



A new pricking Carnation (*Caryophyllaceae*) grows on tuff from Turkey: *Dianthus aculeatus* sp. nov.

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Abstract

During the taxonomic revision of the Turkish *Dianthus* species, the specimens collected from Koroğlu Pass (İscehisar, Afyonkarahisar, Turkey) was described as a new species. It was named as *Dianthus aculeatus* Hamzaoğlu sp. nov., and its description, images, distribution, ecology and threat category were given. Also, it was compared with closely related species, *D. erinaceus* Boiss. and *D. goekayi* Kaynak, Yılmaz & Daşkın, based on its general morphology and seed micromorphology.

Key words: *Dianthus*, taxonomy, new species, West Anatolia, Turkey

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Türkiye’den tüf üzerinde yetişen yeni bir Karanfil türü (*Caryophyllaceae*): *Dianthus aculeatus* sp. nov.

Özet

Türkiye *Dianthus* türlerinin revizyonu esnasında Koroğlu geçidinden toplanan (İscehisar, Afyonkarahisar, Türkiye) örnekler, yeni bir tür olarak tanımlandı. *Dianthus aculeatus* Hamzaoğlu sp. nov. olarak adlandırılan yeni türün betimlemesi, resimleri, yayılışı, ekolojisi ve tehlike kategorisi verildi. Ayrıca, yakın akraba olduğu *D. erinaceus* Boiss. ve *D. goekayi* Kaynak, Yılmaz & Daşkın ile genel morfoloji ve tohum mikromorfolojisi bakımından karşılaştırıldı.

Anahtar kelimeler: *Dianthus*, taksonomi, yeni tür, Batı Anadolu, Türkiye

1. Introduction

Dianthus L., is easily distinguished from the other genera in the *Caryophyllaceae* family by its epicalyx scales and tubular calyx. This genus consists of approximately 300 species and is mainly distributed in Mediterranean region of Europe and Asia. However, its few species grows in Africa and America (Reeve, 1967; Bittrich, 1993). Because many *Dianthus* species have glamorous flowers, nowadays they are plants that are indispensable to landscape architecture. So *Dianthus* genus has an indispensable reputation and economic importance (Mabberley, 2002).

The genus *Dianthus* represented by 121 species in the Flora Europaea, 78 species in the Flora of the U.S.S.R., 49 species in the Flora Iranica, 19 species in the Flora of Syria, Palestine and Sinai, and 3 species the Flora of Iraq and the Flora of Cyprus (Post and Dinsmore, 1932; Tutin, 1964; Rechinger, 1964 and 1988; Hooper, 1977; Shishkin, 1985). The most comprehensive taxonomic revision of *Dianthus* in the Flora of Turkey was carried out by Reeve (1967). As a result of this revision there were 67 species introduced into the second volume of the Flora of Turkey and the East Aegean Islands (Reeve, 1967). This number was increased to 76 by the latter studies (Shishkin, 1985; Davis *et al.*, 1988; Gemici and Leblebici, 1995; Güner, 2000; Menemen and Hamzaoğlu, 2000; Aytaç and Duman, 2004; Özhatay and Kültür, 2006; Vural, 2008; Yılmaz *et al.*, 2011; İlçim *et al.*, 2013).

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2. Materials and methods

Dianthus specimens, collected from Koroğlu Pass located between Bayat and İncehisar (Afyonkarahisar, Turkey) in the framework of revision of *Dianthus* in Turkey, were thoroughly evaluated using the related literature and the specimens present in GAZI, ANK, HUB, E, K and P herbaria (Boissier, 1843 and 1867; Reeve, 1967; Yılmaz et al., 2011; MNHN Paris, 2014; RBG Kew, 2014; RBG Edinburgh, 2014). The images were taken using the Olympus C-5060 digital camera and Leica EZ4 HD microscope, and the seed surface micromorphology was visualized using the LEO 440 scanning electron microscope. Normal visualization of the specimens was carried out using the Olympus SZ61 microscope. The vegetative characters were measured using a ruler with 0.5-mm accuracy and the floral characters were determined using an ocular micrometer.

The Koroğlu Pass specimens that were introduced as new species had been collected by the various botanists from the nearby localities (see specimens examined). But these specimens were determined to be *Dianthus erinaceus* Boiss. var. *alpinus* Boiss. according to the identification key of the Flora of Turkey. There were as many specimens with flowers and fruits as possible collected from the Koroğlu Pass belonging to *Dianthus aculeatus* (Tüf Karanfili). The specimens included the materials needed for the seed micromorphology studies. These studies revealed that the specimens collected from Koroğlu Pass belonged to the individuals of a new species.

