

TAXONOMIC REVISION OF THE GENUS *Pinguicula* L. IN THE IBERIAN PENINSULA

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Abstract: In this paper, the genus *Pinguicula* is revised in the Iberian Peninsula. The taxa studied are *P. vulgaris*, *P. nevadensis*, *P. grandiflora* subsp. *grandiflora*, *P. dertosensis*, *P. vallisneriifolia*, *P. longifolia* subsp. *longifolia*, *P. mundi*, *P. alpina* and *P. lusitanica*. Five taxa are endemic to the area studied (*P. nevadensis*, *P. dertosensis*, *P. vallisneriifolia*, *P. longifolia* subsp. *longifolia* and *P. mundi*). Two of them are confined to restricted areas: *P. nevadensis* is endemic to the Sierra Nevada (S Spain) and *P. longifolia* subsp. *longifolia* is endemic to the central Pyrenees (N Spain). Taxonomical, nomenclatural, morphological, chromosomal, biogeographical and ecological data are reported for each taxon. A new combination is proposed: *Pinguicula* Sect. *Longifolia* (CASPER) G. BLANCA, M. RUÍZ-REJÓN et R. ZAMORA.

INTRODUCTION

The genus *Pinguicula* L. (*Lentibulariaceae*) is one of the most widespread carnivorous groups, being present on all continents except Australia; in Africa it is limited to the northwest of the continent. Over 50 *Pinguicula* species have been described to date (CASPER 1966, GIVNISH 1989, JUNIPER et al. 1989). The leaves produce a sticky glandular secretion able to capture and digest small arthropods by means of a passive capture system (HESLOP-HARRISON 1978). Like most carnivorous plants, the *Pinguicula* species are restricted to nutrient-poor habitats, such as bogs and swamps, which remain sunny and moist at least during the growing season (GIVNISH 1989). Despite the rarity of such sites in the Mediterranean ecosystems, many *Pinguicula* species are known from the Mediterranean basin (CASPER 1962). In these regions, where plant growth is greatly limited by water availability, suitable habitats for the *Pinguicula* species are scattered, isolated wet areas surrounded by larger dry habitats. Thus, for example, the populations of *P. dertosensis*, a species that is endemic to the Iberian Peninsula, are separated from one another by distances of 150–400 km. *P. grandiflora* subsp. *grandiflora* is frequent in the northern third of the Peninsula, but occurs in an isolated area in southern Spain (Sierra Nevada), at a minimum distance of 550 km from the other populations (there is also a small intermediate location 450 km away in the Peñalara Massif in the Province of Madrid). *P. vallisneriifolia* is endemic to the Baetic Mountains (Southern Spain), where there is a period of severe summer drought that lasts 4–5 months; its populations are limited to small enclaves located at a considerable distance from one another, in places where

springwaters are available; if severe drought conditions persist for several consecutive summers, these populations teeter on the brink of extinction.

The isolation of the populations must have played an important role in the speciation processes involved. Since the current aridity of the Mediterranean basin has made such small, isolated populations vulnerable to extinction (ZAMORA et al. 1996), there is an urgent need for these endangered groups to be characterized taxonomically (FALK & HOLSINGER 1991, SCHEMSKE et al. 1994).

CASPER (1972) included 12 species within the flora of Europe, 7 of which are present in the Iberian Peninsula: *P. vulgaris*, *P. nevadensis*, *P. grandiflora*, *P. vallisneriifolia*, *P. longifolia*, *P. alpina* and *P. lusitanica*. An additional two new Iberian species have recently been recognized: *P. dertosensis* (MATEO & CRESPO 1995) and *P. mundi* (ZAMORA et al. 1996). In our previous study (ZAMORA et al. 1996), we analyzed the morphometric, cytogenetic, RAPD, ecological and breeding-system data for two new species, *P. submediterranea* (= *P. dertosensis* nom. legit.) and *P. mundi*, and the two species closest to them (*P. grandifolia* and *P. vallisneriifolia*, respectively). The taxonomical delimitation of these two new species with regard to the other remains to be clarified, together with the distribution areas of all these taxa (the populations of some of which have previously been incorrectly ascribed to other species). The objective of the present paper is to resolve these questions and thus establish the diagnostic characters for the species present in the Iberian Peninsula.

This review was carried out by means of studying the material deposited at the BC, GDA, GDAC, JACA, MA, MAF, MGC, SALA and SEV herbaria. The BBF, BM, FI and P herbaria were also consulted for typification of certain species.

KEY FOR THE IBERIAN PENINSULA SPECIES

(Note: Corolla measurements exclude the spur)

- 1a. Corolla-lobes of the lower lip emarginate; plant overwintering as a rosette **9. *P. lusitanica***
- b. Corolla-lobes of the lower lip entire to retuse; plant overwintering as a bud **2**
- 2a. Corolla white, with yellow spots; spur 2–3(–4) mm, obtuse and curved; roots stout **8. *P. alpina***
- b. Corolla violet or pinkish; spur 2.5–18 mm, acute and straight or slightly-curved; roots slender [*P. vallisneriifolia* can have white corolla, but then spur is more than 9 mm] **3**
- 3a. Corolla 9–16 mm; spur 2.5–5(–6) mm, usually under half the length of the rest of the corolla **4**
- b. Corolla 12–26 mm; spur (6–)7–18 mm, usually over half the length of the rest of the corolla **5**
- 4a. Leaves barely longer than wide **2. *P. nevadensis***
- b. Leaves distinctly longer than wide **1. *P. vulgaris***
- 5a. Leaves with involute margin; spring leaves horizontal, close to the soil; summer leaves similar to spring leaves; corolla without violet veins **6**

- b. Leaves with \pm undulate margin; spring leaves suberect to erect; summer leaves much longer than spring leaves; corolla with violet veins, sometimes weakly marked 7
- 6a. Lobes of upper lip of calyx 3–5 mm; corolla (15–)16–25(–26) mm, entirely violet, with white throat; spur (8–)10–16 mm; seed narrowly ellipsoidal **3. *P. grandiflora***
- b. Lobes of upper lip of calyx (2–)2.5–3.5 mm; corolla (12–)13–17(–18) mm, with the lower lobes coloured only in the distal half and dark violet throat; spur (6–)7–12(–13) mm; seed ovoidal **4. *P. dertosensis***
- 7a. Summer leaves elliptic to obovate, slightly undulate in the margin; throat dark violet, except in the middle lobe of the lower lip **7. *P. mundi***
- b. Summer leaves ligulate to lanceolate, strongly undulate in the margin; throat white **8**
- 8a. Summer leaves ligulate, acute; lobes of upper lip of calyx ovate-oblong to ovate **5. *P. vallisneriifolia***
- b. Summer leaves lanceolate to linear-lanceolate, obtuse; lobes of upper lip of calyx oblong to linear-oblong **6. *P. longifolia***

SYSTEMATICS

Pinguicula L., Sp. Pl. 17, 1753

Small insectivorous, scapose and perennial herbs, leaves in a basal rosette, simple, entire, soft and fleshy, clothed with viscid glands above. Flowers solitary, zygomorphic, on naked pedicels often covered with viscid glands, the stalks not more than twice as long as the gland. Calyx persistent, 2-lipped, the lips separated nearly to the base, with viscid glands; upper lip 3-lobed, the lower 2-lobed. Corolla 2-lipped, spurred, with a hairy and often spotted throat; upper lip 2-lobed, lower 3-lobed. Stamens 2, epipetalous. Ovary superior, bicarpelar, 1-locular, placenta free, central; style solitary, short. Fruit a capsule opening by 2 valves; seeds numerous, very small.

Type (BRITTON & BROWN 1913, HITCHCOCK & GREEN 1929): *P. vulgaris* L.

Chromosome basic number: 6, 8.

Table 1 shows the main diagnostic features of the *Pinguicula* species present in the Iberian Peninsula.

Subgen. *Pinguicula*

Roots slender. Overwintering as a bud. Flowers big. Corolla purple-violet, bluish, pinkish or rarely white, with lobes entire to retuse; spur straight or slightly-curved. Capsule ovoid, of equal length or up to twice as long as the calyx.

Sect. *Pinguicula*

Leaves with involute margin; spring leaves horizontal, close to the soil; summer leaves similar in size. Corolla without violet veins.

Table 1. Diagnostic features of the species studied.

	<i>P. vulgaris</i>	<i>P. nevadensis</i>	<i>P. grandiflora</i>	<i>P. dertosensis</i>	<i>P. vallismartifolia</i>	<i>P. longifolia</i>	<i>P. mundi</i>	<i>P. alpina</i>	<i>P. lusitanica</i>
Roots	Slender	Slender	Slender	Slender	Slender	Slender	Slender	Stout	Slender
Overwintering	Bud	Bud	Bud	Bud	Bud	Bud	Bud	Bud	Rosette
Stolons	No	No	No	No	Yes	Yes	Yes	No	No
Leaves	Horizontal	Horizontal	Horizontal	Horizontal	Suberect	Suberect	Suberect	Horizontal	Horizontal
placement	No	No	No	No	Yes	Yes	Yes	No	No
Growing post	Involute	Involute	Involute	Involute	Undulate	Undulate	Undulate	Involute	Involute
anthesis									
Margin									
Corolla									
size (mm)	13-15	10-16	16-25	13-17	15-22	18-27	14-21	7-11	5-9
colour	Violet	Lilac	Violet	Violet in the upper half	Pale violet in the upper part	Pale violet in the upper 2/3	Violet in the upper half	White with yellow spots	Pale lilac to pinkish
Lobes of the lower lip	Not overlapping	Overlapping	Overlapping	Overlapping	Overlapping	Overlapping	Overlapping	Not overlapping	Not overlapping
Throat	Entire	Entire	Entire	Entire	Entire	Entire	Entire	Entire	Emerginate
	White	Violet	White	Dark violet	White	White	Dark violet	White with yellow spots	Yellow
Spur (mm)	Straight	Straight	Straight	Straight	Straight (curved)	Straight (curved)	Straight	Curved	Deflexed
	2.5-5	3-5	10-16	7-12	11-18	10-16	9-14	2-3	2.5-4.5
Capsule (mm)	Ovoid	Ovoid	Ovoid to subglobose	Ovoid to subglobose	Ovoid	Ovoid-subglobose	Ovoid to subglobose	Pear-shaped	Subglobose
	4-6	3-5	5-7	2.5-4.6	3-5	4-5.5	3-5	6-7	2.5-4.5
Seeds (mm)	0.8-0.9	0.7-0.8	0.8-0.9	0.5-0.6	0.7-0.9	0.7-0.9	0.8-1	0.7-0.8	0.5-0.6
	Ovate-lanceolate	Ellipsoidal	Narrowly ellipsoidal	Ovoidal	Clavate	Clavate	Narrowly ellipsoidal	Oblong	Oblong to narrowly ellipsoidal
	Reticulate	Reticulate	Reticulate	Reticulate	Reticulate	Reticulate	Reticulate	Rugose-striate or obscurely reticulate	Prominently reticulate
Chromosome number	64	16	32	48	32	32	48	32	12

1. *Pinguicula vulgaris* L. (Fig. 1)

P. vulgaris L., Sp. Pl. 17, 1753. Ind. loc.: "Habitat in Europae uliginosis".

Lectotype (CHEEK in JARVIS et al. 1993): LINN No. 33.1!

Description

Perennial herbs with slender roots, overwintering as a bud, without stolons. Leaves 5–9, horizontal, close to the soil, petiolate, with the margin somewhat involute; spring leaves (at anthesis) (2–)2.5–4.5(–5) × 1.2–2.4 mm, elliptic oblong or obovate-oblong; summer leaves (at fruiting) similar to spring leaves. Pedicels 1–5, (5–)6–18 cm long, glandular-pubescent. Upper lip of the calyx with lobes 2.5–3 mm long, narrowly elliptic, oblong to ovate, obtuse or subacute; lower lip lobed for 1/3–1/2 of its length. Corolla (12–)13–15(–16) mm long (spur excluded), entirely violet; upper lip with lobes oblong-obovate, obtuse; lower lip longer, with lobes 5–7.5 mm long, much longer than wide, oblong to oblong-obovate, divergent, not overlapping, obtuse or truncate, at times retuse, the middle somewhat longer; throat usually white; tube short, infundibuliform, sparsely glandular outside; spur 2.5–5(–6) mm long, cylindrical-subulate, straight. Capsule 4–6 mm long, ovoid; seeds 0.8–0.9 mm long, ovate-lanceolate, reticulate.

Chromosome number

2n=64 (DOULAT 1947, LÖVE & LÖVE 1944, 1948, 1956, 1982, WOOD & GODFREY 1957, LAANE 1967, 1969, LÖVE & KJELLQVIST 1974 [using material from the Iberian Peninsula], MURÍN 1976).

Distribution

Extends throughout North America, Europe, western and central Asia, and north-west Africa (Morocco). In the Iberian Peninsula, it is dispersed in the northern third (Fig. 2), from the Serra do Geres (Portugal; cf. COUTINHO 1939, and CASPER 1962), León mountains, Cantabrian mountains and Pyrenees; the southernmost locations are in the Universales mountains of Spain (E of the Province of Teruel and NW of the Province of Cuenca).

