



Research article

Interspecific diversity of endemic *Cirsium sommieri* Petr.Abdurrahman Sefali¹ , Yakup Yapar^{*2} ¹ Bayburt University, Faculty of Education, Department of Primary Education, 69000, Bayburt, Türkiye² Bingöl University, Faculty of Arts and Sciences, Department of Molecular Biology and Genetics, 12000, Bingöl, Türkiye

Abstract

The genus *Cirsium* is highly polymorphic, and its members often show surprising variations. *Cirsium sommieri*, an endemic plant in eastern Türkiye, is one of them. An interesting population of *Cirsium sommieri* was examined morphologically. The distribution of the species in Türkiye was examined, and the samples were compared. And also, some morphological characters, such as leaves, involucre, phyllaries, and achene morphology, were examined comparatively. The geographical distribution of this species is given.

Keywords: *Epitrachys*; *Cirsium*; flora of Türkiye; taxonomy

1. Introduction

Asteraceae is the largest vascular plant family around the world. This family consists of approximately 32000 species (Cheek et al., 2020). The genus *Cirsium* Mill. is one of the largest genera with about 250 species, and it is distributed in North and Central America, Europe, a big part of Asia, and North Africa (Charadze, 1963; Davis and Parris, 1975; Petrak, 1979). Europe, Russia, Türkiye, and the Caucasus have most of the species. Türkiye is one of the important gene centres for the genus (Dirmenci et al., 2019), especially northeastern Anatolia, the Kaçkar Mountains (Yıldız et al., 2009). The mountains near the Caucasus and this region have many hybrid forms (Charadze, 1963).

Cirsium's name is derived from the Greek word "kirsos", meaning disease of the veins. According to Tournefort's reports, the roots of *Cirsium* species were used in treating venous diseases. Although some *Cirsium* species are invasive weeds in fields and gardens, some tall species have ornamental features (Charadze, 1963; Tournefort, 1703).

Sommier and Levier (1895), the "*Cirsium Del Caucaso*" described 53 species that belong to Türkiye as well as an identification key and distributions. At present, Türkiye is

represented by 68 species (80 taxa, 33 endemics) and five hybrids (Davis and Parris, 1975; Davis et al., 1988; Yıldız et al., 2011; 2016; Duman et al., 2017; Dirmenci et al., 2019). Turkish *Cirsium* species belong to three sect. [*Cirsium* (17 species, 27 taxa, and 2 hybrids), *Epitrachys* DC. (50 species, 52 taxa and 3 hybrids), and *Cephalonoplos* (Neck.) DC. (1 species)] (Davis and Parris, 1975; Davis et al., 1988; Yıldız et al., 2011, 2016; Duman et al., 2017; Dirmenci et al., 2019).

The sect. *Epitrachys* has some nodding species in Türkiye. Such as *Cirsium sommieri* Petr., *C. adjaricum* Sommier & Levier, *C. caucasicum* (Adams) Petr., *C. trachylepis* Boiss., *C. osseticum* (Adams) Petr. This species belongs to the sect. *Caucasigena* Charadze and Series 3. *Caucasica* (Petrak) Charadze and the type species of sect. *Caucasigena* is *C. caucasicum* in the Flora of the USSR (Charadze, 1963) (Fig. 1).

During field studies between 2019 to 2022, late July, August, and September, an unusual population of *Cirsium* sp. similar to *C. sommieri* was determined on the Soğanlı Pass (Bayburt), which is a part of the Soğanlı Mountain chain, in north-east Türkiye. This interesting species had a large involucre and thickened apical spines of the phyllaries. It resembled *C. sommieri* and a few nodding species, *C. caucasicum*, as well as *C. adjaricum*. After a detailed morphological study of the

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specimens noticed that they are a variation of *C. sommieri*. Researchers wanted to examine specimens from other areas of the species as well. Therefore, an expanded description of the *C. sommieri* has been presented.

