The species of the genus *Villadia* in Peru: a new report of *Villadia virgata* from Cusco, Peru

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Summary. *Villadia virgata* (Diels) Baehni & J. F. Macbride, a species described from Chiquián, Ancash, Perú, is reviewed. Collected by Weberbauer in 1903, it was first described as *Cotyledon virgata* and placed in *Villadia* by Mcbride. We clarify that Peruvian *Sedum* species have terminal branched inflorescences while *Villadia* species have terminal monoaxial inflorescences in spikes or racemes. According to Cerrate, it thrives in rocky places between 3100 and 3900 m associated with other succulents. She reports medicinal properties against urinary inflammations. We have found its presence in Huanuco, and also more abundant and in several locations in Cusco. Other five species of Peruvian *Villadia* are mentioned. Slight differences between the plants of Ancash/Huanuco and Cusco plants are discussed, concluding these latter do not merit being considered as a different taxon. Instead, an extended description of the plant is given.

Keywords: Crassulaceae, *Villadia*.

The German botanist August Weberbauer, who was commissioned by the Royal Academy of Sciences in Berlin to develop botanical research in Peru, arrived in 1901and remained until 1905. After a two year stay in Victoria, Kamerun, the Peruvian government hired him to return and develop the Zoo and Botanical Garden in 1908. He became a PHD in 1922 and taught botany in the National University of San Marcos until his death in 1948. According to his records, he discovered and collected a new species of the Crassulaceae family in 1903 (W 2853, B) between the town of Chiquián and the village of Tallenga, in the province of Bolognesi, Ancash, close to the border of the Department of Lima. In those times this place was located in the province of Cajatambo, which now belongs to Lima. The new species was first described by Diels in 1906 as *Cotyledon virgata*, a genus where most succulent Crassulaceae from the new world were then included. The name of the species probably referred to the twig-like shape of the erect stems. Later Berger

assigned it to *Altamiranoa* because the petals seem to be marginally (N. of the Tr.: *Altamiranoa* were separated from *Villadia* as it was *Villadia* proper that had connate petals – *Atamiranoa* has petals just united) united at the base. Although all Peruvian species of Subfamily Sedoideae (Crassulaceae) were included in *Villadia* by Macbride (1938), Thiede and 't Hart (1999) transferred most of them to *Sedum.* These authors stated that species with inflorescences that branch at the end belong to *Sedum.* (*Altamiranoa* for other authors) This is called a cymose (determinate) inflorescence and in Peruvian *Sedum* it is usually a double cyme (drepanium) or a dichasium. Species that bear flowers along a main central axis remain in *Villadia* and these flowers can be sessile in the case they form a spike or they can have a pedicel in which case it is a raceme.

Weberbauer's pupil Ramón Ferreyra collected this plant again in 1950 near Chiquián, the town where his own pupil and later wife Emma Cerrate was born. Both researchers are the Peruvian founders of Botany and dedicated decades to investigate Andean flora. Few investigators apart from Emma Cerrate have collected this plant in its type locality since then because it seems not to be very abundant. However, recently it was collected again in 2006 in Chiquián by Pablo Carrillo Reyes, a researcher of *Villadia* from Mexico, a country where most of the species of this genus have been described.

According to Emma Cerrate, an expert of the flora of her village Chiquián and surroundings, in her book "Vegetation of the Valley of Chiquián" (1979) *Villadia virgata* grows at the level of the "Monte Bajo" (Low mountain) between 3100 and 3600 m, with heavy rains in the southern hemisphere summer and sunny days with frequent night frosts in the winter months. She states it forms here rupiculous communities together with mosses with other succulent species like *Peperomia peruviana* (now *Peperomia wernerrauhii* Pino &Samain), *P. galioides*, *P.*

1. Inflorescence of ***Sedum isidorum*** (Cymose)

2. The village of Chiquián. © G. Pino

flavamenta (which may not be this species but a yet not described species), *Echeveria peruviana* (probably *E. andicola* Pino) and *Echeveria excelsa* (Diels) A. Berger. She also writes that it grows at the "Monte Mediano" (Medium Mountain) between 3700 and 3900 m, also in rocky places, growing on their surface and between cracks. Here the vegetation seems to be more abundant at the end of the rainy season (April-May) but plants are relatively smaller. The same author writes about its medicinal properties (1988) as a urinary or kidney anti-inflammatory, and giving it a local name "Empanadilla hembra" and "falsa congona".

