

# Honey flora of forest plant community

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**Abstract.** The honey flora of the forest plant community is an important forage resource for the development of beekeeping. That's why it is desirable to assess species composition and total number of honey plants and to determine the honey reserve of the area of the forest community plant. The forest cover of the Orel region is 9.3%, and this cover is distributed on its territory very irregularly. 257 species out of the total number of honey plants in the region are found in the forests. Deciduous forests are dominant in the Orel region including oak, ash, linden, birch and aspen. The results of studies of flowering plants in the forest plant community showed that there is a sufficient number of honey plants in the forest to provide bee families with nectar from spring to late autumn due to the natural flower-nectar conveyor. The assessment of the honey stock of this community shows that the stock equals 4,872 tons from 203 thousand hectares of forest. And bees can sip only about 30% (1,626 tons). It proves that significant honey reserves are concentrated in the forest plant community of the Orel region. The rational use of these reserves will help to solve the problem of reproduction of new bee families of the aboriginal Central Russian breed and to organize a long honey gathering by bees that provide people of the region with honey.

## 1 Introduction

More than 1200 species of plants pollinated by insects have been registered in Russia. The dominant part of them emit very little nectar or is rare [1].

Many scientists studied the natural honey base, in their works making a connection between beekeeping industry and the species diversity of the natural flora.

Beekeeping has been an important subsidiary branch of agriculture that brings considerable income to its owners. In recent years the interest in beekeeping has been constantly growing. Its further development should increase the productivity and the number of bee families with their removal for honey gathering in proper time and correct placement. Special attention is also paid to the study and rational use of the forage base.

The size of apiaries and their placement should be determined by the presence of honey resources of natural lands and crops of agricultural entomophilous crops, which are a source of food for bees. In this regard, a comprehensive assessment of natural honey vegetation is of great importance.

The study of the features of distribution and growth, the species composition of plants,

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their biological characteristics, the time of flowering and honey productivity is a necessary condition for the rational use of the country's honey resources. Beekeepers' knowledge of the composition of honey plants and their honey productivity, areas and flowering calendar makes it possible to assess the honey reserves of the area with great accuracy. Insufficient knowledge of the species composition of honey plants can make an extremely negative impact on the development of beekeeping industry.

The species diversity of natural honey plants in the Central Black Region is represented by forest, meadow, steppe plant communities. Unfortunately, the studies of the species composition of honey plants to assess their nectar productivity were carried out only in some regions of Russia. Among the most studied regions are the Ivanovo region, the researcher N.S. Tumakov [11], the Ryazan region, the scientists A.N. Burmistrov, T.P. Samokhvalova, V.B. Drozdov [6]. Honey plants of the Penza region were described by D.V. Girnik and A.V. Lipina [9], these plants in the Voronezh region were described by V.E. Ryndin [10], in the Kirov region by M.I. Shabardin [13], A. Ya. Menshin [15], L.A. Zubareva [14] and V.V. Shabalin [12]. The scientists presented a catalog of honey plants of the regions and their species composition.

The information on the species composition of honey plants in the forest plant community of the Orel region is not presented in the literature. That's why it's necessary to study this plant community, since the data obtained are of practical and theoretical interest for various sectors of the national economy.

## **2 Materials and Methods**

The objects for study were broad-leaved, small-leaved, coniferous forests of the Orel region. The species composition of honey plants was studied by registering existing plants visited by bees. To determine the species composition of the flora, the reference book written by P.F. Mayevsky was used [7]. Phenological observations were carried out according to the method of I.N. Beidemann [8]. The data on the forest fund were taken from the Forestry Department of the Orel region.

## **3 Results and Discussion**

In the Orel region being a typical representative of the flora of the Central Black Earth Region, more than a thousand plant species have been registered, belonging to 493 genera and 105 families. The dominant position is occupied by forest, meadow, steppe, weed and aquatic plants. This also includes agricultural crops. More than 525 species of honey plants (Fig. 1) are represented by 63 families and 130 genera [2,3].



