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Peucedanum guvenianum (Apiaceae), a new species from West Anatolia, Turkey

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Abstract: *Peucedanum guvenianum* Yıldırım & H.Duman is described as a species new to science. It is endemic to the West Anatolia region of Turkey. It is known from a single locality in İzmir Province. *P. guvenianum* shows similarities to *P. longifolium*, *P. ruthenicum*, and *P. vourinense*. Diagnostic morphological characters are discussed and compared with those of closely related taxa. It is easily distinguished from related species especially by its stem 130–220 cm tall, distinctly striate, densely branched from below the middle to upper part; basal leaves 28–40 cm long and 20–70 cm wide; bracts linear-lanceolate and erect; petals emarginate at apex; mericarp 7.2–14 × 4.3–8 mm, oblong to oblong-orbicular, ±two times longer from pedicel.

Key words: Taxonomy, *Peucedanum*, İzmir, Turkey

1. Introduction

The family Apiaceae comprises 100 genera and a total of 505 taxa (477 species) in Turkey, where 167 of the taxa are endemic (Güner et al., 2012). The genera *Aegokeras* Raf., *Ekimia* H.Duman & M.F.Watson, *Postiella* Kljuykov, *Microsciadium* Boiss., and *Crenosciadium* Boiss. & Heldr. ex Boiss. are endemic for Turkey (Pimenov and Leonov, 1993).

The genus *Peucedanum* L., represented by ca. 100–120 species and mainly distributed in Eurasia and Africa, is characterized by flattened fruits with well-developed lateral wings and without prominent dorsal ribs (Pimenov and Leonov, 1993; Ostroumova and Pimenow, 1997). It is a very complex and heterogeneous genus in the family Apiaceae (Pimenov and Leonov, 1993). Menemen (2012) specified that the genus *Peucedanum* included 22 taxa in Turkey (21 species and an infraspecific taxa), and 9 of them are endemic according to the most recent checklist for the Turkish flora (Chamberlain, 1972; Davis et al., 1988; Güner et al., 2000; Parolly and North, 2004; Parolly and North, 2005; Akpulat and Akalın, 2010; Menemen, 2012).

To date, some authors have separated many smaller genera from *Peucedanum* based on morphological or molecular studies, including *Cervaria* Wolf; *Holandrea* Reduron, Charpin & Pimenov; *Imperatoria* L.; *Oreoselinum* Adans.; *Pteroselinum* Rchb.; *Thysselinum* Adans.; *Tommasinia* Bertol; and *Xanthoselinum* Schur (Leute, 1966; Pimenov, 1987a, 1987b, 1987c; Frey, 1989; Pimenov and Leonov, 1993; Reduron et al., 1997; Spalik et al., 2004).

As a result of recent fieldwork conducted between the Menderes and Gümüldür districts in İzmir Province, West Anatolia (Turkey), a population of *Peucedanum* was found in maquis vegetation and *Pinus brutia* Ten. openings near the Tahtalı Dam in İzmir Province. After detailed macro- and micromorphological and carpological research, it was concluded that the collected *Peucedanum* specimens differed from all of the other species by their morphological characters. It was considered a new species without closely related species. On the other hand, it showed some morphological similarities to *Peucedanum longifolium* Waldst. & Kit., *P. ruthenicum* M.Bieb., and *P. vourinense* (Leute) Hartvig (Tutin, 1968; Chamberlain, 1972; Hartvig, 1986).

2. Materials and methods

This study is based on field, herbarium, and literature surveys. The herbarium specimens of *Peucedanum* (including type specimens, their photographs, or digital images) conserved at E, EGE, GAZI, HUB, and ISTE were studied. The material of the new species was compared with the relevant literature (Tutin, 1968; Chamberlain, 1972; Hartvig, 1986; Rechinger, 1987; Davis et al., 1988; Pimenov and Leonov, 1993, 2004; Pimenov, 1987a, 1987b, 1987c; Güner et al., 2000; Menemen, 2012) was examined. The morphology of specimens was examined by

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stereobinocular microscope. Pollen slides were prepared using Wodehouse's technique (1935) for light microscopy. These preparations were measured under a Leica ICC50 HD light microscope. Measurements were taken for at least 30 pollen grains for each morphological characteristic. Fruits were examined by stereomicroscope and scanning electron microscope (SEM). Macromorphological observations were done using a Leica EZ4D stereomicroscope. Twenty mature fruits were measured for the average sizes. For SEM studies, dried pollen grains and mericarps were transferred onto stubs and then coated with gold. They were observed and photographed with a JEOL JSM 6060 SEM at 15 kV. The pollen terminology was adopted from Faegri and Iversen (1992) and Punt et al. (1994, 2007). The class of pollen shape, based partly on P/E ratio, was identified using Erdtman's system (1969). For fruit anatomy, dried fruit samples were placed in a boiling water for 5 min and subsequently fixed in FAA (50% ethanol, 10% formalin, 5% acetic acid) for 24 h. Samples were washed later with water and anatomical studies were carried out on the transverse sections of the fruit using the paraffin method. These sections were stained with safranin-fast green and mounted using Entellan (Johansen, 1944). Photographs were taken using a Leica ICC50 HD light microscope. Terminology follows Barthlott (1981) and Ostroumova and Pimenov (1997).

