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Passiflora tarminiana, a new cultivated species of *Passiflora* subgenus *Tacsonia.*

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Abstract

The new species *Passiflora tarminiana* differs from its closes relative by the character combination of very small acicular stipules and large almost reflexed petals and sepals. This species has escaped detection despite being widely cultivated. Naturalized populations, particularly on Hawa'ii, have created problems for conservation of the native flora. In Colombia it is more frequently adopted in industrial cultivation because of its rusticity and resistance to fungal diseases.

Introduction

Passifloras of the subgenus *Tacsonia* are cultivated by many small farmers, from Venezuela to Bolivia. Some species are cultivated in New Zealand. The main cultivated species is *Passiflora mollissima* (Kunth) Bailey (Escobar, 1980 & 1988), also called *P.*

tripartita var. *mollissima* (Kunth) Holm-Nielsen & P. Jørgensen (Holm-Nielsen et al., 1988). It is called "curuba de Castilla" in Colombia, "tacso de Castilla" in Ecuador, and “banana passionfruit” in English-speaking countries.. The second species of importance in the Andes is "curuba india," "curuba ecuatoriana," or "curuba quiteña" in Colombia, called "tacso amarillo" in Ecuador (Pérez Arbeláez, 1978; A.A.A., 1992; Campos, 1992). It is most frequently found in private gardens, but some commercial growers have, because of its rusticity, started to grow it instead of the "curuba de Castilla." We describe this overlooked cultigen as a new species under the name *Passiflora tarminiana*, in recognition of Tarmín Campos, a Colombian agronomist who contributed with enthusiasm to the development of banana passion fruit cultivation and introduced the first author to the cultivated passifloras of the central Colombian highlands.

Surprisingly, although producers and consumers easily differentiate *Passiflora tarminiana* from *P. tripartita* var. *mollissima*, it has never been mentioned as a distinct species in taxonomical studies. In a letter to Tarmín Campos, Linda de Escobar considered it to be a hybrid of *P. tripartita* var. *mollissima*, possibly with *P. cumbalensis* (Karst.) Harms. We have observed *P. tarminiana* almost everywhere in the Colombian highlands, as well as in the Andes of Venezuela, southern Ecuador, and Peru, with constant and distinct phenotypic traits. Plants grown from seeds show no segregation for these phenotypic traits, which would not be the case of a hybrid. Recent morphological and isozyme studies have confirmed that *P. tarminiana* is distinct from other common species of subgenus *Tacsonia*, such as *P. tripartita* var. *mollissima*, *P. mixta* L.f, *P. cumbalensis*, and *P. pinnatistipula* Cav. (Segura et al., 1998, Villacis et al., 1998).

Passiflora tarminiana Coppens & Barney sp. nov.

TYPE: Colombia, Department Valle del Cauca. Tenerife (municipio El Cerrito), under cultivation, 2200--2600 m, 3°43.189'N, 76°04.482W, 8 March 1999. *Coppens IPGRI-AM 72* (holotype, COL; isotypes, AAU, AK, BISH, CUZ, GOET, HUA, IPGRI, K, MEXU, MO, MYF, QCA, QCNE, TEX, US, VALLE, VEN). Figure 1--3. Table 1.

Haec species a *P. tripartita* var. *mollissima* (Kunth) Holm-Nielsen & P. Jørgensen sepalos et petalos longioribus et perpendicularis o reflexos; nectarium mayoribus; stipulis menoribus et acicularibus.

