

## **Additions to the Crassulaceae of the State of Veracruz, Mexico**

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## ADDITIONS TO THE CRASSULACEAE OF THE STATE OF VERACRUZ, MEXICO

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**Abstract:** During the ongoing studies of the Crassulaceae family for the Flora of Veracruz (Mexico), we found two new species of Crassulaceae (*Echeveria uxorium* and *Sedum jarocho*), and eight new records for the state: *Crassula connata* var. *connata*, *Echeveria bifida*, *E. coccinea*, *E. halbingeri*, *Sedum corynephyllum*, *S. ebracteatum*, *S. guatemalense*, and *Villadia patula*. Data on the distribution and habitat of each species are given.

**Keywords:** *Crassula*, Crassulaceae, *Echeveria*, floristics, *Sedum*, Veracruz, *Villadia*.

The state of Veracruz, located in the Eastern coast of Mexico, has a great topographical diversity ranging from sea level to more than 5000 m in altitude which provides vast environmental heterogeneity and consequently, supports a complex biological richness. The total number of angiosperms in the state of Veracruz is estimated to be 6869 spp. (Villaseñor 2003), surpassed only by Oaxaca and Chiapas. Although Veracruz is among the most deforested states in Mexico it is also fortunate to be very well collected (Sosa & Dávila 1994) and, is still an important reservoir of taxonomic novelties as well as new records (e.g. McMillan et al. 2006; Senterre & Castillo-Campos 2008; Cházaro et al. 2008; Castillo-Campos et al. 2009; Jimeno-Sevilla et al. 2010). Identification of recent collections and herbarium specimens during the ongoing studies of the Crassulaceae for the Flora of Veracruz as well as the inventory of the species of *Echeveria* for that state (Jimeno-Sevilla 2008), have revealed the presence of two taxonomic novelties and eight native species of Crassulaceae that have not been reported in previ-

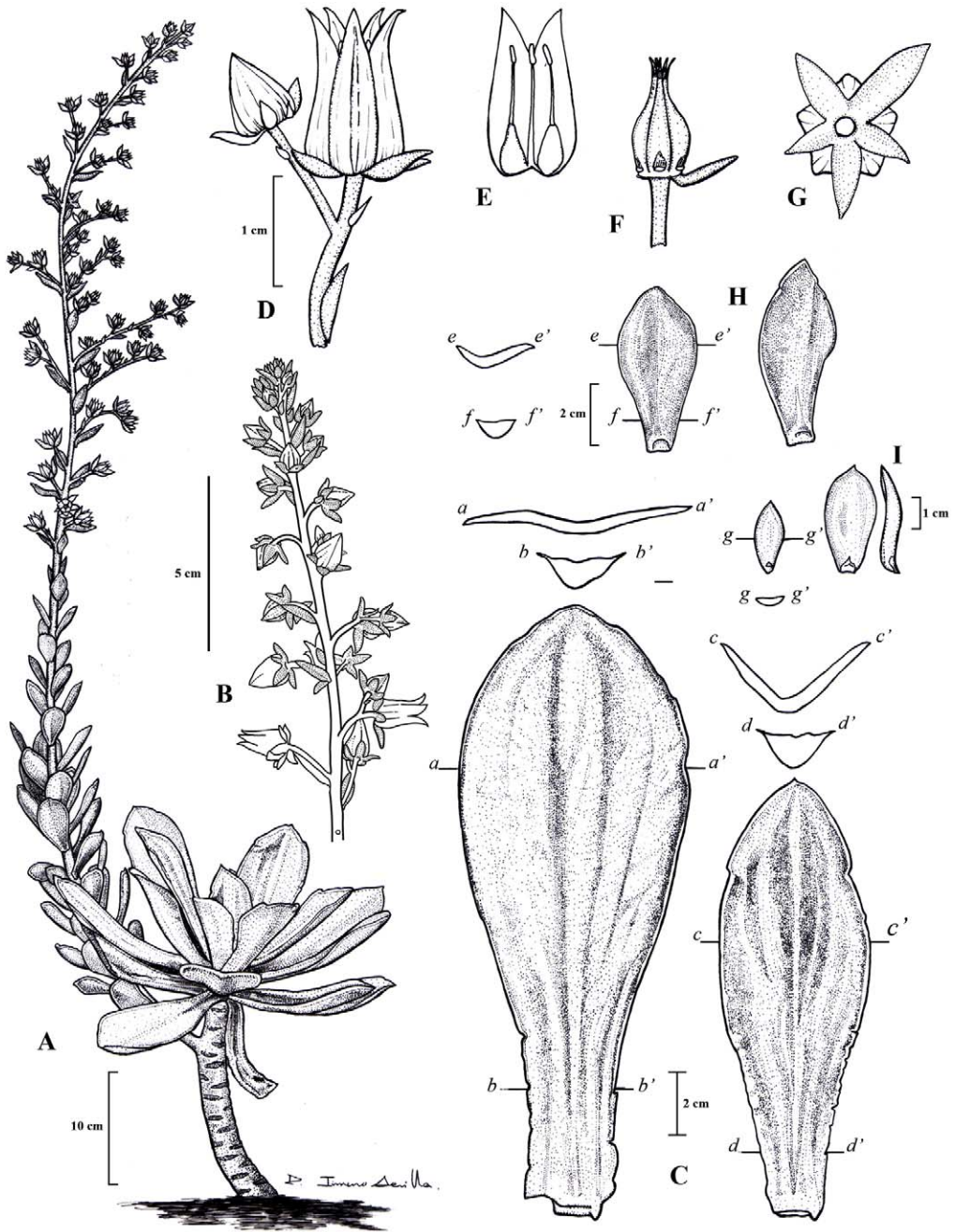
ous taxonomic treatments or the floristic list for the state (Meyrán & López 2003; Pilbeam 2008; Sosa & Gómez-Pompa 1994)

### TWO NEW SPECIES

*Echeveria uxorium* JIMENO-SEVILLA & CHÁZARO sp. nov. (Figs. 1, 2, 3).

*Planta perennis, glabra, caulescens, caulibus ad 15–45 cm longis, folia oblanceolata ad oblanceolata-obovata, viridis valde, margo pallide lutea; inflorescentia racemosae, thyrsiformis vel subracemosae, usque ad 48 ramus; bracteis oblanceolata ad oblanceolata-obovata; pedicellis 4–12(–20) cm longis, bracteolatis; sepala ad basem connata, lanceolata, acuminata, inaequalia, 4.0–13.5 mm longis, corolla conoideis 9–15 mm longis, 9 mm diametro basi, pentagonalibus, petalis lanceolata 9–15 mm longis, 3.8 mm latis, apice acuminata, rubens-armeniacus, pruinosa, intus lutea. Nectar-ia 1.8 mm latis pallide lutea.*

