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A new *Centaurea* L. (Asteraceae) species from Turkey

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Abstract

A new *Centaurea* L. (Asteraceae) species from Turkey is described and illustrated. *Centaurea mersinensis* Uysal and Hamzaoğlu exists on calcareous slopes in *Pinus brutia* forests of Aydıncık (Mersin) in southern Anatolia. It belongs to *C.* sect. *Phalolepis* (Cass.) DC., and taxonomically its closest relative is *C. lycaonica*. Diagnostic morphological characters from very similar taxa are provided, and a key is provided that includes related species of sect. *Phalolepis* from Turkey. The geographical distribution of the new species and relatives of the same section are mapped. The chromosome number of *C. mersinensis*, $2n = 18$, counted in root tips, is also reported and illustrated.

Keywords: *Endemic,* Centaurea*, taxonomy, chromosome, Turkey*

Introduction

An important and relatively large genus for flora of Turkey, *Centaurea* L. currently comprises ca. 250 species distributed across Eurasia, especially in Irano-Turanian and Mediterranean Regions (Anderberg et al. 2007). A broad redefinition of *Centaurea* L. (Asteraceae) has taken place in recent years, thanks to the generalized use of molecular, caryological and biochemical methods (Romaschenko et al. 2004; Uysal et al. 2009a, 2010; Garcia-Jacas et al. 2006; Hilpold et al. 2014b). Comparison of DNA sequences finally demonstrated that the delineation of a monophyletic genus, *Centaurea*, was possible (Garcia-Jacas et al. 2000, 2001; Wagenitz & Hellwig 2000). This new definition, however, does not change the important fact that Turkey is the main centre of *Centaurea* diversity (Wagenitz 1986). *Centaurea* is one of the largest genera having highest rates of endemism in Turkey. The genus is represented with 194 taxa in current and 105 of them are endemic (Uysal 2012), so the endemism rate is about 54%.

The Mediterranean Basin extends into western Asia, covering the western and southern portions of the peninsula of Turkey, excluding the temperate-climate mountains of central Anatolia. Mediterranean floral region is represented in Turkey by «the Eastern Mediterranean Province» which is considered to extend from the eastern half of Italy to Liban, and it reaches to Gallipoli peninsula in the southern part of Thrace, including all the southern Anatolian coast (Avcı 1996). The complicated topography of the Anatolian Peninsula could be considered an important reason to comprise highly endemism. Moreover, refugial effects of mountain ranges in Anatolia have been very important for the occurence of the intense speciation and the high percentage of endemics. Médail and Diadema, (2009) reported that the Mediterranean part of the Anatolian Peninsula has the major importance because of having its functional affect as the main refugia. According to Garcia-Jacas et al. (2006) and Hilpold et al. (2014a), the main centres of diversification of *Centaurea* show compatibility largely with the main refugia defined in the Mediterranean. Therefore, this situation explains why *Centaurea* is the third genus with more endemic species of Turkey. According to last check list of the Flora of Turkey, the genus *Centaurea* is represented with 194 species in the area, 118 of them endemics (Uysal 2012).

Phalolepis is a small section with a high rate of endemism and showing specific diversification in the Mediterranean phytogeographic region. After the latest molecular survey of *Centaurea* (Hilpold et al. 2014a), *C. hieropolitana* Boiss. and *C. tossiensis* Freyn & Sint. ex Freyn were excluded from *Phalolepis* and they are included in a new section, sect. *Hierapolitanae*. Therefore, the remaining species can be ordered as *C. amaena* Boiss. & Balansa, *C. antaliensis* H. Duman & A. Duran, *C. aphrodisea* Boiss., *C. cadmea* Boiss., *C. luschaniana* Heimerl ex

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Table I. Diagnostic characters of *Centaurea mersinensis* sp. nov. and those of the related species, *C. lycaonica* and *C. amaena*.

