



Resurrection of *Dendropemon sintenisii* (Loranthaceae): an endemic mistletoe from Puerto Rico

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On 25 November 1885 German botanist Paul Ernst Emil Sintenis collected a species of mistletoe in a coffee plantation in Aibonito, a municipality located in the central mountain range of Puerto Rico (*Sintenis* 2856, GOET). Ignatius Urban examined the specimen and name it *Dendropemon sintenisii* Krug & Urban (Urban 1897: 25) in honor of its collector. After its description *D. sintenisii* remained unknown in Puerto Rico and, although it was included in all major floristic treatments of the island, the species was a taxonomic ghost known only from the type specimen (Liogier 1985, Liogier & Martorell 2000, Axelrod 2011). No new specimens were labeled with the name in any herbarium since its original description and serious doubts existed among local botanists about its validity. This uncertainty resulted in the provisional placement of *D. sintenisii* under the synonymy of *D. caribaeus* Krug & Urban (Urban 1897: 27) in the recent monograph of *Dendropemon* by Kuijt (2011). This placement was justified because both the vegetative structures and infructescences of *D. sintenisii* share similarities with *D. caribaeus*, and the type specimen lacks flowers, which are key to confidently identify *Dendropemon* species (Kuijt 2011).

In this manuscript we show that *D. sintenisii* is a species with characters that set it apart from other *Dendropemon* species found in Puerto Rico and elsewhere. We show that *D. sintenisii* has been collected many times after its discovery, but that specimens in all herbaria have been universally misidentified. In fact, we have re-identified 40 specimens as *D. sintenisii* that were collected in Puerto Rico from 1913 to 2012 (cited below). We explain the basis of the taxonomic confusion and provide illustrations and fundamental information on the morphology, distribution and host plants of *D. sintenisii*. We also provide an updated key for the identification of the four species of *Dendropemon* found in Puerto Rico.

How to identify *Dendropemon sintenisii*

Until this date all voucher specimens of *D. sintenisii* have been misidentified as *D. bicolor*, *D. caribaeus* or *D. purpureus* (L.) Krug & Urban (1897: 26). Among these three taxa *D. sintenisii* is most commonly confused with *D. bicolor* (70% of the specimens we have re-determined). This is because both *D. sintenisii* and *D. bicolor* have ripe fruits that are red and black (Figures 1 & 2), while fruits of *D. caribaeus* and *D. purpureus* are all black. Nevertheless, there are multiple morphological characters that are consistently different and separate both species easily.

The young stems of *D. sintenisii* lack indumentum and are green (see panel A of Figure 1), while *D. bicolor* has young stems that are always covered with brown furfuraceous indumentum (see Figure 2 all panels). Also the leaf shape and texture is different in the two species, with *D. sintenisii* having coriaceous leaves that are nearly orbicular to broadly obovate and *D. bicolor* having chartaceous and broadly oblanceolate to obovate leaves (Figure 3). Additionally, the angles at which the monads (i.e., flowers) are disposed along the inflorescence are different in *D. sintenisii* and *D. bicolor*. In *D. sintenisii* the monads are almost parallel to the axis and tend to be evenly spaced along the inflorescence and the fruits are erect (Fig.

1a–f). Monads in *D. bicolor* are contrastingly clustered at the tip of inflorescences, fruits are not erect and the basal fruits are almost perpendicular to the axis of the inflorescence (Fig. 2a–f). Although both species produce red fruits with a black tip, the fruits of *D. sintenisii* are always crimson with a sharp line delineating the black tip from the red body of the fruit, and are wider at the tip (Fig. 1b), whereas the fruits of *D. bicolor* vary from deep red or orange with a black tip, to entirely black with faint red at the base (covered by the bracts and bracteoles), and are wider at the base (Figs. 2a and 2f). Most commonly, ripe fruits of *D. bicolor* have a middle red band, exhibiting some dark red on the middle of the fruit and both the tip and basal portions are black (Fig. 2).

