

Short note

Morphology, anatomy and micromorphology of the genus *Oliveria* (Apiaceae)

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Abstract. *Oliveria* is a little-known, monotypic genus of the family Apiaceae. The only accepted species, *O. decumbens*, is distributed throughout Mesopotamia. It is an annual, aromatic plant that has been used in traditional medicine since ancient times. The aim of this study was to examine morphological, micromorphological, and anatomical characters of *O. decumbens* in order to increase the current botanical knowledge of this genus.

Resumen. *Oliveria* es un género monotípico y poco conocido de la familia Apiaceae. La única especie aceptada, *O. decumbens*, se distribuye en toda Mesopotamia. Es una planta anual y aromática que ha sido usada en la medicina tradicional desde tiempos antiguos. El objetivo de este estudio fue examinar los caracteres morfológicos, micromorfológicos y anatómicos de *O. decumbens* para incrementar el conocimiento botánico actual del género.

Keywords. Anatolia, monotypic genus, Iran, Iraq, pollen, Turkey.

Palabra clave. Anatolia, género monotípico, Iran, Iraq, polen, Turquía.

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The Apiaceae Lindl. family contains around 460 genera and 3700 species distributed worldwide, with Turkey being one of the richest countries in southwest Asia in terms of number of species. The country has 105 genera and approximately 495 species of Apiaceae followed in richness by Iran, Georgia, Syria, Azerbaijan, and Iraq. There are 60 genera endemic to Asia, of which 45 are monotypic (Sales & Hedge 2013). Genera *Chamaescidium* C.A.Mey., *Cymbocarpum* DC. ex C.A.Mey., *Diplotaenia* Boiss., *Exoacantha* Labill., *Fuernrohria* K.Koch, *Froriepiea* K.Koch, *Gongylosciadium* Rech.f., *Lisaea* Boiss., *Oliveria* Vent., *Ormosciadium* Boiss., *Petroedmondia* Tamamsch., *Rhabdosciadium* Boiss., *Szovitsia* Fisch. & C.A.Mey, *Thecocarpus* Boiss. and *Trigonosciadium* Boiss. have small geographic ranges and are endemic to Turkey, Iran, and Iraq. Genera *Aegokeras* Raf., *Crenosciadium* Boiss. & Heldr., *Postiella* Kljuykov, *Ekimia* H.Duman & M.F.Watson are only endemic to Turkey.

Oliveria decumbens Vent. is scatteredly distributed in small areas in Iran, Iraq, Syria, and Turkey. The genus *Oliveria* was established by Ventenat (1801). *Oliveria aucheri*

Jaub. & Spach, *O. bruguieri* Jaub. & Spach, and *O. orientalis* DC. were then published as new species and are currently regarded as synonyms of *O. decumbens*. *Oliveria* was placed into tribe *Smyrnea* by de Candolle (1830) and then transferred into tribe *Ammineae* by Bentham (1867) followed by Boissier (1872). Afterwards, *Oliveria* was placed in tribe *Apiaceae* by Rechinger & Hedge (1987). These traditional *Apiaceae* classification systems were largely based on fruit anatomy and morphology. *Apiaceae* is undergoing a major taxonomic rearrangement within the angiosperms given that current systematic knowledge has changed in light of molecular phylogenetics (e.g., Jiménez-Mejías & Vargas 2015). A comprehensive molecular phylogenetic analysis of tribal classification of Apiaceae, based on DNA sequences, showed that *Oliveria* is sister to *Trachyspermum* within *Pyramidoptereae* (Mousavi et al. 2020).

Plants from the *Apiaceae* family are commonly used for food, flavoring, fragrance, and medicines. They are also known for their uses as household remedies for centuries. Many recent experimental and biological investigations have been conducted to validate the ethnomedicinal claims of the plants belong-

ing to this family (Ahmad & al. 2018). In traditional medicine, *Oliveria* has been used for indigestion, diarrhea, abdominal pain, fever, and skin wounds since ancient times (Amin & al. 2005; Mahboubi & al. 2016; Alizadeh-Behbahani & al. 2018). There are many studies on the antioxidant, antihemolytic, anticancer, and anti-inflammatory properties of *Oliveria*. However, there are no detailed morphological, anatomical, and palynological studies about this genus (Sajjadi & Hoseini 2002; Amin & al. 2005; Mahboubi & al. 2016; Eftekhari & al. 2019). For this reason, the aim of this study was to investigate the morphological, carpological, and palynological characteristics of *O. decumbens* and to evaluate their significance in Apiaceae taxonomy.

