

THE ECHEVERIAS OF ECUADOR

and a new species from its border with Peru

Abstract. The current status of genus *Echeveria* in Ecuador is reviewed. Although in 1994 Alina Freire-Ferro transferred all species in Ecuador to one taxon: *E. quitensis*, which she considered a single, variable species, we believe there are considerable differences, enough to consider some separate species and varieties. Plants found around the city of Quito are considered var. *quitensis* as the type variety. *E. quitensis* var. *sprucei* is here considered a synonym of var. *quitensis* due to contradictions in the annotations on the Herbarium types and the similar features with the type variety. *Echeveria cuencaensis* is reduced to variety status *Echeveria quitensis* (Kunth) Lindley var. *cuencaensis*. These two belong to Series Nudae. *Echeveria cojitambensis* is a new species discovered at Cañar, North of Cuenca. *Echeveria tabaconasensis* is another new species from Tabaconas, Peru, near the border with Ecuador. It was previously misidentified as *E. cuencaensis* due to a lack of description of plants around Cuenca. It is close to the Peruvian *Echeveria eurychlamys*.

Keywords: Crassulaceae, *Echeveria*. Ecuador, Peru.

1. *Echeveria quitensis* (Kunth) Lindley var. *quitensis*. *Jour. Hort. Soc.* Vol VII: 268, 1852; Poellnitz, in *Fedde Repert.*, Vol 39: 230, 1936; Walther E, *Echeveria*. California Academy of Sciences, San Francisco: 287-289, 1972. Pilbeam J. *The Genus Echeveria*. The British Cactus and Succulent Society, Essex, UK: 227-228, 2008. (Fig. 1a)

Synonyms: *Sedum quitense* Kunth, *Nova Genera et Species plantarum*. Vol VI: 46-47. 1823. De Candolle, *Prodromus*, Vol 3: 410, 1828. *Cotyledon quitensis* (Kunth) Baker in Saunders & Baker *Refug. Bot.* Vol I(5), 1869. *Echeveria aequatorialis* Rose ex von Poellnitz in *Fedde Repert.*, Vol 38: 185, 1935; Vol 39: 236, 1936. *Echeveria columbiana* von Poellnitz in *Fedde Repert.*, Vol 38: 186, 1935; Vol 39: 236, 1936. *Echeveria quitensis* var. *sprucei* (Baker) von Poellnitz, in *Fedde Repert.*, Vol 39: 232, 1936. *Cotyledon sprucei* Baker in Saunders & Baker *Refug. Bot.* Vol I(31), 1869. *Echeveria sprucei* (Baker) Berger in Engler *Nat. Pflanzenf.* Ed. 2, Vol XVIIIa: 473, 1930.

Holotype: ECUADOR, Prov. Pichincha, Cantón Quito. On waste ground near Guayllabamba (20 km NE of Quito) and on walls in the town of Quito. Humboldt & Bonpland 1802/3096, P 00679607 as *Sedum quitense*. **Isotype:** B-W 08915-010

The type variety of *E. quitensis* was described by Kunth from plants collected by Bonpland and Humboldt at the North of the city of Quito and even growing in the same city "*Crescit in ruderalis prope Guayllabamba, et in muris urbis Quito*". His description is meagre, and he placed the species in *Sedum*. The sheet at

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1a. *Echeveria quitensis* var. *quitensis* growing in habitat in Pifo, near Quito.

Paris clearly shows only floral scapes, only one with bracts. The isotype in Berlin of the Willdenow collection has only one bractless scape, the annotation reads: "*Decandria pentagynia, foliis obovatis ... (illegible), racemo terminalis, habitat prope Quito*." Lindley transferred



1b. A multi-stemmed plant of *Echeveria quitensis* var. *quitensis*.

this taxon to *Echeveria* and expands the description from a plant that Isaac Anderson-Henry, an importer of Andean plants, collected at an unknown locality. Walther gives a more complete description, but using plants that were collected in South Colombia. He ascribes the considerable variation to be due to weather and environmental factors. In this treatment we consider plants that originally grew at the city of Quito as the closest to the type. Nowadays, perhaps no plants grow naturally inside the urban part of the city, although they were abundant in the last century. Some of them survived in undisturbed relicts like the Botanical Garden of Quito.

Description: A succulent glabrous herb with conspicuous branched stems (Fig. 1b). **Primary root** a short taproot, straight or slightly curved, in old plants with 2–4 very narrowly tuberous branches, 1–3 mm diam. **Secondary roots** fibrous from sides of tuberous roots, short (Fig. 1c). **Stem** aerial, erect when young, sometimes decumbent in old plants growing on vertical walls, simple when young or many branched alternately, 0.8–2 cm diam. at base, gradually tapering, light grayish brown at base, later greenish or redder, light green near apical leaves. **Branches** 2–30, born from base or alternately every 5–10 cm, 0.4–1 cm diam. at base, 0.3–0.8 near tips, 10–50 cm long or more in very old plants, same color as stem. **Rosettes** one at the end of stem



1c. Young plants of *Echeveria quitensis* var. *quitensis* showing taproot and fibrous roots.



1d. Detail of *Echeveria quitensis* var. *quitensis* rosette and back of leaves.



