

New species and new synonymy in the genus *Gypsophila* L. subgenus *Pseudosaponaria* Williams (Caryophyllaceae)

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ABSTRACT

Gypsophila farsensis Falat., Assadi & F. Ghahrem., sp. nov. is described as a new endemic species of the Center of Iran. Morphological evidences (dichasial inflorescence, tubular-campanulate calyx with wide hyaline intervals, petals two to two and a half times as the calyx with distinct limb and claw, ovules 17-27) support taxonomic placement of the new taxon in *Gypsophila* L. subgenus *Pseudosaponaria* Williams. *Gypsophila farsensis*, sp. nov. is close to *G. platyphylla* Boiss., but it differs with having shorter habit, thinner stems, glandular-hairy lower internodes, shorter internodes, linear-lanceolate leaves with less width and spatulate petals. Moreover, *G. boissieriana* Hausskn. & Bornm. is proposed as a synonym of *G. platyphylla* Boiss. Micromorphology of seeds and pollen grains is described and compared between the described taxa.

RÉSUMÉ

Une espèce nouvelle et un synonyme nouveau dans le genre *Gypsophila* L. sous-genre *Pseudosaponaria* Williams (Caryophyllaceae).

Une nouvelle espèce endémique du centre de l'Iran, *Gypsophila farsensis* Falat., Assadi & F. Ghahrem., sp. nov. est décrite et illustrée. Les caractères morphologiques (inflorescence dichasiale, calice tubulaire-campanulé à sinus hyalins, pétales deux à deux fois et demi plus grands que le calice à limbe clairement onguiculé, 17 à 27 ovules) démontrent que ce nouveau taxon doit être placé dans le sous-genre *Pseudosaponaria* Williams. *Gypsophila farsensis*, sp. nov. est affine de *G. platyphylla* Boiss., mais en diffère par sa stature plus réduite, ses tiges plus minces, les feuilles linéaires-lancéolées et les pétales spatulés. En outre, *G. boissieriana* Hausskn. & Bornm. est proposé comme synonyme de *G. platyphylla* Boiss. La micromorphologie des semences et des grains de pollen est décrite et comparée entre les taxa décrits.

KEY WORDS

Silenoideae,
Caryophyllaceae,
Fars province,
Iran,
pollen grains,
seed micromorphology,
new synonym,
new species.

MOTS CLÉS

Caryophyllaceae,
Silenoideae,
Province de Fars,
Iran,
grains de pollen,
micromorphologie des
semences,
synonyme nouveau,
espèce nouvelle.



FIG. 1. — Distribution of *Gypsophila farsensis* Falat. Assadi & F. Ghahrem., sp. nov. (■) and *G. platyphylla* Boiss. (★).

INTRODUCTION

Genus *Gypsophila* L. (baby's-breath in English), a member of the Pink family (Caryophyllaceae; “*Mikhakian*” in Persian), with nearly 150 species (Mabberley 2008) is the fourth largest genus of the subfamily Caryophylloideae Rabeler & Bittrich. The main center of diversity of the genus is the Black Sea region, Turkey, Caucasus, north Iraq and Iran (Barkoudah 1962). *Gypsophila* is one of the most polymorphic genera of the family Caryophyllaceae (Rabeler & Bittrich 1993).

In this paper, a new species of the genus *Gypsophila* subgenus *Pseudosaponaria* sect. *Hispidae* Boiss. is described from Fars province, Central Iran. It is a part of our results during preparing a new taxonomic revision for *Gypsophila* in Iran. Because of its dichasial inflorescence, tubular-campanulate calyx with wide hyaline intervals, long petals with distinct limb and claw and 17-27 ovules, the new species is located in subgenus *Pseudosaponaria* Williams (1889). This subgenus includes nearly seven species over the World. It

includes four taxa, in one section, in Iran (Barkoudah 1962; Rechinger 1988; Nejad Falatoury *et al.* 2015). Also a new synonymy in this subgenus is proposed.

