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FOUR NEW *TEAGUEIA* (ORCHIDACEAE: PLEUROTHALLIDINAE) FROM THE UPPER RÍO PASTAZA WATERSHED OF EAST-CENTRAL ECUADOR

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ABSTRACT. The genus *Teagueia*, once considered a minor genus with few species, has undergone a surprisingly diverse local evolutionary radiation in the upper Río Pastaza watershed of the eastern Andes of Ecuador. All species forming this local radiation are long-repent, in contrast to the rest of the species in the genus. Six species from this local radiation have been described previously, and four additional species are described here. The four new species are each distinguished by their particular lip shapes, differences in flower sizes, and differences in leaf textures. The new species, like the others in this radiation, all have extremely narrow distributions.

RESUMEN. El género *Teagueia*, una vez considerado como un género menor con muy pocas especies, ha experimentado una sorprendente radiación evolutiva de alta diversidad en la cuenca alta del Río Pastaza ubicada en los Andes orientales del Ecuador. Todos los miembros de esta radiación local comparten un hábito largo-reptante, en contraste con el resto de las especies del género. Seis especies de esta radiación local fueron descritas anteriormente; aquí se describe cuatro especies adicionales. Cada una de las cuatro especies nuevas se distingue por la forma particular de sus labelo, diferencias en los tamaños de sus flores, y diferencias en las texturas de sus hojas. Todas las especies nuevas, al igual que las otras de esta radiación, tienen distribuciones extremadamente reducidas.

KEY WORDS: *Teagueia*, Pleurothallidinae, *Platystele*, Orchidaceae, Ecuador

Introduction. In the first volume of his classic *Icones Pleurothallidarum*, Carl Luer (1986) proposed *Teagueia* Luer as a new subgenus of *Platystele* Schltr. (Orchidaceae: Pleurothallidinae), to accommodate three aberrant large-flowered Andean species: *P. phasmida* Luer & R.Escobar and *P. rex* Luer & R.Escobar from Colombia, and *P. teaguei* Luer from Ecuador (Luer 1986). These three species had much larger plants and flowers than typical *Platystele*, with multiple veins in the sepals, while the rest of the species of *Platystele* had single-veined sepals. The most distinctive trait of the members of the new subgenus was the involute margin of the lip, forming a central channel or orifice near the lip's apex (Luer 1986).

A fourth species, *Platystele zeus* Luer from Ecuador, with even larger flowers than the first three species, was soon added to subgenus *Teagueia* (Luer 1990). The following year Luer (1991) found that these four distinctive yet morphologically similar species, along with two species that had not been

known at the time of the earlier publications, merited their own genus, *Teagueia* (Luer) Luer. The two new species were *T. tentaculata* Luer & Hirtz from Ecuador and *T. lehmannii* Luer from Colombia. A tiny new species, *T. portillae* Luer, was added eleven years later (Luer 2002). All of these *Teagueia* species have very restricted distributions; each is known only from a single locality. *Teagueia lehmannii* Luer has only been collected once, one hundred years ago (Luer 1991), and has not been seen in modern times. Nevertheless, the high montane habitat of the genus is notoriously inaccessible, so the individual species and the genus as a whole may have somewhat wider distributions than the sparse collection records indicate. The recent discovery of *T. moisesii* Chocce & M.E.Acuña in Peru (Chocce *et al.* 2011) highlights the incompleteness of our knowledge of the distribution of this genus.

The eight *Teagueia* species mentioned above, the so-called “typical” *Teagueia* species, grow in



FIGURE 1. Cerro Mayordomo, where the first long-repent *Teagueia* species were discovered. Photograph by Lou Jost.

isolated populations without sympatric congeners, giving the impression that the genus was one of the smaller pleurothallid genera. This changed in 2000 when four new *Teagueia* species (*T. alyssana* Luer & L.Jost, *T. cymbisepala* Luer & L.Jost, *T. jostii* Luer, and *T. sancheziae* Luer & L.Jost) were found in one small section of trail at 3100 m on Cerro Mayordomo in the high Andes of the upper Río Pastaza watershed (Fig. 1) in east-central Ecuador (Luer 2000, Jost 2004). Since that time we and our students (Scot Grossman, Ali Araujo, and Pailin Weddel) have discovered many more species of *Teagueia* in the same area. Two of these, *T. barbeliana* L.Jost & Shepard and *T. puroana* L.Jost & Shepard, were recently described (Jost & Shepard 2011). All these new species have clear morphological similarities that unite them and distinguish them from the eight “typical” *Teagueia* species. Most notably, all of these new *Teagueia* species from the upper Río Pastaza watershed are long-repent, with three (very rarely two) long

rhizome segments between ramicauls, with only one or two roots per ramicaul, and no roots on the rhizome internodes which lack ramicauls. The flowers are also different between the two groups of species. Seven of the eight “typical” *Teagueia* species have a conspicuous, often ciliate callus near the base of the lip (the exception is the tiny *T. portillae*), while all the long-repent *Teagueia* species lack this basal callus. As suggested by their morphological cohesion, genetic analysis reveals that these new species belong to a single monophyletic clade which has no known representatives outside the upper Río Pastaza watershed (Jost *et al.* in prep.).

The present paper describes four new species in this clade of long-repent *Teagueia*. A DNA-based phylogeny is also being prepared for publication elsewhere. With so many closely related species packed into such a small area, and with many of them growing sympatrically on the same mountain peaks, this is one of the most diverse and puzzling local evolutionary radiations in the Orchidaceae.

TAXONOMIC TREATMENT

Teagueia kostoglouana L.Jost & A.Shepard, *sp. nov.*

TYPE: Ecuador. Tungurahua: south of the Río Pastaza, Cerro Negro, lat. -1.43° , long. -78.37° , 3000m, terrestrial in deep moss, April 30 2002, L. Jost, A. Shepard, P. Weddel, A. Araujo 4037 (holotype: QCA! both pressed plant and spirit flower, from a single gathering from the same individual; isotype QCNE! spirit). Fig. 2–4.

DIAGNOSIS. This species (Fig. 2) is most similar to *T. sancheziae* (Fig. 3) but is distinguished from all other described species by the combination of long nearly straight column more than 40% as long as the dorsal sepal, and the disc of the lip more than 50% as long as the dorsal sepal and reflexed more than 130° . All other species have proportionally much shorter or sigmoid columns, and have lip discs proportionately shorter or less reflexed.

