

Drymonia peponifera, a new species of Gesneriaceae from Ecuador with an overview of *Drymonia* fruit traits

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Abstract: A new species of *Drymonia* (Gesneriaceae, Columneinae) is described from Ecuador. A descriptive and photographic overview of four *Drymonia* fruit types is provided to facilitate future documentation of *Drymonia* fruit structure and dehiscence. *Drymonia peponifera* differs from other species by the presence of fruits with tardily dehiscent endocarps and calyx lobes pilose, deeply serrate to pinnatifid, with each pinna reflexed and undulate.

Keywords: Columneinae, Ecuador, fruit structure.

Resumen: Se describe una nueva especie de *Drymonia* (Gesneriaceae, Columneinae) del Ecuador y se presenta una descripción e ilustración fotográfica de los cuatro tipos de fruto presentes en *Drymonia*, para facilitar la documentación futura de su estructura y dehiscencia. *Drymonia peponifera* se distingue por el fruto con endocarpo con dehiscencia tardía y los lóbulos del cáliz pilosos, profundamente serrados a pinatífidos con cada pina reflexa y ondulada.

Drymonia Mart. is the third-largest genus of Gesneriaceae in the New World Tropics, with more than 80 recognized species (Clark et al., 2020). The genus is most species-rich in Colombia, where 38 species are known (Clavijo et al., 2019). Based on published species, *Drymonia* diversity is nearly the same in Colombia and Ecuador. We estimate the total number of currently known *Drymonia* in Ecuador at 37 species. The publication of *Drymonia peponifera* brings the total *Drymonia* diversity in Ecuador to 38 species. Our research of museum specimens indicates the number of unpublished species is higher in Colombia than in Ecuador. Likewise, results of recent exploratory research expeditions in Colombia and Ecuador and preliminary studies towards a monographic revision of *Drymonia* suggest that the total number of *Drymonia* species in Colombia will exceed the current number of documented species in Ecuador. *Drymonia* is a member of the subtribe Columneinae (tribe Gesnerieae), the largest subtribe of Gesneriaceae with 26+ genera and 16% (ca. 525+ spp.) of the total species diversity in the family (Weber et al., 2013, 2020).

Drymonia is morphologically diverse and difficult to characterize by a single morphological synapomorphy. Habits range from terrestrial to hemiepiphytic or epiphytic (facultative or obligate) herbs, sub-shrubs, shrubs, or vines. Corollas vary among the species, being campanulate, tubular, or hypocyrtoid (i.e., constricted apically with a ventral pouch). Anthers are usually dehiscent by basal pores, a trait that was long used as a defining character for *Drymonia* (Wiehler, 1983). However, within *Drymonia* two clades show reversals to longitudinal dehiscence (Clark et al., 2006, 2015). In addition, *Drymonia* is strongly supported as monophyletic based on molecular sequence data (Clark et al., 2015). Most genera in the subtribe Columneinae have fruits that are defined as berries or fleshy capsules, but variation is actually much broader than what is typically reported in the literature. Fruit types and dehiscence in *Drymonia* are not well documented because the fleshy structures are consumed quickly by animals or readily damaged by rain or wind. As a result, *Drymonia* fruits are short-lived or ephemeral. Thus, accurate documentation of

fruits is often lacking. In contrast to the presence of abundant flowers on herbarium specimens, specimens having fruits are relatively rare. In addition, specimens with fruits are difficult to interpret because fleshy fruits are often altered in the process of drying, losing their shape, size, and texture. Thus, field work with photography is essential for the observation, documentation, and preservation of fruit characters in *Drymonia*. The following guide is intended as a tool for field biologists to facilitate the accurate description and documentation of the four *Drymonia* fruit types and dehiscence. Taxa bearing the fruit types outlined here are strongly supported as belonging to *Drymonia* (Clark et al., 2006). Fruits of *Drymonia* are organized into four primary categories or types.