MATERIAL AND METHODS

Gypsophila specimens preserved in TARI, T, LE, FAR, IRAN, TUH & FUMH herbaria were examined using an Olympus SZH stereomicroscope. Samples were scanned with a Dino-Lite digital microscope AM413T model. Photographs of *Gypsophila* specimens in E, W, KEW, P and G virtual herbaria were reviewed. Pollen and seed samples were scanned with a KYKY SEM, EM3200 model. To describe pollen characters it is referred to the glossary of pollen and spore terminology by Punt *et al.* (2007) and for the seeds to Yildiz (2002) and Amini *et al.* (2011). Local and neighboring floras were also considered (Schischkin 1936; Barkoudah 1962; Huber-Morath 1967; Davis *et al.* 1988; Rechinger 1988; Ataşlar 2000).

A SIMPLIFIED KEY FOR THE TAXA OF *GYP SOPHILA* L. SUBGENUS *PSEUDOSAPONARIA* WILLIAMS IN IRAN

1. Plant annual 2
- Plant perennial 3
2. Stem and calyces glandular-hairy *G. pilosa* Huds. var. *pilosa* Huds.
- Plant completely glabrous *G. pilosa* var. *glabra* Falat., F. Ghahrem. & Assadi
3. Stem erect, middle leaves ovate, petals narrow cuneate, truncate *G. platyphylla* Boiss.
- Stem ascending to erect, middle leaves narrow lanceolate, petals spatulate, divided to lamina and claw, undulate *G. farsensis* Falat., Assadi & F. Ghahrem., sp. nov.



FIG. 2. — *Gypsophila platyphylla* Boiss. (Hamzehee & Khaledian 893, TARI).

