

A new species of the genus *Potentilla* L. (Rosaceae)
from the Tehran province (Iran)

Marzieh Beygom FAGHIR,
Samira SADEGHI & Farideh ATTAR

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A new species of the genus *Potentilla* L. (Rosaceae) from the Tehran province (Iran)

Marzieh Beygom FAGHIR
Samira SADEGHI

Department of Biology, Faculty of Science, University of Guilan, Rasht (Iran)
marziegbeygomfaghir@gmail.com (corresponding author)

Farideh ATTAR

School of Biology, University College of Science,
University of Tehran, Tehran (Iran)

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ABSTRACT

Potentilla alborzensis Faghir & Attar, sp. nov. (Rosaceae) is collected from steppe Mountains of Tang-e Washi, in the middle of Alborz Mountains for the first time. The new species is related to section *Aureae* (Rydb.) Juz. for its palmate radical leaves, having straight hairs and glandular trichomes; corymbiform inflorescence; hairy and glandular sepals; clavate and papillose style, shorter than or as long as matured ovary. Detailed micro- and macromorphological descriptions of the newly collected species, as well as photographs and distribution map are provided. In addition, comparison of diagnostic traits with allied species especially *P. crantzii* (Crantz) Beck ex Fritsch, *P. adenophylla* Boiss. & Hohenack., *P. gelida* C. A. Mey., *P. geranioides* Willd. and identification key are presented.

RÉSUMÉ

Une nouvelle espèce de Potentilla L. (Rosaceae) de la province de Téhéran (Iran).

Potentilla alborzensis Faghir & Attar, sp. nov. (Rosaceae) a été récoltée pour la première fois dans les steppes d'altitude de Tang-e Washi, au centre des monts Elbourz. Cette nouvelle espèce est rattachée à la section *Aureae* (Rydb.) Juz. par ses feuilles radicales palmées à poils dressés et trichomes glandulaires, son inflorescence corymbiforme, des sépales pileux et glanduleux, ainsi que par un style claviforme et papilleux, plus court ou aussi long que l'ovaire mûr. Des descriptions micro- et macromorphologiques détaillées, ainsi que des photographies et la carte de répartition en sont données. En outre, une comparaison des caractères diagnostiques est effectuée avec les espèces parentes, notamment *P. crantzii* (Crantz) Beck ex Fritsch, *P. adenophylla* Boiss. & Hohenack., *P. gelida* C. A. Mey. et *P. geranioides* Willd. et une clé d'identification est proposée.

KEY WORDS

Flora of Iran,
micromorphology,
pollen,
Sect. *Aureae*,
new species.

MOTS CLÉS

Flore de l'Iran,
micromorphologie,
pollen,
Sect. *Aureae*,
espèce nouvelle.

INTRODUCTION

With its subterminal styles, two thecae anthers and ventral stipule, *Potentilla* L. is classified in the tribe *Potentilleae* Sweet and subtribe *Potentillinae* Presl (Soják 2008, 2004). It is one of the largest *Rosaceae* genera, mostly holarctic in distribution, however some of its representatives are also found on the mountains of Southeast Asia (Eriksson *et al.* 1998; Dobeš & Paule 2010). In the flora of Iran, they are composed of *c.* 42 species, *c.* 22 endemics arranged in 10 sections including *Persicae* (Th. Wolf) Juz., *Potentillae*, *Micranthae* Soják., and *Speciosae* (Th. Wolf) Juz., *Rectae* (Th. Wolf) Juz., *Rivales* Poeverl., *Aureae* (Rydb.) Juz., *Terminales*, (Döll) Gren. & Godr., and *Pensylvanicae* Poeverl., *Lipskyanae* Czevtabjva and intersectional hybrids (Faghir *et al.* 2014; Naqinezhad & Faghir 2019). They grow in Hyrcanian (Caspian), Irano-Turanian and Zagros phytogeographical regions, mainly in the northern, northwestern provinces (Schiman-Czeika 1969; Khatamsaz 1993; Faghir *et al.* 2010a). With *c.* 26 species (*c.* 7 endemics), Tehran is one of the most species rich province for the genus *Potentilla* in Iran (after Guilan and Mazandaran provinces) (Schiman-Czeika 1969; Khatamsaz 1993; Naqinezhad & Faghir 2019). The new species was collected in the framework of the biosystematic study of the genus from northern Iran in Tehran province. *Potentilla alborzensis* Faghir & Attar, sp. nov. grows mainly on basic rocks and boulders, which are among the most stressful ecosystems (e.g. Medina & Fernandes 2007) and important refuges for many national and local endemic taxa (Davis 1951; Zohary 1973; Juvan *et al.* 2011). However, more studies are needed to identify Iranian endemics. The main aim of the current paper is to describe a new species of the genus *Potentilla* from an ecosystem scarcely explored in the Central Hyrcanian area, North of Iran, to compare it with its allied species and to present an identification key.

