THE TECHNOLOGY OF PASTORAL BEEKEEPING

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Abstract

The purpose of the research was to study honey bee colony dynamics, the areas of nectar and pollen producing crops and the improvement of the technology of pastoral beekeeping. The melliferous plants in Moldova can keep four and a half times the number of bee colonies that are registered nowadays. To increase the productivity and the production of qualitative honey, pastoral beekeeping based on various melliferous sources and in different ecological areas, and the correct performance of processes of care and exploitation of bee colonies are recommended.

Key words: bee colony, nectar and pollen producing crop, technology, pastoral beekeeping

INTRODUCTION

Apiculture plays an important role in Moldova's agriculture due to the fact that bees provide the population with products such as honey, wax, pollen, maiden wax, propolis and royal jelly. They also produce queens, swarms etc, and, thanks to the significant content of biologically active substances with therapeutic qualities, all these products are successfully used as raw material in apitherapy, pharmaceutical and cosmetic industry. At the same time, honey bees participate in the pollination of crops, which significantly increases the quantity and quality of seeds and fruits [7].

In many regions of the Republic of Moldova the potential of nectar and pollen producing crops of spontaneous flora is not used, and in some regions with intensive farming there is a critical shortage in pollinating bees.

The pastoral beekeeping is a way of full utilization of nectar and pollen producing sources located beyond the productive radius of honey bees' flght (2-3 km), in order to increase the bee-keeping prodution (honey, wax, pollen and propolis) and to enhance the pollination of entomophilous crops in different areas, which will increase the quantity and quality of fruit and seeds. The utilization of intensive apiculture can not be achieved without pastoral beekeeping.

One of the main ways to achieve higher honey production, is to gather honey from hives more times per apicultural season. In order to have more harvests per season, it is necessary to transport the hives to different distances from the location of the hives, where other species of pollen producing plants grow. It is also necessary that the pastoral beekeeping is widely employed in pollination of entomophilous crops such as fruit trees, bushes, rape, sunflower, sainfoin, buckwheat, medicinal hubs etc. The value of the total harvesting, as a result of plant pollination by bees, is from ten to fifteen times the value of the obtained apicultural products [8].

Honey harvesting is characterized by a blossom period of nectar and pollen producing plants. The quantity of the harvest depends on the number of honey crops, the composition of species, the blossom period, the location of the hives and other natural and anthropogenic factors [14].

The development of bee colonies in spring and their keeping at a high biological and productive level requires the existence of places full of melliferous plants which would be able to ensure the nectar and pollen gathering throughout the active season, as well as the rational feeding of the bees during the periods without natural harvesting [1, 11].

The rational utilization of honey bees consists in the use of pastoral beekeeping,

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The manuscript was received: 30.08.2016
Accepted for publication: 15.09.2016

which ensures the reproduction of biological resources that increase the productivity of the bee colonies and crops due to cross-pollination carried out by bees. Thus, the pastoral beekeeping will make possible the utilization of nectar and pollen producing resources in environmental regions, which, in its turn, will influence the quantity and quality of bee products.

Generalizing the aforesaid, the purpose of this research was to study the honey bee colony dynamics, of the nectar and pollen producing crop areas, and the development of the technology of pastoral beekeeping.

MATERIAL AND METHOD

The research subjects were the dynamics of bee colonies, the areas of nectar and pollen producing crops such as fruit trees, agricultural crops, medicinal plants, forest plants and wild flora, their biological potential and the reserve of honey, the beginning and end of plant blossom, the choice of places for the hives, the transportation and location of the hives and the norm of hives per hectare.

To analyze the dynamics of bee population and the productivity of bee colonies, the data of the National Bureau of Statistics of Moldova were used.

To systematize the regions of nectar and pollen producing cultures, the data from the Ministry of Agriculture and Food Industry of Moldova and of the Institute of Forestry Research and Arrangement were used.

The obtained data were processed using the statistical variation method [12, 13] and the computer program Microsoft Excel.

RESULTS AND DISCUSSIONS

In order to employ pastoral beekeeping, it is necessary to know the number of bee colonies and their location, which must be moved to gather and pollinate entomophilous crops.

