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# *Arenaria kandavanensis* is a synonym of *A. fursei* and belongs in *Eremogone* (Caryophyllaceae)

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*Arenaria kandavanensis*, recently described from the type area of *A. fursei*, is synonymized with the latter species. It is a narrow endemic of the Chalus Gorge in the Kandovan Mountains, Alborz Range (Mazandaran Province, northern Iran). A new nomenclatural combination, *Eremogone fursei* (Lazkov) Lazkov & Sennikov, is proposed for this species name in agreement with its phylogenetic placement in *E.* sect. *Sclerophyllae*. An updated description and distribution map of the species is provided, with an identification key to the species of *E.* sect. *Sclerophyllae* occurring in Iran.

The taxonomic status of *Eremogone* has been debated in the second half of the 20th century. Some influential researchers accepted it as a subgenus of *Arenaria s. lato* (e.g. McNeill 1962), whereas others treated it as a distinct genus clearly different from *Arenaria s. stricto* in its coriaceous sepals, large appressed pyriform seeds, suffrutescent life form and basic chromosome number of x = 11 (Ikonnikov 1973). The phylogenetic position of *Eremogone* (Eremogoneae) has recently been established (Harbaugh *et al*. 2010) outside the clade containing *Arenaria s. stricto* (Arenarieae), thus falling into a different tribe. Further phylogenetic studies (Sadeghian *et al*. 2015) confirmed the dismemberment of *Arenaria s. lato* and the separation of *Eremogone*.

The number of species in *Eremogone* has not been established yet, and revisionary works with new species combinations have been published only for certain geographic areas (e.g. Ikonnikov 1973, Pusalkar & Singh 2015, Rabeler & Wagner 2015). The mountainous areas of Iran host a significant number of species of *Eremogone*. Rechinger (1988) accepted 18 species in this group in his *Flora Iranica*. Subsequent studies added four species described from Iran (Lazkov 2003, Fadaie *et al*. 2010, Fadaie 2013).

A certain controversy has recently appeared around *Arenaria fursei*, a narrow endemic of the Kandovan (Kandavan) Mts. in northern Iran (Mazandaran Province), which was originally (Rechinger 1988) included in *A. insignis* and later described as a separate species by Lazkov (2003). Fadaie *et al*. (2010) reported that they examined the type locality of *A. fursei* and failed to find the species described by Lazkov; instead, they allegedly discovered a new species

of the same affinity in the same area, which they described as new to science and named *A. kandavanensis*.

The reported disappearance of *A. fursei* in its type locality and the discovery of a taxonomic novelty in its place seems confusing to us. In this paper, we aim to clarify the identities of *A. fursei* and *A. kandavanensis*, in order to establish their correct taxonomic status.

Dried specimens identified as *Arenaria fursei* and *A. kandavanensis* were examined *de visu* or from photographs at K, LE and TARI. Taxonomically significant characters were recorded and compared on the basis of previous treatments and revisions (McNeill 1967, Rechinger 1988). The protologues of both species names (Lazkov 2003, Fadaie *et al*. 2010) were scrutinized and compared with each other. Morphologically similar species were studied by examination of protologues, critical revisions and herbarium specimens kept at K and LE.

*Arenaria kandavanensis* was compared in its protologue (Fadaie *et al*. 2010) with *A. lychnidea*, a species occurring in the Caucasus and Anatolia, rather than with *A. fursei* or any other species occurring in Iran. Since both species, *A. kandavanensis* and *A. fursei*, are referable to *Eremogone* and were described from the same locality without mutual comparisons, we traced their diagnostic characters from protologues and type specimens (Table 1).

The comparison shows that *A. fursei* and *A. kandavanensis* share a large set of important diagnostic characters: suffruticose habit with densely branched caudex, which is tightly covered by strongly lignified remains of withered leaves, basal leaves filiform but not rigid, flowering stems with sparse but distinct leaves, and lax inflorescence. The differences are rather minor: stems twice taller and inflorescence with many flowers and lateral branches in *A. fursei* vs. smaller inflorescences in *A. kandavanensis*, which was seemingly described on the basis of depauperate individuals turning to the subsenile life stage and therefore having very large caudices and shorter stems with smaller inflorescences. The smaller flowers of *A. kandavanensis* may also be attributed to the feeble condition of the plants.

