



A taxonomic Revision of the genus *Graellsia* (Brassicaceae, tribe Thlaspidae)

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Abstract

Graellsia includes nine species, of which five (three endemic) are native to Iran. The new species *G. isfahan* is described and illustrated, and its relationship to the Turkish endemic *G. davisiana* is discussed. The new combination *G. longistyla* is proposed, and the lectotypes of *G. graellsifolia*, *G. integrifolia*, and *G. stylosa* are designated.

Keywords: Afghanistan, Cruciferae, *Draba*, Iran, Iraq, *Physalidium*, Turkmenistan

Introduction

The genus *Graellsia* Boissier (1841: 379) (Brassicaceae or Cruciferae) was based on the Iranian *Cochlearia saxifragifolia* de Candolle (1921: 370) and remained monospecific for the following 114 years. Poulter (1956) united *Graellsia* with the later-published *Physalidium* Fenzl in Tchihatcheff (1860: 327) and recognized six species in the genus. Hyam & Jury (1990) recognized the same taxa as Poulter and transferred *Draba hederifolia* Cosson (1880: 69) to *Graellsia*. As shown below, however, that controversial transfer was not accepted by subsequent botanists.

Both *Physalidium* and *Graellsia* are remarkably similar in almost every aspect of morphology except for having angustiseptate fruit (flattened perpendicular to septum) in the former and latiseptate (flattened parallel to septum) in the latter. Prantl (1891) and Hayek (1911) placed both genera in subtribe Cochleariinae of Thlaspidae and subtribe Parlatoriinae of tribe Arabideae, respectively. By contrast, Schulz (1936) placed *Physalidium* in subtribe Thlaspidinae of Lepidieae and *Graellsia* in the invalid Matthioleae that was published without Latin diagnosis.

Molecular phylogenetic studies by the first author (in prep.) supported Poulter (1956) in uniting *Physalidium* with *Graellsia* and several authors (e.g., Beilstein *et al.* 2006, Al-Shehbaz *et al.* 2006, Khosravi *et al.* 2009) in placing the combined genus in the tribe Thlaspidae. However, morphological studies by Schulz (1927a) and Poulter (1956) and molecular studies by Jordon-Thaden *et al.* (2010) do not support Hyam & Jury (1990) in transferring the Moroccan *Draba hederifolia* to *Graellsia*. The species is separated by at least 5000 air kilometers from the nearest range of *Graellsia*. None of the 42 species of the tribe Thlaspidae has branched trichomes, whereas *D. hederifolia* and almost all of the approximately 400 species of *Draba* Linnaeus (1753: 642) have branched trichomes.

Materials and Methods

Extensive fieldwork by the first author was conducted in Iran, and plants were studied in the wild and in the greenhouses in Brno. Herbarium studies were done by the first and/or last author in AAU, B, BM, E, FMUH, G, K, KW, LE, M, MIR, MO, P, PR, PRC, TUH, and W. The herbaria in Isfahan University and the Research Center of Agriculture and Natural Resources, Kurdistan Province (Sanandaj city) have no acronyms and, therefore, their cities are listed instead.

Images available at E (<http://data.rbge.org.uk/herb>) and the JSTOR Global Plants project database (plants.jstor.org) were consulted.

Results

The following taxonomic revision of *Graellsia* treats nine species centered in Iran (5 spp., 3 endemic), with the range of one reaches NE Iraq and that of another into neighboring Afghanistan and Turkmenistan. Two species are endemic to Tajikistan and one each in Turkey and Pakistan.

Taxonomy

Graellsia Boissier (1841: 379). Type species: *G. saxifragifolia* (DC.) Boiss.

Syn.: *Physalidium* Fenzl in Tchihatcheff (1860: 327). Type species: *P. stylosum* (Boiss. & Hoh.) Fenzl

Description:—Herbs perennial, with woody caudex covered with persistent petiole bases of previous seasons. Trichomes absent. Stems erect to ascending, simple or branched distally, leafy. Basal leaves long petiolate, rosulate, simple, entire, obtusely toothed, or palmately lobed; cauline leaves petiolate, not auriculate at base, entire, dentate, or palmately lobed. Racemes many flowered, ebracteate, corymbose, elongated in fruit; rachis straight; fruiting pedicels erect to divaricate, persistent. Sepals ovate, free, deciduous, spreading, equal, base of lateral pair not saccate; petals white, erect at base with flaring blade, ascending, or spreading, longer than sepals; blade obovate to suborbicular, apex rounded; claw short, slightly differentiated from blade, shorter than sepals, glabrous, unappendaged, entire; stamens 6, slightly exserted, erect, tetradynamous; filaments wingless, unappendaged, glabrous, free; anthers ovate to oblong, not apiculate; nectar glands confluent, subtending bases of all stamens; median nectaries present; lateral nectaries annular; ovules 4–16 per ovary; placentation parietal. Fruit dehiscent or indehiscent, capsular silicles or rarely siliques, oblong, obovate, or elliptic, strongly latiseptate or angustiseptate, inflated or not, unsegmented; valves papery, obscurely veined or with a prominent midvein, glabrous, not keeled, smooth, wingless, unappendaged; gynophore absent; replum rounded, visible; septum complete, perforated, reduced to a rim, or lacking, membranous, veinless; style to 2 mm long, slender, persistent; stigma capitate, entire or slightly 2-lobed, unappendaged. Seeds uniseriate or biseriate, wingless or rarely distally winged, oblong, slightly flattened; seed coat smooth, not mucilaginous when wetted; cotyledons accumbent.

Nine species: Afghanistan, Iran, Iraq, Pakistan, Tajikistan, Turkey, and Turkmenistan.

Key to the species

1. Fruit angustiseptate.....2.
- Fruit latiseptate, sometimes slightly inflated.....3.
2. Leaves 5-lobed or subentire; stems unbranched above; fruit twisted; Tajikistan..... *Graellsia graellsifolia*
- Leaves 9–13-lobed; stems few to several branched above; fruit not twisted; N Iran *Graellsia stylosa*
3. Fruit indehiscent, readily detached from pedicel4.
- Fruit dehiscent, not detached from pedicel.....5.
4. Fruiting pedicels shorter than or rarely subequaling fruit; fruit valve usually without a midvein; C & S Iran
..... *Graellsia saxifragifolia*
- Fruiting pedicels distinctly longer than or rarely subequaling fruit; fruit valve with a distinct midvein; Afghanistan, NE Iran, Turkmenistan..... *Graellsia integrifolia*
5. Leaves 9–15-lobed or -toothed.....6.
- Leaves 3–7-lobed or -toothed.....7.
6. Style 1–2 mm long; ovules 8–12 per ovary; fruiting pedicels ascending, not flattened at base; main raceme 10–18-flowered; C Turkey..... *Graellsia davisiana*
- Style 0.5–0.8 mm long; ovules 14–16 per ovary; fruiting pedicels horizontal, flattened at base; main raceme to 65-flowered; C Iran..... *Graellsia isfahan*
7. Fruit 3–4 mm wide; style 0.8–2 mm long; septum complete; W Iran and NE Iraq..... *Graellsia longistyla*
- Fruit 1.5–2 mm wide; style 0.5–1 mm long; septum perforate; Pakistan and Tajikistan.....8.
8. Leaves 3–5-lobed; fruit 1.5–2 mm wide, valves not reticulate; Pakistan *Graellsia chitralensis*
- Leaves 5–7-lobed; fruit 2–3 mm wide, valves reticulate; Tajikistan *Graellsia hissarica*

Graellsia chitralensis Schulz (1927b: 1085). Type:—PAKISTAN. **Chitral:** Tarashnur, 5650 m, 9 August 1899, *S. A. Harriss s.n.* (lectotype designated by Poulter (1956: 90): DD, n.v.; isotype: B-10_0241454!).

