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Potentilla greuteriana* (Rosaceae), a new species from Mt. Taigetos (S Peloponnisos, Greece)

Abstract

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Potentilla greuteriana Kyriak., Kamari, Kofinas & Phitos is a new species of *P.* sect. *Plumosistylae*, known from two localities (summit Xerouvouni and Langada gorge) on Mt. Taigetos (S Peloponnisos). The habitat of this *Potentilla* species is black bituminous, deeply karstified limestone. The closest relative of *P. greuteriana* is *P. arcadiensis*, which is distributed on the neighbouring Mt. Parionas (E Peloponnisos), but belongs, to *P.* sect. *Crassinerviae*. The main morphological differences between the new species and its related taxa of *P.* sect. *Crassinerviae* (*P. ulrichii*, *P. nerimaniae*, *P. davisii*) and *P.* sect. *Plumosistylae* (*P. libanotica* and *P. isaurica*) are discussed. Additionally, the conservation status of this species is provided.

Key words: Greek flora, *Potentilla*, conservation, endemism, taxonomy.

Introduction

The high diversity of the flora of Greece, rich in endemic and rare plant species, is a consequence of the country's geological history, which has resulted in the formation of a multitude of isolated areas and habitats along the flora's migratory pathways, from Anatolia to central and northern Europe. Peloponnisos is the southern part of the Greek mainland and, at the same time, of the Balkan Peninsula. Mt. Taigetos is one of the main biodiversity hotspots of mainland Greece, with a high percentage of endemic and rare taxa (Phitos & al. 2009), having strong phytogeographical connections with other mountains of Peloponnisos (examples being the endemic monotypic genus *Phitosia crocifolia* (Boiss. & Heldr.) Kamari & Greuter, *Achillea taygetea* Boiss. & Heldr., *Crepis heldreichiana* (Kuntze) Greuter occurring also on Mt. Parionas; *Globularia stygia* Orph. and *Teucrium aroanium* Boiss. occurring also on Mt. Chelmos, etc.) and of Crete (*Herniaria parnassica* subsp. *cretica* Chaudhri, *Ranunculus subhomophyllus* (Halácsy) Vierh., occurring also on the Lefka Ori range). The

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study of these connections is the subject of the first author's PhD thesis.

Several new taxa have recently been described from Mt. Taigetos and its surroundings, such as: *Allium orestis* Kalpoutz. & al. (Kalpoutzakis & al. 2012), *Campanula kamariana* Kyriak. & al. (Kyriakopoulos & al. 2017), *Geranium kikianum* Kit Tan & Vold (Tan & al. 2011) and also *Asperula lutea* subsp. *griseola* Greuter, *Ballota nigra* subsp. *anomala* Greuter, *Lolium scholzii* Greuter, *Nepeta hystrix* Greuter and *Trifolium michaelis* Greuter (Greuter 2012).

Potentilla L. is one of the largest *Rosaceae* genera, mostly Holarctic in distribution, though some of its representatives are also found on the mountains of southeast Asia (see Eriksson & al. 1998; Dobeš & Paule 2010; Dobeš & al. 2013). Wolf (1908), the monographer of the genus, recognized ca. 300 *Potentilla* species and divided the genus into two sections, based on the presence (*P. sect. Trichocarpae*) or absence (*P. sect. Gymnocarpae*) of hairs on the carpels, six subsections based on the shape of the pistils and the insertion of the styles, and several lower-ranking groups that are his main units of classification. Wolf's classification was adopted and modified by others, such as Juzepčuk (1941), who upgraded Wolf's subsections to subgenera and his groups to sections, and also Pawłowski (1965), who separated *P. subg. Fragariastrum* (Ser.) B. Pawł. into two sections (*P. sect. Fragariastrum* Ser. and *P. sect. Plumosistylae* B. Pawł.). Ball & al. (1968), in *Flora Europaea*, divided the genus *Potentilla* into 5 subgenera, among them the subg. *Fragariastrum* (Heister ex Fabr.) Reichenb., which was further divided into two sections, i.e. sect. *Fragariastrum* and sect. *Plumosistylae*, according to Pawłowski (1965). Later, Soják (1987) divided Wolf's *Potentilla* sect. *Trichocarpae* Th. Wolf into 19 sections, based on flower and anther structure and style shape. Moreover, by using molecular phylogenetic methods, a better understanding of the origin of subfamily *Rosoideae* Arn. of *Rosaceae* Juss. and of *Potentilla* itself has been achieved (see Eriksson & al. 1998, 2003; Potter & al. 2007; Lundberg & al. 2009).

Recently, Soják (2008), while presenting a new genus-level classification of the *Potentilleae* Sweet, suggested its division into two subtribes, i.e. *Potentillinae* J. Presl and *Fragariinae* Torr. & A. Gray, based on morphological characters, which is consistent with the phylogenetic tree by Eriksson & al. (1998), who proposed that *Potentilla* contains ca. 485 species of annual, biennial and perennial herbs, several of hybridogenous origin. According to phylogenetic reconstructions (Dobeš & Paule 2010), *Potentilla* s. str. comprises mainly herbaceous species, representing 24 of the 31 series distinguished by Wolf (1908).

In Greece, there are 26 taxa of *Potentilla* (eight in Peloponnisos), three of which are endemic. These include the submontane *Potentilla arcadiensis* Iatrou (Iatrou 1985) from Mt. Parnonas, E Peloponnisos, and two mountain species, *P. kionaea* Halácsy (Halácsy 1888) from Mt. Giona, Sterea Hellas and *P. deorum* Boiss. & Heldr. (Boiss. & Heldr. 1856) from Mt. Olimbos, NC Greece (Strid 1986).

