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JALTOMATA SANMIGUELINA (SOLANACEAE), A NEW SPECIES FROM NORTHERN PERU

Abstract.

Background. *Jaltomata* (Solanaceae) is a plant genus most closely related to the potato and tomato genus, *Solanum*, and is represented by some 70 shrubby to herbaceous species having edible berries. Over 50 *Jaltomata* species grow naturally in Peru, from near sea level to 4,000 m elevation, and found in several varied ecologic and distinct geographic regions.

Materials and methods. Over a period of more than twenty years, we conducted fieldwork in remote places in Peru, borrowed herbarium specimens from numerous museums, and thoroughly studied all relevant taxonomic literature ever published in any language. While studying the taxonomy of the genus *Jaltomata* we discovered a new-to-science species, *J. sanmiguelina* Mione & S. Leiva.

Results. In the province of San Miguel, Department of Cajamarca, in northern Peru, a new-to-science species, *J. sanmiguelina*, is described and illustrated. It is a shrub growing 80–90 cm high with 5 (-6) flowers per inflorescence, and having protogynous flowers that close at night. The corolla is nearly rotate, and white with both 10 green petal spots in a ring and 10 purple petal spots proximal to the green spots. The lower half of the staminal filaments are purple and surrounded by transparent simple, nonglandular hairs while the distal half of the filament is white and hairless. The berries, orange at maturity, contain 20–39 seeds.

Conclusions. *J. sanmiguelina* grows only in Department Cajamarca, Province San Miguel, along the route from San Miguel to El Empalme, at 6° 56' 20.7" S, 78° 49' 57.7" W, elevation of 3,193 m. It is considered critically endangered because the extent of its range is smaller than 100 km², the only place where it has been collected is the type locality, and there are also fewer than 50 mature individuals in the only known population.

Key words: *Jaltomata*, new species, Solanaceae, Northern Peru.

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Аннотация.

Актуальность и цели. Род *Jaltomata* (Solanaceae (Паслёновые)) является наиболее близким растительным видом к картофелю и томатам, род *Solanum*, который представлен более 70 сортами, от кустарниковых до травянистых, со съедобными ягодами. Более 50 видов *Jaltomata* естественно произрастают в Перу на территориях, находящихся на уровне моря и на высотах до 4000 м, и встречаются в нескольких регионах с различными экологическими и географическими особенностями.

Материалы и методы. Более двадцати лет мы проводили полевые исследования в удаленных регионах Перу, изучали экземпляры гербариев различных музеев и детально изучали все доступные литературные источники по

классификации, касающиеся данного вопроса, когда-либо опубликованные на любом языке. В ходе исследования классификации вида *Jaltomata* мы обнаружили вид, ранее не известный науке – *J. sanmiguelina* Mione & S. Leiva.

Результаты. Новый вид *J. sanmiguelina*, найденный в провинции Сан Мигель округа Кайамарка, Северный Перу, был описан и пояснен иллюстрированными примерами. Он представляет собой кустарник 80–90 см в высоту с 5–6 цветками в соцветии, имеющий протерогинные цветки, которые закрываются в ночное время суток. Венчик почти колесовидный, белый, с десятью зелеными пятнами в кольце на лепестках и десятью фиолетовыми пятнами рядом с зелеными пятнами. Нижняя часть тычиночных нитей фиолетовая, окруженная прозрачными простыми нежелезистыми волосками, тогда как периферическая часть нитей белая, без волосков. Ягоды, оранжевые по достижении зрелости, содержат 20–39 семян.

Выводы. *J. sanmiguelina* произрастает только в округе Кайамарка, провинция Сан Мигель, вдоль пути следования из Сан Мигель в Ель Эмпалм, координаты 6° 56' 20,7" S, 78° 49' 57,7" W, на возвышенности 3193 м над уровнем моря. Данный вид находится на грани исчезновения, так как территория его произрастания составляет менее 100 км², единственным местом, где его можно встретить, является типовая местность, при этом в единственной известной популяции насчитывается менее 50 зрелых экземпляров.