1e. Detail of leaves of *Echeveria quitensis* var. *quitensis*.

or branch, (4–) 6–9 cm diam. (Fig. 1d). **Leaves** (10–) 18–30, present at the distal 3–7 cm, rarely present below, crowded at the apex, inserted every 3–5 mm more proximally, narrowly obovate, sessile, slightly incurved, 2–6 cm long, 0.3–0.6 cm wide at base, 0.4–0.8 cm wide at



1f. Scape of *Echeveria quitensis* var. *quitensis*.

proximal third, 0.7–1.3 cm wide at middle, 1.2–1.8 cm wide at distal third, 5–6 mm thick at base, 3–4 mm thick at the middle, upper side flat to channelled at distal half, light glaucous green, somewhat pruinose, reddish at margins and tips, lower side flat or with recurved margins, slightly lighter than upper side, with central nerve prominent; reddish at margins, distal third, central nerve and sometimes near base, apex obtuse or rounded, with an acute mucro 0.5–1 mm long at apex, base rounded or oval in section, hyaline whitish (Fig. 1e).

Flowering stem usually 1 lateral subterminal



1g. Detail of the bracts of *Echeveria quitensis* var. *quitensis*.

equilateral or unilateral raceme, **rachis** 15–25 cm long, 5–6 mm diam. at base, 1.5–2 mm diam. at apex, light pink at base, dark pink distally (Fig. 1f). **Peduncular bracts** 20–25, at proximal half of stem, spaced 2–4 mm apart at base and 4–6 mm more distally, obovate, erect, 1–1.7 cm long, 0.4–0.9 cm wide, 1.5–2 mm thick, flat or channelled in upper side, subcarinate in lower side, same color as leaves (Fig. 1g). **Flowers** 8–16 (–20), appearing from September to December, present only at distal half of the scape, in a cluster clearly separate from bracts, 0.8–1 cm long and 0.5–0.6 cm diam. **Pedicels** 2–4 mm long, longer in lower flowers, oblique or ascending, 1–1.2 mm diam., same color as flowering stem, with 1 small oblong bracteole at base, and 1–2 along the pedicel, 3–7 mm long, 0.5–1 mm wide. **Calyx** lobes united at base, sepals unequal, narrowly triangular, acuminate, erect or inserted in 30–45°, some reflexed, inner side concave, outer side subcarinate, 4–7 mm long, 1.5–2 mm wide, glaucous green, reddish at tips and keel. **Flower buds** ovoid, 0.6 diam. × 0.8 cm long, dark pink. **Corolla** urceolate, subprismatical, 0.5–0.6 cm thick near base, 3.5–4 mm thick near apex, 0.8–0.9 cm long, petals oblong to narrowly ovate, acute, 0.8–0.9 cm long, 2.5–3 mm wide, outer surface keeled, dark pink, apex slightly recurving, inner surface yellow. **Stamens** 10, the 5 epipetalous 5–5.5 mm long, the antesealous 6.5–7.5 mm



1h. Detail of flowers; from left to right: sepals (4), flower bud, sectioned flower showing gynoecium, petals (2), fruit, dry fruit.

long, filaments cream, 0.6 mm thick at base, gradually tapering to 0.3 mm. **Anthers** ovoid, yellow, 1–1.2 mm long and 0.4–0.6 mm wide. **Gynoecium** ovoid, 6–7 mm long, 3.5–4 mm thick. **Carpels** 5, cream. **Styles** 2–2.5 mm long, parallel, almost touching each other, dark red. **Stigma** dark red. **Nectaries** reniform, cream, 1–1.2 × 0.2–0.3 mm. **Fruit** a dehiscent capsule 0.4–0.6 cm long, 1.2–1.5 cm diam. (spreading dry sepals), dark brown (Fig. 1h).

Other localities: ECUADOR: Prov. Pichincha, Cantón Quito. Quito city, on roof of the Catholic University, 2816 m, 00° 10' S, 78° 29' W, Mar 1954, as a gift of *Tinajero family 1439*, (QCA 35111). Garden of J. R. Tinajero, 2820 m, 00° 15' S, 78° 30' W, Apr 22, 1972, *Tinajero s/n*, (QCA 35110). Pifo, banks of Rio Ayaguaico, 2400 m, 00° 12' S 78° 21' W, Apr 8, 1990, *A. Alvarez 17* (QCNE 97577, MO). Sigsipamba via Pifo, hills near quarries, 2813 m, 00° 14' 27.81" S, 78° 19' 05.05" W, Mar 17, 2011, *L. Delgado & T. Prado 413* (QCA 217170). Road Quito-Lloa-Guagua Pichincha, near El Refugio, 3700 m, 00° 12' S, 78° 34' W, Apr 13, 1993, *A. Freire Fierro & E. Andersen 2541* (QCA 35086). 1–2 km NE-E of Hacienda Pinantura, ca 5 km E of Pintag, dry rocky lava flow with scattered shrubs and herbs, 3200–3300 m, 00° 23' S, 78° 19' W, Jul 1, 1979 *B. Løjtman & U. Molau 15418* (AAU, GB). Road to Nono, 2706 m, 00° 01' 53" S, 78° 33' 7" W, Jun 28, 2011, *L. Delgado, C. Quintana, M. Proaño & L. López 116* (QCA 206618). Montane scrub c. 12.5 km SE of Nono, 3150m, 00° 05' 5" S, 78° 33' W, Jul 1, 1991, *G.L. Webster et al. 28670* (QCNE 80904). Gorges near Casitagua Volcano, NE of the Volcano. 3283 m, 00° 01' 22.5" S, 78° 33.5' W, Nov 24, 2011, *L. Delgado, C. Quintana, M. Proaño & L. López 203* (QCA 217284). Reserva Geobotánica Pululahua, Moraspungo path, 3050 m, 00° 05' S, 78° 30' W, Mar 22, 2011, *P. Paredes 44*, (QCA). Guagua Pichincha Volcano, Paramo and secondary foprest near base of volcano, 3500 m, 00° 10' S, 78° 35' W, Apr 21, 1996, *J.L. Clark 2528* (QCNE 115171). Tumbaco, near Antisana Reserve, Cooperativa Inga Alto Montserrat, Paramo and scrub, subalpine forest, 3800 m, 00° 20' S, 78° 15' W, Mar 8, 1994, *A. Álvarez 1359* (QCNE 97370). **Cantón Cayambe:** Road from Cayambe to Comunidad Sayaru, detour to the right to Corrales, 3600 m, 00° 03' S, 78° 03' W, Dec 4, 1993, *A. Freire-Ferro, O. Graff & A. Gauzzi 2594* (QCA 35087). Cayambe, just North of the town on the road towards Ibarra, road banks, 3000 m, 00° 03' N, 78° 09' W, Nov 19, 1981, *P. Filskov, M. Søndergaard & I. Gregersen 37217* (QCA 35085). Parroquia Olmedo, Humid montane forest, 3097 m, 00° 08' S, 78° 05' W, Jul 22, 1990, *C. Cerón 11508* (QCNE



