

A new species of subgenus *Seriphidium* of *Artemisia* L. (Asteraceae) from Turkey

Murat KURŞAT^{1*}, Şemsettin CİVELEK², İsmail TÜRKOĞLU³, Selma TABUR⁴, Nazmi GÜR⁵

¹Department of Biology, Faculty of Arts and Sciences, Bitlis Eren University, Bitlis, Turkey

²Department of Biology, Faculty of Sciences, Firat University, Elazığ, Turkey

³Department of Secondary Science and Mathematics Education, Faculty of Education, Firat University, Turkey

⁴Department of Biology, Faculty of Sciences and Arts, Süleyman Demirel University, Isparta, Turkey

⁵Department of Bioengineering, Faculty of Engineering, Firat University, Elazığ, Turkey

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Abstract: *Artemisia bashkalensis* Kurşat & Civelek sp. nov. from Hakkari Province in East Anatolia, Turkey, has been described. The differences between *Artemisia bashkalensis* and the related species *Artemisia stenocephala* Krash. ex Poljak. and *Artemisia khorassanica* Podl. are reported. The diagnosis, description, distribution map, and taxonomic comments on the new species are provided.

Key words: *Artemisia*, Asteraceae, endemic, new species, Turkey

1. Introduction

The genus *Artemisia* L., which comprises approximately 500 species, is the best-known representative of subtribe *Artemisiinae* that shows the main characteristics of this subtribe, and it widely exists in the northern hemisphere (Bremer and Humphries, 1993).

Asia and China have 150, Russia has 174, and Japan has about 50 species of *Artemisia*; these regions are known to be the common areas for this genus (Kitamura, 1939, 1940; Poljakov, 1961; Hu, 1965; Shinskin and Bobrov, 1995). Tutin and Persson (1976) reported that there are 57 *Artemisia* species in Europe.

The genus *Artemisia* was represented by 22 species in the *Flora of Turkey* (Davis, 1975). *Artemisia verlotiorum* Lamotte was added to the 10th volume (first supplement) of *Flora of Turkey* as a new record. Genus *Artemisia* was then represented by 23 species, which are not placed into any subdivisions of the genus in Turkey (Davis, 1975; Davis et al., 1988).

The most commonly accepted subdivisions of *Artemisia* are separated into 5 subgenera as *Artemisia* Less., *Absinthium* (Mill.) Less., *Dracunculus* (Bess.) Rydb., *Seriphidium* (Bess.) Rouy., and *Tridentatae* (Rydb.) McArthur. The taxa of the first 4 subgenera are represented in Turkey, whereas there is no Turkish taxon belonging to the subgenus *Tridentatae* (McArthur et al., 1981; Kurşat et al., 2011a; Kurşat, 2012).

Artemisia taxa found in Turkey are classified into 4 subgenera, which are subgen. *Artemisia* with 9 taxa, subgen. *Absinthium* with 5 taxa, subgen. *Dracunculus* with 4 taxa, and subgen. *Seriphidium* with 8 taxa (Kurşat et al., 2011a).

As a result of the taxonomical revision of the genus *Artemisia* in Turkey, it was determined that *Artemisia* taxa growing in Turkey include 4 subgenera, 21 species, and a total of 26 taxa at the species and subspecies level (Kurşat et al., 2011a; Kurşat, 2012). It was also determined that species *Artemisia herba-alba* Asso. was present in Turkey. However, according to new developments, *Artemisia herba-alba* Asso. in *Flora of Turkey* was renamed as *Artemisia sieberi* Bess. subsp. *sieberi*, which was a new record for *Flora of Turkey* in terms of the specimens (Kurşat et al., 2011a). Furthermore, *Artemisia santonicum* L. subsp. *patens* (Neilr.) K.M.Perss. was determined to be a new record for *Flora of Turkey* (Kurşat et al., 2011b).

As a result of the systematical, palynological, and cytogenetical studies executed within the framework of *A. bashkalensis*, which belongs to the subgenus *Seriphidium* of the genus *Artemisia*, this was defined as a new species.

2. Materials and methods

Studied materials were composed of samples belonging to *A. bashkalensis* sp. nov. collected between September and October of 2007 and 2009. The samples were transformed into herbarium material by drying and some of the

* Correspondence: botanikkursat@hotmail.com

samples were placed in the Firat University Herbarium (FUH). The specimens of the new species were compared with herbaria specimens in LE, W, and WU (Appendix).