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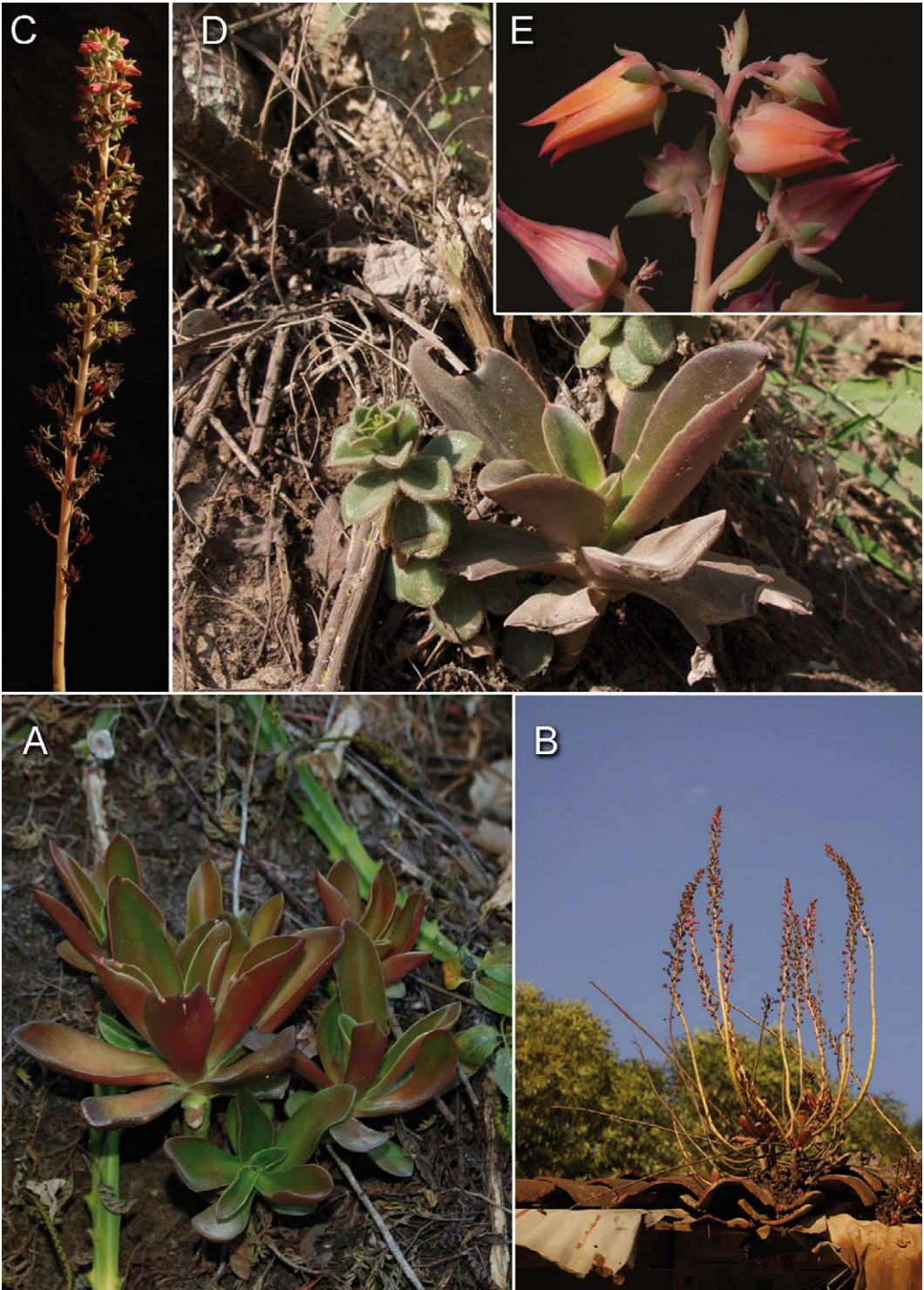


**Figure 1.** *Echeveria uxorium*; A. Plant with inflorescence; B. Details of the inflorescence apex; C. Leaves, upper side and transverse cuttings; D. Flower; E. Corolla lobes with stamens; F. Carpels; G. Flower, inferior side. Based on D. Jimeno-Sevilla, M. Cházaro & A. Albalat 245 (IEB).

**Type:** MEXICO. Veracruz, Municipality of Amatlán de los Reyes. Summit of the hill Rostro Divino 2 km NE of the bus Terminal of Cordoba city. Limestone rocks with East exposure. 18°52'42"N, 96°54'18"W, 843 m, 1 Aug 2006. D. Jimeno-Sevilla, M. Cházaro & A. Albalat 245. (Holotype: IEB. Isotypes: IBUG, MEXU, XAL).

**Paratypes:** MEXICO. Veracruz, Mun. Zongolica, along the road between Acontla towards Apanga, on rocky talus, at roadside 18°38'56.54"N, 96°59'25.1"W, 1280 m, 9 Mar 2009, D. Jimeno-Sevilla, J. Viccon, T. Krömer & G. Sánchez 1082 (IEB, MEXU, XAL); Street Ignacio Zaragoza at Zongolica village, on roof tiles, 10 Mar 2009, D. Jimeno-Se-





**Figure 2.** *Echeveria uxorium*. A., B., and D. Habit; C. Inflorescence; E. Details of the inflorescence. All photos by D. Jimeno-Sevilla.

*villa*, J. Viccon, T. Krömer & G. Sánchez 1083 (IEB, MEXU, XAL).

Perennial herbaceous plant, glabrous, caulescent;

solitary or forming individual clumps; fibrous roots; stem 15–45 cm long or more, 4 cm diameter; rosette 8–20(–30) cm in diameter, with 13–18 leaves, some-

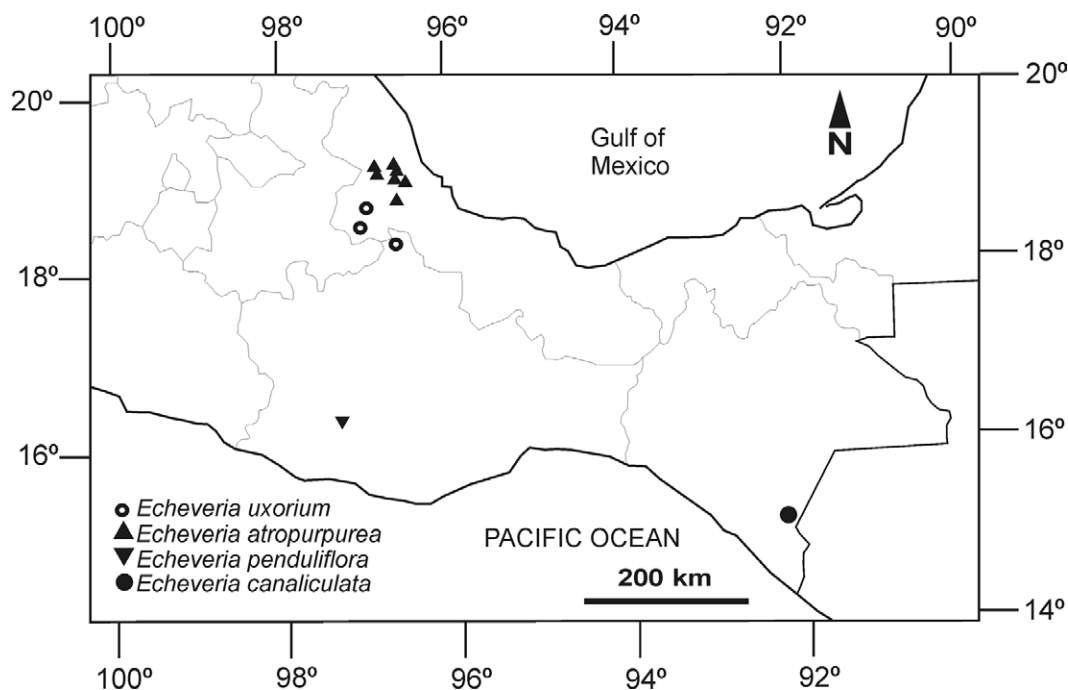


Figure 3. Distribution of *Echeveria uxorium* and related species.