Ключевые слова: *Jaltomata*, новые виды, семейство Паслёновые, Северный Перу.

Introduction

The genus *Jaltomata* was described by Schlechtendal in 1838, then some species currently recognized as *Jaltomata* were treated as a different genus, *Hebecladus*, created by Miers in 1845. Hunziker [1] and Nee [2] recognized that both genera should be treated as one, *Jaltomata*. In contrast, Davis [3] and D'Arcy [4, 5] considered the genera to be separate. Mione [6] adopted the approach of Hunziker [1] and Nee [2] and unified *Jaltomata* and *Hebecladus*. Molecular data presented by Mione [6] and Mione et al. [7] supported the unification of the two genera, and to date this broader concept of the genus has been adopted by all researchers. D'Arcy's view changed over time: in a letter (January 1993) he asked T. M. to continue transferring the remaining species of *Hebecladus* to the genus *Jaltomata*.

Jaltomata (including *Hebecladus*) is classified in the family Solanaceae, subfamily Solanoideae, Solaneae Tribe [8]. The molecular phylogeny of the Solanaceae by Olmstead et al. [9] shows that *Jaltomata* is most closely related to, is the sister group of, the genus *Solanum*. The genus *Jaltomata* is represented by some 70 shrubby to herbaceous species having edible berries [6, 7, 10–34]. The genus is distributed from the southwestern United States to Bolivia, and with one species growing on the Greater Antilles (Cuba, Jamaica, Haiti, Dominican Republic, Puerto Rico) and another on the Galapagos Islands. The genus has two centers of diversity: Mexico with about 7 species, and western South America with about 63 taxa. In Peru, 59 species grow from the desert coast to 4,000 m elevation, and in northern Peru there is the greatest diversity with about 39 species, all or nearly all with edible fruits.

***Jaltomata* is characterized by:** 1) basal pedicel articulation; 2) staminal filaments inserting on the ventral surface of the anthers; 3) an ovarian disk; 4) a corolla having 5 or 10 lobes with valvate aestivation in bud; 5) the fruit is a juicy berry consumed by rural people. Nearly all species of the genus have protogynous flowers.

Materials and methods. The specimens studied were either collected by the authors or borrowed from herbaria (F, K, MO, US). Our collections are mainly de-

posited at CORD, F, HAO, HUT, and MO herbaria, and some are in the working collection of T. M. and will be deposited at an herbarium. Acronyms of herbaria are as presented by Thiers [35]. In addition to herbarium specimens we collected, we store preserved specimens in 50 % ethanol, to study in detail exomorphological characters, including for the rendering of illustrations by S. L. G.

Jaltomata sanniguelina Mione & S. Leiva G. sp. nov. (Fig. 1, 2)

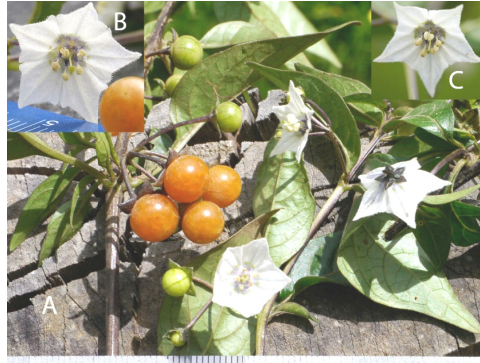


Fig. 1. *a* – branches, leaves, flowers and fruits. Note pistillate-phase flower near center (having whitish anthers), and the upside down flower towards right (with purple calyx on top). Units along bottom are mm; *b* – face-on view of flower during hermaphroditic phase (all anthers dehiscent). Note 10 green petal spots in a ring near the base and 10 purple petal spots proximal to and aligned radially with the green spots. Smallest units are mm; *c* – face-on view of flower showing some anthers dehiscent and others undehiscent. Photos by Thomas Mione at the type locality. *T. Mione, S. Leiva G. & L. Yacher 846*

