Angelica archangelica (*Apiaceae*), a new species to Turkey: a contribution to its taxonomy and distribution

Ruziye Daşkın & Gönül Kaynak

Department of Biology, Faculty of Arts and Sciences, Uludag University, 16059, Görükle, Bursa, Turkey, e-mail: ruziyeg@uludag.edu.tr (corresponding author)

Received: January 25, 2012 ▷ Accepted: March 15, 2012

Abstract. *Angelica archangelica* (*Apiaceae*) collected from Mt Uludağ (NW Turkey), is reported for the first time for the flora of Turkey. The authors provide an expanded description, detailed photos and habitat preference of the species. Furthermore, its taxonomy and geographical distribution across the world are also discussed.

Key words: *Angelica archangelica*, Mt Uludağ, taxonomy, Turkey

Introduction

The genus *Angelica* L. is widely distributes in northern temperature zone and comprises 110 species growing across the world (Mabberley 2008). In Europe it is represented by eight species (Cannon 1968): nine species in the former USSR (Shishkin 1974) and two in West Pakistan (Nasir 1972). Two varieties of *A. sylvestris* L., namely var. *sylvestris* and var. *stenoptera* Lallem., have been described from Turkey so far. Of these, *A. sylvestris* var. *stenoptera* is endemic and only known from the type locality (Chamberlain 1972; Davis & al. 1988; Güner & al. 2000). In this paper *A. archangelica* L. is recorded for the first time for the Turkish flora. Thus, the total number of *Angelica* species known from Turkey has now increased to two.

Material and methods

The material was collected during the floristic studies of Mt Uludağ, between 2003 and 2006, and was identified according to several Floras: *Flora Europaea* (Cannon 1968), *Flora of USSR* (Shiskin 1972), *Flora Nordica* (Fröberg 2009), *Flora of West Pakistan* (Nasir 1974), and *Flora of Turkey* (Chamberlain 1972; Davis & al. 1988; Güner & al. 2000). The species was described according to our observations of the collected specimens and the above-mentioned literature. Transverse sections of the fruit of *A. sylvestris* and *A. archangelica* are also given (Fig. 4). Terminology in these sections follows Liu & al. (2006). All collected materials were numbered and deposited in the Herbarium of Uludağ University, Department of Biology (BULU).

Results

***Angelica archangelica* L., Sp. Pl. 250 (1753)** (Figs 1–2)

Syn.: *A. officinalis* Moench in Methodus Plantas Horti Botanici et Agri Marburgensis, 81 (1794); *A. officinalis* Bernh., Syst. Verz. (Bernhardi) 170 (1800); *A. archangelica* L. var. *himalaica* (Clarke) Nasir in Fl. W. Pakistan 20: 126 (1972); *A. archangelica* L. subsp. *himalaica* (Clarke) G. Singh in Forest Fl. Srinagar 183 (1987); *A. archangelica* L. subsp. *himalaica* (Clarke) G. Singh & G. M. Oza in Bull. Bot. Surv. India 16(14): 168 (1974 publ. 1977); *A. archangelica* L. f. *himalaica* (Clarke) Weinert, Feddes Repert. 84 (4): 310 (1973).
Typus: "Hab. in Alpibus Lapponiae, ad rivulos" Linn.

Fig. 1. *Angelica archangelica* L. **A**, General view in the natural habitat. **B**, Fruit. **C**, Inflorescence. Photo G. Kaynak, BULU 28222).

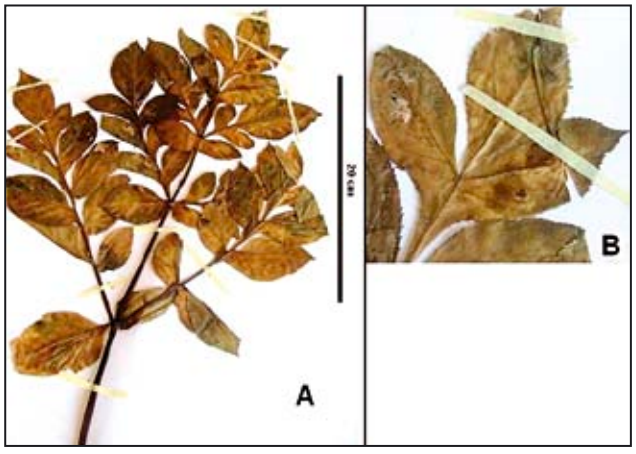

Fig. 2. Basal leaf (**A**) and ultimate segment of leaf (**B**) of *A. archangelica* (BULU 20389).

Herb. 354.1 (LINN). **Lectotype:** sel. by Reduron, Nordic J. Bot. 22: 83 (2002).