Plants belonging to the genus *Artemisia* show genetic variation in terms of indumentum and flower color. Flower colors and indumentum of plants change during the passage from preflowering to flowering and from flowering to fruiting (in particular, their hairs are usually shed as they pass from the flowering stage to the fruiting stage), and plants show different general appearances in different phases. Therefore, we went to the same location at different times (at least 2–3 times) to collect samples from different phases.

Achenes germinated of *Artemisia bashkalensis* (1–1.5 mm) were pretreated with saturated paradichlorobenzene at room temperature for 4 h before they were fixed in ethanol and glacial acetic acid (3:1) at room temperature for 24 h. Subsequently, the materials were transferred to 70% ethanol and stored at 4 °C. Root tip meristems obtained were hydrolyzed in 1 N HCl for 15–18 min at 60 °C, stained in Feulgen for 1–2 h at room temperature, compressed, and mounted in a drop of 45% acetic acid

(Sharma and Gupta, 1982). The best 10 metaphase plates were photographed with a digital camera (Olympus C-5060) mounted on an Olympus CX41 microscope. Thereafter, chromosome morphologies and karyograms were constructed. The system of Levan et al. (1964) was used in determining centromere location. All of the quantitative values were obtained from chromosome character measurements.

Light microscopic observations were prepared using the method of Wodehouse (1935) and a scanning electron microscope (SEM) was used. Pollen samples were examined and photographed with a Leo EVO40 model SEM at the İnönü University Scientific and Technological Research Center.

The natural appearances of basal leaves, capitula, phyllaries (or involucre bracts), floral parts (of corolla, pistil, and stamen), cypselae (or achenes), and herbarium samples of *A. bashkalensis* sp. nov. were photographed in detail.

3. Results and discussion

Artemisia bashkalensis Kurşat & Civelek sp. nov. (Figures 1–10)

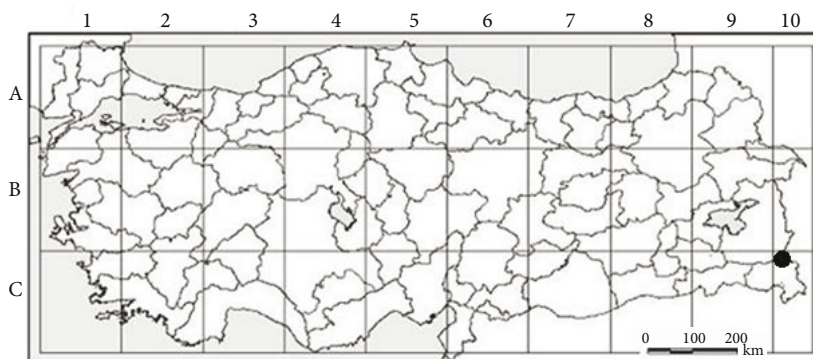


Figure 1. The distribution map of *A. bashkalensis* sp. nov. in Turkey (●).



Figure 2. The habitat of *A. bashkalensis* sp. nov.



Figure 3. *A. bashkalensis* sp. nov. a- Detailed appearance of differently sized lower leaves, b- aspect in nature of differently sized leaves, c- detailed appearance of cauline leaves shrinking toward the upper leaves.

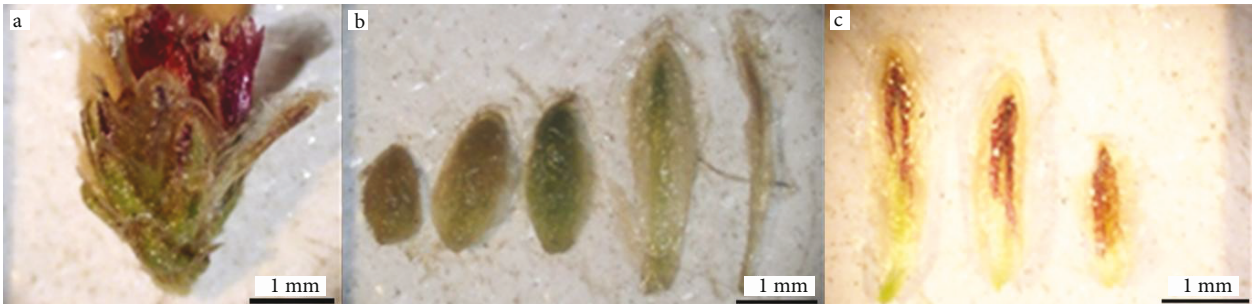


Figure 4. *A. bashkalensis* sp. nov. a- Capitulum (head), b- phyllaries from outside to inside, c- purple on dorsal part of mature phyllaries.