3. Results

3.1. *Dianthus aculeatus* Hamzaoğlu, sp. nov. – Figures 1 and 2.

Type: Turkey, Afyonkarahisar: Between Bayat and İncehisar, Koroğlu Pass, 1500 m, rocky igneous slopes with tuff gravels and shrub openings, 16 June 2013, Hamzaoğlu 6744, A.Aksoy & M.Koç (holotype: GAZI; isotypes: GAZI, ANK, HUB).

Diagnosis: *Dianthus aculeatus* is related to *D. erinaceus* var. *erinaceus*, *D. erinaceus* var. *alpinus* and *D. goekayi*. It mainly differs from the related taxa because it has epicalyx scales indistinctly 3–5-veined (not 1–3-veined); inner epicalyx scales c. 1/2 as long as calyx (not 3/5–4/5 as long as calyx); calyx distinctly 45–50-veined, purplish (not 36–45-veined, greenish or rarely purplish); petals 22–26 mm long (not 14–21 mm), limbs broadly cuneate, 6.5–7.5 mm wide (not narrowly cuneate, 3–5.5 mm wide), claws 15–18 mm long (not 9.5–14 mm long), collar 1/2 as wide as claw (not as wide as claw).

Description: Perennial, cushion-form, spinose and pruinose herbs. Stems erect, 2–6 cm tall, unbranched or rarely only branching from upper node, 2–4-noded, pubescent, dead leaves persistent at base. Leaves linear-subulate, canaliculate, thick, glabrous, margins scabrous, apex spinose; sterile shoots leaves subequal cauline leaves; cauline 8–12 × 0.6–1 mm, separated from stem, equal or shorter than internodes, rigid, 3-veined, sheaths equal or slightly longer than wide; upper similar but smaller, nodes sometimes purplish. Stems usually one-flowered or rarely with strict inflorescence, flowers solitary; -if present- branches angled at 5–15°, pubescent, up to 2 cm long; pedicels 3–7 mm, pubescent, greenish. Epicalyx scales 6–8, cartilaginous, spinose, greenish or purplish, ± separated from calyx, veinless below, indistinctly 3–5-veined above, with narrowly scarious (c. 0.1 mm) margins, apex acute-obtuse except arista; outer linear to linear-lanceolate, 9–13 × 1–1.5 mm, glabrous or pubescent, up to 1/2 as long as calyx, arista c. 2/3 as long as scale; inner oblanceolate, 10–14 × 2.4–3.6 mm, glabrous, c. 1/2 as long as calyx, arista c. 1/3 as long as scale. Calyx cylindrical-lanceolate, 18–26 × 3–4 mm, distinctly 45–50-veined above, glabrous, purplish; teeth narrowly triangular, 4–6 × 1–1.5 mm, 7–9-veined, with ciliate and scarious margins, apex acuminate and long mucronate. Petals 22–26 mm long; limb broadly cuneate, 7–8 × 6.5–7.5 mm, c. 1/3 as long as petal, c. 3/4 exerted from calyx, spotted, barbulate, pinkish purple on both surfaces, 9–11-toothed from middle to apex, teeth narrowly triangular, up to 1/5 as long as limb; claw 15–18 × 1.2–1.5 mm, collar c. 1/2 as wide as claw. Capsule not exerted from calyx. Seeds elliptic, 1.8–2.5 × 1.2–1.5 mm, blackish.

3.2. Seed morphology

Seeds of *Dianthus aculeatus* are elliptic, 1.8–2.5 × 1.2–1.5 mm, black, ungranular; dorsal surface convex, with regular rectangular cells, tuberculate, with 2–4 teeth on each margin, teeth S-undulate, apparent; ventral surface flat, with irregular rectangular cells, tuberculate, with 4–7 teeth on each margin, teeth S-undulate, not apparent; apex beaked. The seeds of *D. aculeatus* are different than the seeds of *D. goekayi* as regard to the size and the shape and the seeds of *D. erinaceus* var. *erinaceus* and *D. erinaceus* var. *alpinus* as regard to their ungranular dorsal surface cells and V-undulate appearance of the dorsal and ventral surface cells (Table 1, Figures 3 and 4).

