



The genus *Spryginia* (Brassicaceae) in Iran and Afghanistan

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Abstract

The oligotypic Irano-Turanian mustard genus *Spryginia* (Brassicaceae, Euclidieae) is revised in Iran and Afghanistan. Species composition and distribution within the region are clarified. Unlike previously believed, the genus includes two (not one) species in the studied area. Both *S. afghanica* and *S. winkleri* are distributed in Afghanistan while only the latter species occurs in Iran representing the first record of the genus for the country. Updated morphological descriptions, data on type specimens, ecology, phenology, and distribution map of both species within the studied area are provided. *Spryginia winkleri* is illustrated based on Iranian material. A modified generic key is also presented.

Keywords: Cruciferae, Euclidieae, Irano-Turanian Region, *Spryginia afghanica*, *S. winkleri*

Introduction

Spryginia Popov (1923: 35) is a small genus of the mustard family (Brassicaceae or Cruciferae) endemic to the Irano-Turanian Region of the Holarctic Floristic Kingdom (Hedge 1976, Takhtajan 1986) and, more specifically, confined to the southern part of the Middle Asia (from eastern Kopet-Dagh to western Pamir-Alay Mountains within southern and eastern Turkmenistan, southern Uzbekistan, and southern Tajikistan) and northern to central Afghanistan. For over 40 years, *Spryginia* included only one species, the generic type, *S. winkleri* (Regel 1886: 612) Popov (1923: 35) (Schulz 1936, Busch 1939, Botschantzev & Vvedensky 1955), until Botschantzev (1966) demonstrated that more taxa are involved. All members of the genus are very close to each other morphologically and ecologically and can be separated based on the slight differences predominantly in indumentum and fruit characters (see the key below). For this reason, some authors treat certain Botschantzev's species as either subspecies (Vassilczenko & Vassilyeva 1986) or even synonyms (Yunusov 1978) of *S. winkleri*. Nonetheless, the genus is recognized usually as having seven species (Appel & Al-Shehbaz 2003, Warwick *et al.* 2006, Al-Shehbaz 2012), one Afghan (*S. afghanica* Botschantzev (1966: 131): Podlech 2012, Breckle *et al.* 2013) and six Middle Asian (Kovalevskaya 1974, Czerepanov 1995). Of them, *S. winkleri* is the most widely distributed species covering the northern (Middle Asian) half of the geographic range of the genus and previously reported for Afghanistan (see below), and the other five are endemic to certain parts of western Pamir-Alay. All *Spryginia* species occupy open dry clayey slopes of foothills and predominantly lower mountain belt (Botschantzev 1966, Kovalevskaya 1974, Yunusov 1978, Nikitin & Geldikhanov 1988).

Representatives of *Spryginia* possess original combination of morphological features, viz annual, often rather robust habit; usually unevenly distributed, sometimes subsequently disappearing indumentum of simple or a mixture of simple and forked stalked trichomes; wide, entire to serrate-dentate, petiolate leaves; big violet or pink (occasionally white) flowers; inner stamens with connate filaments and linear, apiculate anthers with one theca well- and another underdeveloped; latiseptate (compressed to subterete), often torulose siliques (Popov 1923, Botschantzev 1966, Appel & Al-Shehbaz 2003) and therefore their generic placement can be identified relatively easily. However, tribal assignment and affinity of *Spryginia* has long been unclear. It was usually placed in Brassicaceae DC. as a purported relative of habitually somewhat