	Taxa		
Characters	*C. mersinensis*	*C. lycaonica*	*C. amaena*
Stem	Up to 60 cm, erect-ascending, with branched uninterruptedly (pseudomonochasial) from the base to top	Up to 35 cm, erect or ascending a few branched in upper half	Up to 55 cm, with ascending branched in upper half
Leaves	Basal leaves irregularly pinnatipartite with 1–3 linear lateral lobes, floccose-tomentose; all stem leaves simple	Basal leaves regularly pinnatipartite with 3–5 linear lateral lobes, sparsely floccose, stem leaves pinnatisect or only uppers simple	Basal leaves regularly pinnatipartite with 5–8 pairs of linear segments, tomentose, 4–10 cm, pinnatipartite with 1–5 lateral segments, tomentose, stem leaves pinnatisect, upper cauline leaves simple
Involucre	15–20 × 10–15 mm, oblong to cup-shaped, attenuate at the base. Phyllaries with scarious margins, superficially with 5–7 longitudinal linea, abaxial surface glabrous; outer phyllaries narrowly ovoid-oblong, 4–6 × 2–3 mm, median oblong, 7–9 × 3–3.5 mm, inner narrowly oblong to lanceolate, 9–11 × 1.5–2 mm	11–13.5 × 5–8 mm, narrowly ovoid-oblong, Phyllaries with scarious margins, superficially with 4–6 longitudinal linea, abaxial surface slightly with hairy, outer phyllaries oblong, 2.5–6 × 1.7–3 mm, median phyllaries oblong 8–9 × 2.5–3.4 mm, inner 11–13 × 2–3 mm	19–14 × 7–12 mm, ovoid, outer phyllaries 4–6 × 2–3 mm, median phyllaries 7–10 × 2–3 mm, inner phyllaries 10–12 × 1–2 mm
Appendage	Large-sized, ovate-orbicular, 4–6.5 × 3.5–5, absolutely concealing basal part of phyllaries, slightly decurrent, hyaline, straw-coloured to darkly brownish in centre, phyllary appendages irregularly with toothed on each side, ending in a very slender spine, up to 2 mm long	Medium-sized, orbicular, 1.8–2.2 × 1.5–2 mm partly concealing basal part of phyllaries but not absolutely, shortly with decurrent margin, with largely blackish-brown central part, firm central part and broad minutely denticulate and lacerate hyaline, emarginate at tip, terminal mucro absent or minute	Large-sized, orbicular, 3–5 × 2.5–4.5 mm, almost concealing basal part of phyllaries, decurrent, with small brown central part, fimbriate lacerate with few well-differentiated cilia (1–2 mm) near apex, ending in a 0.1–0.6 mm a mucro
Flowers	Marginal florets purple, weak and slightly longer than central florets, 17–18 mm long, infundibular limb and 5 linear lobes, lobes 4–6 mm long, central flowers pinkish, 15–17 mm long, with 5 lobes, lobes ca. 5–6 mm long. Anthers of central florets purple, equal to corolla, style usually included	Marginal scarcely radiant, pink-rose, 12–14 mm, prominent, rising equally to central florets; central flowers pinkish white, anthers of central florets pink, clearly longer than corolla, style usually excluded	Both central and marginal flowers pink-rose, 14–15 mm, with 5 lobes, lobes ca. 4–5 mm, marginals prominent, rising equally to central florets; Anthers of central florets straw-coloured or rarely pinkish, clearly longer than corolla, style usually excluded
Achene	4–4.5 × 1.8–2 mm, oblanseolate, creamish or creamish-brown, not shiny, with slightly striated	3.5–4 × 1–1.5 mm, linear-lanceolate, blackish-brown, shiny, distinctly longitudinally with striated	3.5–4 × 1–1.8 mm, linear oblong, brownish, smooth and shiny, undistinctly and irregular longitudinally with striated with setaceous hairy
Pappus	Outer series scabrous, creamish-brown, 3.5–4 mm, inner series distinctly scale like, cream, 0.8–1 mm	Outer series scabrous, whitish-cream, 3–3.5 mm, inner series similar to outer, 0.2–0.5 mm	Outer series scabrous, creamish, 3.2–3.5 mm, inner series distinctly scale like, cream, 0.5–1 mm

Stapf, *C. lycaonica* Boiss. & Heldr., *C. lycia* Boiss., and *C. wagenitzii* Hub.-Mor., *C. baseri* Köse & Alan, *C. dursumbeyensis* Uysal & Köse.

The scope of this study was to describe a new, isolated population of a *Centaurea* section *Phalolepis* and to establish through comparative morphological and karyological analyses, whether this population belongs to an already described taxon or is a new one.

Methods

Morphology

In 2014, the second author collected some interesting plant specimens from the Aydıncık province during an expedition comprising floristic studies (Table I). One of the specimens belonged to the genus *Centaurea*. The specimens had very characteristic stem branching, involucre, leaves and achenes and were later compared to specimens of supposedly related species in the herbaria of G and GOET as well as our *Centaurea* collections. These comparisons demonstrated that our specimens could represent a species new from sect. *Phalolepis* to science. Many specimens of this new species were used for the description. The specimens were examined and compared with specimens of the closely related species *C. lycaonica*. The authors of the plant names used in this text are based on Brummitt and Powell (1992).

