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# Diversity and characteristics of the genus *Artemisia* L. growing in Jetisu region

The article presents information on the species composition and distribution of the genus *Artemisia* L. in the Jetisu region based on an analysis of literature sources and herbarium materials. A total of 81 Artemisia species are recorded across Kazakhstan, occurring in deserts, steppe zones, and mountainous regions, with more than 35 species identified in the Jetisu region. An extensive review of the species found in the Jetisu region and the Jetisu Alatau was conducted, and the herbarium data of the wormwood species found in the study area (AA, AFKNU, MW funds) were accurately presented. In addition, using herbarium samples and literary data, the GPS coordinates of the wormwood found in the Jetisu were determined. The conducted study allowed to clarify and supplement information on the distribution area of the genus *Artemisia* L.

*Keywords:* wormwood, *Artemisia* L., endemic, distribution, herbarium, Kazakhstan, Jetisu region, Zhetysu Alatau.



## *Introduction*

Wormwood (*Artemisia* L.) more than 500 species are distributed worldwide in the temperate climate zone of Eurasia and North America, including 174 species in the CIS countries [1–3]. Wormwood is widely distributed in various ecological conditions: steppes, deserts, meadows, forests, mountainous areas, some of which are found as weeds in all zones. Wormwoods include annual, biennial, and perennial plants, as well as semi-shrubs and shrubs, reaching heights of 5–170 cm. [4–10] There are 81 species of wormwood growing in Kazakhstan, 17 of which are endemic [4]. After systematizing this data, we began work on analyzing the species composition and distribution of wormwood in our scientific article.

*Artemisia* L. a great contribution to the study of the genus was made by the scientist V. Besser, who divided the flowers of wormwood into three groups according to their sexual composition: Seriphidium Bess, Dracunculus Bess, Abrotanum Bess. [11]. Scientists who described a significant part of the genus and its species were: C. Linnaeus, A. DeCandolle, Weber, K.F. Ledebour, I.M. Krashennikov [12]. In addition, information about wormwood is found in the works of I. Gmelin, V. Besser, K.F. Ledebour, I.M. Krasnoborov. *Artemisia* L. was traditionally accepted as a relative and was approved by C. Linnaeus [13].

Also I.M. Krasheninnikov [12] made a significant contribution to the systematics of the genus by grouping related species into cycles and series. He described numerous species and provided detailed information on their geographic distribution. In the book *Flora of Kazakhstan*, N. S. Filatova presented a comprehensive description of the genus *Artemisia* L., including its subgenera occurring in Kazakhstan [4].

The classification of the genus Artemisia has undergone significant changes, reflecting progress in botanical science. Early taxonomic systems were based on morphological features, while modern approaches use molecular-phylogenetic data. In the middle of the 20th century, in "Flora of the USSR", P.P. Poliakov [5] divided the genus *Artemisia* into three main groups: *Artemisia* L., *Seriphidium* (Bess.) Rouy, *Dracunculus* (Bess.) Rydb. These groups, in turn, were divided into separate sections. This classification was relevant for its time, and the vast majority of species growing on the territory of Kazakhstan belong to the subgenus Seriphidium. Based on a more detailed morphological analysis, researchers such as Hobbs and Baldwin [14] proposed an expanded classification, dividing the genus *Artemisia* into six subgenera: Absinthium, Artemisia, Dracunculus, *Seriphidium*, Tridentatae, and Pacifica. But in 2023 Jiao B., Chen C., Wei M. et al. [15] after Molecular phylogenetic research proposed a new classification and expansion of the genus Artemisia to 8 subgenera (added subgenera *Pectinata* and *Ponticat*): *Dracunculus, Pectinatae, Pacifica, Ponticae, Seriphidium, Tridentatae, Absinthium, Artemisia*.

The Jetisu region we are studying is located in the southeastern part of our republic and was established as a separate region in 2022 as a result of the division of Almaty region into two regions. Currently, the Jetisu Region borders the Almaty Region to the south, the Karaganda Region to the northwest across Lake Balkhash, the Abai Region to the north, and China to the east. Accordingly, it has a complex ecological structure, from mountain forests and alpine meadows to semi-desert areas. It, in turn, is characterized by a diversity of plants. Systematizing this data, our study analyzes the species composition and distribution of wormwood throughout Jetisu region.

*Experimental*

In the process of writing this article we study materials from the herbarium fund of the Institute of Botany and Phytointroduction of Almaty city (AA), herbarium of the Al-Farabi Kazakh National University (AFKNU), herbarium of Moscow University (MW) and international platforms such as GBIF, iNaturalist were reviewed to study the species composition and distribution features of species of the genus *Artemisia* L. distributed in the Zhetysu region. In addition, the databases "Flora of Kazakhstan" (1960), "Illustrative Dictionary of Kazakhstan" (1969) and POWO (https://powo.science.kew.org) were used to identify species.

