NOMENCLATURAL NOTES ON THE ANDEAN GENERA PYCNOPHYLLOPSIS AND PYCNOPHYLLUM (CARYOPHYLLACEAE)

Martín E. Timana
Departamento de Humanidades, Sección Geografía, and Centro de Investigación en Geografía Aplicada (CIGA)
Pontificia Universidad Católica del Perú, Av. Universitaria 1801, San Miguel, Lima 32. Perú
Email: mimana@pucp.edu.pe

Abstract: The nomenclature of the high Andean genera Pycnophyllopsis Skottsb. and Pycnophyllum J. Rém y is examined. Eight species of Pycnophyllopsis are recognized; lectotypes or neotypes are selected when required; a new species, Pycnophyllopsis smithii is proposed and two new combinations are made. The genus Plettkea Mattf. is reduced to a synonym of Pycnophyllum. Ten species of Pycnophyllum are accepted, including a new species, Pycnophyllum huascaranum and lectotypes or neotypes are selected when needed.

Resumen: Se examina la nomenclatura de los géneros altoandinos Pycnophyllopsis Skottsb. y Pycnophyllum J. Rém y. Se reconocen ocho especies de Pycnophyllopsis; se designan lectotipos y neotipos cuando es requerido; se propone una nueva especie, Pycnophyllopsis smithii, y dos nuevas combinaciones. Se aceptan diez especies de Pycnophyllum, incluyendo una nueva especie, Pycnophyllum huascaranum; se designan lectotipos y neotipos cuando es requerido.

Keywords: Caryophyllaceae, Alsinoideae, Pycnophyllopsis, Pycnophyllum, Plettkea, Andes, nomenclature, Peru, Bolivia.

The Caryophyllaceae consists of 100 genera and almost 3000 species (Hernández et al., 2015). Traditionally, the family has been divided into three subfamilies (Alsinoideae Fenzl, Caryophylloideae Arnott, and Paronychioideae Meisner, but see Harbaugh et al., 2010) based on various floral and vegetative features. In that same scheme, the subfamily Alsinoideae encompasses 28 genera and nearly 750 species worldwide. Members of this subfamily are distinguished from the Caryophylloideae by their free sepals, and from the Paronychioideae by their exstipulate leaves and possession of true petals (versus petaloid staminodes; McNeill, 1962).

Although the family is mainly north temperate in distribution, with its center of diversity in the Mediterranean and Irano-Turanian region (Bittrich, 1993), several genera of Caryophyllaceae are also distinctive components of alpine floras around the world. They are found in the mountain regions of the Middle East, central Asia, alpine New Zealand and Australia, the Andes and the mountain regions of North and Central America. Some genera (including several endemics) of the Caryophyllaceae reach the southern hemisphere, particularly the high Andes and the south temperate and sub-Antarctic regions. Of the currently recognized genera, 22 are native in South America (plus another ten represented by introduced species), particularly along the Andean region with several of these genera endemic to the Andes, e.g., Pycnophyllum J. Rém y, Pycnophyllopsis Skottsb., Reichella Pax, and Philippiella Speg.

Pycnophyllopsis and Pycnophyllum are among the most poorly known members of the Caryophyllaceae in the New World. Herbarium specimens are, to date, extremely scarce. This under-representation may be because they are naturally found in the most remote parts of the Andes, usually near the snow line. It may also be due to their reduced size and, thus, to their inconspicuousness.

Here I present some long-needed nomenclatural notes regarding both Pycnophyl-
lum and Pycnophyllopsis. Because several former students of these genera, including Pax, Mushler, and Mattfeld, were based at the herbarium of the Botanic Garden and Botanical Museum Berlin-Dahlem (B), several, if not most, of the specimens they selected as types were destroyed (see Hiepko, 1987). Therefore, lectotypification, and in some cases neotypification, were required. The present work is based upon my doctoral dissertation at The University of Texas in Austin (Timaná, 2005). A revision of each genus with detailed descriptions, illustrations, distribution maps and exsiccate is currently in progress.

**MATERIALS AND METHODS**

This study is based upon the examination of herbarium specimens and extensive fieldwork. Specimens borrowed from 67 herbaria (see list in Acknowledgments; abbreviations follow Thiers, continuously updated) were examined. In addition, nine major European herbaria (B, BM, CGE, E, Fl, K, MA, OXF, and P) were visited for the study of historically important collections. The Weberbauer collection deposited at MOL was also examined on three occasions. Digital specimen images available on the Internet were also studied. Field observations and collecting were carried out in Peru, Bolivia, Argentina, and Chile between 1998 and 2013. A set of collections is deposited at the Plant Resources Center (TEX-LL), The University of Texas, Austin. Duplicate sets were left in the country of collection and additional sets were distributed to various herbaria.

**TAXONOMIC TREATMENT**

**Pycnophyllopsis Skottsb.**

Pycnophyllopsis Skottsb. is composed of eight species of cushion-forming plants occurring near the highest Andean peaks of central Peru, Bolivia, central Chile, and southern Argentina. The genus is here circumscribed in a wider sense than originally proposed by Skottsberg (1916) to include all species of the genus Plettkea established by Mattfeld (1934a).

When Mattfeld proposed Plettkea (Mattfeld, 1934a), he discussed in detail the position of this taxon (and that of Pycnophyllopsis s.s.) in the context of the subfamily Alsinoideae. His analysis clearly expressed what has been confirmed by later authors (e.g., McNeill, 1962; Bittrich 1993) – namely, that we could establish based on which characters are emphasized, not only multiple classification schemes within the subfamily but also, even generic boundaries. Various genera have been delimited based on single characters; for a detailed discussion on how this has affected large genera such as *Arenaria* refer to McNeill (1962). Although Mattfeld (1934b) recognized the close relationship of these genera by placing them within a new subtribe (*Plettkeinae*), in fact, his separation of *Pycnophyllopsis* s.s. and *Plettkea* was primarily based on the weakly- perygynous ovary of the former versus the strongly perygynous state among *Plettkea* species. Based on the evaluation of multiple characters and their variation among individuals along with a cladistic analysis of morphological data, Timaná (2005) demonstrated that such separation cannot be maintained and therefore, these two taxa are here merged.


