

Full Length Research Paper

***Jaltomata aijana* (Solanaceae) of Ancash, Peru**

Thomas Mione^{1*}, Segundo Leiva González² and Leon Yacher³

¹Biology Department, Copernicus Hall, Central Connecticut State University, New Britain, CT 06050-4010, USA.

²Museo de Historia Natural, Universidad Privada Antenor Orrego, Avenida América Sur 3145, Trujillo, Perú.

³Department of the Environment, Geography and Marine Sciences, Southern Connecticut State University, New Haven, CT 06515-1355, USA.

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Abstract

Hebecladus weberbaueri Dammer is the oldest name for a common species of the genus *Jaltomata* (Solanaceae) of the Department Ancash, Peru. To transfer this species to the genus *Jaltomata* we here select a new specific epithet because the epithet *weberbaueri* is preoccupied in *Jaltomata*. We select the specific epithet *aijana*, and thus the correct name for *H. weberbaueri* Dammer is now *J. aijana*. We collected *J. aijana* nine times during 10 different years of field study in Peru. For *J. aijana*, geographic distribution, local names, phenology, a description, an illustration, and photographs are provided.

Key words: Ancash, *Hebecladus*, Peru, protogyny, self-compatibility.

INTRODUCTION

The genus *Jaltomata*, with 70 species (Mione, unpubl.), is remarkably diverse: there are both herbaceous species and shrubs, flowers per inflorescence ranges from one to 41, corolla size varies from less than 1 cm to 6 cm across, and habitats range from full sun in the desert (Mione *et al.*, 2015b) to shaded trail edges in the rainforest. *Jaltomata* species grow from near sea level to 4100 m in elevation, and are distributed from Arizona, USA to Bolivia and grow on both the Galápagos and Greater Antilles Islands. The fruit, a berry, is fleshy, and orange, red, purple/black or green. Berries of at least 40 *Jaltomata* species are eaten by people (Mione, unpubl. data). Bees and hummingbirds have been seen visiting the flowers of different species (Mione, unpubl. data), and among species the nectar color ranges from transparent to blood-red (Mione and Anderson, 1996; Hansen *et al.*, 2007). Both widespread species and narrow endemics are known. For example *J. procumbens* (Cav.) J. L. Gentry grows from Arizona, USA to Ecuador (Mione and Yacher, 2005) but

J. truxillana S. Leiva & Mione grows only on one small mountain on the coast of Peru, in a *lomas* community, which receives all of its moisture from fog (Leiva González *et al.*, 2008). *Jaltomata* is of interest for studies of ethnobotany (Davis and Bye, 1982; Williams, 1990), floral biology and colored nectar (Leiva González *et al.*, 2016b; Mione *et al.*, 2001), seed germination (Saldivar-Iglesias *et al.*, 2010), biogeography (Dillon, 2005; Mione *et al.*, 2016), phylogeny (Miller *et al.*, 2011; Mione *et al.*, 1994), taxonomy (Leiva González *et al.*, 2008, 2010, 2016b; Mione, 1992, 1999; Mione *et al.*, 1993, 2000, 2004, 2007, 2008, 2011, 2015a, 2015b), ecological genomics (Haak *et al.*, 2014), and the genetic basis of morphological evolution (Mione and Anderson, 2016).

The genus *Jaltomata* includes the genus *Hebecladus* (Mione *et al.*, 1994) and all *Hebecladus* species are being transferred to *Jaltomata*. *Hebecladus weberbaueri* Dammer is the oldest name for a common species of the genus *Jaltomata* of the Department Ancash, Peru. Within *Jaltomata*, the specific epithet *weberbaueri* is preoccupied (Mione and Coe, 1992; Mione and Granda Paucar, 2006), and we choose the epithet *aijana* as the replacement. The specific epithet refers to the town and province Aija, a province in Department Ancash, Peru. As part of ongoing efforts towards a complete taxonomic

treatment of the genus *Jaltomata*, we make the taxonomic revision shown below.

