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Honey significance of forest lands in south Uzbekistan

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Abstract. A characteristic feature of any plant group is the species composition. Therefore, the study of the honey productivity of a particular community is primarily ascertained by the species composition of plants and the calculation of the number of individuals of each type of melliferous plants per unit area. The number of plants is determined by laying out test plots of the studied areas. To calculate the nectar and honey productivity of associations, we use the data on the honey productivity of one plant, obtained by us as a result of research. Due to the variety of soil, climatic and natural conditions, the mountain range of the Surkhandarya region is characterized by a large variety of plant groups and their complexes. Since we did not set ourselves the task of covering all the diverse flora and vegetation of the mountains with surveys, we will restrict ourselves to those communities that play a certain role in beekeeping as a forage base, where primary melliferous plant species participate in associations.

1. Introduction

Beekeeping is of particular importance as a branch of agriculture, since it is a supplier of valuable products such as honey, pollen, wax, royal jelly, bee venom, propolis, and bee pollination can significantly increase the yield of entomophilic agricultural crops [1,2]. In the beekeeping of the Republic of Uzbekistan, the cultural and wild-growing melliferous flora is of importance as a fodder base.

The peculiar climate and duration of vegetation of plants create all the conditions for the successful development of apiculture in the Surkhandarya region. The lower and middle parts of the mountains are especially rich in melliferous species such as *Perovskia scrophularifolia*, *Amygdalus bucharica*, *Amygdalus spinosissima*, *Cerasus verrucosa*, *Althaea nudiflora*, *Psoralea drupacea*, *Salvia virgata*, *Salvia deserta*, *Salvia sclarea*, *Salvia spinosa*, *Capparis spinosa*, *Alhagi pseudoalhagi*, *Melilotus officinales*, *Nigella integrifolia*, *Nigella bucharica*, *Ziziphora tenuior*, *Ziziphora pedisellata*. Starting from April, in spring and summer, honey plants are used in nomadic beekeeping.

Mountain deciduous forests, although they occupy small territories in the mountain slopes of the Gissar ridge, have a significant role in beekeeping. The largest areas are occupied by walnut-fruit forests, developed in the basins of the Sangardak, Tupalang and Obizarang rivers. The upper tier of such a forest is formed by *Juglans regia*, *Malus sieversii*, *Cerasus mahaleb*. The second tier consists of maple species: *Acer turkestanicum*, *A. pubescens*, *A. semenovii*, and in some places *Populus alba*. The undergrowth is represented by shrubs *Lonicera nummulariifolia* and *L. altmannii*, *Berberis*



integerrima Bge., Species *Cotoneaster hissaricus* Pojark., *Rosa hissarica*, meadowsweet. Apple-hawthorn and apple-cherry-plum groves grow along the southern slopes.

On the slopes of mountains that are not covered with forests, communities of rosary shrubs are widespread, rosehip species – *Rosa kuhitangi*, *R. bilicosa*, *R. hissarica*.

These types of trees and shrubs are important for beekeeping as a stable forage base, which gives marketable honey.

2. Research methodology

The accounting of the species composition of the melliferous flora was carried out by means of geobotanical descriptions of the encountered plant species according to the methodology developed by a team of specialists from the Botanical institute named after V.L. Komarov [3], plant species were determined by the Flora of Uzbekistan and the Qualifier of Plants of Central Asia [4,5]. Determination of the amount of nectar was carried out by the microcapillary method. The nectar of plants with open nectaries was extracted by rinsing [6]. The amount of nectar was determined on a TV-500 torsion balance, the sugar content in the nectar was determined with an RL-3 refractometer.

3. Research results

Due to the variety of soil, climatic and natural conditions, the zone of the Surkhandarya region is characterized by a large variety of plant groups and their complexes. Since we did not set ourselves the task of covering all the diverse flora and vegetation of the mountains with surveys, we will restrict ourselves to those communities that play a certain role in beekeeping.

It is known that the type of mountain deciduous forests and shrubs remains one of the characteristic for mountains, although, as noted by V.P. Drobov [7], the species composition and distribution of groups of tree and shrub vegetation are greatly changed by humans. Forests of this type are located on mountain slopes of various exposures at an altitude of 1500-2000 m above sea level; their distinctive feature is sparseness and fragmentation of the area. Here the dominant species are *Malus sieversii*, *Acer turkestanicum*, *Acer pubescens*, *Crataegus pontica*, most often they are found in separate trees or groves, and only in some cases they form closed communities.

Plant groups such as deciduous forests and shrubs are widely represented in the basins of the Sangardak and Tupalang rivers. This type of vegetation combines several formations. However, we characterize only some of them, which have the largest number of melliferous species in their composition.

Table 1. Biological honey productivity of the main formations of the mountains of the Surkhandarya region.