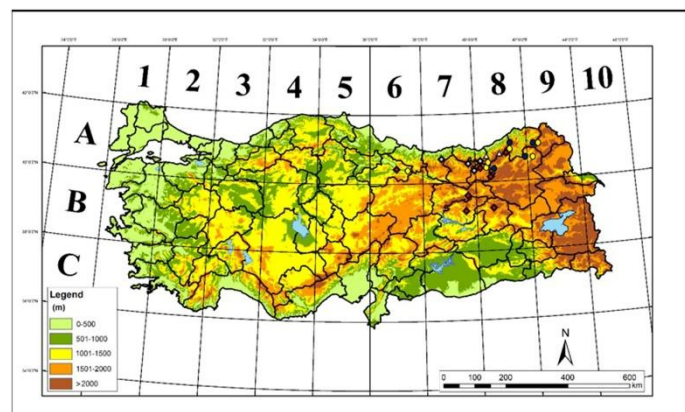


Fig. 1. Distribution of *Cirsium sommieri* (♦) and related species: *C. caucasicum* (○), *C. adjaricum* (●), *C. trachylepis* (◆), and *C. osseticum* (Δ).

3. Results and discussion

The newly detected morphological measurement intervals show that *Cirsium sommieri* is related to *C. caucasica*. Because in the general appearance of the plant, it is seen that some capitula resemble *C. caucasica* in their phyllaries. It differs from *C. caucasica* by its small involucre, 20-28 × 30-35 mm (vs. 30-50 mm), involucre glabrous or sparsely arachnoid hairy (vs. densely arachnoid hairy).

3.1. Expanded description

Perennial, few or many-stemmed from base, erect or ascending, 40-120 cm tall, unwinged but longitudinally striate, arachnoid, with a few or many branches above, sterile shoots absent. Basal leaves long-petiolate, petioles 4-12 cm long, winged; lamina broadly elliptic-lanceolate, 12-35 × 4.5-10 cm, green, spinulose-strigose above with 1-1.5 mm long, adpressed to curved setae, ca. 2-3 per 2 mm square, very sparsely arachnoid; lower surface densely arachnoid, 1/2 pinnatifid with 3-4-paired, 8-15 × 15-20 mm lobes with stout 10-12 mm apical spine. Middle cauline leaves are similar but smaller and narrower than the basal leaves, with spiny-auriculate tips lamina broadly lanceolate 8-20 × 3-10 cm long, lateral and terminal lobes 4/5 pinnatifid with 6-10 lobes, spinulose-strigose above with 0.8-1.0 mm long, adpressed setae, ca 3-4 per 2 mm square, not arachnoid with stout 9-13 mm apical spine. Upper cauline leaves are similar to middle cauline leaves but smaller, not deeply pinnatifid, and lanceolate, auriculate. Uppermost (involucral) leaves (0-) 3 (-4), 1.5-4 cm long, linear-lanceolate with sinuate-dentate margin, shorter than the involucre, sessile or at least auriculate. Capitula nodding, 1 on each branch, 30-60-capitula, 20-40 mm × 15-35 mm, sessile or peduncles 0.5 cm long; involucre 20-25 × 30-35 mm, subglobose to globose; phyllaries 8-11-seriate, green or rarely purplish, adpressed, glabrous or sparsely arachnoid, greenish ± erecto-reflexed, the outer 4.5-12 × 2 mm, with reflexed, ovate-elliptic, 1-7 mm long apical spine lateral spin if present 1 mm or scattered; the median 12-22 × 1.25-2.0 mm long, with ± reflexed, oblong-lanceolate, 4-10 mm long apical spine; the inner 15-30 × 1.0-2.0 mm, linear,

3-5 mm long apical spine or absent. Corolla purple-lilac, 20-28 mm long, lobed to 1/5. Style 24-28 mm long, exerted, bilobed; filaments 18-20 mm long, hairy; Achenes dirty white or brownish with longitudinal black stains, 4.5-6.5 × 1-2.5 mm, oblong, slightly or clearly asymmetric, compressed. Pappus 15-21 mm long, plumose, dirty white, or yellowish.

3.2. Phenology

Flowering from July to August; fruiting in September to October.

