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STUDY OF THE HONEY PRODUCTIVITY OF SOME TREE SPECIES

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Abstract

For the proper development of the bee families and the best and varied grazing, the beekeeper needs to know theavailableplantsbearing honey that bees will use as a source of food. And all the factors that affected the flowering period of individual honey plants and conditions ensuring best separation of nectar.To clarify the underlying factors, we started a series of studies.Thepurpose of our study was to establish the phenology of flowering, nectar-productivity, sucrose productivity and honey productivity of tree species in urban conditions. This determines the nectariferous potentialof the species of the family Fabaceae and genus Tilia. Briefly flowering period these species emit a significant amount of nectar with high sugar content.

Key words*: honey qualities, tree honey species, honey productivity, blossoming phenology.*

INTRODUCTION

The life of bees is closely related to the bearing-honey plants as a source of food. From these plants, bees receive essential nutrients-nectar and pollen (Bizhev, 2003). Family *Fabaceae* includes over 19,400 species in about 730 genera, which is the third largest family among the angiosperms. In Bulgaria there are present 291 species, 49 of which are tree plants. Black locust is one of the most honey- bearing wood in our country and for many regions it appears to be the firstmajor grazing. In the lower and richest soils regions of Bulgaria, especially in northern Bulgaria along the Danube and Dobrudja, it produces much more nectar in comparison to those in the semi-mountainous and mountainous regions. Acacia's grazing it is very unreliable because it blooms during a period of the most variable weather, with frequent winds and rainfalls and bees very rarely use it fully (Bizhev, 2003).

Blossoms are white and emit very strong and pleasant aroma, which attract the bees. *Styphnolobium japonicum* (*Sophora japonica*) produces a lot of nectar and bees visit it intensely, including the fallen blossoms on the ground. Honey locust is very valuable honey bearing tree species. It flowers immediately after the acacia and provides the preparation of very aromatic honey. The Lindens (*Tilia*) is a genus of trees which includes about 40 species. In Bulgaria are mainly distributed three species of linden- large-leaf, small-leaf and silver-leaf. These three species in our country are appreciated as the most honey-bearing plants, releasing nectar in large quantities (Bizhev, 2003).

They are not flowering at the same time and that is how they provide longer period of honey collecting. The phenology of flowering of honey bearing plants is directly dependent on the climatic conditions of the geographical area (Fukusima-Hein et al., 1986; Moreti, 1992).

Bee hives and bee families can also successfully survive in urban conditions. This type of beekeeping has gained great popularity over the last few years. Growing conditions are more appropriate for these purposes, the temperatures in the cities are higher, and there is a variety of vegetation in the parks and the green areas. In these city areas the pesticides are not use and genetically modified organisms (GMO) are not grown.

The dirty air and exhaust gases from the cars are not obstacles, as the bees have the unique ability to filter and purify the nectar they collect (Ilieva, 2017).

MATERIALS AND METHODS

The Sofia valley is located between the mountainous parts of Stara Planina mountain in the northeast and the mountains Lyulin,

Vitosha and Lozenska in the southwest. It is the largest of all off-Balkan valleys in Bulgaria at altitude 560 m.

The study was carried out in 2017. For the purpose of the experiment are used single trees in the parks in the central city part of Sofia.

In order to establish the period and the duration of the flowering, are performed phenological observations in the area. The quantities of the collected nectar, its sugar content and honey productivity of the plants are determined by the method of Simidchiev (1980).

We determined the quantities of nectar by the capillary method and the sugar concentration of the nectar by the refractometer.

We determined the honey productivity by multiplying the total quantity by a coefficient 1.25 (Radoev and Ilieva, 1955), as the water content in the honey is 20%.

For the purpose of the experiment we chose branches of different heights and from different locations of the crown for study. We isolated the flowering branches with tulle for 24 hours. Depending on the flowering period, we studied the blossoms of each tree.

RESULTS AND DISCUSSIONS

Phenological observations of honey-bearing plants have been done by following: the flowering period by months (Table 1).

Table 1. Flowering period of tree species of family Fabaceae and genus Tilia

Latin name	March	April	May	June	July	August	September
Robinia pseudoacacia	-	-	⬢	-	-	-	-
Laburnum anagyroides	-	-	⬢	-	-	-	-
Cercis siliquastrum	⬢	⬢	-	-	-	-	-
Gleditschia triacanthos	-	-	⬢	⬢	-	-	-
Amorpha fruticosa	-	-	-	⬢	⬢	⬢	-
Albizzia julibrissin	-	-	-	⬢	⬢	⬢	⬢
Tiliagrandifolia	-	-	-	⬢	-	-	-
Tiliaparvifolia	-	-	-	⬢	-	-	-
Tiliaargentea	-	-	-	⬢	⬢	-	-
Sophora japonica	-	-	-	-	⬢	⬢	-

The results of Table 1 show that the *Albizzia julibrissin* has the longest period of flowering from June to September. It is pleasure for the bees to visit it for collecting nectar and pollen. The shortest period of flowering we observed in *Robinia pseudoacacia*, *Laburnum anagyroides*, *Tilia grandifolia* and *Tilia parvifolia* for an average of about 10 days.

