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One new species, two new combinations and taxonomic notes on the All-spice genus *Pimenta* (Myrtaceae) from Hispaniola

THAIS N.C. VASCONCELOS[1, 3], EVE J. LUCAS[1] & BRIGIDO PEGUERO[2]
[1]*Comparative Plant and Fungal Biology Department, Jodrell Laboratory, Royal Botanic Gardens Kew, TW9 3DS, Richmond, Surrey, UK.*
[2]*Departamento de Botaìnica, Jardiìn Botaìnico Nacional, Santo Domingo, Repuìblica Dominicana*
[3]*Corresponding author: thais.nogales@gmail.com*

Abstract

One new species and two new combinations are here published as taxonomic updates on the all-spice genus *Pimenta* (Myrtaceae) for the flora of Hispaniola, Greater Antilles. *Pimenta berciliae* is a small tree, the type of which was found in the vicinity of the National Botanical Gardens in Santo Domingo. Natural populations of this species are restricted to a small area in Samaná and Cordillera Septentrional, and the preliminary assessment of its conservation status indicates an endangered species. Additionally, *Eugenia yumana* and *Eugenia samanensis* are here formally transferred to *Pimenta* after molecular and morphological analyses demonstrate that they belong to this latter genus. Two new combinations, *Pimenta yumana* and *Pimenta samanensis* are here provided. These three additions to the flora of *Pimenta* in Hispaniola increase the known diversity of the genus on the island and are important to better understand the diversity of the all-spice genus in the region.

Key words: Caribbean, *Eugenia*, Myrteae

Resumen

Una nueva especie y dos nuevas combinaciones en el género *Pimenta* (Myrtaceae) se publican aquí para la flora de La Española en las Antillas Mayores. *Pimenta berciliae* es un árbol pequeño, cuyo tipo se encuentra en la zona del Jardín Botánico Nacional de Santo Domingo. Las poblaciones naturales de esta especie están restringidas a un área limitada en la Sierra de Samaná y en la Cordillera Septentrional, y el estado de conservación preliminar indica que es una especie en peligro de extinción. Además, *Eugenia yumana* y *Eugenia samanensis* se transfieren formalmente a *Pimenta* después de que análisis moleculares y morfológicos evidenciaran que pertenecen a este último género. Dos nuevas combinaciones, *Pimenta yumana* y *Pimenta samanensis* se proponen aquí. Estas tres adiciones a la flora de *Pimenta* en La Española aumentan la diversidad de especies en la isla y son importantes para comprender mejor la diversidad del género en la región.

Palabras clave: Caribe, *Eugenia*, Myrteae

Introduction

The family Myrtaceae (c. 5500 spp.; WCSP, 2017) is one of the most ecologically important angiosperm families in Neotropical forests and savannas (e.g. Oliveira-Filho & Fontes, 2000). Nevertheless, systematic work focused on the family has been scarce until the last decade and consequently species descriptions and taxonomic rearrangements are frequently required (e.g. Santos *et al*., 2016; Wilson *et al*., 2016; Snow *et al*., 2016). Placed within tribe Myrteae, *Pimenta* Lindley (1821: 19) is a genus of 16 accepted species (WCSP, 2017), with its distribution restricted to the Neotropics and center of diversity in the Caribbean region, particularly the Greater Antilles (WCSP, 2017). From these areas, seven species are endemic to Cuba, three to Jamaica and one to Hispaniola (comprising Haiti and Dominican Republic). *Pimenta* is one of the most economically important Myrteae, with many species used as spices worldwide and in the Caribbean (Peguero, 2011), where the all bay pimento [*Pimenta racemosa* (Miller, 1768: 5) J.W.Moore

