



The Presence of *Berteroa incana* (L.) DC. in Turkey

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ABSTRACT

Berteroa incana (L.) DC. (Cruciferae) is cited in first supplement of Flora of Turkey from Çilingöz (Thrace). But according to our field and herbarium studies, it was understood that this specimen is *B. obliqua* not *B. incana*. For this reason in this study *B. incana* is given as a new record from Kars for the flora of Turkey. Detailed morphological description, including photograph, distribution map and pollen morphology are given.

Keywords: *Berteroa incana*, Cruciferae, Taxonomy, Palynology, Turkey

1. INTRODUCTION

The genus *Berteroa* DC. (Cruciferae) consists of five annual to perennial herb species distributed in Europe, Mediterranean zone and temperate Asia [1]. The first revision of the Turkish *Berteroa* species was performed by Cullen [2] in *Flora of Turkey and the East Aegean Islands* and he listed two species. Two species were added in the first supplement of Flora of Turkey [3]. The last revision was performed by Mutlu [4] in the *Türkiye Bitkileri Listesi* and the genus is represented by four species in Turkey (*B. incana* (L.) DC., *B. mutabilis* (Vent.) DC., *B. obliqua* (Sm.) DC., *B. orbiculata* DC.).

B. incana is generally reported as native to Europe, specifically east central Europe and west Asia. However, due to the introduction and naturalization of *B. incana* in many countries, determination of its

original area is difficult. It is widespread from central and eastern Europe to south eastern Siberia. It has spread into other parts of northern and western Europe and eastwards through Asia to China [5, 6]. *B. incana* became recognized as an invasive plant in North America when it began to proliferate in the 1950s and 1960s in forage crops harvested as hay [7, 8]. It is also considered an invasive alien in parts of Europe [9].

According to the Flora of Turkey *B. incana* is only known from Thrace region of Turkey. The species was collected by Hermann from the 2 localities in the Thrace. The first collection is from Tekirdağ province given as doubtful record and the second one is from Çilingöz (İstanbul province) [3].

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In this paper, *B. incana* is described and illustrated as a new species record for Turkey. In addition to the morphological description and distribution of the species in Turkey are given and also the pollen morphology were determined by taking into account the literatures of pollen morphology of Brassicaceae [10-15].

2. EXPERIMENTAL

The specimens were identified according to the relevant literatures [2, 3,16]. Voucher specimens are deposited at the herbarium of Gazi University Faculty of Science (GAZI) and İstanbul University Faculty of Pharmacy (ISTE).

Pollen slides were prepared using Wodehouse's technique [17]. These preparations were measured and photographed under the Leica ICC50 HD Light Microscope. Measurements were taken from at least 20 pollens for each morphological characteristic. For scanning electron microscopy (SEM), dry pollen grains were transferred onto stubs and then coated with gold. They were observed and photographed with a JEOL JSM 6060 Scanning Electron Microscope at Gazi University. The terminology of Faegri and Iversen [18], Punt et al. [19, 20] and Pinar et al. [12] was used. The class of pollen shape, based partly on P/E ratio, was identified using Erdtman's system [21].

3. RESULTS AND DISCUSSION

Berteroa incana (L.) DC., Syst. Nat. 2:291 (1821). (Figs. 1-5).

Syn: *Alyssum incanum* L., Sp. Pl. 2: 650 (1753). *Draba cheirifolia* Bergeret, Phytonom.Univ. 3: 89 (1786). *D. cheiranthifolia* Lam., Encycl. 2: 328 (1786). *D. cheiriformis* Lam., Encycl. 2: 328 (1786). *Farsetia incana* (L.) R. Br., Hortus Kew. 4: 97 (1812). *Vesicaria incana* Decv., J. Bot. Agric. 3: 171 (1815). *Draba cheirifolia* Bergius ex DC., Syst. Nat. 2: 291 (1821). *Berteroa stricta* Boiss., Diagn. Pl. Orient. II, 1: 35 (1854)

Biennial or perennial herbs. Stems terete, up to 70 cm, branched usually in upper half, hairs stellate and simple. Basal and median leaves subsessile, 2.5–3 x 0.5–1 cm, lanceolate to oblong, usually entire. Upper leaves similar to basal and cauline leaves, reduced to upwards, 0.7–1.5 x 0.1–0.4 cm. Raceme with siliculae appressed to rachis, often overlapping. Fruiting pedicels 4–6 mm, erect. Sepals 2–2.5 mm, ovate-lanceolate, stellate-pubescent, inner ones not saccate at base. Petals white, 4–6 mm, deeply bifid. Siliculae 3–6 x 2–4 mm, elliptic to broadly ovoid, inflated, with convex valves, pubescent and stellate hairs. Style 1–2 mm. Seeds 4–6 in each loculus, not winged, sometimes marginate, 1.5–1.75 x 1–1.5 mm, ovoid, dark reddish-brown, smooth.