*Results and Discussion*

According to the system of classification of all flora by P.P. Poliakov [5], the genus *Artemisia* is divided into three genera: *Artemisia* Less., *Dracunculus* (Bess.), Rydberg and *Seriphidium* (Bess.) Rouy. According to The Plant List, there are over 500 species of wormwood in the world. In Kazakhstan, 81 species are found (Tab. 1). 17 species of wormwood found in Kazakhstan are rare endemic species [4, 8, 16].

Table 1

**The list of species composition of the genus *Artemisia* L.**
**(compiled from literary and herbarium data)**

| № | The name of the species according to the Flora of Kazakhstan | The name of the species in the POWO database | I | II | III | IV |
|---|---|---|---|---|---|---|
| 1 | *A. absinthium* L.<br>A. albida (AA) | *A. absinthium* L. | + | + | | + |
| 2 | *A. austriaca* Jacq. | *A. austriaca* Jacq. | + | + | + | + |
| 3 | A. *annua* L. | *A. annua* L. | + | + | | + |
| 4 | *A. albicerata* Krasch. | *A. arenaria* DC. | + | + | | |
| 5 | *A. aschurbajevii* Wiknl. | *A. aschurbajewii* C.Winkl. | + | + | | + |
| 6 | *A. arenaria* DC. | *A. arenaria* DC. | + | + | | + |
| 7 | *A. dracunculus* L. | *A. dracunculus* L. | + | + | | + |
| 8 | *A.* eranthema Bge. | *A. eranthema* Bunge | + | + | + | + |
| 9 | *A. frigida* Willd. | A. *frigida* Willd. | + | + | | + |
| 10 | *A. gmelini* Web. | *A. gmelinii* Weber ex Stechm. | + | + | | + |
| 11 | *A. heptapotamica* Poljak | *A. heptapotamica* Poljak | + | + | | + |
| 12 | *A. juncea* Kar. & Kir. | *A. juncea* Kar. & Kir. | + | + | + | + |
| 13 | *A. laciniata* Willd. | *A. laciniata* Willd. | + | + | | + |
| 14 | *A. leucodes* Schrenk. | A. leucodes Schrenk. | + | + | + | + |
| 15 | *A. macrocephala* Jacq., | *A. macrocephala* Jacquem. ex Besser | + | + | | |
| 16 | *A. nitrosa* Web. | *A. nitrosa* Weber ex Stechm. | + | + | | + |
| 17 | *A. pamirica* Winkl. | *A. dracunculus* var. *pamirica* (C. Winkl.) | + | + | + | |
| 18 | *A. pauciflora* Web.<br>*A. maikara* (Krasch.) Pavlov (AFKNU) | *A. pauciflora* Weber ex Stechm. | + | + | + | |
| 19 | *A. procera* Willd. | *A. abrotanum* L. | + | | | |
| 20 | *A. rupestris* L. | *A. rupestris* L. | + | + | + | + |
| 21 | *A. rutifolia* Steph. | *A. rutifolia* Stephan ex Spreng. | + | + | + | + |
| 22 | *A. songarica* Schrenk. | *A. songarica* Schrenk ex Fisch. & C.A. Mey. | + | + | + | + |
| 23 | *A. scoparia* Waldst. Et Kit. | *A. scoparia* Waldst. & Kit. | + | + | + | + |
| 24 | *A. scopaeformis* Ldb. | | + | + | | |

Continuation of Table 1

| № | The name of the species according to the Flora of Kazakhstan | The name of the species in the POWO database | I | II | III | IV |
|---|---|---|---|---|---|---|
| 25 | *A. sieversiana* Willd., Kar. | | + | + | + | + |
| 26 | *A. santolina* Schrenk. | *A. santolina* Schrenk. | + | + | | + |
| 27 | *A. semiarida* (Krasch. Et Iljin) | *A. semiarida* (Krasch. & Lavrenko) Filatova | + | + | | |
| 28 | *A. serotina* Bge. *Seriphidium serotinum* (AA) | *A. oliveriana* J.Gay ex Besser | + | + | + | + |
| 29 | *A. sublessingiana* (Kell.) Krasch. | *A. sublessingiana* (B.Keller) Krasch. ex Poljakov | + | + | + | + |
| 30 | *A. schrenkiana* Ldb. | *A. schrenkiana* Ledeb. | + | + | + | + |
| 31 | *A. marschalliana* Spreng. | *A. marschalliana* Spreng. | + | | | |
| 33 | *A. terrae-albae* Krasch. | *A. terrae-albae* Krasch. | + | + | + | + |
| 34 | *A. turanica* Krasch. | *A. turanica* Krasch. | + | + | + | |
| 35 | A. *tournefortiana* Rchb. | *A. tournefortiana* Rchb. | + | + | | + |
| 36 | *A. tomentella* Trautv. | *A. tomentella* Trautv. | + | | | |
| 38 | *A. vulgaris* L. | *A. vulgaris* L. | + | + | | + |
| 39 | *A. santolinifolia* (AA), *(KazNU)* | *A. stechmanniana* Besser | | + | + | + |
| 40 | *A. salina* Willd. *(KazNU)* MW | *A. maritima* subsp. *maritima* | | + | + | + |
| 41 | *Seriphidium kaschgaricum* (AA) | *A. kaschgarica* Krasch. | | + | | |
| | Species in total: | | 38 | 36 | 18 | 28 |