Description:—Herbs perennial; caudex woody, covered with petiolar remains of previous seasons. Stems ca. 20 cm tall, erect to ascending. Basal leaves rosulate, petioles 2–7 mm long; blade reniform to broadly ovate, 7–18 × 6–14 mm, base cordate to truncate, margin obtusely 3–5-lobed or -toothed, apex obtuse; cauline leaves few, similar to basal ones, or absent. Racemes lax, elongated considerably in fruit, 12–25-flowered; rachis straight; fruiting pedicels slender, 5–15 mm long, suberect to ascending or divaricate, glabrous, straight. Flowers not seen. Fruits lanceolate to elliptic-oblong, 5–9 × 1.5–2 mm, latiseptate, straight or curved; septum fenestrate; style 0.5–0.8 mm long. Seeds not seen.

Distribution:—Endemic to Pakistan.

Conservation status:—*Graellsia chitralensis* is named after Chitral district (Pakistan) and is known only from the type collection. Therefore, it is given the assessment of Data Deficient (DD) according to the IUCN (2001) criteria.

Graellsia davisiana Poulter (1956: 91). Type:—TURKEY. **Maraş:** dist. Göksun (Anti-Taurus): Binboga dag, in ravine above Yalak, 2000 m, 14 July 1952, *P. H. Davis, J. G. Dodds & R. Çetik 19972* (holotype E-00195757!, isotypes BM-000582810!, G-00371684!, K-000697687!, LE-00012878!, W-1960-0012481!).

Description:—Herbs perennial, glabrous throughout; caudex woody, 0.75–1.5 cm in diam., densely covered with petiole remains. Stems 20–30 cm tall, erect to ascending, few from caudex, simple from base, 2- to 3- branched above. Basal leaves rosulate; petioles 4.5–13 cm long, not persistent, slightly indurate at base; blade reniform to suborbicular, 1.5–5 × 2–7 cm, slightly wider than long, acutely 9–15-toothed or -lobed, base cordate, apex acute; cauline leaves 1–3, with fewer teeth and shorter petioles upwards. Main racemes lax, 10–18-flowered, elongated in fruit; rachis straight; fruiting pedicels slender, 8–18 mm long, ascending at 30–60° angle, not flattened at base, straight. Sepals oblong, 2.5–3 mm long, glabrous; petals white, obovate, 3–4.5 × 1.7–2 mm, attenuate to claw-like base ca. 1 mm long; ovules 8–12 per ovary. Fruit oblong to elliptic or obovate, slightly inflated, 5–12 × 2–3.5 mm, latiseptate; valves papery, acute at both ends, straight, with obscure midvein and somewhat reticulate lateral veins; septum fenestrate or complete, membranous; gynophore ca. 0.5 mm long; style 1–2 mm long. Seeds ovate to oblong or obovate, 2.5–3.5 × 1.4–2 mm, compressed, with a distal apicula or minute wing.

Distribution:—Endemic to Turkey.

Conservation status:—*Graellsia davisiana*, named after the British botanist Peter Hadland Davis (18 June 1918–5 March 1992) and the chief editor of the Flora of Turkey, is known only from only two collections and is therefore given the assessment of Data Deficient (DD) according to the IUCN (2001) criteria.

Representative specimens:—TURKEY. **Gaziantep** (as Aintab): Zaitoon, 1900 m, *M. Kharadj s.n.* (P-05036599).

Notes:—The above collection from Gaziantep Province, which is adjacent to Maraş Province where the type was collected, represents the second known record of *Graellsia davisiana* and is reported here for the first time. The species is very distinctive and superficially resembles *G. saxifragifolia*, though it is readily distinguished by having dehiscent (vs. indehiscent) fruit, 8–12 (vs. 4) ovules per ovary, longer styles, and fruiting pedicels longer (vs. shorter than or rarely subequaling) the fruit. Hyam & Jury (1990: 19) indicated that *G. davisiana* is “very close to *G. saxifragifolia* and may well be sunk into it when more material is available.” They also cited *Archibald 2755* (E, K) from Isfahan (Iran) as *G. davisiana*, but as shown below, that collection belongs to the related *G. isfahan*, from which it is distinguished below.

Graellsia graellsifolia (Lipsky) Poulter (1956: 92). ≡ *Physalidium graellsiaefolium* Lipsky, (1900: 12). Type:—TAJIKISTAN. **Darwass:** ad glaciem fl. Ticharvi (confl. Arzyung), 3352.8 m, 16 July 1899, *V. I. Lipsky 248*, (lectotype, partially designated by Junussov (1980: 166) and second-step designation here: LE-00050364!, isolectotypes LE-00050365!, LE-00050366!, LE-00050367!, all images seen).

Description:—Herbs perennial, glabrous throughout; caudex woody, several branched, covered with petiole remain of previous seasons. Stems 27–35 cm tall, erect to ascending, several from caudex, simple, unbranched above. Basal leaves rosulate; petioles 4–10 cm long, persistent and indurated at base; blade cordate to suborbicular or reniform, 7–14 × 8–18 mm, obtusely 5-lobed, base cordate to subtruncate, apex obtuse; cauline leaves 1–3, uppermost oblanceolate. Racemes dense, 9–20-flowered, elongated in fruit; rachis straight; fruiting pedicels slender, 8–18 mm long, divaricate-ascending to ascending, straight. Flowers not seen. Fruit dehiscent, not detached from pedicel, oblong to oblong-

obovate, 6–12 × 2.5–4 mm, angustiseptate, notched at apex, irregularly curved; valves papery, obtuse to acute at apex, septum complete; gynophore obsolete, style 0.9–1 mm long. Seeds uniseriate.

Distribution: Endemic to Darvaz, Tajikistan.

Conservation status:—*Graellsia graellsifolia* is known the type and fewer additional collections. Its conservation status is given Data Deficient (DD) according to the IUCN (2001) criteria.

Representative specimens:—TAJIKISTAN. **Gorno-Badakhshan:** Shugnan range, gorge beyond kishlak Vuzh, ca. 3200 m, 10 July 1977, *A. Dengubenko 3076* (LE). **Badakhshan:** river Bartang, kishlak Bartang, valley of Khotsorzho, 3400 m, 30 July 1964, *S. S. Ikonnikov, 16259* (LE).

Notes:—In his original description of *Physalidium graellsiaefolium*, Lipsky (1901) cited two syntypes, of which one was from Darvaz and the other from Hissar. They were shown by Junussov (1980) to belong to two different species. The Darvaz plants have angustiseptate fruit and uniseriate seeds, whereas those from Hissar have latiseptate fruit and biseriate seeds. Both Poulter (1956) and Hyam & Jury (1990) erroneously listed both collections as the type of *Graellsia graellsifolia*, and the species features they provided reflected Lipsky's bispecific concept. Junussov (1980) described the plants from Hissar as *G. hissarica*, and lectotypified *G. graellsifolia* based on the Darvas plants. However, there are four sheets of the Darvas collection at LE, and the sheet anonymously annotated as the lectotype is designated here as such.

Graellsia hissarica Junussov (1980: 165). Type:—TAJIKISTAN. “Tadzhikistania Centralis, declive australe jugi Hissarici, trajectus Anzob, ad rupes remanentes 3600 m. s. m., n° 859, 25 VIII 1944, fr., *V. V. Pissjaukova*”. Holotype: LE!

