



## Confirmation of *Valeriana nivalis* (Valerianaceae) to the Argentinian flora

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### Abstract

We confirm the occurrence of *Valeriana nivalis* to the Argentinean flora, based on results of both morphological and molecular phylogenetic studies. We also include a taxonomic description, distribution, and additional information to discern *V. nivalis* from *V. pycnantha*.

**Key words:** Argentina, Flora, New record, Taxonomy, *Valeriana*

### Introduction

*Valeriana* Linnaeus (1753: 31) includes ca. 250 species distributed all over the world except Australia and New Zealand. Most *Valeriana* species grow in temperate regions of the northern hemisphere, and particularly along the South American Andes, which is an important center of secondary diversification (Kutschker 2008a, 2011). The Argentinean flora includes 48 species of *Valeriana*, mainly distributed along the Andes and central mountains (Xifreda 1999, Kutschker 2008b, 2011).

Diagnostic characters used to discriminate species in most local taxonomic and floristic works on *Valeriana* (eg. Borsini 1942, 1944, 1966, 1999, Cabrera 1993) are considered inadequate (Reese-Krug & Weberling 1991). In addition, some nomenclatural problems have come to light (Reese-Krug & Weberling 1991, 1996). *Valeriana nivalis* Wedd. was recorded for Argentina by Borsini (1942, 1944, 1966, 1999) and Cabrera (1993). However, those records were based on specimens of *Valeriana pycnantha* A. Gray (Reese-Krug & Weberling 1991) and so *V. nivalis* did not occur in later accounts (Xifreda 1999; Kutschker 2008a).

After examining new collections from Jujuy province, Argentina (specimens from BAA, CONC, F, LIL, SI, ULM) and original descriptions, we confirm the existence of *V. nivalis* to the Argentinean flora. This taxonomic placement was confirmed using molecular phylogenetic analysis, based on Bell et al. (2012). Morphological description, distribution and additional material examined of *V. pycnantha* are also included to update information of a sympatric species that could be easily confused with it. In addition, we include *V. altoandina* Cabrera as a new synonym of *V. nivalis* based on a morphological analysis.