Guide to the fruit types of *Drymonia*

Type 1: Fleshy display capsules (no separate endocarp; Fig. 1A–C).—The most common fruit type in *Drymonia* is a fleshy, loculicidally dehiscent, bivalved capsule in which the valves curve back and become separated from the placentae to reveal a central cone covered by a glistening mass of funicles and seeds (e.g., *Drymonia brochidodroma* Wiehler in Fig. 1C). Wiehler (1983) called this fruit type a “display capsule” because of the strikingly colored, cone-shaped central structure. This fruit type has received considerable attention and is known by the common name “hot lips.” Wiehler (1983) suggested this type of display fruit offers an outstanding visual target for dispersal by birds, bats, and possibly monkeys, but his hypothesis has not been confirmed. It should be noted that in some cases, the cone-shaped central structure is similar in color to the valves (e.g., *Drymonia croatii* Clavijo, Zuluaga & J.L.Clark) or the central cone-structure is bright red with contrasting yellow (e.g., *Drymonia macrantha* (Donn.Sm.) D.N.Gibson).

An early published example of the fleshy display fruit (Type 1) was *Drymonia serrulata* (Jacq.) Mart., first illustrated by Maria Sibylla (“Sybille”) Merian during her exploratory research expedition to Suriname from 1699 to 1701 (Merian, 1705). More recently, Suriname issued postage stamps to

honor Merian’s contributions to science (Skog & Clark, 2021). One of the many plants used to commemorate her contributions included an image of a fleshy display capsule of *D. serrulata* (from Plate 53 in Merian, 1705).

Type 2: Fleshy capsules with tardily dehiscent endocarps (Fig. 1D–E).—The fleshy capsule with tardily dehiscent endocarp is a synapomorphy that defines a clade of *Drymonia* species that are facultative epiphytes (Clark et al., 2006). This fruit is similar to display capsules described above in Type 1 with one major difference: the endocarp remains attached and surrounds the placentae and mass of funiculi and seeds. The endocarp eventually becomes dehiscent at a later stage, but becomes detached from the outer layers of the fruit wall when they reflex. The new species described here, *D. peponifera*, is likely a member of this clade. Other species that share this fruit type include *Drymonia collegarum* J.L.Clark & J.R.Clark (Fig. 1E), *Drymonia crenatiloba* (Mansf.) Wiehler (Fig. 1D), and *D. macrophylla* (Oerst.) H.E.Moore (Fig. 4C).

Type 3: Fleshy capsules with non-dehiscent endocarps (Fig. 1F–G).—The fleshy capsule with non-dehiscent endocarps is a synapomorphy that defines a small clade of Central American *Drymonia* species (Clark et al., 2006). The capsule-like fruit dehisces and exposes an indehiscent inner wall that is fleshy and berry-like (Fig. 1F–G). The outer layer (exocarp) is dehiscent and the inner layer (endocarp) is non-dehiscent. It differs from those tardily dehiscent endocarp fruits (Type 2) by lacking an endocarp suture and by a more contrasting and glistening endocarp layer. Species having this type of fruit include *Drymonia folsomii* L.E.Skog, *D. multiflora* (Oerst. ex Hanst.) Wiehler (Fig. 1G), *D. parviflora* Hanst. (Fig. 1F), and *Drymonia rubripilosa* Kriebel.

Type 4: Berries—indehiscent and fleshy (Fig. 1H–J).—Indehiscent berries in Neotropical Gesneriaceae are commonly found in *Besleria* L., *Codonanthe* (Mart.) Hanst., *Codonantheopsis* Mansf., *Columnea* L., *Corytoplectus* Oerst., *Oerstedina* Wiehler, and *Rufodorsia* Wiehler. Also, indehiscent berries occur in a few species in other groups that have for the most part dehiscent fruits, e.g., *Trichodrymonia metamorphophylla* (Donn.Sm.) M.M.Mora & J.L.Clark. In contrast, berries are uncommon in *Drymonia*. Fleshy,

