

BEE COLONIES EXPLOITATION AT APPLE BLOSSOM POLLINATION IN THE ORCHARDS

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Abstract

It was done an experiment in order to test comparative the three methods (ways) of hives placement on the ground at the apple pollination, in 3 analogous intensive orchards, with four sorts, that are compatible to the pollination, of 10 hectares each, which were located at a distance of 600 m from each other. In all sectors of the orchard, bee colonies have been assigned with the charge of 3 families/ha. In the first sector (I Batch - control) of orchard, hives with bee colonies were located at the edge of the orchard (sector) in the front side of rows. In the second sector (II batch), the hives were located on the technologic road which separated in the centre the sector of orchard, perpendicular to fruit trees rows. The distance between hives was 10 m from each other. In the third sector of the orchard (III batch), the hives were located between the trees rows, in line, at a distance of 100 m from each other and over every 7th row of trees. In each experimental batch were rated the free entomophily pollination results (crossed) and isolated (auto pollination). It was found that, in the 1st batch, frequency of bees visit at tree blossom, has been weaker in the first days of hives placement, but was pretty good in batches II and III, even from first day. With the increase of air temperature, in all batches was registered a growth tendency of bees visits frequency at blossom. The results of the experiment, have shown that free pollination (cross) entomophily (with predominant participation in proportion of 90 - 95% of honey bees) of apple trees in the orchard ensures the flowers fertilization, depending of beehives location on the field, at the level of 22.2 - 47.5%, that is 13.8-22.6 times higher, compared with the isolated pollination - auto pollination (1.5 - 1.6%). Therefore, it has been confirmed, once again, the conclusion of many researchers, that, the participation of honey bees at pollination of apple's culture is an indisputable necessary measure. Uniform and proportional placement of bee hives inside the orchard, between the rows, in line, at a distance of 100 m from each other, and over every 7th row of trees, ensures a significant increase, compared to the control batch (located at the orchards edge), of bees visit frequency to the flowers is 2.4 times more ($td = 20.0$; $P < 0.001$), of the bees flight intensity (with and without balls) with 24.5 - 53.3% ($td = 3.5 - 4.8$; $P < 0.001$), of collected pollen quantity - with 46.2% ($td = 2.8$; $P < 0.01$), of flowers fertilizing degree - with 2.1 times ($td = 14.4$; $P < 0.001$) and, compared to traditional methods of hives placement (on the technological roads of the orchard), ensured the growth of bees visits frequency on blossom - with 74.4% ($td = 12.9$; $P < 0.001$), of collected pollen quantity from apple - with 17.5 % ($td = 2.4$; $P < 0.05$), and of fertilization degree of flowers - with 36.9% ($td = 7.0$; $P < 0.001$).

Keywords: exploitation, honey bees, pollination, apple, placement, bee hives

INTRODUCTION

According to some scientific analysis (Vancea, 2013) in modern global agriculture, in recent years, because of using chemical pesticides and insecticides for wrestling against weeds and pests, there has been a drastic reduction in the number of species and populations of pollinating insects, what did the entomophily pollination in orchards of fruit trees, to be carried out, almost exclusively, by the honeybees, the only insects that you can count on, and that can be controlled by pollination requirements, through various training methods and permutation of bee families to pastoral. Multiple researches in this area (Guladze,

1973; Ivaşcu, 2010; Cîrnu and Cociu, 1973; Curennoi, 1973; Gerster, 2013; Landridge, 1973; Petcov, 1973) demonstrates that the process of pollination on fruit trees is accomplished in proportions of 90% by honeybees. By their number, and power of their exceptional work, through their ability to explore the inflorescences of entomophily plants, on a fairly large area, through ability and their tendency to profit of all the flowers in the area close to the hive, honey bees are the most active pollinating insects. By transporting the pollen from the male floral organ-anther, to receptive surface of female floral organ - stigma, honeybees ensures the cross pollination of fruit trees that leads to the fertilization of