MATERIAL AND METHODS

To identify the newly collected species, we used *Flora Iranica* (Schiman-Czeika 1969), *Flora of Iran* (Khatamsaz 1992), *Flora of USSR* (Yuzepchuk 1941), *Flora of Turkey* (Peşemen 1972) and Soják's papers (Soják 2008, 2009, 2012). In addition, several type specimens photos have been studied from W and Iranian herbaria IRAN, TABRIZ, Sanandaj, and TARI. A comparison between diagnostic characters of the new species and its most closely related species is presented in Table 1. Different morphological characters were studied on photographs by digital microscope, Dino-Lite, AN-413T model. Leaf, calyx and pollen micrographs were carried out using Scanning Electron Microscope (Tescan SEM Vega Razi Instrument). The collected and examined specimens were housed in Tehran (TUH) and Guilan Universities (GUH) herbaria.

SYSTEMATICS

Family ROSACEAE Juss.
Tribe *Potentilleae* Sweet
Subtribe *Potentillinae* Presl
Genus *Potentilla* L.

Potentilla alborzensis Faghir & Attar, sp. nov.
(Figs 1-3).

Distinguished from *P. adenophylla* Boiss. & Hohenack. by its erect (vs prostrate) stem, covered by long crispate (vs short and long straight) flexuose hairs, 3-5 (vs 5-7)-foliolate radical leaves, petals 8-10 mm (vs 10-20 mm) long, pollen grain prolate P/E = 1.45 (vs subprolate P/E = 1.19).

TYPUS. — Iran. Tehran province, Firouzkuh, Tang-e Washi, 21.VII.2017, Attar, Zamani & Habibi 48569 (holo-, GUH [GUH8030]!; iso-, TUH!).

DISTRIBUTION AND ECOLOGY. — The new species was collected from Tehran province, Firouzkuh, Tang-e Washi, 35°28'N, 52°46'E, 1731 m a.s.l., (Fig. 4). It grows on dry steppe mountains area. *Potentilla alborzensis* Faghir & Attar, sp. nov. grows on bare rocks and boulders near the river, at about 1.5 to 2 meters above the water surface, accompanied by only a few lithophytic species e.g. *Parietaria judaica* L. and *Graellsia integrifolia* (Rech.f.) Rech.f. However, we found several populations of *Hypericum perforatum* L., *H. scabrum* L., *Cirsium hygrophilum* (Greene) Jeps., *Heracleum persicum* Desf. ex Fisch., *Epilobium montanum* L., *Centaurea aucheri* (DC.) Wagenitz, *Drymocallis poteriiifolia* (Boiss.) Soják and *Potentilla balansae* Soják. (Faghir *et al.* 2010a) in the stony slopes, open meadows, and along the riverside.

CONSERVATION STATUS. — We categorized *Potentilla alborzensis* Faghir & Attar, sp. nov. as Endangered (criteria EN) according to criteria B1 (indicating the extent of occurrence, less than 5000 km²), subcriterion a (severely fragmented or known to exist at no more than five locations); criterion B2 (indicating by area of occupancy, less than 500 km²), subcriteria a (grows at no more than five locations) and b (comprising of mature individuals); criterion D (total number of individuals does not exceed 200 mature individuals) (IUCN 2019). The population of this new species is endangered by the following factors: risk of flooding with a basic rocks destruction and extinction due to tourism in the region, especially in summer, when the favorable climate and beautiful natural waterfalls attract many tourists. Endangered: B1a; B2a; D.

