

Pinguicula panfetiae (Lentibulariaceae), a new Caribbean butterwort from eastern Cuba

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Abstract

Background and aims – *Pinguicula* is a cosmopolitan genus of carnivorous plants with more than 100 species, most of them distributed in two centres of diversity: Europe and the Central American-Caribbean region. Fourteen species are reported for Cuba. During fieldwork to study *Pinguicula* populations in eastern Cuba, a white-flowered taxon, previously misidentified as *Pinguicula albida* or *Pinguicula jaraguana*, was collected in the mountainous regions of the Alejandro de Humboldt National Park. This taxon represents a new species for which we present a full description, a distribution map, illustrations, photographs, and a conservation status.

Material and methods – Living and preserved material of several populations of white-flowered *Pinguicula* from Cuba were analysed, measured, and described based on vegetative and reproductive characters. Statistical analyses were carried out to explore the differences among the collections. The preliminary conservation status of the new species was assessed based on the IUCN guidelines and criteria.

Key results – *Pinguicula panfetiae* is described as a new species endemic to eastern Cuba. It thrives on permanently wet, ferritic soils derived from serpentine bedrocks, on slopes above the banks of the River Toa in association with surrounding semi-arid montane serpentine shrubwood (charrascal). It differs from the closely related species, *Pinguicula albida* and *Pinguicula jaraguana*, primarily by its smaller rosettes with obovate, suberect to erect leaves, non-involute leaf margins, smaller flowers up to 1–1.3 cm including the spur, longer (0.6–0.7 mm) and wider (0.18–0.22 mm) seeds, and that it grows in full sun.

Conclusion – The newly described species increases the number of *Pinguicula* in the Cuban archipelago to 15. *Pinguicula panfetiae* is preliminarily assessed as Critically Endangered (CR) according to the IUCN Red List Categories and Criteria.

Keywords

butterwort, carnivorous plant, critically endangered, endemic, *Pinguicula albida*, *Pinguicula jaraguana*, taxonomy

INTRODUCTION

Cuba is a remarkably rich source of diversity of the genus *Pinguicula* L., considering it is an island with an area of only 110,860 km². The distribution of the genus *Pinguicula* in Cuba shows a disjunction over three regions – west, central, and east – with significant gaps between

the regions. Of the 14 Cuban species currently accepted (Panfet 2024), nine occur within the eastern region. Before the middle to late 1960s, only five species had been recorded for the entire country: *Pinguicula albida* C.Wright ex Griseb., *P. benedicta* Barnhart, *P. filifolia* C.Wright ex Griseb., *P. jackii* Barnhart, and *P. lignicola* Barnhart (Alain 1957; Ernst 1961; Casper 1966). This

changed from 1966 onwards when botanical expeditions were organised in Cuba as part of the work, Flora de la República de Cuba (Méndez 1995; Regalado Gabancho et al. 2008), which yielded numerous observations and collections of *Pinguicula*, including several new species. The resulting specimens are kept at the Herbarium Prof. Johannes Bisse (HAJB, National Botanic Garden of Cuba, University of Havana) with duplicates in German herbaria (B, Botanic Garden and Botanical Museum Berlin-Dahlem and JE, Friedrich-Schiller-Universität Herbarium Haussknecht).

During this period of botanical field trips, the identities of some specimens of white-flowering *Pinguicula* from the eastern region of Cuba remained undetermined (HFC-21959a, Ebel s.n. [HAL 36587], HFC-39913) but several were mistakenly identified as *P. albida* (HFC-16747, HFC-16918, HFC-21649a, HFC-21649b, HFC-21959b, HFC-21959c, HFC-56240b, HFC-56240c). This taxon was previously and correctly only known from the west of Cuba. At that time, only three white-flowered taxa were known, *P. albida*, the epiphytic *P. lignicola*, and some populations of *P. filifolia*, the latter two could not be confused with other Cuban *Pinguicula* species because of their distinctly unique morphological differences. Likewise, eastern *Pinguicula* with non-white flowers were commonly determined to be *P. benedicta* (HFC-56240a) based on superficial similarity.

Bisse et al. (1975) discussed an eastern *Pinguicula* identified as *P. albida* (HFC-16747) and outlined several differences between these plants, collected at Cayo Fortuna (located on the River Toa), and the more typically western populations but dismissed their importance. Thus, despite an early indication by F. Ebel in 1972 that another specimen from Cayo Fortuna (Ebel s.n. [HAL 37587], in sched.) was a new species, the view was maintained that *P. albida* was not restricted to western Cuba.

Fortunately, the late Siegfried Jost Casper recognised that many of the herbarium specimens from eastern Cuba were new taxa. His descriptions (Casper 2003, 2004, 2007, 2019) allowed a better comparison between the species, especially those from the east that were significantly less well known. Among these new species was the white-flowered *Pinguicula jaraguana* Casper (Casper 2003), of which the type material (HFC-39913) was collected beside a stream, the Arroyo Jaragua, within the Alejandro de Humboldt National Park, where it is generally found growing on vertical wet walls in shaded locations. As a result of separating eastern white-flowered species into *P. jaraguana*, thereafter, *P. albida* was considered endemic to western Cuba and all white flowering species from eastern Cuba were considered to be *P. jaraguana*. However, Casper was unaware of a number of specimens from separate gatherings from Cayo Fortuna, a region within the Ojito de Agua sector of the same park. Therefore, these specimens remained uncited and without proper determination. Later, Casper (2019) published a revision of the genus in the Greater Antilles and included the Cayo Fortuna specimens within his concept of *P. jaraguana*.