During the years under study (2008/2015) a slight increase in the number of bee colonies was noticed, their number ranging from 98303 in 2008 to 124330 pieces in 2015, i.e. by 1.26 times higher than in 2008.

The growth in number of bee colonies led to the increase of honey production, namely from 2403 tons in 2008 to 3896 tons in 2015, or by 62.13%. The production of honey produced on average by a bee colony was 24.4 kg in 2008 and 33.6 kg in 2014, i.e. by 37.7% higher [9].

The honey flora in Moldova is represented by a wide variety of species that bloom from March to October; it provides maintenance and production gatherings which are distributed unevenly during the beekeeping season.

The most important fruit trees of interest to beekeeping are sweet cherry trees, sour cherry trees, apple trees, plum trees and apricot trees.

Of all the studied fruit trees the largest area is occupied by apple trees – 31653 hectares which constitutes 71.15%, sour cherry trees occupies the smallest area – 648 hectares or 1.54% (Table 1). Analyzing the location of orchards by regions, it can be mentioned that apple trees occupy the largest areas and are located in the North – 21283.8 ha or 67.24% of the total area of this species, while the Central area is occupied by plum trees – 4594.2 ha (47.63%), cherry trees – 678.4 ha (45.03 %), apricot trees – 472 ha (47.29 %) and sour cherry trees – 306 ha (44.74 %).

Table 1 Fruit trees areas in Moldova (on average in 2010-2014), ha

Fruit trees	Average for 5 years	Regions		
		North	Central	South
Apple trees	31653	21283.8	7097.4	3271.8
Apricot trees	998	238.4	472	287.6
Plum trees	9645.6	2465.2	4594.2	2586.2
Sweet cherry trees	1506.4	610.8	678.4	217.2
Sour cherry trees	684	236.4	306	141.6
Total	**44487.0**	**24834.6**	**13148.0**	**6504.4**

The largest areas of cultivated lands in Moldova are occupied by sunflower crop – 223492.8 ha or 88.63% of the total areas, followed by rape – 28450.6 ha (11.26%) and buckwheat – 265 ha (0.1%) (Table 2).

In the north the sunflower crop occupies an area of 95492.8 hectares or 42.65% of the total area of this crop; in the south – 76810.2 ha (34.30%), and in the central region – 51607.6 ha (23.05%). The rape crop is grown in the south on an area of 15446.8 hectares or 54.29% of the total area of this crop, in the north – on 8163.8 ha (28.69%), and in the central zone – on 4840 ha (17.02%). In the north, the buckwheat is grown on an area of 194.6 hectares, which constitute 73.43%, in the central region – on 50.4 ha (19.02%) and in the south – on 20 ha (7.55%).

Table 2 Areas of agricultural crops in Moldova (on average in 2010-2014), ha

Agricultural crops	Average for five years	Regions		
		North	Central	South
Sunflower	223910.6	95492.8	51607.6	76810.2
Rape	28450.6	8163.8	4840	15446.8
Buckwheat	265	194.6	50.4	20
Total	**252626.2**	**103851.2**	**56498.0**	**92277.0**

Apiculture is interested in medicinal herbs because they help the bee colonies to maintain their activity and to be well prepared for wintering. On average, the area of medicinal herbs has varied in the past five years, namely between 561.6 ha (31.58%) of lavender and 1217.2 ha (68.42%) of meadow sage. In the Republic of Moldova the biggest areas of meadow sage – 481.8 ha or 39.58% of the total area of this crop – can be found in the central part of the country, in the north, it grows on 358.2 ha (29.43%), and in the south – on 377.2 hectares (30.99%).

In the central region of Moldova, the area of lavender constitutes 475.8 ha or 84.72% of the total area occupied by this culture, in the north – 55.2 ha (9.83%), and in the south – 30.6 ha (5.45%).

In forests, the most important nectar and pollen producing sources of interest for apiculture are acacia, white lime, maple, willow, chestnut and others. Lime is a constituent part of deciduous woods of plains and hills, where it grows together with other species.

The most important number of lime trees is located in the central zone of the country, namely 4190.1 ha or 91.48%; in the north lime trees grows on 288.2 thousand ha (6.29%), in the south – on 76.2 thousand ha (1.66%), and in the municipality of Chisinau – on 25.8 thousand ha (0.57%).

