A New Species of *Columnea* (Gesneriaceae) from Ecuador with a Unique Correlation Between Leaf Symmetry and Stem Architecture

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Abstract. *Columnea dimorpha* J. L. Clark (Gesneriaceae), a new species endemic to the Pastaza Valley of Ecuador, is described and illustrated. The species exhibits a distinctive vegetative dimorphism in which flexuous shoots consistently bear anisophyllous leaf pairs, whereas straight shoots consistently bear isophyllous leaf pairs. This correlated variation in stem architecture and leaf symmetry has not previously been documented in *Columnea* L. A conservation assessment based on the IUCN Red List Categories and Criteria supports a preliminary status of Vulnerable (VU).

Resumen. *Columnea dimorpha* J. L. Clark (Gesneriaceae), una nueva especie endémica del valle del Pastaza, Ecuador, se describe e ilustra. La especie presenta un dimorfismo vegetativo distintivo caracterizado por tallos flexuosos asociados con nudos anisófilos y tallos rectos asociados con nudos isófilos. Esta variación coordinada en la arquitectura del tallo y la simetría foliar no había sido documentada previamente en *Columnea* L. Una evaluación de conservación basada en las Categorías y Criterios de la Lista Roja de la UICN respalda una categoría preliminar de Vulnerable (VU).

Key words: Anisophylly, Gesnerioideae, isophylly, Pastaza Valley, taxonomy.

The flowering plant family Gesneriaceae, a member of the order Lamiales, comprises more than 4000 species in over 150 genera (Weber, 2004; Weber et al., 2013; GRC, 2026). Molecular phylogenetic studies support its classification into three subfamilies and seven tribes, each representing a well-supported monophyletic lineage (Möller & Clark, 2013; Ogutcen et al., 2021). Within the family, subfamily Gesnerioideae comprises a Neotropical radiation of approximately 1200 species in 77 genera (Clark et al., 2020; GRC, 2026).

The genus *Columnea* L. is placed in tribe Gesnerieae, subtribe Columneinae (Weber et al., 2013, 2020). It is distinguished from closely related genera primarily by its fruit, which is typically an indehiscent berry; the sole exception is *C. dielsii* Mansf., which bears a fleshy bivalved capsule. *Columnea* is the largest genus in the tribe, with more than 220 currently accepted species (Clark et al., 2020; GRC, 2026). A new species discovered in Ecuador and described here as *C. dimorpha* J. L. Clark is readily distinguished by a unique vegetative dimorphism characterized by the correlated occurrence of flexuous shoots with anisophyllous leaf pairs and straight shoots with isophyllous leaf pairs.

Although molecular phylogenetic analyses consistently support the monophyly of *Columnea* (Clark et al., 2006; Smith et al., 2013; Schulte et al., 2014), they do not support previously proposed infrageneric classifications. Historical classifications relied largely on morphological characters that are homoplasious or otherwise phylogenetically uninformative (Smith & Carroll, 1997; Smith, 2000; Clark & Zimmer, 2003; Clark et al., 2012; Smith et al., 2013; Schulte et al., 2014). Consequently, *C. dimorpha* is not assigned here to an infrageneric taxon or to any of the segregate genera recognized by Wiehler (1983), all of which are now treated as synonyms of *Columnea*.

Columnea species are usually categorized as growing epiphytically or terrestrially. The climbing habit of the species described here, however, is more accurately described as that of a "nomadic vine" sensu Moffett (2000). These plants establish on the ground and subsequently ascend surrounding vegetation using elongate scandent shoots and/or adventitious roots; as upward growth continues, older portions of the stem may become detached from the terrestrial substrate (Zotz, 2013). Because *C. dimorpha* has woody stems, the habit is referred to here as a nomadic climber rather than a nomadic vine.

Materials and Methods

The type collection was made during a 2014 field expedition to the Río Zuñac Reserve, conducted as part of a field botany course organized jointly by the Universidad Estatal Amazónica and the University of Alabama. Plants were photographed in the field and subsequently pressed and dried as herbarium specimens. Voucher specimens are deposited in the following herbaria: Herbario Amazónico de la Universidad Estatal Amazónica (ECUAMZ), Missouri Botanical Gar-

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den (MO), New York Botanical Garden (NY), United States National Herbarium (US), Pontificia Universidad Católica del Ecuador (QCA), and Marie Selby Botanical Gardens (SEL).

