Ann. Bot. Fennici 48: 361–367 ISSN 0003-3847 (print) ISSN 1797-2442 (online)
Helsinki 30 August 2011 © Finnish Zoological and Botanical Publishing Board 2011

Bilacunaria aksekiensis (Apiaceae), a new species from south Anatolia, Turkey

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Received 1 Oct. 2009, revised version received 28 Apr. 2010, accepted 4 May 2010


A new species, Bilacunaria aksekiensis A. Duran & B. Doğan (Apiaceae), is described and illustrated from Anatolia, Turkey. It grows in open Pinus brutia forests and on calcareous stony slopes of the Taurus Mountains in the district of Akseki (C3 Antalya province). Bilacunaria aksekiensis is morphologically close to B. microcarpa. The diagnostic morphological characters of B. aksekiensis are discussed. In addition, the pollen characteristics and mericarp surface of B. aksekiensis and B. microcarpa are examined by SEM. The geographical distribution of the new species and the morphologically related species is mapped. Bilacunaria aksekiensis is diploid with the chromosome number of 22.


The genus Hippomarathrum was previously revised by Chamberlain (1972) for the Flora of Turkey. Traditionally Hippomarathrum is divided into two genera according to carpological differences (Pimenov & Tikhomirov 1983): Bilacunaria and Cachrys. Bilacunaria has four species, mainly distributed in Anatolia, Armenia, Cyprus, Iran, Israel, Transcaucasia and Syria (Davis 1972, Meikle 1977, Rechinger 1987, Shishkin 1950, Zohary 1987). Two of them, B. microcarpa and B. scabra, are distributed in the southeast and east Anatolia. The Mediterranean species of Hippomarathrum are placed in Cachrys (Pimenov & Tikhomirov 1983). That genus has two species in Turkey, C. crassiloba and C. cristata, which mainly grow in southwest and west Anatolia.

Bilacunaria differs from Cachrys primarily in its fruit characters. Bilacunaria species have almost round fruits with indistinct ridges and projections on the surface. In anatomical studies of the fruits of Bilacunaria, the cross-section appears round with two lacunae in the funiculus.
There are five ridges on each mericarp and five vascular bundles beneath the ribs. *Cachrys* species have oblong or ovate and relatively large fruits with conspicuous ridges and projections on the surface. *Cachrys* species do not have lacunae in the funiculus; however, there is sclerification throughout the mesocarp layer. Therefore, it is possible to distinguish *Bilacunaria* from *Cachrys* according to fruit characteristics (Pimenov & Tikhomirov 1983).

Turkey has two native *Bilacunaria* species: *B. microcarpa* and *B. scabra*, distributed in Anatolia. In this paper, a new species is added to the genus.

The *Bilacunaria* specimen did not have fruits when it was collected in 2005. Specimens with fruits were collected from the same locality in 2008. The specimens were not referable to any known *Bilacunaria* or *Cachrys* species. Therefore, it is possible to distinguish *Bilacunaria aksekiensis* from *Cachrys* according to fruit characteristics (Pimenov & Tikhomirov 1983).

Each provided numerical value is the average of ten measurements from different specimens. The specimens of *Bilacunaria aksekiensis* were examined and compared with specimens of the morphologically similar *B. microcarpa* and *B. scabra*.

Pollen grains were prepared for examination by light microscopy according to Wodehouse (1935), and the measurements were made with an Olympus BX-50 microscope. The pollen diameter measurements are based on ca. 50 samples and the other characters on approximately ten. For SEM study, the pollen grains and mericarp surfaces were coated with gold, and the micrographs were obtained using an Oxford Leo-440 microscope. The descriptive terminology of Erdtman (1969) was followed.

For the study of somatic chromosomes, root tips were obtained from germinated seeds, which were pre-treated in *a*-monobromonaphthalene overnight and then fixed in alcohol:acetic acid (3:1). Roots were hydrolyzed in 1 N HCl at 60 °C for 16 minutes and stained in Feulgen; in addition, squashes were made in 1% lactopropionic orcein. Permanent slides were made in Depex. Chromosome measurements were based on at least five metaphase plates.