Bisexual or dioecious, perennial, densely caespitose, hemispheric shrubs, 5—30 cm in diameter. Stems woody to sub-woody, 1.5—6 mm in diameter, branches 1.8—5 mm thick, herbaceous. Leaves extispulate, imbricate, rarely tetristichous or spirally arranged, adpressed, scarious; sheath glabrous; blade sessile, incurved or flat, lanceolate to nearly triangular, complanate to cymbiform, base
connate, margin entire, denticulate or ciliate, midvein absent, apex acute, or mucronate, abaxial surface shiny, glabrous, adaxial surface shiny or opaque, glabrous. 

**INFLORESCENCE** terminal, single-flowered; foliaceous prophylls paired, rarely only one, subtending the flower; pedicel up to 2.5 mm long. **FLOWER** bisexual or unisexual, haplostemonous, tetracyclic, perigynous, sub-perigynous or rarely hypogynous, ovate to obdeltate; receptacular cup present or poorly developed, annular, cotyliform or infundibuliform; flower disk present or absent. **CALYX** oblong-cylindrical or stellate. **SEPALs** 4 or 5, imbricate-decussate, valvate or quincuncial, lanceolate to ovate, cymbiform or slightly so, free above the receptacular cup, scarious, margin either entire, denticulate, or ciliate, straight to involute, apex acute, abaxial surface nitid, smooth, or glabrous. **PETALS** 4 or 5, rarely 3, free, alterni-sepalous, translucent, obovate to wide obovate, very reduced, membranaceous, base cuneate or oblong, margin entire, apex deeply bifid to bilobed, glabrous, staminal disk absent or present, anular. **STAMENS** (3) 4 or 5, episepalous or antisepalous, filament base strongly enlarged or filiform; anthers introrse, dorsifixed; staminodes (in dioecious species) 5, episepalous, filament minutely enlarged or filiform, flattened, sterile anthers dorsifixed. **PISTIL** with ovoid to turbinate, glabrous unilocular ovary, gynophore absent; styles 2 or 3; stigma terete, slightly clavate; ovules 3, arranged on the base of a central placental column. **PISTILLODE** (in dioecious species) 3-carpelate, unilocular, reduced ovary pooidy ovary to cylindric, glabrous, stigma terete. **FRUIT** an utricule, enclosed in by the persistent sepals. **SEED** 1, light to dark brown, reniform, laterally compressed, rarely shortly crested dorsally with surface nitid or opaque, smooth, minute papilose to asperulate.

1. **Pycnophyllopsis muscosa** Skotts., Kongl. Svenska Vetenskapsakad. Handl. N.S. 56(5): 216. Fig. 11, Tab. 22(5). 1916. — **TYPE:** ARGENTINA. Patagonia Andina, territorio Chubut, Meseta Chalía, c. 1300 m, 5 Dec 1908, Skottsberg 606 (LECTOTYPE, here designated S!); ISOLECOTYPES: LD!, UPS!).

This is a very peculiar species. It is the only species that shows a relatively long pedicelate flower — up to 2.5 mm long, compared to all the other species with pedicels less than 0.5 mm long. **Pycnophyllopsis muscosa** is also the only species with a stellate calyx rather than the typical oblong, nearly cylindrical calyx that characterizes all the other species in this genus.

2. **Pycnophyllopsis keraioptala** Mattf., Schriften Vereins Naturk. Unterweser N.F. 7: 22. 1934. — **TYPE:** BOLIVIA. La Paz: zwischen Palca und La Paz, an Felzen, 4800 m, Apr 1908, Pflanz 223 (HOLOTYPE: B†). **NEOTYPE:** BOLIVIA. La Paz: Murillo: Cordillera Real, Chacaltaya, N of Milluni crossing, E of Lake Milluni, 4600 – 4900 m, 16°22’ S, 68°10’ W, 25 Jan 2000, Timaná 3804 (NEOTYPE here designated: LPB!; ISONEOTYPES: BM!, K!, MCSN!, MICH!, LL!, USM!) (Fig. 1).

Among members of the genus, **Pycnophyllopsis keraioptala** is the only species with trimerous petals and stamens, although tetramerous and pentamerous forms are also found (sometimes all three forms in the same plant, e.g., **Timaná 3804**). In the case of trimerous androecia, the two stamens missing are always those that would be opposite the outermost sepals. This species is also characterized by an enlarged filament base (described as a nectary by Mattfeld, 1934a), forming a weak staminal disk, a character shared with **P. muscosa**.

Fig. 1. Isoneotype of *P cynophyllopus keraiopetala*. —The University of Texas Herbarium (LL).
A very distinctive species, *Pycnophyllopsis cryptantha* is unique in the genus because of its tetramerous condition and two free styles. It is also characterized by decussate sepals with the inner pair shorter and non-ciliate as opposed to the outer pair. This Peruvian endemic species is found in populations near the divide between the Departments of Lima and Junín (central Peru) in the area known as Ticlio (Anticona Pass), around 4800 m and the puna of Cuzco and Puno between 4800 to 5200 m.


*Pycnophyllopsis macrophylla* differs from *P. cryptantha* in the number of floral parts: *P. macrophylla* is consistently pentamerous with three free styles; *P. cryptantha* is a tetramerous species with two free styles. In addition, the leaves of *P. macrophylla* are slightly narrower toward the apex, taking the geometric form of a narrow triangle, while those of *P. cryptantha* resemble an equilateral triangle.

The isolecotype was examined and annotated as such during one of my research visits to the MOL herbarium in 2000, as can be attested to in the corresponding JSTOR Plants photograph (MOL00000509, photo!). Unfortunately, designation of such in Timaná (2005) does not qualify as effective publication (McNeil et al., 2012) whereas Molinari’s (2016) designation, based on the study of Timaná (2005), does (see Grayum et al., 2016, for further comments on this practice).

5. *Pycnophyllopsis laevis* (Bartl.) Timaná, **comb. nov.**  
≡ *Stellaria laevis* (Bartl.) Rohrbach, Linnaea 37: 275. 1871. TYPE: PERÚ. Quebrada de l’Obrachillo, s.d., Haenke s.n. (LECTOTYPE designated here, PR!); ISOLECTOTYPES: HAL 0117903 (photo!), GOET 000715 (photo!).

