

Dianthus nezahataiae (Caryophyllaceae), a new species from Northwest Turkey

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Abstract – Some *Dianthus* specimens collected from Sakarya and Bolu Provinces (Turkey) are proposed as a new species. *Dianthus nezahataiae* Hamzaoğlu (Caryophyllaceae) is naturally distributed in subalpine meadow habitats in the altitude range of 1450 and 1620 m a.s.l. *Dianthus nezahataiae* differs from *D. akdaghensis* Gemici et Leblebici because its inner bracts are 1.7–2.1 mm wide, the apex of the epicalyx scales is attenuate–rounded, the petal collar is almost half of the claw width, and the capsule is longer than calyx. This paper gives a description of the species, a comparison with a close taxon, photographs, the distribution map, and its habitat preference.

Keywords: *Carthusiani*, *Dianthus*, new species, NW Turkey, taxonomy

Introduction

Although *Dianthus* L. (carnation) does not have as many taxa as *Silene* L., it is a well-known genus of the Caryophyllaceae family owing to its showy flowers and ornamental plants (e.g., carnation: *Dianthus* spp.) (Greenberg and Donoghue 2011, Madhani et al. 2018). It is easily distinguished from similar genera (e.g., *Petrorhagia* (Ser.) Link, *Saponaria* L., *Velezia* L.) through its multi-veined calyx, tightly arranged epicalyx scales, two styles and peltate seeds with a facial hilum. *Dianthus* L. is represented by about 350 species in the world, and the majority of them grow in the temperate climate zone of Eurasia (Bittrich 1993, WFO 2021).

Boissier (1867) in “Flora Orientalis” described the genus *Dianthus* L. in 5 sections as *Verruculosi* Boiss., *Leiopetali* Boiss., *Fimbriati* Boiss., *Dentati* Boiss. and *Carthusiani* Boiss. Williams (1893) divided the genus *Dianthus* L. into three subgenera (*Carthusianastrum* F.N.Williams, *Caryophyllastrum* F.N.Williams, *Proliferastrum* F.N.Williams), 8 sections and 19 subsections, together with the sections given by Boissier. Among these sections, species in the *Carthusiani* (Boiss.) F.N.Williams section are characterised by leaf sheaths three times as long as they are wide, unbranched stems, sessile flowers and head-shaped inflorescences (Reeve 1967, Greenberg and Donoghue 2011). Our study gives a detailed description, images, habitat preference and the distribution

of the newly described species from the *Carthusiani* (Boiss.) F.N.Williams section. Along with the new species described here, the number of the species in the *Carthusiani* (Boiss.) F.N.Williams section are increased to 11, thus the taxa in the genus *Dianthus* L. in Turkey is increased to 93 (85 species) (Davis et al. 1988, Gemici and Leblebici 1995, Güner 2000, Aytaç and Duman 2004, Özhatay and Kültür 2006, Vural 2008, Yılmaz et al. 2011, İlçim et al. 2013, Hamzaoğlu et al. 2014, 2015a, b, c, 2017, 2018, 2020, 2021, Hamzaoğlu and Koç 2015, 2018, 2019, Deniz et al. 2016, Oskay 2018, Hamzaoğlu 2020).

Materials and methods

The new species was first collected by the second author (S.S.Kanoğlu) in July 2009, Davlumbaz Platue, in Bolu Province (NW Turkey), while doing the flora fieldwork for the Sülüklügöl Nature Reserve Project (Kanoğlu et al. 2016). In total 2 herbarium specimens (5 individuals) of the presumed new species were collected from two adjacent localities and deposited in the herbarium of DUOF, but these specimens were misidentified. After the senior author (E.Hamzaoğlu) made a careful examination and comparison of the specimens in DUOF, it was realized that the specimens belonged to a new, undescribed species of the genus *Dianthus* L. from sect. *Carthusiani* (Boiss.) F.N.Williams.

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Thirty-two specimens of the new species were collected and measured in June and August from Gölbaşı Plateau, above Sülüklügöl, located to the east of Çubukköy in the Göynük district (Bolu, NW Turkey). In the diagnosis and evaluation of the specimens, the relevant literature and the specimens found in the GAZI, ANK, HUB, ISTO, ISTE, KNYA, VANF, EGE and K herbaria were used (Reeve 1967, Gemici and Leblebici 1995, Hamzaoglu and Koç 2019). A Leica EZ4 stereo microscope was used to examine the specimens. A Nikon Coolpix S9500 camera was used for taking photos of the species, and ruler with a precision of 0.5 mm was used for the measurements in the description.