similar *Moricandia* Candolle (1821: 243) and *Orychophragmus* Bunge (1833: 7) (e.g., Schulz 1936, Busch 1939, Hedge 1968, 1976) or, less often, in Hesperideae Prantl (in a traditional sense) with assumed affinity to *Hesperis* Linnaeus (1753: 663), *Clausia* Kornuch-Trotzky (1839: 2), and *Pseudoclausia* Popov (1955: 18) (Botschantzev 1966). This uncertainty was partly removed by the molecular phylogenetic studies (Couvreur *et al.* 2010, Warwick *et al.* 2010, German *et al.* 2011) which unambiguously indicated its placement in Euclidiaceae. Position of *Spryginia* within the tribe still needs elucidation: it could not be determined based on ITS phylogeny though according to the analysis of a chloroplast DNA marker *trnL-F* (German *et al.* 2011), it appears to be close to *Strigosella* Boissier (1854: 22) which makes morphological and biogeographical sense. The two genera share a number of characters: *Strigosella* is also represented by annuals with pink to violet (less often white) flowers, erect sepals, lacking median nectaries, fruits linear, many-seeded dehiscent, often latiseptate and falcate or coiled siliques, conical stigmas with connivent lobes, incumbent to oblique-incumbent cotyledons, sometimes flexuous inflorescence axis and united filaments of median stamens, etc. and it is most diverse in the Irano-Turanian Region. At the same time, it differs from *Spryginia* by denser, persistent, usually coarser and more branched indumentum, smaller flowers, non-saccate bases of lateral sepals, anthers with both thecae developed, etc. (Botschantzev 1972b, Al-Shehbaz *et al.* 2014).

From the geographic viewpoint, *Spryginia* is studied pretty unevenly. While the data on the northern (Middle Asian) half of the generic distribution area are based on abundant material and appear sufficient (Botschantzev 1966, Kovalevskaya 1974, Yunusov 1978, Nikitin & Geldikhanov 1988), information on the southern part (Afghanistan and potentially Iran) is based on less numerous gatherings, apparently incomplete and quite controversial.

In particular, all gatherings from Afghanistan were first reported by Hedge (1968: 58) as *S. winkleri* though based on one of them, from the northeast of Bamyán Province (northernmost part of central Afghanistan, according to the division accepted in *Flora Iranica*), *S. afghanica* was shortly before that described by Botschantzev (1966) who mentioned the latter species as the only representative of the genus occurring in this country (which was the only option having the single specimen from Afghanistan at hand). This novelty was noted by Hedge (1968: 343) who also stressed that no other Afghan material was studied by Botschantzev. Although no comments were provided on the status of *S. afghanica* and no formal synonymy has been proposed, the species apparently was not accepted by Hedge. Accordingly, the identity of the rest of gatherings was left unchanged and additional collection, the first from NW Afghanistan (the west of Herat Province) was also cited as *S. winkleri* (Hedge l.c.: 343). In contrast, this species was not included in more recent accounts on Afghanistan where *S. afghanica* is reported as the only species occurring in the country (Podlech 2012, Breckle *et al.* 2013). Hence, all available sources agree in reporting just one species of *Spryginia* for Afghanistan but no congruence is observed regarding its identity. By the present moment, this incongruence remained unresolved.

Another aspect is that based on the known geographical ranges of *Spryginia* representatives, the occurrence of the genus in Iran could also be expected. This suggestion is first of all based on the fact that *S. winkleri* is known since a long time from Kopet-Dagh of Turkmenistan just near the Turkmen/Iranian border (Vassilczenko 1948, Nikitin 1965, Botschantzev 1966, Nikitin & Geldikhanov 1988). Besides, the above-mentioned westernmost Afghan locality of either *S. afghanica* or *S. winkleri* (Hedge 1968: 343, as *S. winkleri*) is also situated not so far (in about 60 km) from the border with Iran. The absence of any records of the genus from Iran seems, therefore, a matter of lack of relevant material from north-easternmost parts of the country rather than the true absence of *Spryginia* in the flora of Iran.

Material and Methods

For the present study, *Spryginia* collections were examined in the herbaria M (incl. MSB), W and partly LE. Images of Afghan specimens from E and KUFS available online via Royal Botanic Garden Edinburgh Herbarium Catalogue [2017] and JACQ Virtual Herbaria [2017] portals were also used. Information on the rest of original material of *S. winkleri* was considered as well based on the study of either specimens (LE, WU) or online images of those from K and P (The Kew Herbarium Catalogue 2006, Global Plants [2017], MNHN 2017).

