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New species of Crassulaceae from Huancavelica and a new *Echeveria* from Junín, Peru

Abstract. The *Crassulaceae* of the department of Huancavelica, Peru are updated. Two new species of *Echeveria* and one species of genus *Sedum* are described : *Echeveria incaica* from province Tayacaja near the border with Junín is morphologically similar to *E. oreophila* from Cajamarca; *Echeveria ostolazae* from the province Castrovirreyna at the southern border of the department of Huancavelica near Chincha, Ica was first taken for *E. chiclensis* var. *chiclensis* or *E. deltoidea; Sedum xerophilum*, first thought to be *Sedum incarum,* grows at drier, much lower locations than the latter. Moreover, two already previously described *Sedum* species, *S. incarum* and *S. renzopalmae*, up to now only known from the department of Lima, have also been found in the department of Huancavelica. Finally, a new species of genus *Echeveria* from the department of Junín, looking like a miniature version of *E. incaica*, is described.

Keywords: Peru, Castrovirreyna, Tayacaja, Concepción, *Crassulaceae*, *Echeveria*, *Sedum*.

Introduction

The department of Huancavelica is one of the least known in Peru. It borders the departments of Lima and Ica in the west, Junín in the north and Ayacucho in the east. It is embedded in the central Andes which means it has a rough geography. Most of the area is at high elevation (above 3,500 up to 5,000 m asl) and is surrounded by sheer cliffs which make it relatively isolated. It has the largest cinnabar mines (the mineral source of mercury, used to amalgamate silver) in Spanish America, but after the Independence War these were gradually abandoned, so that now it is one of the regions with the lowest per capita income in the country. Snow-capped mountains, beautiful lakes, natural landscapes, and interesting archaeological sites are present but seldom visited, mainly due to the scarce roads and the clever advertising of other places of interest in Peru. Maybe this is the reason why we found only one report of a member of the *Crassulaceae* in this department in the literature (Ostolaza 2002) and no specimens in the herbaria we have searched.

1a. *Echeveria incaica* ex situ from the type locality.

1. ***Echeveria incaica*** Pino, Alcalá & Marquiegui **sp. nova**

Holotype: PERU, Dept. Huancavelica, Prov. Tayacaja, Dist. San Marcos de Rocchac. Anexo Santa Rosa de Jatun Corral, 3,076 m, S 12°06'32", W 74°52'08", Jan 22 2021, *G. Pino, A. Alcalá & D. Marquiegui 3276*. (USM 324183) (Fig 1a)

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1b. *Echeveria incaica* in anthesis growing in a colony at San Marcos de Rocchac (D.M.)

1c. A plant in habitat showing rosette-like scape. (D.M.)

There is only one humid region in the high and mostly dry department Huancavelica. Most of this zone is within the northern province of Tayacaja, relatively close to Junín department, at the rainier eastern side of the Andes influenced by the Amazon jungle. This area is irrigated by the Huari river, a tributary to the Mantaro. The latter is particularly important for Peru because of its size and length, moreover it is alleged to be the headwaters of the Amazon. Its source is the Junín Lake (The second largest in Peru after Lake Titicaca). Lately, several collections of orchids and bromeliads have been reported from Tayacaja. If there should be *Crassulaceae* in Huancavelica, this is the most likely place to find them. This new species of *Echeveria* was first noticed by plant enthusiast Milton P. Franco N. who received a specimen as a gift from Gregorio Misiyauri Arco, a local from the town of Santa Rosa de Jatun Corral, (pronounced "hatoon") who told him that plants grew there. Milton Franco contacted our third author, who came all the way from Argentina to verify the existence of a new *Echeveria* in this area.

Description: A **succulent** glabrous, solitary herb with a conspicuous thick, aerial stem, erect or rarely shortly decumbent at base (Fig 1b). **Primary roots** 3–8 (–20) cm long, 0.6–8 mm diam., some of them thicker at base (to 1.5–1.8 mm diam.), gradually tapering; **secondary roots** in young plants fibrous, 2–5

1d. Young plants of *Echeveria incaica* showing attachment of the leaves.)

cm long, 0.4–1 mm diam., only at base and horizontal part of the stem. **Stem** grayish green to brownish, 3–15 (–45) cm long, (0.8–) 1.2–1.6 (–2.2) cm diam., terete or slightly irregular due to oval, somewhat projected 0.3 × 0.4 leaf scars every 0.8–1 cm.

Rosettes terminal, (7–) 12–15 (–18) cm diam. (Fig. 1c). **Leaves** sessile, in young plants 7–10, ovate, acute (Fig. 1d), in mature plants (10–) 13–25, spirally arranged, obovate in central leaves, orbicular to subspatulate in peripheral ones, narrowly obovate in very large plants, 4.5–9 cm long, 0.5–0.8 cm wide at base, 0.8–1.4 cm wide at proximal third, 2–3 cm wide at middle, 2–2.8 wide at distal third, 0.6–1 cm thick, apex subobtuse (acute in very large leaves), with a 1 × 2 mm

1e. Detail of leaves of large plants of *Echeveria incaica* from the rainy season.

recurved mucro, **margins** smooth; upper side slightly concave to canaliculate, **central nerve** depressed, dark green to yellowish green, brownish red near margins, **central leaves** somewhat purplish; lower side subcarinate near apex, light green or olive green – brownish/purplish in distal 2/3 or near margins and keel, **base** subcuneate, hyaline, lighter in color (Fig. 1e).

Flowering stem 1(–2) a slightly incurved raceme, erect, **rachis** 18–25 cm long, 4–7 mm diam. at base, tapering to 2–2.1 mm diam. at apex, light green at first or in shade, bright red in full sun (Fig 1f). **Peduncular bracts** 12–22, spaced evenly 0.5–2 cm all along the stem, crowded at beginning of anthesis, giving a pseudo-rosulate appearance, also crowded near apex later, inserted at 45°, sometimes pseudo-opposite at the base, larger at proximal half, upper side flat to convex or subcanaliculate, lower side subcarinate, both sides olive green/brownish or lemon green towards apex, lighter near bract base, apex obtuse with a 0.5 mm recurved reddish mucro, base hyaline (Fig 1g). **Flowers** 12–22, appearing from April to June, present only at distal third or half of the scape, 1.3–1.7 cm long and 9–11 mm diam., each closely subtended by a small 1–2 cm long, 0.5–1 cm wide, 2–3 mm thick, lanceolate bract, strongly incurved, adaxially concave, abaxially convex, generally slightly surpassing flower length. **Pedicels** in right angle or recurved, 2–5 mm long, 1.8–2.3 mm diam., slightly lighter than flowering stem. **Calyx lobes** united at base, sepals unequal, oblong to subtriangular, appressed to ascending, slightly incurved, 6–8 mm long, 3–4 mm wide, reddish-olive green, **Flower buds** ovoid, 0.8–1 cm long, 0.8–1.1 cm diam., yellowish at base, reddish at apex and keels. **Corolla** subpentagonal, 0.9–1.1 cm diam. at base, 0.6–0.7 cm diam. at apex, 1.3–1.7 cm long,

