

REVISION OF *PINGUICULA* (LENTIBULARIACEAE) IN CHILE AND ARGENTINA

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Abstract: The distribution range of *Pinguicula chilensis* is revised and it is shown that the type specimen represents *P. antarctica* and not the high Andean taxon erroneously treated under the name *P. chilensis* by most recent authors. The latter is therefore named as a new species, *P. australandina*, with a different type. Populations from the Cordillera de Nahuelbuta, Chile, formerly likewise included in *P. chilensis*, are described and illustrated as a new distinct species and key differences to the most closely related species *P. antarctica* and *P. australandina* are shown.

Introduction

Until now, six butterwort species have been described from South America (Lampard *et al.* 2016). While *Pinguicula elongata* belongs to the tropical-heterophyllous growth type, forming two distinct sets of leaves, the five other species *P. calyptrata*, *P. involuta*, *P. jarmilae*, *P. chilensis*, and *P. antarctica* belong to the tropical-homophyllous growth type, which means that the plants form only one set of leaves all year round. Especially the two southernmost butterwort species in South America, *P. chilensis* (*sensu* Clos 1849; Ernst 1961; Casper 1966) and *P. antarctica*, are occurring in habitats that are characterized by cold winters with long periods of frost, that the plants survive as open rosettes of carnivorous leaves, often covered under snow.

During several visits to locations of butterwort populations assigned to *P. chilensis* in the Nahuelbuta mountain range west of the city of Angol, Araucanía region, Chile, and the Sierra Nevada mountain range in the Andes south-east of Curacautín, Araucanía region, Chile, the author was able to study plants *in situ* during and after flowering. Although the author considered those populations as belonging to *P. chilensis* in the past (Gluch 2007), more detailed studies of field data and data from cultivated specimens revealed that the populations in the Cordillera de Nahuelbuta had several characters different from the plants from the Andes, which themselves differ significantly from the description of *P. chilensis* given by Clos (1849). This initiated a more detailed study of herbarium specimens and existing literature.

Discussion

1. Revision of taxonomic status and distribution of *P. chilensis* in South America

In 1849 Clos described in his part of Claudio Gay's publication about the Chilean flora (Clos 1849) a new butterwort species that he named *Pinguicula chilensis* Clos which was different from the already known butterwort species *Pinguicula antarctica* Vahl occurring in Chile. In his protologue, Clos mentioned that the new species occurs in bogs of the Valdivian coastal mountain range and that in January the flowering had already finished. Therefore, he did not describe any characters of the flower itself ("corolla ...") and he also did not give any details about sizes of different parts of the plant.

In his revision of the genus *Pinguicula*, Ernst (1961) was not questioning Clos' hypothesis and gave a more detailed description of the characters of the 2-lipped corolla, including the conical, 2-3 mm long spur, and the 2-parted palate located at the base of the middle lobe of the lower lip (characters that differentiate the flower easily from *P. antarctica*). For the flower scape, he mentioned that the size varies between 2 and 5 cm (compared to 2.5-12 (20) cm for *P. antarctica*). The distribution range of *P. chilensis* was indicated as "central Chile".

In Casper's monograph of the genus *Pinguicula* (Casper 1966), Casper was also referring to herbarium specimens that he studied. Casper had not seen Clos' type from Chile, but he had examined other original material from the Valdivian mountain range, which is located in the herbarium of the Muséum Nationale d'Histoire Naturelle in Paris, France (*Gay 169*, (P-photo!)). He also studied specimens from Volcan Llama in the Chilean Andes, from the Puyehue pass in the Andes (Chilean-Argentinian border region), a location about 540 km further south, and from several locations from the Nahuel Huapi National Park region in Argentina. He had not studied any specimen from the Nahuelbuta coastal mountain range at that time. Casper concluded about the distribution of *P. chilensis*, that along the coastal mountain range of central Chile, *P. antarctica* still occurred in the mountains on the island of Chiloé, while further north, from the Valdivian coastal cordillera on, only *P. chilensis* was present. For the Andes, Casper (1966) mentioned the southernmost distribution of *P. chilensis* at about 41° southern latitude and the northernmost area at about 38° southern latitude. In his monograph, he was just following for *P. chilensis* what had already been stated by Ernst (1961).