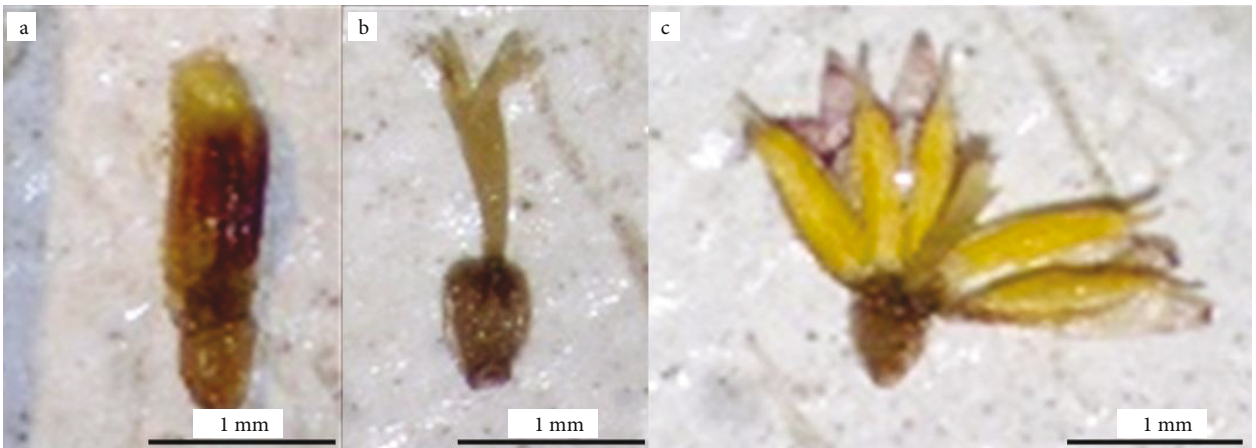


Figure 5. *A. bashkalensis* sp. nov. a- Hermaphrodite flower, b- pistil of hermaphrodite flower, c- stamens of the hermaphrodite flower.

Type: C10 Hakkari: 58 km from Hakkari to Van, roadside, slopes, steppe, 20.09.2007, 1805 m, 37°47.817'N, 44°05.156'E, *M. Kurşat & Ş. Civelek* 1057 (FUH).

Paratype: C10 Hakkari: the highway between Van and Hakkari provinces, 58 km to Hakkari Province,

found at roadsides and slopes, steppe, 20.09.2007, 1805 m, 37°47.817'N, 44°05.156'E, *M. Kurşat & Ş. Civelek* 1057 (flowered samples); ibid, 31.10.2007, *M. Kurşat* 1182 (flowered and seeded samples); ibid, 01.11.2009, *M. Kurşat & Ş. Civelek* 1057 1210 (flowered and seeded samples).

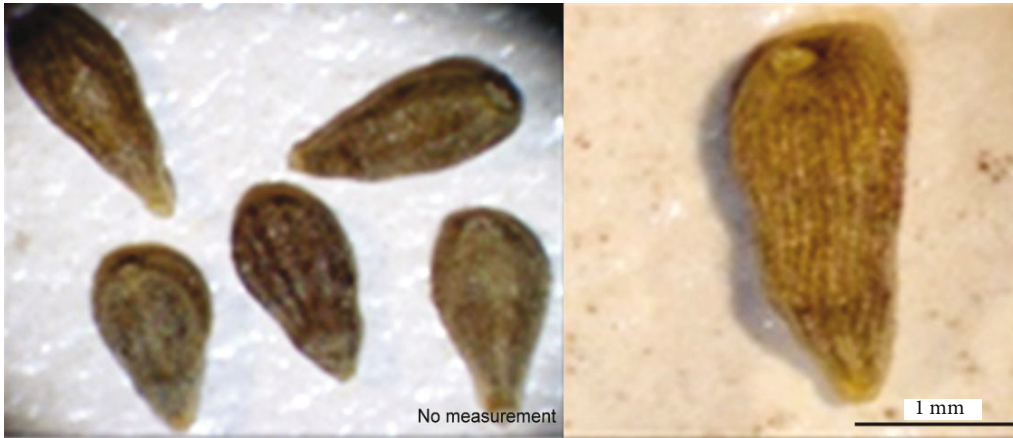


Figure 6. The fruit (cypsela) of *A. bashkalensis* sp. nov.