Photographs of live plants were taken in the field using a Nikon DSLR camera equipped with a Nikon 105 mm macro lens and a Nikon SB-29S ring flash (Nikon, Tokyo, Japan). Morphological observations and measurements were based on live plants, alcohol-preserved material, herbarium specimens, and digital images. Measurements from digital images were obtained using ImageJ (Schneider et al., 2012). The conservation status was assessed according to the IUCN Red List Categories and Criteria (IUCN, 2012) and the Guidelines for Using the IUCN Red List Categories and Criteria (IUCN, 2024).

Taxonomic Treatment

Columnea dimorpha J. L. Clark, sp. nov. TYPE: Ecuador. Tungurahua: Cantón Baños, Parroquia Río Negro, Río Zuñac Reserve (Fundación EcoMinga), Llanganates–Sangay Ecological Corridor, ridgeline toward Sacha-Llanganates (Cordillera Abitagua), 1°22′7.0242″S, 78°8′23.43″W, 2000–2423 m, 14 May 2014 (fl.), *J. L. Clark, D. A. Neill & L. Clavijo 14100* (holotype, QCA [barcode] QCA253119!; isotypes, BM!, BRIT!, E!, G!, MO!, MT!, NY!, QCA!, SEL [bc] SEL084597!, US!). Figures 1–3.

Diagnosis. *Columnea dimorpha* J. L. Clark is distinguished from all other species of *Columnea* L. by a distinctive vegetative dimorphism in which straight shoots consistently bear isophyllous leaf pairs, whereas flexuous shoots consistently bear anisophyllous leaf pairs. The occurrence of both isophyllous and anisophyllous leaf pairs is shared with *C. fluidifolia* J. L. Clark & Tobar, but *C. dimorpha* differs from that species in the consistent correlation between stem architecture and leaf symmetry, and further by its smaller, narrowly oblong calyx lobes that enclose the base of the corolla tube (vs. broadly oblong calyx lobes extending nearly half the length of the corolla tube in *C. fluidifolia*), greenish-white (vs. orange) calyx, and dark pink (vs. orange) corolla tube.

Elongate scandent nomadic climbers. Stems slender, horizontal, and subwoody, terete in cross section, 2–4 mm diam., sparsely to densely pilose; shoots 1–2 m, with 2 distinct architectures: straight shoots with isophyllous leaf pairs and flexuous shoots with anisophyllous leaf pairs. Leaves opposite, pairs isophyllous or strongly anisophyllous; larger leaf ovate to slightly oblong, 3–5 × 1.6–2 cm, apex acuminate, base rounded, margin serrate, lateral veins 3 to 5 per side, adaxial surface shiny green, uniformly pilose, abaxial surface uniformly light green or light green suffused with red, sparsely pilose, more densely pubescent along veins; petiole of larger leaf 1–2 mm, pilose; smaller leaf nearly sessile, blade ovate, 1–1.2 × 0.6–0.8 cm, lateral veins 2 to 4 per side, otherwise similar to larger leaf. Inflorescences reduced to a single axillary flower; bracts absent; pedicel 1.8–2.3 cm, greenish-white, densely pilose, with prominent nectary glands. Calyx lobes greenish-white, sometimes with red splotches, narrowly oblong, 1.7–2.2 × 0.4–0.6 cm, apex acuminate, exterior pilose, interior glabrous, margin with 3 to 5 prominent serrations. Corolla 3.8–4.3 cm, tubular, ca. 1 cm wide, apically constricted, ampliate on lower surface, shallowly bilabiate; lower lobe recurved, 1.5–2.6 × 2.5–3.5 mm; lateral lobes 1.5–1.8 × 1.5–1.9 mm; upper lobes fused into a bilobed hood, 1.5–2 × 3–4 mm; all lobes rounded and sparsely serrate, exterior pilose, interior with glandular trichomes near throat, mostly dark pink with pinkish-orange lobes. Androecium with filaments ca. 4.2 cm, connate at base for 0.2 cm and free from corolla, glabrous; anthers ca. 3 × 3 mm, included in the corolla throat, quadrangular. Gynoecium with ovary ca. 4 mm high, conical, pilose; style 3 cm, covered with glandular trichomes, stigma shallowly bilobed; nectary consisting of a single truncate gland dorsal to the ovary. Fruiting material not observed.