Results

Dianthus nezahatiae Hamzaoglu, **sp. nov.** (sect. *Carthusiani*)

Type: TURKEY. **A3 Bolu:** Göynük, above Çubukköy village, east of Gölbaşı Yaylası, above Sülüklügöl, 1490 m a.s.l., forest clearing, 09.09.2021, Hamzaoglu 7975 (holo. GAZI!, iso. GAZI!, ANK!, HUB!, DUOF!, NGBB!).

Diagnosis. *Dianthus nezahatiae* is similar to *D. akdaghensis* Gemici et Leblebici, but it is separated with the sheaths of its middle leaves 3 times as long as they are wide (not 4–5), inner bracts 1.7–2.1 mm in width and apex attenuate–rounded (not 2.3–4.6 mm in width) and apex obtuse–truncate or truncate–emarginate, epicalyx scale apex attenuate–rounded (not obtuse–truncate or emarginate), petal collar \pm on half as wide as claw (collar not wide as claw) and capsule as long as or longer than calyx (not shorter).

Description. Perennial herbs. Stems loosely caespitose, decumbent, ascending or erect, 5–25 cm tall, unbranched, glabrous or pubescent, 5–8-noded. Sterile shoot leaves linear, flattened or canaliculate, glabrous or scabrous, as long as or longer than cauline leaves, apex acuminate. Cauline leaves linear, flattened or canaliculate, separated to stem, shorter or longer than internodes, soft, glabrous to scabrous, apex acuminate; lower persistent after anthesis; middle 12–55 \times 1.8–2.1 mm, distinctly 3–veined, margins distinctly scarios towards sheath, sheaths 3 times as long as wide; upper flattened, with unexpanded sheath, nodes not swollen. Inflorescences capitate, unbranched, (2–)3–4(–6)–flowered; peduncles glabrous, 1–6 cm long. Bracts glabrous, green, straw–coloured, brownish or purplish, shorter than calyx; outer \pm herbaceous, linear to narrowly lanceolate; inner scarios–herbaceous, oblong, veinless below, indistinctly 5–9–veined above, separated to calyx, 3/4–4/5 as long as calyx, 9–15 \times 1.7–2.1 mm, with 0.3–0.5 mm scarios and straight margins, apex attenuate–rounded, arista 2/5–1/2 as long as bract. Epicalyx scales 4; outer scarios–herbaceous, whitish below, greenish, straw–coloured, brownish or purplish above, indistinctly 7–9–veined at apex, glabrous, 1/2–4/5 as long as calyx, elliptic–oblanceolate, 10–12 \times 2–3 mm, with 0.3–0.5 mm scarios and straight margins, apex attenuate–rounded, arista one third to two fifths as long as scale; inner similar to outer. Enlarged portions of bracts and epi-

calyx scales enclosing 1/3–2/5 of calyx. Calyx cylindrical–lanceolate, 11–13 \times 3–4.5 mm, \pm distinctly 40–45–veined above, glabrous, purplish or sometimes brownish; teeth ovate–triangular, 2.5–3.2 \times 1.7–2.5 mm, glabrous or pubescent towards apex, 7–9–veined, margins narrowly scarios and ciliate, apex acuminate. Petals 14–18 mm long; limb cuneate to obovate, 5–7 \times 4–5 mm, c. one third as long as petal, c. 1/3 exerted from calyx, unspotted, ebarbellate or sparsely barbellate, reddish–purple or pinkish, 7–9–toothed, teeth irregular, very broadly triangular, up to 1/6 as long as limb; claw 10–11 \times 1.0–1.1 mm, collar \pm 1/2 as wide as claw. Capsule as long as or longer than calyx. Seeds ovate, blackish, 2.3–3.0 \times 1.6–2.1 mm.

Etymology. The Nezahat Gökyiğit Botanik Bahçesi is one of the organizations that financially supported the collection of the first specimens from nature, so that authors proposed the name as Nezahat Gökyiğit.

Vernacular name. There is no recognized vernacular name for this new species. For this reason, the name 'Hanım Karanfil' (in Turkish) is proposed.

Distribution and habitat. According to the observations at the type locality, especially the surroundings of Sülüklügöl Nature Reserve (Bolu and Sakarya Provinces, NW Turkey), *Dianthus nezahatiae* prefers subalpine meadows between 1450–1620 m a.s.l. The flowering period is June–September. *Festuca heterophylla* Lam., *Elymus hispidus* (Opiz) Melderis subsp. *hispidus*, *Marrubium astracanicum* Jacq. subsp. *astracanicum*, *Minuartia anatolica* (Boiss.) Woronow, *Stachys byzantina* K.Koch, *Trifolium hybridum* L., *Sedum pallidum* M.Bieb., *Hypericum linarioides* Bosse and *Allium sibthorpiatum* Schult. et Schult.f. from herbaceous species and *Buxus sempervirens* L., *Juniperus communis* L. var. *saxatilis* Pall. and *Crataegus monogyna* Jacq. from woody species are most commonly observed in the habitat of the species, which generally prefers less sloping lands. Due to the intensive grazing at the subalpine habitats of Sülüklügöl Nature Reserve its nearby, the population of this newly described species is sparse. Individuals of the species may be found around sheltered shrubby species (usually *Buxus sempervirens*) (Fig. 1).