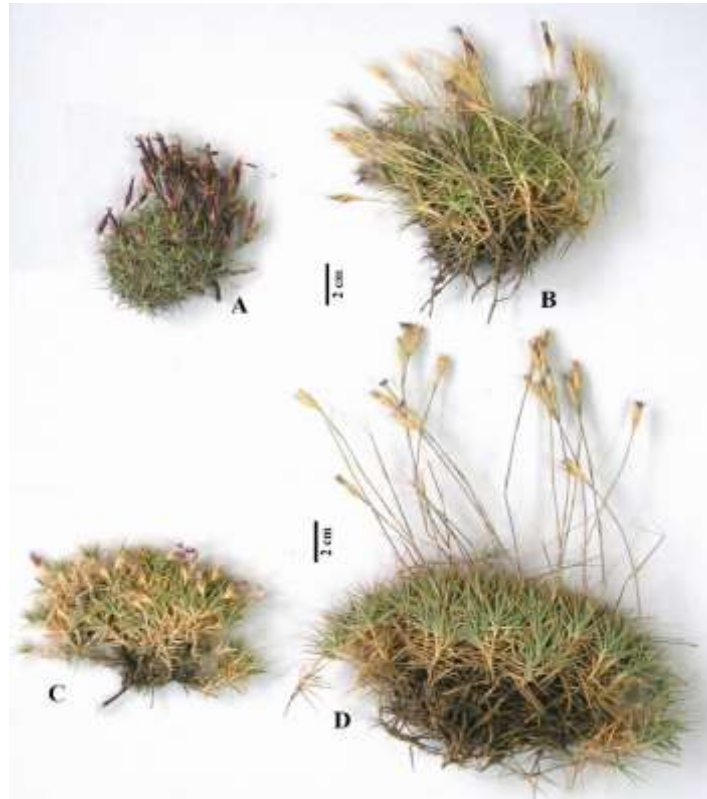


Figure 1. Habits: A. *Dianthus aculeatus* (Hamzaoglu 6744), B. *D. erinaceus* var. *erinaceus* (Hamzaoglu 6589), C. *D. erinaceus* var. *alpinus* (Hamzaoglu 6590), D. *D. goekayi* (Hamzaoglu 6596).



Figure 2. Flowers: A. *Dianthus aculeatus* (Hamzaoglu 6744), B. *D. erinaceus* var. *erinaceus* (Hamzaoglu 6589), C. *D. erinaceus* var. *alpinus* (Hamzaoglu 6590), D. *D. goekayi* (Hamzaoglu 6596).

Table 1. Diagnostic seed characters between *Dianthus aculeatus* and related taxa.

Seed Characters	<i>D. aculeatus</i>	<i>D. goekayi</i>	<i>D. erinaceus</i> var. <i>erinaceus</i>	<i>D. erinaceus</i> var. <i>alpinus</i>
Size	1.8–2.5 × 1.2–1.5 mm	3–3.6 × 1.8–2.1 mm	2–2.8 × 1.2–1.5 mm	2–3 × 1.1–1.5 mm
Shape	elliptic	oblong-elliptic	elliptic	elliptic
Cells of dorsal surface	non granular	non granular	granular	granular
Cell edges of dorsal surface	S-undulate	S-undulate	V-undulate	V-undulate
Cell edges of ventral surface	S-undulate	S-undulate	S-undulate	V-undulate

3.3. Distribution and ecology

Dianthus aculeatus is distributed between Bayat (Afyonkarahisar) and Gediz (Kütahya) where cold Mediterranean climate prevails. This area is located between Irano–Turanian and Mediterranean phytogeographic regions (Davis, 1965). The species is grows in rocky igneous slopes with tuff gravels or coniferous forest and shrub openings and prefers the altitudes of 1250–1900 meters (Figure 5). *Dianthus aculeatus* grows on rocky igneous slopes with tuff gravels, within open *Pinus nigra* J. F. Arnold forest together with *Quercus cerris* L., *Cistus laurifolius* L., *Juniperus oxycedrus* L., *Salvia tomentosa* Mill., *Alyssum strigosum* Banks & Sol., *Bromus tectorum* L., *Chamaecytisus hirsutus* (L.) Link, *Silene compacta* Fisch., *Myosotis discolor* Pers., *Anthemis tinctoria* L. var. *pallida* DC., *Campanula lyrata* Lam., *Veronica chamaedrys* L., *Arenaria serpyllifolia* L., *Phleum exaratum* Griseb. and *Hypericum organifolium* Willd.