3. ***Villadia virgata*** Habitat Huanuco.

There was a strong suspicion of its presence in the Department of Huanuco due to plants collected by Sidney Novoa in 2005 near Tomayquichua, and this was confirmed during the January 2010 Ghent University *Peperomia* expedition led by Marie-Stéphanie Samain to Ancash and Huanuco. We found first Pablo Carrillo's locality in Chiquián but were truly surprised to find it crossing the border in the Department of Huanuco, in two localities where it grows more abundant than in Ancash.

Pino (2006) reduces *Villadia dyvrandae* to *Sedum incarum* because of its branched inflorescence, and this is perhaps supported by the fact that most *Villadia* have 9-21 chromosomes, whereas *Sedum andinum* Ball from Perú has 48 chromosomes, *Sedum grandyi* Raym-Hamet 38-40, *Sedum* sp. from Huancabamba ca. 50 and *Sedum incarum* from Peru up to 89 chromosomes. (Uhl & Moran, 1999) After this, *V. virgata* remained as the only *Villadia* species in Peru until 2009, when five new species were described from the eastern slopes of the Andes of Cajamarca, where they get heavier rains coming from the Amazon rainforest than in the drier, western

slopes (Pino, 2009). They only grow in rocky but rainy spots and this could also explain why they dry up so easily in cultivation. *Villadia klopfensteinii* Pino & Cieza is a species with greenish-yellow, bell-shaped, echeveria-like flowers with stiff, fused petals. *Villadia aureistella* Pino & Cieza is a species with showy star-shaped yellow flowers, unique among Peruvian species in having petals completely recurved to form a loop. *Villadia thiedei* Pino & Cieza is a species close to *Villadia virgata*, but the plants are taller and the flowers much smaller, yellow and with incurving apices. *Villadia paniculata* Pino & Cieza is a species with panicles of spikes that, when bractless, resemble racemes; the apical flowers are greenish white with slightly recurving petals. *Villadia kimnachii* Pino & Cieza is a species with erect, narrow, lycopodium-like branches with adpressed, almost upright leaves and dense spikes of small flowers with distinctive salmon-colored nectaries.

In Cusco this species was probably first collected by Julio César Vargas Calderón, (the first botanist from Cusco and founder of the Herbarium CUZ) at Hacienda Huayoccari in 1963, and it was determined as an *Echeveria* in his Herbarium. The lack of leaves of the specimen could have led to confusion but plants of this species

