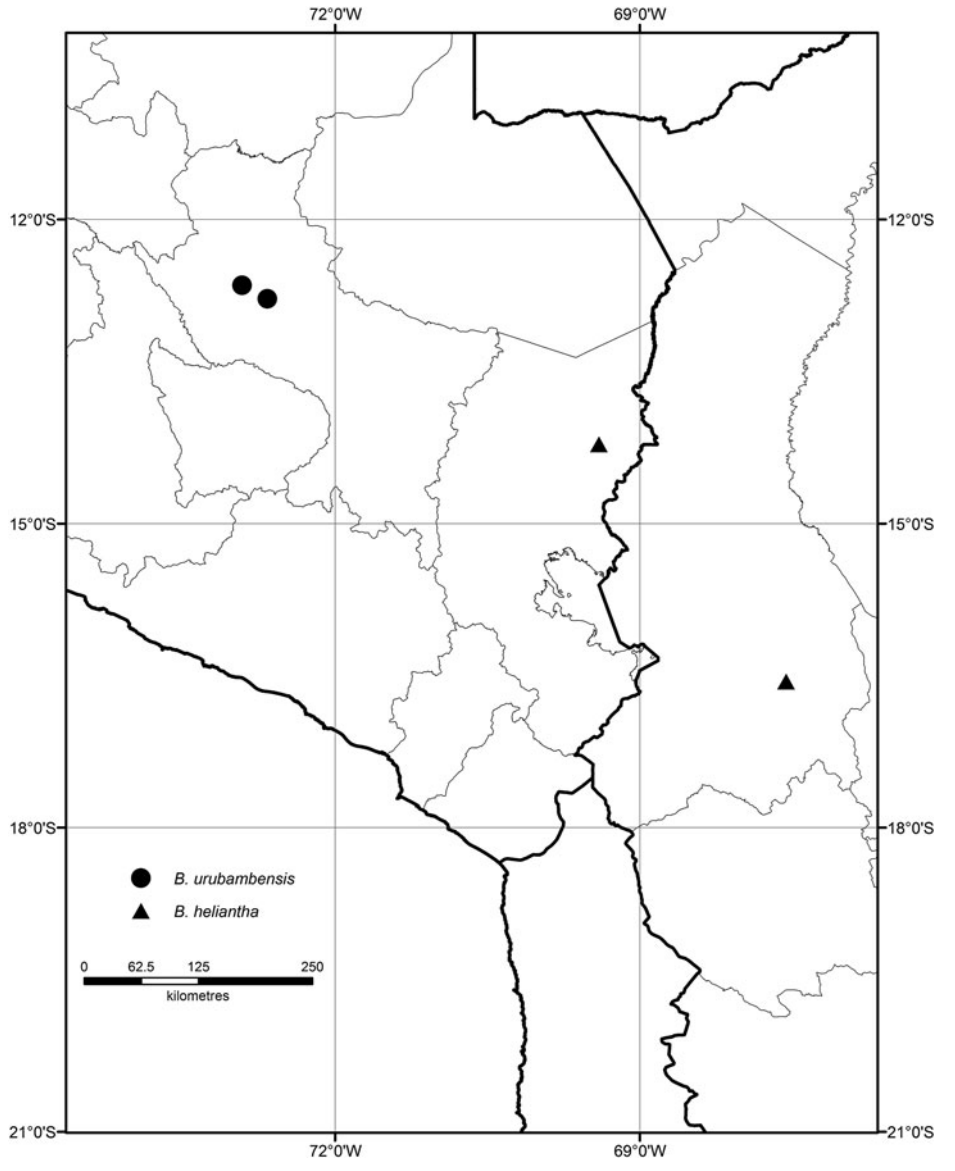

FIG. 3. The distributions of *Begonia urubambensis* Tebbitt in southern Peru and *B. heliantha* Tebbitt in southern Peru and northern Bolivia.

