Fig. 1. J. C. van Keppel and a part of his *Echeveria* collection.

SOME NOTES ON SOUTH AMERICAN ECHEVERIAS

J.C. van KEPPEL

It will be known to most readers of this Journal that Mexico is the homeland of many echeverias. A great many of these Mexican species, since the discovery of *E. coccinea* in about 1790, have been grown in collections all over the world, and through the botanical expeditions of leading American *Echeveria* experts more old and new species become available every year to collectors. I need not tell you about these species because acknowledged American experts periodically inform you about their discoveries in Mexico. Less known is the fact that echeverias occur far into South America. Especially in the Cordillera de los Andes, stretching away from north to south along the west coast of the whole of South America. The literature on South American echeverias is scattered as short notes in many periodicals and books, and this paper is an unpretentious resume, based especially on Dr. K. von Poellnitz's "Zur Kenntnis der Gattung *Echeveria*" (1936). It may well be that I have overlooked some later paper. Also, the contents of Walther's unpublished monograph are unknown to me; it is possible that he has solved some of the problems mentioned here.

Von Humboldt and Bonpland discovered the first South American echeverias, described as *Sedum bicolor* and *S. quitense*, in Venezuela about 1800. Other botanists have since described about 20 species from Venezuela, Colombia, Ecuador, Peru, Bolivia, Chile and Argentina. Unfortunately some of the descriptions are poor, without drawings or photographs, and some type specimens are lost, consequently identification of some species is possible only by re-collecting them at the type localities.

I became interested in the South American species in 1968 when I received more than a hundred plants collected by Rausch and van Vliet at ten localities in Bolivia. It is noteworthy that the South American echeverias seem to occur at above 2,000 m. Although in Mexico some species occur at lower regions, neither in Argentina (near Cordoba), nor in Uruguay where the mountains are lower (up to 2,000 m.) were any echeverias found. In Bolivia and Peru most echeverias occur at higher elevations. Van Vliet and Rausch found most echeverias in Bolivia at about 2,800 m. Ball (1887) recorded *E. chiclensis* as high as 4,300 m. in the Peruvian Andes.

The described species from South America can be divided (with some exceptions) into two geographically and morphologically separate groups.

GROUP I

The species of this group occur in the northern countries of South America: Venezuela, Colombia and Ecuador. They are sometimes related to Central American species. Most belong to the series *Nudae* Walther (1958). This series may be described as follows: plants glabrous (sometimes papillose), caulescent, shrubby; leaves thin or thick, loosely arranged or in more compact rosettes at the tops of the stems; flowers in racemes or sometimes in spikes; pedicels bibracteolate.

Moran (1965) combined Walther's series *Australes* and *Elatae* in the series *Nudae,* validly published in 1958. I agree, basing my opinion on a specimen in my collection from near Caracas, Venezuela, resembling in habit *E. bicolor* (series *Elatae*) and a specimen of *E. montana* (series *Australes*). In habit and size of the leaves there is no difference between these species; they differ only in color and form, *E. montana* having glossy green leaves whilst those of the Caracas specimen are glaucous green.

The species belonging to Group I are:

E. quitensis (H.B.K.) Lindley, discovered by von Humboldt and Bonpland about 1800, near Quito, Ecuador. Further known from Colombia and also from Jaipa, Bolivia, collected by Fiebrig in 1904.

E. sprucei (Baker) Berger, collected by Spruce in 1858 in the Andes in Ecuador and said to be a variety of the former.

E. bicolor (H.B.K.) Walther, collected by von Humboldt and Bonpland about 1800 near Caracas, Venezuela.

E. bracteolata Link, Klotzsch & Otto, grown from seed collected in 1840 by E. Otto near Chacao, Caracas, Venezuela. It is sometimes said to be synonymous with *E. bicolor.*

E. venezuelensis Rose, collected in 1913 by Pittier near Caracas, Venezuela, is(according to Walther, synonymous with *E. bicolor.*

E. subspicata (Baker) Berger, collected by Purdie in Colombia on rocks near the snowline (additional data is missing). According to Walther this is a variety of *E. bicolor.*