1i. *Echeveria quitensis* var. *quitensis* at the Botanical Garden of Quito. (T.J.)

66967).

Discussion: In 1994 Alina Freire-Ferro studied the Herbarium sheets of 116 Ecuadorian collections of *Echeveria* and transferred all of this species in Ecuador to one taxon: *E. quitensis*. She explains that although Poellnitz (1936) had divided Ecuadorian plants into four species and one variety, she lumped them all and considered this to be a single, variable species. We partially follow this criterion in the sense that many of the taxa we observe in Ecuador seem to belong to a same species, *E. quitensis*, but they show considerable and consistent variation that would merit to place some within varieties, clearly distributed in geographical and altitudinal boundaries. *E. quitensis* belongs to series *Nudae* Walther, because it has racemose inflorescences, plants not hairy with long stems and a subshrubby habit. (Walther, 1972)

In this study we consider var. *quitensis* as the type variety, with its main distinctive features: Plants mostly with erect, many branched stems, glaucous pruinose narrow leaves, margins of lower leaves sometimes recurved laterally (they remind *E. runyonii* Walther ‘Topsy Turvy’ Kimnach) but tinged purplish red at margins and tips, short flowers, dark to light pink outside, yellowish inside. The webpage of the Native plants of the Quito Basin published by the Botanical Garden of Quito clearly shows these features in the photos Tatiana Jaramillo made from plants that grew spontaneously in the Botanical Garden, published in the web in its Humboldt Collection: <http://plantasnativas.visitavirtualjbq.com/index.php/epoca/xix-humboldt-bonpland/30-echeveria-quitensis> (Fig. 1i).

Here we consider *E. quitensis* var. *sprucei* as a synonym of var. *quitensis*. The type of *E. quitensis* var. *sprucei* (Spruce 5463, K 000006128, 6129) indicates in the original black ink: “*Andes Quitenses, in*

declivibus saxosis, frequens” Then there is an annotation in blue and another handwriting that seems to have been written later: “*Ambato, Quito, frequens in prae-ruptis*”. The syntype extant at Vienna does not mention Ambato at all. Walther (1972) describes *E. sprucei* from a plant collected by Harry Johnson and he indicates it comes from near the type locality in Ecuador (UCBG 57.452). However the plant with this number originally came from Colombia. He even remarks that Baker’s description of 1869 differs from his own description. The photos he publishes are taken also from Johnson’s plant. The characters he and Pilbeam (2008) mention are common for var. *quitensis*: greyish green, glaucous leaves, corolla pinkish red, yellow inside. The reflexed sepals and recurved pedicels have been observed in plants around Quito as well. Since the type seems to be from Quito and matches the plants found around Quito, we consider *E. quitensis* var. *sprucei* as a synonym of var. *quitensis* in this treatment. Uhl (2006, p. 39) finds its chromosome number $n = 22$, the same for all plants collected in Ecuador, including the reputed ‘*sprucei*’, in contrast to *E. bicolor* ($n = 21$).

Etimology, uses and distribution: Freire (2004) records the name “Siempreviva” for this *Echeveria* in the Pichincha area. She mentions that it is used locally to combat fever. The type variety is distributed in the North of Ecuador, mainly in the Province of Pichincha in altitudes of 2700 to 4100 m, in moderately exposed places.

2. *Echeveria quitensis* (Kunth) Lindley var. *cuencaensis* Pino & Kabir Montesinos. var. nova

Synonyms: *Echeveria cuencaensis* Poellnitz in *Fedde Repert.*, Vol 38: 187, Vol 39: 248, 1936. *Echeveria pachanoi* Rose ex von Poellnitz in *Fedde Repert.*, Vol 38: 187, 1935; Vol 39: 226, 1936.

Holotype: ECUADOR, Prov. Azuay, Cantón Cuenca. Vicinity of Cuenca, Rose J.N., Pachano & Rose G. 18/22941, Sep 17-24, 1918 US 1022515. (Fig. 2a)

During the USDA explorations in South America for the Gray Herbarium of Harvard University, Joseph Nelson Rose and his two assistants discovered this taxon near the city of Cuenca, capital of the Azuay province and Rose intended to call it *Echeveria ingens* n.n. as it is handwritten in the respective herbarium label. However, he had already described *Dudleya ingens* in 1903, and this later was renamed to *Echeveria ingens* (Rose) by Alwin Berger in 1930, a name that remained only as a synonym and therefore could not be used any more. The plant was never



2a. *Echeveria quitensis* var. *cuencaensis* in Guzho, within the City of Cuenca.