3.3. Taxonomic relationships

Sections of *Epitrachys*, in the Türkiye, have generally been distinguished by root form, leaf shape, and indumentum, involucral leaves, capitulum, and involucrum characteristics. *Cirsium sommieri* belongs to sect. *Epitrachys* and its characteristic is that its capitulum is nodding. Similarly, *C. adjaricum*, *C. caucasicum*, *C. trachylepis*, and *C. osseticum* have nodding capitula (Fig. 2). These species, with current records, appear to be distributed in the northeast of Türkiye (Fig. 3) and are related to each other in the sect. *Epitrachys* (Davis and Parris, 1975). On the other hand, in the Flora of the USSR (Charadze, 1963), *C. caucasicum* belongs to the sect. *Caucasigena* Charadze and Series 3. *Caucasica* and the type species of sect. *Caucasigena* is *C. caucasicum*. The species is a kind of determiner in this nodding species group. Another species, *C. cilicicum* P. H. Davis & Parris, similar to this nodding species, but it has no nodding capitulum in the sect. *Epitrachys*. In Türkiye, *Cirsium sommieri*, *C. adjaricum*, *C. caucasicum*, *C. trachylepis*, and *C. osseticum* are mainly distributed northeast regions (Davis and Parris, 1975). Only *C. sommieri* distributed to the south and east. These nodding species have been distinguished by involucrum features that include reflexed or non-reflexed outer phyllaries and length, reflexed or non-reflexed median phyllaries, soft or rigid spin of phyllaries, and especially outer phyllaries with or without spinules.

These five nodding species were examined to their relationship with each other among the Sections of *Epitrachys*. These species are divided into two groups by the first character, reflexed or not the outer phyllaries. The first group includes reflexed and finely spinules (about 1 mm) outer phyllary, which are *Cirsium sommieri*, *C. trachylepis*, and *C. osseticum*. The second group has two species, *C. caucasicum* and *C. adjaricum*, which have not reflexed and are without spinules outer phyllary. The species of the second group very rarely have long spinules (2-3 mm) on their outer phyllaries. Significantly involucral bracts are extended and connected to the capitulum of the *C. caucasicum*. Lateral spines are prominent on these bracts. Because of this, the phyllaries may appear to have spinules and can be confusing (Fig. 2).

Cirsium sommieri has some polymorphic features that are leaf shape, leaf spin, length of the stem, and capitulum shape (Fig 3). Despite these features, it has a smaller capitulum, not strong spines, and the shortest outer phyllaries of the involucrum in all of the nodding species. According to Davis and Parris (1975), in the and the East Aegean Islands, vol. 5, *C. sommieri* has three syntypes, collected from Gümüşhane (Szandschak), Gümüşhane (Tenbeda), and Erzincan. These syntypes typically have a smaller capitulum, short-reflexed outer phyllaries generally with spinules about (-1 -1.5) mm. *C.*



Fig. 2. Capitulum of the some nodding *Cirsium* species: a-b. *C. sommieri*, c. *C. adjaricum*, d. *C. caucasicum*, e. *C. trachylepis* and f. *C. osseticum*.



Fig. 3. Variation of capitulum of *Cirsium sommieri*. A. Bayburt (Maden Village), B. Gümüşhane, C. Bayburt (Yoncalı Village), D. Artvin (Yusufeli), E. Bayburt (Soğanlı Mountains) and F. Trabzon (Sultan Murat Highland).

adjaricum is different from other nodding species with dark purplish involucral phyllaries. *C. caucasicum* has the most robust looking (longest involucral bracts and phyllaries and densely arachnoid hairy) capitulum among all the nodding species, and also it has the biggest capitulum. *C. trachylepis* is closely related to *C. sommieri* (Davis and Parris, 1975), differs from *C. sommieri*, its reflexed outer phyllaries have long and finely spinulose hairs, median-inner phyllaries have sparsely or densely arachnoid hairs. Also, when examined type material (Specimen G00758235 in Genova) has long connected involucral bracts, like phyllaries. When another species, *C. osseticum*, is examined, typically, it typically has weak (soft) and short spines (almost 3 mm) of the reflexed median phyllaries.