Associations	Honey plants	Honey productivity, kg/ha
	Apple formation	
Barley-apple	<i>Malus sieversii</i> , <i>Prunus divaricata</i> , <i>Crataegus pontica</i> , <i>Crataegus turkestanica</i> , <i>Cotonestermultiflorus</i> , <i>Cotonesterhissaricus</i> , <i>Cerasus mahaleb</i> , <i>Ferulajaeschkeana</i>	20.0
Wheatgrass-apple	<i>Malus sieversii</i> , <i>Coluteaorbiculata</i> , <i>Clematis orientalis</i> , <i>Onobrychispulchella</i> , <i>Melilotus officinalis</i> , <i>Origanum tythanthum</i>	12.0
Mixed-herb-apple	<i>Malus sieversii</i> , <i>Anchusa italica</i> , <i>Echium italicum</i> , <i>Eremurusregelii</i> , <i>Eremurusolgae</i> , <i>Cousinia radians</i> , <i>Cousinia aurea</i> , <i>Ligulariathomsonii</i> , <i>Nepeta olgae</i>	50.0
Shrub-apple	<i>Malus sieversii</i> , <i>Acer turkestanicum</i> ,	25.0

	Rhamnus coriacea, Fraxinus raibocarpa, Berberis oblonga, Ziziphorabrevicalyx, Ziziphorapamirolaica	
Maple formation		
Cereal-maple	Acer pubescens, Acer turkestanicum, Origanum tythanthum, Onobrychischorassanica, Onobrychis grandis, Trigonella zaprjagaevii, Trigonella lipskyi	25.0
Inule-maple	Acer pubescens, Inulagrandis, Inula glauca, Althaea nudiflora, Glycyrrhiza glabra, Cousiniaumbrosa, Origanum tythanthum, Eremurus robustus, Eremostachyslehmanniana	52.5
Ferul-maple	Acer pubescens, Ferulajaeschkeana, Onobrychis grandis, Cousiniaumbrosa, Cousinia radians, Dipsaculaciniatus, Senecio franchetii	43.7
Ferul-prangos	Prangospabularia, Ferulajaeschkeana, Althaea nudiflora, Centaurea squarrosa, Solidago kuhistanica, Inula grandis, Origanum tythanthum, Onobrychispulchella, Onobrychis micrantha	34.5
Oregano-Prangos	Prangospabularia, Origanum tythanthum, Cousiniaumbrosa, Onobrychispulchella	16.4
Ferula Eschke Formation		
Mixed-herb-ferulic	Ferulajaeschkeana, Ferulstenuisecta, Prangospabularia, Inula grandis, Gentiana olivirii, Scabiosa songorica, Senecio subdentatus, Onosmadichroantha	27.5
Cereal-ferulic	Ferulajaeschkeana, Trachelanthushissaricus, Eremurusturkestanicus,	16.3
Prangos-ferulic	Ferulajaeschkeana, Prangospabularia, Solidago kuhistanica, Origanum tythanthum, Ligulariathomsonii	34.5

As can be seen from Table 1, the association and formation of mountains is characterized by high biological honey productivity. Associations of the maple formation are distinguished by the highest honey productivity, the nectar productivity of its associations is 25.0-53.5 kg/ha. Then comes the apple (12.0-50.0 kg/ha) and prangos (16.4-34.5 kg/ha) formations. The honey productivity of the Eshke ferula formations reaches 27.5-34.5 kg/ha. In general, the possible honey yield from mountain associations ranges from 4.6-17.5 kg/ha.

The communities of forests and shrubs in the mountains are sparse and are found in fragments. In these communities, the most widespread herbs are *Agroptilon repens*, *Allium suvorovii*, *Althaea nudiflora*, *Althaea rhyticarpa*, *Astragalus turkestanus*, *Centaurea squarrosa*, *Cichorium intybus*, *Convolvulus lineatus*, *Convolvulus pseudocantabrica*, *Convolvulus subhirsutus*, *Eremostachys lehmanniana*, *Eremurus regelii*, *Eremurus olgae*, *Ferulaj aeschkeana*, *Medicago sativa*, *Muretia fragratissima*, *Onobrychis chorassanica*, *Onobrychis pulchella*, *Origanum tythanthum*, *Prangos pabularia*, *Ziziphora pamiralaica*, *Cousinia microcarpa*, *Salvia virgata*, *Scabiosa songorica*, *Senecio subdentatus*, *Inula grandis*; somewhat less often *Trifolium pratense*, *Trifolium repens*, *Leonurus turketanicus*, *Ligularia thomsonii* and *Nepeta cataria*.

The most important component of deciduous forests is the maple formation. The main edifier of this formation is the Turkestan maple (*Acer turkestanicum*). It forms communities on steep, shady and humid slopes at an altitude of 1800-2400 m above sea level [8]. Other types of maple (*Acer pubescens*, *A. regelii*, *A. semenovii*) occur singly. The composition of honey maple formation of trees and shrubs include *Malus sieversii*, *Pyrus korschinskyi*, *Pyrus regelii*, *Sorbus persica*, *Sorbus turkestanica*, *Rhamnus dolichophylla*, *Fraxinus raibocarpa*, *Amygdalus bucharica*, *Lonicera zarasvchanica*, *Colutea orbiculata*, *Caragana turkestanica*, *Cotoneaster multiflorus*, *Berberis oblonga*, *Clematis orientalis*, from pollen *Pistacia vera*, species of the genus *Rosa*.