An erect perennial with pungent odour. Roots long, thick and fleshy. Stems up to 2 m, with ridges and grooves, hollow and tinged with purple, not glaucous. Basal leaves very large, 2-pinnate, glabrous. Primary leaflets 4–9 × 2–4.5 cm, angle to rachis 40–55°, ovate to elliptic, acutely serrate, acuminate; irregular in outline and incised, often distinctly decurrent on the rachis. Ultimate leaf segments 8.5–12 × 5.5–10 cm, with 3 acuminate to obtuse and distinctly decurrent lobes, sessile, usually doubly serrate, with acute to acuminate teeth; base attenuate to cordate; apical lobe 4.5–7.0 × 2.0–3.5 cm. Cauline leaves 2-pinnate, *ca*. 11 × 10 cm and with petioles strongly sheated at the base. Upper leaves reduced to inflated sheaths, which enclose the developing umbels. Umbels globose, 10–20 cm across. Peduncles 2–22 cm, stout, glabrous. Bracts absent. Umbellules 30–40, 30–70-flowered, 1–3.5 cm diam. Pedicels 0.3–1.7 cm, papillose all over. Bracteoles 8–13, persistent, linear, 0.8–1 × 0.2–0.7 mm, glabrous or papillose. Sepals 0.2 mm. Petals 1.5–2.0 × 1.0 mm (excluding the *ca*. 0.5 mm long acuminate and incurved tip), olive-green to cream, ovate, cordate at base. Filaments 2.0–4.0 mm; anthers 0.8–0.9 mm. Fruits oblong, slightly dorsiventrally flattened, glabrous. Mericarps 6–9 × 3.0–4.5 mm (excluding lateral ridges); dorsal ridges prominent and acute, the lateral ones developed as 0.2–0.8 mm wide wings (marginal wings) measured from the lateral veins.

Chromosome number. $2n = 2x = 22$.

Habitat. On damp rocks and at watersides, under mixed forest of *Pinus nigra-Fagus orientalis,* between 1450–1700 m, in Mt Uludağ, Turkey.

Phenology. Flowering in June, fruiting July–August.

General distribution. N & NE Europe, Himalayas in India, Pakistan, Nepal, former USSR and NW Turkey.

Specimens examined: (Europe) unspecified, (B, digital image!). (Turkey). A2 (A) Bursa: Uludağ Mt; Keles, above Pınarcık village, on damp rocks, 1450–1500 m, 2003.07.09, *G. Kaynak, R. Daşkın* & *Ö. Yılmaz*, BULU 17338; İnegöl, Kıranköy village to Kıran Plataeu, at watersides, 1700 m, 2004.07.20, *G. Kaynak, R. Daşkın* & *Ö. Yılmaz*, BULU 20389; above Pınarcık village to Dutçalık Locality, 7. km, on damp rocks, 1450–1500 m, 2006.07.17, *G. Kaynak, R. Daşkın* & *K. Daşkın*, BULU 28222.

Discussion

There are no earlier records of *Angelica archangelica* from Turkey before this study. A comparison between our findings and the accounts given in *Flora Europaea* (Cannon 1968), *Flora Nordica* (Fröberg 2009) and *Flora of West Pakistan* (Nasir 1972) was made (Table 1). As can be seen from the Table, the species shows a variation in the length of peduncles, pedicels, bracteoles, and petal colour, as well as in the features of umbel rays and fruit. The species is native to N and NE Europe, South Greenland, N and C. Siberia, the Himalayas in India, Pakistan, and Nepal (Fig. 3). A big gap exists between the European and Asian continents in the distribution of the species. The population recorded from Uludağ (NW Turkey) is important, because it supports a connection between the European and Himalayan populations. The northern part of Uludağ is similar to Europe in terms of habitat and ecological conditions. The fact that the Euro-Siberian elements are dominant and that some species originating from Europe are present in the mountain verify this opinion (Daşkın & al. 2006; Daşkın & al. 2007; Daşkın & Kaynak 2010a, b, 2011).

The species is close to *A. sylvestris* but mainly differs in its more irregular and incised, acutely serrate and decurrent on rachis leaf lobes, distinctly decurrent and 3-lobed ultimate segments, greenish to cream or whitish flowers, and fruits with rather thick mericarps (Cannon 1968; Fröberg 2009). The genus *Angelica* has fruits comprising two homomorphic mericarps that are laterally compressed and is one of the genera in the family Apiaceae that have fruits with marginal wings (Liu & al. 2006). Transverse sections of the fruit of *A. sylvestris* and *A. archangelica* show that the mericarps of *A. archangelica* are thicker, its marginal wings

Table 1. A comparison of selected characters of *Angelica archangelica* in this study with different Floras.

