

FERULA HINDUKUSHENSIS (APIACEAE), A NEW RECORD FOR THE FLORA OF IRAN FROM KHORASSAN

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Ferula hindukushensis Kitamura which was formerly known from Afghanistan and Pakistan, is reported here as a new record for the flora of Iran from Kuh-Mish Mount in Sabzevar, Khorassan Razavi province. Notes on its morphology, taxonomy, distribution and conservation status is presented.

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Key words: biodiversity; taxonomy; Umbelliferae; *Ferula*; new record; conservation; Iran

گزارش جدید گونه *Ferula hindukushensis* (تیره چتریان) برای فلور ایران از خراسان

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گونه *Ferula hindukushensis* Kitamura که پیش از این فقط از افغانستان و پاکستان گزارش شده بود، برای اولین بار برای فلور ایران از کوه‌میش سبزوار در استان خراسان رضوی جمع‌آوری شده و گزارش می‌شود. نکاتی درباره ریخت‌شناسی، رده‌بندی، پراکندگی جغرافیایی و وضعیت حفاظتی این گونه ارائه می‌گردد.

INTRODUCTION

The genus *Ferula* L. with ca. 170 species is among the largest genera of Apiaceae. It occurs in Europe, Asia and North Africa with a center of diversity in Central Asia (Pimenov & Leonov 1993). Chamberlain & Rechinger (1987) recorded 53 *Ferula* species for the *Flora Iranica* region. Based on current information, *Ferula* encompasses 32 species in Iran, 18 out of which occur in Khorassan provinces (Mozaffarian 2007, Ghahremaninejad & al. 2005, 2012). *Ferula* is traditionally classified in the tribe Peucedaneae and six subgenera are recognized in the genus (Pimenov & Leonov 1993, Korovin 1947). However, serological studies by Shneyer & al. (1995, 2003) indicated the distant position of *Ferula* from all other genera of traditionally delimited Paucedaneae. *Ferula* species are usually tall perennials or biennials with stout stems, finely divided leaves with inflated sheaths. Morphological characters of the basal leaves and

mature fruits are important for correct identification of the species (Kurzyrna-Młynik & al. 2008). However, herbarium specimens usually lack both of them because basal leaves are dried up before fruit ripening and regarding to the large size of the plants, only parts of leaves and branches are usually collected and pressed. Therefore the identification of *Ferula* species should be based on examination of living plants (Korovin 1947).

In this paper, we record an additional *Ferula* species for the flora of Iran based on new collections and observations of living plants from Kuh-Mish Mount located in the south of Sabzevar, Khorassan Razavi province, NE Iran.

MATERIALS AND METHODS

The morphological characters of herbarium specimens of the newly collected *Ferula* species and its closely related species in Khorassan were evaluated using identification keys and species descriptions in the

relevant literature (Chamberlain & Rechinger 1987; Mozaffarian 2007). Several living plants were examined in their natural habitats. All of the collected specimens are preserved in Herbarium of Ferdowsi University of Mashhad (FUMH). The images of the herbarium specimens of *Ferula hindukushensis* in E, KUFS, MW, and W herbaria were consulted in order to confirm the identity of the new species record. The distribution map of *F. hindukushensis* was produced by geo-referencing the distribution data in the *Flora Iranica* (Chamberlain & Rechinger 1987) and herbarium specimens in FUMH. The threat status of the new species record was evaluated using IUCN Red List categories and criteria (IUCN 2016).

RESULTS AND DISCUSSION

New record

Ferula hindukushensis Kitamura, Acta Phytotax. Geobot. 19: 100 (1963); figs. 1 & 2.

Perennial, glabrous. Stems 100-210 cm high, at base 2-3 cm thick, stout, yellow-green, with long branches. Basal leaves 30-43 × 25-30 cm, 5-6-ternate-pinnate, glabrous; leaf segments 15-50 (-60) × 0.5 (-1) cm; the ultimate segments filiform; the uppermost sheaths up to 15×10 cm, leathery, glabrous. Panicle loose. Umbels in fruit with 20-32 rays; rays 3-6 cm long; umbellets (10-)12-15(-17)-flowered. Petals yellow, ca. 1.5 mm long, glabrous. Mericarps (10-)14-20 × 6-11 mm; wings ca. 1.5 mm long; vallecular vittae 1-3; commissural vittae 4-6.

