



A new gypsophilous species of *Echeveria* (Crassulaceae) from Guerrero, Mexico

Una nueva especie gipsófila de *Echeveria* (Crassulaceae) de Guerrero, México

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Abstract:

Background and Aims: Recent botanical explorations in southern Mexico have led to the discovery of new species of Crassulaceae and gypsophilous flora. During an exploration near Tlapa de Comonfort in the state of Guerrero, an unknown *Echeveria* of the series *Gibbiflorae* was documented on gypsum outcrops. The objective of this work was to record its characteristics, describe it as a new species to science, and develop an identification key for the members of the series *Gibbiflorae* from Guerrero.

Methods: Living plants of the new species of *Echeveria* were collected and documented. Specialized literature, protologues, and herbarium specimens of members in the series *Gibbiflorae* were studied and a morphological comparison was conducted. A distribution map was elaborated, and its conservation status was assessed according to IUCN Red List criteria.

Key results: *Echeveria jeivana* is proposed as a new species of the series *Gibbiflorae* and is endemic to the state of Guerrero. It is similar to *E. gibbiflora* and *E. grisea*, from which it mainly differs by the presence of red nectaries with white base, entire and non-undulate leaf margins, and its occurrence on gypsum outcrops. Given its limited distribution and specific habitat, it is classified as Critically Endangered (CR) based on IUCN criteria.

Conclusions: *Echeveria jeivana* contributes to the knowledge of *Echeveria* series *Gibbiflorae* and the gypsophilous flora of southern Mexico. It also highlights the need for further exploration and conservation of the gypsum soil ecosystems, which are centers of high diversity and endemism.

Keywords: *Gibbiflorae*, gypsum outcrops, microendemic species, southern Mexico.

Resumen:

Antecedentes y Objetivos: Exploraciones botánicas recientes en el sur de México han derivado en el descubrimiento de nuevas especies de Crassulaceae y de flora gipsófila. Durante una exploración cerca de Tlapa de Comonfort, en el estado de Guerrero, se documentó una *Echeveria* desconocida de la serie *Gibbiflorae* en afloramientos de yeso. El objetivo de este trabajo fue registrar sus características, describirla como una nueva especie para la ciencia y desarrollar una clave de identificación para los miembros de la serie *Gibbiflorae* de Guerrero.

Métodos: Se recolectaron y documentaron plantas vivas de la nueva especie de *Echeveria*. Se estudiaron literatura especializada, protólogos y especímenes de herbario de los miembros de la serie *Gibbiflorae*, y se realizó una comparación morfológica. Se elaboró un mapa de distribución y se evaluó el estado de conservación según los criterios de la Lista Roja de la UICN.

Resultados clave: *Echeveria jeivana* se propone como una nueva especie de la serie *Gibbiflorae* y es endémica del estado de Guerrero. Es similar a *E. gibbiflora* y *E. grisea*, de las cuales se diferencia principalmente por la presencia de nectarios rojos con base blanca, márgenes de las hojas enteros y no ondulados, y su ocurrencia en afloramientos de yeso. Dados su distribución limitada y hábitat específico, se clasifica como En Peligro Crítico (CR) según los criterios de la UICN.

Conclusiones: *Echeveria jeivana* contribuye al conocimiento de *Echeveria* serie *Gibbiflorae* y de la flora gipsófila del sur de México. Asimismo, resalta la necesidad de realizar más exploraciones y acciones de conservación en los ecosistemas de suelos de yeso, los cuales son centros de alta diversidad y endemismo.

Palabras clave: afloramientos de yeso, especie microendémica, *Gibbiflorae*, sur de México.

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Introduction

The genus *Echeveria* DC. (Crassulaceae) includes about 204 species and is endemic to the Americas. Its distribution ranges from the southern United States of America to northern Argentina, and Mexico is the country with the highest number of taxa, harboring around 158 endemic species (Pérez-Calix and Guadián-Marín, 2025; Reyes-Santiago et al., 2025). It comprises succulent herbs with leaves arranged in rosettes, lateral inflorescences, pentamerous flowers, and tubular corollas with bright colors (Walther, 1972; Reyes-Santiago et al., 2011c).

In the last decade, taxonomic revision and botanical exploration have resulted in the description of several new species within the genus *Echeveria* (e.g., de la Cruz-López et al., 2021; Pino et al., 2021; Reyes-Santiago and de la Cruz-López, 2021, 2022; Rosales-Martínez et al., 2024; Steinmann and Ramírez-Amezcuca, 2024; Vázquez-García et al., 2024; Jimeno-Sevilla et al., 2025a, b; Pérez-Calix and Guadián-Marín, 2025; Reyes-Santiago et al., 2025), and this number is expected to increase. Likewise, recent fieldwork documenting the gypsicolous flora in southern Mexico has led to the discovery of new taxa (e.g., Cruz-Durán et al., 2023; García-Mendoza and Sandoval-Gutierrez, 2024; Reyes-Santiago et al., 2024; Sandoval-Gutierrez et al., 2024), including a new gypsophile Crassulaceae species (García-Mendoza et al., 2023).

In this context, during a field trip to explore the gypsum outcrops of Guerrero, a distinctive species of *Echeveria* was collected near the town of Tlapa de Comonfort, Guerrero, in October 2024. To assess its identity, we performed literature and herbaria revision. Given that the plants presented the combination of large stems, glabrous and large leaves, paniculate inflorescences with several cincinni, and free reddish styles, we identified that they belonged to *Echeveria* series *Gibbiflorae* (Baker) Berger *sensu* Kimnach (2003).

Currently, there are four species of *Echeveria* series *Gibbiflorae* documented for the state of Guerrero: *E. aurantiaca* J. Reyes, O. González & Brachet from the surroundings of Taxco (Reyes-Santiago et al., 2011b); *E. grisea* E. Walther from Cañón de la Mano near Iguala (Walther, 1938; 1972); *E. guerrerensis* J. Reyes, O. González & Brachet from the mountains of Zihuatanejo and San Miguel Toto-

lapan (Reyes-Santiago et al., 2011a); and *E. xochipalensis* J. Reyes, L.E. Cruz-López & Verg.-Silva from near Xochipala (Reyes-Santiago et al., 2019). Moreover, there are only three *Echeveria* species documented to grow on gypsum in southern Mexico: *E. macdougallii* E. Walther, *E. nodulosa* (Baker) Ed. Otto, and *E. subcorymbosa* Kimnach & Moran (Ortiz-Brunel et al., 2023b). All of them occur in Oaxaca state and none belong to the series *Gibbiflorae*. However, none of the descriptions of the aforementioned species completely fit with the plants we found in Tlapa de Comonfort. After a morphological comparison, we concluded that the plants collected corresponded to an undescribed species.