In his treatment of the genus *Plettkea*, Mattfeld (1934a) included the species described by Rohrbach in 1872 as *Stellaria laevis* (≡ *Cherleria laevis* Bartling), suggesting that this taxon may be congeneric with members of *Plettkea* but he did not have access to the original specimens collected by T. Haenke in Peru later used by both Bartling and Rohrbach. The Haenke specimen was finally located in the National Museum of Prague Herbarium (PR), where most collections made by Haenke during the Malaspina Expedition were sent (Stearn, 1973). After examining this specimen, I can confirm that this taxon indeed belongs in *Pycnophyllopsis*.

6. *Pycnophyllopsis tetrasticha* (Mattf.) Timaná, **comb. nov.**  

When Mattfeld (1934a) described *Plettkea tetrasticha*, he did so by simply stating that this species was in most aspects similar to *Pycnophyllopsis weberbaueri* (his *Plettkea weberbaueri*) but mainly differed in the more robust habit, somewhat larger leaves, and
Fig. 2. Isotype of *Pycnophyloopsis smithii*. — The University of Texas Herbarium (LL).
flowers notably longer. No duplicates of the original Berlin type material have been located; therefore, determining the identity of this species has been based on the various measurements made and the geography of the original specimen and current collections. The specimen selected perfectly falls within the size ranges given by Mattfeld for flower, receptacular cup, sepalis, and pistil.

7. *Pycnophyllopsis smithii* Timana, sp. nov.

— **TYPE:** PERÚ. Lima: Huarochirí, Paso de Anticona, Ticlio, 4850 m, 16 Dec 1998, Timana & Tate 3768 (HOLOTYPE: USM; ISOTYPES: BM!, K!, F!, LPB!, MICH!, LL!) (Fig. 2).

Perennial, caespitose SHRUB, (5) 8—20 cm in diameter, dioecious. Roots woody, robust. STEM woody, 3—5 mm in diameter, primary branches 2 mm in diameter, yellowish green to stramineous. LEAVES imbricate, (2.0) 2.5—3.5 (3.8) mm long, sheath stramineous, 0.8—1.0 mm long, smooth; blade incurved, stramineous to slightly yellowish-green, lanceolate to nearly triangular, cymbiform, (1.7) 2.0—2.5 × 0.8—1.2 mm wide, margin minute ciliate to denticulate, cilia sparsely distributed along the blade margin, single-celled, 0.05 mm long, venation a weak midvein on abaxial side, blade apex mucronate, abaxial surface nitid, smooth, adaxial surface shiny. INFLORESCENCES terminal, included; prophylls paired, 1.2—1.5 mm long; pedicel 0.1—0.3 mm long. PLANTS dioecious. STAMINATE FLOWER perigynous, ovate, 2—3.0 × 1.0—1.3 mm with a receptacle cup present, crateriform, 0.7—0.9 mm long; calyx ovoid; sepals 5, imbricate, slightly incurved apically, stramineous, lanceolate to narrowly ovate, slightly cymbiform, 1.2—1.5 × 0.5 (0.7) mm, margin entire, slightly involute distally with apex acute, surface smooth, with a fine midvein visible adaxially; petals 5, light cream-colored to pale stramineous, translucent, obovate, 0.3—0.4 × 0.2—0.3 mm, its apex bifid, divided 1/2 —2/3 the petal length; flower disk absent; staminodes 5, 0.25—0.30 mm long, filament base terete; pistil 1.5—2.0 mm long its ovary obpyriform to turbinate, 0.6—0.8 × 0.6—0.8 mm; styles 3; stigma terete. FRUITS 1.5 × 1 mm. SEED 1, brown, reniform, laterally flattened, 0.8 × 0.8 mm, shiny, minutely papillose.

**Phenology** — Collected in flower from December to May and in fruit from August to January.

**Distribution** — Primarily found in the divide between Lima and Junin, central Peru, in the area locally known as the Anticona Pass, from 4300 to almost 4900 m, where it is sympatric with *Pycnophyllopsis cryptantha* and members of the genus *Pycnophyllum*. *Pycnophyllopsis smithii* has also been reported in the Department of Ancash, within the boundaries of Huascaran National Park, at nearly 4800 m.

**Eponymy:** It is a great honour to name this new species after the American botanist David N. Smith (1945–1991). David spent nearly four years botanizing the highest peaks of central Peru, particularly the Cordillera Blanca (Ancash) as part of his doctoral dissertation on the flora and vegetation of Peru’s Huascaran National Park (Smith, 1988). His numerous collections of *Pycnophyllopsis* and *Pycnophyllum* have greatly enhanced our understanding of these two genera, having an impact parallel to that of A. Weberbauer a century earlier.

**Additional Specimens examined** — PERÚ. Ancash: Recuay, Huascaran National Park, quebrada Quenua Ragra, 4700 - 4850 m, 9°58 S, 77°13 W, 11 Mar 1985, Smith et al. 11772 (MO). Junin: Ticlio, 4740 m, Dec 1986, Rivas et al. s.n. (USM); Capillacocha,
20 km E Carhuamayo, 4300 – 4350 m, 25 Nov 1951, Tovar 381 (TEX). Lima: Huarochiri, Anticona, 4843 m, 8 Aug 1987, Chanco et al. 1219 (USM); Anticona Pass, approx. 140 km E of Lima on road to La Oroya, ca 4890 m, 16 Dec 1978, Dillon & Turner 1301 (MO, TEX); Ticlio, 4800 m, 27 Sep 1974, Waechter 217PW (GOET). Pasco: Huayllay, Lago Huarón, 4750 m, 14 Jan 1971, Ellenberg 4061 (US).