Cirsium sommieri population of Soğanlı Pass and Aydıntepe Highland has reflexed outer phyllaries with sparse spinules or not, and it has connected involucral bracts which are extended and also robust looking (has an appearance between general *C. sommieri* (Fig. 5) and *C. caucasicum*) (Fig. 6). Its reflexed outer phyllaries are similar to *C. sommieri*, *C. trachylepis*, and *C. osseticum*. Differs from *C. sommieri* is

known by its longer reflexed outer phyllaries, a larger capitulum by the side of robust looking. Additionally differs from *C. trachylepis* by its shorter reflexed outer phyllaries, rarely with or without fine spinules, rarely sparsely arachnoid hairy, not densely, and shorter capitulum. According to Davis and Parris (1975), sometimes *C. trachylepis* approaches *C. osseticum*. Therefore, *C. osseticum* has fine spinulose of its outer and median phyllaries and typically its median phyllaries with weak and short spines. Finally, this suspected population of *C. sommieri* is not similar to *C. osseticum*. When investigated, another two nodding species, *C. caucasicum* and *C. adjaricum*. These two species have no reflexed outer phyllaries, and their involucrum are sparsely or densely arachnoid hairy. But *C. sommieri* has a generally glabrous involucre, seldom it is sparsely arachnoid. When the syntype specimens were examined, polymorphism related to the capitulum of *Cirsium sommieri* was observed. Regarding the herbarium specimen (B 100367902 [Mus. Bot. Berol.]) identified as *typus* by Turan Arabacı. And also, this herbarium material has both small and large capitula, the small capitula have short phyllaries while the large capitula have long phyllaries (Fig. 6). Finally, *C. sommieri* has been observed to