He noted that there are differences in flower morphology between the plants from the *P. jaraguana* locus classicus beside the Arroyo Jaragua and those from Cayo Fortuna. Despite these differences, he concluded that the observed differences were within the range of variation of *P. jaraguana*. Thus, all Cayo Fortuna collections were subsumed under *P. jaraguana*. By 2007, the early F. Ebel gathering (Ebel s.n. [HAL 36587]), originally determined as “*Pinguicula* nov. spec.”, had captured Casper’s attention and he newly determined it as “*Pinguicula* c.f. *jaraguana*”. Later still, this specimen, as well as a colour photograph of living plants in habitat also supplied by F. Ebel, was cited by Casper (2019); his explicit mention of the Cayo Fortuna population, where he used those plants as a comparison of *P. jaraguana* with *P. albida*, demonstrated his inclusion of the population within *P. jaraguana*. By this time, other specimens from Cayo Fortuna were also subsumed within *P. jaraguana*, likely because they lacked flowers (HFC-16747 and HFC-16981). However, our preliminary analyses of herbarium specimens revealed that, without exception, specimens from this locality do not represent the *P. jaraguana* species concept.

In recent years (2019–2025), several expeditions had been undertaken to study populations of eastern Cuba *Pinguicula*. Morphological analyses and field observations allowed the recognition of clear morphological and ecological differences between the population of *Pinguicula* from Cayo Fortuna and all other known white-flowered species these plants have been confused with. Thus, a new species of *Pinguicula* from eastern Cuba is herein described and illustrated. Its taxonomic relationships, distribution and ecology, and its preliminary conservation status are also presented.

MATERIAL AND METHODS

Field trips were conducted between November 2019 and March 2025 to study *Pinguicula* populations in eastern Cuba. Plants from a single population previously attributed to *P. jaraguana*, located at Cayo Fortuna, (a section of the River Toa), were examined and compared with type material and specimens (Supplementary material 1) of *Pinguicula albida* and *P. jaraguana* from herbarium collections (A, B, BRU, GH, GOET, HAC, HAJB, HAL, HFA, HPPR, HUMC, JE, MA, MO, MT, NY, US, and YU; acronyms follow Thiers 2025). Collected material was also compared to descriptions in the relevant literature (Alain 1957; Ernst 1961; Casper 1966, 2003, 2004, 2007, 2019; Bisse et al. 1975; Domínguez et al. 2014; Temple et al. 2023).

Macro- and micromorphological analyses of recently collected specimens and older specimens in herbarium collections, as well as field observations, were carried out to describe the new taxon. Field photographs were taken using a Canon R6 Mark 2 camera with 100 mm f2.8 macro (Canon, Japan) or Laowa 25mm f2.8 2.5–5× ultra macro lens (Venus Optics, China). Micromorphological characters were analysed and photographed using a BEL

Table 1. Quantitative vegetative and reproductive characters used in the statistical analyses, codes, and descriptions. All measurements were taken in mm.

Character	Code	Description
1 Leaf length	LFL	Measured from the base of the leaf blade to its apex
2 Leaf width	LFW	Measured at the widest part of the leaf blade
3 Scape length	SCL	Measured from the centre of the rosette to the apex of the inflorescence
4 Flower length	FLL	Measured from the tip of the spur to the apex of the corolla midlobe
5 Corolla lobe length (except the midlobe)	LBL	Measured from the apex of the corolla tube to the apex of the lobe
6 Corolla lobe width (except the midlobe)	LBW	Measured at the widest part of the lobe
7 Corolla midlobe length	MLL	Measured from the apex of the corolla tube to the apex of the midlobe
8 Corolla midlobe width	MLW	Measured at the widest part of the midlobe

microscope model SOLARIS-T with a coupled digital camera BEL EU 12 CONVS (Bel Photonics®, China) using the software Capture 2.1 (Meiji Techno, Japan). Eight quantitative vegetative and reproductive characters (Table 1; Supplementary material 2) were recorded for each taxon ($n = 60$). The normality of the data was assessed for each variable individually using the Shapiro-Wilk's test (p values = 0.000–0.020; Supplementary material 3). To compare morphometric data, a multivariate analysis was performed to reduce dimensionality and obtain new axes that better explain data variation. A principal component analysis (PCA) based on the correlation matrix was performed, with the absolute values transformed to z-scores and plotted in a two-dimensional space defined by the first two principal components (Factor 1 and 2). All statistical analyses were performed using SYSTAT 13 v.13.2.01 (Systat Software, Inc. 2023).

The preliminary conservation status of the new species was assessed following IUCN Red List Categories and Criteria (IUCN 2024), for which the extent of occurrence (EOO) and the area of occupancy (AOO, with 2×2 km grid) were calculated using the software GeoCAT (Bachman et al. 2011). The distribution map, based on the known distribution of the species according to herbarium records and field surveys, was prepared with QGIS v.3.40.3 (QGIS Development Team 2024).

TAXONOMIC TREATMENT

Pinguicula panfetae Panco, P.Temple & Y.Domínguez, sp. nov.

urn:lsid:ipni.org:names:77357113-1

Figs 1–4A

Type. CUBA – **Guantánamo** • Yateras, Parque Nacional Alejandro de Humboldt, Palenque, Cayo Fortuna, cuenca del río Toa, 3 km desde la estación Piedra La Vela; 20°24'54.6"N, 74°57'39.5"W; 460 m; 31 Mar. 2023; J. Imbert Planche, I. Pančo, G. Rodríguez Cobas, I. Matisova, N. Coutin Lobaina s.n.; holotype: HAJB [G 002601]; isotypes: B, BSC [22092].

