GYPSOPHILA AND STELLARIA: AN UNEXPECTED PROBLEM IN GENERIC DELIMITATION*

J. McNeill**

ABSTRACT. It is confirmed that the Caryophyllaceae species originally described as *Gypsophila alsinoides* Bunge should not be retained in that genus. However, it is shown that it cannot be included in *Arenaria*, to which it has been transferred as *A. bungei* Barkoudah, but is best referred to *Stellaria*, where it has been independently described as *S. blatteri* Mattf. This becomes the correct name for the species, a spring-flowering annual in E Iran, Soviet C Asia, Afghanistan and Pakistan.

The subfamilies Alsinoideae and Silenoideae of the Caryophyllaceae are usually regarded as being very distinct groups and have sometimes been treated as separate families (e.g. by Lindley 1836, Boissier 1867, or more recently by Löve et al. 1971). The main diagnostic character is normally unambiguous: the sepals are united into a tube in the Silenoideae and free to the base in the Alsinoideae; with this often goes an anthophore and long petal claws in the former, features which are lacking in the latter, in which instead a hypanthium is developed to some degree (cf. Rohweder, 1970: 203).

In at least one genus of the Silenoideae, namely *Gypsophila*, these diagnostic features are less readily applicable. As Barkoudah (1962) points out the adnate bases of the stamens and petals in that genus form a short, thick disc and are not elongated to form an anthophore; the petals show no clear differentiation into limb and claw and even the degree of fusion of the calyx is variable, with the hyaline membrane between the green sepal lobes being less than half the length of the calyx in some species. Schischkin (1936) even describes *Gypsophila* subgenus *Dichoglottis* as having the calyx dissected nearly to the base.

Within this subgenus Schischkin includes three species, *G. linearifolia* (Fischer & Meyer) Boiss., *G. spathulifolia* (Fischer & Meyer) Fenzl and *G. alsinoides* Bunge. The first two of these are included by Barkoudah (1962) in the same subsection (*Drypidipetala*) of his section *Dichoglottis*, but *G. alsinoides* is excluded from the genus altogether and transferred to *Arenaria* in the subfamily Alsinoideae under the new name *A. bungei* Barkoudah. Podlech & Dieterle (1969) have followed this treatment in a report of a chromosome count on the species. Apart from rejecting, on the grounds of erroneous typification, Blakelock's (1957) suggestion that *G. alsinoides* is conspecific with *G. melampoda* Bien. ex Boiss., Barkoudah makes no further comment on the transfer, but Podlech & Dieterle point out that the somatic chromosome number of 40 fits better in *Arenaria* than in *Gypsophila*.

The species, in whatever genus it is placed, appears to be a not uncommon spring-flowering plant in an area extending from eastern Iran, Turkmenia and Uzbekistan through Afghanistan to Baluchistan and other western parts

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** Plant Research Institute, Canada Agriculture, Ottawa, K1A 0C6, Canada.

of Pakistan. It is not, however, at all like any known species of *Arenaria* and not only cannot fit into any existing section (cf. McNeill 1962, 1963) but can be excluded on technical grounds by the possession of prominently bifid petals. In fact in 1968 before I was aware of the problem, I identified specimens of this species from Hedge & Wendelbo's 1962 Afghanistan collection as *Stellaria* sp. In habit the species, which is an annual, is reminiscent of *Gypsophila heteropoda* Freyn & Sint. (especially the subsp. *minutiflora* Barkoudah), *G. linearifolia* or *G. parva* Barkoudah rather than any Orient *Stellaria* species. The digynous flowers, a very rare feature in *Stellaria*, are also characteristic of *Gypsophila*. Is this species, then, a *Gypsophila* with the calyx lobes unusually divided to the base or a digynous *Stellaria* superficially resembling some *Gypsophila* species?

To resolve this question a detailed examination of the macro- and micromorphology of this species has been made particularly in relation to the diagnostic generic characters of *Gypsophila*, *Stellaria* and *Arenaria* and the individual characteristics of any species to which it might be related. The main results are summarized in table 1. In addition it has been observed that the pollen grains are polyporate, the capsule dehisces by twice as many valves (four) as styles, the seeds are asymmetrically reniform with a reticulate testa, and the cotyledons are incumbent, all characteristics which occur either universally or widely in all three genera. The completely free sepals, the bifid petals and the frequent basal placentation, all lacking even from the habitually similar species of *Gypsophila* Section *Dichoglottis*, make me agree with Barkoudah (1962) that *G. alsinoides* must be excluded from that genus. The dissimilarity of the species to any known *Arenaria* has already been noted; it is totally different from the only taxon known to exhibit bifid petals (*A. kingii* (Watson) M. E. Jones subsp. *kingii* var. *kingii*—other infraspecific taxa of *A. kingii* have entire petals, cf. Baad, 1969) nor can it be linked with subgenus *Odontostemma*, to which almost all the digynous species belong. The species of this group have a truncate calyx with the sepals almost saccate at the base, a rugulose often inflated testa and a diffuse habit with no clear separation of the inflorescence region. In that both are relatively slender annuals, there is some habit similarity with *A. provincialis* Chater & Halliday (= *A. gouffeia* Chaub.), the only species of the other digynous subgenus *Arenariastrum*, and indeed this species has a gametic chromosome number of 20 (Favarger, 1962). However in the usually valuable characters of sepal structure and venation, there are noticeable differences, the one species having obscure veins and an obtuse often purplish apex while *A. provincialis* has long acute, green, prominently 3-veined sepals. The chromosomal evidence also should not be rated too highly because in all these genera a wide range of base numbers exists and as still relatively few species have been examined, additional base numbers are being reported (see, for example, Wenger-Razine, 1970).