spreading, white, outer pair broadly ovate or broadly elliptic, 1.1–1.3 × 0.8–1.1 cm, apex obtuse, margin entire, surfaces glabrous, inner pair elliptic, 1.1–1.3 cm × c.5.5 mm, apex obtuse, margin entire, surfaces glabrous; stamens c.50, attached directly to receptacle, filaments c.3 mm long, free to base, anthers slightly asymmetrically basifixed, globose, 0.5–0.75 mm long and wide, dehiscing via short slits along sides of locules, connective not projecting. *Female flowers*: bracteoles absent, tepals not

persisting in fruit, spreading, 5, white, outermost broadly elliptic, c.6 × 4.5 mm, apex obtuse, margin entire, glabrous, inner tepals not observed; ovary body ellipsoid, 4–5.5 × 3–5 mm, glabrous, unequally 3-winged, longest wing triangular-oblong, c.9 × 5.5 mm, shorter two wings c.4 × 5.5 mm, triangular; 3-locular, placentas not observed; styles 3, free, c.3 mm long, bifid from c.1 mm above base, branches erect, stigmatic papillae in a once spiral band. *Fruiting peduncle* to 40 cm long, subnutant, fruiting pedicel to 3.5 cm long, body broadly ellipsoid to almost spherical, to 1 × 0.85 cm, glabrous, wings same shape as in ovary, longest wing to 2 × 1.5 cm, shorter two wings to 1.3 × 1.45 cm.

Phenology. Flowering and fruiting in February and March.

Distribution. Southern Andean Peru (Cusco Region).

Habitat. Growing on steep rocky cliffs in shady situations above the Río Urubamba at an elevation of 700 to 1310 m.

IUCN conservation category. *Begonia urubambensis* is known only from a short stretch of roadside cliff located between Palma Real and Kiteni (Cusco Region) in southern Andean Peru, where it is locally abundant. The species' small population size (less than 10,000 individuals composed of subpopulations with less than 1000 individuals), limited area of occupancy (less than 10 km^2) and the fact that its unprotected roadside habitat could potentially be degraded by future roadwork place this species in the IUCN category of Vulnerable (VU-D2) (IUCN Standards and Petitions Subcommittee, 2014).

Etymology. *Begonia urubambensis* is named after the Urubamba River. The species is known only from rocky slopes above this river.

Additional specimens examined. Peru. **Cusco**: La Convencion Province, río Manguriari (Manguyari), Alto Urubamba upstream to río Manguriari, 12°47′S, 72°40′W, *P. Nunez & G. Ortiz* 12802 (USM); La Convención Province, Echarate District, San Antonio, 12°39′S, 72°55′W, *L. Valenzuela, J. Farfán & I. Huamantupa* 6652 (MO, US, USM); La Convención Province, Echarate District, 3–4 km south of Palma Real to Kiteni, *M.C. Tebbitt & A. Daza Y.* 800 (E, MOL, USM).

Notes. *Begonia urubambensis* is similar to *B. erythrocarpa* and *B. serotina* but differs from both these species by lacking an aerial stem, by its more asymmetrical inflorescences, and by its inner pair of male tepals that are elliptic (versus obovate in *B. erythrocarpa* and spatulate in *B. serotina*). In addition *Begonia urubambensis* differs from *B. erythrocarpa* by its unlobed leaf margins and its less dense indumentum of hairs on the leaves, peduncles and pedicels. *Begonia urubambensis* differs from *B. serotina* by its deciduous female tepals (the female tepals of *B. serotina* persist in fruit), its unequal fruit wings (the fruit wings of *B. serotina* are subequal), its longest fruit wing being oblong with an obliquely rounded apex and up to 2 cm long (the longest fruit wing in *B. serotina* is subdeltoid and up to 1.5 cm long), and its leaf blade margins with minutely crenate teeth (those of *B. serotina* are denticulate, or rarely serrately toothed).

The GPS data on the specimen *Nunez & Ortiz* 12802 (USM) appears to be in error. This GPS location does not match the description of the collecting location. A search of the locality indicated by the GPS data was unsuccessful in finding either the species or suitable habitat, whereas the species was located at the site described on this sheet.

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