Given the minor character differences between *A. fursei* and *A. kandavanensis*, which have seemingly resulted from modification, and the fact that both were collected from the same locality, we are convinced that these two names belong to the same species, which should be called *A. fursei* according to priority.

The infrageneric taxonomy of *Eremogone* was developed by McNeill (1962) and is discussed here on the basis of this work. The collection of *Arenaria fursei* (*Furse 2825*) at K was originally identified by J. McNeill as "aff. *A. insignis* Litw.", and duplicates were subsequently distributed under this name to other herbaria (E, LE). Later this identification was published by Rechinger (1988) with doubts removed. *Arenaria insignis* (= *Eremogone insignis*) is a species of *A.* sect. *Sclerophyllae*, which is also characterized by a densely tufted caudex but is clearly different from *A. fursei* in its basal leaves that are shorter, rigid, spiny and horizontally deflected. Besides, the leaf bases in *A. fursei* are much more strongly lignified than in *A. insignis*.

Lazkov (2003) rejected the identity of *Furse 2825* with *A. insignis* and described the collection as a new species. He compared *A. fursei* with *A. paulsenii*, another member of *A.* sect. *Sclerophyllae* with very similar, setaceous leaves 10–30 mm long, which is different from *A. fursei* in its caudex being laxly covered by weakly lignified remains of leaf bases. *Arenaria paulsenii* occurs in Central Asia (Western Tian-Shan and Alay Mts.), at high elevations, far from the distribution area of *A. fursei*. The records of *A. paulsenii* from Afghanistan (Rechinger 1988) are remotely isolated from the main distribution area of the species and are most likely misidentifications.

Fadaie *et al*. (2010) compared *A. kandavanensis* with *A. lychnidea*, a species of high elevations that occurs in the Caucasus and Anatolia, and was placed in *A.* sect. *Capillares*. That species clearly differs from *A. fursei* in its lax caudex, which is laxly covered by weakly lignified remnants of leaf bases.

These comparisons (Table 1) show that *A. fursei* most likely belongs to *A.* sect. *Sclerophyllae* and has no morphologically closely similar species in Iran, and probably nowhere. Its precise taxonomic placement requires a complete phylogenetic revision of *Eremogone*; although larger

**Table 1.** Comparisons among *Arenaria fursei, A. kandavanensis* and other species considered similar in previous works (Schischkin & Knorring 1936, Adylov 1971, Rechinger 1988, Lazkov 2003, Fadaie *et al.* 2010).

| | *A. fursei* | *A. kandavanensis* | *A. lychnidea* | *A. insignis* | *A. paulsenii* |
|---|---|---|---|---|---|
| Caudex | densely tufted; tightly covered by strongly ligneous leaf bases, not pungent | densely tufted; tightly covered by strongly ligneous leaf bases, not pungent | laxly tufted; laxly covered by weakly ligneous leaf bases, not pungent | densely tufted; laxly covered by ligneous leaf bases, pungent | rather densely tufted; laxly covered by weakly ligneous leaf bases, not pungent |
| Plant height (cm) | 15–35 | 15–20 | 10–25 | 10–25 | 5–25 |
| Basal leaves (on sterile shoots) | 5–6 cm long, almost filiform, erect | 2.5–6 cm long,setaceous, erect | 3–10 cm long, linear, erect | 0.5–1 cm long, linear, almost horizontally deflected | 1–2.5 cm long, linear-subulate, erect |
| Cauline leaves | sparse, 1–2 cm long | sparse, 1–2 cm long | sparse, 2–3 cm long | very sparse, 0.3–0.5 cm long | sparse, 2–3 cm long |
| Inflorescence | lax, flowers in 3–5-flowered cymes | lax, flowers in 2–5-flowered cymes | compact, flowers in 3–15-flowered cymes | lax, flowers in 3–5-flowered cymes, or solitary | lax, flowers in 3–5-flowered cymes, or solitary |
| Pedicel length (mm) | 20–30 | 5–12 | 4–7 | 10–35(45) | 10–30 |
| Sepals | ovate, acute, 4–5 mm long | ovate to suborbicular, acute, 3.5–4 mm long | ovate-oblong, acute, (3.5)4–5 mm long | ovate-oblong, acute, (3.5)4–5 mm long | ovate to broadly ovate, acute, 4–5(6) mm long |
| Petals | oblong-obovate, twice longer than sepals, 8–10 mm long | oblong-obovate, nearly twice longer than sepals, 6.5–7 mm long | cuneate-oblong, twice longer than sepals, 7–10 mm long | oblong-obovate, 1.5–2 times longer than sepals, 6.5–8 mm long | oblong-obovate, 1.5–2 times longer than sepals, 7–8 mm long |
| Distribution | Iran (Mazandaran); at 1200 m a.s.l. | Iran (Mazandaran); at 1100–1300 m a.s.l. | Caucasus, Turkey; at 1800–3200 m a.s.l. | Iran, Turkmenistan, Afghanistan; at 1800–3500 m a.s.l. | Central Asia (Kyrgyzstan); at 2300–3500 m a.s.l. |