Description:—Plants perennial, glabrous; caudex many branched, covered with petiole remains of previous years. Stems 12–21 cm tall, few, slender, ascending. Basal leaves numerous, rosulate, with petioles 3–6 cm long; blade reniform, coarsely sinuate dentate, 0.7–2.5 × 0.8–3.5 cm, base cordate, margin obtusely 5–7-toothed, apex obtuse; cauline leaves absent, rarely 1, petiole 3–4.5 mm long. Raceme lax, elongated in fruit; fruiting pedicels slender, 4–10 mm long, ascending, straight. Flowers not seen. Fruit silicles, oblong-elliptic, latiseptate, slightly inflated, 5–10 × 2–3 mm; valves navicular, thin leathery, midvein and lateral veins somewhat distinct; septum membranous, perforate; style 0.6–1 mm long; stigma entire. Seeds 6–10, biseriate, 1.5–2 × 0.9–1.2 mm, elliptic, black, minutely reticulate.

Distribution:—Endemic to Tajikistan.

Conservation status:—*Graellsia hissarica* is known only from the holotype specimen collected from Hissar Range and is therefore given the assessment of Data Deficient (DD) according to the IUCN (2001) criteria.

Graellsia integrifolia (Rech.f.) Rechinger (1951: 58). ≡ *Physalidium integrifolium* Rechinger (1940: 35) Type:—IRAN. **Khorasan:** Kopet Dag, inter Kučan et Lutfabad, in fissuris rupium calc. Jugi Allah Akbar, 1800 m, *K. H. Rechinger 1710* (lectotype designated here: W-1952-0005992!; isolectotype: W-1952-0005993!).

Description:—Herbs perennial, glabrous throughout; caudex woody, to 1.5 cm in diam., densely covered with petioles of previous seasons. Stems 9–35 cm tall, erect to ascending, one or few from caudex, simple from base, 1- or few-branched above. Basal leaves rosulate; petioles (1–)2–10(–20) cm long, persistent, indurate at base; blade cordate to suborbicular or broadly ovate, 0.8–3 × 0.8–4 cm, margin entire to obscurely or strongly 5–13-lobed, base obtuse, truncate or deeply cordate, apex obtuse to subacute; cauline leaves 1–3, uppermost petiolate, oblanceolate, entire, short petiolate. Racemes dense, few to several flowered, slightly elongated in fruit; rachis straight; fruiting pedicels slender, (8–)10–18 mm long, divaricate to ascending, longer than or rarely subequalling fruit. Sepal oblong, ca. 2 mm long; petals white, oblanceolate, 4–4.2 × 2–2.2 mm, attenuate to claw-like base ca. 1 mm long; ovules 4 per ovary. Fruit obovate to elliptic or narrowly oblong-elliptic, 5–11 × 2.8–5 mm, latiseptate, indehiscent, detached at maturity from pedicel; valves papery, obtuse to acute at apex, cuneate at base, straight, with a distinct midvein and less conspicuous lateral veins; septum absent; gynophore obsolete, style ca. 0.1 mm long. Seeds oblong-ovate, 1.5–2.5 × 1–2 mm, compressed. $2n=14$.

Distribution:—Afghanistan, NE Iran, and Turkmenistan. This is the most widespread species in the genus. It grows on serpentine grounds and on limestone crevices.

Representative specimens:—AFGHANISTAN. **Balkh:** Georges, Roebers, 2550 m, 22 April 1958, *H. Pabot A664* (G). **Bamyan:** 20 km W of Panjao, 2800 m, 11 June 1969, *I. Hedge & P. Wendelbo 8787* (E); Shahtu, 2800–3000 m, 23–28 June 1967, *K. H. Rechinger 36362* (AAU, E, G, K, MO, W); 8 km, above Paghman, 2774 m, 13 May 1971, *Gibbons 251* (K, MO); Paghman, 1900 m, 23 April 1971, *J. E. Carter 1168* (K); Panjao, 37 km SW of Panjao, 2600