Characters	This study	Flora Europaea	Flora Nordica	Flora of W Pakistan
Leaves	2-pinnate	2-pinnate to ternate	2-pinnate to ternate	2–3 pinnate
Leaf lobes	4–9 × 2–4.5 cm ovate to elliptic	not indicated	not indicated	4–15 × 2–3 cm lanceolate to ovate
Ultimate leaf segments	8.5–12 × 5.5–10 cm 3-lobed, decurrent	not indicated 3-lobed, decurrent	6.5–13 × 8–17 cm with shallow sinuses	not indicated with decurrent bases
Peduncle length	2–22 cm	not indicated	10–13 cm	8–15 cm
Number of bracts	0	0–few	0–8	not indicated
Umbel rays	30–40, glabrous	numerous, puberulent	22–54, papillose	15–40, not indicated
Pedicel length	3–17 mm	not indicated	9–15 mm	5–8 mm
Number of bracteoles	8–13	not indicated	2–13	not indicated
Bracteole size	0.8–1 × 0.2–0.7 mm	not indicated	2.5–18 × 0.2–15 mm	not indicated
Number of flowers/ umbellule	30–70	not indicated	34–68	numerous
Petal colour	olive-green to cream	greenish-white to cream	green-grey to olive or white to greenish-white	white
Petal size (excl. petal tip length)	1.5–2 × 1 mm	not indicated	1–1.9 ×0.7–1.4 mm	not indicated
Fruit shape	oblong	oblong to elliptic	broadly oblong or rectangular	oblong to sub-quadrate
Fruit size	6–9 × 3–4.5 mm	5–8 ×3.5–5 mm	3–9 × 1.1–2.2 mm	6–8 × 3–4 mm
Dorsal ridges of fruit	prominent acute	prominent or not acute to obtuse	prominent or not not indicated	prominent not indicated
Lateral ridges of fruit	with 0.2–0.8 mm wide wings	not indicated	with 0.2–0.9 mm wide wings	not indicated

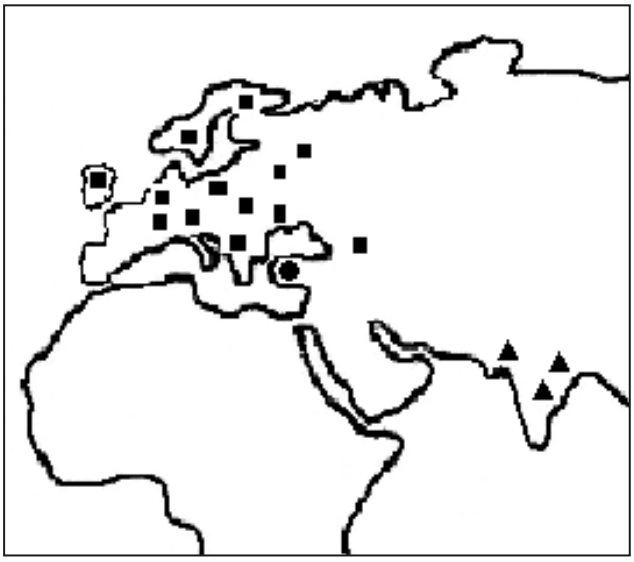

Fig. 3. Geographical distribution of *A. archangelica* L. across the world. N and NE Europe, South Greenland, N and C. Siberia (■), NW Turkey (●), India, Pakistan, and Nepal (▲).