I — data on the Flora of Kazakhstan, 1960; II — on the Herbarium of the Institute of Botany and Phytointroduction (AA); III — on the Herbarium of the Al-Farabi Kazakh National University (AFKNU), IV — on the Herbarium of Moscow University (MW)

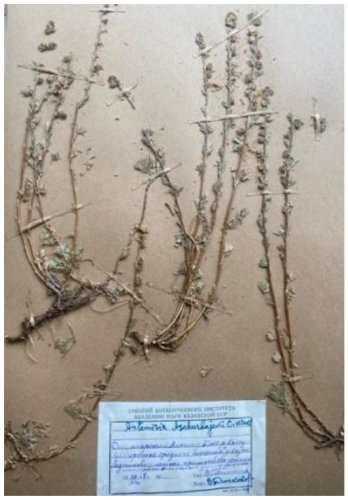
The endemic species of wormwood include the following species: *A. succulenta* Ldb., *A. tomentella* Trautv., *A. albicerata* Krasch., *A. quinqueloba* Trautv., *A. scopaeformis* Lbd., *A. halophile* Krasch., *A. semiarida* (Krasch. Et Lavr.) *A. heptapotamica* Poljak., *A aralensis* Krasch., *A. camelorum* Krasch., *A. amoena* Poljal., *A. transiliensis* Poljak., *A. karatavica* Krasch. et Abol. ex Poljak, *A. mucronulata* Poljak., *A. cina* Berg., *A. valida* Krasch. [4]. However, according to modern sources (https://powo.science.kew.org), the endemic species have been revised, that is, of the above-mentioned species, only *A. quinqueloba* Trautv., *A. aralensis* Krasch., *A. camelorum* Krasch., *A. saissanica* (Krasch.), *A. karatavica* Krasch. et Abol. ex Poljak, *A. mucronulata* Poljak., and *A. cina* Berg. are endemic.

*A. cina* Berg. (Darmene) is an endemic species of special importance as a medicinal herb and is included in the Red Data Book of Kazakhstan [17]. The aerial part of the plant is rich in essential oils, cyclitols, sesquiterpenoids, flavonoids and nitrogenous compounds. These natural components make the plant an effective anthelmintic, analgesic, anti-inflammatory, anti-tuberculosis, anti-tumor, antibacterial, antifungal, as well as a blood pressure stabilizer [18–20].

According to the floristic zoning of Kazakhstan, as indicated in the Flora of Kazakhstan [4] the *Artemisia* L. species found in the Dzungarian Alatau include *A. laciniata* Willd., *A. gmelinii* Web., *A. tournefortiana* Rchb., *A. rupestris* L., *A. frigida* Willd., *A. aschurbajewii* Wiknl., A. *annua* L., A. *austriaca* Jacq., A. *absinthium* L., A. *sieversiana* Willd., A. *dracunculus* L., *A. rutifolia* Steph., A. *macrocephala* Jacq., *A. pamirica* Winkl., *A. juncea* Kar., *A. heptapotamica* Poljak. And in the Balkhash-Alakulsky floristic district, which is now the territory of the Jetisu region, the wormwood types are found: A. *vulgaris* L., *A. procera* Willd., *A. tournefortiana* Rchb., *A. marschalliana* Spreng., *A. tomentella* Trautv., *A. arenaria* DC., *A. albicerata* Krasch., *A. songarica* Schrenk., *A. eranthema* Bge., *A. scoparia* Waldst. Et Kit., *A. santolina* Schrenk., *A. leucodes* Schrenk., *A. juncea* Kar., *A. scopaeformis* Ldb., *A. annua* L., *A. austriaca* Jacq., *A. absinthium* L., *A. sieversiana* Willd., *A. dracunculus* L., *A. terrae-albae* Krasch., *A. semiarida* (Krasch. Et Iljin), *A. pauciflora* Web., *A. nitrosa* Web., *A. schrenkiana* Ldb., *A. sublessingiana* (Kell.) Krasch., *A. serotina* Bge., *A. turanica* Krasch.

According to literary data, the following species of wormwood are found in the Jetisu region: *A. aschurbajewii, A. sieversiana, A. absinthium, A. heptapotamica, A. sublessingiana, A. frigida, A. scoparia, A. arenaria, A. schrenkiana, A. songarica, A. santolina, A. nitrosa, A. terrae-albae, A. pauciflora, A. vulgaris, A. austriaca, A. juncea, A. gmelinii, A. annua, etc.* [21, 22].