In July 2011, Ioannis Kofinas, during a visit to the Langada climbing area of Mt. Taigetos, noticed an interesting *Potentilla* chasmophyte with robust and richly leafy flowering stems, growing on vertical rocks. On August of the following year (Aug 5, 2012) during a field survey by the first author on N Taigetos, west of the Xerovouni peak (1523 m), an additional, larger population with the same characteristics was found. The substrate in the two above localities, where this species grows, is black bituminous, deeply karstified limestone. Macroscopically, it resembles *P. arcadiensis* (*P. sect. Crassinerviae*), endemic to the neighbouring Mt. Parnonas (SE Peloponnisos), from which, however, it differs morphologically in

several features, such as its strongly supine flowering stems and visibly compact inflorescences with short pedicels, attributes that rather point to representatives of *P.* sect. *Plumosistylae*, such as *P. libanotica* Boiss. and *P. isaurica* (P. H. Davis) Pawł. from S Anatolia.

In this paper we describe these *Potentilla* plants from Mt. Taigetos as a new species, which is related to the neighboring *P. arcadiensis* (*P.* sect. *Crassinerviae*) from Mt. Parnonas and also to the Anatolian taxa *P. libanotica* Boiss. (Boissier 1872) and *P. isaurica* B. Pawł. (Pawłowski 1965) of *P.* sect. *Plumosistylae*. We also clarify the relationships of the new species with other close relatives.

Materials and methods

For the description of the new species, both living and dried material of all related *Potentilla* taxa from Greece and S-SE Anatolia & E Mediterranean area was used. The herbarium material that we also used for comparisons is deposited in the following Herbaria: B, E, L, P, Herb. Phitos & Kamari (UPA) and UPA (acronyms follow Thiers 2018).

Morphological observations were carried out under a Zeiss stereomicroscope. For taxonomic identification, scientific papers and floras (Boissier 1872; Juzepčuk 1941; Pawłowski 1965; Ball & al. 1968; Schiman-Czeika 1969; Peşmen 1972; Iatroú 1985; Soják 1987, 2008; Duman & Mill 1999; Tan & Iatroú 2001; Parolly & Nordt 2002) were used. The collection localities for all species were georeferenced and the distributions were mapped using the freeware GIS software QGIS 2.18 (2017), and Image Editor GIMP 2.8.22.

A detailed comparison between the new species and other morphologically related taxa is given in Table 1.

Results

Potentilla greuteriana Kyriak., Kamari, Kofinas & Phitos in Fl. Medit. 28: 353. 2018. (Figs. 1 & 2).

Diagnosis: *Potentilla greuteriana* differs from its related Greek endemic *P. arcadiensis* by the absence of digitate leaves, longer petioles, different indumentum of 1.2-1.5 mm long glandular and 1.0-1.2 mm long simple hairs, larger leaflets, longer stipules and auricles of the basal leaves, dense inflorescences with much shorter pedicels (7-10 mm against 15-35 mm long), glabrous petals, and usually pubescent to almost plumose, rarely glabrous, persistent styles.

P. greuteriana is related to the members of *P.* sect. *Plumosistylae*. It differs from its closest relatives in that section, *P. libanotica* and *P. isaurica*, by its indumentum (long glandular and slightly shorter simple hairs), the longer leaflets, shorter epicalyx segments and petals, anther shape (ovate to obovate rather than globose) and smaller achenes. Additionally, it differs from *P. libanotica* by the number of leaflet teeth (5-6 rather than 6-9) and seed hairiness (apex pilose to pubescent) and from *P. isaurica* by the obtuse rather than acute teeth and the shape of the petals (obovate to ovate instead of elliptic).



Fig. 1. Individual of *Potentilla greuteriana* from its *locus classicus* on the summit Xerovouni of North Taigetos.

Type: Greece: S Peloponnisos: Nomos Arkadias: Mt. N Taigetos, W-SW of Xerovouni summit, 37° 09'N, 22° 13' E, alt. c.1150 m, with *Pinguicula cristallina* subsp. *hirtiflora*, *Campanula asperuloides*, *Teucrium aroanium* etc., on vertical karstified limestone rocks, 9 Jul 2017, Ch. Kyriakopoulos 2334 (Holotype: Herb. Phitos & Kamari, UPA!). Isotypes: ACA! and PAL-Gr!

Description: Perennial, densely tufted to pulvinate. Flowering stems several, decumbent-ascending, 8-24(-27) cm long, 1-2 mm in diameter, longer than basal leaves, densely clothed with 1.2-1.5 mm long, erect to erect-patent glandular hairs and equally numerous, up to 1.0-1.2 mm long, patent simple hairs. Leaves in rosettes, long-petiolate, trifoliolate, green to yellowish-green, concolorous, smooth, almost sericeous, with appressed long hairs along the nerves, and a mixture of short and long hairs to the rest of the surface, with scattered 2-4 celled, <0.5 mm long glandular hairs along the leaflet margins; leaflets obovate, cuneate at base, terminal: (20-)25-38(-44) × (10-)15-28 mm, lateral: (20-)22-35 × (10-)15-26 mm, terminal tooth of leaflets equalling or shorter than the first lateral teeth; margins crenate (-serrate), lateral teeth 4-6(-7) on either side; petiole 3-6(-7.2) cm long, with erect glandular hairs up to 2 mm long and patent-erect simple hairs up 1mm long (length ratio almost 1:2); stipules lanceolate-acuminate, 2.0-2.4 × 0.6-0.7 cm, with auricles 0.8-1.3 cm long, with simple appressed hairs, up to 0.8 mm long and shorter, scattered glandular along both margins, green, becoming yellowish-green at