3.4. Phenology

Flowering from June to early July. Capsules ripening from the beginning of August.

3.5. Etymology

The *Dianthus* species introduced here has aculeate apex of the leaves and epicalyx scales. That was why it was given the epithet of “**aculeatus**”.

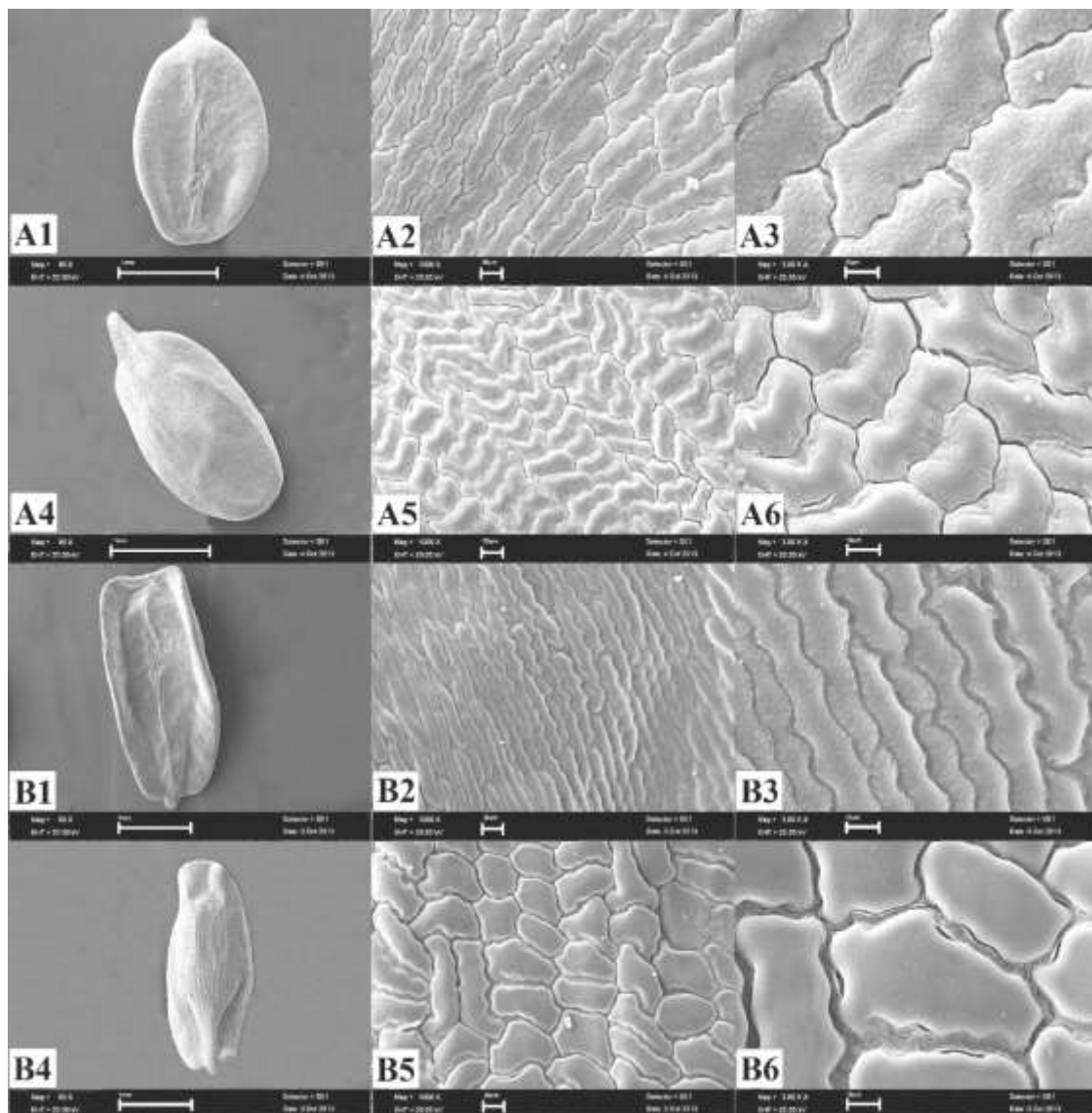


Figure 3. SEM photographs of the seed coat: A. *Dianthus aculeatus*, B. *D. goekayi*; 1-3: dorsal surface, 4-6: ventral surface; Scale bars. 1 and 4: 1 mm, 2 and 5: 20 μ m, 3 and 6: 10 μ m.