According to the label data in the herbarium collections of the Institute of Botany and Phytointroduction (AA), the following species of Artemisia L. are frequently found in the Zhetysu Alatau (Fig. 1): *A. annua*, *A. absinthium*, *A.* albida, *A.* aschurbaoevii, *A. austriaca*, *A.* juncea, *A.* heptapotamica, *A. frigida*, *A. rutifolia*, *A. rupestris*, *Seriphidium serotinum* (*A. oliveriana*), *A.* serotina, *A.* sublessingiana, *A. sieversiana*, *A.* scoparia, *A.* santolina, *A. santolinifolia*, *A. gmelina*, *A. laciniata*, *A. kaschgarica*, *Seriphidium kaschgaricum* (A. *kaschgarica*). And we observe that the majority of it was collected by N.V. Pavlov in 1928, S. Yu. Lipshits in 1928, N.V. Shipchinsky in 1928, V.P. Goloskokov in 1948, 1956, 1959, 1971, P. Polyakov in 1950, 1953, 1955, 1960 and 1961. Furthermore, the herbarium specimens collected by E.P. Mataeva in 1930, E. Cherniakowska in 1930, N.I. Rubtsov 1934, P. Polyakov, L.A. Kupriyanova, 1934, Godvinsky, 1958, BoranbaevaM.S.1987, T.M. Kudabaeva, N.V. Nelina 1993, 2018, I.M. Krasnoborov 1995, A.N. Kupryanova 2014, Ramazanova 2017, M.P. Danilov et al. 2018, 2019 are also stored there.

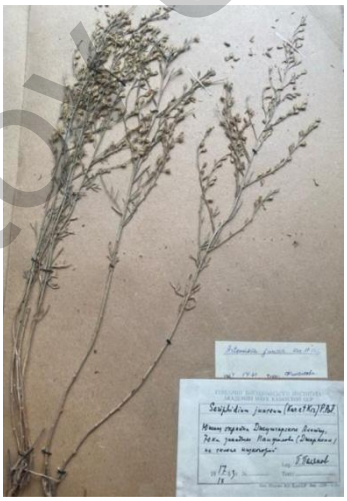


A. aschurbajewii Wiknl

A. austriaca Jacq

A. absinthium L

A. kaschgarica Krasch



A. juncea Kar

A. heptapotamica Poljak



Figure 1. Herbarium specimens of some species of the genus *Artemisia* L. collected in the Zhetysu Alatau (AA)

According to the label information in the Al-Farabi Kazakh National University herbarium fund (AFKNU), herbariums of 73 species of wormwood are preserved, including the following species of wormwood found in the region of Jetisu region: *A. austriaca* Jacq., *A. eranthema* Bge., *A. juncea* Kar. & Kir., *A. leucodes* Schrenk., *A. pamirica* Winkl., *A. maikara* (A. Pauciflora), *A. rupestris* L., *A. rutifolia* Steph., *A. songarica* Schrenk., *A. scoparia* Waldst. & Kit., *A. sieversiana*, *A. serotina* Bge. (*A. oliveriana*), *A. sublessingiana*, *A. schrenkiana*, *A. terrae-albae*, *A. turanica*, *A. santolinifolia* (*A. stechmanniana*), *A. salina* (*A. maritima*). The majority of herbarium specimens collected from the region of Jetisu region were collected by P.P. Polyakov and L.A. Kupriyanova (1934), Ageeva N.T. (1932, 1951, 1969), Karnilova V.S. (1947),

Karnilova V.S., Tkanova (1947), Tkanova (1947), Tarabaeva B.I. (1945, 1946), Krashennikov I.M., Linchevsky I.A. and O.A. We note that Linchesky (1934), collected. In addition, P. Volkova (1931), N.I. Rubtsov, Krivova (1935), Mirovnova (1935), V.P. Goloskokov (1936), Sushkov (1936), Shokolova (1946), Ogai (1946), Solomchenko (1949), Kalekenov (1951), Mambetov (1951), Lashkina M. (1958), Lutsai. (1959), Penkin (1970), Popova (1970), A. Samsonova (1973), Asanova T.T. (1984), Boranbaeva (1987), Aipeisova S. (1987), Aldabekova (1990) herbarium specimens have been preserved.

In the herbarium data of the Moscow University (MW) fund, species belonging to the genus *Artemisia* L. were considered by the Department of Herbarium of Central Asia and Kazakhstan, the herbarium of Muyunkum, Pribalkhashye and Betpak-Dala, Dzhungarsky Alatau and Tarbagatay District. Of these, 153 herbarium data belonging to 29 species were collected from the region that is now part of the Jetisu region. The majority were collected from Semirechye, Taldy-Kurgansky uyezd, Sarkandsky district, Dzhungarsky Alatau, and other nearby regions. Species with coordinates are shown in Table 2 and Figure 2.