m, 30 June 1967, *K. H. Rechinger 36559* (E, G, K, W); 4.8 km N of Shibar pass., near Nionysis, 2530 m, 14 June 1969, *R. Palmer 101* (K, W); Shibar Pass, 2400 m, 18 May 1964, *H. E. Neubauer 4693* (W); Shibar to Doshi, 16 km W of summit of Shibar, 2743 m, 12 May 1964, *P. Furse 5829* (K); between Bulola and Shibar, 2600–2800 m, 14 June 1962, *K. H. Rechinger 16835* (E, G, LE, W); N of Ortes, 2800 m, 11 June 1971, *A. Dieterle 1292* (G). **Gardez**: Safed Kuh, W of Altimur, 23 km N of Gardez, 2850–3200 m, 5 July 1965, *K. H. Rechinger 31856* (B, K, W); Montes Safed Kuh, W of Altimur, 2600–2700 m, 6 July 1965, *K. H. Rechinger 31915* (G, M, W). **Ghorat**: Mollah Allah, 12 km SW of Taiwara, 2200–2300 m, 29 July 1962, *K. H. Rechinger 18987* (W). **Herat**: above Cheshmeh Obek, Kuh e Darunta, 2500 m, 11 May 1969, *I. Hedge et al. 7832* (E). **Kabul**: Kabul to Gardez, 23 km from Gardez, Altimar Pass, 2800–3000 m, 6 July 1965, *J. Lamond 2336* (E); Kabul Pass, 1990 m, 2 May 1969, *J. E. Carter 199* (K); Tangi Gharu, between Kabul and Sarobi, 1500–1700 m, 12 May 1967, *K. H. Rechinger 34356* (W, G); Tangi Gharu, E of Kabul, 16 April 1964, *H. E. Neubauer 4045* (B, W); Tangi Gharu, 1500 m, 2 April 1970, *J. E. Carter 789* (K); Tangi Gharu, 24 April 1951, *O. H. Volk Würzburg 1504* (W); Tangi Gharu, 1560 m, 11 May 1951, *A. Gilli 1107a* (W); Paghman, 11 August 1950, *H. E. Neubauer 523* (W); Paghman, 7 May 1964, *H. E. Neubauer 4178* (W); Paghman, 2300 m, 13 June 1959, *H. Pabot A959* (G); Paghman, 18 May 1988, *K. Lindberg 269* (W); Paghman, 2700 m, 27 April 1962, *I. Hedge & P. Wendelbo 2818* (E); Paghman Pass, 2520 m, 19 May 1950, *A. Gilli 1107b* (W); 27.4 km W of Kabul, 2438–2743 m, 21 May 1939, *J. L. Chaworth-Musters s.n.* (BM); Pandschiertal, Basarak, 27 May 1950, *H. E. Neubauer 522* (W); Barbur and Gulbagh, 1700 m, 25 April 1935, *G. Kerstan 135* (W); Nozi, 3048 m, 21 June 1937, *W. N. Koelz 11979* (W); Gomando, 2743 m, 5 June 1937, *W. N. Koelz 11707* (E, W); Bagrami, Nedjerou-Tal, 2500 m, 27 June 1951, *H. E. Neubauer 295* (B, W); Korogh Koh, 18 km SW of Kabul, 2250 m, 13 April 1969, *I. Hedge & L. Ekberg 7012* (E). **Lugar**: Terra Kotal (Altimir pass), 2800 m, 16 June 1969, *I. Hedge & P. Wendelbo 8830* (E). **Maymana**: Dara Zang, near Belceragh, 1400 m, 29 May 1962, *I. Hedge & P. Wendelbo 3744* (E). **Nuristan**: 20 km to Doab, 6 May 1958, *H. Pabot A918* (G). **Parwan**: Salang, 2300–2600 m, 25 June 1965, *K. H. Rechinger 31372* (G, W); Salang pass, between Qaltak and Samedia, 2150 m, 25 May 1970, *D. Podlech 18074* (G, K, M); Salang Pass, 2500 m, 1 August 1969, *P. L. Carter 660* (K); Tob Darrah, 3 km SW of Charikar, 2300 m, 28 April 1969, *I. Hedge et al. 7387* (E); Panjahir valley, Darrah Rastagal, 3200 m, 18 July 1962, *I. Hedge & P. Wendelbo 5231* (E). **IRAN. Khorasan**: between Reshvanlu and Namanlu, N Shirvan, 1600 m, 1 June 1975, *K. H. Rechinger 53275* (B, G, K, M, MO, W); Shirvan, Namanlou, 14 June 1975, 2200–2500 m, *F. Termé s.n.* (E); N of Mashhad, All, *G. Faghihnia & H. Zangoeei 24985* (MO); Gulul Sarani protected region, Kopet Dag, 2300 m, 12 June 1975, *K. H. Rechinger 53430* (AAU, B, E, G, K, M, MO, W); Montes Kuh-e Nishapur, 1600–1800 m, 30 May 1948, *P. Allen 4602* (AAU, B, E, G, K, M, MO, W); Montes Hazar Masdjid, 2800 m, 8–9 June 1948, *P. Allen 5060* (B, E, G, K, MO, W); Akhlamad, 26 March 1947, *K. Lindberg s.n.* (W); Gulul Sarani Protected Region, Kopet Dag, 2400–2900 m, 13 June 1975, *K. H. Rechinger 53478* (AAU, E, G, K, W), 53479 (W); Kopet Dag range, 45 km NNE of Shirvan, Kuh-e Alam, c. 6 km of Cheshmeh-e Gabri, 2700 m, 1 July 1973, *J. R. Edmondson 1208* (E, W); Tandoure national park, 21 April 1998, *L. Ghoreishi 1741* (MIR); 40 km SE of Qutshan, N of Amarat village, 12 July 2007, *M. Mirtadzadini 1828* (MIR); Chenaran, Radkan, Mt. Parichegan, 1500 m, 12 May 1985, *M. Ayatollahi & H. Zangoeei 12777* (FUMH); between Quchan and Dargaz, Allah-o Akbar pass, N slope, 1650 m, 30 April 1988, *M. R. Joharchi & H. Zangoeei 16517* (FUMH); N of Mashhad, Kalat Naderi road, Sandough Shekan pass, 1700–1750 m, 22 April 1989, *M. R. Joharchi & H. Zangoeei 17047* (FUMH); S of Dargaz, between Rishkhar and Darbandi, Kalat-e Goorni, 1800 m, 28 May 1990, *M. R. Joharchi & H. Zangoeei 18652* (FUMH); Sarakhs, Mt. Gherghereh, 900 m, 8 April 1992, *G. Faghihnia & H. Zangoeei 21417* (FUMH); Sarakhs, Mt. Bazangan village, 1500 m, 12 April 1993, *G. Faghihnia & H. Zangoeei 22655* (FUMH); N of Neyshabour, Mt. Mirabad, second gate of Ghal-e Bala, 1650 m, 23 April 1997, *G. Faghihnia & H. Zangoeei 28229* (FUMH); Dargaz, between Shekarab and Tandoure, 2000 m, 8 June 1997, *A. Rafeie & H. Zangoeei 29106* (FUMH); NE of Chenaran, Mt. Boqmach, 1600 m, 21 May 2000, *Hojjat & H. Zangoeei 32846* (FUMH); 10 km from Boghmach, E Radkan, N of Chenaran, 1750–1850 m, 20 May 1982, *J. Ghorashi 1698G* (FUMH); SW of Kalat Naderi, between Urtakan and Baq-Kand village, 1600 m, 18 May 1994, *G. Faghihnia & H. Zangoeei 23925* (FUMH); N of Mashhad, N of Kardeh dam, All village, 1700 m, 23 April 1995, *G. Faghihnia & H. Zangoeei 24985* (FUMH, MO); S of Kalat-e Naderi, Rorf village, 1950–2100 m, 16 June 1996, *A. Rafeie & H. Zangoeei 27370* (FUMH); W of Bojnord, between Jozak and Chaman-Bid, Cheshm-e Jozak, 1000 m, 17 April 2000, *M. R. Joharchi & H. Zangoeei 32635* (FUMH); SW of Bojnord, Reien, Zovi Reien to Garmak, 1560–1644 m, 15 April 2006, *F. Memariani & H. Zangoeei 37183, 37197* (FUMH); SW of Bojnord, Reien, Zovi Reien to Garmak, 1460–1640 m, 23 April 2006, *F. Memariani & H. Zangoeei 37295* (FUMH); NW Esfaraien, Sarmeran (Salook national park), Juz valley, 1789 m, 4 May 2008, *M. R. Joharchi & H. Zangoeei 39763, 39764* (FUMH); SW Bojnord, Hesar road, Shoqan, Salook protected region, near Mohammad-Apo stop, 2542 m, 1 June 2008, *M. R. Joharchi & H. Zangoeei 40639* (FUMH). **TURKMENISTAN. Ashkhabad**: western Kopet Dag, Nokhur Canyon, 20 April 2001, *J. M. Kurbanov 37* (MO); C Kopet Dag, W of Karanki, Gaudan, 1800 m, 28 May 1975, *G.*

Proskuriakova & N. Belianina s.n. (MO, W); Ashkhabad, 27 April 1897, *D. I. Litwinow 584* (E, G, LE, MO, P, PRC); Ashkhabad, 1219 m, 27 April 1897, *D. I. Litwinow 984* (W); Kopet Dag, Mt. Tschapan, 2 July 1923, *Korvin 671* (E).

Notes:—As shown above, there are two sheets of the type collection at W, and Rechinger (1940, 1951), Poulter (1956), and Hyam & Jury (1990) did not designate any of them as the lectotype. The lectotype sheet was annotated by J. Walter in February 2014 as a holotype.

Poulter (1956), Hedge (1968), and Hyam & Jury (1990) relied heavily on leaf morphology to separate *Graellsia integrifolia* from *G. saxifragifolia*. They indicated that the former has weakly lobed or entire (vs. deeply 5–9- or 11-lobed) leaf margin and non-cordate (vs. cordate leaf base). However, this feature is totally unreliable, as one can find in specimens, such as *Wendelbo & Foroughi 11512* and *11429* (both at W), basal leaves with as many as 13 lobes, and in *Rechinger 46600* (AAU, K, MO, W) the leaves are up to 8-lobed. These three collections represent a disjunct range of *G. integrifolia*, but they have the characteristic fruit valves with a distinct midvein, and fruiting pedicels clearly longer than fruit. As for the material of *G. integrifolia* from Afghanistan and neighboring NE Iran and Turkmenistan, the leaf margin ranges from subentire to 5–9-lobed, as in *Rechinger 31372* and *Neubauer 4178* (both at W). All five sheets above were annotated by Hyam in Nov. 1989 as *G. saxifragifolia* subsp. *saxifragifolia*. There is every transition from entire to distinctly lobed leaves within a given population of *G. integrifolia*. As for the non-cordate leaves in *G. integrifolia*, some collections (e.g., *Rechinger 53275* at G) have deeply cordate leaves with base to 1.5 cm deep. This collection was cited by Hyam & Jury (1990: 20) as *G. integrifolia*. Therefore, we believe that leaf morphology is unreliable in the separation of these two species.

The other feature used by Poulter (1956), followed Hyam & Jury (1990), to separate *Graellsia integrifolia* from *G. saxifragifolia* is the relative length of the fruit to the fruiting pedicels. They indicated that the former species has fruiting pedicels equal or up to $2.5 \times$ longer (vs. shorter than or subequaling) the fruit length. Although the feature shows minimal overlap, it is rather useful for the separation of the two species.