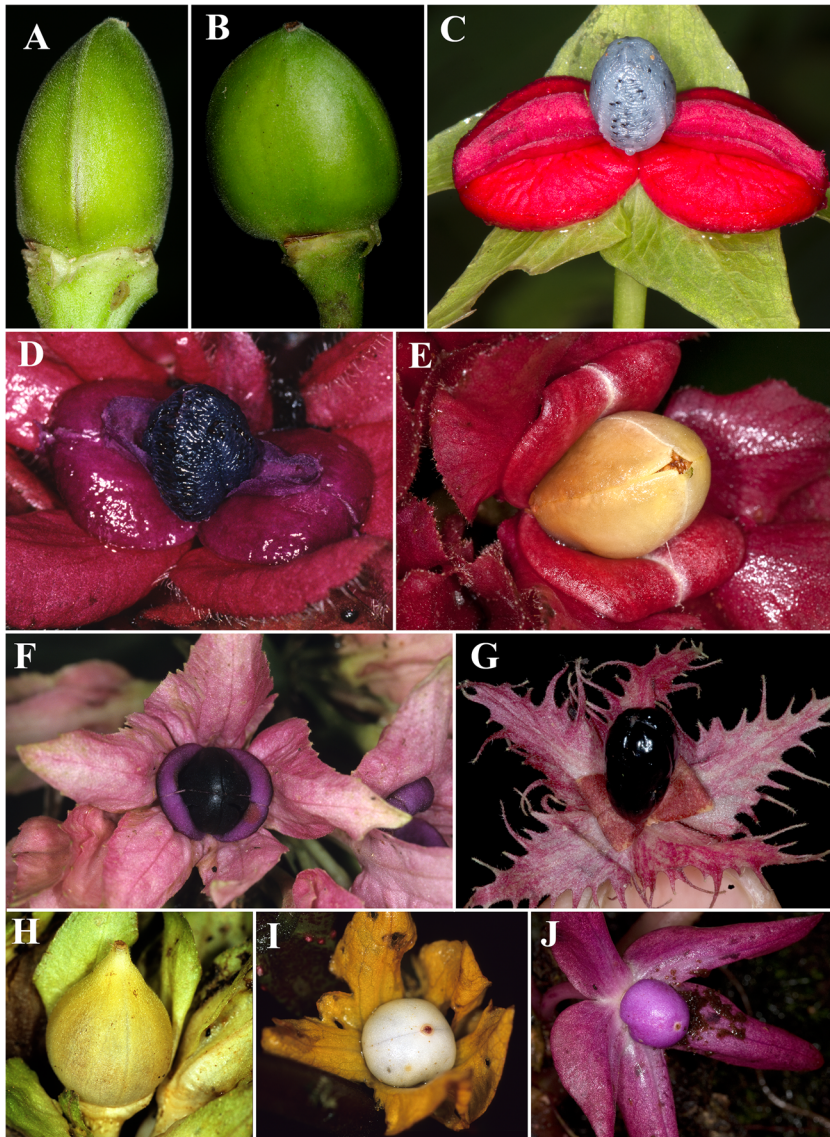


FIG. 1. A–B. Side view (A) and front view (B) of immature fleshy display capsule (Type 1) of *Drymonia serrulata*. C. Mature fleshy display capsule (Type 1; no separate endocarp) of *Drymonia brochidodroma*. D–E. Mature fleshy capsules with tardily dehiscent endocarps (Type 2) of *Drymonia crenatiloba*(D) and *Drymonia collegarum* (E). F–G. Mature fleshy capsules with non-dehiscent endocarps (Type 3) of *Drymonia parviflora*(F) and *Drymonia multiflora* (G). H–J. Indehiscent and fleshy fruit (Type 4; berry) of *Drymonia urceolata* (H), *Drymonia ambonensis* (I), and *Drymonia turrialvae* (J). [A&B = J. L. Clark 12,889; C = J. L. Clark 15,941; C = J. L. Clark 7284; D = J. L. Clark 9821; F = J. L. Clark 8676; G = J. L. Clark 12,499; H = J. L. Clark 9005; I = J. L. Clark 8698; J = J. L. Clark 12,628.]

indehiscent berries are known in *Drymonia ambonensis* (L.E. Skog) J.L. Clark (Fig. 1I), *D. lanceolata* (Hanst.) C.V. Morton, *Drymonia turrialvae* Hanst.(Fig. 1J), and *D. urceolata* Wiehler (Fig. 1H).