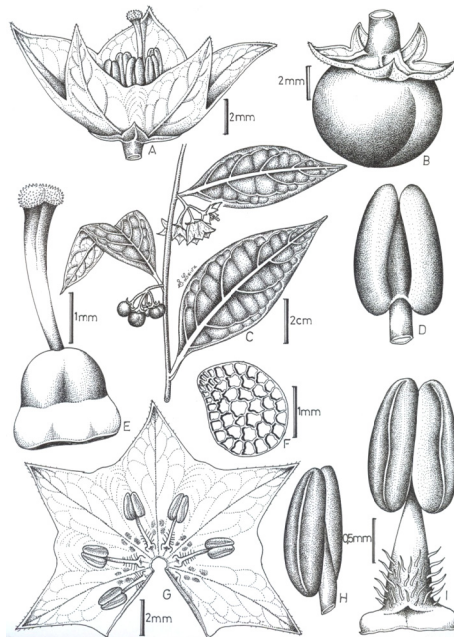


Fig. 2. *a* – flower in side view; *b* – fruit in side view with calyx on top; *c* – branch with leaves, inflorescence and infructescence; *d* – anther's outer (dorsal) face; *e* – gynoecium with stigma, style, and ovary having disk around base; *f* – seed; *g* – flower with adnate stamens, cut to lay flat; *h* – anther in oblique view; *i* – stamen in ventral view.

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TYPE: PERU. Department. Cajamarca, Prov. San Miguel, route San Miguel-El Empalme, 6° 56' 20.7" S, 78° 49' 57.7" W, 3,193 m, 13 May 2015, *S. Leiva, T. Mione & L. Yacher 5856* (holotype: HAO; isotypes: CORD, F, MO).

Shrub 0.8–0.9 m high. **Older stems** brown, terete, having lenticels, glabrous, 7–8 mm in diameter at the base; **younger stems** nearly terete to slightly angular, purple adaxially (Fig. 1,*a*) and green abaxially, glabrous and shiny. Basal **leaves** alternate (Fig. 2), the distal geminate; the **blade** elliptic-lanceolate to ovate, to 4.5 cm long × 4.2 cm wide, lustrous-green above, membranous, glabrous on both faces, the apex acute (Fig. 1,*a*), the base cuneate, most leaves entire but a few of the older/larger leaves toothed, the main vein lighter in color most conspicuously on the lower face; the **petiole** 5 mm to 2 cm long, glabrous, with a conspicuous main vein on the abaxial surface. **Flowers** (2-) 3–5 (-6) per node; **peduncle** purple to greenish (Fig. 1,*a*), nearly terete, glabrous, nearly straight, 9–14 mm long; **pedicel** purple-lustrous, terete, glabrous, to 1 cm long. **Calyx** during anthesis dark purple (Fig. 1,*a*), nearly planar (flat), five-lobed (stellate in outline), 5 to 5.2 mm diameter, touching the back of the corolla (never reflexed), glabrous, the lobes triangular, 1.8 to 2.4 mm long × 1.7 to 1.8 mm wide, the main vein somewhat raised on the abaxial face. **Corolla** white, having 10 green spots in a ring near the base and 10 purple spots proximal to and aligned radially with the green spots (Fig. 1,*b*), nearly rotate when fully open, 5-lobed (no lobules, Fig. 2*a,g*), 14 mm diameter prior to anthers dehiscing (the pistillate phase), 16–17 mm diameter after anthers dehiscence (hermaphroditic phase), glabrous abaxially and adaxially, the margin ciliate with simple, nonglandular hairs. **Nectar** unpigmented. **Stamens** 5, angling away from the style 15–20 degrees (Fig. 1,*b*), exerted, of equal length, 2.8 mm long, the lower 50 % of the filament intensely purple and villous with unpigmented, nonglandular, simple hairs, the distal (upper) half of the filament whitish in color and glabrous; **anthers** pale-yellow to whitish prior to dehiscence (Fig. 1,*a*), not mucronate, glabrous, slightly wider than long prior to dehiscence: 1.5–1.7 mm long × 1.7–1.8 mm in wide. **Stigma** capitate (Fig. 2,*e*), darker green than the style, exerted, shallowly bilobed, 0.5–0.6 mm in diameter; the style and ovary both pale-green, lighter than the stigma; the **style** filiform, widening slightly toward the distal end, glabrous, 3.8 mm long; the ovary 1.7–1.8 mm high × 1.9 to 2 mm wide including the annular disk, the annular disk orange and approximately 42 % of the height of the ovary. **Berry** orange at maturity, globose, compressed at the poles, without persistent style, to 7.5 mm (pole to pole) × 8.5 mm in diameter (Fig. 1,*a*); calyx at fruit maturity planar, purple, 7–11 mm in diameter. **Seeds** 20–39 per fruit, kidney-shaped, brown, grid-foveolate, 1.7–1.8 mm long × 1.3–1.4 mm wide.