E. colombiana v. Poelln., collected in 1927 by Killip and Smith near Vetas, Santander, Colombia.

E. aequatorialis Rose ex v. Poelln., collected in 1918 by J. N. and G. Rose near Huigra, Ecuador.

E. pachanoi Rose ex v. Poelln., collected in 1918 by J. N. and G. Rose near Santa Rosa de Cañar, Ecuador.

E. cuencaensis v. Poelln., collected in 1918 by J. N. and G. Rose and Pachano near Cuenca, Ecuador.

E. johnsonii Walther, collected by Johnson near Iabara, Ecuador (described in 1958).

E. ballsii Walther, collected near Siachoque, Dept. Boyaca, Colombia (described 1958). This is the only known northern species belonging to the series *Racemosae.*

I mention these species from northern South America just for the sake of completeness. Most of them are not in cultivation and are scarcely known by specialists even in the United States. I am growing six specimens from these northern countries, and I hope to return to the subject later, after I have had them under observation for a longer time.

GROUP II

The species of this group occur mainly in the Andes of Peru and Bolivia, though one species, *E. peruviana,* is said to extend into Chile and northern Argentina. All described species of this group belong to the series *Racemosae* (Baker) Berger (Walther, 1959). This series may be described as follows: acaulescent or shortly caulescent, often branching from base; leaves closely-set, small or medium sized, seldom large, mostly thick; floral stems erect or ascending; inflorescence an equilateral raceme, in wild collected plants sometimes seeming paniculate or cymose; pedicels short to long, bibracteolate (sometimes lacking); corolla whitish, yellowish or red, sharply pentagonal; roots fibrous or fusiform. The type of this series is the well-known Mexican *E. racemosa* Schlechtd. & Cham. (syn. *E. lurida* Haw.). The only species of group 2 known to me which does not belong to the *Racemosae* is a plant collected by Rausch which seems very similar to the Guatemalan *E. pittieri* Rose, of the series *Spicatae* (Baker) Berger.

The species belonging to group 2 are:

E. peruviana Meyen, the first named species of this group, collected by Meyen near Tacna, in 1834. The original description is very simple, and from this description it is nearly impossible to identify any plant not known to be from the type locality. Baker (1874) described what he took to be this species from plants presented to the Kew Gardens by a Mr. Green at Reigate, England; his description is somewhat different from the original and more comprehensive. According to von Poellnitz (1936) this species occurs as far as Chile, and according to Walther, quoted by von Poellnitz (1936) to northern Argentina!

E. chilonensis (O. Kuntze) Walther, collected by Kuntze near Chilon, Bolivia in 1892. It

was originally described by Kuntze as *Sedum chilonense,* with a cymose inflorescence and yellow flowers. Von Poellnitz (1936) quoted Walther as having stated in a letter "that anyone capable of placing this in the genus *Sedum* might well have been color-blind too," in reference to the sole difference between *E. chilonensis* and *E. whitei.* In my opinion Walther did Kuntze an injustice, for I have seen all colors between yellowish-white and red on wild plants collected in Bolivia.

E. whitei Rose, collected by White near Quime, Bolivia in 1921. It was well illustrated by Rose (1925). According to Rose, a plant collected by Rusby near La Paz in 1890 also belongs here.

E. buchtienii v. Poelln., collected by Buchtien near Obrajas, La Paz, Bolivia in 1932 and 1934. Walther considered this a synonym of *E. chilonensis* (v. Poell. 1936), and it has also been suggested to be synonymous with *E. peruviana.* (I have compared the descriptions of *E. peruviana, E. chilonensis, E. whitei* and *E. buchtienii,* and in view of the differences among my wild-collected Bolivian specimens, even from one locality, I suppose that these four may be local varieties of one species. I hope to obtain more plants from Bolivia and Peru, if possible collected at the type localities of the earlier described species. This is the only way of knowing anything more about the several species whose type specimens in the Berlin Herbarium were destroyed during the last world war.