Herb, terrestrial, long-repent; roots *ca.* 0.8 mm thick. Rhizome with three (rarely two) major segments, each 4–11 mm long, 1.6–2.8 cm between ramicauls. Ramicauls slender, *ca.* 2 mm long, consisting of two equal segments, each enclosed by a thin, gray, ribbed, loosely imbricating, apiculate, sparsely verrucose persistent sheath, the warts mainly near the top of the sheath; the sheath of the basal segment 2–3 mm long, the sheath of the distal segment 5–8 mm long. *Leaf* erect, coriaceous, verrucose, elliptical, the blade $2.0\text{--}2.2 \times 1.0\text{--}1.2$ cm, apex with a small mucronate sinus, base gradually narrowing into a slender petiole 1.1–1.4 cm long, emerging from the apex of the ramicaul. *Inflorescence* a loose, more or less erect, strict, successive, distantly many-flowered raceme arising from the apex of the ramicaul, up to 25 cm long, including the peduncle 2.5–6.0 cm long, sparsely verruculose, with imbricating apiculate sheaths, 8–11 mm between pedicels; floral bracts thin, sparsely verrucose, imbricating, apiculate, *ca.* 2 mm long; pedicels verrucose, curved at base, 3.5–4.5 mm long; ovary terete, *ca.* 1.4 mm long. *Flowers* borne face down, usually yellow-orange, heavily suffused with red-purple along veins; *sepals* papillose, longer papillae near tips; dorsal sepal three-veined, elliptical-ovate, shortly acuminate,

$3.6\text{--}3.9 \times 2.5\text{--}2.7$ mm; lateral sepals two-veined, $3.1\text{--}3.4 \times 1.7\text{--}1.9$ mm, connate for 2 mm, forming a concave broadly elliptical-ovate synsepal; *petals* obovate, acute, microscopically ciliate, one-veined, $2.4\text{--}2.6 \times 1.3\text{--}1.4$ mm; *lip* yellow heavily suffused with red-purple, three-veined; basal segment 0.8–0.9 mm long, closely appressed to column, rigidly attached to column by a narrow ligule, side lobes 1 mm long embracing the column, then widening and spreading to form a collar around the column, collar flattened in the same plane as the disc; disc deltoid, microscopically ciliate, 2.7–2.9 long and 1.3–1.4 mm wide at top, disc with a central orifice; *column* terete, $1.8\text{--}2.0 \times 0.8$ mm, straight, anther hooded, apical, anther cap white, covering two pyriform yellow pollinia united by a drop-like viscidium; the stigma single-lobed.

PARATYPES: Ecuador. Tungurahua: north of the Río Pastaza: Cerro Negro, lat. -1.44° , long. -78.37° , 3400 m, terrestrial in deep moss, April 30 2002, L. Jost, A. Shepard, P. Weddel, A. Araujo 4030 (QCA!-spirit); Cerro Candelaria, lat. -1.46° , long. -78.30° , 3100 m, terrestrial in deep moss, Jan 20 2003, L. Jost, R. Kunstaetter, D. Kunstaetter 5278 (QCA!; QCA-spirit!).

VARIATION: The type specimen and most others have an unsaturated orange-yellow ground color, but individuals can be found with a more yellow ground color, and the amount of red-purple coloration in the lip can vary (Fig. 4). Flower size varies by about 15% but shape is fairly consistent, though specimens from Cerro Candelaria have less reflexed floral parts. Leaf width relative to length varies considerably. Like most long-repent *Teagueia* species, the lip of the flower begins to curve sharply forward at the orifice when the flower is old.

This species is easily distinguished from all others by the following combination of characters: leaves verrucose like those of many *Porroglossum* species; long thin straight column 1.8–2.0 mm long; the correspondingly long basal portion of the lip parallel to the column and appressed to it; disc or midlobe of the lip sharply reflexed at an angle of about 135° to the axis of the column, flat, widest at its base, tapering gradually to a rounded apex.

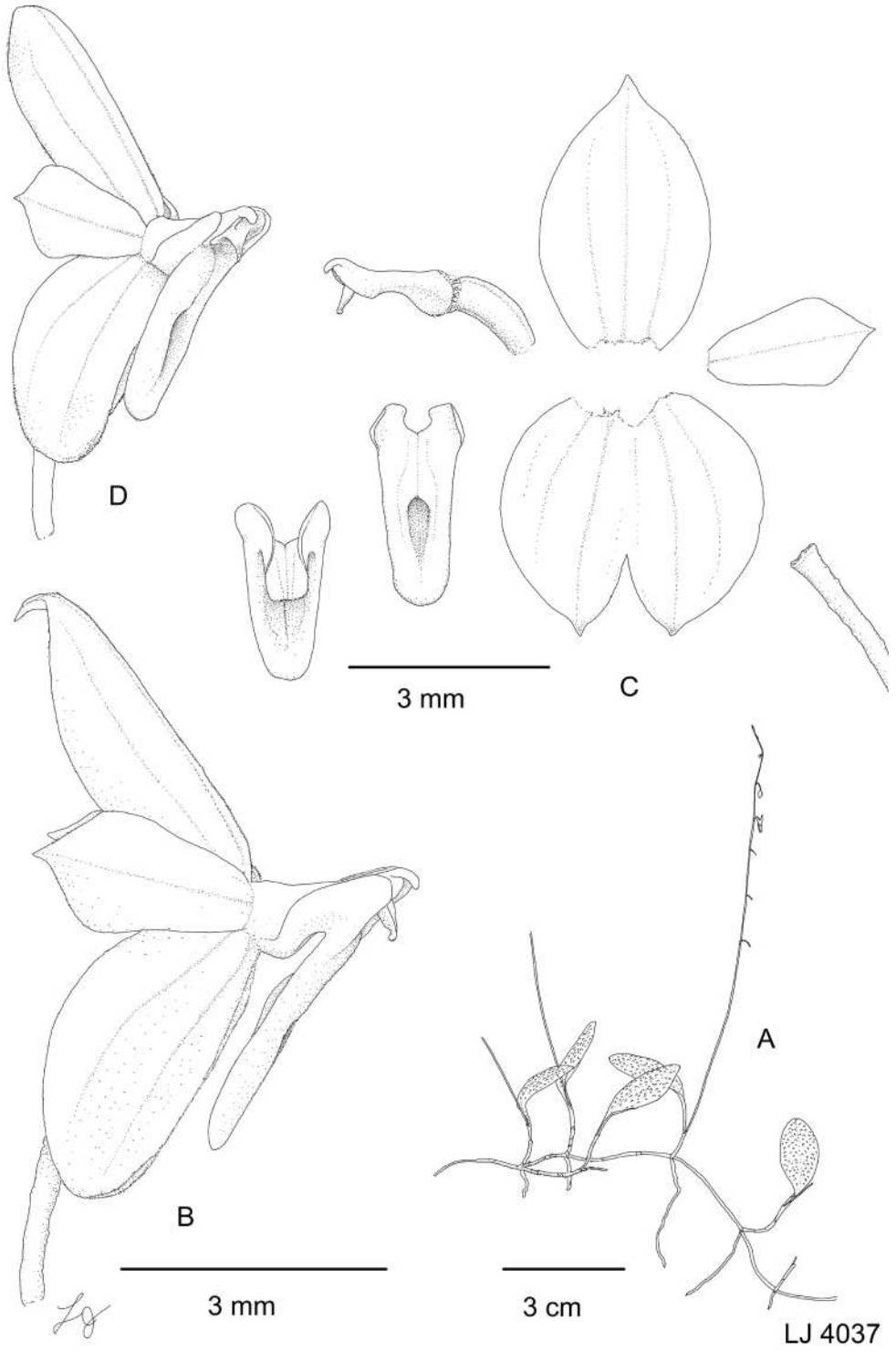


FIGURE 2. *Teagueia kostoglouana* L.Jost & A.Shepard. A. Plant. B. Lateral view of flower. C. Dissected flower. D. Oblique view of flower. From the holotype LJ 4037. Upper scale bar applies to both C and D. Drawing by Lou Jost.