Liana, stem cylindrical, bark fibrous ; internodes 6--12 cm long; indument canescent, soft to the touch. Stipules auricular and aristate 4--7 × 2(--3) mm (1--3 mm long without the aristate apex), arista 3--4 mm long, early deciduous. Petioles 1.5--4 cm, slightly caniculate adaxially, canescent-ferruginously pubescent, 1--4 pairs of adaxial glands. Leaves trilobed (7--) 16 (--29) cm wide; lobes ovate, acuminate; margin serrate, central lobe (5.5--) 11 (--16) × (2.5--) 5 (--8) cm, lateral lobes (5--) 9 (--16) × (2.3--) 4 (--7) cm; lamina moderately lustrous above, scarcely pubescent, trichomes short, although some very long; undersurface canescent-pubescent, the trichomes ferrugineous along the nerves. Flowers axillary, solitary, pendent; peduncles 3--10 cm, canescent-pubescent; bracts 3--5 × 2--3 cm, united halfway, margins entire, ovate, acuminate, nerves yellowish, reticulate venation visible, located 1 cm from hypanthium base; hypanthium (floral tube) 6--8 × 0.7--1 cm, light green outside, whitish inside; nectar chamber semiglobose, 1.4--2 cm wide; operculum reflexed, margin recurved; annulus present; sepals and petals bright pink to light pink, generally 64D or 75A in the RHS Kew color chart, perpendicular to the hypanthium or reflexed; sepals 4.5--6 × 1.2--2.5 cm, oblong, aristate subterminally, awn 3--4 mm; petals 3--6 mm shorter than the sepals; corona tuberculate, white with

purple base; androgynophore 7--10 cm, white; free filaments 2 cm, white; anthers yellow; ovary fusiform, green, pubescent; styles white, stigmas green. Fruit 10--14 × 3.5--4.5 cm, fusiform; young fruits canescent, the pericarp dark green with white dots except along the carpel seams, the dried styles persistent; during maturation dots disappearing and fruit turning yellow to orange yellow. Seeds asymmetrical, reddish brown when dry, reticulate, acute, cordate; arils orange, sweet, and aromatic.

Figure 2 shows the sites where *P. tarminiana* has been observed or collected in the Andes. Table 1 presents a comparison of *P. tarminiana* against two other common species of the subgenus *Tacsonia.* The most typical traits of *P. tarminiana* are the absent or reduced pubescence on the upper side of the leaves, the minute stipules that are almost always deciduous, the flower with a greater sepal/calyx tube ratio, as compared to other common species as *P. tripartita* or *P. mixta.* It is further characterized by reflexed light pink petals, a nectar chamber that is much wider than the calyx tube, a fusiform fruit, with small whitish dots which are evenly distributed on the pericarp before maturity, except on the aristas between the carpels. In comparison, the other widely cultivated banana passion fruit, *P. tripartita* var. *mollissima*, shows a marked pubescence on both leaf sides, permanent and larger stipules, a bell-shaped corolla, a longer calyx tube and shorter sepals and petals. The fruit of the cultigen *P. tripartita* var. *mollissima* is oblong with round extremities, and uniformly green before maturity (however *P. tripartita* var. *tripartita* may also show the whitish dots on the immature fruit). When both cultigens can be compared in the same orchard, *P. tripartita* var. *mollissima* shows much darker foliage, magenta flowers, and pale yellow mature fruits. The fruits of *P. tarminiana* are of a deeper yellow to orange color, and their pulp is less aromatic and tart. These differences

in shape and color make them easy to recognize for the consumer and it is surprising that this species has escaped detection by botanists for so long.

According to the botanical keys of Colombia and Ecuador, *P. tarminiana* would key out to species with broadly ovate-reniform or auriculate and denticulate stipules and pendent peduncles, near *P. cumbalensis* and *P. tripartita* (*P. mollissima* in Escobar, 1988). Our new species can easily be distinguished from these species by the size and permanence of the stipules and the widening of the nectar chamber. Leaf pubescence is not useful to discriminate *P. tarminiana,* as both *P. cumbalensis* and *P. tripartita,* show variation for this trait. In Colombia, because *P. tarminensis* had not been described before as a distinct species, and because it is sometimes named "curuba quiteña" or "curuba ecuatoriana," some researchers confused it with *P. tripartita* var. *tripartita,* from Ecuador. This confusion is sometimes found in the "gray literature" (research reports and student theses, e.g. Sañudo and Jurado, 1990).