Phenology. The flowering and fruiting periods of *D. nezahatiae* are quite long and successive. While the first flowers are in fruit, new flowers may bloom. The flowering period is between mid–June and late September. The first fruit becomes mature at the end of July. Fruiting period proceeds up to mid–October.

Conservation status. According to the current data, *D. nezahatiae* is currently known from the Gölbaşı, Karabey and Davlumbaz Plateaus in the subalpine meadows around Sülüklügöl Nature Reserve (Bolu and Sakarya Provinces, NW Turkey). It is observed that the individuals of this species are mostly found near the dwarf shrubs like *Buxus sempervirens*. Only few individuals are observed due to there being heavy grazing in the open area. However, it is not possible to say that this situation poses a threat to the species, because there are many shrubs in the subalpine

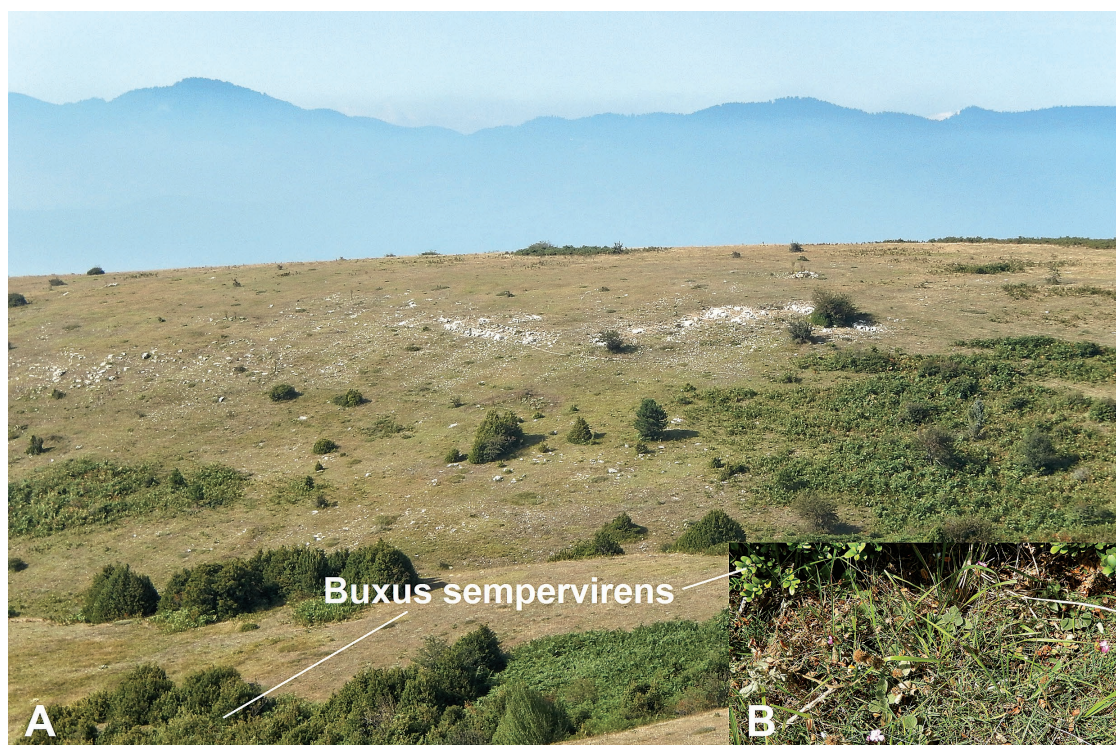


Fig. 1. A – subalpine habitat above Sülüklügöl Nature Reserve (Bolu and Sakarya Provinces, NW Turkey), B – *Buxus sempervirens* surroundings.

meadow area and the probability of encountering the species at the edges of these shrubs is quite high. In addition, when mature fruits were examined, it was observed that the species was quite successful in fertility of seed production. Considering that *Gölbaşı*, *Karabey* and *Davlumbaz Plateaus* (Bolu and Sakarya Provinces, NW Turkey) and similar habitats are in the immediate vicinity, the population area of *D. nezahatiae* is measured as less than 100 km² (EOO: approximately 32 km²). Considering together the known distribution area and the possible threats, the threat category is assessed as “Vulnerable [VU: B2b(iii)]” based on (IUCN Standards and Petitions Committee 2019).