cultivated and Rose died in 1928 without giving it a name. Eight years later Poellnitz described this plant from the herbarium sheet, naming it *E. cuencaensis* after its locality. The description is very poor, considering he actually never saw a living plant and that the sheet contains only three leaves and a flower stalk. First of all, he considered the plant stemless, with oblong grayish pruinose glaucous leaves, red at edges, scape of 20 cm, over 30 flowers in an equilateral raceme, red with yellow toward apex, frequently paired in the lower pedicels. Many of these characters were difficult to deduce from a dry, colorless plant. Poellnitz apparently described the leaf color pattern of *E. quitensis* var. *quitensis*, which he may have seen and mistaken. Walther transcribes his description and he adds that it may be close to *E. excelsa* from Peru differing in the longer pedicels and shorter corolla. Pino (2006) gives a detailed description of the true *E. excelsa* and even though both taxa have conspicuous stems, these are thicker, relatively shorter and decumbent in *E. excelsa*, its leaves are larger and the flowers are larger and totally different. Another plant thought to be related was *E. andicola* (Pino, 2005) but it has only



2b. Multibranched *Echeveria quitensis* var. *cuencaensis* in cultivation at the University of Cuenca at Balzain.

somewhat similar leaves, short stems and flowers closer to *E. excelsa* but smaller, placing these last two species best in Series Racemosae. Rauh collected plants (Rauh 35148) in Ecuador (Pilbeam, 2008). The chromosome count of this collection was published by Uhl (2007) is $n = 200$, but his description: “small, glaucous pale green leaves, rose scape, flowers all turning to the same side and pointing down a little” the picture associated with it clearly shows these features and the pale pink flowers of *E. quitensis* var. *quitensis* and not var. *cuencaensis* (U 2293).

In 2009 the first author published the description of *E. cuencaensis* based on plants found in northern Peru, 200 km to the south of the type locality. These plants matched the very short text of Poellnitz. Since no other species had been reported in the geographical area between them, he thought this was a new locality for *E. cuencaensis*, and the description and photos were published also by Pilbeam. In that article he mentioned that further research was needed at the type locality of *E. cuencaensis* in Ecuador, a task that could not be completed until now, resulting in a complete description of plants observed in several



2c. Young rosette of *Echeveria quitensis* var. *cuencaensis* showing grass green leaves.

localities in the Cuenca Cantón and the recognition of a new species in northern Peru, which will be described later in this article.

Based only in herbarium specimens, we totally agree with Alina Freire’s reduction of var. *quitensis* and var. *cuencaensis* to only one species. However, after the analysis of some interesting differences of living plants of both taxa, we consider it deserves the status of variety.

Description: A succulent glabrous herb with conspicuous branched stems. **Primary root** a taproot, straight or slightly curved, 0.5 cm gradually tapering to 2–3 mm diam., up to 30 cm long, secondary roots fibrous. **Stem** aerial, erect when young, very frequently decumbent in old plants growing on vertical walls or shade, simple when young or many branched alternately, 0.8–2 cm diam. at base, gradually tapering, light grayish brown at base, later greenish gray, light green and sometimes reddish near apical leaves, up to 90 cm long, sometimes red from the very base (Fig. 2b). **Branches** 2–10, born from base or alternately every 5–10 cm, 0.4–1 cm diam. at base, 0.3–0.8 near tips, 10–50 cm long or more in very old plants, same color as stem. **Rosettes** one at the end of stem or branch, (5–) 8–11 cm diam. (Fig. 2c). **Leaves** (14–) 16–26, present at the distal 4–12 cm, rarely present below, crowded at the apex, inserted every 6–8 mm



2d. Detail of *Echeveria quitensis* var. *cuencaensis* leaves.



2f. Detail of the bracts of *Echeveria quitensis* var. *cuencaensis*.



2e. Scape of *Echeveria quitensis* var. *cuencaensis* at the beginning of anthesis.

more proximally, narrowly obovate, sessile, incurved at proximal third, 3–7 cm long, 0.4–0.6 cm wide at base, 0.4–0.8 cm wide at proximal third, 0.9–1.8 cm wide at middle, 0.7–1.7 cm wide at distal third, 5–6 mm thick at base, 3–4 mm thick at the middle, upper side flat to slightly channelled, grass green, reddish at margins and tips, lower side obscurely keeled, with central nerve prominent, reddish at margins, apex acute, with an acute mucro 0.5–1 mm long at apex, base rounded or oval in section, hyaline whitish (Fig. 2d).

Flowering stem usually 1 lateral subterminal



2g. *Echeveria quitensis* var. *cuencaensis* scape with mature flowers. The bracts have fallen.

equilateral or unilateral raceme, **rachis** 20–45 cm long, 5–6 mm diam. at base, 1.5–2 mm diam. at apex, light pink at base, dark pink distally (Fig. 2e). **Peduncular bracts** 20–25, at proximal half of stem, soon deciduous, spaced 2–4 mm apart at base and 4–6 mm more distally, oblong obovate, erect, 1–1.5 cm long, 0.3–0.5 cm wide, 1.5–2 mm thick, flat or slightly channelled in upper side, subcarinate in lower side, same color as leaves (Fig. 2f). **Flowers** 14–25, appearing from August to November, present only at distal half of the scape, in a cluster clearly separate from bracts,



2h. Detail of *Echeveria quitensis* var. *cuencaensis* flowers; from left to right: sepals (4), flower bud, sectioned flower showing gynoecium, petals (3), fruit, dry fruit expelling seeds.