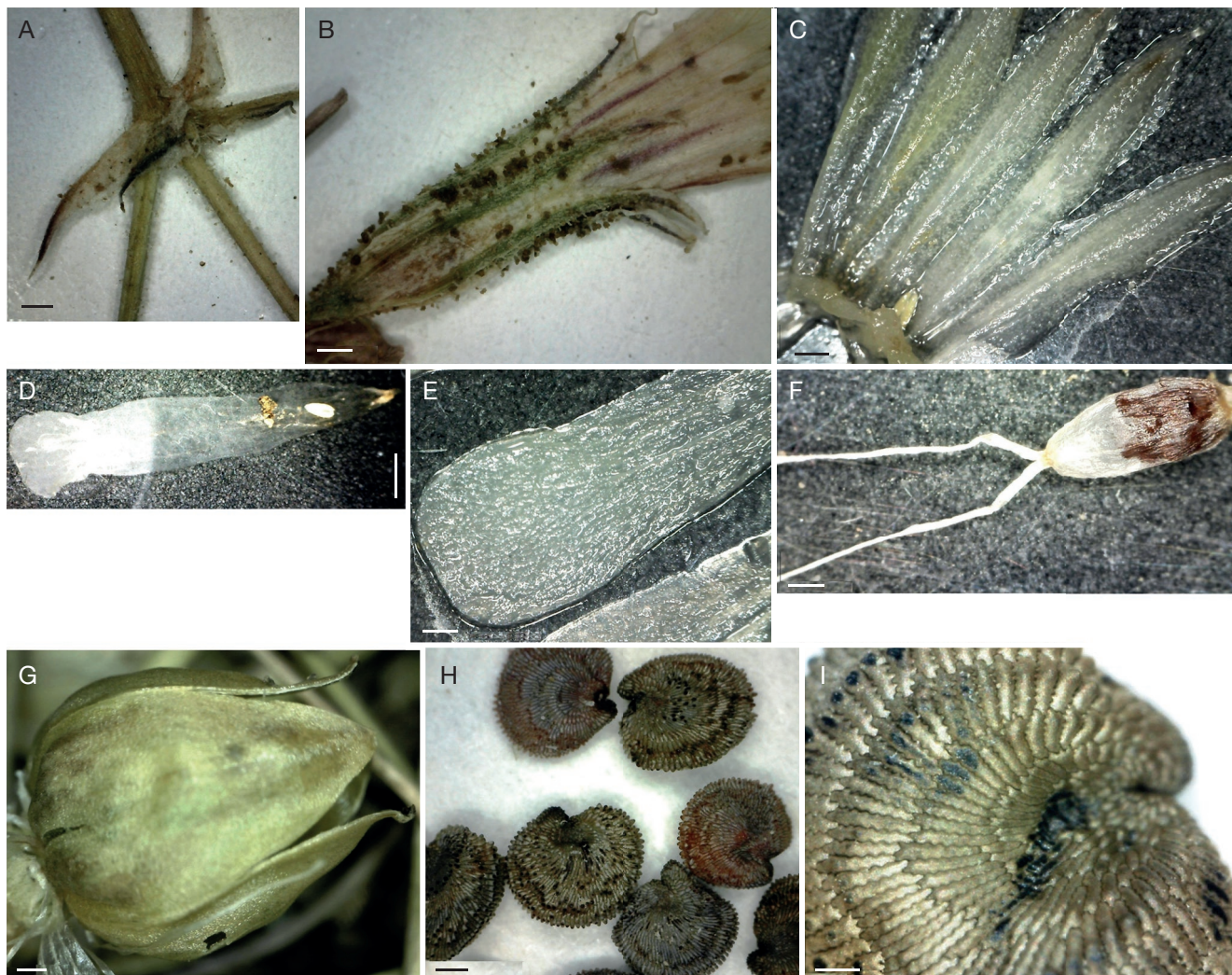


FIG. 3. — Details of morphological characters of *Gypsophila platyphylla* Boiss.: **A**, bracts (Assadi 75259); **B**, calyx; **C**, open calyx; **D**, petal; **E**, petal apex; **F**, ovary and styles; **G**, capsule; **H**, seeds; **I**, close view of the seed surface; **B-I**, Assadi & Mehregan 89308. Scale bars: A-C, E-H, 0.5 mm; D, 1 mm; I, 0.2 mm.

SYSTEMATICS

1. *Gypsophila platyphylla* Boiss.

Based on Bornmüller (1911), *G. boissieriana* Hausskn. & Bornm. (holo-, B, destroyed) is distinguishable from *G. platyphylla* Boiss. (the lectotype *G.-Boiss* was designated by Barkoudah [1962: 152]) by being glandular-hairy only in upper internodes and pedicels, and having thicker and higher stems, longer calyx with acuminate teeth, petals without contraction between limb and claw. Barkoudah also mentioned some other differences such as having longer stamens and styles and having only 12-16 ovules.

REMARKS

Having studied numerous specimens we found more variation in ranges of characters. All of our specimens – even of type locality of *G. platyphylla* (Mt. Shahu) – show more resemblance to *G. boissieriana* description. Although *G. boissieriana* was for the first time reported from Iraq, the type localities of these two species are very close together (Fig. 1). Moreover, based on photos of type specimens, it seems that differences in size of many parts of two species which is mentioned in two descriptions

are due to phase of growing of specimens. The type specimens of *G. platyphylla* (Haussknecht 183, iso-, LE[LE00012092]!; K photo [K000725732]!; JE photo [JE00015476]!; P photo [P04981475]!) obviously are in fruiting phase, but the type specimens of *G. boissieriana* (Bornmüller 957; iso-, LE!; K photo [K000725733]!; JE photo [JE00015517, JE00015518]!; P photo [P01903168]!) are in flowering phase.

Gypsophila platyphylla Boiss. (Figs 2; 3; 6)

Flora Orientalis: Suppl. 87 (1888).

Gypsophila boissieriana Hausskn. & Bornm., *Beihefte zum Botanischen Centralblatt* 28 (2): 137 (1911), *syn. nov.*

EXAMINED SPECIMENS. — **Iran**. Kurdistan province, nearly 15 km from Marivan to Sanandaj from the old-road, Gardan-e Garan, 1400-1850 m, 8.VII.1995, *Mozaffarian* 74657; 36 km from Sanandaj to Kamiaran, Nashur valley, nearly 2000 m, 15.VI.1987, *Assadi* 60602; N E of Kuh-e Shahu, between Kamiaran and



FIG. 4. — Holotype of *Gypsophila farsensis* Falat., Assadi & F. Ghahrem., sp. nov. (Mozaffarian 83620, TARI).