The Sülüklügöl Nature Reserve and nearby surroundings are a natural arboretum due to the diversity of woody plants (Kanoğlu et al. 2016). This is important in terms of botanical tourism. On the other hand, *D. nezahatiae* in the subalpine habitat is valuable in terms of alpine gardening with the dwarf form and long flowering period. Therefore, it is suitable for use as an ornamental plant in alpine gardens and rock gardens, and on road slopes. It is important to protect the area for the reasons specified above. *Dianthus nezahatiae* is included in Nezahat Gökyiğit Botanic Garden (İstanbul Province, Turkey) live collections and the first step for *ex-situ* protection studies was taken.

Discussion

Studies have shown that the epicalyx scales are the most reliable feature to be used in differentiating the species of the *Carthusiani* section of Turkey (Hamzaoğlu et al. 2017, Hamzaoğlu and Koç 2019). The shape of the enlarged por-

tions of the bracts and epicalyx scales (except arista), margin membrane width, apex shape (acute, obtuse, truncate, emarginate), number and prominence of the vein, ratio of arista/calyx can be used to distinguish taxa. In addition to the bracts and epicalyx scales; other characters such as calyx length, number of veins, tooth shape and dimension; petal length, limb shape and dimensions, number of teeth, collar / claw ratio parameters also contribute to the identification. To generalize, it can be said that the shapes and the rates are more reliable as distinctive characters. features.

Dianthus nezahatiae is closely related to *D. akdaghensis* in that the petal limb is cuneate or obovate, the arista in the inner bracts are two fifths to one half of the whole bract, and the calyx teeth are 2.5–4 mm long (Gemici and Leblebici 1995). When these two species are morphologically compared, it is understood that some characters are the most distinctive while some are only partially so because they overlap (Tab. 1).

For instance, the width of the middle cauline leaves and the width of the sheath length seem to be non-overlapping, and thus they are distinctive characters. It can be said that the ratio of leaf sheath length to its width is a reliable character for the *Carthusiani* section (Hamzaoğlu and Koç 2019). On the other hand, considering that it is easily affected by environmental factors, the same cannot be said of leaf width (Tab. 1).

When only the examined specimens are taken as a criterion, the width of the inner bracts is a distinctive character. Inner bracts are 1.7–2.1 mm in width for *Dianthus nezahatiae*, 2.3–4.6 mm for *D. akdaghensis* (Fig. 2, Tab. 1). Difference between the largest values of *D. nezahatiae* (2.3

mm) and *D. akdaghensis* (2.1 mm) is considered not to be a distinctive feature considering later collections of this species from the wild in further studies.

On the other hand, when a large number of specimens of both species are examined, it can be said that the probability of encountering a *D. nezahatae* specimen with a

Tab. 1. Distinguishing characters between *Dianthus nezahatae* Hamzaoglu and *D. akdaghensis* Gemici et Leblebici.

Characters	<i>Dianthus nezahatae</i>	<i>Dianthus akdaghensis</i>
Clearly distinguishing		
Width of middle leaves	1.8–2.1 mm	0.9–1.5 mm
Medium leaves sheath	3 times as long as wide	4–5 times as long as wide
Width of inner bracts	1.7–2.1 mm	2.3–4.6 mm
Apex of inner bracts	attenuate-rounded	obtuse-truncate or truncate-emarginate
Apex of epicalyx scales	attenuate-rounded	obtuse-truncate or emarginate
Enlarged portions of bracts and epicalyx scales	enclosing 1/3–2/5 of calyx	enclosing c. 1/2 of calyx
Petal collar/claw ratio	collar \pm 1/2 as wide as claw	collar as wide as claw
Capsule/calyx ratio	capsule as long as or longer than calyx	capsule shorter than calyx
Seed shape	ovate	elliptic
Partially distinguishing		
Calyx length	11–13 mm	13–16 mm
Shape of calyx teeth	ovate-triangular	lanceolate-triangular
Size of calyx teeth	2.5–3.2 \times 1.7–2.5 mm	3–4 \times 1.3–1.8 mm

