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Research article/Araştırma makalesi

Artemisia taurica Willd. var. *vanensis* Kursat & Civelek (Asteraceae: Anthemideae), a new variety from Eastern Anatolia of Turkey

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Abstract

During our revisionary study on the taxa of the genus *Artemisia* L. (Asteraceae) distributed in Turkey, we came across two populations that we anticipated could be a new variety of the species *Artemisia taurica* Willd. belonging to the subgenus *Seriphidium* (Besser) Fourr. In the morphological and cytological studies, we found that the new variety should be included in the species *A. taurica* but it also has some considerable morphological differences. These morphological differences include the length of stems, peduncles, pistils, styles, forks of stigmas, stamens, filaments, and dimensions of leaves, phyllaries, corollas, ovaries, anthers, achenes, the direction of synflorescens branches, the orientation of the capitula on the synflorescens branches, colour of corolla, and the type of indumentum. The new variety was also different in terms of chromosome number. Based on these differences, we suggested that a new variety of the species *A. taurica* should be described, as *A. taurica* var. *vanensis* which is only distributed in a very limited area in the Eastern of Turkey. In this article, an identification key for all taxa in the subgenus *Seriphidium* and a rearranged description of the species *A. taurica* for including its two varieties, a diagnosis and an identification key for two sister varieties, a distribution map and a few descriptive figures of the new variety have been given.

Key words: *Artemisia taurica*, Asteraceae, *Seriphidium*, taxonomy, Turkey

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Artemisia taurica Willd. var. *vanensis* Kursat & Civelek (Asteraceae: Anthemideae), Türkiye'nin Doğu Anadolu'sundan yeni bir varyete

Özet

Türkiye'de yayılış gösteren *Artemisia* L. (Asteraceae) cinsinin taksonlarına yönelik yaptığımız revizyon çalışması sırasında, *Seriphidium* (Besser) Fourr. altcinsinde yer alan *Artemisia taurica* Willd. türünün yeni bir varyetesi olabileceğini tahmin ettiğimiz iki populasyonla karşılaştık. Morfolojik ve sitolojik çalışmalar neticesinde, bu yeni varyetenin *A. taurica* türüne dahil edilmesi gerektiğini, aynı zamanda bazı önemli morfolojik farklılıklara sahip olduğunu bulduk. Bu morfolojik farklılıklar; gövdelerin, kapitulum saplarının, pistillerin, situlusların, stigma çatallarının, stamenlerin, filamentlerin uzunlukları, yaprakların, fillarilerin, korollaların, ovaryumların, anterlerin, akenlerin boyutları, sinfloresens dallarının yönelimleri, kapitulumların sinflorosens dalları üzerindeki düzenlenişleri, corolla rengi ve tüy örtüsü tipini kapsamaktadır. Bu yeni varyete, kromozom sayısı bakımından da farklıydı. Bu farklılıklara dayanarak, Türkiye'nin doğusunda sınırlı bir alanda yayılış gösteren *A. taurica* türünün yeni bir varyetesinin *A. taurica* var. *vanensis* olarak tanımlanması gerektiğini önerdik. Bu makalede, *Seriphidium* altcinsindeki tüm taksonlar için bir teşhis anahtarı, *A. taurica* türünün iki varyeteyi de kapsayacak şekilde yeniden düzenlenmiş betimi, kardeş varyeteler için bir diyagnoz ve teşhis anahtarı, yeni varyetenin bir yayılış haritası ve birkaç tanımlayıcı resim verilmiştir.

Anahtar kelimeler: *Artemisia taurica*, Asteraceae, *Seriphidium*, taksonomi, Türkiye

1. Introduction

The genus *Artemisia* Linnaeus includes nearly 500 species in the world, and is distributed widely in the north hemisphere (Bremer and Humphries, 1993; Bremer, 1994). The majority of species of the genus *Artemisia* grow sparsely

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or form small populations, but several taxa form large, expansive populations and characterize landscapes (Vallès and McArthur, 2001).

The most commonly accepted subdivisions of the genus *Artemisia* are separated into 4 subgenera as the subgenus *Artemisia* Lessing, the subgenus *Dracunculus* (Besser) Rydberg, the subgenus *Seriphidium* (Besser) Fourr and the subgenus *Tridentatae* (Rydberg) McArthur (McArthur et al., 1981). McArthur et al., (1981) have created the new subgenus *Tridentatae* by taking members of the genus *Artemisia* of the "New World" that are composed by eleven taxa that have habitus of xerophilous shrub and homogamous capitula, distributed in North-East America and placed in the subgenus *Seriphidium* formerly (McArthur et al., 1981; Mcarthur et al., 1992; Mcarthur and Sanderson, 1992). While the taxa of subgenera *Artemisia*, *Dracunculus* and *Seriphidium* are naturally growing in Turkey, the subgenus *Tridentatae* lacks naturally growing taxa in Turkey (Civelek et al., 2010; Kursat, 2010; Guner et al., 2012).

There are 22 species that belong to the genus *Artemisia* in the 5th volume of the Flora of Turkey (Cullen, 1975). Later, *Artemisia verlotiorum* Lamotte is added as a new record for Turkey on the 10th volume of the Flora of Turkey, which is a supplementum, so the species numbers of this genus in Turkey became 23 in total (Davis et al., 1988). Recently, Civelek et al. (2010) carried out a revision study of the genus *Artemisia* distributed in Turkey, and according to their results, there are 22 species and 25 taxa which include these species and their infraspesific taxa belong to 3 subgenera. When we publish this new variety, the number of taxa of the genus *Artemisia* in Turkey will increase to 26.