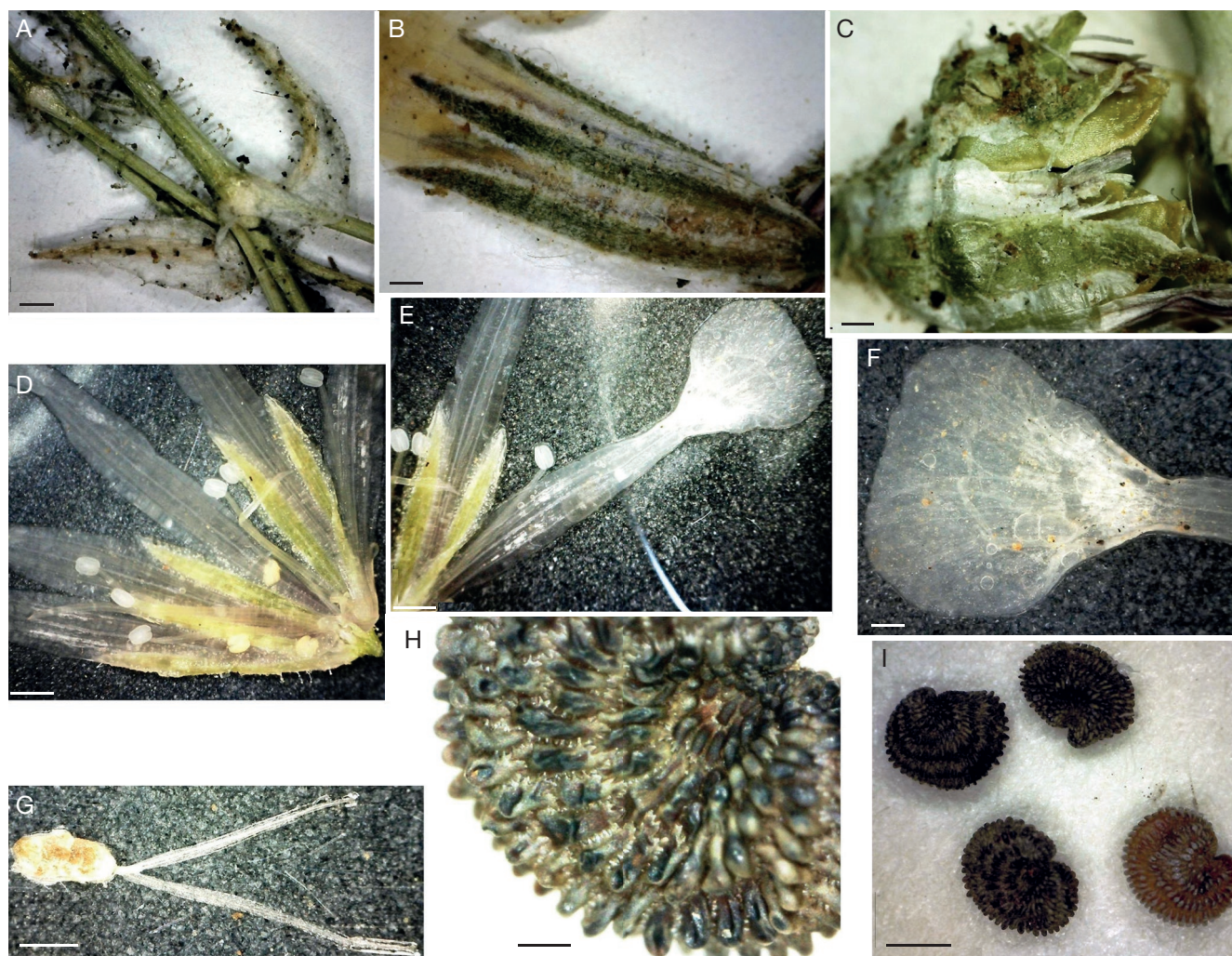


FIG. 5. — Details of morphological characters of *Gypsophila farsensis* Falat., Assadi & F. Ghahremani, sp. nov.: **A**, bracts (Mozaffarian 47077); **B**, calyx (**B**, **D-G**, Jamzad, Taheri & Javidtash 69318); **C**, capsule (without collector 183); **D**, open calyx; **E**, petal; **F**, petal apex; **G**, ovary and styles; **H**, close view of the seed surface; **I**, seeds; **H-I**, without collector 183. Scale bars: A-C, F, 0.5 mm; D, E, G, I, 1 mm; H, 0.2 mm.

Marivan, before Dagaga village, 35°10'N, 46°30'E, 3.VII.2005, 1650 m, *Assadi & Mehregan* 89308; Baneh to Marivan, neck Mount, between Sute and Sonnat to Saghez (between Hajimohammad and Khorkhore), 2100 m, 30.VII.1992, *Mozaffarian* 71644; Mountain slope of Awallan, upper Nashoor village, South of Sanandaj, 45 km from Sanandaj, 2100 m, 16.VI.1986, *Hamzehee & Khaledian* 893; Nearly 50 km N of Sanandaj, between Sarabghamish village and Kuh-e Chehelcheshmeh, 2100 m, 30.VII.1995, *Assadi* 75259. — West Azerbaijan province, Sardasht, 1500 m, 9.VII.1974, *Zehzad & Siami* 3029 (all the above specimens are preserved in TARI Herbarium); Marivan to Sanandaj from old road Gardane Garan, 1400-1850 m, 8.VII.1995, *Ghahremani & Mozaffarian* 18306 (TUH); Sanandaj: 10 km to Divan-Darreh, 1600m, *Attar, Dadjou, Mehdigholi & Okhovat* 14285 (TUH); Marivan, 1800-2100 m, 4.VIII.1967, *Iranshahr & Terme* 60449 (IRAN); Bidjar to Sanandaj, 60 km to Sanandaj, 1800 m, 1.VII.1971, *Termeh* 4597 (IRAN); *Haussknecht* 182 (LE).