Thus, the aims of the present work were to 1) describe the new species, 2) include an illustration, 3) compare morphologically with the most similar taxa (*Echeveria grisea* and *E. gibbiflora* DC.), 4) describe its ecological preferences, and 5) assess its conservation status. In addition, a distribution map and a key for the species of *Echeveria* series *Gibbiflorae* in Guerrero are presented.

Materials and Methods

When exploring the surroundings of Tlapa de Comonfort in November 2020, a small population of *Echeveria* with unusual characters was found growing on gypsum soils. Photos of the plants found were uploaded to the iNaturalist platform (iNaturalist, 2021). An additional expedition to the gypsum outcrops of Guerrero was made in October 2024 to locate more plants of this *Echeveria*. Flowering plants were collected and then prepared as herbarium vouchers following Lot and Chiang (1986). In addition, photographs, notes, and measurements were taken *in situ*.

To determine the status of the plants and their morphological affinities, a comprehensive review of specialized literature was conducted (Walther, 1972; Uhl, 2002; Kimnach, 2003; Meyrán and López, 2003; Pilbeam, 2008; de la Cruz-López et al., 2019; Jimeno-Sevilla et al., 2019), along with the review of protologues of species in the series *Gibbiflorae* that occur in Guerrero (Walther, 1938; Reyes-Santiago et al., 2011a, b, 2019). Online platforms such as JSTOR Global Plants (JSTOR, 2025), the New York Botanical Garden (NYBG, 2025), and the Red de Herbarios Mexicanos (RHM, 2025) were consulted. Also, herbarium

specimens deposited in IBUG and digital collections from CAS, MEXU, and NY were examined (acronyms according to Thiers, 2025). The collected specimens resembled *Echeveria gibbiflora* and *E. grisea*. Therefore, a comparative table was prepared using morphological data from both the reviewed literature (especially Walther, 1938, 1972; Rosales-Martínez et al., 2024) and the herbarium specimens. This information was also used for the identification key.

After a detailed revision, we concluded that the plants collected corresponded to an undescribed species. Although the plants found in Tlapa de Comonfort shared some similarities with *E. gibbiflora* DC. and *E. grisea*, we identified key differences, such as larger corollas and the development of red nectaries with a white base. Even though the circumscription of *Echeveria* series *Gibbiflorae* sensu Kimnach (2003) does not include species with a simple or bifurcated cincinnus, we included *E. aurantiaca* and *E. guerrerensis* in the key. The former was proposed as a member of the series *Gibbiflorae* by Reyes-Santiago et al. (2011b) and the latter was nested in a clade of solely members of the series in a phylogenetic analysis, showing a clear relationship with them (de la Cruz-López et al., 2019). Moreover, both species develop free styles with reddish color, a character that is also present in all *Gibbiflorae* species.

In addition, while searching for literature, we detected a study that included a sample of this potential new species in a phylogenetic analysis (de la Cruz-López et al., 2019, Fig. 2D, sample JE-8814 labeled as *Echeveria* sp.). This specimen information and photographs of living plants are available on the BOLD Systems portal (BOLD Systems, 2025). The morphology of the photographed plants matched with the plants found in the present work. Moreover, according to the authors of the abovementioned phylogenetic study, this sample was collected in Tlapa de Comonfort near the place where we found the plants that we propose as a new species. In the aforementioned work, the sample JE-8814 is the sister group of a clade composed by other members of the series *Gibbiflorae*. This supports our hypothesis that the plants found in the gypsum outcrops near Tlapa de Comonfort belong to a different lineage than *Echeveria gibbiflora* and *E. grisea*, which are the morphologically most similar species and were nested in another

clade that had low support for its relationships (de la Cruz-López et al., 2019).

A distribution database of *Echeveria* series *Gibbiflorae* from Guerrero was created with the same aforementioned herbarium vouchers and digital platforms used for the morphological comparison. The distribution map was elaborated in QGIS v. 2.14.3 (QGIS Development Team, 2018) using this database.

To assess the conservation status of the new species, GeoCAT (Bachman et al., 2011) was used to calculate the Area of Occupancy (AOO) and the Extent of Occurrence (EOO), following IUCN Red List guidelines (IUCN, 2022). Additionally, threats that may endanger the new species were identified.

Results

Taxonomy

Echeveria jeivana Rosales, I.G. Olivares & Ortiz-Brunel, sp. nov. Figs. 1, 2.

TYPE: MEXICO. Guerrero: municipality Tlapa de Comonfort, afloramiento de yeso al norte de Tlapa de Comonfort, 1290 m, 26.X.2024, J. P. Ortiz-Brunel 2066 (holotype: IBUG!, isotype: MEXU!).

Echeveria jeivana is similar to *E. grisea* in the size of the leaves, height of the inflorescence and number of cincinni per inflorescence; however, *E. jeivana* differs from the latter in the obovate-oblongate leaves (vs. obovate-spathulate), straight and entire leaf margins (vs. undulate and sometimes crenulate), cincinni length of 9-18 cm (vs. 5-8 cm), 8-14 flowers per cincinnus (vs. 4-7), pedicel length of 6-12 mm (vs. 2-4 mm), corolla size of 16-21 × 11-13 mm (vs. 12-13 × 8-9 mm), and red nectaries with white base (vs. entirely pale yellow).