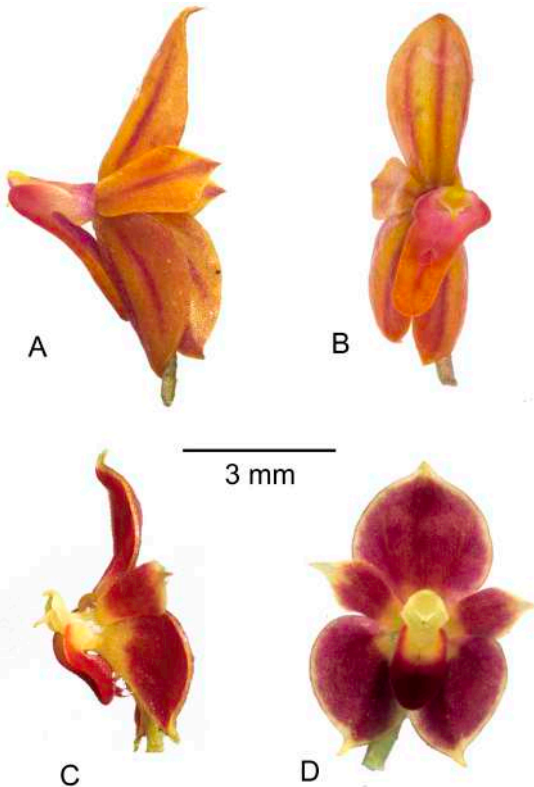


FIGURE 3. A–B. *Teagueia kostoglouana* LJ 4037 (type material). C–D. *Teagueia sancheziae* from its type locality, Cerro Mayordomo. All at same scale.

DISTRIBUTION. The species has been observed from Cerro Candelaria and Cerro Negro south of the Río Pastaza in Tungurahua, Ecuador, at elevations from about 2900m to 3400m.

CONSERVATION STATUS. All known localities for this species are found within a 10×5 km rectangle, though the species is common where it occurs. The Cerro Candelaria population lives in forests owned and protected by Fundacion EcoMinga, an Ecuadorian conservation foundation. We propose VU (Vulnerable) as its IUCN threat category based on its small known range.

EPONYMY. Named after Dr. Katerina Kostoglou, London cancer researcher, at the request of Martin Travis, also of London. Martin helped the Ecuadorian NGO, Fundacion EcoMinga, purchase and protect unique montane cloud forests containing new and endemic orchid species.

Teagueia lizziefinchiana L.Jost & A.Shepard, *sp. nov.*

TYPE: Ecuador. Tungurahua: south of the Río Pastaza on Cerro Negro, lat. -1.43° , long. -78.37° , 3040 m, terrestrial in deep moss, April 30 2002, L. Jost, A. Shepard, P. Weddel, A. Araujo 4033 (holotype: QCA! both pressed plant and spirit flower, from a single gathering from the same individual). Fig. 5–8.

DIAGNOSIS. Similar to *T. jostii* Luer (Figs. 7, 8) but all floral and vegetative parts smaller by about a factor of 2/3, flowers dark colored instead of yellow, lateral sepals connate for less than 1/3 of their length instead of more than 1/3 their length, stigma forming a sharp angle with base of column instead of a gradual bend, and flowers generally held horizontally instead of face-down.



FIGURE 4. Variation in size and color of flowers of *Teagueia kostoglouana* from the type locality, Cerro Negro. All flowers are at the same scale. Photos by Lou Jost

Herb, terrestrial, long-repent; roots *ca.* 1 mm thick. Rhizome with three (rarely two) major segments, each 1.0–2.7 cm long, 3–8 cm between ramicauls. Ramicauls slender, *ca.* 4–9 mm long, consisting of two equal segments, each enclosed by a thin, ribbed, loosely imbricating, apiculate, persistent, strongly verrucose sheath bearing prominent purple warts, the basal sheath 2–3 mm long, the distal sheath 4–9 mm long. *Leaf* erect, coriaceous, almost smooth to pustulate, elliptical to ovate-elliptical, the blade 12–30 × 6–13 mm, gradually narrowing into a slender petiole 9–20 mm long arising from near the apex of the ramicaul. *Inflorescence* a loose, more or less erect, strict, successive, distantly many-flowered raceme arising from near the apex of the ramicaul, up to 25 cm long, including a peduncle 5–6 cm long, with imbricating thin apiculate sheaths and floral bracts 2 mm long bearing prominent purple warts, 1.2–2.0 cm between pedicels; pedicels verrucose, curved at base, 5–6 mm long; ovary terete, straight, *ca.* 1.3 mm long. *Flowers* borne more or less horizontally; *sepals* dark purple, papillose; dorsal sepal three-veined, ovate-triangular, acuminate, 3.5–3.7 × 1.6–1.7 mm; lateral sepals triangular, acute, two-veined, 3.5–3.7 × 1.3–1.4 mm, connate for *ca.* 1 mm; *petals* dark purple, elongate, triangular, acute, one-veined, 1.8–1.9 × 0.5 mm; *lip* dark orange-yellow heavily suffused with dark purple, three-veined; basal segment 0.3 mm long, closely appressed to column, rigidly attached to column by a narrow ligule, side lobes 0.3 mm long, embracing the column; disc obovate, microscopically ciliate, 2.3 mm long, 1.9–2 mm wide, disc with a central orifice; *column* terete, 1.4 × 0.4 mm, straight basally, stigma and anther hood sharply upturned; anther hooded, apical, anther cap white, concealing two pyriform light yellow pollinia united by a drop-like viscidium; the stigma single-lobed.

PARATYPES: Ecuador. Tungurahua: south of the Río Pastaza: Cerro Candelaria, lat. -1.47°, long. -78.30°, 3500 m, terrestrial in deep moss, Jan 23 2003, *L. Jost*, *R. Kunstaetter*, *D. Kunstaetter* 5180 (QCA!; QCA-spirit), 5265 (QCA!; QCA!-spirit); Cerro Chamana, lat. -1.43°, long. -78.38°, 3400 m, terrestrial in deep moss, Dec 8 2003, *L. Jost*, *A. Shepard*, *S. Grossman* 6603 (QCA!-spirit).

VARIATION: Vegetative parts vary greatly in size from one individual to another. The adaxial surface of the blade is usually smooth but sometimes pustulose. Specimens from Cerro Candelaria and Cerro Chamana are similar to the type specimen from Cerro Negro (Fig. 6). However, occasional xanthine or near-xanthine individuals have been observed.