METHODS

We collected specimens of the genus *Jaltomata* in Peru in 1998, 1999, 2005, 2007, 2008, 2010, 2011, 2013, 2015 and 2016. Specimens have been deposited at CONN and HAO. Herbarium specimens were borrowed from or studied at BH, CONN, F, G, GH, K, M, MA, MO, MOL, NY, P, US, USM, VT and WIS with herbarium acronyms as in Thiers (continuously updated). Collections *Mione et al. 726* and *728* were used for the pollen counts ($n = 3$), *Mione et al. 728* was used for the ovule count, seeds of *Mione et al. 872* were measured, and *Leiva González et al. 5892* was used for the seed count. Other characters were measured on all of the specimens we collected in Department Ancash (Table 1).

TAXONOMIC REVISION

Jaltomata aijana Mione & S. Leiva, nom. Nov. Figures 1 and 2. Replaced synonym: *Hebecladus weberbaueri* Dammer, Bot. Jahrb. Syst. 37(5): 638. 1906 [not *J. weberbaueri* (Dammer) Mione, Novon 2(4): 383. 1992; Basionym: *Saracha weberbaueri* Dammer, Bot. Jahrb. Syst. 37(5): 638. 1906]. This taxonomic revision corrects the erroneous placement of *H. weberbaueri* Dammer in synonymy with *J. bicolor* (Mione *et al.*, 1993).

Shrub to 2 (–3 m) high, older stems (Figure 2E) brown, terete, with lenticels, glabrous, to 15 mm diameter at the base; younger stems 4- or 5-sided, purple on upper surfaces, green on lower surfaces, sparsely to densely pubescent with eglandular unpigmented mostly simple hairs. Basal leaves alternate, the distal geminate; the blade ovate, to 8 (–14.5) cm long X 5 (–12) cm wide, the younger membranous, the older somewhat coriaceous, the upper face sparsely pubescent to glabrous, the lower puberulent to glabrous, the apex usually acute, the base of smaller leaves at times cuneate, the base of the largest leaves truncate, the margin usually entire but the largest are sinuate to sinuate-dentate; the petiole to 6 mm (–3 cm) long, with a conspicuous main vein abaxially.

Flowers 2–5 (–6) per inflorescence; peduncle green, terete, sparsely pubescent, to 3.1 cm long; pedicel purple, terete, sparsely pubescent, to 1.4 cm long. Calyx during anthesis abaxially green to purple, planar to recurved (Figure 2A, B), five-lobed (stellate in outline), 1.6 cm diameter, sparsely pubescent with simple to dendritic eglandular hairs, the lobes triangular, to 6.5 mm long X 5 mm wide, the main vein somewhat raised abaxially.

Corolla green, lacking spots, tubular with a 10-lobed (lobes and lobules alternating) limb (Figure 1, 2D), the tube and limb together to 3.5 cm long, the tube narrowing

slightly from proximal to distal, 6–10 mm diameter at midlength, the exterior of the corolla densely pilose, the hairs simple or sometimes dendritic, the interior of the tube glabrous, the limb pubescent on both faces. Stamens 5, adnate to base of corolla, connivent, hidden inside corolla tube when corolla opens, elongating at unequal rates but finally equal, 3.1–3.5 cm long including anther, exerted beyond mouth of corolla, the filament pale-green, the proximal 10% villous with unpigmented, eglandular, simple hairs; anthers dark purple (Figure 2C), the connective greenish, mucronulate, sagittate after dehiscence, glabrous, conspicuously longer than wide, 3–3.5 mm long X 1.8–2 mm wide (fresh), 2.5–3 mm long X 1–1.5 mm wide (pressed specimens), finally in close proximity with stigma or to 2 mm beyond stigma; 65,450–93,250 pollen grains per flower.

Stigma capitate (Figure 2C), dark green, exerted, shallowly bilobed, 0.5–1 mm diameter (pressed specimens); the style straight, filiform, pale-green, lighter than the stigma, 2.3–2.9 cm long; the ovary 2.4 mm high X 3.4 mm wide including the annular disk, containing 236 ovules, the annular disk pentagonal, pale-orange and approximately 60 % of the height of the ovary. Berry likely orange at maturity, globose, compressed at the poles, to 11 mm (pole to pole) X 13 mm diameter, the style persistent; calyx at fruit maturity enclosing 1/3 to 1/2 of the fruit (Figure 1A), to 3.1 cm diameter; 15 mm from pedicel to lobe tip.