4. ***Villadia klopfensteinii*** habitat

5. inflorescence

© G. Pino

6. ***Villadia aureistella*** habitat

7. inflorescence © G. Pino

8. ***Villadia thiedei*** habitat

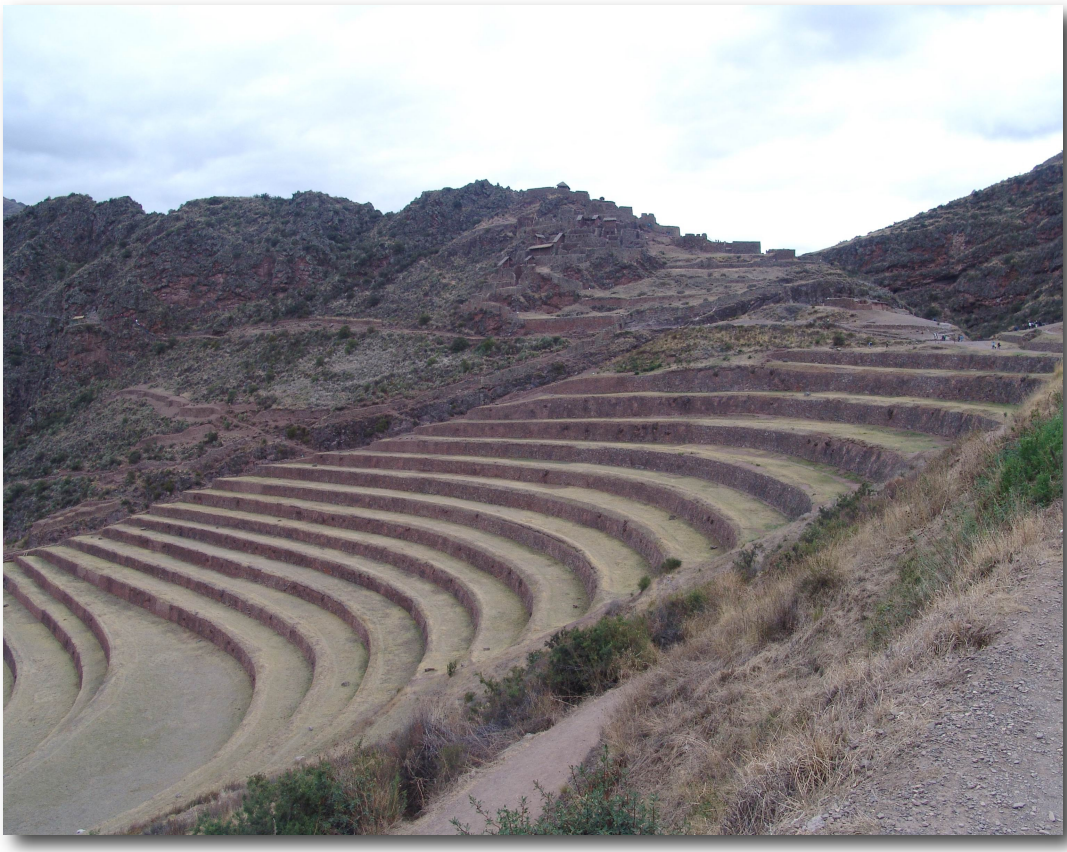
9. inflorescence © G. Pino

10 & 11. ***Villadia paniculata*** : inflorescence © G. Pino

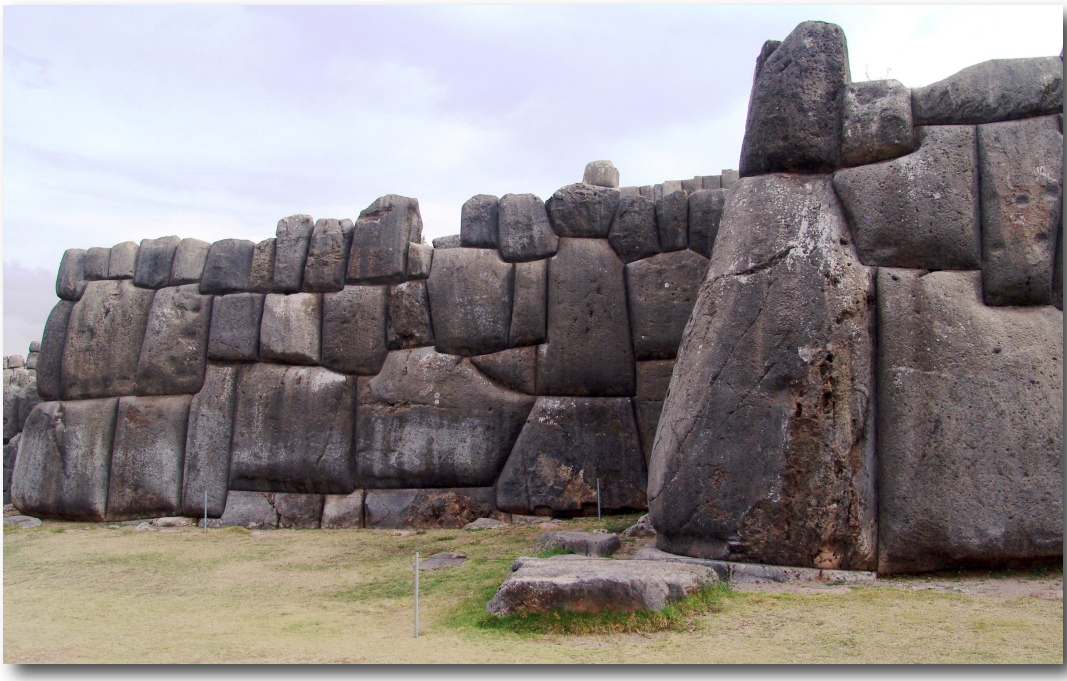
12. ***Villadia kimnachii*** habitat 13. inflorescence © G. Pino