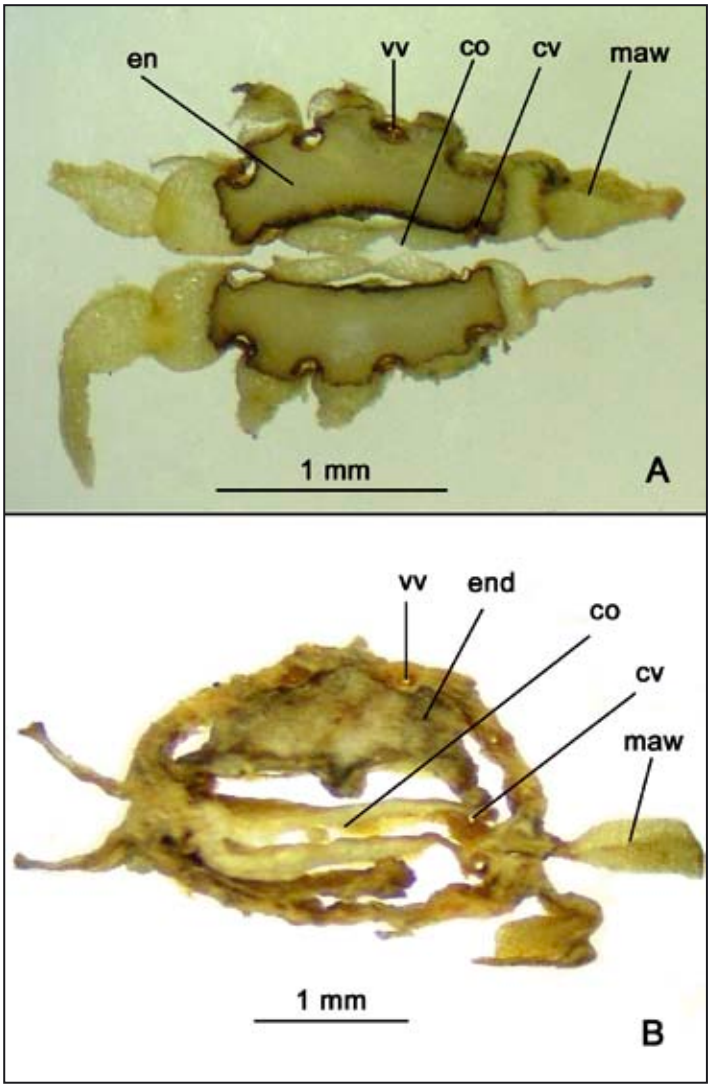

Fig. 4. Transverse sections of fruit of *A. sylvestris*, BULU 26232 (**A**) and *A. archangelica*, BULU 28222 (**B**). co – comissure; cv – commissural vitta; en – endosperm; maw – marginal wings; vv – valecular vitta.

are wider and the number of valecular vitta on each mericarp exceed that of *A. sylvestris* (Fig. 4).

Angelica archangelica is subdivided into two subspecies in *Flora Europaea* (Cannon 1968), *Flora Nordica* (Fröberg 2009). *Angelica archangelica* subsp. *archangelica* is distributed in the mountains and has long bracteoles and large fruits with acute ridges. On the contrary, *A. archangelica* subsp. *littoralis* (Wahlenb.) Thell. is distributed at seashore and has short bracteoles and small fruits with rounded ridges. A comprehensive investigation of the species taxonomy in Norway has indicated a correlation between habitat and fruit morphology in the southern, but not in the northern parts. Generally, the fruits are larger in subsp. *archangelica* than in subsp. *littoralis*. Furthermore, several characters, i.e. length/width ratio of the apical leaflet, number and size of bracteoles and petal colour, can be used in delimiting the two subspecies (Cannon 1968; Fröberg 2009). The species is known for the flora of W. Pakistan as *A. angelica* var. *himalaica* (Nasir 1972).

According to *Flora Nordica* (Fröberg 2009), *A. a.* subsp. *archangelica* is sweetly fragrant in taste, with rather easily compressed, not glaucous stem and petioles, elongated apical leaflet (length/width ratio 1.5–2.7), 8–13, 4–18 × 0.3–1(–1.5) mm large bracteoles, flowers with green-grey to olive-green petals, and fruits with 6–9 × 4–6 mm large mericarps. On the contrary, subsp. *A. a. littoralis* is sharp in taste, with a usually distinctly glaucous, hard stem and petioles, rounded apical leaflet (length/width ratio 1.2–1.6), 2–12, 2.5–5 × 0.2–0.4 mm large bracteoles, flowers with white to greenish white petals, fruits with 5–6.5 × 3.5–4.5 mm large mericarps. Since *A. archangelica* has been cultivated for a long time, many intermediates occur between the two subspecies. This makes difficult the taxonomy of the species. Therefore, our specimens can be classified as belonging to subsp. *archangelica,* according to the above-mentioned characters, but we assume that they are given at a species level in this paper.

As a result of this study, the total number of the *Angelica* species recorded from Turkey has increased to two. Distribution of these taxa in Turkey is shown in Fig. 5. The following key is offerred for the genus *Angelica* in Turkey:

1. Terminal leaf lobes coarsely dentate, usually simple and not decurrent; umbels rays puberulent; flowers pinkish-white .... ***A. sylvestris***

1a. Basal leaves lanceolate to ovate, with usually serrate ultimate segments; fruit wing 1–1.5 mm wide .... var. ***sylvestris***

1a*. Basal leaves ovate, with crenate ultimate segments, fruit wing 0.3–0.8 mm wide ..... var. ***stenoptera***

1*. Terminal leaf lobes acutely serrate, 3-lobed and distinctly decurrent; umbels rays glabrous; flowers greenish to cream ..... ***A. archangelica***

