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Article

Pinguicula habilii (Lentibulariaceae), a new carnivorous species from South-West Anatolia, Turkey

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Abstract

Pinguicula habilii (Lentibulariaceae), described as a new species of carnivorous plants, is distributed in the province of Muğla in Southwestern Anatolia, Turkey. A full description, diagnostic morphological characters, and detailed photographs of this new species including SEM microphotographs of seed and pollen are given. The new species belongs to the section *Cardiophyllum* of *Pinguicula* subgenus *Isoloba.* It resembles the *P. crystallina* and *P. hirtiflora.* It differs from the related species by its heterophyllous growth, leaf shape and peculiar seed coat sculpture. It grows on serpentine rocks at elevations between 100 and 200 m.

Key words: Marmaris, Muğla, *Pinguicula* section *Cardiophyllum*, taxonomy

Introduction

Pinguicula Linnaeus (1753: 17) is the second most diverse and species-rich genus of the “carnivorous” family Lentibulariaceae, only rivaled by *Utricularia* Linnaeus (1753:18) (Steiger 1998, Legendre 2000, Conti & Peruzzi 2006). It comprises about 100 species (Degtjareva *et al.* 2006, Beck *et al.* 2008, Rodondi *et al.* 2010). It is one of the most widespread genera of carnivorous plants genera (Casper 1966, Givnish 1989), distributed in subarctic, tropical, Mediterranean and temperate areas of Eurasia, North America, Central America (from Mexico to the Caribbean Islands), South America (Andes from Colombia to Ecuador, Chile and Patagonia) and northernmost Africa (Zamora *et al*. 1996, Steiger 1998, Legendre 2000, Degtjareva *et al*. 2004, 2006, Fischer *et al*. 2004, Cieslak *et al*. 2005).

Two important distribution centers of the genus *Pinguicula* are Central America (Mexico) and the Caribbean, and the Mediterranean region (Steiger 1998, Cieslak *et al*. 2005). Although it is known that there are about 20 *Pinguicula* species in the Mediterranean Basin, they are rare and restricted to certain sites in Mediterranean ecosystems (Casper 1962, Blanca 2001). In these regions, where plant growth is very limited due to water unavailability, appropriate habitats for *Pinguicula* are scattered, and isolated in wet areas surrounded by larger dry habitats (Blanca 2001). This caused the formation of small, isolated *Pinguicula* populations (Zamora *et al*. 1996).

The leaves of the carnivorous *Pinguicula* produce sticky glandular secretions on short-stalked glands in order to capture and digest small arthropods (Heslop-Harrison 1978). Members of the genus *Pinguicula* can be distinguished from the other two genera of Lentibulariaceae, *Utricularia* and *Genlisea* Saint-Hilaire (1883: 428), by a combination of plesiomorphic character states, such as the presence of true roots, leaves and sticky adhesive traps (Casper 1962, 1966). *Pinguicula* taxa are limited to nutrient-poor habitats (Givnish 1989), as are most carnivorous plants.

Casper (1966) divided the *Pinguicula* taxa into 3 subgenera with respect to their floral features and into 12 sections by the features of vegetative parts. Moreover, Casper (1966) and Steiger (1975, 1998) divided the

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Pinguicula taxa into four groups according to their annual growth cycles: tropical-homophyllous, tropical-heterophyllous, temperate-homophyllous and temperate-heterophyllous. Although the tropical growth type assimilates leaves all the year round, the temperate type hibernates by means of a winter bud called hibernaculum. On the other hand, in the homophyllous growth type, only one rosette type is formed and all the leaves of the rosettes have the same morphological features. Nevertheless, in the heterophyllous growth type, two different rosettes are formed; in the tropical-heterophyllous type, generative rosettes (summer rosettes) are larger but vegetative rosettes (winter rosettes) are smaller and they are morphologically different. On the other hand, in the temperate-heterophyllous type, generative rosettes (spring rosettes) are smaller than vegetative rosettes (summer rosettes) which turn into a hibernaculum in winter (Casper 1966, Steiger 1975, 1998).

Some studies including a detailed morphological, anatomical and microstructural examination of seeds of *Pinguicula* taxa provided several useful, taxonomically significant data concerning the seed coat (Netolitzky 1926, Casper 1962, 1966, Degtjareva *et al.* 2004). Recently, some microstructural studies on seeds of *Pinguicula* taxa defined the variation of seed coat sculpture (Zamora *et al*. 1996, Degtjareva *et al*. 2004, 2006). According to Degtjareva *et al.* (2006), details of contacts between adjacent exotesta cells are the most informative characters of seed coat structure.

Seeds of *Pinguicula* and some dicots such as Apiaceae, Ranunculaceae, Primulaceae and Stylidiaceae are extraordinary among seeds of dicotyledons in being variable in cotyledon number (Haccius & Hartle-Baude 1957, Degtjareva *et al*. 2004, 2006). Though some *Pinguicula* species have embryos with two cotyledons, the majority of the taxa develop just one cotyledon (Treviranus 1839, 1848, Kamienski 1891, Buchenau 1865, Dickson 1869, Velenovsky 1907, Netolitzky 1926, Crete 1956, Haccius & Hartle-Baude 1957, Casper 1966, Blanca *et al.* 1999, Blanca 2001, Degtjareva *et al*. 2004). The majority of the published data on *Pinguicula* seeds focus on the phenomenon of monocotyly (Degtjareva *et al*. 2004). Monocotyly in the genus is probably a result from secondary loss of the second cotyledon (Velenovsky 1907, Haccius & Hartle-Baude 1957, Crete 1956).