### Materials and methods

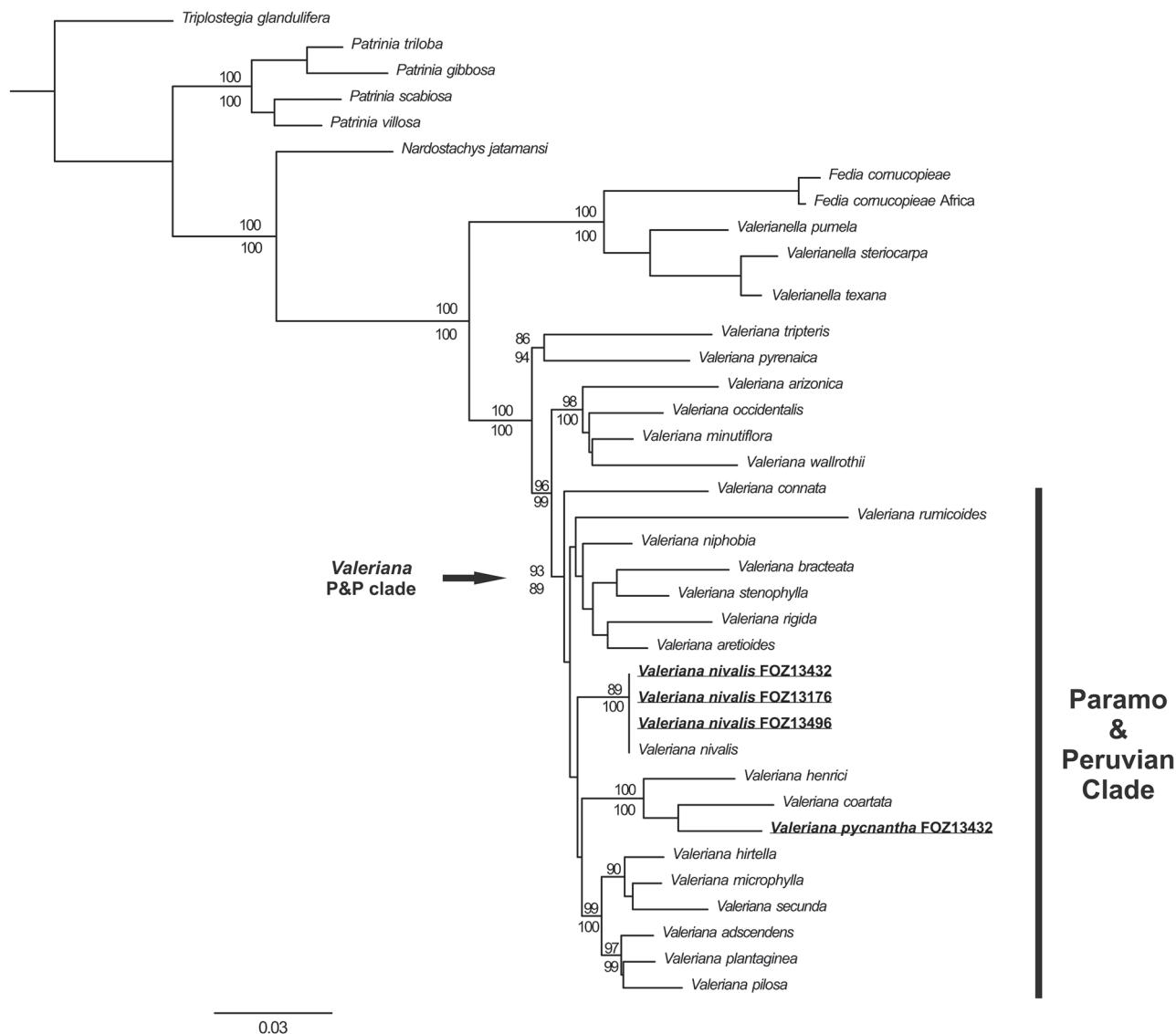
We examined collections from BAA, CONC, F, LIL, SI, ULM, original descriptions, floras (Borsini 1942, 1944, 1966, 1999, Cabrera 1993) and taxonomic works (Reese-Krug & Weberling 1991).

We amplified and sequenced the chloroplast marker *trnL-F* and the ribosomal ITS region of *V. nivalis* and *V. pycnantha*. DNA extraction, sequencing and alignment were carried out as described in Bell et al. (2012). We used Maximum Likelihood (ML) analysis to infer phylogeny as performed in Bell et al. (2012). Specimens used in molecular analysis are marked with (\*) in the list of examined material of each species. Taxon names and GenBank accession numbers for ITS and *trnL-F* sequences used in the phylogenetic analysis are given in TABLE 1.

## Result

Three vouchers of *Valeriana nivalis* sequenced in our work formed one distinct clade, including the voucher used by Bell et al. (2012). The other taxon sequenced in our work, *V. pycnantha*, was included in the southern Andean clade. (FIG. 1).

The morphological studies from the material examined and original descriptions, affirm the result of this phylogenetic analysis.



**FIGURE 1.** Maximum likelihood (ML) tree topology inferred with RAxML using a concatenated dataset (*trnL-F* and ITS, see text for details). Numbers above and below the branches represent bootstrap values greater than 85% for ML and Maximum Parsimony respectively. Vouchers sequenced in this work are in bold and underlined. P&P= Paramo and Peruvian.

## Taxonomic treatments

*Valeriana nivalis* Weddell (1857: 23). Type (designated by H. Reese-Krug & F. H. E. Weberling 1991: 406):— Bolivia. Potosí. Quebradas de las Lagunas de Potosí, no date, *A. C. V. d'Orbigny 1472* (P barcode #00757590!).