**Bilacunaria aksekiensis** A. Duran & B. Doğan, sp. nova (Figs. 1–3)

*Species plantis perennibus; caulibus glabris; folis segmentatis 25–60 × 0.4–0.7 mm, glabris, apiculatis; radiis 7–22 mm longis, asperis; bracteis 4–5; petalis puberulis; stylis 4–6 mm longis; fructibus 5–6 × 6–6.5 mm, distincte aculeatis diversa.*

**Type:** Turkey. Antalya: Akseki, Çukurköy, Alçaktepe, Kocaöz vicinity, 920 m, 7.VIII.2005 A. Duran 7087 (holotype KNYA; isotypes GAZI, ANK, HUB, and Selçuk University, Herbarium of Education Faculty).

Perennial, monocarpic, 70–130 cm tall, thickened rootstock cylindrical-oblong, vertical, 3–6 cm in diameter. Stem stout, glabrous, sparsely or densely resinous at surface, distinctly sulcate, angular or ± terete, entirely much branched, with a weakly developed fibrous collar 3–6 cm long, 4–8 cm diameter at base, lower and middle stem sometimes slightly purplish. Basal leaves broadly oblong to obovate, verticillate, 50–75 × 40–60 cm (including petiole), petiolate with weakly developed sheath, lamina 5–7 pinnate, primary segments 3 and remote, ultimate segments linear, filiform, 25–60 × 0.4–0.7 mm, apiculate, glabrous. Petioles ± flattened, 12–17 cm long. Lower cauline leaves partly reduced, semiamplexicaule, broadly obovate in outline, 50–75 × 40–60 cm (including petiole), petiolo with weakly developed sheath, lamina 5–7 pinnate, primary segments 3 and remote, ultimate segments linear, filiform, 25–60 × 0.4–0.7 mm, apiculate, glabrous. Petioles ± flattened, 12–17 cm long. Lower cauline leaves partly reduced, semiamplexicaule, broadly obovate in outline, middle and upper cauline leaves gradually reduced to flowering parts, especially upper cauline leaves much reduced, sessile, sometimes slightly asperulous, 1–2 pinnate or few segments, or lobed to entire. Inflorescence much branched, the branches ascending to erect, alternate, opposite or in whorls 3 or more, upper flowering branches very dense, leaves at base of lateral branches reduced to oblong sheath. Flowers hermaphrodite. Umbels 5–8 rayed, rays 7–22 mm long, equal, asperulous; bracts 4–5, (3–)5–10(–15) × 0.8–1.2 mm, linear-lanceo-
late, acuminate, slightly asperulous, persistent. Umbellules 9–11-flowered, when ripe 2–9, 4–6 mm long, asperous. Bracteoles 5–8, 2–5 × 0.7–1 mm, linear-subulate, slightly asperulous. Sepals nearly obsolete, ca. 0.5 mm, ± rounded, yellow, minutely puberulent. Petals yellow, 0.7–1.0 × 0.8–1.0 mm, oblong, strongly incurved, puberulous externally. Stylopodium flattened, with an undulate margin, not embedded in corky pericarp; style clearly long, slightly curved at the upper part, graceful conical, minutely scabridulous especially lower part, 4–6 mm long; stigma capitate. Mericarps mostly well-developed, didymous or slightly unequal. Mature fruits 5–6 × 6–6.5 mm, broadly oblong, aculeate. Chromosome number: 2n = 22 (in holotype). Flowering June–July, fruiting July–August.