As in *Arenaria* there are two digynous groups of *Stellaria*: sections *Pseudalsine* and *Oligosperma* (cf. Pax & Hoffmann, 1934). The one species of the former, *S. alsinoides* Boiss. & Buhse is, however, tetramerous and has notched or shortly and unequally bifid petals and a very distinctive habit resembling species of *Minuartia* Section *Sabulina* (e.g. *M. hybrida* (Vill.) Schischkin). One species of Section *Oligosperma* is well-known, *S. kotschyana* Fenzl ex Boiss., a fairly robust annual or perennial from Iran, northern

TABLE 1.

Comparison of diagnostic characters of *Gypsophila*, *Stellaria* and *Arenaria* with those of the species known as *Gypsophila alsinoides* or *Arenaria bungei*.

	"*Gypsophila alsinoides*/ *Arenaria bungei*"	*Gypsophila*	*Stellaria*	*Arenaria*
Sepal fusion	free to base (to insertion of petals & stamens)	joined by a membrane to at least half-way	free to base	free to base
Petal apex	bifid to at least half-way	entire or retuse, rarely sinuous	bifid, usually to half-way or more	almost always entire, rarely retuse or sinuate
Number of styles	2	2	usually 3, rarely 2	usually 3, sometimes 2
Placental column	usually absent (placentation basal)	always present*	present or absent	present or absent
Chromosome base number	10 (or 20)	usually 17, also 13, 15, 16 & 18	usually 13, also 10 & 11	usually 11, often 10, also 9, 12, 13, 14, 15 & 23

* According to Barkoudah, 1962, p. 172.

Iraq, and eastern Turkey with a stiffly erect habit and many flowers. A second species *S. cilicica* Boiss. & Bal. was referred to this section by Boissier (1867) but, as Coode (1967) points out, it is in fact trigynous; in habit it resembles species of Subsection *Larbreae* of Section *Stellaria*. However a third species, *S. blatteri*, was described by Mattfeld in 1933 on the basis of specimens collected in northern Waziristan near the Pakistan/Afghanistan border. The three specimens cited by Mattfeld have not been seen (the type at least was conserved in the Berlin Herbarium and will have been destroyed as a result of wartime bombing) but the detailed description matches almost identically the Edinburgh and Kew material of the species otherwise known as *Gypsophila alsinoides* or *Arenaria bungei*. The only exceptions are that in the specimens studied the sepals are often only 2·5–3.0 mm long (as against 3·0–3·5 mm), the apex is frequently purple (not mentioned by Mattfeld) and the seeds are usually 0·8–1·0 mm long (not 1·2 mm). The quantitative differences are, however, within the expected range of variation of the species and it seems safe to conclude that the plants upon which *Stellaria blatteri* is based are conspecific with *G. alsinoides*. Mattfeld, the acknowledged Caryophyllaceae authority of his day, appears then to have had the same view on the generic disposition of this species as that reached in this paper.

Although Mattfeld (1933) refers the species to Section *Oligosperma* and relates it to *S. kotschyana*, the two species are not particularly similar. *Stellaria blatteri*, which it now appears is the correct name, has more numerous ovules (8–12) most of which develop into seeds (*S. kotschyana* is 1- or 2-seeded), foliaceous lower bracts, linear to oblanceolate rather than narrowly triangular to lanceolate stem leaves and smaller flowers. The details of the publication, types, synonymy and distribution of the species of *Stellaria* Section *Oligosperma* are as follows:—

Sect. *Oligosperma* Boiss., Fl. Orient. 1: 705 (1867).

Leaves linear to triangular-lanceolate or oblanceolate, sessile or the lower petiolate. Sepals and petals 5; stamens 10; styles 2; ovary 4- to 12-ovulate. Lectotype: *S. kotschyana* Fenzl ex Boiss.

Sepals (3·0–) 3·5–6·5 mm long, acute to acuminate; robust plants usually 25–50 cm tall; stem leaves usually broadest near base, narrowly triangular to lanceolate, rarely linear; ovules 2–5; seeds 1–2, c. 2·5 mm diam.
S. kotschyana

Sepals 2·0–3·5 mm long, obtuse to broadly acute; slender plants usually 8–25 cm tall; stem leaves parallel-sided or broadest above the middle, linear-oblong to linear-oblanceolate, ovules 8–12; seeds 6–12, 0.8–1·2 mm diam. . . . . *S. blatteri*

S. kotschyana Fenzl ex Boiss., Fl. Orient. 1: 705 (1867).
Type. Iran: Ostan Haftom (Prov. Fars): "Monte Kuhdelu Pers. austr.", *Kotschy* 534 (holo. G)
Distribution. E Turkey, N Iraq, N, W & SW Iran, S Turkmenia.