Associations of the apple formation are of great importance for beekeeping in the mountains of the Surkhandarya region. Among the accompanying woody and shrub species, many honey plants grow: *Acer turkestanicum*, *Fraxinus raibocarpa*, *Prunus divaricata*, *Sorbus persica*, *Crataegus pontica*, *Crataegus turkestanica*; *Rhamnus coriacea*, *Cotoneaster multiflorus*, *Cotoneaster hissaricus*, *Lonicera zarasvchanica*, *Colutea orbiculata*, *Berberis oblonga* and a species of the genus *Rosa* are found singularly.

The species composition of the herbaceous cover of apple associations is characterized by the abundance of *Hordeum bulbosum*, *Elytrigia trichophora*, etc.

The hawthorn formation is found in the vegetation cover of the mountains. It involves *Crataegus pontica*, *Crataegus altaica*, *Crataegus songorica*. Of these, *Crataegus turkestanica* in some places form small clean thickets or thickets mixed with other *Crataegus pontica* species; in the form of singly scattered trees, they are also found in the zone of ephemeral vegetation of the adyrs. In hawthorns, among solitary plants, there are woody melliferous species *Acer pubescens*, *Prunus divaricata*, *Celtis caucasica*, shrubs *Lonicera zarasvchanica*, *Colutea orbiculata*, *Rosa kokanica*, and *Rosa maracandica*.

Phytocenoses rich in species composition, the edifier of which is ash (*Fraxinus raibocarpa*), one of the most widespread tree species in the Surkhandarya region. It forms pure and mixed thickets with the participation of such arboreal species as *Acer pubescens*, *Acer turkestanicum*, *Celtis caucasica*, *Prunus divaricata*, *Cerasus mahaleb*, *Amygdalus bucharica*, as well as shrubs *Lonicera nummulariifolia*, *Lonicera zarazaravsorphyus*, *Lonicera nummulariifolia*, *Lonicera zarazaravsoygyus* the listed plants are good melliferous plants.

We studied and described the Andysh-ash association of the Sangardak river valley in the Kataligor gorge, located at an altitude of 1600 m above sea level. The terrain is mountainous, the soils are fine-earth and powerful. The main components are ash (50%), maple, honeysuckle (20%), with a well-defined herbaceous layer of mesophilic type. Here, along with the above-mentioned melliferous trees and shrubs, among the herbaceous melliferous species grow *Inula grandis*, *Althaea nudiflora*, *Glycyrrhiza glabra*, *Origanum tythanthum*, *Eremurus robustus*, *Eremurus turkestanicus*, *Taraxacum macrochlamydeum*, *Trigonellazarpjagaei*, *Trigonellalipskyi*, *Onobrychis grandis*, *Ferula jaeschkeana* and species of the genus *Eremostachys*. From pollen species the common are the genus *Gagea*, *Ranunculus*, *Rosa* and *Artemisia lehmanniana*, *Plantago lanceolata*. Honey production of hawthorn and ash phytocenoses ranges from 30 to 40 kg/ha, everything depends on the presence of melliferous plants in them. Among the mountain communities one can distinguish prangos-ferulic junipers. Associations of prangos-ferulic junipers are widely represented in Shargun, the upper reaches of the Sherabaddarya. These communities are the most honey productive in the mountainous zone.

The ferulic-juniper association was noted in the Western Hissar, in the upper reaches of the Vakhshivarsay gorge on powerful soils. The overall coverage is 80%.

In the upper reaches of the Vakhshivarsay, on the right bank, a steep slope, a lateral river (1500 m above sea level), an association of ferulic-oregano juniper stands out. The soil is brown, the aspect is green, the overall coverage is 80%. The honey productivity of the ferulic-oregano association is 25.0-31.2 kg/ha.

In prangos-ferulic juniper forests, they are distinguished by high honey content from the tree-shrub layer of *Lonicera nummulariifolia*, *Fraxinus raibocarpa*, *Amygdalus bucharica* and *Cotoneaster racemiflorus*, grass *Ferula jaeschkeana*, *Origanum tythanthum*, *Eremurus robustus*, *Centaurea squarrosa*, *Solidago kuznetsovii*.

In the upper strip of mountains, the honey-producing lands are communities of mountain meadows; large-grass-laserowy formation with edificators of *Ferulatenuisecta* and *Prangospabularia*. Both species are primary honey plants, providing bees with nectar and pollen. Among this formation, the most nectar-producing are two associations; prangos-ferulic and inulic-prangos, widespread in the basin of the Tupalang River.

The main massifs of the prangos-ferulic association are located in the valley of the Khondize River, on the slopes strewn with fragments of stones. The aspect is green, the degree of total projective plant cover is 100%, of which *Prangospabularia* accounts for 40%, and *Ferulajaeschkeana* 50%, the nectar productivity of this association is 35-40 kg/ha.

In the aforementioned area, there are communities of the inulic-prangos association. We described one of its sections to the southwest of the Degisurkh village on the right bank of the Arza river (1800 m above sea level). The total projective cover of plants is 95% with a predominance of *Prangospabularia* (40%) and *Inulagrandis* (30%). The honey productivity of prangos-ferulic thickets is 31.2-37.5 kg/ha.