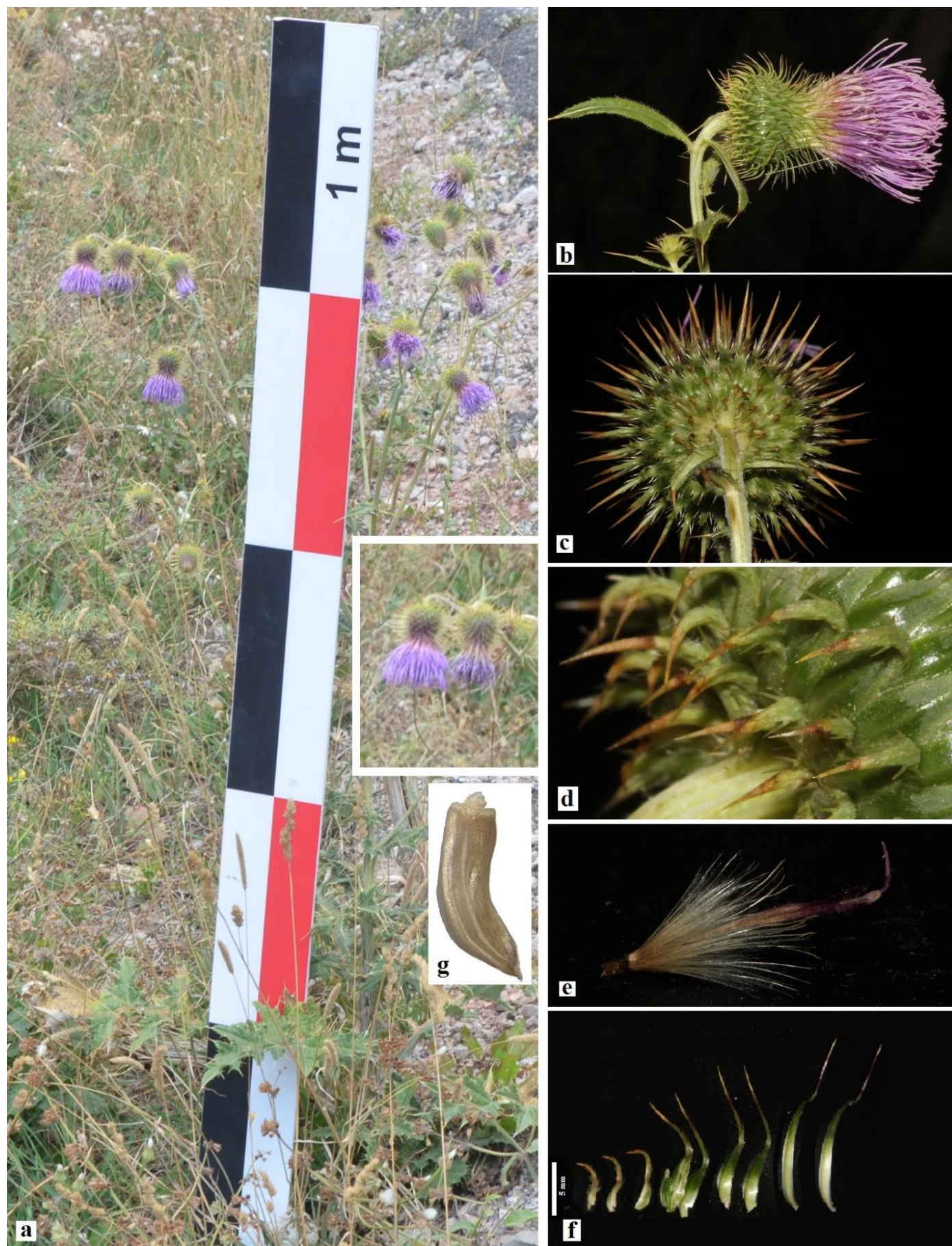


Fig. 4. *Cirsium sommieri* (Bayburt, Maden province): a. Habitus, b-c. capitulum, d. outer phyllaries, e. flower f. Bracts and phyllaries and g. achen.