Examined specimens: Khorassan Razavi province: S Sabzevar, 34 km SW of Sheshtamad, eastern summit of Kuh-Mish Mount, 2800 m, 35° 51' 54"N, 57° 41' 18"E, Joharchi & Memariani 46187 (FUMH); S Sabzevar, 31 km SW of Sheshtamad, eastern slopes of Kuh-Mish Mount, 2475 m, 35° 51' 41"N, 57° 41' 58"E, Joharchi & Memariani 46190 (FUMH); S Sabzevar, Kuh-Mish Mount, 2340 m, 35° 51' 51"N, 57° 41' 57"E, Joharchi 46239 (FUMH).

Ferula hindukushensis is the third recorded species of subgenus *Ferula* in Iran after *F. stenocarpa* Boiss. & Hausskn. and *F. hezarlalezarica* Y. Ajani. The former is an endemic species restricted to the south and southwest of Iran, and the latter is endemic to the high mountains of Kerman province (Chamberlain & Rechinger 1987, Ajani & Ajani 2008). *F. hindukushensis* differs from the other species of subgenus *Ferula* by several morphological characters such as the shape of basal leaves, upper sheath size, number of umbel rays, and larger size of mericarps (table 1). *Ferula kokanica* Regel & Schmalh. is an aberrant

member of subgenus *Ferula* differing from the others by its larger and elliptic-oblong leaf lobes (not filiform) (table 1; Chamberlain & Rechinger 1987). *Ferula hindukushensis* can be distinguished from *F. hezarlalezarica*, and also from *F. koso-poljanskyi* Korovin (a Central Asian species), by its swollen upper leaf sheaths and not crowded terminal leaf segments (Ajani & Ajani 2008). *Ferula hindukushensis* may be related to some species of subgenus *Peucedanoides* (Boiss.) Korov., especially *F. badghysi* Korov., *F. oopoda* (Boiss. & Buhse) Boiss., and *F. tabasensis* Rech.f., in having large leaf sheaths and linear-filiform leaf segments. However, it can be distinguished by its narrower leaf segments (less than 1 mm). Moreover, the members of subgenus *Ferula* have 2-5 vallecular vittae in their mericarps unlike the members of subgenus *Peucedanoides* with 1(-3) vallecular vittae.

Phytogeography and conservation

The distribution range of *F. hindukushensis* covers mainly the higher elevations of Hindu Kush Mountains in the central and east-northeast of Afghanistan and also north of Pakistan (Chamberlain & Rechinger 1987, Breckle & Rafiqpoor 2010, Breckle & al. 2013). Based on the newly recorded localities, it grows mainly on stony slopes in grassy and cushion-form vegetation of higher elevations in Kuh-Mish Mount (2300-2800 m) (fig 1A-B). The new records of this species extend its distribution range more westward to Khorassan in NE Iran (fig. 3). This area belongs to Khorassan- Kopet Dagh (KK) floristic province in Irano-Turanian (IT) region. In KK about 3.2% of the flora show a distribution pattern such as that of *F. hindukushensis* which is well known as Khorassan- Kopet Dagh-Afghanistan chorotype (IT^{KK-Afgh.}) whose ranges are restricted mainly to KK and mountainous areas of NW/N/NE Afghanistan (Memariani & al. 2016).

Based on the red listing categories and criteria (IUCN 2016), *F. hindukushensis* has a relatively wide distribution range and it is evaluated here as LC (Least Concern). Although it is not threatened globally, the newly recorded species has a very restricted extent of occurrence (EOO=0.160 km²) and area of occupancy (AOO=0.035 km²) in Iran. According to the very peculiar habitats of fragmented populations in the alpine zone and severe grazing pressure, this species is regionally evaluated as Critically Endangered (CR, B1+B2ab (i, iii)) for the flora of Iran. The urgent and effective conservation practices are highly recommended in order to protect the remaining populations of the species.

Table 1. Morphological comparison between *Ferula hindukushensis* and the closely related species of *Ferula* subgenus *Ferula*.