The morphological analyses were conducted on individuals collected in the field from Late May to early June 2014. We analysed morphologically one capitulum from each of 15 plants, particularly an interesting specimens and its relatives (*C. amaena* and *C. lycaonica*). We measured the traits diagnostic at the species level (Ertuğrul et al. 2004), including capitulum length (CL), capitulum width (CW), medium appendages length (AL), medium appendages width (AW), fimbrium width (FW), spine length (SL). Additionally, achene length (ACL) and pappus length (PL) features were added for morphometry. The determined qualitative and quantitative characters were turned to a data matrix. Morphometric data (CL, CW, AL, AW, FW, ACL, PL and SL) were analysed using multivariate techniques with the PRIMER software package (Plymouth Marine Laboratory, Plymouth, UK; Clarke & Warwick 1994). Data were not transformed. A Bray–Curtis similarity matrix was used to generate a two-dimensional ordination plot applying non-metric multidimensional scaling (nMDS; Clarke 1993). The similarity percentages (SIMPER) procedure (Clarke 1993) was used to determine similarities within populations and dissimilarities among populations and to identify the major morphological traits contributing to the differences among the populations.

Karyology

Particularly, mature seeds were selected and periodically germinated for chromosomal analyses. Chromosome counts were made on somatic metaphases using the squash technique. Root meristems from germinating achenes in Petri dishes collected in the wild were used. Samples were pretreated with 0.002 M 8-hydroxyquinoline at 4°C for 8 h. The material was fixed with Carnoy for 24 h at low temperatures (+4°C). Before staining, the material was hydrolysed with 5 N HCl for 1 h at room temperature, stained with 1% aceto-orcein and mounted in 45% acetic acid. Slides were made permanent in Euparal by means of Bowen's method (1956). At least 10 metaphases were examined per taxa; the best metaphase plates were photographed (100 X) with a digital camera (Olympus DP-72), mounted on an Olympus BX53 microscope. We took into account seven different asymmetry indices to analyse the karyomorphologies of the endemic *Rhaponticoides* species using the KAMERAM, which is a newly designed karyotype analyzer program that is able to simultaneously compute all indices (KAMERAM 21, Argenit, İstanbul, Turkey). Chromosome nomenclature followed that proposed by Levan et al. (1964), with the symbols m and sm designating metacentric and submetacentric chromosomes, respectively. The intrachromosomal asymmetry index (A_1) and the interchromosomal asymmetry index (A_2) proposed by Romero Zarco (1986) were used. Karyotype asymmetry was also calculated according to the indexes suggested by Paszko (2006).

Results

As a result of morphometric and karyological analyses, we decided that the interesting specimens examined are belonging to a new *Centaurea* species from *Phalolepis* section.

Taxonomic comparison

Centaurea mersinensis Uysal & Hamzaoğlu sp. nov. (Figures 1 and 2) Sect. *Phalolepis* (*Centaurea*).

Affinis *C. lycanica* sed diversus quam grandior involucris, foliis mediis indivisus et extenuatus gradatim filiformibus (nec divisa et linearibus.

Type: Turkey. C4 Mersin, Aydıncık-Yenikaş köyü üstü, *Pinus brutia* orman açıklıkları, kireçli yamaçlar, 36° 08′ 38″ N, 33° 15′ 18″ E, 520 m, 3.6.2014, *Hamzaoğlu* 7009 (*Holotype*: GAZI, *isotypes*; KNYA, ANK, HUB, GAZI).

Perennial with woody rootstock, many stemmed, up to 60 cm long. Stem erect to ascending, freely branched from near base with long branches, almost rigid, floccose or thinly floccose-tomentose. Leaves dimorphic; basal and lower leaves filiform, entire or divided, if divided irregularly pinnatipartite with lateral 1–3 pairs of linear segments (0.5–0.8 mm), 8–12 cm long (incl. petiole), 3–5 cm wide (in outline); all median and upper cauline leaves simple, similar and linear, 15–40 × 0.7–1 mm, gradually, reduced to upper half, entire and sessile. Capitula solitary, radiant 20–25 mm long (incl. flowers) erect. Involucre 15–20 × 10–15 mm, oblong to cup-shaped, attenuate at the base. Phyllaries imbricate, with scarious margins, superficially with longitudinal linea, baxial surface glabrous; outer phyllaries narrowly ovoid-oblong, 4–6 × 2–3 mm, median phyllaries oblong, 7–9 × 3–3.5 mm, inner phyllaries narrowly oblong to lanceolate, 9–11 × 1.5–2 mm. Appendages ovate to orbicular, 4–6.5 × 3.5–5 mm concealing most of basal part of phyllaries, slightly decurrent, hyaline, straw-coloured to clearly brownish in centre, phyllary appendages irregularly with toothed on each side, ending in a very slender spine, up to 2 mm long. Marginal florets pinkish purple, weak and slightly longer than central florets, 17–18 mm long, infundibular limb and 5 linear lobes, lobes 4–6 mm long, without staminode. Central flowers pinkish, hermaphrodite, 15–17 mm long, with 5 lobes, lobes ca. 5–6 mm long. Anthers of central florets purple, equal to corolla, style usually included. Achenes 4–4.5 × 1.8–2 mm, oblanseolate, creamish or creamish-brown, slightly striated and