Pycnophyllopsis smithii is perhaps the most difficult species to distinguish using just a single set of characters. Morphologically, it most resembles the disjunct Pycnophyllopsis weberbaueri with which it maintains differences that, although gradual, are consistent. The two differ in leaf margin: _P. weberbaueri_ clearly has noticeable cilia (up to 0.2 mm) whereas those of _P. smithii_ can be better characterized as denticulate, with projections less than 0.05 mm that can be observed at 40X magnification. In addition, leaves of _P. smithii_ are normally shortly mucronulate, while in _P. weberbaueri_ they are consistently acute and without any further projection. Although flowers of both species are approximately the same length, the pedicel of _P. smithii_ is relatively shorter (0.1 – 0.3 mm) than those of _P. weberbaueri_ (0.3 – 0.5 mm). Petals of _P. smithii_ are also shorter (0.2 – 0.4 mm) and more deeply cleft apically (over ½ the total petal length) compared to those of _P. weberbaueri_ (0.4 – 0.8 mm, petals cleft ½ — ¼ the petal length). The stamens of _P. smithii_ are up to 1.2 mm in length, while those of _P. weberbaueri_ can be as long as 2 mm and the staminodes of the former species are also smaller. The style of _P. smithii_ is somewhat longer relative to the total length of the pistil (mean = 60% of the total pistil length) compared to the corresponding character in _P. weberbaueri_ (mean = 48%). There are also differences in the overall aspect of these species: although they both have imbricate leaves, each opposite pair in _P. smithii_ is greatly overtopped by the corresponding lower (inferior) pair, giving the appearance of a tightly arranged, very compact cushion where the most visible part is the light green-colored leaf tips. In _P. weberbaueri_ the leaves are also imbricate, yet they do not overlap to the degree previously described, giving the overall impression of a more loose cushion, with various brown-colored branches clearly visible. Finally, one needs to consider the geographic distribution. The two taxa, both dioecious, and with inconspicuous flowers and probably very limited dispersal mechanisms, are geographically separated by a distance of nearly 1000 km by two of the highest mountain ranges in this part of the Andes. Placing them within the same species would suggest the possibility of potential gene flow between the two populations. Given the evidence at hand, this seems to be very unlikely. With these considerations in mind I have therefore decided to circumscribe this new species.

8. _Pycnophyllopsis weberbaueri_ (Muschl.)


Although it is morphologically rather uniform, this dioecious species has flowers that are consistently pentameric with three free styles. It shares several similarities with _Pynophyllopsis smithii_, from central Peru [see the discussion under _P. smithii_ for various distinguishing features that separate these two species]. _Pycnophyllopsis weberbaueri_ is found sympatrically with _P. keraiopetala_, a bisexual species with a weakly perigynous flower and a reduced number of stamens.

_Pycnophyllum_ J. Rémy

_Pycnophyllum_, a genus of ten species, is one of the few known genera in the Caryophyllaceae restricted exclusively to
the high central Andes. The genus is here circumscribed as in Mattfeld’s (1922) original concept, namely excluding members of *Pycnophyllopsis* Skottsb. and *Plettkea* Mattf. which were previously merged into *Pycnophyllum* by MacBride (1937).


**Type species**, designated here: *Pycnophyllum molle* J. Rémy

≡ *Stichophyllum* Phil. in Fl. atacam. 19, Tab. 1d (1860). **Type species**: *Stichophyllum bryoides* Phil. (≡ *Pycnonphyllum bryoides* (Phil.) Rohrb.)

Dioecious, perennial, densely caespitose, hemispheric to irregularly shaped shrubs, 20—ca 200 cm in diameter. **Stem** woody, 5—10 mm in diameter; branches herbaceous, crowded or flabelliform, proximal branches sometimes enclosed by shriveled leaves. **Leaves** extipulate, imbricate, tetra-stichous or spirally arranged, adpressed or spreading from the branch axis, scarios to membranous, sheath 0.5—2.5 mm long, scarios to membranous, smooth, glabrous; blade sessile, incurved, straight, or recurvate, lanceolate to wide ovate, complanate to cymbiform, scarios, base connate, margin entire, sometimes expanded into a translucent membrane, then the blade composed of a scarios callous and a peripheral membrane, apex obtuse, acute or long aristate, midvein obscure or weakly developed on the adaxial side, abaxial side nitid or opaque, smooth, glabrous. **Inflorescence** terminal, solitary, weakly exserted above the leaves, single flowered; bracts 4—10 (12), opposite, decussate, complanate to slightly cymbiform, ovate to spatulate, membranous, base obtuse, margin entire, apex obtuse to rounded, rarely acute, medial callosus present or absent, smooth, glabrous; pedicel 0—0.4 mm long. **Flowers** unisexual, haplostemonous, tetracyclic, hypogynous, ovate, obovate, or oblong; receptacular cup absent.

**Calyx** ovoid, cylindrical to obovoid. **Sepals** 5, very rarely 6, imbricate quincuncial, wide to narrowly ovate, cymbiform to slightly so, free, scarios, with a membranous margin or not, central callous present or absent, margin entire, usually involute, apex acute to obtuse, abaxial side nitid, smooth, glabrous, colored or not. **Petals** 0 to 5, free, alternisepalous, transluent or cream-colored to light brown to violaceous, oblong to obovate, membranous, base cuneate, margin entire, apex dentate to divide, or truncate, glabrous. **Stamens** 3 to 5, alti-sepalous, heterandrous, rarely homandrous, filament base filiform, terete or complanate, sometimes weakly subulate; anthers introrse, dorsifixed; staminal disk present, flattened to prominent; staminodes (in pistillate flowers) 2 to 5, antisepalous, filaments terete or complanate, sterile anthers dorsifixed. **Pistil** 1.5—4.5 mm long; ovary 3-carpellate, unilocular, ovoid to ellipsoid, frequently trigonous, glabrous, sometimes minute stipitate; style single, stigma terete, shortly capitate at the apex with 3—6 ovules arranged at the base of a central placental column; pistillode (in staminate flowers) 3-carpellate, unilocular, 1—2 mm long, reduced ovary ovoid to cylindrical, sometimes apically compressed, 0.4—1.5 mm long, glabrous, stigma terete. **Fruit** an utricle or septicidal capsule opening by 3 valves, or an irregular circumscissile capsule opening near the base of the ovary; ovoid or ellipsoid, usually trigonous, 1.0—3.5 mm long, 1—2 mm wide, enclosed by persistent sepals. **Seeds** 1 to 6, light to dark brown, reniform, laterally compressed, surface nitid or opaque, smooth or minute papilose.

