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# *Ferula brevipedicellata* and *F. duranii* (Apiaceae), two new species from Anatolia, Turkey

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Two new species in Apiaceae, *Ferula brevipedicellata* Peşmen *ex* M. Sağıroğlu & H. Duman and *F. duranii* M. Sağıroğlu & H. Duman are described and illustrated from East and South Anatolia, Turkey, respectively. The diagnostic morphological characters are discussed; notes on the ecology of the new species are presented and electron micrographs of the mericarp surfaces of *F. brevipedicellata* are provided. A somatic metaphase plate of *F. duranii* shows a chromosome number of 2n = 22.

Key words: Apiaceae, *Ferula*, morphology, new species, taxonomy

The genus *Ferula* (Apiaceae) contains 180–185 species (Pimenov & Leonov 2004), with the highest diversity in central and southwest Asia. There about 130 species occur, of which approximately 100 are endemic (Korovin 1951, Chamberlain & Rechinger 1987a). In Turkey, the first revision of *Ferula* was done by Peşmen (1972), who recognized 18 species, one of them incompletely known and nine of them endemic. Two new species have since been added to the flora of Turkey, and we collected and described one incompletely known species (Duman & Sağıroğlu 2005, Sağıroğlu & Duman 2007a, 2007b).

Specimens of *Ferula* were collected from Hizan (Bitlis) in 1974 by Dr. Hasan Peşmen. He named them *Ferula brevipedicellata* in 1974 (Peşmen 1974). Unfortunately, Dr. H. Peşmen died in a traffic accident in 1980, and the name remained a *nomen nudum*. While preparing his Ph.D. thesis in 2000–2005, the first author of the present paper collected specimens of the same species in Hizan (Bitlis), Arapkir (Malatya) and Pülümür (Tunceli) districts.

In 1995, Dr. Ahmet Duran collected some *Ferula* specimens during the field work related to his Ph.D. thesis and identified them as *F. cf. orientalis*. While revising the genus, however, we noticed that the specimens did not match *F. orientalis*. Later, during a subsequent visit to the collection locality, sufficient flowering and fruiting material was collected to establish that a species new to science was at hand.

After thoroughly checking the *Ferula* account in *Flora of Turkey and the East Aegean Islands* (Peşmen 1972), it was clear that the specimens were quite different from all other Turkish *Ferula* species. The specimens were also compared with the *Ferula* accounts in other floras, such as *Flora Iranica* (Chamberlain &