The above diploid chromosome count for the species, see Warwick & Al-Shehbaz (2006) and BrassiBase in Kiefer *et al.* (2014), was based on plants from Afghanistan misidentified as *G. saxifragifolia*, a species that does not occur in that country.

Graellsia isfahan Esmailbegi & Al-Shehbaz, *sp. nov.* (Fig. 1).

Diagnosis:—*Graellsia isfahan* is readily distinguished by a combination of acutely 9–15-toothed basal leaves, up to 65-flowered racemes, 14–16-ovuled ovaries, latiseptate fruit with prominent midvein and marginal veins, and distally winged seeds.

Type:—IRAN. **Isfahan:** between Tiran and Damane, south of Kord-e-Olia village, 2450–2600 m, 26 May 2010, *Mansour Mirtadzadini 1748* (holotype MIR!, isotype MO-6737249!).

Description:—Herbs perennial, glabrous throughout; caudex woody, ca. 1 cm in diam., densely covered with petioles of previous seasons. Stems 25–35 cm tall, erect to ascending, few from caudex, simple from base, 1- or 2- branched above. Basal leaves rosulate; petioles 7–18 cm long, persistent and indurate at base; blade cordate to suborbicular, $1.2\text{--}2.5 \times 1.8\text{--}2.8$ cm, slightly wider than long, acutely 9–15-toothed, base cordate to truncate, apex acute; cauline leaves 1–3, with fewer teeth and shorter petioles upwards. Main racemes dense, to 65-flowered, elongated in fruit; rachis straight; fruiting pedicels slender, 7–13 mm long, horizontally attached and flattened at base, gently curved upwards. Sepal oblong, 2.2–2.5 mm long, glabrous; petals white, oblanceolate, $3.5\text{--}5 \times$ ca. 1.5 mm, attenuate to claw-like base ca. 1 mm long; ovules 14–16 per ovary. Fruit oblong, $6\text{--}10\text{--}12 \times 2\text{--}3\text{--}3.3$ mm, latiseptate; valves papery, obtuse at both ends, straight, with a prominent midvein and conspicuous marginal and lateral veins; septum complete, membranous; gynophore 0.2–0.5 mm long; style 0.5–0.8 mm long. Seeds oblong-ovate, $2.2\text{--}3 \times 1\text{--}1.5$ mm, compressed, with a distal wing 0.4–0.6 mm wide.

Distribution:—Endemic to Isfahan province of Iran.

Conservation status:—*Graellsia isfahan* is known from the type and two additional collections. Its conservation status is given Data Deficient (DD) according to the IUCN (2001) criteria.

Etymology:—the species epithet *isfahan*, named after the Iranian province Isfahan, is a noun used in apposition and, therefore, should be maintained according to Article 23.5 of the International Code of Nomenclature for algae, fungi, and plants (McNeill *et al.*, 2012).

Additional specimens examined (paratypes):—IRAN. **Isfahan:** Isfahan, 3350 m, 14 July 1966, *J. C. Archibald 2755* (E, K); Isfahan, *P. M. R. Aucher-Eloy 4124* (P).

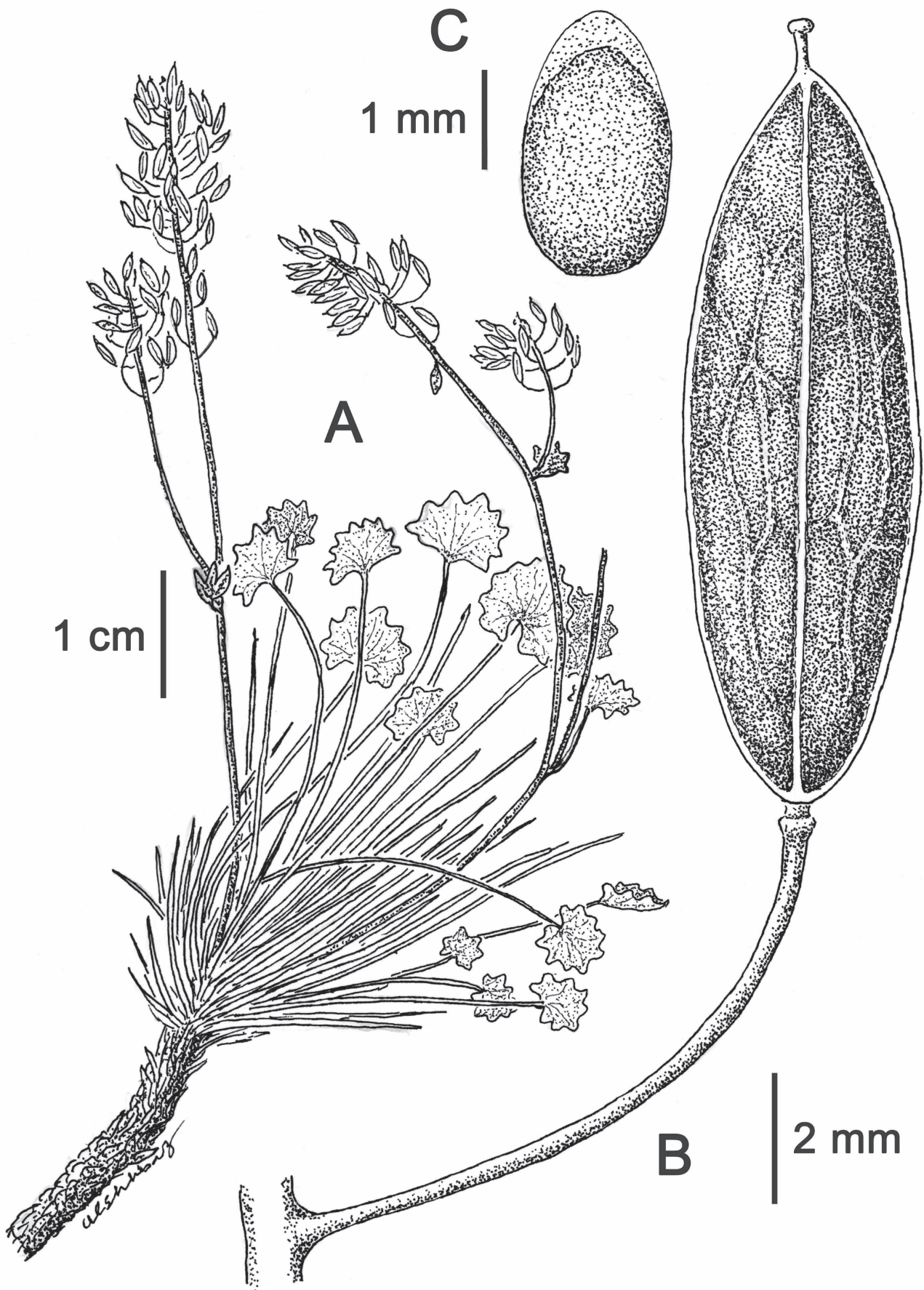


FIGURE 1. *Graellsia isfahan*. **A.** Plant. **B.** Fruit and fruiting pedicel. **C.** Seed showing distal wing. Drawn by Al-Shehbaz from the isotype (MO 6737249).

Discussion:—*Graellsia isfahan* resembles *G. davisiana*, a disjunct species endemic to Turkey (provinces Maras and Gaziantep) and remotely isolated by an air distance of 1448 km, in having basal leaves with 9–15 well-developed teeth. However, *G. isfahan* is readily distinguished by having a caudex covered with persistent whole petioles of previous seasons, smaller leaf blade 1.2–2.5 × 1.8–2.8 cm, dense main racemes with up to 65 flowers, fruiting pedicels flattened at base and gently curved towards apex, oblanceolate petals, 14–16 ovules per ovary, fruit valves obtuse at both ends and with a prominent midvein, styles 0.5–0.8 mm long, and seeds with well-developed apical wing. By contrast, *G. davisiana* has a caudex covered with petioles remains of previous seasons, larger leaf blade 1.5–6 × 2–7 cm, lax main racemes with 10–18 flowers, ascending fruiting pedicels not flattened at base and straight towards apex, obovate petals, 4–12 ovules per ovary, fruit valves acute at both ends and with obscure midvein, styles 1–2 mm long, and apiculate seeds rarely with a minute wing.