Despite its overall morphological similarities with members of *Pycnophyloopsis* and *Arenaria* L., species of *Pycnophyllum* form a single, coherent group united by a combination of various morphological characters not found among other members of Caryophyllaceae. In addition to their cushion-like life form, species of *Pycnophyllum* are characterized by dioecy, simple, opposite leaves generally fused at the based forming a distinctive sheath, a complete lack of any form of pubescence or marginal cilia,
Fig. 3. Lectotype (P 00156958) of *Pycnophyllum molle*. — Reproduced by kind permission, © MNHN collection-Paris.
hypogynous flowers, 5 free sepals, 3 to 5 antisepalous stamens (or staminodes) forming a well-defined staminal disk, a pistil terminating in a single style with 1—3 stigmatic lobes, and a one to three-seeded fruit. Fruits can be indehiscent (P. sect. Gymnopycnophyllum), or dehiscent (3-valved capsule) as in P. sect. Pycnophyllum.

Pycnophyllum sect. Pycnophyllum


1. Pycnophyllum molle J. R´emy, Ann. Sci. Nat. Bot., Sér. 3, 6: 355, Tab. 20, fig. 2-8 (Dec. 1846) —TYPE: BOLIVIA. Potosi: Lagunas de Potosi, March, D’Orbigny 442. (LECTOTYPE, designated here: P! (P00156958); ISOLECTOTYPES: P (P00156959, photo!), F! (fragment; 871384), G! (G00226948) (Fig. 3).

≡ Pycnophyllum aculeatum Muschl., Bot. Jahrb. Syst. 45: 456, Fig. 1. (1911). TYPE: PERU. Arequipa: Vincocaya, en el ferrocarril de Arequipa a Puno, 4300—4400 m, s.d. (24 Aug 1902, per Mattfeld), Weberbauer 1374 (HOLOTYPE: B†; LECTOTYPE, designated here: MOL!)


The French traveller, palaeontologist and explorer Alcide d’Orbigny (1802-1857) visited Bolivia from 1830 to 1833; his plant collections were studied by Jules Ezechiel R´emy (1826-1893) and published in the Annales des Sciences Naturalles in two articles, Analca Boliviana I and Analecta Boliviana II (R´emy, 1846, 1847; Stafleu and Cowan 1981, 1983). There are two d’Orbigny’s specimens at the Paris herbarium belonging to this species, but only the one selected as lectotype carries the label which coincides with the locality described by R´emy in the original description.

Given its wide geographic distribution across various degrees of latitude, Pycnophyllum molle shows a considerable degree of variation. Although the main source of variation is in leaf size, shape, and color, the floral structure remains rather constant. Much of the apparent variation among P. molle specimens is caused by the different branching patterns detected within the same cushion – a condition produced by either intrinsic causes, such as branch age, or extrinsic ones, such as micro-topography. Consequently, one often finds a wide range of variation within a single individual. The same effect has been noticed in P. tetra-stichum.

2. Pycnophyllum huascaranum Timana, sp. nov. —TYPE: PERÚ. Ancash: Carhuaz, Huascaran National Park, lateral valley of Quebrada Ishinca, trail to Lago Ishinca, 4730—4930 m, 9°23’ S, 77°25’ W, 12 Feb 1985, Smith, Valencia & Gonzales 9453; (HOLOTYPE: MOL! 3311207); ISOLECTOYPES: AAA!, F! MO! (3311209) (Fig. 4).

Pycnophyllum huascaranum differs from Pycnophyllum molle in the dark orange to orange-yellow blade callous, the strongly involute blade margin, 6(8) bracts, and the 3-valved capsule.

Hemispherical, convex shrub, up to 60 cm in diameter and 25 cm high; stem woody, 6—9 mm in diameter; branches compact, crowded, primary branches terete to clavate, 2.5—3.5 mm wide, light brown to yellowish green. Leaves imbricate, appressed to the branch axis, 2.3—3.1 mm long; sheath stramineous, ovate to obovate, slightly cymbiform, 1.3—2.1 × 1.0—1.4 mm, margin membranous, translucent, strongly involute, blade venation obscure, apex obtuse to rounded, apiculate, less than 0.1 mm long, blade surface shiny, smooth, blade callous present, obspathulate, 1/2 — 2/3 the total blade length, dark orange to orange yellow. Inflorescence single, terminal, bracts 6(8), obovate to obspathulate, 3.0—3.5 × 1.3—1.6 mm, bract apex obtuse
Fig. 4. Holotype (MO 3311207) of *Pycnophyllum huascaranum*. — Reproduced by kind permission, © Mo. Bot. Garden. (MO).
to rounded, callous bract absent, pedicel 0—
0.2 mm long. **Staminate flower** obovate,
obconical to ovoid; sepal slightly incurved,
from light cream to pale yellow, peripherally
membranous, scarious medially, obovate,
carinate to slightly cymbiform, 3.8—4.1 ×
1.5—2.5 mm, margin slightly involute, apex
obtuse to rounded, abaxial surface smooth,
veins obscure, callous present, 2/3—3/4 the
sepal length, light yellow; petals 5, translu-
cent, obovate, 1.1—1.4 × 0.1—0.5 mm, apex
obtuse to truncate; stamens 5, heterandrous,
1.4—2.3 mm long, filament base filiform,
floral disk poorly developed; pistillode 1.3—
1.7 mm long, pistillode ovary ovoid, 0.6—
0.7 × 0.4—0.7 mm. **Pistillate flower**
oboavate, obconical to ovoid; sepal slightly
incurved, from light cream to pale yellow,
peripherally membranous, scarious medially,
oboavate, carinate to slightly cymbiform,
3.4—3.8 × 2—2.3 mm, margin slightly
involute, apex obtuse to truncate; petals 5, translu-
cent, obovate, 0.8—1.3 x nearly 0.2 mm, apex
obtuse to truncate; staminodes 5, homandrous, less than 0.2
mm long, filament flattened, floral disk
minute; pistil 1.8—2.5 mm long, ovary
ovoid, 1.2—1.5 × 0.9—1.2 mm, ovules 3,
stigma trifid. FRUIT a 3-valved capsule, 1.5—
1.8 × 1.2—1.5 mm, ovoid. SEEDS 2—3, light
brown, asymmetrically reniform, ca 1 x ca
0.7 mm, minute papillose.

**Phenology** — Flowering from October to
April and fruiting from February to May.

**Distribution** — Endemic to the Depart-
ment of Ancash, Peru, in the vicinity of
Huascaran National Park, from 4200 to 5000
m.