3. Results

Peucedanum guvenianum **Yıldırım & H.Duman sp. nov. (Figures 1 and 2)**

Type: Turkey, İzmir, Menderes-Gümüldür yolu, Tahtalı Baraj gölü karşısı, Gümüldür'e 40 km kala, maki içi, 237 m, 07.11.2016, H.Yıldırım 4112 (holotype: EGE 42440!, isotypes: GAZI!, HUB!, NGBB!).

3.1. Diagnosis

P. guvenianum is related to *P. ruthenicum*, *P. longifolium*, and *P. vourinense*. It differs from these species especially by its stem 130–220 cm tall, distinctly striate, densely branched from below the middle to upper part (not maximum to 120 cm tall, slightly striate, slightly or densely branched from above the middle); basal leaves 28–40 cm long and 20–70 cm wide (not 5–30 long and 10–20 wide); bracts linear-lanceolate and erect (not filiform and deflexed); petals emarginate at apex (not without emarginate apex or slightly emarginate at apex); mericarp 7.2–14 × 4.3–8 mm, ±two times longer from pedicel (not 4.5–9 × 3–4 mm, ±equal or slightly shorter).

3.2. Description

Polycarpic perennials with taproot; taproot 25–45 mm in diameter; fibrous collar present. Stems 130–220 cm tall, 6–13 mm diameter at base, completely glabrous, striate, rounded at cross-section in lower part, from the middle and upper part dichotomously branched. Leaves mostly basal, with the remains of old leaf bases. Basal leaves rosulate, outer soon withering but not falling off, with sheaths 1–6 cm long and petioles 6–20 cm long, leaf blade 28–40 × 20–70 cm; flabellate in outline; lamina 4–6 ternate; their segments with long petiolules; terminal lobes 2.5–10 cm long, 1–2 mm wide, linear. Middle and upper cauline leaves acropetally decreasing in size, their sheaths triangular, blades very reduced, almost without blades at uppermost leaf. All umbels with peduncles, 4–19 cm long, (5–)7–16-rayed; rays unequal, 15–65(–90) mm long, glabrous; finely furrowed; bracts 2–4, linear to linear-lanceolate, entire, 3–7 mm long, herbaceous, caducous in fruiting time. Umbellules 8–19-flowered; pedicels at flowering 1–5 mm long, pedicel at fruiting 3–8 mm long; bracteoles 7–9, linear to linear-lanceolate, entire, 1–3 mm long, herbaceous, inflexed. Sepals up to 0.5 mm, triangular, with whitish acuminate tip. Petals bright yellow, glabrous, 1–1.5 × 1 mm long, obovate, cuneate at the base, emarginate at the tip, strongly incurved at apex, attached to petal blade. Filaments 2–2.5 mm long, anthers ±oblong, 0.5–0.75 mm long. Stylopodium shortly conical, styles up to 1 mm long, reflexed. Mericarps oblong to oblong-elliptic, 7.2–14 × 4.3–8 mm, compressed dorsally; brown when ripe; dorsal ridges inconspicuous, filiform, lateral wings 0.8–1.2 mm wide, stylopodium shortly conical, styles up to 1 mm long, reflexed, dorsal vittae 1 per vallecula, commissural 2.

3.3. Carpological characters

Mericarps 7.2–14 × 4.3–8 mm with lateral wings, oblong to oblong-elliptic, compressed dorsally, dorsal ribs and vittae prominent, dorsal vittae 4, regularly 1 per vallecula, commissural vittae 2. The exocarp is composed of thin-walled rectangular and polygonal epidermis cells with a thin, smooth cuticle. The mesocarp consists of thin-walled parenchymatous cells of various sizes with lignified cells in the ribs and lateral wings near the vascular bundles. All vittae are situated between the vascular bundles. Collateral vascular bundles are embedded in the ribs and at the base of the lateral wings. Endocarp is composed of a single line of long and thin-walled cells (Figure 3).

3.4. Pollen morphology and mericarp surface

The pollen grains of *Peucedanum guvenianum* are tricolporate, radially symmetrical, and isopolar. Polar axis (P) is 29.92 ± 0.97 µm, equatorial axis (E) is 14.83 ± 0.7 µm. The shape of pollen grain (P/E: 2.02 ± 0.06) is perprolate. Colpus length is 21.37 ± 1.73 µm and colpus width 0.87 ± 0.14 µm. Pore length is 4.8 ± 0.47 µm and pore width 5.76 ± 0.52 µm. The intine thickness is 0.68 ± 0.15 µm and the exine is 1.01 ± 0.09 µm. Exine sculpturing is rugulate in the meridional and polar optical sections (Figure 4). The mericarp surface is striate (Figure 5).