what lax; **leaves** oblanceolate to oblanceolate-obovate, with entire margin, and lacerate to undulate toward the base, 13–19 cm long by 5.7–7.2 cm wide, 4 mm thick, with the upper side flattened to cuneate, channeled, with the underside convex, with a somewhat rounded keel, intense green color fading to yellow at the rims, apex acuminate with a small notch, 1.5 mm, reddish; **inflorescences** in racemes usually in a thyriform arrangement, with several branches (up to 48); floral stem 1, lateral, length of the peduncle up to the first branching 41–65 cm, total length of peduncle up to 97 cm, diameter of the base 1.7 cm, brilliant green, number of flowers per cincinnus 1–8, total number of flowers to 60; leaves of the floral stem to 59, alternate, ascendant, oblanceolate to oblanceolate-obovate, shattering, convex and keeled underside, and concave upper surface, to 8 cm long and 3.4 cm wide, 5 mm thick, deep green, fading to yellow at the margin, apex oblique acuminate to round, mucronate; bracteoles lanceolate to oblanceolate-obovate, spurred, shattering, convex on the underside and concave on the upper side, to 3.5 cm long and 16 mm wide, acuminate apex, mucronate, pedicels 4–12(–20) mm long and 2.5 mm in diameter, green color, usually with 2 bracteoles; calyx of 5 sepals slightly united at base, lanceolate, acuminate, unequal, erect, convex on both sides, the largest 13.5 mm long and 6 mm wide, the smallest 4 mm long and 3 mm wide, green color; corolla conoid, 9–15 mm long and 9 mm wide in the base, forming a tube 2.3 mm long, pentagonal; petals 5, lanceolate, to 9–15 mm long and 3.8 mm wide, keeled, somewhat pruinose, apex acuminate, external color reddish-orange, internal color yellow with the margin and apex reddish, with nectarial cavity conspicuous; stamens

10, of which the 5 epipetalous stamens are 8 mm long, and the 5 antepetalous stamens 10 mm long, cream color, with anthers yellow; nectaries inconspicuous, reniform, 1.8 mm wide, pale yellow; ovary superior, 5 free carpels, each 6 mm high and 2.3 mm wide; style 3 mm long, reddish; **follicles** ascendant, reddish brown, with numerous seeds.

**Distribution and habitat.** This species is so far known only from the states of Oaxaca and Veracruz, in the latter from the region of Córdoba, where it has been located growing at the summit of three small limestone (karstic) hills, on rocky outcrops, at an elevation of 850 m. The climate in the region it is semi-hot and humid, with rainfall in summer, influenced by trade winds (ca. 2000 mm annual precipitation) (Soto 1986), the vegetation being tropical subdeciduous forest (sensu Rzedowski 1978) or medium-sized subperennial forest (sensu Miranda & Hernández 1963). This type of vegetation is unusual for the genus. Some floristic elements of this locality are: *Plumeria rubra* L., *Cnidoscolus multilobus* (Pax) I.M. Johnston, *Protium copal* (Schl. & Cham.) Engl., *Agave gomezpompae* Cházaro & Jimeno-Sevilla, *Vil-lasenorria orcuttii* (Greenm.) B.L. Clark, *Hechtia purpusii* Brandegee, and *Yucca elephantipes* Regel. In the Zongolica region it grows on the tiles of the roofs of houses in the village of Zongolica, as well on rocky talus at the roadside ca. 2 km SSE of Zongolica, at an altitude of 1300 m, in the cloud forest, the regional climate being temperate-humid, with summer rains (Soto 1986) thriving with *Quercus* spp., *Agave obscura* Schiede, *Bocconia frutescens* L., and *Talauma mexicana* (DC.) Don.

Although no herbarium specimens were examined from the state of Oaxaca, Pilbeam (2008) presents a

		<i>Echeveria uxorium</i>	<i>Echeveria canaliculata</i> *	<i>Echeveria penduliflora</i> **	<i>Echeveria atropurpurea</i> ***
<b>Rosette</b>	diameter (cm)	30	—	28	40
	no. of leaves	18	13	—	19
<b>Stem length (cm)</b>		45	short	30	More than 25
<b>Leaves</b>	Outline	oblanceolate, oblanceolate-obovate	oblong	oblong-oblanceolate	oblong-oblanceolate
	Hairiness	glabrous	glabrous	glabrous	pilose
	Length (cm)	19	10–15	14	7–21
	Width (cm)	7.2	—	4	1.5–4
	Color	Green intense Fading to yellow	glaucous, tinged with purple	Green	Green to purple
<b>Bracts</b>	shape	oblanceolate, oblanceolate-obovate	oblong	obovate-oblong	oblong-oblanceolate spurred
	length (cm)	8	—	5	7.3
	width (cm)	3.4	—	1.5	1.7
	apex	oblique acuminate to roundish, mucronate	acute	acute	acute
<b>Floral stem length (cm)</b>		97	35–50	30	77
<b>Flower arrangement</b>		erect	erect	pendulous	erect
<b>Inflorescence</b>	type	racemose to thyrsiform	racemose	racemose, unilateral	racemose
	No. of branches	Up to 48	no branches	no branches	no branches
	No. total of flowers	60	22	60	14
<b>Corolla</b>	Diameter (mm)	9	—	9	8
	Length (mm)	13	25	13	14
<b>Calyx</b>	Sepal position	erect		erect	flattened
	symmetry	unequal	flattened-reflex, subequal	unequal	subequal
	shape	lanceolate, acuminate	linear-lanceolate	linear-deltoid	oblanceolate
	length (mm)	4–13.5	—	6	5–7.5
	width (mm)	3–6	—	—	3–4
<b>Type of vegetation</b>		tropical subperennial forest and cloud forest	—	xerophytic scrub (Pérez Calix & Franco 2004)	tropical deciduous forest
<b>Flowering time</b>		June–March	April	—	July–January
<b>Distribution</b>		central Veracruz and northeast Oaxaca	Motozintla, Chiapas?	Ejutla, Oaxaca	central Veracruz
<b>Altitude (m)</b>		843–1300	1200	1200–500	437–642

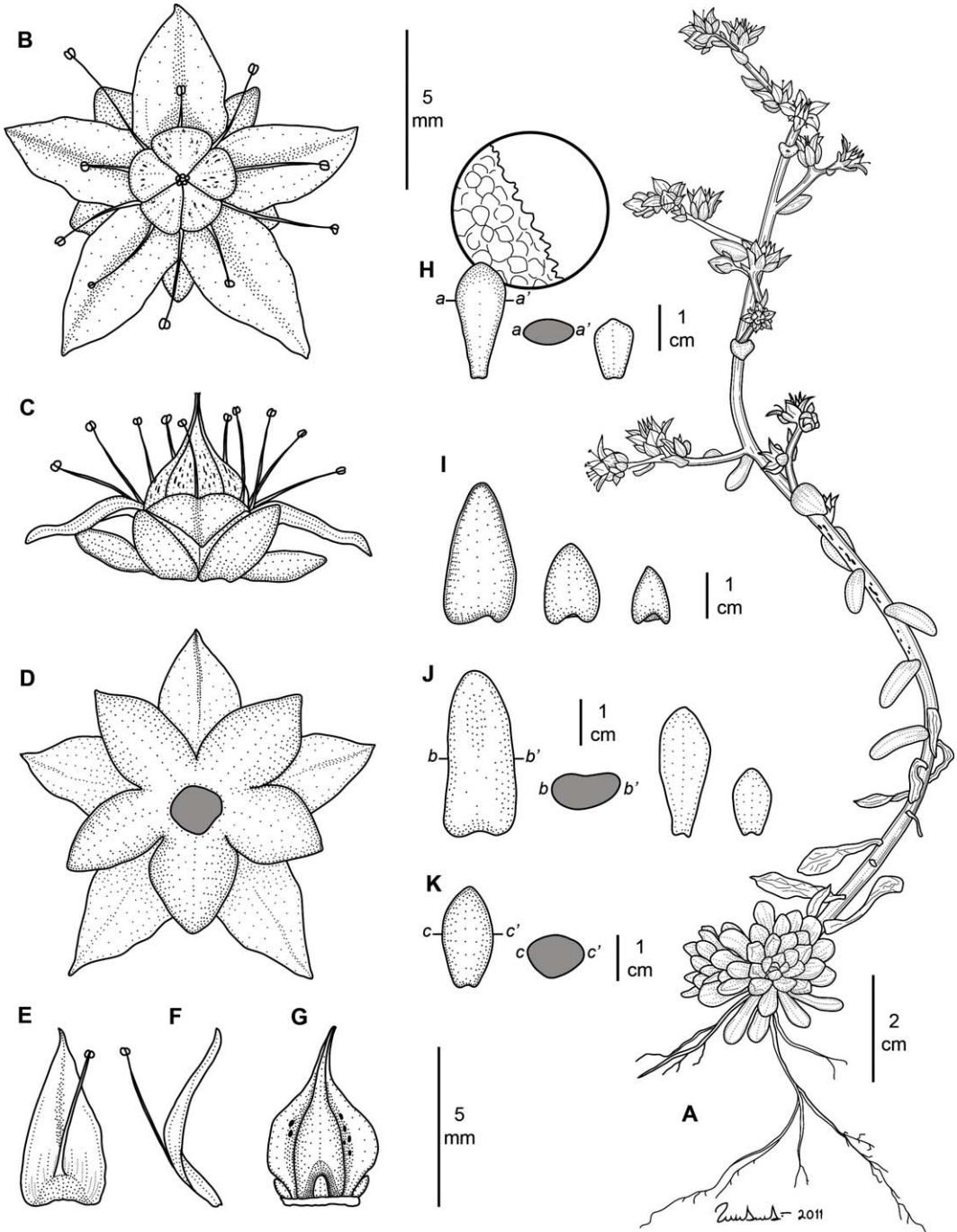
\*The measurements of *Echeveria canaliculata* were taken from Walther (1972).