**Eponymy** — This new species is named
after the type locality, Huascaran National
Park, a magnificent Peruvian National Park
where a number of interesting caryophylla-
ceous species are found.

**Additional Specimens examined** — PE-
RU. Ancash: Llanganuco valley, slopes of
Huandoy, Cordillera Blanca, 18 Jul 1968,
*Balitgate* 10 (E, F); near lago Safuna,
northern Cordillera Blanca, northeast of
Alpamayo, 4250 m, rocky sites with granitic
or crystalline rocks, some glacial debris,
some large outcrops; on soil as a yellow
mound, level site, 4250 m, 22 Jul 1975,
*Binun* s.n. (COLO); Huarapasca, estacion 40
miles east of Huaraz, 5500 m, 3 Oct 1922,
*MacBride* & *Featherstone* 2488 (BM, F, G,
MA, NY, S, US); Cordillera Huayhuasch,
4600 m, 19 Jul 1954, *Rauh* & *Hirsch* P1894
(F); Cordillera Raura, 4900 m, 21 Jul 1954,
*Rauh* & *Hirsch* P1902 (F); south of Huaraz,
32 km from Pachacoto towards La Union,
Punta Huarapasca, 4750 m, 6 Apr 1988,
*Renvoize* & *Laegaard* 5132 (K); Huascaran
National Park, between pass and Carpa, rio
Pachacoto drainage, 4600—4350 m, 9°53’ S,
77°14’ W, 31 Mar 1985, *Smith* & *Escalar*
10216 (F, MO); Huascaran National Park,
Llanganuco sector, quebrada Demanda,
between Lago 69 and glacier coming from
Nevado Pisco, 4800 m, 9°00’ S, 77°36’ W, 12
Apr 1985, *Smith* & *Cautivo* 10273 (AAU);
Huascaran National Park, quebrada Quenua
Ragra, 4700—4600 m, 9°10’ S, 77°38’ W, 28 Sep
1985, *Smith* 11506 (F, MO); Huascaran National
Park, 3—4 km below Cahuish Tunnel, 4500—4550 m, 9°41’ S,
77°14’ W, 10 Jul 1985, *Smith* & *Buddensiek*
11115 (F, MO); Huascaran National Park,
Parón Valley, E of Lake, 4600—4900 m, 8°58’
S, 77°38’ W, 28 Sep 1985, *Smith* 11506 (F,
MO); Huascaran National Park, lateral
valley of quebrada Ishinca, 4730—4930 m,
9°23’ S, 77°25’ W, 12 Feb 1985, *Smith* et al.,
9453 (AAU, F, MO); Huascaran National
Park, quebrada Alpamayo, at foot of Alpa-
amayo and Quitaraju, 4600—4750 m, 8°53’ S,
77°41’ W, 8 Mar 1985, *Smith* et al. 9738
(AAU, F, MO); Huascaran National Park,
pass between quebrada Los Cedros and
Hatuncocha, 4600—4850 m, 8°51’ S, 77°45’
W, 12 Mar 1985, *Smith* & *Valencia* 9949
(AAU, MO); Pisco Creek, Llanganuco Val-
ley, S. exposure, ca 3200 m, Aug 1959,
*Tothill* 147 (CORD, F, UC).

This taxon is characterized by its robust,
densely packed primary branches, its mark-
edly involute leaf margin, particularly to-
ward the apex, the conspicuously bright
orange to light brown, shiny, protruding
callous and dehiscent fruit. The callous can
sometimes be so conspicuous that, to an
untrained eye it may resemble the sporangia of some Sellaginella species (some Pycnophyllum specimens have been determined as such in the past). The fruits are also peculiar because they can unambiguously be considered capsules, opening from the bottom of the ovary into three valves.


As with many others of Stübel’s specimens deposited in Berlin, the type of **Pycnophyllum spathulatum** is no longer extant. The only fertile specimen (with pistillate flowers) gathered in the same locality as the type is that of S.G. Beck, which is therefore selected here as the neotype. Morphologically **Pycnophyllum spathulatum** is most similar to **P. macropetalum**, from which it can be easily distinguished by its upright, uniformly terete, brownish-yellow branches, whereas **P. macropetalum** has lax, light green to yellow, club-shaped branches.


**Pycnophyllum macropetalum** exhibits numerous unique characteristics that make it easily recognizable: it not only has the largest petals in the genus but also it is the only species in which petals are longer than the sepals; in addition, **P. macropetalum** is the only species with coloured sepals – from light brown to a rather intense violaceous color, particularly toward the apical region of the sepals. Although fruits in the genus **Pycnophyllum** have been described as indescent or irregularly rupturing (Mattfeld, 1922; Bittrich, 1993) **P. macropetalum** clearly produces a 3-valved capsule.


**Pycnophyllum holleanum** is one of the most distinctive and handsome species in this genus. It is characterized by squarrose leaves, a sharp awn, and the light brown color of the foliar callous. Morphologically it is most similar to **P. aristatum** from which it differs in the shorter awn and the blade shape (ovate in the latter). Mattfeld described this species based on a subsequently destroyed Berlin specimen. Of the 15 isotypes studied, only two (K and MOL) have the same complete collection information as that of the protologue. The Kew specimen label reads “Ex Museo Botanico Berolinensi” and shows the accession date as “24 Apr. 1923” (one year after Mattfeld’s monograph). The Berlin isolectotype cited above was acquired from the Stockholm herbarium in June 1961, thus it presumably cannot be considered part of the original material studied by Mattfeld.


**Pycnophyllum aristatum** is another distinctive species in this genus. It is easily recognized by the long, filamentous, spiraled awns, the flabelliform disposition of branches, and the light brown coloration of the young branches.

Pycnophyllum sect. Gymnopycnophyllum

**Type species:** Pycnophyllum tetrastichum J. Rémy.
See discussion under Pycnophyllum tetra- 
stichum


7. *Pycnophyllum bryoides* (Phil.) Rohrb., Linnaea 36: 662 (Dec 1870) ≡ *Stichophyllum bryoides* Phil., Fl. atacam. 19. Tab. Id. (1860) — **Type:** CHILE. **Atacama:** Alto de Piuquis in deserto Atacama, Feb. 1854, R. Philippi s.n (Holoype: SGO 48876! p.p., marked as No. 2).