Diagnosis. *Pinguicula jaraguana* Casper affinis sed brevibus, foliis ovobatis, erectis suberectis, margine

integerrima non involute, flores parvi 10–13 mm (calcaribus inclusis), semina 0.6–0.7 mm longa (appendix inclusis), 0.18–0.22 mm lata.

Description. Perennial herb, scapose, in a basal rosette, (19–)25–30(–35) mm in diameter; suberect to erect, sometimes growing densely grouped together in colonies of many individuals exhibiting calathiform rosettes. **Rhizome** short, with fibrous roots. **Leaves** (4–)5–7(–10), homophyllous, yellow-green or reddish-brown, (10–)12–15(–17) $\times$ (6–)8–10(–11) mm, obovate, apex rounded, base narrowly cuneate into a short petiole, margins entire; adaxial surface densely covered with glandular trichomes. **Scapes** 1(–3), 1-flowered, erect, green or reddish-brown, (50–)80–110(–150) mm long, $\pm$ 0.30–0.45 mm thick, sparsely glandular with very few stalked and sessile trichomes. **Flowers** white, indistinctly 2-lipped (subisolate). **Calyx** distinctly 2-lipped, similar colour to leaves, shorter than the tube, $\pm$ 4 mm; outer surface sparsely covered with stalked glandular trichomes; upper lip divided nearly to the base into 3 lobes, lobes oblong-obtuse, apex retuse, $\pm$ 2 $\times$ 1 mm; lower lip 2-lobed, the lobes free nearly from their bases. **Corolla** (8.5–)9–10(–11.3) mm long (including the spur), $\pm$ 9 mm diameter, widely opened; the lobes forming an angle with the tube of $\pm$ 90°, broadly obovate, margins overlapping for less than half their length, white, (3.8–)4–4.7(–5.2) $\times$ (2.9–)3.5–3.8(–4.3) mm, adaxial surface covered sparsely with non-glandular trichomes that are more abundant at the entrance to the tube; upper lip 2-lobed, lobes smaller than the two lateral lower-lip lobes; lower-lip deeply 3-lobed, lobes obovate, apex rounded, midlobe (4.5–)4.8–5(–5.2) $\times$ (3.8–)4(–4.2) mm. **Tube** yellow with deep brown veins, cylindric, short, (2.5–)3–4(–4.5) $\times$ 1.5–2.5 mm, without palate, distinctly bent (geniculate) and held at an angle of $\pm$ 90°, tripartite, the entrance with long uniseriate non-glandular trichomes, the middle part with medium-length uniseriate and stipitate glandular trichomes, the inner part with short glandular trichomes. **Spur** yellowish-brown, thick, conical, very short, (2.5–)3–4(–4.5) $\times$ 1.5–2.5 mm, apex rounded, saccate. **Stamens** $\pm$ 1.5 mm long, slightly curved; anthers $\pm$ 0.5 mm wide. **Pollen** prolate (P:E = 1.49), zonoaperturate, 4(5)-colporate, (34.63–)35.52–37.32(–39.17) $\times$ (23.53–)24.12–24.88(–