\*\*The measurements of *Echeveria penduliflora* were taken from Walther (1958).

\*\*\*The measurements for *Echeveria atropurpurea* were obtained from Jimeno-Sevilla & Albalat-Botana (2011).

**Table 1.** Comparison of distinctive morphological characters, phenology and distribution of *Echeveria uxorium*, *E. penduliflora* E. Walther, *E. canaliculata* Hoof. f. and *E. atropurpurea*. (Baker) E. Morren.





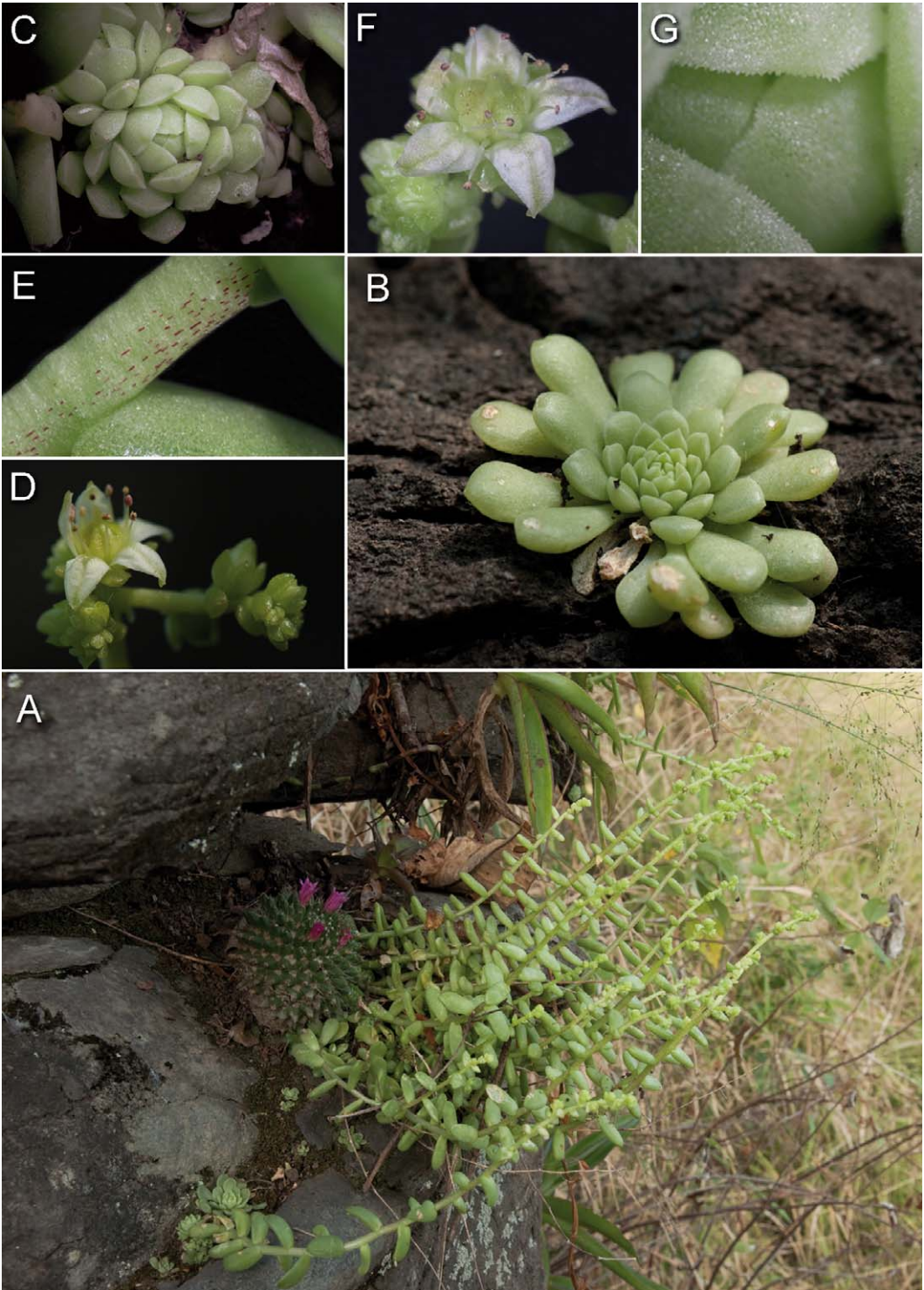
**Figure 4.** *Sedum jarocho*. A. Habit; B. Flower; C. Flower in lateral view; D. Flower inferior view; E. Petal; F. Petal in lateral view; G. Carpels; H. Leaves, transversal cutting and detail; I. Bractlets; J, K. Bracts and transversal cutting. A-J Based on D. Jimeno-Sevilla 1335 (XAL), K based on D. Jimeno-Sevilla & A. Albalat 420 (XAL).

photograph of a plant from La Margarita, north of the dam Miguel Alemán, misidentified as *Echeveria canaliculata* Hook. f. Due the similar ecological conditions, *E. uxorium* likely also occurs in the state of Puebla. Expeditions should be carried it out to the SE corner of that state (Fig. 3).

**Phenology:** *Echeveria uxorium* blooms and sets

fruit from June to March.

**Etymology:** The species name *uxorium* (the Latin word meaning “of a wife”) acknowledges and recognizes the unconditional help of Mrs. María Patricia Hernández de Cházaro, wife of the second author, who for many years was a companion and assistant in the task of collection and pressing plants, and



**Figure 5.** *Sedum jarocho*. A. Habit; B. Rosette; C. Bud; D. Detail of inflorescence; E. Detail of peduncle; F. Flower; G. Detail of young leaves showing the pubescence. All photos by D. Jimeno-Sevilla except B by P. Carrillo-Reyes.

who photographed them throughout the state of Veracruz, and likewise acknowledges Biologist Amparo Albalat Botana, wife of the first author, who works

with great enthusiasm and dedication in the field of applied botany.