Confusion with *P. tripartita* var. *mollissima* or with supposed hybrids is frequent in the horticultural, weed science, and fruit culture literature. Pictures of flowers and fruits of *P. tarminiana* are frequently presented as those of *P. tripartita* var. *mollissima* (e.g., Vanderplank, 1996; Ulmer & Ulmer, 1997; Wagner et al., 1999).

As commonly observed in the subgenus *Tacsonia*, *P. tarminiana* hybridizes easily with other species of the subgenus. The hybrids with *P. mollissima* and *P. mixta* are fertile and show intermediate phenotypes (pers. obs.). Hybrid seeds have also been obtained with *P. cumbalensis* (J.F. Restrepo, pers. com.).

Passiflora tarminiana is adapted to a wide range of elevations as compared to other species of subgenus *Tacsonia* growing at tropical latitudes. It may be cultivated

from about 2000 m up to more than 3000 m. In comparison, *P. tripartita* var. *mollissima* is not well adapted under 2400 m. As in *P. tripartita* var. *mollissima*, the fruits of *P. tarminiana* grow larger at higher elevations. *Passiflora tarminiana* seems to be more resistant to fungi. We have never observed oidia on its leaves or a significant number of anthracnosis necrotic spots on its fruits. On the contrary, the pericarp of *P. tripartita* var. *mollissima* fruits is often affected by anthracnosis, which reduces its market value despite its superior taste. In Venezuela, *P. tripatita* var. *mollissima* has shown high susceptibility to fusariosis while *P. tarminensis* appeared tolerant or resistant (E. González, pers. com). The adaptative potential and rusticity of *P. tarminensis* have probably been key factors in its conquest of new habitats in New Zealand and Hawaii where it is reported as a noxious weed (La Rosa, 1984).

Villacis et al. (1998) studied morphological variation in an Ecuadorian field collection including the most common species of subgenus *Tacsonia*. The cluster analyses based on both quantitative and qualitative morphological data clearly separated accessions of *P. tarminiana* from the other species. *Passiflora tarminiana* appeared closer to *P. tripartita* var. *mollissima* and *P. mixta* than to *P. cumbalensis* and *P. pinnatistipula*. Similarly, using six isozyme systems, Segura et al. (1998) showed that *P. tarminiana* is clearly separated from *P. tripartita* var. *mollissima*, *P. mixta*, and *P. cumbalensis*, while *P. tripartita* var. *mollissima* and *P. mixta* could not be clearly distinguished from each other. In a study by Fajardo et al. (1998) with RAPD markers on a sample of 52 plants from seven subgenera and 14 species of passifloras, the eight plants of *P. tripartita* var. *mollissima* and five plants of the species here described (identified in the work as *Passiflora* sp. “india”) formed two different subclusters within the subgenus *Tacsonia*.

Three of these five plants produced the same cpDNA RFLP pattern, distinct from that obtained on cpDNA from *P. tripartita* var. *mollissima* (Sánchez et al., 1999).

Paratypes:

COLOMBIA. **Cauca,** Silvia, *Barney IPGRI-AM-14* (IPGRI). **Valle del Cauca**, Barragán, 4°01.52'N, 75°53.54'W, 2900 m, *Coppens & S. Segura IPGRI-AM-3* (IPGRI); Tenerife (municipio El Cerrito). under cultivation, 2200--2600 m, 3°43.189'N 76°04.482W, same plants as type, *Coppens & Barney IPGRI-AM 2* (IPGRI, MO).