The species *Artemisia bashkalensis* Kursat & Civelek is identified as a new species globally (Kursat et al., 2015). The taxa, *Artemisia fragrans* Willdenow, *Artemisia sieberi* Besser subsp. *sieberi* and *Artemisia santonicum* Linnaeus subsp. *patens* (Neilreich) Persson are identified as new records for Turkey (Civelek et al., 2010; Guner et al., 2012; Kursat, 2010; Kursat et al., 2011a; Kursat et al., 2011b; Kursat et al., 2014). Recently, New taxa have been published in the Eastern Anatolian Region (Fidan et al., 2017;. Hamzaoğlu and Koç, 2018).

During our revisionary study, we have observed that all samples identified as the species *Artemisia herba-alba* in the Turkish herbaria are actually the taxon *A. sieberi* subsp. *sieberi*, and the species *Artemisia herba-alba* are not distrubed in Turkey (Civelek et al., 2010; Kursat, 2010; PlantList, 2010). In addition, the species *Artemisia alba* Turra is only known from the East Aegean Islands which are outside Turkey's borders. For these reasons, the taxa *A. alba* and *A. herba-alba* were removed from the Turkey's species list (Civelek et al., 2010; Guner et al., 2012; Kursat, 2010; Kursat et al., 2011a; Kursat et al., 2014).

The general distribution regions of the species *Artemisia taurica* on the earth are Europe, southern Russia (Caucasus), Crimea, Turkey. The species *Artemisia taurica* shows the wide distribution in the steppes of Central, Eastern and Southeastern Anatolia in Turkey. This species is one of the three species have wide distribution in Turkey. The other two species have a wide distribution in Turkey are *Artemisia absinthium* L. and *Artemisia campestris* L. (Civelek et al., 2010; Kursat, 2010).

As a result of the systematical, morphological and cytologycal evidence studies executed within the framework of *Artemisia taurica*, which belongs to the subgenus *Seriphidium* of the genus *Artemisia*, this was defined as a new variety in present study (Civelek et al., 2010; Kursat, 2010).

2. Materials and methods

The present study is one of the results of our revisionary study which was carried out between the years 2007–2010 under the research project titled 'The Researches of Taxonomical, Chemical (Flavonoids and Essential Oils), Karyological, Palynological and Antimicrobial Activities on Taxa of the Genus *Artemisia* L. (Asteraceae) Growing in Turkey'(Civelek et al., 2010; Kursat, 2010).

For the revisionary study, hundreds of samples were collected from all over the country, and the samples were transformed into herbarium materials, and vouchers were deposited in the Fırat University Herbarium (FUH). Examined materials of the new variety, *A. taurica* var. *vanensis* were collected between September and November of the years 2007 and 2009. The samples of the new variety were compared with other allied taxa of the genus *Artemisia* in the herbaria WU, LE, W, FUH, EGE, ANES, AIBU, AEF, ANK, GAZI, CU, CUFH, HUB, HUEF, ISTE, KNYA, OMUB and VANF (acronyms according to Thiers, 2015). Examined all samples of the species *A. taurica* are given appendix 1.

3. Results and discussion

3.1. Artemisia taurica Willd. var. *vanensis* Kursat & Civelek, var. nov. (Figs 1- 6)

Type : Turkey, B9 Van, 30th km of the highway from Van to Hakkari, slopes around Zernek irrigation dam lake, mountain steppe, 1960 m., 38º 20.872N, 43º 41.867E, 20 September 2007, S. Civelek & M. Kursat 1056 (holotype FUH) (Fig. 5).
Paratypes : Turkey, B9 Van, Gurpinar district, between Cavustepe castle and Zernek irrigation dam lake, at field edges and roadsides, 1851 m., 38º 21.936N, 43º 33.846E, 20 September 2007, *M. Kursat 1052* (FUH) ; B9 Van, 30th km of highway from Van to Hakkari, slopes of around of Zernek irrigation dam lake, mountain steppe, 1960 m., 38º 20.872N, 43º 41.867E, 24 November 2007, *M. Kursat 1112* (FUH) ; ibid, 31 October 2009, *S. Civelek & M. Kursat 1208* (FUH).

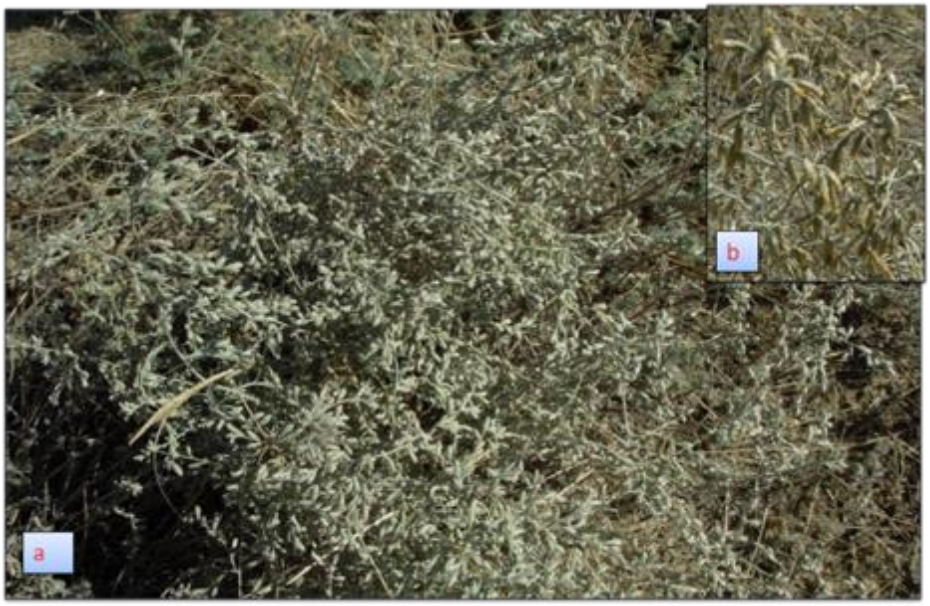

Figure 1. **a.** A general wiev in the natural habitat, **b.** Orientation of capitula of *A. taurica* var. *vanensis*

