

A New Species of *Draba* (Brassicaceae) from North Anatolia, Turkey

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ABSTRACT. *Draba anatolica* A. Duran & Dinç, a new species of Brassicaceae collected from Kastamonu province in North Anatolia, Turkey, is described and illustrated. The species grows on rocky crevices and stony slopes in Ilgaz Mountain National Park. It is related to *D. siliquosa* M. Bieberstein, from which it mainly differs in its densely stellate-pubescent fruit, the 10- to 20-flowered inflorescence, the stellate-pubescent stems with five to eight leaves, the petals 4.5–5 mm long and sparsely stellate-pubescent externally, and the pubescent, 8–10 mm, fruiting pedicel. The ecology, biogeography, and conservation status of the species are discussed. Fruit and seed coat surface micromorphology of *D. anatolica* are examined by SEM, and the chromosome number and morphology are determined, with $2n = 16$.

Key words: Alysseae, Brassicaceae, *Draba*, IUCN Red List, North Anatolia, Turkey.

Draba L. is the largest genus in the Brassicaceae and includes about 300 species distributed in north temperate and arctic regions and in the mountains of Central and South America (Hedge, 1968; Hickey & King, 1997; Tan & Stevanović, 2002). Recently, eight new taxa have been described, and the number of *Draba* species in the world has been increased (Al-Shehbaz, 2002, 2004). Ecologically, most species grow in open, rocky, or gravelly places (Walters & Akeroyd, 1993). The genus was previously revised by Coode and Cullen (1965) for the *Flora of Turkey*, with 16 species. Two more *Draba* species have since been added to the Turkish flora, *D. terekemensis* Yıldırımli and *D. narmanensis* Yıldırımli. (Yıldırımli, 2000). This paper describes and illustrates another new *Draba* species from Turkey.

The authors collected the type specimens from Ilgaz Mountain National Park in North Anatolia in 2006. On close examination, the authors concluded that these specimens clearly differed from related *Draba* in Turkey. Based on a study of the literature (Coode & Cullen, 1965; Hedge, 1968; Tolmachev, 1970; Yıldırımli, 2000; Tan & Stevanović, 2002) and herbarium specimens of *D. siliquosa* M. Bieberstein, the authors conclude that the specimens represent a new species.

MATERIAL AND METHODS

Each numeric value in the species description is the average of 10 measurements from different specimens of the new species (*A. Duran* 7372 & *M. Dinç* and *M. Dinç* 2982 & *A. Duran*) from the type locality. For fruit and seed micromorphology, SEM images were taken with a JSM-5600 microscope (JEOL, Tokyo, Japan). The descriptive terminology of Brochmann (1992) has been followed. For cytogenetic study, root tips from germinated seeds were pretreated with α -mono-bromonaphthalene at 4°C for 16 hours, fixed in ethanol:acetic acid (3:1) overnight, and then stored at 4°C. Fixed root meristems were hydrolyzed in 1 N HCl for 21 minutes at room temperature, and chromosomes were stained with 2% aceto-orcein. The classification of chromosomes, the length of long and short arm, arm ratio, centromeric index, and relative chromosome length were measured by Image Analysis System (BAB Bs200ProP Image System software, BAB Mühendislik Müh., Turkey). Chromosomes were classified using the nomenclature of Levan et al. (1964).

SPECIES OF *DRABA*

Draba anatolica A. Duran & Dinç, sp. nov. TYPE: Turkey. Kastamonu: Ilgaz Mtn., Büyük Hacetepe, rock crevices, 1750 m, 10 July 2006, *A. Duran* 7372 & *M. Dinç* (holotype, KNYA; isotypes, GAZI, HUB). Figures 1, 2.

Haec species *Drabae siliquosae* M. Bieberstein affinis, sed ab ea planta omnino stellato-pubescente (non supra vel omnino glabra), foliis caulinis 5 ad 8 (non 0 ad 3), racemis 10- ad 20-floris (non 4- ad 8-floris), pedicellis fructiferis 8–10 mm longis stellato-pubescentibus (non 2–6 mm glabris), petalis 4.5–5 mm longis extus sparse stellato-pubescentibus (non 2–4 mm longis extus glabris), fructu dense stellato-pubescente (non glabro) atque stylo 1–1.3 mm longus (non usque ad 0.4 mm) differt.