Hyam & Jury (1990) cited *Archibald 2755* (E) as *Graellsia davisiana* and its duplicate at K as *G. stylosa*. Neither of these two species grows in Isfahan, and the authors overlooked the fact that they were dealing with an undescribed species. Furthermore, *G. stylosa* has angustiseptate fruit and is endemic in Alborz Mountains, where no other species of the genus grows. Both *G. isfahan* and *G. davisiana* have latiseptate fruit.

Graellsia longistyla (Poulter) Esmailbegi & Al-Shehbaz, *stat. et comb. nov.* ≡ *Graellsia saxifragifolia* subsp. *longistyla* Poulter (1956: 90). Type:—IRAN. “Persia australis, in rup. M. Kellal, 3000 m, *H. C. Haussknecht*, Iter orientale 1868” (holotype K-000697683!; isotype BM-000582806!).

Description:—Herbs perennial, glabrous throughout; caudex woody, to 1.5 cm in diam., densely covered with petioles of previous seasons. Stems 15–22 cm tall, erect to ascending, 1 or few from caudex, simple from base, 1- to few-branched above. Basal leaves rosulate, petioles 3–14 cm long, persistent, strongly indurate at base; blade cordate to suborbicular or reniform, 0.5–3 × 0.7–4 cm, 7-toothed or lobed, base truncate to cordate, apex subacute; cauline leaves 2–4, much smaller than basal leaves, uppermost oblanceolate, entire or few toothed. Racemes somewhat lax, few to several flowered, slightly elongated in fruit; rachis straight; fruiting pedicels slender, 6–11 mm long, divaricate, straight. Sepal oblong, 1.5–2.2 mm long; petals white, obovate, 2.5–3.5 × 1.5–2 mm, attenuate to claw-like base ca. 1 mm long; filaments 1.5–2 mm long; anthers ca. 0.4 mm long; ovules 4 per ovary. Fruit elliptic-oblong, 7–12 × 3–4 mm, latiseptate, dehiscent, not detached at maturity from pedicel; valves papery, acute to subobtusate at both ends, straight, inconspicuously veined; septum complete; gynophore obsolete, style 0.8–2 mm long. Seeds biseriate, ovate, 2.5–3 × 1.8–2 mm, compressed.

Distribution:—NW Iran and NE Iraq. It is somewhat common on calcareous mountain slopes.

Representative specimens:—IRAN. **Kurdistan:** Shahu, June–July 1867, *H. C. Haussknecht s.n.* (K, W); Mt. Kellal, 1868, *H. C. Haussknecht s.n.* (BM, P, W); Avroman et Schahu, June–July 1867, *H. C. Haussknecht s.n.* (BM, P); Maryvan Tah-tah pass, 2200 m, 12 June 2000, *H. Maroofi & Karegar 456* (Sanandaj); Maryvan to Paveh, Tah-Tah pass, 2200 m, 27 May 2001, *H. Maroofi et al. 525* (Sanandaj); Maryvan, Tah-Tah pass, 2500 m, *Hooshidary 2745* (Sanandaj); Maryvan to Paveh, Darband dezli, Maryvan to Paveh, Tah-Tah pass, 2500 m, 21 October 2003, *H. Maroofi & Mohammadi 6483* (Sanandaj); Maryvan to Paveh, Tah-tah pass, 2400 m, 10 June 2007, *H. Maroofi & Kargar 8132* (Sanandaj); ca. 25 km from Sanandaj to Dehgolan, Salavatabad pass, 2000 m, 25 June 2012, *H. Maroofi 11254* (Sanandaj); Maryvan to Paveh, Sline village, 2400 m, 28 June 2012, *M. Advayee 11369, 12512* (Sanandaj); S of Maryvan, N of Tah-tah pass, 2520 m, 24 August 2007, *M. Mirtadzadini 1747b* (MIR). IRAQ. **Sulaimani:** Hawraman (as Mt. Avroman), above Daramar, 2250 m, 8 July 1948, *J. B. Gillett 11884* (K); Qara Dagh, 1700 m, 23 April 1947, *J. B. Gillett 7295* (K).

Notes:—Poulter (1956) treated this species as a subspecies of *Graellsia saxifragifolia*, a position that was followed by Hedge (1968), Townsend (1980), and Hyam & Jury (1990). However, *G. longistyla* can easily be separated by having a complete septum (vs. none), longer styles (0.8–2 vs. 0.1–0.2 mm long), and dehiscent (vs. indehiscent) fruit persistently attached to (vs. readily detached from) the pedicel.

Graellsia saxifragifolia (DC.) Boissier (1841: 379). ≡ *Cochlearia saxifragifolia* de Candolle (1821: 370). Type:—IRAN. Mt. Elvend, *G. A. Oliver & Brugiére* (holotype P-00747680!, isotypes B-10_0241453!, P-00747681!).

Graellsia saxifragifolia var. *yezdana* Boissier (1867: 307). Holotype:—IRAN. “Hab. in montibus prope Yezd,” May 1849, *Buhse s.n.* (G?).

Description:—Herbs perennial, glabrous throughout; caudex woody, to 1.5 cm in diam., densely covered with petioles of previous seasons. Stems 15–35 cm tall, erect to ascending, one to several from caudex, simple from base, 1- or few-branched above. Basal leaves rosulate; petioles 2–10 cm long, persistent, strongly indurate at base; blade cordate to

suborbicular, 0.4–2 × 0.6–3.5 cm, 7–9-lobed, base obtuse, truncate or deeply cordate, apex obtuse to subacute; cauline leaves 1–4, uppermost entire or few toothed, oblanceolate. Racemes dense, few to many flowered, slightly elongated in fruit; rachis straight; fruiting pedicels slender, 4–10 mm long, divaricate, straight, flattened at base, shorter than or rarely subequaling fruit. Sepal oblong, 1.5–2.2 mm long, glabrous; petals white, obovate, 2.5–3.5 × 1.5–2 mm, attenuate to claw-like base ca. 1 mm long; filaments 1.5–2 mm long; anthers ca. 0.4 mm long; ovules 4 per ovary. Fruit obovate to elliptic, 6–8(–10) × 3–4 mm, latiseptate, indehiscent, detached at maturity from pedicel; valves papery, obtuse to acute at apex, cuneate at base, straight, without or rarely with an obscure midvein, with inconspicuous lateral veins; septum absent; gynophore obsolete, style 0.1–0.2 mm long. Seeds aseriate, ovate, 2.8–3.1 × 1.8–2.1 mm, compressed. $2n=14$.

Distribution:—Endemic to Iran. This rather common species grows primarily on calcareous grounds just as the remaining species of the genus.