*Pycnophyllum bryoides* is one of the most distinctive and well-defined species in *P. sect. Gymnopycnophyllum*. It can easily be recognized by its uniformly spirally arranged leaves, and by the presence of five small, apically divided petals, a unique condition among members of this section. While various specimens collected by Philippi from the Atacama Desert region have been located, only the SGO holotype that was collected in 1854, all of the others were collected later or lack enough information to decide their nomenclatural status.

8. *Pycnophyllum convexum* Griseb., Pl. lorentz. 28 (1874); also in: Abh. Königl. Ges. Wiss. Göttingen 19: 76 (1874) — **Type:** BOLIVIA. **Potosi:** 4000 m, D’Orbigny s.n. (Lectotype selected here: P!, P00156960; Isolectotype designated here: P!, P04925579) (Fig. 5).

= Pycnophyllum argentinum Pax and P. mucronulatum Mattf. Although the study of type material of these taxa shows some differences between them, the analysis of multiple populations across their geographic range demonstrates that these three taxa cannot be kept separate. As discussed under *P. tetrastichum*, the levels of phenotypic variation even within individual plants show that the species limits set by Mattfeld are not meaningful.

9. *Pycnophyllum tetrastichum* J. Rémy, Ann. Sci. Nat. Bot., Ser. 3, 6: 356, Tab. 20, fig. 1 (Dec. 1846). **Type:** BOLIVIA. **Potosi:** 4000 m, D’Orbigny s.n. (Lectotype selected here: P!, P00156960; Isolectotype designated here: P!, P04925579) (Fig. 5).


= Pycnophyllum filiforme Mattf., Feddes Repert. Spec. Nov. Regni Veg. 18: 172 (1922). **Type:** PERU. **Arequipa:** Caylloma, 15°20’-15°30’ S, am See Villafro über Caylloma, 4700—4800 m, 29 Mar 1914, Weberbauer 6885 (Holoype: B†; Lectotype
designated here: MOL!; isolectotypes: GI!, US!).


When Rémy proposed the genus Pycnophyllum in 1846, he included two species: P. molle and P. tetrastichum. The description of the latter makes reference to a single specimen that included both species ("mixta in herbario parisiensi cum praecedente"). However, currently, the D’Orbigny 442 specimen at P (P00156958, Fig. 3) only consists of material corresponding to P. molle. A second sheet at P (P00156960, Fig. 5) containing P. tetrastichum, is attributed to D’Orbigny but without collection number, and includes the annotation “etais avec la congénère” – which can be translated as “it
was with its congener”, namely Pycnophyllum molle. Thus this specimen is here designated as the lectotype.

In his 1922 revision of the genus Pycnophyllum and subsequent 1930 publication, Mattfeld described several new species in P. sect. Gymnopycnophyllum, some of which are here reduced to synonyms of Pycnophyllum tetrastichum. Such a merger requires justification. First, an analysis of Mattfeld’s 1922 key to species shows that, for the most part, the differences supporting his species are primarily based on the shape (outline) and the size of flowers and/or leaves. This leads to a rather artificial separation since these two characters are each part of a continuum. Mattfeld’s new species were based only upon one or two specimens (some of them fragmentary), and while the differences he suggested may well apply to such a small sample, a thorough examination of additional specimens revealed less support for such division. Second, plants of this taxon show a tremendous amount of phenotypic plasticity, even within the same individual cushion plant. While carrying out field studies in Peru and Bolivia, I found that, depending on factors such as branch age, position within the cushion (central vs. peripheral), and micro-topography, characters used by Mattfeld such as phylotaxis, leaf, and internode size, and even branching organization may vary tremendously. Other diagnostic features such as shape, size, and position of the blade apex may dramatically change along a single primary branch depending on the leaf distance from the branch tip. Lastly, after comparing Mattfeld’s descriptions with extant type material, I have found that several, if not all, of his linear measurements, have been clearly over-estimated. This fact is most burdensome when, as stated earlier, his species definitions are based mainly on organ size. Consequently, after long consideration and in light of these observations, I have decided to combine these previously recognized species under the oldest binomial available, namely P. tetrastichum. While this solution may be less than perfect, I fail to see any set of correlated characters (and particularly discrete characters) to recognize and support more than one species. While some regional variation may be suggested, additional detailed field studies and sampling is needed to finally justify species recognition.

August H. R. Grisebach (1879) placed Rohrbach’s Pycnophyllum lechlerianum and his own Colobanthus lycopodioides into an unusual new genus, Drudea, combining these two species as Drudea lycopodioides. This arrangement was based on two specimens: Lecher 1078, the type of Colobanthus lycopodioides Griseb. (1854) and Lecher 1742, the type of Pycnophyllum lechlerianum Rohrb. (1870). Pax (1893) later reduced Grisebach’s anomalous species to a synonym of P. lechlerianum Rohrb. (keeping C. lycopodioides as a synonym as well) and proposed Pycnophyllum sect. Drudea to include it. Finally, Skottsberg (1916) emended Pax’s section by removing Colobanthus lycopodioides Griseb. from synonymy and reducing P. lechlerianum to a synonym of C. lycopodioides.

Regarding the enigmatic Pycnophyllum lechlerianum Rohrb. that puzzled previous workers such as Grisebach, Pax, and Mattfeld with its alleged 3-styled flowers, although ten of the 12 type specimens (Lecher 1742) are sterile (as reported by all previous workers), two (G, TCD) do bear flowers which show a single style fused lengthwise with three stigmatic regions, as in all other members of Pycnophyllum. Consequently, the separation of this taxon into a separate section, as P. sect. Drudea (Griseb.) Pax, is no longer supported.


In my 2005 study, I considered P. kobalanthum a synonym of P. tetrastichum. New material from LPB made available to me in 2015 convinced me to maintain its
species status. *P. kobalanthum* is an endemic Bolivian species found between 4000 and 4600 m; it can be recognized by its characteristic gibbous leaves with the apex suddenly arched into a small mucron.