Pinguicula in Turkey was previously revised by Mill (1978), who reported only two species: *P. crystallina* and *P. balcanica* Casper (1962:105).

Habil Issı who is an amateur botanist collected an unusual, interesting specimen of *Pinguicula* from Marmaris in Muğla province. He sent some interesting pictures of *Pinguicula* to us for identification in 2010. In spring and autumn of 2010 and 2011, we gathered flowering and fruiting material. Moreover, we collected summer and winter rosette forms of this plant during the fieldworks. Results of our study show that this *Pinguicula* represents a new species for science.

Materials and Methods

We checked our *Pinguicula* specimens with relevant taxonomic literature (Boissier 1875, Ernst 1961, Casper 1962, 1966, 1972, Steiger 1975, Mill 1978, Pignatti 1982, Strid & Kit Tan 1991, Romo *et al*. 1996, Blanca *et al.* 1999, Legendre 2000, Blanca 2001, Degtjareva *et al.* 2004, 2006, Conti & Peruzzi 2006) and collections and digital images of *Pinguicula* specimens in the herbaria ANK, E, EGE, GAZI, GZU, ISTF, K, MICH, UC and WU.

Features of gross morphology of *P. habilii* were examined under a binocular stereoscopic microscope. Seed and pollen samples, coated with gold, were examined with a scanning electron microscope (SEM). Photographs of the living material were taken with a digital camera.

Description

Pinguicula habilii Yıldırım, Şenol & Pirhan, ***sp. nov.*** **(Figs. 1–5)**

Type:—TURKEY. C2 Muğla: along the stream near Marmaris, on serpentine rocks, 100–200 m, 21 May 2011, *H. Yıldırım, A.F. Pirhan & S.G. Şenol 3498* (holotype EGE!; isotypes EGE!, HUB!, ISTF!, Yıldırımlı Herbarium!)

Pinguicula habilii is related to *P. crystallina* and *P. hirtiflor*a but it is easily distinguished from them by heteropyllous growth type; seeds with longitudinal anticlinal walls of exotesta cells covered with tubercles, lateral anticlinal walls of exotesta cells are very thin and shallow; pollen ornamentation regulate-microreticulate on mesocolpium and perforated on polar axis.