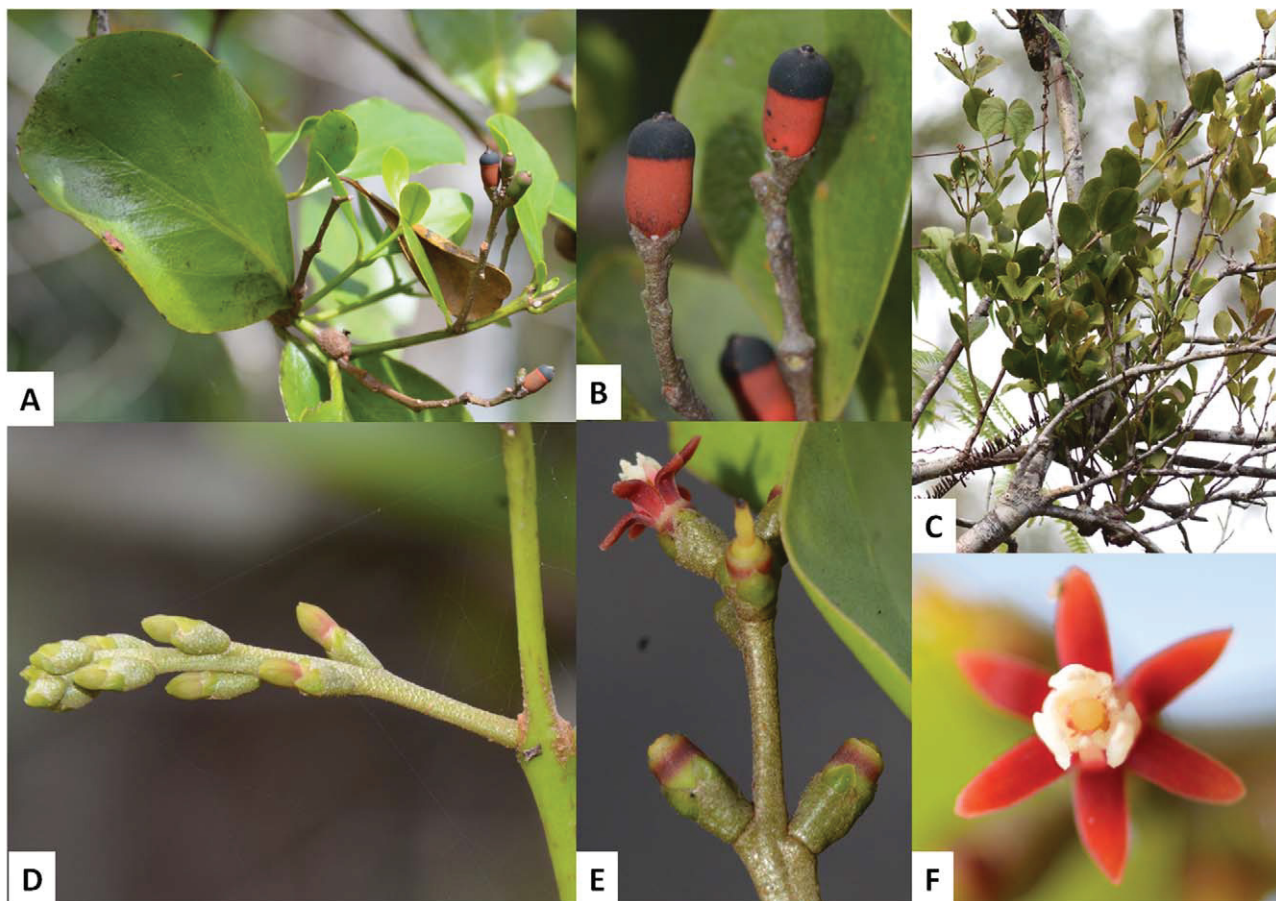


FIGURE 1. *Dendropemon sintenisii* (Loranthaceae): A. leaves and infructescences. B. ripe fruits. C. habit. D. inflorescence with flower buds. E. detail of inflorescence. F. flower at anthesis. Photographs by T.A. Carlo.