Updated morphological description

Oliveria decumbens Vent., Descr. Pl. Nouv., pl. 21 (1801). Type: cultivated in Hort. Cels, s.d., E.P. Ventenat s.n. (lectotype designated by Callmänder & al. 2017: G 00341532, image!). Fig. 1–2.

Ascending to erect or rarely decumbent, aromatic, annual herbs. Stem (13–)20–45(–75) cm tall, rigid, whitish,

± much branched, glabrous or rarely hirsute, solid, terete, 2–4 mm in diameter at base. Basal leaves soon withering; 3–10 cm long (inc. petiole), lamina oblong in outline, ± glabrous, 1-pinnate with 4–5 pairs of segments; each segment divided into smaller, decurrent lobes; ultimate segments lanceolate, ± toothed; petioles 0.6–2.5 cm long with sheathing base. Lower cauline leaves similar to basal leaves; middle and upper cauline leaves ovate, subsessile or sessile, pilose, pinnatisect. Umbels 1.5–2.5 cm in diameter, ± condensed, (2–)3–5(–7) rayed; rays (2–)3–10 mm long, slightly thickened, hairy, ± equal. Bracts 3–5, 3–8 mm long, obovate, dissected, densely pilose. Flowers 15–35(45), hermaphrodite, condensed, pedicellate. Pedicels 0.5–2 mm long, slightly thickened, rounded, hairy. Bracteoles 6–8, 2.5–5 mm long, dissected, obovate, densely pilose. Sepals 5, 0.5–0.75 mm, distinct, persistent, ovate-triangular, acute, hairy. Petals 5, 1–1.6 × (0.6–)0.8–1.1 mm, white or pink, ± oblong-obovate, emarginate, with narrow tip bent inward, hairy on abaxial surface. Ovary hairy. Stamens enrolled; filaments whitish, c. 1.5 mm long; anthers 0.4–0.9 mm, sub-globular, dorsally inserted. Fruits 2.0–3.6 × 1–1.6 mm, oblong; mericarps densely hirsute, laterally

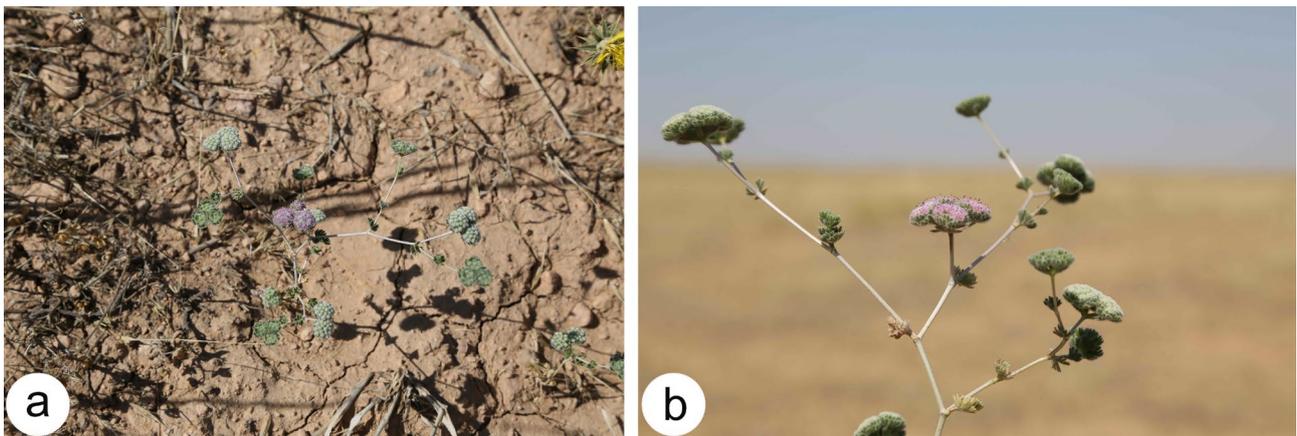


Fig. 1. *Oliveria decumbens* Vent.: a, plant in the field; b, umbel [based on Çelik 1103 (GAZI)].