Phytocenoses of floodplain mountain forests with honey productivity from 18 to 23 kg/ha are widespread in the mountain zone. In the mountain river valleys of Sangardak and Tupalang, willow stands and comb thickets are represented by isolated groups, in the form of separate narrow strips or islets. Such places are characterized by melliferous species of *Clematisorientalis*, *Trifoliumrepens*, *Trifoliumpratense*, *Melilotusofficinalis*, *Monthaasiatica*, *Anchusaitalica*, *Dipsacuslasiniatus* and *Cuscutamonogyana*.

In addition, the floodplain forests of the mountains include numerous shrubs, some of which are of melliferous value. The thickets of the original melliferous plant in the south of the republic - poplar vineyards (*Ampelopsisaegyrophylla*) - should be especially noted. It most often grows on pebbles and old floodplains, sometimes rises to the lower parts of the slopes, especially typical of the Tupalang River valley. Poplar vineyard - a shrub with creeping stems, the flowers of which are collected in corymbose panicles. It blooms in June-July; bears fruit in August. This species is a honey plant of the mountains, in some places it gives a marketable honey harvest. During the period of mass flowering, the daily weight gain of the control hive ranged from 0.6 to 3.5 kg. It is appropriate to note here that there is no data on such a valuable melliferous plant of tau and its nectar content in the literature. For the first time we managed to determine its nectar content. The flowers of the vineyard are small and their nectar productivity does not exceed 0.08-10.0 mg. The honey productivity of its dense thickets reaches 25.0-35 kg/ha.

When studying the composition of melliferous plants, we identified plants with a wide range, actively visited by entomophilous insects to collect nectar and pollen, but not mentioned in the literature as melliferous plants. Of the identified honey plants, the most interesting are *Trigonella lipskyi*, *Trigonella adscendens*, *Trifolium lappaceum*, *Astragalus spryginii*, *Astragalus maveranagri*, *Onobrychis schugnanica*, *Zygophyllum gontscharovii*, *Althaea ludwigii*, *Solidago kuhistanica*, *Lindelofia olgae*, *Solenanthus coronatus*, *Inula glauca*.

The average amount of sugar in 100 flowers in these melliferous plants ranges from 1.4 to 243 mg. Species of the genus *Onosma* turned out to be very highly nectariferous. The average amount of nectar secreted by 100 flowers from plants of this genus ranges from 100 to 243 mg.

Most of the new melliferous plants from the families Fabaceae (6 genera, 9 species), Boraginaceae (3 genera, 9 species), Rosaceae and Asteraceae (3 genera and 6 species each), Lamiaceae (3 genera, 3 species).

Table 2. Newly identified wild species of melliferous plants in foothill and mountain zones.

Ranunculaceae Family	
<i>Nigella integrifolia</i> Rgl	<i>Nigella</i> whole-leaved
<i>Nigella bucharica</i> Schipcz.	<i>Nigella</i> Bukhara

Brassicaceae Family	
Strigosella scorpicides (Bge) Botsch.	Stregozele scorpion-like
Strigosella spryginoides (Botsch.et Vved.) Botsch	Stregosela spinyinform
Rosaceae Family	
Cotoneaster pojarkovae Zak.	Poyarkov's cotoneaster
Cotoneaster zeravchanicus Bge	Zeravshan cotoneaster
Cotoneaster hissaricus Pojark.	Hissar cotoneaster
Crataegus hissarica Pojark.	Hissar hawthorn
Crataegus pamiroalaica Zapr.	Pamir Alai hawthorn
Poterium lasiocarpum Boiss.	Blackhead fluffly
Fabaceae Family	
Trigonella foenum-graecum L.	Fenugreek greek
Trigonella lipskyi Sir.	Fenugreek Lipsky
Trigonella adscendens (Nevski) Aphan.	Fenugreek ascending
Trifolium lappaceum L.	Burdock clover
Colutea orbiculata Sumn.	Colutea L. rounded
Calophaca reticulate Sumn	Maikaragan net
Astragalus spryginii M.Pop.	Astragalus Sprygin's
Astragalus maveranagri M.Pop	Astragalus maveranagrski
Onobrychis schugnanica B. Fedtsch	Shugnansky sainfoin
Zygophyllaceae Family	
Zygophyllum gontscharovii Boriss.	Goncharov's parifolia
Malvaceae Family	
Althaea ludwigii L.	Althea Ludwig's
Boraginaceae Family	
Lindelofia olgae (RgL.et Smirn.) Brand.	Lindelofia Olga's
Solenanthus coronatus Rgl.	Tube flower crowned
Onosma barszczewskii Lipsky	Onosma Borshchevsky's
Onosma albicaule M.Pop.	White-stemmed onosma
Onosma gmelinii Ldb.	Onosma Gmelin's
Onosma baldshuanicum Lipsky	Onosma Baljuana
Onosma livanovii M.Pop.	Onosma Livanov's
Onosma macrorrhizum M.Pop.	Large-rooted onosma
Lamiaceae Family	
Eremostachys baissunensis M. Pop.	Baysun desert grate
Stachys hissarica Rgl.	Chistets Hissar
Ziziphora interrupta Juz.	Ziziphora interrupted
Scrophulariaceae Family	
Scrophularia alata Gilib.	Norichnik winged
Scrophularia integrifolia Pavl.	Norichnik whole-leaved
Scrophularia turkomanica Bornm.et Sint.	Norichnik Turkmen
Asteraceae Family	
Solidago kuhistanica M.Pop.	Kugitang goldenrod
Inula glauca C.Winkl.	Elecampane gray
Inula britannica L.	Elecampane British
Senecio subdentatus Ldb.	Almost toothed rootwort
Senecio franchetii C.Winkl.	Franchet's Ragwort