**Fig. 1.** Systematic spectrum of honey plants: a - in spring, b - in summer, c - in autumn, d – total.

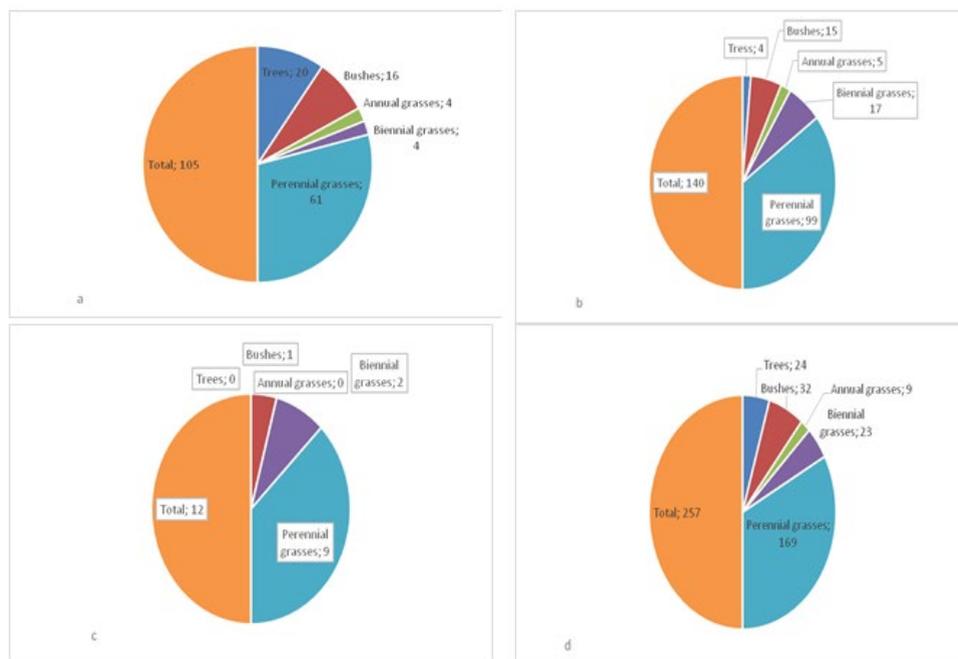
The following families are rich in honey plants: Compositae - 63 species; Fabaceae - 53 species; Rosaceae - 44 species; Labiatae - 43 species; Cruciferae - 36 species; Scrophulariaceae - 29 species; Ranunculaceae - 25 species; Orchidaceae and Salicaceae, 17 species each; Liliaceae 16 species; Caryophyllaceae - 14 species; Violaceae - 13 species; Campanulaceae - 12 species; Boraginaceae - 11 species; Umbelliferae - 10 species; Rubiaceae, Onagraceae, 9 species; Geraniaceae - 8 species; Polygonaceae - 6 species; Caprifoliaceae, Ericaceae, Iridaceae, Aceraceae, Polygalaceae 4 species each. The remaining families include from one to three species.

In the genera such as *Geranium* L., *Epilobium* L., *Campanula* L., *Viola* L., *Salix* L., *Dianthus* L., *Ranunculus* L., *Verbascum* L., *Veronica* L., *Potentilla* L., *Galium* L., *Trifolium* L., *Cirsium* Mill., *Centaurea* L., *Vicia* L. honey plants are most often found.

### 3.1 Species composition of the honey flora

The vegetation of the Orel region is dominated by forest and herbaceous communities. Significant forest areas are concentrated on the left bank of the rivers Oka, Nerussy, Rechitsa, Vitebet. They go beyond the territory of the Orel region and are located in the neighboring regions of Kaluga and Bryansk. Forests in the region occupy 9.3% of the territory, they are located very irregularly. The forest cover in the districts ranges from 25.3% (Dmitrovsky district) to 6.4% (Korsakovsky district), and in the Livensky and Dolzhansky districts, the forest cover decreases to 1.8 - 2.0%.

The share of forest species out of the total number of honey plants is 257. Forest honey plants belong to 47 families and 140 genera. Among them there are 24 species of trees, 32 species of shrubs and 201 species of grasses (Fig. 2).



**Fig. 2.** Systematic spectrum of honey forest plants: a - in spring, b - in summer, c - in autumn, d - total.

The largest number of species of honey plants are represented by the following families: *Compositae*; *Rosaceae*; *Labiatae*; *Fabaceae*; *Scrophulariaceae*; *Orchidaceae*; *Liliaceae*; *Campanulaceae*; *Caryophyllaceae*; *Violaceae*; with a number from 8 to 25 species. In the families: *Salicaceae*; *Umbelliferae*; *Rubiaceae*; *Geraniaceae*; *Ericaceae*; *Aceraceae*; *Gentianaceae*; *Caprifoliaceae*; *Boraginaceae*; *Primulaceae*; *Onagraceae*; *Cruciferae*; *Fumariaceae*; *Pinaceae*; *Grossulariaceae*; *Ulmaceae*; *Tiliaceae*; *Hypericaceae*; *Celastraceae*; *Valerianaceae*; *Dipsacaceae*; *Iridaceae*, the number varies from 2 to 7 species. In other families, honey plants are found singly.