1f. Comparison of the scapes of *Echeveria incaica* (right) and *E. intiwayta* (left).

petals narrowly oblong, acute, 1.4–1.6 cm long, 5–6 mm wide, outer surface keeled, light red to orangish yellow, redder at keel, apex intense red and recurving, inner surface yellow, reddish near apex. **Stamens** 10, the 5 epipetalous 9–11 mm long, the antesepalous 12–13 mm long, filaments cream, 0.7–0.8 mm thick at base, gradually tapering to 0.2 mm. **Anthers** ovate, yellow, 1.5–1.8 mm long and 0.8–1 mm wide. **Gynoecium** turbinate, 10–11 mm long, 5–6 mm thick. **Carpels** 5, white. **Styles** 4–5 mm long, parallel, almost touching each other, greenish, stigma yellow.

1g. Detail of the bracts of *Echeveria incaica* just before the dry season.

Nectaries white to light green, 0.9 × 3 mm (Fig. 1h). **Fruit** a dehiscent capsule consisting of five follicles, 1.5–1.6 cm long, 1.6–1.7 cm diam. (spreading dry sepals), dark brown or blackish (Fig. 1i).

Other localities: PERU: Dept. Huancavelica, Prov. Tayacaja, Dist. San Marcos de Rocchac. San Marcos de Rocchac, on rocks with moss, growing with *Peperomia galioides,* orchids, bromeliads and begonias, 3,225 m, S 12° 5'38", W 74°51'55", Jan 22, 2021, *G. Pino, A. Alcalá & D. Marquiegui 3279*. (USM 324184)

Differential diagnosis: By far the most similar species is *E. oreophila* Kimn. from Cajamarca. (Kimnach 2002, Pino 2009) Seen from afar, both have a succulent stem with a rosette of obovate or spatulate leaves atop. However, stems tend to be solitary in *E. incaica* while *E. oreophila* sometimes branches from the base, and the stems of the latter can be slightly stouter in exposed plants. Rosettes are about the same diameter, but they can get larger in *E. oreophila*. Although leaves of the new species are fewer and darker in color, they can have the same shape, and small plants of *E. oreophila* can have leaves of the same length and almost the same width as in *E. incaica,* but the leaves of the latter are more constantly rounded near the apex, with a clear spathulate and even suborbicular shape. *E. oreophila* has longer, flatter, lighter (glaucous) leaves inserted in 45° compared to the horizontally inserted, concave and thicker leaves of *E. incaica*. Another difference concerns the inflorescence, the scape of *E. incaica* is somewhat shorter and thinner, bracts are fewer but relatively longer, wider, and thicker (very similar to its leaves) at the proximal half of stem, the distal ones subtend the flower and surpass it in length. Pedicels in *E. incaica* are noticeably short, horizontal, or sometimes reflexed, compared to the ascending somewhat longer pedicels of *E. oreophila*. Flowers of the latter are more crowded, with more deltoid sepals, spreading in a right angle to 45°, its

1h. Comparison of the flowers and fruits of *Echeveria incaica* (above) and *E. intiwayta* (below). From left to right: Flower bud, bract, bud with bract, sepals (4), complete flower (2), petals (2), sectioned flower showing gynoecium, dry fruit.

1i. Detail of the dry inflorescences of *Echeveria incaica*.

petals are dull pink, their inner side is light cream, both sides lacking the orange-yellowish hues of the flowers of *E. incaica*. The nectaries and carpels of *E. oreophila* are also whiter but its styles dark red.

Etymology and Ethnobotany: The Quechua native name of this *Echeveria* in Santa Rosa de Jatun Corral is "Qishpisisa": "Qishpi" is a quechua word in Huancavelica dialect, the official word is "Q'ispi" in Cusco dialect, meaning "glass", and by extension bright or shiny, pronounced "keshpih" with the initial sound somewhat like French "r" in the local dialect; Sisa means inflorescence. The name chosen for the epithet of this *Echeveria* refers to the Inca Empire that ruled Peru before the Spaniards. According to historians, they had a lot of trouble to conquer the fierce local Chancas from Huancavelica. As with most Echeverias, in Rocchac the liquid extracted from crushed, roasted leaves is used for irritation or damage of the eyes. For this purpose, the plants are extensively collected in habitat, and some measures should be taken to stop reduction of the populations.

Distribution: To date, *E. incaica* has only been found in two close localities in the district of San Marcos de Rocchac, province Tayacaja, department Huancavelica. Its distribution area is likely to be wider, including perhaps neighboring districts of the province of Huancayo in department Junín, like Pariahuanca, Santo Domingo de Acobamba or the surroundings of the Huaytapallana mountain.

2a. *Echeveria intiwayta* in habitat at the type locality. (I.P.).

2. ***Echeveria intiwayta*** Pino & Payano **sp. nova**

Holotype: PERU Dept. Junín, Prov. Concepción, Dist. Cochas. Road from Concepción to Satipo, detour to the North from Cochas to Comas, Parco community, on cliffs, growing with *Peperomia galioides, Epidendrum calanthum, Sauroglossum* aff. *corymbosum,* other orchids and bromeliads, 3,271 m, S 11° 41'29.9", W 75°04'58.5", Apr 14 2021, *G. Pino, I. Payano 3297*. (USM 324185) (Fig. 2a)

This plant was discovered by Iván Payano Casachahua in 2016, on one of his many trips to photograph orchids across the elevated Amazon jungle of Peru, east of the department of Junín. He is a tireless adventurer with a trained eye to discover new species. He returned to the locality in 2019 but failed to bring back plants with intact inflorescences. However, in view of his photographs, we

2b. Plant ex situ in anthesis showing branching at the base.

2c. Young plants of *Echeveria intiwayta* showing erect leaves.

thought he had found a small variety of *E. incaica* outside the department of Huancavelica, but after visiting the habitat again this year and making a close comparison of morphological features of both taxa it was clear that this is a different species.

Description: A **succulent** glabrous herb, with a conspicuous thick, erect aerial stem, sometimes branching at base, with a single rosette at the apex. **Roots** only at base; primary roots 4–9 cm long, 2.5–4 mm diam., gradually tapering; **secondary roots** in young plants fibrous, 1.5–3.5 cm long, 0.1–1.2 mm diam. **Stems** simple, sometimes up to 4, greenish-gray to brownish, 1.5–5 cm long, 0.8–1.2 cm diam., terete or slightly irregular due to oval, somewhat projected 0.2 × 0.5 leaf scars every 0.3–0.4 cm.(Fig. 2b).