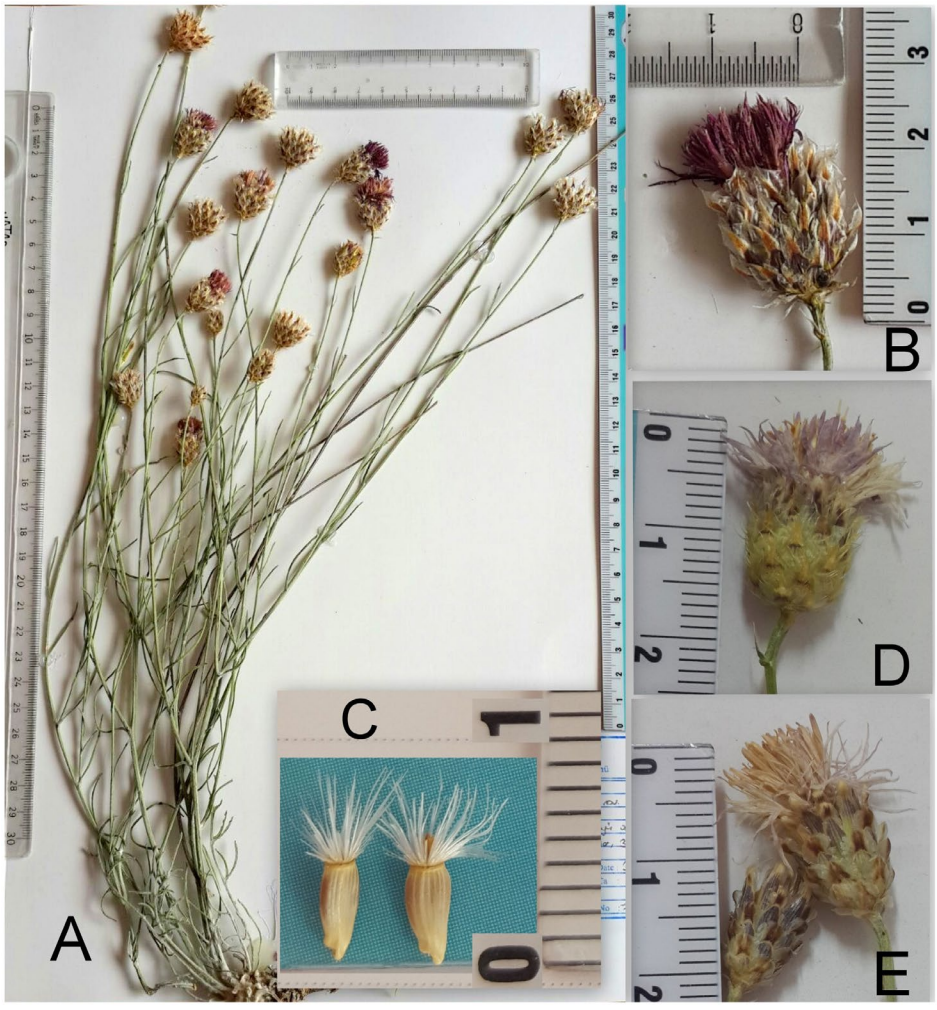

Figure 1. (A) General shape, (B) capitula, (C) achene and pappus (from Isotype of *Centaurea mersinensis*) capitulas of (D) *C. amaena*, (E) *C. lycaonica.*

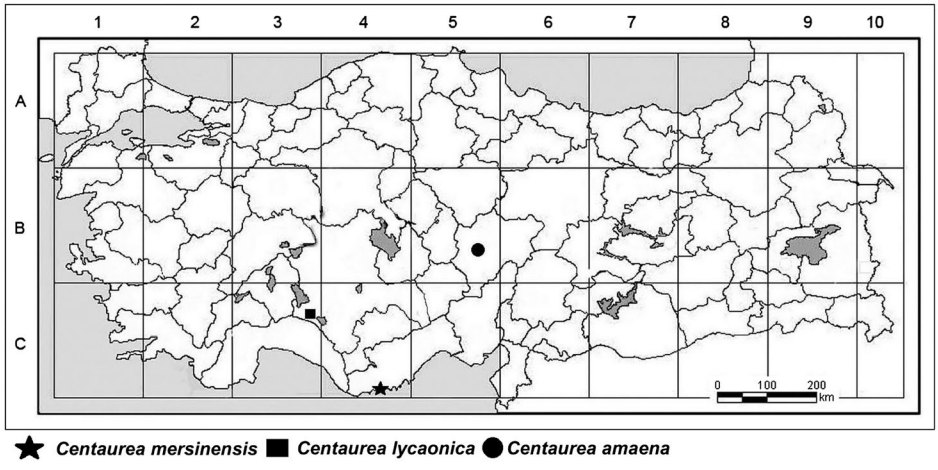

Figure 2. A distribution map of *Centaurea mersinensis* and its relatives.