*Valeriana altoandina* Cabrera (1993: 452). Type:—Argentina. Jujuy. Depto. Humahuaca. Mina Aguilar, 4,500 m., 18 January 1953, *H. Sleumer 3476* (holotype SI-063673!; isotype LIL-479810!). *Syn. nov.*

Perennial rosette herb, glabrous, 5-15(-30) cm tall, gynodioecious. Rhizome with visible leaf scars, densely arranged. Stem shortly branched, erect or sometimes horizontal. Petiole flat, amplexicaul, 1-3 × 0.2-0.4 cm; simple leaves, entire margin or lightly sinuose to crenate, fleshy, ovate-spatulate, 1-2 × 0.5-2(-3.5) cm, apex obtuse, base attenuate. Inflorescence a apical cymose, with, usually (1-)2-3(-4) lateral pairs of branches. Peduncle scapiform, 2-15(-25) cm long, bracts of the lateral branches opposite, sessile or shortly petiolate, ovate, amplexicaul, 1-1.5 × 0.5-1 cm, margin crenate, reddish at anthesis. Flower densely arranged, capitulum-like, 30-80 flowered, 13-17 mm diam., sessile or pedunculate. Floral bracts ovate-lanceolate, entire, to 7 × 4 mm. Calyx of perfect flower involute. Corolla funnel-shaped, 5-lobed, 3 mm long, white-pinkish. Stamens three, of different length attached to the middle portion of the tube, anthers exserted. Pistillate flowers 2-2.5 mm, with aborted stamens. Achene piriform, dorso-ventrally compressed, glabrous, 2-2.5 × 1 mm; calyx acrescent and persistent, with 6 bristles, 9 mm long, plumose on the 2/3 distal portion.

**Common name and uses:**—"Flor de Tierra" (Argentina) [*Meyer no number* (LIL-34206)]; "Vaji" (Chile) [*Olivares, no number* (LIL-368761)]. According to Meyer, *V. nivalis* has medicinal properties against malaria and cough.

**Geographical distribution and habitat:**—*V. nivalis* grows in Peru, northern Chile and northwestern Argentina, along the high mountains of the Puna, and prefers rocky soils with grassy vegetation from glens between 3500 and 5100 m, growing sympatry with *V. pycnantha* (FIG. 2).



FIGURE 2. Distribution map of *V. nivalis* and *V. pycnantha*.

**Notes:**—*V. nivalis* is morphologically similar to *V. pycnantha*, but with globose, spherical inflorescence, and 6 bristles united at the base by a membranaceous ring on the achene.

**Specimens examined:**—ARGENTINA. **Salta.** Depto. Los Andes, Abra del Gallo, ca. 40 km al SO de San Antonio de los Cobres, en el camino a Pastor Grande, 17 December 1946, *Krapovickas 3205* (LIL). Depto. Santa Victoria, Abra Fundición, camino a Nazareno, 4750 m, 22° 26' 14" S, 65° 10' 08" W, 21 February 2011, *Zuloaga, et al. 13176* (SI) (\*). **Jujuy.** Depto. Humahuaca, Mina Aguilar, Cerro Aguilar, arriba de la mina, cerca de la toma de agua, 4,700 m, 4 March 1983, *Hunziker, et al. 10586* (SI). Mina Aguilar, arriba de la mina, 5,100 m, 29 March 1952, *Petersen & Hjerting 157 p.p.* (LIL). Mina Aguilar, toma de agua de la veta, 20 January 1970, *no collector no number* (BAA-7189). Mina Aguilar, toma de agua de la veta, 20 January 1971, *Ruthsatz I-25, I-29* (BAA). Subida al Cerro Aguilar, 4,800 m, 17 January 1953, *Sleumer et al. 3447* (SI). Cerro La Soledad, 3,500 m, 22 March 1929, *Venturi 8636* (SI-4326). Ruta de Abra de Zenta a Santa Ana, 4,500 m, 23° 14' 01" S, 65° 02' 53" W, 12 January 2012, *Zuloaga et al. 13426* (SI-057751) (\*). Depto. Rinconada, cerro a 5 km del pueblo, 28 February 1980, *Arenas no number* (BACF-1915, SI). Depto. Dr. Manuel Belgrano, del Refugio Militar al Chañi Chico, 4,740 m, 24° 2' 13" S, 65° 42' 58" W, 27 January 2012, *Zanotti & Suescún 273* (SI-056948, MU). Depto. Tilcara, Subida a la Abra de Remate, 4,300 m, 15 February 1953, *Fiebrig, no number*: (LIL-409935). Depto. Tumbaya, Al sur del Refugio Jefatura de los Diablos, 4,925 m, 24° 02' 20" S, 65° 45' 39" W, 30 January 2012, *Zanotti & Suescún 294* (SI). Depto. Valle Grande, de Santa Ana a Palca de Aparzo, 4,557 m, 23° 16' 08" S 65° 01' 06" W, 13 January 2012, *Zuloaga et al. 13496* (SI) (\*). Depto. Yavi, Cerro Negro, 4,000 m, 25 February 1940, *Meyer, no number* (LIL-34206, SI).