Phenology. *Columnea dimorpha* has been documented with flowers during March, May, and November. Fruits have not been observed.

Distribution and habitat. The upper Río Pastaza forms a deep, east-facing valley approximately 40 km long that cuts through several closely spaced, north–south mountain ranges along the western margin of the Amazon basin. These ranges occur along a pronounced east–west precipitation gradient, with precipitation decreasing from east to west (Jost, 2004). Jost (2004) noted that the distributions of many pleurothallid orchids in the upper Río Pastaza region form north–south bands associated with this precipitation gradient, a pattern associated with the region's high number of localized endemics.

Cerro Abitagua is the first mountain range on the northern side of the upper Pastaza Valley to intercept these moisture-laden winds. *Columnea dimorpha* is known from Cerro Abitagua and an isolated mountain ridge approximately 7 km to the east, known locally as Cerro Mayordomo, near the Río Topo watershed above Río Machay. The species is currently documented only from Tungurahua Province, although the Cerro Abitagua subpopulation occurs on the ridge that forms the boundary between Tungurahua and Pastaza provinces and likely also occurs in Pastaza Province. The known subpopulations occur in upper montane cloud forests above 2000 m elevation, where exposed ridges support forests with a lower-stature canopy than the surrounding lower-elevation forests. These ridge top forests are characterized by persistent cloud cover, relatively cool temperatures, and high humidity.