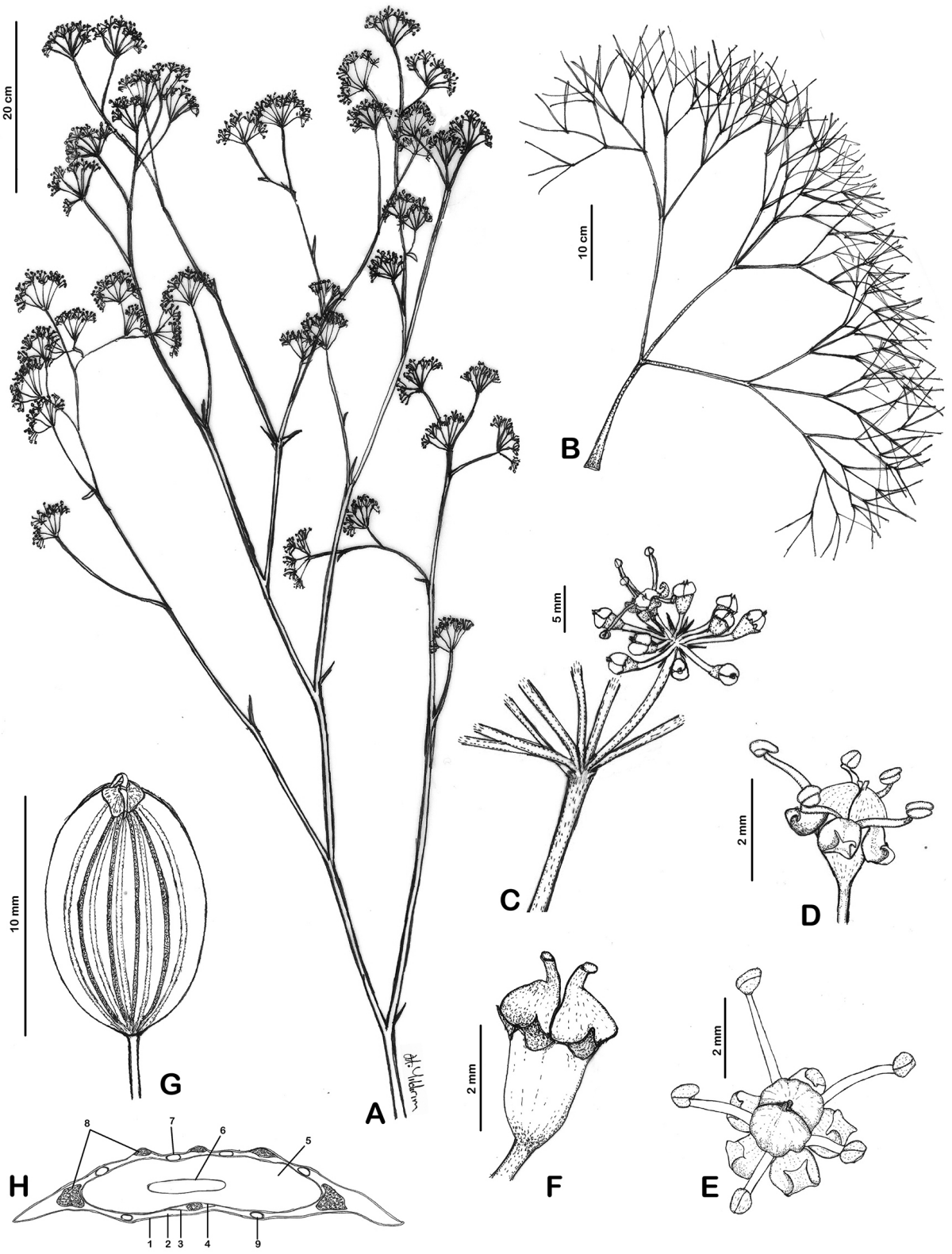

Figure 1. *Peucedanum guvenianum*: A- Middle and upper stem; B- basal leaf; C- umbel; D, E- flower; F- immature fruit; G- mature fruit; H- mericarp structure (1: exocarp, 2: mesocarp, 3: endocarp, 4: seed coat, 5: endosperm, 6: embryo, 7: dorsal vittae, 8: vascular bundles, 9: commissural vittae).

Figure 2. *Peucedanum guvenianum*: A- Habitus; B- flowers and umbel; C- immature fruits; D- mature fruits; E- stages of budding to mature fruit.