Some specimens of *D. sintenisii* have been confused with *D. caribaeus* when sterile or with flowers only. This is because sometimes *D. sintenisii* has coriaceous leaves with a nearly orbicular shape. Also, the glabrous stems with grey-furfuraceous inflorescences of *D. sintenisii* might resemble those of *D. caribaeus*. However, *D. caribaeus* can be readily distinguished by its quadrangular stems with keeled internodes, dull black fruits and its pendent habit, as opposed to the terete stems, red fruits with a black tip and erect habit of *D. sintenisii*.

Key to the species of *Dendropemon* in Puerto Rico

1. Young stem internodes furfuraceous 2
- Young stems internodes glabrous 3
2. Internodes terete, brown-furfuraceous; peduncle at least half of the total inflorescence length; monads 2–6 pairs clustered on the distal part of inflorescence; fruits red or orange with a black tip, banded (black tip, red in middle, dark base) or completely black with faint red near base..... *Dendropemon bicolor*

- Internodes keeled or quadrangular, white-furfuraceous; peduncle less than half the total inflorescence length; monads 4–8 pairs spreading along the inflorescence; fruits dull black *Dendropemon caribaeus*
- 3. Internodes terete 4
- Internodes compressed, keeled or quadrangular 5
- 4. Inflorescence axis glabrous; pedicels 3–6 mm long; bracts and bracteoles without evident nails; leaves narrowly elliptic, 0.5–1.0 cm wide; fruits shiny black *Dendropemon purpureus*
- Inflorescence axis white-furfuraceous; pedicels 1 mm long; bracts and bracteoles with evident nails; leaves broadly elliptic or rounded, (1.7–) 2.0–3.0 (– 3.5) cm wide; fruits red with a black tip *Dendropemon sintenisii*
- 5. Leaves narrowly elliptic, 0.5–1.0 cm wide *Dendropemon purpureus*
- Leaves broadly elliptic, obovate or rounded, 1.5–3.5 cm wide 6
- 6. Internodes strongly quadrangular; monads 45–90° from the inflorescence axis; fruits dull black *Dendropemon caribaeus*
- Internodes compressed; monads erect and nearly parallel to the inflorescence axis; fruits red with a black tip *Dendropemon sintenisii*