Rosettes 4.5–8.5 cm diam. **Leaves** in young plants 8–11, obovate, almost erect, mucronate (Fig. 2c); in mature plants 14–27, arranged spirally in 45° at the last 1–1.5 cm of distal stem, sessile, central leaves obovate, peripheral ones very narrowly obovate, 3–5 cm long, 0.7–0.9 cm wide at base, 0.9–1.2 cm wide at proximal third, 1.4–2.3 cm wide at middle, 1.7–2.4 wide at distal third, 0.4–0.5 cm thick, upper side slightly concave to canaliculate, glaucous, dark reddish to purplish near margins or distal third, central leaves completely glaucous; lower side very convex, subcarinate near apex, dark to bright reddish or the whole surface glaucous, margins smooth, apex subobtuse with a 1 × 1 mm recurved mucro, base subcuneate, hyaline, lighter in color (Fig. 2d).

Flowering stem 1(–2) erect, a slightly incurved raceme, **rachis** 12–18 cm long, 3.8–5 mm diam. at base, tapering to 2–3 mm diam. at apex, light green to dark red, glaucous (Fig 2e). **Peduncular bracts** 10–18, larger at the proximal half, spaced evenly 0.4–1.2 cm all along the stem, crowded at the beginning of anthesis near apex and more or less appressed to the peduncle, sometimes pseudo-opposite at the base,

2d. Comparison of the leaves of *Echeveria incaica* (above) and *E. intiwayta* (below), in the dry season.

oblong to very narrowly obovate, 2.2–3 cm long, 0.8–1.5 cm wide, 3–4 mm thick, upper side flat to convex or subcanaliculate, lower side subcarinate, both sides same color as leaves, reddish green near apex and lighter near base, tips obtuse with a 0.5 mm recurved reddish mucro, base hyaline (Fig 2f). **Flowers** 8–14, appearing from May to June, present only at distal third or half of the scape, 1–1.2 cm long and 7–11 mm diam., each closely subtended by a small 1–1.5 cm long, 0.35–0.45 cm wide, 2–3 mm thick lanceolate bract, strongly incurved, adaxially concave, abaxially convex, generally surpassing slightly flower length. **Pedicels** in right angle or recurved, 1–6 mm long, 1.8–2 mm diam., same color as flowering stem. **Calyx** lobes united at base, sepals unequal, oblong to narrowly ovate, acute, ascending or spreading in 30°, both sides convex, 7–9 mm long, 2.5–4.5 mm wide, intense red. **Flower buds** ovoid, 0.7–0.8 cm long, 0.6–0.8 cm diam., bright red. **Corolla** subpentagonal, 0.8–0.9 cm diam. at base, 0.5–0.6 cm diam. at apex, 1–1.2 cm long, petals oblong to lanceolate, acute, 1–1.3 cm long, 4.5–6 mm wide, outer surface keeled, dark red, pruinose, proximal half sometimes orangish, apex slightly recurving, redder, inner surface light red, orangish in proximal half. **Stamens** 10, the 5 epipetalous 6–7 mm

2e. *Echeveria intiwayta* in habitat at the beginning of anthesis, showing bract details. (I.P.)

2f. Detail of the bracts of *Echeveria intiwayta*.

long, the antesepalous 8–9 mm long, filaments cream, 0.6–0.8 mm thick at base, gradually tapering to 0.2 mm. **Anthers** ovate, yellow, 1.5–2 mm long and 0.8–1 mm wide. **Gynoecium** turbinate, 7–8 mm long, 5–6 mm thick. **Carpels** 5, white. Styles 2–3 mm long, parallel, almost touching each other, greenish, stigma reddish (Fig. 2g). **Nectaries** lunate, greenish white, 1 × 2 mm. **Fruit** a dehiscent capsule consisting of five follicles, 1.1–1.2 cm long, 1.4–1.5 cm diam. (spreading dry sepals), dark brown (Fig. 2g).

Other localities: PERU Dept. Junín, Prov. Concepción, Dist. Cochas. Road from Cochas to Comas, Parco community, 2,828 m, S 11° 41' 38.5" W 75° 05' 0.9", May 21, 2021, *G. Pino & I. Payano 3303*. (USM 324186). Same road, Parco Community, 2,840 m, S 11° 41' 42.8" W 75° 04' 55.5", May 21, 2021, *G. Pino & I. Payano 3304*. (Observed). **Dist. Comas**. Road from Cochas to Comas, 3,000 m, S 11° 41' 41.9" W 75° 04' 52.2"', May 21, 2021, *G. Pino & I. Payano 3305*. (USM 324187). Same road, 3,100 m, S 11° 41' 41.6" W 75° 04' 52.1", May 21, 2021, *G. Pino & I. Payano 3306*. (Observed). Same road, 3,200 m, S 11° 41' 36.2" W 75° 04' 48.6", May 21, 2021, *G. Pino & I. Payano 3307* (USM 324188).

Differential diagnosis: The stems are thinner than in *E. incaica*, the rosettes are about half the size, the scapes are shorter, the bracts more narrowly obovate, the flowers smaller and less numerous and of course the petals are also smaller. However, the stems of *E. intiwayta* are frequently many branching from the

2g. From left to right: Flower bud, bract, bud with bract, sepals (4), complete flower with bract, sectioned flower showing gynoecium, petals (3), gynoecium, dry fruit.

3a. A colony of *Echeveria ostolazae* in habitat near Tantará. (D.M.)

base, especially after the first blossom, a feature seldom seen in *E. incaica*. The leaves are more constantly elongated, narrowly obovate and acute, seldom spatulate or suborbicular as seen in *E. incaica*, with an overall glaucous color and covered with pruine. The sepals are redder, relatively more elongated and spreading in 45° compared to the erect, more glaucous sepals of *E. incaica*, and the petals of *E. intiwayta* are more homogenously dark red, stockier and pruinose, while those of *E. incaica* a more yellowish hue and reddish only on keels, borders, and apex.

Etymology: When Iván discovered this plant, he right away called it "Inti", which is the Quechua name of the Sun God of the Incas. "Wayta", the second part of the epithet, means "flower" in the local Junín dialects. So "intiwayta" means flower of the Sun God. The beautiful round glaucous rosettes look like succulent flowers, and as they are growing on inaccessible east facing cliffs, they are the first plants to reflect the sunrays of the King Star at the early dawn.

Distribution: *Echeveria intiwayta* has only been collected in six adjacent localities in province Concepción, department Junín, on the eastern slopes of the Andes facing the Amazon Jungle. The closest species are *E. incaica* some 80 km to the southeast and *E. andicola* in valleys 100 km to the northwest.