have definite terminal inflorescences in spikes, thus placing its genus in *Villadia*. Since then, it has been collected at many localities in different provinces, but recently it is surprising the fact that most of the plants have been collected in or very near the famous Inca ruins of P'isaq, Ollantaytambo, and it was even found by Washington Galiano in the fortress of Saqsayhuaman, located just 1 km away from the famous former capital of the Inca Empire. No native name has been heard for this plant recently in Cusco, although Soukup (1987) records the name Sarasara (Little maize) as a quechua name without any locality, a logical name in any Andean valley because of the appearance of these plants.

Even without seeing the flowers, this species can be almost correctly determined as *Villadia virgata*, although the leaves of the Ancash and Huanuco plants are constantly narrower. Most of the other vegetative features are very similar, including the reticulated white pattern on the surface of leaves, bracts and sepals. Alike *V. virgata* from Ancash, all stems and even the leaves have a strong tendency to turn reddish in the sun.



14. inca ruines of P'isaq.



15. Fortress of Sacsayhuaman.

16. ***Villadia virgata*** habitat, Sacsayhuaman

17. ***Villadia virgata,*** Cuzco, infl. © G. Pino

The main differences found in Cusco plants are the inflorescences. *V. virgata* from the type locality can develop racemes instead of spikes with the pedicels longer at the base and subsessile leaves towards the tip. Some of the basal pedicels can bear two flowers. Sepals look wider in Cusco corresponding to its wider leaves. *Villadia virgata* from Cusco, when cultivated in a shady place, has pure white flowers, or slightly greenish inside, its narrower petals are constantly bent outwards in a graceful curve. Petals of *V. virgata* grown in the sun are slightly longer but almost twice as wide so flowers have a stiff appearance, they are keeled and with a brown stripe in both sides.

Although at the beginning we thought we had found a new taxon of *Villadia* from Cusco, all the differences showed are not enough to declare the Cusco plants as a new species, thus we just complete its description given in Pino, 2006.

18. ***Villadia virgata,*** Cuzco, plante in culture

19. ***Villadia virgata,*** Chiquián, details © G. Pino

Villadia virgata (Diels) Baehni& J. F. Mcbride

Villadia virgata (Diels) Baehni& J. F. Mcbride. Candollea 7: 286. 1937. Mcbride. Flora of Peru. Vol. XIII, Part. II, No. 3: 1012. 1938.
Cotyledon virgata Diels in Englers. Botan. Jahrbuch 37: 410. 1906
Altamiranoa virgata (Diels) Berger in Engl. und Prantl, Pflanzenfam., ed. 2, 18a: 470. 1930.
Type: Dept. Ancash inter Chiquián et Tallenga in muris rupibusque 3300–3600 m, April 1903 (Weberbauer 2853, B).