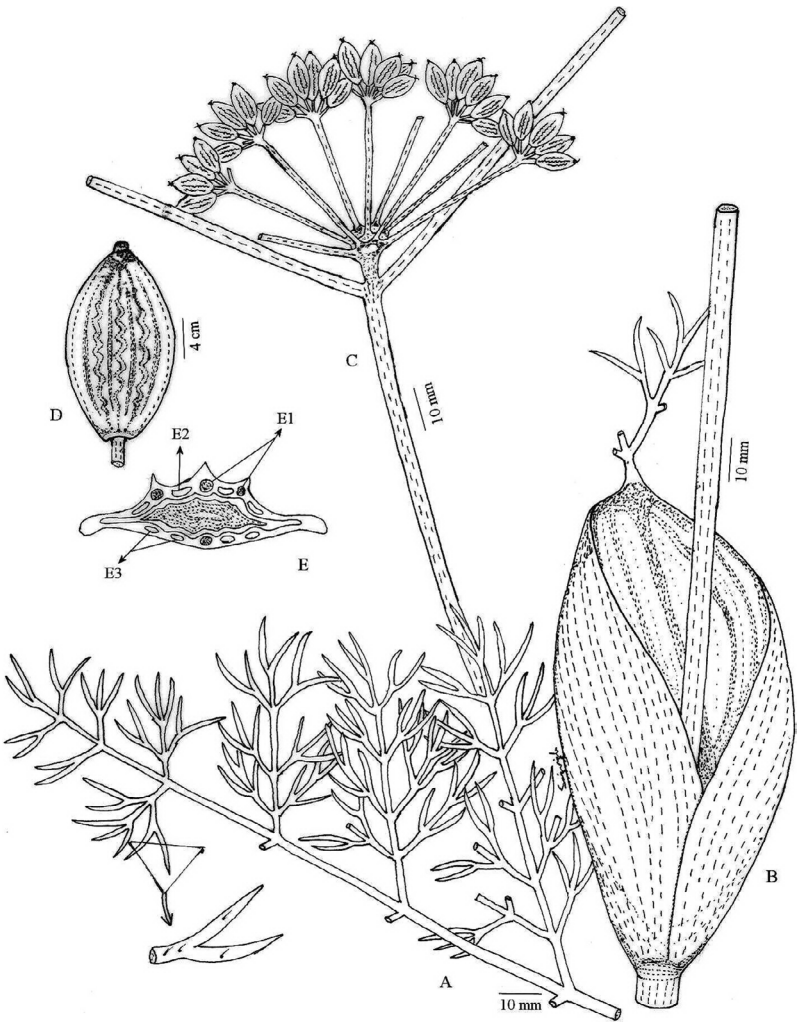


**Fig. 1**. *Ferula brevipedicellata* (from the holotype). — **A**: Part of basal leaves. — **B**: Middle sheath. — **C**: Upper part of plant. — **D**: Dorsal surface of mericarp. — **E**: Section of mericarp, E1 = vascular bundle, E2 = dorsal vittae, E3 = commissural vittae.

Rechinger 1987a, 1987b), *Nouvelle Flore du Liban et de la Syrie* (Mouterde 1986a, 1986b), *Flora Palaestina* (Zohary 1966a, 1966b), *Flora Europaea* (Cannon 1968), Flora of the U.S.S.R. (Korovin 1951), Flora of Cyprus (Meikle 1977), as well as with specimens in E, K, GAZI, ANK and HUB. We were finally confident that our specimens represented two new species.

### ***Ferula brevipedicellata*** Peşmen *ex* M. Sağıroğlu & H. Duman, *sp. nova* (Fig. 1)

*Affinis F. haussknechti et F. rigidulae sed ab F. haussknechti petiolis 10–20 cm longis (non carentibus), petiolis rachidibus scabridis (non dense setulosis), segmentis ultimis (3–)7–12 × 1–2(–2.5) mm (nec 0.5–3(–7) × (0.5–)0.7–1.5 mm) et scabridis ad glabris (non dense setulosis), vaginis late ovatis (nec ovato- lanceolatis), pedicellis fructiferis brevioribus (0.5–6 mm, non 5–12 mm), mericarpiis ellipticis, cristis dorsalibus anguste alatis et dilute undulatis (non elliptico-oblongis, cristis dorsalibus dilute filiformibus et non undulatis) differt. A F. rigidula petiolis 10–20 cm longis (non 1–12 cm), petiolis et rachidibus scabridis (non sparse scabridis), segmentis ultimis (3–)7–12 × 1–2(–2.5) mm (nec 1–5(–8) × 0.2–0.8 mm), vaginis late ovatis (nec cylindricae-oblongis), pedicellis fructiferis brevioribus 0.5–5(–6) mm (non (5–)7–15 mm), mericarpis ellipticus, cristis dorsalibus anguste alatis et dilute undulatis (non oblongo-obovatis, cristis dorsalibus dilute filiformibus et non undu-*

*latis), alis lateralibus 0.5–1 mm latis (non 1–2 mm) differt.*

TYPE: Turkey. B9 Bitlis: Hizan–Bahçesaray road 22 km, 1000 m, 9.VI.2002 *M. Sağıroğlu 2003* (holotype GAZI; isotypes ANK, E). — PARATYPES: Turkey. B9 Bitlis: Hizan–Bahçesaray road 22 km, 1000 m, 2002, *M. Sağıroğlu 2152* (GAZI). B7 Malatya: Arapkir–Kemaliye road 3–9 km, 1100 m, 2002, *M. Sağıroğlu 2177* (GAZI). B8 Tunceli: Erzincan-Tunceli crossroads 3 km, 1300 m, 2002, *M. Sağıroğlu 2065* (GAZI).