Perennial, cushion-forming herbs, 8–16 cm tall, stellate-pubescent throughout; caudex branched, 1.5–2.5 mm diam., with sterile rosettes, covered with leaf remains of previous years; trichomes mostly stalked-stellate, 4-branched, rarely forked or simple, 0.1–0.2 mm diam.; stems erect, unbranched, pubescent. Sterile rosette leaves densely imbricate, sessile,

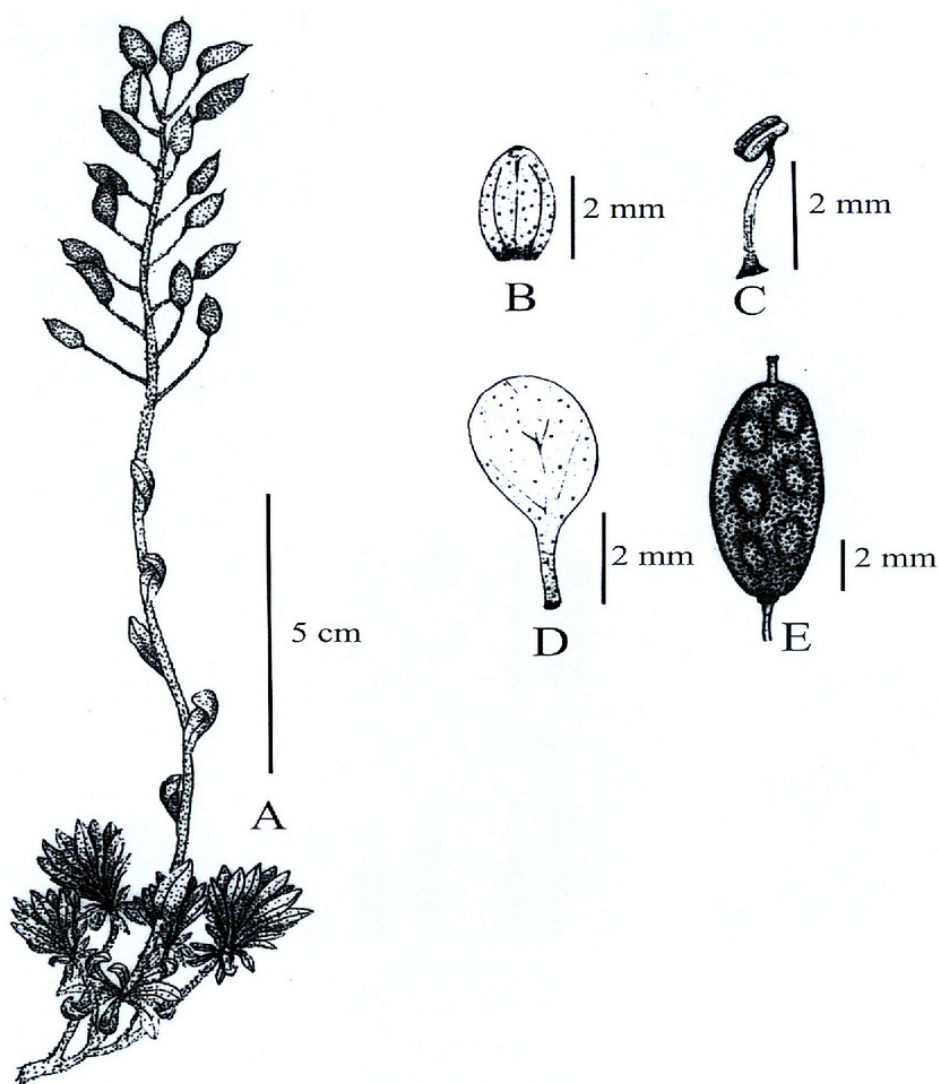


Figure 1. *Draba anatolica* A. Duran & Dinç. —A. Plant. —B. Sepal. —C. Stamen. —D. Petal. —E. Fruit. A, E drawn from the holotype Duran 7372 & Dinç (KNYA); B–D drawn from the isotype Duran 7372 & Dinç (HUB).