3. *Echeveria ostolazae* Pino, Alcalá & Marquiegui **sp. nova**

Holotype: PERU: Dept. Huancavelica, Prov. Castrovirreyna, Dist. Tantará, Road from Tantará to Chincha, growing with *Trichocereus peruvianus* subsp. *puquiensis*, 2,708 m, S 13°06´13.04", W 75°39´30.92", Jan 19 2021, *G. Pino, A. Alcalá & D. Marquiegui 3269*. (USM 324182) (Fig. 3a)

In 2002, Carlos Ostolaza and Félix Soldevilla visited the basin of the San Juan River, which flows from the slopes of the western Andes in province Castrovirreyna, department Huancavelica, to the coastal province Chincha, department Ica, not far from the southern border of department Lima, Peru. This expedition was partially supported by the BCSS Conservation Fund, mainly aimed to assess the status of endangered cacti in the gorges that feed this river. (Ostolaza, 2002) In the Tantará gorge, on shaded, rocky walls at 1,950 m, near the small town of San Juan de Castrovirreyna, Ostolaza found a dry *Echeveria* without inflorescence growing together with *Peperomia galioides* on dry mosses, took a photo of it and provisionally determined it as *E.* aff. *chiclensis*, the geographically closest species. The photo, published in his article,

3b. *Echeveria ostolazae* in the dry season near Arma. (S.Z.)

3d. Ex-situ plant showing detail of aerial stem.

shows lilac deltoid-leaved plants with a thick semi-buried stem and persistent dry leaves. In Pino et al. 2018, we considered this plant as part of the distribution of *Echeveria deltoidea* because it matched exactly its leaf shape in dormancy, but two doubts remained: the structure of the inflorescence and more than 200 km distance and six valleys between the known-occurrence of *E. chiclensis* and the new locality. In Peru it is considered almost a rule that a species grows only in two to five adjacent valleys. Also, in the respective article the first author erroneously wrote that Tantará is close to the border with Lima, while he should have said close to the border with Ica.

In 2015, together with Carlos Montalva Grimaldi, the second author, Andrés Alcalá Bacigalupo, initiated a series of explorations to assess cacti in the same area. He also found this *Echeveria* in two places: On

3c. Young *Echeveria ostolazae* showing tuberous roots.

the road from Chincha to Villa de Arma together with Santiago Zambrano Godoy, who took a picture exactly like Ostolaza's (Fig. 3b), and on the way from Villa de Arma to Aurahuá. In 2017 he made a presentation at the Peruvian National Cactus Congress in Ayacucho (CONACYS) with the title "Cactáceas de la cuenca del río San Juan", where he also showed a slide of the yet unidentified *Echeveria*. And in 2019 he and Natividad Martínez found it again at a locality closer to Chincha, so they suspected that it could also be present in the department of Ica.

As most of these explorations had happened in the dry period, we decided to assess the status of flowering plants in the rainy season, profiting from the partial easing of the pandemic lockdown in January.

Description: A succulent glabrous, solitary herb, very rarely forming clusters, growing on moss or between rocks. **Primary roots** in young plants 5–8, tuberous, 3–6 cm long, 8–10 mm diam., slightly tapering to 2–3 mm diam., light brownish yellow, born from a disc at the base, (1–) 2–3 cm diam., that gradually develops into the stem, secondary roots fibrous from sides of tuberous roots or stem, 3–15 cm long, 0.5–1 mm diam. (Fig. 3c). **Stem** conspicuous, erect, semiburied to aerial, up to 20 cm long, (1–)1.5–3(–4) cm diam., annularly constricted with scars of fallen leaves and inflorescences, light grayish brown when exposed, dark brown when moist inside moss (Fig. 3d).

Rosettes terminal, usually one, (8–)12–20(–35) cm diam. **Leaves** in young plants 6–8, obovate, subacute-mucronate, upper side slightly concave to faceted 2 mm near blunt margins, lower side subcarinate, bright dark green (Fig. 3e). In mature plants (10–)12–16(–18) leaves, the peripheral ones narrowly obovate

3e. Detail of the leaves of young *Echeveria ostolazae* showing almost horizontal attachment.

to suboblong, incurved or recurved from distal half, central ones slightly rhombic and incurved, sessile, (5–) 8–14 (–20) cm long, (1–) 1.2–1.6 (–2) cm wide at base, 1.5–2 (–4) cm wide at proximal third, 2.2–3.2 (–4.5) cm wide at middle, (1.6–) 2–3.4 (–4.8) cm wide at distal third, 3–6 mm thick, upper side concave to canaliculate, central nerve depressed, apex subacute or acute with a 1.5 × 2.5 mm mucro, in the dry period lilac, in the rainy period bright dark green, lighter in color, sometimes with a light reddish/brownish hue in distal half or near margins and keel, base hyaline, lighter in color (Fig. 3f).

3f. Detail of the leaves of mature *Echeveria ostolazae*.

Flowering stem 1–2 erect racemes, dry scapes persistent, **rachis** (20–)30–50(–70) cm long, 1–1.2 cm diam. at base, tapering to 2–2.5 mm diam. at apex, light green, slightly reddish in full sun, terete or slightly sulcate due to decurrent pedicels (Fig. 3g). **Peduncular** bracts 16–26, spaced evenly 1.5–3 cm along the stem, sometimes paired at the base, larger at proximal half, spreading at 45°, slightly recurved, oblong to narrowly obovate or ovate, slightly recurved, 2–4.5 cm long, 0.5–1.4 cm wide, 3.5–4 mm thick, upper side flat to convex or subcanaliculate, lower side convex, both sides same color as leaves, tips acute to mucronate, sometimes reddish, base hyaline (Fig. 3h). **Flowers** (10–) 13–22 (–28), appearing from February to April, crowded at distal half of the scape, 1.2–1.8 cm long and 7–8 mm diam. **Pedicels** erect or in acute angle to the axis, 0.5–2 cm long, 1–1.5 mm diam., slightly redder than flowering stem, with a small 1–2 cm long, 2.5–4 mm wide bracteole at base, lanceolate, incurved. **Calyx lobes** united at base, sepals unequal, oblong to very narrowly ovate acute, spreading at 45–90°, both sides convex, 7–12 mm long, 2–2.5 mm wide, light green. **Flower buds** ovoid, 0.8–1 cm long, 0.5–0.7 cm diam., yellow at base, reddish at apex. **Corolla** subpentagonal, 1.1–1.7 cm long, 7–8 mm diam. along all its length. **Petals** narrowly oblong, acute, 0.9–1.4 cm long, 3–4 mm wide, light red to salmon orange, apex markedly recurving, inner surface red 1 mm near margins and distal end, yellowish at the middle. **Stamens** 10, the 5 epipetalous 7–8 mm long, the antesepalous 10–11 mm long, **filaments** cream, 0.7–1 mm thick at base, gradually tapering to 0.3 mm. **Anthers** ovate, yellow, 1.5–2 mm long and 0.8–1 mm wide. **Gynoecium** turbinate, 10–11 mm long, 5–6 mm thick. **Carpels** 5, greenish white. **Styles** 3–4 mm long, parallel, almost touching each other, greenish, stigma reddish (Fig. 1g). **Nectaries** inconspicuous, white to very light greenish, 0.6 × 1.2 mm. **Fruit** a dehiscent capsule made of five follicles, 1.2–1.3 cm long, 1.5–1.8 cm diam. (spreading dry sepals), dark brown (Fig. 3i).