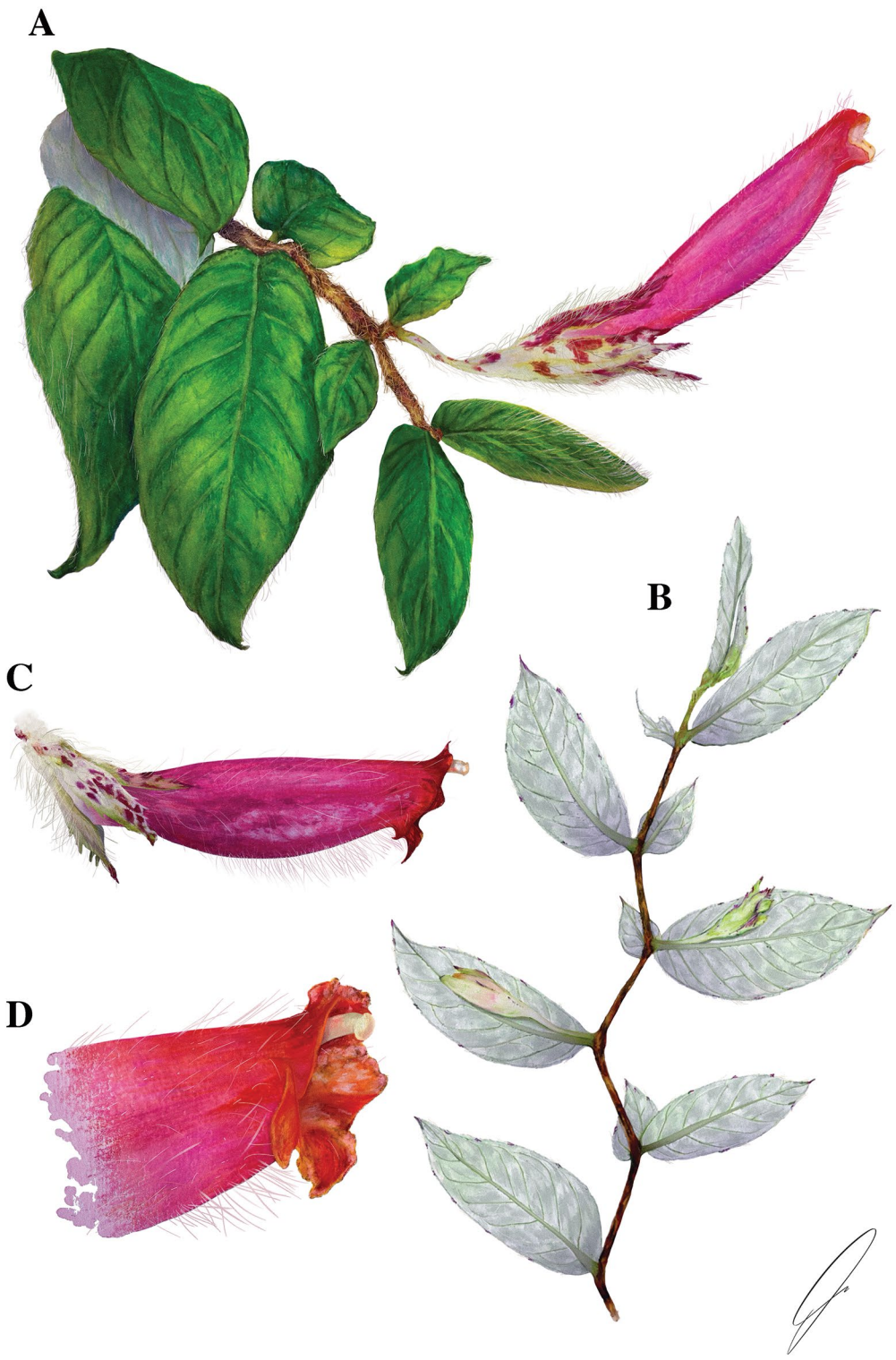


Figure 1. Illustration of *Columnea dimorpha* J. L. Clark —A. Straight stem architecture associated with isophyllous leaf pairs. —B. Flexuous stem architecture associated with anisophyllous leaf pairs. —C. Lateral view of flower. —D. Corolla. All from *J. L. Clark et al. 14100*. Illustration by Teddy Wordsworth.