Additional material examined. PERU. Department Cajamarca, Prov. San Miguel, 6° 56' 20.7" S, 78° 49' 57.7" W, 3,185–3,193 m, 19-III-2007, *T. Mione, S. Leiva G., L. Yacher 738 & S. Leiva G., T. Mione, L. Yacher 3641*; 13-V-2015, *T. Mione, S. Leiva & L. Yacher 846* (no herbarium specimen: flowers preserved in 50 % ethanol and dessicated leaves for extraction of nucleic acids).

Jaltomata sanmiguelina was included in the molecular phylogeny of Miller et al. [36, as “J. SanMiguel”] where it was found to be most closely related to *J. oppositifolia* (98 % bootstrap value). However, the accession of “*J. salpoensis*” used in that study was collected in Department Amazonas, and is no longer identified as *J. salpoensis* (now understood to be endemic to Department La Libertad).

If phylogeny is again investigated we anticipate that *J. sanmiguelina* will be most closely related to *J. salpoensis*, because only these two species have a 5-lobed corolla (no lobules), a ring of purple spots at the base of the corolla, stamens about 3 mm long, and short styles (Table 1). *J. sanmiguelina* is also akin to *J. huancabambae*, not included in the study of Miller et al. [36]. All four of these species (Table 1) grow in northern Peru, have glabrous, lustrous leaves, purple pedicels, a white corolla that lacks radial thickenings, unpigmented nectar, pale-yellow to whitish anthers, and orange fruit.

Table 1

Comparison of *Jaltomata* species similar to *J. sanmiguelina*

	<i>J. huancabambae</i> S. Leiva & Mione	<i>J. oppositifolia</i> S. Leiva & Mione	<i>J. salpoensis</i> S. Leiva & Mione	<i>J. sanmiguelina</i> Mione & S. Leiva
Plant Height m	1.2	1.2	0.5	0.9
Flowers per inflorescence	1–2	2–3	2–4	2–6
Calyx color during anthesis	purple	green	green or purple	purple
Corolla Form	very broadly infundibular-campanulate	broadly infundibular to rotate	crateriform	nearly rotate
Corolla lobes/lobules	5/5	5/5	5/0	5/0
Corolla having ring of green spots	yes, 10	yes, 10	no	yes, 10
Corolla having ring of purple spots at base	no	no	yes	yes
Corolla having purple ring immediately distal to green spots	yes	no	no	no
Stamen length, mm	10	5–6.5	3	2.8
% of filament's length that is hairy	60–70	55–70	35	50
Color of filament: base/upper half	purple/whitish	whitish/whitish	purple/whitish	purple/whitish
Color of filament hairs	lowest are dark purple, mostly unpigmented	unpigmented	unpigmented	unpigmented
Style length, mm	8–10	6.5–8	2.5	3.8
Altitude	3,165	2,250–3,090	3,500–3,900	3,190
Distribution	Piura, Huancabamba	Cajamarca, Chota	La Libertad, Otuzco & Santiago de Chuco	Cajamarca, San Miguel