Description

A succulent erect glabrous herb 5-9 (-18) cm tall, 15-25 (-35) cm tall when in flower. Roots fascicular, 1–4 cm long, 1–1.5 mm diam., whitish brown. Stem procumbent, 2.5–5 mm diam. at base, grayish brown, branching alternately every 2–8 cm. Branches 1–5, erect, vegetative shoots 2-12 cm long, flowering shoots up to 30 cm long, stem 2–3 mm diam., light green. Leaves succulent, sessile, spirally arranged, crowded near the base, spreading in right angle or slightly recurving on young shoots actively growing, incurving in the dry period, more widely spaced (2-3 mm) and in a 45º angle in the flowering shoots, narrowly ovate to narrowly oblong, 5-9 mm long, 2-4 mm wide, 2–2.5 mm thick, obtuse-subacute, upper (inner) side convex to flat, lower (outer) side convex, obscurely keeled, spurred at base, dull green with a lighter reticulate pattern, almost glaucous in the dry period, margins entire.
Inflorescence a terminal spike (2.5-) 5–9 (-15) cm long. Flowers (4–) 12-16 (-20), appearing from November to March. Bracteoles 3 per flower, unequal, slightly incurved, the largest, central one opposite the stem, with the two smaller ones on either side of the central one, 2.5-3.5 (-5) mm long , 1.5-2.5 mm wide, ovate, subacute, inner side flat to concave, outer side convex, with a hyaline spur at base, same color as leaves. Pedicels absent or 2-4 mm long at base. Sepals narrowly ovoid, 2-2.5 mm long, 1.2–1.5 mm wide, same color as leaves. Petals oblong, acute-deltoid at tip, recurved at ½, slightly expanding, 3-3.5 mm long, 1.5–2 mm wide, outside pure white or with a brownish stripe in the sun, inside white or with a green stripe at the center, margins entire. Stamens 10, the 5 epipetalous 2–2.5 mm long, the antesepalous 2.2–2.5 mm long, filaments white, 0.25 mm diam at base. Anthers ovoid, 0.3 0.4 mm, yellow. Gynoecium ovoid, 2 × 2.5 mm. Carpels 5, 2.5 mm long, light green. Style 0.3 mm diam., 0.4 mm long, green, stigma white. Nectary scales oblong-spathulate, 0.6-0.7 mm, white. Fruit a dehiscent capsule, 3-3-5 long, 3.5-4.5 mm diam, dry carpels brown. Seeds narrowly obovoid, reddish brown, 0.65-0.7 mm long, 0.25-0.3 mm max. diam., apex acuminate.

20. ***Villadia virgata,*** Chiquián, ex situ

21. ***Villadia virgata,*** Chiquián, habitat © G. Pino

22. ***Villadia virgata,*** Chiquián, fl.

23. ***Villadia virgata,*** Chiquián, seeds © G. Pino

Distribution

PERU. **Dept. Ancash**, Prov. Bolognesi, Dist. Chiquián, Near Chiquián, 3250m, on hill slope, rocky-clay soil, May 18, 1950, *Ramón Ferreyra7562.*(USM 19612). Footpath from Chiquián towards Rio Pativilca, 3000–3400m, hedges and fields with numerous dry walls, rock outcrops with remnants of natural vegetation, March 17, 2001, *M.Weigend*, *K.Weigend et al. 5184* (HUT 038973). 7.4km (in a straight line) N of Chiquián on the way to Tallenga, rocky slope beside the road, ca. 0.5km N of Pachi, 3280 m, S10º04'56", W77º09'02", May 8, 2006, *P. Carrillo Reyes and M.Chocce5176* (USM 210587). **Dept. Huanuco**, Prov. Dos de Mayo, Dist. Shunqui. Road from La Unión to Pachas, Km 125, 3182m, S09º47'54", W77º48'20", Jan 31, 2010, *G. Pino, M.S. Samain, V. Morales 2457*. Prov. Yarowilca, Dist. Pampamarca, Road to Huanuco near Chavinillo, Km 82, 3245m, S09º40'39", W76º38'49", Jan 31, 2010, *G. Pino, M.S. Samain and V. Morales 2481.* Prov. Ambo, Dist. Tomayquichua, on cave just before the village of Chinchobamba. 2800m, S10º04'18", W76º11'01", Mar 2005, *Sidney Novoa s/n* (*G. Pino 1627)*