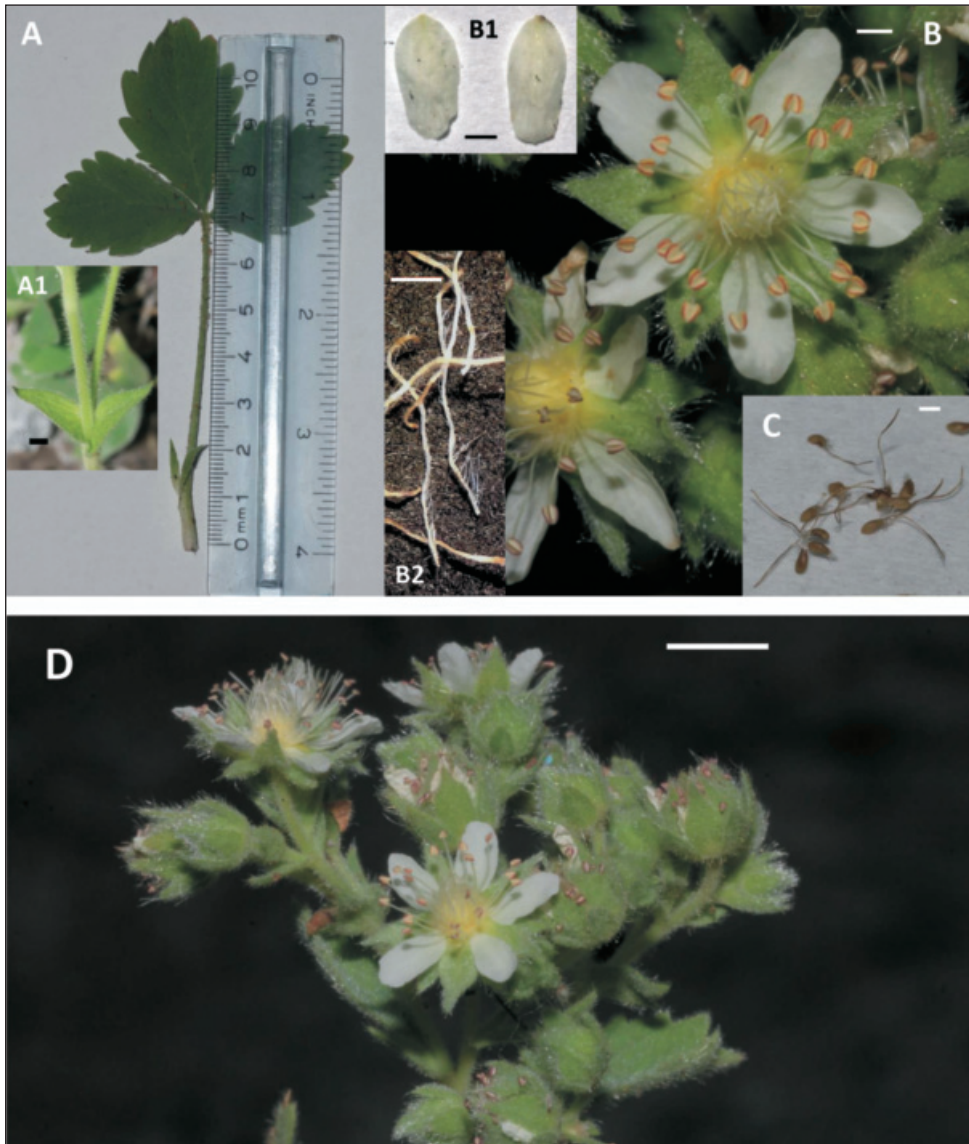


Fig. 2. *Potentilla greuteriana* sp. nova: **A**, basal leaf, petiole, stipules; **A1**, stipules of cauline leaves; **B**, flower; **B1**, petals; **B2**, styles; **C**, achenes with persistent styles; **D**, inflorescence. – Scale bars A-C = 1 mm; D.= 5 mm.

the base. Cauline leaves similar but smaller, with green, broader stipules, leaflets with 4-5 teeth, the larger 27-32(-37) × 18-22(-26) mm, in the middle of the stems (4th-5th from the bracts), diminishing upwards. Inflorescence a compact, terminal, rather dense cyme, ca. 12-30(-40) flowered, densely to moderately villous with long (≤1.2 mm) patent simple hairs and erect glan-

dular (≤ 1.2 - 1.5 mm long). Bracts foliaceous, usually less than 1.5 - 2.0×0.7 - 1.1 cm, with up to two teeth each side. Pedicels 7 - 10 (- 15) mm long, slender (diameter 0.5 - 0.8 mm). Flowers relatively small. Epicalyx segments 5 , narrowly ovate-lanceolate, acute, ca. 3 - 3.5×1 - 1.5 mm, not visible in front view of the perianth, with patent simple and sparse, short glandular hairs. Calyx densely sericeous-villous, (7 -) 8 - 9 (- 11) mm in diam., moderately accrescent in fruit; divided into 5 sepals (4 - 4.5×1.5 - 2.0 mm), indumentum with long erecto-patent simple hairs chiefly on the abaxial face, slightly larger than the epicalyx segments, cuneate to truncate at base. Petals white, with an obovate to obovate-oblong, rounded to broadly obtuse apex and a rounded to cuneate base, slightly longer than the sepals, 3.2 - 4.5×2.5 - 3 mm, glabrous. Stamens ca. 30 ; filaments 2.5 - 3.5 mm long, pilose in proximal $5/6$, more loosely so in the distal $1/2$, anthers pale yellowish with reddish margins, ovate to obovate, 0.4 - 0.5×0.3 mm. Style subapical, usually pubescent (for $1/3$ - $1/2$ of its length) or rarely glabrous, ca. 3 - 4 mm long, filiform (nematostylous). Nutlets ivory, kidney-shaped, distinctly compressed, 0.9 - 1.3×0.9 mm, smooth, apex pilose, margin narrowly winged, with persistent style.