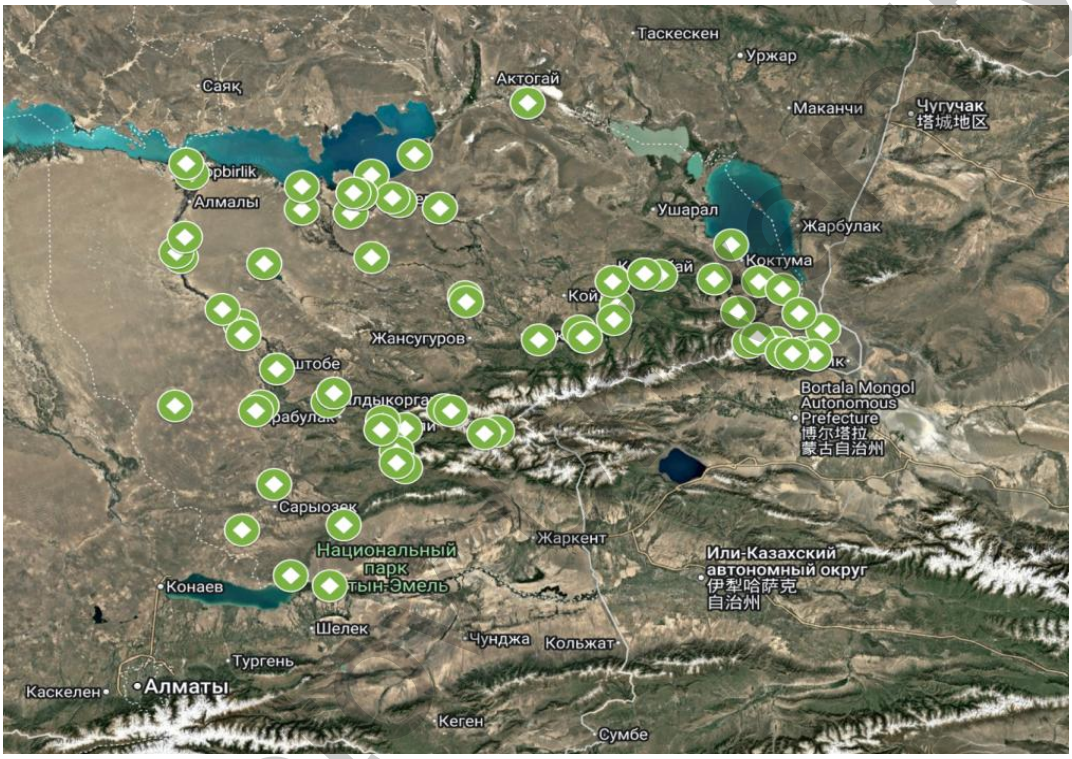



Figure 2. Distribution area of *Artemisia* L. in the Jetisu region

Table 2

**Distribution area of the genus *Artemisia* L. in the Jetisu region**

| № | Species | Coordinates | Dataset |
|---|---|---|---|
| 1 | *A. absinthium* L. | 45°26'00.0"N,80°21'00.0"E | [22] |
| 2 | | **45°00′16.67″ N,78°22′37.00″ E** | iNaturalist Research-grade Observations |
| 3 | | 44°50′22.79″ N,78°58′38.77″ E | iNaturalist Research-grade Observations |
| 4 | | 44°41′48.61″ N,78°54′57.25″ E | iNaturalist Research-grade Observations |
| 5 | A. *annua* L. | 45°28'41.1"N077°40'44.7"E | AA |
| 6 | *A. arenaria DC.* | 46°22′43.45″ N,78°42′48.03″ E | iNaturalist Research-grade Observations |
| 7 | | 46°10'27.4476"N78°10'19.8732"E | MW |
| 8 | | 46°15'47.5380"N78°38'2.2416"E | MW |
| 9 | | 45°50'43.7352"N77°52'24.5892"E | MW |
| 10 | | 45°53'5.0388"N78°42'48.4920"E | MW |