This species, which grows only on the south side of the Río Pastaza, is similar to *T. jostii* from the north side of the Río Pastaza (Figs. 7, 8), but all floral and vegetative parts are about 2/3 the size of those of *T. jostii*. The stigma of *T. lizziefinchiana* forms a sharp degree angle with the column base, with a distinct ridge dividing the base of the stigma from the column, while that of *T. jostii* forms a more gradual and obtuse angle. The stigma of the new species is also proportionally wider in relation to the anther than that of *T. jostii*. The lateral sepals of the new species are more acuminate than those of *T. jostii* (see Fig. 9 p. 140 in Luer 2000), and are connate for less than 1/3 of their length as opposed to more than 1/3 their length in *T. jostii*. The dorsal sepal of the new species is slightly reflexed, while that of *T. jostii* is held perpendicular to the column. The disc of the lip of the new species is also reflexed slightly while the disc of *T. jostii* is perpendicular to the column. In life *T. lizziefinchiana* holds its flowers more horizontally, while *T. jostii* holds its flowers facing downward. The new species normally has dark purple-black sepals and petals while *T. jostii* has yellow sepals and petals striped red-purple.

DISTRIBUTION: Found on Cerro Candelaria, Cerro Negro, and Cerro Chamana, all south of the Río Pastaza in Tungurahua province, Ecuador; observed at elevations from 3000 m to 3500 m. The mountains immediately north of the Río Pastaza were extensively searched and this species was not found there. This species was also not found in the area south of Cerro Chamana in the páramo of Laguna Minsas behind Volcán Tungurahua. The areas immediately south of Cerro Candelaria and Cerro Negro, on the other hand, are inaccessible and the species may occur there.

CONSERVATION STATUS: This species is only known from three small peaks, though it is common where it occurs. The Cerro Candelaria population lives in forests owned and protected by Fundación EcoMinga,

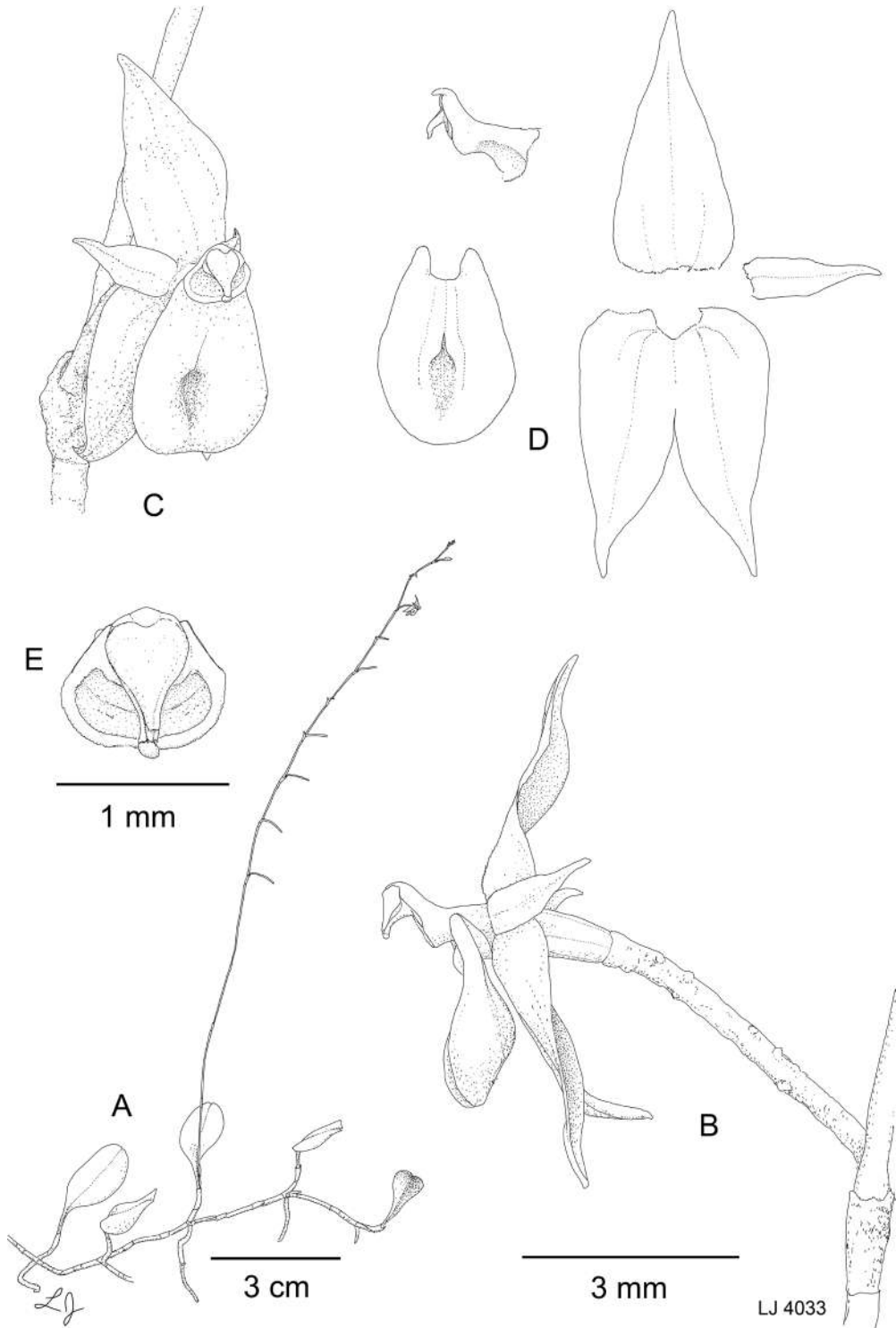


FIGURE 5. *Teagueia lizziefinchiana* L.Jost and A.Shepard. A. Plant. B. Lateral view of flower and pedicel. C. Oblique view of flower. D. Dissected flower. E. Column apex. 3 mm scale bar applies to B, C, and D. From the holotype LJ 4033. Drawing by Lou Jost.



FIGURE 6. *Teagueia lizziefinchiana* from three mountains. A. L.J. 4033 (type material) from Cerro Negro. B. L.J. 6603 from Cerro Chamana. C. L.J. 5265 from Cerro Candelaria. Variation is insignificant. All at same scale. Photographs by Lou Jost.



FIGURE 7. Comparison in life of *T. lizziefinchiana* and *T. jostii*.

A. *Teagueia lizziefinchiana* L.J. 4033 (type material) from Cerro Negro; B. *Teagueia jostii* from the type locality of that species, Cerro Mayordomo. Both photos at same scale. Photographs by Lou Jost.

an Ecuadorian conservation foundation. We propose VU (Vulnerable) as its IUCN threat category based on its small known range.