All new honey plants, a brief description of which is given below, can be used as a supporting bribe, and in combination with other melliferous vegetation can serve as sources of honey collection.

Nigella (*Nigella* L.). Species of this genus belong to the Ranunculaceae family in the spurs of the Hissar ridge, Babataga, there are two species - *Nigella integrifolia* and *Nigella bucharica*. They are widespread in the ephemeral herbage from the foothills to the middle belt of the mountains, sometimes found on fallow lands and crops. These species are nectar-bearing and pollen-bearing. They bloom in April-May. Duration of flowering of one plant is 10-12 days, in thickets - up to 20 days. The average amount of sugar secreted by 100 flowers reaches 10 mg. The average number of flowers per plant is 7-8 pcs. Although they do not form large thickets, they are components of many associations common in the lower belt of the Hissar Range and are of great importance for beekeeping, as they provide bees with nectar and pollen.

Strigosella (*Strigosella* R.Br.). Species of this genus belong to the Brassicaceae family and are distinguished by their high honey content. In the conditions of the Surkhandarya region, we were the first to observe the visit of the flowers of *Strigosella scorpicides* and *Strigosella spryginoides* by honey bees. The species of the genus grow in the lower belt of the mountains, and sometimes at the outcrops of variegated-colored rocks. They blossom in April-May, bears fruit in May-June. During the mass flowering period, it is well visited by bees. The average amount of sugar secreted by 100 flowers is 4-5 mg. Although some species of this genus were described in the literature, they were not given as honey plants.

Cotoneaster (*Cotoneaster* Medik.) belongs to the Rosaceae family. In the Surkhandarya region, within the mountains, there are several species of the genus *Cotoneaster*, which are good honey plants. *Cotoneaster zeravchanicus*, *Cotoneaster hissaricus*, *Cotoneaster pojarkovae* - shrubs with a height of 1.5-2.0 m grow on the slopes of the mountains in the tree-shrub belt. Their flowering begins in May. Flower nectar production lasts 3-4 days. Duration of flowering of one plant is 10-12 days, in thickets up to 20 days. Nectar productivity of 10 flowers - 7-8 mg. These species do not form large thickets.

Fenugreek (*Trigonella* L.). A herbaceous plant belonging to the Fabaceae family. For the first time, the following species of *Trigonella foenum-graecum*, *Trigonella lipskyi*, *Trigonella adscendens* were observed to be honey.

Trigonella foenum-graecum is a plant 10-15 cm high, grows on mountain slopes among trees and shrubs, blooms in May-June. The average amount of nectar secreted by 100 flowers is 1-3 mg.

Trigonella adscendens is a perennial herb up to 30 cm high. It is abundant on fine earth-gravel soils, in the upper part of juniper forests and in the subalpine belt of mountains. It blossoms in June-July; bears fruit in July-August. Mass flowering lasts 15-20 days. The average amount of nectar in 100 flowers is 3 mg. It is found in small spots and single specimens.

Trigonella lipskyi is a perennial herb with numerous stems 100 cm high. It is abundant on the mountain slopes in the lower zone of juniper forests. Flowering occurs in May, bears fruit in June. Nectar productivity of 100 flowers is 3-5 mg. In dense thickets, its sugar productivity reaches 26 kg/ha.

(*Colutea* L.). *Colutea orbiculata* is a shrub of the Fabaceae family, height 3.5-4 m. It is abundant on fine-earth slopes in the upper part of the adyr and within the mountains. It blooms in May-June. Mass flowering lasts 25-30 days. Flower life and functioning of nectaries 3 days. Nectar productivity of 100 flowers 130-150 mg. It does not form large thickets, occurs in single or small groups.

Astragalus (*Astragalus* L.). Shrub 45-60 cm high grows on stony slopes of low mountains. *Astragalus maverranagri* is a shrub 50 cm high, widespread in the low foothills in the zone of bluegrass-sedge vegetation, less often in the upper part of the adyr belt. They bloom in April, bear fruit in May, the lifespan of one flower varies - two days. Mass flowering lasts 10-15 days. The nectar productivity of 100 flowers ranges from 6 to 11 mg. According to our calculations, the nectar productivity of thickets of these species ranges from 14.1 to 51 kg/ha; well visited by bees.

Lindelofia (*Lindelofia* Lehm.). *Lindelofia olgae* is a perennial herb from the Boraginaceae family, 30-50 cm high. It is abundant on gravelly and stony wet slopes of the upper belt of mountains. It blooms in June-July. It bears fruit in July-August. The duration of nectar production of one flower is two days. Mass flowering lasts 15-20 days, in thickets - up to 25 days. Nectar productivity of 100 flowers 8-32 mg, thickets up to 25 kg/ha.