Phenology: *Potentilla greuteriana* flowering from mid-June to mid-August. Fruiting from late August to the end of September.

Distribution and Habitat: *Potentilla greuteriana* is a narrow endemic of Mt. Taigetos (S Peloponnisos). Based on current data, its area of occurrence (Fig. 4) is limited to two, disjunct areas, on the rocky systems of North Taigetos, west of the summit Xerovouni and at suitable habitats of Langada gorge, in Central Taigetos. *P. greuteriana* is a typical chasmophyte. It grows on shady or half-shaded places, on vertical rocks, which consist of gray to black bituminous (containing solid organic ingredients), karstified limestone, capable of providing the flora that grows on it with the needed water (Fig. 3). The species appears to have adapted to the particular features of that limestone substrate, its dense root network effectively penetrating and absorbing water and nutrients from it.

Potentilla individuals on the Xerovouni summit grow at an altitude of ca. 1150 - 1200 m in N-NE exposure, while those of the Langada climbing area grow at an altitude of 750 - 800 m in S-SE exposure (Fig. 3).

Together with *Potentilla greuteriana* on the summit of Xerovouni, N Taigetos, there also grows the carnivorous *Pinguicula crystallina* subsp. *hirtiflora* (Ten.) Strid (this is the first report of its presence on N Taigetos, which constitutes its southernmost known occurrence) and, additionally, some Peloponnese endemic taxa, e.g. *Globularia stygia*, *Teucrium aroanium*, *Campanula asperuloides* (Boiss. & Orph.) Engl., *Minuartia pichleri* Maire & Petitm, etc.

In Langada gorge, *Potentilla greuteriana* co-exists with the following endemic taxa: *Asperula boryana*, *Campanula asperuloides*, *Carum depressum* Hartvig & Kit Tan, *Inula verbascifolia* subsp. *methanaea* (Hausskn.) Tutin and *Stachys candida* Bory & Chaub., whereas the local endemic *Hypericum taygeteum* Quézel & Contandr. is found nearby.

Conservation status: *Potentilla greuteriana* is a narrow endemic with a very limited area of occurrence in specialized habitats. Based on in-situ observations, it appears that a necessary condition for the species survival is the uninterrupted supply of water through the capillaries of the calcareous rocks on which it occurs. Possible changes of