Concerning the habitat of the species, Casper (1966) stated that the most common habitats are wet pastures at the edges of the melting glaciers at elevations of 2000-3000 m a.s.l. in the alpine regions of the Andes, locally called "mallín". Casper further mentioned that *Pinguicula chilensis* occurs there together with *Caltha andicola*, *Melandrium cucubaloides*, and *Calandrinia colchaguaensis*.

In Reiche (1907), a detailed description of the vegetation of the plains of the Cordillera Pelada (the higher parts of the Valdivian coastal mountain range, ca. 1000 m a.s.l.) is given. In open, peat-bog-like areas there is a typical Antarctic vegetation consisting of the dominating species *Donatia fascicularis*, *Astelia pumila*, *Sphagnum acutifolium*, and *Tribeles australis*. In between this vegetation, Reiche stated that *Carpha viridis*, *Pinguicula chilensis*, *Acaena pumila*, *Drosera uniflora*, and *Schizaea fistulosa* can be found.

For the higher areas of the Isla Grande de Chiloé (about 800 m a.s.l.), Reiche reported that the vegetation was identical as described for the Cordillera Pelada, with the same typical Antarctic vegetation dominated by *Sphagnum* sp. and *Donatia fascicularis*. But for the Chiloé island he mentioned the presence of *P. antarctica* instead of *P. chilensis*.

In a more recent botanical guide of the Chiloé National Park (Villagran 2002), the occurrence of *P. antarctica* was reconfirmed and also documented by a photograph, that shows a plant in flower, which is without doubt *P. antarctica*.

This Antarctic flora does not fit to the common high Andean habitat of *P. chilensis* described by Casper (1966) and also not the personal observations of the present author in the Chilean Andes and the Cordillera de Nahuelbuta (Nahuelbuta coastal mountain range).

Could the type specimen of *P. chilensis* from the Valdivian Cordillera be *P. antarctica* instead?

Several attempts were undertaken to get access to the holotype voucher of *P. chilensis* from Chile, but without success. Recently Dominguez *et al.* (2017) were trying to locate the holotype in any herbarium collection (as in Casper's publication from 1966 there was no herbarium linked to the holotype cited), but they couldn't find any duplicate and therefore selected the herbarium specimen indicated as "isotype" located in Paris Herbarium (P) as lectotype. So, the author investigated this

specimen from the same collection of Gay (as the voucher contains a handwritten label from Gay indicating the same location and collection date as cited in Casper's publication for the holotype, it indeed seems to represent an isotype). Interestingly, the plant was initially determined by the collector Claudio Gay as *P. antarctica*, but then changed to *P. chilensis*. As the plant does not have any flowers but only flower scapes with open seed capsules (so no details about the flower were given in the original description (Clos 1849)), a clear identification of the species is difficult. But there is one character of the specimen that still could serve as a good indicator to differentiate between the Andean plant and *P. antarctica*, which is the length of the flower scape. From my personal studies in the greenhouse as well as from observations at different habitats, after flowering, the flower scape of the Andean plant (thus far assigned to "*P. chilensis*") only elongates very little, while the flower scape of *P. antarctica* shows a significant elongation from flowering to maturity of the seed capsule, sometimes doubling in length. As a consequence, at seed maturity the flower scape of *P. antarctica* is significantly longer compared to the Andean plants and thus a morphological character to distinguish those two species at this developmental stage. Measurements of the flower scapes of the lectotype specimen from Paris show a length of 9.5 cm. This clearly indicates that the length of the fruiting scape does not fall into the range of the Andean plants ("*P. chilensis*" sensu Ernst 1961 and Casper 1966) and therefore the lectotype of *P. chilensis* in reality represents *P. antarctica*, and as a consequence the name *P. chilensis* Clos has to become a later synonym of *P. antarctica* Vahl. Other names do not seem to exist for the high Andean taxon. Therefore, the author is describing the high Andean taxon formerly known as *P. chilensis* as a new species with a new type specimen.

***Pinguicula australandina* Gluch spec. nov.** (Fig. 1 & Front Cover)

Holotype: Argentina, Provincia de Neuquén, Copahué, 1900 m, 11.1.1965, *S. Schajovskoy, s.n.* (M!).