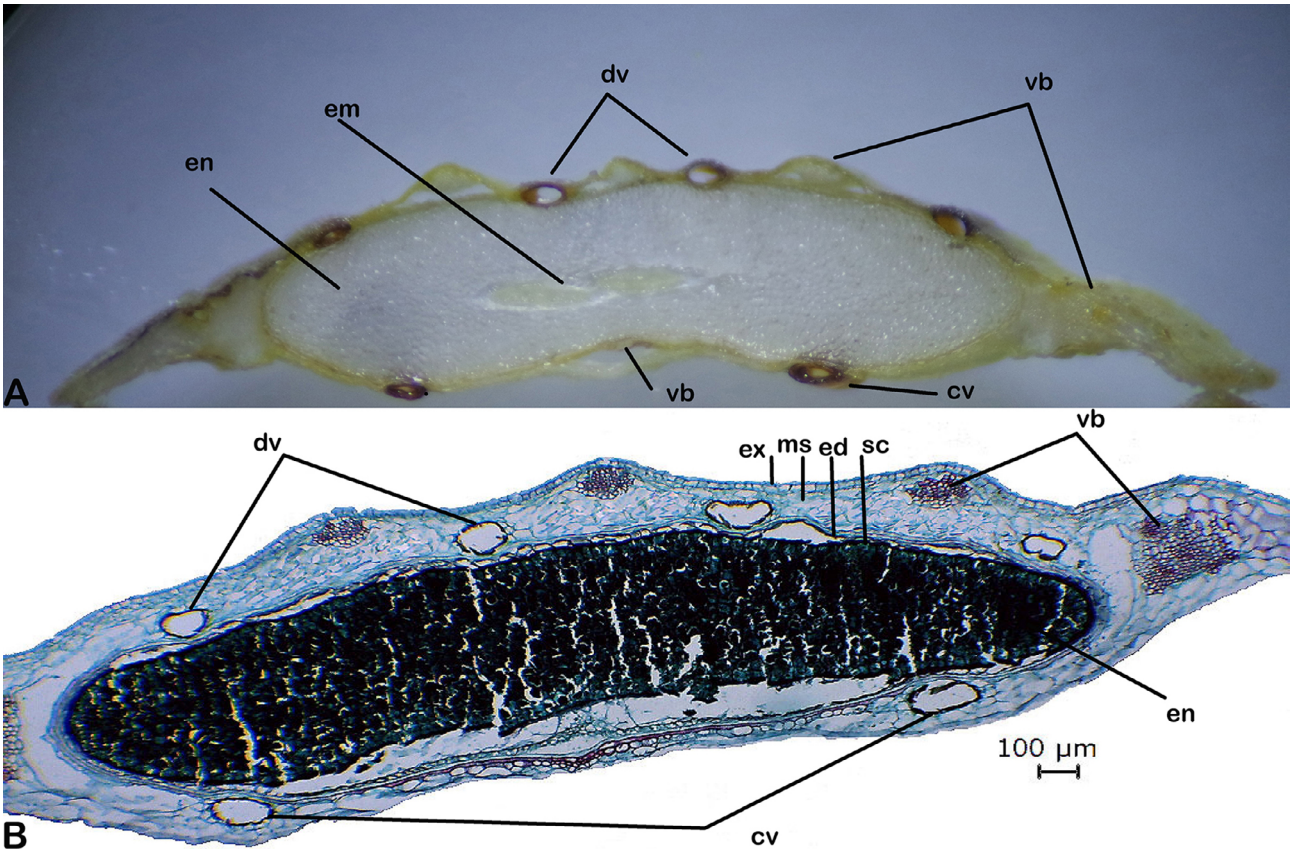

Figure 3. A, B- Mericarp structure of *Peucedanum guvenianum* (ex: exocarp, ms: mesocarp, ed: endocarp, sc: seed coat, vb: vascular bundles, dv: dorsal vittae, cv: commissural vittae, en: endosperm, em: embryo).