BOLIVIA. **Depto. La Paz**, Prov. Murillo, Valle de Zongo, 12 January 1980, *St. G. Beck 2782* (ULM). La Paz, ca. 30 km hacia NNE, pie del nevado Huayna Potosi, 26 February 1983, *St. G. Beck 8696* (ULM). Palca, 5 km hacia Mina San Francisco, subida al nevado Mururata, 9 September 1979, *St. G. Beck 2220* (ULM). La Paz hacia las Yungas, senda vía Coroico, 23 March 1987, *St. G. Beck 13564* (ULM)

CHILE. **I Región de Tarapacá.** Prov. Parinacota, Guanaguane, 4,600 m, 18° 18' S 69° 15' W, 18 May 1989, *Niemeyer et al. 8998* (CONC-105558), Bofedal al NE de Parinacota, 4,690 m, 18° 07' S, 69° 12' W, 31 March 1992, *Arancio 92-476* (CONC-122194). **II Región de Antofagasta.** Prov. El Loa, El Tatio, 8 December 1949, *Olivares no number*: (LIL-368761). Quebrada El Tatio, 4,200 m, 15 February 1943, *Pisano & Venturelli 1870* (CONC-143809).

PERU. Junin, *Weberbauer 6632* (F). Cuzco, *Beck 24* (GOET, B)

*Valeriana pycnantha* A. Gray (1862: 322). Type:—Perú. Lima, Alpamarca, 1838–1842, *Wilkes Expedition, no number*: (holotype US!; isotype F!).

*Additional material examined.* ARGENTINA. **Catamarca.** Depto. Santa María, El Cajón, Cumbre de Negro Ara, 4,000–4,600 m, 17 January 1914, *Castillón 3326* (LIL). **Jujuy.** Depto. Dr. Manuel Belgrano, del Refugio Militar al Chañi Chico, 24° 2' 13" S 65° 42' 58" W, 4,740 m, 27 January 2012, *Zanotti & Suescún 275* (SI-056947, MU). Depto. Humahuaca, subida al Cerro Aguilar, 4,800–4,900 m, 17 January 1953, *Sleumer 3442* (SI). Mina Aguilar, toma de agua de la veta, 5,000 m, 20 January 1971, *no collector, no number* (BAA, LIL-573907). Ruta de Abra de Zenta a Santa Ana, 23° 16' 43" S, 65° 01' 12" W, 4,610 m, 12 January 2012, *Zuloaga et al. 13432* (SI-056839) (\*). Depto. Valle Grande, Ruta Provincial 73, de Abra de Zenta a Santa Ana, 23° 11' 48" S 65° 03' 20" W, 4,550 m, 15 March 2013, *Zuloaga et al. 14347* (SI, MU). Depto. Yavi, entre Yavi y Santa Victoria, cumbre cerro Poposayo, 4,860 m, 1 February *Sleumer 3687* (SI, LIL). **La Rioja.** Dpto. Famatina, Real Viejo, 4,000 m, 3 January 1942, *Rohmeder, no number* (LIL-110321). **Salta.** Depto. Cachi, Quebrada Río Las Cuevas, 4,800 m, 23 February 1966, *Bravo, no number*: (LIL-535288). Depto. Cafayate, Nevado del Cajón, 4,500 m, no date, *Rodríguez 1385* (F, SI). **Tucumán.** Depto. Tafí, Cumbres Calchaquies, lagunas, 4,600 m, January 1908, *Castillón 133* (LIL). Cumbres Calchaquies, Cerro Isabel, 4,600 m, 19 February 1990, *Ayarde 362* (LIL). Cumbres Calchaquies, 4,200 m, 29 January 1909, *Lillo 5559* (LIL-22870). Cumbre de Calchaquí, Cerro Pelado, 4,400 m, 4 March 1952, *Sparre 9706* (LIL). Depto. Tafí del Valle, Cumbres Calchaquies, 4,500 m, 19 March 2009, *Cuello 374* (LIL). Cumbre vega sinuosa (sitio gloria 3), 4,556 m, 26° 38' S, 65° 44' W, 4 April 2007, *Grau no number* (LIL-611011). Cumbres Calchaquies, Lagunas de Vacahuasi, 4,300 m, 27 December 1913, *Castillón 3241* (LIL).