Field investigations in NE Iran have been conducted in 2015–2016 and *Spryginia* was found in Zarrin Kuh Mountains north of Daregaz (Razavi Khorassan, Iran). Plants were studied in the wild and herbarium specimens were prepared which are deposited at FUMH. For identification, relevant sources were used such as Kovalevskaya (1974), Yunusov (1978) and, especially, Botschantzev (1966). The same publications were used as a template for preparing the updated generic key and morphological descriptions of both studied species. Nomenclature is given according to the Melbourne edition of the Code (McNeill *et al.* 2012).

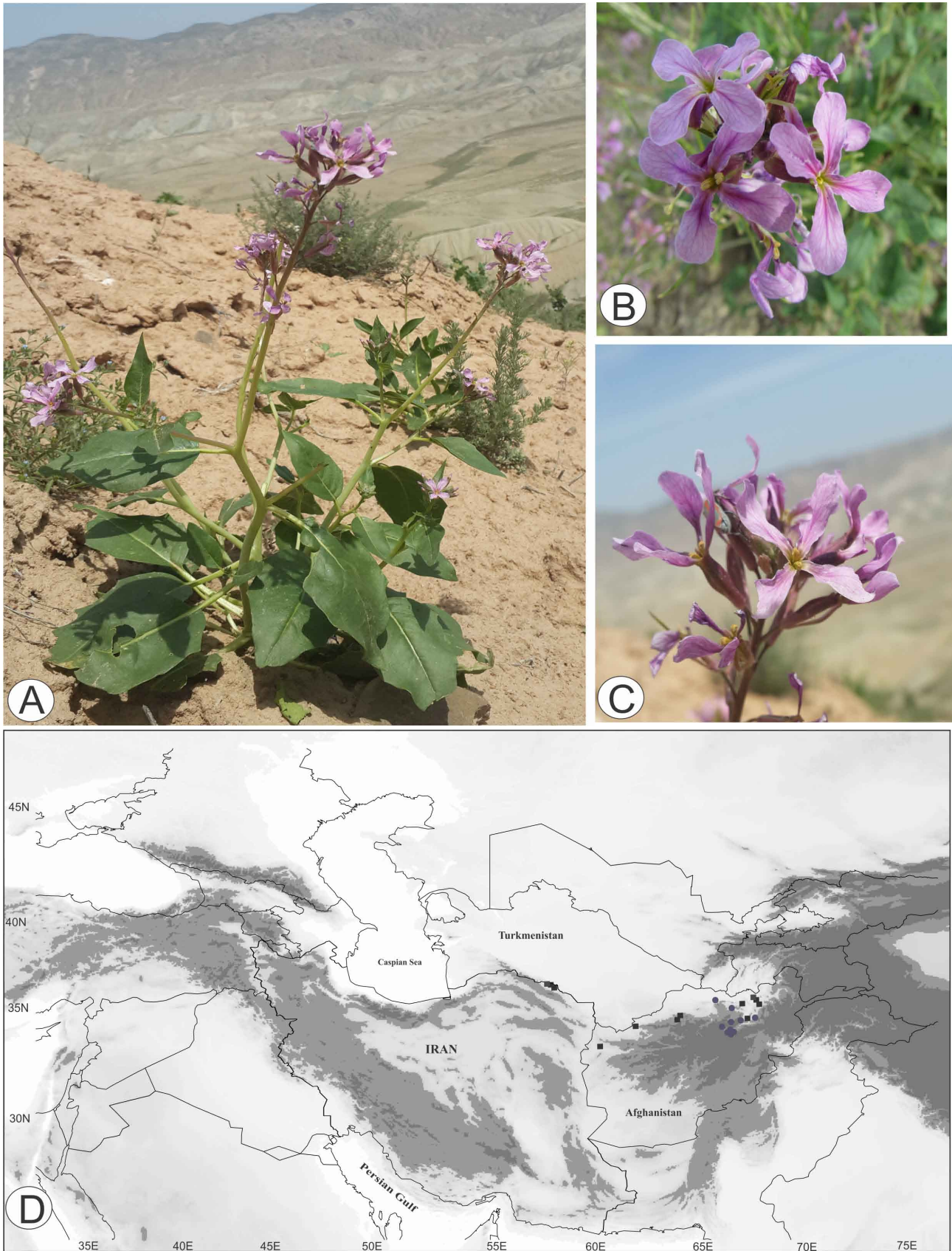


FIGURE 1. A–C *Spryginia winkleri* from Zarrin Kuh Mts, (A) habit, (B & C) flower. Photographs taken by F. Memariani. (D) Distribution map of *S. afghanica* and *S. winkleri* in Iran and Afghanistan based on revised and newly collected specimens. *S. winkleri* (■), *S. afghanica* (●).

Results and discussion

Identification of Iranian and revision of Afghan *Spryginia* material revealed that based on the characters of indumentum it is clearly separated onto two groups. First of them comprised the specimens with inflorescence axis, usually leaves in the upper part (often throughout when very young), the proximal portion of pedicels and sometimes sepals in buds covered with minute, easily detached, patent, simple and 1(2)-forked trichomes. Plants with such indumentum confined to the northern and central Afghanistan, correspond the type and fit well the description of *S. afghanica*. Another group included specimens with long simple subappressed crisped trichomes in the apical part of inflorescence, pedicels and sometimes sepals of buds, occasionally with single, less crisped to straight long simple trichomes on pedicels and/or leaves. Relevant plants from Iran, northern and northwestern Afghanistan clearly represent *S. winkleri*. Hence, two species of *Spryginia* occur in the southern part of the generic distribution area. The widespread *S. winkleri* ranges from northeastern Iran, representing the first findings of