DESCRIPTION

Perennial herbs; caudex sturdy, erect-ascending, multicapital, densely covered with brown remains of stipules (Fig. 1); stems 12-20 cm long, slightly branching, having long crispate flexuose hairs (Fig. 2A); radical leaves and dead stipules on stock polystichous; radical leaves mainly 5-foliolate, rarely 3-foliolate, 8-10 × 12-15 mm, leaflets subsessile, obovate-oblong, cuneate, obtuse, with 5 pairs of oblong acute teeth, both sides hairy (long flexuose trichome) (Fig. 2B-D) and glandular; petiole of radical leaves 2.5-4 cm long, having appressed-subappressed hairs (Fig. 2E); stipules of radical leaves lanceolate; lower cauline leaves 5-foliolate, petiolate; upper cauline leaves 3-foliolate with short-petiole; stipules of cauline leaves lanceolate with 1 tooth (Fig. 2F); inflorescence a lax corymb; flowers 10-15 mm in diameter (Fig. 2G-

TABLE 1. — Morphological differences between *Potentilla alborzensis* Faghir & Attar, sp. nov. and its closely related species (Yuzepchuk 1941; Schiman-Czeika 1969; Peşemen 1972; Khatamzaz 1992; Soják 2012).

Characters	<i>P. alborzensis</i> Faghir & Attar, sp. nov.	<i>P. crantzii</i> (Crantz) Beck ex Fritsch	<i>P. adenophylla</i> Boiss. & Hohenack.	<i>P. gelida</i> C. A. Mey.	<i>P. geranioides</i> Willd.
1. Arrangement of radical leaves and dead stipules on stock	polystichous	distichous	polystichous	polystichous	polystichous
2. Flowering stem height	12-20 cm	5-20 cm	5-15 cm	5-20(30) cm	3-10 cm
3. Flowering stem type	Erect -ascending	Ascending-prostrate	Ascending-prostrate	Erect-ascending, rarely prostrate	Ascending
4. Stem hair types	Long crispate and flexuous hairs	Flexuous hairs	Long and short straight hairs	Long and short straight hairs	Short hirsute hairs
5. Radical leaves number of leaflets	3-5-foliolate	Mainly 5, sparsely 3-foliolate	5-7 foliolate	3-foliolate	7-foliolate
6. Radical leaves leaflets shape	Shallowly divided, obovate-oblong, cuneate	Shallowly divided, obovate-cuneate	Shallowly divided, narrowly obovate	Shallowly divided, obovate, cuneate, suborbicular	Deeply divided, flabellate,
7. Radical leaves leaflets hairs	Both side with sub appressed hairs	Both side with flexuous, villose hairs	Long straight hairs	Glabrescent on both sides or less pubescent on both sides	Upper surface glabrous, lower side with appressed long
8. Radical leaves number of teeth	5 pairs	2-5 pairs	3-6 pairs	3-5 pairs	3-7 pairs
9. Radical leaves teeth shape	Oblong acute, obliquely forward pointing	Obovate, suborbicular, obliquely forward pointing	Obovate, suborbicular, directly forward pointing	Ovate, oblong or lanceolate, obtuse or acute	Oblong- elliptical
10. Hairs on petiole of radical leaves	Appressed-sub appressed	Long patent	Long and short patent	Long and short patent	Appressed and erect-patent
11. Length of the petiole of radical leaves	Long (2.5-4 cm)	Long (5 cm)	Short (2 cm)	Long	Short
12. Stipule of upper cauline leaf	Lanceolate with one tooth	Lanceolate-ovate, entire	Lanceolate, obtuse entire	broadly ovate, obtuse, entire	Lanceolate, obtuse, entire
13. Flower diameter	10-15 mm	10-25 mm	10-20 mm	10-20 mm	10 mm
14. Shape of outer sepal	Oblong-linear	Oblong-elliptical, obtuse	Lanceolate, obtuse	Elliptic or oblong, obtuse	Linear-oblong
15. Shape of inner sepal	Ovate-lanceolate acute	Ovate-oblong, elongated at top	Ovate-lanceolate, obtuse	Oblong-ovate acute	Linear-oblong, ovate -oblong
16. Outer and inner sepals length	Almost the same height (5 × 2.5-3 mm)	Outer shorter than inner (8 × 4/4 mm)	Almost the same height (3-5/5 mm)	Almost the same height	Outer shorter than the inner (3-4/5 mm)
17. Inflorescence	Lax-flowered	Many-flowered	Lax-flowered	Many-flowered	Many-flowered
18. Petal length	8-10 mm	1-1/2	1-1.7	Twice longer than sepals	5.6-10 mm