BOLIVIA. **Depto. La Paz.** Caxata, Cotacocha. Sierra de Tres Cruces, 4,950 m, February 1979, *Ceballos et al. 513*. Palca, zona basal del Illiamani, 4,900 m, February 1979, *Ceballos et al. 526* (SI).

CHILE. **I Región de Tarapacá.** Depto. Tarapacá, cordillera Cerro Columtusca, Apacheta, 4,600 m, March 1926, *Werdermann 1081* (F, G, LIL, SI).

**TABLE 1.** Taxon names and GenBank accession numbers for ITS and *trnL-F*. New vouchers sequenced are underlined.

Species	ITS	trnL-F
<i>Fedia cornucopiae</i> (L.) Gaertn	AY236193	AF447013
<i>Fedia cornucopiae</i> (L.) Gaertn (Africa)	HQ878123	JF269260
<i>Nardostachys jatamansi</i> DC.	AY236190	AF447010
<i>Patrinia gibbosa</i> Maxim.	AY792824	AY792886
<i>Patrinia scabiosifolia</i> Link	AY792825	AY792887
<i>Patrinia triloba</i> Miq.	AY236191	AF447011
<i>Patrinia villosa</i> Juss.	AY792826	AY792888
<i>Triplostegia glandulifera</i> Wall. ex DC.	AY236189	AF447009
<i>Valeriana adscendens</i> Turcz.	AY792830	AY792892
<i>Valeriana aretioides</i> Kunth	AY792833	AY792895
<i>Valeriana arizonica</i> A. Gray	AY792834	AY792896
<i>Valeriana bracteata</i> Benth	AY792836	AY792898
<i>Valeriana coarctata</i> Ruiz & Pav.	AY792884	AY792904
<i>Valeriana connata</i> Ruiz & Pav.	AY792842	AY792905
<i>Valeriana henrici</i> (Graebn.) B.Eriksen	AY360105	AY360128
<i>Valeriana hirtella</i> Kunth	AY360114	AY360134
<i>Valeriana microphylla</i> Kunth	AY360113	AY360122
<i>Valeriana minutiflora</i> Hand.-Mazz.	AY236192	AF447012
<i>Valeriana niphobia</i> Briq.	AY360106	AY360129
<i>Valeriana nivalis</i> Wedd.	AY792851	AY792914
<u><i>Valeriana nivalis</i> Wedd. FOZ13426</u>		KJ756526
<u><i>Valeriana nivalis</i> Wedd. FOZ13176</u>	KJ741395	KJ756528
<u><i>Valeriana nivalis</i> Wedd. FOZ13496</u>		KJ756527
<i>Valeriana occidentalis</i> A. Heller	AY792852	AY792915
<i>Valeriana pilosa</i> Ruiz & Pav.	AY360109	AY360131
<i>Valeriana plantaginea</i> Kunth	AY792855	AY792918
<u><i>Valeriana pycnantha</i> A. Gray FOZ13432</u>	KJ741394	KJ756525
<i>Valeriana pyrenaica</i> L.	AY360111	AY360132
<i>Valeriana rigida</i> Ruiz & Pav.	AY360108	AY360130
<i>Valeriana rumicoides</i> Wedd.	AY792861	AY792924
<i>Valeriana secunda</i> B. Eriksen	AY792865	AY79298
<i>Valeriana stenophylla</i> Killip	AY792868	AY792930
<i>Valeriana tripteris</i> L.	AY792874	AY792937
<i>Valeriana wallrothii</i> Kreyer	AY792877	AY792940
<i>Valerianella pumila</i> DC.	AY792882	AY792945
<i>Valerianella stenocarpa</i> Krok	DQ354175	DQ354211
<i>Valerianella texana</i> Dyal	DQ354173	DQ354209

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