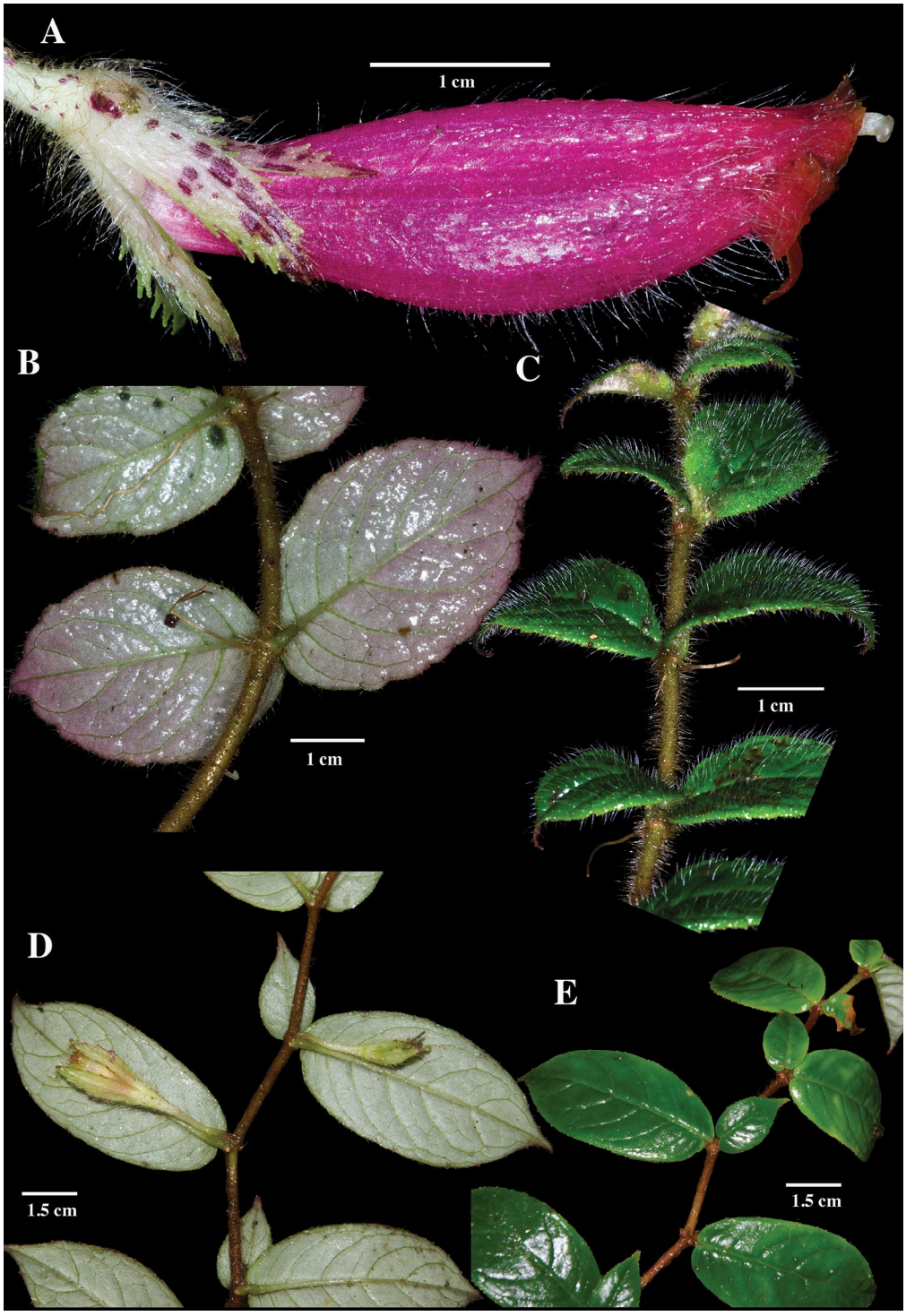


Figure 2. Field images of *Columnea dimorpha* J. L. Clark. —A. Flower. —B. Straight stem architecture associated with isophyllous leaf pairs; abaxial (lower) leaf surfaces shown. —C. Straight stem architecture associated with isophyllous leaf pairs; adaxial (upper) leaf surfaces shown. —D. Flexuous stem architecture associated with anisophyllous leaf pairs; abaxial (lower) leaf surfaces shown. —E. Flexuous stem architecture associated with anisophyllous leaf pairs; adaxial (upper) leaf surfaces shown. A–E, *J. L. Clark et al. 14100*. Photos by John L. Clark.



Figure 3. Isotype of *Columnea dimorpha* J. L. Clark (SEL), showing straight shoots with isophyllous leaf pairs and flexuous shoots with anisophyllous leaf pairs.

Preliminary IUCN Red List category. *Columnea dimorpha* is known from three georeferenced localities: two represented by herbarium collections from Cerro Abitagua and a third documented on Cerro Mayordomo, an isolated mountain west of the Río Topo drainage above Río Machay. The first known collection of *C. dimorpha* was made by David A. Neill in 2001 near the type locality, an area that the author visited with Neill on a separate expedition 13 years later. The population on Cerro Mayordomo is not represented by a voucher specimen; it was photographed by EcoMinga Foundation co-founder Lou Jost on 19 March 2018 and independently verified by EcoMinga park guards Fausto ("Tito") and Luis Recalde on 13 August 2026. Because this locality is supported by photographic documentation (not reproduced in this article) and recent field verification, it is included in the conservation assessment. Accordingly, the assessment is based on three georeferenced localities.

One locality occurs within Parque Nacional Llanganates, a protected area administered by the Government of Ecuador, and the remaining two occur within privately protected reserves (Machay and Río Zuñac reserves) managed by the EcoMinga Foundation. Although all known populations are within protected areas, the surrounding forests continue to experience pressure from agricultural expansion. The calculated area of occupancy (AOO) is 12 km².

Based on the currently available information and the IUCN Red List Categories and Criteria (IUCN, 2012) and the Guidelines for Using the IUCN Red List Categories and Criteria (IUCN, 2024), *Columnea dimorpha* is preliminarily assessed as Vulnerable [VU D2] because of its very restricted distribution (AOO = 12 km²), its occurrence on two isolated mountain ranges, and the plausible future threat of habitat loss or degradation resulting from agricultural expansion, should the current level of protection be reduced or become ineffective. Although all known populations are currently protected, the long-term persistence of this species will depend on the continued protection and effective management of these reserves.