Seeds (Figure 1E) 206 per fruit, brown, sub-orbicular to sub-triangular, the surface reticulate, 1.55–1.7 X 1.25–1.4 X 0.5–0.6 mm thick.

DISCUSSION

Phenology

Flowers of *Jaltomata aijana* are protogynous: both open flowers having undehisced anthers (pistillate phase) and open flowers having dehisced anthers (hermaphroditic phase) were seen on the same plant at the same time (Figure 2B).

The anthers of a flower do not dehisce simultaneously (Figure 2B). This species is self-compatible and flowers do not close for the night (Kostyun, personal communication, 2014). *J. aijana* flowers November through June.

Habitat

The habitat of *Jaltomata aijana* is roadsides, rock fences/borders, and edges of farm fields. It lives in association with plants of *Eucalyptus amygdalina* Labill. “eucalipto” (Myrtaceae), *Bidens pilosa* L. “cadillo,” *Viguiera weberbaueri* S. F. Blake “suncho,” *Ambrosia peruviana* Willd. “marco,” *Tagetes minuta* L. “chiche,” *Mutisia cuminata* R. & P. (Asteraceae), *Jaltomata*

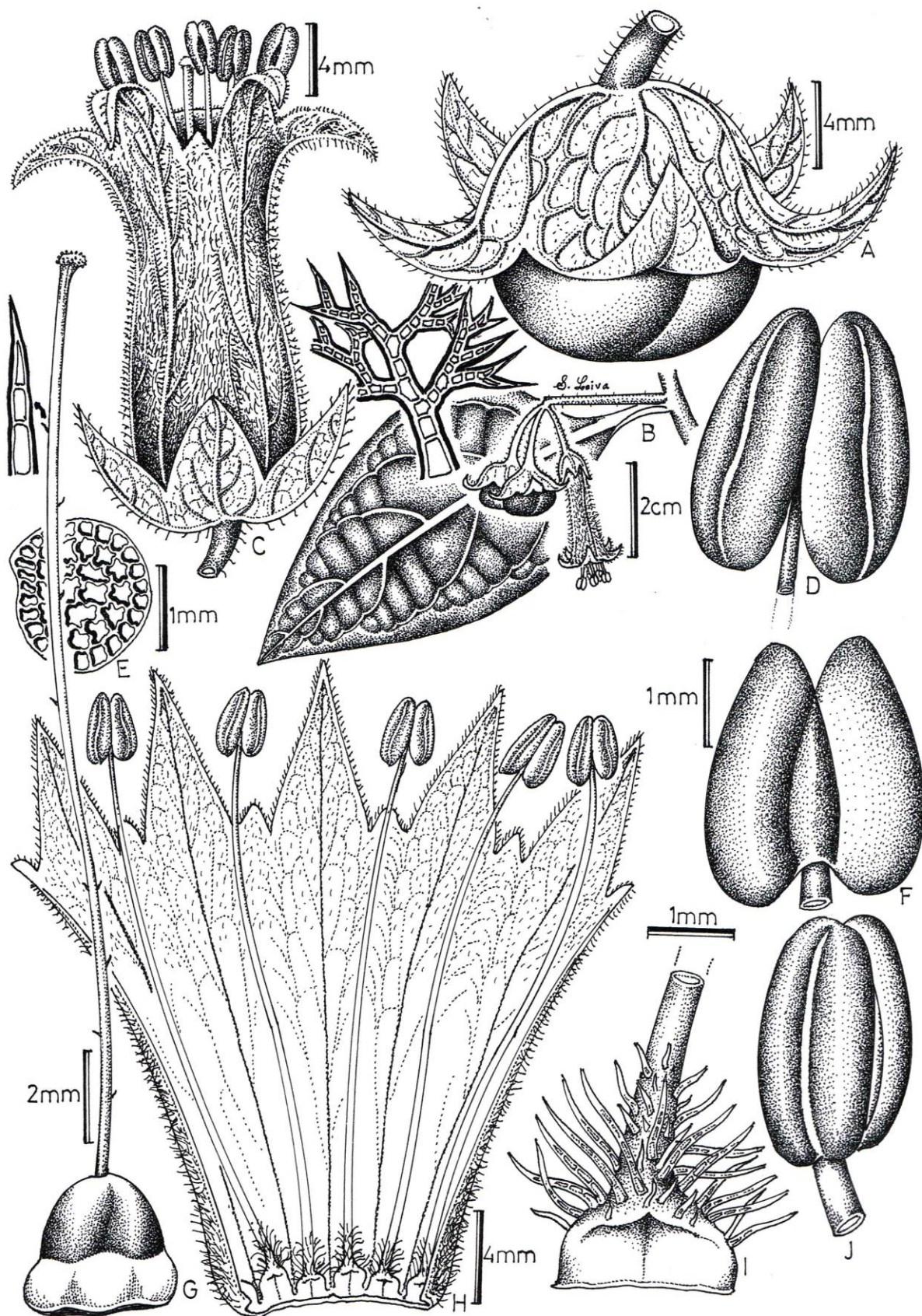


Figure 1. *Jaltomata ajjana*. **A**—Fruit in side-view, approximately half-hidden by calyx. **B**—Branch with inflorescence and leaf with an expanded view of a dendritic hair. **C**—Open flower. **D**—Anther in ventral view. **E**—Seed. **F**—Anther in dorsal view. **G**—Gynoecium. **H**—Corolla with adnate stamens dissected open longitudinally. **I**—Base of staminal filament in ventral view. **J**—Anther in lateral view. Illustration by Segundo Leiva González, S. Leiva G. et al. 5892