Description of new species

Drymonia peonifera J.L.Clark & Clavijo, **sp. nov.**—Type: Ecuador, Morona-Santiago: Cantón Limón-Indanza, Cordillera del Cóndor,

trail from camp #1 to camp #2 towards crest of Cordillera del Cóndor, 10–15 km S/SE of the Comunidad Warints, 03°14'S, 78°16'W, 1200–1800 m, 13 Dec 2002, *J. L. Clark & L. Jost* 6957 (holotype: US-3496812 [!]; isotypes: AAU [!], K [!], LOJA [!], MO [!], NY [!], QCNE [!], SEL [!]). (Figs. 2, 3.)

Diagnosis.—*Drymonia peponifera* differs from all congeners by pilose calyces and calyx

lobes that are deeply serrate to pinnatifid with reflexed and undulating pinnae. The combination of erect unbranched shoots, a facultative epiphytic habit, and tardily dehiscent endocarps (Type 2) is also unique. The habit, foliage, and fruit type of *Drymonia macrophylla* (Fig. 4) are similar to *D. peponifera*, but *D. macrophylla* has calyx lobes that are flat (vs. calyx lobes with reflexed and undulating pinnae in *D. peponifera*) and

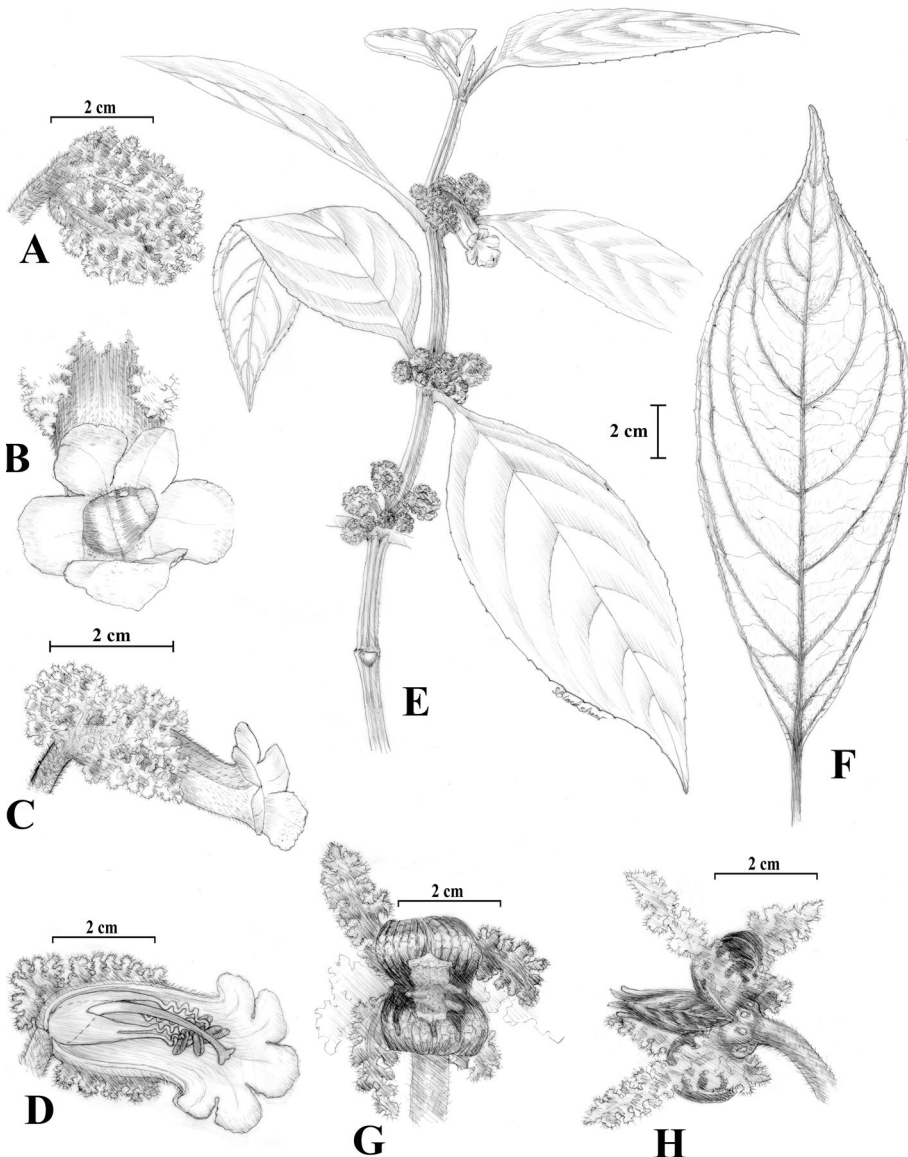


FIG. 2. *Drymonia peponifera*. A. Calyx. B. Front view of flower. C. Lateral view of flower. D. Open flower featuring gynoecium and androecium. E. Habit. F. Leaf. G. Upper view of mature fruit. H. Lateral view of mature fruit. [Illustration by Sue R. Blackshear, drawn from the holotype, *J. L. Clark & L. Jost* 6957, US.]