Perennial, polycarpic herbs. Rootstock cylindrical, 2–4 cm diameter; fibrous collar dense. Stems 100–250 cm, terete, weakly sulcate, glabrous, 1–2.5 cm diameter at base. Basal leaves triangular-ovate in outline, 30–65 × 20–45 cm; petioles 10–20 cm long, sulcate, petioles and rachis scabrid; lamina 5–6-pinnate, ultimate segments linear, (3–)7–12(–18) × 1–2(–2.5) mm, sparsely scabrid, acute to mucronate. All sheaths amplexicaul, coriaceous, broadly inflated, weakly sulcate, glabrous; lower sheaths broadly oblong, 4–7 × 2.5–4 cm, lamina 4–5-pinnate; middle sheaths broadly ovate, 6–12 × 5–8 cm, lamina 2–3-pinnate; upper sheaths ovate, 4–7 × 2.5–4 cm, lamina with a few segments; ultimate segments to 30 mm at all stem leaves. Inflorescence long branched paniculate-corymbose; central umbels peduncled 1–4 cm; lateral umbels long-peduncled (10–16 cm), sterile; rays 6–12(–18), 2–5 cm; umbellules 8–12-flowered; fruiting pedicels 0.5–5(–6) mm. Bracteoles 4–5, linear-lanceolate, 1–1.5 mm, glabrous, caducous, rarely 1–2 and persistent. Sepals obsolete. Petals yellow, glabrous, 1.5 mm, deflexed. Mericarps elliptic, 8–14 × 4–7 mm, green when ripe; dorsal ridges narrowly winged and undulate, lateral wings 0.5–1 mm wide; stylopodium tereteconical; style usually persistent; stigma capitate; dorsal vittae per valecula 1, commissural 2–4.

PHENOLOGY AND HABITAT ECOLOGY. Flowering occurs in June and fruiting in July and August. *Ferula brevipedicellata* grows at 1000–1300 m in calcareous rocky areas with *Ostrya carpinifolia*, *Quercus robur* subsp. *pedunculiflora*, *Fraxinus ornus*, *Micromeria cymuligera, Poa bulbosa, Corylus avellana* var. *avellana, Populus tremula*, *Alnus glutinosa* subsp. *glutinosa*, *Chaerophyllum macrospermum*, *Platanus orientalis*, *Pistacia eurycarpa*, *Dactylis glomerata*, *Iris* sp., *Astragalus* sp., *Bromus* sp., *Helichrysum* sp. and *Eryngium* sp.

*Ferula brevipedicellata* is very distinct due to its short pedicels and narrowly winged undulate dorsal mericarp ridges. A more detailed comparison of the new species with relevant species is given in Table 1. The mericarp surface of *F. brevipedicellata* contains dense and irregular wax-scales (Figs. 2 and 3), whereas that of *F. haussknechtii* is reticulate and has indistinct scales (Figs. 4 and 5).

ADDITIONAL EXAMINED SPECIMENS. — *Ferula rigidula*: **Turkey**. A4 Ankara: Çubuk dam, 2001 *M. Sağıroğlu 1681* (GAZI); ibid., 2003 *M. Sağıroğlu 2290* (GAZI). A9 Kars: Kağızman to Akçay, 1966 *D. 46866-A* (E). B3 Kütahya: Dumlupınar, 1982 *T. Ekim 5526* (ESSE). B4 Ankara: Haymana-İkizce village, 2004 *B. Şahin 2290* (GAZI). B7 Erzincan: İliç, Munzur mountain, Yakuplu village, 1979 *Ş. Yıldırımlı 1866* (HUB). **Iran**. Zanjan to Asadabad, 1972 *Forughian-Hariri 22442* (E). **Armenia**. Razdan

**Table 1**. Comparison of the diagnostic characters of *Ferula brevipedicellata*, *F. haussknechtii* and *F. rigidula*.

| Characters | *F. brevipedicellata* | *F. haussknechtii* | *F. rigidula* |
|---|---|---|---|
| Stem length | 100–250 cm | 50–150 cm | 30–130 cm |
| Petioles | 10–20 cm | absent | 1–12 cm |
| Petioles and rachis | scabrid | densely setulose | sparsely scabrid |
| Ultimate segments | (3–)7–12 × 1–2(–2,5) mm, scabrid to glabrous | 0.5–3(–7) × (0.5–)0.7–1.5 mm, densely setulose-puberulent | 1–5(–8) × 0.2–0.8 mm, scabrid |
| Sheaths | broadly ovate, 7–12 × 5–8 cm | ovate-lanceolate, 6–8 × 2–5.5 cm | cylindric-oblong, 3–12 × 1.5–3 mm |
| Fruiting pedicels | 0.5–6 mm | (5–)7–10(–12) mm | (5–)7–15 mm |
| Mericarps | elliptic | elliptic-oblong | oblong to obovate |
| Dorsal ridges | narrowly winged and undulate | weakly filiform and not undulate | weakly filiform and not undulate |
| Lateral wings | 0.5–1 mm wide | 0.5–1 mm wide | 1–2 mm wide |