In different types of forests, the species composition of honey plants varies considerably. In the deciduous forests of the Orel region, such tree species as ash, linden, birch, aspen, oak are more common. The predominant forests in the region are broad-leaved, with areas ranging from 65 to 80% [5].

In the composition of oak forests, there are tall-stemmed and low-stemmed tree species located on the slopes of ravines and gullies. In oak forests, the first tier is made up of oak together with honey plants *Acer platanoides* L., *Fraxinus excelsior* L., *Betula* L., *Populus tremula* L. The second tier is represented by shrubs *Frangula alnus* Mill., *Rhamnus cathartica* L., *Lonicera xylosteum* L., *Euonymus verrucosa* Scop, and the third by herbaceous plants *Geranium sylvaticum* L., *Gagea Salisb.*, *Fragaria vesca* L., *Campanula tracheliuml* L., *Anthriscus sylvestris* (L.) Hoffm., *Convallaria majalis* L., *Polygonatum officinale* All., *Pulmonaria obscura* Dum., *Viola canina* L., *Lathyrus vernus* (L.) Burnh.

Low-stemmed oak forests of coppice origin prevail on the territory of the region. The majority of them is concentrated in the Znamensky district [5]. The dominant species is *Quercus* L. together with *Fraxinus* L., *Acer* L., *Tilia* L., *Betula* L., *Ulmus* L., *Populus tremula* L. Herbaceous cover dominates in the places with single trees and the most part of the cover include the following honey plants: *Geum rivale* L., *G. urbanum* L., *Galobdolon luteum* Huds., *Melampyrum nemorosum* L., *Inula hirta* L., *Origanum vulgare* L., *Trifolium medium* L., *Potentilla atba* L., *Galium verum* L., *Polemonium caeruleum* L., *Achillea miliefolium* L.

In the southeast of the region broad-leaved forests are more common with ash, linden, birch and aspen prevailing. In the north-west of the region aspen forests with meadow-steppe and weed species of plants prevail, which are the first to occupy abandoned arable lands.

In small-leaved forests, the species composition of plants is more scarce and is represented by *Betula* L., *Populus tremula* L., as well as by honey bushes - *Frangula* Mill., *Euonymus* L.

*Pulmonaria obscura* Dum., *Aegopodium podagraria* L., *Fragaria vesca* L., *Campanula patula* L., *Cirsium* Mill., *Urtica dioica* L., *Leonurus quinquelobatus* Gilib, *Paris quadrifolia* L. are types of honey plants in small-leaved middle-aged forests.

Coniferous forests are much less common; the main species is pine. The species composition of pine forests is influenced by soil and terrain.

### 3.2 Blossoming of honey plants of forest plant community

In early spring tree species begin to blossom in the deciduous forests of the region - *Salix fragilis* L., *S. acutifolia* W., *S. Carpea* L. Blossoming can last from 5 to 25 days, depending on weather conditions. In the same period about 28 plant species also blossom: *Betula pendula* Roth, *Prunus padus* L., *Populus nigra* L., *Sambucus rasemosa* L., *Syringa vulgaris*. In early May *Pyrus communis* L., *Malus sylvestris* Mill., *Sorbus aucuparia* L., *Acer campestre* blossom, and in late spring and early summer *Quercus robur* L. does. The blossoming of these honey plants coincides with the blossoming of shrubs *Caragana arborescens* Lam., *Crataegus sanguinea* Pall., *Viburnum rasemosa* L., *Ribes nigrum* L., *Euonymus verrucosa* Scop., *E. europae* L., *Frangula alnus* Mill., *Rubus idaeus* L.