Onosma. Common species of the genus *Onosma albicaule*, *Onosma gmelinii*, *Onosma baldshuanicum*, *Onosma livanovii*, *Onosma macrorrhizum*.

Onosma albicaule is a perennial herb, 20-25 cm high, distributed on variegated and stony dry slopes of the lower and middle belt of mountains. It blossoms in April, bears fruit in August. Nectar productivity of 100 flowers - 189 mg.

Onosma livanovii- widespread on outcrops of variegated rocks in the foothills. It blossoms in April, bears fruit in July. Nectar productivity of 100 flowers - 155 mg.

Desert grate (*Eremostachys* Bge.). *Eremostachys baissunensis* is a perennial, herbaceous plant 40-60 cm high. It grows on rocky slopes in the middle belt of mountains, blooms in May-June, bears fruit in June-August. Mass flowering lasts about 20 days. The life span of a flower is two days. Nectar productivity of 100 flowers on average is 149 mg. The nectar productivity of thickets reaches 20 kg/ha.

Surkhandarya region is also distinguished by relict subtropical plant species. In the mountain gorges of Sangardak and Tupalang, although in a limited area, there are thickets of wild persimmon (*Diospyros lotus*), figs (*Ficus carica*), sumach (*Rhus coriaria*), unabi (*Zizyphus jujube*), which are good honey plants. We have established the nectar productivity of these species in natural habitat for the first time.

In Surkhandarya region, persimmon grows on the slopes of the Hissar ridge at an altitude of 1200-2000 meters above sea level where about 600-900 mm of precipitation falls. Frosts below 20 °C are rare. The common persimmon formation is distributed only in the southwestern spurs of the Hissar ridge in the basins of the Tupalang and Sangardak rivers. Persimmon is one of the very rare subtropical tree species. Under natural conditions, the common persimmon tree grows up to 12-14 m tall, has a wide spherical, dense dark green crown and even trunks 20-40 cm in diameter. Leaves are leathery, oblong, broadly ovate with a sharp apex and wedge-shaped base, dark green glossy above, lighter below, slightly drooping, relatively short 1.2-1.4 cm long petioles. The plant is dioecious. Flowers are separate, four-membered actinomorphic, fruits are spherical or oblong-shaped berries. Female flowers are small, whitish-reddish in color, located singly. Male flowers are united by three flowers to form inflorescences. In the conditions of the Surkhandarya region, persimmon blooms in late April and early May. The flowers bloom for 10-12 days. Nectar productivity of 100 persimmon flowers is 15.0-16.0 mg. The amount of sugar in the nectar of 100 flowers is 20.0 mg. The fruits ripen in October. Under natural conditions, persimmon reproduces by seeds and vegetatively with root suckers. According to the observations of I.V. Bondarenko [9], it lives for 100 -200 and more years. The common persimmon grows on moist slopes protected from cold winds, forming small shady groves, clean or with a slight admixture of accompanying species. Persimmon trees are usually placed along the banks of rivers and springs with clean cold water.

Persimmon groves in the basin of the Tupalang and Sangardak rivers are found as accompanying species *Celtis caucasica*, *Crataegus pontica*, *C. turkestanica*, *Cerasus mahaleb*, *Prunus divaricata*, *Morus alba*, *Acer semenovii*, *Fraxinus sogdiana*, and *Juglans regia*. The undergrowth is formed from shrub species *Cotoneaster hissaricus*, species of rose hips *Rosacina*, *R. fedtschenkoana*, honeysuckle - *Lonicera altmannii*, Hissar grape - *Vitis hissarica*, poplar vine *Ampelopsis aegyrophylla*, clematis *clematis orientalis* and some other species. The herbaceous layer is characterized by an abundance of herbaceous melliferous plants such as *Inpatiens parviflora*, *Codonopsis clematidea*, *Polygonatum severtzovii*, *Epipactis royleana*, *Adiantum capillus-veneris*, *Cystopteris filix-fragilis*, *Scrophularia alata*. *Punicagranatum* L. occurs in the wild on the southwestern spur of the Hissar ridge: in the basins of the Tupalang and Sangardak rivers. Habitat humid and sheltered areas, in small gorges and crevices of the mountains at an altitude of 1000-1600 m above sea level, are very rare single bushes or small thickets mixed with other tree and shrub species. Sometimes it is very rare with small clean thickets. In nature, it reproduces by root suckers vegetatively, rarely by seeds. The reasons for the decrease in the area and number are economic development, collection of fruits and felling of shrubs by the population. *Punicagranatum* L. shrub 2.0-3.0 meters high, leaves are oblong-obovate, leathery 6-8 cm long, 7-15 cm wide, sit on shortened shoots in bunches opposite. The flowers are

actinomorphic, dioecious, the petals are brightly colored, the calyx is leathery. Petals are 4-7 membered, bright red. Anthers are numerous, forming 3-4 circles. The pistil consists of 7 carpels. Wild pomegranate grows in dry stony-gravelly mountain slopes. Pomegranate is an entomophilous plant, bees actively visit to collect pollen and perfectly pollinate the plant. The plant can self-pollinate. Wild pomegranate is listed in the Red Book of Uzbekistan by status 2.