**Excluded names**


Because of the lack of original material and the contradictory nature of Muschler’s description (he described bisexual flowers for a dioecious species), I cannot assign this taxon to any known species. The closest taxon with which this description fits is that of *Pycnophyllum huascaranum*, although the two greatly differ in petal size. Muschler described his specimen as having petal and stamens of equal size, which is not the case in the newly described species where the petals are always much shorter than the stamens. Mattfeld (1922) pointed out the overall leaf similarities with *P. molle* and *P. spathulatum* but was unable to assign a species status.


Muschler described this species based on two gatherings by August Weberbauer. *Weberbauer* 2529 is most probably destroyed—it has not been located at either B, MOL, or any other herbarium. The second specimen, *Weberbauer* 951, has not been located in either of the two herbaria. A specimen with the same collection number is listed as the holotype of *Bulbophyllum incarum* Kraenzl. (Orchidaceae, Kraenzlin, 1905) and cited as such by Schweinfurth in his “Orchids of Peru” (Schweinfurth, 1960), however, the image of the F photograph presented in JSTOR Global Plants carries the number 591 (F0BN018331, photo) instead of 951. In 1994, Christenson (1994) de-
scribed the orchid collection at the Herbarium Hamburgense (HGB); he reported (p. 348) specimen Weberbauer 951 as the holotype of B. incarum (HBG501372, photo!). The Weberbauer specimen that Muschler examined for the description of P. carinatum remains a mystery. He described a ciliated leaf margin, an unknown characteristic among species of Pycnophyllum; Mattfeld (1922) suggested this could be a member of Arenaria sect. Dicranilla; finally, Macbride (1937) speculated this taxon could be conspecific with Arenaria boliviana Williams. Thus, while Molinari’s combination might be correct from a nomenclatural point of view, it is also purely speculative since the true identity of this taxon cannot be confirmed.


This is a synonym of Arenaria dicranoides Kunth. Muschler (1911) cited Weberbauer 5120 (B) when proposing this combination but no duplicates have been located.


Muschler (1911) described ciliated leaves and bisexual flowers in this specimen, none of which occur in Pycnophyllum. Mattfeld (1922) suggested this could be a member of Arenaria sect. Dicranilla. No duplicates have been located.


This name was published by R.A. Philippi based on specimens collected near the Cordillera Illapel in the Province of Coquimbo, Chile (Philippi, 1892). Philippi missed the small, inconspicuous flowers concealed by the dense indumentum that characterizes Pycnophyllum lanatum and therefore proposed the new species with some reservation, adding a question mark after the generic name, thus as Pycnophyllum ? lanatum. Mattfeld (1922), the last monographer of Pycnophyllum, was unable to study any part of the original material and listed this taxon as species dubia, placing some doubts on its generic position due to its heavy white indumentum. The examination of additional specimens has demonstrated that this taxon does not belong in Pycnophyllum. Further details will be given in a publication in preparation (Timana, in prep.)


As proposed earlier by Mattfeld (1922), this is a member or Arenaria sect. Dicranilla. Mushler described ciliated leaf margins and bisexual flowers, both features known to be absent in members of Pycnophyllum. The Weberbauer specimen cited by Molinari and deposited at MOL emerges under unusual circumstances. As part of my research I visited MOL in 1999, 2000 and 2016; during my first two visits Weberbauer 2597 was not in the collection. In fact, such a specimen is not mentioned in Velarde’s authoritative catalogue of Weberbauer’s isotypes kept at the MOL herbarium (Velarde 1969). The specimen location is not listed in neither the Cano and Sánchez report on endemic Caryophyllaceae of Peru (Cano & Sánchez, 2006), nor is included, to July 2017, among MOL type specimens submitted to JSTOR Plants in 2013. The specimen itself lacks all the characteristic elements of the Weberbauer specimens stored at MOL: no original label (with Weberbauer’s distinctive handwriting), barcode, or official herbarium seal.
and number (compared with, for example, the type specimen of *Pycnophyllum filiforme* available in JSTOR Plants (Weberbauer 6885, MOL-00000494, photo!). The fragmentary material is sterile, thus allowing limited comparison with Mushler’s description and therefore it is impossible to assert that it is indeed a *P. peruvianum* specimen.


*Pycnophyllum stuebelii* is a most enigmatic taxon. Mattfeld commented that this species presented similarities with *Pycnophyllum lechlerianum* (here *P. tetrastichum*). Based on the leaf and bract sizes it would fit near Mattfeld’s *P. glomeratum* but the lack of original material precludes confirming this.


**Acknowledgments**

This work represents a portion of a Ph.D. Dissertation submitted to the Graduate School of The University of Texas, Austin. I would like to thank my academic advisor, Dr. Beryl B. Simpson who guided me throughout this research. Dr. Richard (Rich) Rabeler (MICH) introduced me to the world of the Caryophyllaceae 20 years ago and has shared his expertise and friendship with me since then. Jorge Chiapella (INBIV, Córdoba) and Carlos Martel (U. of Ulm) provided much-needed support and advice when needed. Sabine von Mering (B) assisted me with arranging a visit to the Berlin herbarium and issues related to Weberbauer’s type specimens. I thank Christine Nieszgoda (F), M. Jeanson (P), Carmen Ulloa (MO) and Lauren Peters (MO) for facilitating obtaining digital images of type specimens. I would like to thank curator Tom Wendt (TEX) for acquiring all herbarium loans required and supporting my project. The following herbaria are acknowledged for providing specimens on loan for morphological study: AAS, AAU, AK, ASU, B, BAB, BM, BR, C, CAS, CGE, CHR, COL, COLO, CORD, CTES, E, F, FI, G, GB, GH, GOET, H, HAL, HO, K, L, LD, LP, LPB, LY, M, MA, MCNS, MEL, MICH, MO, MOL, MSC, NA, NHA, NSM, NSW, NY, OS, OXF, P, PH, PR, PRE, RNG, S, SGO, SI, TCD, TEX, TUB, UC, UPS, US, USM, W, WIS, WU, Z. RBG Kew’s Latin America Research Fellowship Programme (KLARF) allowed me to visit several major European herbaria to study historical collections. The Department of Humanities and the Applied Geography Research Center (CIGA) at PUCP provided me with logistic support and funding to visit B and TEX in 2015. This paper is dedicated to the memory of Dr. William “Bill” Anderson, former Director of the MICH herbarium, and dear friend and teacher.

**Literature Cited**