Other localities: Dept. Huancavelica, **Prov. Castrovirreyna, Dist. Arma**, Road from Chincha to Villa de Arma, after Palca, growing with *Trichocereus peruvianus* ssp. *puquiensis, Loxanthocereus acanthurus, Loxanthocereus pachycladus* and *Weberbauerocereus rauhii,* 1,937 m, S 13°13´12", W 75°35´38", Jan 19, 2021, *G. Pino, A. Alcalá & D. Marquiegui 3248*. (USM 324172). Same road, some kilometers after (very large plants), growing with same species of Cacti, *Sedum xerophylum*, *Tillandsia* sp. and *Peperomia galioides,* 1,963 m,

3g. Detail of the leaves of mature *Echeveria ostolazae*.

3h. Detail of the bracts of *Echeveria ostolazae*.

S 13°13´06", W 75°35´33", Jan 19 2021, *G. Pino, A. Alcalá & D. Marquiegui 3249*. (USM 324173, Fig. 3j). Same road, growing with same species and *Mila caespitosa* subsp. *densiseta, Opuntia pestifer, Armatocereus matucanensis, Jatropha* sp. and *Portulaca* sp., 2,003 m, S 13°12´57", W 75°35´27", Jan 19 2021, *G. Pino, A. Alcalá & D. Marquiegui 3254* (USM 324175). Close to Villa de Arma, growing with *Trichocereus peruvianus* subsp. *puquiensis, Opuntia ficus indica, Tillandsia* sp. and *Agave cordillerensis*, 2,514 m, S 13°10´26", W 75°33´51", Jan 19 2021, *G. Pino, A. Alcalá & D. Marquiegui 3256*. (USM 324176). **Dist. Aurahuá**, Road from Villa de Arma to Aurahuá, before Aurahuá, growing with *Austrocylindropuntia floccosa* and *Matucana haynei*, 4,150 m, S 13°03´42", W 75°34´15", Jan 19 2021, *G. Pino, A. Alcalá & D. Marquiegui 3257*. (USM 324177). **Dist. Chupamarca**, Road from Aurahuá to Tantará, before Chupamarca, at the second waterfall, growing with *Trichocereus peruvianus* subsp. *puquiensis*, 3,210 m, S 13°01´59", W 75°36´03", Jan 19 2021, *G. Pino, A. Alcalá & D. Marquiegui 3266*. (USM 324180). **Dist. Tantará**, Road from Aurahuá to Tantará, before Tantará, 2,847 m, S 13°04´03", W 75°38´42", Jan 19 2021, *G. Pino, A. Alcalá & D. Marquiegui 3267*. Road from Tantará to Chincha, after Tantará, 2,762 m, S 13°05´41", W 75°39´36", Jan 21 2021, *G. Pino, A. Alcalá & D. Marquiegui 3268*. (USM 324181). **Dept. Ica,** Prov. Chincha, Dist. San Pedro de Huacarpana. Tambo, detour coming from Chupamarca to enter Tantará, growing with *Trichocereus peruvianus* subsp. *puquiensis*. 2,984 m, S 13°03´25.84", 75°38´06.6", Jan 21 2021, *G. Pino, A. Alcalá & D. Marquiegui 3266a* (Observed)

Etymology: The name of this *Echeveria* honors its discoverer, Carlos Ostolaza. He is a Medical Doctor, General Surgeon and Botanist, national expert and authority of Cacti in Peru, member of IOS, Fellow of the CSSA, founder/past-president of the Peruvian

3i. From left to right: *Echeveria ostolazae* flower buds (2), flower, sepals (4), petals (3), sectioned flower showing gynoecium, gynoecium, premature fruit, dry fruit.

Table 1. Comparison of all taxa of *Echeveria* found in the department of Huancavelica and related species. Measurements obtained from the present study and from the first author's descriptions (Pino 2002, 2005, 2006, 2009; Pino et Vilcapoma 2018; Pino & Kamm 2018), updated with additional field data and from cultivated plants.