(Fig. 2g) 1–1.2 cm long and 0.7–0.8 cm diam., usually facing all towards sun exposure. **Pedicels** 6–10 mm long, longer in lower flowers, oblique or ascending, 1.5–1.8 mm diam., same color as flowering stem, with 1 small oblong bracteole at base, and another along the pedicel, soon deciduous, 7–9 mm long, 1.5–2 mm wide. **Calyx lobes** united at base, **sepals** unequal, narrowly triangular, acuminate, inserted in 45–60°, inner and outer sides convex, 8–14 mm long, 3–4 mm wide, grass green, reddish at tips and distal margin, tips frequently recurved. **Flower buds** ovoid, 0.8 diam × 1 cm long, yellow or orange with a blush. **Corolla** prismatic, 0.7–0.8 cm thick near base, 6–7 mm thick near apex, 1–1.2 cm long, petals oblong, acute, 1–1.2 cm long, 3–3.5 mm wide, outer surface keeled, orange to orangish yellow at proximal 2/3, apex and distal 1/3 of margins yellow, slightly recurving, inner surface yellow. **Stamens** 10, the 5 epipetalous 6–6.5 mm long, the antesepalous 7.5–8.5 mm long, **filaments** cream, 0.6 mm thick at base, gradually tapering to 0.3 mm. **Anthers** ovoid, cream, 1.3–1.5 mm long and 0.4–0.6 mm wide. **Gynoecium** ovoid, 7–8 mm long, 5–6 mm thick. **Carpels** 5, cream. **Styles** 2.5–3 mm long, parallel, almost touching each other, orange. **Stigma** red. **Nectaries** reniform, cream, 1.2–1.5 × 0.4–0.5 mm. **Fruit** a dehiscent capsule 0.6–0.8 cm long, 1–1.2 cm diam. (spreading dry sepals), brown (Fig. 2h).

Other localities: **ECUADOR:** Prov. Azuay, Cantón Cuenca. Guzho, on walls at the side of the road, 2588 m, 02°55' 40.4" S, 79°01'44.7" W, Oct 21, 2018, *G. Pino, K. Montesinos & X. Neyra* 2867. Huaylug, on shaded gorge aside fields, growing with *P. galioides* and *P. rotundata*, 2765 m, 02° 57' 25.4" S, 79° 00' 29.6" S, Oct 21, 2018, *G. Pino, K. Montesinos & X. Neyra* 2873. Balzaín, on rock walls around field in front of the University of Cuenca, Av. Víctor Manuel Albornoz, Campus Quinta Balzaín, 2600 m, 02°

53' 31.7" S, 79° 02' 18.6" W, Oct 21, 2018, *G. Pino, K. Montesinos & X. Neyra* 2873 (Orange flowers) 2874 (Yellow flowers). Cuenca- Azogues road, km 5 from the city, 2600 m 02° 53' S, 78° 57' W, Feb 23, 1984, *Madsen* 50310 (AAU, QCA 35102, QCNE 49850). Cuenca-Cañar road, km 5 from the city, Semiarid area with Eucalyptus trees, on stony E-facing slope, 2500 m 02°52' S, 78°56' W, Nov 22, 1981, *Madsen* 36668 (AAU, QCA 35099). Road from Cuenca to Dos Chorreras, 3995 m 02° 53' S, 78° 59' W, Jul 7, 1995, *B. León & K. Young* 3600 (QCA 35072). Cuenca-Molleturo road, 48 km W of the pass, 3200–3300 m, 02° 45' S, 79° 20' W, Feb 16, 1987, *J. Bohlin, B. Stahl, R. Lundin & M. Neuendorf* 1399 (GB, QCA 35080); Río Mihuir, ca 1 Km below Mioir on road Cuenca-Molleturo, 3400 m, Mar 8, 1985, *G. Harling & L. Andersson* 22917 (GB, QCA 35088). Cantón Oña: Cuenca-Loja road, Rio León (Before Oña), cliff with xerophytic vegetation dominated by cacti, 1800–2000 m, 03° 25' S, 79° 09' W, Oct 25, 1985, *J. Madsen* 61094 (AAU, QCA 35104). km 107 of Pan American Highway, steep rocks with debris, very dry, dominated by *Tillandsia medusa*, 2250 m, 03° 27' S, 79° 09' W, May 4, 1973, *L. Holm-Nielsen, S. Jeppesen, B. Lejtnant & B. Øllgard* 5027 (AAU). Prov. Cañar, Cantón Cañar, Vicinity of Santa Rosa de Cañar, flowers reddish orange, Sept 15, 1918, *J.N. Rose & G. Rose* 22726. (US 00096763, Holotype of *E. pachanoi* Rose). Road Cañar–El Tambo, app. 4 km from Cañar. Rocky slopes with xerophytic vegetation dominated by *Borziacactus sepium*, 3000 m, 02° 32' S, 78° 56' W, Feb 22, 1984, *J. Madsen* 50298 (AAU, QCA 35101, QCNE 49860). 4 km S of Cañar, on Cañar-Azogues Highway. Edge of cultivated field, corolla bright orange red, turning yellow at the tip. 3100 m, 02° 33' S, 78° 56' W, Oct 21, 1988, *L.J. Dorr & L.C. Barnett* 5794 (QCA 35082, QCNE 36760).



2i. *Echeveria quitensis* var. *cuencaensis* with yellowish flowers near Balzain.