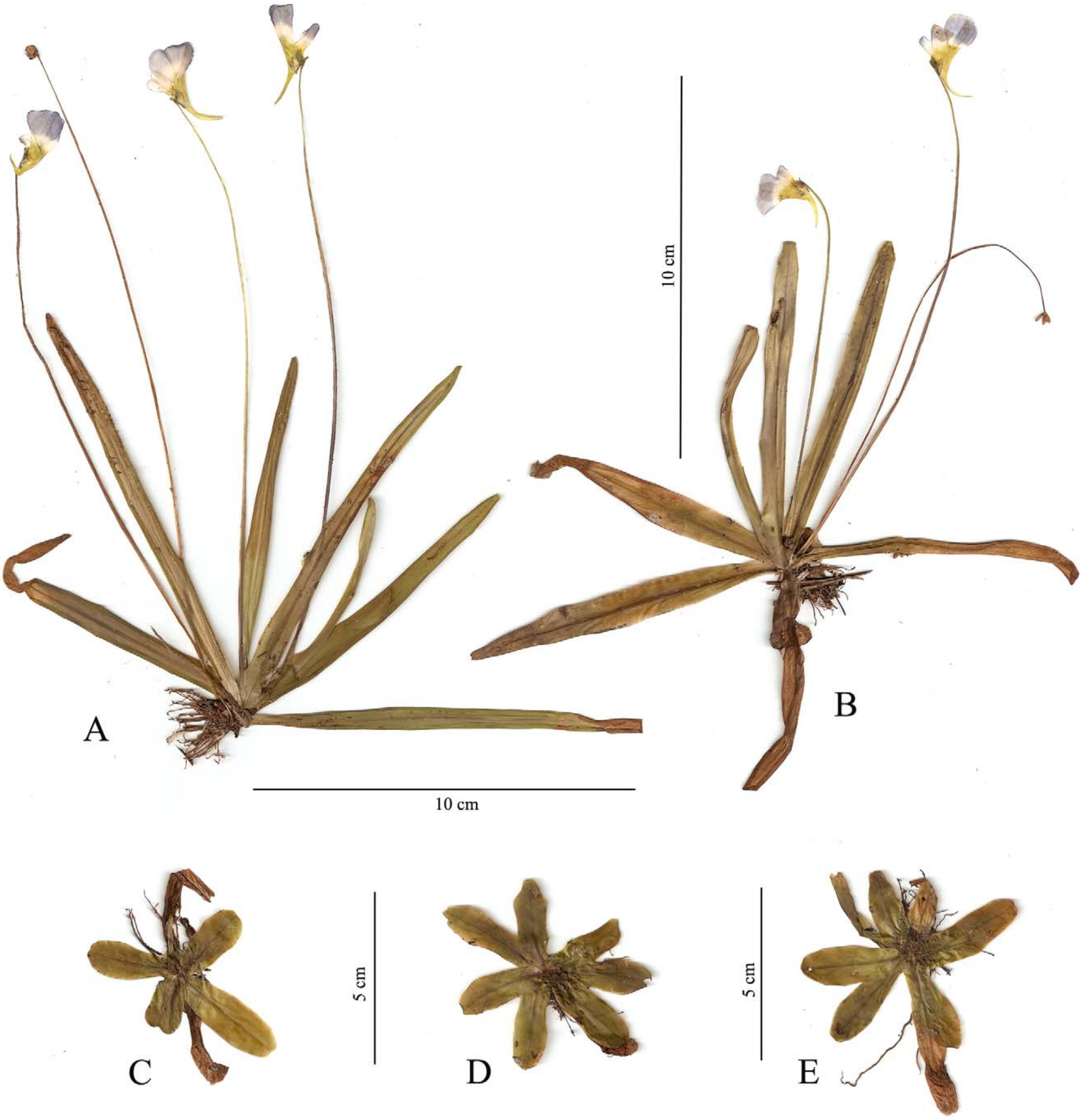

FIGURE 1. *Pinguicula habilii*: **A–B,** generative rosettes; **C–E,** vegetative rosettes (A–B from *S.G. Şenol 3498*; C–E from *H. Yıldırım 1790*).

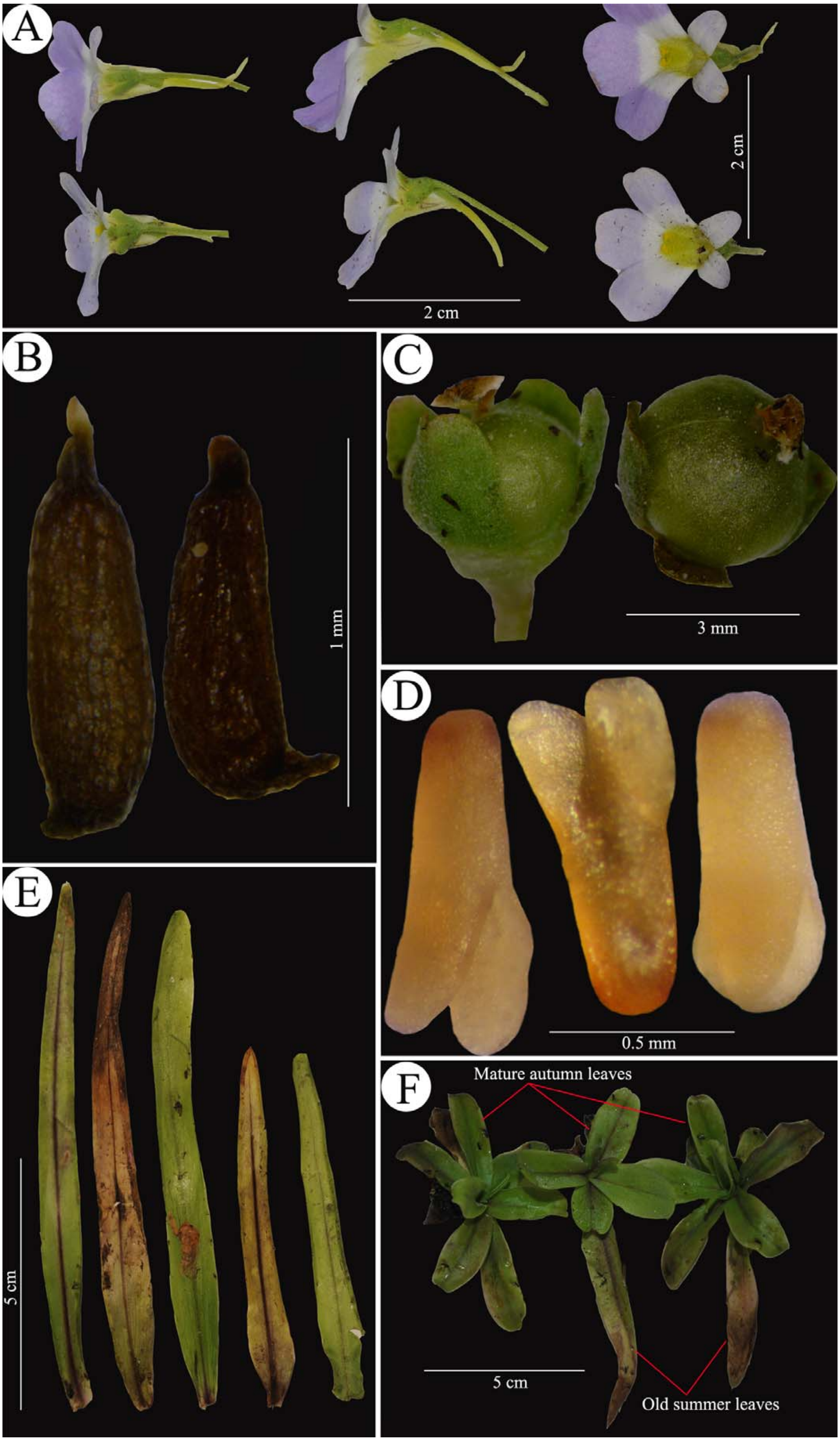

FIGURE 2. *Pinguicula habilii*: **A,** Flowers; **B,** capsules; **C,** seeds; **D,** cotyledons; **E,** generative rosette leaves; **F,** vegetative rosette leaves (A–E from *S.G. Şenol 3498*; F from *H. Yıldırım 1790*).