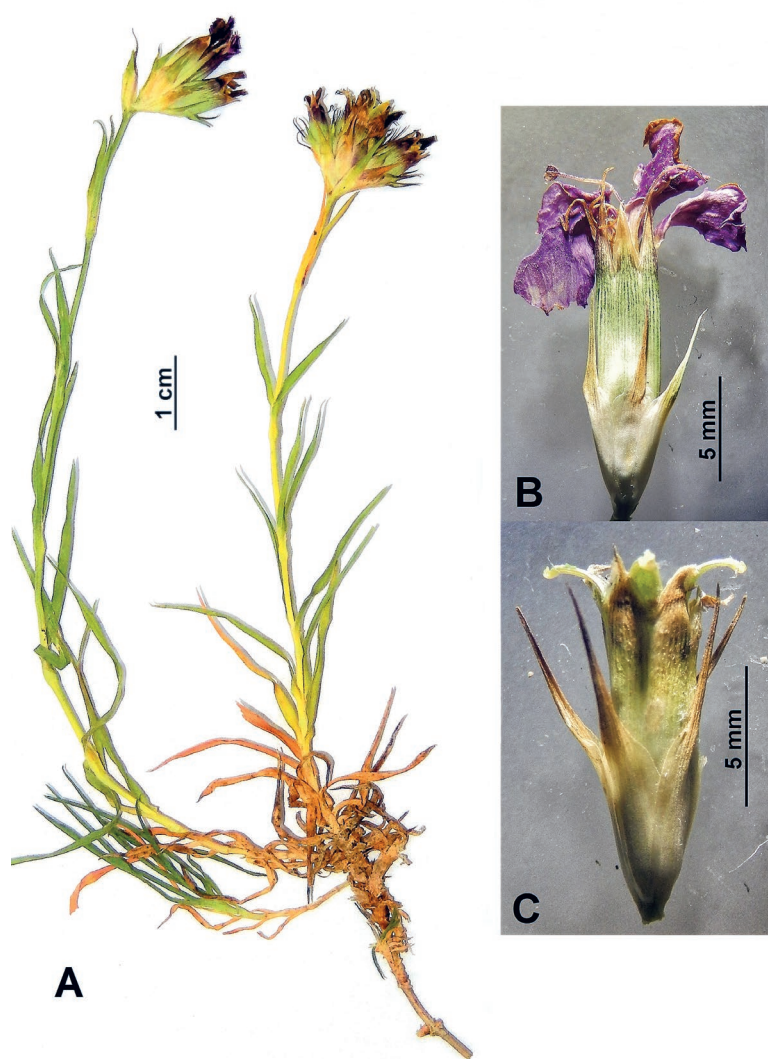


Fig. 2. *Dianthus nezahatae* Hamzaoglu. A – habit of holotype specimen (Hamzaoglu 7975, GAZI herbarium), B – flower, C – capsule and calyx.

width of 3 mm or more in future studies is quite low. The shape of the inner bracts apex (except arista) are a more reliable character and can be used to distinguish these two species.

Since it has a stable structure, the shape of the epicalyx scales apex provides a clear distinction between *Dianthus nezahataiae* and *D. akdaghensis* (Fig. 2, Tab. 1). The calyx closure ratio of the enlarged parts of the bracts and epicalyx scales is one third to two fifths in *D. nezahataiae* and one half or slightly more in *D. akdaghensis*. two fifths and ca. one half; while the values seem close, the one third value can be used as a clear discriminator. The ratio of the petal collar width to the claw width, whether the capsule passes through the calyx, and the seed shape are distinctive characters in the discrimination of these two species. Although these characters are not used directly as distinguishing characters, it is possible to use them as supporting characters (Fig. 2, Tab. 1).

Dianthus nezahataiae prefers subalpine meadows 1450 m a.s.l. as lowest, 1620 m s.s.l. as highest altitude in Northwest Turkey (above Sülüklügöl, Bolu and Sakarya Provinces). *Dianthus akdaghensis* is similar to *D. nezahataiae* in terms of habitat and altitude preference, but *D. akdaghensis* grows in relatively more arid climatic conditions in Southern Turkey (Antalya, Isparta, Konya and Mersin Provinces) (Fig. 3).

Key to the species of *Dianthus* section *Carthusiani* in Turkey

1. Epicalyx scales narrowed gradually into an acute or acuminate apex *giganteus*
 – Epicalyx scales abruptly contracted into an aristate apex 2
2. Inflorescence (4–)7–15(–35)-flowered; enlarged portions of bracts and epicalyx scales enclosing 1/3 of calyx; epicalyx scales with membranous margin 0.6–1.1 mm wide *cruentus*
 – Inflorescence (2–)4–9(–16)-flowered; enlarged portions of bracts and epicalyx scales enclosing 1/2–4/5 of calyx;