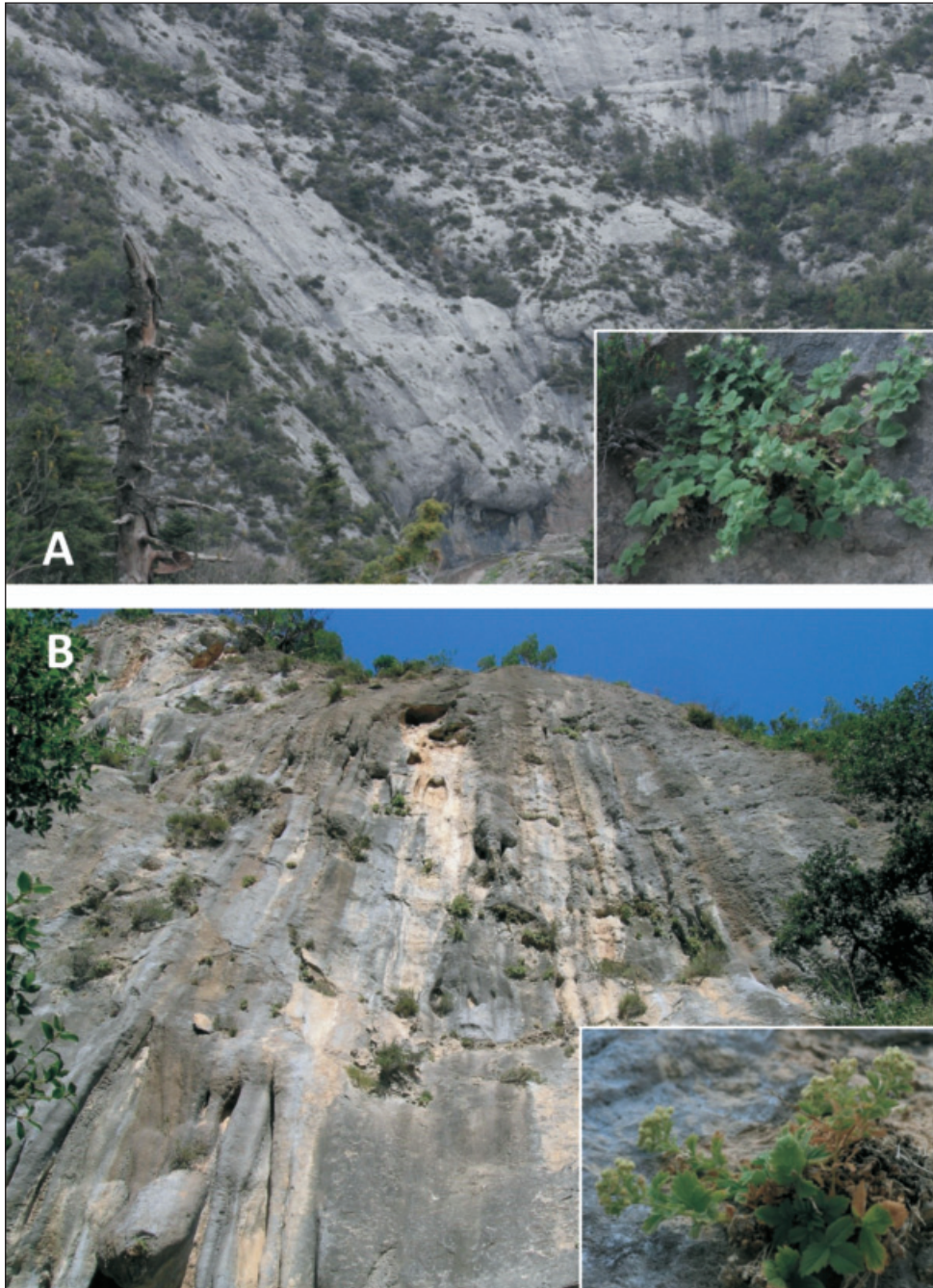


Fig. 3. Biotopes of the typical chasmophyte species *Potentilla greuteriana*: **A**, the summit area of Mt. Xerouvouni (*locus classicus*) of the north Taigetos and **B**, the climbing area of Langada gorge in central Taigetos.

water potential of the karstified limestone systems, on which it grows, may cause a population decline. The subpopulation of the Langada area occupies an area of less than $300 \times 50 \text{ m}$ ($< 1 \text{ km}^2$) and consists of 100-150 mature individuals, while the subpopulation of N Taigetos (Xerouvouni) develops over an area of $250 \times 30 \text{ m}$ ($< 1 \text{ km}^2$) and consists of 400-600 mature individuals. Moreover, the subpopulation of the former locality is potentially threatened by the fact that the area is used as a climbing field. Following the IUCN (2017) criteria, the taxon should be categorized as Endangered (EN), on the basis of its restricted distribution [restricted, extent of occurrence (EOO $< 100 \text{ km}^2$) and area of occupancy (AOO $< 100 \text{ km}^2$)], the fact that no more than 750 mature individuals were counted, and the high possibility of erosion of the substrate as a result of human activities (climbing) [B1ab(i,ii,iii,iv), B2ac(i,ii,iii,iv)].

Etymology: The species is named after Werner Greuter, Professor Emeritus of Plant Systematic, Nomenclature and Phytogeography of the world flora and especially expert of the Greek and Cretan flora, for his 80th birthday.

Discussion: *Potentilla greuteriana* is one more new stenoendemic taxon of Mt. Taigetos (S Peloponnisos). It is related to the Greek endemic *P.* (sect. *Crassinerviae*) *arcadiensis* from Mt. Parnonas (SE Peloponnisos), but also to the Anatolian endemics *P. isaurica* & *P. libanotica* (*P.* sect. *Plumosistylae*), which spread around S Turkey, Syria and Lebanon (see Fig. 4).

The only close relative of *Potentilla greuteriana* in Greece is *P. arcadiensis* (Fig. 5), which, however, according to Iatrou (1985), is a distinct and geographically isolated



Fig. 4. Distribution map of the two *Potentilla* Greek endemic species and their related species in S & SW Anatolia, Syria and Lebanon.

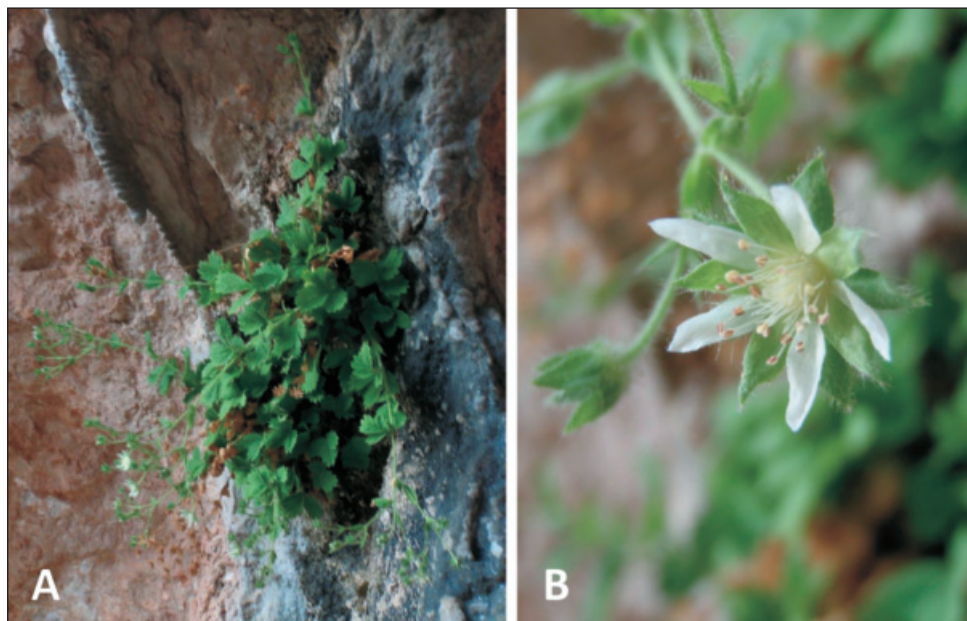


Fig. 5. *Potentilla arcadiensis* from its *locus classicus* at the Monastery of Elona, Mt. Parnonas: **A**, individual; **B**, inflorescence and flower.

species without any other close relatives in Greece. *P. arcadiensis*, in contrast to *P. greuteriana*, exhibits 1-2 digitate basal leaves, a feature that, according to Iatrou (1985), “suggests an intermediate position between the species of the E and W Mediterranean area”. The diploid chromosome number of *P. arcadiensis*, $2n = 14$, is an additional character of the representatives of the *Crassinerviae* group, such as *P. crassinervia* Viv., *P. valderia* L. and *P. haynaldiana* Janka (Contadriopoulos 1962; Baltisberger 2006). Based on this chromosome number, along with the hairlessness of styles and some other morphological features, Iatrou (1985) suggested that *P. arcadiensis* belongs to *P. sect. Fragariastrum* Ser., group *Crassinerviae*.