the genus in the country, through northwestern to northern Afghanistan where it is partly sympatric with Afghan endemic *S. afghanica* which also reaches the central part of the country. Iranian findings are situated in some 10 km from the closest known localities in Turkmen part of Kopet-Dagh. Details of distribution of both species within the studied region are given on the map (Fig. 1D) and respective specimens are cited below.

In addition to the material from LE, M, MSB, and W, specimens studied online are also taken into consideration because in all cases it turned out to be possible to identify them. Most of such specimens are simply duplicates of those studied physically and three remaining gatherings revealed enough characters to be determined online, without knowing the details of indumentum. Two of them (E00372195 and KUFS 000755) were unambiguously identified as *S. winkleri* first of all due to the presence of broadly ovate to elliptic leaves typical for well-developed specimens of this species and not characteristic for another. The last one (E00372196) based on narrower leaves, strongly flexuous and, most important, shortly pubescent inflorescence axis could only be assigned to *S. afghanica*. Hence, all these gatherings are also cited and plotted on the map (Fig 1D).

Conspectus of *Spryginia* in Iran and Afghanistan is given below. Somewhat updated (especially for *S. afghanica*) descriptions of both species are also provided. Besides, the key for all *Spryginia* species is presented having in mind that findings of other representatives of the genus within the studies area (especially Afghanistan on the border with Tajikistan and Uzbekistan) are still possible and all hitherto published identification keys are only available in Russian.

Conspectus of *Spryginia* in Iran and Afghanistan

Spryginia afghanica Botschantzev (1966: 131). Type:—AFGHANISTAN. Prov. Bamian: Doab, c. 15 km west on side road. Alt. c. 1450 m. 21 May 1962. *Ian Hedge & Per Wendelbo No. W. 3445* (LE: LE01037336!; isotype E: E00372193 [<http://data.rbge.org.uk/herb/E00372193>]).