Rosetted perennial herb, heterophyllous, scapose. Summer and winter rosettes different in shape; summer rosettes from 140 to 200 mm in diameter; winter rosettes from 40 to 60 mm in diameter. Summer rosette leaves 3–6, 70–110 × 6–11 mm, linear to very narrowly lanceolate; margin entire, recurved or flat; apex obtuse to acute, entire; upper surface densely covered with mucilaginous sessile and stalked glands. Winter rosette leaves 4–8, 18–35 × 11–16 mm, oblong-elliptic to slightly oblanceolate; margin entire, sometimes slightly curved; apex obtuse or sometimes slightly emarginate, upper surface densely covered with mucilaginous sessile and stalked glands. Scapes 1–4(–6), erect, 110–170 mm tall, terete, 1-flowered, densely covered with stalked glands just beneath flower. Flowers 24–28 mm long (spur included). Calyx distinctly bilabiate, upper surfaces densely covered with stipitate glands; upper lip divided nearly to base into 3 lobes, elliptic to slightly oblanceolate, each lobes 3–4 × 1.5–2 mm; lower lip 1 lobe, truncate to entire, 3–4 × 1–2 mm. Corolla distinctly bilabiate, blue violet to pinkish violate with whitish central zone, near to corolla tube surface covered with white and yellow hairs; upper lip 2 lobes, 5–6 × 3–3.5 mm, obtus, entire ; lower lip 3 lobes, 8–9 × 6–7 mm, obtuse, entire to slightly truncate. Corolla tube infundibulariform, 5–7 mm, greyish-yellow, inside densely covered with golden yellow clavate multi cellular hairs. Spur infundibulariform to cylindrical, curved downwards, 6–11× 0.6–0.8 mm, yellowish. Stamens with filaments incurved, covered with whitish hairs. Ovary globose, covered with glandular hairs. Capsule globose, c. 3 mm in diameter, glabrous at mature period. Seed 0.8–1.1 × 0.3–0.35 mm, oblong to elliptical, dark brown; seed coat surface reticulate; exotesta cells 30–70 × 15–40 × 10–20 µm; longitudinally anticlinal walls of exotesta cells with thickenings in the form of “tubercles”; lateral anticlinal walls exotesta cells without any thickening, very thin, shallow. Micropylar and chalazal seed appendages present. Cotyledons 2, flat, symmetric in cross section. Pollen shapes prolate, radially symmetric, zonocolporate with 8–9 colpori; ornamentation is rugulate–microreticulate on mesocolpium and perforated on polar axis; muri length 0.2–0.5 µm.

Etymology:—The new species is named *Pinguicula habilii* in honour of Habil Issı, who is an amateur botanist and first collected the new species.

Distribution, Habitat and Ecology:—*Pinguicula habilii* is endemic to Southwestern Anatolia, Turkey. It is located in Marmaris, a district of the province of Muğla. It belongs to the Mediterranean floristic region’s elements. It grows only on the serpentine rock cliffs along a small stream near Marmaris, at elevations between 100 and 200 m. Flowering time of *P. habilii* is between May and July, and fruiting time between June and August.

Suggested conservational status:—The population area of *Pinguicula habilii* was calculated as 0.14 km^2. Moreover, we observed high anthropogenic effects caused by concrete embankment built along the stream which is the habitat of *P. habilii*. In accordance with the criteria laid out by IUCN (2001), the plant is categorized as ‘Critically Endangered’ (CR) B1+2a(ii), on account of its restricted distribution in Turkey.

Affinities and discussion

Pinguicula habilii shows a tropical heterophyllous growth. It has two rosette types a summer rosette (from the spring to the end of summer) form characterized with longer and smaller leaves and a winter rosette (from the beginning of autumn to the end of winter) form characterized with shorter and larger leaves.

Taking into consideration Casper’s (1966) study, *P. habilii* should be placed in the section *Cardiophyllum* of *Pinguicula* subgenus *Isoloba* according to the following morphological features: perennial herb, slender roots; no winter buds, the assimilating leaves present through the annual cycles; pale lilac to pinkish, slightly emarginate to the entire; corolla lips bilabiate; spur deflexed, dilated, cylindrical to infundibular; capsule globose, scarcely larger than calyx; calyx persistent at fruiting time.

Although *P. habilii* shows heterophyllous growth, it does not belong to sect. *Heterophyllum* Casper (1963: 332) of *Pinguicula* subgen. *Isoloba*. All species of sect. *Heterophyllum* are distributed in Mexico. These are *Pinguicula heterophylla* Bentham (1839: 70–71), *P. acuminata* Bentham (1839: 71), *P. parvifolia* Robinson (1894: 320) and *P. imitatriks* Casper (1963: 12) (Casper 1966). According to the study of Cieslak *et al.* (2005), Mexican *Pinguicula* species constitute a monophyletic group, and are isolated from other *Pinguicula* species. Legendre (2000) discussed that the winter rosette formed by species of the tropical growth type generally looks like the *Sempervivum* Linnaeus (1753: 464) plant in winter and is rarely carnivorous, and that these rosette form leaves carry out active photosynthesis unlike those of the temperate taxa. On the other hand, the winter rosette leaves of *P. habilii* are well developed, do not resemble *Sempervivum* plants and these leaves have densely sticky glandular hairs and thus they display carnivorous features.

Degtjareva *et al.* (2004) stressed that cotyledon number was quite unstable in the evolution of *Pinguicula* and they postulated that the presence of two cotyledons represented a plesiomorphic condition in *Pinguicula*. According to Casper (1966), the section *Cardiophyllum* has two members: *P. crystallina* (Figure 6) and *P. hirtiflora*, and the former has two cotyledons whereas the latter has a single cotyledon. *P. habilii* has two cotyledons as does *P. crystallina*. The aestivation of its cotyledons is flat and symmetric (Fig. 3).