Figure 7. General appearance of *A. bashkalensis* sp. nov. herbarium samples.

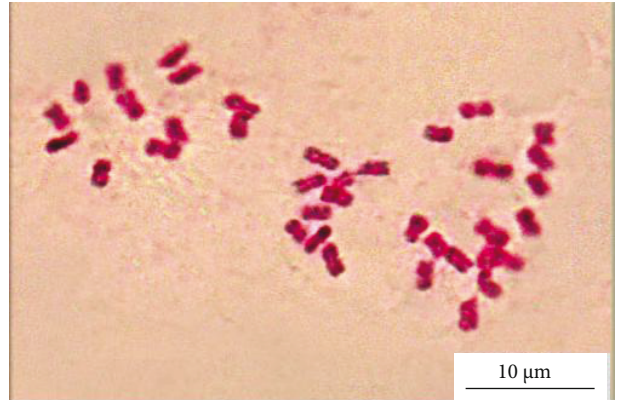


Figure 8. Micrograph of the somatic metaphase chromosomes of *A. bashkalensis* sp. nov. ($2n = 4x = 36$).

Diagnosis: *A. bashkalensis* is similar to *A. stenocephala* and *A. khorassanica*. It mainly differs from *A. stenocephala* in suffrutescens (not suffruticose), in young stages it is completely tomentose, but later it becomes very sparsely (simple) hairy or glabrous and has prominently white glandular punctate due to hair shedding (not dense tomentose), fertile (flowering) stems 25–100 cm (not 40–60 cm), longitudinal stripes and dark brown-purple colored after hair shedding (not light brown after hair shedding), synflorescence branches are rather rich and horizontal (not average rich and spread), pedicels of lower capitula 2–5 mm, upper capitula sessile (not all capitula sessile), capitula 3–5(–7) flowered (not 3–4), phyllaries



Figure 9. Karyogram of the *A. bashkalensis* sp. nov.

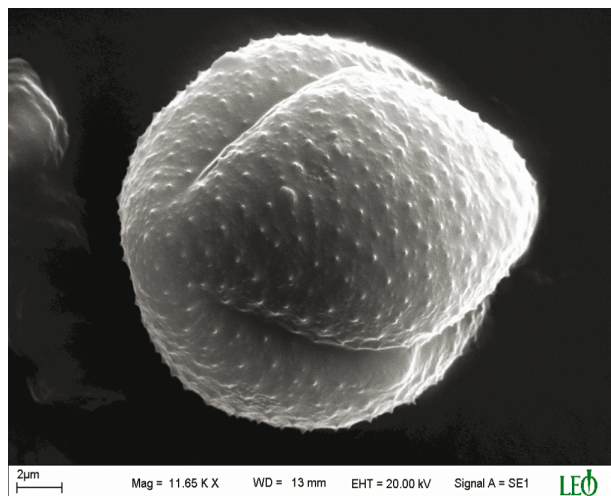


Figure 10. *A. bashkalensis* sp. nov. SEM photograph.

prominently white glandular punctuate, dorsal part green at flowering but usually turns purplish at fruiting (not subglabrous or glandulous; dorsal part green), corolla violet-purple (not pink-purple) and differs from *A. khorassanica* in suffrutescent (not suffruticose), in young stages it is completely tomentose, but later it becomes very sparsely (simple) hairy or glabrous and has prominently white glandular punctuate due to hair shedding (not dense tomentose), longitudinal stripes and dark brown-purple colored after hair shedding (not light brown after hair shedding), synflorescence branches are rather rich and horizontal (not average rich and spread), phyllaries

prominently white glandular punctuate, dorsal part green at flowering but usually turns purplish at fruiting (not densely pilose, dorsal part green), corolla violet-purple (not light pink) (Table 1).