The short flowering period of these species is due to species and climatic conditions during the period. Their flowering is very intensive in spring and stimulates the development of bee families.

False indigo-bush (*Amorpha fruticosa*) blooms late in May-early in June. It has long flowering period 20-25 days. It has a high capacity of honey, and if there are more plantings, it can strengthen the main bee grazing.

In our country common species of Linden bloom a little after the blossomed of *Acacia* and *Honey locust,* which coincides with the beginning of the summer. Earliest starts to flower *Tilia parvifolia*. After that*Tilia grandifolia* starts to flower *Tilia argentea* which is the most common in Bulgaria flowers at the latest.

Honey locust (*Gleditsia triacanhos*) is very good honey-bearing plant. Starts its flowering after the blossomed of Black locust. If there are these two species, the major grazing is extended by about two weeks.

Blossoms of the Honey locust produce less quantity of nectar than the blossoms of the Black locus (Table 2), but, if there are greater number of plants, her honey productivity is also high.

Table 2. Honey productivityof honey-bearing tree species

Latin name	Flowering duration (days)	Quantitynectar of 1 blossom in period of mass flowering (mg)	Sugar content (%)
Robinia pseudoacacia	10	3.5	43.2
Laburnum anagyroides	7	0.5	35.3
Cercis siliquastrum	13	0.95	41.5
Gleditschia triacanthos	15	0.42	37.8
Amorfa fruticosa	23	0.97	43.2
Albizzia julibrissin	34	0.16	32.6

During the flowering of the Honey locust we have established better weather conditions than those in the flowering of the Acacia. Under these conditions the major gazing from Honey locust is more permanent and more sure.
Flowering of *Styphnolobium japonicum* (*Sophora japonica*) we noted in July-August when the other flowering honey-bearing vegetation is too scarce. For that reason the *Styphnolobium japonicum* is very suitable for planting near the apiary to improve bee grazing
The flowering period of trees in the region of Sofia averages between 7 and 34 days for different species. It is significantly affected by climatic factors such as temperature and rainfall.
On the Table 2 is shown the amount of nectar of one blossom and sugar content in the nectar. The trees of the Fabaceae family have a high sugar content of 32.6 % for the Persian silk tree and up to 43.2 % for the Acacia.
In addition to nectar, bees also collect pollen from the flowers.
All tree species from the Fabaceae family, in table. 2 are good honey-bearing plants. They can provide the necessary quantities of nectar and pollen for bee colonies grown in large cities.
All three types of Linden are widespread in the area of the study. They are excellent hony-bearing plants and are well attended by bees for nectar and pollen throughout the day (Table 3).

Table 3. Honey productivity of genus *Tilia*

Latin name	Quantity nectar of 1 blossom in period of mass flowering	Sugar content (%)	Honey productivity (kg/dka)
Tilia grandifolia	9.5	48	15.2
Tilia parvifolia	3.9	50.3	14.5
Tilia argentea	4.7	28	4.8

The flowers are small, tender, gathered in the inflorescence of the midnight, stained in pale yellow. In one inflorescence there are from 5 to 7, with some limes being able to reach up to 15 colors. Depending on the type, it can be with or without hairs.

Of the three types of Linden, which are the subject of the study, the highest sugar content was recorded at *Tilia parvifolia*– 50.3%.
At Tilia argentea were recorded the lowest level of sugar content – 28% and relatively low honey productivity – 4.8 kg/dka.
The highest amount of nectar was recorded in *Tilia grandifolia* 9.5 mg, and the lowest for *Tilia parvifolia* 3.9 mg, but the sugar content is at the highest percent of 50.3. The median productivity is the lowest in *Tilia argentea* 4.8 kg/dka and approximately the same in the other two species (14.5p-15 kg/dka).
With the highest honey productivity – 15.2 kg/dka was *Tilia grandifolia*, and the reported sugar content (48%) is approximately as in the *Tilia parvifolia*.

CONCLUSIONS

The studied tree species successively bloom and create conditions for long and varied bee grazing. Bees are transferred fromone to theotherspeciesaccording to their flowering.
For the different species are reported the difference between the quantities of nectar and the sugar content of the flowers is due to the species specificity. The largest contribution as a source of nectar has the Black locust and the three species of Linden, which are very good pastures for bees and obtaining high yields of commodity honey for a honey.
With the made evaluation of honey-bearing tree species the possibility of developing apiculture in urban conditions has been explored.

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