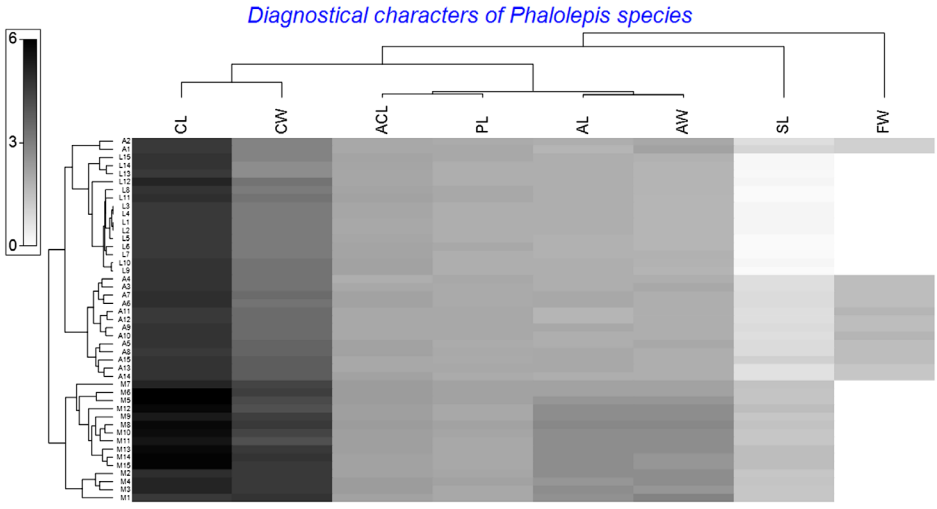

Figure 3. The dendrogram showing relationships between samples and variables.

glabrous pappus distinctly biseriate, outer series scabrous, creamish-brown, 3.5×4 mm, inner series often distinctly scale like, cream, 0.8–1 mm. Flowering in June, fruiting in July.

Examined other species and their localities

C. lycaonica: Turkey. C3/C4 Konya, in aridis Lycaoniae inter Beychehr (Beyşehir)et Koniah (Konya), 9.v. 1845, Heldreich (Holotype G!, isotype GOET!); C4 Konya, Konya-Seydişehir motor-way, near Bulumya village, rocky slopes, 1580 m, 28 vi 2006, N 37° 45' 02", E 32° 04' 29", *O. Tugay* 4146 & *T. Uysal*. *C. amaena*: B5 Kayseri**,** prope Caesaream (Kayseri) Cappadociae ad occasum sitas, vii 1856, *Balansa* 890 (Holotype G! GOET!), B5 Kayseri, nr Kayseri, 11 vi 1939, *Skrivanek*!, Yılanlı dağı, 1150–1250 m., Kaya çatlakları, 22 ıx 1993, GAZİ!; Yılanlı mountain, rocky slopes, 1194 m, N 38° 42′ 55.4″-E 35° 25′ 18.2″, 17.07.2004, YBK 153.

The following key, except from the Flora of Turkey, contains those species that we consider related to *C. mersinensis* (modified from Wagenitz 1975).

17. Appendage large, nearly concealing basal part of phyllary	
18. Stem leaves simple(undivided)	33.a. *mersinensis*
18. Stem leaves divided (pinnatipartite or pinnatisect)	
19. Involucre 5-6 mm broad	33. *lycaonica*
19. Involucre 8-9 mm broad	30. *amaena*

Morphologic comparison

Centaurea mersinensis (M) is seen mainly different from *C. amaena* (A) and *C. lycaonica* (L) species in CW and CL, whereas the other measures were moderately similar except from FW and SL (Figure 3). A and L species could be evaluated more closely according to basic capitulum andother features. The nMDS plot of morphological traits showed clear separation among all species (Figure 4). The SIMPER procedure showed similarity within populations of the each species >90% (M = 93.02%, L = 96.61%, A = 95.15%), whereas the dissimilarity determined between species was noteworthy. Prominently, dissimilarity between M and A was higher (20.97%) than from between L and A (8.44%); the highest dissimilarity was between M and L (23.65%). Finally, SIMPER identified certain morphological traits as major contributors to the dissimilarities observed between different populations (Table II): the trait mostly contributing to the dissimilarity among the different populations was CW and CL in all cases.