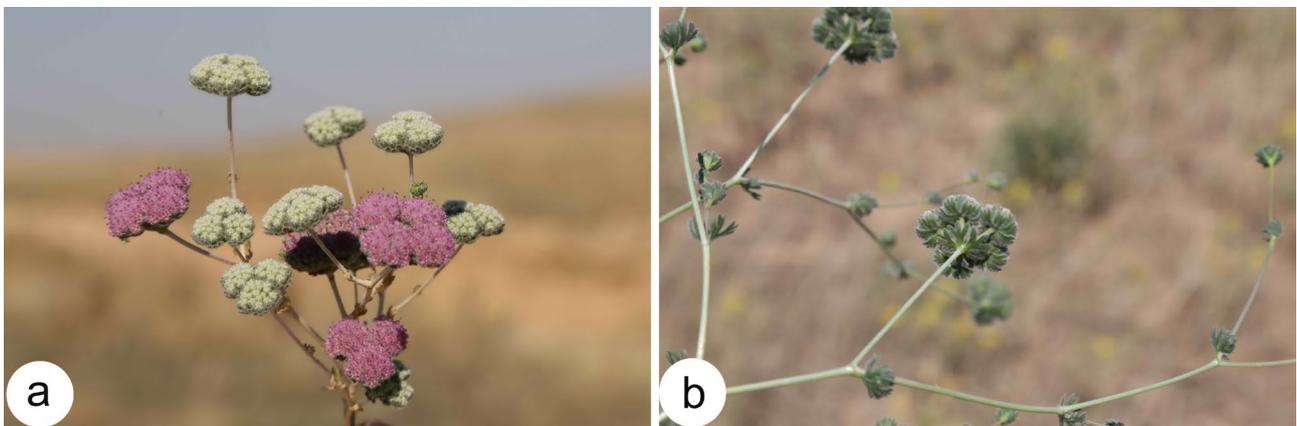


Fig. 2. *Oliveria decumbens* Vent.: a, flowers; b, bracts and bracteoles [based on Çelik 1103 (GAZI)].

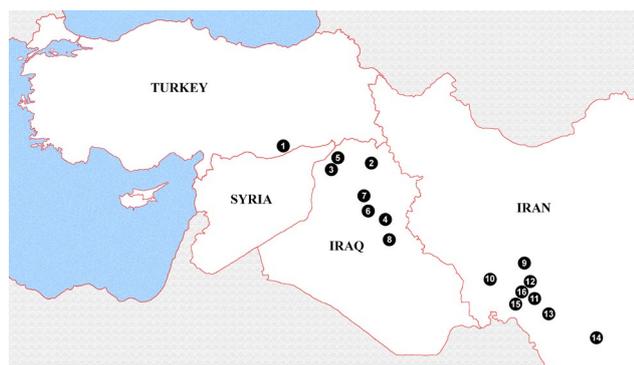


Fig. 3. Map showing the distribution and locations of the studied specimens of *Oliveria decumbens* Vent. (numbers correspond to those given in Appendix 1).

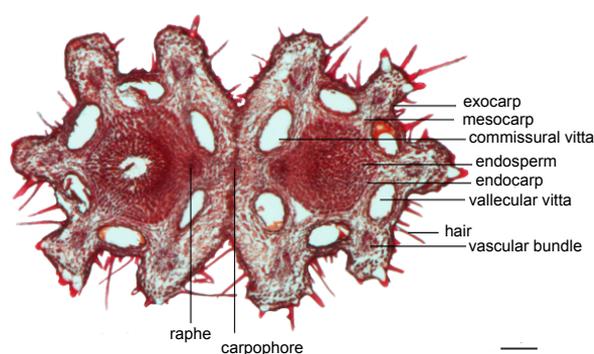


Fig. 4. Cross-section of a fruit of *Oliveria decumbens* Vent. [based on Çelik 1103 (GAZI); scale: 100 μ m].

compressed; ribs filiform, obscured by hair; stylopodium \pm conical; style 1.0–1.8 mm, slender, erect; vittae large, oblong, vallecular vitta 1; commissural vittae 2.

Distribution and phenology.—*Oliveira decumbens* is distributed along the northwest-southeast transect of a narrow area in the western and southern region of Iran and the northern regions of Iraq (Fig. 3; Appendix 1) at elevations between 150 and 1700 m. In Turkey, the species is only known from the Ceylanpinar region near the border with Syria. It grows in steppes and flowers in May and July.