Boissier (1867) attributes publication to "Fenzl in Ky. pl. Pers. austr. 1845", but this is simply a set of printed exsiccata labels without descriptions and Coode (1967) rightly cites Boissier as the publishing author. There is no

evidence, however, that Fenzl provided the description; hence the citation should be "Fenzl ex Boiss." not "Fenzl in Boiss." but it seems reasonable to interpret Boissier's citation as designating the original Kotschy collection (no. 534), the only one from southern Iran, as the type, rather than treat the four specimens cited by Boissier as syntypes, as Coode (1967) has done.

Stellaria kotschyana is a rather variable species, notably in pubescence, leaf shape, bract and bracteole form, pedicel length, sepal length and apex, and pollen grain size. Much of this variation shows no apparent correlation with other characteristics or with geography or ecology. This is true of pubescence upon which the only named infra-specific taxa have been based. Coode (1967) discusses these, and as he implies there appears to be variation within populations. Plants which are minutely puberulent in part (usually towards the base) are however more common than he claims and one densely pubescent collection (Iran: Bakhtiari Country: near Kord, *Wendelbo* 1732) is known.

Plants from Turkey, Iraq and Iran generally have shorter pedicels (the lowermost 10–25 mm), leaves broadest at or near the base, distinctly (though sometimes very narrowly) triangular or lanceolate, whereas those from Afghanistan have long pedicels (lowermost 20–60 mm), and often more or less linear leaves. In general plants from Turkey, Iraq and Iran appear to have more sharply acute or acuminate leaves and sepals and larger pollen grains with thicker walls but the correlation is not complete, and no taxonomic recognition is proposed.

S. blatteri Mattf. in Feddes Repert. 31: 334 (1933).
Syn.: *Gypsophila alsinoides* Bunge in Arb. Naturf.-Ver. Riga 1, 2: 179 (1847), non *Stellaria alsinoides* Boiss. & Buhse (1860).
Arenaria bungei Barkoudah in Wentia 9: 180 (1962), non *Arenaria alsinoides* Willd. ex Schlecht. (1813).

Type. Pakistan: Dera Ismail Khan, steinige Ebene östlich von Datta Khel Fort, 4600 ft. [1,400 m.], 16 iv 1930, *Blatter & Fernandez* 1333 (holo.: B—destroyed; iso.: BLATT?)

Distribution & representative specimens.
IRAN. Ostan Dahom (Prov Yazd): Gerdekuh, inter Kerman et Jesd [Yazd], iv 1859, *A. Bunge* (K!); Jan-Darja inter Ispahan [Esfahan] et Jesd [Yazd], v 1859, *A. Bunge* (L,P), (type of *G. alsinoides*); ? Ostan Hashtom: "E Iran", 4000–6000 ft [1220–1825 m], iv 1936, *E. Daly* 75 (K!).

USSR. Tadzhikskaya SSR: Zeravshan, ad pagum Kumar, 4500 ft [1370 m.] (sub *Gypsophila linearifolia*), *V. L. Komarov* (K!). Also reported by Schischkin (1936) from Kȳzȳl Kum (Uzbekskaya SSR & S Kazakhskaya SSR) and Kara Kum (Turkmenskaya SSR).

AFGHANISTAN. Herat: 60 mls [95 km] S of Herat, 3500 ft. [1070 m], 22 iv 1964, *P. Furse* 5467 (K!). Bamian: Ajar valley, W of Doab, 1200 m, 12 vi 1962, *Hedge & Wendelbo* W. 4101 (E!). Parwan: 2 km W of Charikar, 27 v 1965, *D. Podlech* 10884 (E!, M). Kabul: 12–15 km W of Sarobi, 1100 m, 27 iv 1962, *Hedge & Wendelbo* W. 2784 (E!). Nangarhar: 5 km W of Jalalabad, 750 m, 1 v 1969, *Hedge, Wendelbo & Ekberg* W. 7469 (E!). Kurram: Ali Khel 8 vi 1879, *J. E. T. Aitchison* 531 (K!). Kandahar-Ghazni, 4500 ft.

[1370 m], 26 iv 1964, *P. Furse* 5613 (K!). Helmand: 50 km E of Dilaram, 1400 m, 22 iv 1969, *Hedge & Ekberg* W. 7229 (E!).

PAKISTAN. Baluchistan: Quetta, Khojak pass, 11 iv 1888, *J. F. Duthie* 8620 (K!); near Quetta, 5000–6000 ft. [1525–1825 m], 2–10 v 1957, *R. R. Stewart* 28140 (K!). Dera Ismail Khan: 4 mls [6 km] from Datta Khel Fort, 30 iii 1930, *Blatter & Fernandez* 607 (? BLATT).

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