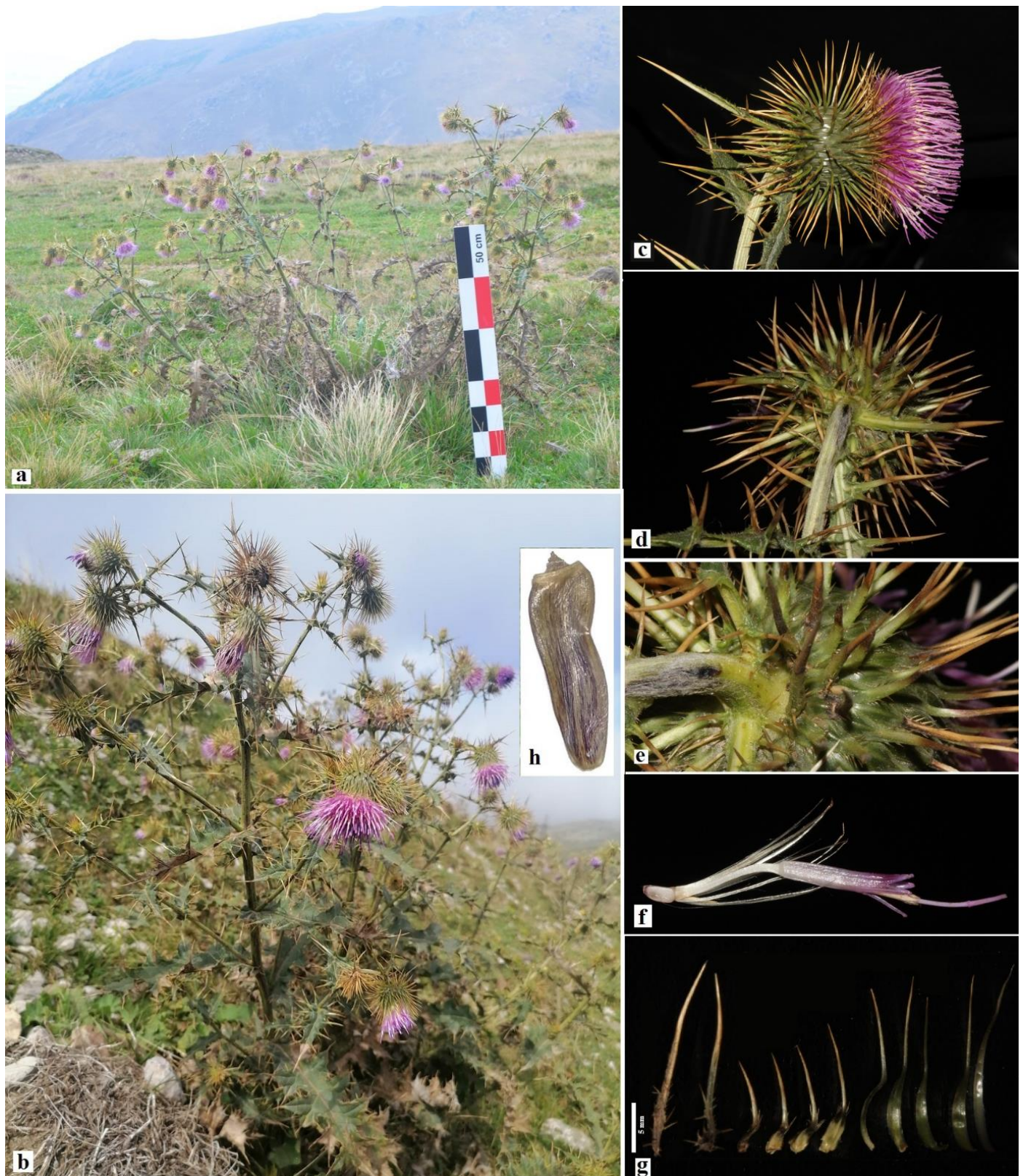


Fig. 5. *Cirsium sommieri* (Bayburt Soğanlı Pass): a-b. Habitus, c-d. capitulum, e. Bracts and outer phyllaries, f. flower, g. Bracts and phyllaries and h. achen.

change gradually. The analyzed examples draw attention to the following features: The shape and size of the capitula, the length, color, and reflexed of the phyllaries, and the length and frequency of the apical and lateral spines.

Long-term field observations and large amounts of herbarium specimens are needed to clearly understand the relationships of *Cirsium sommieri* with related species and

within species. Observation of the plant in the field will be very important.

3.4. Selected specimens examined

Cirsium sommieri - Türkiye Gümüşhane, in pascuis et fruticetis ad Tempede (Tenbeda), 22 viii 1894, Sintenis 7438,



Fig. 6. Type of *Cirsium sommieri* from Erzincan (Spikör). Small and large capitulas at the same sample.

7438b (Synype: B 100367902! [Mus.. Bot. Berol.]); Szandschak Gümüşhane, Sintenis 7438, 7438a (Synype: JE 00020849! [Herbarium Hausknecht Jena]), 10 km N of Torul village on the road to Trabzon, S. of Zigana Dağı Pass, 1370 a. s. l., 22 viii 1972, Ilkka Kukkonen 8078 (E 00463544!); in declivibus supra Istavros, 9 viii 1889, Sintenis 1759 (W 7170!) (as a syntype of *C. sommieri*); Bayburt, S. foot of Soğanlı Da. N. of Bayburt, 1650 m, 03.08.1957, Davis & Hedge D. 32012 (E 00463542! ANK!) (as a *C. sommieri*), Soğanlı Pass, Soğanlı Mountains Chain, alpine meadow, 2365 m, 40°30'N, 40°14'E, 27 July 2020, A. Sefalı 780 (VANF! BIN!); Erzincan, Sipikör, Kainik-dere, ad versuras, 31 vii 1890, Sintenis 3287 (Synype: W 246!) E00463546!, above Üzümlü (Cimin), track up E part of Keşiş Dağ massif, open grassy slopes, serpentine soil, 2000-2250 a.s.l., R.D. Reeves & N. Adigüzel 2252 (E 00287692!), Üzümlü, Keşiş Dağı, 2250 a. s. l., serpentine places, N. Adigüzel & R. Reeves 4130 (GAZI!); Tunceli, Pülümür, 16 VIII 1972, 1800 a.s.l., T. Baytop 23209 (E 00463546!); Bayburt, Maden, Mezge Dag, sandy places, 20 IX 2021, A. Sefalı 775 (BIN!); Sancaktepe village, near the damp, roadside, 03XII 2021, A. Sefalı 770 (BIN!); Tokat, Topçam road, 1200 a.s.l. l., places of open forest, 8 ix 1994, N. Adigüzel & Z. Aytaç 1825 (GAZI!); Bingöl, Genç, south and southeast of Şamdağı, forest and open forest places, roadside, 25 ix 2011, 1600 - 2100 a. s. l., L. Behçet B7420 (BIN 9!), Genç, 2 km to Bayırlı Village, side, 16 IX 2018,