Ecological behaviour

Peat bogs, wetlands, waterlogged pastures, banks of streams, etc. Indifferent to soil type. Altitude: 1400–2600 m. Flowering season: (V–)VI–VII(–VIII).

2. *Pinguicula nevadensis* (LINDB.) CASPER (Fig. 1)

P. nevadensis (LINDB.) CASPER, Feddes Repert. 66: 112, 1962.

≡ *P. vulgaris* subsp. *nevadensis* LINDB., Acta Soc. Sci. Fenn. 2: 142, 1932.

Holotype: Hispania, Sierra Nevada, in turfosis humidis in declivi supra Laguna de las Yeguas, c. 2600 m (22.VII.1926 LINDBERG LD).

– *P. leptoceras* auct. non RCHB. 1823: BOISS., Voy. Bot. Espagne 2: 521, 1841.

Description

Perennial herbs with slender roots, overwintering as a bud, without stolons. Leaves 5–8, horizontal, close to the soil, sessile to shortly petiolate, yellowish, with the margin more or less involute; spring leaves (at anthesis) 1.5–4.5(–5) × 0.7–2.5 cm, suborbicular to ovate, frequently little longer than wide; summer leaves (at fruiting) similar to spring leaves. Pedicels 1–3(–4), 3–10(–11) cm long, glandular-pubescent. Upper lip of the calyx with lobes 2–3 mm long, ovate to oblong-ovate, obtuse, more or less divergent; lower lip lobed for up to 1/3 of

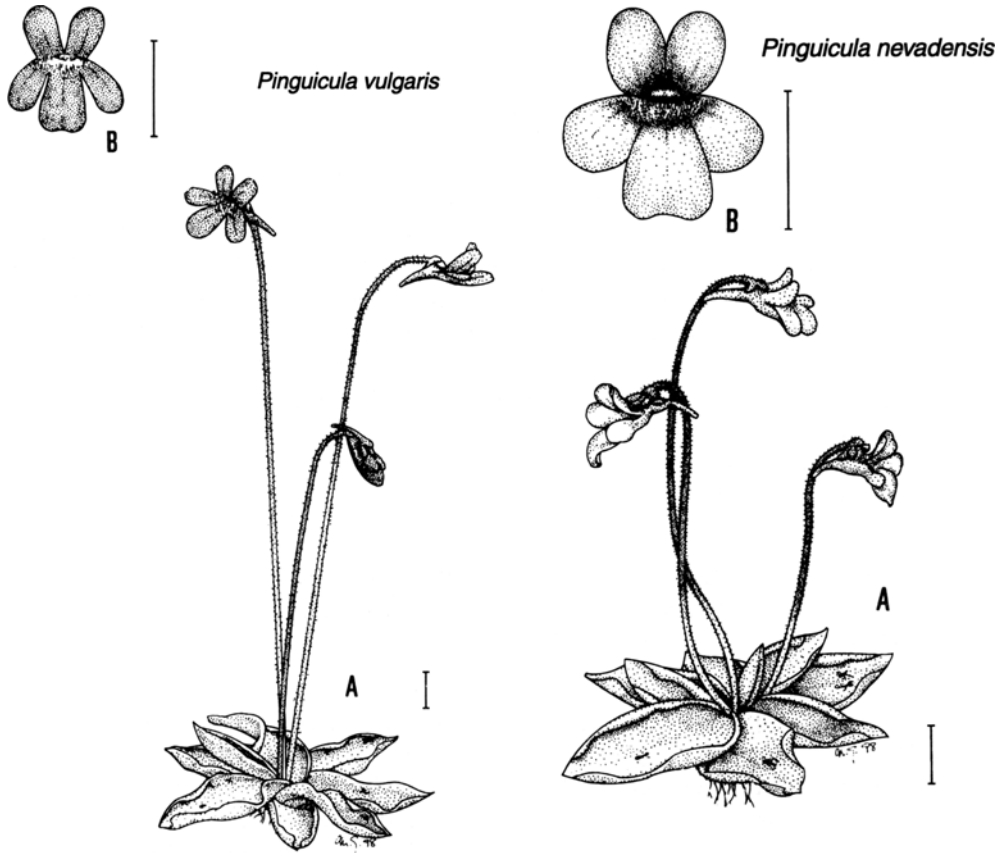


Fig. 1. *Pinguicula vulgaris* and *Pinguicula nevadensis*; A – habit, B – flower. Scale bars 1 cm.

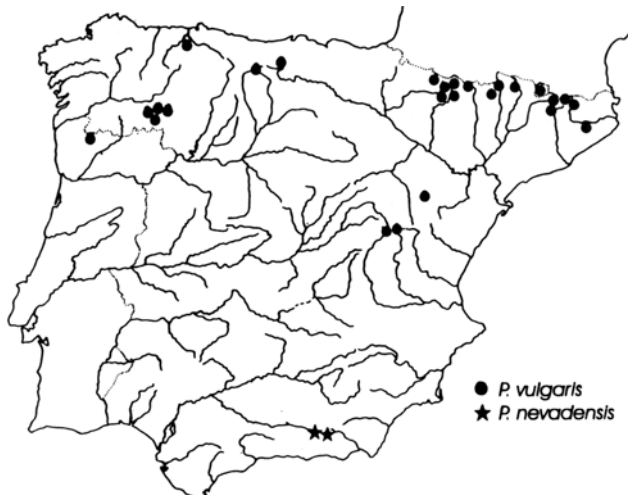


Fig. 2. Distribution map of *Pinguicula vulgaris* in the Iberian Peninsula and *P. nevadensis*.

its length. Corolla (9–)10–16 mm long (spur excluded), lilac; upper lip with lobes ovate, obtuse; lower lip with lobes (3–)4–7 mm long, obovate-oblong to broadly obovate, overlapping, obtuse, pale lilac to whitish, the middle entire to retuse; throat violet; tube short, infundibuliform, about as long as the lips, sparsely glandular outside; spur 3–5(–6) mm long, cylindrical-subulate, straight or weakly-curved. Capsule 3–5 mm long, ovoid; seeds 0.7–0.8 mm long, ellipsoidal, reticulate.

Chromosome number

$2n=16$ (ZAMORA et al. 1996).

Distribution

Endemic to the Sierra Nevada (Province of Granada; Fig. 2). The presence of this species in the Sierra de Alfacar (Province of Granada), based on a voucher specimen of Gandoger deposited at the PRC herbarium (cf. CASPER 1962: 113), must be discounted, as it has not subsequently been found in the Alfacar mountains and the area in question does not meet the ecological requirements of the species; this report must almost certainly be due to a labelling error.

Ecological behaviour

Moist peat soils, waterlogged meadows (known locally as “borreguiles”). Silicicolous. Altitude: 2000–3100 m. Flowering season: (VI–)VII–VIII.

3. *Pinguicula grandiflora* LAM.

P. grandiflora LAM., Encycl. Méth. Bot. 3: 22, 1789.

Lectotype (**designated here**): *Pinguicula magnoflore*, je ne sai si cest une variete du vulgaire cuillie au Villard de Lan dans une montagne proche le moulin aumois de juin (s.a. [LAMARCK] P!).

3.1. *Pinguicula grandiflora* LAM. subsp. *grandiflora* (Fig. 3)

= *P. inaequilobata* SENNEN, Bol. Soc. Ibér. Ci. Nat. 35: 20, 1936.

Lectotype (**designated here**): Castille: Obarenes, ruisseau tourbeux (17.V.1906 FRES. SENNEN et ELÍAS, Plantes d'Espagne – F. SENNEN no. 87, MA 115239! “*Pinguicula leptoceras* RCHB.?”).

≡ *P. grandiflora* var. *inaequilobata* (SENNEN) CASPER, Feddes Repert. 66: 86, 1962.

= *P. eliae* SENNEN, Bol. Soc. Ibér. Ci. Nat. 35: 21, 1936.

Lectotype (**designated here**): Burgos: Montes Obarenes, ruisseaux vers 900 m (6.VI.1918 HNO. ELÍAS, Plantes d'Espagne – F. SENNEN no. 3465, BC 832087! “*Pinguicula Eliasii* SENNEN”). Isolectotypes: BC 832088!, MA 115236!

= *P. merinoana* SENNEN, Bol. Soc. Ibér. Ci. Nat. 35: 20, 1936.

Lectotype (**designated here**): Asturias: Colunga, lieux frais (V.1914 HNO. JERÓNIMO, Plantes d'Espagne – F. SENNEN no. 2050, BC 832089! “*Pinguicula grandiflora* LAM.”). Isolectotypes: BC 53037!, MA 115254!

= *P. grandiflora* subsp. *coenocantabrica* RIVAS. MART. et al., Los Picos de Europa, 279, 1984. Holotype: Asturias, Santuario de Covadonga (7.III.1974 LADERO, LÓPEZ & MORENO MAF 94496!).

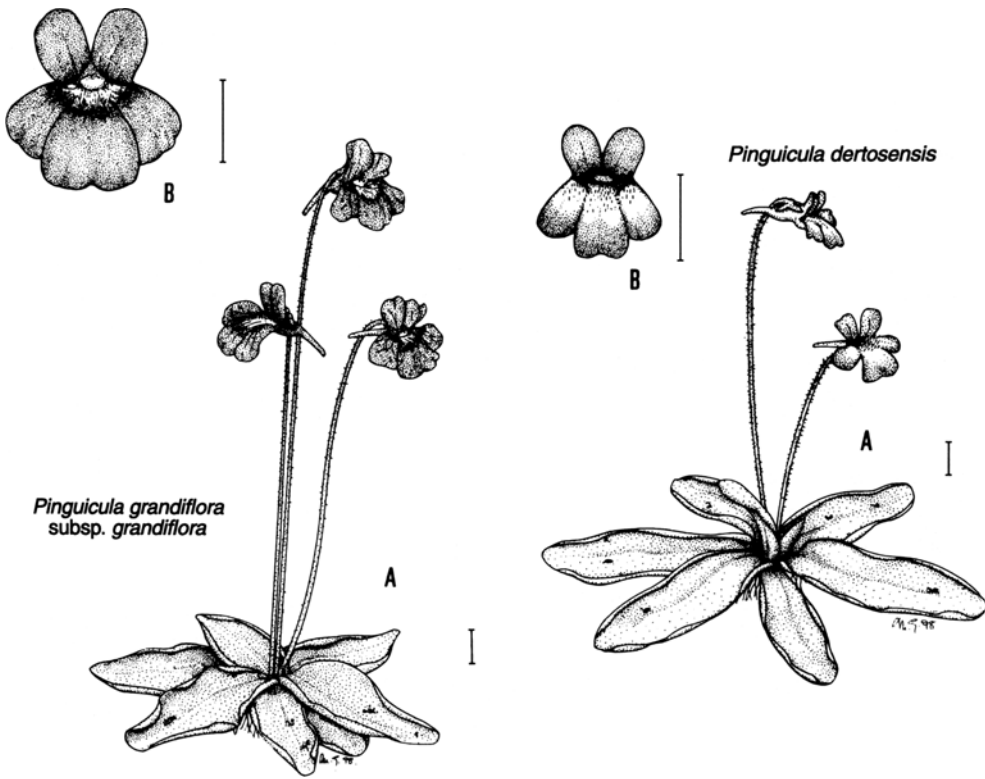


Fig. 3. *Pinguicula grandiflora* subsp. *grandiflora* and *Pinguicula dertosensis*; A – habit, B – flower. Scale bars 1 cm.

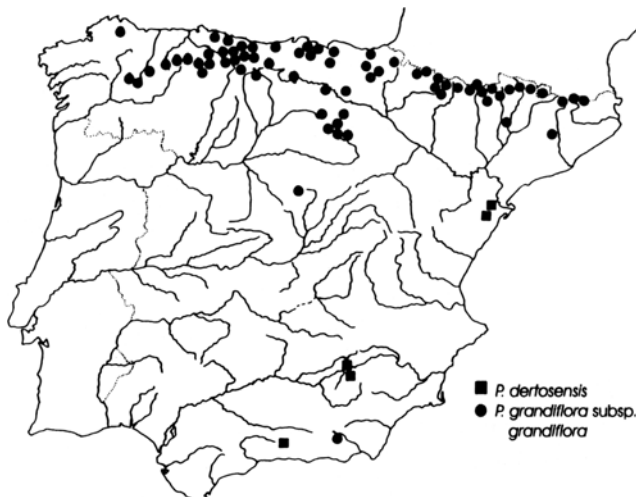


Fig. 4. Distribution map of *Pinguicula grandiflora* subsp. *grandiflora* in the Iberian Peninsula and *P. dertosensis*.

Description

Perennial herbs with slender roots, overwintering as a bud, without stolons. Leaves 5–9, horizontal, close to the soil, petiolate, with the margin more or less involute; spring leaves (at anthesis) 3–6(–6.5) × 1.5–3 cm, oblong, obovate-oblong to elliptic; summer leaves (at fruiting) similar to spring leaves. Pedicels 1–5, (4.5–)6–18(–20) cm long, glandular-pubescent. Upper lip of the calyx with lobes (2.5–)3–5 mm long, oblong, elliptic or subtriangular, obtuse or subacute; lower lip lobed for up to 1/3 of its length. Corolla (15–)16–25(–26) mm long (spur excluded), entirely violet; upper lip with lobes suborbicular to obovate, obtuse; lower lip with lobes (5–)6–11 mm long, about as long as wide, suborbicular to obovate, overlapping, obtuse or truncate, at times retuse, the middle one wider; throat white, with two dark spots in the upper part, near the stigma; tube short, broadly infundibuliform, sparsely glandular outside; spur (8–)10–16 mm long, cylindric-subulate, straight, sometimes slightly bifid. Capsule (4–)5–7(–8) mm long, ovoid to subglobose; seeds 0.8–0.9 mm long, narrowly ellipsoidal, reticulate.