Walther (1972) places the robust species with in-



florescences in equilateral racemes, with long bracteolate pedicels and with a conspicuous stem, in the series *Elatae* E. Walther, which contains the species *Echeveria atropurpurea* (Baker) Ed. Morren, *E. bicolor* (Kunth) E. Walther, *E. canaliculata* Hook. f., *E. cuencaensis* Poelln., *E. penduliflora* E. Walther, and *E. venezuelensis* Rose. On the other hand, Kimnach (2003) placed them in the series *Nudae* E. Walther. Moran (1974) and Meyrán & López (2003) consider a more ample criterion for the series *Racemosae* (Baker) Berger, including also the species of the series *Elatae*. However in phylogenetic studies based on DNA sequences (Carrillo et al. 2009), series *Racemosae* and *Nudae* are not shown as natural groups, although it must be pointed out that the majority of species placed in these series have yet to be tested in this kind of analysis.

Until future phylogenetics studies on *Echeveria uxorium* are carried out, in the meantime we placed it in the series *Racemosae* (Baker) Berger, following the criteria of Moran (1978) and of Meyrán & López (2003). Since *E. uxorium* presents an equilateral racemose inflorescence with long and bracteolate pedicels, it has affinities with *E. penduliflora*, *E. atropurpurea* and *E. canaliculata*, due to the caulescent habit and a somewhat lax rosette. However, it differs in the form of the rosette leaves and the floral bracts, as well in the vegetation type (see Table 1). A unique character within the series *Racemosae* is an inflorescence generally thyriform with numerous branches; this trait could cause confusion with members of the series *Gibbiflorae* (Baker) Berger, however the branches do not form cincinni and the superior portion shows an equilateral raceme, a fact that does not occur with other members of the series.

It is very likely that the illustration of *E. canaliculata* shown by Pilbeam (2008, figures 48 and 49), from material collected at La Margarita north of the dam Miguel Alemán, in the state of Oaxaca, in fact could be *E. uxorium*. The inflorescence can be clearly distinguished as thyriform with branches at the base, as well oblancoolate leaves with yellow margins. Unfortunately we did not have a chance to go there and verify this possible identity in living material, nor did herbarium material exist from this locality to confirm our suspicion.

***Sedum jarocho* P. CARRILLO & JIMENO-SEVILLA sp. nov.** (Figs. 4, 5, 6)

*Planta herbacea perennis, succulenta, diffusae pubescens, trichomae triangularis ad 0.15–0.2 mm longa, rosulae folia 10–40 laxae disposita vel spiraliter, obovatis vel spatulatae, 9–13 mm longis, inflorescencia paniculata ad 29 cm longis, erectis vel decumbentis, ramis 4–7 late divaricatis ad 8.8 cm longis, 3 ad 11 flores habent, flores sessiles vel subsessiles, petalae (4)5, alba, 3.5–4.0 mm longa, carpella 5, glabra, 3.2–4.0 mm longa, ad basem cavata. Taxon novum ad sectio Sedastrum pertinens; S. hemsleyanum DC. affinis.*

**Type:** MEXICO. Veracruz, Mun. Emiliano Zapata, parte alta de la cascada de Cerro Gordo, 19°26'55"N, 96°41'13"W, 420 m, 4 Nov 2007, P. Carrillo-Reyes & D. Cabrera-Toledo 5245. (Holotype IEB; isotype XAL).

**Paratypes:** MEXICO, Veracruz, Mun. Actopan, 5 km al N de Mozomboa, 11 Nov 1996, G. Castillo et al. 16067 (XAL); Mun. Actopan, Sierra de Manuel Díaz, 19°32'36"N, 96°26'17"W, 1 Apr 1998, G. Castillo et al. 17560 (XAL); Mun. Actopan, La Raja del Chalahuite, base del Cerro Manuel Díaz, 150 m, 29 Dec 1995, M. Cházaro et al. 7595 (IBUG, IEB, XAL); Mun. Comapa, Barranca de Panoaya, entre Dos Caminos y Tlacotepec de Mejía, 500 m, 1 Jan 1993, M. Cházaro & R. Acevedo 7051 (IBUG, MEXU); Mun. Emiliano Zapata, camino de Cerro Gordo hacia Xoltepec, pasando el río, 19°27'10"N, 96°41'23"W, 26 Oct 2008, D. Jimeno et al. 509 (XAL); Mun. Emiliano Zapata, A 20 m al N de la carretera entre Cerro Gordo y Plan del Río, sobre afloramientos rocosos. 19°25'24.06"N, 96°40'42.95"W, 513 m, 20 Oct 2010, D. Jimeno & R. Castro 1335 (IEB, MEXU, XAL); Mun. Emiliano Zapata, La Cañada, al NW del Poblado de Plan del Río, 19°25'05"N, 96°39'08"W, 364 m, 12 Aug 2007, D. Jimeno & A. Albalat 418 (XAL). Mpio Jalcomulco, 1.5 km al NW de Jalcomulco, 19°20'9"N, 96°46'29"W, 17 Jun 1993, G. Castillo et al. 17889 (XAL); Mun. Paso de Ovejas, Baños sulfurosos cerca de Acazónica, cañada cercana al río, 300 m, 20 Nov 1991, H. Oliva & F. Ramón 1000 (CORU, MEXU) *idem*, 25 Oct 2007, D. Jimeno & A. Albalat 420 (XAL); Mun. Puente Nacional, Rinconada, 60 m, 12 Jan 1973, R. Hernández y J. Dorantes 1782 (F, XAL); Mun. Puente Nacional, Tamarindo, sobre peñas, 100 m, 7 Dec 1979, F. Ventura 16662 (CAS, MEXU); Mun. Puente Nacional, barranca de Santa María Tetetla, 600 m, 30 Dec 1986, M. Cházaro et al. 4345 (IBUG, XAL); Mun. Puente Nacional, 2 km al SE de Camaroncillo, cerca del nacimiento de agua de azufre., 19°13'N, 96°41'W, 325 m, 11 Dec 1985, M.E. Medina & M. Ortiz 725 (XAL); Mun. Puente Nacional, Chichicaxtle, 50 m, 10 Dec 1976, F. Ventura 13727 (MEXU); Mun. Tenampa, Barranca de Mayatla, Rancho Belreguard de Sochipa, 19°16'58"N, 96°48'44"W, 26 Apr 2008, D. Jimeno & A. Albalat 445 (XAL); Mun. Teocelo, 1 km al S de Llano Grande, 19°21'37"N, 96°53'3"W, 24 Jun 1998, G. Castillo, S. Avendaño & R. Palestina 17997 (XAL); Mun. Tlaltetela, Barranca de Xopilapa, vereda de Buena Vista a Xopilapa, 19°17'17"N, 96°46'49"W, 19 Oct 2008, D. Jimeno & M. Cházaro 459 (XAL).

Perennial herb, rosettes, bracts and sepals sparsely pubescent, pubescence of hyaline hairs 0.15–0.20 mm long. Rosettes sessile or nearly so, densely arranged at the base. **Leaves** 10–40, rosulate, crowded, spiraled, deltoid when young, obovate to spatulate at maturity, 9–13 mm long, 4–6 mm wide and ca. 2.7 mm thick, apex rounded, papillose. **Floriferous stems** erect or decumbent, 6–39 cm long, 2–6 mm in diameter at the base, glabrous, non-papillose. In-

	<i>S. jarocho</i>	<i>S. hemsleyanum</i>
Shape of leaves	obovate to spatulate	oblanceolate to obovate
Floral stems	glabrous	papillose
Shape of bracts	oblong-lanceolate, spatulate or elliptic	oblanceolate
Vegetation type	tropical deciduous forest	xerophytic scrub and tropical deciduous forest
Altitude (m)	50–800	1150–2350