(1933: 33)] and the all spice [*Pimenta dioica* (Linnaeus 1759: 1056) Merrill (1947: 37)] are popular in local cuisine. Observations during a field expedition to Hispaniola in 2015, alongside recent morphological and molecular assessments, demonstrates that taxonomic rearrangements are necessary for at least three species associated with *Pimenta*. The first discovery is a collection from the Dr. Rafael Ma. Moscoso National Botanical Garden in Santo Domingo, initially identified as *Pimenta* sp. (voucher *T. Vasconcelos 576*) and placed in *Pimenta* through molecular analysis (Vasconcelos et al., 2017), but with morphological characteristics that do not correspond to any currently accepted species of *Pimenta*. A new species, *Pimenta berciliae* is here formally described for this entity; its natural distribution and conservation status are also documented. The other two species treated here were previously described in the sometimes similar genus *Eugenia* Linnaeus (1753: 470)—*Eugenia yumana* Alain (Liogier, 1973: 268) and *E. samanensis* Alain (Liogier, 1986: 359)—, but were shown to be species of *Pimenta* by molecular and morphological examination (Vasconcelos *et al*., 2017) and are here formally transferred to *Pimenta* with two new combinations provided. General notes on these and other Hispaniola species of *Pimenta* are also provided.

Material and Methods

Pimenta of Hispaniola is a group of shrubs and small tree species with cymose, often paniculate inflorescences, a coiled or c-shaped embryos, uni- or bi-locular ovaries with 1 to ca. 9 ovules organized in a single series around a protruding, subapical placenta and seed coat membranous to submembranous (Landrum, 1986). Many of these individual characters can be present in other Myrteae genera, but in this combination are exclusive to *Pimenta.* Moreover, *Pimenta* leaves produce a characteristic 'clove scent' making this perhaps the most strongly aromatic group of Myrteae (see Tucker 1991a, 1991b, 1992) with a variety of essential oils. These characters make *Pimenta* relatively easy to distinguish from other Myrteae genera in Hispaniola (see Identification Key below).

The description of *Pimenta berciliae* was mostly based on a single collection bearing buds and flowers (voucher *T. Vasconcelos 576*). A second collection bearing immature fruits (voucher *T. Clase 10164*) was used for fruit description. Structures were measured with a caliper rule. Buds and flowers from dried material were re-hydrated, dissected and observed under a dissection microscope for androecium and gynoecium descriptions. Collection localities were either estimated given the collection locality or provided by coordinate points, following label information. A preliminary conservation assessment was estimated in GeoCat (Bachman *et al*., 2011) using collection points from paratypes collected in the natural distribution of the species (red circles, Figure 1A).

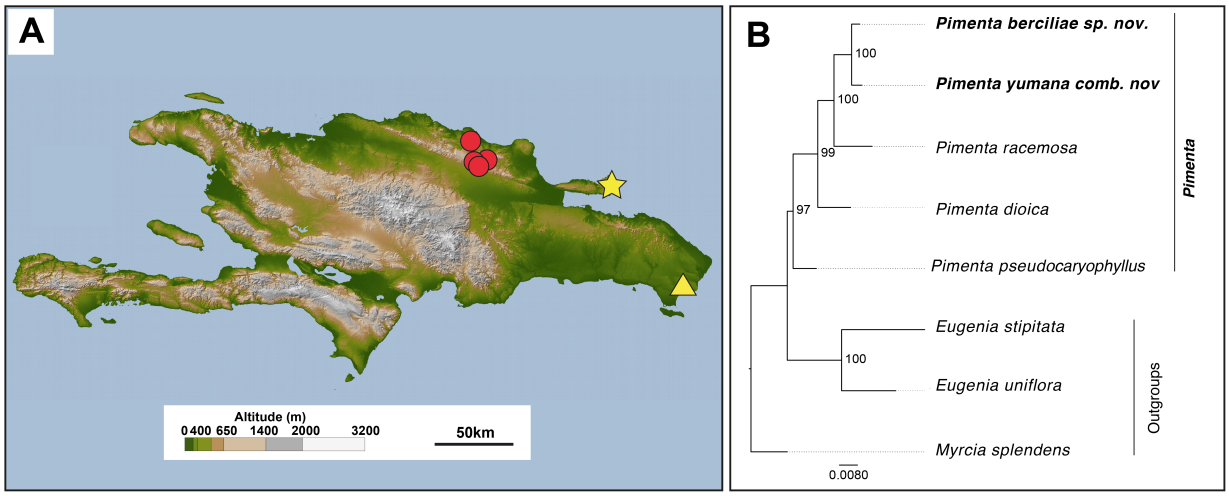

FIGURE 1. Distribution and phylogenetic position of treated species within *Pimenta*. (A) Natural distributions of *Pimenta berciliae* (red circles); *P. yumana* (yellow triangle) and *P. samanensis* (yellow star). (B) An extract from the Myrteae phylogeny (see Vasconcelos *et al*., 2017 for methodology) based on maximum likelihood analysis of two markers (ITS and *psb*A-*trn*H; see Appendix 1 for Genbank accession codes) showing phylogenetic positions of *Pimenta berciliae* and *Pimenta yumana*. Bootstrap values above 90 are given at each node.