Description: Perennial herb, forming one set of leaves (homophyllous growth type). **Rosette** consists of (3) 4-6 (8) ovate or obovate leaves. **Leaves** are (12) 14-22 (24) mm long, 8-11 mm wide, having a narrow base. The leaf margin is distally involute for 2/3 the length of the leaf. Leaf color is green, green-brown or yellowish green, showing a brown midrib and brown lateral veins. The upper surface of the leaf is densely covered with stipitate glandular hairs, while the upper surface of the base is clothed in long, white, non-glandular hairs. **Flowering** period starts in January and ends beginning of March. Plants form 1-2 erect flower **scapes**, each 2-5 cm long and moderately covered with short, stipitate glandular hairs, of yellowish to green color towards the base and of reddish-brown color towards the flower, darkening further as the seed capsule matures. The **calyx** is bilabiate, reddish-brown, the three lobes of the upper lip are triangular-lanceolate, with an obtuse to slightly pointed tip, ca. 1.5 mm long and 0.5 mm wide at the base. The two lobes of the lower lip are broadly obovate, obtuse to slightly pointed at the tip, divided by up to 1/2 of their length, 1.5-2.0 mm long, 0.5-0.8 mm wide. The outer surface of the calyx is covered with stipitate glandular hairs. The **corolla** consists of five almost equally-sized lobes, each subcuneate or obovate, and incised by up to 1 mm, of a violet, pinkish or lilac color, often with darker veins at the base of the lobes. The two lobes of the upper lip are 3 mm long, 2.5 mm wide, and the three lobes of the lower lip up to 3.7 mm long and 2.7 mm wide. The corolla tube is almost conical or funnel shaped, white, pale violet or pale lilac, often with parallel pale violet or pale lilac veins on the outside, sparsely covered with short, stipitate glandular hairs. The palate is located 1 mm below the base of the middle lobe of the lower lip inside the tube, and is conical or vesiculose, consisting of 2 parts, 0.5 mm long, 0.5 mm



Figure 1: *Pinguicula australandina*. Plant in flower growing in volcanic debris at the edge of a typical alpine wet pasture in the Sierra Nevada, region Araucanía, Chile, at about 1670 m a.s.l. Note the almost isolobiate pink corolla with the yellow 2-parted palate located in the tube below the middle lobe of the lower lip.

wide, and covered with short, yellow subclavate hairs. Behind the palate are 3 rows of long, white, cylindrical hairs. The walls of the corolla tube are also clothed in long, white hairs. The conical spur is 2-3 mm long, obtuse or slightly pointed at the tip, light green and sometimes brownish-green towards the tube, and sparsely covered with short, stipitate glandular hairs. The **seed capsule** is ovoid.

Etymology: The epithet *australandina* refers to the Southern Andes in Chile and Argentina, where populations of this species do occur.

Another consequence of this study is that the ranges of *P. australandina* and *P. antarctica* must be adjusted. *P. australandina* seems to occur only in the alpine regions of the Andes at elevations between 1400 and 2300 m a.s.l., mainly in alpine wet pastures, between 36° (Laguna del Maule, Chile) and about 41° (Cerro Nireco, Argentina) southern latitude. Possibly the range of the species is extending further south, but accessibility to those regions is very difficult. Currently the following locations are known for *P. australandina* (location information based on Casper (1966), Neger (1897), and personal field observations): **Chile:** región del Maule, Laguna del Maule, ca. 2300 m (personal observations); región de la Araucanía, Curacautín, Volcán Llaima; región de la Araucanía,



Figure 2: *Pinguicula antarctica*. Front view of a flower. The yellow 2-parted palate is located at the base of the middle lobe of the lower lip and the corolla is bilabiate with white colored petals (photo from a cultivated specimen originating from Isla Grande de Chiloé, Chile).

Curacautín, Sierra Nevada, ca. 1670 m (personal observations); región de los Ríos, Osorno, paso Puyehue; **Argentina:** provincia de Río Negro, Parque Nacional Nahuel Huapi, Cerro Nireco; provincia de Río Negro, Parque Nacional Nahuel Huapi, Cerro de la Nubes; provincia de Neuquén, paso de Pino Hachado; provincia de Neuquén, Cerro Campana; provincia de Neuquén, Arroyo los Guemados; provincia de Neuquén, Copahué (see Fig. 3).