**Table 2.** Comparative table of distinctive characters between *Sedum jarocho* and *S. hemsleyanum*.

florescence a panicle, peduncle 4.9–29 cm long with 4–14 secondary thyrsoid branches, to 8.8 cm long, each branch with 3–8(–11) flowers in cincinni to 35 mm long; bracts oblong-lanceolate, spatulate or elliptic, 1.9–26.5 mm long, 1.2–11.4 mm wide and 4–7 mm thick; bractlets deltoid, ovate to ovate-lanceolate, 0.7–1.5 mm long, 0.8 mm wide and 5–8 mm thick. **Flowers** sessile to subsessile, pedicel ca. 1.5 mm long, 0.7 mm in diameter, with a fetid odor; calyx with (4–)5 subequal lobes, the lobes deltate, triangular, to ovate or elliptic, 2.0–3.7 mm long, 1.8–2.7 mm wide at the base, apex obtuse; **corolla** glabrous, with (4–)5 free white to greenish white petals, these ovate to lanceolate, 3.5–6.5 mm long, ca. 2.9–4.0 mm wide in the widest part; **stamens** (8–)10, glabrous, (4–)5 of them opposite and adnate to the petals (at 1.2 mm above the base of the petals), 3.8 mm long, the other (4–)5 stamens alternate to the petals, 5.0–5.4 mm long; filaments white; anthers pinkish when predehiscent, suborbicular, 0.4 mm long, ca. 0.5 mm wide, pollen yellow; nectaries lanceolate, ca. 0.5–0.9 mm long, 0.3 mm wide, carpels glabrous, vesiculose, whitish green with reddish dots, 3.2–4.5 mm long including the style, with a concavity at the base where nectarial scale is placed, styles 1.1–1.5 mm long, terete. **Follicles** containing numerous seeds. Seeds 0.45–0.5 mm long, ca. 0.2 mm wide, reddish brown.

**Distribution.** *Sedum jarocho* is endemic to the canyons of the eastern slopes at the end of the Trans-Volcanic Belt in the central part of the state of Veracruz (Fig. 6). It occurs at elevations from 50 to 800 m in volcanic outcrops in tropical deciduous forest. This habitat has a high floristic diversity with a noticeable representation of succulent plants. *S. jarocho* occurs mostly on rocky sites with difficult access, which has helped to maintain the species relatively well preserved. (Castillo-Campos et al. 2007). Some floristic elements of the localities where *S. jarocho* occurs are: *Agave*, *Combretum*, *Comocladia*, *Croton*, *Dioon edule* Lindl., *Eugenia hypargyrea* Standl. *Euphorbia calcarata* (Schltdl.) V.W. Steinm., *Hechtia myriantha* Mez, *Mammillaria sartorii* J.A. Purpus, *Neobuxbaumia*, *Plumeria rubra* L., and *Ruprechtia chiapensis* Lundell, *Yucca*.

**Phenology.** Flowering from October to January. Fruiting from December to March.

**Etymology:** The specific epithet *jarocho* has an unknown origin; apparently it comes from old Spanish and was used during colonial times to refer to people of black ancestry. Today, it is proudly used to

designate persons, items, and music from the state of Veracruz (Aguirre-Beltrán 1989).

Based on the presence of dense basal rosettes, stems dying back after flowering, paniculate inflorescences, and flowers with very thin white petals and a nectarial concavity in the base of each carpel, *Sedum jarocho* is clearly a member of section *Sedastrum* (Clausen 1943; Uhl 1992). This section contains about six species (Pérez-Calix 1998; Carrillo-Reyes & Lomeli-Senci6n 2008). Although *Sedum jarocho* has not yet been included in any phylogenetic analysis, based on its morphological features, its closest relative seems to be *S. hemsleyanum* DC., with which it shares many morphological characters and with which it has been largely confused. In fact, J.N. Rose realized differences between the two taxa and attempted to publish it as a distinct species (Clausen 1959: 234), but apparently he did not. Among the shared characters of *Sedum jarocho* and *S. hemsleyanum*, are the small size of the rosettes and the erect to decumbent inflorescences with narrow bracts. However, *S. jarocho* can be separated by its glabrous inflorescences and its spatulate leaves. Additionally, those species are geographically and ecologically separated: *Sedum jarocho* occurs only in the state of Veracruz, on cliffs in tropical deciduous forest ranging from 50 to 800 m, while *S. hemsleyanum* is widely distributed in central and Southern Mexico along the Trans-Mexican Volcanic Belt and the Sierra Madre del Sur (Fig. 6). *S. hemsleyanum* grows in tropical deciduous forests and xerophytic scrubs at elevations from 1150 to 2350 m (Clausen 1943) (Table 2). In the state of Veracruz, *S. hemsleyanum* is known only from the regions of Orizaba and Perote and is not sympatric in any locality with the new species. In Appendix 1 a selected list of examined specimens of *Sedum hemsleyanum* used for morphological comparison is given.

## EIGHT NEW RECORDS

The following species are reported for first time in the state of Veracruz:

### 1. *Crassula connata* (RUIZ & PAVON) BERGER var. *connata*

Specimens examined: MEXICO, Veracruz, Mun. Calchualco, 1 km al W de Jacal, hacia la cima del Pico de Orizaba, 19°06'24.8"N, 97°13'46.3"W, 3163 m, 6 Feb 2009, D. Jimeno-Sevilla et al. 916 (IEB, MEXU, XAL, XALU).

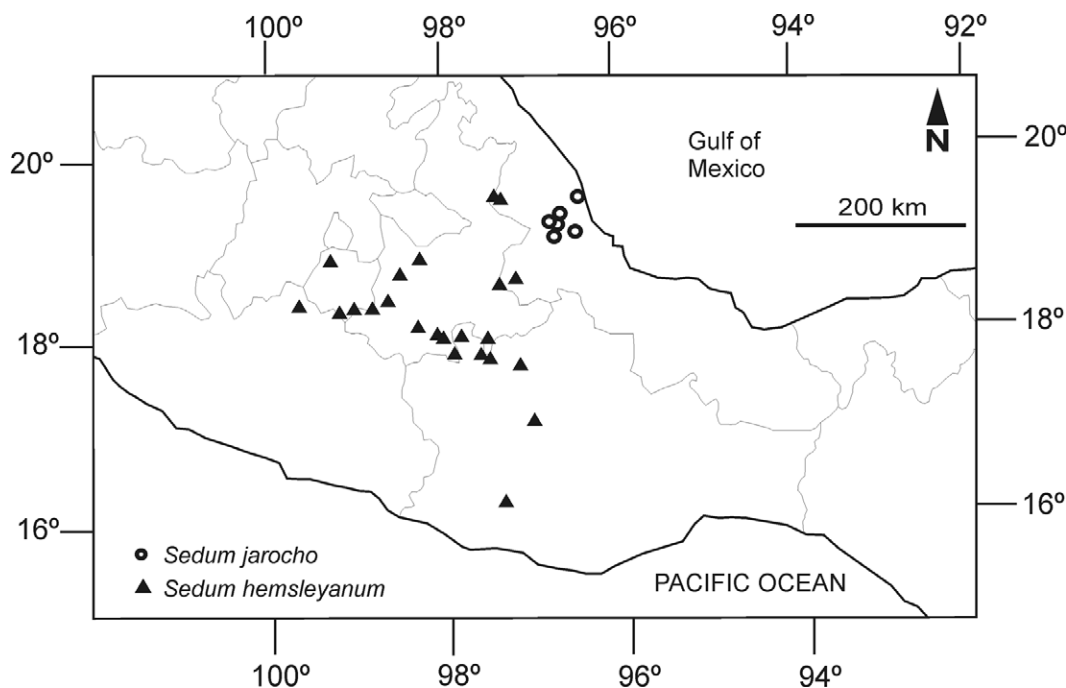


Figure 6. Distribution of *Sedum jarocho* and *S. hemsleyanum*.

Previously known from USA (California), Guatemala, Colombia, Ecuador, Peru, Bolivia, Argentina, Chile and Mexico (Baja California, Hidalgo, and the state of Mexico) (Bywater & Wickens 1984; Meyrán & López 2003).

