**Analysis of honey plants in the republic of Karakalpakstan**

Gulnara Аbdiniyazova a), Luiza Baxieva

*Karakalpak State University named after Berdakh, Nukus, Karakalpakstan, Uzbekistan*

*a) Corresponding author:* [*gulnarabd29@mail.ru*](mailto:gulnarabd29@mail.ru)

**Abstract.** Based on data collected and analyzed in the territory of the Republic of Karakalpakstan, our scientific research, the results of numerous scientific field studies conducted in nature, and the analysis of existing scientific literature, as well as using herbarium materials stored at the Institute of Botany of the Academy of Sciences of the Republic of Uzbekistan, a list of honey-producing plant species growing naturally in the territory of Karakalpakstan was compiled. It was determined that they currently consist of 206 species belonging to 42 families and 125 genera. There are also many species grown in honey-producing cultivation in our territory. However, we conduct research only on naturally growing plant species. There are more than 1,000 honey-producing plants in Uzbekistan. Bee products are an important source of medicine in the treatment of numerous diseases: nervous, gastrointestinal, digestive, cardiovascular, kidney, liver, skin disorders, tuberculosis, brucellosis, and hypertension [2,3].

**INTRODUCTION**

The Republic of Karakalpakstan is the largest region of the Republic of Uzbekistan, situated in the northern part of Uzbekistan and occupying about 37% or 167.1 thousand km² of Uzbekistan's area [4].

The population of this region is approximately 1,800,000 people. According to natural complexes, Karakalpakstan is divided into 4 regions: Plateau Ustyrt of Karakalpakstan, Kizilkum part of Karakalpakstan, Quyi Amudariya, and the newly formed Aralqum (Sherbaev, 1988). According to literature data, about 1,100 species of vascular plants grow in Karakalpakstan [4].

In determining the Latin names of families, orders and species of medicinal and honey plants distributed in the territory of Karakalpakstan, the following sources were used: "Opredelitel rastenii Srednei Azii"[9], the international index - International Plants Names Index (www.ipni.org), www.plantarium.ru, The Plant List (www.theplantlist.org), as well as S.K. Cherepanov [6] In studying the life forms of higher medicinal and honey plant species in the region, S.Raunkiaer [10] according to the classification developed by: A.I.Kamelin [11], and A.L.Takhtadjian [12], S.Yerzhepov [5] sources were used.

**EXPERIMENTAL RESEARCH**

We set ourselves the task of studying and comprehensively analyzing the honey plants growing naturally in Karakalpakstan. Karakalpakstan is vast, and different parts experience varying weather conditions. Karakalpakstan has a sharply continental climate, with high summer temperatures reaching 43.5°C in July. In early spring, during flowering, bees begin collecting nectar and pollen from flowers. The collected nectar, after undergoing certain changes, turns into pure honey.

The honey plants found in our region are listed in the work by S.E. Yerezhepov [5]. He analyzed the flora of useful plants in Karakalpakstan and noted that the region contains 68 honey plants belonging to 19 families and 32 genera.

Based on data collected and analyzed in the Republic of Karakalpakstan, our own research, the results of several field studies conducted in the wild, an analysis of existing scientific literature, and herbarium materials stored at the Institute of Botany of the Academy of Sciences of the Republic of Uzbekistan, a list of honey plant species naturally occurring in Karakalpakstan has been compiled. It has been determined that this list currently consists of 206 species belonging to 42 families and 125 genera. Our territory also has numerous species that are cultivated for honey production. However, we conduct research only on naturally growing plant species [1-6].

**RESEARCH RESULTS**

An analysis of honey plants in Karakalpakstan revealed that the class Magnoliopsida includes 194 species, and the class Liliopsida includes 13 species. Furthermore, the flowers of these plants secrete various types of nectar annually. Adverse conditions quickly reduce nectar production. Only under favorable weather conditions for flower opening does nectar flow in large quantities. The 12 main families rich in nectar had the largest number of species, 150, and 82 genera (65.6%), accounting for 72.46% of the total nectariferous flora. The taxonomic analysis of such plants was carried out using the method of C. Raunkiaer [10]. Other important plants are species of the genus Tamarix L., which are ubiquitous and have significant biomass reserves. In addition, the following species play a significant role in beekeeping: Ferula foetida (Bunge) Regel, Alhagi canescens (Regel) Shap., Alhagi pseudalhagi (Bieb.) Fisch., Acroptilon repens (L.) DC., Cichorium intybus L., Convolvulus arvensis L., Convolvulus hamadae (Vved.) V. Petrov, Capsella bursa-pastoris (L.) Medik., Malva neglecta Wallr., Capparis herbacea Willd., Ammodendron conollyi Bunge, Ammothamnus lehmannii Bunge, Centaurea squarrosa Willd., Strigosella grandiflora (Bunge) Botsch., Isatis violascens Bunge, Isatis minima Bunge, and Glycyrrhiza glabra L.[7].