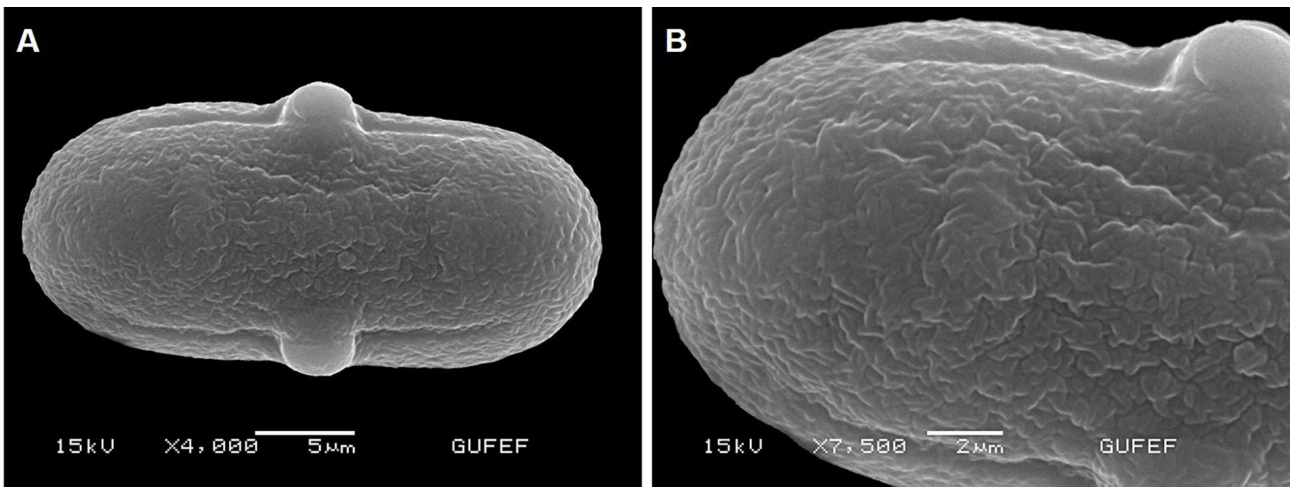

Figure 4. SEM micrographs of pollen grains of *Peucedanum guvenianum*: A- General aspect, B- exine ornamentation.

3.5. Etymology

The new species was named in honor of Turkish botanist Prof Dr Güven Görk, who is an expert on the flora of Turkey. The Turkish name of this species is given as "Eferezenesi", according to the guidelines of Menemen et al. (2013).

3.6. Paratypes

Turkey, İzmir, Menderes-Gümüldür yolu, Tahtalı Baraj gölü karşısı, Gümüldür'e 40 km kala, maki içi, 250 m, 15.10.2012, H.Yıldırım 2404; ibid, 03.05.2012, H.Yıldırım 2305.

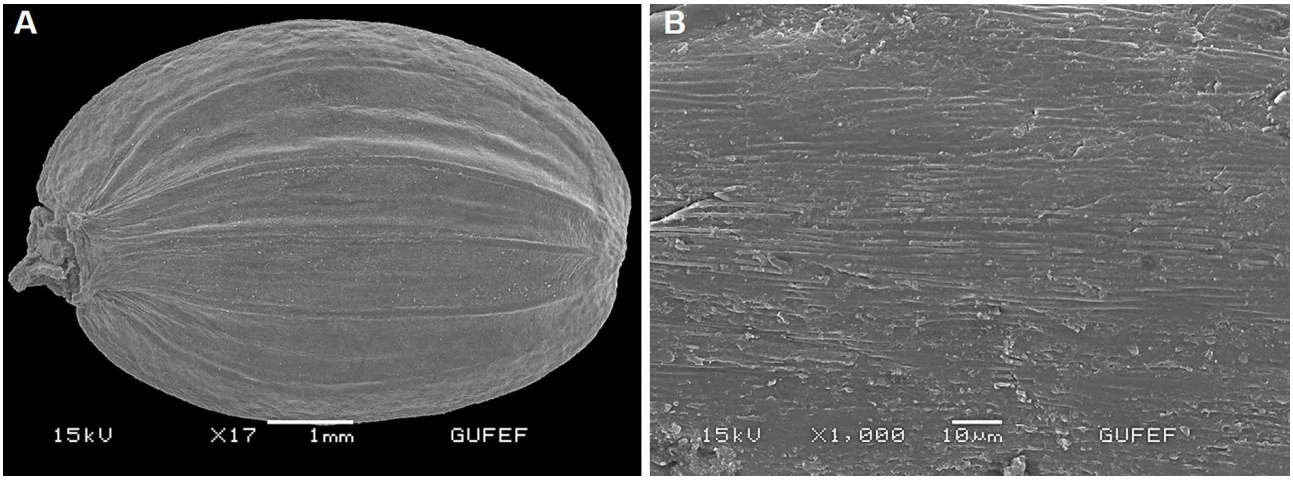

Figure 5. SEM micrographs of fruits of *Peucedanum guvenianum*: A- General aspect, B- surface ornamentation.

3.7. Suggested conservational status

The occupancy area (AOO) of *Peucedanum guvenianum* was calculated as 7.5 km^2, in which about 500 individuals were estimated to occur. Overgrazing by sheep and goat herds on nearby individuals to the soil level was also observed. Moreover, the anthropogenic effects, including littering, observed on the population had likely severely harmed the individuals of *P. guvenianum*. Thus, from the criteria laid out by the IUCN (2016), *P. guvenianum* is here assessed as 'Critically Endangered' (CR) B2ab (iii,v), on account of its restricted distribution and anthropogenic effects on the population.

3.8. Distribution and ecology

Peucedanum guvenianum is locally endemic to İzmir Province, West Anatolia. It is an element belonging to the Mediterranean floristic region. The new species grows in the maquis vegetation and opening *Pinus brutia* area, between 220 and 270 m a.s.l. in the triangle of the Seferihisar, Menderes, and Gümüldür districts in İzmir. Species growing in the near vicinity include *Arbutus andrachne* L., *Arbutus unedo* L., *Asparagus acutifolius* L., *Centranthus calcitrapa* (L.) Dufr., *Cerotonia siliqua* L., *Cistus creticus* L., *Dittrichia viscosa* (L.) Greuter, *Lavandula stoechas* L. subsp. *stoechas*, *Lavetera puctata* All., *Lonicera caprifolium* L., *Lupinus micranthus* Guss., *Origanum onites* L., *Osyris alba* L., *Phillyrea latifolia* L., *Pistacia lentiscus* L., *Satureja thymbra* L., and *Verbascum rupicola* (Hayek et Siehe) Hub.-Mor.