DESCRIPTION

Perennial. Woody at base, more or less glandular-pubescent in upper internodes. Stems few, erect, cream, thick, sometimes viscous, 75-100 cm high, branching usually above the

middle; internodes 1.5-10 cm long. Lower leaves 30-80 × 7-17 mm, oblanceolate, tapering at base, acute to obtuse, light green sometimes; middle leaves 60-70 × 20-30 mm, ovate narrowed at base; upper leaves 10-50 × 2-17 mm, lanceolate, acute. Inflorescence lax, compound dichasia. Bracts 1.5-4 mm long, lanceolate to ovate, acuminate, ciliate, glandular-pubescent on the lower surface especially on midrib, scarious with a green or purple midrib. Pedicels 7-20 mm long, glandular-pubescent. Calyx tubular-campulate, 6-10 mm long, incised from one third to the middle with narrow triangular acute teeth, glandular-pubescent, with crowded large crystals. Petals 11-17 mm long, narrow cuneate, truncate, white with purple veins. Stamens 10, unequal, longer than calyx. Ovary elliptic; styles two, parallel; ovules 16-24. Capsule ovate, about 4.5-6 mm long, up to 14 seeded; seeds 1.6-2 × 1.7-2 mm, reniform, with marginal hilum, with obuse to acute tubercles, with glossy surface. In terms of exomorphology, the surface of the seed is constructed of regularly arranged elongate cells with sinuate margins and convex periclinal walls.