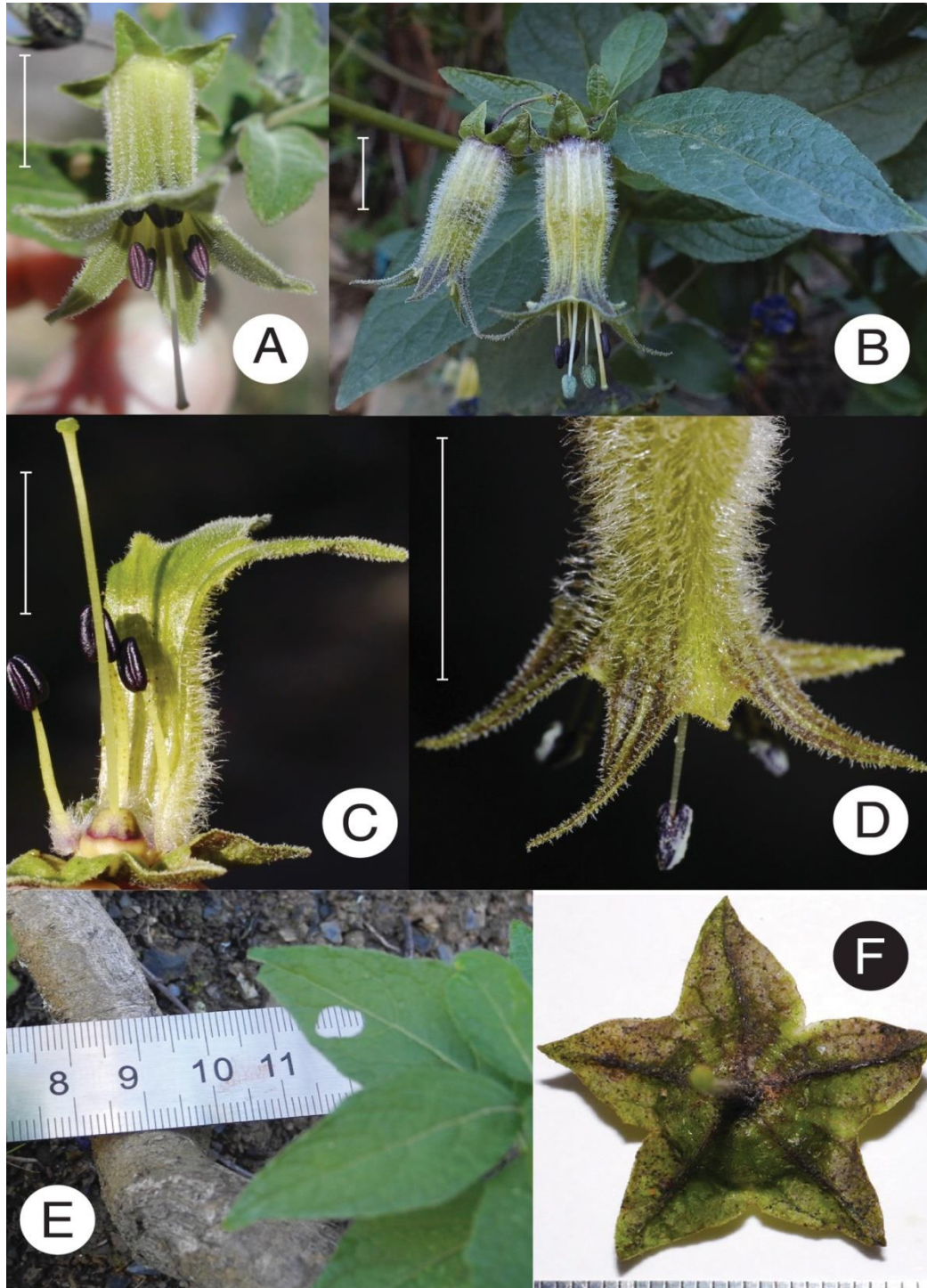


Figure 2. *Jaltomata aijana*. **A**—Flower in pistillate phase, anthers are purple. **B**—Flower near center has two dehiscent and three undehiscent anthers showing nonsimultaneous anther dehiscence. The flower on the left opened more recently; we can infer this because the stamens are not yet exerted. **C**—Corolla was opened longitudinally to show androecium and gynoecium; two of the five stamens were removed. **D**—Distal end of corolla showing alternating lobes and lobules (10 total) and dehiscent anthers. **E**—Woody stem, smallest units are mm. **F**—Calyx in overhead view, attached to fruit hidden under the calyx, units along bottom are mm. All scale bars equal one cm. Photos are of Mione et al. 863 = Leiva G. et al. 5892 except **A** is Mione et al. 728. Photos were taken by T. M. except **B** was taken by S. L. G.

weberbaueri (Dammer) Mione “frutilla,” *Brugmansia sanguinea* (R. & P.) D. Don “floripondio rojo” (Solanaceae), *Pisum sativum* L. “arveja,” *Otholobium pubescens* (Poir) J. W. Grimes “culén” (Fabaceae), *Rumex