E. eurychlamys (Diels) Berger, collected by Weberbauer near Hualgayoc, Cajamarca, Peru in 1904.

E. excelsa (Diels) Berger, collected by Weberbauer between Samanco and Caraz, Peru in 1903.

E. chiclensis (Ball) Berger, collected by Ball near Chicla, Peru in 1882.

E. neglecta v. Poelln., collected by Ball in the Andes, South America in 1882.

E. backebergii v. Poelln., collected by Backeberg near Matucana, Peru in 1933.

E. vanvlietti v. Keppel, collected by vanVliet near Sucre, Bolivia in 1968.

E. rauschii v. Keppel, collected by van Vliet between Sucre and Los Alemos, Bolivia in 1968.

It has been suggested that *Echeveria backebergii* and *E. neglecta* may be synonyms of *E. chiclensis* along with *E. excelsa* and *E. eurychlamys,* all occurring in Peru. As far as I know, none of these species are in cultivation. *E. chiclensis* and *E. backebergii* are described as nearly or quite acaulescent and with fusiform roots. *E. neglecta* is said to be caulescent, up to 25 cm. long. *E. chiclensis* is described with the longest leaves, viz. 15 to 20 cm. long! *E. excelsa* is supposed to have a flower stalk up to 1.2 m. long and, like *E. eurychlamys,* is described as acaulescent. Although the differences of these described plants may be caused

Fig. 2. *Echeveria racemosa* from Mexico, type of the Series *Racemosae.* Photo Buining in van Keppel collection.

by physiological or ecological circumstances, these last species at least seem to be different from the plants belonging to the *peruviana-chilonensis* complex.

Walther's publication (1958) is, as far as I know, the last paper on South American echeverias except for my own (van Keppel, 1969), although I know that echeverias were collected in South America by Mason, Lutzenberg, Rausch and perhaps others. When, in 1968, the Dutch collector, D. J. van Vliet accompanied the Austrian collector, W. Rausch on his journey of exploration through South America, he looked for echeverias for me and collected both seeds and many living plants. Among these I recognized two new species and one collection identical to *E. whitei* Rose. After more study on the other South American echeverias in my collection, I hope to be able to recognize some other old or new species.

Now, the story of the two recently described species, *E. vanvlietii* and *E. rauschii* in May of 1968 Rausch and van Vliet searched the mountains northeast of Yamparaez on the watershed area between Sucre and Yamparaez in Central Bolivia, about 2800 m. above sea level, looking for an echeveria which they had seen some days before in slides of Mr. Klawitter, teacher at the German school at Sucre. There they found the light yellow to whitish, sometimes pinkish or red flowering echeveria which I named *Echeveria vanvlietii* in honor of its discoverer, Dirk Jan van Vliet, a well-known Dutch fancier of cacti and authority on the genus *Notocactus*.

They found the plant again on the mountain Chica Chica, just behind the town of Sucre. The plants flowered in my collection, first in October of 1968 and again in 1969 and 1970. Although the leaf form of all wild collected plants is very similar, there is great variability in color of both leaves and flowers. Some plants are pale or darker gray-green, others flushed bronze-purplish. Some plants have nearly whitish flowers, usually yellowish-green in bud; others have pale pinkish spots; and one plant in 1970 bore crimson flowers. Knowing, however, the great variability between clones of an *Echeveria* species, I consider them to belong to one and the same species. *E. vanvlietii* belongs to the Series *Racemosae* (Baker) Berger, and differs from the other species of this series in its green, not glaucous leaves, and mostly yellowish-green to whitish flowers nodding on short pedicels. The plants seem to be stemless, but they form a short stem in older plants. They don't branch freely at the base. In their natural habitat they grow in cracks and hollows filled with humus and/or limestone, on very steep, often unreachable slopes. The habitats are mostly in full sun for some hours each day. The soil pH is between 5 and 6, thus rather acid. Dew at night moistens the ground. Temperatures by day and night are very different: by day very hot, by night cold with frosts.