Pinguicula antarctica (Fig. 2) occurs from Isla de los Estados (Staten Island) in Argentina, about 54° southern latitude, along the Magellan Strait further north along the Chilean coast, up to the island of Chiloé, and then again further north in the higher part of the Valdivian coastal mountain range (Cordillera Pellada), at about 40° southern latitude (see Fig. 3). The location indicated in the map with a question mark also shown in Casper's publication (1966), which probably refers to Reiche's (1907) citation of *P. antarctica*. From the latter description of the vegetation east of lake Tagua Tagua (región de los Lagos, Chile) in the Andes above 1400 m below the snow level, it is very doubtful that this is a location of *P. antarctica*, but might be more likely a location of *P. australandina*, as the vegetation described does not fit to the typical Antarctic flora, where *P. antarctica* normally occurs.

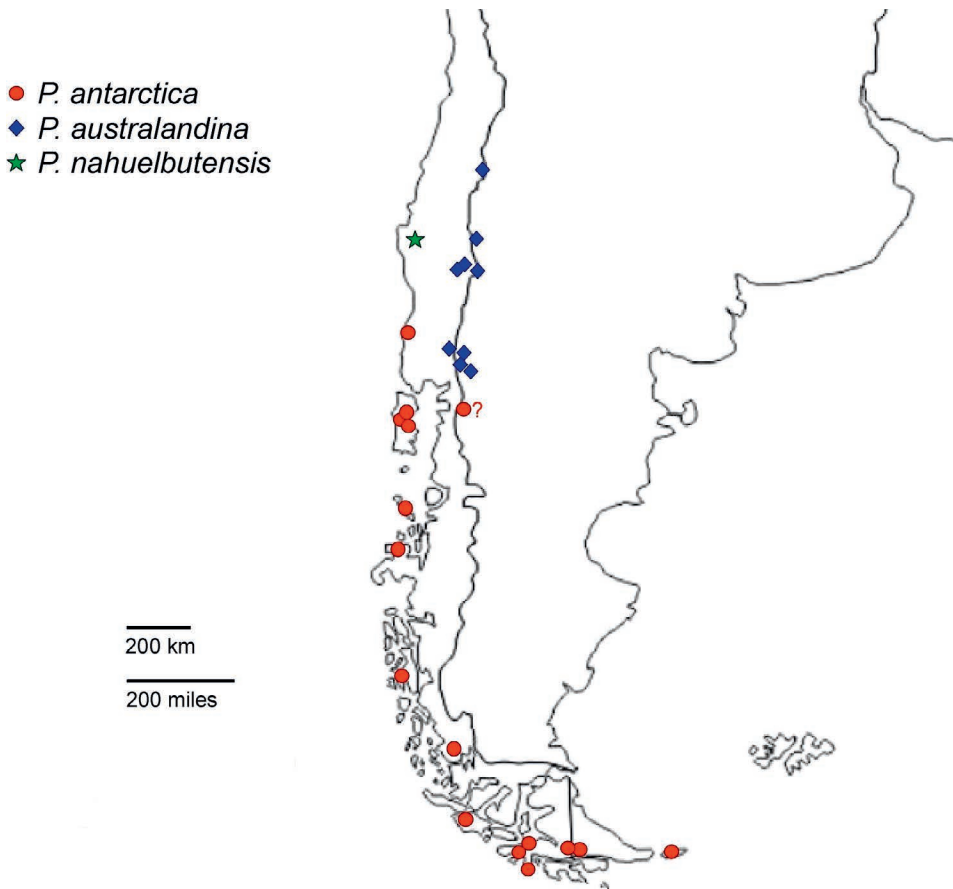


Figure 3: Range of *Pinguicula antarctica*, *P. australandina*, and *P. nahuelbutensis* in the southern part of South America (map based on information from Casper (1966, 1984), Diaz *et al.* (2008), Domínguez (2012), Neger (1897), and personal field observations).

2. Butterwort populations in the Cordillera de Nahuelbuta

In the Chilean Cordillera de Nahuelbuta, Malleco Province, at elevations above 1200 m a.s.l. climatic conditions are comparably similar to the Andean mountains, at seepage or waterlogged areas the vegetation is dominated by typical South American peatbog species like *Donatia fascicularis*, *Astelia pumila*, and *Oreobolus obtusangulus* (Cavieres *et al.* 2005).