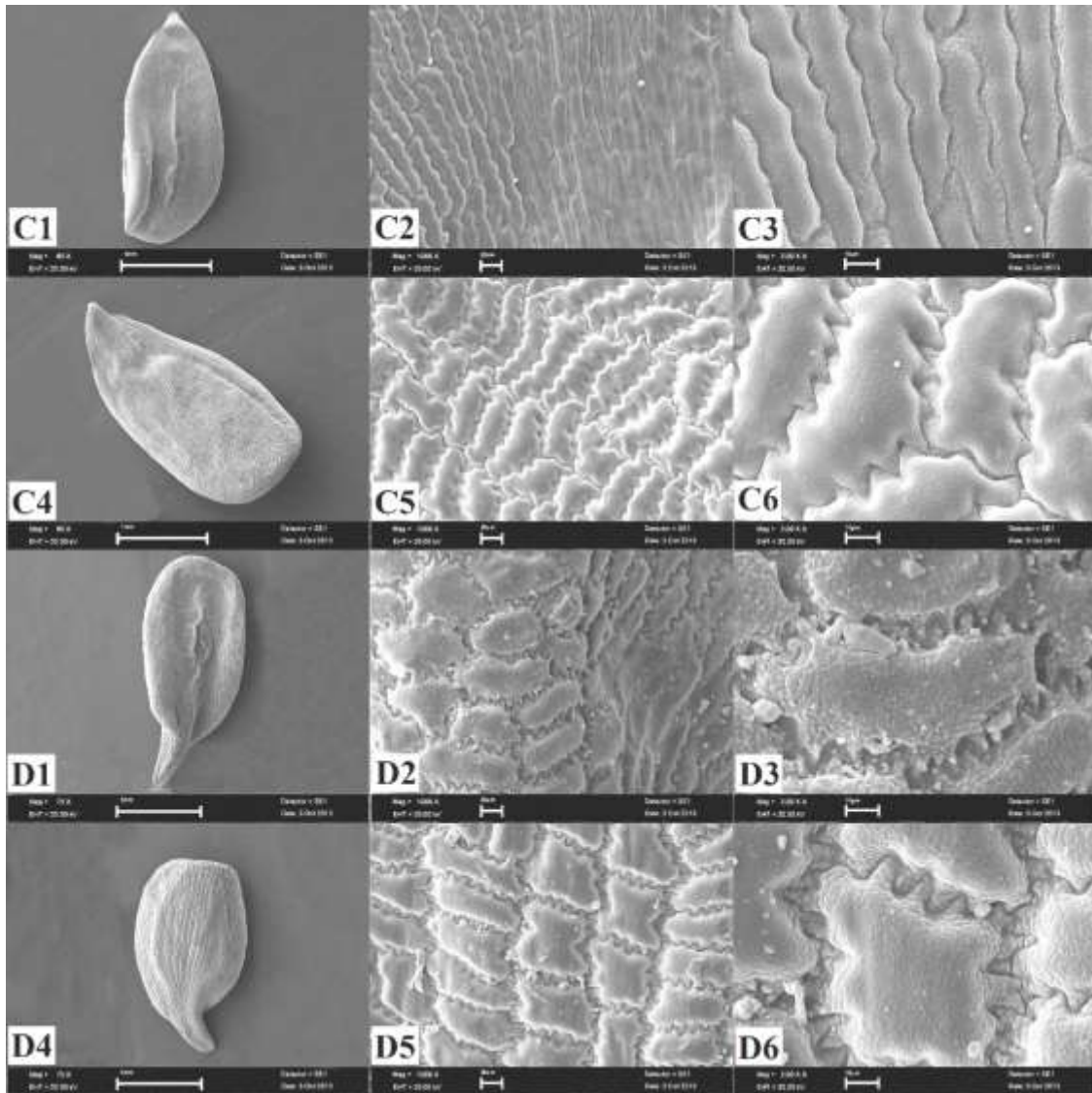


Figure 4. SEM photographs of the seed coat: C. *Dianthus erinaceus* var. *erinaceus*, D. *D. erinaceus* var. *alpinus*; 1-3: dorsal surface, 4-6: ventral surface; Scale bars. 1 and 4: 1 mm, 2 and 5: 20 µm, 3 and 6: 10 µm.