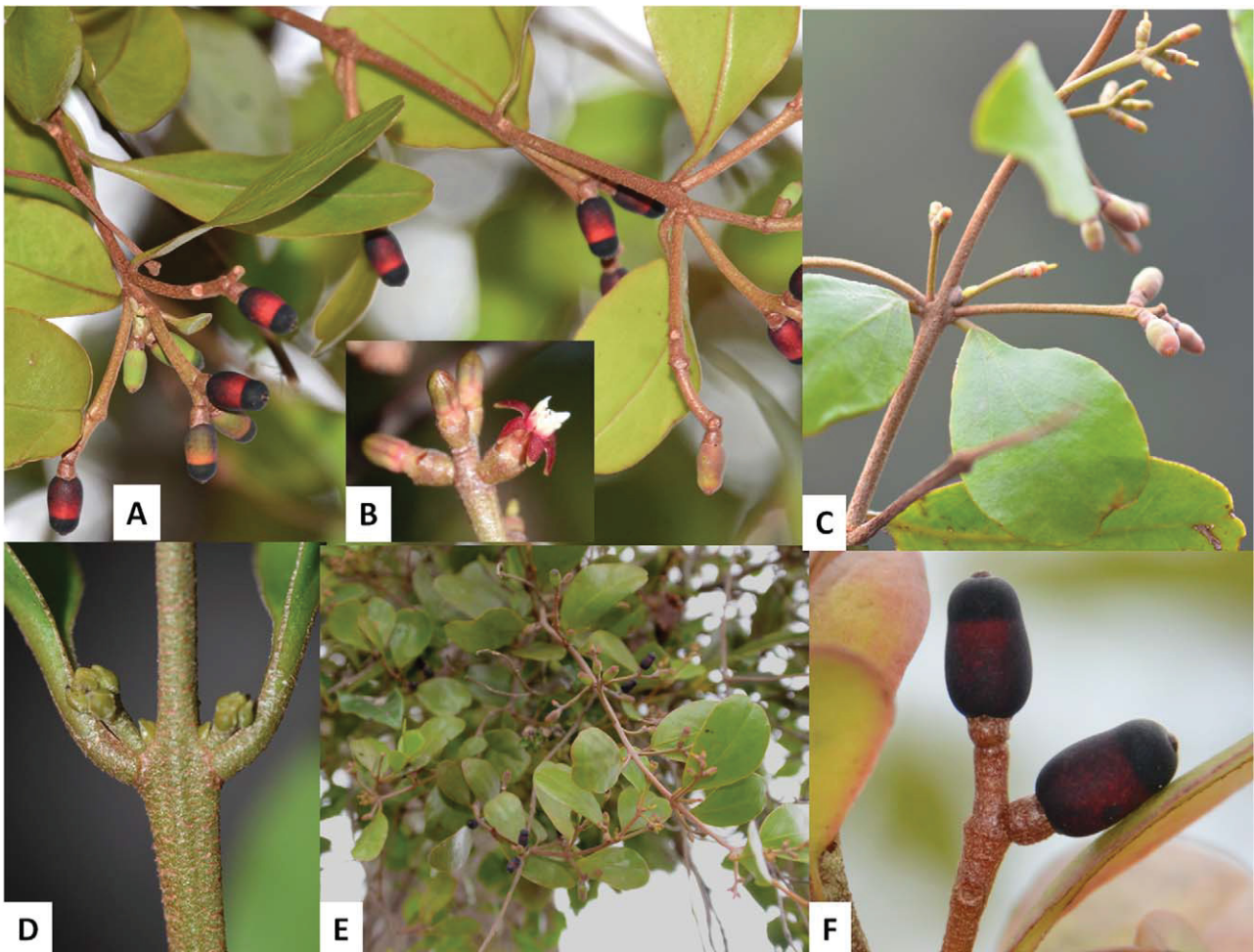


FIGURE 2. *Dendropemon bicolor* (Loranthaceae): A. fruiting branch. B. flower buds and flower at anthesis. C. leaves, inflorescences and infructescences. D. twig and young inflorescences. E. plant habit. F. ripe fruits. Photographs by T.A. Carlo.

Taxonomy

Dendropemon sintenisii Krug & Urban in Urban (1897: 25). *Phthirusa sintenisii* (Krug & Urban) Engler (1897: 135). Type:—PUERTO RICO. Aybonito [Aibonito]: ad Barrio del Pasto, 25 November 1885, *Sintenis 2856* (holotype: B!, destroyed; lectotype (designated by Kuijt (2011)): GOET; isolectotypes: PH!, K, G-DC, MO, NY!, US!).

Plants sparsely branched with erect stems; basal epicortical roots present; lateral branches lacking basal corky craters; stems glabrous even when young; internodes 2.0–4.5 cm long, flattened and keeled when young, becoming woody and terete with age. Petioles 2–3 mm long, distinct. Blades to 5.0×3.5 cm, coriaceous, broadly obovate to elliptic or nearly orbicular, bases cuneate to nearly obtuse, apices slightly acute, obtuse or slightly emarginate, sometimes minutely apiculate; venation pinnate, obscure; abaxial midveins keeled. Inflorescences 1.5–3.5 cm, terete, densely white-furfuraceous, the axis angular, basal crater absent; peduncle to 1 cm long, quadrangular; monads mostly in 3–5 pairs, parallel to the axis; pedicels 1 mm or less, furfuraceous or sometimes completely glabrous, the bract and bracteoles apices with conspicuous glabrous nails running down the length of the pedicel. Mature flower buds 3 mm, yellowish-red, apices acute; ovaries 1.5 mm, slightly emergent at anthesis, yellowish; calyculi smooth and reddish; petals ca. 3 mm long, red. Sterile anthers white, as wide as long, fertile anthers ca. 1 mm long. Styles 1.5 mm, expanded in the middle, stigma indistinct, papillate. Fruit 7–8×4 mm distally, 3 mm in diameter proximally, ellipsoid, proximally crimson, distally black, with a sharp edge between black and red colours, calyculi conspicuous in fruit; nectaries protruding slightly; styles rarely persistent in fruit.