**Fig. 2**. SEM of *Ferula brevipedicellata* (from *M. Sağıroğlu 2252*).

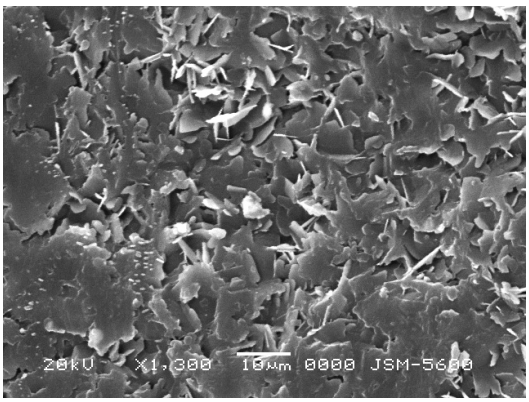


**Fig. 3**. SEM of surface of *Ferula brevipedicellata* valecula (from *M. Sağıroğlu 2252*).

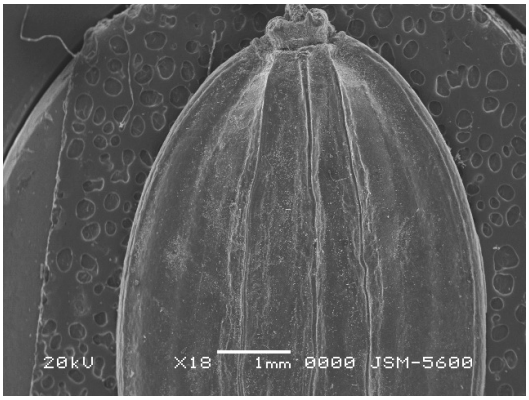


**Fig. 4**. SEM of *Ferula haussknechtii* (from *M. Sağıroğlu 2255*).

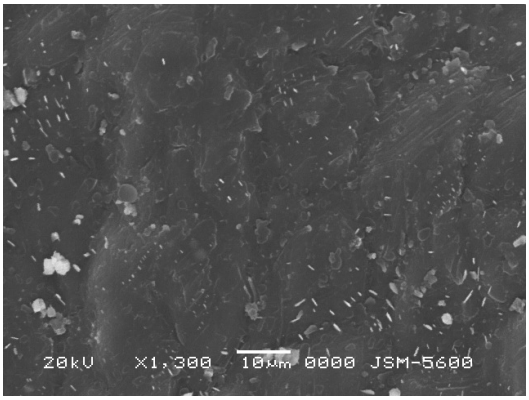


**Fig. 5**. SEM of *Ferula haussknechtii* mericarp valecula (from *M. Sağıroğlu 2255*).

prope pagum Arzni, 1975 *W. Greuter 13004* (E). — *Ferula haussknechtii*: **Turkey**. B9 Bitlis: Tatvan–Van yolu, 66 km, 2002 *M. Sağıroğlu 2011* (GAZI); Van: Van–Başkale road, 2002 *M. Sağıroğlu 2255* (GAZI). Van: Tımar–Van, 6 km, 1966 *D. 44190* (E); Bitlis: Kotum Karz mountain, 1954 *D. 24602 & O. Polunin* (E); Bitlis: Adilcevaz-Süte plateau, 1993 *D. 22584 & O. Polunin* (ANK); Tatvan-Pelli south side, 1972 *H. Peşmen 3214* (HUB); Van: Başkale–Hakkari road 1972 *H. Peşmen 3393 & M.Ş. Gürer* (HUB); Van–Hakkari road, 89 km, 1972 *H. Peşmen 3029* (HUB).