Chromosome number

2n=32 (DOULAT 1947, WOOD & GODFREY 1957, CONTANDRIOPOULOS 1962, CASPER 1963, ZAMORA et al. 1996; the latter using material from the Iberian Peninsula).

Distribution

Western Europe (Ireland, France, Switzerland and Spain). *P. grandiflora* has two subspecies: subsp. *grandiflora*, distributed throughout the range of the species, and subsp. *rosea* (MUTEL) CASPER, in south-eastern France (Savoie), which is distinguished from subsp. *grandiflora* by the smaller size of all its parts and by the pinkish to pale lilac corolla with subulate spur. In the Iberian Peninsula, the former subspecies is distributed throughout the northern third (Fig. 4), reaching south to the Peñalara massif (Province of Madrid) and the Sierra Nevada (Province of Almería).

Ecological behaviour

Wetlands, waterlogged pastures, peat bogs, rocky banks, springs, banks of streams, etc. Indifferent to soil type. Altitude: (200–)500–2300 m. Flowering season: III–VIII.

Comments

A highly variable species, including a number of taxa of low taxonomical value. SENNEN (1936) described three new species, *P. merinoana*, *P. eliae* and *P. inaequilobata*, the latter two at the same location. The characters of the former two, as CASPER (1962) noted, coincide with those of *P. grandiflora*, whereas *P. inaequilobata* was considered to be a mere variety.

With regard to the subsp. *coenocantabrica*, the characters listed by RIVAS MARTÍNEZ et al. (1984) correspond to individuals that are bigger as a result of more favourable ecological conditions; such specimens are also to be found in other geographical areas mixed with individuals of usual size.

4. *Pinguicula dertosensis* (CAÑIG.) MATEO et M.B. CRESPO (Fig. 3)

P. dertosensis (CAÑIG.) MATEO et M.B. CRESPO, Fl. Abrev. Com. Valenciana, 1995: 430.

≡ *P. grandiflora* var. *dertosensis* CAÑIG., Collect. Bot. 5: 413, 1957.

Holotype: Puertos de Beceite, in confinibus Aragoniae et catal. pr. Font del Teix, in initio Barranc del Parrissal (IV.1935 BARTOMEUS BC 87830!).

≡ *P. grandiflora* subsp. *dertosensis* (CAÑIG.) O. BOLÒS et VIGO, Collect. Bot. 14: 99, 1983.

= *P. submediterranea* BLANCA et al., Pl. Syst. Evol. 200: 57, 1996.

Holotype: Sierra de Cazorla (Jaén provincia, Hispania), 1300 m s.m. alt. in clivis terreis humidissimis atque muscis coopertis (10.VI.1993 R. ZAMORA GDAC 37732!).

Description

Perennial herbs with slender roots, overwintering as a bud, without stolons. Leaves 6–9(–12), horizontal, close to the soil, shortly petiolate to petiolate, with the margin more or less involute; spring leaves (at anthesis) (2–)3–7(–9) × 1.5–2.5 cm, obovate to obovate-oblong; summer leaves (at fruiting) similar to spring leaves. Pedicels 1–5, 5–13 cm long, glandular-pubescent. Upper lip of the calyx with lobes (2–)2.5–3.5 mm long, ovate-lanceolate to lanceolate, obtuse or subacute; lower lip lobed for up to 1/2 of its length or sometimes nearly to the base. Corolla (12–)13–17(–18) mm long (spur excluded), violet; upper lip dark violet, with lobes suborbicular to obovate, obtuse; lower lip with lobes 5–10 mm long, longer than wide, obovate, overlapping, obtuse, coloured only in the upper half, the middle entire to retuse, white- to yellow-spotted near the base; throat dark violet, except in the middle lobe of the lower lip; tube short, broadly infundibuliform, sparsely glandular outside; spur (6–)7–12(–13) mm long, cylindrical-subulate, straight, sometimes slightly bifid. Capsule 2.5–4.6 mm long, ovoid to subglobose; seeds 0.5–0.6 mm long, ovoidal, reticulate.

Chromosome number

$2n=48$ (ZAMORA et al. 1996). As noted by ZAMORA et al. (1996), *P. dertosensis* very probably has an allopolyploid origin, from the crossing of a tetraploid species ($2n=32$, probably *P. grandiflora*, the one taxonomically closest to *P. dertosensis*) with a unknown diploid species, and the subsequent duplication of the chromosome number. Another possibility would be the result of the crossing of an octoploid species ($2n=64$) and a tetraploid one ($2n=32$); the two species involved may have been *P. vulgaris* and *P. grandiflora*, respectively. This latter possibility would be highly probable if *P. vulgaris* were an autopolyploid originating from *P. grandiflora*.

Distribution

Dispersed throughout the east and southeast of the Peninsula (Fig. 4), from the Tortosa (Tarragona) and Beceite (Teruel) mountain passes to the Sierra Tejada (Granada). Its presence in the Province of Castellón was reported by AGUILELLA et al. (1992).

Ecological behaviour

Waterlogged pastures, rocky banks, banks of streams, etc. Calcicolous. Altitude: 600–1700 m. Flowering season: IV–VI(–VII).

Comments

This species was considered to be a variety of *P. grandiflora* by CAÑIGUERAL (1957). The protologue of this variety is rather confusing. The published location, “Ports de Tortosa” (Province of Tarragona) is not the same as that given on the label of the voucher specimen denominated as the holotype (BC 87830), namely, “Puertos de Beceite” (Province of Teruel), even though the two locations in fact coincide, since a single mountain pass forms the border between two Spanish regions and the pass is known by a different name in each. Furthermore, CAÑIGUERAL (1957: 413) noted in the description of the new variety that the corolla was “alba in gutture”, whereas one of the most striking characters of the species is that the throat of the corolla is a dark violet colour (ZAMORA et al. 1996: 57, sub *P. submediterranea*).

The taxonomic category of the variety was upgraded to the rank of subspecies and species by BOLÒS & VIGO (1983) and MATEO & CRESPO (1995), respectively.

ZAMORA et al. (1996), having made a detailed study of several Spanish *Pinguicula* species, detected a chromosome number ($2n=48$) that differed from the number known for *P. grandiflora* ($2n=32$); this character, together with the morphological features indicated above in the identification key and the genetic isolation demonstrated by experimental hybridization, would suggest that this taxon merits consideration at species rank. Owing to the difficulties posed by CAÑIGUERAL's protologue, they opted for a new name, *P. submediterranea*, although while their article was still in press the book by MATEO & CRESPO (1995) was published, in which *P. dertosensis* was elevated to the category of species; the difference of a few months in the appearance of these two publications would give priority to the combination proposed by MATEO & CRESPO (1995).

In the southeastern Iberian Peninsula the populations of this species had been traditionally included within *P. vallisneriifolia*.

Sect. *Longifolia* (CASPER) BLANCA, M. RUÍZ REJÓN et ZAMORA, comb. et stat. nov.

≡ Ser. *Longifolia* CASPER, Feddes Repert. 66: 61, 1962.

Leaves with \pm undulate margin; spring leaves suberect to erect; summer leaves much longer. Corolla with violet veins, sometimes weakly marked.

5. *Pinguicula vallisneriifolia* WEBB (Fig. 5)

P. vallisneriifolia WEBB, Otia Hisp. ed. 2: 48, 1853.

Ind. loc.: "HAB. Hanc plantam in Baetica circa rivulorum fontes et in rupibus lapsu aquarum madidis Espumaredas dictis, non longe ab oppido Velez-el-Rubio, julio fructiferam et fere defloratam, legit anno 1851 cl. Antonius Blanco".

Lectotype (**designated here**): In montibus circa Velez Rubio (s.a. BLANCO FI!).

The reference to Vélez Rubio, a village in the Province of Almería (SE Spain; see Fig. 6, locality marked with "?") appears to have been an error, as studies made of the flora of this village (CUETO 1989, CUETO & BLANCA 1997) discounted the presence of *P. vallisneriifolia* in the area. Furthermore, the area called "Espumaredas" is totally unknown to the villagers; however, there is a small valley and river called "Espumaderas" in the Sierra de Cazorla (Province of Jaén), where *P. vallisneriifolia* is indeed present, which could explain the confusion. As this shows every sign of being a labelling error, the presence of this species in the Province of Almería should be discounted.

Description

Perennial herbs, with slender roots and stolons present, overwintering as a bud. Leaves suberect to erect, sessile, with prominent median nerve on the back, with the margin not involute; spring leaves (at anthesis) 5–8, 2.5–7 \times 1–2(–2.5) cm, elliptic to obovate-oblong; summer leaves (at fruiting) 6–15, much longer, (5–)10–25 \times (0.5–)0.7–2.5 cm, ligulate, undulate in the margins, subpetiolate, acute or subacute. Pedicels 1–8(–10), (5–)7–15(–7) cm long, glandular-pubescent. Upper lip of the calyx with lobes 3–5 mm long, ovate-oblong to ovate, obtuse or subacute; lower lip lobed for 1/3–1/2 of its length. Corolla (14–)15–22 mm long (spur excluded), pale-violet to pinkish, rarely almost white, with violet veins in the tube; upper lip scarcely darker, with lobes obovate to \pm broadly oblong, obtuse; lower lip

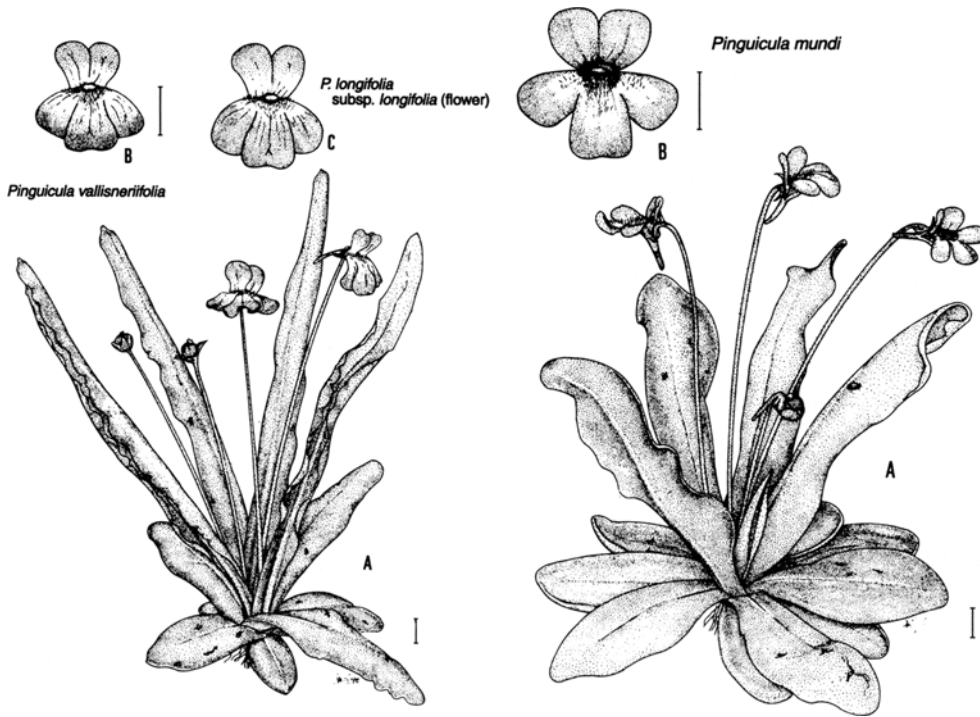


Fig. 5. *Pinguicula vallisneriifolia* and *Pinguicula mundi*; A – habit, B – flower. *P. longifolia* subsp. *longifolia*; C – flower. Scale bars 1 cm.

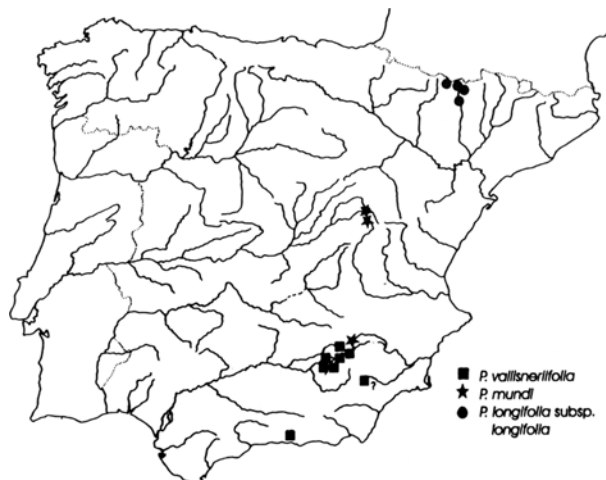


Fig. 6. Distribution map of *Pinguicula vallisneriifolia*, *P. longifolia* subsp. *longifolia* and *P. mundi*.

with lobes 6–13 mm long, longer than wide, obovate-oblong, overlapping, obtuse, coloured only in the upper part, the middle yellow-spotted near the base; throat white; tube very short, broadly infundibuliform, sparsely glandular outside; spur (9–)11–18 mm, cylindrical-subulate or subulate, straight or slightly-curved. Capsule 3–5 mm, ovoid; seeds 0.7–0.9 mm long, clavate, reticulate.