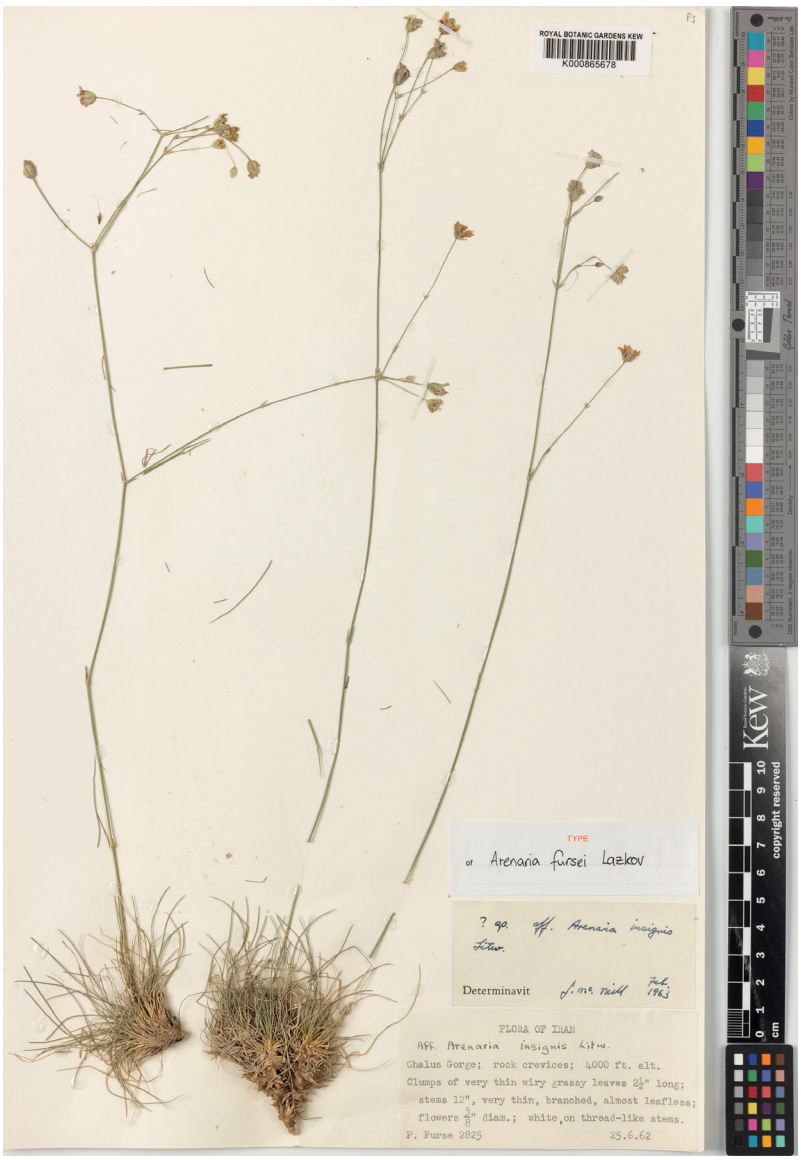


**Fig. 1.** Isotype of *Arenaria fursei* (K000865678).

sections of this genus as defined by McNeill (1962) appeared to be unnatural and the separation of *A.* sect. *Sclerophyllae* and *A.* sect. *Capillares* is clearly artificial, the current resolution of phylogenetic trees is not sufficient to reclassify the genus (Sadeghian *et al*. 2015).