Annual (10–)20–40(–55) cm tall. Inflorescence axis, often pedicels (lower part) and leaves in the upper part (very young leaves usually throughout, soon becoming glabrescent to completely glabrous), sometimes sepals (in buds) and seldom the whole stem pubescent with short (0.1–0.3 mm long) thickish patent, simple and 1(rarely 2)-forked, easily detached trichomes. Stems erect, stout, branched from the base or above, in the part of inflorescence usually slightly to profoundly flexuous. Leaves petiolate, 0.5–12.5 cm long (incl. petiole 0.1–2.5 cm), 0.1–3 cm wide; basal and lower cauline biggest and broadest (narrowly ovate, narrowly elliptic or broadly lanceolate), remotely dentate to entire, sometimes serrate, acute or obtusate, cuneate at base. Middle cauline leaves on shorter petioles, smaller and usually narrower; uppermost to linear-lanceolate or almost linear, predominantly entire, acute. Raceme 5–25(–30)-flowered, considerably elongated in fruit; pedicels divaricate-ascending, in flower 2.5–6, in fruit 3.5–8.7 mm long and 0.5–0.8 mm wide. Sepals linear, violet, (8–)9–12(–15) × 0.8–2.5 mm; petals 17–32 (claw 10–18 and blade 7–14) mm long and 3.5–7.5 mm wide. Inner stamens 10–18, outer 9–14 mm long; anthers, respectively, 2–3.5 and 2.8–4.2 mm. Siliques sessile or on a stout gynophore 0.5–0.8 mm, (4–)8–10.5 cm × 1.3–1.6 mm, subterete-compressed, falcate or coiled to 3 times, rarely almost straight; valves torulose, with obsolete thin midvein; style cylindrical, 1–1.5 (2–4 including narrowly conical stigma) mm long. Seeds oblong, 1.2–1.8 × 0.8–1 mm.

Distribution:—Afghanistan (northeast and northern part of the center); endemic.

Specimens examined:—AFGHANISTAN. Prov. Bamian: unteres Sayghan Tal bei Pesheng, 1550 m. 35°14'N,

67°57'E. 15 May 1971. *O. Anders* Nr. 6367 (MSB-125577!); Prov. Bamian: Ajar Tal (Kamard Tal), bei Darband, 1520 m. 35°17'N, 67°56'E. 14 May 1971. *O. Anders* Nr. 6261 (M-13758!, KUFS 000754 [<http://herbarium.univie.ac.at/database/detail.php?ID=215334>]); Prov. Bamian: In valle Ajar "Königstal", a Doab occidentem versus, ca. 35°15'N, 67°45'E, 1400–1500 m. 12 June 1962. *K.H. Rechinger* 16596 (W 1963-3708!); Prov. Bamian: Doabe Mekhe Zarin, 1480 m. 35°16'N, 67°59'E. 9 June 1962. *O.H. Volk* Nr. 2682 (M!, W 1964-16396!); [Prov. Baghlan]: Andarab valley below Khinjan, near Ghazan. 1000 m. 19 June 1968. *H. Freitag* No. 3048 (MSB-178365!, KUFS 000752 [<http://herbarium.univie.ac.at/database/detail.php?ID=215332>]); [Prov. Baghlan]: 10 km west of Doshi, 3500' alt. Loose conglomerate cliff and flat stony ground. 14 May 1964. *P. Furse* 5926 (LE!, M!); Baghlan Province. 60 m SW of Dashi on road to Bamian. On scree slopes. 1890 m. 23 May 1969. *R. Palmer* 68 (W 1974-19148!); [Prov. Samangan]: 20 km south of Tang-i-Tashkurgan, alt. 650 m. South-exposed slopes on red grid. 27 April 1969. *H. Freitag* No. 5125 (MSB-175188!, MSB-175190!); [Prov. Samangan]: Prov. Qataghan: Mirza Atbili pass, SE of Samangan, steep soil slopes. Alt. c. 1350 m. 10 June 1962. *Ian Hedge & Per Wendelbo* No. W. 4012 (E: E00372196 [<http://data.rbge.org.uk/herb/E00372196>]).