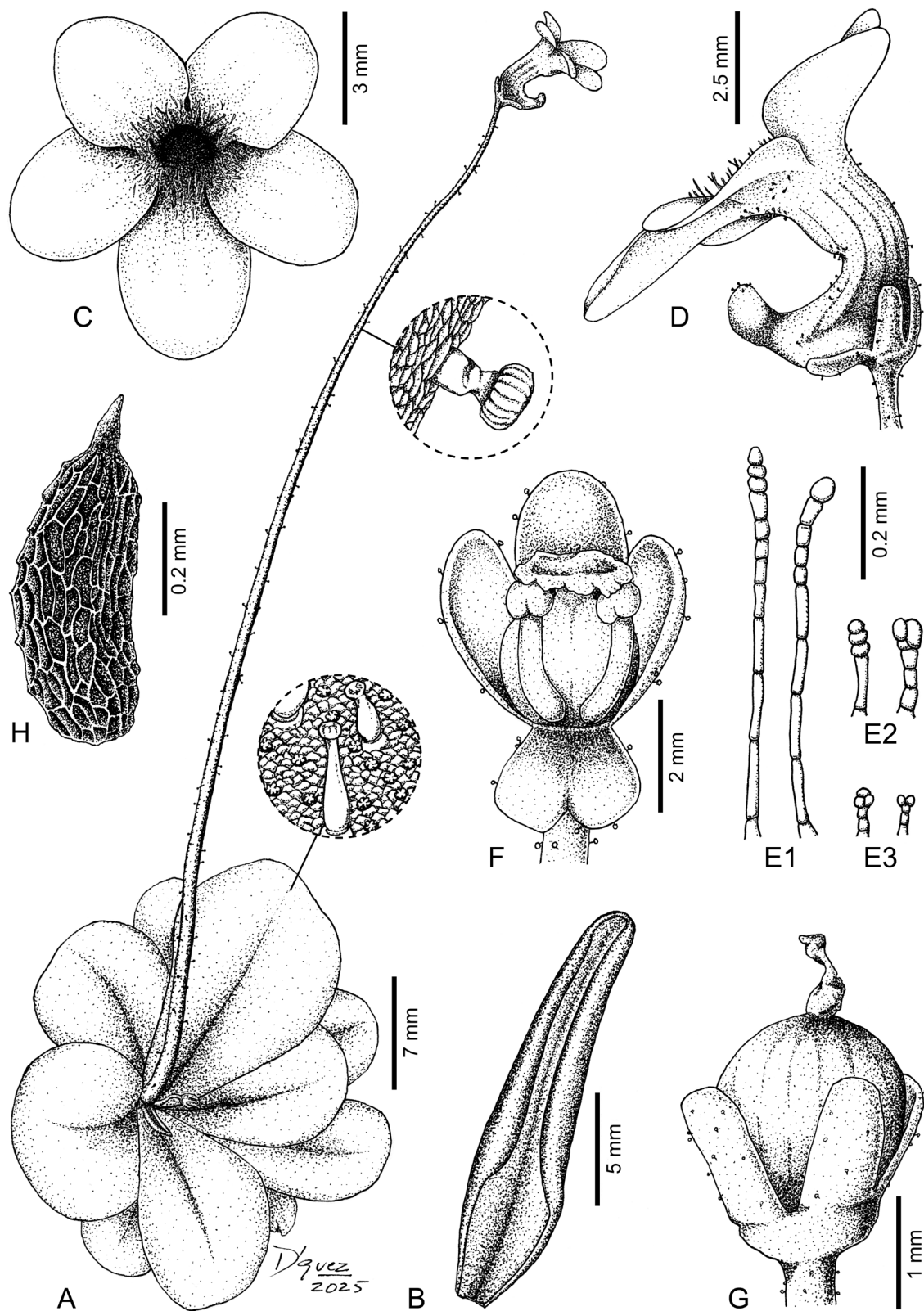


Figure 1. *Pinguicula panfettiae* based on type specimens (holotype HAJB [G 002601], isotypes B, BSC [22092]) and on living material. A. Habit, perennial herb with details of the trichomes of the leaf and the inflorescence scape (circles). B. Emerging leaf with involute margin. C. Frontal view of the flower. D. Lateral view of the flower. E1. Internal trichomes of the outer part of the corolla tube. E2. Internal trichomes of the middle part of the corolla tube. E3. Internal trichomes of the inner part of the corolla tube. F. Dissected flower with the persistent calyx and lateral view of the stamens and gynoecium. G. Fruit with persistent calyx. H. Lateral view of the seed. Illustration by Yoannis Domínguez.