Discussion: The main differences of this variety are that plants are less branched, stems more decumbent and rosettes are slightly larger. Leaves are fewer and more scattered, flatter, light to dark glossy green, sometimes reddish on the abaxial side and never pruinose. Scapes are longer with more flowers that are slightly larger. Although most collections have red orange flowers, yellowish towards the tips, at Balzain we observed plants with almost completely yellow flowers growing together with the normal colored plants (Fig. 2i). Here we consider *Echeveria pachanoi* Rose as a synonym of this variety. Although it was collected in the Province of Cañar, close to the locality of *E. cojitambensis*, its holotype at US herbarium clearly shows the short flowers of *E. quitensis* var. *cuencaensis*, an annotation on the label indicates that flowers are reddish orange. Other collections close to this place match also var. *cuencaensis*. The presence of occasional geminate flowers mentioned in the original description was not observed.

Etymology and distribution: The name of the plant stands for the city of Cuenca, capital of the Province of Azuay, where it is widely distributed, however, it may be present in neighboring provinces.



3a. *Echeveria cojitambensis* in habitat at Cojitambo.

3. *Echeveria cojitambensis* Pino & Kabir Montesinos. **sp. nova**

Holotype: ECUADOR, Prov. Cañar, Cantón Azogues, Cojitambo, slopes of Cojitambo mountain facing NW, in scrub and vertical rocks, 3000 m, S02° 45' 39", W 78° 53' 18", April 2, 2019, K. Montesinos 001. (QCA 241726)

Cojitambo Archaeological Complex is located 21 kilometers northeast of the city of Cuenca, (18 km in a straight line). This dome-shaped volcanic rock formation that stands out in the landscape rises up to 3020 masl amid Azogues sandstone low hills with the appearance of a sleeping lion. The pre-inca (500 BC onwards as a military and religious site of the Cañari) and Inca (1460-, conquest by Pachakuti) ruins and surroundings extend for aprox. 52 hectares, including the Qhapaq Ñan, (the Inca Trail), several Inca buildings and quarries of andesite for the building of northern Inca capital of Tomebamba (Tumipampa, now Cuenca). This is Ecuador's most popular site for rock climbing with a vertical cliff 500 m high in a north-south direction. On the NW faces of these cliffs Kabir Montesinos discovered an amazing, large *Echeveria* related to *E. quitensis* (Fig. 3a).

Description: A large succulent glabrous herb with conspicuous decumbent stems. **Primary roots** 5–10, narrowly tuberous, 1.5–3 mm diam. at base, gradually tapering, 10–20 cm long, light gray brownish,



3b. Young plant ex-situ of *Echeveria cojitambensis* showing erect stem and roots.

secondary roots fibrous, around primary roots and along the stem. **Stem** aerial, erect when young, (Fig. 3b) mostly decumbent in old plants growing on vertical walls or shade, simple when young or scarcely branched alternately, very slowly tapering, light grayish brown at base, later glaucous greenish gray near apical leaves, 2–3 cm diam. at base, 30–60 (–200) cm long or more in very old plants (Fig. 3c). **Branches** 0–10 or more, erect, short, born from base or alternately every 30–100 cm, 2–2.5 cm diam. at base, 1–1.5 cm diam. near tips, same color as stem or sometimes reddish (Fig. 3d). **Rosettes** one at the end of stem or branch, 12–18 cm diam. (Fig. 3e). **Leaves** 15–35, present at the distal 5–10 cm, rarely present below, crowded at the apex, inserted every 2–4 mm more proximally, narrowly obovate to oblong, sessile, slightly incurved, 7–13 cm long, 1–2 cm wide at base, 1.5–2.5 cm wide at proximal third, 2–4.5 cm wide at middle, 2.5–4.5 cm wide at distal third, 6–8 mm thick at base, 3.5–5.5 mm thick at the middle, upper side flat to slightly concave, glaucous green, reddish at distal margins and tips, lower side obscurely keeled, with central nerve prominent, reddish at distal margins and keel, on proximal third or entirely reddish, apex acute, with an acute mucro 1–2 mm long at apex, base oval in section, hyaline whitish (Fig. 3f).

Flowering stem 1–2 lateral subterminal equilateral or unilateral raceme, rachis 40–60 cm long, 0.8–1.2



3c. Detail of *Echeveria cojitambensis* terminal stem and rosette.



3d. Young rosette of *Echeveria cojitambensis* showing stem.



3e. *Echeveria cojitambensis* rosette seen from above.



3f. Detail of the leaves of *Echeveria cojitambensis*.

cm diam. at base, 4–6 mm diam. at apex, light green at base, then pink and dark red distally (Fig. 3g). **Peduncular bracts** 25–30, at proximal two thirds of stem, soon deciduous, spaced 4–6 mm apart, ovate lanceolate to oblong or obovate, erect, 2–4 cm long, 0.5–1.8 cm wide, 1.8–2.5 mm thick, flat or slightly channeled in upper side, subcarinate in lower side, same color as leaves (Fig. 3h). **Flowers** 20–35, appearing from August to October, present only at distal third of the scape, in a cluster clearly separate from bracts, 1.5–2 cm long and 0.8–1.2 cm diam. **Pedicels** short, 1–2 mm long, 1.5–2 mm diam., same color as flowering stem, with 1 small oblong bracteole at base, soon



3g. Scape of *Echeveria cojitambensis*.