ECUADOR. **Carchi**, S of Tulcán, 0°30.52'N, 77°54.05'W, 2690 m, *Coppens & Barney IPGRI-AM-13* (IPGRI). **Chimborazo**, Volcán Chimborazo, *Barney IPGRI-AM-8* (IPGRI); Riobamba, Químiag, 2650 m, *C. Tapia & J. Velásquez CS-070* (INIAP). **Loja,** Santiago, 3°47.38'S, 79°17.38'W, 2450 m, *Coppens IPGRI-AM-10* (IPGRI); Saraguro, San Lucas, 2550 m, *C. Tapia & E. Morillo CTEM-040* (INIAP). **Pichincha**, cultivada, Parraoquia Calacali, Reserva Geobotánica Pululahua, 0°05'N, 78°30'W, *Cerón & Cerón 2740* (MO); 0°22'S, 78°25'W, 2650 m, *Coppens & Barney IPGRI-AM-12* (IPGRI); Unchibamba, S of Quito, 1°07.85'S, 78°35.32'W, 2610 m, *Coppens & Barney IPGRI-AM-11* (IPGRI); Rumiñahui, Iasa, 0°22'S, 78°25'W, 2650 m, *N. Mazón & B. Elizalde NMO-038* (INIAP). **Tungurahua**, Ambato, 1°22.02'S, 78°36.21'W, 2500 m, *Barney IPGRI-AM-9* (IPGRI); Baños, 2680 m, *Coppens IPGRI-AM-4* (IPGRI).

ETHIOPIA. Alemaya, cultivated, 2000 m, Jul 1967, *Westphal & Westphal-Stevels 494* (MO).

MEXICO. **Distrito Federal**, cultivated at El Rosario, 20 Aug 1936, *MacDaniels 635* (BH). **Michoacán**, desv. a San José del Rincón carr. Angangeo--Villa Victoria, 2750 m, *Soto & Ramírez 1496* (MEXU, MO). **Morelos**, Mpio. Huitzilac, *H. Hernández 16*

(MEXU); Mpio. Huitzilac, 1.2 km de la Carr. Federal Cuernavaca--México, D.F., rumbo a Zempoala, 2500 m, *Luna C. 21* (MEXU, MO).

NEW ZEALAND. **North Island**, Mount Albert, 36º54'S, 174º44'E, *Astridge* (AK-*219103*); Wellington, 41º17'S, 174º 46'E, *Brownsey* (AK-*152731*); Titirangi, 36º05'S, 174º03'E, *Cameron* (AK-*221386*); Grafton Gully, 36º52'S, 174º46'E, 50 m, *Cameron* (AK-*221519*); Waiheke Island, 36º49'S, 175º07'E, 80 m, *Cameron 7524* (AK-*229217*); Swanson, 36º52'S, 174º34'E, 100 m, *Cameron 9458* (AK-*236385*); Paihia, 35º17'S, 174º06'E, *Cumber* (AK-*116173*); Mount Albert, 36º54'S, 174º44'E, *Dingley* (AK-*122719*); Palmerston, 40º24'S, 175º33'E, *Esler* (AK-*173113*); Mount Albert, 36º54'S, 174º44'E, *Esler* (AK-*219104*), *Esler* (AK-*219109*); Kerikeri, 35º14'S, 173º57'E, *Esler* (AK-*219107*); Wood Bay, 36º57'S, 174º40'E, *Esler* (AK-*219108*); between Nelson City and Whakapuaka, *Healy 74/80* (MO); Waitemata, 36º57'S, 174º35'E, 240 m, *Mackinder* (AK-*162676*); Tutukaka and Matapouri, 35º35'S, 174º31'E, *Newfield* (AK-*212296*); Epsom, 36º54'S, 174º46'E, *J. Reid* (AK-*116084*); Motuihe, 36º49'S, 174º56'E, 30 m, *Sikes* (AK-*220536*); Buller, Karamea, near Karamea, *Sykes 10/85* (MO); Hokianga, 35º37'S, 173º29'E, 1100 ft, *Wright 912* (AK-*138965*); Waitemata, 36º53'S, 174º27'E, *Wright 1657* (AK-*140997*); Mount Albert, 36º54'S, 174º44'E, *B. Young* (AK-*114204*), *B. Young* (AK-*114205*), *B. Young* (AK-*116172*), *B. Young* (AK-*117558*); Titirangi, 36º05'S, 174º03'E, *B. Young* (AK-*116171*), *B. Young* (AK-*117563);* Otahuhu, 36º55'S, 174º51'E, *G. Young* (AK-*116164*). **South Island**, Port Hills, 43º34'S, 172º04'E, *Sikes* (AK-*225281*); Punakaiki, 42º07'S, 171º20'E, *B. Young* (AK-*117584*), *B. Young* (AK-*221387*).