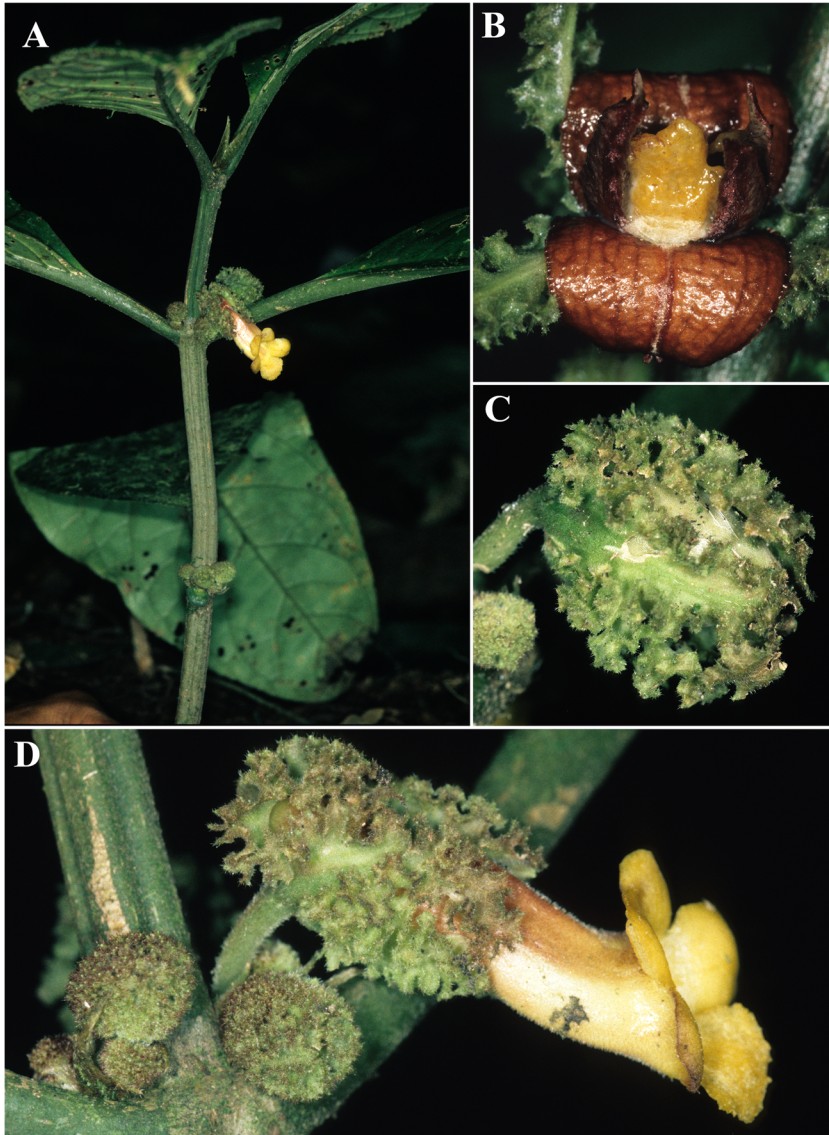


FIG. 3. *Drymonia peonifera*. A. Habit. B. Upper view of mature fruit. C. Lateral view of immature calyx lobes. D. Lateral view of axillary inflorescence with a single mature flower. [A–D from the holotype; J. L. Clark & L. Jost 6957, US.]

margins that are shallowly serrate (vs. deeply serrate to pinnatifid in *D. peonifera*).

Terrestrial, hemiepiphytic or epiphytic herb or subshrub, with erect shoots to 1 m tall. Stems subquadrangular to quadrangular in cross-section, 0.8–1 cm in diameter, strigillose to glabrate, internodes 2.3–6 cm long. **Leaves** opposite, decussate, evenly spaced along the stem, sometimes apically clustered, equal to unequal in a pair; petioles 0.5–3.5 cm long,

strigillose, terete in cross-section; blade elliptic to ovate, 8.2–35 × 3.5–14 cm, membranous to subcoriaceous, the base cuneate or acute, sometimes unequal, the apex acute to acuminate, the margin denticulate to crenate or serrulate, adaxial surface glossy-green, glabrate or strigillose to scabrous, abaxial surface light green, reddish or purplish, especially between the veins, strigillose, the lateral veins 5–7 pairs, prominent abaxially, higher order of venation more evident abaxially.