Succulent herbs, solitary, caulescent, glabrous; roots fibrous, enlarged when old; stems simple, 8-35 cm long, 1.5-2.5 cm wide, ascendant, horizontally wrinkled, with conspicuous scars of fallen leaves, gray to light brown-colored, glaucous towards the apex; rosettes terminal, 8-22 cm wide, compact; leaves 8-14 per rosette, 9-16 cm long,



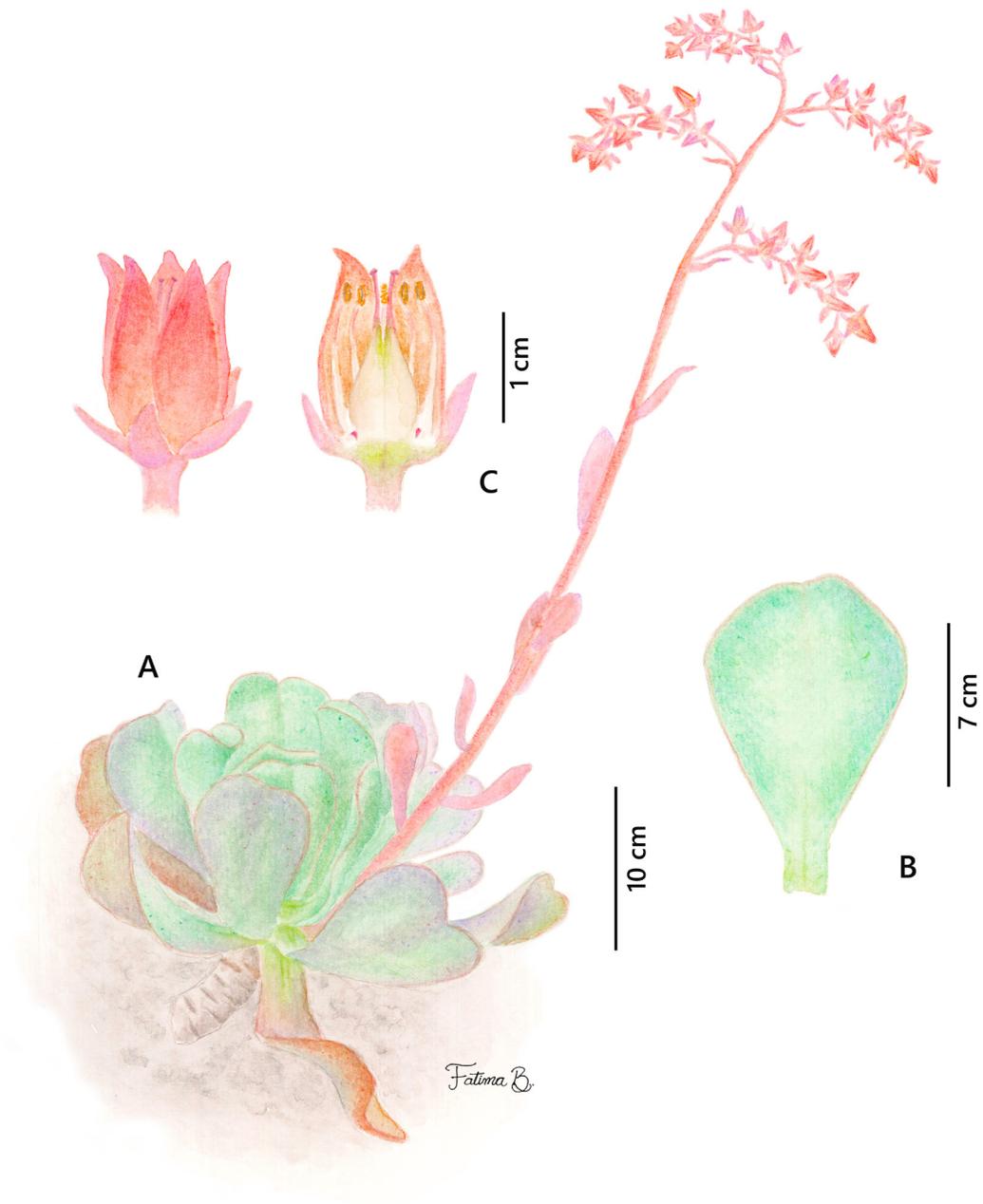


Figure 1: *Echeveria jeivana* Rosales, I.G. Olivares & Ortiz-Brunel. A. plant and inflorescence; B. leaf; C. flower detail: lateral view (left) and dissection (right). Illustrated by Fátima Bracamontes based on *J. P. Ortiz-Brunel 2066* (IBUG).