Chromosome number

2n=32 (LÖVE & KJELLQVIST 1974, ZAMORA et al. 1996).

Distribution

Endemic to the south of the Iberian Peninsula. The main centre of distribution of this species (Fig. 6) is in the Sierra de Cazorla and adjacent Sierra de Segura (Province of Jaén); it has also been seen by the present authors in a part of the Sierra de Segura, the river Tus, that is on the Province of Albacete side of the Jaén-Albacete border. There is also a disjunctive location in the Sierra de Cázulas (Province of Granada).

Ecological behaviour

Calcareous rock outcrops and at the feet of calcareous rocky outcrops, cave entrances, often in shady places. Calcicolous. Altitude: 600–1700 m. Flowering season: (IV–)V–VI(–VII).

Comments

The size, shape and colour of the corolla vary considerably in this species, following a north-south variation gradient in the Sierra de Cazorla and Sierra de Segura. The flowers of the northernmost populations are smaller and paler in colour, sometimes nearly white and even with no dark veins, whereas the flowers of the southernmost populations are larger, with a greater relative difference in size of the upper and lower petals, more brightly coloured and contrasted, and dark-veined (HERRERA et al. 1994).

The variability of this species has often caused it to be confused with other species described recently. Many of the citations made to date actually correspond to *P. mundi* and *P. dertosensis*, so the real distribution area of this taxon is far more limited than has often been thought.

6. *Pinguicula longifolia* RAMOND ex DC.

P. longifolia RAMOND ex DC. in LAM. et DC., Fl. Fr. ed. 3, 3: 728, 1805

Lectotype (**designated here**): Rochers du Port de Pinède (1797 M. RAMOND BBF 001442 left specimen!). Lectosytype: Vallée d'Ordesa (1802 M. RAMOND BBF 001442 right specimen!).

6.1. *Pinguicula longifolia* RAMOND ex DC. subsp. *longifolia* (Fig. 5C)

Description

Perennial herbs, with slender roots and stolons present, overwintering as a bud. Leaves suberect to erect, petiolate or sessile, with prominent median nerve on the back, with the margin not involute; spring leaves (at anthesis) (2.5–)3–6.5(–8) × 1.5–2.5(–2.8) cm, obovate to elliptic; summer leaves (at fruiting) 4–10, longer, 7–17(–20) × 1.2–2.5 cm, lanceolate to linear-lanceolate, undulate in the margins, obtuse or subacute. Pedicels 1–7, (5–)6–16(–17) cm long, glandular-pubescent. Upper lip of the calyx with lobes (3–)4–6 mm long, oblong to linear-oblong, obtuse or subacute; lower lip lobed for 1/2 of its length or sometimes nearly to the base. Corolla 18–27 mm long (spur excluded), violet, with veins in the tube; upper lip

scarcely darker, with lobes obovate to broadly oblong, obtuse; lower lip with lobes (7–)8–15 mm long, longer than wide, obovate-oblong, overlapping, obtuse, coloured in the upper 2/3, the middle one yellow-spotted near the base; throat white; tube very short, broadly infundibuliform, sparsely glandular outside; spur (9–)10–16(–18) mm, cylindrical-subulate, straight or somewhat curved. Capsule 4–5.5 mm, ovoid-subglobose; seeds 0.7–0.9 mm long, clavate, reticulate.

Chromosome number

$2n=32$ (DOULAT 1947, CASPER 1962, 1963, ZAMORA et al. 1996).

Distribution

Pinguicula longifolia is distributed in the mountainous regions of southern Europe, from the central part of southern France to the central Pyrenees (Spain) and central Apennines (Italy). It has three subspecies: subsp. *longifolia*, which is endemic to the Iberian Peninsula (central Pyrenees, Province of Huesca; Fig. 6); subsp. *caussensis* CASPER, from the central part of southern France, characterized by its smaller corolla (22–35 mm, spur included); and subsp. *reichenbachiana* (SCHINDL.) CASPER, from the mountains of northern and central Italy and south-eastern France, which is distinguished by the lobes of the upper lip of the calyx being linear, and by having sometimes more than 3 ones.

Ecological behaviour

Similar to *P. vallisneriifolia*. Altitude: (640–)900–2000 m. Flowering season: V–VII.

Comments

This species is closely related to *P. vallisneriifolia*, although no confusion between the two has occurred, since they are geographically isolated from each other (Fig. 6). This species, like *P. vallisneriifolia*, shows considerable morphological variation, as noted by GARCÍA & ANTOR (1992).

7. *Pinguicula mundi* BLANCA et al. (Fig. 5)

P. mundi BLANCA, JAMILENA, RUÍZ-REJÓN et ZAMORA, Pl. Syst. Evol. 200: 58, 1996.

Holotype: In orto fluminis Mundo, loco dicto Cueva de los Chorros, Sierra del Calar del Mundo, pr. Riópar (Albacete provincia, Hispania), 1200 m s.m. alt. (15.VI.1993 R. ZAMORA GDAC 37729!).

– *P. vallisneriifolia* auct. p.p., non WEBB 1853.

Description

Perennial herbs, with slender roots and stolons present, overwintering as a bud. Leaves 6–12(–15), suberect to erect, sessile, with prominent median nerve on the back, with the margin not involute, slightly undulate; spring leaves (at anthesis) 3–6 × 1.5–2.5 cm, elliptic to obovate-oblong; summer leaves (at fruiting) longer, 6–11 × 1.5–3 cm, elliptic to obovate. Pedicels 1–10, 5–12 cm long, glandular-pubescent. Upper lip of the calyx with lobes 2.5–3.5 mm long, triangular-obtuse or slightly elliptic, obtuse or subacute; lower lip lobed for up to 1/2 of its length. Corolla (12–)14–21(–23) mm long (spur excluded), violet, sometimes with weakly-marked veins; upper lip dark violet, with lobes suborbicular to obovate, obtuse; lower lip with lobes 6–12 mm long, longer than wide, obovate, overlapping, obtuse, coloured only in the upper half, the middle one white- to yellow-spotted near the base; throat dark violet, except in the middle lobe of the lower lip; tube short, broadly infundibuliform, sparsely

glandular outside; spur (8–)9–14(–15) mm, cylindric-subulate, straight, sometimes slightly bifid. Capsule 3–5 mm, ovoid to subglobose; seeds 0.8–1 mm, narrowly ellipsoidal, reticulate.

Chromosome number

$2n=48$ (ZAMORA et al. 1996). *P. mundi* very probably has an allopolyploid origin, as ZAMORA et al. (1996) stated, from the crossing of a tetraploid species ($2n=32$, probably *P. vallisneriifolia*) with a diploid one ($2n=16$), and the subsequent duplication of the chromosome number.

Distribution

Endemic to the Iberian Peninsula: Serranía de Cuenca (Province of Cuenca and SE of the Province of Guadalajara); Sierra de Alcaraz and Sierra de Calar del Mundo (Province of Albacete). The distribution area of this species (Fig. 6) has been widened considerably in the most recent studies made, since when it was described it was considered to be restricted to the headwaters of the Mundo River (with a single place of occurrence, ZAMORA et al. 1996: 57).

Ecological behaviour

Bryocormophyte communities on calcareous banks and outcrops. Altitude: 900–1600 m. Flowering season: (V–)VI–VII.

Comments

This species was previously confused with *P. vallisneriifolia*, since it also has suberect leaves, with an undulated margin, which grow for a considerable time after anthesis. However, there are notable differences in the chromosome number and the elliptic to obovate summer leaves of *P. mundi*, which have a slightly undulate margin, and also the dark violet throat of the corolla, whereas *P. vallisneriifolia* has summer leaves ligulate with the margin markedly undulate and throat of the corolla white.

Subgen. *Micranthus* CASPER, Feddes Repert. 66: 41, 1962

Roots stout. Overwintering as a bud. Flowers small. Corolla white, with yellow spots in the throat; corolla-lobes entire; spur curved. Capsule pear-shaped, somewhat over twice the length of the calyx.

8. *Pinguicula alpina* L. (Fig. 7)

P. alpina L., Sp. Pl. 17, 1753.

Ind. loc.: “Habitat in Alpibus Lapponicis”.

Lectotype (BLANCA & JARVIS, **designated here**): Although there is a specimen labelled as *P. alpina* in LINN (sheet 33.2!), the annotations seem to not be by Linnaeus and it does not appear to be original material for the name. There is an original specimen in the Lapland herbarium in the Institut de France, Paris!; this is in rather poor condition. Linnaeus took his diagnosis from his *Flora lapponica* account (LINNAEUS 1737), where there is an illustration (t. 12, f. 3), which is here selected as the lectotype.

Description

Perennial herbs with brownish, long and relatively thick roots, overwintering as a bud, without stolons. Leaves 5–8, horizontal, close to the soil, sessile, the margin involute; spring leaves (at anthesis) 1.5–3 × 0.5–1 cm, oblong-elliptic to oblong-lanceolate, yellowish-green; summer leaves (at fruiting) similar to spring leaves. Pedicels 1–4(–5), 4–10 cm long, glabrous

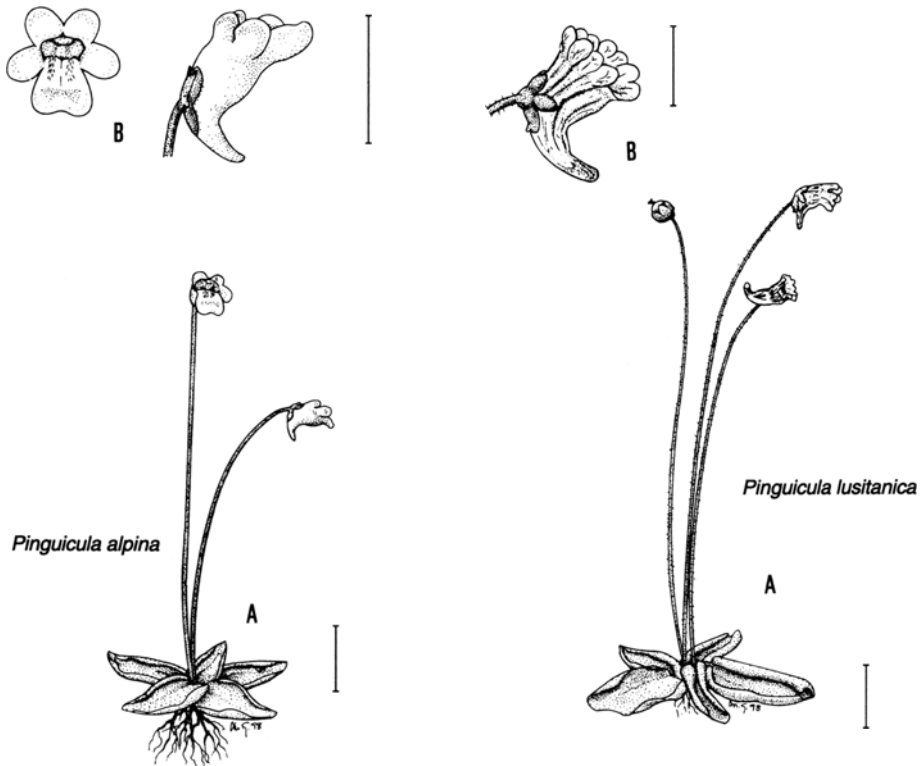


Fig. 7. *Pinguicula alpina*; A – habit, B – flower. Scale bars 1 cm. *Pinguicula lusitanica*; A – habit, B – flower. Scale bar: A – 1 cm, B – 0.5 cm.

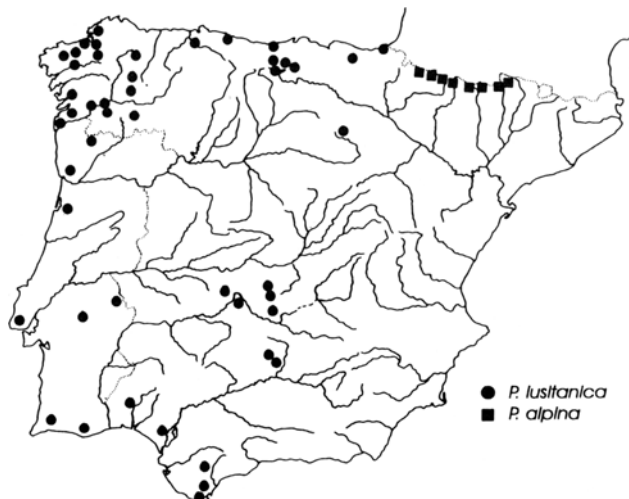


Fig. 8. Distribution map of *Pinguicula alpina* and *P. lusitanica* in the Iberian Peninsula.

or sparsely glandular principally in the top. Calyx glabrescent; lobes of the upper lip 2.2–2.7(–3) mm long, triangular to ovate, obtuse or subacute, scarcely divergent; lower lip lobed for up to 1/3 of its length, lobes not divergent. Corolla 7–11(–12) mm (spur excluded), white, with yellow spots at the throat, lips markedly unequal; upper lip shorter, with lobes suborbicular, obtuse; lower lip with lobes not overlapping, the middle one 4–6(–7) mm, much longer than lateral ones, with apex obtuse or truncate; tube short, broadly infundibuliform, glabrescens outside; spur 2–3(–4) mm, conoidal or subcylindrical, obtuse, curved, yellowish. Capsule 6–7 mm long, pear-shaped, acute, longer than the calyx; seeds 0.7–0.8 mm long, oblong, rugose-striate or obscurely reticulate.