This is a widely distributed species in the New World, however, due its small size and annual habit, its presence might have been unnoticed (overlooked) by most botanical collectors and consequently is poorly represented in Mexican herbaria. At Calchualco municipality, *Crassula connata* var. *connata* was found in crevices of volcanic rock on the hills of the Orizaba Volcano associated with *Beschorneria yuccoides* K. Koch, *Echeveria mucronata* Schtdl., *Pinus bartwegii* Lindley, *Sedum praealtum* DC., and *Vaccinium* sp. The new population seems to be restricted to a very limited area, where it is locally abundant, forming dense mats. Unfortunately we failed to locate other populations in surrounding areas. At the collection time (February 6, 2009) the plants were dry with only fruits and seeds.

**2. *Echeveria bifida* SCHLETDL.**

Specimens examined: MEXICO, Veracruz, Mun. Huayacocotla, al E de la barranca de Santiago, L. Cabrera & H. Narave 178, 179, 180, 181 (XAL); Mun. Huayacocotla, Ojo de Agua, Barranca de Santiago, 20°26'58"N, 98°32'40"W, 1978 m, D. Jimeno & A. Albalat 265 (IEB, XAL, MEXU); Mun. Huayacocotla, Paraje Ojo de Agua Grande, Barranca de Santiago, 20°25'45"N, 98°32'33"W, 1812 m, D. Jimeno-Sevilla & A. Albalat 271 (IEB, XAL, MEXU).

Previously known from the states of Querétaro and Hidalgo (Pérez-Calix, 2008). Meyrán & López (2003) cited this species from the Atexcac Lagoon

area, in the state of Puebla, close to the Veracruz border, however, this is a mistaken report based on *Echeveria heterosepala* Rose (Jimeno-Sevilla 2008).

**3. *Echeveria coccinea* DC.**

Specimens examined: MEXICO, Veracruz, Mun. Acultzingo, 1 km al N de Acultzingo, 18°43'42"N, 97°17'49"W, 1770 m, D. Jimeno-Sevilla, et al. 548 (XAL); Mun. Huayacocotla, Paraje El Salto, Barranca de Santiago, 20°26'39"N, 98°31'56"W, 1990 m, D. Jimeno-Sevilla & A. Albalat 261 (IEB, XAL, MEXU); Mun. Huayacocotla, Paraje Ojo de Agua Grande, Barranca de Santiago, 20°26'58"N, 98°32'40"W, 1978 m, D. Jimeno-Sevilla & A. Albalat 267 (IEB, XAL, MEXU).

Previously known from Guanajuato, Querétaro, Hidalgo, D.F., Tlaxcala, Puebla, Oaxaca, and Chiapas (Pérez-Calix, 2008).

*Echeveria coccinea* is perhaps the most widespread species of *Echeveria* in Mexico. It grows mostly in xerophytic scrub and unlike other species of Crassulaceae, appears to have no preference for a specific substrate. In the state of Veracruz, it has been found in two municipalities: in Huayacocotla, on slopes of volcanic rock along with *Agave lechuguilla* Torr., *Echeveria bifida* Schldtl., *Echinocactus* sp., *Hechtia* sp., *Mammillaria geminisipina* Haw., *M. longimamma* DC., *Pinus* sp., *Sedum ebracteatum* DC., and *Villadia jurgensenii* (Hemsl.) Jacobsen; and in Acultzingo on a limestone slope associated with *Agave* sp., *Mammillaria mystax* Mart. *Sedum lucidum* R.T. Clausen, *S. hemsleyanum* Rose, and *Tillandsia grandis* Schtdl.

**4. *Echeveria halbingeri* E. WALTHER**

Specimens examined: MEXICO, Veracruz, Mun.



Huayacocotla, Ojo de Agua Grande, Barranca de Santiago, 2 km al SW del poblado de Santiago, 20°29'39"N, 98°32'29"W, 1800 m, *D. Jimeno-Sevilla* & *A. Albalat* 268 (IEB, XAL, MEXU); Mun. Huayacocotla, Santiago, cerca del Río, *F. Otero* 4023 (MEXU); Mun. Huayacocotla, cuenca del Río Santiago, 5 km al W de Santiago, límite con Hidalgo, 20°26'54"N, 98°34'00"W, 1750 m, *A. Rincón* & *C. Durán* 1167 (XAL).

Previously known only from the state of Hidalgo (Walther 1972; Kimnach 2003).

In the new locality *Echeveria halbingeri*, grows on volcanic rocky slopes near annual streams with poor soil xerophytic scrub with *Agave striata* Zucc, *Mammillaria* sp., *Sedum ebracteatum* DC. and *Stenocereus* sp.

### 5. *Sedum corynephyllum* (ROSE) FRÖD.

Specimens examined: MEXICO, **Veracruz**, Mun. Huayacocotla, Ojo de Agua Grande, Barranca de Santiago, 2 km al SW del poblado de Santiago, 20°29'39"N, 98°32'29"W, 1810 m, *D. Jimeno-Sevilla*, *J. Viccon* & *L. Montoy* 654 (XAL).

Previously known from Guanajuato, Hidalgo, Querétaro and San Luis Potosí (Meyrán & López 2003; Pérez-Calix 2008).

*Sedum corynephyllum* occurs on limestone crevices in tropical subdeciduous forest and xerophytic scrub between 500–1500 m (Pérez-Calix 2008). In Veracruz it was found associated with *Agave striata* Zucc and *Cephalocereus senilis* (Haw.) Pfeiff. The new locality, at 1800 m of altitude seems to represent the highest collection known for this species. The type of *Corynephyllum viride* Rose, the basionym of this species, was collected by C.A. Purpus in 1904 in Eastern Mexico. Presumably these collections might have been made in Veracruz (Fröderström 1935), however, no confirmed collections from Veracruz were known before this report.

### 6. *Sedum ebracteatum* DC.

Specimens examined: MEXICO, **Veracruz**, Mun. Huayacocotla, Ojo de Agua, Barranca de Santiago, 1.5 km approx. al W del Poblado de Santiago, 20°26'39"N, 98°31'56"W, 1990 m, *D. Jimeno-Sevilla*, *J. Viccon* & *L. Montoy* 661 (XAL).

Previously known from Tamaulipas, Durango, Zacatecas, San Luis Potosí, Guanajuato, Querétaro, Hidalgo, Jalisco, Michoacán, Mexico State, DF, Puebla, Guerrero, and Oaxaca (Clausen 1943, 1959; Pérez-Calix 2008).

*Sedum ebracteatum* is a widely distributed species in the Central Mexican Plateau and adjacent areas, mostly on cliffs and in crevices between 1100 and 2300 m in altitude. It occurs mainly in xerophytic scrub and tropical deciduous forests (Clausen 1959; Pérez-Calix 2008). The occurrence of *S. ebracteatum* in Veracruz is not surprising. Probably it was not previously reported due the insufficient botanical exploration in the arid portion of the state, including Huayacocotla.

### 7. *Sedum guatemalense* HEMSLEY

Specimens examined: MEXICO, **Veracruz**, Mun. Coacoatzintla, entre El Aguacate y Cerro de La Magdalena, 19°43'23"N, 96°58'41"W, 2460 m, *P. Carrillo-Reyes et al.* 5433 (IBUG, IEB, MEXU, XAL); Mun. Coatepec, Camino entre Loma Alta y Mesa del Laurel, 19°30'45"N, 97°04'10"W, 2650 m, *P. Zamora C.* 2363 (XAL).

Previously known from Guatemala (Sololá) and México (Oaxaca and Chiapas) (Breedlove 1986; Meyrán & López 2003).