Distribution: E. Europe, extending to Denmark and Italy, but precise native distribution uncertain owing to widespread introduction.

Turkey. NE Anatolia, A9 Kars: Boğazköy to Kars, edge of cultivated and fallow fields, roadsides, 1701 m,

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During the projects of "Revision of Turkish *Berteroa*" and "Determining the plant species distributed in lake area of Kars dam", many plant specimens were collected from different parts of Turkey in 2013. A specimen from Kars was determined as *Berteroa incana*. According to the Flora of Turkey, *B. incana* was collected only from Tekirdağ and İstanbul by Hermann. The herbarium vouchers (deposited in GAT, see Fig. 1) of Hermann were investigated and the sufficient materials were collected by second author from Tekirdağ and İstanbul (same as Hermann's localities). At the end of the identifications of Hermann's and our specimens, they were clearly recognised as *B. obliqua* not *B. incana*.

Berteroa species can be distinguished from other Cruciferae species with rounded seed pods by its stalkless, non-clasping stem leaves with entire margins, the dense star-shaped hairs, and by its small ovoid seed pods borne erect and close to the stem with a distinctive membranous partition [22-23]. Petals of *Berteroa* species, which are either pale yellow or white. *B. orbiculata* DC. is unique taxon which has pale yellow petals although all of the other species in Turkey has white petals. *Berteroa mutabilis* is also easily separated from the other *Berteroa* species by its glabrous fruits. *B. incana* is closely related to *B. obliqua*, which occurs in European part of Turkey (Thrace). It mainly differs from *B. obliqua* in its inflated silicula (not flat) and non-winged seeds (not broadly winged). Thus, our collection of *B. incana* is presented as a new record for Turkey.



Fig.1. The specimen of *Berteroa incana* in GAT herbarium from Çilingoz

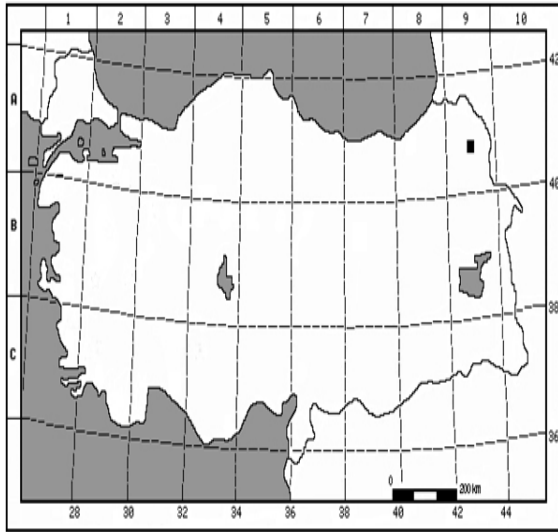


Fig.2. Geographical distributions of *Berteroa incana* (■) in Turkey.