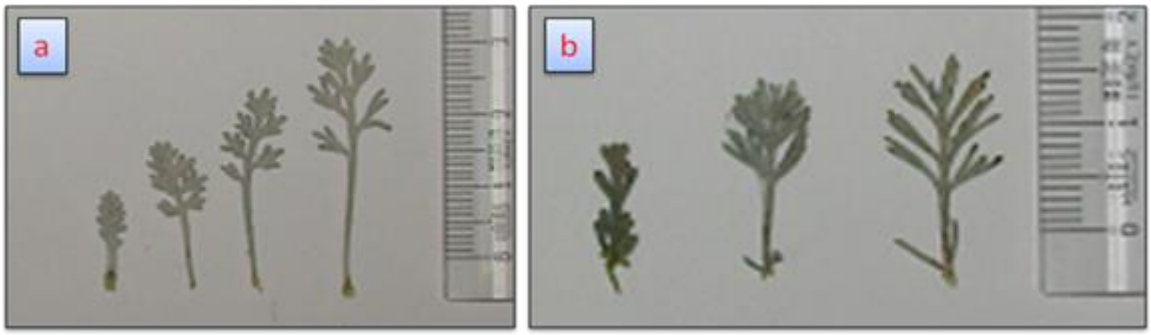

Figure 2. **a.** The detailed appearance of different sized lower dryed leaves, **b.** The detailed appearance of different sized lower fresh leaves of *A. taurica* var. *vanensis*

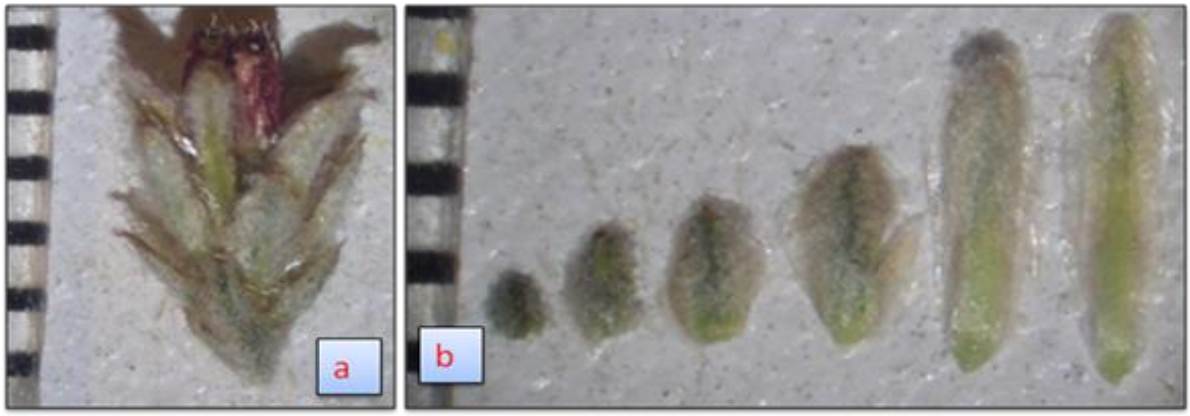

Figure 3. **a.** A capitulum (head), **b.** Phyllaries of capitulum from outside to inside of *A. taurica* var. *vanensis* (each range of the scale is 1mm)

3.2. Description of the species Artemisia taurica Willd.

Suffruticose perennial, stock stout and woody, Stems many, usually ascending, rarely more or less erect, to 15–60 cm high, sulcate, densely dark grayish arachnoid or tomentse hairy at pre-flowering stage, later partially poured. Basal rosettes present at flowering stage. Leaves densely dark greyish arachnoid or tomentse hairy; lower leaves and leaves of sterile shoots petiolate, 0.5–2.5 × 0.5–1.2 cm, twice or thrice pinnately (pinnatisect) divided, their lobes linear-oblong, apex of lobes acute; middle and cauline leaves sessile, pinnatisect divided, their lobes linear, apex of lobes obtuse-acute;