Distribution and ecology

Centaurea mersinensis is a local endemic species only known with the type locality (Figure 2), which is an Mediterranean element. It grows in openings *P. brutia* forests with species such as *Quercus coccifera*, *Styrax officinalis*, *Pistacia terebinthus* subsp. *palaestina*, *Cistus creticus*, *Lithodora hispidula* subsp. *hispidula*, *Ruscus aculeatus* var. *angustifolius*, *Gonocystisus angulatus*, *Phlomis fruticosa*, *Eryngium falcatum*, *Hyparrhenia hirta*, *Micromeria myrtifolia*, *Geranium purpureum*, *Crepis reuteriana* subsp. *reuteriana* at the altitude of 520 m.

Conservation status

Centaurea mersinensis is restricted to a single location and an area of occupancy estimated to be less than 5 km. On the basis of our knowledge, we argue that the species is potentially critically endangered (CR),

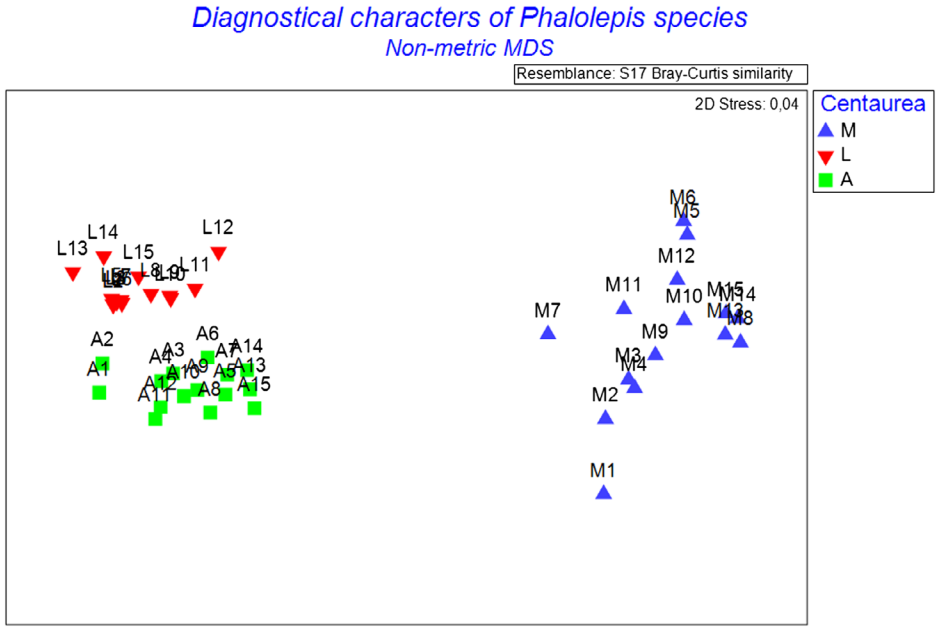

Figure 4. Two-dimensional nMDS ordination of individual replicates (capitula) comparing morphological characters among three relative taxa (M, *C. mersinensis*; L, *C. lycaonica*; and A, *C. amaena*).

Table II. Major morphological characters contributing (%) to dissimilarity among three relative taxa (*C. mersinensis* M*; C. lycaonica* L; and *C. amaena* A) according to SIMPER analysis.

Characters	Av. Abund. M	Av. Abund. L	Av. Diss	Contrib%
Taxa M & L				
Average dissimilarity = 23.65				
CW	17.00	7.93	8.87	37.52
CL	25.47	18.73	6.60	27.92
AW	5.57	2.59	2.92	12.33
AL	5.60	2.96	2.57	10.88
SL	1.68	0.03	1.61	6.81
PL	3.69	3.13	0.54	2.29
ACL	4.27	3.73	0.53	2.24
FW	0.00	0.00	0.00	0.00
Taxa M & A				
Average dissimilarity = 20.97				
CW	17.00	9.93	6.59	31.41
CL	25.47	18.80	6.20	29.58
AL	5.60	3.10	2.32	11.06
AW	5.57	3.17	2.23	10.62
FW	0.00	1.87	1.73	8.26
SL	1.68	0.57	1.03	4.89
ACL	4.27	3.63	0.59	2.82
PL	3.69	3.38	0.28	1.36
Taxa L & A				
Average dissimilarity = 8.44				
CW	7.93	9.93	2.73	32.33
FW	0.00	1.87	2.23	26.43
CL	18.73	18.80	1.04	12.28
AW	2.59	3.17	0.70	8.31
SL	0.03	0.57	0.65	7.73
AL	2.96	3.10	0.39	4.58
PL	3.13	3.38	0.37	4.43
ACL	3.73	3.63	0.33	3.91

Notes: Cut-off for low contributions: 100.00%. Av. Abund., average abundance; Diss., dissimilarity; Contrib., contribution. Achene length (ACL), medium appendages length (AL), medium appendages width (AW), capitulum length (CL), capitulum width (CW), fimbrium width(FW), pappus length (PL), spine length (SL).