During my personal studies, three locations were examined in the Nahuelbuta mountains where *Pinguicula* populations can be found between 1150 and 1250 m a.s.l. In one place that is locally called “las turberas”, the area is characterized by more open grass vegetation dominated by Poaceae and Cyperaceae. They occur amid stagnant or slightly running water accumulating in a depression between the surrounding mountains, in a forest mainly consisting of *Araucaria araucana* and different *Nothofagus* species. In locations with soils having reduced draining capacities, at the edges of moist and shady areas in mostly organic soils, as well as under grass or on open pure organic soil exposed to direct sun, butterwort populations were found. The number of flowers per individual

Table 1. Comparison of different morphological characters of *Pinguicula nahuelbutensis* with its closest related species *P. australandina* and *P. antarctica*.

Morphological character:	<i>P. nahuelbutensis</i>	<i>P. australandina</i>	<i>P. antarctica</i>
Length of flower scape	0.5-1.0 (1.5) cm	2.0-5.0 cm	2.5-12.0 (20.0) cm
Presence of glandular hairs on flower scape	densely covered with stipitate glandular hairs	whole scape moderately covered with stipitate glandular hairs	almost glabrous in the upper part of the scape, towards the base increasing presence of stipitate glandular hairs
Corolla shape	subisolate to isolate	subisolate to isolate	bilabiate, upper lip shorter than lower lip
Corolla color	white or light violet	pink, lilac, or violet	white
Form and size of spur	1.0-2.5 mm, conical, rounded, or pointed at the tip	2.0-3.0 mm, first half slightly conical, obtuse, or slightly pointed at the tip	1.0-1.5 mm, saccate
Location of palate	at the base of the middle lobe of lower lip	below the middle lobe inside the tube	at the base of the middle lobe of lower lip
Stolons	present	unknown	present

plant seemed to be more numerous compared to the Andean populations of *P. australandina*, maybe due to the longer and warmer vegetation period in the Cordillera de Nahuelbuta.

Two other *Pinguicula* populations were growing at seepage locations in a forest dominated by *Nothofagus dombeyi* and *N. pumilio*. Plants were growing mostly in shade in wet organic soil, often together with different mosses. Under these conditions, plants had exclusively green leaves and were bigger in size compared to the plants growing at the “las turberas” location. In flower, the corolla lobes were showing only a light violet color with few to no darker venation. In January, when the plants are in full flower, numerous seedlings were seen close to the adult plants that must have had emerged from seed produced in the previous year, as at this point no mature seed was present. At all locations, plants were showing very short flower scapes not corresponding to the original description of the former *P. chilensis sensu* Clos (1849). When studying other morphological characters, it became obvious that the butterwort populations in the Cordillera de Nahuelbuta differ in various characters from *P. australandina* as well as from *P. antarctica* (see Table 1). The author therefore proposes to classify the populations of the Cordillera de Nahuelbuta as a distinct new species.

***Pinguicula nahuelbutensis* Gluch spec. nov.** (Figs. 4–7)

Holotype: Chile, región de la Araucanía, Provincia de Malleco, Parque Nacional de Nahuelbuta, 1250 m, 7.1.1968, *Ricardi, Marticorena and Matthei, 1831* (M!)



Figure 4: *Pinguicula nahuelbutensis*. Front view of a flower. The yellow 2-parted palate is located at the base of the middle lobe of the lower lip. (photo from location “las turberas” in the Nahuelbuta National Park, 26 January 2010).



Figure 5: *Pinguicula nahuelbutensis*. Plant with pale violet flower and flower bud (in cultivation). The flower shows a dark violet venation on the outside of the corolla, tube and spur.



Figure 6: *Pinguicula nahuelbutensis*. Lateral view of a flower with pale violet corolla lobes and a white to light yellowish tube (in cultivation). The flower shows almost no venation on the corolla or tube. The lobes of the calyx are divided almost to the base.



Figure 7: *Pinguicula nahuelbutensis*. Stolon with plantlet developing at the base of the leaf rosette (in cultivation).

Other specimens seen: Chile, región de la Araucanía, Provincia de Malleco, Nahuelbuta, 1300 m, 28.10.1987, *K.H. & W. Rechinger*, 63162 (M!); observations made *in situ* on 3 populations in the Nahuelbuta mountain range on 5 October 2004, 21 January 2005, 8 January 2006, 12 January 2007, and 26 January 2010.