Echeveria rauschii was named in honor of Walther Rausch, the Austrian specialist in *Lobivia* and *Rebutia*, a well-known cactus hunter who has already been three times in South America. It was collected 15 km. northwest of Sucre in the direction of Los Alemos. In habit this species somewhat resembles *E. vanvlietii*, but the rosettes are smaller, the leaves fresher green (in the resting period sometimes gray-green) but not flushed purple. The edges are marked with a fine dark red margin. The inflorescence is very different from that of *E. vanvlietii* it is a lax raceme, with longer pedicels bearing ascending to spreading but not nodding flowers. The flower color is a splendid orange, consisting of red spots on a yellow background. Although this species was found in the same area as *E. vanvlietii* and other *Echeveria* species, it has quite a different habit from the other species of the Series *Racemosae* collected in Bolivia.

The description of these two species is as follows:

Echeveria vanvlietii v. Keppel

TYPE: *Echeveria* sp. Bolivia No. 5 van Vliet (van Keppel No. 6849) sent to the Herbarium of the Royal Botanic Gardens, Kew.

Description: HABIT caulescent; stems short, 5 cm. long or more, 1-2 cm. thick, erect, sometimes decumbent, with a dense rosette on the top 8-12 cm. diam.; LEAVES fleshy, 20-25, spreading, oblong-oblanceolate, 4-8 cm. long, 1-2 cm. broad, older leaves flat, younger leaves deltoid, on the upper part deeply channelled, mucronate, apiculate, backside convex, somewhat keeled, color pale grey-green flushed bronze purplish; edges paler, seldom reddish; FLORAL STEMS 20-40 cm. long, erect from the beginning, greenish-white, 5 mm. broad at base; flowering portion a single, equilateral raceme 10-20 cm. long with 15-20 horizontally spreading leaves below, the largest 2.5 cm. long, 1 cm. broad, the lowest ovate, next oblanceolate and the floral bracts awl-shaped, green, with a broad or slender recurved white spur, the largest obtuse, the smaller mucronate; FLOWERS 15-40, nodding, later erect, on green pedicels 5-10 mm. long, 2 mm. thick with 2 filmy, linear bracteoles; buds yellowish on the top and keel of the petal; sepals wide-spreading at anthesis, later ascending, 5-10 mm. long, unequally ovate-deltoid; corolla

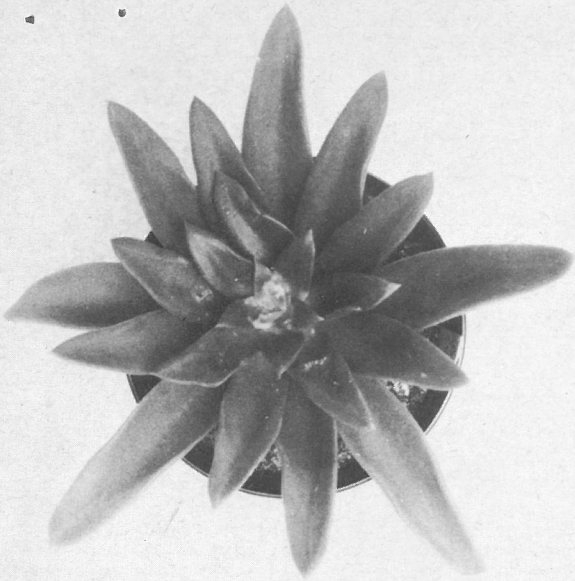

Fig. 3 (above). *Echeveria vanvlietii.* Photo van Keppel.

Fig. 4 (right). Inflorescence of *E. vanvlietii.* Photo Buining.

Fig. 5. *Echeveria vanvlietii.* Photo Buining.

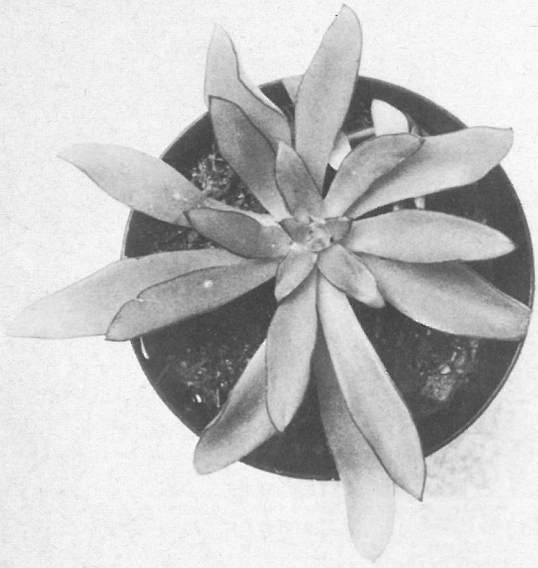

Fig. 6. (above). *Echeveria rauschii.* Photo van Keppell.