Rhus coriaria L. - tannic sumach is a rare species of the Hissar ridge of the basin of the Tupalang and Khondiza rivers. It is distributed on dry rocky slopes with fine earthy soils in the lower belt of the mountains. The plant is light-loving, grows in open places at an altitude of 1200-1400 m above sea level, forms small groves or grows singly. At this time, this species is widely cultivated as an ornamental plant in cities and villages. In nature, it reproduces vegetatively with root suckers and seeds. Sumach is not a tall tree 3-5 m, deciduous plant. Annual shoots are gray-brown, older perennial stems are brown. Leaves are compound, odd-pinnate, 7-9 paired, up to 30 cm long. Flowers are greenish-white, at the tops of the shoot forms an elongated fusiform inflorescence. It is cross pollinated by pollinators. In natural conditions, sumach suffers from logging by the population and is used as pastures.

Vitishissarica Vass. - Hissar grape is a rare species with a broken range, widespread in the Hissar ridge of the Tupalang River basin. It grows on fine-earth gravelly mountain slopes and in gorges. In mountains it occurs as solitary specimens or in small groups. In nature, it reproduces by seeds and vegetatively. The reasons for the reduction in the area are due to the use as fuel and grazing. Grape creeping liana 25-30 m long, leaves are simple, almost rounded, 3-5 lobed or finger-dissected, with a base with a notch along the edge with blunt or pointed teeth. The inflorescence is a dense or loose panicle. It blossoms in May-June, bears fruit in July-October. The fruits of the examined thickets of grapes are mostly black, spherical or oval, up to 10-15 mm in diameter. Rarely, there are separate thickets with white fruits. In terms of taste, ripe fruits are not much inferior to some cultural varieties.

Ficus carica L. - Figs are found in the form of single trees, less often they form small groves. Figs are confined to the lower zone of distribution of trees and shrubs within 900-1800 m above sea level. It grows mainly on the slopes of the southern, southeastern and southwestern exposures. Figs are undemanding to soil and ground conditions, inhabits almost exclusively dry stony - crushed stone areas of mountain slopes. Here figs are represented by bush-shaped trees, with a wide spreading crown, with a large number of shoots and trunks of various ages. The height of the trees is 3-6 m, the diameter of the trunk is from 8-25 cm. In some groves, depending on the occupied area, there are from 20-60 fig trees. Distribution of figs on the banks of the Sangardak, Khondiza, Malyand and Chosh rivers, at an altitude of 950 m above sea level.

Zizyphus sativus Gaertn. - unabi are distributed in separate scattered spots. Small areas, tree stands of pure composition are more often confined to the southern slopes of various directions within 800-1800 m above sea level. Unabi is a good drought-resistant plant, undemanding to soil and soil conditions, grows well and develops on dry gravelly barren slopes. Unabi often forms dense, impenetrable stands. Here it is represented by trees up to 6-8 m in height, up to 30-40 cm in diameter, with a narrow pyramidal crown. Along with this, as a result of frequent felling, sparse bushy thickets are formed. One of the characteristic features of unabi stands is the complete absence of accompanying species and undergrowth. The herbaceous cover is sparse, usually composed of ephemeral grains with an insignificant participation of motley grass. In stands located on steep gravelly slopes, due to the mobility of the substrate, the herbaceous cover is very rare or absent.

In the conditions of dry slopes, the renewal of unabi proceeds by root suckers, pneumatic shoots, and less often by seeds. On a test plot of 25 m², laid in a stand of average density, there are from 4 to 6 young plants, 20-40 cm in height, with a trunk thickness at the root collar of 1-4 cm. The life state of the surveyed stands is very good. All trees are healthy and dry. Regeneration and fruiting are normal, no cases of frosting of undergrowth and mature trees were observed.

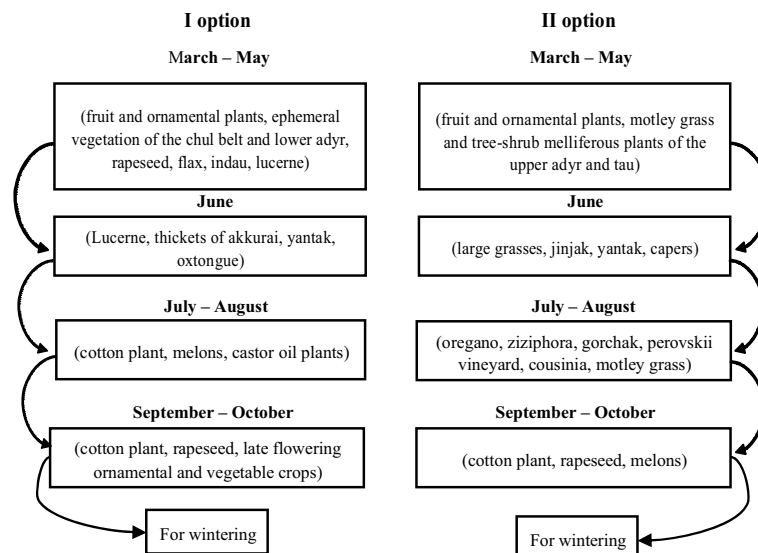
It should be noted such plants widespread in different mountain communities, distinguished by good melliferous properties, such as *Colutea orbiculata*, *Caragana turkestanica* and species of the genus *Lonicera*, *Berberis*, *Cerasus*.