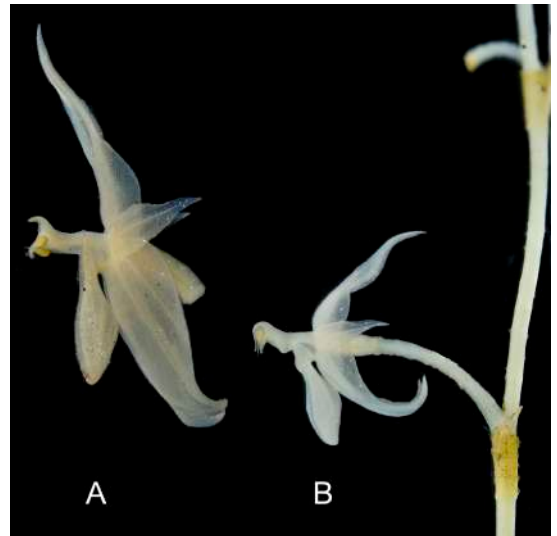


FIGURE 8. Lateral views of *T. lizziefinchiana* and *T. jostii* in alcohol. A. *Teagueia jostii* from the type locality of that species, Cerro Mayordomo. B. *Teagueia lizziefinchiana* L.J. 4033 (type material) from Cerro Negro. Both photos at same scale. Photographs by Lou Jost.

EPONYMY: Named after Elizabeth Cheryl Finch, London, UK, youngest daughter of conservationists Rohini and Robert Finch, board members of the World Land Trust. Through the World Land Trust they have helped Fundacion EcoMinga purchase and protect the montane cloud forests where this species grows.

Teagueia beverlysacklerae L.Jost & A.Shepard, *sp. nov.*

TYPE: Ecuador. Tungurahua: north of the Río Pastaza on Cerro Anangu, lat. -1.35° , long. -78.38° , approx. 3400 m, terrestrial in deep moss, Dec 19 2003, *L. Jost, A. Shepard, S. Grossman, A. Araujo 6668* (holotype: QCA! both pressed plant and spirit flower, made from a single gathering from the same individual). Fig. 9–11.

DIAGNOSIS. Similar to small specimens of *T. cymbisepala* but distinguished by the two large hemispherical calli basal to the orifice on the disc of the lip, margin of the disc not thickened, and the side lobes of the lip forming a broad flat high collar behind the anther hood of the column (Fig. 10).

Herb, terrestrial, long-repent; roots *ca.* 1 mm thick. Rhizome with three (rarely two) segments, each $6\text{--}13 \times 1$ mm, 2–2.5 cm between ramicauls. Ramicauls slender, 3–4 mm long, consisting of two equal segments, each covered by a thin, ribbed, loosely imbricating, apiculate, persistent sheath; the sheath of the basal segment is 2–3 mm long and that of the apical segment is 5 mm long. *Leaf* erect, coriaceous, smooth, broadly elliptical, obtuse, the blade $18\text{--}20 \times 8\text{--}12$ mm, gradually narrowing into a slender petiole 14–15 mm long. *Inflorescence* a loose, erect, strict, successive distantly many-flowered raceme arising from near the apex of the ramicaul, up to 12 cm long, including the peduncle 4–5 cm long, with imbricating long-apiculate sheaths 3–4 mm long, 8–13 mm between pedicels; floral bracts thin, loosely-imbricating, long-apiculate, 3–4 mm long, sparsely verrucose; pedicels curved at base, sparsely verrucose, 4–6 mm long; ovary terete, *ca.* 0.8 mm long. *Flowers* borne face down, yellowish heavily suffused with red-purple, or completely red-purple; *sepals* with clavate cilia on margins; dorsal sepal three-veined, elliptical-ovate, acuminate, $6\text{--}7 \times 3.7\text{--}4.0$ mm; lateral sepals $6\text{--}7 \times 2.8\text{--}3.0$ mm, two-veined, connate to within 0.5 mm of tips, forming a concave ovate-elliptical synsepal; *petals* with clavate cilia on margins, rhombic, acute, $3.3\text{--}3.4 \times 2$ mm; *lip* three-veined, fringed with 0.1 mm long non-clavate hairs; basal segment 0.7 mm long closely appressed to column, rigidly attached to column by a narrow ligule, side lobes embracing the column, then widening to 1 mm forming a planar collar around the column, collar flattened in the same plane as the disc;

disc 2.5–2.8 mm long covered with short non-clavate hairs, fringed with long hairs 0.1 mm long, deltoid, bearing two large round calli basal to a central orifice, narrowing to a short often upcurved apex; *column* terete, 1.3×0.8 mm, sigmoid, anther apical, anther cap white, concealing two pyriform yellow pollinia, united by a drop-like viscidium; the stigma single-lobed.

PARATYPES: Ecuador. Tungurahua: north of the Río Pastaza, Cerro Anangu: lat. -1.34° , long. -78.38° , 3450 m, terrestrial in deep moss, Oct 23 2001, *L. Jost, A. Araujo 3384* (QCA!-spirit; Fig. 11); lat. -1.35° , long. -78.38° , approx. 3400 m, terrestrial in deep moss, Dec 19 2003, *L. Jost, A. Shepard, S. Grossman, A. Araujo 6667* (QCA!-spirit; Figs. 9, 11, 12, 13).

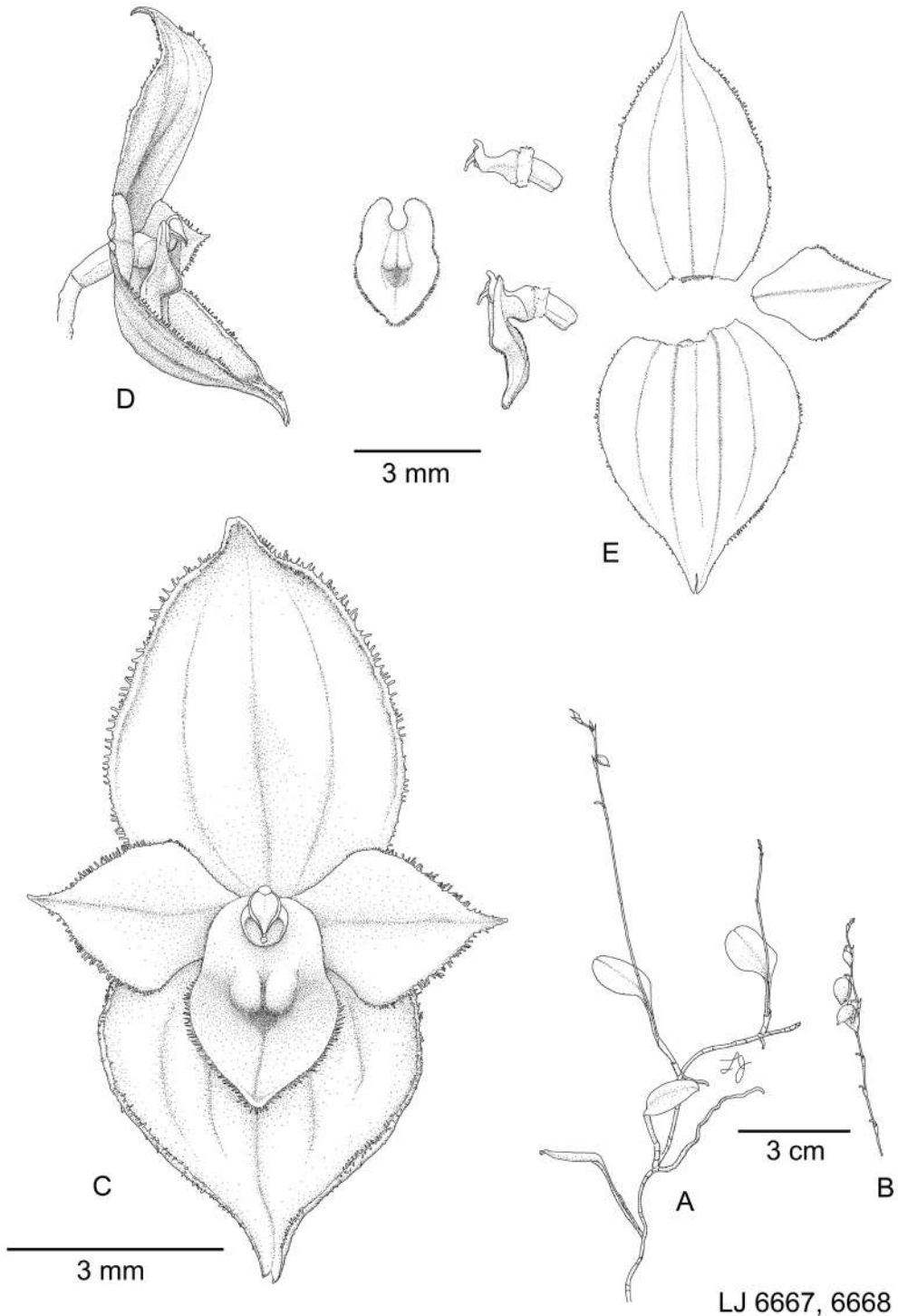
VARIATION: Flowers vary widely in their degree of flatness, even on the same plant. The type population is fairly uniform but another population one kilometer away has shorter clavate marginal hairs, and flowers range from dark red-purple to yellow with red-purple stripes on the veins (Fig. 11).