narrowly oblanceolate-spatulate, entire, distinctly 1-veined, $10\text{--}15 \times 1\text{--}2.5$ mm, stellate-pubescent and ciliate with long simple trichomes at the base; basal leaves rosulate, sessile, persistent, oblanceolate, $5\text{--}12 \times 2\text{--}3$ mm, pubescent with stellate trichomes and ciliate with long simple trichomes only at basal margins, base narrowly cuneate, margin entire, apex acute; cauline leaves decreasing in size toward inflorescence, 5 to 8, sessile, not similar to basal leaves, oblong to oblong-lanceolate, mostly entire or rarely minutely few-toothed, $8\text{--}14 \times 1\text{--}4$ mm. Racemes 10- to 20-flowered, ebracteate, elongated in fruit; fruiting pedicel equal or longer than fruit, 8–10 mm, divaricate, stellate-pubescent. Sepals ovate-oblong, pale green, $2.5\text{--}3 \times 1.25\text{--}1.5$ mm, erect, externally sparsely pubescent with stellate trichomes; petals white, spatulate, $4.5\text{--}5 \times 2\text{--}2.5$ mm, externally sparsely pubescent with stellate trichomes, apex rounded; claw 2.5–3.5 mm; stamens with filaments 2–2.5 mm, dilated at the base; anthers linear-oblong,

0.6–0.7 mm. Fruit oblong, $6\text{--}8 \times 2.3\text{--}3$ mm, densely stellate-pubescent, compressed parallel to septum, slightly twisted; valves pubescent with mostly 4-branched, rarely forked trichomes, base and apex subacute; persistent style 1–1.3 mm, glabrous; seeds 6 to 10, brown, ovate, biseriate.

The seed coat of *Draba anatolica* was studied by SEM. The seeds average $1.3\text{--}1.4 \times 0.8\text{--}0.9$ mm, with alveolate-reticulate surface ornamentation. The reticulum is rectangular or polygonal in shape, and $15\text{--}25$ μm diam. The thickness of the reticulum wall is $2.5\text{--}3.2$ μm , and the lumen is not warty (Fig. 2).

Chromosome number. The somatic chromosome number and morphology of *Draba anatolica* were studied and determined as $2n = 16$. Total chromosome length ranges from $1.41\text{--}2.58$ μm . Chromosomal classification is given in Table 1. The total length of the haploid set is 15.90 μm . The eight chromosome pairs of the new species were found to be five metacentric and three submetacentric.