To determine the raw material reserves of honey plants, the area in hectares and kilograms of honey that can be collected from five species considered nectar-producing in the region were determined. The distribution areas of these plants around bee colonies were also determined. To increase bee productivity, it is necessary to plant and propagate honey plants, shrubs, fruit trees, and annual plants, as well as regularly relocate beehives to areas rich in honey plants, knowing precisely when these plants bloom.

**Alhagi pseudalhagi** is a honey plant whose flowering period is from May to July. Each flower secretes nectar for 3 days, and the amount of nectar reaches 0.10 ml. The sugar content in the nectar is 65%. It is possible to collect 25 kg or more of nectar per hectare from the plants [1,7]. The distribution area in the study region is 22,640 ha. Local beekeepers can extract 130 kg of honey from each hectare.

**Glycyrrhiza glabra** is a honey-rich plant. The flowering time is from April to June, the amount of nectar from its flowers is 0.15-0.20 mg, and the sugar content is 35-57% [1, 7-12]. The distribution area in the study region is 2,856 ha. Local beekeepers can extract 55 kg of honey from each hectare.

**Ferula foetida** is a perennial plant, flowering in March-April, with a nectar yield of 0.03-0.12 ml. Sugar content is 20-34% [7]. The distribution area in the study region is 2,425 ha. Local beekeepers can extract 90 kg of honey from each hectare.

**Capparis herbacea** is one of the plants rich in nectar. Flowering time is May-June. One caper flower secretes 1-5 ml, on average 2 ml of nectar. The most nectar is secreted on the second day of flowering. The total area determined at the time of the study was 870 ha, and up to 65 kg of honey can be collected from each hectare.

**Halimodendron halodendron** is a shrub plant rich in honey and nectar. Its flowering period is April-May. The distribution area in the study region is 2,460 ha. Local beekeepers can obtain 95 kg of honey and nectar from each hectare [1].

**TABLE 1.** Raw material reserves of honey-succulent plants, which are common in the territory of Karakalpakstan

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| № | Plant name | Total area (ha) | kg /ha | Tons |
| 1 | *Alhagi pseudalhagi* | 22 640 | 130 ± 6,5 | 2 943,20 ± 147,16 |
| 2 | *Glycyrrhiza glabra* | 2 856 | 55 ± 3 | 157,08 ± 8 ,5 |
| 3 | *Ferula foetida* | 2 425 | 90 ± 4,5 | 218,25 ± 10,91 |
| 4 | *Capparis herbacea* | 870 | 65 ± 3,25 | 56,55 ± 2,83 |
| 5 | *Halimodendron halodendron* | 2 460 | 95 ± 5,7 | 233,70 ± 14,02 |

It should be emphasized that to develop beekeeping in the region and increase the food base of bees, it is necessary to expand the cultivation of plants that are medicinal, forage, and honey-producing, such as: *Elytrigia repens, Medicago sativa, Medicago lupulina, Glycyrrhiza glabra, Acroptilon repens, Cichorium intybus, Convolvulus arvensis*, *Elaeagnus angustifolia,* and others.

As a result of our scientific research analysis, it was revealed that honey-producing plant species growing in the territory of Karakalpakstan belong to 17 areal types. When conducting a geographical analysis of plant species, areal types were combined into 7 classes based on geographical principles.

**1. TURAN CLASS.** The Turan class includes the areal types of Turan, the Central Asian plains and the slopes of the mountain ranges extending to Kulja, Kashgar, Northern Afghanistan and Iran. This class includes 43 species, which account for 20.8% of nectariferous plants. Among them are Caragana grandiflora, Ammodendron conollyi, Convolvulus hamadae, Alhagi canescens, Calligonum eriopodum, Zygophyllum brachypterum, Tamarix ramosissima, Acanthophyllum elatius, and others.

**2. IRAN-TURAN CLASS.** The Iran-Turan class includes habitat types from Iran to Eastern Anatolia and the Tien Shan, Western Pamir and Turan regions. This class includes 2 habitat types and 31 species, which account for 15% of honey plants. For example, Cynanchum sibiricum, Artemisia turanica, Taraxacum bicorne, Sisymbrium irio, Lotus corniculatus, Limonium otolepis, and others.