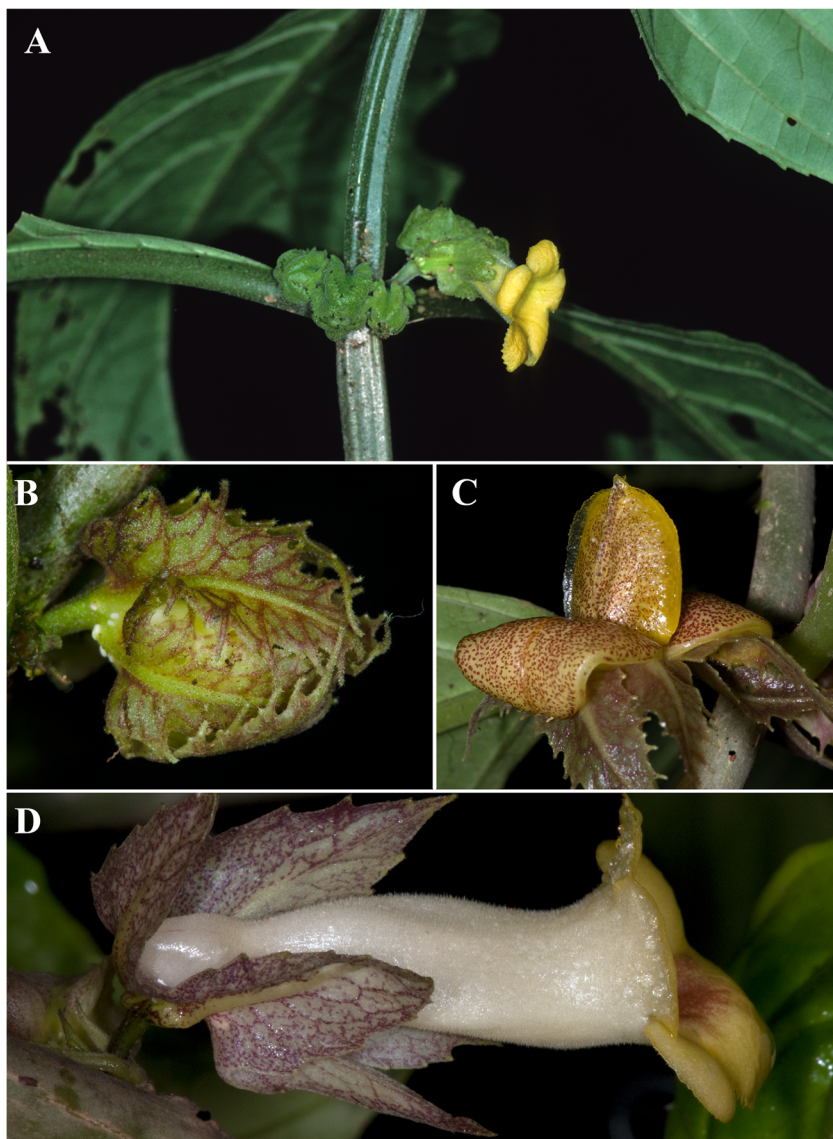


FIG. 4. *Drymonia macrophylla*. A. Habit. B. Lateral view of calyx lobes. C. Lateral view of mature fruit. D. Lateral view of flower. [A = J. L. Clark 9,479; B = J. L. Clark 13,585; C = J. L. Clark 12,119; D = J. L. Clark 10,044.]

Inflorescence a reduced pair-flowered axillary cyme in the upper leaf axils, with 1–8 flowers; peduncle absent; bracts small, lanceolate, $3.3\text{--}5.1 \times 1.1\text{--}1.2$ mm, green, the apex acuminate, abaxial surface glabrescent; pedicels short, 5–10 mm long, green, pilose, with prominent gland-like enations at apex. **Flowers** with calyx green, pilose throughout, surrounding the base of the corolla, $10\text{--}22 \times 5.0\text{--}10$ mm, persistent in fruit; lobes 5, four nearly equal, free, membranous, ovate to oblong, acute at apex,

the margins deeply serrate to pinnatifid with each pinna reflexed and undulating. Corolla zygomorphic, tubular, elongate and straight, gibbous at base; basal gibbosity or spur 3.0–4.5 mm long; tube oblique relative to calyx, amplified toward the limb, not contracted above, 20–45 mm long, 6.5–11 mm wide at the mid portion, uniformly pale yellow outside, usually lighter yellow in the throat and on the limb, the inside glabrous or glandular; throat 5.2–7.3 mm in diameter, yellow; limb