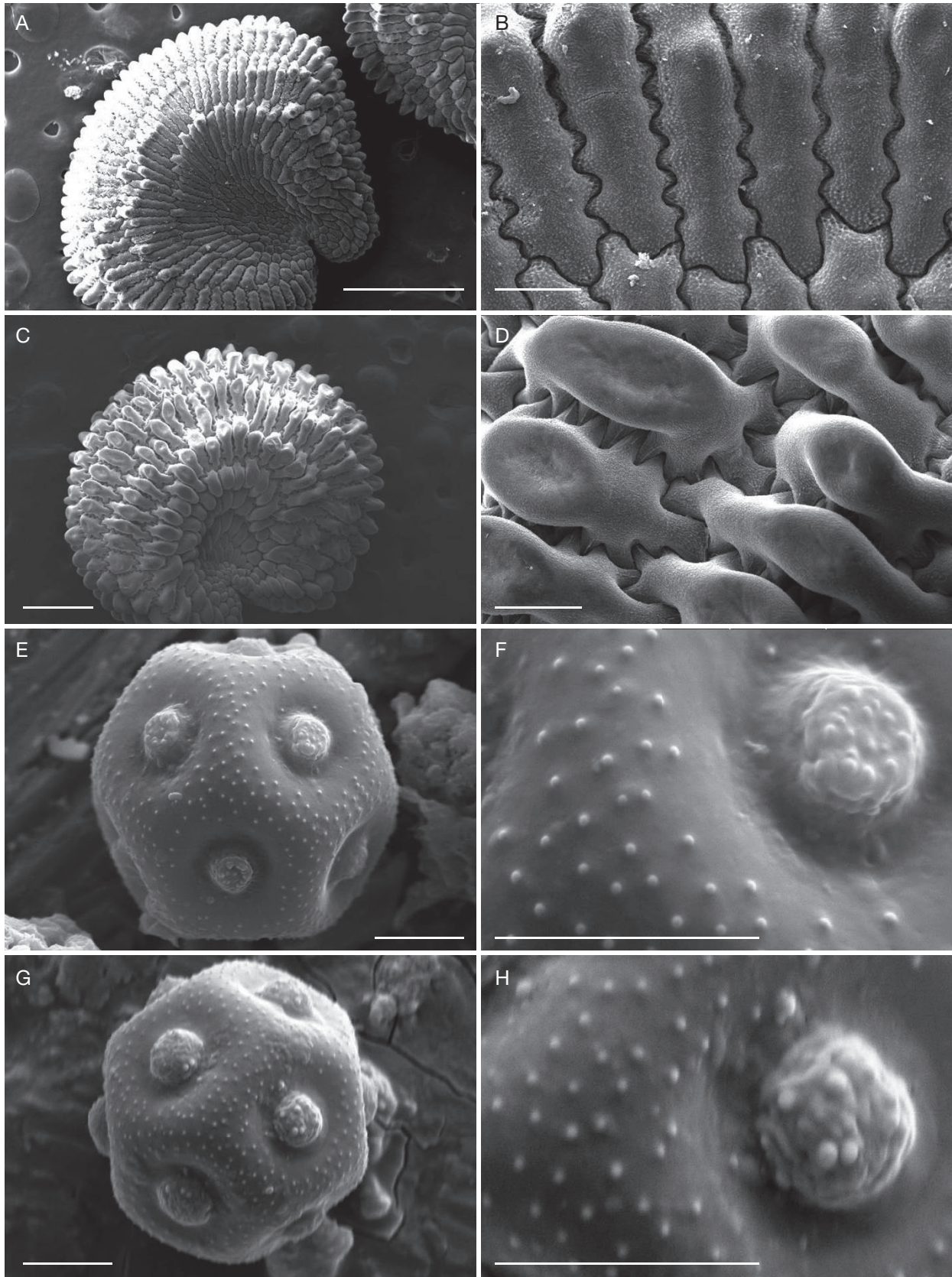


FIG. 6. — Scanning electron micrographs (SEM) of pollen grain and seed in: **A, B, E, F**, *Gypsophila platyphylla* Boiss. (Assadi & Mehregan 89308); and **C, D, G, H**, *Gypsophila farsensis* Falat., Assadi & F. Ghahrem., sp. nov. (without collector 183); **A, C**, outline of the seeds; **B, D**, close view of the seed surface from median part of the seed at the position between hilum and abfunicular side; **E, G**, pollen grain; **F, H**, detail of ornamentation. Scale bars: A, 1 mm; B, D, 100 μ m; C, 500 μ m; E-H, 10 μ m.