floral (uppermost) leaves sessile, from pinnatisect to linear with two basal lobes, 0.1–1 × 0.1–0.4 cm, apices of their lobes obtuse-acute. Synflorescence rasemose-paniculate, branches of synflorescens ascendant (spread and upwards) or horizontal ; capitula oblong-obovate, 3–6 × 1.5–3.2 mm, spread or drooping (pendulose), usually pedunculate, peduncle to (1–) 3–5 mm long, capitula becoming sessile towards the end of synflorescens branches, arachnoid-tomentose and punctate-glandular (glands-dotted or sessile glands); phyllaries (involucral bracts) 4–6 series, from ovate-oblong to lanceolate, outer phyllaries divided or not to base, 0.2–0.9 × 0.1–0.8 mm, middle phyllaries 0.8-2.2 x 0.6-1.7 mm, inner phyllaries 2-4.2 x 1- 1.5 mm; reseptacle glabrous; all flowers hermaphrodite and fertile,, 3–8 per capitula; corollas tubulate, 2.8–4.2 × 0.5–1 mm, yellow or pinkish red or purplish red, punctate-glandular (glands-dotted or sessile glands); pistils 2.6–3.9 mm long, ovaries 0.5–1 × 0.2–0.7 mm in dia; stigmas bifid (forked), ciliate at apices forks of bifid stigma 0.3-0.7 mm long; stamens 2.2–4.2 mm long, filaments 0.8–1.5 mm long, anthers with lanceolate apical appendage, 1.2–2.7 × 0.1–0.3 mm in dia. Achenes (cypselae) 1.2–2.7 × 0.5–1.4 mm in dia, oblong-obovate, longitudinally ribbed, bright brown. Somatic chromosome numbers 2*n*=4*x*=36 or 2*n*=6*x*=54 (Figure 6).

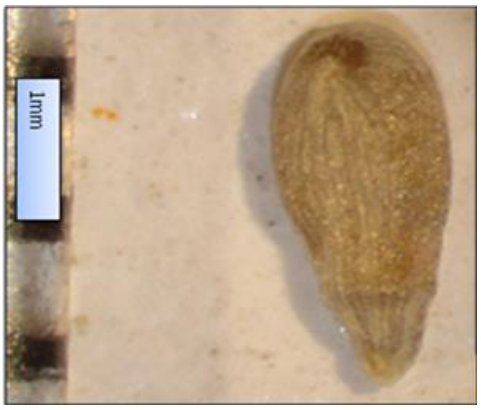

Figure 4. A fruit (cypsela or achene) of *A. taurica* var. *vanensis*

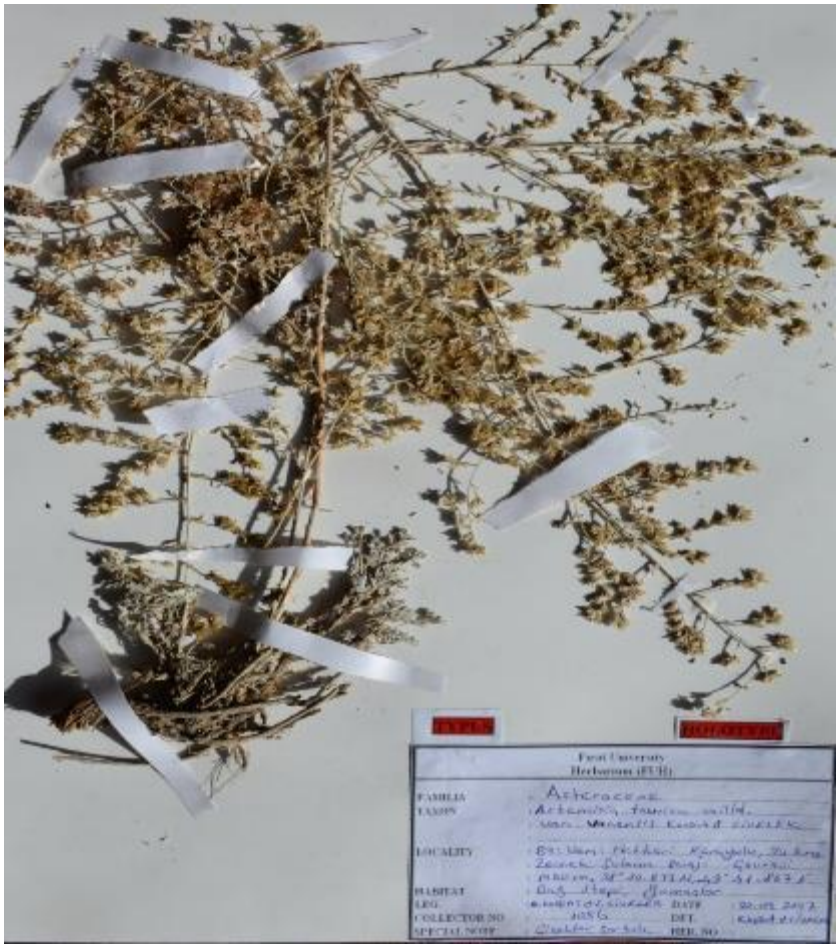

Figure 5. Holotype of *Artemisia taurica* var. *vanensis* Kursat & Civelek, var. nov. (*M. Kursat 1056*, FUH)