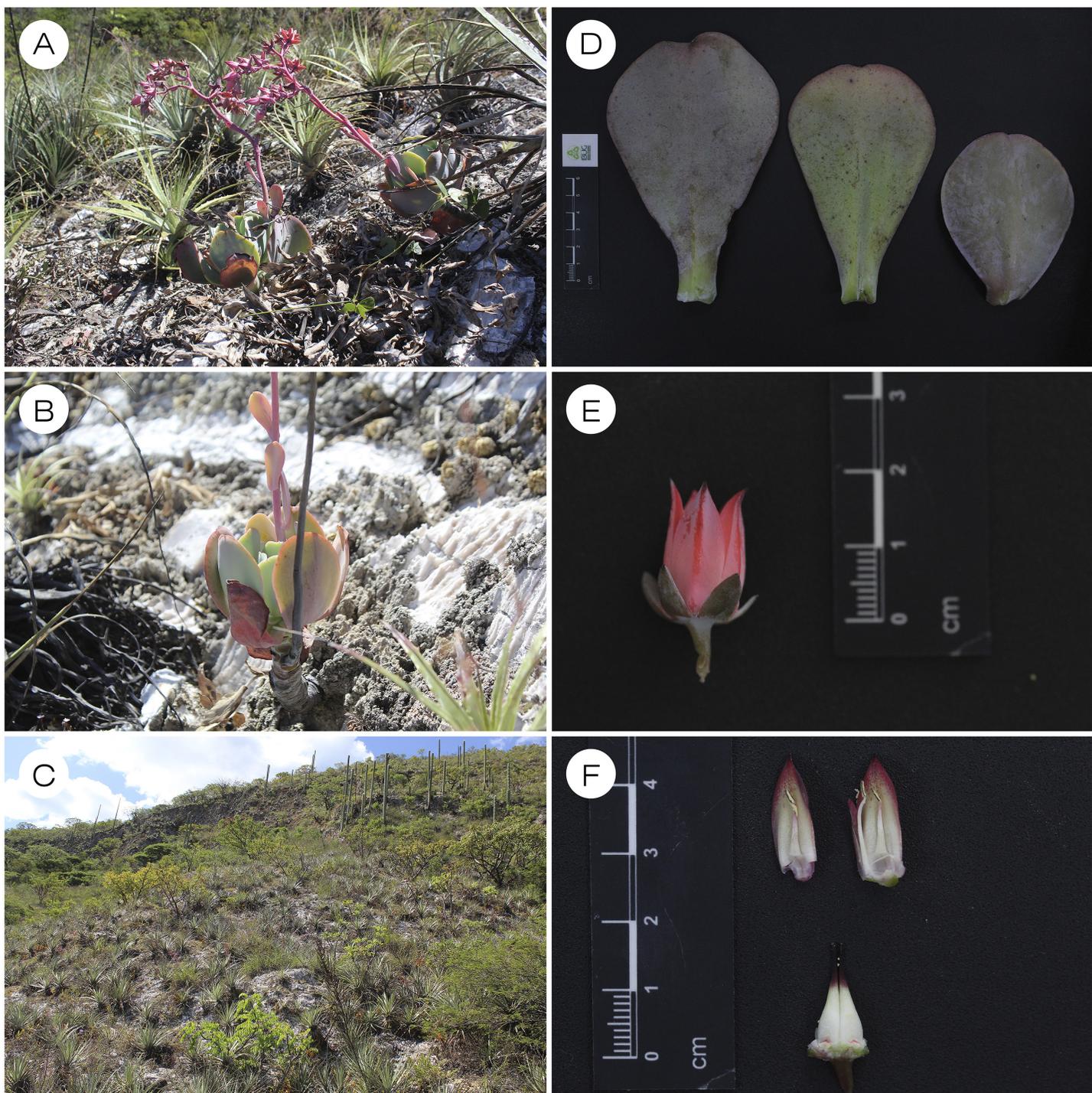


Figure 2: *Echeveria jeivana* Rosales, I.G. Olivares & Ortiz-Brunel. A-C. plant habit and habitat; D. leaves; E. lateral view of the flower; F. androecium and gynoecium detail. Photographs by Juan Pablo Ortiz Brunel.

7-10 cm in the widest part, glabrous, pruinose, pseudopetiolate, obovate-oblongate, cuneate towards the base, slightly obcordate at the apex, with an inconspicuous mucro, generally flattened, sometimes concave on the lower surface, slightly keeled, canaliculate towards the base, as-

pendent, imbricate, glaucous or slightly whitish, with orange tinges under abiotic stress, margins straight, entire, whitish, slightly hyaline; inflorescence a lateral panicle, 1 per season, 25-55 cm long, erect or obliquely ascending, peduncle 5-10 mm wide at the base, strong pink-colored,

bracts 2-10 cm long, obovate to oblanceolate, cuneate towards the base, rounded at the apex, glaucous to pinkish, cincinni 3-5 per inflorescence, 9-18 cm long, straight or slightly pendulous, pink; flowers 8-14 per cincinnus, pedicels 6-12 mm long, up to 3 mm wide, linear, calyx not symmetrical, 13-17 mm diameter, discoid, sepals unequal, 3-8 mm long, 2-4 mm in the widest part, deltoid, acute to the apex, purple to dark purple in the outer face, purple to pink in the inner, pruinose, corolla 16-21 mm long, 11-13 mm diameter, tubular, oblongoid to ovoid, petals 16-21 mm long, 5-7 mm in the widest part, fused at the base, forming a short tube 2 mm long, widely oblong-lanceolate, shortly acuminate, keeled, concave in the inner part, strong pink-colored on the outer face, slightly red and whitish on the inner one, nectaries 2 mm wide, reniform, red colored in the upper part and white at the base, stamens 10, 5 epipetalous and 5 episepalous, filaments 10-12 mm long when episepalous, 6-8 mm long when epipetalous, linear, narrowing towards the apex, whitish, anthers 2 mm long, ovate, pink when immature, yellow to cream colored in anthesis, pistil 14-15 mm long, 6-7 mm wide at the base, pyriform, carpels 5, free, ovaries white, styles wine red or dark purple, greenish at the base, stigmas capitate, translucent yellow; follicles erect, brown; seeds inconspicuous, dark orange colored.

Distribution and ecology: *Echeveria jeivana* is a strict gypsophile. It is restricted to a small area of gypsum outcrops in the municipality of Tlapa de Comonfort in eastern Guerrero (Fig. 3). The vegetation corresponds to tropical deciduous forest, and it is similar to other tropical plant gypsicolous communities that occur in southern and western Mexico (Ortiz-Brunel et al., 2023b). The new species grows with *Agave megalodonta* García-Mend. & D. Sandoval (Asparagaceae), *Begonia* sp. (Begoniaceae), *Cephalocereus mezcalaensis* Bravo (Cactaceae), *Dahlia* sp. (Asteraceae), *Euphorbia* sp. (Euphorbiaceae), *Hechtia* sp. (Bromeliaceae), and *Pseudosmodingium perniciosum* (Kunth) Engl. (Anacardiaceae). Moreover, two observations uploaded to the iNaturalist platform (iNaturalist, 2020; 2023) might represent records of *E. jeivana* from western Oaxaca, as they show vegetative similarities and were also found growing on gypsum outcrops. However,

flowering material with supporting collections is needed to confirm the identity of the plants from these populations.

Phenology: plants flower from late September to early December and fruit from November to February.

Etymology: the specific epithet honors Jeiv Leilani González Gálvez, daughter of Jesús Iván González Olivares, second author of this manuscript and discoverer of the species.

Preliminary conservation status: Although the gypsum outcrop where the plants occur is extensive, the new species has been only found in very small patches where the individuals are scarce. The estimated population is around 100 individuals, but more exploration is needed to confirm this. The calculated Area of Occupancy (AOO) was 4 km², while the Extent of Occurrence (EOO) was less than 10 km². Following the criteria B1ab(i,ii) + B2ab(i,ii) of the IUCN (2022), it is proposed that *Echeveria jeivana* should be classified as Critically Endangered (CR) due to its highly specific habitat and restricted distribution. In addition, changes in the use of the soil and vegetation loss were detected very close to the type locality during the explorations.