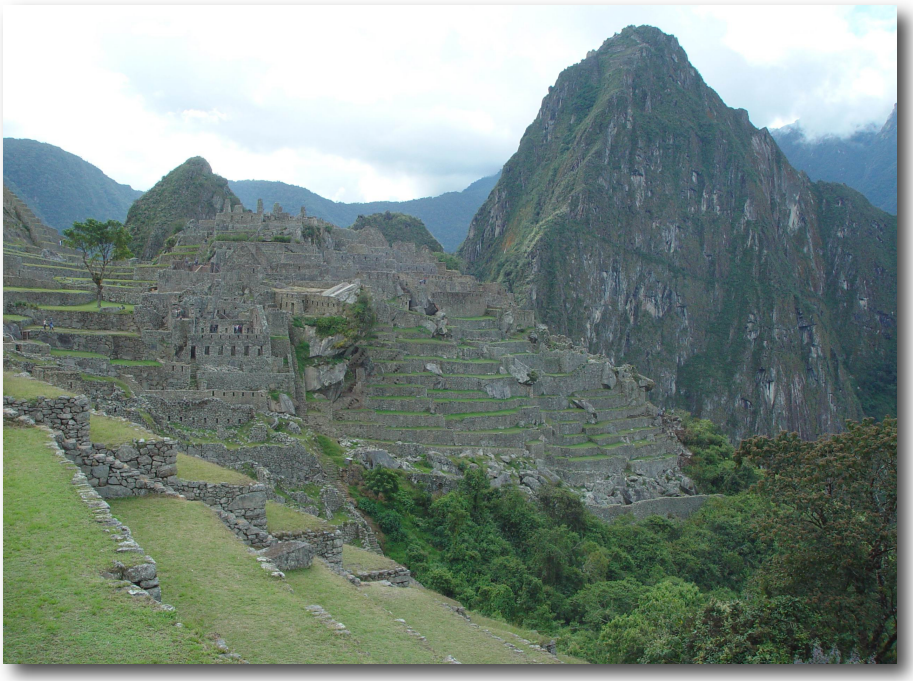
Dept. Cusco, Prov. Urubamba, Dist. Huayllabamba, Hacienda Huayoccari, on rocks, 3500m, Dec 30, 1963, *C. Vargas C. 014976 Herbario Vargas* 003511(CUZ 4798). Dist. Chinchero, High trail fromChinchero center through Urquillos, through community of PerqaKachun, "kongoña" 3000-3000m, S13°23', W72°03', Feb 16, 1982, *S.King, E. Franquemont, C. Franquemont, C. Sperling 297* (USM 62344, K). Steep wet rock slopes where brook from Pojpoj waterfall meets brook in quebrada, 3330m, S13°23', W72°03', Jan 25, 1982, W. Davis, *E. Franquemont, C. Franquemont, S.King, C. Sperling 1811* (USM 58798, F 1900229, K).Dist. Yucay, Madre Iglesias, 3300m, Feb 26, 1992, *A. Tupayachi H.2029,* Herbario Vargas 028357 (CUZ 4809). Dist. Ollantaytambo, Pinkuylluna, on the trail from town to the ruins in front of the main Ollantaytambo ruins, along the rocks before first Tambo, 2875m, S13°15'27", W72°15' 42", Nov 18,2014, *G. Pino 2764* (USM). Prov. Paruro, Dist. Yaurisque, SW Cusco, road from Cusco to Paruro, 3300m, Mar 7, 1987, *P. Núñez 7386* (CUZ 4803). Prov. Calca, Dist. Pisac, P'isaq, on Rìo Urubamba, hillsides around ruins, 3000m May 23, 1977, *J.C. Solomon 3023* (USM 53214, MO). Km. 35 on road from Cusco to Urubamba, ca. 2 Km NW of P'isaq, steepy rocky slopes mostly covered by shrubs ca. 1 m tall, 3500-4000m Jan 10, 1983, *W. Douglas Stevens 22077* (USM 64556, MO). Ruins of P'isaq, on slopes, Oct 3, 1995, *E. Rodríguez 441* (HUT 029240).Road from Cusco to P'isaq, on steepy rocky walls along the left side of the road, 2980 m,S13°25'16", W71°50'43", Jun 24, 2013,*G. Pino 2662* (USM).Prov. Quispicanchis, Dist. Lucre, Yanamanchi, trail above the town of Lucre along river canyon, on rocks of the left banks, 3400 m, S13°39'31", W71°46'07", Nov 15, 2014, *G. Pino, W.H. Galiano, P. Núñez V. 2701* (USM). Prov. Cusco, Dist.Cusco, Sacsayhuaman Archaelogical Park Zone X, 3,700m, S13°29' 42" W71°58'26"W, Mar 1, 2014, *W.H.Galiano, E.Galiano, V.Candia 15-221.*(CUZ).