Additionally, *P. nerimaniae* Duman and *P. davisii* Mill & Duman, described by Duman & Mill (1999) from S & SW Anatolia, were also classified in *P. (subg. Fragariastrum) sect. Crassinerviae* (Th. Wolf) Juz. The taxa of *P. sect. Crassinerviae* differ from those of *P. sect. Plumostistylae* mainly by the predominant indumentum of simple hairs, \pm hiding the much shorter glandular hairs, loose inflorescences, flowers with long pedicels, pilose filaments, achenes with scrobiculate-reticulate surface etc (see Table 1).

Potentilla ulrichii Parolly & Nordt, which was described more recently (Parolly & Nordt 2002), also from S Anatolia, was classified in *P. sect. Crassinerviae* and placed in the *P. nerimaniae* group, together with *P. davisii* and *P. arcadiensis*. This species is also considered a close relative of *P. libanotica* and *P. isaurica* (Table 1).

However, *P. libanotica* and *P. isaurica*, together with *P. saxifraga* De Not. (a taxon growing in the lowland and the middle altitudinal level of Mediterranean Alps) were clas-

Table 1. Morphological features of *Potentilla greuteriana* and its relatives (bold letters denotes the main differences of the Greek endemic species of Peloponnisos).

Taxon	<i>Potentilla</i> sect. <i>Plumosiskypae</i>			<i>Potentilla</i> sect. <i>Crassinerviae</i> p.p. (<i>P. nerimantiae</i> group)			
	<i>P. greuteriana</i>	<i>P. libanotica</i>	<i>P. saurica</i>	<i>P. arcadiensis</i>	<i>P. ulrichii</i>	<i>P. nerimantiae</i>	<i>P. davisi</i>
<i>Stem (length in cm)</i>	8-25(+27)	5-20	5-20	10-25(+30)	(5-)10-35, decumbent to ascending, rarely erect	5-15, decumbent to ascending, rarely erect	5-12
<i>Stem leaves</i>	numerous	numerous	numerous	numerous	sparse	sparse	sparse
<i>Petioles (cm)</i>	4-7, thin	5-7, stout	3-5, stout	3-5, thin	5-12, thin	1-7, thin	≤10, stout
<i>Indumentum</i>	simple hairs, longer glandular hairs	glandular hairs dominant, glutinous	glandular hairs dominant, glutinous	simple hairs, shorter glandular hairs	simple hairs dominant, ± hiding the much shorter glandular hairs	simple hairs dominant, ± hiding the much shorter glandular hairs	simple hairs dominant, ± hiding the much shorter glandular hairs
<i>Leaves</i>	ternate, not bicoloured	ternate, green, not bicoloured	ternate, green, not bicoloured	ternate (1-2 basal digitate), not bicoloured	ternate, (distinctly) bicoloured	ternate, (weakly) bicoloured	ternate, bicoloured
<i>Leaflet size (mm)</i>	25-38(44) × 15-26(+28)	15-25 × 10-20	15-20 × 8-15	15-25 × 10-18	(20-)25-60(-70) × (15-)20-35(-45)	(7-)10-25 × (6)10-20	15-30 × 12-20
<i>Leaflet margin</i>	crenate-serrate	crenulate-serrate, rarely dentate	dentate to crenate-serrate	crenate-serrate	dentate	dentate	crenulate-serrate
<i>Lateral teeth of leaflets</i>	5-6	6-9	3-5(-6)	5-6(-7)	(6-)8-9(-10)	(3-)4(-5)	(4-)5-7(-10)
<i>Tip of teeth</i>	obtuse	± obtuse	± acute	obtuse	acute	acute	obtuse
<i>Inflorescence</i>	compact cyme, 12-30(-40) flowers	compact cyme	compact cyme	loose cyme, 15-20(-30) flowers	loose, ± corymbose cyme, (10-)15-30 flowers	loose, cymose	loose, cymose
<i>Pedicels (length in mm)</i>	7-10(-15), stout	≤12, stout	≤10, stout	15-35, ± thin	(10-)12-20(-35), thin	10-30, thin	10-30, thin
<i>Epicalyx segments (mm)</i>	≤3.5 × 1.5, shorter than sepals	4.6, 5 × 1.5-2.2, equal to sepals	4-6.5, equal to sepals	3.5-5.5, equal to sepals	4.5 × 1-1.5(-2), equal or slightly smaller than sepals	2-4, shorter or as long as the sepals	6-10, equal to sepals
<i>Petals length (mm)</i>	3.2-4.5 × 2.5-3	5-7.5 × 2.6-4.1	6-8	4.5-6 × 2-2.5	4.5-6(-7)	5-5.5	6-10
<i>Petals shape</i>	obovate to broadly oblong	obovate to ovate	elliptic	oblong to narrowly oblong	obovate	obovate	obovate-orbicular
<i>Petals apex</i>	rounded, glabrous	rounded ± retuse, glabrous	± acute, apex glabrous	usually acute, pubescent	rounded to broadly obtuse, glabrous	obtusely or shallowly obtuse, glabrous	obtusely, glabrous
<i>Filaments</i>	glabrous, base not dilated	glabrous, base not dilated	glabrous, base not dilated	glabrous, base dilated	pubescent, base dilated	pubescent, base dilated	pubescent, base dilated
<i>Anthers</i>	ovate to obovate often with base cordate, yellowish with reddish margins	globose, yellow	globose, reddish	oblong, yellowish with reddish margins	oblong, yellowish	oblong, yellowish	oblong, yellowish
<i>Style</i>	usually pubescent or rarely glabrous, persistent	plumose, persistent	plumose, persistent	glabrous, caducous	glabrous, caducous	glabrous, caducous	glabrous, caducous
<i>Achenes (mm)</i>	Smooth, 0.9-1.3, apex pilose, margin narrowly winged	Smooth, 1.2-1.8, pubescent margin narrowly winged	Smooth, apex loosely pilose	Smooth, 0.7-1.0, apex pilose, margin narrowly winged	Scrobiculate-reticulate, 1.6-1.8 × 0.9, glabrous, margin narrowly winged	Scrobiculate-reticulate, 1.5-2.0, glabrous	Scrobiculate-reticulate, apex pilose
<i>Altitudinal range (m)</i>	750-1200	1450-2100	1100-1700	450-650	300-550	1350-1950	1370-1630