crispus* L. “acelga” (Polygonaceae), *Alnus acuminata* Kunth “aliso” (Betulaceae), *Passiflora tripartite* (Juss.) Poir. “puro puro” (Passifloraceae), *Sambucus peruviana* Kunth “saúco” (Adoxaceae), *Alonsoa meridionalis* (L. f.) Kuntze (Scrophulariaceae), and the genera *Urtica* L. (Urticaceae), *Cestrum* L., *Solanum* L., *Salpichroa* Miers (Solanaceae), *Calceolaria* L. (Calceolariaceae), *Barnadesia* Mutis ex L. f. (Asteraceae) among others.

Phylogeny

Jaltomata aijana was included in the molecular phylogeny of Miller et al. (2011) as “*J. bicolor* 726” where it was found to be most closely related to *J. umbellata* (R. & P.) Mione & M. Nee in both the strict consensus and the majority-rule consensus trees. We now understand that the circumscription of *J. bicolor* was artificial when Miller et al., (2011) published, and that *J. bicolor* and *J. aijana* are distinct and defensible species (Table 2).

Local names

“shuplac” (Lopez et al. 7601, US); “musho” (Leiva G. et al. 2133, F); “frutilla” (Spanish) and “uyma” (Quechua) (Mione et al. 863 = Leiva González et al. 5892).