Identification Key

A simplified identification key to genus level is here provided to highlight important morphological differences between *Pimenta* and other Myrtaceae genera in Hispaniola, especially in light of new combinations in *Pimenta* from *Eugenia* basionyms. The key considers only genera native to Hispaniola. These are: *Eugenia*, *Mosiera* Small (1933: 937), *Myrcia* de Candolle (1827: 406), *Myrciaria* O.Berg (1855–1856: 136), *Myrcianthes* O.Berg (1855–1856: 315), *Pimenta*, *Plinia* Linnaeus (1753: 516) and *Psidium* Linnaeus (1753: 470). *Eugenia* includes *Hottea* Urban (1929: 40), *Calyptrogenia* Burret (1941: 541), *Pseudanamomis* Kausel (1956: 511) and *Calycorectes* O.Berg (1855–1856: 136), and *Myrcia* includes *Marlierea* Cambessèdes (1833: 373) and *Calyptranthes* Swartz (1788: 79), as evidenced by previous works (Lucas *et al.,* 2011; Mazine *et al*., 2014; Vasconcelos *et al*., 2017).

1. Calyx open or closed in the bud; inflorescence racemose orcymose;ovaries 2-locular to multilocular, never unilocular; ovules usually attached to the placenta in multiple series or reduced to two per locule; seeds one to many; leaves weakly to moderately aromatic ..... ***Eugenia, Mosiera, Myrcia, Myrciaria, Myrcianthes, Plinia,Psidium***
2. Calyx open in the bud; inflorescence cymose, usually paniculate but also frequently reduced to solitary flower;ovariesuni or bilocular; ovules arranged in a single series around a protruded placenta;seeds one or two;leaves strongly aromatic ..... ***Pimenta***

Taxonomy

1. *Pimenta berciliae* T. Vasc. & B. Peguero *sp. nov.* (Figures 2 and 3).

Type:—DOMINICAN REPUBLIC. Santo Domingo: Jardín Botánico Nacional Dr. Rafael Ma. Moscoso, 18°29’32.2”N, 69°57’29.4”W 10 Apr. 2015 (b, fl), *T. N. C. Vasconcelos 576* (holotype JBSD!; isotype K!).

Pimenta berciliae is easily identifiable in flower by the unilocular ovary and pentamerous flowers. Even though these characters are found in other *Pimenta* species [e.g. pentamerous *P. haitiensis* (Urban, 1921: 404) Landrum (1984: 242) and unilocular *P. cainitoides* (Urban, 1924: 301) Burret (1941: 514)], this combination is unique to the new species.

Tree to 7m high. Young twigs glabrous, light green, flattened and keeled, becoming brown-red and terete at maturity. Trunk reddish brown, bark smooth and somewhat papery-flaky. Leaves opposite to subopposite petiole to 0.6cm long. Blades lanceolate, 5.9–9.3 × 2.1–3.8 cm, slightly discolorous, bright-dark green becoming gray adaxially when dried, light green on the abaxial side, coriaceous, both surfaces punctuate and glabrous, entire margin slightly revolute in fresh material, undulatingin dry material, apex acute, slightly atenuate on apical leaves, base cuneate. Secondary veins 4–7 mm apart, 12–16 pairs per blade, held at an angle of c. 60° relative to the midvein; marginal vein c. 1.5mm from the margin at the mid point, tertiary veins conspicuous; mid vein canaliculate adaxially, keeled abaxially. Inflorescence a simplified panicle, 3–7 cm long, subterminal, rachis mostly glabrous, with white-grayish simple trichomes on the apical portion and in the axils of branches; branches subopposite terminating in dichasia. Bracteoles linear, 2–3mm, caducous before flower anthesis; floral bud clavate, constricted between the ovary and hypanthium, mature buds to 5mm long, densely covered in white hairs. Hypanthium slightly extended above ovary summit, internally and externally pubescent. Perianth free, 5-merous. Sepals brownish green, sometimes dark gray in dried material, dentate, opening to a star shape at anthesis, lobes 2.0–2.5 × 2.0–2.5 mm, apex acute, base truncate, internally and externally covered in white hairs. Petals white, obovate, reflexed at anthesis; externally pubescent, internally mostly glabrous, apex rounded, base truncate, 2.0–2.5 × 4.0–4.5 mm. Staminal ring pubescent, 1.0–1.5mm wide, stamens ca. 100, 2.5–3.0mm, anthers 0.5–0.6mm; style 4.5–4.8mm long, filiform, ovary unilocular, free apical placentation, *ca*. 10 ovules. Fruits subglobose, 5–8 mm in diameter with persistent calyx lobes, covered in white-grayish hairs and purple when mature. A single seed, brown to black and subglobose. Embryo not seen.