*Bilacunaria aksekiensis* appears to be endemic to south Anatolia and thus belongs to the East Mediterranean floristic element. The specimens were collected in Akseki (Antalya province), where the species appears to be rare.
and local (Fig. 4). *Bilacunaria aksekiensis* grows on calcareous stony slopes in open *Pinus* forest and scrubs of *Conringia grandiflora*, *Rhamnus nitidus*, *Cotinus coggyria*, *Rhus coriaria*, *Pistacia terebinthus* subsp. *terebinthus*, *Cercis siliquastrum* subsp. *hebecarpa*, *Colutea ciliica*, *Astragalus lusitanicus* subsp. *orientalis*, *Ononis viscosa* subsp. *breviflora*, *Crataegus monogyna* subsp. *monogyna*, *Ferulago cassia*, *Valeriana dioecorous*, *Xeranthenum annuum*, *Helichrysum pamphilicum*, *Styrax officinalis*, *Fraxinus ornus* subsp. *cilicica*, *Phlomis grandiflora* var. *grandiflora*, *Micromeria myrtifolia*, *Quercus infectoria* subsp. *boissieri*, *Q. coccifera*, *Ostrya carpinifolia* and *Piptatherum coerulescens*.

Mericarp surfaces and pollen grains of *B. aksekiensis* and *B. microcarpa* were studied by SEM. The mericarp surface of *B. aksekiensis* is aculeate whereas in *B. microcarpa* it is verrucose (Fig. 5). The pollen grain characteristics of *B. aksekiensis* and *B. microcarpa* are compared in Table 1 and Fig. 6.

*Bilacunaria aksekiensis* is clearly related to *B. microcarpa*, which is endemic in south Anatolia. The former differs from *B. microcarpa* mainly by the characters given in Table 2.

*Bilacunaria aksekiensis* also resembles *B.
scabra, which grows in southeast Anatolia, Cyprus and Syria. The former differs from B. scabra by its glabrous (vs. hairy) stems; not swollen nodes (vs. swollen); oblong–obovate, 5–7 pinnate basal leaves (vs. broadly oblong–obovate, 4–5 pinnate); umbels with 5–8 rays, 7–22 mm long, slightly asperous (vs. 4–5 rays, 10–20 mm long, ± unequal, scabridulous); slightly puberulous sepals (vs. papillose–puberulous); 4–6 mm long styles (vs. 1–3 mm long) and
oblong, 5–6 × 6–6.5 mm fruits (vs. globose, 4–5 × 4–5 mm).

*Bilacunaria aksekiensis* has 2n = 22, which is the basic number in the genus *Bilacunaria* (Fig. 7). Also *B. boissieri*, *B. microcarpa* and *B. scabra* have 2n = 22 (Pimenov & Vassilieva 1983).

Palaeopalynological data show that Anatolia had a dense vegetation cover in the last interglacial period. The topography of Turkey has changed many times since then, which resulted in different microclimates in the tectonic valleys (Gemici 1993). The Taurus Mountains are a botanically interesting area located in the Mediterranean phytogeographical region and very rich in local endemic plants (Duran et al. 2005). *Bilacunaria aksekiensis* grows in the Taurus Mountains, which are affected by the Mediterranean Sea (Fig. 2C). Recently several new species have been described from this region, including *Linaria dumanii*, *Arabis davisi*, *Centaurea antalyensis* (Özhatay & Kültür 2006), Chaerophyllum aksekiense (Duran & Duman 1999), *Tordylium ketenoglui* (Duman 2000), *Peucedanum isauricum* (Parolly & Nordt 2004), and *Astragalus antalyensis* and *A. cedricola* (Duran & Podlech 1999).

**Table 1.** Pollen morphology of *Bilacunaria aksekiensis* and *B. microcarpa*.

<table>
<thead>
<tr>
<th>Pollen morphology</th>
<th><em>B. aksekiensis</em></th>
<th><em>B. microcarpa</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>Polar axis (µm)</td>
<td>29.43 ± 1.2</td>
<td>29.24 ± 1.2</td>
</tr>
<tr>
<td>Equatorial axis (µm)</td>
<td>15.35 ± 1.1</td>
<td>13.99 ± 1.1</td>
</tr>
<tr>
<td>P/E</td>
<td>1.91</td>
<td>2.09</td>
</tr>
<tr>
<td>Exine thickness (µm)</td>
<td>1.43 ± 0.7</td>
<td>1.75 ± 0.7</td>
</tr>
<tr>
<td>Intine thickness (µm)</td>
<td>0.75 ± 0.2</td>
<td>0.81 ± 0.2</td>
</tr>
<tr>
<td>Shape</td>
<td>subprolate</td>
<td>perprolate</td>
</tr>
</tbody>
</table>

**Table 2.** A comparison of the diagnostic characters and fruit anatomy of *Bilacunaria aksekiensis* and *B. microcarpa*.