*Sedum guatemalense* is an epiphytic plant that occurs in the high cloud forests of Guatemala and Southern Mexico. In the municipality of Coacoatzintla, it was found associated with *Echeveria rosea* Lindl., *Nelsonianthus tapianus* (B.L. Turner) C. Jeffrey, *Peperomia* sp., and *Tillandsia macrochlamys* Baker. Our report represents a range extension of about 200 km to the north from the closest previously known locality in northern Oaxaca. Two additional species of truly epiphytic *Sedum* are known from Veracruz: *S. botteri* Hems. and *S. hultenii* Fröd. In addition, *S. dendroideum* DC., has been reported as epiphytic (Clausen 1959; Hietz & Hietz-Seifert 1995), but for this species, this habit seems to be rather incidental. Cloud forest occupies less than 1% of the surface of Mexico. In the central part of Veracruz deforestation has reduced the original coverage of this type of vegetation to 10% (Williams-Linera 2007). It is considered that *Sedum guatemalense* is in critical danger of disappearing from the area.

### 8. *Villadia patula* MORAN & UHL

Specimen examined: MEXICO, **Veracruz**, Mun. Huayacocotla, barranca de Santiago, 20°26'34"N, 98°32'02"W, 1969 m, *D. Jimeno-Sevilla* & *R. Castro* 1331 (XAL).

Previously known from San Luis Potosí, Guanajuato, and Querétaro (Moran & Uhl 1991; Pérez-Calix 2008;).

*Villadia patula* is known at few localities from central Mexico. The distance between the new locality and the closest known locality in Querétaro are about 120 km. Its occurrence in the state of Hidalgo is highly expected. In Veracruz it grows in xerophytic scrub with *Echeveria halbingeri* E. Walther, *Agave lechuguilla* Torr., *Echinocactus* sp., and *Opuntia* sp.

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### APPENDIX 1

Selected list of herbarium specimens of those species used for geographic distribution and morphological comparison with *E. uxorium* and *S. jarocho* respectively.

*Echeveria atropurpurea* (Baker) Ed. Morren  
MEXICO, **Veracruz**: Mun. Comapa, Barranca de Panoaya, 2.5 km al NE de El Coyol, 450 m, 21 Dec 1995 M. Cházaro, C. Viveros & R. Cházaro

7591 (XAL); Mpio. Comapa; Barranca de Panoaya, 1.5 km al NE de El Coyol, 829 m, 12 Dec 1985 *M. E. Medina* 829, (XAL); Mpio. Jalcomulco, Al N de Jalcomulco, 12 Jul 1991, *G. Castillo*, & *Zamora* 8265 (XAL); Mpio. Paso del Macho, 4 km de Paso del Macho-Camarón- Medellín, puente de Paso del Macho, 437 m, 1 Aug 2006, *D. Jimeno*, *A. Albalat*, *M. Cházaro* & *H. Oliva* 237 (IEB, XAL, MEXU); Mpio: Tlaltetela, Carretera Tlaltetela-Puente Los Pescados, 642 m, 30 Sep 2006, *D. Jimeno* & *M. Cházaro* 320 (IEB, XAL, MEXU); Mpio. Totutla, 4 km al S del poblado de Jalcomulco, vereda de Jalcomulco-Buena Vista, 642 m, 13 Nov 2005, *D. Jimeno* & *A. Albalat* 205 (IEB, XAL, MEXU).

*Echeveria penduliflora* E. Walther

MEXICO, **Oaxaca**, Mun. Villa Sola se Vega, in soil between Arroyo de la Y and San Sebastian de los Fustes, Ejutla, 4000 ft, 18 Jun 1958, *T. MacDougall* B-174 (CAS).

*Sedum hemsleyanum* DC.

MEXICO, **Morelos**, Mun. Tepalcingo, 4 km al SW de Ixtlilco El Grande, 1380 m, *D. Romero de la Vega et al.*, 73 (HUMO); Mun. Tlaquiltenango, 4.5 km al N de Huautla, 18°26'37"N, 98°58'53"W, *A. Maldonado* & *R. Castro* 201 (HUMO, IBUG); Mun. Tlaquiltenango, 3.5 km al SE de Ajuchitlán, 18°27'15"N, 98°56'26"W, 1200 m, *R. Cerros et al.*, 727 (IBUG); Mun. Tepoztlán, 5 miles from Tepoztlán on road to Cuernavaca, Aug 1962, *M. Kimmach* 374 (CAS); **Oaxaca**, Mun. Nochixtlán, Arroyo Tinú, 10 km al SE de Nochixtlán, 17°22'23"N, 97°05'47"W, 1700 m, 9 Nov 2001, *A. García-Mendoza* & *E. Solano* 7303 (MEXU); Mun. San Pedro y San Pablo Tequixtepec, Cerro Lobo, 18°07'41.7"N, 97°35'39.1"W, 2091 m, 9 Dec 2009, *N. González-Castañeda* 195 (IEB, MEXU); Mun. Santa María Ixcatlán, Río Seco a Río Santiago, al SSO de Tecmavaca, 1150–1250 m, 17°54'N, 97°04'W, 5 Dec

1991, *A. Salinas et al.* 6475 (CAS, MEXU); Mpio. Santa María Sola, cerro al N de Tierra Blanca, 16°33'51.8"N, 97°02'56.5"W, 1510 m, *N. Mendoza-Díaz* 185 (MEXU); Mun. Santiago Chazumba, Agua del Coyote, ca. 1.5 km al O de Olleras de Bustamante, 18°13'22"N, 97°43'41"W, 1670–1710 m, *P. Carrillo-Reyes* & *D. Cabrera-Toledo* 6056 (IEB); Mun. Tepelmeme de Morelos, km. 116 autopista Oaxaca-Tehuacán, 17°20'15"N, 97°02'86"W, *M. Cházaro* & *B. Mostul* 7701 (IBUG); Mun. Zapoquila, Guadalupe Membrillos, 2100 m, 25 Nov 1991, *P. Tenorio* 18227 (CAS, MEXU); **Puebla**, Mun. Ahuehuetitla, 2.5 km al O de Nuevos Horizontes, 18°13'36"N, 98°09'59"W, 1380 m, 26 Oct 2005, *P. Carrillo-Reyes* & *F.Z. Vaz-de-Mello* 4858 (IEB); Mun. Caltepec, Rincón del Guayabo; 5.1 km al SSO de San Luis Atolotitlán, 18°09'39"N, 97°24'54"W, 2030 m, *P. Carrillo-Reyes* & *D. Cabrera-Toledo* 5062 (IEB); Mun. Caltepec, El Zapote, Barranca de los Membrillos, 1860 m, *P. Tenorio* & *C. Romero* 8031 (MEXU); Mun. Chietla, Chietla, 10 Jul 1942, *F. Miranda* 2344 (MEXU); Mun. Petalcingo, Cliffs by Río Petalcingo, near Petalcingo, 18°04'N, 97°54'W, 1325 m, 19 Nov 1957, *R. Moran* 6399 (MEXU); **Vera-cruz**, Mun. Acultzingo, 1 km al N de Acultzingo, 18°43'42.9"N, 97°17'49"W 1170 m, 30 Oct 2008, *D. Jimeno et al* 547 (XAL). Mun. Perote, 1 km al W de Frijol Colorado, 19°35'6"N, 97°21'25"W, 28 Nov 1997 *G. Castillo-Campos*, *S. Avendaño* & *R. Palestina* 16789 (XAL). Mun. Perote, cerca de Frijol Colorado, 97°22'38"N, 19°33'58"W, 2334 m, *E. Ruiz-Sánchez* & *N. Jiménez-Pérez* 84 (IEB); Mun. Perote, Frijol Colorado, rumbo a Los Humeros, Pue. 19°36'18"N, 97°22'04"W, 25 Oct 2008, *D. Jimeno et al* 493 (XAL); Mun. Río Blanco, Autopista (MEX 150 D) at km 145.4, S side of Río Blanco Valley, *C.H. Uhl* 1888 (MEXU); South side of river east of bridge, Río Blanco, 1340 m, 9 Nov 1955, *R.T. Clausen s.n.* (MEXU).