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

deciduous, 12–16 mm long, 2.5–3 mm wide. **Calyx lobes** united at base, sepals unequal, narrowly triangular, acuminate, erect or incurving, inner and outer sides convex, 7–9 mm long, 2.5–4 mm wide, red both sides, tips sometimes recurved. Flower buds ovoid, 0.8 diam × 1.2 cm long, cream with a blush on keels. **Corolla** narrowly pyramidal, 0.8–1.2 cm thick near base, 5–6 mm thick near apex, 1.5–2 cm long, **petals** oblong, acute, 1.5–1.8 cm long, 4–5 mm wide, outer surface keeled, cream to pale yellow, apex and keel reddish, tip slightly recurving, inner surface cream or



3i. Detail of *Echeveria cojitambensis* flowers; from left to right: bractlet, sepals (3), flower with bud, single flower, sectioned flower showing gynoecium, petals (3), dry fruit.

pale yellow. **Stamens** 10, the 5 epipetalous 7–8 mm long, the antepetalous 1.1–1.2 mm long, **filaments** cream, 0.8 mm thick at base, gradually tapering to 0.3 mm. **Anthers** ovoid, yellow, 1.5–2 mm long and 0.8–1 mm wide. **Gynoecium** ovoid, 11–12 mm long, 6–7 mm thick. **Carpels** 5, cream. Styles 4–6 mm long, parallel, almost touching each other, greenish yellow. **Stigma** red. **Nectaries** reniform, cream, 2–2.5 × 0.7–0.9 mm. **Fruit** a dehiscent capsule 1.2–1.4 cm long, 1.4–1.5 cm diam., reddish brown (Fig. 3i).

Other localities: ECUADOR, Prov. Cañar, Cantón Azogues. Cojitambo, on stiff slopes facing NW, growing with *Peperomia galioides* and *P. rotundata*, 2974 m, 02°45'37.4" S, 78° 53' 23.8" W, Oct 21, 2018, G. Pino, K. Montesinos. E. Sanchez & X. Neyra 2875. (Observed) Prov. Azuay, Cantón Cuenca, Baños, Narancay, 2741 m, 02° 57' 0" S, 79 °3' 0" W, July 18, 2019, K. Montesinos 002. Tarqui, Panamerican Highway, Troncal de la Sierra, road from Cuenca to La Yunta, West of Saltana, 2741 m, 02° 58' 08.1" S, 79° 02' 56.2" W, Jul 28, 2019, X. Neyra s.n. (Observed)

Discussion: This species resembles a large version of *E. quitensis* var. *quitensis*, but it is quite different. Although its stem can be erect in young plants and branches, it is more frequently decumbent, almost never branched, evenly thick and sometimes very long (up to 3 m). Rosettes are larger, its leaves are larger and more numerous, lighter and more glaucous than *E. quitensis* var. *cuencaensis* that occurs in the area. Scapes are longer, with more flowers that are almost twice as large, yellow to cream with reddish keels and tips instead of reddish at the base and yellow at the tips. Morphologically it should be placed in Series Nudae E. Walther as the two previous taxa, but preliminary results of phylogeny carried out by the team led by our third author, Gerardo Salazar, together with Jerónimo Reyes, Gabriela Espino-Ortega and Luis De la Cruz-López of the UNAM-Mexico show this taxon is more



4a. *Echeveria tabaconasensis* in habitat at Tabaconas. (S.N.)

closely related to the Series Racemosae (Baker) Berger.

Etymology and distribution: This plant is named after the ruins of Cojitambo, the place where the type was collected. Shortly after its discovery two other locations were found at the South of the city of Cuenca, so its current distribution would be provinces Cañar and Azuay, in Southern Ecuador.

4. *Echeveria tabaconasensis* Pino & Novoa, sp. nova

Holotype: PERU: Dept. Cajamarca, Prov. San Ignacio, Dist. Tabaconas, San Miguel de Tabaconas, Cerro el Salado, on a southwest-facing 45° slope, in



4b. Young *Echeveria tabaconasensis* showing roots.

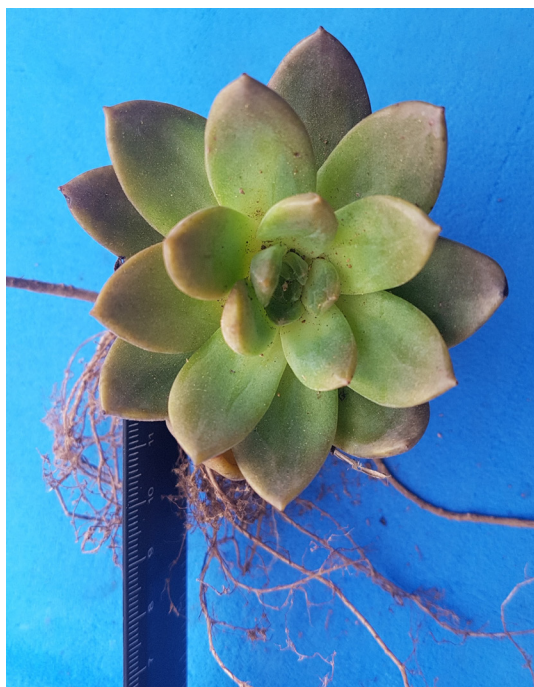


4c. Old *Echeveria tabaconasensis* ex-situ showing short stem covered with dry leaves.

soil among grasses (*Chusquea* sp.) that eventually cover the *Echeveria*, growing with *Oncidium* sp. and *Pteridium* sp. ("Lashipa"), 5° 18' 04" S, 79° 17' 53" W, 1888 m., June 12, 2007, SNS-001 (USM 217,134). (Fig. 4a)

This taxon was discovered by Sidney Novoa Shepard during a World Wildlife Fund (WWF) expedition to the Buffer (non-protected) Zone of the Tabaconas Namballe Sanctuary near the border with Ecuador. In *Haseltonia* 15: 3-26, (Pino, 2009) we erroneously identified this plant as *Echeveria cuencaensis*, due to the lack of a complete description of this latter, a fact that has been amended above. Here we present an extended description of this new species.

Description: A succulent glabrous herb with a single rosette. **Primary root** a narrow taproot, 2–4 mm diam. at the base slowly tapering to 1 mm diam., light



4d. Rosette of *Echeveria tabaconasensis*.