Chromosome number

2n=32 (LÖVE & LÖVE 1944, 1956, DOULAT 1947, WOOD & GODFREY 1957, CASPER 1962, 1963, MURÍN et al. 1980).

Distribution

Mountainous and alpine regions of Eurasia. In the Iberian Peninsula it is only present in the central Pyrenees (Provinces of Navarra, Huesca and Lérida; Fig. 8).

Ecological behaviour

Damp and shady places, waterlogged pastures, banks of streams, etc. Calcicolous. Altitude: 1800–2700 m. Flowering season: VII–VIII.

Subgen. *Isoloba* BARNHART, Mem. New York Bot. Gard. 6: 51, 1916

Roots slender. Overwintering as a rosette. Flowers small. Corolla pale lilac to pinkish, with lips subequal and lobes all emarginate; spur deflexed. Capsule subglobose, scarcely larger than the calyx.

9. *Pinguicula lusitanica* L. (Fig. 7)

P. lusitanica L., Sp. Pl. 17, 1753. Ind. loc.: “Habitat in Lusitania”.

Neotype (BLANCA & JARVIS, **designated here**): Habitat in arenosis humidis pr. S. Gens, Sta Cruz do Bispo, circa Porto (V.1883 E. JOHNSTON – Flora lusitanica exsiccata no. 2662, Herbario A.A. de Carvalho Monteiro, BM!).

There seem to be no original elements for this name, with no specimens traceable, and only a brief description, without any illustration. Therefore a neotype had to be selected.

Description

Perennial herbs with slender roots, overwintering as a rosette, without stolons. Leaves 5–12, horizontal, close to the soil, shortly petiolate, sometimes with petiole up to 1/2 of the limb, the margin strongly involute; spring leaves (at anthesis) (0.7–)1–3(–3.5) × 0.3–0.9(–1) cm, oblong to oblong-ovate, sometimes elliptic or obovate, greyish, with purple veins; summer leaves (at fruiting) similar to spring leaves. Pedicels 1–6(–8), (3–)4–20(–25) cm long, very slender, glandular-pubescent principally in the upper part. Upper lip of the calyx with lobes (1.5–)2–4 mm long, ovate, obtuse or subacute, strongly divergent; lower lip lobed for up to 1/3 of its length, lobes scarcely divergent. Corolla 5–9 mm long (spur excluded), pale lilac to pinkish with marked veins, yellow at the throat; lips subequal, with lobes 1.5–3.5 mm, not overlapping, suborbicular and emarginate; tube cylindrical, longer than the lobes; spur 2.5–4.5(–5) mm, subcylindrical, sometimes enlarged in the apex, obtuse, deflexed, yellowish.

Capsule 2.5–4.5 mm long, subglobose; seeds 0.5–0.6 mm long, oblong to narrowly ellipsoidal, prominently reticulate.

Chromosome number

2n=12 (CONTANDRIOPOULOS 1962, KONDO 1969, SCHOTSMAN 1970).

Distribution

Western Europe (British Isles, France, Spain and Portugal) and north-west Africa (Morocco). In the Iberian Peninsula it is distributed throughout the western half (Fig. 8).

Ecological behaviour

Peat bogs, waterlogged places, banks, etc. Silicicolous. Altitude: 10–1200 m. Flowering season: IV–VIII.

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REFERENCES

- AGUILLELLA A., TIRADO J. & VILLAESCUSA C. (1992): Consideraciones sobre el género *Pinguicula* en la provincia de Castellón. *Anales Jard. Bot. Madrid* 50: 121.
- BOLÒS O. & VIGO J. (1983): Notes sobre taxonomia i nomenclatura de les plantes, II. *Collect. Bot. (Barcelona)* 14: 89–103.
- BRITTON N.L. & BROWN A. (1913): *An illustrated flora of the Northern United States*. Ed. 2. Charles Scribner's sons, New York.
- CANIGUERAL J. (1957): Una variedad de *Pinguicula grandiflora* en los montes cercanos a Tortosa: *Pinguicula grandiflora* LAMK. var. *dertosensis* nova. *Collect. Bot. (Barcelona)* 5: 413–415.
- CASPER S.J. (1962): Revision der Gattung *Pinguicula* in Eurasien. *Feddes Repert.* 66: 1–148.
- CASPER S.J. (1963): Gedanken zur Gliederung der Gattung *Pinguicula* L. *Bot. Jahrb. Syst.* 82: 321–335.
- CASPER S.J. (1966): Monographie der Gattung *Pinguicula* L. *Biblioth. Bot.* 127/128: 1–209.
- CASPER S.J. (1972): *Pinguicula* L. In: TUTIN T.G., HEYWOOD V. H., BURGESS N.A., MOORE D.M., VALENTINE D.H., WALTERS S.M. & WEBB D.A. (eds.), *Flora europaea* 3, Cambridge University Press, Cambridge, pp. 294–296.
- CONTANDRIOPOULOS J. (1962): Recherches sur la flore endémique de la Corse et sur ses origines. *Ann. Fac. Sci. Marseille* 32: 1–354.
- COUTINHO A.X.P. (1939): *Flora de Portugal*. Ed. 2. Ailland, Alves & Cia, Lisboa.
- CUETO M. (1989): *Los recursos vegetales de las Sierras de María y Orce como base para la gestión de un espacio natural*. Ph.D. thesis, Universidad de Granada, Granada.
- CUETO M. & BLANCA G. (1997): *Flora del Parque Natural "Sierra de María-Los Vélez"*. SAHN, Almería.
- DOULAT E. (1947): Recherches caryologiques sur quelques *Pinguicula*. *Compt. Rend. Acad. Sci. Paris* 225: 354–356.
- FALK D.A. & HOLSINGER K.E. (1991): *Genetics and conservation of rare plants*. Oxford University Press, New York.
- GARCÍA M.B. & ANTOR R.J. (1992): Variabilidad fenotípica de un endemismo localizado en islas ecológicas: *Pinguicula longifolia* subsp. *longifolia* (Lentibulariaceae). *Pirineos* 139: 97–104.
- GIVNISH T.J. (1989): Ecology and evolution of carnivorous plants. In: ABRAHAMSON W.G. (ed.), *Plant-animal interactions*, McGraw Hill, New York, pp. 243–290.
- HERRERA C., ZAMORA R., BENAVENTE A., LUQUE P. & NIETO R. (1994): *Pinguicula vallisneriifolia*. *Planes de Actuación de las Especies Vegetales Amenazadas*. Agencia de Medio Ambiente, Sevilla.
- HESLOP-HARRISON Y. (1978): Plantas carnívoras. *Invest. Ci.* 19: 56–66.

- HITCHCOCK A.S. & GREEN M.L. (1929): Standard-species of Linnaean genera of *Phanerogamae* (1753-1754). In: *Int. Bot. Congr. Cambridge (England), 1930, Nomencl. Prop. Brit. Bot.*, pp. 111-199.
- JARVIS C.E., BARRIE F.R., ALLAN D.M. & REVEAL J.L. (1993) (eds): A list of Linnaean generic names and their types. *Regnum Veg.* 127: 1-100.
- JUNIPER B.E., ROBINS R.J. & JOEL D.M. (1989): *The carnivorous plants*. Academic Press, London et al.
- KONDO K. (1969): Chromosome numbers of carnivorous plants. *Bull. Torrey Bot. Club* 96: 322-328.
- LAANE M.M. (1967): Chromosome numbers in the flora of eastern Finmark. II. *Blyttia* 25: 45-54.
- LAANE M.M. (1969): Further chromosome studies in Norwegian vascular plants. *Blyttia* 27: 5-17.
- LINNAEUS C. (1737): *Flora lapponica*. Salomonem Schouten, Amsterdam.
- LÖVE A. & KJELLQVIST E. (1974): Cytotaxonomy of spanish plants. IV. Dicotyledons: *Caesalpinaceae-Asteraceae*. *Lagasalia* 4: 153-211.
- LÖVE A. & LÖVE D. (1944): Cytotaxonomical studies on boreal plants. III. Some new chromosome numbers of Scandinavian plants. *Arkiv. Bot.* 31A, 12: 1-22.
- LÖVE A. & LÖVE D. (1948): Chromosome number of Northern plant species. *Rept. Dept. Agric. Univ. Inst. Appl. Sci. (Iceland), Ser. B* 3: 9-131.
- LÖVE A. & LÖVE D. (1956): Cytotaxonomical conspectus of the Icelandic flora. *Acta Horti Gothob.* 20: 65-291.
- LÖVE A. & LÖVE D. (1982): [Report]. In: LÖVE A. & LÖVE D. (eds.), IOPB Chromosome number reports LXXV, *Taxon* 31: 344-360.
- MATEO G. & CRESPO M.B. (1995): *Flora abreviada de la Comunidad Valenciana*. Ed. Gamma, Alicante.
- MURÍN A. (1976): Index of chromosome numbers of Slovakian flora. Part 5. *Acta Fac. Rerum Nat. Univ. Comeniana, Bot.* 25: 1-18.
- MURÍN A., HÁBEROVÁ I. & C. ŽAMSRAN C. (1980): Karyological studies of some species of the Mongolian flora. *Folia Geobot. Phytotax.* 15: 395-405.
- RIVAS MARTÍNEZ S., DÍAZ T.E., PRIETO J.A.F., LOIDI J. & PENAS A. (1984): *Los Picos de Europa*. Ed. Leonesas, León.
- SCHEMSKE D.W., HUSBAN B.C., RUCKELSHAUS M.H., GOODWILLIE C., PARKER I.M. & BISHOP J. (1994): Evaluating approaches to the conservation of rare and endangered plants. *Ecology* 75: 584-606.
- SCHOTSMAN H.D. (1970): Contribution à la caryologie des angiospermes de la Sologne et du Val de Loire. *Bull. Cent. Étud. Rech. Sci.* 8: 21-63.
- SENNEN F. (1936): Plantes d'Espagne. Diagnoses et comentaires. Troisième partie. *Bol. Soc. Ibér. Ci. Nat.* 35: 17-32.
- WOOD C.E. & GODFREY R.K. (1957): *Pinguicula (Lentibulariaceae)* in the southeastern United States. *Rhodora* 59: 217-230.
- ZAMORA R., JAMILÉNA M., RUÍZ REJÓN M. & BLANCA G. (1996): Two new species of the carnivorous genus *Pinguicula (Lentibulariaceae)* from Mediterranean habitats. *Pl. Syst. Evol.* 200: 41-60.

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Encl. Appendix pp. 356-361

APPENDIX

Material studied

P. vulgaris (Fig. 2)

Andorra. 31TCH9209 (UTM coordinate), Grau-Roig to Estanys dels Pessons, 2350 m (3.VII.1992 C. NAVARRO et al. MA 525601). **Spain. Barcelona:** Bagà, pr. Santuario de Pallars (15.VI.1969 J. FERNÁNDEZ CASAS MA 411396). **Cuenca:** WK98, Sierra del Tremedal, Tajo gorge, 1500 m (9.VII.1979 G. LÓPEZ MA 439040). **Gerona:** Mollera, SE Matagalls, 1500 m (1.VII.1982 J.M. PANAREDA & J. NUET BC 641319). Puigmal, eastern Pyrenees, 2400 m (21.VII.1922 J. CUATRECASAS MAF 33519). Puigmal, Ribes Valley (no date R. GARCÍA ADÁ et al. MA 439056). Sant Antoni, Camprodón, 1200 m (8.VI.1921 J. CUATRECASAS BC 53063, MAF 33518). **Guadalajara:** 30TXK0885, Orea, SE Orea campsite, 1540 m, *Sphagnum* peat bog (26.VI.1997 L.M. FERRERO, L. MEDINA & J.M. PISCO MA 589327). **Huesca:** Aisa, Igüer, 1620 m (18.VI.1986 P. MONTSERRAT & J.L. REMON JACA 417686). Aneto, Llauset, 2200–2400 m (17.VIII.1984 G. MONTSERRAT JACA 177184). Benasque, 2100–2480 m (17.VII.1992 J.A. SESE & J.L. BENITO JACA 260592). Canfranc, Circo de Ip, 2120 m (19.VII.1989 J.V. FERRÁNDEZ JACA 443989). Panticosa, Bachimaña, 2250 m (28.VII.1982 L. VILLAR et al. JACA 132882). Ibidem, 2200 m (26.VII.1983 L. VILLAR et al. JACA 243783). Piedrafita de Jaca, 1700 m (18.VI.1992 L. VILLAR et al. JACA 96792). 30TYN0834, Pyrenees, Ip pond, 2150 m (31.VII.1985 M. LUCEÑO et al. MA 439054). Renclusa, Benasque (7.VIII.1979 F. AMICHET al. SALA 23102). Ibidem, 2300 m (10.VII.1975 D. BELMONTE MAF 119798). 30TYN0939, Sallent del Gállego, Formigal, 2200 m (26.VII.1982 P. & G. MONTSERRAT JACA 114182, MA 314171). Tòrta, river Ara, 1850–2200 m (28.VI.1983 L. VILLAR JACA 191283). Sarriós Valley, Ansó, 2000–2150 m (12.VIII.1988 P. MONTSERRAT & L. VILLAR JACA 263288). Ordesa Valley (23.V.1960 F. BELLOT & B. CASASECA MA 182695). Yebra de Basa, Oturia, 1500 m (9.VI.1979 P. MONTSERRAT JACA 76079). **León:** 29TPG8681, La Baña, Sierra de la Cabrera, 1400 m (10.VII.1981 LANSAC & G. NIETO FELINER MA 328481). 29TQG0775, Truchas, Sierra de la Cabrera, El Vizcodillo, 1750 m (5.VII.1978 E. TEMPRANO MA 328483). 29TQG0774, Ibidem, 1650 m (10.VII.1983 G. NIETO FELINER MA 328484). **Lérida:** Espot, 2350–2600 m (7.VIII.1979 L. VILLAR JACA 564574). Ibidem, La Mosquera, 2050 m (14.VII.1934 W. ROTHMALER BC 78039, MAF 103246). Riu (8.VIII.1963 A. SEGURA ZUBIZARRETA MA 354200). **Teruel:** 30TXK029277, Albarracín, 1530 m, limestone spring (25.VI.1997 L.M. FERRERO & L. MEDINA MA 589326). De Guadalaviar a Griegos, waterlogged meadows (13.VII.1989 E. BAYÓN & E. MONASTERIO MA 503031). **Zamora:** Between Porto and Puente Porto reservoir (11.VIII.1985 E. RICO SALA 47074). Peña Trevinca, 1900 m (3.VIII.1965 M. LAÍNZ MA 198802). San Martín de Castañeda, Peces pond, (10.VII.1979 M. LADERO GDA 6826). Ibidem (19.VI.1981 F. AMICH SALA 25338). Sierra Calva de Porto, (19.VII.1973 B. CASASECA MA 197860, MAF 89885, SALA 5684). Sierra de Moncalvo, 1700 m (VI.1948 M. LOSA BC 114351).