3.6. Taxonomic remarks

According to the related literature and the Flora of Turkey *Dianthus aculeatus* shows close similarities to *D. erinaceus* var. *erinaceus*, *D. erinaceus* var. *alpinus* and *D. goekayi* because of toothed and barbulate petals, containing less than 10 epicalyx scales, double or solitary flowers, and short and glabrous calyx (Boissier, 1843 and 1867; Reeve, 1967; Yılmaz et al., 2011). Despite these similarities, there are distinctive morphological differences between *D. aculeatus* and the taxa mentioned above such as the number of veins on the epicalyx sales, their ratio to calyx, and its calyx and petal sizes (Table 2 and Figure 2).

3.7 Conservation status

According to the current data (paratypes), *D. aculeatus* grows between Bayat (Afyonkarahisar) and Gediz (Kütahya) districts, which have an area of approximately 3000 km² (Figure 5). This species, which prefers gravelly slopes, due to dense forests, settlement and farming areas, marble and stone quarries, has a discontinuous distribution. That is why it is proposed that the species should be classified as Endangered [EN (B1b-iii)] according to International Union for Conservation of Nature (IUCN) categories (2013)].

Key to closely related *Dianthus* species

- 1. Inner epicalyx scales c. 1/2 as long as calyx; petals 22-26 mm long *D. aculeatus*
- Inner epicalyx scales more than 1/2 as long as calyx; petals 14-21 mm long 2
- 2. Cauline leaves adpressed to stem; petal limbs 3-3.2 mm wide *D. goekayi*
- Cauline leaves separated from stem; petal limbs 4-5.5 mm wide 3
- 3. Calyx 16-20 mm long; petals 18-21 mm long *D. erinaceus* var. *erinaceus*
- Calyx 12-15 mm long; petals 14-16 mm long *D. erinaceus* var. *alpinus*

Table 2. Diagnostic characters between *Dianthus aculeatus* and related taxa

Characters	<i>Dianthus aculeatus</i>	<i>Dianthus erinaceus</i> var. <i>erinaceus</i>	<i>Dianthus erinaceus</i> var. <i>alpinus</i>	<i>Dianthus goekayi</i>
Stems	2–6 cm tall	4–14 cm tall	3–4 cm tall	7–20 cm tall
Cauline leaves	separated from stem	separated from stem	separated from stem	adpressed to stem
Epicalyx scales	6–8 pieces, indistinctly 3–5-veined	8–10(–12) pieces, distinctly 1–3-veined	8–10 pieces, distinctly 1–3-veined	6–8(–10) pieces, indistinctly 1–3-veined
Inner epicalyx scales	c. 1/2 as long as calyx	3/5–4/5 as long as calyx	3/5–4/5 as long as calyx	3/5–4/5 as long as calyx
Calyx	18–26 mm long, distinctly 45–50- veined, purplish	16–20 mm long, distinctly 36–45- veined, greenish or rarely purplish	12–15 mm long, distinctly 36–45- veined, greenish or rarely purplish	14–20 mm long, indistinctly 40–45- veined, greenish or rarely purplish
Petals	22–26 mm long	18–21 mm long	14–16 mm long	14–18 mm long
Petal limbs	broadly cuneate, 7–8 × 6.5–7.5 mm	narrowly cuneate, 6.5–8 × 4.5–5.5 mm	narrowly cuneate, 5–6 × 4–5 mm	narrowly cuneate, 4.5–6 × 3–3.2 mm
Petal claws	15–18 mm long, collar c. 1/2 as wide as claw	12–14 mm long, collar as wide as claw	10–11 mm long, collar as wide as claw	9.5–12 mm long, collar as wide as claw
Seeds	elliptic, 1.8–2.5 mm long	elliptic, 2–2.8 mm long	elliptic, 2–3.2 mm long	oblong-elliptic, 2.2–3.7 mm long