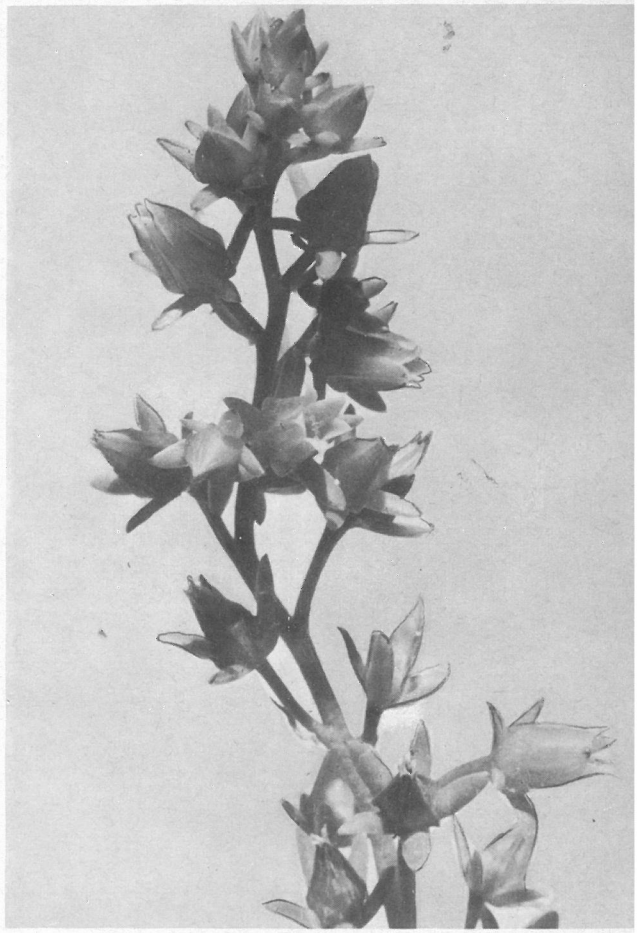

Fig. 7 (right). Inflorescence of *E. rauschii.* Photo Buining.

Fig. 8. *Echeveria rauschii.* Photo Buining.

creamy white; petals c. 12 mm. long, 4 mm. wide at base, pentagonal, tips curving outwards, keeled dorsally; carpels green; SEEDS dark brown. Flowers in June to October. DISTRIBUTION: Type locality northeast of Yamparaez, c. 12 km. southeast of Sucre at 2,800 m. elevation on steep slopes (19/5/1968) and on the mountain Chica Chica, south of Sucre at 2,500 m. elevation (21/5/1968), coll. no. 6850 v.K.

Echeveria rauschii v. Keppel

TYPE: *Echeveria* sp. Bolivia No. 8 van Vliet (van Keppel No. 6852) sent to the Herbarium of the Royal Botanic Gardens, Kew.

Description: HABIT caulescent; stems short, c. 5 cm. long, 1-2 cm. thick, erect, or very thin, longer and decumbent; branching at base; rosette with 10-15 closely arranged leaves, 5-12 cm. diam.; LEAVES fleshy, oblong-oblanceolate to ovate-deltoid, acute, with a red mucro, upper part flat to concave, backside convex, faintly keeled, color fresh green, not glaucous, with strong dark red edges, 4-7 cm. long, 8-15 mm. broad; FLORAL STEMS reddish, erect, 10-25 cm. long, 2-4 mm. broad at base; flowering portion a single, equilateral raceme c. 10 cm. long with 5-10 spreading to ascending leaves below, the largest 3-4 cm. long, oblong, concave; bracts linear-oblong, small, scarcely spurred; FLOWERS 7-20, on reddish, erect pedicels up to 2 cm. long with 2 filmy bracetoles which soon wither; sepals horizontally spreading to ascending, green, linear-oblong, unequal, 3-10 mm. long; corolla orange to orange-red, orange-yellow within with yellow edges; petals c. 10 mm. long, 6 mm. broad at the base, sharply pentagonal, 2-3 mm. wide at the apex, tips recurved, sharply keeled dorsally; carpels green. Flowers in June to October. DISTRIBUTION: Known only from the type locality 15 km. northwest from Sucre at 2,800 m. elevation; collected May 29th, 1968.