P. nevadensis (Fig. 2)

Spain. Granada: 30SVG6301, Dñlar ravine, 2350 m (8.VII.1988 M.L. GIL & J.A. ALEJANDRE MA 467878). Capileira, River Seco pond, 3000 m (VIII.1975 J. MOLERO MESA GDA 10023). Ibidem, Trancada de Aguas Verdes, 3000 m (24.VI.1976 J. MOLERO MESA GDA 10024). Los Bérchules, river Chico ravine, 2200 m (27.VIII.1979 J. MOLERO MESA GDA 10022). Sierra Nevada (VII.? M. RIVAS MATEOS MAF 33497). Ibidem, 2500 m (10.VI.1993 R. ZAMORA GDAC 37730). 30SVG6801, Ibidem, below the summit of Veleta, 3100 m (22.VII.1984 M. LUCEÑO MA 439053). Ibidem, Guarnón ravine (VII.1976 J.A. GIL GDAC 2967). Ibidem, San Juan ravine (8.VII.1973 J. FERNÁNDEZ CASAS MA 421543). Ibidem, San Juan ravine, 2600 m (no date C. MORALES GDAC 6071). Ibidem, El Chorrillo “borreguil” (15.VII.1981 J. M. NIETO MGC 8648). Ibidem, San Juan “borreguiles”, 2600 m (3.VII.1988 A. PÉREZ LATORRE MGC 26018). Ibidem, Otero fields, 2100 m (25.VI.1970 C. MORALES GDAC 963). Ibidem, Chorreras Negras, 3000 m (14.VIII.1906 C. PAU MA 115280). Ibidem, Mora basin (9.VII.1970 M.C. FISAC MAF 78340). Ibidem, Mora basin, 2100 m (7.VII.1971 J. FERNÁNDEZ CASAS MA 411326). Ibidem, Mora basin, 2500 m (8.VII.1983 J. FERNÁNDEZ CASAS MA 422508). Ibidem, San Juan basin, 2000 m (5.VII.1971 J. FERNÁNDEZ CASAS MA 410283). Ibidem, Aguas Verdes pond, (6.VII.1953 MUÑOZ MEDINA GDAC 6197). Ibidem, Aguas Verdes pond, 2950 m (22.VIII.1979 F. PÉREZ RAYA GDA 15187). Ibidem, Las Yeguas pond (VII.1965 J. VARO GDAC 962). Ibidem, Las Yeguas pond (27.VII.1967 A. SEGURA ZUBIZARRETA MA 354201). Ibidem, Lanjarón, Colorado rock, 2900 m (30.VII.1930 C. VICIOSO MA 115237). Ibidem, Chordi hill, 2600 m (9.VII.1976 L. GARCÍA GDAC 3538). 30SVG6604,

Ibidem, river San Juan (6.VII.1988 R. GAVILÁN MAF 129786). Ibidem, Trevélez, Siete Lagunas gully, 2900 m (31.VII.1978 J. MOLERO MESA GDA 10025).

***P. grandiflora* subsp. *grandiflora* (Fig. 4)**

Andorra. 31TCH9212, Grau Roig, banks of River Valira, "Bordas de Envalira", 2050 m (3.VII.1992 G. NIETO FELINER MA 514088). **Spain. Alava:** 30TVN9657, Amurrio, Sierra de Salvada, Tertanga ravine, 570 m (21.IV.1985 B.F. BETOÑO & J.A. ALEJANDRE MA 339630). Pipaon, 950 m (VI.1929 M. LOSA MA 115252, MAF 33485). **Almería:** Sierra de Abrucena (4.V.1929 E. GROS MA 115245). Ibidem (2.VII.1929 E. GROS MA 115246). Sierra Nevada, Diablo ravine, 1700 m (2.VI.1995 G. BLANCA GDAC 40126). **Asturias:** Cangas de Onís, 500 m (17.V.1993 R. ZAMORA GDAC 37724). Colunga (V.1914 HNO. JERÓNIMO BC 53037, 832089, MA 115254). Covadonga, 1050 m (18.VI.1969 P. MONTSERRAT JACA 264769). Ibidem (5.V.1976 B. CASASECA et al. MA 207723). Lake Enol (18.VI.1969 A. SEGURA ZUBIZARRETA MA 354202). Arvás pond (12.VII.1974 S. RIVAS GODAY et al. MA 439047, MAF 90311). Picos de Europa, lake Ercina, 1100 m (15.V.1993 R. ZAMORA GDAC 37723). Ibidem, Peña Vieja (15.VII.1976 B. CASASECA et al. SALA 9233). Ibidem, Vega Redonda (17.VIII.1951 E. GUINEA MA 164262). Puerto de Leitariegos (8.VI.1864 E. BOURGEAU MA 115253). Ibidem, 1550 m (15.VII.1935 P. FONT QUER BC 92522). Ibidem, Arvás pond, 1860 m (12.VII.1974 S. CASTROVIEJO MA 439042). Pajares pass (17.V.1914 C. MARTÍNEZ MA 149048). Ventana pass (27.V.1981 B. CASASECA & F.J. FERNÁNDEZ DÍEZ MGC 10388). 29TQH4372, Ibidem, 1600 m (27.V.1981 B. CASASECA & F.J. FERNÁNDEZ DÍEZ SALA 63823). Ibidem, 1600 m (27.V.1981 B. CASASECA et al. BC 640321, GDA 13159, MA 258342, MAF 111988, SALA 25980). 30TQH57, Ibidem, 1550 m (21.VII.1981 F. PÉREZ RAYA et al. GDA 13726, GDAC 12633). Santuario de Covadonga (7.III.1974 M. LADERO et al. MAF 94496). 30TUN5582, Sotres, 1150.1800 m (7.VII.1978 S. CASTROVIEJO et al. MA 439045). Trescares, Peñamellera Alta (18.III.1987 C. AEDO MA 391020). **Barcelona:** Berguedá, Molí de Llinars, Riera de Canals (30.V.1954 J.C. VIVES BC 145132, 602635). Ibidem, Torre de Canals, Llinars de Berga (17.VI.1956 J.C. VIVES BC 145131). **Burgos:** Lunada, 1500.1600 m (20.VI.1983 P. MONTSERRAT JACA 172683). Montes Obarenes (1908 HNO. ELÍAS BC 53052). Ibidem (20.VI.1910 HNO. ELÍAS BC 53053, 832091). Ibidem, 900 m (6.VI.1918 HNO. ELÍAS BC 53083, 832087, 832088). Ibidem (15.VI.1997 G. BLANCA M. RUÍZ-REJÓN & R. ZAMORA GDAC 42110). Los Tornos pass, 925 m (19.VI.1983 P. MONTSERRAT & J.L. GONZÁLEZ REBOLLAR JACA 160883). Quintanar de la Sierra (8.VII.1914 P. FONT QUER BC 53036). Sierra de la Demanda, San Millán (VII.1981 J. GUERRA & E. SALVO MGC 8228). VN3838, between Valdelateja and Quintanilla. Escalada (24.IV.1982 A. BARRA MA 439046). **Cantabria:** Aliva (21.VIII.1950 E. GUINEA MA 164258). Between Potes and Urdón (1.IV.1980 F. AMICH & J. SÁNCHEZ MA 258344, SALA 23497). 30TUN86, Hermandad de Campo de Suso, 1600 m (3.VII.1987 E. VILLANUEVA et al. MA 437470). La Hayuela (31.V.1951 M. LAÍNZ BC 117296). La Hermita, 200 m (11.III.1977 P. MONTSERRAT & F. FILLAT JACA 5777). Picos de Europa, Peña Vieja (16.VII.1954 B. CASASECA MAF 60662). Ibidem (15.VII.1976 B. CASASECA et al. MA 204279). Potes, La Hermita gorge (21.III.1975 J. VARO et al. GDAC 4092). Lunada pass, 1350 m (15.VII.1980 A. SEGURA ZUBIZARRETA MA 354197). Tornos pass (20.VI.1975 A. SEGURA ZUBIZARRETA MA 354206). Ruentes (7.VII.1954 B. CASASECA SALA 2052). Soto de Campó, Campó de Suso, Palombera pass (16.VI.1984 C.J. VALLE SALA 69188, 69189). **Gerona:** Camprodón, 1400 m (15.VI.1921 J. CUATRECASAS MAF 33486). Núria (VII.1880 TREMOLS MA 115251). Ibidem, 2000 m (20.VII.1922 J. CUATRECASAS MAF 33487). Ibidem, Núria road (VIII.1919 M. GALLARDO BC 126124). Ibidem, Monseny (VII M. RIVAS MATEOS MAF 33488). Puigmal (21.VII.1922 J. CUATRECASAS BC 53045). Ripollés, Feifús (29.VI.1957 A. & O. BOLÒS BC 617062). Ribes Valley, 825 m (3.VI.1975 J. VIGO BC 611164). Ibidem, Toses, 1900 m (23.VI.1968 J. VIGO & A. ANGLADA BC 604204). **Guipúzcoa:** Campa de Urbia, Aitzgorri massif, 1100 m (7.VI.1981 J. LOIDI & ARNÁIZ MAF 115567). Erlo-Izarraitz massif (5.VII.1979 J. LOIDI MAF 112973). **Huesca:** Aisa, Candanchú-Tortíella, 1800–1900 m (13.VII.1969 P. MONTSERRAT JACA 422469). Ibidem, El Bozo, 2050–2100 m (19.VII.1967 P. MONTSERRAT & G. RODRÍGUEZ JACA 429467). Ibidem, Tobazo, 1950 m (11.VII.1971 P. MONTSERRAT & L. VILLAR JACA 443471). Ansó, Agua Tuerta, 1650 m (23.VI.1975, L. VILLAR JACA 10049675). Ibidem, Marcón ravine, 1350 m (L. VILLAR JACA 10063972). Ibidem, Zuriza, 1100 m (30.V.1972 L. VILLAR JACA 10028672). Biescas, 1100 m (20.VI.1971 P. MONTSERRAT JACA 323871). Bisauri, 1850–1950 m (5.VII.1987 J.A. SESE et al. JACA 687787). Campó, river Essera, central Pyrennees (14.V.1934 J. CUATRECASAS MAF 33489). Candanchú (6.VII.1947 S. RIVAS GODAY & E. FERNÁNDEZ GALIANO MAF 77742). Ibidem (7.VIII.1972 M.E. RON SALA 4451). Canfranc (VII.1921 C. VICIOSO MA 115278). Castillo de Jaca, 850 m (24.VI.1971 P. MONTSERRAT & L. VILLAR JACA 345271). Circo de Soaso, Torla, Ordesa, 1700 m (18.VII.1929 J. CUATRECASAS BC 53049). Ibidem, 1750–1800 m (3.VII.1973 P. MONTSERRAT & L. VILLAR JACA 274773). Fanlo, Añisclo, 1000–1040 m (6.IV.1972 P.