## ***Ferula duranii*** M. Sağıroğlu & H. Duman, *sp. nova* (Fig. 6)

*Affinis F. lyciae et F. hermonis. A F. lycia segmentis ultimis linearibus, 3–8(–11) mm longis (non oblongo-linearibus et 1–6(–8) mm longis), vaginis oblongae-lanceolatis (non ovatis), vaginis supernis foliaceis (non aphyllis), umbellis lateralibus omnino sterilibus (non fertilibus vel sterilibus), umbellis centralibus radiis (10–)14–22 (non 6–18), umbellulis 20–40-florae (non 10–20-florae), mericarpiis anguste elliptico-oblongis (non orbiculari-oblongis), jugis dorsalibus conspicue filiformibus et infirme undulatis (non infirme filiformibus), alis lateralibus 0.3–0.5 mm latis (non (0.5–)1–1.5 mm latis), vittis dorsalibus 2–3 (non 1–2), vittis commisuralibus 4–6 (non 2–4) differt. A F. hermonis vaginis supernis foliaceis (non aphyllis), umbellis lateralibus omnino sterilibus (non fertilibus vel sterilibus), umbellis centralibus radiis (10–)14–22 (non 5–16), umbellulis 20–40-florae (non 6–15-florae), alis lateralibus 0.3–0.5 mm latis (non (0.5–0.9 mm latis), vittis dorsalibus 2–3 (non 1–2) recedit.*