Continuation of Table 2

| № | Species | Coordinates | Dataset |
|---|---|---|---|
| 11 | | 46°15'47.5380"N78°38'2.2416"E | MW |
| 12 | *A. arenaria* DC., *A. scoparia* Waldst. Et Kit., *A. terrae-albae* Krasch. | 45°19'00.1"N77°19'00.1"E | [22] |
| 13 | *A. arenaria* DC., *A. santolina* Schrenk. | 44°58'59.9"N77°10'00.1"E | [22] |
| 14 | *A. aschurbajewii* C.Winkl. | 44°52'59.9"N78°48'00.0"E | [22] |
| 15 | | 44°57′13.24″ N,79°17′23.84″ E | iNaturalist Research-grade Observations |
| 16 | | 45°22'12.6372"N81°41'51.3492"E | MW |
| 17 | *A. aschurbajewii* C.Winkl. | 45°17'23.7228"N82°12'41.5836"E | MW |
| 18 | | 44°49'48.0000"N78°47'24.0000"E | MW |
| 19 | | 45°45'00.0"N81°25'00.1"E | [22] |
| 20 | *A. austriaca* Jacq. | 45°18'25.4196"N82°05'54.1176"E | MW |
| 21 | | 45°18'11.7612"N81°57'41.1876"E | MW |
| 22 | *A. dracunculus* L. | 46°16'21.4428"N78°34'8.0292"E | MW |
| 23 | | 46°12'58.6800"N78°56'3.4008"E | MW |
| 24 | | 45°03′40.95″ N,78°25′07.17″ E | iNaturalist Research-grade Observations |
| 25 | | 44°35′44.48″ N,78°59′09.70″ E | iNaturalist Research-grade Observations |
| 26 | | 45°03′40.95″ N, 78°25′07.17″ E | iNaturalist Research-grade Observations |
| 27 | *A. frigida* Willd. | 45°22'50.3"N80°01'50.4"E | AA |
| 28 | | 45°22'12.6372"N81°41'51.3492"E | MW |
| 29 | | 45°17'23.7228"N82°12'41.5836"E | MW |
| 30 | | 44°14'33.7488"N78°29'55.8924"E | MW |
| 31 | *A. frigida* Willd., A. sublessingiana (Kell.) Krasch. | 45°24'00.0"N75°51'59.9"E | [22] |
| 33 | *A. gmelini* Web. | 45°22'0.5880"N81°54'18.1800"E | MW |
| 34 | | 45°17'42.2016"N82°01'39.7272"E | MW |
| 35 | | 45°12'12.3912"N77°57'59.8320"E | MW |
| 36 | | 45°26'28.6224"N82°16'30.8568"E | MW |
| 38 | *A. gmelini* Web. *A. vulgaris* L. | 45°43'59.9"N81°46'00.1"E | [22] |
| 39 | *A. heptapotamica* Poljak | 45°33'11.3"N81°36'33.0"E | AA |
| 40 | | 44°13'00.00"N77°42'00.00"E | AA |
| 41 | | 45°35'23.6"N80°38'51.0"E | AA |
| 42 | *A. juncea* Kar. & Kir. | 44°29'34.0800"N77°56'45.9600"E | MW |
| 43 | *A. laciniata* Willd. | 45°18'11.7612"N81°57'41.1876"E | MW |
| 44 | | 45°18'25.4196"N82°05'54.1176"E | MW |
| 45 | *A. maritima* subsp. *maritima* | 45°53'4.8804"N77°12'37.3284"E | MW |
| 46 | *A. nitrosa* Weber ex Stechm., A. scoparia Waldst. Et Kit. | 45°55'00.1"N77°10'59.9"E | [22] |
| 47 | *A. rupestris* L. | 45°23'13.92"N81°45'23.4"E | MW |
| 48 | | 45°17'42.2016"N82°01'39.7272"E | MW |
| 49 | | 45°18'11.7612"N81°57'41.1876"E | MW |
| 50 | | 44°49′31.92″ N,79°42′12.14″ E | iNaturalist Research-grade Observations |
| 51 | *A. rutifolia* Stephan ex Spreng. | 45°46'57.8208"N80°52'15.7692"E | MW |