- epicalyx scales with membranous margin 0.2–0.6 mm wide 3
3. Epicalyx scales 5–9 mm long; cauline leaves filiform, 0.5–1 mm wide, 1–3-veined, circular or canaliculate in cross-section 4
 – Epicalyx scales 10–26 mm long; cauline leaves linear, 0.9–3 mm wide, 3–5-veined, flattened or canaliculate in cross-section 6
4. Apex of epicalyx scales acute to obtuse-emarginate, arista 1/3–1/2 as long as scale; petal 16–20 mm long, limb 5–7 mm long and barbellate *pinifolius*
 – Apex of epicalyx scales obtuse-truncate to emarginate, arista 1/4 as long as scale; petal 11–15 mm long, limb 3.5–5 mm long and ebarbellate 5
5. Sheaths of medium cauline laeves 5–7 times as long as wide; enlarged portions of bracts and epicalyx scales enclosing 3/5–4/5 of calyx; calyx c. 2 mm wide and 25–35-veined *moesiacus*
 – Sheaths of medium cauline laeves 3–5 times as long as wide; enlarged portions of bracts and epicalyx scales enclosing 1/2–3/5 of calyx; calyx 2.5–4.0 mm wide and 40–45-veined *ucarii*
6. Petal limb cuneate or obovate, 4–7 × 3.5–6 mm 7
 – Petal limb broadly obovate or suborbicular, 8–12 × 6–10 mm 10
7. Epicalyx scales 13–26 mm long, ± distinctly 9–13-veined at apex; calyx 17–22 mm long *cibrarius*
 – Epicalyx scales 10–12 mm long, indistinctly 7–9-veined at apex; calyx 11–16 mm long 8
8. Stems erect; arista of inner bracts 1/4–1/3 as long as bract; calyx teeth 4–6 mm long *carthusianorum*
 – Stems decumbent, ascending or erect; arista of inner bracts 2/5–1/2 as long as bract; calyx teeth 2.5–4 mm long 9
9. Sheaths of medium cauline laeves 4–5 times as long as wide; apex of epicalyx obtuse-truncate or truncate-emarginate; petal collar as wide as claw; capsule shorter than calyx; seeds elliptic *akdaghensis*

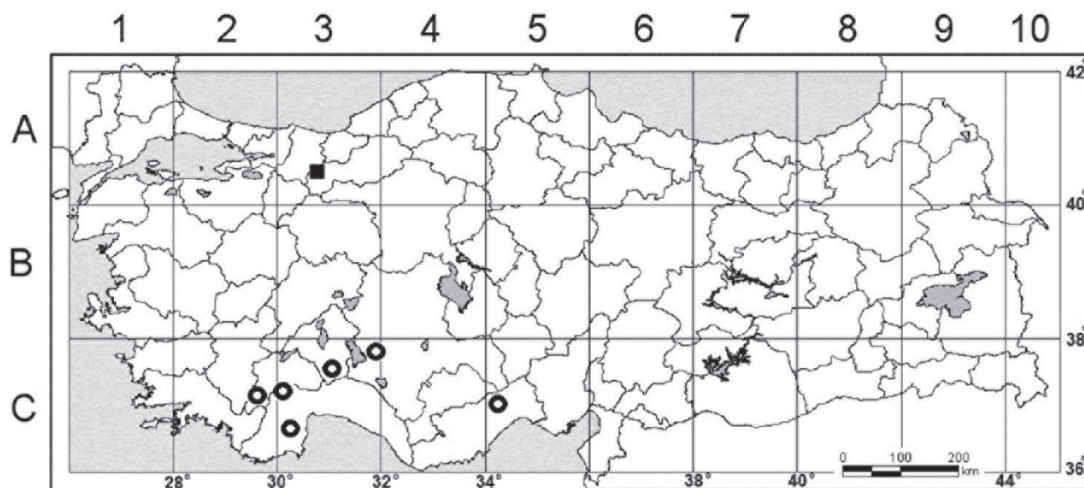


Fig. 3. Distribution map of *Dianthus nezahataiae* (■) and *D. akdaghensis* (○).

- Sheaths of medium cauline leaves 3 times as long as wide; apex of epicalyx attenuate-rounded; petal collar $\pm 1/2$ as wide as claw; capsule as long as or longer than calyx; seeds ovate *nezahatiae*
10. Inner bracts with 0.6–1.1 mm wide scarious margins; epicalyx scales acute or obtuse and distinctly 7–9–veined at apex; petal limb 7–11–toothed *carmelitarum*
- Inner bracts with 0.3–0.5 mm wide scarious margins; epicalyx scales obtuse-truncate or emarginate and indistinctly 3–5–veined at apex; petal limb 5–7–toothed *lydus*

Specimens examined

***Dianthus nezahatiae* (paratypes).** TURKEY. **A3 Bolu:** Göynük, down Davlumbaz Yaylası, above Sülüklügöl, 1505 m a.s.l., 21.6.2009, S.S.Kanoğlu 1679 and A.Kaya (DUOF 2527!); Göynük, down Davlumbaz Yaylası, above Sülüklügöl, 1466 m, step, 01.08.2010, S.S.Kanoğlu 1871 and A.Kaya (NGBB 10001!); **Sakarya:** Akyazı, S of Dokurcun village, above Sülüklügöl, around Karabey Yaylası, 1530 m a.s.l., 26.6.2021, Hamzaoğlu 7869 and N.Aksoy (GAZI!); above Sülüklügöl, Davlumbaz Yaylası, 1610 m a.s.l., subalpine meadows, 13.8.2021, N.Aksoy 8441 (DUOF!); *ibid.*, 1600 m a.s.l., N.Aksoy 8442 (DUOF!).