I); pedicel long and thin; sepals hairy and glandular, erect (Fig. 2G), patent in mature flower (Fig. 2I); outer sepals oblong-linear, obtuse, 5×12.5-3 mm; inner sepals almost as long as outer ones, ovate-lanceolate, acute; petals 8-10mm, obovate, emarginate yellow (Fig. 2J); stamens 20; receptacle conoid, hairy; style subterminal, shorter than fruitlets; stigma dilated, clavate and papillate (Fig. 2K); achene ovoid, smooth (Fig. 2L).

Leaf and calyx micromorphology

Leaf and calyx micromorphological data revealed straight flexuose (villose), subappressed, hairs and small glandular

trichomes having a 1-2 celled stalk and single head, on both surfaces of the leaves (Fig. 3A) and adaxial surface of the outer and inner sepals (Fig. 3B).

Pollen morphology

Pollen grains are monads radially symmetrical, isopolar, trizonocolporate, polar axis length (P) = 28.4-30.89 µm, equatorial axis length (E) = 18.33-22.5 µm, P/E = 1.45, prolate in shape and medium in size. The outline of the pollen grains is elliptical in equatorial view (Fig. 3C) and triangular in polar view (Fig. 3D). The exine sculpturing is striate in this species.

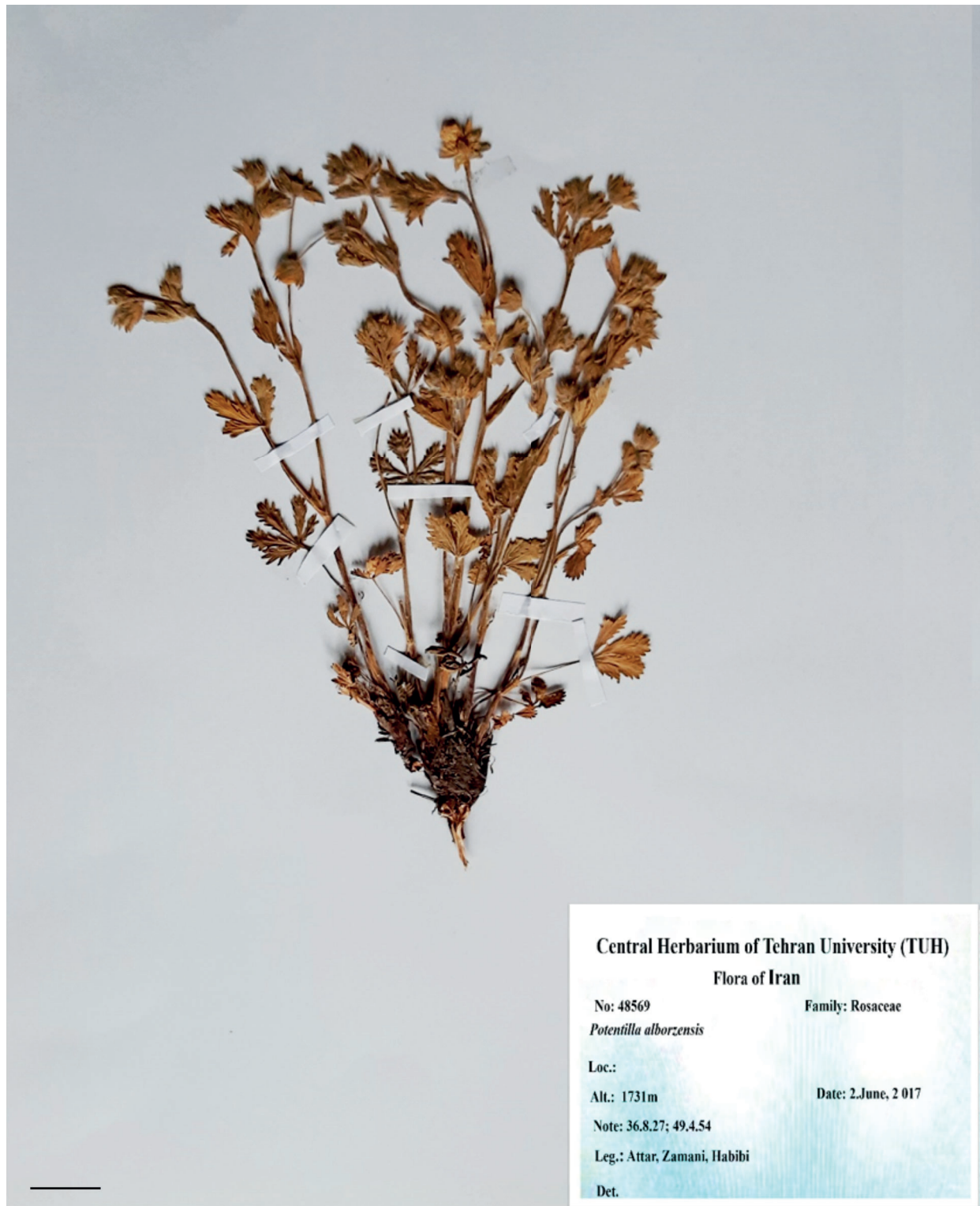


FIG. 1. — *Potentilla alborzensis* Faghir & Attar., sp. nov. From holotype: Attar, Zamani & Habibi 48569 (TUH).

TAXONOMIC REMARKS

The features that distinguish the new species are the indumentum types of stem and petiole of radical leaves, the shape of basal and cauline leaves and their stipules, the sepal shape and petal length. The new species was found