Continuation of Table 2

| № | Species | Coordinates | Dataset |
|---|---|---|---|
| 52 | | 45°46'31.7460"N80°59'42.5724"E | MW |
| 53 | | 45°47'6.4392"N80°52'14.5344"E | MW |
| 54 | *A. santolina* Schrenk. | 46°22'59.9"N77°18'00.0"E | [22] |
| 55 | | 46°00'5.3748"N77°14'26.7108"E | MW |
| 56 | | 46°18'30.0348"N78°10'15.5496"E | MW |
| 57 | | 45°50'43.7352"N77°52'24.5892"E | MW |
| 58 | | 46°15'47.5380"N78°38'2.2416"E | MW |
| 59 | *A. schrenkiana* Ldb. | 43°52'01.2"N78°22'58.8"E | [22] |
| 60 | | 46°10'38.1864"N79°15'4.5036"E | MW |
| 61 | | 46°12'58.6800"N78°56'3.4008"E | MW |
| 62 | *A. schrenkiana* Ldb. *A. pauciflora* Weber ex Stechm. | 43°55'59.9"N78°28'00.1"E | [22] |
| 63 | *A. scoparia* Waldst. Et Kit. | 46°09'00.0"N78°33'00.0"E | [22] |
| 64 | | 44°58'59.9"N77°51'00.0"E | [22] |
| 65 | | 46°14′17.60″ N,78°52′50.69″ E | iNaturalist Research-grade Observations |
| 66 | | 46°29′41.98″ N,79°03′45.34″ E | iNaturalist Research-grade Observations |
| 67 | | 46°48′38.74″ N,79°56′58.68″ E | iNaturalist Research-grade Observations |
| 68 | | 45°57′41.28″ N,81°32′59.74″ E | iNaturalist Research-grade Observations |
| 69 | | 45°34′13.97″ N,77°32′23.98″ E | iNaturalist Research-grade Observations |
| 70 | | 45°24′49.92″ N,77°42′24.37″ E | iNaturalist Research-grade Observations |
| 71 | | 45°17'47.8140"N82°02'3.1164"E | MW |
| 72 | | 45°17'23.7228"N82°12'41.5836"E | MW |
| 73 | | 45°38'54.6324"N79°27'6.3036"E | MW |
| 74 | | 46°16'21.4428"N78°34'8.0292"E | MW |
| 75 | *A. scoparia* Waldst. Et Kit. | 44°57'00.0"N77°48'00.0"E | [22] |
| 76 | *A. serotina* Bge. | 45°50'43.7352"N77°52'24.592"E | MW |
| 77 | *A. sieversiana* Ehrh. ex Willd. | 44°37′53.70″ N,78°54′50.83″ E | iNaturalist Research-grade Observations |
| 78 | | 45°44′11.07″ N,80°37′20.61″ E | iNaturalist Research-grade Observations |
| 79 | | 45°26'28.6224"N82°16'30.8568"E | MW |
| 80 | | 45°17'23.7228"N82°12'41.5836"E | MW |
| 81 | | 45°30'36.5868"N80°37'44.8860"E | MW |
| 82 | *A. songarica* Schrenk ex Fisch. & C.A. Mey. | 46°15'47.5380"N78°38'2.2416"E | MW |
| 83 | *A. stechmanniana* Besser | 43°56'00.0"N78°05'00.1"E | [22] |
| 84 | | 45°23′33.44″ N,80°24′28.29″ E | iNaturalist Research-grade Observations |
| 85 | | 44°44′38.06″ N,79°13′37.42″ E | iNaturalist Research-grade Observations |
| 86 | | 45°18'11.7612"N81°57'41.1876"E | MW |
| 87 | *A. sublessingiana* (Kell.) Krasch. | 45°41'19.8744"N81°57'45.5112"E | MW |
| 88 | | 46°10'38.1864"N79°15'4.5036"E | MW |
| 89 | *A. terrae-albae* Krasch. | 45°32'38.3604"N82°05'25.9080"E | MW |
| 90 | *A. tournefortiana* Rchb. | 46°16'21.4428"N78°34'8.0292"E | MW |
| 91 | | 45°12'12.3912"N77°57'59.8320"E | MW |
| 92 | | 46°26'33.9576"N77°15'24.1812"E | MW |
| 93 | | 45°36'44.8560"N79°28'0.5988"E | MW |
| 94 | *A. viridis* Willd.ex DC. | 44°57′0.67″ N,79°20′31.31″ E | iNaturalist Research-grade Observations |

Continuation of Table 2

| № | Species | Coordinates | Dataset |
|---|---|---|---|
| 95 | | 44°48′43.07″ N,79°36′8.73″ E | iNaturalist Research-grade Observations |
| 96 | *A. vulgaris* L. | 45°47'6.4392"N80°52'14.5344"E | MW |
| 97 | | 45°17'47.8140"N82°02'3.1164"E | MW |
| 98 | | 45°49′5.37″ N,81°04′31.42″ E | iNaturalist Research-grade Observations |
| 99 | | 45°24'00.0"N80°24'00.0"E | [22] |

In addition, as a result of field research funded by the Abai Kazakh National Pedagogical University (Tab. 3), the following distribution area of wormwood was identified.

Table 3

**Data from species distribution in Abai Kazakh National Pedagogical University**

| № | Species | Coordinates (N/E) | Height above sea level, m |
|---|---|---|---|
| 1 | *Artemisia leucodes* Schrenk. | 44°58′37.74″; 77°53′58.87″ | 430 |
| 2 | *Artemisia nitrosa* Web. | 44°52'00.1"; 77°30'00.0" | 500 |
| 3 | *Artemisia terrae-albae* Krasch. | 44°55'59.9"; 77°45'00.0" | 435 |
| 4 | *Artemisia absinthium* L. | 44°52'19.2"; 78°48'03.6" | 1100 |
| 5 | *Artemisia austriaca* Jacq. | 44°52'44.2"; 78°48'10.0" | 1350 |
| 6 | *Artemisia rutifolia* Steph. | 44°52'40.9"; 78°48'39.7" | 1150 |

Wormwoods are widely distributed throughout the Jetisu region. Many species of the *Artemisia* L. genus have been widely used in folk medicine for treating tumors, inflammatory, infection, bacterial and viral diseases, as well as illnesses like malaria, and some of these uses are still preserved today [23, 24].