Fruit color

The fruit color was not mentioned in the protologue, and was not mentioned by Macbride (1962, p. 40) for *Hebecladus weberbaueri*. Jamie Kostyun grew this species (Mione et al. 726) and after an inquiry about mature fruit color responded (personal communication, 2016) that “I remember that ripe fruits were orange.” Orange fruits would be predicted given the phylogenetic position of *Jaltomata aijana* in “Clade 3 orange fruits” (Miller et al. 2011). Surprisingly, we made a single observation (20 May 2015, Mione et al. 863) of fruits of *J. aijana* with purple pigmentation. This was the first observation of purple pigmentation in the fruits of any species of section *Hebecladus* (Mione, 1992) and we suspect that the purple fruits we saw on *J. aijana* were a developmental error and/or atavism.

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Table 1. All specimens of *Jaltomata aijana* examined, all collected in Department Ancash, Peru

Province. Locality	Elevation m	Habitat	Date	Collector (herbarium)
See footnote 1.	3200– 3400	interwoven grasses and bushes ("graminosis fruticibus intertextis") ²	27 March 1903	Type of <i>Hebecladus weberbaueri</i> Dammer. Weberbauer 2652: Isotype G!, photos of B specimen (destroyed) GH!, NY!
Huari. road from San Marcos to Chavín de Huántar. Río Mosna valley near Olayan	2800	Low but closed tropical dry forest vegetation with <i>Arnaldoa</i> , <i>Llangunoa</i>	13 Mar 2001	M. Weigend et al. 5151 (M)
Huaraz. km 186 Recuay - Huaraz	3150	on dry ground along bank of tributary to Río Santa	Jan 1998	T. Mione, S. Leiva G. & L. Yacher 627
Huaraz. 15 km S of Huaraz, 77 29' W, 9 41' S	3450	brush borders in agricultural land	27 Jan 1985	D. N. Smith et al. 9388 (NY)
Bolognesi. km 107, poblado Sta. Rosa (ruta Pativilca-Recuay)	3300	borde de río entre <i>Ambrosia</i> sp., <i>Barnadesia</i>	18 Jan 1998	S. Leiva, T. Mione & L. Yacher 2133 (F) T. Mione, S. Leiva G. & L. Yacher 625
Bolognesi. Huacacorral, 22.4 km E of Conococha, 77.2 W, 10.1 S	3820	growing among <i>Opuntia</i> in clay soil	3 Apr 1999	D. M. Spooner et al. 7356a
Bolognesi. 9 57' 23.5" S, 77 05' 57.0" W	3971	steep roadside	20 May 2016	T. Mione, S. Leiva G. & L. Yacher 870 S. Leiva, T. Mione & L. Yacher 6048
Bolognesi. Arriba de Chiquián	3500–3600	falda pedregosa	31 Mar 1957	R. Ferreyra & E. Cerrate 12133 (USM)
Bolognesi. Chiquián	3400–3900	fields, pastures and quebrada above village	5 Feb–2 Apr 1997	M. Weigend & N. Dostert 97/185 (F)
Bolognesi. Below Chiquián 10 08' 16.3" S, 77 09' 43.2" W	3338	roadside	20 May 2016	T. Mione, S. Leiva G. & L. Yacher 871 S. Leiva, T. Mione & L. Yacher 6049
Bolognesi. Chiquián	3338	hedgerows, trail edges	20 May 2016	T. Mione, S. Leiva G. & L. Yacher 872 not pressed, seeds only
Bolognesi. highway Pativilca - Recuay, 10 9' 47" S, 77 20' 16" W	3645	steep roadside	15 Jun 2005	T. Mione, S. Leiva G. & L. Yacher 728 digital photos only, not pressed
Recuay. Bosque de Pararín	2800– 3000	bosque	24 May 1988	N. Valencia 2168 (NY)
Recuay. km 110 road from Lima to Huaraz, 19.7 km N of Cajacay, 77.3 W, 10.2 S	3600	growing among <i>Opuntia</i> and shrubs	3 Apr 1999	D. M. Spooner et al. 7359a (BH, MOL, P)