Type: Turkey. C3 Antalya: Akseki-Çukurköy, Istarlas

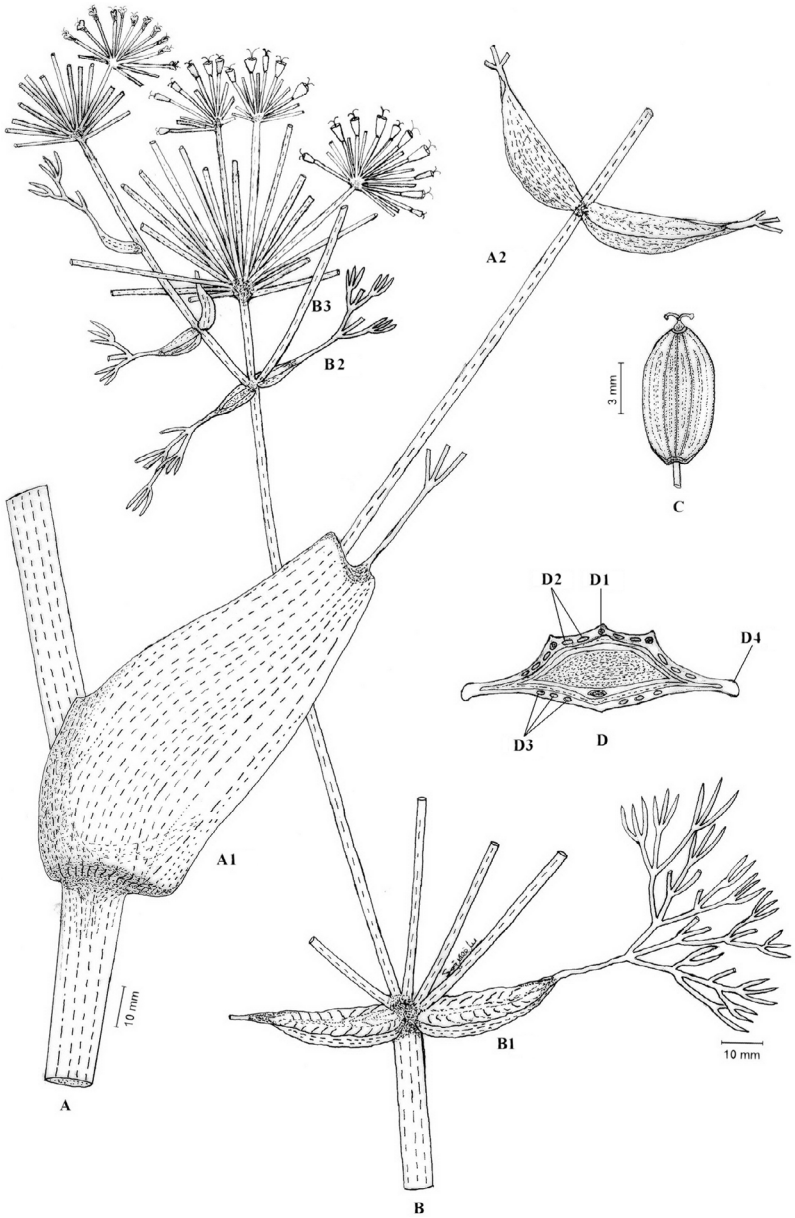


**Fig. 6**. *Ferula duranii* (from the holotype). — **A**: Middle part of plant, A1 = middle sheath, A2 = lateral branches. — **B**: Upper part of plant, B1 and B2 = upper sheath, B3 = lateral umbel. — **C**: Dorsal surface of mericarp. — **D**: Section of mericarp, D1 = vascular bundle, D2 = dorsal vittae, D3 = commissural vittae, D4 = lateral wing.

mountain, 900–950 m, 25.V.2002 *M. Sağıroğlu 1896 & Akçiçek* (holotype GAZI; isotypes ANK, Hb.YILDIRIMLI, E). — Paratypes: Turkey. C3 Antalya: Akseki-Çukurköy, Istarlas mountain, 950 m, *M. Sağıroğlu 2163* (GAZI); ibid., 2002 *M. Sağıroğlu 2240* (GAZI); ibid., *A. Duran 4129* (GAZI). C4 Antalya: Alanya castle, 50 m, 2006 *M. Sağıroğlu 2606 & F. Karavelioğulları* (GAZI).

Etymology. This new species is named in honour of Dr. Ahmet Duran, who collected it for the first time.

Perennial, polycarpic, herbs. Rootstock thick, cylindrical, 2–4 cm in diameter; fibrous collar dense. Stems 100–230 cm, terete, sulcate, glaucous, glabrous, 1–3 cm diam. at base. Basal leaves triangular-ovate in outline, 40–55 × 25–35 cm, glabrous; petioles 6–10 cm, terete and sulcate; lamina 6–7-pinnate, ultimate segments linear, 3–8(–11) × 0.4–0.8 mm, glaucescent, mucronate to acuminate. All sheaths amplexicaul, coriaceous, sulcate, glabrous; lower and middle sheaths lanceolate, 4–8(–10) × 2–5 cm, inflated,

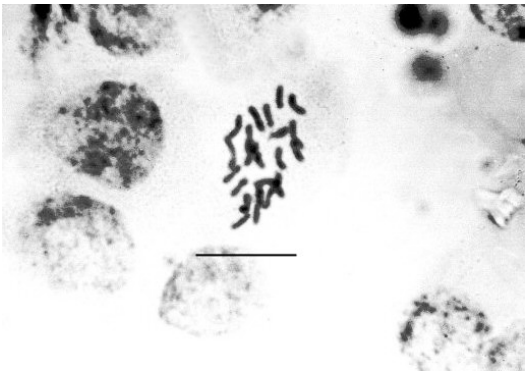

**Fig. 7**. Somatic metaphase chromosomes of *Ferula duranii* (from *M. Sağıroğlu 2240*). Scale bar = 10 µm.

**Fig. 8**. Photograph of *Ferula duranii* mericarp (from *M. Sağıroğlu 2240*).

**Fig. 9**. Photograph of *Ferula lycia* mericarp (from *M. Sağıroğlu 2164*).

distinctly leafy at apex, lamina (3–)5–6-pinnate; all bracts like upper sheaths distinctly leafy at apex, lamina 1–5 cm, 1–2-pinnate or a few segments. Inflorescence paniculate-corymbose; central umbel (0.5–)1–2(–5) cm long peduncled, lateral umbels usually 2–4, long-peduncled (15–25 cm), usually sterile; rays (10–)14–22, 2–4.5 cm long. Umbellules with 20–40-flowers; fruiting pedicels 5–10(–12) mm long. Bracteoles linear, 4–6, caducous. Sepals obsolete. Petals yellow, 1–1.5 mm long, glabrous, weakly deflexed. Mericarps narrowly elliptic-oblong, 6–10(–11) × 3–5 mm, dark brown when ripe; dorsal ridges conspicuously filiform and weakly undulate, lateral wings 0.3–0.5 mm wide; stylopodium short conical; style usually persistent; stigma capitate; dorsal vittae per vallecula 2–3, commissural vittae 4–6. Chromosome number: 2n = 22 (*M. Sağıroğlu 2240*, Fig. 7).