Description: Suffrutescent, completely tomentose when young, later very sparsely hairy or glabrous and has prominently white glandular punctuate due to hair shedding. Plenty of (sometimes a few or only 1) flowering (fertile) stems, fertile stems from woody stock ascending, (25–)35–100 cm, longitudinal stripes and dark brown-purple-colored after hair shedding. One or a few short sterile shoots from woody stock, ascending or erect. Leaves tomentose when young, later very sparsely (simple) hairy or glabrous and has prominently white glandular punctuate due to hair shedding, and the margins of lobes become purplish. Basal leaves petiolate, obovate in outline, 2-pinnatisect, 0.5–5 × 0.5–1.5 cm (including petiole), lobes linear, obtuse-acute. Stem leaves sessile, auriculate, 1–2-pinnatisect, 0.5–3.5 × 0.5–1.5–0.5 cm, lobes acute. Floral leaves sessile, from pinnatifid-pinnatisect to linear with auricles, 0.1–0.5 × 0.1–0.3 cm, lobes linear, acute. Synflorescence racemose-panicle, capitula oblong-obovate, 2.8–3.5 × 1.5–2.5 mm, tomentose when young, later only with white glandular punctuate. Receptaculum hairless, pedicels of lower capitula 2–5 mm, upper capitula sessile, capitula 3–5(–7) flowered. Phyllaries in 4–5(–6) rows, ovate to oblong, margins membranous, dorsal part green at flowering, usually turns purplish at fruiting. Outer phyllaries 1–1.1 × 0.5–0.8 mm, central phyllaries 1.5–3.3 × 1–1.3 mm, inner phyllaries 3–3.5 × 1–1.3 mm. Flowers in each capitulum 3–5(–7), hermaphrodite, violet-purple

Table 1. The distinctive features of *A. bashkalensis* sp. nov. and species related to it, *A. stenocephala* and *A. khorassanica*.

Taxa	<i>A. bashkalensis</i> sp. nov.	<i>A. stenocephala</i>	<i>A. khorassanica</i>
Habitus and fertile stems	Suffrutescent; fertile stems 25–100 cm, longitudinal stripes, and dark brown-purple colored after hair shedding	Suffruticose; fertile stems 20–60 cm, light brown after hair shedding	Suffruticose; fertile stems 40–100 cm, light brown after hair shedding
Indumentum	Completely tomentose when young, later very sparsely simple hairy or glabrous and prominently white glandular punctuate due to hair shedding	Densely tomentose	Densely tomentose
Synflorescence branches	Rather rich and horizontal	Averagely rich and spread	Averagely rich and spread
Pedicel of capitula	Lower capitula pedicellate as long as 2–5 mm, upper capitula sessile	All capitula sessile	Lower capitula pedicellate as long as 2 mm, upper capitula sessile
Number of flowers in each capitulum	3–5(–7)	3–4	5–6
Phyllaries	Very sparsely simple hairy or glabrous and prominently white glandular punctuate; dorsal part green at flowering, usually turns purplish at fruiting	Subglabrous or glandulous; dorsal part green	Densely pilose; dorsal part green
Color of corolla	Violet-purple	Pink-purple	Light pink

colored, with white glandular punctate, corolla tubes 2.5–4.2 × 0.8–1 mm. Pistils 2.2–3.3 mm, ovary 0.6–1.2 × 0.3–1 mm, styles 1–1.4 mm, stigmas bipartite, ciliate, 0.5–0.7 mm. Stamens 2–3.4 mm, filaments 0.8–1.4 mm, anthers 1.2–1.9 × 0.1–0.3 mm, apical appendages of anthers subulate to lanceolate. Cypselae (achenes) obovate, light brown, longitudinal stripes, 1.5–2.2 × 0.7–1.2 mm.

Distribution and proposed conservation status: *A. bashkalensis* is endemic to Turkey (Başkale district between Hakkari and Van provinces in East Anatolia) and an Irano-Turanian element.

Phenology: Flowering and fruiting from September to November.

Habitat and Ecology: *A. bashkalensis* is distributed in the East Anatolia region, at an altitude of 1805 m. The habitats of the plant are riversides and slopes.

Etymology: Plant samples collected from around the Başkale district were located in between Van and Hakkari provinces. *A. bashkalensis* is named after the district.

Karyological characters: According to our data, the somatic chromosome number of the new species is $2n = 4x = 36$ and its basic chromosome number is also $x = 9$. All of the chromosomes of this taxa were determined as median centromeres and the karyotype formula was found to be 36 m (Figures 8 and 9; Table 2). The chromosome numbers of *A. stenocephala* and *A. khorassanica* (closely related to *A. bashkalensis*) were $2n = 18, 36$ (Podlech and Boder, 1974; Nishikava, 1981) and $2n = 18$ (Dolatyari et al., 2013), respectively. Considering the detailed morphological features of these taxa and their distribution area, we think that this new species is not a polyploid of the other taxa mentioned.

Palynology: The polar and equatorial views of *A. bashkalensis* pollen can be easily recognized. Pollen grain is radially symmetrical, isopolar, tricolporate, with tiny spinule sculpture. The shape of the pollen grains in *A. bashkalensis* is oblate spheroidal in the equatorial view and 3-lobed circular in the polar view (Figure 10; Table 3).