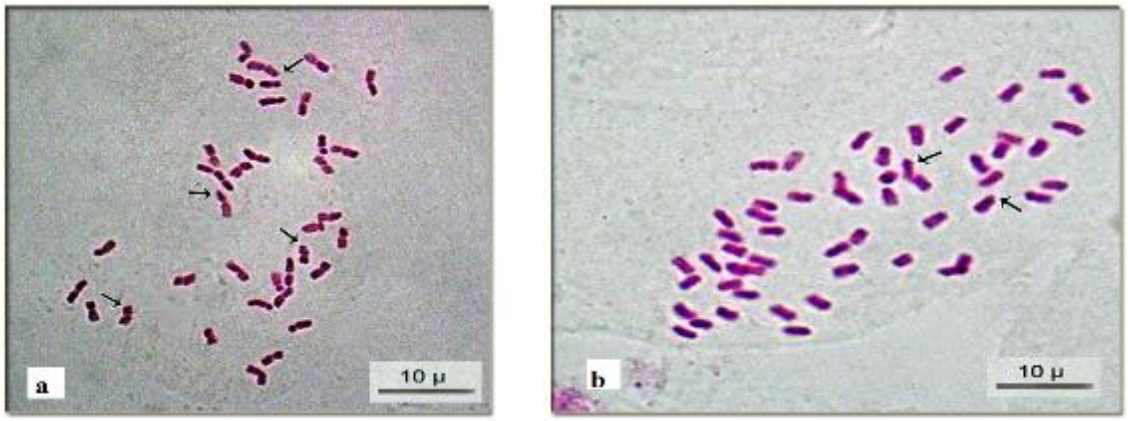

Figure 6. Mitotic metaphase chromosomes of two sister variety of the species *Artemisia taurica*. (**a:** var. *taurica*, 2*n*=4*x*=36) and (**b:** var. *vanensis*, 2*n*=6*x*=54; arrows show the satellite chromosomes) (Civelek et al., 2010)

3.3. Diagnosis for the sister varieties of the species of A. taurica in Turkey

The new variety *A. taurica* var. *vanensis* differs from its sister variety *A. taurica* var. *taurica*; with fertile stems 20–45(–60) cm high [15–35 (–45) cm high in var. *taurica*]; indumentum densely arachnoid [tomentose in var. *taurica*]; synflorescence branches usually horizontal [usually ascendant i.e spread to erect in var. *taurica*]; capitula usually drooping (pendulose) at flowering and fruiting stages and loose after pressing process [spread, not drooping at flowering and fruiting stages and remains tight after pressing process in var. *taurica*]; outer phyllaries usually not divided to base [usually divided to base in var. *taurica*]; corolla yellow or pinkish-red or purplish-red [yellow in var. *taurica*]; pistils and stamens usually not exerted the corolla [pistils and stamens usually exerted the corolla in var. *taurica*]; somatic chromosome number 2*n*=6*x*=54 [2*n*=4*x*=36 in var. *taurica*] (Table 1).

3.4. Diagnostic key for for the sister varieties of the species of A. taurica in Turkey

I. Synflorescence branches ascendant (spread and upwards); outer phyllaries usually divided to base; capitula not drooping (pendulose) at flowering and fruiting stages, remains tight after pressing process; corolla yellow
var. *taurica*

- Synflorescence branches horizontal; outer phyllaries usually not divided to base; capitula drooping (pendulose) at flowering and fruiting stages, start to loose and seperated comparatively after pressing process; corolla yellow or pinkish red or purplish red
var. *vanensis*

3.5. Distribution, habitat and ecology

The general distribution regions of the species *Artemisia taurica* on the earth are Europe, southern Russia (Caucasus), Crimea, Turkey. The species *A. taurica* shows the wide distribution in the steppes of Central, Eastern and Southeastern Anatolia in Turkey (Fig. 7). In Turkey apparently confined to the Irano – Turanien region.

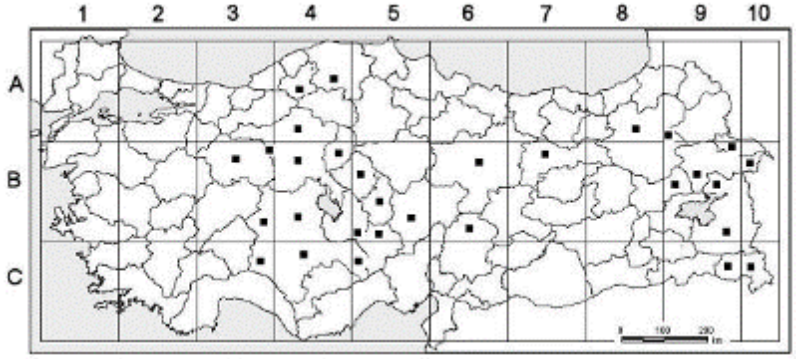

Figure 7. The distribution of the species *A. taurica* in Turkey

The new variety *A. taurica* var. *vanensis* is endemic to Van province in Eastern Anatolia of Turkey and to the Irano-Turanian element. It is distributed in the Eastern Anatolia of Turkey, mountain steppe and slopes, at altitudes between 1800–1960 m. The habitats of the plant are stony, gravelley and sandy slopes on mountain steppe. Its currently known two close populations may be shown as one point on the map of Turkey (Fig. 8).

Table 1. Comparison in terms of key features that distinguish the sister varieties of the species of *Artemisia taurica* in Turkey