Additional specimens examined: MEXICO. Guerrero, municipality Tlapa de Comonfort, Cañada La Loma, al Noroeste de Tlapa de Comonfort, *J. Reyes 8814* (MEXU).

Discussion

Echeveria jeivana belongs to the series *Gibbiflorae*, fitting well within the current morphological circumscription of this group (Kimnach, 2003). It also falls within its recorded geographic distribution, ranging from northwestern Mexico to Guatemala (Rosales-Martínez et al., 2024). This series is a monophyletic group that contains two main clades: one with species that occur in the northwestern portion of the country and another with taxa distributed in the southwestern (de la Cruz-López et al., 2019). In the aforementioned work, a sample labeled as *Echeveria* sp. JE-8814 corresponds to what here is proposed as *E. jeivana*, based on its locality of occurrence and same morphological characters (BOLD Systems, 2025). The new species was nested

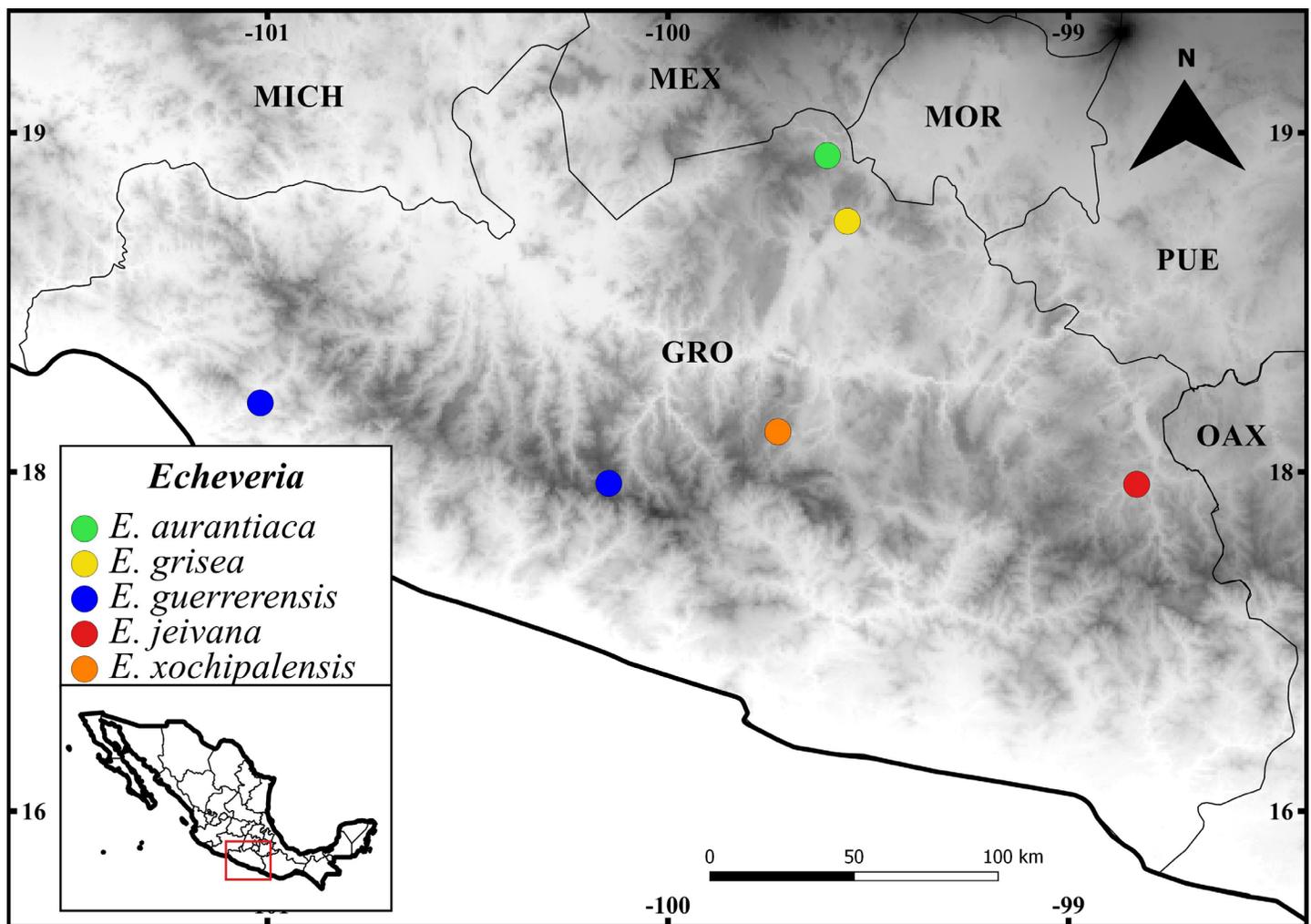


Figure 3: Distribution of *Echeveria* series *Gibbiflorae*: *Echeveria aurantiaca* J. Reyes, O. González & Brachet, *E. grisea* E. Walther, *E. guerrerensis* J. Reyes, O. González & Brachet, *E. jeivana* Rosales, I.G. Olivares & Ortiz-Brunel, and *E. xochipalensis* J. Reyes, L.E. Cruz-López & Verg.-Silva in the state of Guerrero, México.

within the southwestern clade and is sister to a smaller clade whose internal relationships are not well resolved. This latter clade contains some morphologically unrelated species with *E. jeivana*, like *E. triquiana* J. Reyes & Brachet, *E. crenulata* Rose, and *E. fulgens* Lem., but also includes morphologically similar species such as *E. grisea* and *E. gibbiflora*.

The morphologically most similar species to *Echeveria jeivana* is *E. grisea*, sharing a similar leaf size, inflorescence height and number of cincinni per inflorescence, being both endemic to the state of Guerrero. Nevertheless, *E. jeivana* differs in having obovate-oblancheolate leaves with straight and entire margins, longer cincinni with a higher number of flowers, and longer pedicels and corollas (Table 1). The

nectaries in *E. jeivana* are also distinctive, since they are red with a white base (vs. pale yellow nectaries in *E. grisea*). Likewise, *E. gibbiflora* is another morphologically similar species, but *E. jeivana* can be distinguished by its obovate to oblancheolate leaves, entire straight margins, lower number of cincinni, longer pedicels and corollas, and the previously mentioned red nectaries. Additionally, *E. jeivana* is the only species of the series *Gibbiflorae* documented on gypsum and one of just four *Echeveria* species in southern Mexico inhabiting these environments (Fig. 4).