The spring period is characterized by the most diverse blossoming honey vegetation including 12 species of trees, 21 species of shrubs and 30 species of herbaceous honey plants in forests: *Anemone nemorosa* L., *Galeobdolon luteum* Huds., *Ajuga reptans* L., *Ranunculus auricomus* L., *Veronica chamaedrys* L., *Lathyrus vernus* Bernh., *Viola tricolor* L. that has a very favorable effect on the development of bee families in the woodlands during the movement of bees. Such honey plants as *Campanula patula* L., *Fragaria vesca* L., *Geranium sylvaticum* L., *Convallaria majalis* L., *Anthriscus sylvestris hoffm* have an extended flowering period, which lasts from July to the end of August that allows bees to prepare food reserves for wintering.

In autumn, 13 more species of honey plants including *Prunella vulgaris* L., *Hieracium umbellatum* L., *Centaurea phrygia* L. provide the supporting honey gathering for bee families. Honey plants with an extended blossoming period occupy a primary place in the forest plant community. In total, these plants are represented by a very large group, including 58 plant species, and provide bees with nectar from May to October.

In coniferous forests, the honey composition of plants is poorer and it includes *Pinus* L., *Picea* A. Dietr., *Larix* Mill. The most valuable honey plants in these forests are *Sorbus aucuparia* L., *Prunus padus* L., *Frangula alnus* Mill., *Sambucus rasemosa* L., as well as the herbaceous cover including honey plants.

*Populus tremula* L., *Fraxinus* L., *Betula* L. blossom in coniferous forests at the end of April, and *Pinus* L., *Picea* A. Dietr., *Sorbus aucuparia* L., *Prunus padus* L., *Frangula alnus* Mill., *Sambucus rasemosa* L., *Caragana arborescens* Lam. blossom in the middle of May. Such honey plants as *Ericaceae* - *Vaccinium myrtillus* L., *V. vitis-idaea* L., *V. uliginosum* L., *Oxycoccus palustris* Pers. blossom for about 30 days from May to June. During this period, herbaceous plants of coniferous forests such as *Majanthemum bifolium* F.W. Schmidt-M., *Oxalis acetosella* L., *Pyrola rotundifolia* L., *Trientalis europae* L. also begin to blossom.

The analysis of the results of plant blossoming in the forest plant community showed that there is a sufficient number of honey plants in the forest to provide bee families with

nectar from spring to late autumn due to the natural flower-nectar conveyor.

So, *Corylus avellana*, *Salix caprea* blossom in April. *Betula pendula*, *Salix acutifolia*, *Populus tremula*, *Acer negundo*, *Sambucus rasemosa*, *Caragana arborescens*, *Rubus idaeus* blossom from April to May. From May to June *Malus silvestris*, *Malus domestica*, *Quercus robur*, *Acer tataricum*, *Tilia cordata*, *Lonicera xylostenum*, *Crataegus sanguinea*, *Rhamnus cathartica*, *Frangula alnus*, *Viburnum opulus*, *Ribes nigrum*, *Caragana arborescens*, *Sambucus rasemosa* bloom. Then from June to July *Tilia cordata*, *Rosa canutina*, *Rubus idaeus*, *Cytisus ruthenicus*, *Calluna vulgaris* do the same, and later from July to August *Calluna vulgaris* begin to blossom.

### 3.3 Honey resources of forest plant community

The forest and honeybees have developed a close relationship for centuries. Bees are inhabitants of the forest, and they are still found in it in the wild, playing an important role in its life. Pollinating the flowers of trees and shrubs, they, in turn, benefit from forest honey plants themselves gathering pollen and nectar from them.

Any intrusion into the life of the forest does not pass without a trace: it reacts very sharply to any violations and changes in the existing ecological complex. Many types of secondary forest use such as cattle grazing, haymaking, various types of mining, etc. often harm forestry. In this sense, beekeeping is a happy exception.

The bee is a forest insect by its nature. The outstanding biologist G.D. Kozhevnikov emphasized repeatedly that forests are a typical habitat of bees, and pointed out that forest bees should be especially protected.

Forest and forest plantations create their own microclimate that influences favorably the healthy growth of bee families. Forests keep moisture better than fields do and there is no the destructive influence of the wind in the forest. Due to all this the best conditions are created for the flight activity of bees during the honey gathering period.

Bee families in the forest develop their strength earlier. Forests have all conditions for the development of beekeeping. It is the place where exemplary breeding apiaries should be concentrated.

However, not enough attention is paid to the use of bees for pollination of flowers of forest trees and shrubs. Forest authorities do not propagandize among beekeepers the need for apiaries to migrate to the forest, and often even prevent their placement.