MONTERRAT & L. VILLAR JACA 35372). Gistaín, Paso del Gato, 1950 m (12.VII.1980 P. MONTERRAT & F. FILLAT JACA 268580). Hecho, Chipeta, 2170–2200 m (11.VII.1975 L. VILLAR JACA 10097175). Jaca, El Boalar, 900 m (18.V.1970 P. MONTERRAT JACA 99370). Larra, Pyrenees (5.VIII.1973 A. ASENSI & B. DíEZ MGC 590). Laspuña, Peña Montañesa, 1850–2000 m (31.VII.1975 P. MONTERRAT & L. VILLAR JACA 401575). Los Lecherines (3.VIII.1979 F. AMICH et al. MA 258355, SALA 23103). Panticosa (VIII.1918 L. ATERIDO MA 149053, 149068). Ibidem (30.VI.1953 J. MALATO BÉLIZ MA 283290). Ibidem, Bachimaña, 1850 m (21.V.1967 P. MONTERRAT JACA 363067). Ibidem (10.VII.1960 S. RIVAS GODAY & S. RIVAS MARTÍNEZ MAF 92113). Ibidem (14.VII.1965 S. RIVAS MARTÍNEZ et al. MAF 103244). Peña Montañesa, 2000–2250 m (23.VIII.1980 P. MONTERRAT & D. GÓMEZ JACA 461080). Plan, 1200 m (1.V.1993 R. ZAMORA GDAC 37725). Sallent de Gállego, 1700 m (2.VII.1971 L. VILLAR & A. LANASPA JACA 391771). Ibidem, 1850–1900 m (20.VII.1981 L. VILLAR JACA 165481). Ibidem, 2100 m (9.VII.1980 P. MONTERRAT & L. VILLAR JACA 252080). 30TYN0442, Ibidem, river Aguas Limpías, 1480 m (10.VI.1970 P. MONTERRAT & L. VILLAR BC 636949, GDA 13484, MA 258345, 354196, SALA 23740). Santa Cruz de la Serós, 1100 m (5.VI.1978 A. LANASPA JACA 53578). 30TYN0442, Astún Valley, between Candanchú and the Somport pass, 1620–1680 m (21.V.1982 A. BARRA et al. MA 439050). Ordesa Valley (23.V.1960 F. BELLOT & B. CASASECA SALA 2051). Yebra de Basa, 1580 m (9.VI.1979 P. MONTERRAT JACA 66079). **La Rioja:** Sierra Cebollera, Lomos de Orios (21.VII.1983 F. AMICH & ELÍAS SALA 28250). 30TVM97, Sierra de la Demanda, near Pozo Negro pond, 1700 m (9.VIII.1976 J. FERNÁNDEZ CASAS MA 395785). 30TWM0576, Ibidem, San Millán de la Cogolla, 1400–1550 m (12.VII.1985 F. HERAS & J.A. ALEJANDRE MA 339628). Valdezcaray, Sierra de San Lorenzo (12.VII.1981 F. AMICH & J. SÁNCHEZ MA 258341, 258343). Ibidem, 1600 m (31.VII.1979 F. AMICH SALA 23208). Ibidem (21.VII.1981 F. AMICH & J. SÁNCHEZ SALA 23197). **León:** Corona-Caín, 550 m (26.III.1978 C. GARCÍA GONZÁLEZ JACA 50585). El Tombo, Corona, 700 m (18.VI.1978 C. GARCÍA GONZÁLEZ JACA 479685). Monte Fontún (5.VI.1978 J.M. LOSA QUINTANA MA 354203, MAF 101690). Vegarada pass, 1560 m (29.VI.1983 E. BAYÓN et al. MA 439049). Ventana pass (18.VI.1979 F. AMICH et al. MA 258347, SALA 20569). River Cares, Cordiñanes, Posada de Valdeón, 600 m (3.V.1964 M. LAÍNZ BC 373800). Vegahuerta, 2050 m (13.VIII.1978 C. GARCÍA GONZÁLEZ JACA 479585). Villarino del Sil (13.IV.1976 B. CASASECA SALA 10889). **Lérida:** Alt Urgell, between Coll de Narsó and Vall Jasques, 800 m (16.V.1972 O. BOLÓS BC 606781). Boí, river Noguera de Tior (28.VII.1944 O. BOLÓS BC 95292). 31TCH31, Espot, 1700 m (9.VII.1977 J. FERNÁNDEZ CASAS et al. MA 409572). Ibidem, lake Amitges (24.VII.1980 B. CASASECA et al. SALA 47849). 31TCH3616, Ibidem, lake San Mauricio, 1850 m (11.VII.1988 R. MORALES et al. MA 456453). Ibidem, Ribera de Peguera, 1600 m (5.VII.1934 W. ROTHMALER BC 78040, MAF 103245). Selva Plana, Alt Pallars, 2100 m (19.VII.1912 P. FONT QUER BC 53042). Arán Valley (VII.1909 M. LLENAS BC 53039). Ibidem, 1680 m (3.VI.1982 A.M. ROMO BC 676464). Ibidem, 1950 m (4.VII.1934 P. FONT QUER BC 78988). Vall Ferrera, Estany d'Aixeus, 1900 m (13.VII.1975 J.E. FARSENY BC 619879). **Lugo:** Piornedo (29.VI.1982 F. AMICH et al. SALA 50813). Sierra de Ancares, Lagos summit, 1700 m (6.VII.1965 M. LAÍNZ BC 596135). 29TPH74, Ibidem, 1400 m (29.VI.1982 G. NIETO FELINER MA 328482). Sierra del Caurel, 1350 m (19.VII.1935 P. FONT QUER & W. ROTHMALER BC 92521). Vivero, San Martín en Galdo hermitage (2.V.1957 F. BELLOT & B. CASASECA MA 182528). **Madrid:** Circo de Hoyocerrado, Peñalara massif, 1650 m (4.VII.1983 S. RIVAS MARTÍNEZ et al. MAF 120283). Peñalara (25.VI.1986 A. GALÁN MAF 125856). Ibidem, 2300 m (24.VII.1927 H. CRUZOTT MAF 60280). **Navarra:** Lizarraga, 1000 m (21.VI.1972 P. MONTERRAT JACA 336572). Velate pass (13.V.1973 S. CASTROVIEJO MA 439043). Sierra de Aralar, 1150 m (15.V.1993 R. ZAMORA GDAC 37726). Sierra de Urbasa (16.IV.1972 E. FUERTES & M. LADERO MAF 82377). Roncal Valley, Eraice, 1650 m (20.VII.1970 P. MONTERRAT & L. VILLAR JACA 374770). Ibidem, Belagua refuge (23.VII.1981 S. RIVAS MARTÍNEZ et al. MAF 113594). Ibidem, Belagua-Larra, 1700 m (2.VIII.1967 P. MONTERRAT JACA 475767). Ulzama-Velate, 820–880 m (14.VI.1968 P. MONTERRAT JACA 253268). **Soria:** Montenegro (4.VII.1958 A. SEGURA ZUBIZARRETA MA 354195). Picos de Urbión, 2000 m (4.VII.1958 P. MONTERRAT JACA 49958). Ibidem, El Machachón (16.VII.1975 S. RIVAS MARTÍNEZ et al. MAF 93903). 30TWM1251, Ibidem, Larga pond, 2000 m (16.VII.1986 M. LUCEÑO & P. VARGAS MA439055). Ibidem, Larga pond, 2000 m (23.VIII.1972 P. MONTERRAT & L. VILLAR JACA 706472). Pinar de Covaleta (8.VI.1933 L. CEBALLOS MA 115247). River Urbión (VI.1925 A. CABALLERO MA 115281). Santa Inés, Cebrían, 1400 m (23.VI.1972 A. SEGURA ZUBIZARRETA MA 354191). Ibidem, Negra pond (27.VII.1969 A. SEGURA ZUBIZARRETA MA 354198). Sierra de Urbión (10.VII.1935 L. CEBALLOS & C. VICIOSO MA 115277). **Vizcaya:** Bilbao, Arraitz spring (V.1947 E. GUINEA MA 164259). Gorbea (V.1936 M. LOSA GDA 7920). 30TWN1864, Ceanuri, Gorbeia, 1390 m (22.VI.1986 B.F. BETOÑO & J.A. ALEJANDRE MA 366194).

***P. dertosensis* (Fig. 4)**

Spain. Granada: VF 2282, Sierra de Almijara, Arenas del Rey, La Venta stream, 1000 m (19.VII.1985 B. CABEZUDO & J.M. NIETO MGC 15170). Sierra de Tejada, 1700 m (1.VII.1993 R. ZAMORA GDAC 37731). Ibidem, Salto del Caballo (16.V.1981 J.M. NIETO et al. MGC 7492). Ibidem, Salto del Caballo (31.V.1981 J.M. NIETO et al. MGC 7493, 7494, 7495). Ibidem, Salto del Caballo (22.I.1982 J.M. NIETO MGC 26049). **Jaén:** 30SWG1495, Guadalentín ravine, 1300 m (25.V.1975 J.L. GONZÁLEZ REBOLLAR et al. MA 479893). Ibidem (18.VI.1975 J.L. GONZÁLEZ REBOLLAR et al. MA 479892). Ibidem (25.IX.1975 J.L. GONZÁLEZ REBOLLAR et al. MA 479891). 30SWG1499, Valdeazores ravine, 1460 m (30.V.1976 J.L. GONZÁLEZ REBOLLAR et al. MA 479890). Sierra de Cazorla, 1300 m (10.VI.1993 R. ZAMORA GDAC 37732). Ibidem, 1400 m (10.VI.1993 R. ZAMORA GDAC 37733). Sierra de Segura, 1400 m (10.VI.1993 R. ZAMORA GDAC 37734). **Tarragona:** Ports de Tortosa (29.VI.1917 P. FONT QUER BC 53082). Ibidem, La Senia, 600 m (18.VI.1956 CANIGUERAL et al. BC 148968). Tortosa and Beceite passes, 800 m (5.IV.1993 R. ZAMORA GDAC 37735). **Teruel:** Beceite, Alto Matarrana, 750–800 m (10.IV.1990 P. MONTSERRAT JACA 0060390). Beceite passes, near Font del Teix, Parrissal ravine (IV.1935 BARTOMEUS BC 87830). Tortosa and Beceite passes, 900 m (5.IV.1993 R. ZAMORA GDAC 37736).

***P. vallisneriifolia* (Fig. 6)**

Spain. Granada: Jete, 900 m (20.V.1993 R. ZAMORA GDAC 37737). **Jaén:** Barrancon de Valentina (Guadalentín ravine), 1700 m (VI.1904 E. REVERCHON MA 115272, MAF 33510). 30SWG0094, Cazorla, Chorreaderos de la Magdalena, 1040 m (26.IX.1975 F. MUÑOZ GARMENDIA & C. SORIANO MA 449894). Ibidem (24.V.1976 F. MUÑOZ GARMENDIA & C. SORIANO MA 479887). 30SWG1199, La Iruela, head of Guadahornillos ravine, 1300 m (16.VI.1976 C. SORIANO MA 479889). River Madera, 1100 m (25.V.1993 R. ZAMORA GDAC 37738). 30SWH3525, Santiago de la Espada, river Segura, Arrancapechos homestead, 1200 m (12.VI.1975 J. FERNÁNDEZ CASAS & J. FERNÁNDEZ PIQUERAS MA 198803, 354208, MAF 93530). 30SWH3429, Ibidem, Arrancapechos homestead, 1050 m (23.VI.1976 S. CASTROVIEJO & E. VALDÉS BERMEJO MA 439041). Santiago de la Espada, river Borosa, 700 m (8.VI.1989 M.F. RASCÓN GDA 26809). 30SWH1602, Ibidem, 1220 m (9.VII.1976 F. MUÑOZ GARMENDIA & C. SORIANO MA 479888). Sierra de Cazorla (VI.1962 J. BORJA MA 204278). Ibidem, 1400 m (12.VI.1993 R. ZAMORA GDAC 37739). Ibidem, Aguilones de Fuente Umbría, 1360 m (15.VI.1928 J. CUATRECASAS BC 77773, MAF 33511). Ibidem, Siles, Molinos stream (19.V.1983 J.A. Gil et al. GDAC 24059, 24067). Ibidem, La Magdalena cave (V.1903 E. REVERCHON MA 115273). Ibidem (1.VII.1947 V.H. HEYWOOD MA 162555). Ibidem (8.V.1977 G. BLANCA GDAC 3479, 3480). Ibidem, 1000 m (31.V.1928 J. CUATRECASAS MAF 33512). Ibidem, La Iruela (6.VII.1975 E.F. GALIANO et al. MA 204277). Ibidem, river Borosa (23.V.1986 M. FERNÁNDEZ ALCALDE GDAC 23512). Ibidem, La Malena gorge (VI.1980 J. GUERRA & E. SALVO MGC 8405). Sierra de Segura, 1200 m (30.V.1993 R. ZAMORA GDAC 37740). Ibidem, 1300 m (25.V.1993 R. ZAMORA GDAC 37741). Ibidem, Goterón ravine (27.VI.1955 V.H. HEYWOOD MA 177513). Ibidem, Calar de los Caracoles, river Madera ravine (12.IX.1954 E.F. GALIANO MAF 33509). Ibidem, river Segura waterfall (14.VII.1971 J. FERNÁNDEZ CASAS MA 411353). WH1602, Ibidem (12.VI.1983 A.M. HERNÁNDEZ BC 652358, JACA 322983, MA 258352). Ibidem, near Siles, 900 m (10.V.1993 R. ZAMORA GDAC 37742). 30SWH12, Villanueva del Arzobispo, Charco de la Pringue (12.IV.1990 M.A. GUIRAO & M.A. PÉREZ GDAC 34099).