Fruit anatomy and micromorphology.—The fruit of *Oliveria decumbens* is oblong-elliptic in the transverse section. Mericarps are homomorphic, nearly circular, and have five projecting ribs. The exocarp is a single layer and consists of rectangular-like cells near the distal ends of the marginal ribs. Their walls are slightly thickened and the outer walls are covered with a smooth cuticle layer and simple unicellular trichomes, which originate from the epidermal cells. The mesocarp is multilayered with thin-walled parenchymatous cells. They are irregularly shaped and polygonal. Vascular bundles are located under the ribs and are surrounded by

mesocarp cells. The vittae are large and oblong-elliptic or nearly orbicular. They are lined with thin-walled epithelial cells. There is one vitta per vallecule and two commissural vittae. The endocarp is single layer and consists of thin-walled cells. Endosperm cells are irregular, polygonal in shape, and are filled with granular contents (Fig. 4). The fruit of *O. decumbens* is covered with dense, long, hirsute hairs that have a papillose surface (Fig. 6).

Palynology.—Pollen materials were taken from herbarium specimen. Light microscopy (LM) observations were carried out on acetolyzed pollen and prepared according to Erdtman (1952). Measurements, based on 50 samples from one population, were taken with a Leica microscope. For SEM analyses, the acetolyzed pollen grains were mounted on stub and coated with gold, using a Polaron SC7620 sputter coater. Microphotographs were taken using an incorporated Zeiss LS-10 camera. The terminologies of Erdtman (1952) and Faegri & Iversen (1975) were used for the micromorphological features. The pollen grains of *Oliveria decumbens* are monad, isopolar, radially symmetric, and tricolporate (Fig. 5). The polar axis (P) ranges from 28.30 to 35.55 μ m and the equatorial axis (E) ranges from 11.39 to 16.58 μ m. The mean length of the polar axis (P) is $30.05 \pm 2.30 \mu$ m, and the mean of the equatorial diameter (E) is $12.68 \pm 1.74 \mu$ m. P/E averages 2.29 ± 0.16 , making the pollen grain shape prolate. In polar view, the pollen grains are nearly triangular with obtuse angles. In an equatorial view, the grains are narrowly oblong with slightly equatorial constriction and obtuse polar caps. The colpus extends nearly to the poles. The pore area is slightly protruding and located in the middle of colpus. The sculpturing pattern is striate or psilate at the polar area and irregularly rugulate at the equatorial area, but sometimes striate at the polar area and psilate-foveolate toward the polar area. The fruit of *O. decumbens* is covered with dense, long, hirsute hairs that have a papillose surface (Fig. 6).

Comments.—*Oliveria* is very isolated from other members of Apiaceae and its morphological characteristic is rather distinctive and apparently does not closely resemble other genera in tribe *Apieae*. *Oliveria* is characterized by a much-branched and bright whitish stem; conspicuous and persistent sepals; densely hairy and divided bracts and bracteoles; dorsally hairy and white or pink petals; and slightly laterally compressed, densely hairy, and ovoid-oblong fruits.

Although our description corresponds to that in Flora of Turkey (Matthews 1972), there are several differences as follows: the stem is (13)20–45(60) cm (not 20–40 cm), basal leaves 3–10 cm long (not determined), the rays are (2–)3–5(–7) (not 3–5) in number and 3–5(–10) mm long (not 5–10 mm long), bracts are 3–5 (not determined) in number, 3–8 mm long (not determined), sepals are 0.5–0.75 mm long (not determined), petals are 1–1.6 x (0.6–) 0.8–1.1 mm in size (not determined).