In the Surkhandarya region there is a possibility of receiving several takes (from wild plants, fruits, melons, alfalfa and cotton), there is a need to organize nomadic apiaries to sources of takes, to such remote beekeeping regions as Boysun and Saryassi. Currently, apiaries can be brought to them and to many other remote places by road.

However, a number of gorges and massifs with rich melliferous flora are still difficult to access for apiaries. Based on our research and taking into account the experience of leading beekeepers, we have drawn up a scheme of apiaries for the Surkhandarya region, which is widely used by beekeepers of this region.

Vertical-belt distribution of vegetation, favorable soil-climatic and natural conditions of the Surkhandarya region, as noted earlier, contribute to the development of nomadic beekeeping. But this requires an accurate diagram of the movements of the apiaries. Taking into account the latter circumstance, and having carefully analyzed the materials obtained in the results of our research, we came to the conclusion that in the Surkhandarya region, two variants of the scheme of migrations of apiaries (Figure 1) can be used, depending on the zonal distribution of melliferous vegetation.

Figure 1. Schemes of migrations of apiaries in the Surkhandarya region.



The first option of the scheme of migrations of apiaries in the Surkhandarya region can be recommended for use by farms located in an oasis or foothill zone, the second variant in mountainous regions.

First option. It is recommended for the beekeeping regions of Sherabad, Termez, the vicinity of the Babatag and Boysun mountains. The first takes (March-May) are provided by fruit and ornamental trees. And also, ephemeral vegetation of the chul belt and lower adyr and from agricultural crops of spring rape, flax and indau.

From fruit trees, bees are attracted by almonds, apricots, cherry plums, cherries, peaches, plums, grapes, unabi, persimmons, jiydah, from decorative ones - mulberries, poplar, acacia, ailanthus, gledichia, catalpa.

In the zone of the lower foothills in spring, honey-bearing species of the genus goose onion, stregosella, buttercup, as well as long-legged erantus, Tatar ixiolirion, unfolded Remeria, peacock poppy, common rape, sheath purse, etc. bloom in the spring.

In May-June, you can use flowering crops of alfalfa. In June, Akkuray, Dzhinjak, Yantak, and Bittersweet also bloom.

In July-August, apiaries can be transported to agricultural crops: cotton, melons, castor oil plants. Late takes (September-October) can be taken from cotton, rapeseed, late flowering ornamental and vegetable crops. At the end of October, the season ends and the apiaries are transferred to the wintering place - to the garden, where in early spring it is used to collect nectar and pollen.

Second option. It is recommended for mountain beekeeping regions in the basins of the Tupalang, Sangardak, Obizarang, Shargunsay rivers, can be used in the vicinity of Vakhshivar and Boysun. The first takes on March-May 9 are provided by fruit and ornamental trees, tree and shrub honey plants of the upper adyr and tau. After the flowering of fruit and ornamental crops, beekeepers can move apiaries to mountain honey lands.

In May-June, you can use large grasses (prangos, Ferula, sweet clover, eremurus, grapevine), as well as ginjak, amber and marque thickets of the lower belt of the mountains.

In July-August, it is possible to successfully use communities of wild thickets of oregano, zizifora, gorchak, vineyard, perovskii and cousinia, and motley grass.

At the end of August, we recommend transporting apiaries to agricultural crops, in particular to cotton, winter rapeseed and melons. Takes can be received until the end of October. This migration is the last, the last apiary can be brought to the wintering place.

It seems that the recommended by us schemes for the migrations of apiaries will help raise the culture of nomadic beekeeping in the south of Uzbekistan to a higher level.

4. Conclusions

A detailed study of the mountainous regions of the Surkhandarya region showed that their plant groups sharply differ in floristic composition and honey productivity.

In the lower tier of the mountains, highly honey-producing, the Perovskian-norichnik-leaved formation (125.0-168.7 kg/ha), medium-large herb-ephemeroïd (25-46.2 kg/ha) and the formation of Bukhara almonds (25.0-31.3 kg/ha), low-pistachio formation (18.75 kg/ha).

In the upper tier of the mountains, all formations of average honey productivity: maple - 25.0-52.5 kg/ha, apple - 20.0-50.0, prangos - 54.5, ferulic - 27.5-40.5 kg/ha. Some associations of these formations are of low honey productivity (cereal-ferulic-16.37 kg/ha, wheatgrass-apple -12.5 kg/ha). The honey productivity of hawthorn and ash phytocenoses ranges from 30-40 kg/ha.

The new melliferous plants that we have identified in the Surkhandarya region broadens our understanding of the melliferous flora of this region and, we think, will attract the attention of researchers and beekeepers.

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