as isolated populations on rocks and boulders, without any other species of *Potentilla* growing with it. It appears that *P. balansae* Soják is geographically the closest species to *P. alborzensis* Faghir & Attar, sp. nov. However, the two species show great differences in terms of ecology and mor-



FIG. 2. — Details of morphological characters of *Potentilla alborzensis* Faghir & Attar., sp. nov. (Attar, Zamani & Habibi 48569): **A**, stem surface; **B**, radical leaves; **C**, leaflets lower surface; **D**, leaflet upper surface; **E**, petiole of radical leaf; **F**, upper cauline leaves and stipules; **G**, flower with erect sepals; **H**, flower from outer view; **I**, flower from inner view; **J**, petal; **K**, carpels with style and stigma; **L**, achene. Scale bars: A,–F, H 0.5 mm; G, I–K 1mm; L 2 mm.

phological evidences especially style morphology, hair types and leaf shape. Therefore, the participation of *P. balansae* (having a long style characteristic of the section *Persicae*) in the origin of *P. alborzensis* Faghir & Attar, sp. nov. is less likely. Moreover, the morphological traits of the new

species do not show any variability within a population. According to Soják (2006), worthy of attention are especially those species morphologically isolated and without any obvious close relationship, which are thus rather unlikely of hybrid origin