Etymology. The specific epithet *dimorpha* (Greek, "two forms") refers to the distinctive vegetative dimorphism of the species, with flexuous (zig-zag) shoots at anisophyllous nodes (Fig. 1B) and straight shoots at isophyllous nodes (Fig. 1A).

Notes. In *Columnea dimorpha*, stem architecture is strongly correlated with leaf symmetry. Shoots bearing isophyllous (equal-sized) leaf pairs are straight (Figs. 1A, 2B, C), whereas shoots with anisophyllous (unequal-sized) leaf pairs are distinctly flexuous (Figs. 1B, 2D, E). The occurrence of both isophyllous and anisophyllous leaf pairs on the same individual is highly unusual in *Columnea*. This association was documented during the type collection, where the herbarium label (Fig. 3) states, "Leaves anisophyllous and isophyllous on the same individual," and both shoot forms are represented on the isotype at SEL (Fig. 3). These observations were subsequently confirmed during an August 2026 reconnaissance expedition by EcoMinga park guards Fausto ("Tito") and Luis Recalde, who documented mature flowers on both straight shoots with isophyllous leaf pairs and flexuous shoots with anisophyllous leaf pairs. Thus, the association between stem architecture and leaf symmetry has been independently documented at both known localities of *C. dimorpha*.

Most species of *Columnea* are consistently isophyllous or anisophyllous, although exceptions are known. The first species reported to exhibit both conditions on the same individual was *C. fluidifolia* (Tobar et al., 2022) (Fig. 4B), whose specific epithet refers to the pronounced variability in leaf morphology along a single shoot. In contrast to *C. dimorpha*, however, the shoots of *C. fluidifolia* are consistently flexuous (Fig. 4B), with anisophyllous leaf pairs predominating and only occasional isophyllous pairs.

Most species of *Columnea* with anisophyllous leaves have straight shoots, particularly species characterized by subwoody horizontal or dorsiventral shoots. Likewise, many species with isophyllous phyllotaxy are nomadic climbers with pendent shoots. Flexuous shoots are relatively uncommon in the genus, but among species exhibiting this architecture, they are associated with anisophylly. Examples include *C. conopurpurea* J. L. Clark, Y. Ramos-Arias & J. L. Peña (Fig. 4A), *C. fractiflexa* J. F. Sm. & J. L. Clark, *C. fluidifolia* (Fig. 4B), *C. pendens* J. L. Clark, J. F. Sm. & Tobar (Fig. 4C), and *C. paramicola* (Wiehler) L. P. Kvist & L. E. Skog (Fig. 4D). These examples suggest that the association between anisophylly and flexuous stem architecture may be more widespread in *Columnea* than previously recognized. However, *C. dimorpha* is unique in exhibiting both isophyllous and anisophyllous leaf pairs on the same individual, with each condition consistently corresponding to a distinct stem architecture.

Paratypes. ECUADOR. **Tungurahua:** Baños, Parque Nacional Llanganates, Cordillera Sacha Llanganates, summit ridge, overlooking the Amazon lowlands to the E, Río Zuñac watershed to the W, 1°21′50″S, 78°7′33″W, 2740 m, 28 Nov. 2001 (fl.), *D. A. Neill, L. Jost, J. Caranqui & E. Toapanta 12495* (MO, QCNE).

Acknowledgments. The 2014 field expedition was conducted as part of an annual field course and marked the final University of Alabama field course in Ecuador that I directed, ending this chapter of field-based teaching before I transitioned to a new position. I



Figure 4. Field images of selected species of *Columnea* L. exhibiting flexuous stem architecture. —A. *Columnea conopurpurea* J. L. Clark, Y. Ramos-Arias & J. L. Peña. —B. *Columnea fluidifolia* J. L. Clark & Tobar. —C. *Columnea pendens* J. L. Clark, J. F. Sm. & Tobar. —D. *Columnea paramicola* (Wiehler) L. P. Kvist & L. E. Skog. A, *J. L. Peña & Y. Ramos-Arias 944*; B, *J. L. Clark & L. Jost 16286*; C, *J. L. Clark et al. 17146*; D, *J. L. Clark et al. 13600.* A, photo by J. L. Peña & Y. Ramos-Arias; B–D, photos by John L. Clark.

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