TABLE 1. — Diagnostic morphological characters of *Gypsophila farsensis* Falat., Assadi & F. Ghahrem., sp. nov. compared with *G. platyphylla* Boiss.

Character	<i>Gypsophila farsensis</i> , sp. nov.	<i>Gypsophila platyphylla</i> Boiss.
Habit	ascending to erect, 20-45 cm high	erect, 70-100 cm high
Indumentum	glandular-hairy except at most lower internodes	glandular-pubescent only at the most upper internodes
Middle leaves	lanceolate	ovate
Petal	spatulate, divided to lamina and claw, undulate at apex	narrow cuneate, truncate

POLLEN MORPHOLOGY

Monade, apolar, rounded polyhedral-spheroidal, 30.5-31.5 μm . Grains pantoporate. Pores 3.5-4 μm . in diameter, annulate. Distance between pores (without annulus) 5.5-6 μm . Annulus with granules, operculate. Ornamentation is nanoechinatanoperforate (Fig. 6E, F).

2. *Gypsophila farsensis*

Falat., Assadi & F. Ghahrem., sp. nov.

REMARK

G. platyphylla Boiss. was described as a species of west of Iran (Boissier 1888), but Barkoudah mentioned one specimen of southern part of Iran (Aucher-Éloy 1378 [P04981476]) as *G. platyphylla* (Barkoudah 1962). Rechinger (1988) in *Flora Iranica* identified all specimens of west of Iran as *G. boissieriana* and specimens of Fars province as *G. platyphylla*. In addition to the obvious separation of distribution of two collections of Kurdistan and Fars provinces, by comprehensive morphological study we found that there are a number of significant characters which separate the collections of the Fars province. Therefore, we describe them here as a new species. Accordingly, the specimens identified as *G. platyphylla* in *Flora Iranica* (Rechinger 1988) from Fars province (Alava 10639, 10640; Soják 5151 photo!, 5152, 5154, 5234) are probably *G. farsensis*, sp. nov.

Gypsophila farsensis

Falat., Assadi & F. Ghahrem., sp. nov.
(Figs 4, 5, 6; Table 1)

Species nova affinis G. platyphylla Boiss. sed differt a caulibus 20-45 cm longis, ascendentibus vel erectis (non 75-100 longis et erectis), internodiis brevioribus 1-4 cm longis (non 1.5-10), internodiis inferioribus glanduloso-pilosis, foliis lineare-lanceolatis (non ovatis), petalis latioribus spathulatis (non angustis cuneatis).

TYPUS. — Iran. Fars province, Kharam, between Jahanabad and Runiz, Gardane Bezan, Tange Naghare khane, 1900 m, 26.IV.2003, *Mozaffarian* 83620 (holo-, TARI!).

PARATYPUS. — Iran. Fars province, Fasa, Zahedan, Gharebeigon, 1200 m, 12.V.1992, *Mozaffarian* 71289 (TARI!); Between Sarvestan and Fassa, 20 km to Fassa Mian-Jangal Research Station, 1700 m, 29.V.1991, *Jamzad, Taheri & Javidtash* 69318 (TARI!); between Sarvestan and Fassa, 3 km after Police Station, 1500 m, 29.V.1991, *Jamzad, Taheri & Javidtash* 69307 (TARI!); Fasa, 1450 m, 16.IV.1988, *without collector* 183 (TARI!); 10 km from Estahbanat to Niriz, 1800-2000 m, 8.VI.1983, *Mozaffarian* 47077 (TARI!). — Yazd province, Harat, between Kurkhengun and Khansar, nearly 1900 m, 18.VI.1991, *Mozaffarian* 77811 (TARI!).