Representative specimen:—IRAN. **Chaharmahal Bakhtiari:** Zard Kuh, 3100 m, 4 July 1977, *A. Aryavand 2810* (Isfahan); Zard Kuh, 1837, *P. M. R. Aucher-Eloy 420* (G, P); Zard Kuh, 8 June 1975, *Kramer 1088* (E); Zard Kuh, 3450 m, 4 July 1977, *J. C. Klein 11310* (G); Zard Kuh mts., 3658 m, 14 August 1965, *R. Timmis 121* (K); Gahar, 2743 m, 30 May 1941, *W. N. Koelz 17920* (W); Shahr-e Kord, Baba-Heidar, 2150–2500 m, 1 June 1986, *V. Mozaffarian 54829* (TUH); Kuhrang, 2400 m, 31 May 1959, *P. Wendelbo s.n.* (E); above Kuhrang valley, 4140 m, 5 August 1966, *J. C. Archibald 2991* (E, K). **Fars:** Kuh Dena, 3800 m, 1955, *Remaudier s.n.* (P); Kuh Dena, 29 July 1842, *T. Kotschy 767* (BM, E, G, K, MO, P, PRC, W); Dena, Sicani pass, 1 August 1949, *Behboudi 1375E* (W); Sultanabad, Tochal, 25 May 1892, *J. F. N. Bornmüller s.n.* (G); Sultanabad, Aug 1893, *T. Strauss s.n.* (W); Sultanabad, in monte Schuturunku, May 1897, *T. Strauss s.n.* (G). **Isfahan:** Kuh-e Karkas, 2880 m, 27 May 1974, *K. H. Rechinger 46600* (AAU, G, K, MO, W); Qashqai, Kuh-e Surmandeh (Kuh-e Alijuq), N Semirum, 2700–3900 m, 7 June 1974, *K. H. Rechinger 47537* (B, E, G, K, M, MO, W); Taleghan, c. 30 km SW of Ardestan, 2200 m, 15 May 1974, *P. Wendelbo & H. Foroughi 11512* (E, W); Kuh-e Karkas, near television mast N side of pass (N. of Targh), 2800 m, 14 May 1974, *P. Wendelbo & H. Foroughi 11429* (W). **Kashan:** Barzuk, near Kashan, 2134 m, 20 May 1968, *C. Berens 20* (E). **Kerman:** Mt. Jupar, *Anonymous 26018* (TUH); Abshar-e Rayen, 23 July 1997, *M. Mirtadzadini 1735* (MIR); Abshar-e Rayen, 21 April 1999, *F. Peyravian 1736* (MIR); Kuhpayeh, 6 May 1997, *M. Mirtadzadini 1737, 1742* (MIR); Kuhpayeh, 27 May 1999, *F. Peyravian 1738* (MIR); mountain of N Tunel-e Sirch, 20 April 2004, *M. Mirtadzadini & M. Khodami 1739b* (MIR); Kuh-e Hezar, 20 km SW of Rayen, 3600 m, 2 June 1977, *J. R. Edmondson & A. G. Miller 1583* (E, G, W); Kuhpayeh, May 1999, *Z. Heidari 1740* (MIR); Ravar, Feyz-Abad, Darab, 7 May 2004, *M. Mirtadzadini & M. Khodami 1743* (MIR); Rabor, N of Qanat-Malek village, Tangal valley, 3215 m, 15 June 2012, *M. Mirtadzadini 1780c* (MIR); Mt. Kuh-e Jebal Barez in vicinities vici Deh Bakri, 1700–2700 m, 2 May 1973, *J. Sojak 3954, 3949* (PR); Mt. Lalezar, 3800 m, 17 June 1892, *J. F. N. Bornmüller 2202* (G); Mt. Kuh Lalezar, 3800 m, 17 July 1892, *J. F. N. Bornmüller 2201* (BM, E, G, K, LE, P, PR, PRC, W); Kuh Hazar, 2800–3200 m, 16 June 1975, *H. Foroughi & M. Assadi 16257* (E). **Lorestan:** Khorramabad, Sefid-Kouh, Northern slope, 2900 m, 21 July 1999, *Veiskarami 23845* (TUH). **Markazi:** ca. 40 km E of Shahzand, Kuh-e Soorakhe-Khonsa, 2000–2980 m, 10 June 1986, *H. Akhiani 1452* (TUH); Sefidkhani-Arak, 14 May 1985, *A. Ghahreman & Shaikhaleslami 12313* (TUH). **Tehran:** Mt. Elwend, 15–16 May 1895, *T. Strauss 98* (G, K). **Yazd:** 5 km S of Sheykh Ali Shah, near Shirkuh, 2700 m, 25 May 1977, *Anonymous 2808* (Isfahan); Shir Kuh, 20 km SSW of Taft, 2700 m, 25 May 1977, *A. Aryavand et al. 1407* (E, G), Barfkhaneh Tezerjan, 3000 m, 4 July 1972, *H. Foroughi 4703* (E); Barfkhaneh Tezerjan, 3330 m, 4 July 1972, *H. Foroughi 4704* (E); Tezerjan Kuh, SE of Shir Kuh, 3000 m, 26 May 1977, *A. Aryavand et al. 1438* (E).

Notes:—There are two sheets of the type collection of *Graellsia saxifragifolia* at P. The sheet with three flowering plants carries de Candolle's determination as *Cochlearia saxifragifolia*, and it perfectly matches the original species description, including the presence of four ovules per ovary. The isotype sheet is a sterile rosette with a printed label and determination as *G. saxifragifolia*. Evidently, de Candolle did not examine this duplicate.

As presented here, the range of this species is much narrower than that given by Poulter (1956), Hedge (1968), and Hyam & Jury (1990) because all of the collections cited by these authors from Afghanistan, Turkmenistan, and NE Iran belong to *Graellsia integrifolia*. Furthermore, the collections these authors cited from NW Iran and NE Iraq belong to *G. longistyla*, a species very distinct from *G. saxifragifolia* (see above). Hyam & Jury (1990) erroneously cited *Bornmüller 2201* from Kerman as subsp. *longistyla*, but this collection has indehiscent fruit characteristic of *G. saxifragifolia*, whereas *G. longistyla* always has dehiscent fruit.

The leaf-margin variation in *Graellsia saxifragifolia* approaches that of *G. integrifolia*. A case in point, *Foroughi 4703* with subentire leaves and *Foroughi 4704* with strongly dentate leaves were identified as *G. integrifolia* and *G. saxifragifolia*, respectively. The differences of 330 meters in elevation unlikely caused the variation in leaf margin, and it is highly likely that both forms grow along that elevational gradient.

Graellsia stylosa (Boiss. & Hohen.) Poulter (1856: 92). ≡ *Sobolewskia stylosa* Boiss. & Hohen. in Boissier (1849: 41). ≡ *Physalidium stylosum* (Boiss. & Hohen.) Fenzl in Tchihatcheff (1860: 327). Described from: “Hab. in declivibus septentrionalibus montis *Elbrus* [for Alborz] propè *Derbend* Kotschy No 85.” Type:—IRAN, “In m. Elbrus pr. Derbend. 5 maj. 1843. Alt. 4000' [1219 m].” *T. Kotschy* 85. (Lectotype designated here: G-BOIS-00332493!, isolectotypes BM-000582807!, BM-000582808!, G-00446234!, G-00446235!, G-BOIS-00332494!, GH-00062503!, K-000342190, K-000697688!, KW!, LE!, P-02141415!, P-02141416!, P-02141417!, W-0050814!).

Description:—Herbs perennial, glabrous throughout; caudex woody, ca. 1 cm in diam., densely covered with petioles of previous seasons. Stems 24–35 cm tall, erect, 1–5 from caudex, simple from base, always branched above. Basal leaves rosulate; petioles 6–15 cm long, persistent and indurate at base; blade cordate or reniform, 0.9–3 × 1.2–4.5 cm, slightly wider than long, with 7–13 teeth, base cordate to truncate, apex acute; cauline leaves 1–7, with fewer teeth and shorter petioles than those of basal leaves; uppermost leaves entire or 3-lobed. Raceme dense, many flowered, elongated in fruit; rachis straight; fruiting pedicels slender, 7–17 mm long, horizontal at flattened base, becoming divaricate, straight or slightly curved. Sepal oblong, 1.9–2.1 mm long, glabrous; petals white, spatulate, rounded at apex, 4.2–5 × 2–2.5 mm, attenuate to claw-like base ca. 1 mm long; filaments 2–3 mm long; ovules 4 per ovary. Fruit oblong-elliptic, 10–15 × 4.5–6 mm, angustiseptate, dehiscent, not detached from pedicel, strongly keeled; valves thin papery, acute at both ends, straight, obscurely veined; septum complete, membranous; gynophore obsolete; style 1–2 mm long. Seeds uniseriate, oblong-ovate, 2–2.1 × 0.8–1.1 mm, compressed. $2n=14$.