4. Discussion

According to recent molecular studies on *Peucedanum* s. str. and segregated genera from *Peucedanum* s. lato, which are *Xanthoselinum*, *Pteroselinum*, *Tommasinia*, and *Oreoselinum*, they are closely related to each other and to *Peucedanum* s. str. taxa (Spalik et al., 2004). On the other hand, the other segregated genera from *Peucedanum* s. lato, *Cervaria* and *Holandrea*, distinctly differ from *Peucedanum* s. str. based on molecular and morphological evidence (Pimenov and Leonov, 1993; Reduron et al., 1997; Spalik et al., 2004).

Furthermore, Spalik et al. (2004) revealed close relations among the *Peucedanum* s. str. taxa based on ITS sequences studies. The taxa in *Peucedanum* s. str. Are similar in habit, sharing not only mericarp characters but also linear-filiform leaf lobes (Pimenov and Leonov, 1993; Spalik et al., 2004). *P. guvenianum* is found in *Peucedanum* s. str. based on linear-filiform leaf lobes and dorsally compressed orthospermous mericarp without prominent dorsal ribs and with a broad commissure.

P. guvenianum morphological shows some similarities especially to *P. longifolium*, *P. ruthenicum*, and *P. vourinense*.

P. guvenianum is characterized by stem 130–220 cm tall; many-branched from near the base to the top of the stem; ultimate leaf lobes up to 10 cm and relatively bigger basal leaves and mericarps compared to related species.

P. guvenianum also shows some similarities to *P. officinale* L., which is the type species of *Peucedanum* s. str., distributed from Central and South Europe to SE England. *P. officinale* is easily separated from *P. guvenianum* by stem 60–120 cm tall (not 130–220 cm); 15–40 rays per umbel (not 7–16); umbellules including more than 30 flowers (not 8–19); pedicels 20–40 mm long (not 3–8 mm); population found on grassy slopes at 1000–1800 m in altitude (not in maquis and between 200–250 m in altitude). However, all related taxa (*P. longifolium*, *P. ruthenicum*, *P. vourinense*, and also *P. officinale*) of *P. guvenianum* are distributed from high altitudes, mostly in subalpine mountain areas. *P. guvenianum* is a Mediterranean phytogeographical area element. The population of it was found in maquis vegetation at lower altitudes (200–250 m).

The detailed differences among *P. guvenianum* and closely related taxa *P. longifolium*, *P. ruthenicum*, and *P. vourinense* are listed in the Table.

Table. Morphological differences among *Peucedanum guvenianum*, *P. ruthenicum*, *P. longifolium*, and *P. vourinense*.

Characters	*Peucedanum guvenianum*	*Peucedanum ruthenicum*	*Peucedanum longifolium*	*Peucedanum vourinense*
Stem	130–220 cm tall; green, distinctly striate; densely branched from below the middle to upper part	100–120 cm tall, green, slightly striate; slightly branched from above the middle	60–120 cm tall; green, slightly striate; slightly branched from above the middle	60–80 cm tall; green, slightly striate; more branched from above the middle
Basal leaves	28–40 cm long; 20–70 cm wide; 4–6 ternate; lobes 2.5–10 cm × 1–2 mm, linear	8–15 cm long and 10–20 cm wide; 3–4 ternate; lobes 2–9 cm × 1–5 mm, linear	10–15 cm long and 10–25 cm wide; 2–6 ternate; lobes 2–4 cm × 0.5–1 mm, filiform	5–30 cm long; 5–6 ternate; lobes 20–40 mm × 0.3–5 mm, filiform
Rays	7–16 per umbel; 15–65 mm long	8–25 per umbel; 20–60 mm long	15–30 per umbel; 40–100 mm long	6–8(–10); 15–30(–40) mm long
Bracteoles	7 – 9, inflexed	5–7, filiform, deflexed	c. 10, deflexed	3–6
Petals	Emarginate at apex	Not emarginate	Slightly emarginate	Slightly emarginate
Umbellules	8–19-flowered	25–35-flowered	25–35-flowered	6–12-flowered
Pedicel	3–8 mm in fruit	Up to 10 mm in fruit	Up to 10 mm in fruit	3–6 mm
Mericarps	7.2–14 × 4.3–8 mm, oblong to oblong-elliptic; ±two times longer from pedicel	6–7.5 mm × 3–4 mm, ellipsoid; ±equal or slightly shorter to pedicels	(6–)7–9 mm × 3–4 mm, oblong; ±equal to pedicels	4.5–6 mm; ±equal to pedicels
Habitat	On volcanic soil, in maquis, 200–250 m in altitude	On calcareous soil or rarely metamorphic soil, in meadows, rocky edges, and slopes; 700–1550 m in altitude	On calcareous soil or rarely on volcanic soil, in meadows, rocky edges, and slopes; 250–2000 m in altitude	On serpentine, dry rocky slopes, 1200–1800 m in altitude