Note 1. The holotype of *S. afghanica* has been recently located along with the type specimens of some other Asian Brassicaceae including *Hesperis kunawarensis* Royle ex Regel (1870: 272) and *Neuroloma griffithii* Botschantzev (1972a: 670) previously reported as "lost or misplaced" (Al-Shehbaz & German 2013). Fortunately, relevant material is not lost and it is on the way to be properly placed now.

Note 2. All specimens were stored under the name *S. winkleri* except for MSB-178365 identified as *Malcolmia spryginoides* Botsch. & Vved. and a duplicate of *Furse* 5926 from LE revised by Botschantzev in 1971.

Phenology:—Flowering April–June, fruiting May–June.

Ecology:—Dry open stony, clayey, gravelly, and loess slopes and flats, sometimes saline habitats at 650–1890 m a.s.l.

Spryginia winkleri (Regel) Popov (1922: 35) ≡ *Moricandia winkleri* Regel (1886: 612) ≡ *Orychophragmus winkleri* (Regel) Schulz (1916: 56). Original locality designation: "In Turkestanicae amudariensis regione bucharica orientali in montibus Taschbulak ad latus sinistrum fluvii Kafirnagan sitis ad alt. 5–6000' 29 Aprili (11 Majo) 1883, prope Baldschuan ad alt. 3–4000' nec non prope Saiat atque Sarai ad fl. Pändschi ad alt. 1000' Aprili 1884 (A. Regel)". Lectotype (designated by Botschantzev 1966: 130):—TAJIKISTAN. Sarai ad fl. Pjandsch, rip. dextr., III, IV 1884, [fl., fr. immat.], *A. Regel* s.n. (LE!; isoelectotypes K: K000653965 [<http://specimens.kew.org/herbarium/K000653965>], LE (2×)!, P: P05332676 [<http://coldb.mnhn.fr/catalognumber/mnhn/p/p05332676>]; syntypes and other original elements K: K000653964 [<http://specimens.kew.org/herbarium/K000653964>], LE (7×)!, M (2×)!, P: P05332677 [<http://coldb.mnhn.fr/catalognumber/mnhn/p/p05332677>], P05332678 [<http://coldb.mnhn.fr/catalognumber/mnhn/p/p05332678>], WU!).

= *S. winkleri* subsp. *araneosa* Botschantzev (1966: 131). Type:—TURKMENISTAN. [Ahal Region]: Transcaspian Prov., Krasnovodsk distr., saline-clayey hill slopes near the station Baba-Durmaz. 8 April 1912. *N.V. Androsov* No. 4322 (LE!, isotypes (3×) LE!).