Characters	**var. *vanensis***	**var. *taurica***
Stem length (cm)	20–45(–60)	15–35(–45)
Indumentum	densely arachnoid	arachnoid-tomentose
Dimensions lower leaves (cm)	1–2.5 × 0.5–1.2	0.5–2.5 × 0.5–0.9
Dimensions of cauline leaves (cm)	0.5–2.5 × 0.3–1	0.5–1 × 0.1–0.6
Dimensions of floral leaves (cm)	0.1–1 × 0.1–0.4	0.1–0.5 × 0.1–0.3
Orientation of synflorescens branches	usually horizontal	usually ascendant (spread and upwards)
Orientation of capitula	usually drooping (pendulose) at flowering and fruiting stages, loose after pressing process	spread, not drooping (pendulose) at flowering and fruiting stages, remains tight after pressing process
Peduncules of capitula length (mm)	(1–) 3–5 mm long, becoming sessile towards the end of synflorescence branches	1–3 mm long, becoming sessile towards the end of synflorescence branches
Capitula dimensions	4.3-6 x 2-3.2 mm in dia	3-5 x 1.5-2.3 mm in dia
Overview of outer phyllaries	usually not divided to base	usually divided to base
Outer phyllaries dimensions (mm)	0.6–0.9 × 0.5–0.8	0.2–0.4 × 0.1–0.3
Middle phyllaries dimensions (mm)	1–2.2 × 1.3–1.7	0.8–2.2 × 0.6–1.7
Inner phyllaries dimensions (mm)	4–4.2 × 1.2–1.5	2–2.5 × 1–1.2
Corolla colour	yellow or pinkish red or purplish red	yellow
Corolla dimensions (mm)	2.8–3.3 × 0.5–1	2.8–4.2 × 0.5–1
Comprasion of pistil and stamens length with corolla length	pistils and stamens usually not exerted to the corolla	pistils and stamens usually exerted to the corolla
Pistil length (mm)	3.1–3.9	2.6–3.5
Ovarium dimensions (mm)	0.7–1 × 0.2–0.7	0.5–0.8 × 0.3–0.6
Style length (mm)	1.5–2.2	1.2–1.5
Forks length of bifid stigma (mm)	0.4–0.7	0.3–0.6
Stamens length (mm)	3–4.2	2.2–3.2
Filaments length (mm)	1–1.5	0.8–1.2
Anhters dimensions (mm)	2–2.7 × 0.1–0.3	1.2–2 × 0.1–0.3
Achenes (cypselas) dimensions (mm)	1.8–2.7 × 0.8–1.4	1.2–2.5 × 0.5–0.9
Somatic chromosome number	2*n*=6*x*=54	2*n*=4*x*=36

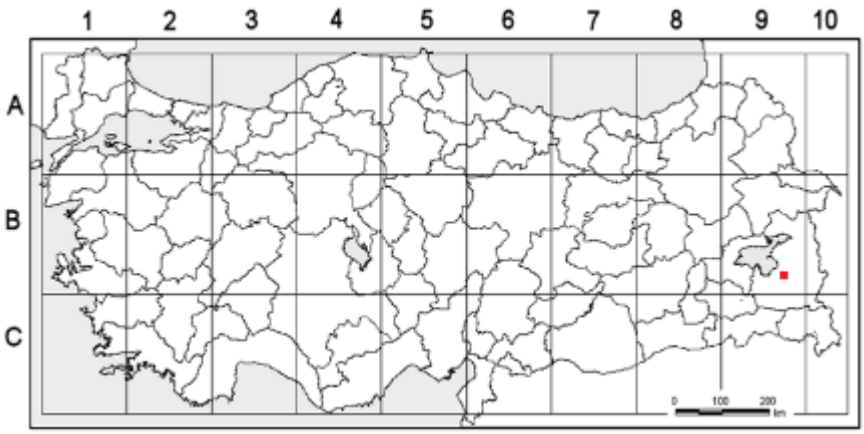

Figure 8. Currently known very close two populations of *A. taurica* var. *vanensis* (square mark ■)

3.6. Phenology

Flowering samples were collected in September and October, and fruiting samples in October and November.

3.7. Etymology

Plant samples were collected from the Van province of Turkey. The epithet of the new variety (var. *vanensis*) is derived from the province name.

3.8. Conservation status

The variety *A. taurica* var. *vanensis* is only known from very close two localities in Eastern Turkey:

1. B9 Van: Gurpınar district, between Cavustepe castle and Zernek irrigation dam lake, at field edges and roadsides,

2. B9 Van: 30th km of the highway from Van to Hakkari, at slopes around Zernek irrigation dam lake, mountain steppe (Fig. 8). The main location of the new variety is slopes around the Zernek irrigation dam lake near the highway from Van to Hakkari.

If grazing pressure increases and the road widening work is completed, the plant may become extinct in the near future. On the basis of the IUCN Red List categories and criteria (IUCN, 2014), due to the small populations size and an inferred decline of the populations, it is here suggested to consider the new species under the Endangered threat category, as EN (endangered) according to criteria C2(a)I of IUCN.

3.9. The identification key for taxa of the subgenus Seriphidium in Turkey

1a. Suffruticose, woody stock evident, thick and in the shape of a trunk 2
1b. Suffrutescent, woody stock not evident, thin, and cylindrical 6
2a. Plant very sparsely hairy at flowering stage after hair shedding or glabrous every stage, stems dark brown; lower leaves 2- times pinnately divided, all floral leaves usually undivided and linear 3
2b.Plant usually hairy at flowering stage, stems grey; lower leaves 2-3-times pinnately divided, floral leaves generally divided, only the ones of top undivided and linear 4
3a. Stems glabrous at fruiting, stems dark-brown; 3 – 5 florets per capitulum *A. spicigera*
3b. Stems sparse hairy at fruiting, stems grayish to light brown; 5 – 8 (-10) florets per capitulum *A. fragrans*
4a. Branches of synflorescence usually horizontal and intertwined into each other, with an appearance of bushy *A. sieberi* subsp. *sieberi*
4b. Branches of synflorescence usually erect or ascendant (spread), if horizontal when not intertwined into each other, don't like an appearance of bushy 5
5a. Synflorescence branches erect or ascendant; capitula usually erect or spread, not nodding (pendulose) at flowering and fruiting stages, remain tight after pressing process; outer phyllaries usually divided to the base; corolla yellow *A. taurica* var. *taurica*
5b.Synflorescence branches usually horizontal; capitula usually nodding (pendulose) at flowering and fruiting stages, start to loose and seperated comparatively after pressing process; outer phyllaries usually not divided to the base; corolla yellow or pinkish-red or purplish-red *A. taurica* var. *vanensis*
6a. Fertile stems 25–60 cm, hairy and with yellowish punctuated glands (glands-dotted or sessile glands), stems grey-brown colored; margins of the phyllaries membranous and usually transparent, very rarely partially purplish 7
6b. Fertile stems 25–100 cm, glabrous or very sparsely hairy, usually with only white punctuated glands (glands-dotted or sessile glands), stems brown-red colored; margins of the phyllaries membranous and usually purplish *A. bashkalensis*
7a. Synflorescence branches erect or ascendant; capitula usually erect or spread, or very rarely nodding (pendulose); corolla usually yellow, very rarely partially reddish at mature stage *A. santonicum* subsp. *santonicum*
7b.Synflorescence branches usually horizontal; capitula usually nodding (pendulose); corolla usually red, very rarely yellowish *A. santonicum* subsp. *patens*