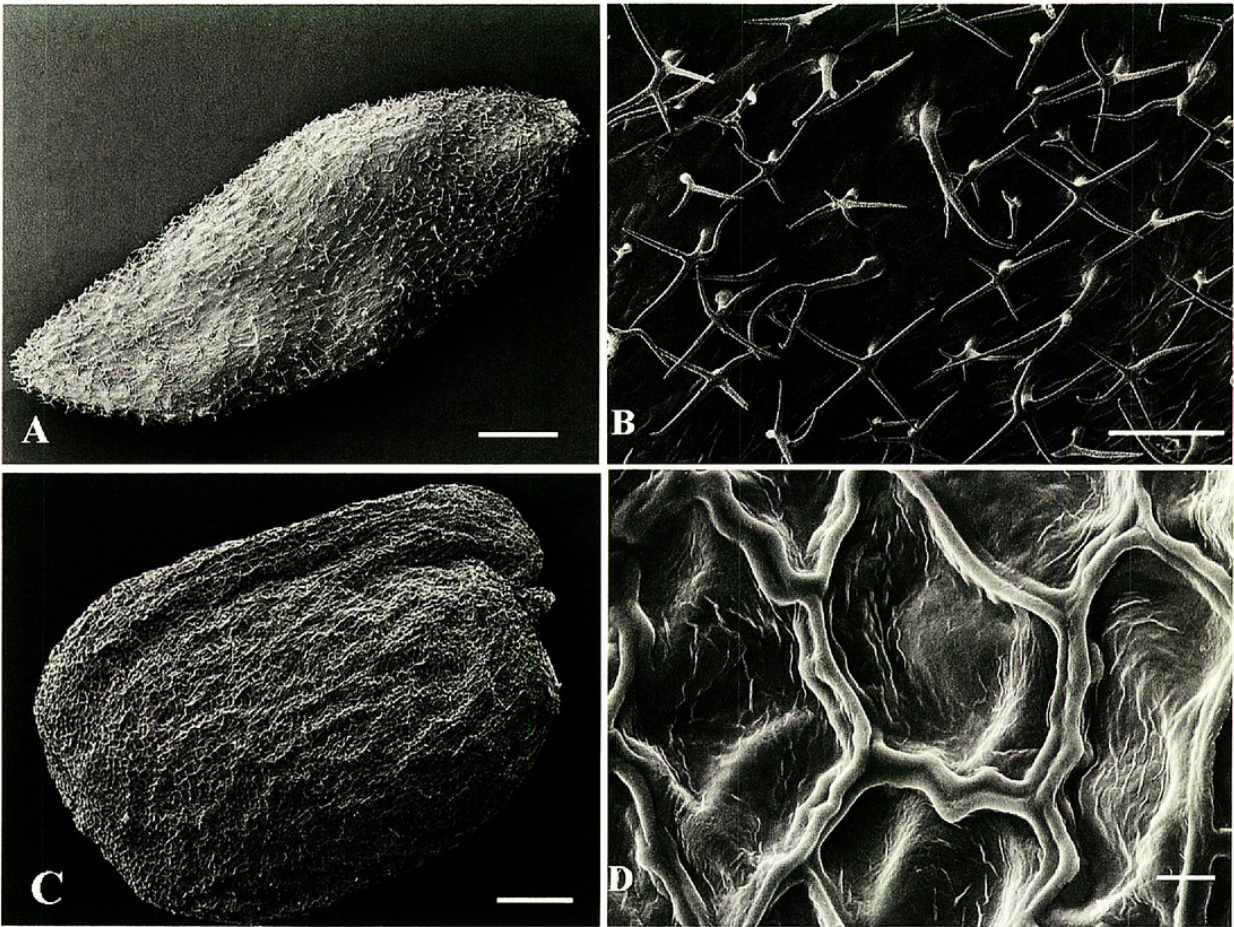


Figure 2. *Draba anatolica* A. Duran & Dinç. A, B. SEM images of fruit. —A. General view. —B. Surface details. C, D. SEM images of seeds. —C. General view. —D. Surface details. Scale bars: A = 1 mm; B, C = 200 µm; D = 5 µm.

Distribution and ecology. *Draba anatolica* is endemic to the Euro-Siberian region. It has only been collected at the type locality in Ilgaz Mountain National Park in North Anatolia. According to field investigations, one population of the new species was found, with approximately 100 mature individuals observed on rocky sites at 1750–1800 m. Associates of the new species included *Juniperus nana* Willdenow, *Genista vuralii* A. Duran & Dural, *Ranunculus illyricus* L. subsp. *illyricus*, *Asyneuma virgatum*

(Labillardière) Bornmüller, *Jasione supina* Sieber, and *Aster alpinus* L.

IUCN Red List category. *Draba anatolica* appears to be known only from the present locality, and its estimated area of occupancy is less than 10 km² with a population of less than 100 individuals. Because of its localized distribution and small population size, the new species should be considered Critically Endangered (CR) according to IUCN Red List criteria (IUCN, 2001).

Table 1. Measurements (µm) of somatic chromosomes in *Draba anatolica*, 2n = 16.

Chromosome pair no.	Chromosome arms (µm)		Total length* (µm)	Arm ratio (L/S)	Relative length (%)	Chromosome type
	Long arm (L)	Short arm (S)				
1	1.81	0.77	2.58	2.33	16.22	submetacentric
2	1.29	1.03	2.32	1.25	14.56	metacentric
3	1.37	0.86	2.23	1.59	14.02	metacentric
4	1.29	0.77	2.06	1.66	12.95	metacentric
5	1.34	0.65	1.99	2.00	12.92	submetacentric
6	0.98	0.77	1.76	1.26	11.03	metacentric
7	0.94	0.55	1.50	1.72	9.40	submetacentric
8	0.77	0.64	1.41	1.21	8.90	metacentric

* Total length of haploid complement: 15.90 µm.

Table 2. Diagnostic characters of *Draba anatolica* A. Duran & Dinç compared with *D. siliquosa* M. Bieberstein. Measurements for *D. siliquosa* were taken from *Flora of Turkey and the East Aegean Islands* (Coode & Cullen, 1965), *Flora Iranica* (Hedge, 1968), *Flora Hellenica* (Tan & Stevanović, 2002), and *Flora of the USSR* (Tolmachev, 1970), and from A. Güner 4932 (HUB) and Demirkuş 3499, 3550 (HUB).