*Ferula duranii* resembles *F. lycia* and *F. hermonis*, from which it differs mainly in that the bracts are like upper sheaths, distinctly leafy at the apex, and by the number of flowers and mericarp (Fig. 8) features. A more detailed comparison of the new species with relevant species is given in Table 2.

*Ferula duranii* is distributed in the Alanya and Akseki areas. This part of the Taurus range is interesting in terms of the plant diversity because of the many recently published local endemic species, such as *Chaerophyllum aksekiense*, *Peucedanum isauricum*, *Todylium ketenoglui*, *Arabis davisii*, *Astragalus antalyensis* and *Astragalus cedreticola* (Duran & Duman 1999, Parolly & Nordt 2004, Duman & Duran 2001, Podlech 1999).

Additional specimens examined. — *Ferula lycia*: **Turkey**. C2 Antalya: in regione alpina montium Lycia supra Elmalı, *Bourgeau* (holotype G; photo GAZI); Burdur: Yeşilova opposite lake Salda, 2001 *Ş. Yıldırımlı 26802 & M. Dinç* (Hb. YILDIRIMLI); Burdur: Yeşilova, 2001 *Ş. Yıldırımlı 26815* (Hb. YILDIRIMLI). C3 Antalya: Bakırlı Dağ, 1999 *H. Duman 7074* (GAZI); ibid., 2002 *A. Duran* 5813 (GAZI). C4 Konya: Konya-Hadim road, 90 km, 2002 *M. Sağıroğlu 2164* (Fig. 9, GAZI). — *Ferula hermonis*: **Turkey**. C6 Kahraman Maraş: Çağlayancerit, Öksüz mountain, 2002 *M. Sağıroğlu 2246* (GAZI); ibid. 1991 *Z. Aytaç 4033 & H. Duman* (GAZI); Adana: Saimbeyli-Bozoğlan mountain, 2000 m 1952 *Davis 19691 et al.* (E).

Phenology and habitat ecology. Flowering takes place in May and June and fruiting in June and July. *Ferula duranii* is restricted to the Alanya and Akseki regions (Antalya), and it represents the East Mediterranean phytogeographic element. It grows in calcareous rocky locations at altitudes between 50–1000 m, together with *Juniperus oxycedrus*, *Ostrya*

**Table 2**. Comparison of the diagnostic characters of *Ferula duranii*, *F. lycia* and *F. hermonis*.

| | | | |
|---|---|---|---|
| Diam. of stem at base (cm) | 1–3 | 0.4–1.5 | 1–3 |
| Ultimate segments of leaves | linear, 3–8(–11) mm long | oblong-linear, 1–6(–8) mm long | linear, 1–4(–9) mm long |
| Sheaths | oblong-lanceolate | ovate | ovate-oblong |
| Bract like upper sheats | present and conspicuously leafy | absent | absent |
| Peduncle of central umbels | (0.5–)1–2(–5) cm | 0.5–2(–4) cm | 0.2–1 cm |
| Rays of central umbels | (10–)14–22; 2–4.5 cm | 6–14(–18); (2–)3–5(–7.5) cm | 5–16; 1–2.5(–3) cm |
| Lateral umbels | sterile | fertile or sterile | fertile or sterile |
| Umbellules | 20–40-flowered | 10–15(–20)-flowered | 6–15-flowered |
| Petal length | 1–1.5 mm | 2–2.5 mm | 2–2.5 mm |
| Mericarps | narrowly elliptic-oblong | orbicular-oblong | elliptic-oblong |
| Dorsal ridges of mericarps | conspicuously filiform and weakly undulate | weakly filiform | filiform |
| Lateral wings of mericarps | 0.3–0.5 mm wide | (0.5–)1–1.5 mm wide | 0.5–0.9 mm |
| Dorsal vittae | 2–3 | 1(–2) | 1(–2) |
| Commissural vittae | 4–6 | 2(–4) | 4–6 |

*carpinifolia*, *Quercus coccifera*, *Calicotome villosa*, *Jasminum fruticans, Laurus nobilis*, *Styrax officinalis*, *Fraxinus ornus*, *Pistacia terebinthus* subsp. *palaestina*, *Micromeria myrtifolia, Aegilops biuncialis*, *Poa bulbosa, Phlomis grandiflora*, *P. leucophracta* and *Phillyrea latifolia*.

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