The discovery of *Echeveria jeivana* contributes to the knowledge about the gypsophilous plant diversity in southern Mexico. The recent description of several new species (e.g. *Agave gypsicola* García-Mend. & D. Sando-

Table 1: Morphological comparison between *Echeveria jeivana* Rosales, I.G. Olivares & Ortiz-Brunel and morphological similar species.

Character	<i>Echeveria jeivana</i> Rosales, I.G. Olivares & Ortiz-Brunel	<i>Echeveria grisea</i> E. Walther	<i>Echeveria gibbiflora</i> DC.
Leaf shape	Obovate-oblanceolate	Obovate-spathulate	Broadly obovate-orbicular
Leaf color	Glaucous or slightly whitish, with orange tinges under abiotic stress	Glaucous green to grayish green, becoming purplish under abiotic stress	Glaucous green with tendency to show reddish coloration in the whole leaf
Leaf margin	Straight, entire	Undulate, sometimes crenulate	Undulate, sometimes crenulate
Peduncle color	Strong pink, sometimes glaucous	Glaucous green to grayish brown	Strong pink, sometimes glaucous
Number of cincinni	3-5	3-5	6-18
Cincinni length (cm)	9-18	5-8	10-29
Flowers per cincinnus	8-14	4-7	5-18
Pedicel length (mm)	6-12	2-4	2-4
Corolla size (mm)	16-21 × 11-13	12-13 × 8-9	12-16 × 10-11
Nectary color	Red at the upper portion, white at the base	Pale yellow	White

val, *Dahlia gypsicola* J. Reyes, Ortiz-Brunel & Art. Castro, *Dalea verticillata* Cruz Durán, D. Sandoval & García-Mend., *Graptopetalum irmasoniae* García-Mend., Pérez-Calix & D. Sandoval, *Polystemma leopardum* L.O. Alvarado, García-Mend., D. Sandoval & Lozada-Pérez, *Tigridia gypsicola* García-Mend. & D. Sandoval, and *Zeltnera fonsecae* Vigosa, D. Sandoval & D. Morales) highlights the importance of studying gypsum habitats, which usually host microendemic taxa. Interestingly, some gypsophiles that occur in tropical gypsum ecosystems tend to inhabit only a very small portion of the outcrop. This has been documented in species as *Mixtecalia teitaensis* Redonda-Mart., García-Mend. & D. Sandoval and *Graptopetalum irmasoniae* in southern Mexico, and in *Pinguicula colimensis* McVaugh & Mickel and *Hunzikeria gypsophila* Ortiz-Brunel & Díaz-Mart. in western Mexico (McVaugh and Mickel, 1963; García-Mendoza et al., 2020, 2023; Ortiz-Brunel et al., 2023a). Across Mexico, overall gypsum ecosystem plant diversity might be highest in the south, but the level of exploration of the sites is heterogeneous. For example, there are around 300 plant species documented for some gypsum outcrops in Oaxaca, while in some outcrops in the neighboring state of Guerrero only 30 species have been recorded (Ortiz-Brunel et al., 2023b). This suggests the need for further explorations,

not only in gypsum-rich soils but also in the whole state of Guerrero to document its botanical diversity.

This contribution also increases the known diversity of the genus *Echeveria* in the state of Guerrero, now represented by eight species: *E. aurantiaca*, *E. grisea*, *E. guerrerensis*, *E. islasiae* J. Reyes & L.E. Cruz-López, *E. jeivana*, *E. multicaulis* Rose, *E. waltheri* Moran & J. Meyrán, and *E. xochipalensis*. All of them are endemic to the state except *E. waltheri*. Due to the irregular topography of the state of Guerrero as well as to the presence of several vegetation types where members of the Crassulaceae thrive, it is highly probable that future fieldwork will lead to the description of new taxa and the potential rediscovery of *Echeveria longiflora* E. Walther, presumably collected from Guerrero but not yet found in the wild (Walther, 1972).

The following is an identification key to the species of *Echeveria* series *Gibbiflorae* found in the state of Guerrero:

Identification key to the species of *Echeveria* series *Gibbiflorae* in Guerrero

- 1a. Stems inconspicuous; cincinni simple or bifurcated .. 2
- 1b. Stems evident; panicles 3-branched or more 3
- 2a. Leaves pruinose; corolla urceolate; nectary scales white



Figure 4: *Echeveria* species recorded growing on gypsum in southern Mexico. A. *Echeveria jeivana* Rosales, I.G. Olivares & Ortiz-Brunel; B. *Echeveria macdougalii* E. Walther; C. *Echeveria nodulosa* (Baker) Ed. Otto; D. *Echeveria subcorymbosa* Kimmach & Moran. Photographs by Juan Pablo Ortiz Brunel.

- *E. guerrerensis* J. Reyes, O. González & Brachet
- 2b. Leaves not pruinose; corolla conic to cylindrical; nectary scales yellow
- *E. aurantiaca* J. Reyes, O. González & Brachet
- 3a. Corolla more than 1.6 cm long; nectary scales red with

- white base
- *E. jeivana* Rosales, I.G. Olivares & Ortiz-Brunel
- 3b. Corolla less than 1.3 cm long; nectary scales white to pale yellow
- 4
- 4a. Peduncle bracts oblong-obovate; cincinni 5-8 cm long



- *E. grisea* E. Walther
 4b. Peduncle bracts oblanceolate; cincinni 10-25 cm long ..
E. xochipalensis J. Reyes, L.E. Cruz-López & Verg.-Silva

Author contributions

Conceptualization: JPOB; Data curation: CSRM, JAQT, JDHC, JIGO, and JPOB; Investigation: CSRM, JAQT, JDHC, and JPOB; Writing - original draft: CSRM, JAQT, JDHC, JIGO, and JPOB; Writing - review & editing: CSRM, JAQT, JDHC, JIGO, and JPOB.