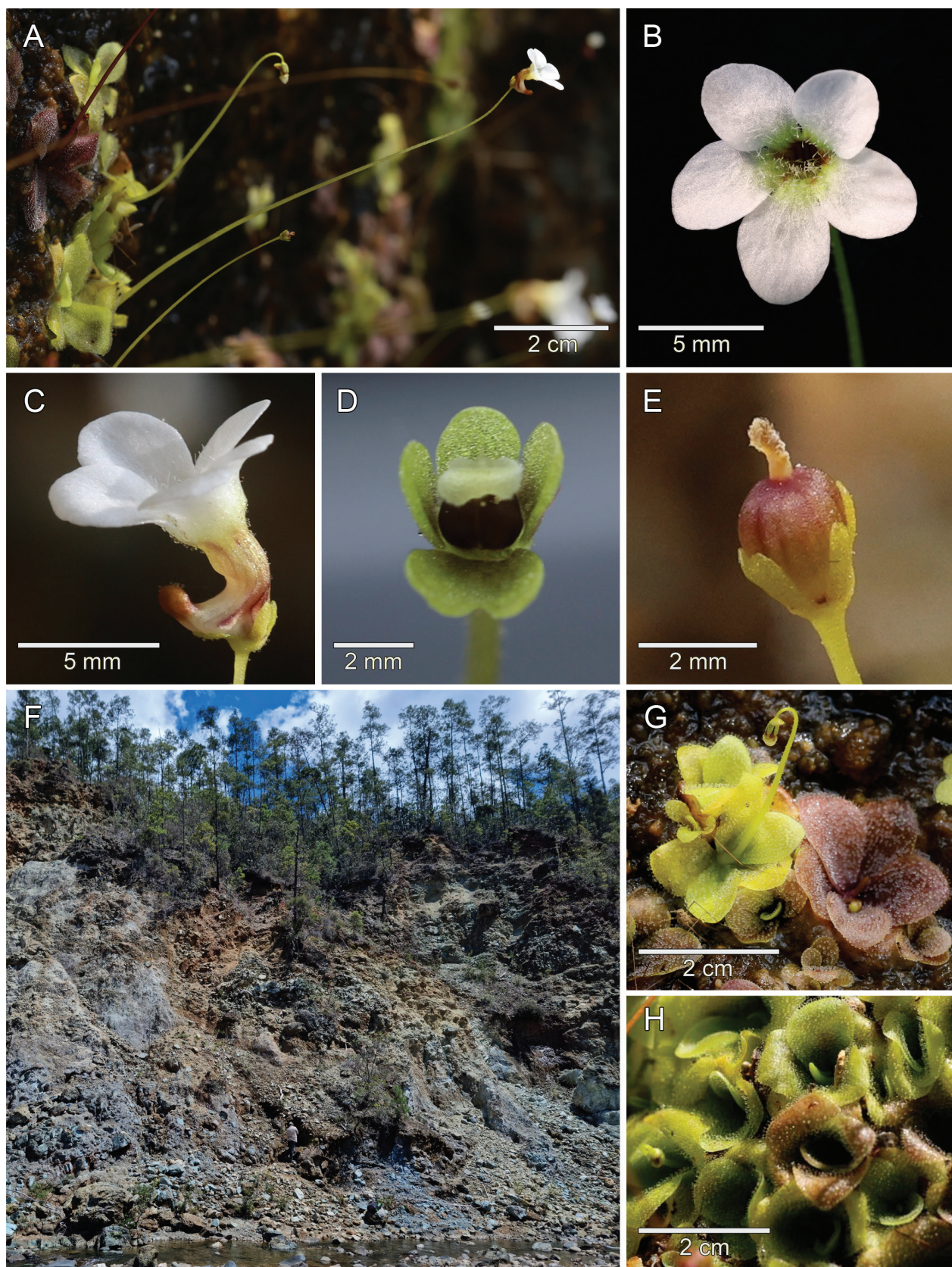


Figure 2. *Pinguicula panfetiae* at the type locality in the Alejandro de Humboldt National Park, eastern Cuba. **A.** Habit. **B.** Frontal view of the flower. **C.** Lateral view of the flower. **D.** Dissected flower showing the persistent calyx and stamens and gynoecium. **E.** Lateral view of the fruit. **F.** Habitat at the banks of the River Toa. **G.** Regular rosettes with suberect leaves. **H.** Calathiform rosettes with erect leaves. Photos by Ivan Pančo (A–E, G–H) and Ivana Matisova (F).

25.39) μm . **Ovary** subglobose-ovoid, sessile, ± 1.5 mm in diameter, 1-loculate, ending in a short style, glabrous. **Stigma** short, 2-lobed, margin fringed. **Capsule** globose, $\pm 2 \times 2$ mm. **Seeds** dark brown, fusiform, $(440\text{--})520\text{--}540\text{--}(590) \times (180\text{--})200\text{--}215\text{--}(220) \mu\text{m}$ excluding appendage, testa reticulate, mycropilar appendage prominent, $(60\text{--})80\text{--}(90) \mu\text{m}$.

Etymology. *Pinguicula panfetiae* is named in honour of the late Cuban botanist, Prof. Dr Cristina Mercedes Panfet Valdés, to acknowledge her contributions to Cuban flora research, in particular, with regard to the carnivorous plant families for which she was the main Cuban specialist. Besides her research, Prof. Panfet dedicated most of her life to empowering many generations of Cuban botanists to achieve professional standing, which is also acknowledged herein.

Phenology. Based on the presence of flowers or fruits, or both, in the analysed specimens and according to the in situ observations, the flowering period extends from February to June.

Distribution and habitat. *Pinguicula panfetiae* is endemic to eastern Cuba (Fig. 3) where it is limited to a small area within Cayo Fortuna, a subdepartment of the Ojito de Agua sector of the Alejandro de Humboldt National Park. Plants are found at an altitude of ca 460 m, on steep slopes above the banks of the River Toa (Fig. 2F), where they grow in dense patches totalling a few thousand individuals. Where a group of plants grow in a tight arrangement, they typically exhibit calathiform (cup-like) rosettes with suberect to erect leaves (Fig. 2H). While we can be certain of the location of *Pinguicula panfetiae* in Cayo Fortuna, the records of the locations of other specimens mention Palenque, Cayo Fortuna, or eastern Cuba (Oriente) but the use of such names is not detailed enough to determine whether any corresponds to the true Cayo Fortuna or to one or more other locations. The vegetation at the type

locality is semi-arid montane serpentine shrubwood (charrascal) that occurs in association with ferritic soils derived from serpentine bedrocks (Borhidi 1996). However, *Pinguicula panfetiae* grows on permanently wet landslides and seeps on or just above rivers banks. Despite the semi-arid conditions of the charrascal, this area supports edaphic climax communities developed under a humid tropical rainforest climate.

Relationships. According to the infrageneric classification proposed by Fleischmann (2021), *Pinguicula panfetiae* belongs to subg. *Temnoceras* Barnhart, sect. *Homophyllum* Casper, which also includes all Caribbean species from Cuba and the Dominican Republic. Among the Cuban species, *Pinguicula panfetiae* shows close morphological affinities with *P. albida* and *P. jaraguana* as they have white flowers with subisolate corolla and a thick, short spur. However, morphological and morphometric analyses have shown that these three species can be separated on the basis of vegetative and reproductive traits (Figs 4, 5). In addition to the differences highlighted in the diagnosis, a comparative overview of *Pinguicula panfetiae*, *P. albida*, and *P. jaraguana* is provided in Table 2.

Preliminary IUCN assessment. Very few records exist for this species according to the analysed material in herbarium collections and, due to the limited access to material and insufficient information associated with old specimens (1970–1972), it is difficult to determine if all of them originated from a single population. Casper (2019) remarked that several of the independent sightings of plants, herein described as *Pinguicula panfetiae*, may all represent records for the same and currently only known population (Fig. 3). Observations from our field explorations in eastern Cuba support Casper's view. This population already has the highest Cuban protection status and comprises thousands of plants. Nevertheless, the population is restricted to small patches in a