of 5 rounded lobes, the lobes spreading, subequal, rotund to oblong, rounded at apex, ventral lobe minutely toothed, lateral and dorsal lobes entire, glabrous abaxially and adaxially, lateral and dorsal lobes 5–12 × 4.0–11 mm, the lower lobe 5–14 × 4.0–13 mm. Androecium of 4 didynamous stamens, included; filaments ca. 30 mm long, adnate to the base of the corolla tube for 2–3 mm, glabrous, coiled after anthesis; the anthers at first coherent, after anthesis separating, dehiscent by basal pores, 3–4 × 1.4–1.6 mm. Gynoecium with a single dorsal nectary gland, thick, ovate, 2–3 mm long, glabrous; the ovary superior, sparsely pubescent, green; style included, 25–20 mm long, white, puberulent; stigma stomatomorphic. **Fruit** a bivalved fleshy capsule, 20–45 mm long, the valves green abaxially, dark brown adaxially, at dehiscence reflexed 180°, revealing a central cone of fleshy, dark yellow funicular tissue covered by a thin, dark purple endocarp that remains attached and surrounds the placenta and mass of funiculi and seeds, and then dehisces at a later stage. **Seeds** numerous, initially covered by the endocarp, but immersed in the central cone of funicular tissue, each seed 0.4–0.5 × 0.2–0.3 mm, brown, subglobose, pointed at both ends, striate.