FIGURE 3. *Pinguicula habilii*: **A–B,** generative rosettes; **C,** habitat; **D–E,** vegetative rosettes

The two related species (*P. crystallina* and *P. hirtiflora*) are characterized by their homophyllous tropical growth-type and rose to bluish sub-bilobed flowers (Casper 1966, Peruzzi *et al.* 2004, Peruzzi 2006). Although Strid (1991) categorized *P. hirtiflora* as a subspecies of *P. crystallina* [*P. crystallina* subsp. *hirtiflora* (Tenore) Strid (1991:276)], recent morphological, molecular, cytological and seed morphological-anatomical studies have shown that there are distinct differences between these related species (Casper and Stimper 2004, Peruzzi 2004, Peruzzi *et al.* 2004, Casper 2006, Casper & Stimper 2006, Peruzzi 2007, Shuka 2007, Casper & Stimper 2009).

P. habilii seeds surfaces have a very unique structure, which helps to easily separate the new species from its relatives *P. crystallina* and *P. hirtiflora* according to seeds features (Fig. 4).

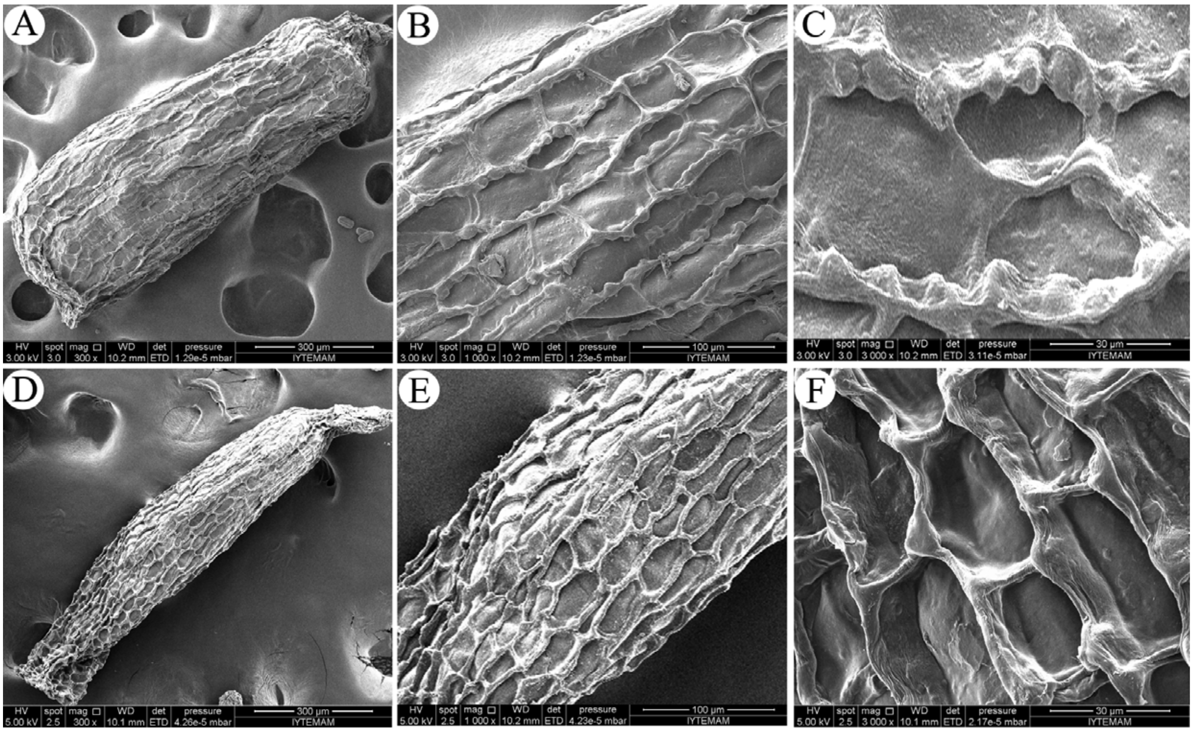

FIGURE 4. A–C, SEM photographs of *Pinguicula habilii* seed coat surface; **D–F,** SEM photographs of *Pinguicula crystallina* seed coat surface (A–C from *S.G. Şenol 3498*; D–F from *H. Yıldırım 1795*).

Degtjareva *et al.* (2004) indicated that in *P. hirtiflora,* the anticlinal walls are thickened in the outer part only. However, in *P. crystallina* thickenings of the anticlinal walls form vertical bolsters. The thickening of anticlinal wall of exotesta cells of *Pinguicula* seeds are a stable characteristic for seed identification and specific level taxonomy (Degtjareva *et al.* 2004, Degtjareva *et al.* 2006). Acording to Degtjareva *et al.* (2004) in *P. hirtiflora*, the thickenings form a continuous ring in the upper part of anticlinal walls; the remaining part of anticlinal walls is thin. In *P. crystallina,* the thickenings form several vertical bolsters while the continuous ring in the upper part of the walls is absent. In their study, they stressed that these seed features contrast with the opinion that *P. hirtiflora* should be treated as a subspecies of *P. crystallina* (Degtjareva *et al.* 2004).

P. habilii seeds have longitudinal anticlinal walls of all exotesta cells covered with dense thickenings in the form of "tubercles". Although *P.crystallina* seeds have thickenings of the anticlinal by vertical bolsters, these thickenings are not distinct and appear less dense. Although several detailed studies were performed on seed coat stcructure of genus *Pinguicula* (Zamora *et al.* 1996, Degtjareva *et al.* 2004, 2006), these studies did not mention-anticlinal walls of exotesta cells with thickenings in the form of "tubercles". We think that this character was firstly seen on *P. habilii* seeds surfaces.