Distribution and habitat:—*Dendropemon sintenisii* is distributed from mid to high elevations (600–1000 m) in moist to wet forests across the Central Cordillera and the Sierra de Cayey in Puerto Rico (Fig. 3). The distribution of *D. sintenisii* overlaps with *D. bicolor* in the western and central regions of the Cordillera Central, where both mistletoes can be found growing next to each other, but on different species of host trees. Although *D. sintenisii* does not overlap in distribution with *D. caribaeus* (which is found in dry and mesic habitats from sea level to 500 m), the range of both species approach each other in the region between the eastern Central Cordillera and the Sierra de Cayey, but here the distributions do not overlap: *Dendropemon caribaeus* is found in dry mountain hills at 500 m, whereas *D. sintenisii* is found in wet and humid forests at 850 m.

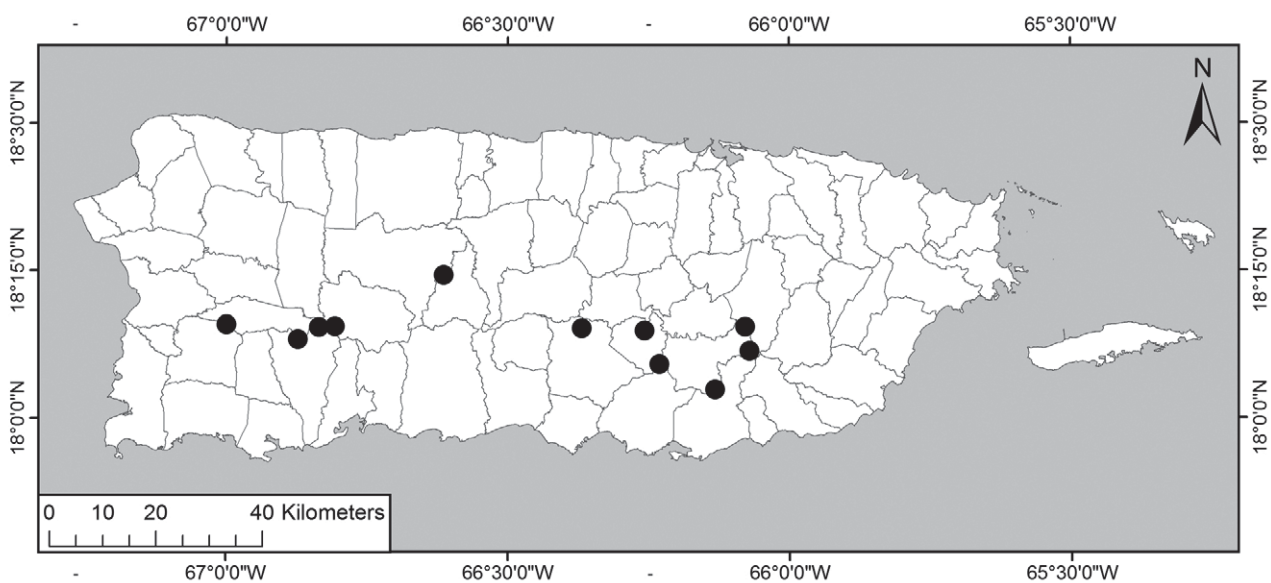


FIGURE 3. Map of Puerto Rico showing the locations (circles) where *Dendropemon sintenisii* has been collected.