Annual (10–)20–50 cm tall. Inflorescence axis (throughout or only in the uppermost part), pedicels (often only in buds) and sometimes leaves and sepals (throughout or only at base) covered with long thin simple subappressed crisped, often intermingled trichomes; occasionally single, straight to slightly bent long (to 1 mm) simple trichomes may occur on pedicels and/or leaves. Stems erect, stout, branched predominantly from the middle, rarely from the base or simple, in the part of inflorescence sometimes slightly flexuous. Leaves petiolate, 1.5–14 cm long (including petiole to 4 cm), 0.15–7 cm wide; basal and lower cauline leaves biggest and broadest (ovate or elliptic to broadly or narrowly so), acute or, less often, obtuse, entire, remotely and minutely to coarsely repand-dentate or serrate, broadly to narrowly cuneate (occasionally subcordate in the biggest leaves) at base. Middle and upper cauline leaves similar to lower ones, on shorter petioles, in general, smaller and narrower (ovate or narrowly ovate to lanceolate, uppermost sometimes linear-lanceolate), predominantly entire and acute. Raceme to 32-flowered, considerably elongated in fruit; pedicels divaricate-ascending, in flower 3–10(–12), in fruit (4–)6–10(–15) mm long and 0.5–1 mm wide. Sepals linear, usually violet, (7–)10–12 × 0.9–2.7 mm; petals purple or rarely white, 16–30 (claw (9–)11–16 and blade 7–14) × (3–)4–6.5 mm. Inner stamens 10–16, outer 9–11.5 mm long; anthers, respectively, 2.5–3.2 and 3.5–4 mm. Siliques (3–)6–10(–12) cm × 1.5–2.5 mm, straight or, usually, falcate, compressed-subterete; valves torulose, with obsolete midvein; style cylindrical, 1–2 (to 4 with narrowly conical stigma) mm long. Seeds oblong, 1.8–2.4 × 0.8–1.3 mm.

Distribution:—Afghanistan (north and northwest), Iran (northeast), Tajikistan (south), Turkmenistan (south and east), and Uzbekistan (south).

Specimens examined:—AFGHANISTAN. Prov. Baghlan: Andarab Tal zwischen Khenjan und Syachobe Mazar, 1150 m. 35°36'N, 68°57'E. 20 April 1971. *O. Anders* Nr. 5814 (M-13759!, KUFS 000751 [http://herbarium.univie.ac.at/database/detail.php?ID=215331]); Prov. Qunduz: Surkhab Tal bei Qezel Say, an der Straße von Baghlan nach Qunduz, 500 m. 36°27'N, 68°53'E. 17 April 1971. *O. Anders* Nr. 5647 (M-13760!, KUFS 000753 [http://herbarium.univie.ac.at/database/detail.php?ID=215333]); Prov. Fariab: between Nishar and Belcheragh. Stony limestone slopes. Alt. 1150 m. 23 May 1969. *I. Hedge, P. Wendelbo & L. Ekberg* No. W. 8338 (E: E00253331 [http://data.rbge.org.uk/herb/E00253331], LE!, W 1972-7552!); [Prov. Fariab]: Kowljan east of Belcheragh. Alt. 1200 m. South-exposed slopes on red grid. 25 May 1969. *M. Amin* No. 6213 (MSB-175192!); [Prov. Fariab]: Faryab Koalyan east of Belcheragh. Alt. 1200 m. Flat plains. 25 May 1969. *Mohamad Amin* No. 160 (KUFS 000755 [http://herbarium.univie.ac.at/database/detail.php?ID=215335]); Prov. Takhar: Eshanan, 22 km östlich Khanabad an der Straße nach Taluqan, 720 m. Lößhänge. 26 April 1965. *D. Podlech* 10243 (M!, MSB-125575!, W 1966-24413!); Prov. Takhar: Qarandu, an der Straße von Khanabad nach Taluqan nach, 650 m. 36°46'N, 69°20'E. 1 May 1971. *O. Anders* Nr. 6010 (M-14263!, KUFS 000756 [http://herbarium.univie.ac.at/database/detail.php?ID=215336]); Prov. Takhar: 15 km westlich von Taluqan, ca. 650 m. 5 April 1968. *S.W. Breckle* 1048 (MSB-125578!); Prov. Herat: 52 km E Kisil Islam Qaleh, 34°40'N, 61°05'E, in arenosis ad viam versus Herat, 34°30'N, 62°10'E, 750 m. 22 April 1967. *K.H. Rechinger* 33277 (W 1969-1233!); Prov. Badghis: 15 [km] S of Bala Murghab, Murghab river. Soil slopes. Alt. c. 520 m. 19 May 1969. *I. Hedge, P. Wendelbo & L. Ekberg* No. W. 8221 (E: E00372195 [http://data.rbge.org.uk/herb/E00372195]). IRAN:—Prov. Razavi Khorassan, N Daregaz, W Yaghol, bifurcation road of Mash towards Zarrin Kuh, 37°31'04.32"N, 59°09'13.62"E, elev. 405 m, 19 March 2016, *M.S. Amiri* 45681 (FUMH!); N Daregaz, East of Border post in E Zarrin Kuh Mts, 37°31'21.48"N, 59°07'57.73"E, elev. 420 m, 5 Feb. 2015, *M.S. Amiri* 45560 (FUMH!); NW Daregaz, N Nokhandan, S of Zarrin Kuh Mts, 37°33'14.8"N, 59°01'4.6"E, 781 m, 19 March 2016, *M.S. Amiri* 45682 (FUMH!).