**TABLE-2.**Distribution of nectariferous plant species in the territory of Karakalpakstan by areal types

|  |  |  |  |
| --- | --- | --- | --- |
| № | Areal types | Number of species | Total nectariferous plants (%) |
|  | TURON CLASS |  |  |
| 1 | Turan | 43 | 20,8 |
|  | IRAN-TURAN |  |  |
| 2 | Iran | 2 | 0,97 |
| 3 | Iran-Turan | 29 | 14 |
|  | CENTRAL ASIA |  |  |
| 4 | Central Asia | 26 | 12,6 |
| 5 | Iran-Central Asia | 14 | 6,8 |
|  | ANCIENT MEDIEVAL |  |  |
| 6 | Ancient Middle Ages | 21 | 10,14 |
| 7 | Eastern Ancient Middle Ages | 13 | 6,28 |
| 8 | Euro - Siberia - Central Asia | 3 | 1,44 |
| 9 | Euro - Ancient Middle Earth | 4 | 1,93 |
| 10 | Euro-East-Ancient Mediterranean | 3 | 1,44 |
| 11 | Pontic - Ancient Middle Ages | 7 | 3,4 |
| 12 | Pontic - East-Ancient Mediterranean | 5 | 2,41 |
|  | PALEARCTIC |  |  |
| 13 | Palearctic | 1 | 0,48 |
| 14 | Southern Palearctic | 1 | 0,48 |
| 15 | Middle Palearctic | 4 | 1,93 |
|  | HOLARCTIC |  |  |
| 16 | Holarctic | 20 | 9,7 |
|  | PLUREGIONAL |  |  |
| 17 | Pluregional | 11 | 5,31 |
|  | Total: | 207 | 100 |

**3. CENTRAL ASIAN CLASS.** The Central Asian class includes areal types distributed in Central Asia, from Tarbagatai to Kopetdag, Western Mongolia and China, Afghanistan and Northern Iran. This class includes 2 areal types and 40 species, which make up 19.4% of the total nectariferous plants. For example, Centaurea depressa, Haloxylon aphylla, Alyssum szovitasianum, Onobrychis micrantha, Mentha asiatica, Calamagrostis dubia, Tamarix elongata, Salix songarica, Zygophyllum eichwaldii, Artemisia diffusa, and others.

**4. ANCIENT MEDITERRANEAN CLASS.** The Ancient Mediterranean class includes areal types distributed from Spain and Morocco to the Western Himalayas, Western China and Western Mongolia, and Central Europe. This class includes 7 habitat types and the largest portion of species - 56 species, which make up 27.04% of the melliferous plants. For example, Roemeria hybrida, Cynodon dactylon, Euphorbia densa, Cuscuta approximata, Erysimum canescens, Eruca sativa, Vitis vinifera, Populus alba, Rosa canina, Conringia orientalis, Acroptilon repens, and others.

**5. PALEARCTIC CLASS. T**he Palearctic class includes habitat types in the Palearctic, Arctic, Northern Siberia and the Far East. This class includes 3 habitat types and 6 species, which make up 2.89% of the melliferous plants. For example, Melilotus albus, Inula britannica, Brassica juncea, Amoria repens, Vicia angustifolia, Polygonum scabrum, Limonium gmelinii, and others.

**6. HOLARCTIC CLASS.** The Holarctic class includes the Holarctic, North American, and northern hemisphere habitat types. This class includes 20 species, accounting for 9.7%. For example, Tribulus terrestris, Consolida rugulosa, Dactylis glomerata, Plantago lanceolata, Epilobium hirsutum, E. tetragonum, Nepeta cataria, Medicago lupulina, Gypsophila paniculata, Descurainia sophia, Onopordum acanthium, Artemisia vulgaris, and others.

**7. PLUREGIONAL CLASS.** This class includes species distributed in at least three floristic realms and includes one pluriregional habitat type (in the alien and ruderal groups). This class includes 11 species, accounting for 5.31%. For example, Bidens tripartita, Conyza canadensis, Senecio subdentatus, Capsella bursa-pastoris, Calystegia sepium, Convolvulus arvensis, Medicago sativa, Lythrum salicaria, Plantago major, Verbena officinalis, and others.

**CONCLUSIONS**

In the flora, there are 7 classes and 17 types of honey-bearing species. Honey-bearing plants in our flora can produce: Alhagi pseudalhagi – 2,943.20 tons, Glycyrrhiza glabra – 157.08 tons, Ferula foetida – 218.25 tons, Capparis herbacea – 56.55 tons, and Halimodendron halodendron – 233.70 tons of honey.

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