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Literature cited

- Bachman, S., J. Moat, A. W. Hill, J. de la Torre and B. Scott. 2011. Supporting Red List threat assessments with GeoCAT: geospatial conservation assessment tool. *ZooKeys* 150: 117-126. DOI: <https://doi.org/10.3897/zookeys.150.2109>
- BOLD Systems. 2025. Public data portal: specimen record. https://v3.boldsystems.org/index.php/Public_RecordView?processid=LEDCL071-17 (consulted January, 2025).
- Cruz-Durán, R., D. Sandoval-Gutiérrez and A. García-Mendoza. 2023. *Dalea verticillata* (Leguminosae, Papilionoideae, Amorpeae), una nueva especie de Oaxaca, México y segunda para el subgénero *Psoropteris*. *Brittonia* 76(1): 19-25. DOI: <https://doi.org/10.1007/s12228-023-09768-6>
- de la Cruz-López, L. E., F. Vergara-Silva, J. Reyes-Santiago, G. Espino-Ortega, P. Carrillo-Reyes and M. Kuzmina. 2019. Phylogenetic relationships of *Echeveria* (Crassulaceae) and related genera from Mexico, based on three DNA barcoding loci. *Phytotaxa* 422(1): 33-57. DOI: <https://doi.org/10.11646/phytotaxa.422.1.3>

- de la Cruz-López, L. E., J. Reyes-Santiago and F. Vergara-Silva. 2021. A new species of *Echeveria* (Crassulaceae) from Durango, Mexico, supported by morphology and DNA diagnostic characters. *Brittonia* 73(4): 374-382. DOI: <https://doi.org/10.1007/s12228-021-09684-7>
- García-Mendoza, A. and D. Sandoval-Gutiérrez. 2024. Una especie nueva y una nueva combinación en *Tigridia* (Tigridieae, Iridoideae, Iridaceae) de Oaxaca, México. *Acta Botanica Mexicana* 131: e2301. DOI: <https://doi.org/10.21829/abm131.2024.2301>
- García-Mendoza, A., D. Sandoval-Gutiérrez and R. Redonda-Martínez. 2020. *Mixtecalia*, a new monotypic genus of the subtribe Tussilaginiinae (Senecioneae, Asteraceae) from the state of Oaxaca, Mexico. *Phytotaxa* 438(2): 119-129. DOI: <https://doi.org/10.11646/phytotaxa.438.2.5>
- García-Mendoza, A., D. Sandoval-Gutiérrez, A. López-Santiago and E. Pérez-Calix. 2023. *Graptopetalum irmasoniae* (Crassulaceae), una especie nueva de Oaxaca, México, y lectotipificación de *G. macdougalii*. *Acta Botanica Mexicana* 130: e2253. DOI: <https://doi.org/10.21829/abm130.2023.2253>
- iNaturalist. 2020. Foto 72876541 Eder O. (CC BY-NC). iNaturalist México. <https://www.inaturalist.org/observations/45948775> (consulted June, 2024).
- iNaturalist. 2021. Foto 161981566 Iván González (CC BY-NC). iNaturalist México. <https://www.inaturalist.org/observations/97401155> (consulted June, 2024).
- iNaturalist. 2023. Foto 182994342 John Kemner (CC BY-NC). iNaturalist México. <https://www.inaturalist.org/observations/182994342> (consulted June, 2024).
- IUCN. 2022. Guidelines for Using the IUCN Red List Categories and Criteria. Ver. 15.1. Standards and Petitions Committee. <https://www.iucnredlist.org/resources/redlistguidelines> (consulted January, 2024).
- Jimeno-Sevilla, H. D., J. A. Vázquez-García, M. A. Muñiz-Castro, I. García-Ruiz, G. Hernández-Vera and J. Villa-Castro. 2019. *Echeveria sonianevadensis* (Crassulaceae), una nueva especie del Volcán Nevado de Colima del occidente de México y una clave para la serie *Gibbiflorae*. *Brittonia* 71(3): 156-165. DOI: <https://doi.org/10.1007/s12228-018-9560-2>
- Jimeno-Sevilla, H. D., J. D. Hernández-Campos, K. G. Posadas-Trejo and C. S. Rosales-Martínez. 2025a. Dos especies nuevas de *Echeveria* (Crassulaceae) del oriente de México. *Boletín Nakari* 36(1): 1-11.