One of the most important honey plants is white acacia, which in our republic occupies over 98630.2 thousand hectares, of which 40576,6 ha (41.14%) are located in the central region, 36492.6 ha (37.0%) – in the south, 19920.7 ha (20.20%) – in the north, and 1640.3 ha (1.66%) – in the municipality of Chisinau (Table 3).

Table 3 The area of nectar and pollen producing plants in forests, the year 2014, thousand ha

Region	Lime	White acacia	Chestnut	Willow	Maple
Municipality of Chisinau	25.8	1640.3	0.1	8.5	75.2
North	288.2	19920.7	16.1	598.6	1822.6
Central	4190.1	40576.6	2.7	1132.1	1458.6
South	76.2	36492.6	1.3	1448.8	1001.9
Total	**4580.3**	**98630.2**	**20.2**	**3188.0**	**4358.3**

Maple cultivated area is 3188.0 thousand hectares on the South region with variation of 1001.9 up to 1822.6 thousand hectares, in the North region, respectively willow - 3188.0 thousand hectares (598.6 -1448.8 ha). Chestnut is cultivated on an area of 20.2 ha (1.3 to 16.1 thousand ha).

As a result of the analysis of the melliferous crops, it was found that the biological potential of the nectar and pollen plants in Moldova was 106561787 kg, of which only 66601116 kg belongs to the honey reserve. In order to utilize the reserves of honey and the pastoral beekeeping, 555009 bee colonies are necessary [10].

The melliferous plants base of the Republic of Moldova can provide maintenance for four and a half times more bee colonies than are registered nowadays.

In order to use pastoral beekeeping, it is very important to know the sources that produce nectar and pollen (date and duration of blossom).

Rape blossoms after the blossom of fruit trees, and white accacia blossoms in the second half of May– the first half of June. In June, the summer gathering starts which are dominated by lime and sunflower.

The preparation of bee colonies for wintering has a primary influence on a valuable pastoral beekeeping.

For the bees to be as strong as possible in spring, and in order to obtain a higher number of brood, a series of measures must be taken in summer and autumn. Thus, a normal wintering, a reduced consumption of food in winter, and a reduced wear of bees in winter are provided.

For these results achieving all a stimulating feeding is carried out, which should be made in small doses throughout the period of brood growth of, respectively from the last sunflower gathering until the building up of the reserves of feed for wintering, which are made in high doses of two to five kilos.

Providing prolific breeding queen bees is of major importance, especially at the beginning of autumn. In autumn, as well as in spring, queen bees do not lay eggs in the new honeycombs which retain heat harder. Too old combs or those with many cells of drones are removed from the nest and reformed.

The spring stimulative feeding is performed regardless of the amount of honey reserves existing in the colony, if there are no natural maintenance collection, aimed at strengthening the queens' egg-laying.

In cases when in the bee colonies the amount of feed reserve is insufficient, the bees must be fed additionally. The breeding of bee colonies, which includes the feeding of bees with 50% sugar syrup, supplemented with a nutritional additive is well known [4]. The result of the proposed method consists in enhancing bees' immunity, the reduction of mortality, the increase of the power of a bee colony during spring, and the advancing of the queens' prolificacy and honey production.

It was also found that the use of a nutritional additive in stimulative feeding of bees, from spring till the early main collection from white acacia, increase the honey production deposited in the nest. The bee colonies in the experimental groups had a higher quantity of honey, namely by 3.0 to 10.1 kg, which was by 3.9 to 31.2% compared to the control groups [6].

Another method that has been developed is to select a nutritional additive that contains probiotics which can normalize metabolism, increase immunity, reduce mortality, boost resistance against Nosema, make the prophylaxis and therapy of the digestive tract, help to recover the intestinal microflora and normalize metabolic processes, increase the power of bee colonies during spring and the bees' productivity and safety. The utilization of the proposed method ensures, in spring, an increase in power by 5.56 to 8.29%, the number of the closed brood increases by 28.26-31.41%, and the productivity of bee colonies – by 5.87 to 12.47% higher than in the control groups [5].