Character	<i>F. hindukushensis</i>	<i>F. kokanica</i>	<i>F. stenoloba</i>	<i>F. stenocarpa</i>
Stem height (cm)	100-200	100-150	60-200	up to 200
Basal leaves	5-6- ternato-pinnate	2- pinnate	4- pinnate	4- pinnate
Ultimate leaf segments	filiform	elliptic-oblong	filiform	filiform
Leaf segments size (mm)	15-50 × 0.5(-1)	40-110 × 20-40	5-10 × 0.3	10-60 × 1
Upper sheaths size (cm)	15 × 10	6 × 35	4.5 × 1	6 × 5
Number of rays in umbels	20-32	8-11(-15)	6-11	15-20
Rays length (cm)	3-6	?	4-5	3-5
Umbellets	(10-)12-15(-17)-flowered	18-25- flowered	12-15- flowered	18-25- flowered
Mericarps size (mm)	(10-)14-20 × 6-11	10 × 5	10 × 4	4 × 2

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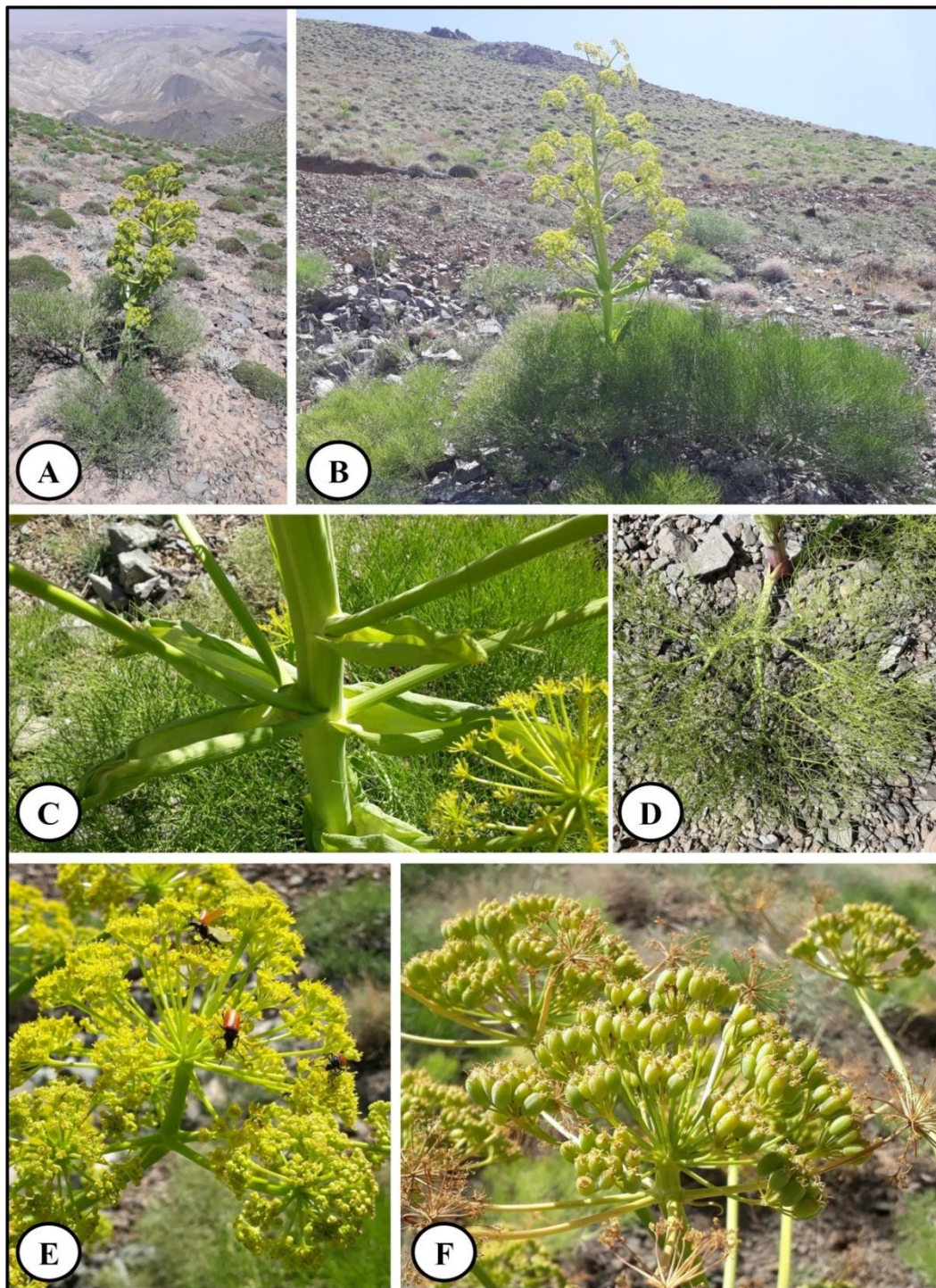


Fig. 1. *Ferula hindukushensis*: A-B, Plants in natural habitats; C, leaf sheaths; D, basal leaf; E, umbels in flowering stage; F, umbels in early fruiting stage.