Hosts:—The recorded hosts of *D. sintenisii* include ten species of trees in eight families ranging from basal angiosperms (Magnoliales) to asterids (Lamiales and Solanales). Of these, only two hosts are known to be shared with *D. bicolor* (*Casearia decandra* Jacq. (Salicaceae) and *Cestrum diurnum* L. (Solanaceae)). When both *D. sintenisii* and *D. bicolor* co-occur, they usually parasitize different host species. This suggests that although both mistletoe species can share some hosts, they have different host ranges. We have observed a similar pattern of host use in coexisting populations of *D. bicolor* and *D. caribaeus* in northwestern Puerto

Rico, where *D. caribaeus* is commonly found parasitizing *Citharexylum spinosum* L. (Verbenaceae) but not *Tabebuia heterophylla* (DC.) Britton (Bignoniaceae), whereas *D. bicolor* is a common parasite of the latter species, but has never been recorded on the first. In contrast to *D. bicolor*, *D. sintenisii* can parasitize both species of *Citharexylum* found in Puerto Rico (*C. spinosum* and *C. caudatum* L.). Other hosts for *D. sintenisii* include *Coccoloba pyrifolia* Desf. (Polygonaceae), *Coccoloba swartzii* fo. *urbaniana* (Lindau) R.A.Howard (Polygonaceae), *Cordia collococca* L. (Boraginaceae), *Hieronyma clusiooides* (Tul.) Griseb. (Phyllanthaceae), *Magnolia portoricensis* Bello (Magnoliaceae) and *Turpinia occidentalis* (Sw.) G.Don (Staphyleaceae).

Phenology:—Like other species of *Dendropemon*, *D. sintenisii* flowers and fruits throughout the year.

Conservation status:—Although *D. sintenisii* has a broad distribution in central Puerto Rico, known populations are small and consist of a few scattered individuals in one to several hosts. Studies are necessary to determine the population status of this species in order to better assess its conservation status.

Vernacular name & illustrations:—As with other species of *Dendropemon* from Hispaniola and Puerto Rico, *D. sintenisii* is locally known as ‘Conde’ (*Woodbury s.n.*, UPR). The only known illustration of *D. sintenisii* available was published under the name of *D. caribaeus* and consists of a monad showing the pedicel, bract and bracteole, ovary and flower bud (Kuijt 2011 [Fig 14 c, based on *Taylor et al. 7230*, UPRRP]).