After analyzing scientific articles, we came to the conclusion that the following types of wormwood are currently being actively studied in terms of their chemical composition: *A. vulgaris*, *A. pontica*, *A. annua*, *A. absinthium*, *A.* selengensis, *A. gmelini*, *A. frígida*, *A. mongolica*, *A. jacutica*, *A. argyi*, *A. austriaca*, *A. austrica*, *A. abrotanum*, *A. arctica*, *A. glabella*, *A. gmelinii*, *A. frígida*, *A. sieversiana* and others [25–29].

Types of wormwood used for fodded purposes include *A. pontica*, *A. obtusiloba*, *A. frigida*, *A. marschalliana*, *A. kelleri*, *A. scoparia*, *A. santolina*, *A. halophila*, *A. lercheana*, *A. terrae-albae*, *A. semiarida*, *A. pauciflora*, *A. nitrosa*, *A. schrenkiana*, *A. vulgaris*, A. *austriaca*, *A. lessingiana* and others [4, 30].

In addition to their medicinal uses, wormwoods are also popular as decorative, aromatic, and culinary herbs. *A. dracunculus*, *A. abrotanum*, *A. absinthium*, *A. annua*, *A. frigida*, *A. japonica*, *A. pontica*, A. *scoparia*, *A. vulgaris*, etc. are used for food purposes worldwide [31–35].

Analysis of the studied literature and herbarium materials made it possible to determine the current state of knowledge about the genus *Artemisia* L. The practical significance of this work lies in planning expedition routes and clarifying the distribution areas of the species.

## *Conclusions*

In conclusion, it was found that 81 species of the genus *Artemisia* L. grow in various ecological zones of Kazakhstan, and more than 35 species are distributed in the Jetisu region. In addition, more than 90 GPS coordinates were identified, which allow planning expedition routes. Their value in medicinal, folk medicine, fodder, culinary and perfumery industries was determined. A review and description of the species of the genus *Artemisia* L. distributed in the Zhetysu Alatau and Jetisu region was given, and the need for further field research to develop protection measures was noted.

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## *Conflict of interest*

The authors declare no conflict of interest.

*Author contribution*

The manuscript was written through contributions of all authors. All authors have given approval to the final version of the manuscript: **Seidekhan M.K. —** conceptualization, data analysis, investigation, writing draft; **Aidarbayeva D.K**. — methodology, data curation, data collection.

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## Жетісу облысында өсетін *Artemisia* L. туысының көптүрлілігі мен ерекшеліктері

Мақалада әдеби дереккөздер мен гербарий материалдарын талдау негізінде *Artemisia* L. туысының Жетісу облысындағы түрлік құрамы мен таралуы жайлы мәліметтер қарастырылған. *Artemisia* L. Қазақстанның барлық аймақтарында — шөл-шөлейтті, далалы аймақта, таулы жерлерде 81 түрі, Жетісу облысында 35-тен астам түрі кездеседі. Жетісу облысында және Жетісу Алатауында кездесетін түрлеріне кеңейтілген шолу жасалып, зерттеу аймағында кездесетін жусан түрлерінің гербарий деректері (AA, AFKNU, MW гербарий қорлары) берілген. Сонымен қатар гербарий үлгілері мен әдеби деректерді пайдалана отырып Жетісу облысында кездесетін жусанның GPS кординатталары анықталды. Жүргізілген зерттеу *Artemisia* L. туысының таралу аймағы туралы ақпаратты нақтылауға және толықтыруға мүмкіндік береді.

*Кілт сөздер:* жусан, *Artemisia* L., эндемик, таралуы, гербарий, Қазақстан, Жетісу облысы, Жетісу Алатауы

М.Қ. Сейдехан, Д.К. Айдарбаева

## Разнообразие и особенности рода *Artemisia* L., произрастающего в Жетысуской области

В статье представлена информация о видовом составе и распространении рода *Artemisia* L. в Жетысуской области на основе анализа литературных источников и гербарных материалов. 81 вид *Artemisia* L. встречается во всех регионах Казахстана — в пустынной, степной и горной зонах, а более 35 видов — в Жетысуской области. Проведен обширный обзор видов, обнаруженных в Жетысуской области и Жетысуском Алатау, и представлены гербарные данные видов полыни, найденных на исследуемой территории (гербарные фонды AA, AFKNU, MW). Кроме того, с использованием гербарных образцов и литературных данных определены GPS-координаты полыни, найденной в Жетысуской области. Проведенное исследование позволило уточнить и дополнить информацию о распространении рода *Artemisia* L.

*Ключевые слова:* полынь, *Artemisia* L., эндемик, распространение, гербарий, Казахстан, Жетысуская область, Жетысуский Алатау

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