Additional specimens examined (similar taxa)

***P. longifolium*: Turkey**, Çoruh: Borçka-Hopa, Borçka yukarıları, 250 m a.s.l., 16.08.1957, *Davis-Hedge* (ANK!). **Erzurum:** Erzurum-Bayburt yolu, Erzurum'dan 85 km sonra, Kop Dağı, 1980 m a.s.l., 27.07.1956, *K. Karamanoğlu* (ANK!). **Iğdır:** Tuzluca Turabi-Sürmeli arası, 1100 m a.s.l., 30.09.2008, *E. Altundağ* (ISTE 85834!). **Kars:** Kağızman, Paslı-Kötek arası, 1400–1650 m a.s.l., 25.07.1980, *O. Güneş 1745* (HUB 17847!). **Kayseri:** Sarız, Keklikoluk Köyü, Işık Dağı, 2300 m a.s.l., 12.9.1991, *H. Duman 4446 & Z. Aytaç* (GAZI!); Sarız, Keklikoluk Köyü, Işık Dağı, 2400–2600 m a.s.l., 11.9.1991, *H. Duman & Z. Aytaç* (HUB 18339!, GAZI!); Sarız, Yalak, Binboğa Dağı, 1500–1700 m a.s.l., 04.08.1991, *H. Duman 4333*, *Z. Aytaç* (HUB 18340!–18341!, GAZI!). **Ordu:** Ünye'nin yukarısı, c. 300 m a.s.l., 05.09.1954, *Davis*, *O. Polunin* (ANK!). **Samsun:** Salıpazarı, Gorpukale Tepesi, 800–900 m a.s.l., 10.10.2008. *B.* Şahin *3600* (GAZI!). **Trabzon:** Maçka-Meryemana arası, 700 m a.s.l., 10.08.1969, *T. Baytop* (ISTE 15966!); Maçka, 350 m a.s.l., 12.08.1981, *Y. Gemici 1108* (EGE 31577!); Zafanos, c. 1000 m a.s.l., 04.10.1975, *Y. Akman* (ANK!). **Zonguldak:** Devrek, c. 600 m a.s.l., 06.08.1984, *M. Demirörs* (ANK!).

***P. ruthenicum:* Turkey, Hatay:** Dörtyol, Amanos Dağları, Ahmetçiğin Düzü, 550 m a.s.l., 20.09.1967, *Y. Akman* (ANK!); Dörtyol, Kuzuculu Kasabası, Çat köyü altları, Atkası mevkii, 27.10.2001, *E. Akalın & U. Uruşak* (ISTE 80778!); Dörtyol, Kuzuculu Kasabası, Çat köyü yolu, Karagöl mevkii, 17.10.2002, *E. Akalın & U. Uruşak* (ISTE 81360!). **Kastamonu:** Hanönü, Kapan Köyü'nden anayola 2.2 km, 06.08.2009, *A. A. Dönmez 16041* (HUB!); Altunhisar-Karakapı köyleri arası, Hasandağı eteği, 1700 m a.s.l., 17.08.1996, *A. A. Dönmez 5462* (HUB!). **Trabzon:** Yomra, Yeşilyurt Köyü, 300 m a.s.l., yamaç, 07.08.2004. *S. Aslan 1711* (GAZI!); Yomra, Yeşilyurt Köyü, 300–400 m a.s.l., yamaçlar, 27.07.2003. *S. Aslan 1332* (GAZI!).

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References

Akpulat HA, Akalın E (2010). *Peucedanum ozhatayiorum* (Apiaceae), a new species from NE Turkey. Ann Bot Fenn 47: 59-62.

Barthlott W (1981). Epidermal and seed surface characters of plant: systematic applicability and some evolutionary aspects. Nord J Bot 1: 345-355.

Chamberlain DF (1972). *Peucedanum* L. In: Davis PH, editor. Flora of Turkey and the East Aegean Islands, Vol. 4. Edinburgh, UK: Edinburgh University Press, pp. 473-481.

Davis PH, Mill RR, Tan K, editors (1988). Flora of Turkey and the East Aegean Islands, Vol. 10, Suppl. 1. Edinburgh, UK: Edinburgh University Press.

Erdtman G (1969). Handbook of Palynology, Morphology, Taxonomy and Ecology. Copenhagen, Denmark: Munksgaard.

Faegri K, Iversen J (1992). Textbook of Pollen Analysis. 4th ed. New York, NY, USA: Wiley.

Frey R (1989). Taxonomische Revision der Gattung *Peucedanum*: Sektion *Peucedanum* und Sektion *Palimbioidea* (Umbelliferae). Candollea 44: 257-327 (in German).