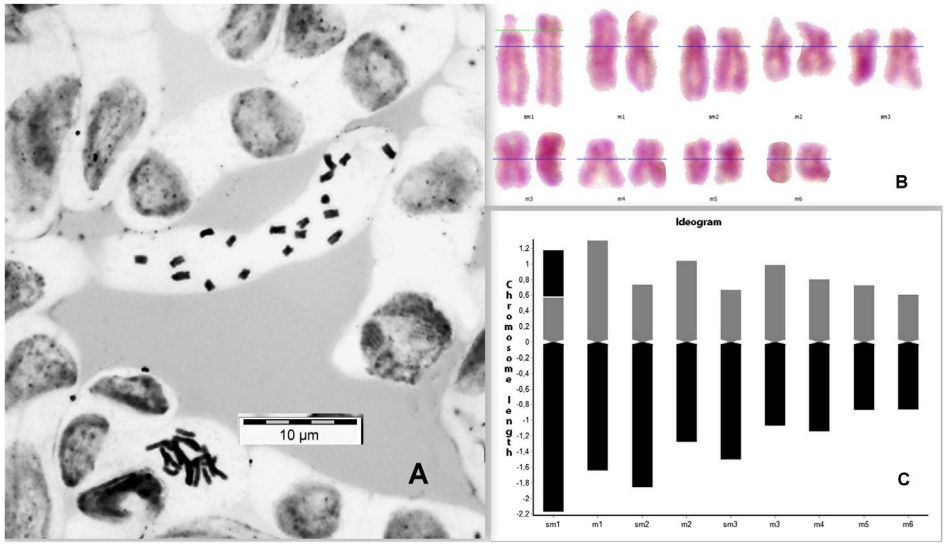

Figure 5. Karyomorphology of *Centaurea mersinensis*, with $2n = 18$. (A) Metaphase plate, (B) Karyogram, (C) Ideogram.

Table III. Karyomorphological data of *Centaurea mersinensis.*

Chromosomes of *Centaurea mersinensis*	Mean length (µm)	Total length (µm)	Long arm (µm)	Short arm (µm)	Centromeric index	Centromere position
1	3.341 (0.053)	6.681	1.17 (0.002)	2.171 (0.055)	0.35 (0.006)	sm
2	2.945 (0.054)	5.89	1.295 (0.052)	1.649 (0.003)	0.44 (0.009)	m
3	2.596 (0.146)	5.192	0.732 (0.029)	1.864 (0.117)	0.282 (0.005)	sm
4	2.32 (0.052)	4.641	1.036 (0.032)	1.284 (0.02)	0.446 (0.004)	m
5	2.173 (0.003)	4.346	0.666 (0.017)	1.507 (0.013)	0.306 (0.007)	sm
6	2.055 (0.044)	4.111	0.983 (0.023)	1.072 (0.021)	0.478 (0.001)	m
7	1.942 (0.022)	3.885	0.794 (0.003)	1.148 (0.019)	0.409 (0.003)	m
8	1.589 (0.042)	3.178	0.721 (0.019)	0.868 (0.023)	0.454 (0)	m
9	1.471 (0.022)	2.941	0.606 (0.006)	0.865 (0.017)	0.412 (0.002)	m

Table IV. Karyotype formula according to Levan et al. (1964) and characteristics of the studied *Centaurea mersinensis.*

Taxa	$2n$	x	Ploidy	R (SC-LC) (µm)	Ratio LC/SC	P (µm) mean (±SD)	Q (µm) mean (±SD)	CL (µm) Mean (±SD)	TCL	CI Mean (±SD)	CF
Centaurea mersinensis	18	9	2*x*	1.47–3.34	2271	0.89 (±0.23)	1.38 (±0.43)	2.27 (±0.57)	20.432	40 (±0.07)	6sm + 12 m

Table V. Karyotypes of *Centaurea mersinensis* using different methods of evaluating karyotype asymmetry.

Taxa	A_1	A_2	CV_{CL}	CV_{CI}	AI	DI	Stebbins
Centaurea mersinensis	0.322	0.253	25.327	16.354	4.142	9.256	3B

but more data are needed to measure or estimate its decline.