Dianthus akdaghensis. TURKEY. **B3 Konya:** Ilgın, N of Diğrak and Çiğil road, 1450 m a.s.l., Quercus clearing, 14.7.2017, C.Sağlam 1113 (KNYA!); **C2 Muğla:** Fethiye, Akdağ, W side, above Camialanı, 2200 m a.s.l., rocky limestone slopes, 8.7.1993, Y.Gemici 6928, G.Görk and N.Özel (holotype, EGE!); **Antalya:** Between Elmalı and Seki, Akdağ, Yılmazlı Yaylası road, 1700 m a.s.l., grassy plains, 17.6.2013, Hamzaoğlu 6762, A.Aksoy and M.Koç (ANK!, GAZI!, HUB!, ISTE!, ISTO!, KNYA!, VANF!); **C3 Antalya:** Kemer, above Çukuryayla, 1790 m a.s.l., grassy plains, 1.8.2013, Hamzaoğlu 6958 (GAZI!); **Isparta:** Sütçüler, above Beydili village, W slopes of Sarp Mountain, 1610 m a.s.l., grassy plains among rocks, 10.7.2014, Hamzaoğlu 7079 and M.Koç (ANK!, GAZI!, ISTE!); *ibid.*, Çimenova [just this written], c. 1500 m a.s.l., 28.7.1949, P.H.Davis 15816 (ANK!); Eğridir Kasnak [*Quercus vulcanica*] forest, Otluca Kuyusu place, 1140 m a.s.l., 7.7.1970, A.Gökşin s.n. (ISTO–16039!); Yukarı Gökdere, Kasnak [*Quercus vulcanica*] forest, c. 1700 m a.s.l., calcareous rocks, 11.7.1974, H.Peşmen and A.Güner 1819 (HUB!); **C5 [Mersin]:** “... oberhalb Fındıkbunar in ... Taurus” [Mezitli, above Fındıkpınar], 1700 m a.s.l., 6.1912, W.Siehe 551 (undiagnosed) (E, E00613495, virtual image!).