The use of forests as a fodder base for beekeeping is constrained by the poor knowledge of forest honey resources. Therefore, it is useful to include a beekeeping specialist in the forest management expeditions, whose task would be to survey the territory, analyze the location of apiaries and the ecological situation, draw up maps of honey reserves, study their distribution by area and periods of the season. There is also a need for the commonwealth of foresters and beekeepers in planning forestry, reforestation and forest protection works.

Forests are waiting for bees. The tons of nectar generously provided by our nature should not be allowed to disappear without a trace. The slogan "apiaries to the forest", put forward almost 100 years ago by the famous entomologist I. Shevyrev, should find support among foresters and beekeepers nowadays.

Forests with their vegetation cover have the area of 203,000 hectares (ha) in the region. 135,341 ha out of them belong to the Federal forests, 61,617 ha belong to agricultural formations and 6,042 ha are the forests of settlements, etc.

The predominant tree species are oak, birch, aspen, about 20% of timber reserves are coniferous species (pine, spruce). The relatively high honey productivity of deciduous forests is due to the admixture of linden and maple in the tree layer, as well as the rich development of the undergrowth.

The undergrowth shrub layer contains trees and shrubs, which are excellent honey plants as it is in the table 1.

**Table 1.** Scheme of forest types in the Orel region.

№/ №	Forest types	Undergrowth	Undergrowth shrub layer	Cover
1	2	3	4	5
Pine forests				
1	Lichen pine forest	Rare: pine	Very rare: broom	Lichen, cat's-foot ( <i>Antennaria</i> ), mouse-ear hawkweed ( <i>Hieracium pilosella</i> ), bluegrass
2	Lingonberry pine forest	Rare: pine	Rare: broom, rosehip, mountain ash	Lingonberry, green mosses, heather
3	Blueberry pine forest	Rare: pine	Rare: buckthorn, mountain ash	Blueberry, lingonberry, green mosses, cinquefoil, heather
4	Polytric pine forest	Rare: pine	Rare: buckthorn, grey willow, bird cherry, arrow-wood ( <i>Viburnum</i> )	Haircap ( <i>Polytrichum gen.</i> ), blueberry, potentilla, woodreed ( <i>Calamagrostis</i> ), blue cowwheat ( <i>Melampyrum nemorosum</i> )
5	Bog moss pine forest ( <i>Sphagnaceae</i> )	Rare: pine	Rare: willow	Sphagnum, sedge ( <i>Carex</i> ), cotton grass ( <i>Eriophorum</i> )
6	Broom ( <i>Cytisus</i> ) and grass ( <i>Gramineae</i> ) pine forest	Rare: pine	Medium density: Broom ( <i>Cytisus</i> ), mountain ash, juniper	Grass ( <i>Gramineae</i> ), mouse-ear hawkweed ( <i>Hieracium pilosella</i> )
7	Upland pine forest	Rare: pine	Medium density: spindle-wood ( <i>Euonymus gen.</i> ), buckthorn, mountain ash, juniper.	Green mosses, lichen, wintergreen ( <i>Pyrola</i> ), lingonberry, batfish ( <i>Myliobatis</i> ), wild strawberry, blueberry
8	Beadruby ( <i>Majanthemum</i> ) and blueberry pine forest	Medium density: pine, birch	Rare: mountain ash, buckthorn, spindle-wood ( <i>Euonymus gen.</i> ), bird cherry ( <i>Prunus padus</i> )	Blueberry, beadruby ( <i>Majanthemum</i> ), green mosses, batfish ( <i>Myliobatis</i> ), wintergreen ( <i>Pyrola</i> )
9	<i>Spiraea</i> pine forest (Swampy pine forest with grass cover)	Rare: pine, birch	Medium density: buckthorn, bird cherry ( <i>Prunus padus</i> ), currant, arrow-wood ( <i>Viburnum</i> ), grey willow and	Meadowsweet ( <i>Spiraea</i> ), nettle ( <i>Urtica gen.</i> ), avens ( <i>Geum</i> ), buckler fern ( <i>Dryopteris</i> ), bedstraw ( <i>Galium</i> ), comarum ( <i>Comarum</i> )