Distribution and ecology.—*Drymonia peonifera* is a narrow endemic along the eastern Andes in southern Ecuador. It has been documented from the Cordillera de Cutucú and the Cordillera del Cóndor. All known populations are within the province of Morona-Santiago in premontane and montane wet forests between 400 and 1350 m.

Conservation and IUCN Red List category.—This species has not yet been found in any formally protected area in Ecuador. According to the IUCN Red List criteria (IUCN, 2012; IUCN Standards and Petitions Committee, 2019) for limited geographic range (e.g., B1=EOO <5000 km²) and associated subcriteria, including occurrence at less than five locations (B1a) and continuing decline of Andean forests and the uncertain future of habitat conservation (B1b), *Drymonia peonifera* should be listed in the category Endangered (EN).

Etymology.—The specific epithet suggests the resemblance of the cluster of calyx lobes to pom-poms, which are large clusters of brightly colored streamers often waved in pairs by cheerleaders or

fans at sporting events. The specific epithet is derived from Middle French *pépon*, from Latin *peponem* (accusative of *Pepo* or *melon*).

Additional specimens examined.—**ECUADOR.** **Morona-Santiago:** Cantón Limón-Indanza, Cordillera del Condór, camp #1, ca. 7–10 km S/SE of the Comunidad Warints, 03°13'59"S, 078°15'11"W, 1200–1350 m, 12 Dec 2002, *J. L. Clark & T. Katan 6947* (QCNE, US); Cordillera del Cóndor, Cuenca del Río Coangos, Comunidad Shuar de Kuankus, Sendero que conduce hacia la Cueva de los Tayos, 03°02'59"S, 078°12'32"W, 850 m, 20 Jun 2005, *C. Morales & M. Tupiza 1310* (MO, QCNE, UNA); Cantón Palora, Parroquia 16 de Agosto, main road from Macas-Puyo highway towards the town of Palora, near bridge, 01°44'11"S, 077°53'55"W, 860 m, 25 Jun 2003, *J. L. Clark & J. Katzenstein 8362* (QCNE, US); Vieja Cordillera del Cutucú, Patuca-Santiago road, E of Río Namangoza, km 35, 02°40'S, 078°12'W, 600–1000 m, 23 Oct 1988, *L. J. Dorr & L. C. Barnett 5841* (US); Cordillera del Cóndor, Valle del Río Coangos, Centro Shuar Numpatkain, 03°16'50"S, 078°14'08"W, 960 m, 14 Oct 1999, *P. Fuentes et al., 1086* (MO, US); Santiago and Yaup, around km 1000, Cutucú area, 400 m, Aug 1989, *A. Hirtz & X. Hirtz 4375* (SEL).

Drymonia peonifera is distinguished from all congeners by the remarkable pinnatifid serrations along the margins of the calyx with each pinna reflexed, undulating, and pilose. The calyx lobes form globose clusters that resemble the cultivar and culinary cauliflower (*Brassica oleracea* L.). In addition, it is one of the few *Drymonia* species with tardily dehiscent endocarps (Type 2) that has elongate, erect, unbranched stems reaching 1 m tall. Most other *Drymonia* species with this fruit type are facultative epiphytes that rarely reach 50 cm tall. Some of the museum specimens of *D. peonifera* were initially annotated as *D. macrophylla*. The two species have a similar habit, foliage, and fruit type (fleshy capsules with tardily dehiscent endocarps). The differences in calyx lobes readily differentiate these two species: the calyx lobes in *D. macrophylla* are flat (Fig. 4B&D) (vs. calyx lobes with reflexed and undulate pinnae in *D. peonifera*) and the margins range from serrate (Fig. 4B) to shallowly serrate (Fig. 4D) (vs. deeply serrate to pinnatifid in *D. peonifera*).

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Conflict of interest declarations

The authors declare that there is no conflict of interest.

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