In my experience it is not difficult to cultivate these Bolivian echeverias. I lost only a few of my original wild collected plants, and they flower easily. They grow well in a mixture of leafmold, sand and loam. Like all plants from high mountains, they want much fresh air and a temperature of 5 to 10° C. in winter. After acclimatization they flowered earlier each year: in October of 1968, in July of 1969, and in June of 1970.

REFERENCES

Baker, J. G. 1869. The American species of Cotyledon (Echeveria DC). Saunders Ref. Bot. 1, without page numbers, plates 56-71.

——— 1874. New Garden Plants in Gard. Chron. 2:(new series) 258.

Ball, J. 1887. On the flora of the Peruvian Andes. Journ. Linn. Soc. 22:38.

Berger, A. 1930. Crassulaceae in Engler, Nat. Pfl. 2, band 18a:468-483.

Diels, L. 1906. Crassulaceae andinae in Engler, Bot. Jahrb. 37:411, 412.

Keppel, J. C. van 1969. Two new Echeverias from Bolivia. Nat. C. S. Journ. 24:90, 91, 2 fig.

——— and van Vliet, D. J. 1970. De ontdekking van enige Echeverias in Bolivia. Succulenta 49: 165-172, 4 fig.

Meyen, J. 1834. Reise 1:448.

Moran, R. 1965. Echeveria montana Rose. Cact. Succ. Journ. 37:178-183, 6 fig.

Poellnitz, K. von 1935. Die südlich von Mexiko vorkommenden Arten der Gattung Echeveria DC. Fedde's Rep. Sp. Nov. 38:185-193.

——— 1936. Zur Kenntnis der Gattung Echeveria DC. l. c. 39:193-270.

Rose, J. N. 1911. Studies of Mexican and Central American Plants. Contr. U.S. Nat. Herb. 13(9): 296.

——— 1925. Echeveria whitei. Addisonia 10:47, pl. 344.

——— 1930. South American novelties. Gentes Herbarum 2:200-200, fig. 104.

Walther, E. 1935. Notes on the genus Echeveria. Cact. Succ. Journ. 7:35-40.

——— 1958. Further notes on Echeveria. l. c. 30: 40-48.

——— 1959. Echeveria: Conspectus serierum. Leafl. West. Bot. 9:1-4.

QUESTION: Mrs. Thornton H. Cofield, Houma, Louisiana asks: "Would appreciate any help you can give me on making a rock garden for cactus and other succulent plants."

ANSWER: Rock gardens planted with cactus and succulents are very effective. Perfect drainage is the first essential and this is obtained by outlining the section with large, closely-fitted rocks placed on the ground level. Fill the enclosed area with broken rocks about the size of a walnut to a depth of at least two inches and spread over this some coarse sand. Never use beach sand. If plants are to be planted directly in the bed, fill to the level of the border-rocks with the soil recommended for general use: 1/3 sand, 1/3 top soil and 1/3 leafmold, and the addition of lime or old mortar. If plants are to be potted and sunk in the soil, the bed can be built of sand and the pots plunged so that the plants appear to be growing in the sand. Over the surface, scatter rocks with attractive faces and colors, in front of which the plants are placed. Arrange the larger species in the background, the bushy types in the center, and the smaller ones nearest the edge. If the ground is sloping, the border of rocks is not needed. You might place flattish, long rocks in a position designed to prevent washing out and place the plants back of the rocks in pockets of specially prepared soil. Watering by irrigation can be done at any time during warm weather, but if water is applied by sprinkling, the early morning or middle afternoon is the best time, so as to avoid the water remaining on the plant bodies overnight. Virginia F. Martin, Corresponding Secretary