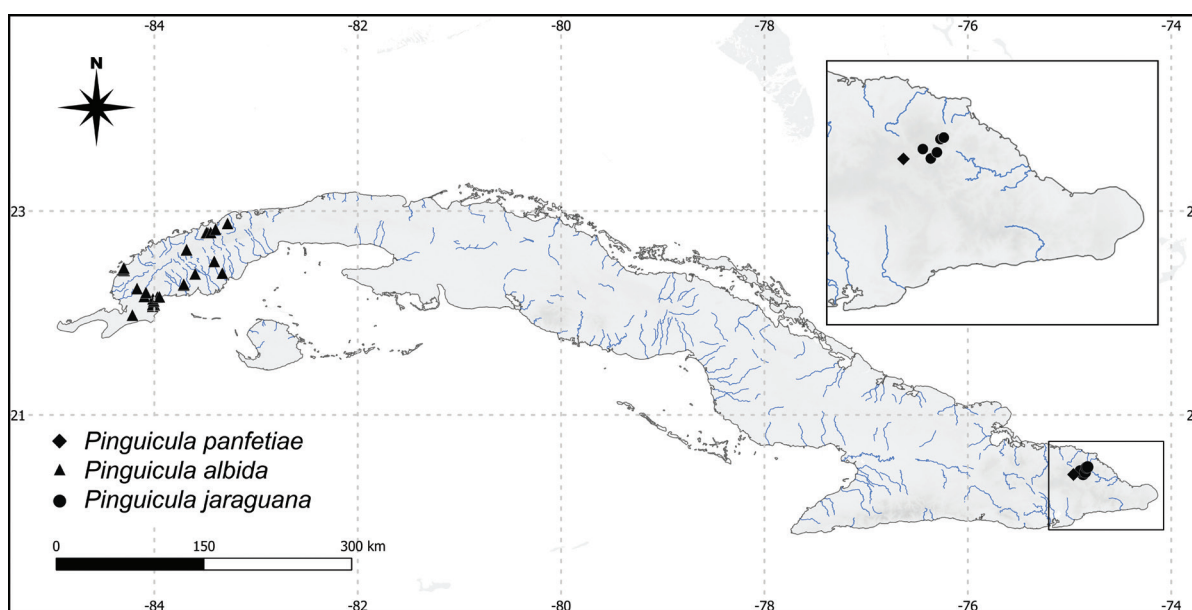


Figure 3. Distribution of *Pinguicula panfetiae*, *Pinguicula albida*, and *Pinguicula jaraguana* in Cuba based on herbarium records and field surveys.

Table 2. Comparison of morphological and habitat differences between *Pinguicula panfetiae*, *P. albida*, and *P. jaraguana*. Diagnostic characters of *P. panfetiae* are indicated by an asterisk (*).

	<i>P. panfetiae</i>	<i>P. albida</i>	<i>P. jaraguana</i>
Rosette diameter* (mm)	(19–)25–30(–35)	(28–)34–50(60)	(19–)28–42(–60)
Leaf			
Type	Homophyllous, with consistently uniform carnivorous leaves	Homophyllous, with consistently uniform carnivorous leaves	Homophyllous, with carnivorous leaves exhibiting seasonal variation of shape and size
Growth*	Suberect to erect	Flat, adpressed to the substrate	Flat, adpressed to the substrate
Size* (mm)	(10–)12–15(–17) × (6–)8–10(–11)	(14–)17–20(–45) × (9–)10–20(–30)	(10–)19–20(–31) × (4–)8–8.5(–13)
Shape*	Obovate	Ovate to suborbiculate	Oblong to spatulate
Margin*	Entire, non-involute	Involute	Involute
Flower			
Lobe size* (mm)	(3.8–)4–4.7(–5.2) × (2.9–)3.5–3.8(–4.3)	(5–)7–8(–10) × (4–)5–7(–9)	(6–)9–10(–13) × (4–)6–7(–12)
Tube (mm)	(2.5–)3–4(–4.5) × 1.5–2.5	(1.5–)2–3.5(–4.5) × (1.8–)2.5–3.2(–4)	(2.5–)3–4(–5) × 1.5–2.5
Spur (mm)	(2.5–)3–4(–4.5) × 1.5–2.5	(1.9–)3.3–4.6 × (0.7–)1–1.4(–1.8)	(3–)4–5(–6) × (2–)2.5–3(–6)
Spur-tube angle	Right	Right	Acute
Capsule			
Size (mm)	1.9–2.1 × 1.9–2.1	1.8–2.5 × 1.5–2.3	3.3–3.9 × 3.3–3.9
Seed			
Size (including appendage)* (µm)	(595–)610–625(–670) × (180–)200–215(–220)	(304–)418–480(–540) × (120–)150–170(–201)	(430–)500–580(–650) × (130–)150–200(–210)
Habitat	In full sun, in semi-arid montane serpentine shrubwood (charrascal)	In shade, in grassland, pine savanna and pine-mixed shrubwood, dry lowland shrubwood (cuabal)	In shade, in semi-arid montane serpentine shrubwood (charrascal)