Character	<i>D. anatolica</i>	<i>D. siliquosa</i>
Stems	8–16 cm tall, stellate-pubescent throughout	2–15 cm tall, glabrous throughout or plants stellate-pubescent below and glabrous above
Leaves	sessile, basal ones entire, cauline ones mostly entire or rarely minutely few-toothed, with stellate trichomes	petiolate, dentate or serrate, with forked and stellate trichomes
Basal leaves	oblongeolate, densely pubescent	elliptic to linear-lanceolate, glabrous or pubescent
Cauline leaves	5 to 8	0 to 3
Petals	4.5–5 mm, sparsely stellate-pubescent externally	2–4 mm, glabrous externally
Inflorescence	10- to 20-flowered	4- to 8-flowered
Fruiting pedicel	8–10 mm, stellate-pubescent	2–6 mm, glabrous
Fruit	6–8 × 2.3–3 mm, densely stellate-pubescent with persistent style 1–1.3 mm	3–10 × 1.5–2 mm, glabrous with persistent style to 0.4 mm

Phenology. *Draba anatolica* was found flowering from May to June, and fruiting from June to July.

Discussion. The genus *Draba* (Brassicaceae), in which specific differences are often slight, is well known for its notorious taxonomic complexity, particularly in arctic-alpine areas (Hedge, 1968; Tolmachev, 1970; Walters & Akeroyd, 1993). Extensive range expansion during interglacial intervals, coupled with autogamy and sibling species formation at the diploid level, as well as multiple origins of allopolyploids and interploidal gene flow, have resulted in blurred morphological and geographic relationships in the genus (Brochmann, 1992; Widmer & Baltisberger, 1999). Due to polyploidy, *Draba* species have diverse base chromosome numbers ($x = 6, 7, 8, 9, 10, 12$, and 15) and diploid chromosome numbers ($2n = 12, 16, 20, 24, 28, 30, 32, 36, 40, 42, 48, 52, 54, 56, 60, 64, 72, 76, 80, 96, 100, 112, 120$, and 128) (Warwick & Al-Shehbaz, 2006). However, the basic chromosome number of the genus is mostly $x = 8$ (Brochmann et al., 1992). The basic chromosome number of *D. anatolica* corresponds with $x = 8$, and its diploid chromosome number is $2n = 16$. Its closest relative, *D. siliquosa*, shares a similar somatic chromosome number (Tischler, 1950).

The nature and density of the indumentum are often used in the taxonomy of *Draba* (Walters & Akeroyd, 1993). The morphological separation between some *Draba* species has commonly relied on a single character, absence versus presence, respectively, of stellate hairs on a vegetative organ (Coode & Cullen, 1965; Hedge, 1968; Tolmachev, 1970; Mulligan, 1974; Rollins, 1993; Walters & Akeroyd, 1993). Molecular studies of *Draba* have indicated that even single indumentum characters that separate *Draba* species are taxonomically significant (Scheen et al., 2002). In particular, fruit indumentum has been commonly used for the classification of *Draba* species

as a definitive character (Coode & Cullen, 1965; Hedge, 1968; Walters & Akeroyd, 1993; Tan & Stevanović, 2002). Although *D. siliquosa* is a variable species for vegetative characters such as plant length, sepal size, pedicel length, and leaf indumentum, it is invariable with regard to its glabrous fruits (Coode & Cullen, 1965; Hedge, 1968; Tolmachev, 1970; Walters & Akeroyd, 1993). *Draba anatolica* can be readily distinguished from *D. siliquosa* by its densely stellate-pubescent fruit.

Otherwise, *Draba anatolica* is similar to *D. siliquosa*, a species distributed in Turkey (Gümüşhane, Trabzon, Artvin, and Rize provinces), the Caucasus, Iran, and Central and Southern Europe (Coode & Cullen, 1965; Walters & Akeroyd, 1993). Both species are perennial with leafy stems, ciliate leaves, and white flowers. In addition to the fruit indumentum, *D. anatolica* is easily distinguished by having a pubescence with mostly stellate trichomes throughout the plant, 5- to 8-leaved stems, a 10- to 20-flowered inflorescence, fruiting pedicels 8–10 mm long, and petals 4.5–5 mm long and externally sparsely pubescent. In contrast, *D. siliquosa* has both forked and stellate trichomes, 0- to 3-leaved stems that are partially pubescent or glabrous, a 4- to 8-flowered inflorescence, fruiting pedicels 2–6 mm long, petals 2–4 mm long and glabrous, and fruits glabrous and elliptic to linear-lanceolate (Table 2).

Paratype. TURKEY. **Kastamonu:** Ilgaz Mtn., Büyük Hacettepe, rock crevices, 1750 m, 25 June 2007, *M. Dinç* 2982 & *A. Duran* (KNYA).

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