Recuay. km 107 between Recuay and Pativilca	3300	moist ravines	30 Jan 1983	M. Dillon et al. 3178 (BH, F)
Recuay. ca. Laguna Conococha, km 107 (Pativilca-Recuay)	3500	quebrada de arbustos	17 Nov 1995	S. Leiva G. 1738 (HAO)
Recuay. Culquimarca (Pativilca-Conococha)	3600	en ladera de arbustos	27 May 1970	A. López M. et al. 7601 (US)
Aija. En la bajada de Tranca hacia Huayán	3000–3200	no data	23 Apr 1983	C. Ochoa & A. Salas 15,168 (F)
Aija. 7 km E of town of Aija, canyon San Juan (containing Río San Juan), at Cuesta de Melliso, 77.6 W, 9.8 S	2945	on a rocky slope with grasses, <i>Calceolaria</i> , <i>Solanum hirsutum</i>	1 April 1999	D. M. Spooner et al. 7352c (MOL)
Aija. 6 km down from Aija 9 48' 18" S, 77 36' 18" W	3309	along river and edge of agricultural field	14 Jun 2005	T. Mione, S. Leiva G. & L. Yacher 726 T. Mione, S. Leiva G. & L. Yacher 863
Aija. Road from Aija to Huarney	3474	roadside	20 May 2015	S. Leiva G., T. Mione & L. Yacher 5892 (HAO)

1. In the protologue the type locality is given as “Prov. Cajatambo, dep. Ancachs: Ocros 3200-3400 m.” On modern maps Ocros is the capital town of the province Ocros, at the south end of the department of Ancash, while province Cajatambo is at the north end of the department of Lima, just south of the department of Ancash.

2. from the protologue.

Table 2. Comparison of *Jaltomata* species most similar to *J. ajana*. All three species are shrubs having 10-lobed corollas (the lobes and lobules alternating), purple anthers, unpigmented floral nectar (in the field) and orange fruits.

Character	<i>J. ajana</i> Mione & S. Leiva	<i>J. bicolor</i> (R. & P.) Mione	<i>J. biflora</i> (R. & P.) Benítez
Distribution	Peru: Department Ancash	Peru: Departments Lima, Huancavalica, and Moquegua	Peru: Department Junín
Altitude (m)	2800–3970	2100–3800	2700–3200
Corolla color	green	proximal 2/3 intensely purple, distal 1/3 green	green
Corolla shape	straight-tubular	urceolate-tubular	urceolate
Indument of external face of corolla tube	unpigmented	purple	unpigmented
Radial thickenings in corolla ¹	no	no	yes
Nectar (floral) color when plants are cultivated	clear, turning orange with age ²	no data	clear, turning orange with age ³
Fruit, at maturity, hidden by calyx?	upper ¼ to 1/2 of fruit hidden by calyx	no	upper ¼ to 1/3 of fruit hidden by calyx
Fruit size (mm)(measured in the field, not cultivated)	9 x 13.5 11 x 13	8.5 x 18	11 x 16
Seeds per fruit (fruits collected in the field)	206	196, 216	119, 161, 166
Fruits eaten by humans	no data	Yes ⁴	Yes ⁴
Synonyms and page number(s) in Macbride (1962)	<i>Hebecladus weberbaueri</i> Dammer, p. 40	<i>Hebecladus bicolor</i> (R. & P.) Miers, p. 30; <i>Atropa biflora</i> R. & P., p. 30; <i>H. intermedius</i> Miers, p. 35.	<i>Saracha biflora</i> R. & P., p. 31
Authors' collection numbers	625, 627, 726, 728, 863, 870, 871, 872	612, 617, 795, 880	608, 876

1. A subset of species of section *Hebecladus* have radially oriented thickenings that extend from the base of each stamen toward the corolla lobule (or where the lobule would be if present); where present, these create troughs (between radial thickenings) that hold nectar at the base of the corolla.

2. Jamie Kostyun, personal communication (2013), from observations on cultivated plants.

3. Mione et al., (2001).

4. Leiva González et al., (2016a, pp. 49–50) and fieldwork by the authors.