Similar in shape to *T. cymbisepala* (Fig. 10) and the large species described below, but flowers smaller; distinguished from all other large species by the combination of clavate hairs on the margins of the sepals and petals (Fig. 14), two very large hemispherical calli just above the orifice on the disc of the lip (Fig. 12), and the lip forming a broad flat high collar behind the anther hood of the column.

DISTRIBUTION: The species is known from north of the Río Pastaza on Cerro Anangu in Tungurahua province, Ecuador, at elevations around 3400 m.

CONSERVATION STATUS: This species is only known from one small peak, and is uncommon. Its habitat falls within the Parque Nacional Los Llanganates. Though it lives in a nominally protected area, we propose VU (Vulnerable) as its IUCN threat category based on its small known range and uncertainty about effective protection of the area.

EPONYMY: Named in honor of Beverly Sackler, at the request of her son Dr. Richard Sackler of Austin, TX, USA. Through the World Land Trust, Dr. Sackler has helped Fundacion EcoMinga purchase and protect montane cloud forests containing new and endemic orchid species.



LJ 6667, 6668

FIGURE 9. *Teagueia beverlysacklerae* L.Jost & A.Shepard. A. Plant. B. Inflorescence. C. Frontal view of flower. D. Lateral view of flower. E. Dissected flower. Upper 3 mm scale bar applies to both D and E. A, C and D from the holotype LJ 6668; B and E from LJ 6667. Drawing by Lou Jost.



FIGURE 10. Comparison of lips of *T. cymbisepala* and *T. beverlysacklerae*. A. Lip of *T. cymbisepala*. B. Lip of *T. beverlysacklerae*, LJ 6668 (type material). Both to same scale. The lip of *T. cymbisepala* lacks hemispherical calli above the orifice; instead the margins of the apical half of the midlobe of the lip are thickened. The apical half of the midlobe of the lip of *T. beverlysacklerae* is thin and flat. Photographs by Lou Jost.

Teagueia anitana* L.Jost & A.Shepard, *sp. nov.

TYPE: Ecuador. Tungurahua: south of the Río Pastaza, Cerro Negro, lat. -1.43°, long. -78.37°, 3200 m, terrestrial in deep moss, April 30 2002, L. Jost, A. Shepard, P. Weddel, A. Araujo 4058 (holotype: QCA! both pressed plant and spirit flower, made from a

single gathering from the same individual). Fig. 15-18.

DIAGNOSIS. This species is most similar to *T. cymbisepala* (Figs 10, 19) but differs in the following traits: verrucose rather than smooth leaves; lip oblong, flat, and slightly constricted near the middle rather than rhomboid and thickened along the edges; and lateral sepals connate for only about half their length rather than completely connate.

Herb, terrestrial, long-repent; roots *ca.* 1 mm thick. *Rhizome* with three (rarely two) major segments, each 7–15 mm long, 2.5–4.5 cm between ramicauls. *Ramicauls* slender, 6–10 mm long, consisting of two equal segments, each enclosed by a thin, ribbed, imbricating, apiculate, persistent, verrucose sheath; the sheath embracing the basal segment 3–4mm long, the sheath embracing the apical segment 7–9 mm long. *Leaf* erect, coriaceous, lightly to heavily verrucose, broadly elliptical, obtuse, the blade 2–3 × 1.0–1.7 cm, gradually narrowing into a slender petiole 1–2 cm long. *Inflorescence* a loose, erect, strict, successive distantly many-flowered raceme arising from near the apex of the ramicaul, up to 30 cm long, including the peduncle 7–9 cm long with imbricating apiculate sheaths 3–4 mm long, 8–18 mm between pedicels; floral bracts thin, imbricating, apiculate, with sparse purple warts, 2–3 mm long;



FIGURE 11. *Teagueia beverlysacklerae* variations on Cerro Anangu. A. LJ 6668 (type material). B. LJ 6667. C. LJ 3384 from a population 1 km away. All at same scale. Photos: Lou Jost.



FIGURE 12. *Teagueia beverlysacklerae* specimen in alcohol showing the bright white calcium oxylate crystals. *LJ 6667*. Photograph by Lou Jost.