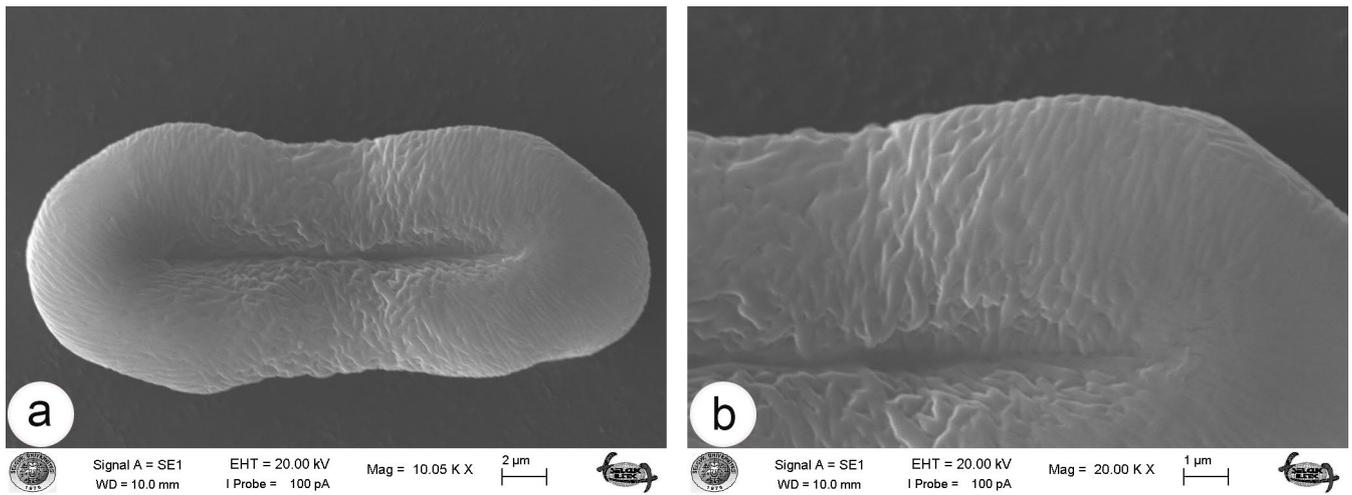


Fig. 5. SEM images of pollen grains of *Oliveria decumbens* Vent.: **a**, general view; **b**, detail of pollen grain surface [based on Çelik 1103 (GAZI)].