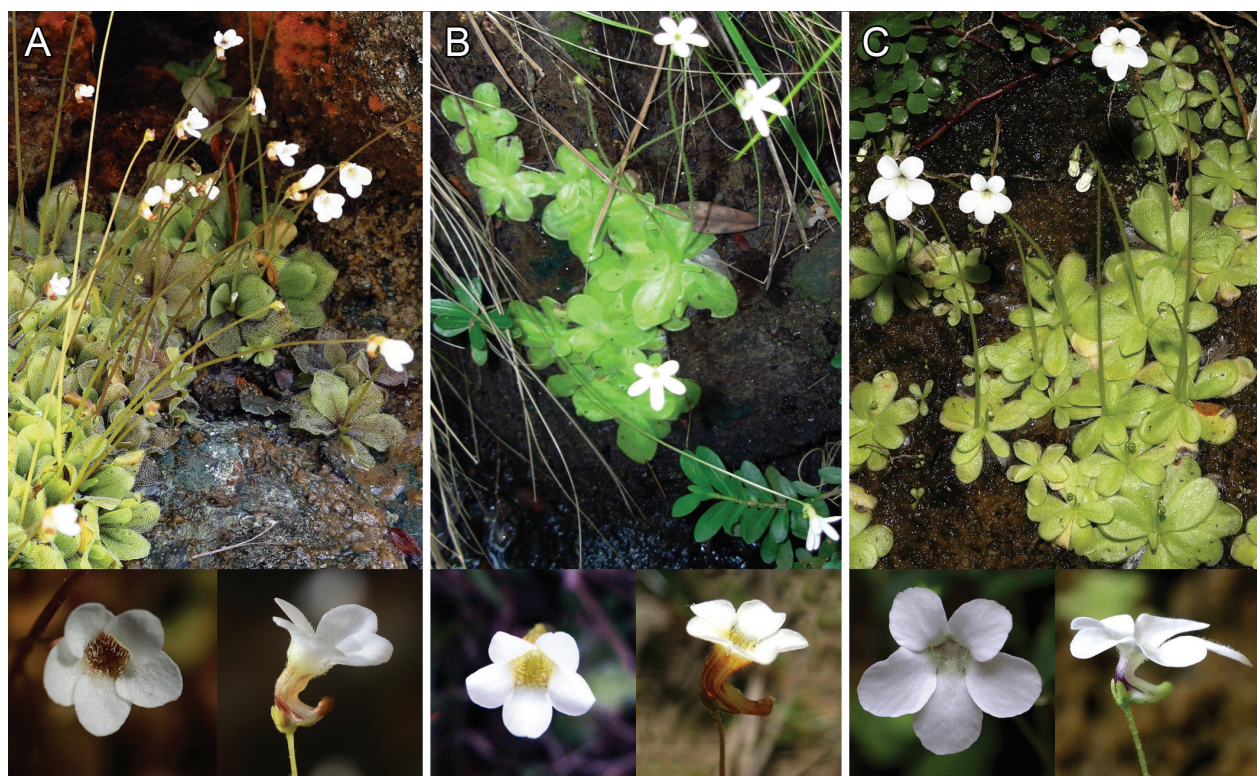
**Figure 4.** Distinct vegetative and reproductive morphological traits of related species. A. *Pinguicula panfetiae*. B. *Pinguicula albida*. C. *Pinguicula jaraguana*. Photos by Ivan Pančo (A, C) and Yoannis Domínguez (B).

Table 3. Loading of the first two axes (Factor 1 and 2) of the principal component analysis on quantitative morphological variables. Character codes correspond to those in Table 1.

Character	Factor 1	Factor 2
LFL	0.306	0.842
LFW	-0.458	0.774
SCL	0.782	-0.255
FLL	0.958	-0.026
LBL	0.938	0.073
LBW	0.941	0.174
MLL	0.968	0.096
MLW	0.957	-0.005
Variance explained by components	5.451	1.419

narrowly defined area; most occur on disturbed ground from recent landslides where they are at risk of further similar events. Therefore, based on the number of known locations (1), the extent of occurrence and the area of occupancy (EOO/AOO = 0.810 km²), the preliminary conservation status proposed is Critically Endangered CR B1ab(i,ii,iv)+B2ab(i,ii,iv) following IUCN criteria (IUCN 2024).

Additional material studied (paratypes). CUBA – Oriente [Guantánamo] • Palenque, Cuchillas de Toa, Cayo Fortuna, a lo largo del río Toa; Apr. 1970; *J. Bisse HFC-16747*; HAJB • Palenque, Cuchillas de Toa, Cayo Fortuna, a lo largo del río Toa; Apr. 1970, *J. Bisse HFC-16918*; HAJB • 35 km nordöstlich von Guantanamo, Gebiet von Palenque, Cayo Fortuna, Auf überrieseltem

Felsen am Ufer des Rio Toa; 22 Mar. 1972; *F. Ebel s.n.*; HAL [36587].

DISCUSSION

Morphological differences observed among the three species are useful to characterise and identify them (Fig. 4; Table 2) and showed consistency among the analysed individuals of each taxon. Furthermore, the results of the PCA revealed two principal components that together explain 81.86% of the total variation in the data (Factor 1: 68.13%, eigenvalue 5.451; Factor 2: 17.73 %, eigenvalue 1.419; Fig. 5A; Table 3). Plotting z-scores of the individuals' characters against the axes defined by Factors 1 and 2 also revealed three separated groups corresponding to the sampled individuals of each species,