Additional space for brood in horizontal hives is necessary when all the combs in the nest are occupied by the brood, save two marginal honeycombs. The widening of the nest is done by introducing a new honeycomb, which must be placed between the last honeycomb containing the brood and the marginal one, with feed reserve. If the wreathed gets considerably worm, and there is a natural maintenance collection, the widening of the nest can be done using two combs, which must be placed on both sides of the nest, between the last frame containing the brood and the marginal frame.

In *multi-storeyed* hives, when the colonies have wintered in one body, the second body will be added, after six or seven combs of brood have grown, and all the nine spaces between the existing honeycombs in the body are occupied by bees. The new body will placed at the base, and the initial body will be placed above. It is recommended that the frames of the additional body contain small quantities of honey or be sprinkled with sugar syrup. After two or three days, when bees have inhabited the newly introduced body, the bodies will be reversed; the body with brood will be placed at the bottom of the hives, and the other – above it.

When there are powerful colonies that have wintered in two bodies, the bodies will be reversed immediately when in the upper body there are six or seven combs with brood.

After 1015 days the reversals of the bodies will be repeated, and during the pollen collection, another body will be added.

The development and productivity of bee colonies largely depend on the melliferous plants and nectar secretion which are influenced by many factors which can be classified as follows: factors related to plants, soil and climatic conditions (temperature, humidity, etc.). The weather elements, together with other environmental factors, permanently influence the evolution of nectar collection, and, consequently, the honey production [2].

Before the beginning of the honey season, the elaboration of a melliferous balance and map of the future location is recommended. The nectar gathering is planned according to these data.

Three or four days before the transportation, an inspection of bee colonies is carried out, and the honey combs that contain a quantity of honey higher than 1.5-2.0 kg, are removed unsealed from the hives, and replaced with empty honeycombs or with honeycombs that contain a lower reserve of honey, and the hives are packet.

If the horizontal hives do not contain all the twenty frames, the existing frames will be set close with the help of the diaphragm, with two nails. Before the departure, after the cessation of the flight of bees, the bee entrances are closed. In *multistoried* hives, all the components are fixed and the ventilation of the hives is ensured.

The site for the apiary should be well protected from winds, especially from the cold ones that prevail in the region. The territory must be dry, not closed to underground waters. When the bee garden is located in woods in which white acacia, lime etc. grow, the site should be in a clearing in the centre or the edge of the woods. In southern and northern plains, the site should be in an orchard, forest belts, protection strips of trees and other places where the hives will be protected from the wind and sun.

The relief plays an important role in the choice of a site for the apiary. High places open from all sides, hill ridges, deep valleys are not recommended, because these places are cold, windy and very wet [3].

The apiary site should be as close as possible to the gathering source. The distance from other apiaries, their veterinary state, the distance from water sources, the state of the land and roads are also taken into consideration. The apiary location should be far away from polluting sources, in a quiet place, and far from high traffic roads (highways) and large rivers.

The beehives are usually placed in the apiary in a *checkerboard* pattern, with the entrance for bees oriented toward southeast, at a distance of 2-3 m in a row, and 4-5 m between the rows. In small spaces, the hives can be arranged in rows by one, two or four, at a distance of 0.5 m between them for the work with every hive to be comfortable. Each hive must be placed on a stand or four poles (stakes), stuck into the ground.

The drinker is arranged in a place well protected from sun and wind, before installing the hives, for the bees to know its place from their first flight, and not to seek other sources of water.

The transportation of the bee colonies to the melliferous sources is made when 4-5% of flowers blossom, usually overnight in summer; in spring and autumn, if the weather is cool, the hives can be transported in the daytime too.

Different means of transportation can be used: trailers, bee pavilions, trucks, railroad cars, etc. The next day, each bee colony is verified, any abnormal states are recorded, and the honey nests are prepared.

Before the returning from the site, the same preparatory operations for the transportation are carried out.

CONCLUSIONS

1. The melliferous base of the Republic of Moldova can provide the maintenance of four and a half times more bee colonies than registered nowadays.

2. To increase the bees' productivity and the quality of honey, pastoral beekeeping based on various honey sources and employed in different ecological zones, the correct performance of activities of care and exploitation of bee colonies, and the exclusion of contamination of honey throughout the trophic chain (water-soil - plant-bee-honey-nectar) are recommended

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