Karyology

According to a search of the literature, the chromosomal counts of Turkish *Centaurea* sect. *Phalolepis* species were reported in previous studies by several Turkish experts. Additionally, there are some chromosomal reports from Greece that are relevant to species of sect. *Phalolepis* and the basic chromosome number was reported as $x = 9$ (Kalpoutzakis & Constantinidis 2004). In the present work, mature *Centaurea mersinensis* seeds were used for chromosomal counts. As suitable with previous reports, the constant chromosome number of $2n = 18$ was observed in all metaphase plates examined (Figure 5). The species is therefore

diploid and based on $x = 9$. In the previous studies, the number and karyotype of chromosomes of the *C. amaena* and *C. lycaonica* were analysed in detail (Uysal 2008; Uysal et al. 2009b; Martin et al. 2009; Atasagun et al. 2013). In the previous reports, the number of somatic chromosomes of the *C. amaena* and *C. lycaonica* was defined to be $2n = 18$. Therefore, the number of basic chromosomes was reported as $x = 9$ in the mentioned papers. It is also reported that the karyotype formula of *C. amaena* was to be composed of three median and six submedian chromosome types whose lengths are changed among 2.09–3.19 µm (Atasagun et al. 2013). Martin et al. (2009) reported that *C. lycaonica* has four submedian and five median chromosomes which are between in 1.71 and 3.52. Our karyomorphological results indicated that the new species had moderately asymmetrical chromosomes which are between in 1.471 and 3.341 µm (Tables III–V). However, the new species has more median chromosomes in comparison with *C. amaena* and its karyotype formula composed of three submedians and six median chromosomes. As a result, the new species are seen more related to *C. lycaonica* comparing to *C. amaena* in terms of karyomorphological features.

Discussion

The morphologic traits and the base chromosome numbers $x = 9$ place *C. mersinensis* in the *Phalolepis* group. Turkish *Phalolepis* species have mostly diploid chromosome number except from *C. dursunbeyensis* and *C. aphrodisea*. However, polyploidy reports are fairly rare in the section (Uysal et al. 2009a, 2009b). At the point of chromosome number and morphology, *C. mersinensis* is absolutely similar to its relatives by having $2n = 18$ chromosome number, but it displays mainly important differences in chromosome formula and asymmetry indices (Figure 5).

Morphologically, Turkish *Phalolepis* species display high similarity particularly in terms of vegetative characters. However, involucre bracts and appendages are accepted very important in separation of close taxa (Wagenitz 1975; Köse et al. 2010). According to our morphometric analyses, capitulum length and width have been basically very important in separation of closely relative taxa. Secondarily, appendages and achene features could be assessed as diagnostical among the discussed taxa and its populations (Figure 3). Additionally, they are mainly different from *C. mersinensis*, both by the habit and by the colour of florets (pink-rose). *Centaurea mersinensis* is seen closely relative to *C. lycaonica* which is local endemic species to Konya province of Central Anatolia. These two species can be easily separated by the way of stem branching, stem leaves and involucre sizes as well as indumentum (Table I). Moreover, the new species has more robust habit comparing to other related species. In contrast to the new species, *C. amaena* and *C. lycaonica* are more similar to each other in terms of leaf characteristics, stem branching and habitat. As the other characteristic, *C. mersinensis* is branched continuously from the base with long branches (like a pseudomonochasial branching) with a few relatively medium capitula, basal leaves deeply divided into filiform few segments, irregularly pinnatifid in contrast to simple filiform stem leaves, phyllary appendages membranous, slightly decurrent, minutely denticulate at the margines, Therefore, it is easily separated from the other taxa of the same sections by this morphologic feature. *C. mersinensis* and its relatives show common phenologic features that they usually bloom in June and get in fruit late July. While *C. mersinensis* grows on limestone slopes at the lower altitudes, related species occur on dry and stony hills at the higher altitudes.

According to our observations, the population of *C. lycaonica* is 250 km far more than *C. mersinensis* and there is no any known interaction among them. Comparing these two taxa, *C. amaena* takes place further away, c.350 km, and any connection is not known with populations of other related species. Therefore, each of them is seen as very isolated populations or taxa. In a similar manner reported before (Rokas et al. 2003; Dubey et al. 2006; Fritz et al. 2009), the formation of these isolated populations in Anatolia may be due to the existence of suitable habitats for temperate species to survive the last glacial maximum. The southern Anatolian Peninsula and especially the western and central sections of Taurus Mountains is home of several of the refugia defined by Médail and Diadema (2009) and is also characterized by a high concentration of plant diversity and endemism (Médail & Quézel 1997).

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