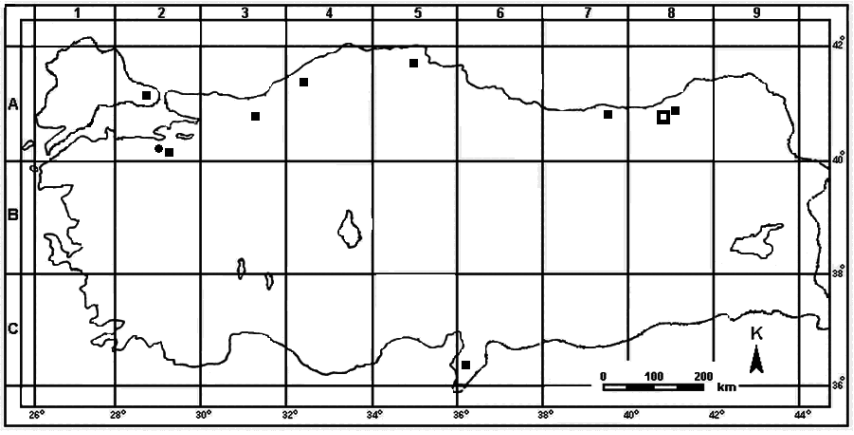

Fig. 5. Distribution of genus *Angelica* in Turkey. *A. sylvestris* L. var. *sylvestris* (■), *A. sylvestris* var. *stenoptera* Lallem. (□) and *A. archangelica* L. (●)

References

Cannon, J.F.M. 1968. *Angelica* L. – In: **Tutin, T.G. & al.** (eds), Flora Europaea. Vol. **2**. pp. 357-358. Cambridge Univ. Press, Cambridge.

Chamberlain, D.F. 1972. *Angelica* L. – In: **Davis, P.H.** (ed.), Flora of Turkey and the East Aegean Islands. Vol. **4**. pp. 431-432. Edinburgh Univ. Press, Edinburgh.

Daşkın, R. & Kaynak, G. 2010 a. Vascular flora of the Uludag Mt (Bursa, Turkey) I. – Phytol. Balcan., **16**(3): 367-384.

Daşkın, R. & Kaynak, G. 2010 b. Vascular flora of the Uludag Mt (Bursa, Turkey) II. – Phytol. Balcan., **16**(3): 385-411.

Daşkın, R. & Kaynak, G. 2011. Conservation status of five endemic species distributed in Northwest Turkey. – Phytol. Balcan., **17**(2): 213-219.

Daşkın, R., Yılmaz, Ö. & Kaynak, G. 2006. Presence of *Cirsium eriophorum* (L.) Scop. (*Asteraceae*) in Turkey. – Turk. J. Bot., **30**(6): 461-465.

Daşkın, R., Yılmaz, Ö. & Kaynak, G. 2007. A new record for the flora of Turkey: *Dactylorhiza maculata* (L.) Soó subsp. *maculata* (*Orchidaceae*). – U.U.J.Biol. & Envirom. Sci. (JBES), **1**-(1): 11-14.

Davis, P.H., Mill, R.R. & Tan, K. (eds). 1988. Flora of Turkey and the East Aegean Islands. Vol. **10**. Edinburgh Univ. Press, Edinburgh.

Güner, A., Özhatay, N., Ekim, T. & Başer, K.H.C. (eds). 2000. Flora of Turkey and the East Aegean Islands. Vol. **11**. Edinburgh Univ. Press, Edinburgh.

Fröberg, L. 2009. *Angelica* L. – In: Flora Nordica electronic version code 6 b. – http://www.floranordica.org/Review/-Review_public/accounts/Angelica.html (accessed 20.06.2009).

Liu, M.R., Plunkett, G.M., Lowry, P.P. II, van Wyk, B.E. & Tilney, P.M. 2006. The taxonomic value of wing types in the order *Apiales*.– Amer. J. Bot., **93**: 1357-1368.

Mabberley, D.J. (ed.). 2008. Mabberley's Plant-book. A portable dictionary of plants, their classification and uses. 3rd edit. Cambridge Univ. Press, Cambridge.

Nasir, E. 1972. *Angelica* L. – In: **Nasir, E. & Ali, S.I.** (eds), Flora of West Pakistan. Vol. **20**, pp. 126. Univ. of Karachi, Pakistan.

Shishkin, B.K. 1974. *Angelica* L. – In: **Shishkin, B.K.** (ed.), Flora of USSR. Vol. **17**, pp. 11-33. Translated from Russian by the Israel Program Scientific Translations Ltd, Jerusalem.