3.7. Additional specimens seen

***Dianthus aculeatus* Hamzaoğlu sp. nov. (paratypes):** Turkey, Afyonkarahisar: Bayat, between Asartepe and İnpazarcık, c. 1300 m, rocky slopes with schist, 3 July 1975, M.Vural 874 (KNYA); İscehisar, NW of Karakaya village, 1250–1500 m, slopes with tuff gravels, 27 June 2002, Z.Aytaç 8413 (GAZI); Kütahya: Gediz, Murat Mountain, between Hamam and Kesiksöğüt, 1400 m, metamorphic rocks, 5 July 1962, Davis 36871 & Coode (E, photo); *ibid.*, above Kesiksöğüt, 1900 m, rocky igneous slopes, 5 July 1962, Davis 36814 & Coode (E, photo); ***Dianthus erinaceus* Boiss. var. *erinaceus*:** Turkey, Manisa: National Park of Spil Dağı, Atalanı, around forest watchtower, 1475 m, rocks, 5 August 2012, Hamzaoğlu 6589, A.Aksoy & M.Koç (GAZI); In mt. Sypilos supra Magnesiam, ?? July 1842, Boissier s.n. (E, K, photos); Sommel du Mont Sipyle, au-dessus de Magnesie, 11 August 1854, Balansa s.n. (P, photo); Spil Mountain, S of Atalanı, 1200–1300 m, rocks, 8 August 1983, H.Duman 1083 (GAZI); ***Dianthus erinaceus* Boiss. var. *alpinus* Boiss.:** Turkey, Balıkesir: Edremit, Zeytinli village, National Park of Kaz Dağı, Sarıkız road, 1675 m, rocks, 6 August 2012, Hamzaoğlu 6590, A.Aksoy & M.Koç (GAZI); Mt. Ida, in marmor, montis Kapu-Dagh [Kapıdağ], 1 July 1883, Sintenis 556 (E, K, P, photos); *ibid.*, in jugo, 15 July 1883, Sintenis 416 (K, photo); *ibid.*, calcareous rocks in summit, 1968, P.Quezel et al. s.n. (ANK); *ibid.*, 25 July 1968, A.Pamukçuoğlu & P.Quezel s.n. (HUB); ***Dianthus goekayi* Kaynak, Yılmaz & Daşkın:** Turkey, Bursa: Between Soğukpınar and Karaıslah villages, 860 m, *Quercus* forest openings, serpentine stony slopes, 8 August 2012, Hamzaoğlu 6596, A.Aksoy & M.Koç (GAZI); Kütahya: Tavşanlı, between Derbent and Elmağacı villages, 960 m *Quercus* forest openings, serpentine stony slopes, 9 August 2012, Hamzaoğlu 6605, A.Aksoy & M.Koç (GAZI).

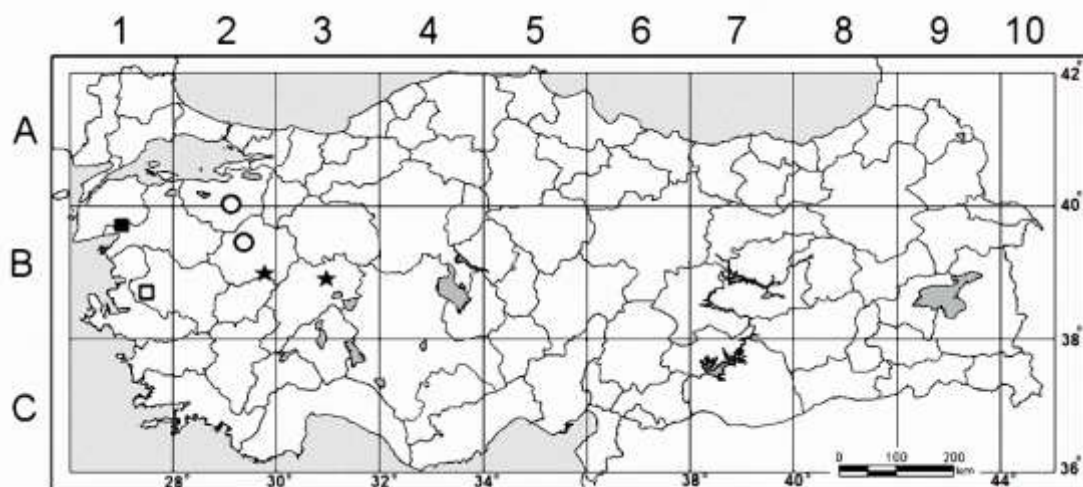


Figure 5. Distribution map of *Dianthus aculeatus* (★), *D. erinaceus* var. *erinaceus* (□), *D. erinaceus* var. *alpinus* (■) and *D. goekayi* (○) in Turkey

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