Distribution and ecology. *Jaltomata sanmiguelina* has a limited distribution and is apparently endemic to the collection area. Despite having made many plant collections in numerous places at different times in northern Peru, we have found

J. sanmiguelina only at the type locality. We attempted to also find it, but did not find it, within 10 minutes walk of the type locality along a man-made canal above the type locality, and along a stream some 100 m below, both having natural vegetation along them. Not finding *J. sanmiguelina* nearby, where there was natural vegetation, suggests that either this species is rare and or that it has a specific habitat requirement. Where it grows it is a member of the grass and shrub community on the edges of the road. It appears to prefer moist, deep, clay soils, sometimes rocky, with plenty of humus and lives associated with *Eucalyptus amygdalina* Labill. “eucalipto” (Myrtaceae), *Hypericum laricifolium* Juss. “chinchango” (Linaceae), *Chusquea serrulata* Pilg. “suro” *Zea mays* L. “maíz” (Poaceae), *Sambucus peruviana* Kunth “saúco” (Adoxaceae), *Rubus floribundus* Kunth “zarza” (Rosaceae), *Pinus sylvestris* L. “pino” (Pinaceae), among others.

Phenology. We have seen and collected *J. sanmiguelina* twice, in March of 2007 and May of 2015; it was flowering and had ripe fruits on both occasions. Based on S. L. G.’s extensive experience in northern Peru, he contributes that it likely flourishes with the return of rains in November or December and flowers and then fruits from February until May. Some open flowers had stamens having undehisced anthers, and other open flowers on the same plant at the same time had stamens having dehisced anthers, and so we characterize the flowers as protogynous. The anthers of any one flower do not dehisce simultaneously (Fig. 1,c). The first time we collected this species we encountered it at dusk and noticed that the flowers were closing for the night.

Current status. Using the criteria of the IUCN [37] *Jaltomata sanmiguelina* is considered critically endangered (CR). The extent of its range is smaller than 100 km²; the only place where it has been collected is the type locality (Criterion B1). There are also less than 50 mature individuals in the population (Criterion D). However, we have not determined whether there is a decline in its geographic range. There is urgent need for a thorough study of the ecology, distribution and population structure of this species to clarify its condition.

Local name: “frutilla” (*S. Leiva G., T. Mione & L. Yacher 5856*, HAO).

Etymology. The specific epithet refers to San Miguel, a prosperous and beautiful province in Department Cajamarca, Peru. Among its hills, valleys and rivers there is biological and cultural wealth that needs further study.

Uses. One person, walking by while we collected and photographed the type specimen, said that the fruits are not eaten. However, the berries of nearly all other *Jaltomata* species of the Andes are eaten when ripe, and it is therefore possible that some of the local residents at least occasionally consume the ripe berries.

Conclusions

A new species of Northern Peru, *Jaltomata sanmiguelina* Mione & S. Leiva (Solanaceae), is described and illustrated. This species is apparently endemic to the collection area, growing only in Peru, Department Cajamarca, Province San Miguel, along the route from San Miguel to El Empalme, at 6° 56' 20.7" S, 78° 49' 57.7" W, elevation 3,193 m. *J. sanmiguelina* is a shrub growing 80–90 cm high with 5 (-6) flowers per inflorescence. The flowers are protoynous and close at night. The corolla is nearly rotate, glabrous both inside and outside, and white with both 10 green spots in a ring and 10 purple spots proximal to the green spots.

The lower half of the staminal filaments is purple and surrounded by transparent simple, nonglandular hairs while the distal half of the filament is white and hairless. The berries, orange at maturity, contain 20–39 seeds.

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