№/ №	Forest types	Undergrowth	Undergrowth shrub layer	Cover
1	2	3	4	5
			roundear willow ( <i>Salix aurita</i> )	
10	Oak and aise-weed ( <i>Aegopodiu m</i> ) pine forest	Medium density: pine, oak, linden, birch, aspen	Medium density: cobnut ( <i>Corylus avellana</i> ), mountain ash, Bearwood ( <i>Rhamnus gen.</i> ) spindle-wood ( <i>Euonymus gen.</i> ),	Aise-weed ( <i>Aegopodium</i> ), hazelwort ( <i>Asarum</i> ), gill-ale ( <i>Glechoma</i> ), starwort ( <i>Stellaria gen.</i> ), stone brambleberry ( <i>Rubus saxatilis</i> ), tufted vetch ( <i>Vicia cracca</i> )
Spruce forests				
11	Grass and oak spruce forest	Rare: pine, aspen, birch, linden, maple, pine	High density: cobnut ( <i>Corylus avellana</i> ), linden, mountain ash, honeysuckle ( <i>Lonicera</i> ), spindle-wood ( <i>Euonymus gen.</i> )	Lungwort ( <i>Pulmonaria gen.</i> ), aise-weed ( <i>Aegopodium</i> ), hazelwort ( <i>Asarum</i> ), starwort ( <i>Stellaria gen.</i> ), blueberry
12	Blueberry spruce forest	Medium density: spruce ( <i>Picea</i> ), birch, aspen, pine	Rare: Buckthorn, willow, mountain ash.	Blueberry, lingberry, beadruby ( <i>Majanthemum</i> ), starflower ( <i>Trientalis</i> ), haircap moss ( <i>Polytrichum commune</i> )
13	Spruce forest near the brook	Rare: spruce ( <i>Picea</i> ), birch	Rare: bearwood ( <i>Rhamnus gen.</i> ), willow	Meadowsweet ( <i>Spiraea</i> ), nettle ( <i>Urtica gen.</i> ), fern ( <i>Filicales</i> ), horsetail ( <i>Equisetum L.</i> ), aise-weed ( <i>Aegopodium</i> )
Oak forests				
14	Oak ravine forest	Not found	Single: Tartarian maple	Steppe vegetation with admixture of broad-leaved grasses of oak forests and coniferous forests
15	Grass oak forest	Rare: oak	Rare: Tartarian maple, mountain ash, cobnut ( <i>Corylus avellana</i> ),	Grasses
16	Aise-weed ( <i>Aegopodiu m</i> ) oak forest	Medium density: oak, aspen, birch, maple	High density: cobnut ( <i>Corylus avellana</i> ), spindle- wood ( <i>Euonymus gen.</i> ), honeysuckle ( <i>Lonicera</i> ), bearwood	Aise-weed ( <i>Aegopodium</i> ), starwort ( <i>Stellaria gen.</i> ), hazelwort ( <i>Asarum</i> ), and others typical for oak forests

№/ №	Forest types	Undergrowth	Undergrowth shrub layer	Cover
1	2	3	4	5
			( <i>Rhamnus gen.</i> )	
17	<i>Spiraea</i> oak forest	Rare: oak, elm, aspen	High density: arrow-wood ( <i>Viburnum</i> ), bird cherry tree ( <i>Padus</i> ), cobnut ( <i>Corylus avellana</i> ), Tartarian maple	Nettle ( <i>Urtica gen.</i> ), <i>Spiraea</i> , aise-weed ( <i>Aegopodium</i> ), avens ( <i>Geum</i> ), sedge grass ( <i>Carex</i> ), blackberry
18	Floodplain oak forest	Rare: oak, elm	Medium density: arrow-wood ( <i>Viburnum</i> ), bird cherry tree ( <i>Padus</i> ), willow, bearwood ( <i>Rhamnus gen.</i> )	Nettle ( <i>Urtica gen.</i> ), avens ( <i>Geum</i> ), sedge ( <i>Carex</i> ), fern ( <i>Filicales</i> ), <i>Spiraea</i> , blackberry
19	Alder forest	Rare: alder	Rare: grey willow, roundear willow ( <i>Salix aurita</i> ), bearwood ( <i>Rhamnus gen.</i> ), arrow-wood ( <i>Viburnum</i> )	Comarum ( <i>Comarum</i> ), <i>Spiraea</i> , fern ( <i>Filicales</i> ), bedstraw ( <i>Galium</i> ), snapweed ( <i>Impatiens</i> ), moneywort ( <i>Lysimachia nummularia</i> ), avens ( <i>Geum</i> ), nettle ( <i>Urtica gen.</i> ), blackberry

According to their national economic importance, forests perform various functions. The specially protected natural areas of the region include 40 thousand ha. They include the forests of the national park "Orlovskoye Polesie", natural monuments of landscape gardening, forest natural monuments, a complex reserve and the Shatilovsky forest.