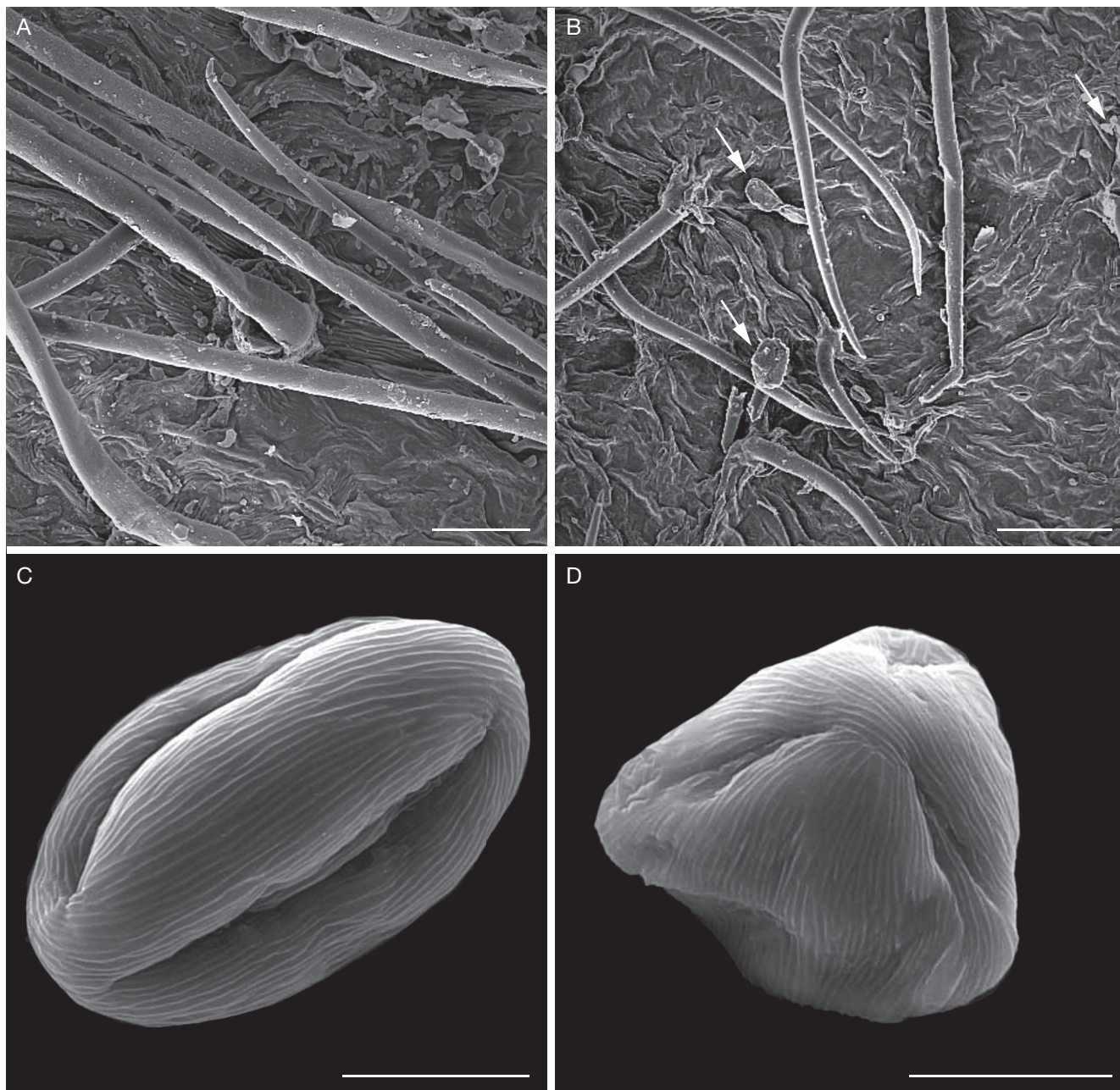


FIG. 3. — Micrographs of *Potentilla alborzensis* Faghir & Attar., sp. nov. from (Attar, Zamani & Habibi 48569): **A**, leaf upper surface; **B**, outer sepal upper surface; **C**, pollen from equatorial view; **D**, pollen from polar view. Arrows indicate glandular trichomes. Scale bars: A, 50 μ m; B 100 μ m; C, D, 10 μ m.

The new species is close to *P. crantzii* (Crantz) Beck ex Fritsch and *P. adenophylla* Boiss. & Hohenack. in the Flora of Iran. The two latter species are classified in the section *Aureae* (Th. Wolf) Juz. (Yuzepchuk 1941), comprising four representatives in the area covered by Flora Iranica (Schiman-Czeika 1969) and four species in the Flora of Iran (Khatamsaz 1992). They prefer alpine meadows, ravines, forest edges, stony slopes, limestone rocks and gravels of Hyrcanian and Irano-Turanian regions of N, NW of Iran (Schiman-Czeika 1969; Khatamsaz 1992). Palmate radical leaves, covered with straight hairs (not tomentose) and glandular trichomes; corymbiform inflorescence; hairy and glandular sepals; clavate and papillose