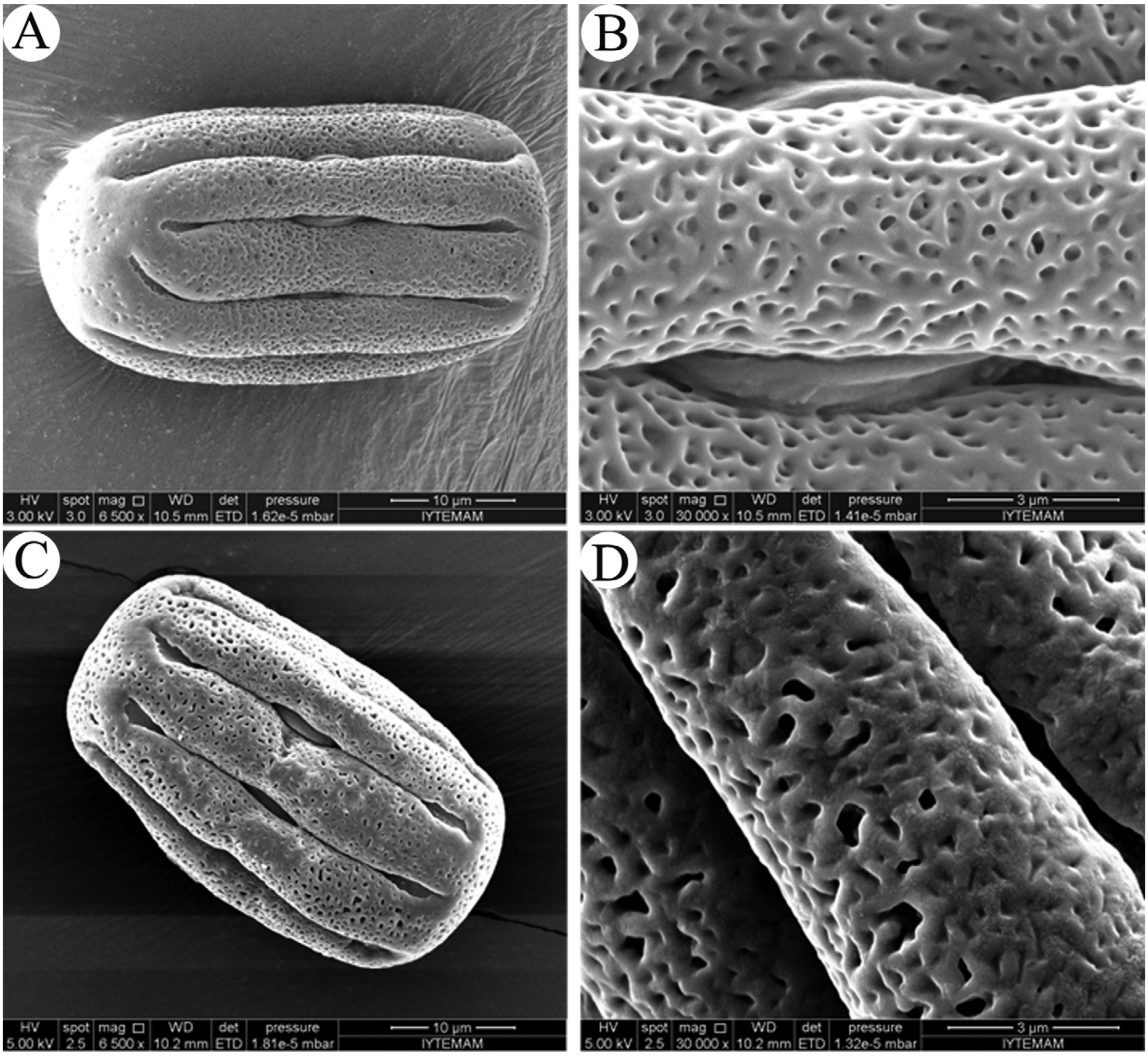

FIGURE 5. A–B, SEM photographs of *Pinguicula habilii* pollen grain; **CD,** SEM photographs of *Pinguicula crystallina* pollen grain (A–B from *S.G. Şenol 3498*; C–D from *H. Yıldırım 1795*).

In the seed of our new species, lateral anticlinal walls of exotesta cells do not show any tubercle-like thickening and these walls are very thin and shallow. For this reason, adjacent exotesta cells are not distinctly separate from each other in some seed portions. On the contrary, in the seeds of related species (*P. crystallina* and *P. hirtiflora*) not only are lateral anticlinal walls of exotesta cells well developed but also adjacent exotesta cells are distinctly separate from each other. Moreover the depth of anticlinal walls of exotesta cells of *P. habilii* is thinner than that of *P. crystallina* and *P. hirtiflora.* Although, in the *P. habilii* seeds, exotesta cells do not show a regular arrangement, exotesta cells of *P.habilii* seeds are irregular in shape. However, in the seeds of *P. crystallina* and *P. hirtiflora*, exotesta cells show almost a regular sequence and nearly all of them have the same shape.

Shimai & Kondo (2007) recently used molecular approaches to study evolutionary history in the Lentibulariaceae. Several molecular studies on the genus *Pinguicula* indicated that phylogenetic relations among species are seen as an evidence for geographical distribution (Cieslak *et al.* 2005, Shimai *et al.* 2007, Shimai & Kondo 2007). Accordingly, *P. habilii* is very different from *P. crystallina* and *P. hirtiflora* in terms of vegetative and generative rosette types and peculiar seed coat surface (Table 1) but very similar in terms of floral features which can be explained with co-evolution. This approach can be used to explain the origin of floral features resembling *P. habilii, P. crystallina* and *P. hirtiflora*. These species have overlapping or close distribution areas and probably they had similar ecological, climatic conditions and more importantly same pollinators in historical times. As a result, these ancient conditions may have stimulated similar floral evolution of the species at issue.