FIGURE 13. Lip of *T. beverlysacklerae* in alcohol showing the distinctive pair of large hemispherical calli above the orifice. LJ6667. Photograph by Lou Jost.

pedicels verrucose, curved at base, 6–10 mm long; ovary 1.9–2.2 mm long. *Flowers* borne face down; *sepals* purple-black, microscopically ciliate; dorsal sepal three-veined, elliptical-ovate, acuminate, 8.0–8.5 × 4.2–4.6 mm; lateral sepals two-veined, 7.0–7.3 × 2.9–3.1 mm, connate for 3 mm, forming a concave broadly ovate synsepal with shortly-acuminate apices; *petals* purple-black microscopically ciliate, obovate, acute, one-veined, 3.8–4.0 × 2.0–2.3 mm; *lip* orange suffused with dark purple, three-veined; basal segment 0.7 mm long, closely appressed to column, rigidly attached to column by a narrow ligule, side lobes 0.9 mm long embracing the column, then widening to form a planar collar around the column, collar flattened in the same plane as the disc; disc microscopically ciliate, longer cilia near apex, deltoid, 3.5–4.0 mm long, 2.1–2.3 mm wide at top, with a central orifice; *column* terete, 2.0 × 0.8 mm,

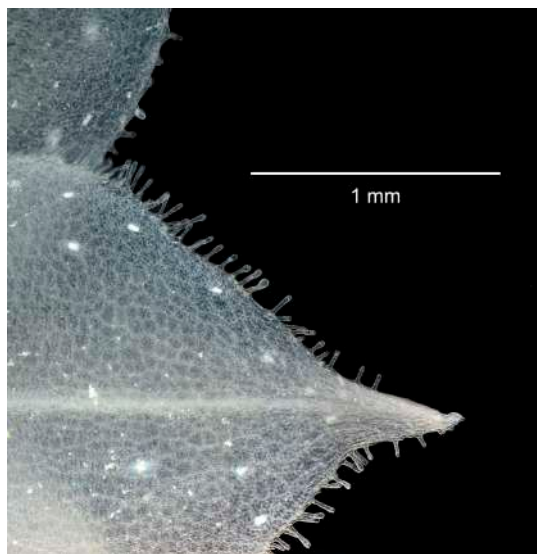
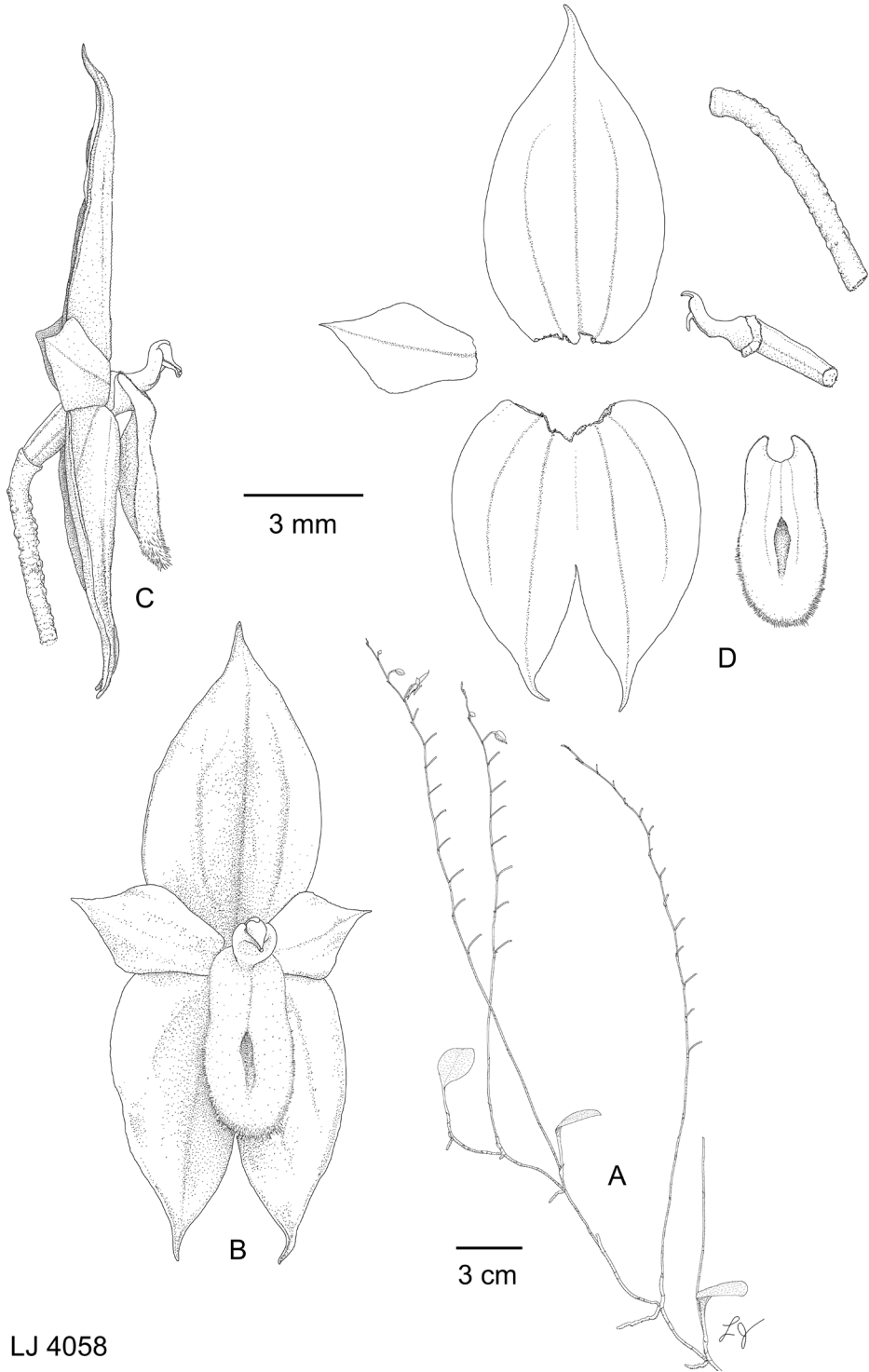


FIGURE 14. Clavate cilia on petal margins of *Teagueia beverlysacklerae*. LJ 6667. Photograph by Lou Jost.

straight, anther sharply curved upward almost 90 degrees, hooded, apical, anther cap white, concealing two pyriform yellow pollinia united by a drop-like viscidium; the stigma single-lobed.

PARATYPES: Ecuador, Tungurahua: north of the Río Pastaza: Cerro Negro, lat. -1.44°, long. -78.35°, 3040 m, terrestrial in deep moss, Apr 30 2002, *L. Jost, A. Shepard, P. Weddel, A. Araujo 4035* (QCA!, QCA!-spirit); Cerro Negro, lat. -1.44°, long. -78.35°, 3200 m, terrestrial in deep moss, Apr 30 2002, *L. Jost, A. Shepard, P. Weddel, A. Araujo 4057* (QCA!, QCA!-spirit); Cerro Candelaria, lat. -1.46°, long. -78.30°, approx 3100 m, terrestrial in deep moss, Oct 3 2003, *L. Jost, A. Shepard, S. Grossman, A. Araujo 6190* (QCA!, QCA!-spirit).

VARIATION: Variation in this species is complex. Plants identical to the type specimen can be found on both Cerro Negro and Cerro Candelaria (Fig. 17). However, on both mountains this species forms what appears to be a hybrid swarm with a much smaller, less hairy yellow form (Fig. 18); intermediates are commonly observed. More genetic work is needed to understand the nature of this hybrid swarm. For now we assign the name *T. anitana* to the distinctive form described above, which is at one extreme of the variation observed in the swarm. The whole swarm



LJ 4058

FIGURE 15. *Teagueia anitana* L. Jost & A. Shepard. A. Plant. B. Oblique view of flower. C. Lateral view of flower and part of pedicel. D. Dissected flower. 3 mm scale bar applies to B, C, and D. From the holotype LJ 4058. Drawing by Lou Jost.