- Jimeno-Sevilla, H. D., J. D. Hernández-Campos, C. S. Rosales-Martínez and K. G. Posadas-Trejo. 2025b. A new species of *Echeveria* ser. *Nudae* (Crassulaceae) from Jalisco, Mexico, and a new combination. *Phytotaxa* 697(3): 234-244. DOI: <https://doi.org/10.11646/phytotaxa.697.3.2>
- JSTOR. 2025. JSTOR Global Plants. <https://plants.jstor.org/> (consulted January, 2025).
- Kimnach, M. 2003. *Echeveria*. In: Egli, U. (ed.). *Illustrated Handbook of Succulent Plants: Crassulaceae*. Springer. Berlin, Germany. Pp. 103-128.
- Lot, A. and F. Chiang. 1986. *Manual de herbario. Administración y manejo de colecciones, técnicas de recolección y preparación de ejemplares botánicos*. Consejo Nacional de la Flora de México. Cd. Mx., México. 142 pp.
- McVaugh, R. and J. T. Mickel. 1963. Notes on *Pinguicula*, sect. *Orcheosanthus*. *Brittonia* 15(2): 134-140. DOI: <https://doi.org/10.2307/2805399>
- Meyrán, J. and L. López. 2003. *Las crasuláceas de México*. Sociedad Mexicana de Cactología, A.C. México, D.F., México. 234 pp.
- NYBG. 2025. New York Botanical Garden Steere Herbarium <https://sweetgum.nybg.org/science/> (consulted January, 2025).
- Ortiz-Brunel, J. P., P. Díaz-Martínez, E. Ruíz-Sánchez and A. Rodríguez. 2023a. A new microendemic species of *Hunzikeria* (Petunieae, Solanaceae) from the gypsum outcrops of southern Jalisco, Mexico. *Phytotaxa* 600(1): 7-15. DOI: <https://doi.org/10.11646/phytotaxa.600.1.2>
- Ortiz-Brunel, J. P., H. Ochoterena, M. J. Moore, J. Aragón-Parada, J. Flores, G. Munguía-Lino, A. Rodríguez, M. M. Salinas-Rodríguez and H. Flores-Olvera. 2023b. Patterns of richness and endemism in the gypsum flora of Mexico. *Diversity* 15(4): 522. DOI: <https://doi.org/10.3390/d15040522>
- Pérez-Calix, E. and J. I. Guadián-Marín. 2025. *Echeveria barbosa* (Crassulaceae), una especie nueva del estado de Guanajuato, México. *Acta Botanica Mexicana* 132: e2466. DOI: <https://doi.org/10.21829/abm132.2025.2466>
- Pilbeam, J. 2008. *The genus Echeveria*. The British Cactus & Succulent Society. Hornchurch, England. 333 pp.
- Pino, G., A. Alcalá, D. Marquiegui and I. Payano. 2021. New species of Crassulaceae from Huancavelica and a new *Echeveria* from Junín, Peru. *Cactus and Succulent Journal* 93(4): 286-302. DOI: <https://doi.org/10.2985/015.093.0404>
- QGIS Development Team. 2018. QGIS Geographic Information System. Open-Source Geospatial Foundation Project. <https://www.qgis.org/> (consulted March, 2018).
- Reyes-Santiago, J. and L. E. de la Cruz-López. 2021. *Echeveria islasiae*, una nueva especie de la serie *Longistylae* (Crassulaceae). *Brittonia* 73(4): 363-373. DOI: <https://doi.org/10.1007/s12228-021-09658-9>
- Reyes-Santiago, J. and L. E. de la Cruz-López. 2022. *Echeveria andreae* (Crassulaceae), una especie nueva de las montañas de la Mixteca Alta, Oaxaca, México. *Revista Mexicana de Biodiversidad* 93(2022): e933565. DOI: <https://doi.org/10.22201/ib.20078706e.2022.93.3565>
- Reyes-Santiago, J., C. Brachet-Ize and O. González-Zorzano. 2011a. *Echeveria guerrensis* (Crassulaceae) una nueva especie para el estado de Guerrero, México. *Cactáceas y Suculentas Mexicanas* 56(3): 75-81.
- Reyes-Santiago, J., L. E. de la Cruz-López and F. Vergara-Silva. 2019. *Echeveria xochipalensis* (Crassulaceae), a new species from Guerrero, Mexico. *Phytotaxa* 399(1): 14-24. DOI: <https://doi.org/10.11646/phytotaxa.399.1.2>
- Reyes-Santiago, J., O. González-Zorzano and C. Brachet-Ize. 2011b. *Echeveria aurantiaca* (Crassulaceae), una nueva especie del estado de Guerrero, México. *Cactáceas y Suculentas Mexicanas* 56(3): 68-74.
- Reyes-Santiago, J., A. Islas-Luna and O. Anguiano. 2025. Five new species of the genus *Echeveria* (Crassulaceae) from the mountains of Oaxaca, Mexico. *Haseltonia* 32(1): 17-37. DOI: <https://doi.org/10.2985/026.032.0105>
- Reyes-Santiago, J., J. P. Ortiz-Brunel, I. H. Lichter-Marck and A. Castro-Castro. 2024. Another new species of the genus *Dahlia* (Asteraceae, Coreopsidae): are we close to knowing its total diversity? *Acta Botanica Mexicana* 131: e2270. DOI: <https://doi.org/10.21829/abm131.2024.2270>
- Reyes-Santiago, J., M. A. Islas-Luna, O. González-Zorzano, P. Carrillo-Reyes, F. R. Vergara-Silva and C. P. Brachet-Ize. 2011c. *Echeveria: manual del perfil diagnóstico del género Echeveria*. Universidad Autónoma Chapingo. Texcoco, México. 141 pp.
- RHM. 2025. Red de Herbarios Mexicanos. <http://herbanwmex.net/portal/index.php> (consulted February, 2025).
- Rosales-Martínez, C. S., J. A. Quirarte-Tejeda and J. D. Hernández-Campos. 2024. *Echeveria sotoi* (ser. *Gibbiflorae*,

- Crassulaceae), a new species from coastal Michoacán, Mexico. *Phytotaxa* 633(2): 125-137. DOI: <https://doi.org/10.11646/phytotaxa.633.2.3>
- Sandoval-Gutiérrez, D., J. L. Vigosa-Mercado and E. D. Morales-García. 2024. *Zeltnera fonsecae* (Gentianaceae, Chironieae, Chironiinae), a new gypsophilous species endemic from Oaxaca, Mexico. *Phytotaxa* 636(2): 194-202. DOI: <https://doi.org/10.11646/phytotaxa.636.2.8>
- Steinmann, V. W. and Y. Ramírez-Amezcu. 2024. Two new species and a new state record of Crassulaceae from Michoacán, Mexico. *Haseltonia* 31(1): 17-25. DOI: <https://doi.org/10.2985/026.031.0103>
- Thiers, B. 2025 (constantly updated). Index Herbariorum: A Global Directory of Public Herbaria and Associated Staff. New York Botanical Garden's Virtual Herbarium. New York, USA. <http://sweetgum.nybg.org/science/ih/> (consulted August, 2025).
- Uhl, C. H. 2002. Chromosomes and hybrids of *Echeveria* (Crassulaceae). VII. Series *Gibbiflorae* (Baker) Berger. *Haseltonia* 9: 121-145.
- Vázquez-García, J. A., R. Cuevas-Guzmán, C. S. Rosales-Martínez, J. G. Morales-Arias and J. Padilla-Lepe. 2024. Two new species of *Echeveria* (Crassulaceae, Saxifragales) from the Sierra de Manantlán, Jalisco, Mexico. *Phytotaxa* 653(2): 115-133. DOI: <https://doi.org/10.11646/phytotaxa.653.2.2>
- Walther, E. 1938. Notes on the genus *Echeveria*. *Cactus and Succulent Journal* 10: 14-15.
- Walther, E. 1972. *Echeveria*. California Academy of Sciences. San Francisco, USA. 426 pp.