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Appendix 1. Examined additional specimens of the species Artemisia taurica

Our collected samples: A4 Kastamonu: The highway from Kastamonu to Samsun, Ilgaz road junction, edges of the road and slopes, 10 October 2009, 40º 54.458N, 33º 37.372E, *M. Kursat 1202* (FUH); Kastamonu: The highway from Kastamonu to Samsun, 10 km to Tosya, roadsides and slopes, 10 October 2009, 866 m., 40º 57.437N, 33º 57.901E, *M. Kursat 1204* (FUH); B3 Eskisehir: Between Polatli and Sivrihisar, 35 km to Sivrihisar, roadsides and slopes, 23 October 2007, 837 m, 39º 34.476N, 31º 51.103E, I. *Turkoglu & M. Kursat 1098* (FUH); B4 Aksaray: Ihlara Valley, between Yaprakhisar village and Aksaray, slopes, 07 July 2007, 1140 m, 38º 19.766N, 34º 13.790E, I. *Turkoglu & M. Kursat 1008* (FUH); Ankara: Şereflikoçhisar, Hamzalı village, Kayacık (Mutlucan) Saltworks, 07 July 2007, 933 m, 38 50.381N, 33 26.922E, I. *Turkoglu & M. Kursat 1009* (FUH); ibid., 03 September 2007, *I. Turkoglu* & *M. Kursat 1020* (FUH); ibid., 22 October 2007, *M. Kursat 1092* (FUH); ibid., 06 December 2007, *M. Kursat 1129* (FUH); Ankara: Şereflikoçhisar, the southern slope of Akin village, steppe, 07 July 2007, 989 m, 39º 06.821N, 33º 15. 624E, *M. Kursat 1011* (FUH); ibid., 22

October 2007, *M. Kursat 1094* (FUH); Ankara: Polatli highway, 37 km to Polatli, roadsides and slopes, 10 September 2007, 843m, 39º 45.799N, 32º 28.355E, *M. Kursat 1028* (FUH); ibid., 23 October 2007, I. *Turkoglu & M. Kursat 1095* (FUH); ibid., 06 December 2007, *M. Kursat 1131* (FUH); Ankara: Golbasi higway, 5 km to Golbasi, steppe, 10 September 2007, 1032 m, 39º 47.977N, 32º 47.486E, *M. Kursat 1031* (FUH), Ankara: from Golbasi to Bayindir dam lake, 14th km, steppe, 10 September 2007, 994 m, 39º 52.206N, 32º 54.367E, *M. Kursat 1032* (FUH), Ankara: Between Lalahan-Elmadag, arround the Military zone, slopes and field edges, 10 September 2007, 1225 m, 39º 57.756N, 33º 11.727E, *M. Kursat 1033* (FUH); B5 Nigde: from Nigde to Kayseri hingway, 5 km, between railway and hingway, 06 July 2007, 1250-1300m, 38º 03. 022 N, 34º 45.740 E, *M. Kursat 1007* (FUH), Kırsehir: the road from Hirfanlı Dam Lake to Sereflikochisar, 5th km, hills and roadsides, 11 September 2007, 972 m, 39º 16.523N, 33º 30.135E, *M. Kursat 1036* (FUH), Kayseri: 39th km the highway from Kayseri to Avanos, roadsides and slopes, 22 October 2007, 1121 m, 38º 43. 377N, 35º 04.811E, *M. Kursat 1089* (FUH), B6 Kahramanmaras: Goksun, open places of forest above Findiklikoyak village, 04 July 2007, 1640 m, 37º 60. 021N, 36º 32.325E, *I. Turkoglu & M. Kursat 1005* (FUH), Kahramanmaras: Goksun, around Findiklikoyak village, 22 October 2007, 1450 m, 37º 60.021N, 36º 32.325E, *M. Kursat 1090* (FUH), Sivas: Ulas, Tecer mountains, *Quercus* community, slopes, 13 July 2008, 1817 m, 39º 25.003N, 37º 07.220E, *M. Kursat 1150* (FUH); B9 Van: 21th km of the highway from Adilcevaz to Ercis highway, slopes, 23 September 2007, 1750m, 38º 57.134N, 43º 13.308E, *M. Kursat 1071*(FUH), Muş: Malazgirt, Aktuzla village, eastern slope, 24 September 2007, 1632 m, 39º 19. 572N, 42º 18.008E, *M. Kursat 1079* (FUH), Ağrı: 4th km of highway from Habur to Tutak, steppe, 26 November 2007, 1605 m, 39º 35.994N, 42º 55.698E, *M. Kursat 1114* (FUH), Mus: Malazgirt, Aktuzla, around the Karıncalı village, slopes, 26 November 2007, 1550 m, 39º 21.474N, 42º 15.551E, *M. Kursat 1119* (FUH),Van: Ercis, Zernaki mountain, Irşat site, steppe, slopes, 02 November 2008, 1712 m, 39º 03.216N, 43º 20.599E, *M. Kursat 1185* (FUH); B10 Ağrı: Dogubeyazıt, around Ishakpasa Palace and Murat camping, 26 August 2008, 1935 m, 39º 31.190N, 44º 07.780E, *M. Kursat 1172* (FUH); C5 Aksaray: the highway from Adana to Aksaray, plains of Konya province border, steppe,11 Steptember 2007, 1202 m, 37 57.851N, 34. 04.924E, *M. Kursat 1037* (FUH); ibid., 22 October 2007, *M. Kursat 1091* (FUH); ibid., 06 December 2007, *M. Kursat 1128* (FUH); C10 Hakkari: the highway from Van to Hakkari, 37 km to Hakkari, steppe, slopes, 20 Steptember 2007, 1496m, 37º 41.720N, 43º 58.504E, *M. Kursat 1058*(FUH).