Habitat and phenology:—The type collection comes from a cultivated specimen growing in the Jardín Botánico Nacional in Santo Domingo, Dominican Republic. Specimens collected at the natural population area (paratypes here designated) show that *Pimenta berciliae* occurs in montane humid forests and on calcarious soil. *Pimenta berciliae* was collected with buds and flowers in April and with fruits in June.

Molecular information:—Sequences for the type specimen are deposited in GenBank under the accession numbers MF954067 (ITS), MF954323 (*psb*A-*trn*H), MF954373 (*rpl*16), MF954235 (*rpl*32-*trn*L), MF954186 (*trn*L-*trn*F), and MF954126 (*trn*Q-*rps*16).

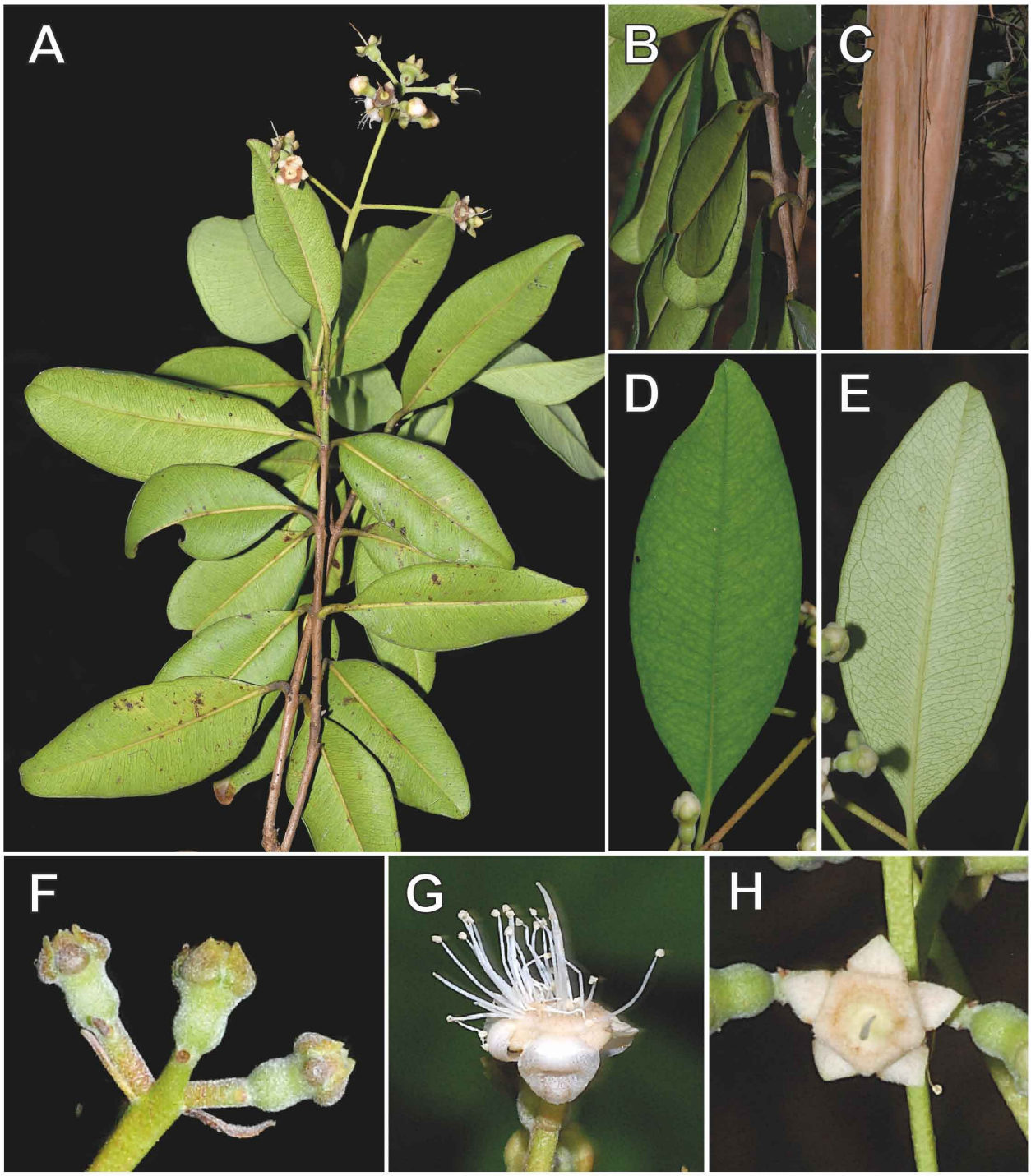

FIGURE 2. Field pictures and details of *Pimenta berciliae* (A–H). (A) Fertile branch with subterminal inflorescence; (B) Leaves with slightly revolute margins; (C) Reddish brown bark, somewhat papery-flaky; (D) Adaxial and (E) abaxial leaf surfaces, showing color difference between surfaces in fresh material. (F) 3-flowered inflorescence with slightly assymetrical lateral branching; (G) Old flower with stamens only partially present showing reflexed petals; (H) Frontal view of old flower remains (without stamens or petals) showing the five calyx lobes and the pentagonous hypanthium.

Conservation:—Natural populations are restricted to a small area in Samaná and Cordillera Septentrional (red circles, Figure 1A). Preliminary conservation status according to IUCN's Extent of Occurrence criteria (IUCN, 2012; EOO = 132.838 km^2) indicates an Endangered species.