4e. Detail of *Echeveria tabaconasensis* leaves.

brownish gray, with 1–6 alternate branches similar to the central root, 10–20 cm long, rest of the root system fibrous (Fig. 4b). Small plantlets formed at the tips of root branches. **Stem** absent or very short, whitish, densely covered with closely clustered dry leaves, 0.5–1 (–4) cm long, erect or sometimes coiled to accommodate to rocks (Fig. 4c). **Rosette** 6.5–14 cm diam. (Fig. 4d). **Leaves** (20–) 30–45, sessile, strongly attached, succulent, oblong to very narrowly obovate, 3–6 (–8) cm long, 0.8–2 cm wide at base, 1–2.5 cm wide at proximal third, 1–3 cm wide at middle, 1–2.5 cm wide at distal third, 4–10 mm thick, upper side flat to slightly concave or subcanaliculate, bright light green, sometimes redder on apical third and near margins where exposed, nerves 3–5 parallel, evident



4f. Flower spike of *Echeveria tabaconasensis*.

on dry leaves, lower side convex or obscurely keeled, very light green or sometimes reddish at distal third, apex acute or acuminate with a minute deltoid mucro, 1.5×1.5 mm, margins blunt and rounded (Fig. 4e).

Flowering stem 1 (–3) racemes, nodding at first, then erect, **rachis** 25–35 cm long, 5–6 (10) mm diam. at base, 1.3–2.8 mm diam. at apex, light green, pink where exposed (Fig. 4f). **Peduncular bracts** 25–45, erect, present from above the proximal 6–10 cm and all along rachis, attached every 0.8–1.5 cm, ovate to oblong, 1–2 cm long, 1–1.2 cm wide, 2–3 mm thick, inner side concave to canaliculate, outer side convex and keeled, bright green to olive green, reddish at the distal third or tip, minutely mucronate, with a transparent spur at the base. **Flowers** 25–35, appearing in habitat from June to July, present only along the distal half of the raceme, 1–1.4 cm long and 6–6.5 mm diam. **Pedicels** 3–5 mm long, 1.5–1.8 mm diam. **Calyx lobes** united at base, spreading, sepals oblong, acute, 4–5 mm long, 1.5–2.5 mm wide, bright green to glaucous with a reddish tip. **Corolla** ovoid, pentagonal, **petals** oblong, acuminate, 1.1–1.2 cm long, 1.5–2.5 mm wide, outer surface cream at base, bright red towards tips, margins and keel, apex recurvate, inner surface cream, reddish towards tip. **Stamens** 10, the 5 epipetalous 3–4 mm long, the antesealous 6–8 mm long, filaments cream. **Anthers** ovoid, yellow, 1.8×0.8 mm wide. **Gynoecium** ovoid, 4 mm long, 3.5 mm thick. **Carpels** 5, white or reddish. **Styles** 2 mm long, parallel, almost touching each other, red (Fig. 4g).



4g. Detail of flowers of *Echeveria tabaconasensis*; from left to right: bracts (4), above: sepals (2), petals (2), below: flower, sectioned flower showing gynoecium.

Fruit a dehiscent capsule 1.2–1.4 cm long, 0.8–1 cm diam. (spreading dry sepals), dark brown (Fig. 4h).

Other localities: PERU: Dept. Cajamarca, Prov. San Ignacio, Dist. Tabaconas, San Miguel de Tabaconas. Road from Tamborapa Pueblo to Huancabamba, just a few kilometers from the shortcut to San Miguel de Tabaconas, towards the town of Granadillas. A few plants were growing along the soil-bank formed during road-construction. *SNS-002*. Behind the town of Tabaconas, on a vertical rock wall, $S5^{\circ}19'14''$, $W79^{\circ}17'33''$, 2052 m., Nov 28, 2018, *G. Pino, M.S. Samain & E. Martínez 3011* (USM 311,157).

Echeveria tabaconasensis is a very different species to all other South American *Echeveria*. Its closest relative seems to be *Echeveria eurychlamys* also from Cajamarca, Peru. They share similar root system, with a narrow taproot, not tuberous, some long branches similar to the main root and abundant fibrous roots corresponding to the lush, rainy areas where they grow. They have almost no stem, but when present, it is erect, very short and thick, with persistent dry leaves for years. In both species small lateral stems emerge from this stem among the dry leaves producing off-sets. Both species share a nodding inflorescence not seen in other groups of *Echeveria* from South America belonging to Series Racemosae, their long flowers are similar but sepals are slightly more spreading in *E. tabaconasensis*. Main differences are: The shape of the leaves, strongly obovate, and frequently spathuliform in *E. eurychlamys*, more flattened, with obtuse to round apices, and blunt margins evident in cross sections (Fig. 4i). Its bracts are also flatter and wider,



4h. Mature *Echeveria tabaconasensis* flower spike with dry fruits.

sometimes almost rotundate. *Echeveria tabaconasensis* thrives at lower elevations, with a shorter dry period and continuous rain almost all over the year.

Etymology and distribution: The epithet “tabaconasensis” refers to the first place where it was found, near the town of Tabaconas, Peru. Local people call it “siempreviva”, as in the neighboring Ecuador. To date, it has only been found in the North of Peru, near the border with Ecuador, but further research could reveal it also exists in this country.

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4i. Comparison of *Echeveria eurychlamys* leaf (above) and *E. tabaconasensis* (below). Right: section of leaves.

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All photos by Guillermo Pino, except where stated: K.M. = Kabir Montesinos, S.N. = Sidney Novoa. T.J. = Tatiana Jaramillo.

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