Table I: Comparison of plants of ***V. virgata*** from the type locality and Cusco

	Ancash and Huánuco plants	***Cuzco plants***
Size	20-25 cm when in flower.	15-35 cm when in flower.
Stem	Mainly erect, 4-8 mm diam. at base.	Procumbent, 3–5 mm diam. at base.
Branches	Erect, 1-3, 2-15 cm long, reddish in the sun.	Erect, 1–5, 2-12cm long, light green or reddish in the sun
Leaves	6-9 mm long, 2-2.5 mm wide, 1-1.5 mm thick. Dull green, sometimes reddish.	5-9 mm long, 2-4mm wide, 2–2.5mm thick. Dull green, sometimes reddish.
Inflorescence	Terminal spike or raceme when large.	Terminal spike
Flowers	10-18, pedicels 2-4 mm long, longer in basal flowers, reddish and sometimes geminate.	4–20, always sessile.
Sepals	2.5-5 mm long, 0.8-1 mm wide.	2-2.5mm long, 1.2–1.5mm wide.
Petals	Oblong hexagonal, keeled, straight or slightly curved outwards. 4-4.5 mm long, 2-2.5 mm wide. Both surfaces white with a brown strip in the middle.	Oblong, keeled, when grown in the shade always curved outwards, slightly expanding, 3-3.5mm long, 1.5–2mm wide, in the shade outside pure white, inside white or with a green strip in the middle. In the sun both surfaces white with a brown strip in the middle.

The reason why this species appears in Central Perú and then jumps to Cusco where it is more abundant remains a mystery. Also, the presence of 5 species in only one Department of the North of Perú, and that no other species have been observed in between is also difficult to understand. Perhaps *V. virgata* has a wider distribution and remains to be collected in other Departments as Pasco, Junin, Ayacucho and Apurimac. Maybe there are new species between Cajamarca and Huanuco yet to be discovered. Further research is needed to clarify these facts about this little known, Peruvian succulent genus.

This article is dedicated to Prof. Emma Cerrate de Ferreyra, one of the most important Peruvian botanists, born in Chiquián, the type locality of this species. She passed away in Feb 28, 2016, anniversary of the Museum of Natural History of Lima Peru, where she was also a Director. She loved Andean plants and this species was one of her favorites.



24. Machupicchu © G. Pino

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