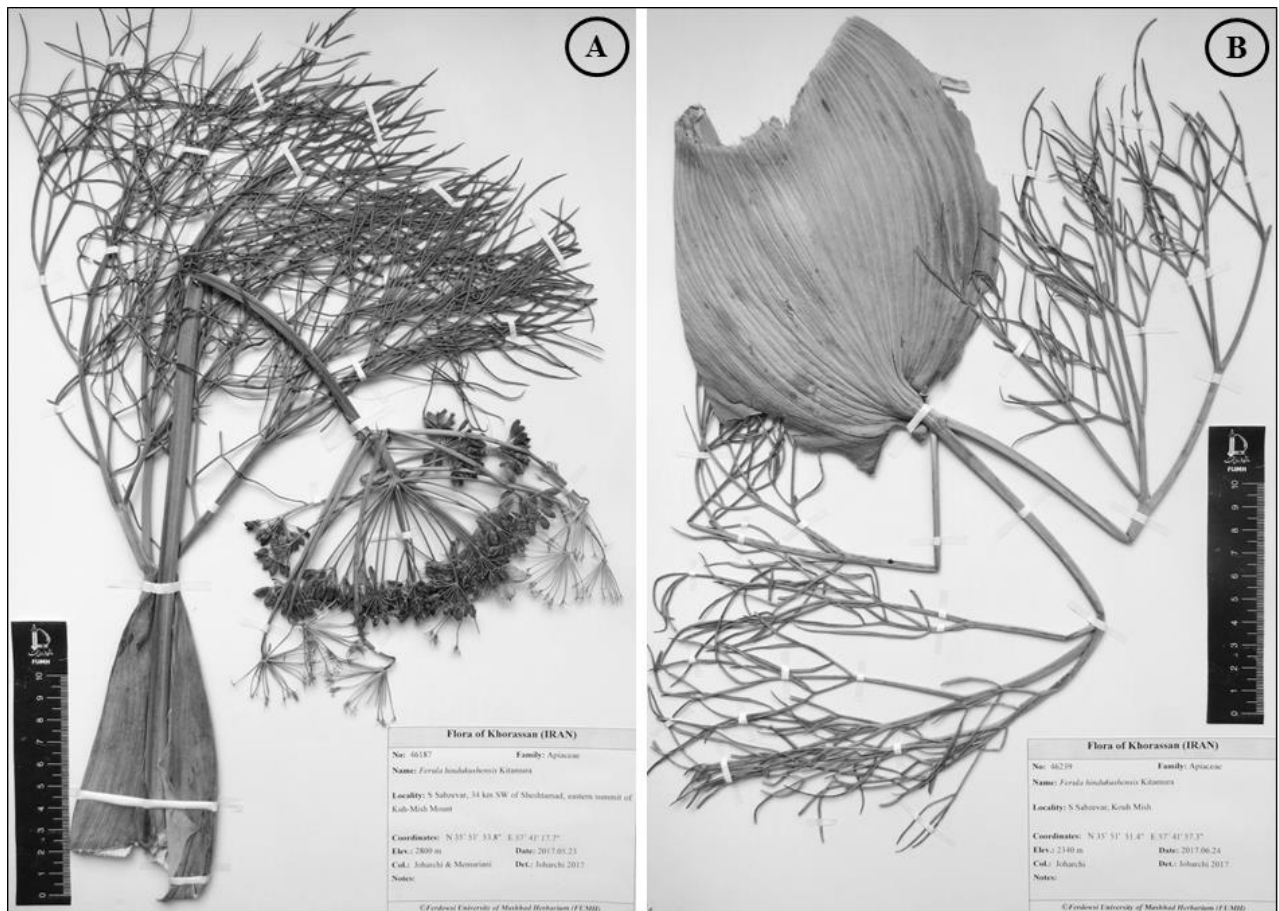


Fig. 2. Herbarium specimens of *Ferula hindukushensis*: A, Joharchi & Memariani 46187 (FUMH); B, Joharchi 46239 (FUMH).