Distribution:—Endemic to northern Iran and primarily in Tehran province on Alborz Mountains.

Representative specimens:—IRAN. **Azerbaijan:** Zandjar to Gheydar, 2200–2650 m, 3 July 1974, *F. Termé & Moussavi s.n.* (E). **Qazvin:** 20 km N Karaj, 1400 m, 27 April 1970, *F. Kasy* 470 (W). **Tehran:** Farahzad and Yondjar, May–June 1936, *A. Parsa* 344 (P); Damavand toward Lake Tar, *American-Iranian Botanical Delegation* 34082 (MO, TUH); N of Kandevar Pass, 3110 m, 25 June 1966, *J. C. Archibald* 2484 (E, K); Bafkajan, Alborz Mt., 1829 m, 30 April 1963, *Bowles Scholarship Bot. Exped.* 1084 (K); 19.3 km W of Firuzkuh Arjaman, 1372 m, 2 June 1963, *Bowles Scholarship Bot. Exped.* 2028 (K); Tochal, near Scheheristanek, 2200 m, 1 June 1902, *J. F. N. & A. Bornmüller* 6218 (E, G, K, LE, P, PR); Tochal, above Imam-sade Davud, 2700 m, 29 May 1902, *J. F. N. & A. Bornmüller* 6217 (BM, E, G, K, P, PR, W); below Qatun-Barga (Kharsang), 2650 m, 19 July 1977, *J. C. Klein* 8531 (G); between Sia-Guk (Massif de l'Alam-Kuh) and Vanderaban, 3340 m, 24 July 1971, *J. C. Klein* 2226 (G); 4.8 km S. of Polur, 2230 m, 7 May 1960, *H. Pabot* 4239 (G); Kandovan, 3100–3500 m, 26 July 1960, *H. Pabot* 4576 (E, G); Ostan, between Karaj and Gach-i-Sare, 100–2500 m, 16 May 1956, *F. Schmid* 5685 (E, G, W); between Kan and Sangan, 15–20 km NW of Tehran, 1400–1800 m, 22 April 1977, *K. H. Rechinger* 54518 (AAU, B, G, W); Mt. Alborz, above Farahzad, 2600 m, 29 May 1902, *J. F. N. Bornmüller* 6219 (BM, P, W); Mt. Alborz, opposite Karaj, Kuh-e Dasht, 21 May 1937, *K. H. Rechinger* 316 (BM, K, W); S of Damavand, N side of Imam Zade Hashim, 2200 m, 14 May 1959, *P. Wendelbo s.n.* (E). Alborz foothills, N. of Tehran, 2134 m, 2 May 1962, *P. Furse* 1710 (E, K, LE, W); 56 km N of Karaj, 10 May 1961, *H. C. Stutz* 1101 (W); Mt. Alborz, Kandavan, 2700–3800 m, 8 July 1977, *J. Sojak s.n.* (PR); Mt. Tochal, above Tehran-Evin, 5 April 1977, *J. Sojak s.n.* (PR); Tochal, 3200 m, July 1939, *N. Lindsay* 517 (BM); Pasghaleh, 1750 m, June 1992, *F. Attar* 16480 (TUH); road Karaj-Chalus, Vineh, 1976, *A. Ghahreman et al.* 25919 (TUH); Vineh, on road from Karaj to Chalus, 29 April 1997, *A. Ghahreman et al. s.n.* (TUH); Darband, 2044 m, 22 June 2015, *S. Esmailbegi* 1744, 1745c, 1746 (MIR); Darband, 8 May 1961, *S. Farsi* 12312 (TUH); Shemshak and Dizin pass, 2842 m, 12 June 2015, *M. Mirtadzadini* 1778a (MIR); Karaj to Tshalus, S of Gatshsar, Talaqan crossroad, 2227 m, 13 June 2015, *M. Mirtadzadini* 1779 (MIR); Chalus road, April 1968, *S. Mobayen* 12311 (TUH); Posht-e Hashisheh, near Karaj Dam, 23 April 1959, *A. Ghahreman* 12314 (TUH); Pase Ghala, *A. Parsa* 12315 (TUH); Darakeh, *Mazouji* 12316 (TUH); Djadgerud, 5 May 1961, *A. Ganjalizadeh* 12317 (TUH); Dare Khan, Kuh Dasht, 1900 m, *A. Parsa* 22043 (TUH); Pass Qale slope, *Farahzadi* 22044 (TUH); S slope of Mt. Damavand, 1 km after Polur to Reneh, in valley, 2200 m, 22 May 2011, *A. Talebi* 43266 (TUH); Mt. Tochal, 5 June 1959, *Kashani s.n.* (TUH); Pas Qale, Ahar valley, 1960, *A. Ghahreman s.n.* (TUH); between Sorkheh Hesar and Polur, June 1961, *A. Ghahreman s.n.* (TUH); Abe-Ali-Sarpolak, 14 May 1966, *Mobayen s.n.* (TUH); Oushan, Kuhe Pand, 1900–2000 m, 21 May 1975, *F. Termé s.n.* (E).

Notes:—A specimen from the Bunge herbarium, P-02141420, from Yezd was mounted on the sheet of the isolectotype P-02141417. It clearly belongs to *Graellsia saxifragifolia*. Another from the Bunge herbarium, P-02141418, was mounted with the isolectotype P-02141416, and it had no locality data, though it belongs to *G. stylosa* and has Boissier's hand-written annotation of the species as *Sobolewskia stylosa*.

Except for the single collection cited above from Azerbaijan province, no other material was seen from the herbaria consulted, and it is unknown whether that record stands or a labeling mistake was made.

Graellsia stylosa resembles *G. graellsifolia* in having angustiseptate fruit, a feature evolved independently in two species (Esmailbegi *et al.*, unpub.). They are strikingly different in features listed in the key above. However, contrary to the claim of Hyam & Jury (1990) the fruits of *G. stylosa* are dehiscent (not indehiscent) and those of *G. graellsifolia* are neither inflated nor with biseriate seeds.

Acknowledgements

Shokouh Esmailbegi and Martin A. Lysak are grateful to the Central European Institute of Technology for the grant CEITEC 2020 (LQ1601) that supported this research. The first author is also grateful to the International Association for Plant Taxonomy (IAPT Research Grant 2017) for supporting the research. Travel support for Al-Shehbaz was provided by United States National Science Foundation (OPUS grant DEB-1252905) that supported part of this research. We are profoundly thankful to Dmitry A. German (HEID) for his help and advice in locating types in various herbaria, in providing literature and images, and in translating label information. We also thank Lesley Scott (E) and Larisa Raenko (LE) for helping with the images of various *Graellsia* species. We are grateful to Farideh Attar (TUH), Nicolas Fumeaux (G), Mohammad Reza Joharchi and Mahboobeh Zangoeei (FUMH), Hossein Maroofi (Sanandaj), Sergei Mosyakin (KW), Patrik Mráz (PRC), Germinal Rohan (P), Otakar Sida (PR), and Ernst Vitek and Johannes Walter (W) for their advice and help during visits to their herbaria. Last but certainly not least, we thank the directors, curators, and collection managers of the herbaria cited above.

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