***P. longifolia* subsp. *longifolia* (Fig. 6)**

Spain. Huesca: Añisclo, 1050 m (1.V.1993 R. ZAMORA GDAC 37727). Ibidem, Fanlo, 1250–1350 m (2.VII.1973 P. MONSERRAT & L. VILLAR JACA 267973). Bielsa (VI.? CAMPO MA 115250). Ibidem, between Pineta and Añisclo, 1300–2000 m (28.VII.1991 J.A. SESE & R. JIMÉNEZ JACA 173791). Circo de Carriata, Ordesa (5.VIII.1973 E. FUERTES MAF 92615). Escuaín, 900–1100 m (8.VII.1990 D. GÓMEZ JACA 0163790). Laspuña, Montañesa crags (31.VII.1975 P. MONTSERRAT & L. VILLAR JACA 396075). Plan, 1150 m (1.V.1993 R. ZAMORA GDAC 37728). River Vero, Lecina ravine, 640 m (14.IV.1981 P., J.M. & G. MONTSERRAT BC 637495). Ibidem, Las Clusas ravine, 640 m (1.V.1981 J.M. MONTSERRAT BC 637495). Salinas de Sín, 1000 m (15.V.1969 P. MONTSERRAT JACA 101569). Torla, 1050 m (22.V.1973 P. MONTSERRAT & L. VILLAR JACA 117973). 30TYN4424, Ibidem, Ordesa National Park, 1700 m (13.VII.1988 R. MORALES J. PAIVA & A. IZUZQUIZA MA 454340). Ibidem, Bujaruelo, 1350 m (16.VII.1971 P. MONTSERRAT & L. VILLAR JACA 495171). 30TYN32, between Torla and Bujaruelo, 1300 m (19.VI.1978 J. FERNÁNDEZ CASAS & F. MUÑOZ GARMENDIA MA 409381). Cinqueta Valley (19.VII.1969 S. RIVAS MARTÍNEZ & M. COSTA MAF 139130).

Ibidem, between Salinas and Plan, 950 m (30.VI.1973 J. VIGO & R. MASALLÉS BC 618409). Ordesa Valley, 1500 m (30.VII.1947 S. RIVAS GODAY MAF 77830). Ibidem, Soaso ravine, 1600 m (18.VII.1929 J. CUATRECASAS BC 53050).

***P. mundi* (Fig. 6)**

Spain. Albacete: Alcaraz, La Molata, 1000 m (28.V.1996 J.M. HERRANZ & J.J. MARTÍNEZ MURCIA n/r). Alcaraz towards La Mesta, Los Batanes, 1100 m (20.V.1997 G. BLANCA & M.J. SALINAS GDAC 41986). Source of river Mundo (4.VI.1959 S. RIVAS GODAY et al. MAF 82726). Ibidem (2.VIII.1981 E. RICO SALA 25586). Ibidem, Los Chorros (6.IX.1950 S. RIVAS GODAY & A. MONASTERIO MAF 33498). Riópar, Los Chorros del Mundo (18.VII.1923 J. CUATRECASAS BC 53051). Ibidem (10.VII.1971 S. RIVAS GODAY et al. MAF 83307). 30SWH4956, Ibidem, 1100 m (28.V.1976 J. FERNÁNDEZ CASAS et al. BC 626256, MA 208452, 354192, 421980, MAF 150816, SALA 11807). Ibidem, 1200 m (19.VII.1986 J.M. HERRANZ MA 361018). Ibidem, source of river Mundo (18.VII.1951 S. RIVAS GODAY MAF 80015). Ibidem, Los Chorros cave (21.VI.1980 J.A. GIL et al. GDAC 27559). Ibidem (28.VI.1988 A. APARICIO et al. MA 485659). Ibidem, Sierra del Calar del Mundo, Los Chorros cave, 1200 m (3.VI.1993 R. ZAMORA GDAC 37729). Sierra de Alcaraz, Calar del Mundo (VI.1981 E. SALVO & J. GUERRA MGC 8406). 30SWH4956, Ibidem, 1150 m (20.VII.1984 M. LUCEÑO MA 439052). Ibidem, Los Chorros cave (17.VI.1982 D. SÁNCHEZ MATA et al. MAF 110181). Ibidem, Las Chorreras (21.VI.1980 E. SALVO MGC 6954). **Cuenca:** Beteta, Beteta gorge (11.VII.1932 A. CABALLERO MA 115271). Ibidem (11.IV.1933 A. CABALLERO MA 115276). 30TWK79, Ibidem, 1100 m (9.VI.1989 GAMARRA et al. MA 472045). Ibidem, chalk outcrops (14.VI.1997 G. BLANCA M. RUÍZ-REJÓN & R. ZAMORA GDAC 42112). 30TWK874959, Ibidem, Tajo canyon, Horcajo gorge, 1130 m, limestone cliff-faces (8.VIII.1997 L.M. FERRERO & L. MEDINA MA 594441). Ibidem, Los Fresnos (sic; "Tilos") spring, 1100 m (2.VIII.1975 J. FERNÁNDEZ CASAS & G. GARCÍA GUARDIA MA 394319, 439461). 30T WK 77, between Fuerte Escusa and Poyatos, river Escalvas (23.VI.1983 C. BENEDÍ et al. BC 652886, MA 334328, MAF 122615, SALA 33635). Ibidem, chalk outcrops (14.VI.1997 G. BLANCA, M. RUÍZ-REJÓN & R. ZAMORA GDAC 42111). 30TWK78, Tragavivos gorge, 990 m (26.VII.1978 G. LÓPEZ MA 439051). **Guadalajara:** 30TXK006745, Checa, along roadside by river Tajo, 1530 m, chalky peat bog (25.VI.1997 L.M. FERRERO & L. MEDINA MA 589325). 30TWK868976, Peralejos de las Truchas, 1120 m, limestone cliff. faces (8.VIII.1997 L.M. FERRERO & L. MEDINA MA 594442).

***P. alpina* (Fig. 8)**

Spain. Huesca: Aisa, 2100 m (12.VII.1990 D. GÓMEZ JACA 0169290). Ibidem, Tobazo, 1950 m (11.VII.1971 P. MONTSERRAT & L. VILLAR JACA 443371). Ibidem, Tortiella. Tobazo, 2100 m (21.VIII.1970 P. MONTSERRAT & L. VILLAR JACA 595070). Ansó, Aspe ravine, 1850–1900 m (16.VII.1976 L. VILLAR JACA 100010576). Bielsa (VII.? CAMPO MA 115228). Ibidem, Circo de Pineta (1.VIII.1982 P. MONTSERRAT & L. VILLAR JACA 144782). Canfranc, Izas Valley, 1950–2150 m (9.VIII.1979 L. VILLAR JACA 355779). Central Pyrenees (VIII.? M. RIVAS MATEOS MAF 33480). Benasque pass (VII.1909 ? MA 115227). Sierra de Llauset, Aneto-Senet (19.VIII.1984 G. & J. MONTSERRAT JACA 201084). Torla, Ordesa, 1850 m (26.VIII.1970 P. MONTSERRAT & L. VILLAR JACA 642770). **Lérida:** Artiga de Viella (VII.1909 ? MA 115227). **Navarra:** Isaba, La Mesa summit, N face (9.VII.1971 L. VILLAR JACA 10146771).

***P. lusitanica* (Fig. 8)**

Portugal. Algarve: S. Braz de Alportel, Ribeira de Aljeruz (V.1947 SILVA FONTES et al. MA 282764). Serra de Monchique, Caldas (22.IV.1968 J. MALATO-BÉLIZ et al. MA 282760). Ibidem (22.IV.1968 A. SEGURA ZUBIZARRETA MA 328609). Ibidem (17.VI.1978 J. MALATO-BÉLIZ & J.A. GUERRA MA 282754). Ibidem, Foia (28.VI.1978 J. MALATO-BÉLIZ & J.A. GUERRA MA 282753). **Alto Alentejo:** Serra de Ona (4.VI.1958 J. MALATO-BÉLIZ & J.A. GUERRA MA 282763). Serra de S. Mamede (30.V.1969 J. MALATO-BÉLIZ & J.A. GUERRA MA 282758). **Beira Litoral:** Agueda (4.V.1953 A. FERNANDES et al. JACA 1953, MGC 591). **Douro Litoral:** Valongo (26.VII.1977 J. MALATO-BÉLIZ & J.A. GUERRA MA 282755). **Estremadura:** Cintra (30.IV.1944 BENTO RAINHA MA 115270). **Minho:** Serra do Gerês, Albergeria (2.VII.1948 S. RIVAS GODAY MAF 79371, 79372). Ibidem, Ermida (5.VIII.1977 J. MALATO-BÉLIZ & J.A. GUERRA MA 282758). Ibidem, Na. Sa. da Peneda (9.VIII.1977 J. MALATO-BÉLIZ & J.A. GUERRA MA 282756). Ibidem, Paradela (6.VIII.1977 J. MALATO-BÉLIZ & J.A. GUERRA MA 282757). Ibidem, Ponte Foia (13.VII.1958 J. MALATO-BÉLIZ et al. MA 182535, 282762). Ibidem, Vade (14.VII.1958 J. MALATO-BÉLIZ et al. MA 282761). **Spain. Asturias:**

Colunga (VII.1914 HNO. JERÓNIMO BC 53080). Grado, El Chorro mountain, 400 m (23.VII.1935 P. FONT QUER & W. ROTHMALER BC 92520). **Badajoz:** Real valley, Herrera del Duque (21.VI.1969 S. RIVAS GODAY & M. LADERO MAF 75809). **Burgos:** Ebro marshes, headwaters of river Nela (21.VI.1996 P. MONTSERRAT JACA 69759). **Cáceres:** Alia (6.VIII.1969 M. LADERO MAF 81711). **Cádiz:** Bacinete stream, Sierra del Niño, Los Barrios (4.V.1975 A. ASENSI MGC 7692). Algeciras, Los Barrios, Sierra de Ojén and Sierra del Niño (23.IV.1990 B. CABEZUDO et al. MGC 32292). Ibidem, Pto. del Cabrito-Las Corzas (26.VI.1988 B. CABEZUDO & J.M. NIETO MGC 22534). Castellar, Almoraima, Guadarranque dam (25.IV.1992 A. PÉREZ LATORRE et al. MGC 34112). Sierra de Algeciras (8.IV.1950 J. BORJA et al. MAF 33500). Tarifa-Algeciras, 300 m (13.VI.1963 P. MONTSERRAT MAF 96763). **Cantabria:** Barcena Mayor (17.VIII.1980 E. RICO, MA 258349, SALA 21461). Comillas (12.VII.1951 M. LAÍNZ BC 117285). Ebro reservoir (20.VI.1969 P. MONTSERRAT JACA 316169). Ibidem, Corconte (13.VII.1969 S. RIVAS GODAY et al. MAF 74140). Ibidem (9.VIII.1972 P. MONTSERRAT & L. VILLAR JACA 566472). Ibidem, Reinosa (15.VII.1984 G. MORANTE & J.A. ALEJANDRE MA 399533). **Ciudad Real:** Fuencaliente (11.VI.1954 A. RODRÍGUEZ MA170398). 30SUJ9761, Sierra de la Higuera, Torre de Abraham reservoir (4.VII.1979 A. VELASCO & A. MOLINA GDA 8824, MA 212637, MAF 105531). Ibidem (6.VII.1977 A. VELASCO MA 258348, MGC 4419). La Viuda Valley, El Gargantón, Piedra. Buena (15.V.1954 S. RIVAS GODAY MAF 78984). **Guipúzcoa:** Fuenterrabía, 10 m (23.VII.1983 P. MONTSERRAT & P. CATALÁN JACA 237383). Irún (VIII.1915 J. MAS Y GUINDAL MAF 64768). **Huelva:** Almonte, Doñana, La Rocina estate (16.IV.1978 S. CASTROVIEJO et al. MA 439048). **Jaén:** UH9748, Sierra de Quintana, El Panizal (22.V.1985 E. CANO & F. VALLE GDAC 23914). **La Coruña:** Arteijo (VII.1923 VILLAR MAF 33501). 29TNH2772, Brandoñas de Arriba (22.VI.1981 S. CASTROVIEJO et al. MA 439044). Lamas-Zas (14.VI.1950 F. BELLOT & B. CASASECA GDA 7921). Santiago de Compostela (V.1866 F. TREMOLS BC 654577). River Dubra Valley (27.VI.1982 B. CASASECA et al. SALA 50380). **Lugo:** Source of river Miño (1896 ? MAF 33506). **Soria:** Santa Inés, Quintanarejo (19.VIII.1982 A. SEGURA ZUBIZARRETA MA 354194). Vinuesa (30.VIII.1963 A. SEGURA ZUBIZARRETA MA 354204). **Toledo:** River Bullaque (6.VI.1977 A. VELASCO MAF 98247). **Vizcaya:** Baquio, Aguazal de la Atalaya (5.VIII.1941 E. GUINEA MA 164261). San Antonio de Urquiola, Amboto mountain road (28.VIII.1946 E. GUINEA MA 164260).