Etymology:—The epithet post humously honors Bercilia Peguero, mother of Brígido Peguero, one of the authors of this species, in recognition and gratitude to those who strove to establish a united, honest, supportive and responsible family.

Paratypes:—DOMINICAN REPUBLIC. Province of Hermanas Mirabal; Salcedo, 19°27’7.27”N, 73°25’0.01”W, March 2009; *R. Rodríguez 296* (JBSD!); Salcedo, 19°26’49.42” N,70°25’1.38”W, March 2009, *R. Rodríguez 339* (JBSD!); Tenares, 19°31’11”N, 70°20’12”W, February 2001, *A. Veloz 2335* (JBSD!). Province of Puerto Plata; Sosúa, 19° 43.1’ N, 70° 26.9’ W, June 2017, *T. Clase 10164* (JBSD!).

FIGURE 3. Isotype image of *Pimenta berciliae* at K.

Affinities and discussion:—*Pimenta berciliae* is compared in the diagnosis with *P. haitiensis* and *P. cainitoides*, since it bears a combination of characters which occur separately in these species. Additionally, it is also distinct from other Hispaniola species of *Pimenta* in its few flowered panicles, relatively large flowers and lanceolate leaves that resemble those of *P. guatemalensis* (Lundell, 1968: 42) Lundell (1971: 159), endemic to continental Central America; its bud and floral morphology also superficially resembles that of the distantly related *Pimenta pseudocaryophyllus* (Gomes, 1812: 92) Landrum (1984: 242) (by the large size of buds and flowers). Its phylogenetic position, however, indicates a close relationship with the sympatric *Pimenta yumana* (Figure 1B). With the latter, *Pimenta berciliae* shares the reduced number of flowers in the inflorescence.

2. *Pimenta samanensis* (Alain) B. Peguero, *comb. nov.*

Basionym:—:*Eugenia samanensis* Alain, Phytologia 61: 359 (1986).

3. *Pimenta yumana* (Alain) T. Vasc., *comb. nov.*

Basionym:—*Eugenia yumana* Alain, Phytologia 25: 268 (1973).