Table 2. Karyomorphological parameters of *A. bashkalensis* sp. nov. Total length (C), long arm (L), short arm (S), arm ratio (AR = L/S), centromeric index (CI = 100S/C), relative length (RL), median (m).

Chromosome number	C	L	S	AR	CI	RL	Type
1	1.84	0.98	0.86	1.13	46.73	3.38	m
2	1.74	0.96	0.78	1.23	44.82	3.19	m
3	1.68	0.92	0.76	1.21	45.23	3.08	m
4	1.65	0.93	0.72	1.29	43.63	3.03	m
5	1.63	0.93	0.70	1.32	42.94	2.99	m
6	1.60	0.87	0.73	1.19	45.62	2.94	m
7	1.58	0.86	0.72	1.19	45.56	2.90	m
8	1.55	0.89	0.66	1.34	42.58	2.85	m
9	1.52	0.87	0.65	1.33	42.76	2.79	m
10	1.49	0.86	0.63	1.36	42.28	2.73	m
11	1.47	0.83	0.64	1.29	43.53	2.70	m
12	1.44	0.81	0.63	1.28	43.75	2.64	m
13	1.42	0.83	0.59	1.40	41.54	2.61	m
14	1.40	0.75	0.65	1.15	46.42	2.57	m
15	1.38	0.75	0.63	1.19	45.65	2.53	m
16	1.34	0.77	0.57	1.35	42.53	2.46	m
17	1.29	0.71	0.58	1.22	44.96	2.37	m
18	1.19	0.66	0.53	1.24	44.53	2.18	m

Table 3. *A. bashkalensis* sp. nov. pollen morphology (\pm : standard error).

Species	P	E	P/E	Pollen shape	Clg	Clt	Pore diameter	Exine
<i>A. bashkalensis</i>	18.8 \pm 1.42	21.3 \pm 1.44	0.88	Oblate-spheroidal	15.9 \pm 0.89	6.1 \pm 0.58	2.9 \pm 0.39	3.4 \pm 0.67

Key to *Artemisia bashkalensis* and related taxa

1. Suffruticose; lignified root stock evident; fertile stems 40–100 cm, light brown after hair shedding and dense tomentose; phyllaries subglabrous or densely pilose, margins membranous, dorsal part green
 2. Fertile stems 40–60; all capitula sessile, number of flowers in each capitulum 3–4 *A. stenocephala*
 2. Fertile stems 40–100; lower capitula pedicellate as long as 2 mm, upper capitula sessile; number of flowers in each capitulum 5–6 *A. khorassanica*
1. Suffruticose; lignified root stock evident weak; fertile stems 25–100 cm, dark brown- purple colored and usually very sparsely hairy or hairless, usually only have a white punctuated gland hair; margins of the phyllaries membranous are generally purplish *A. bashkalensis*

Species identification key of subgenus *Seriphidium*

1. Suffruticose, lignified root stock evident, extremely thickened and in the shape of trunk
 2. The plant is very sparsely hairy or hairless at flowering, dark brown colored after hair shedding; lobes of leaves distinctively linear, floral leaves usually undivided and linear; capitulum generally cylindrical *A. spicigera*
 2. The plant is usually hairy at flowering; floral leaves are generally divided and the upper ones are linear; heads (capitula) usually oblong-ovoid
 3. Branches of synflorescence are usually horizontal and intertwined into each other, with an appearance of a bush; phyllaries undivided.....*A. sieberi* subsp. *sieberi*
 3. Branches of synflorescence are usually spread and not intertwined; phyllaries are usually divided*A. taurica*
1. Suffruticose, lignified root stock evident weak, thin and cylindrical
 4. Fertile stems 25–60 cm, gray-brown colored, and usually have a yellowish punctuated gland hair; margins of the phyllaries membranous are generally transparent, very rarely partially purplish*A. santonicum*
 4. Fertile stems 25–100 cm, brown-red colored and usually very sparsely hairy or hairless, usually only have a white punctuated gland hair; margins of the phyllaries membranous are generally purplish*A. bashkalensis*

We determined that the samples we collected 58 km from Hakkari, between the cities of Van and Hakkari, differed from the existing taxa in Turkey's flora. The stems of the plant are brown-purple, sparsely hairy or hairless, and the synflorescence branches are rich and horizontal; therefore, although *A. bashkalensis* belongs to the subgenus *Seriphidium* at first glance, it could be thought that the plant may actually belong to *Dracunculus*, which includes *Artemisia campestris* L. and *Artemisia scoparia* Waldst. & Kit. However, one can omit this confusion by focusing on the sexual distribution of the flowers in capitula. Capitula in *Dracunculus* subgenus are heterogamous and the outer flowers are female, while flowers in center are staminate. On the other hand, all flowers of the subgenus *Seriphidium* are hermaphroditic in capitula.