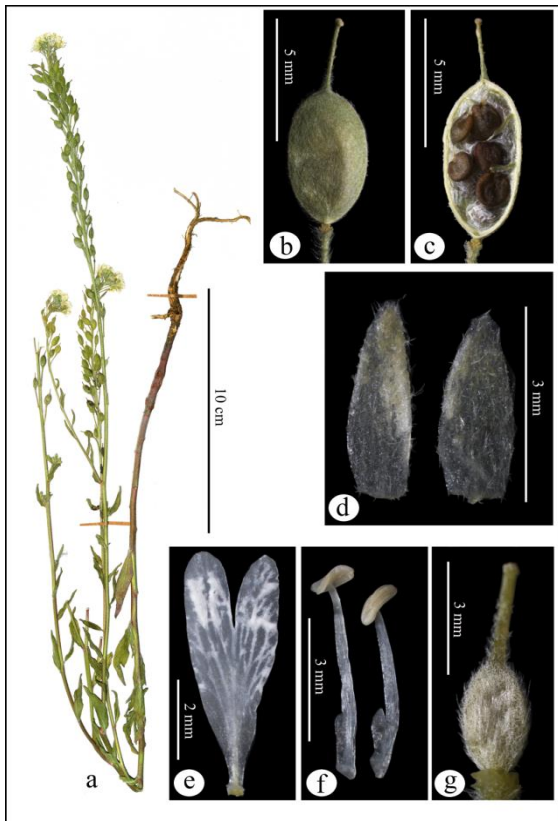


Fig.3. *Berteroa incana* a-Habit, b-Siliculae, c-Seeds, d-Calyx, e-Petal, f-Stamens, g-Pistil

The pollen grains of *B. incana* are tricolpate, radially symmetrical and isopolar. Their shape is subprolate with the polar axes $18.24\text{--}23.04\ \mu\text{m}$ and the equatorial axes $16.32\text{--}19.02\ \mu\text{m}$ (Fig. 4a, 4b). The outline is elliptic in the equatorial view and circular in the polar view. The colpi are linear; Clg $16.08 \pm 1.4\ \mu\text{m}$ and Clt $1.74 \pm 0.14\ \mu\text{m}$. Amb is $17.08 \pm 0.74\ \mu\text{m}$, apocolpium width is $7.61 \pm 0.79\ \mu\text{m}$ (Fig. 4c, 4d). The intine is 0.72

$\pm 0.17\ \mu\text{m}$ thickness. The exine is semitectate and $1.01 \pm 0.1\ \mu\text{m}$ thickness. Exine sculpturing is reticulate in the meridional and polar optical sections. The lumina is polygonal, nearly rounded or amorphous in shaped and is $0.48\text{--}1.43\ \mu\text{m}$ in diameter. The murus diameter is $0.26\text{--}0.45\ \mu\text{m}$ (Fig. 5a, 5b).

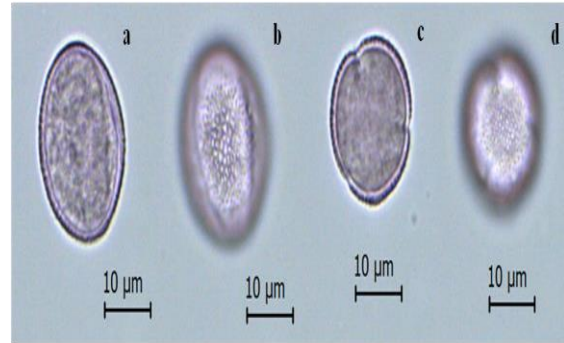


Fig.4. Light microscopy micrographs of pollen grains of *Berteroa incana*. a-Equatorial view, b-Ornamentation (Equatorial), c-Polar view, d-Ornamentation (Polar)

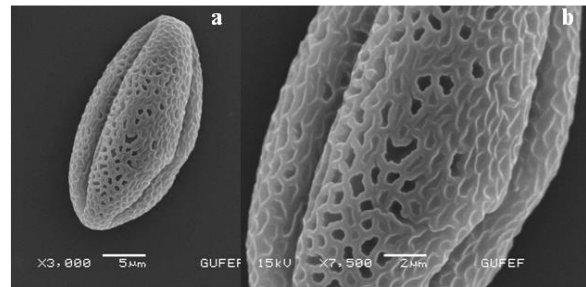


Fig.5. Scanning electron microscopy micrographs of pollen grains of *Berteroa incana*. a-Equatorial view, b-Exine ornamentation.

Brassicaceae is a stenopalynous family, the pollen grains are usually tricolpate and reticulate [11, 24-26]. The pollen grains of *B. incana* are tricolpate, isopolar, reticulate exine with polygonal, nearly rounded or amorphous lumina. Pinar et al. [12] determined 2 types of reticulate pollen ornamentations in which the lumen shape is either irregular and amorphous or regular and polygonal in *Hesperis* taxa. Pollen shape of *B. incana* is subprolate. Lahham and Aleisawi [27] observed prolate and subspheroidal; Anchev and Deneva [10] found prolate spheroidal, subprolate and prolate and Rollins and Banerje [28] reported that prolate, spheroidal and subprolate pollen shape in the studied Brassicaceae taxa.

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CONFLICT OF INTEREST

No conflict of interest was declared by the authors.

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