DISTRIBUTION. — This species is endemic to Iran. It has been collected from Fars and Yazd provinces, Center of Iran (Fig. 1). The species is found on rocky, soily mountains and in steppes beside the road within the Irano-Turanian region, at an altitude 1200-1900 m.

PHENOLOGY. — The flowering and fruiting material was collected from April to June.

ETYMOLOGY. — The specific epithet refers to the locality of the type specimen, Fars province, Iran.

DESCRIPTION

Perennial. Glandular-hairy; glandular hairs patent. Stems several, ascending to erect, cream, more or less viscous except in lowest internodes, 20-45 cm high, branching (branched) throughout; internodes 1-4 cm long. Lower leaves 30-120 $\times$ 3-8 mm, linear-lanceolate, tapering at base, acute, light green sometimes with purple shade; upper leaves 5-60 $\times$ 1-7 mm, narrow lanceolate, acute. Inflorescence lax, compound dichasia, with many flowers. Bracts 3-7 mm long, lanceolate to ovate, acute, more or less ciliate and erose, more or less glandular-hairy on the lower surface especially on midrib, scarious with a green midrib. Pedicels 7-15 mm long, glandular-hairy. Calyx tubular-campanulate, 6-8 mm long incised to one third, with narrow triangular acute teeth, with crowded large crystals. Petals 13-18 mm long, spatulate, divided to lamina and claw, undulate at apex, white with purple veins on the claw. Stamens 10, unequal, shorter rarely longer than calyx. Ovary elliptic; styles two, divergent; ovules 17-27. Capsule ovate, about 6 mm long, 7-seeded; seeds 1.4-1.6 $\times$ 1.8-1.9 mm, reniform, with acute tubercles, with marginal hilum, with glossy surface. In terms of exomorphology, the surface of the seed is constructed of regularly arranged elongate cells with zip-shaped margins and convex periclinal walls.

POLLEN MORPHOLOGY

Monade, apolar, rounded polyhedral-spheroidal, 29-29.5 μm . Grains pantoporate. Pores 5-5.5 μm . in diameter, annulate. Distance between pores (without annulus) 5-5.7 μm . Annulus with granules, operculate. Ornamentation is nanoechinatanoperforate (Fig. 6G, H).

DISCUSSION

There is four taxa of the subgenus *Pseudosaponaria* in Iran, *G. pilosa* Huds. var. *pilosa* Huds., *G. pilosa* var. *glabra* Falat., F. Ghahrem & Assadi (Nejad Falatoury *et al.* 2015), *G. platy-*

phylla and *G. farsensis*, sp. nov. *G. pilosa* is a weed and is distributed nearly throughout Iran with exception of the south eastern region. Distribution of *G. platyphylla* is restricted to the west and *G. farsensis*, sp. nov. to the center of Iran. All these taxa except *G. pilosa* var. *glabra* have long glandular hairs on some parts or whole of stems and calyces. Their seeds, same as the most of *Gypsophila* taxa, are reniform, and the surface of the seeds are constructed of regularly arranged elongate cells with convex periclinal walls. But the margins of testa cells and apex of their protuberances are various among taxa. Testa cells of two varieties of *G. pilosa* seeds have dentate margins with acute tubercles. *G. platyphylla* has testa cells with sinuate margins and obtuse to acute tubercles. Testa cells of *G. farsensis*, sp. nov. seeds have zip-shaped margin and acute tubercles. Pollen grains of *Gypsophila* taxa are very similar, but there are some differences in size and thickness of aperture among taxa. In comparison with the varieties of *G. pilosa* both *G. platyphylla* and *G. farsensis*, sp. nov. have pollen grains with thicker apertures.

Despite of major sampling (23 species) of *Gypsophila* in order to more confidently resolve relationships in Caryophyllaceae (Greenberg & Donoghue 2011), none of these species were of subgenus *Pseudosaponaria* which *G. platyphylla* and *G. farsensis*, sp. nov. belong to. Therefore, The localization of these species in the phylogenetic tree needs more study and is not easily predictable.

Acknowledgements

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