		Echeveria ostolazae	*E. deltoidea*	*E. cerrateana*	*E. incaica*	*E. oreophila*	*E. intiwayta*
Stems	Number, presentation, length	1, semiburied to aerial, erect up to 20 cm.	1, rarely branched, buried, short.	1, scarcely buried to aerial, erect, 2–3 (–6) cm.	1, aerial, shortly decumbent at base and then erect. 3–15 (–45) cm.	1, rarely up to 4 shortly decumbent at base and then erect 9–30 cm.	1, sometimes up to 4, branching from the base, aerial, erect, 1.5–5 cm.
	Diameter at base (cm)	(1–) 1.5–3 (–4)	0.5–3.5	2–2.5 (–3.2)	0.8–2.2 cm	1.5–2.5	0.8–1.2
Rosette diam.		8–35 cm	(10–) 15–25 cm	3–18 cm	12–15 cm	11–25 cm	4.5–8.5 cm
Leaves per rosette		10–18	17–27	12–24	13–25	22–28	14–27
Leaf color		Bright dark green both sides, lilac in winter.	Light green, slightly redder at keel, light blue to glaucous in winter, purplish in outer leaves.	Dark green, dark red brownish in winter.	Dark to yellowish green, brownish red near margins, lower side light or olive green–brownish/ purplish in distal 2/3 or near margins and keel.	Light green to glaucous or dull green, reddish or purplish near margins, lower side reddish-violet.	Glaucous, dark reddish to purplish near margins or distal third, lower side dark to bright reddish or the whole surface glaucous.
Leaf shape	Young	Obovate.	Triangular or mitriform to rhomboid obovate.	Broadly ovate triangular then narrowly triangular.	Ovate.	Widely obovate.	Obovate.
	Mature	Narrowly obovate to suboblong.	Narrowly triangular to narrowly oblong-lanceolate.	Narrowly obovate to oblong.	Obovate in central leaves, orbicular to subspathulate in peripheral ones, narrowly obovate in large plants.	Narrowly obovate to subspathulate.	Obovate in central leaves, very narrowly obovate in peripheral ones.
Leaf size (cm)	Length	8–14	(4–)10–15(–20)	4–10	4.5–9	4.5–6.5 (–12)	3–5
	Width at base	1.2–1.6	2.5–3.5	0.8–1–1.5	0.5–0.8	0.9–1	0.7–0.9
	Width at proximal third	1.5–4	3–5	1–1.4	0.8–1.4 cm	2.4–3.6	0.9–1.2
	Width at middle	2.2–4.5	4–6	1–1.6	2–3	2.2–3.1	1.4–2.3
	Width at distal third	2–4.8	3–5	(0.7–)1–1.2	2–2.8	2.4–3.6	2.4–3.6
	Thickness (mm)	3–6	3–5	3–7	0.6–10	3–7	4–5
Scape	Number, length (cm)	1–2, 30–50	1, 30–45 (–80)	1–2, (25–) 35- 45 (-60)	1(–2) erect, 18–25	1–2, 12–30 or more	1(–2) erect, slightly incurved, 12–18
	Diameter at base (cm)	1–1.2	0.7–1.0	0.4–0.6	0.4–0.7	0.5–0.8	0.38–0.5
	Color	Light green or pink.	Light glaucous green to pink.	Light green to yellowish or pink.	Light green at first or in shade, bright red in full sun.	Light green or pink.	Light green to dark red.
Bracts	Number, shape	16–24, oblong to narrowly obovate.	18–26, oblong to lanceolate.	22–30, narrowly ovoid-oblong to lanceolate.	12–22, obovate to narrow obovate.	15–28, oblong to narrowly obovate.	10–18, oblong to very narrowly obovate.
	Length × width (cm) × thickness (mm)	2–4.5 × 0.5–1.4 × 3.5–4	2–6 (–9) × 1.2–1.8 × 5–6	2–3.5 × 0.5–1.4 × 4–7	2.2–4.5 × 0.9–2.2 × 3.5–6, longer than flowers.	1.2–2.5 × 0.4–0.7 × 3–4, shorter than flowers.	2.2–3 × 0.8–1.5 cm × 3–4
Flowers, arrangement		(10–)13–22(–28), subpentagonal.	22–30, pyramidal.	(12–)16–19, urceolate, subpyramidal.	12–22, subpentagonal.	12–15, subpentagonal.	8–14, subpentagonal.
Pedicels		Ascending or in acute angle to the axis, 0.5–2 cm long, red.	Horizontal and short (1–2 mm) in distal flowers, oblique in lower flowers, up to 1.2 cm long.	Horizontal or in 45°, 0.4–1.8 cm long.	In right angle or recurved, 2–5 mm long.	Ascending or in 45° to the axis, 4–5 (–12) mm long, reddish.	In right angle or recurved, 1–6 mm long.
Sepals	Shape, presentation	Oblong to very narrowly ovate acute, 45–90°	Narrowly ovate acute, spreading in right angle	Narrowly ovate or oblong acute ascending or recurved,	Oblong to subtriangular, ascending, slightly incurved,	Deltoid ovate, subacute, spreading in 60–90°,	Oblong to narrowly ovate acute, ascending or spreading in 30°, both sides convex
	Length × width (mm)	7–12 × 2–2.5	5–8 × 3–4	6–10 × 1.5–2.5	6–8 × 3–4	6–8 × 2.5–4	7–9 ×, 2.5–4.5
	Color	Light green.	Light olive green.	Light green.	Reddish olive green.	Reddish green.	Intense red.
Petals	Length (cm) × width (mm)	0.9–1.4 × 3–4	1.8–2 × 5–6	1.2–1.4 × 3.5–4, apex slightly recurving.	1.4–1.6 × 5–6	1.3–1.6 × 4–5	1–1.3 × 4.5–6
	Outer surface color	Light red to salmon orange, apex recurved,	Salmon red, apex slightly recurving,	Yellow with minute red lines,	Light red to orangish yellow, redder at keel, apex intense red and recurving,	Dull pink, keeled,	Keeled, dark red, pruinose, proximal half sometimes orangish, apex slightly recurving, redder,
	Inner surface color	Red near margins and distal end, yellowish at the middle.	Red near margins and distal end, yellowish at the middle.	Yellow, pinkish at margins and tip.	Yellow, reddish near apex.	Light cream proximal 2/3, reddish distal third.	Light red, orangish in proximal half.

3j. A large rosette of *Echeveria ostolazae* ca. 35 cm diam., growing with *Oxalis* sp. and *Peperomia galioides*, close to Arma. (D.M.)

Cactus Society (SPECS) and author of many books and articles.

Distribution: To date, *E. ostolazae* has been found in the San Juan River basin, department Huancavelica, province Castrovirreyna, where it is abundant in districts Tantará, Aurahuá and Arma and in a single locality of the neighboring highlands of province Chincha, in the department of Ica, Peru. We explored later the adjacent southern valley of Huaytará but failed to find it there.

Differential diagnosis: This new taxon was taken by its discoverer for *E. chiclensis* var. *chiclensis*, (Pino, 2002) geographically the closest species that grows only 200 km to the north. Young plants are almost indistinguishable, but when mature the latter develops more leaves, which are dull green to purplish, almost half as wide, and slightly thicker, bracts are likewise narrower, flowers are longer and of a different color pattern (see Table 1). The first author determined it as *E. deltoidea* without flowers, (Pino et al. 2018) but the new species is less branched and tends to form longer aerial stems. In *E. deltoidea*, rosettes are larger, leaves are more triangular and wider, lighter in color, however in winter the two species can be confused because of the purplish or grayish color. The flowers of *E. deltoidea* are longer, pyramidal instead of prismatic, although their color is similar. The structure of the stem and the tuberous roots of *E. ostolazae* is reminiscent of *E. cerrateana*, (Pino & Kamm, 2018), but leaves of the latter are shorter and not as wide, straight, harsher in surface, narrowly triangular, turning very dark red or brown in winter. Flowers have a bulged base, they are subpyramidal instead of prismatical and have a different color pattern. The leaves of *E. ostolazae* also remind of *E. andicola* (Pino, 2005), but this species has shorter, intense red flowers.

4a. *Sedum xerophilum* at type locality. (D.M.)