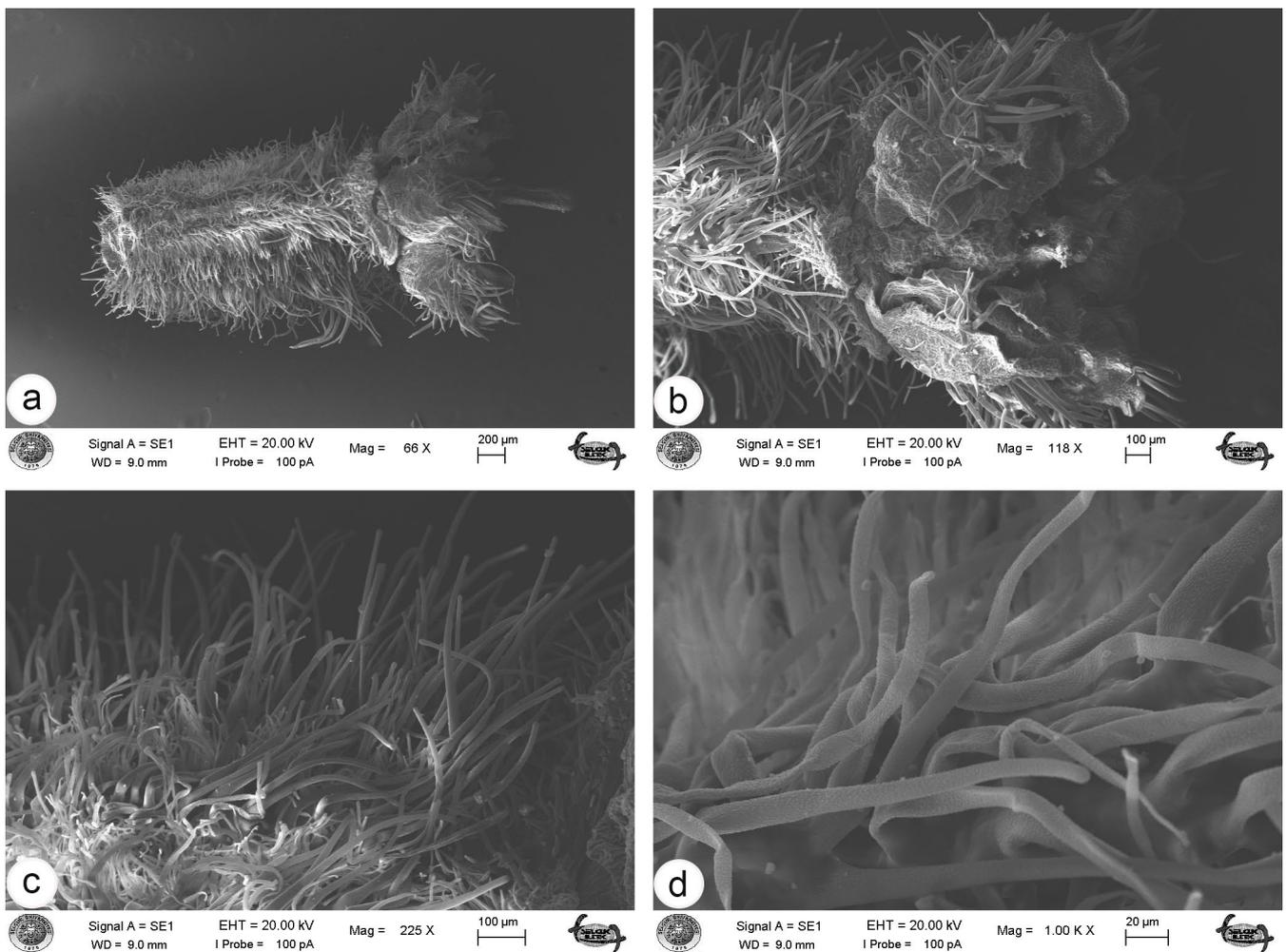


Fig. 6. SEM images of fruits of *Oliveria decumbens* Vent.: **a**, general shape of fruit; **b, c, d**, detail of fruit surface [based on Çelik 1103 (GAZI)].

One of main characteristics of *Oliveria* is its shiny white and glabrous stem. Similar stem structure is also seen in *Ergocarpon* C.C.Towns., *Eryngium* L., and *Schumannia* Kuntze. Amiri & al. (2011) have studied the anatomical characteristics of the leaf and stem of *Oliveria*. Their studies have shown that the surface of leaves is covered by non-glandular hairs, while the cross section of the stems show secretory canals in the cortex region. In the present study, we examined the anatomy and morphology of the fruit. According to our findings, the fruit of *O. decumbens* is oblong, laterally compressed, and densely hirsute. The bracts of *Oliveria* are divided and resemble those of *Ammi* L., *Artedia* L., *Cuminum* L., *Daucus* L., *Eremodaucus* Bunge, *Kalakia* Alava, *Lagoecia* L., *Ormosciadium* Boiss., *Scandix* L., and *Trachyspermum* Link.

According to Erdtman (1952), Umbelliferae species are stenopalynous. Observations by Perveen & Qaiser (2006) have indicated that the pollen grains of Apiaceae are usually radially symmetrical, isopolar, and prolate to perprolate and tricolporate (rarely 4-colporate). The tectal surface is commonly striate-rugulate, rugulate-striate, or simple striate. Our result confirms the stenopalynous characteristic of the family Apiaceae, and the palynological observations reveal that the pollen grains are perprolate in shape and irregularly rugulate in the equatorial area.

Our study provides a detailed account of the morphology, palynology, and micromorphology of *Oliveria*, increasing our botanical knowledge of a species that has been traditionally used since ancient times.

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Appendix 1. Examined herbarium specimens. Superindex corresponds to the location labeled in the map in Figure 3.

TURKEY. Şanlıurfa, Ceylanpınar, 500 m, 11 Jul. 2015, Çelik 405 (GAZI)¹; ibid. 19 Jun. 2017, Çelik 1103 (GAZI). IRAQ. Inter Erbil et Altun Köprü, May 1867, Haussknecht s.n. (JE 33540)²; Ninawa, 27 Jul. 1841, Kotschy 418 (W 62444)³; Diyala, Jabal Hamrin inter Sharaban et Jalaula, 12 Jun. 1957, Rechinger 9962 (NMNH 2636830)⁴; Ain Tellawi near Tell Afar, 29 May 1934, Field & Lazar 527 (NMNH 2407663)⁵; Ad ripas Tigris pr. Behschabur (Behshahr), 27 Jul. 1841, Kotschy 418(W 62442)⁶; Gebel Hamrin inter Bardad et Hannikin, 2 May 1910, Nabelek s.n. (SAV 4394)⁷. IRAN. Environ de Bagdad, 1892-93, Poiret s.n. (P 752836)⁸; Labisufed, Chahar Mahaal and Bakhtiari, 15 May 1940, Koelz 15449 (NMNH 2194950)⁹; Khuzestan, Persica austro-occidentalis, in aren. int. Seytun et Bebehan (Behbehan), Jun. 1868, Haussknecht s.n. (JE 33541)¹⁰; Choram, Kohgiluyeh va Boyer Ahmad, 1 Jun. 2014, Attar s.n. (TUH 451500)¹¹; Charmahale va Bakhtiary, Lordegan, Sarkhon, Shalile to Duabe Bazoft and Karoon river, May 2006, Mozaffarian s.n. (TARI 54897)¹²; Nourabad Mamasani, Jun. 2017, Khosravi (HSHU 55079)¹³; Kahnoyeh Lar, Jun. 2017, Khosravi (HSHU 55076)¹⁴; Behbahan, 394 m, Jun. 2017, Khosravi (HSHU 55075)¹⁵; Dehdasht, Jun. 2017, Khosravi (HSHU 55080)¹⁶.