Note. The single Afghan specimen from LE which was examined by the completion of the manuscript bears confirming identification "*S. winkleri*" by Botschantzev dated 1978. Having in mind his clear concept of *S. afghanica* and relevant annotations, this means that he was the first to reveal that two *Spryginia* species occur in Afghanistan, a conclusion we reached almost 40 years later, but this information has never been published.

Phenology:—Flowering March–May, fruiting April–June.

Ecology:—Dry open habitats on clayey and loess soils at 300–1500 m a.s.l. (Fig. 1)

Conservation status:—In view of a limited distribution of *S. winkleri* in Iran, a conservation status can be proposed. According to the IUCN Red List categories and criteria (IUCN 2016), the species is evaluated as regionally Critically Endangered (CR) in Iran due to very restricted extent of occurrence and area of occupancy and also very peculiar habitats of fragmented populations in the area.

Key for the species of *Spryginia*

- 1a. Trichomes exclusively simple, mainly long, straight and/or crisped, patent and/or subappressed, sometimes absent2
- 1b. Trichomes minute, patent, straight or slightly bent, simple and stalked 1–2-forked5
- 2a. Trichomes straight to slightly bent; rarely plants glabrous. Leaves predominantly oblong-elliptic, rounded and/or slightly pointed apically. Siliques straight3
- 2b. Trichomes exclusively or nearly so strongly crisped and subappressed (often restricted to the apical part of inflorescence, pedicels and bases of sepals of buds). Leaves predominantly ovate, gradually narrowed towards an acute apex. Siliques straight or falcate4
- 3a. Plants moderately to densely pilose throughout. Siliques compressed, ca. 2 mm wide, with distinctly 3-veined valves*S. pilosa* (Tajikistan)
- 3b. Plants glabrous or sparsely pubescent in the upper part, rarely throughout. Siliques subterete, 1.4–1.6 mm wide, valves with 1 obscure vein*S. gracilis* (Tajikistan)
- 4a. Leaves relatively thin, entire to coarsely toothed, the lower ones with long, (12–)15–40 mm, petioles. Fruiting pedicels (4–)6–9(–15) mm long*S. winkleri* (Afghanistan, Iran, Tajikistan, Turkmenistan, Uzbekistan)
- 4b. Leaves thick, usually entire, the lower ones with short, 7–10 mm, petioles. Fruiting pedicels 3–4 mm long*S. crassifolia* (Tajikistan)
- 5a. Pedicels and usually inflorescence axis in the upper part pubescent. Petals not undulate, 3.5–7.5 mm wide. Siliques falcate to coiled, occasionally almost straight, obscurely 1- or prominently 3-veined6
- 5b. Inflorescence axis and pedicels glabrous. Petals undulate, ca. 3 mm wide. Siliques straight to slightly falcate, with one thin but clear vein*S. undulata* (Turkmenistan, Uzbekistan)
- 6a. Siliques compressed-subterete, to 1.6 mm wide, valves obscurely 1-veined*S. afghanica* (Afghanistan)
- 6b. Siliques flat, 3–3.2 mm wide; valves clearly 3-veined*S. falcata* (Tajikistan, Uzbekistan)

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