Since the correct phylogenetic position of *A. fursei* is in *Eremogone*, not in *Arenaria* as originally assigned, a new nomenclatural combination is formally proposed here.

## ***Eremogone fursei*** (Lazkov) Lazkov & Sennikov, *comb. nova*

*Arenaria fursei* Lazkov, Bot. Zhurn. (St. Petersburg) 88(7): 94. 2003. — Type: Iran. Mazandaran Province: Chalus Gorge, rock crevices, 4000 ft. alt., 25 June 1962 *P. Furse 2825* (holotype LE!; isotypes E, photo!, K!) (Fig. 1).

*Arenaria kandavanensis* Fadaie, Sheidai & Assadi, Iran. J. Bot. 16: 219. 2010, *syn. nov.* — Type: Iran. Mazandaran Province: 48 km on the road from Chalus to Tehran, Kandovan Mts., 1112 m a.s.l., 30 May 2008 *F. Fadaie & M. Nasiri 1092F* (holotype TARI, photo!).

Etymology: The species is named after Paul Furse (1904–1978), Rear-Admiral of the British Royal Navy, who

was an assiduous plant collector in Turkey, Iran, Iraq and Afghanistan (Strange 2007).

Plants perennial, completely glabrous, green, not glaucous. Caudex much branched, densely tufted, branches tightly covered with strongly ligneous leaf bases. Basal leaves and leaves on sterile shoots 5–6 cm long, numerous, almost filiform, erect, not rigid, not pungent, margin scabrous. Flowering stems few, 15–35 cm long. Cauline leaves a few pairs, sparse, 1–2 cm long. Inflorescence lax, flowers up to 10 in terminal and lateral 3–5-flowered cymes, in smaller individuals inflorescence reduced to a single 3-flowered cyme. Pedicels (5)15–30 mm long. Bracts 2–3 mm long, 0.7 mm wide, lanceolate, green in middle, margin widely white-scarious. Sepals ovate, acute, (3.5)4–5 mm long, 3–7-veined, green in middle, margin widely white-scarious. Petals white, oblong-obovate, twice longer than sepals, (7.5)8–10 mm long. Nectaries absent. Capsule suborbicular, 5–6 mm long, 3.5 mm wide. Seeds pyriform, 1.9–2 mm long, 1–1.3 mm wide.

Distribution and habitat. Narrow endemic of the Kandovan Mountains, Alborz Range in Mazandaran Province, northern Iran; known from type collections only (approx. 36.28°N, 51.24°E). Rock crevices at elevations of 1100–1300 m a.s.l.

### Identification key to the species of *Eremogone* sect. *Sclerophyllae* occurring in Iran

1. Leaves with distinct white scarious margins, 0.3–0.5 cm long ..... *E. tetrasticha*
1. Leaves without scarious margins, over 0.5 cm long .... 2
2. Basal leaves not pungent, filiform, erect, up to 6 cm long; cauline leaves 1–2 cm long ..... *E. fursei*
2. Basal leaves pungent, linear, almost horizontally deflected, up to 2 cm long; cauline leaves 0.3–0.5 cm long ..... 3
3. Basal leaves 0.5–1 cm long ..... *E. insignis*
3. Basal leaves 1–2 cm long ..... *E. persica*

## Conclusions

The absence of comprehensive taxonomic inventories may lead to omissions of single or even several narrowly distributed taxa. The nomenclatural additions to *Eremogone* in the Old World, presumably complete (Rabeler & Wagner 2015), omitted local Iranian taxa. The most recent identification key to *Arenaria s. lato* in Iran (Fadaie 2013) omitted *A. fursei* which was recently described from the country. The present contribution provides complete and updated data about *Eremogone fursei*, its taxonomic position, diagnostic characters and distribution, to prevent its future disappearance from taxonomic treatments and biodiversity resources.

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