PANAMA. **Chiriqui**, carr. hacia la cima del Volcán Barú, *Montenegro 1630* (MO).

PAPUA NEW GUINEA. New Guinea Group, New Guinea, Eastern Highlands province, Mount Wilhelm near Iwam Pass, 5°49'S, 145°07'E, 2800 m, *Takeuchi 5898* (MO).

PERU. **Arequipa**, Tuhuana; 15º39'06"S, 72º28'09"W, 2545 m, *Ll. Rios, J. Medina & L. López INIA-PRONARGEB 230* (INIA). **Cajamarca**, Barrio Santa Elena; 7º17'51"S, 78º51'56"W, 2730 m, *Ll. Rios, J. Medina & L. López INIA-PRONARGEB 170* (INIA); alrededores de Guzmango, Prov. Contumazá, 2600-2700 m, *Sagástegui A. 122* (US). **Huanuco**, Chinchao, 9º72'72"S, 76º09'68"W, 2650 m, *Ll. Rios, J. Medina & L. López INIA-PRONARGEB 101* (INIA), 2480 m, *Ll. Rios, J. Medina & L. López INIA-PRONARGEB 104* (INIA); Soldado Ucro, 9º80'90"S, 76º80'00"W, 3200 m, *Ll. Rios, J. Medina & L. López INIA-PRONARGEB 113* (INIA); Conchamarca, 10º03'99"S, 76º20'35", 2490 m, *Ll. Rios, J. Medina & L. López INIA-PRONARGEB 116* (INIA); La Libertad-Ting, 10º01'56"S, 76º17'00"W, 2820 m, *Ll. Rios, J. Medina & L. López INIA-PRONARGEB 118* (INIA); Quiulacocha, 10º01'56", 76º17'00"W, 2820 m, *Ll. Rios, J. Medina & L. López INIA-PRONARGEB 120* (INIA).

U.S.A. **California**, cultivated "in Southern California," Jul-Aug 1915, *Boughton 242* (US); Golden Gate Park, San Francisco, Aug 1907, *Wight 1806* (MO). **Hawaii**, Hwy. 550 along Waimea Canyon, mile 14 near NASA tracking station, 3500 ft, *Croat 44833* (MO); Kauai, rd. to Kumuwela Lookout, 22º06'N, 159º39'W, 3400 ft, *Crosby & Anderson 1496* (DUKE); Hawaii, Muana Kea, Aug 1949, *Degener et al. 20354* (MO); Kauai, near Kokee Ranger Station, *Degener & Degener 35181* (MO); Hawaii, Puna, Hawaii Volcano National Park, *Degener & Degener 35183* (MO); Kauai, *Henrickson 4034* (NCU); Puna district, land of Olaa, 1200 m, *D. Horbst* (MYF-*459*); Kauai, Waimea District, Na Pali-Kona Forest Reserve, Makaha Valley, 870--950 m, *Lorence 5221* (MO); Kauai, Pu'u

Hinahina Lookout, Waimea Canyon, 640 m, *Thorne & Zupan 10153* (MO); Hawaii, Muana Kea road by Douglass Monument, 5000 ft, *Trujillo s.n*. (MO); Hawaii, North Kona, Puuwaawaa, 3000 ft, Jun 1948, *Webster & Wilbur 1853* (DUKE).
See also description of localities and ecology in Hawaii by La Rosa (1984).

VENEZUELA. **Junín**, Betania,Villa Paez, 7°31.70'N, 72°26'W, 2000 m, *E. González & Barney IPGRI-AM-5* (IPGRI); **Mérida**, Mucuruba, 8°09.46'N, 71°20'W, 2000 m, *E. González & Barney IPGRI-AM-6* (IPGRI). **Táchira**, Pueblo Hondo, 8°15.19'N, 71°53.07'W, 2500 m, *E. González & Barney IPGRI-AM-7* (IPGRI).

ZIMBABWE. Distr. Inyanga, Inyanga Downs, naturalized in Kloof, near sawmill, Jan 1981, *Geddes s.n.* (MO).