The most similar taxon to this new species in Turkey is *A. santonicum*. However, some differences were determined in terms of certain characteristics, including the length of the plant, which is 25–100 cm (not 25–65 cm). It is usually sparsely hairy or hairless at the flowering phase (not canescent). Additionally, its stem has brown-purple tones at the flowering phase and it usually has a white punctuated gland hair (not densely white canescent and glabrescent below). Its flower is distinctively violet-purple at the ripe phase (not generally yellowish, rarely purplish) and the back part of its phyllaries is purple at the ripe phase (not green).

Detailed photographs of some parts of *A. stenocephala* and *A. khorassanica* were provided to us by the Russian Academy of Sciences VL Komarov Botanic Institute herbarium (LE) and by the herbarium of the General and Natural History Museum, Vienna (W). The herbarium specimens of the genus *Artemisia* in LE were examined by M Kurşat in 2009. The herbarium specimens of genus *Artemisia* in W were examined by M Kurşat between 27 April and 5 May 2013.

It was determined that *A. bashkalensis* was relatively similar to *A. stenocephala*, which is generally distributed in Afghanistan, Pakistan, Iran, and Central Asia, and *A. khorassanica*, which is generally distributed in Afghanistan and Iran (Podlech, 1986; Shinskin and Bobrov, 1995).

Acknowledgment

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Appendix

Additional examined specimens. *A. stenocephala*: Ghazni: Chacar, N Sang-e Masha, 2700 m, 01.x.1973, leg: O. Anders 11184 (W); Afghanistan, Paktia: Ab-e-Istea, West-seite., 1970 m, 19.viii.1976, H. Breckle 4617, (W 05133); O-Afghanistan, Darra chel: (nördlich der strabe Kabul-Tangi gharu), ebene, Steppe, 1800 m, 28.x.1951, A. Gilli (W 7840); Persia: ustro-occidentalis, 1868, C. haussknecht. (W !); Afghanistan, Kandahar: 2 km O Keshkenakhud an der Straße nach Kanda-har, 950 m, 12.x.1978, D. Podlech 32683 (W 2002-14966); Asia centralis: Montes Kopet-dag, in vicinitate pagi Vanovskoie, in vale rivi Firiuzinka. 600–700 m, 8.ix.1976, V. Vasak (W 07731); Takhar: Kalafgan, bei der Verwaltung der Salzmine; Lößboden, 28.ix.1965. D. Podlech 12768 (LE); Belucistan: 10.ix.1939, N. A. Qazilbash B/114 (LE !); Afghanistan, Badghis: Laman, 33 km S Qala-i-Naw an der Straße nach Herat, 1370 m, 06.x.1969, D. Podlech 16947 (WU photo); Afghanistan, Badghis: 14 km NE Qala-i-Naw an der Straße nach Bala Murghab, 970 m, 06.x.1969, D. Podlech 16951 (WU photo); Afghanistan, Kabul: Karisimir, NW von Kabul, 1900 m, 28.ix.1978, D. Podlech 32616 (WU photo); Afghanistan,

Zabul: Moghulzy Kalay, 26 km NO Qalat-i-Ghilzai an der Straße nach Moqur., 1680 m, 10.x.1978, D. Podlech 32632 (WU photo!); Afghanistan, Faryab: Takhate Zabhan, an der Stasse von Maymana nach sare Hawdz Löß. 1100 m, 05.viii.1977, D. Podlech & Kh. Yarmal 29966 (WU photo); Afghanistan, Kandahar: 2 km O Keshkenakhud an der Straße Kandahar - Girishk, Halbwüste, 950 m, 10.xiii.1978, D. Podlech 32683 (WU photo); Afghanistan, Zabul: 12 km SW Qalat-i-Ghilzai an der Straße nach Kandahar, 1500 m, 10.x.1978, D. Podlech 32639 (WU photo); Afghanistan, Kabul: 13 km E, hills near Charkhi, 1830 m, 19.ix.196, H. Freitag 1961 (WU photo); Afghanistan, Kandahar: 1 km N Chineh, 56 km N Kandahar an der Straße nach Tirin, Lößboden; 1470 m, 11.x.1978, D. Podlech 32656 (WU photo); *A. khorassanica*: Khorasan: Cenaran prope Meshhed., *Sabeti* 1353 (W 107); Shahrads, Khorassan: in garden. 3 ft. high. Plant scan ted. Sept. 27. 1940. W. Koble 16955 (Isotypus, W 4840); Shahrads, Khorassan: in garden. 2 feet. Plant scanted. Sept. 26. 1940, W. Koelz 16933 (W 4841); Shahrads, Khorassan: in garden. 3 ft. high. Plant scan ted. Sept. 27. 1940, W. Koble 16955 (Holotypus, W1400).