Güner A, Aslan S, Ekim T, Vural M, Babaç MT (2012). Apiaceae. In: Güner A, Aslan S, Ekim T, Vural M, Babaç MT, editors. Türkiye Bitkileri Listesi (Damarlı Bitkiler). İstanbul, Turkey: Nezahat Gökyiğit Botanik Bahçesi ve Flora Araştırmaları Derneği Yayını, pp. 47-48 (in Turkish).

Güner A, Özhatay N, Ekim T, Başer KHB, editors (2000). Flora of Turkey and the East Aegean Islands, Vol. 11, Suppl. 2. Edinburgh, UK: Edinburgh University Press.

Hartvig P (1986) *Peucedanum* L. In: Strid A, editor. Mountain Flora of Greece, Vol. 1. London, UK: Cambridge University Press, pp. 714-722.

IUCN (2016). The IUCN Red List of Threatened Species, Version 2016.1. Gland, Switzerland: IUCN.

Johansen DA (1944). Plant Microtechnique. New York, NY, USA: McGraw-Hill.

Leute GH (1966). Die Gattungen *Imperatoria* L. und *Tommasinia* Bertol. (Apiaceae). Annalen des Naturhistorischen Museums in Wien 69: 69-79 (in German).

Menemen Y (2012). *Peucedanum* L. In: Güner A, Aslan S, Ekim T, Vural M, Babaç MT, editors. Türkiye Bitkileri Listesi (Damarlı Bitkiler). İstanbul, Turkey: Nezahat Gökyiğit Botanik Bahçesi ve Flora Araştırmaları Derneği Yayını, pp. 72-73 (in Turkish).

Menemen Y, Aytaç Z, Kandemir A (2013). Türkçe bilimsel bitki adları yönergesi. Bağbahçe Dergisi 47: 28-31 (in Turkish).

Ostroumova TA, Pimenov MG (1997). Carpological diversity of African *Peucedanum* s.l. (Umbelliferae) I. The species of southern Africa. Feddes Repertorium 108: 299-318.

Parolly G, North B (2004). *Peucedanum isauricum* (Apiaceae), a striking new species from S Anatolia. Willdenowia 34: 135-144.

Parolly G, North B (2005). A further new *Peucedanum* species (Apiaceae) from the Taurus Mts., Turkey. Willdenowia 35: 97-105.

Pimenov MG (1987a). *Leutea* M. Pimen. In: Rechinger KH, editor. Flora Iranica, Vol. 162. Graz, Austria: Akademische Druck-und Verlagsanstalt, pp. 445-450.

Pimenov MG (1987b). *Cervaria* Gaertn. In: Rechinger KH, editor. Flora Iranica, Vol. 162. Graz, Austria: Akademische Druck-und Verlagsanstalt, pp. 451-454.

Pimenov MG (1987c). *Johreniopsis* M. Pimen. In: Rechinger KH, editor. Flora Iranica, Vol. 162. Graz, Austria: Akademische Druck-und Verlagsanstalt, pp. 454-457.

Pimenov MG, Leonov MV (1993). The Genera of the Umbelliferae, A Nomenclator. Kew, UK: Royal Botanical Gardens.

Pimenov MG, Leonov MV (2004). The Asian Umbelliferae biodiversity database (ASIUM) with particular reference to South-West Asian taxa. Turk J Bot 49: 219-223.

Punt W, Blackmore S, Nilsson S, Le Thomas A (1994). Glossary of Pollen and Spore Terminology. Utrecht, the Netherlands: LPP Foundation.

Punt W, Hoen PP, Blackmore S, Nilsson S, Le Thomas A (2007). Glossary of pollen and spore terminology. Rev Palaeobot Palyno 143: 1-81.

Rechinger KH (1987). *Peucedanum* L. In: Rechinger KH, editor. Flora Iranica, Vol. 162. Graz, Austria: Akademische Druck-und Verlagsanstalt, pp. 442-445.

Reduron JP, Charpin A, Pimenov MG (1997). Contribution à la nomenclature générique des 'Apiaceae' (Ombellifères). Journal de Botanique de la Société Botanique de France 1: 91-104 (in French).

Spalik K, Reduron JP, Downie, SR (2004). The phylogenetic position of *Peucedanum* sensu lato and allied genera and their placement in tribe *Selineae* (Apiaceae, subfamily Apioideae). Plant Syst Evol 243: 189-210.

Tutin TG (1968). *Peucedanum* L. In: Tutin TG, Heywood VH, Burges NA, Moore DM, Valentine DH, Walters SM, Webb DA, editors. Flora Europaea, Vol. 2. Cambridge, UK: Cambridge University Press, pp. 360-364.

Vural M, Adıgüzel N (1996). Türkiye florası ilgili notlar I: *Peucedanum graminifolium* ve *Olymposciadium caespitosum* (Apiaceae/Umbelliferae). Ot Sistematik Botanik Dergisi 3: 59-64 (in Turkish).

Wodehouse PP (1935). Pollen Grains. New York, NY, USA: McGraw-Hill.