sified by Pawłowski (1965) in *P.* sect. *Plumosistylae* because of their main morphological features, which are the non-deciduous, persistent and plumose (for up to $\frac{3}{4}$) styles and the almost globose anthers. The same classification is also followed by Soják (1987), who added to the morphological features of *P.* sect. *Plumosistylae* the slender filaments not dilated at the base, and stems with numerous leaves. According to the above characters, *P. greuteriana* probably belongs to *P.* sect. *Plumosistylae*. The main morphological features commonly found in *P.* sect. *Plumosistylae*, are: numerous leaves on flowering stems (with 5-8 unequal leaves, the largest in the middle of the stems), short-pedicellate flowers [length 0.6-1.2(-1.5) cm], glabrous filaments, glabrous petals, subterminal, filiform, persistent styles pubescent for $\frac{2}{3}$ - $\frac{3}{4}$ of their length, and smooth achenes (Table 1).

Potentilla greuteriana also shows some similarities to *P. arcadiensis* of *P.* sect. *Crassinerviae*, from which, however, it differs mainly by the bigger size [(25-38(-44) × 15-26(-28) mm] of the always trifoliolate leaves; the indumentum of the flowering stems and pedicels, which consists of longer (12-15 mm) glandular and shorter (10-12 mm) englandular hairs; the longer [10-18(-24) mm] stipules of the basal leaves, with significantly longer (8-12 mm) auricles; the epicalyx segments significantly shorter than the sepals; the shorter, glabrous petals, the styles usually pubescent for $\frac{2}{3}$ - $\frac{3}{4}$ of their length, persistent on the achenes; and more significantly the shorter [7-10(-15) mm] pedicels and the compact inflorescences (see Table 1).

Kechaykin & Shmakov (2016) in their revision of *Potentillinae* J. Presl, using molecular data and based on morphological differences, classified *Fragariastrum* Heist. ex Fabr. and *Tormentilla* L. as separate genera and included in them several *Potentilla* species. For example, *P. arcadiensis* and some of its Anatolian relatives are included in *Fragariastrum* sect. *Plumosistylae* (Pawłowski) Kechaykin & Shmakov (*P.* sect. *Plumosistylae* Pawłowski). This new classification of *P. arcadiensis* is uncertain because it does not display any of the key characters of *F.* sect. *Plumosistylae*, such as: anthers globose; style persistent in fruit and plumose at least in its lower half etc. (see: Pawłowski 1965: 79; Ball & al. 1968: 47). Detailed molecular data from *P. arcadiensis* and *P. greuteriana*, as well as from taxa of both *P.* sect. *Plumosistylae* and *P.* sect. *Crassinerviae*, could help elucidate the relationships of the two Greek endemic *Potentilla* species and their relatives.

Identification key to the Greek and the S-SE Anatolian & E Mediterranean *Potentilla* species related to *P. greuteriana*.

- 1. Loose inflorescence2
- . Compact inflorescence5
- 2. Petals pilose, oblong, acute***P. arcadiensis***
- . Petals glabrous, obovate, obtuse3
- 3. Achenes pubescent, leaflet margins crenulate to serrate***P. davisii***
- . Achenes glabrous, leaflet margins dentate4
- 4. Lateral teeth of leaflets (3-)4(-5), epicalyx segments 2-4 mm long***P. nerimaniae***
- . Lateral teeth of leaflets (6-)8-9(-10), epicalyx segments 4-5 mm***P. ulrichii***
- 5. Petal shape elliptic, lateral teeth of leaflets 3-5(-6), acute***P. isaurica***
- . Petal shape obovate to ovate, lateral teeth of leaflets 5-9, obtuse 6
- 6. Lateral teeth of leaflets 5-9, achenes pilose, styles plumose ***P. libanotica***
- . Lateral teeth of leaflets 5-6, achenes pilose only at the apex, styles usually pubescent or rarely glabrous***P. greuteriana***