References

- Bremer K, Humphries CJ (1993). Generic monograph of the Asteraceae-Anthemideae. Bull Br Mus (Nat Hist) Bot 23: 71–177.
- Davis PH (1975). Flora of Turkey and the East Aegean Islands, Vol. 5. Edinburgh, UK: Edinburgh University Press.
- Davis PH, Mill RR, Tan K (1988). Flora of Turkey and The East Aegean Islands, Vol. 10. Edinburgh, UK: Edinburgh University Press.
- Dolatyari A, Valles J, Naghavi MR, Fazeli SAS (2013). Karyological data of 47 accessions of *Artemisia* (Asteraceae, Anthemideae) species from Iran, with first new reports for Iranian populations and first absolute counts in three species. Plant Syst Evol 299: 1503–1518.
- Hu SY (1965). The Compositae of China. Taiwan Mus 18: 1–136.
- Kitamura S (1939). Classification of *Artemisia*. Acta Phytotax Geobot 8: 62–66.
- Kitamura S (1940). Compositae Japonicae. Pars Secunda. Mem Coll Sci Kyoto Univ 25: 286–446.
- Kurşat M (2012). *Artemisia*. In: Güner A, Aslan S, Ekim T, Vural M, Babac MT, editors. Türkiye Bitkileri Listesi (Damarlı Bitkiler). İstanbul, Turkey: Nezahat Gökyiğit Botanik Bahçesi ve Flora Araştırmaları Derneği Yayını (in Turkish).
- Kurşat M, Civelek Ş, Türkoğlu İ, Tabur S (2011a). *Artemisia sieberi* Bess. subsp. *sieberi* A new record for Turkey and a delete record for Turkey *Artemisia herba-alba* Asso. (Asteraceae). Pakistan J Bot 43: 1819–1821.
- Kurşat M, Civelek Ş, Türkoğlu İ, Tabur S (2011b). A new subspecies record for the flora of Turkey: *Artemisia santonicum* L. subsp. *patens* (Neilr.) K.M.Perss. (Asteraceae). Turk J Bot 35: 89.
- Levan A, Fredga K, Standberg AA (1964). Nomenclature for centromeric position on chromosomes. Hereditas 52: 201–220.
- McArthur ED, Pope CL, Freeman DC (1981). Chromosome studies of subgenus *Tridentatae* of *Artemisia*, evidence for autopolyploidy. Am J Bot 68: 589–605.
- Nishikawa T (1981). Chromosome counts of flowering plants of Hokkaido. Rep Taiset Inst Sc 16: 45–53.
- Podlech D (1986). Flora of Iranica, Vol. 158. Graz, Austria: Akademische Druck V. Verlagsanstalt, pp. 159–224.
- Podlech D, Bader O (1974). Chromosome studien an Afghanischen Pflanzen. Mitt Bot Staatssamml Munch 11: 457–485 (in German).
- Poljakov PP (1961). Systematic studies in the genus *Artemisia* L. Trudy Ins Bot Akad, Nauk Kazakh SSR, Alma Acta 11: 134–177.
- Sharma PC, Gupta PK (1982). Karyotypes in some pulse crops. Nucleus 25: 181–185.
- Shinskin BK, Bobrov EG (1995). Flora of the U.S.S.R., Vol. 26. Dehradun, India: Bishen Singh Mahendra Pal Singh and Koeltz Scientific Books.
- Tutin TG, Persson K (1976). Compositae, *Artemisia* L. In: Tutin TG, Burges NA, Moore DM, Valentine DH, Walters SM, Webb DA, Heywood VH, editors. Flora Europea. Cambridge, UK: Cambridge University Press, pp. 178–186.
- Wodehouse RR (1935). Pollen Grains. New York, NY, USA: McGraw-Hill.