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References

- Aytaç, Z., Duman, H., 2004: Six new taxa (Caryophyllaceae) from Turkey. *Annales Botanici Fennici* 41, 213–223.
- Bittrich, V., 1993: Caryophyllaceae. In: Kubitzki, K., Rohrer, J., Bittrich, V. (eds.), The families and genera of vascular plants, Magnoliid, Hamamelid, and Caryophyllid families, 206–236. Vol. 2. Springer, Berlin.
- Boissier, E., 1867: *Flora Orientalis*. Vol. 1. H. Georg, Geneva, Basel.
- Davis, P.H., Mill, R. R., Tan, K., 1988: *Flora of Turkey and the East Aegean Islands*. Vol. 10 (suppl. 1). Edinburgh University Press, Edinburgh.
- Deniz, İ.G., Aykurt, C., Genç, İ., Aksoy, A., 2016: A new species of *Dianthus* (Caryophyllaceae) from Antalya, South Anatolia, Turkey. *Phytokeys* 63, 1–12.
- Gemici, Y., Leblebici, E., 1995: Seven new species for the Flora of Turkey. *Candollea* 50, 41–50.
- Greenberg, A.K., Donoghue, M.J., 2011: Molecular systematics and character evolution in Caryophyllaceae. *Taxon* 60, 1637–1652.
- Güner, A., 2000: *Dianthus* L. In: Güner, A., Özhatay, N., Ekim, T., Başer, K.H.C. (eds.), *Flora of Turkey and the East Aegean Islands*, 48–49. Vol. 11 (suppl. 2). Edinburgh University Press, Edinburgh.
- Hamzaoğlu, E., 2020: *Dianthus dumanii*: A new species from the Central Anatolian gypsum-bearing steppes. *Türler ve Habitatlar* 1, 21–30 (in Turkish).
- Hamzaoğlu, E., Koç, M., 2015: *Dianthus burdurensis* (Caryophyllaceae), a new species from South-western Turkey. *Phytotaxa* 233, 196–200.
- Hamzaoğlu, E., Koç, M., 2018: New *Dianthus* (Caryophyllaceae) records for the Flora of Turkey. *KSU Journal of Agriculture and Nature* 22, 381–388.
- Hamzaoğlu, E., Koç, M., 2019: Taxonomic contributions to the genus *Dianthus* section *Carthusiani* of Turkey (Caryophyllaceae). *Biological Diversity and Conservation* 12, 66–88.
- Hamzaoğlu, E., Koç, M., Aksoy, A., 2014: A new pricking Carnation (Caryophyllaceae) grows on tuff from Turkey: *Dianthus aculeatus* sp. nov. *Biological Diversity and Conservation* 7, 159–162.
- Hamzaoğlu, E., Koç, M., Aksoy, A., 2015a: *Dianthus aticii*, a new species from Turkey (Caryophyllaceae). *Phytokeys* 48, 21–28.
- Hamzaoğlu, E., Koç, M., Büyük, İ., Aksoy, A., Soydam Aydın, S., 2015b: A new serpentine-adapted carnation (Caryophyllaceae) from Turkey: *Dianthus serpentinus* sp. nov. *Nordic Journal of Botany* 33, 57–63.
- Hamzaoğlu, E., Koç, M., Büyük, İ., Aksoy, A., Soydam Aydın, S., 2015c: Presence of *Dianthus roseoluteus* Velen. (Caryophyllaceae) in Turkey and a new species: *Dianthus macroflorus* Hamzaoğlu. *Systematic Botany* 40, 208–213.
- Hamzaoğlu, E., Koç, M., Büyük, İ., 2017: *Dianthus ucarii* (Caryophyllaceae): a new species from the northwest of Turkey. *Turkish Journal of Botany*, 41, 486–492.
- Hamzaoğlu, E., Koç, M., Büyük, İ., 2018: Two new spiny species of *Dianthus* (Caryophyllaceae) from Turkey. *KSU Journal of Agriculture and Nature* 21, 545–554.
- Hamzaoğlu, E., Behçet, L., Yapar, Y., 2020: A new suffruticose taxon of *Dianthus* (Caryophyllaceae) from Bingöl, Turkey. *KSU Journal of Agriculture and Nature* 23, 1529–1534.
- Hamzaoğlu, E., Koç, M., Büyük, İ., 2021: *Dianthus yilmazii* (Caryophyllaceae), a new species from central Turkey. *Kew Bulletin* 76, 523–530.

- IUCN Standards and Petitions Committee, 2019: Guidelines for Using the IUCN Red List Categories and Criteria. Version 14. Prepared by the Standards and Petitions Committee. Retrieved December 25, 2021 from <https://www.iucnredlist.org/resources/redlistguidelines>
- İlçim, A., Behçet, L., Mükemre, M., 2013: *Dianthus vanensis* (Caryophyllaceae), a new species from Turkey. Turkish Journal of Botany 37, 219–224.
- Madhani, H., Rabeler, R., Pirani, A., Oxelman, B., Heubl, G., Zarre, S., 2018: Untangling phylogenetic patterns and taxonomic confusion in tribe Caryophylleae (Caryophyllaceae) with special focus on generic boundaries. Taxon 67, 83–112.
- Kanoğlu, S.S., Aksoy, N., Kaya, A., 2016: The flora of Sülüklü Göl around (Bolu-Adapazarı, Turkey). Bağbahçe Bilim Dergisi 3, 20–42 (in Turkish).
- Oskay, D., 2018: *Dianthus somanus* (Caryophyllaceae), a new species from Turkey. Phytotaxa 347, 263–271.
- Özhatay, N., Kültür, Ş., 2006: Check-list of additional taxa to the supplement Flora of Turkey III. Turkish Journal of Botany 30, 281–316.
- Reeve, H., 1967: *Dianthus* L. In: Davis, P.H. (ed.), Flora of Turkey and the East Aegean Islands, 99–131. Vol. 2. Edinburgh University Press, Edinburgh.
- Vural, C., 2008: A new species of *Dianthus* (Caryophyllaceae) from Mount Erciyes, central Anatolia, Turkey. Botanical Journal of the Linnean Society 158, 55–61.
- WFO, 2021: *Dianthus* L. In: World Flora Online. Published on the Internet. Retrieved December 12, 2021 from <http://www.worldfloraonline.org>
- Williams, F.N., 1893: A monograph of the genus *Dianthus*. Botanical Journal of the Linnean Society 29, 346–378.
- Yılmaz, Ö., Kaynak, G., Daşkın, R., Meriçlioğlu, A., 2011: *Dianthus goekayi* (Caryophyllaceae), a new species from Turkey. Annales Botanici Fennici 48, 74–78.