style, shorter than or as long as matured ovary are important characteristics of the section *Aureae* (Yuzepchuk 1941; Schiman-Czeika 1969; Khatamsaz 1992). Among them, *P. gelida* C. A. Mey. and *P. geranioides* Willd. distinctly differ from *P. alborzensis* Faghir & Attar, sp. nov. in terms of their leaves characteristic features especially number, shape, trichome type and dentation of the leaflets, as well as the shape of outer and inner sepals; flower size; sepals and petals of the same height (Table 2, columns 5 and 6). The new species shows affinities with *P. crantzii* and *P. adenophylla* by upper surface or both sides of radical leaves glabrous, shallowly divided; larger flower in size and petals longer than sepals (Schiman-Czeika 1969;

Soják 2012). *P. crantzii* grows in stony rock streams, ravines, meadows, forest edges of N, NW of Iran. It is well known for its distichous radical leaves and dead stipules on stock; mainly 5-foliolate, obovate-cuneate or suborbicular leaflets, having 2-5 pairs of teeth; entire stipule of cauline leaves; oblong-elliptical, obtuse outer sepals; ovate-oblong inner sepals; petals twice longer than sepals (Table 1[column 2]). While, *P. adenophylla* is distributed in alpine and subalpine meadows (1800 m a.s.l.), stony slopes, limestone (Khatamsaz 1992). The latter species is characterized by its 5-7 foliate radical leaves, leaflets having 3-6 pairs of teeth; petiole of the radical leaves with short and long hairs; stipule of the cauline leaf lanceolate, obtuse entire; outer sepal linear-lanceolate; inner sepal ovate-lanceolate, sepals of the same height and petal longer than sepals (Table 1[column 3]). In addition, the current SEM observations revealed leaf micromorphological features of *P. alborzensis* Faghir & Attar, sp. nov., especially hairs and glandular trichomes are identical to those of *P. adenophylla* (straight, subappressed hairs) (Faghir *et al.* 2010a). Palynological evidences of the new species are also in consistency with the two latter species, having striate exine sculpturing with short ridges interval and similar pollen size (small to medium). However, the pollen shape of *P. alborzensis* Faghir & Attar, sp. nov., varied from the two allied species



FIG. 4. — Distribution map of *Potentilla alborzensis* Faghir & Attar., sp. nov.

(spheroid-prolate, $P/E = 1.06$, in *P. crantzii* and subprolate $P/E = 1.19$, in *P. adenophylla*). Based on the previous study, the pollen shape is useful for separating some sections, but shows changes in others including sect. *Aureae* (Faghir *et al.* 2012). Based on morphological diagnostic characters (Yuzepchuk 1941; Schiman-Czeika 1969; Peşemen 1972; Khatamsaz 1993; Soják 2012) an identification key is presented:

IDENTIFICATION KEY FOR *POTENTILLA* L. SECT. *AUREAE* (RYDB.) JUZ. IN IRAN

1. Radical leaves 3-foliolate; petals twice larger than sepals *P. gelida* C. A. Mey.
— Radical leaves 3 and 5-7 foliolate; petals not twice larger than sepals 2
2. Radical leaves leaflets deeply toothed, flabellate in shape, with 3-7 oblong-elliptical teeth and glabrous on the upper side *P. geranioides* Willd.
— Radical leaves leaflets $\pm$ shallowly toothed, not flabellate, 3-6 teeth, oblong to ovate and suborbicular in shape; hairy on both sides *P. crantzii* (Crantz) Beck ex Fritsch
— Basal leaves and dead stipules polystichous, hairs subappressed 3
3. Flowering stem erect-ascending, covered with long crispate, flexuose hairs, radical leaves 3-5 foliolate, obovate-oblong cuneate, with 5 pairs of oblong acute, obliquely forward pointing teeth, petiole of radical with long crispate, flexuose hairs; petals 8-10 mm *P. alborzensis* Faghir & Attar, sp. nov.
— Flowering stem prostrate, having long and short straight hairs; radical leaves 5-7 foliolate, narrowly obovate, with 3-6 pairs of obovate, suborbicular directly forward pointing teeth, with long and short straight hairs; petals 10-20 mm *P. adenophylla* Boiss. & Hohenack.

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