Germplasm collections:

COLOMBIA. **Boyacá**, Nuevo Colón, 5°21.12'N, 73°27.70'W, 2450 m, *S. Segura & L. López TEN 63* (CIRAD-FLHOR/IPGRI). **Cauca**, Inzá, *Coppens TEN 83* (CIRAD-FLHOR/IPGRI). **Cundinamarca**, San Bernardo, 4°09.05', 74°23.50', 2010 m, *S. Segura & L. López TEN 50* (CIRAD-FLHOR/IPGRI). **Putumayo**, Santa Clara, Sibundoy, 2700 m, *Coppens TEN 58* (CIRAD-FLHOR/IPGRI). **Valle del Cauca**, Barragán, 4°01.52'N, 75°53.54'W, 2900 m, *Coppens & S. Segura TEN 5* (CIRAD-FLHOR/IPGRI).

ECUADOR. **Loja**, Loja**,** *Coppens TEN 21* (CIRAD-FLHOR/IPGRI).

Field observations:

COLOMBIA. **Caldas**, Manizales, 5°02'N, 75°27'W, observ. by Coppens. **Nariño**, La Cocha, 1°09.11'N, 77°09.25'W, observ. by Coppens; San Francisco, 1°09.73'N, 77°0'W, 2140 m, observ. by Coppens.

FRANCE. **La Réunion,** recently introduced at elevations over 700 m, observation and documentation by C. Lavigne (in letter with photography).

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Table 1. Comparison of three common or cultivated species of *Passiflora* subgenus *Tacsonia*

	P. tarminiana	P. tripartita	P. mixta
Stem	terete	terete	subangular
Leaf pubescence	absent on upper surface, moderate on lower surface	var. *mollissima* : dense on both sides; other varieties: variable, often glabrous at least on upper surface	most often glabrous, occasionally pubescent
Stipules	small (4--7 mm long, 2--6 mm wide), subreniform, denticulate or serrulate, deciduous	medium (6--12 mm long, 13--19 mm wide), reniform, serrulate to serrate, permanent	medium to large (6--20 mm long, 12--30 mm wide), reniform, dentate or serrate, permanent
Peduncle	slender, variable in length, flower pendent	slender, short, flower pendent	stout, variable in length, flower half-pendent to erect
Bracts	united 1/2 their length or more	united 1/2 their length or more	united on ¾ of their length or more
Flowers	light pink (Kew color chart: red-	pink to magenta (Kew color chart:	light pink to bright red (Kew color

	purple group, 57D, 66D, 74D, 75A/B/C, rarely white), corolla reflex, calyx tube/corolla length ratio around 1.3-1.6, nectary chamber appreciably wider than the calyx tube	red-purple group, 57C/D, 62A, 65A, 66C-D, 68B, 70D for var. *mollissima*, 53B for var. *azuayensis*, 58B for var. *tripartita*), corolla campanulate, calyx tube/corolla length ratio around 2.4-3.2, nectary chamber slightly wider than the calyx tube	chart: most often red/orange-red group, 39A, 42A, 50A, 51B, 52B, 54A, 54B, 55A, also red-purple group in southern Colombia and Ecuador, 63C/D, 75B), corolla campanulate, calyx tube/corolla length ratio around 1.6-2.6, nectary chamber slightly wider than the calyx tube
Fruits	pericarp yellow, sometime orange-tinged, arils orange and succulent	pericarp pale yellow (var. *mollissima*) to yellow (var. *tripartita*), arils orange and succulent	pericarp often green at maturity, sometimes turning yellow, arils grey to orange, scant

Figure 1. *Passiflora tarminiana* Coppens & Barry. -- A. Habit with bud and flower at anthesis. --B. Fruit. --C. Longitudinal section of hypanthium and floral tube showing nectary chamber, operculum, and reduced corona. --D. Node showing stipules. --E. Seed.

Figure 2. Distribution of *Passiflora tarminina* Coppens & Barney in northwestern South America, circles.

Figure 3. Color photos of the plant that provided the type material.