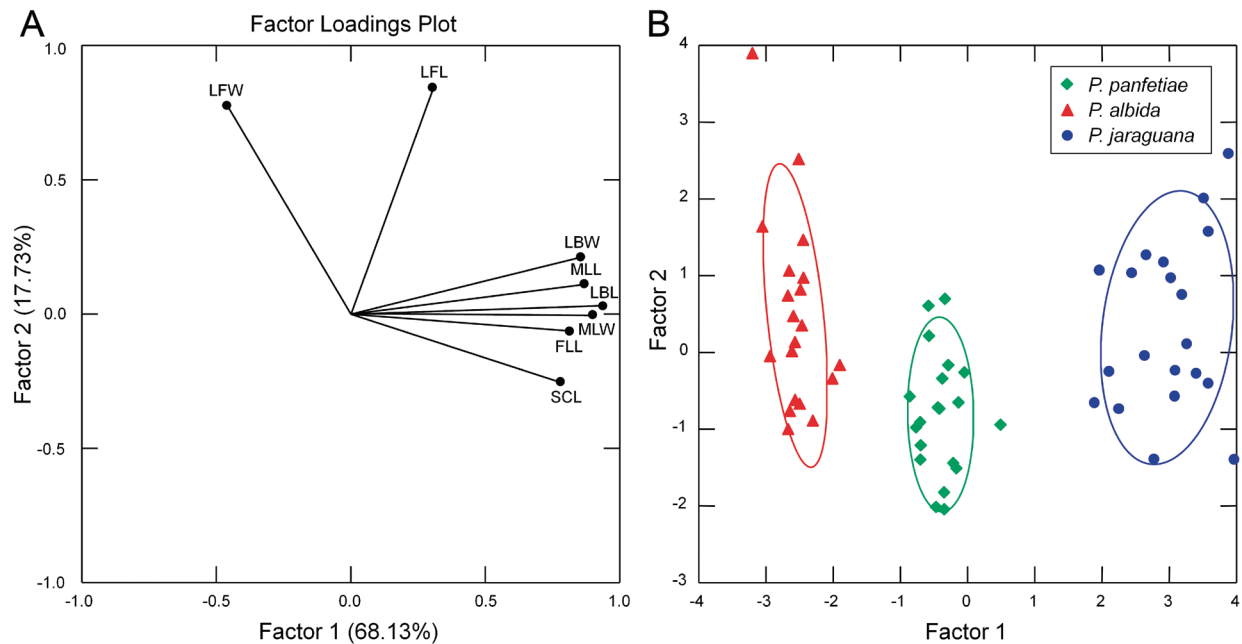


Figure 5. Principal component analysis based on vegetative and reproductive quantitative traits of *Pinguicula panfetae*, *Pinguicula albida* and *Pinguicula jaraguana*. **A.** Projection of the analysed variables onto the first two principal component axes (Factor 1 and 2). **B.** Projection of the sampled individuals for each species onto the first two principal component axes (Factor 1 and 2). Character codes correspond to those in Table 1.

with no overlap in their morphospaces (Fig. 5B). Factor 1 was defined by reproductive characters with high positive weight. This component separated species based on inflorescence scape length (SCL), flower length (FLL), and the length (LBL, MLL) and width (LBW, MLW) of the corolla lobes. *Pinguicula jaraguana* appears to the right end of the axis, showing longer inflorescences and larger flowers, followed by *P. panfetiae*, and finally *P. albida*, with shorter inflorescences and smaller corollas (Fig. 5B; Table 2). These reproductive traits have been highlighted as relevant characteristics to discriminate among related species of *Pinguicula* (Conti and Peruzzi 2006; Peruzzi and Gestri 2013; Domínguez et al. 2014; Burelo-Ramos et al. 2018; Crespo et al. 2020). On the other hand, Factor 2 was defined by leaf length (LFL) and width (LFW), both showing high positive weight (Fig. 5A) indicating the presence of smaller leaves in *P. panfetiae*; however, the overall variation of these vegetative characters is attributed to intraspecific variability (Fig. 5B). Moreover, qualitative vegetative characters, such as leaf growth, shape and margin, were also recognised as diagnostic characters useful to differentiate the three species (Fig. 4; Table 2), as previously noted for other groups of related taxa within *Pinguicula* (Casper et al. 2020; Crespo et al. 2020; Pérez et al. 2023). These traits may be associated with the specific environmental conditions in which each species thrives, including their adaptation to different light exposure and water availability.

The new species was discovered along the banks of the River Toa within the Alejandro de Humboldt National Park. This region is well-known for its high level of endemism, often associated with the presence of serpentine-derived soils, and has been highlighted as the main centre of diversification and endemism of the mountainous flora of Cuba (López Almirall 2013; López Almirall and Duarte 2022). *Pinguicula panfetiae* shares its habitat with *P. jaraguana* in ferritic soils derived from serpentine bedrocks (charrascales) in eastern Cuba; while *P. albida* occurrences include populations in serpentine derived soils in western Cuba (cuabales) (Fig. 4). According to Borhidi (1996), serpentinophilous floras of eastern and western Cuba resulted from intensive local speciation and represent independent evolutionary scenarios.

With the description of *P. panfetiae*, our findings confirm that Cuba is a hotspot for *Pinguicula* diversity, hosting at present 15 species and one subspecies, all of which are endemic to the Cuban archipelago. This diversity aligns with the concept of a Central American-Caribbean centre of diversity for the genus (Casper 2019) and reinforces the need for a more accurate assessment of the taxonomic diversity of the group in remote areas. Ten of the Cuban species are found exclusively in eastern Cuba, a region recognised as a centre of endemism for the genus (Domínguez et al. 2024). Although most Cuban species are distributed within conservation units, they remain exposed to threats due to the limited geographic ranges of known populations, particularly those species

that are known from a single location, such as *P. panfetiae*. Furthermore, as for other species, the single population of *P. panfetiae* may be impacted by local and global climate changes, but no evidence of specific climate risks to this taxon has been obtained as yet.

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SUPPLEMENTARY MATERIALS

Supplementary material 1

List of examined specimens of *Pinguicula albida* C. Wrigth ex Griseb. and *Pinguicula jaraguana* Casper.

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Supplementary material 2

Morphometric data of quantitative variables of *Pinguicula panfetiae*, *P. albida*, and *P. jaraguana* used in the statistical analyses. Vegetative characters: leaf length (LFL) and width (LFW). Reproductive characters: inflorescence scape length (SCL), flower length (FLL), corolla lobe length (LBL) and width (LBW), corolla midlobe length (MLL) and width (MLW). All measurements were taken in mm.

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Supplementary material 3

Normality tests for morphometric variables of vegetative and reproductive traits of *Pinguicula albida*, *P. jaraguana*, and *P. panfetiae* used in the principal component analysis (PCA).

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