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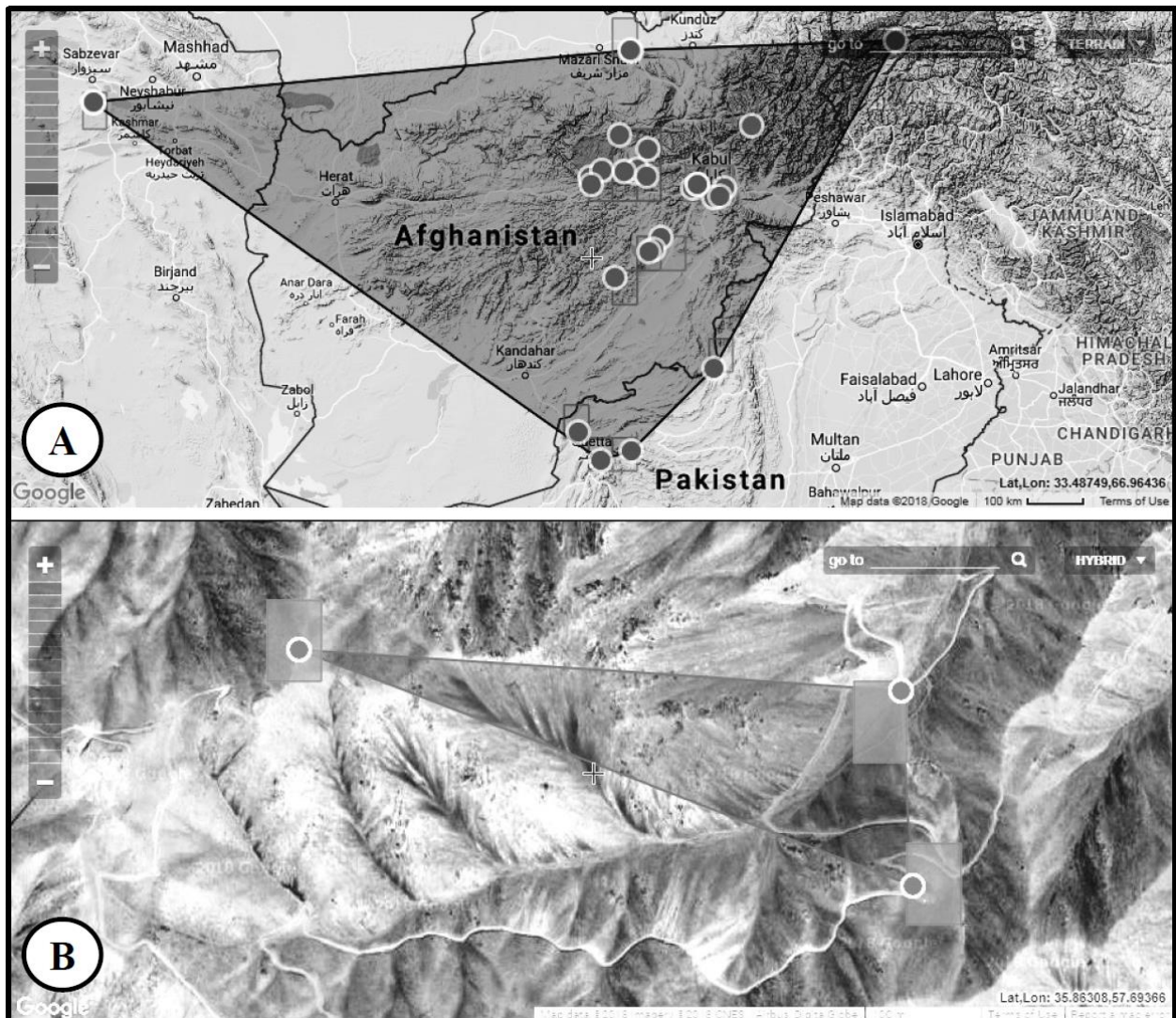


Fig. 3. Distribution map of *Ferula hindukushensis* and estimation of extent of occurrence (EOO) and area of occupancy (AOO) based on IUCN Red List criteria. A, global distribution range; B, local distribution range in Kuh-Mish Mount (Khorassan, Iran).