4. ***Sedum xerophilum*** Pino, Alcalá & Marquiegui **sp. nova**

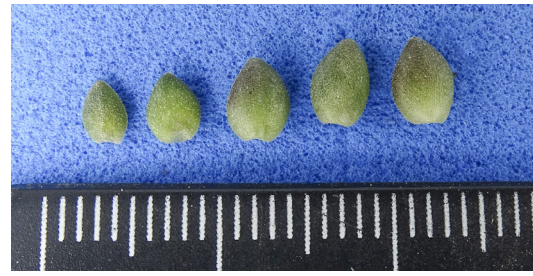
Holotype: PERU: **Dept. Huancavelica, Prov. Castrovirreyna, Dist. Arma.** Road from Chincha to Villa de Arma, after Palca, growing with *Echeveria ostolazae*, *Peperomia galioides*, *Oxalis* sp, *Tillandsia* sp. *Trichocereus peruvianus* subsp. *puquiensis, Loxanthocereus acanthurus, Loxanthocereus pachycladus* and *Weberbauerocereus rauhii,* 1,963 m, S 13°13´05.83", W 75°35´33.17", Jan 19 2021, *G. Pino, A. Alcalá & D. Marquiegui 3251*. (USM 324174)

While collecting *Echeveria ostolazae* we noticed a *Sedum* growing at the second and third localities we visited. Without flowers, regarding size of plants and leaves it looked like *S. berillonanum*. However, some plants with flowers rather suggested *S. incarum* or *Villadia virgata* instead, so we focused on these two species (Fig. 4a). The leaves were only about half as long as theirs. As inflorescences were a clear dichasium, we ruled out the latter genus, and thought we had found a malnourished phenotype of *S. incarum* growing at

4b. Plant ex- situ of *Sedum xerophilum*.

an unusually low habitat, much drier than the high elevations where it normally is occurring, so we collected it for laboratory study. Later many more differences were noticed, so we decided to describe it as a new species (Fig. 4b).

Description: A **succulent** glabrous herb, caespitose, 5–8 cm tall when vegetative, up to 8–12 cm in blossom, forming loose mats to 10–12 cm diam. **Roots** fibrous, 0.2–0.3 mm diam. **Basal stem** 3–7 cm long, 2–2.2 mm diam., gradually tapering to 1.6–1.8 mm, decumbent, then branching alternately every 1–3 cm, light green with brownish red stripes towards apex, light greenish gray in old plants. **Branches** 4–12, erect to slightly decumbent, frequently bended, vegetative branches, 5–7 cm long, leafy stem 8–9 mm diam., reproductive branches up to 15 cm long in blossom, leafy stem 4–5 mm diam. **Leaves** succulent, sessile, spirally attached to stem, in vegetative branches every 1.5–2 mm, in reproductive branches less densely towards apex (up to 3–4 mm apart), broadly ovate on vegetative stems, both sides convex, 3.2–4.5 mm long, 2.5–4 mm wide (narrower near inflorescence),



4c. Detail of the leaves of *Sedum xerophilum*.

2–2.2 mm thick, near inflorescence incurved and concave, base attached in 45° angle to stem, apex obtuse or rounded, olive green with a slight blush towards apex, margins blunt, base hyaline, light green (Fig. 4c).

Inflorescence a terminal cyme (dichasium) with 2 cincinnoid branches and a flower at bifurcation. Each branch 1.8–1.6 mm diam. at base, gradually tapering to 1 mm, 7–8 mm long, light green. Flowers 3–5 per cincinnus, sessile, appearing in habitat from January to February. **Flower buds** ovoid, 5–7 mm long, 3.5–5 mm diam., olive green. **Bracteoles** one at the base of each flower, ovate, 3–5 mm long, 2–3.5 mm wide, subacute, upper side flat, lower side convex, olive green. **Sepals** narrowly ovate, 3–3.5 mm long, 2–2.2 mm wide, erect, outer side olive green. Petals oblong, acute-deltoid at tip, erect, very slightly recurving, 4–4.5 mm long, 1.5–2 mm wide, both sides greenish white to yellowish, outside brownish at keel in distal third. **Flower** diam. 4–4.8 mm. **Stamens** 10, the 5 epipetalous 2.2–2.5 mm long, the antesepalous 3–3.2 mm long, filaments white, 0.2–0.3 mm diam. **Anthers** globose, yellow, 0.3–0.4 mm diam. **Gynoecium** ovoid, 2.5–2.6 mm long, 2–2.2 mm diam. **Carpels** 5, yellowish green. **Style** 0.9–10 mm long, same color, stigma inconspicuous. **Nectaries** lunate, yellow, 0.8–0.9 × 0.4 mm. **Fruit** appearing in habitat from February to March, a dehiscent capsule made of five follicles, 2.5–3.5 cm long, 3–4 mm diam. (spreading dry sepals lighter), brown, star–shaped from above (Fig. 4d).

4d. From left to right: *Sedum xerophilum* flower bud, single flower, sepals (3), petals (2), sectioned flower showing gynoecium, dry fruit (2).

4e. From left to right: Comparison of the leaves of *Sedum incarum* (2), *S. berillonanum* (2) and *S. xerophilum* (2).

Other localities: PERU: **Dept. Huancavelica, Prov. Castrovirreyna, Dist. Arma**. Road from Chincha to Villa de Arma, growing with *Echeveria ostolazae, Trichocereus peruvianus* subsp. *puquiensis, Loxanthocereus acanthurus, Mila caespitosa* subsp. *densiseta, Opuntia pestifer, Armatocereus matucanensis, Jatropha* sp. *Portulaca* sp. *Furcraea occidentalis, Agave cordillerensis* and *Peperomia* sp. 2,603 m, S 13°12´57", 75°35´27", Jan 19 2021, *G. Pino, A. Alcalá & D. Marquiegui 3253*. (Observed)

Distribution: To date, *S. xerophilum* has been found in only few scattered populations in the department of Huancavelica, Peru.

Differential diagnosis: Compared to *S. berillonanum*, plants of *S. xerophilum* are of approximately the same size and habit, but the leaves of the former are slightly larger and somewhat truncate or cylindrical spreading almost at 90° or slightly less, while in *S. xerophilum* they are ovate and less thick (Fig. 4e) and they are spreading at 45°. Its distal leaves near the inflorescence are even flatter, incurvate and concave adaxially. The main difference is the flower, with longer and narrower petals in *S. berillonanum*, pure white and spreading at the middle.

Regarding *S. incarum*, perhaps geographically the closest species, plants of the latter are much taller, with leaves almost twice as long but with the same width. Flowers do look remarkably similar in shape, but *S. xerophilum* has somewhat smaller greenish white to yellowish instead of white petals. Inflorescences are a simple short but clear dichasium in *S. xerophilum*, while *S. incarum* has a quite complex inflorescence, starting sometimes like a raceme at the base but branching dichotomously and most of the times shorter distally. *S. incarum* grows from 3400 to 4,400 masl or more, and this new species has only been found in the 1,900–2,400 m range (Fig. 4f).

4f. From left to right: Comparison of vegetative branches with leaves of: *Sedum incarum, S. berillonanum* and *S. xerophilum*. This last one also showing reproductive leaves.