Eugenia yumana and *Eugenia samanensis* both present tetramerous flowers, inflorescences reduced to solitary flowers and two locules in each ovary. Both *Eugenia* and *Pimenta* can display such traits, which may explain the confusion. The combination of these traits with strongly aromatic leaves, coiled or c-shaped embryos, a single series of ovules around a protruded placenta and occasional dichasial inflorescences (observed in *Eugenia samanensis*), however, is unique to *Pimenta* and supports moving these species into the latter genus. *Eugenia yumana* is confirmed to be placed in *Pimenta* by molecular analysis with high bootstrap (>70%) and posterior probabilities (>0.95) (see Figure 1B and Vasconcelos et al., 2017) and the collection used in that study comes from the type location of that species, in boca de Yuma, sea level (voucher *T. Vasconcelos 584*).

Eugenia yumana and *Eugenia samanensis* are morphologically very similar and likely closely related or even the same taxon (see Liogier, 1986), but the distinct distribution within the Dominican Republic (see Figure 1A, yellow triangle and star respectively) and subtle differences in inflorescence axis length (ca. 0.5 cm long in *Eugenia yumana* and ca. 1.5 cm long in *E. samanensis*) led us to follow a conservative approach and move them into *Pimenta* separately. Liogier (1973) emphasizes the slight resemblance of this species to others in the same genus when describing *Eugenia yumana*: "this plant has little resemblance to any other species of *Eugenia* in the West indies; its subsessile inflorescence, its ellipitic coriaceous leaves, with numerous nearly parallel nerves are the most outstanting characteristics" (1973: 269). *Eugenia yumana* and *E. samanensis* are also very distinct from other Hispaniola *Pimenta* species, especially regarding their reproductive features: both species are tetramerous, whilst all others (*Pimenta berciliae*, *Pimenta haitiensis*, and all endemic varieties of *Pimenta racemosa*) are pentamerous, and its inflorescences are almost sessile with few flowers, whilst all others present longer dichasia or panicles. Leaves of *Eugenia yumana* and *E. samanensis* are similar to *Pimenta ferruginea* (from Cuba), but the latter always presents dichasial inflorescences and longer pedicels (up to 4 cm) in comparison to almost subsessile inflorescences in the former two.

Conclusion and notes on *Pimenta* from Hispaniola

The present work shows that taxonomic novelties and rearrangements are still required even in small, economically important Myrtaceae genera. Furthermore, all species here treated have remarkably restricted distributions and are listed either as Endangered or Critically Endangered (see Peguero & Jiménez, 2011). Correct taxonomic placement is the first necessary step before any conservation initiatives can be planned for these species in Hispaniola. The addition of three new endemic species of *Pimenta* to the flora of Hispaniola increases the number of endemic species within this genus from one to four on the island. *Pimenta racemosa* was circumscribed by Landrum (1984) as a widespread Caribbean species of five varieties, four of which are native to Hispaniola (*Pimenta racemosa var. grisea* (Kiaerskou, 1890: 289) Fosberg (1942: 762) and the endemic *P.racemosa var. ozua* (Urban & Ekman, 1929: 22) (Landrum, 1984: 242)*, P. racemosa var. hispaniolensis* (Urban, 1926: 21) Landrum (1984: 242) and *P. racemosa var. terebinthina* (Burret, 1941: 511) Landrum (1984: 243). These are consistently morphologically different, and a similar degree of variance would conventionally indicate separate species in other Myrteae genera. Future revision of this genus and taxonomic decision-making are desirable, as the possible separation of *Pimenta racemosa* into five species would change the endemic diversity of the genus in Hispaniola island from four to eight, placing the center of diversity of the genus on this island and affecting future modelling of ecology and evolution of *Pimenta*.

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APPENDIX 1. GenBank accession numbers for ITS and *psb*A-*trn*H sequences used to reconstruct phylogeny in Figure 1B.

Species	**ITS**	***psb*A-*trn*H**
*Eugenia stipitata*McVaugh	MF954043	MF954300
Eugenia uniflora L.	AM234088	AM489828
Myrciasplendens (Sw.) DC.	MF954059	MF954315
Pimenta berciliae T.Vasc. & Peguero	MF954067	MF954323
Pimenta dioica (L.) Merr.	AM234081	AM234081
Pimenta pseudocaryophyllus (Gomes) Landrum	AM234083	AM234083
Pimenta racemosa (Mill.) J.W.Moore	AM234082	AM489875
Pimenta yumana (Alain) T. Vasc.	MF954044	MF954044