Additional specimens examined:—**PUERTO RICO.** Mpio. Adjuntas: Bo. Limaní, flanks and summit of peak due N of La Silla de Calderón, 1060 m, 18°09.37'N 66°48.30'W, 5 February 1998, *Breckon et al. 5560* (MAPR). Mpio. Aibonito: carretera 727 detrás de granjas de pollo de camino a Barranquitas (i.e., hacia el norte), on *Citharexylum fruticosum* [*spinosum*], 8 February 2005, *Carlo & Aukema 136* (UPR). Mpio. Aibonito: Bo. Honduras [Caonillas], road 726 km 1.6, roadside in disturbed forest, on *Citharexylum spinosum*, c. 500 m, 18°09.01'N 66°15.42'W, 13 February 2005, *Axelrod et al. 12951* (UPRRP, MAPR). Mpio. Aibonito: Bo. Caonillas, road 726 km 1.6, at roadside next to an abandoned pasture land, on *Citharexylum spinosum*, 598 m, 18°09'01"N 66°15'24"W, 8 March 2012, *Caraballo & Carlo 3041* (PAC, UPR). Mpio. Aibonito: Bo. Caonillas, road 726 km 1.6, at roadside next to an abandoned pasture land, on *Cestrum diurnum*, 593 m, 18°09'00"N 66°15'24"W, 8 March 2012, *Caraballo & Carlo 3042* (UPR). Mpio. Aibonito: Las Tetas de Cayey, 800 m, 11 November 1986, *Axelrod & Ackerman 659* (UPRRP). Mpio. Caguas: Cerro de las Piñas near Las Cruces, 600–720 m, 29 March 1922, *Britton et al. 6875* (NY, UPR). Mpio. Cayey: Bo. Guavate, at the intersection of road 179 and 184 at roadside, on *Citharexylum caudatum*, 763 m, 18°06'56"N 66°04'13"W, May 2012, *Carlo 172* (UPR). Mpio. Cayey: along route 7741 ca. 2 km SE of the intersection with route 741, 760 m, 18°04'N 66°08'W, 15 June 1991, *Miller & Sherman 6364* (UPRRP). Mpio. Cayey: Cuejón, Las Tetas, in forest, 820 m, 10 March 1983, *Liogier et al. 34023* (NY, UPR). Mpios. Cayey-Salinas: base of towers on Cerro Las Tetas, wet thickets and roadsides, 4 August 1988, *Taylor & Ackerman 8144* (JBSD, NY, UPRRP). Mpio. Coamo: North of Coamo, April 1969, *Woodbury s.n.* (NY, UPR). Mpio. Maricao: in forest, 800 m, 12 August 1980, *Liogier 30896* (NY, UPR, US). Mpio. Maricao: Maricao State Forest, road 120 km 14.3, NE ridge of Monte Allegrillo, on *Coccoloba swartzii* fo. *urbaniana*, 850–880 m, 11 June 1986, *Proctor & Padrón 41794* (SJ). Mpio. Maricao: carretera 120 km 15.2, a la orilla de la carretera, 975 m, 31 December 1990, *Acevedo-Rdgz. & Siaca 3757* (NY, UPR, US). Mpio. Maricao: Monte del Estado, área recreacional frente a cabañas, creciendo en *Cordia collococca* y *Turpinia occidentalis*, 850 m, May 2012, *Carlo 173* (PAC, UPR). Mpio. Maricao: Monte del Estado, 18 millas al sureste de Mayagüez, próximo a las antenas de radio, on *Coccoloba pyrifolia*, 28 February 1987, *Mejía et al. 2020* (JBSD, MAPR). Mpio. Maricao: Monte Alegrillo, Maricao Insular Forest, 3 April 1913, *Hess 629* (MAPR). Mpio. Maricao: Maricao to Monte Alegrillo, 900 m, 3 April 1913, *Britton et al. 2615* (NY, US). Mpio. Salinas: Bo. Lapa, vicinity of Las Tetas de Cayey, on *Casearia decandra*, 820–830 m, 1 September 1986, *Proctor & Carrasquillo 42079* (IJ, SJ, US). Mpios. Salinas-Aibonito: border region, 0.5 miles S of Cerro Las Tetas de Cayey, near the radio tower just S of the intersection of route 1 and route 162, thickets and pastures, 700–800 m, 25 October 1986, *Taylor et al. 7230* (UPRRP). Mpio. San Germán: Maricao State Forest, W side of road 120 km 15.6, on *Magnolia portoricensis*, 840 m, 6 July 1985, *Proctor & Laboy 41225* (IJ, NY, SJ, UPR). Mpio. Utuado: Bo. Tetuán, upper NE slopes and summit of Cerro Morales, on *Magnolia portoricensis*,

850–988 m, 24 August 1985, *Proctor 41337* (SJ). Mpio. Yauco: Bo. Río Prieto, Cordillera Central, upper SE ridge and summit of Monte Membrillo (at the summit), on *Casearia decandra*, 950–1100 m, 7 September 1985, *Proctor & Haneke 41405* (IJ). Mpio. Yauco: Rubias, North of Yauco, on *Hieronyma*, ca. 800 m, 11 February 1923, *Britton & Britton 7369* (NY).

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