TABLE 1. Morphological comparison of *P.habilii*, *P. crystallina* and *P. hirtiflora*.

Characters		***P. habilii***	***P. crystallina***	***P. hirtiflora***
Rosette type		heterophyllous	homophyllous	homophyllous
Leaf	**number**	in generative rosette:3–6 in vegetative rosette: 4–8	6–9	6–9
	shape	in generative rosette: linear, very narrowly lanceolate in vegetative rosette: oblong-eliptic to slightly oblanceolate	broadly elliptical to spathulate	elliptic-oblong to ovate oblong, truncate
	apex	entire	entire	truncate
	length (mm)	in generative rosette: 70–110 in vegetative rosette: 18–35	15–35	20–60
	Width (mm)	in generative rosette: 6–11 in vegetative rosette: 11–16	10–25	10–25
Flowers in autumn		absent or very rare	present	present
Cotyledon	**number**	2	2	1
	symmetry	symmetric	symmetric	symmetric
	aestivation	flat	flat	plicate
Exotesta cells	**shape**	irregular, oblong to eliptic	almost regular, oblong to eliptic	almost regular, oblong to eliptic
	depth	shallow	deep	deep
	kind of anticlinal walls thickening	tubercles	vertical bolsters	slightly in outer parts of exotesta cells only
Pollen*	**shape**	prolate	prolate	oblate-spheroidal
	muri	present	present	absent
	ornamentation	rugulate–microreticulate on mesocolpium and perforated on polar axis	rugulate–microreticulate	perforated

* Pollen charecters of *P. hirtiflora* obtained from Rodondi *et al.* (2010)

Although *P. longifolia* Gaudin (1828: 45) and *P. vallisneriifolia* Webb (1853: 48) have temperate-heterophyllous growth type (Casper 1966), these species show distinct similarities with *P. habilii* in leaf shapes since they have two different carnivorous leaf types. Moreover, habitat and ecological requirements (all of them grow in dense mats on vertical rock and under Mediterranean climatic conditions) of *P. longifolia* and *P. vallisneriifolia* resemble those of *P. habilii*. In the light of the information it can be postulated that similar growth types of *P. habilii, P. longifolia* and *P. vallisneriifolia* may have evolved in the same direction because of adaptation to similar habitats.

Additional specimens examined (paratypes):—TURKEY: Muğla: Along the stream near Marmaris, on serpentine rocks, 100–200 m., 02 October 2010, *A.F.Pirhan, S.G. Şenol & H. Yıldırım 1790* (EGE!); same locality, 03 December 2011, *A.F.Pirhan, S.G. Şenol & H. Yıldırım 2245* (EGE!).