Etymology: The epithet (ξηρός= dry, φιλος= lover) refers to the dry, places where this *Sedum* lives, close to the coastal desert of Ica, at lower elevations than the rest of the Peruvian *Sedum* species and always together with many species of Cacti.

5. ***Sedum incarum*** (Ball) Pino, 2006. Little known *Crassulaceae* of Central Peru. *Haseltonia* 12: 58–61.

This species has been thoroughly described in Pino, 2006. It occurs in the high elevations of the Rimac Valley, Lurín Valley and it has also been reported in Laraos, prov. Yauyos at the upper Cañete River basin, (Hamilton Beltrán, pers. comm.), always above 3400 masl. The following reports are the first out of the department of Lima, at the next valley south of Cañete, the San Juan River Valley and in Tayacaja.

New localities: Dept. Huancavelica, Prov. Castrovirreyna, Dist. Aurahuá, Road from Villa de Arma to Aurahuá, before Aurahuá, 4,450 m, S 13°03´41", W 75°34´15", Jan 19 2021, *G. Pino, A. Alcalá & D. Marquiegui 3258*. (USM 324178) **Dist. Chupamarca**. Road from Aurahuá to Chupamarca, between the bridge and first waterfall, 3,401 m, S 13°01´59", W 75°34´40", Jan 19 2021, *G. Pino, A. Alcalá & D. Marquiegui 3264*. (Observed) **Prov. Tayacaja, Dist. San Marcos de Rocchac**. Road from San Marcos de Rocchac to anexo Huari, growing with *Peperomia verruculosa* and *Pilea* sp., 3,742 m, S 12° 3'31", W 74°58'27", Jan 22, 2021, *G. Pino, A. Alcalá & D. Marquiegui 3280* (Observed, Fig 5).

5. *Sedum incarum* growing with *Peperomia verruculosa* at San Marcos de Rocchac. (A.A.)

6. *Sedum renzopalmae* in habitat at Aurahuá (D. M.)

6. ***Sedum renzopalmae*** Pino. Little known Crassulaceae of Central Peru. *Haseltonia* 12: 62–65.

This yellow flowering species has also been described previously in Pino, 2006. It is rare and appears in secondary transversal gorges of the Rimac Valley in dept. Lima, prov. Huarochiri (Sta Eulalia, San Damián) and in prov. Canta (Huaros and Lachaqui). This is the first report for the department of Huancavelica.

New localities: Dept. Huancavelica, Prov. Castrovirreyna, Dist. Chupamarca. Road from Aurahuá to Chupamarca, between the bridge and first waterfall, 3,401 m, S 13°01´59", 75°34´40", Jan 19, 2021, *G. Pino, A. Alcalá & D. Marquiegui 3265* (Fig. 6). **Prov. Huaytará, Dist. Huaytará**. Road Los Libertadores Wari – (from Pisco to Ayacucho), in a small gorge to the south growing with *Matucana haynei* and *Oreocereus hendriksenianus*, 3,887 m, S 13°34´56.8", 75°15´9.84", Mar 16, 2021, *G. Pino, A. Alcalá & J. Cabrera 3291*.

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All photos by Guillermo Pino, except where stated: A.A. = Andrés Alcalá, D.M. = Daniel Marquiegui, I.P. = Iván Payano, S.Z. = Santiago Zambrano.

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Table 2. Comparison of main features of *Sedum xerophilum* with species discussed in text and with *S. renzopalmae*. Measurements obtained from the present study and from the first author's descriptions (Pino 2006, Pino et al. 2017)), updated with additional field data and from cultivated plants.

	Sedum renzopalmae	***S. xerophilum***	***S. berillonanum***	***S. incarum***
Height	6–10 cm	5–8 cm	9–12 cm	10–12 cm
Height with flowers (cm)	10–12	8–12	10–15	12–18
Diameter of the leafy stem (mm)	4–5, stem red to purple	8–9	9–15	12–23
Shape of leaves	Ovoid to subrhombical.	Broadly ovate to slightly narrowly ovate, distally obtuse.	Ovoid to cylindrical.	Very narrowly ovoid to subtriangular, obtuse.
Attachment angle of leaves to vertical axis	30–45°	45°	60–90°	45–90°
Size of leaves	3–4 mm long, 2.2–2.5 mm wide, 1.3–1.5 mm thick.	3.2–4.5 mm long, 2.5–4 mm wide, 2–2.2 mm thick.	4–7.5 mm long, 3–4 mm wide, 2.5–3.5 mm thick.	7–10 mm long, 3.5–4 mm wide, 2.8–3.5 mm thick.
Inflorescence (per branch)	Short, 1.3–1.6 cm long, 3–4 flowers per cincinnus.	7–8 mm long 3–5 flowers per cincinnus.	1–2 cm long 3–4 flowers per cincinnus.	Complex, sometimes initially raceme, then dichasium, each cincinnus 0.5–2 cm long with 1–3 flowers
Sepals	Ovate to subrhombical, 4.5–5 mm long, 2.5–3 mm wide.	Narrowly ovate, 3–3.5 mm long, 2–2.2 mm wide.	Narrowly ovate, 2–5 mm long, 1.2–1.5 mm wide.	Lanceolate, 4–4.5 mm long, 1.2–1.5 mm wide.
Petal size	8–9 mm long, 2.5–3 mm wide.	4–4.5 mm long, 1.5–2 mm wide.	6–8 mm long, 1.8–2.2 mm wide.	5–6 mm long, 2–2.5 mm wide.
Petal color	Bright pure sulphur yellow	Abaxial greenish white with a brownish keel in distal third, adaxial greenish white	Abaxial white, with a greenish white keel, adaxial pure white.	Abaxial white with a brownish keel, adaxial pure white.
Petal disposition	Recurved at the distal half 90°.	Straight or very slightly gradually recurved.	Recurved at the distal third 90°.	Straight or very slightly and gradually recurved.
Nectaries	Lunate, orange yellow, 1 × 0.4 mm	Lunate, yellow, 0.8–0.9 × 0.4 mm	Globose, yellowish green, 0.5–0.8 mm diam.	Yellow, 1 × 0.5 mm

Corrections

We are grateful to readers for providing identifications for the recent article by Fred Dortort (*CSJ* 93–3, 164). The plant identified as *Cumulopuntia ignescens* is more likely *Maihueniopsis atacamensis* — apparently a much rarer plant — and *Cumulopuntia iturbiensis* is better named *C. iturbicola*. The *Portulaca* sp. is probably *P. eruca*, and the caption for Fig. 59 should have read: *Tephrocactus geometricus* — some spinier plants had flowers completely open, but this almost spineless one was the most interesting.