1809 a.s. l., A. Sinan AS2500 (BIN 9601!). *Cirsium caucasicum* - MW 0730650!, E00459315!, E00459319!, E00459321!, E00459322!, Türkiye, Tokat, Nıksar-Karakuş, eroded banks, 1100 a.s.l., 5 ix 1954, Davis 24923 (E00459314!), Artvin, Yalnızçam Dağları, between Ardanuç and Kutul, 1500 m, 2300 m, 18.08.1957, Davis, Hedge, D. 32440, (E00459316! ANK!), Yalnızçam Dağları, on W. side of pass between Ardahan and Artvin, 2350 m, 19.08.1957, Davis & Hedge, D. 32523 (E00459317! ANK!), Ardanuç, Tepedüzü Köyü, 1300 a. s. l., Picea forest, 10 ix 2005, M. Vural 9322 (GAZI!); Erzurum, Şenkaya, Değirmendere Köyü, 2500 a. s. l., 7 ix 1993, places of open forest, Y. Altan 5758 (GAZI!); Bayburt, Aydıntepe, Günbuldu province, riverside, 1900 a.s. l., 30 ix 2021, A. Sefalı 789 (BIN!). *Cirsium adjaricum* - Artvin (Çoruh): Savval Tepe above Murgul, 1800 m, sloping pasture, 14.8.1957, D.32389 (E00459214! ANK!), Savval Tepe above Murgul, 1800 m, sloping pasture, 14.8.1957, D.32387 (E00459215!), Tiryul (Alaca Dag), south east slopes, road of Natenglav Ormanevleri, 400- 1000 a. s. l., 11 x 1977, A. Düzenli 934 (ANK!), Yaylalar village, inner the village, forest roads, ca 2000 a. s. l., 5 ix 2021, A. Sefalı 796 (BIN); Rize dist., İkizdere, Başköy (Cimil), 2200m, 26 viii 1952, D 20943 (E00459218!), Erzurum, İnci köyü yolu, Hanlar Mevkii, 1600-1800 m, 12.8.1995, Abd. 1874, (VANF!); Bayburt, Soğanlı Pass, near the Dumlu, stony places, 2010 a. s. l., 27 vii 2021, A. Sefalı 785 (BIN!). *Cirsium*

trachylepis - Türkiye, Trabzon, ca. 1 km N of Hamsiköy, ca. 60 km SW of Trabzon on the road to Gümüşhane, wet meadow on a steep slope between a house and the road facing E., 1200 a. s. l., 23 viii 1972, Ilkka Kukkonen 8140 (E 00463558!), Zigana Pass near the Hamsiköy, roadside, 20 viii 2021, 1180 a.s. l., A. Sefali 802 (BIN!); Giresun, Balaban Dağları, above Tamdere, 1700-1800 m, 08.08.1952, Davis 20648 (E 00463559!); Rize, Çamlıhemşin, below the Kaçkar Mountains, Kaçkar highlands, Meadows and granite places, 2000 a.s. l., 15 viii 1981, A. Güner 4180 (ANK!); Bayburt, Soğanlı Pass, near the Dumlu, stony places, 27 ix 2021, A. Sefali 782 (BIN!). ***Cirsium osseticum***-MW0730871!, E00463456!, E00463457!, E00463457!, E00463459!, E00463461!, Türkiye, Rize, İkizdere, Sivrikaya,

beside the River Ovit, 1614 a. s. l., alpine meadow on rocky slopes beside stream, surrounded by *Picea orientalis* forest, 23 IX 2005, Güner et al. (E00210298!), Cımil ca. 80 km SE of Rize, above timberline, 3 ix 1969, Hardeveld & v.d.Werff 557 (U1125226!); Trabzon, Bayburt to Of, roadside, 27 vii 2021, 1800 a.s. l., A. Sefali 788 (BIN!).

Conflict of interest: The authors declare that they have no conflict of interests.

Informed consent: The authors declare that this manuscript did not involve human or animal participants and informed consent was not collected.

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