Description: Perennial herb, forming only one set of leaves (homophyllous growth type). **Rosette** consists of 5-8 ovate or obovate **leaves** with a narrow base, obtuse or pointed at the tip, margin involute for 2/3 of its length, green to yellowish, sometimes red brown color with a dark brown to black mid rib and often also red brown colored lateral veins, 14-22 (30) mm long and 8-12 (15) mm wide. The upper surface is densely covered with sessile and stipitate glandular hairs and with, white, non-glandular hairs at the leaf base. **Flowering** starts mid of December and ends beginning of February. Plants form 2-4 (5) erect flower **scapes**, green or green-reddish, only 0.5-1.0 (1.5) cm long, covered with stipitate glandular hairs. **Calyx** bilabiate, green and more reddish-brown towards maturity of the seed capsule, of a lanceolate to triangular form with rounded or slightly pointed tip, moderately covered with stipitate glandular hairs, lobes almost entirely divided to the base. The 3 lobes of the upper lip are 1.5-2.5 mm long and 0.5-1.0 mm at the widest point. The 2 lobes of the lower lip are longer compared to the lobes of the upper lip, 2.5-3.0 mm long and 0.5-1.0 mm wide. **Corolla** subisolobate or isolobate, white to light violet, with pale or darker violet veins at the base, subcuneate or obovate, incised by up to 1 mm, covered with white hairs on the upper side. The 2 lobes of the upper lip are 3-5 mm long and 2.8-3.5 mm wide. The 3 lobes of the lower lip are 3-6 mm long and 3.0-3.5 mm wide. A yellow palate consisting of 2 connected hump-like parts is located at the base of the middle lobe of the lower lip, scarcely covered with yellow hairs. Behind the palate are 3 rows of yellow or white, cylindrical hairs continuing into the tube. The inside walls of the corolla tube are also clothed in long, yellow or white hairs. The corolla tube is conical or funnel-shaped, ventrally depressed, 3-5 mm long, white-yellowish or pale violet with parallel dark violet, pale violet veins on the outside, that often continue into the spur. The conical spur is 1.0-2.5 mm long, rounded or pointed at the tip, of yellow or yellow-green color. **Seed capsule** is ovoid or globose, with the top of the capsule slightly depressed, green or red brown. Plants can form stolons with plantlets developing at the tips of the stolons. Chromosome number is $2n = 16$ (Casper & Stimper 2009, as "*P. chilensis*").

Etymology: the epithet *nahuelbutensis* is derived from the Nahuelbuta mountain range, where the new species is occurring.

P. nahuelbutensis seems to be endemic to the Cordillera de Nahuelbuta, where the plants occur at elevations of 1150-1250 m a.s.l. at wet seepage locations in *Nothofagus dombeyi* and *N. pumilio* dominated forest or at the edge of more open wet grassland vegetation dominated by Poaceae and Cyperaceae spp. surrounded by *Araucaria araucana* and *Nothofagus* forest.

Pinguicula nahuelbutensis can form stolons with new plantlets at the end of the stolon, which has been observed also for *P. antarctica* (Luhrs 2000) as well as for *P. jarmilae* and *P. calyprata* (Fleischmann 2011), but has not been reported for *P. australandina*.

Pinguicula nahuelbutensis seems to be closely related to *P. antarctica* and *P. australandina*. It differs from *P. australandina* by the much shorter flower scape, the color of the corolla, the form of the spur, the location of the palate, as well as by the formation of stolons. It differs from *P. antarctica* by the much shorter flower scape, the presence of stipitate glands on all parts of the flower scape, by the form of the spur, and by the more subisolobate to isolobate corolla form.

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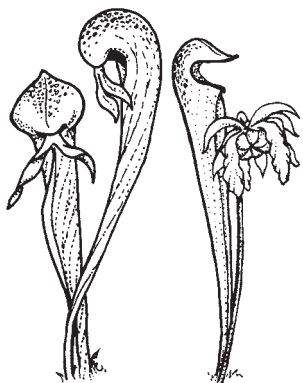
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Front Cover: Flowering plants of *Pinguicula australandina* from Sierra Nevada, Chilean Andes, growing at about 1670 m a.s.l. Photo by Oliver Gluch. Article on page 121.

Back Cover: *Heliamphora* 'Patasola' plant and flowers. Photo by Butch Tincher. Article on page 157.

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