Specimens seen***Potentilla greuteriana***

GREECE: S Peloponnisos: Prov. Arkadias: Mt. N Taigetos, W-SW of Xerovouni summit, 37° 09' N, 22° 13' E, 1150-1200 m, 5 Aug 2012, *Ch. Kyriakopoulos & Chr. Papagiannopoulos* 1300 (Herb. Phitos & Kamari, UPA); ibidem: 24 Jun 2013, *Ch. Kyriakopoulos* 1530 (Herb. Phitos & Kamari, UPA); ibidem: 23 Jul 2013, *Ch. Kyriakopoulos* 1697 (Herb. Phitos & Kamari, UPA); ibidem: 16 Jul 2015, *Ch. Kyriakopoulos* 2240 (Herb. Phitos & Kamari, UPA); ibidem: 24 Sept 2015, *Ch. Kyriakopoulos* 2249 (Herb. Phitos & Kamari, UPA); ibidem: 11 May 2016, *Ch. Kyriakopoulos* 2264 (Herb. Phitos & Kamari, UPA); ibidem: alt. c. 1150 m, with *Pinguicula cristallina* subsp. *hirtiflora*, *Campanula asperuloides*, *Teucrium aroanium* etc, on vertical karstified limestone rocks, 9 Jul 2017, *Ch. Kyriakopoulos* 2334 (Holotype: Herb. Phitos & Kamari, UPA; Isotypes: ACA and PAL-Gr).

GREECE: S Peloponnisos: Prov. Lakonias: Mt. Taigetos, Langada gorge, on vertical limestone cliffs, 37° 04' N, 22° 18' E, 750-800 m, 31 Jul 2011, *Ch. Kyriakopoulos* 895 (Herb. Phitos & Kamari, UPA); ibidem: 22 Jun 2012, *Ch. Kyriakopoulos & E. Kartsonas* 968b, (Herb. Phitos & Kamari, UPA); ibidem: 25 Jun 2012, *Ch. Kyriakopoulos* 1103 (Herb. Phitos & Kamari, UPA); ibidem: with *Campanula asperuloides*, 5 Aug 2012, *Ch. Kyriakopoulos & Chr. Papagiannopoulos* 1310 (Herb. Phitos & Kamari, UPA).

Potentilla arcadiensis

GREECE: E Peloponnisos: Arkadia: Mt. Paronias, in declivibus orientalibus montis Paron; ad Monasterium Elona, in rupestribus calc., alt. c. 550 m, 7 Jul 1983, *G. Iatrou* 1911 (Holotype: UPA); ibidem: the nunnery of Agios Nikolaos Sintzas, c. 6.4 km, SW the village of Leonidion, steep, calcareous rocks mostly to the N and SE of the nunnery, 37° 0.8' N, 22° 49' E, alt. 550-600 m, 30 May 2003, *Th. Constantinidis & E. Kalpoutzakis* 10677 (Herb. Phitos & Kamari, UPA); ibidem: monastery of Panagia Elona, vertical limestone cliffs after the monastery entrance, 37° 09' N, 22° 45' E, alt. 500 m, 10 Jul 2016, *Ch. Kyriakopoulos* 2293 (Herb. Phitos & Kamari, UPA).

Potentilla davisii

TURKEY: C2 Denizli: Acipayam, Bozdag, Olukbañi, above Geyran Yayla, 1450 m, rocks, 4 Aug 1997, Aytaç 7648 (Isotype E00075639); Bozdag, near Geyran Yayla, 4500 ft, rocks, 16 Jul 1947, Davis 13334 (Paratype E00146056); ibidem: 5000-5500 ft, Davis 13435 (Paratype E00146055).

Potentilla isaurica

TURKEY: C2 Antalya: Vil. Antalya (Isauria): Kargi Chai, between Durbanas and Derince valley, in cliffs, fl. white, 25 Aug 1947, *Davis* 14466 (Holotype E00010703, Paratype K000762317); C4 Antalya: Alanya, Dimçayi vadisi, 1200 m, 10 Oct 1992, *Duman* 4677 & *Karaveliogullari* (E00077481).

Potentilla libanotica

LEBANON: Liban, in mount Libano, 1837, *Aucher-Eloy* 1457 (P03342030); In declivita Libani borealis occidentalibus, prope pagum Ehdén, 1450-1700 m, 30 Jun-2 Jul 1910, *Bornmüller* 11766 (E00146058); Bcharré [sentier des Cèdres] (Liban), 1800 m, 14 August 1927, *Gombault* 17 (P03342020); Mt. Lebanon, Akoura, 2000 m, 30 Jul 1932, *Louis* [Frères Maristes d'Alep] s.n. (P04173512); ibidem: Aqoura, 31 Jul 1932, *Gombault* 1981 (P03342018, P03342019, P03342021, P03342018).

SYRIA: Hadret, 1822, *Ehrenberg* 322 (L.1901646); Syria, 1846, *Pinard* s.n. (E00409399).

TURKEY: C5 İçel: Kapudschi Dere, an Felsen, 1896, *Siehe* 643 (E00146059); Osmaniye: Amanus: Mont de Düldül, 1500-2000 m, 15 Aug 1911, *Haradjian* 3890 (E00409400).

Potentilla nerimaniae

TURKEY: C2 Antalya: Elmali, Çiglikara, 1900-1950 m, on calcareous rocks, 1 Aug 1995, *Duman, Ekici & Duran* (Duman 5978), (Isotype E00009314).

Potentilla ulrichii

TURKEY: C3 Antalya: Abzweig der Straße Manavgat - Akseki, nahe Ahmetler SW Muratiçi, 500 m, überhängende, schattige Kalkwand, Exp. E, 15 Oct 2000, *Ulrich* 121 (Holotype B100293986); Balme, nahe Ahmetler sudwest l. Murtiçi, 360 m, Exp. NW, 23 Apr 1997, *Ulrich* (paratype E00084587); near Ahmetler, crevices of limestone rocks, 330 m, Exp. N, 26 Aug 1998, *Ulrich* (Paratype E00077698).

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