The forest areas of the Orel Forestry Administration occupy 135, 3 thousand ha according to forest management data. 125, 0 thousand ha from them are covered with forest.

Basically, these are small plots (there are more than 1,400 pieces), located among fields and various agricultural land. Oak, aspen, Norway maple, birch, linden, alder and green ash are the main tree species in deciduous forests. The undergrowth shrub layer is represented by hazel, bird cherry, yellow acacia, raspberry, buckthorn, willow. Elderberry is found in abundance on rich soils. The ground cover is characterized by grasses, primroses, mosses, lichens, in some natural boundaries - blueberries, etc.

The forest land includes 200 ha of arable land and 1,389 ha of hayfields. Hayfields in its turn contain 1220 ha of dry land, 105 ha of swampy land, 64 ha of flooded land. Pastures include 15,580 ha of the temporary ones in the forest and 76 ha on pastures.

The presence of a certain part of agricultural land makes it possible for forestry enterprises to have subsidiary agriculture. One of the areas of greatest interest is

beekeeping. The largest number of families of bees is in the national park "Orlovskoye Polesie". It has, as researchers and practicing beekeepers say, the most favorable conditions for bees as they can gather nectar from honey plants growing both in the forest and in the steppe.

The process of honey gathering practically does not stop from spring to late autumn: immediately after the snow cover melts, bees begin to visit various types of shrub willows, hazel, euonymus. First honeydew, forest violets (*Violaceae sylvatica*), coltsfoot (*Tussilago*) begin to blossom, then yellow acacia, forest mountain ash, fruit trees, blueberries, lingonberries, wild strawberries, raspberries follow.

On the territory of the park, there are abundant thickets of raspberries and buckthorns. Later bees visit the marsh cinquefoil (*Comarum palustre*), celandine (*Chelidonium*), wood geranium (*Geranium sylvaticum*), meadow knapweed (*Centaurea jacea*) intensively.

Linden and rosebay (*Chamaenerium angustifolium*) blossom in the middle of summer. Then in autumn thistle (*Carduus*) and (*Cirsium*), lion's-tooth (*Leontodon autumnalis*), heather bloom. The abundance of natural food resources annually attracts a large number of amateur beekeepers to the park - not only from the Orel region, but also from neighboring regions.

According to A.M. Kovalev [4] the approximate size of the honey productivity of a hectare in the forest is 24 kg of honey. With 203,000 ha of forest in the region, we can assume that the total honey supply is 4,872,000 kg (4,872 tons), and the possible gathering of honey by bees (30%) is in the range of 1,626,000 kg or 1,626 tons.

Shrubs, making up the undergrowth, occupy large areas and during the flowering period play an essential role in providing honey bees and other pollinating insects with nectar and pollen. The honey value of shrubs is very diverse and averages 23 kg (with fluctuations from 4 to 68 kg) of sugar in the nectar of flowers from 1 ha of natural cover. This value depends on the participation of strong honey plants in its composition - willow, raspberry, bearwood (*Rhamnus gen.*), etc.

Grassland honey vegetation in shrubs has little effect on their nectar productivity.

The biological reserve of sugar in the nectar of flowers of shrubby honey vegetation is used by bees to 50% approximately.

## 4 Conclusion

The forest honey flora consists of 257 species and they belong to 47 families and 140 genera.

The honey flora of the forests of the Orel region according to systematic forms includes 24 species of trees, 32 species of shrubs and semi-shrubs, 9 species of annual grasses, 23 species of biennial grasses and 169 species of perennials.

The total supply of honey from 203 thousand ha of forest is 4,872 tons, and the possible honey gathering (30%) by bees in the forests of the region is about 1,626 tons. The rational use of honey reserves of forest plant community will increase the number of new bee families and keep the aboriginal middle-Russian nature. It also helps to arrange long-term honey gathering. In the future, this will solve the problem of providing the residents of the region with honey and other products.

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