FIGURE 16. *Teagueia anitana* LJ4058 (type material) in alcohol. Photo by Lou Jost.

might best be considered one species, and in that case the name *T. anitana* would apply to them all.

While this species superficially resembles *T. cymbisepala* (Fig 19), unpublished DNA data shows that the two species are not especially closely related. The lip of this species is ligulate, slightly constricted in the middle, and flat, while that of *T. cymbisepala* is rhomboid, widest in the middle, with a central sulcus in addition to the normal orifice, and with unique thickened margins. The lateral sepals of *T. anitana* are connate for less than half their length, while those of *T. cymbisepala* are connate for almost their entire length. The distribution of cilia is different as well: *T. cymbisepala* has long cilia on the sepal and petal

margins and very short cilia on the lip; *T. anitana* has microscopic cilia on the petals and sepals but long cilia on the lip.

DISTRIBUTION: This species is found above about 3000 m on Cerro Candelaria and Cerro Negro in the province of Tungurahua, where it is locally common. In spite of years of searching, it has not been found north of the Río Pastaza.

CONSERVATION STATUS: Because of its very small range we recommend assigning it the IUCN threat category Vulnerable (VU). It is protected in Fundacion EcoMinga's Cerro Candelaria Reserve.

EPONYMY: Named for Anita Zabłudowicz, of London, England who has more than two decades of history supporting philanthropic activities through the Zabłudowicz Collection of fine art. Through the World Land Trust, Anita Zabłudowicz has helped Fundacion EcoMinga purchase and protect montane cloud forests containing new and endemic orchid species.

Discussion. The distributions of these new species are puzzling. None of them have distributions spanning the Río Pastaza; one of these new species is found strictly north of the river, while the other three live on the south side. This pattern is also obeyed by all the previously-described long-repent *Teagueia* species. Yet the distances between apparently-suitable habitat from one side of the river to the other are very small, less than 10 km in some places. To put this in perspective, the orchids of the Islas Galápagos, famous for their plant endemism, are mostly the same as mainland species, suggesting orchid gene flow over 800 km of open ocean. The failure of these orchid seeds to cross 10 km of open unobstructed space is thus almost shocking. LJ had once hypothesized that a difference in terrestrial mycorrhizal fungi between the two sides of the river might explain the distribution limits; however, a recent test of that hypothesis showed that at least the adults of the long-repent *Teagueia* species north of the Río Pastaza use very widespread species of mycorrhizal fungi (Suarez et al. 2016). Perhaps some property of the seeds impedes their dispersal. We do observe what looks like geographical variation over distances of only a kilometer or two in some *Teagueia* species, such as *T. beverlysackleriana*. More investigation is needed to understand this striking pattern.



FIGURE 17. *Teagueia anitana* from two different mountains. A. *LJ 4057*, Cerro Negro. B. *LJ 4058* (type material), Cerro Negro. C. *LJ 6190*, Cerro Candelaria. All at same scale. Photographs by Lou Jost.



FIGURE 18. *Teagueia anitana* hybrid example. All at same scale, all from Cerro Negro. A. *T. anitana*, *LJ 4058* (type material). B. *LJ 4059*, which appears to be a hybrid between the forms illustrated in panels A and C. C. *LJ 4081*, a small yellow form without long lip hairs. Photographs by Lou Jost.

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FIGURE 19. *Teagueia cymbisepala* for comparison. See also Fig. 10 for a different angle. Photographs by Lou Jost.

localities. L. Jost also thanks the Ministry of the Environment for providing the permits under which this work was done: 018-IC-FLO-DFB (2000-2001), 011-IC-FLO-DFP (2001-2002), 006-IC-FLO-DBAP/MA (2002-2003), 017-IC-FLO-DBAP/MA (2003-2004), and 001-IC-FLO-DNBAPVS/MA (2005-2006). We both thank Scot Grossman, Pailin Weddel, and Ali Araujo for their valiant fieldwork under sometimes life-threatening conditions. This work was done under grants by John Moore, San Jose, California, to the Population Biology Foundation. We thank Lorena Endara for helpful advice on the descriptions, and two anonymous reviewers for catching many mistakes.

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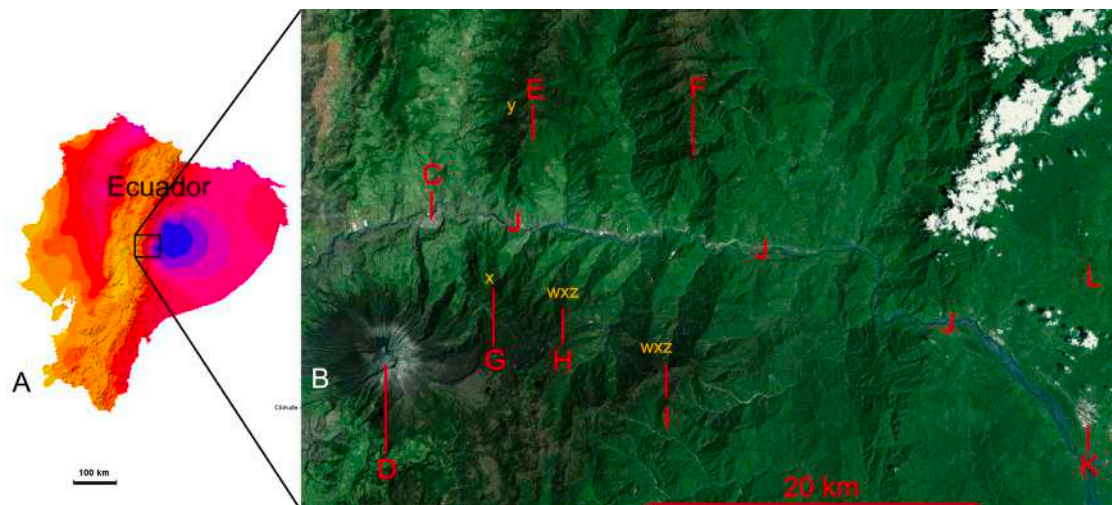


Figure 20. Distribution of the four new *Teagueia* species in the upper Río Pastaza watershed of the eastern Andes of Ecuador. A. Precipitation map of Ecuador, with the general area of the upper Río Pastaza watershed outlined in black; the outlined area is shown in detail at right. In the precipitation map, blue indicates 4500–5000 mm/yr precipitation, yellow indicates 0–500 mm/yr. B. Species locations. C. Town of Baños, 1800 m. D. Volcan Tungurahua, 5016 m. E. Cerro Añangu, 3650 m. F. Cerro Mayordomo, 3450 m. G. Cerro Chamana, 3500 m. H. Cerro Negro, 3600 m. I. Cerro Candelaria, 3860 m. J. Río Pastaza. K. Town of Mera, 1200 m. L. Amazonian lowlands 300–900 m. w: *Teagueia kostoglouana*; x: *T. lizziefinchiana*; y: *T. beverlysacklerae*; z: *T. anitana*. Ecuador map generated by Lou Jost; vegetation basemap made under ESRI license to Lou Jost.

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