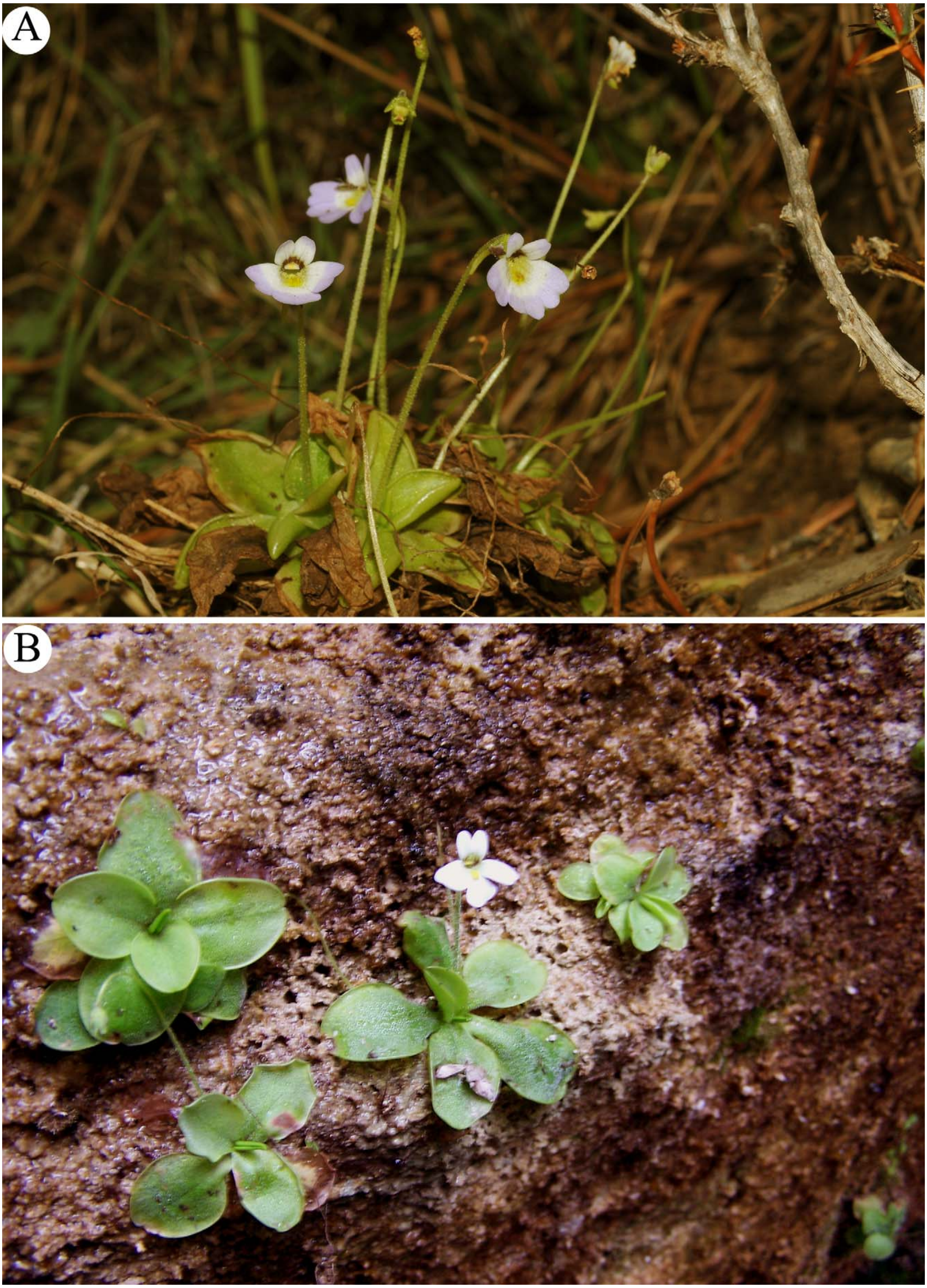

FIGURE 6. *Pinguicula crystallina*: **A,** habit in Turkey: Muğla province, Sandras Mountain **B,** habit in Turkey: Denizli province, Babadağ.

Additional specimens examined (related taxa):

P. crystallina:

CYPRUS. Locus irrigatos ad Panaia tu Troodos, 20 July 1880, *P.E.E. Sintenis & G. Rigo 741* (WU 0062755!). TURKEY. Adana: Karsantı, Yapraklı area, Armutlu Dölek place, on wet serpentine roks, 1200 m, 27 June 1973, *E. Yurdakulol* (ANK!); Burdur: Yeşilova, Salda Lake, 13 October 1946, *C. Kosswig* (ISTF 6682!); Denizli: Babadağ, 30 September 1950, *A. Atilla* (ISTF 10800!); Honaz Mountain, Erikli place,1250 m, 23 May 1972, *G. Oguz et al.* (EGE 11493!); Babadağ, Yeşilköy valley, 750 m, 06 August 1997, *S. Oluk 1781* (EGE 35300!); Babadağ, Yeşilköy valley, 750 m, 18 October 2008, *H. Yıldırım 1475b* (EGE!); Bozdağ, 1300–1400 m, *P.H. Davis 13308* (ANK!); Isparta: Eğirdir, Pazar village, 1100 m, 05 May 1975, *H. Peşmen & A. Güner 2608* (ANK!); Kütahya: Gediz, Murat Mountain, Hamam, ikizce road, 1450 m, 21 June 1978, *A. Çırpıcı* (ISTF 32019!); Muğla: Yılanlı hill, near Karayolları fountain, ca. 1050 m, 04 August 1978, *Ö. Seçmen 1668* (EGE 17136!); Sandras Mountain, Gökceova area, 1600 m, 23 July 1947, *P.H. Davis 13610* (ANK!); Sandras Mountain, ca. 1250 m, 02 September 2010, *H. Yıldırım 1795* (EGE!); Sandras Mountain, Ağla village, Dana stream side, 1500 m, 05 November 1991, *A. Güner 10335 et al.* (GAZI!); Dalaman, Güzeldere stream, 09 June 1881, *F. Luschan* (WU 0062756!); Uşak: Banaz, Murat Mountain, Öküz rock, along stream, 2100 m, 18 June 1978, *A. Çırpıcı* (ISTF 31900!).

P. hirtiflora:

ITALY. Napoli: in rupibus humidis et muscosis montis S. Angelo di Castellammare, 1300 m, 10 June 1910, *G. Pellanda* (WU 0062754!). GREECE. Achaía: Prope Stygeum, in monte Chelmos, *T.G. Orphanides 107* (WU 0062752!—isotype of *Pinguicula megaspilaea* Boiss. & Heldr.); Epirus Distr. Joanina, Montes Pindus, In monte Tsuka Rossa ditionis pagi Vovousa (Viosa), 1600–1980 m, Scaturiginosis, 01 August 1956, *K.H. Rechinger* (WU 0062751!). ALBANIA. Malcija: Rocks near Rapša stream, ca. 750 m, 13 May 1914, *I. Dörfler 108* (WU 0062753!); Korçë: on the road between Korçë and Gramsh, ca. 18,7 km W-NW Moglicë (Maliqi i Oparit), 07 May 2006, *R. Karl* (GZU 252154!).

P. heterophylla:

MEXICO. Without locality, 1840, *K.T. Hartweg 510* (holotype K 000297384!); Mina Guerrero: Zarca stream in pine forest, 05 May 1937, *G.B. Hinton 10417* (K 000297382!).

P. imitatrix:

MEXICO. Guerrero: Galeana Distr., Piedra Ancha, 3025 m, 14 January 2010, *G.B. Hinton 14219* (MICH 1192428!, UC 1113586!).

P. parvifolia:

MEXICO. Guadalajara: Mossy gravel bluffs near Guadalajara, 23 June 1894, *C.G. Pringle 4397* (E 00394342!, K 000297387!—isotypes); Michoacan: Uruapan Hwy. 37, 88 km, 26 June 1981, *W. Hahn 584* (K000297386!).

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