<table>
<thead>
<tr>
<th>Character</th>
<th><em>B. aksekiensis</em></th>
<th><em>B. microcarpa</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>Stem</td>
<td>glabrous</td>
<td>glabrous to ± slightly asperous obconical</td>
</tr>
<tr>
<td>Basal leaves</td>
<td>oblong-obovate</td>
<td>10–30 × 0.5–2 mm, ± hispidulous, acuminate</td>
</tr>
<tr>
<td>Terminal segments</td>
<td>25–60 × 0.4–0.7 mm, glabrous, apiculate</td>
<td>7–10 rays, 20–40 mm long, ± glabrous 5–8</td>
</tr>
<tr>
<td>Umbels</td>
<td>5–8 rays, 7–22 mm long, slightly asperous</td>
<td>glabrous</td>
</tr>
<tr>
<td>Bracts</td>
<td>4–5</td>
<td>1.5–2</td>
</tr>
<tr>
<td>Petals</td>
<td>outer surface puberulous</td>
<td>oblong-globose, 3–5 × 4–6 mm</td>
</tr>
<tr>
<td>Style length (mm)</td>
<td>4–6</td>
<td>obtuse-verrucose</td>
</tr>
<tr>
<td>Fruit shape</td>
<td>broadly oblong, 5–6 × 6–6.5 mm</td>
<td>horseshoe-shaped, tips of endosperm slightly curved</td>
</tr>
<tr>
<td>Fruit surface ornamentation</td>
<td>distinctly aculeate</td>
<td></td>
</tr>
<tr>
<td>Endosperms</td>
<td>horseshoe-shaped</td>
<td></td>
</tr>
</tbody>
</table>

**Additional specimens examined.** — *Bilacunaria aksekiensis* (paratypes): Turkey. C3 Antalya: Akseki, Çukurköy, Alçaktepe, Fireklidünek vicinity, 1000 m, 2005 A. Duran 7074 (KNYA, GAZI); ibid., 2005 A. Duran 7087 (KNYA); ibid., 2007 A. Duran and M. Öztürk 7498 (MR); Antalya: Akseki, Çukurköy, north of Kavzan Dağı, Saytaş vicinity, ca. 1150 m, 2008 A. Duran 8134 (MR). — *Bilacunaria microcarpa*: Turkey. A5 Amasya: Direkli, S. Peker 1545 (Gazi); A7 Gümüşhane: 1968, T. Baytop s.n. (ISTE); Erzurum: Aşkale-Bayburt road, A. Duran 6012 (MR); A9 Kars: between Karaorgan-Sarkamış, A. Duran 6825 (MR); B5 Yozgat: Akdağmadeni, T. Ekim & A. Değerli 4098 (ANK); B6 Kahramanmaraş: Gökşun-Sarız road, A. Duran 6867 (MR); B7 Erzincan: Erzincan-Sivas road, M. Dinç 2841 and
A. Duran (MR); B8 Bingöl: between Göymük-Kanlıova, T. Baytop 18267 (ISTE); B9 Ağrı: Tutak- Ağrı road, A. Duran 7531 (MR); C5 Niğde: Ulukışla, H. Ay 1001 (MR); C8 Mardin: Dargeçit-Midyat road, A. Duran 7958 (MR).

Acknowledgements

We express our thanks to TÜBİTAK (project no. TBAG-105T355) and The Scientific Investigation Projects Coordinator Office of The Selçuk University (project no. 05401046) for financial support.

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