Herbarium samples: A4 Karabük: locations opposite the Sand quarry, 21 June 1985, ca.700 m, *M.Demirors* (ANK1285)!; Kirikkale: around Sulakyurt, steppe, slopes, 19 August 1990, 950m, *A.A.Donmez 2801* (HUB 29858)!; Ankara: the highway from Kalecik to Çankırı, 10 km to Çankırı, 09 October 1992, 650-700m, *Z. Aytac* (GAZI5605)!; Ankara: Cubuk dam lake, *Festuca-Thymus* steppe, 16 November 1996, 1000m, *N. Adıguzel & S. Seven* (ANK 2751)!; A8 Erzurum: 10 km to Ispir, steppe and *Quercus* forest, 25 July 1976, 2000-2400 m, *A.Tatli 5459* (HUB 29854)!; A9 Erzurum: the eastern of Horasan, 24 August 1957, ca.1600 m, *Davis & Hedge* (ANK 32619)!; B3 Eskisehir: Belpinar, Southern of the Cifteler, 9 km to Cifteler, 17 October 1973, 950 m, A. Baytop & *E.Tuzlaci* (ISTE 26908)!, Konya: Cihanbeyli, halophilic steppe, 09 August 1974, 950m, *H. Pesmen & A. Guner 1217* (HUB 29901)!; Ankara: Sereflikochisar, Highway Adana, arround of Tuz Lake, salty lands, 19 October 1982, 800 m, *B. Yildiz 3870* (HUB 29902)!; Ankara: Sereflikochisar, the highway of Adana, 9 October 1984, 900-1000 m, *Demirkus 2777* (HUB29880)!; Eskisehir: Sivrihisar, Yavsan village, 13 October 1987, *T. Baytop* (ISTE 58234)!; B4 Kırıkkale: Keskin, Böbrek Mountain, steppe, 22 June 1991, 600m, *U.Guler* (GAZI 1770)!; Ankara: Sereflikochisar, Hamzalı village, arround the Tuz lake, steppe 17 October 1992, 920 m, *A.A. Donmez, Z.Aytac & F. Karaveliogulları 3068* (HUB 29881)!; Ankara: Ahlatlibel, steppe, 22 October 1994, 1100 m, *M. Vural & H. Duman 7267* (ISTE 72054); Kayseri:İncesu road, Behind of Garipsu Factory, 9 October 1977, 1100 m, *O. Soner* (HUB 29882)!; Kayseri to Develi road: 60 km to Develi, salty soils, 04 August 1978, 1200 m, *A. Ozturk* (VANF)!; Nevsehir, 2 km west of Goreme, 18 October 1989, 1100 m, *M.Vural & U.Kul* (GAZI5602)!; Nigde: around of Dundarlı, 24 May 2004, *E. Ozdemir* (ISTE 81473)!; Nevsehir: Gulsehir, from Egrikuyu to Tuzkoy, volcanic rocks, steppe, 20 October 2005, 982 m, *A.A. Donmez 12612* (HUB)!; B6 Kahramanmaras: 3 km west of Goksu, field edges, 26 August 1977, 1500 m, *B.Yildiz, 1597* (HUB)!; B9 Mus: Malazgirt, from Aktuzla to Karıncalı, steppe, 06 October 2001, 1550 m, *S. Almanar 1870* (VANF)!; Van: Ercis, arround Y. Isıklı village, steppe, 28 October 2006, 1661 m, 39˚02.895N, 45˚20.877E, *O. Karabacak 5591* (VANF 12744)!; Mus: Malazgirt, Karıncalı valley, steppe, 26 October 2006, 1552 m, 39˚21.456N, 42˚15.582E, *L. Behcet, F. Ozgokçe & M. Unal 2558*, (VANF 7399)!; Igdır: Tuzluca, from Hadimli to Sariabdal village, 02 October 2008, 1280 m, *E. Altundag 1086* (ISTE 85839)!; C3 Konya: Cihanbeyli, Tuz Lake, 23 Steptember 1961, ca. 940 m, *K.Karamanoglu* (ANK 706)!; Konya: Tuz Lake, Yavsan village, ca. 900 m, *P.H. Davis* (ANK 16648)!; C4 Konya: from Karaman to Seyithasan village, steppe, ca.1200m. 20 of June 1979, *M. Vural* (GAZI 1896)!; C9 Hakkari: Culemerik, 10 April 1954, ca.1600m, *P.H.Davis & O.Polinim* (ANK 24351)!.

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