flowers (linking of fruits). Among the species of fruit trees, apple is one of the most popular and valuable sources of nectar and pollen (Coman, 2012). At the same time, tree pollination using bees presents much higher benefits to cultivators than for beekeepers. The researchers from the Institute of Beekeeping Research and Development from Bucharest have reached the conclusion that, by cross pollination, performed by honey bees, are obtained production increase, in the ratio of over 50%. In the meantime, beekeepers get advantages, offered by this fruit species as melliferous source, taking into account, the huge number of flowers on a reduced area and the trees tranche blossoming during several weeks. Other research in this area (Roy, 1973; Sharp, 1973) demonstrated that the cross pollination of apple flowers of different varieties provides a significant increase of harvest by at least 50-60%. For these reasons, raising the effectiveness of fruit tree pollination, using honey bees, has become a permanent and current problem for both - cultivators of fruit trees, as well as for beekeepers. Professional tree cultivators, in many countries realized the importance of entomophily pollination of agricultural crops (Gerster, 2013; Astorre, 1973; Girling, 2014; Vancea, 2013). For example, in Australia, the value of pollination services of agricultural crops constitutes, annually 0.6-1.2 billion US dollars. For every invested dollar in renting of bee colonies for pollination, the benefit of agricultural growers is 185 \$. In the United States of America commercial services offered for pollination of agricultural crops were estimated to a number of approximately 14.6 billion dollars per year. The efficiency of pollination, using bees, has been fully realized by the cultivators, particularly at apple and almond, that's why they pay enough the services for bee pollination, rendered by the beekeepers. For example, in the State of California (USA) almond growers are paying up to \$ 100 for each colony of bees brought to pollination. At the same time, payment terms depend on completed harvest. In this context, beekeepers are interested in achieving a more effective pollination with a lower number of bee families, thus covering larger areas of orchards and obtaining good harvests.

Unfortunately, apple growers in our country (Republic of Moldova), not all realized the need for orchards pollination, with the help of the bees, and payment for the services of pollination is ridiculous (130 lei MD/ha or 40-45 lei MD (3.3-3.5 \$) per bee family. In addition, the traditional pollination technique of apple orchards, as well as the proposed one in official editions (Мантоптин, 1990) is not the most efficient, and therefore the need for trees pollination by honey bees is not convincing enough for all orchards cultivators.

In this context, in the present work, we propose a comparative testing of some location techniques of hives with bee families on the field, and the development of some effective proposals for pollination of apple orchards with the help of the bees.

MATERIALS AND METHODS

The work was carried out under the institutional application project: code- 11. 817. 08. 17A "Development of advanced growing technology and diversified exploitation of *Apis mellifera carpatica* bee families". An experiment was carried out in order to test various exploiting techniques of the bee families, at the apple culture pollination in intensive orchards. To do this, during the April 18-23, 2013, was organized the transport of 90 bee families of SRL "Casa Albinei", com. Hulboaca, mun. Chisinau, to the blossomed apple pollination, from orchards of SRL "Codru-ST", Straseni. Within the orchard sectors, there were planted alternated, rows of trees, of four varieties that are compatible to the pollination: Golden, Aidaret, Florena, and Simerenco. The distance between rows was 3.5 m. The distance between the trees in the row was 1.2 m. In this experiment, were tested comparatively, three techniques (ways) of hives location, on the field, at the apple pollination, in 3 similar orchard sectors, 10 ha each, which were over 600 m away from each other. In all orchard sectors, the bee families were distributed, calculated, each 3 families per 1 ha. The first orchard sector (Ist batch), has served as control, where the hives with bee families were located according to the old schema (method) - at the edge of the orchard (sector) in front of the rows. In the second orchard sector (IInd batch), the hives with bee families were

located according to the traditional technology, on a technological road, that separated, in the middle, the orchard sector, perpendicularly to the fruit trees rows. The distance between hives, located along the way, was 10 m from each other. The hearth of the hives placement, on the technological road, was toward the hearth of bee hives, located at the edge of the orchard, at a distance of over 600 m, according to the recommendations of the Institute of Zoology of the ASM (Мантоптин et al., 1990). In the third orchard sector (IIIrd batch), the hives with bee families, were placed in series, between the rows, at a distance of 100 m from each other. Each following number of hives was placed over each 7th row of fruit trees. The third sector of orchard is located at a distance of approximately 600 m from the IInd sector hearth.

In all sectors of the orchards, the beehives with bee families were located at the beginning of the trees full swing flowering period and kept for 6 days, after that being removed.

To speed up the process of bees getting used to the scent of flowers and increasing the flying intensity, in all sectors of hives location, they were fed, daily, throughout all the period, with sugar syrup, mixed with flowers infusion, freshly collected from those trees, in amount of 50 g flowers to 1 litre of syrup. The mixture was administered 50 ml to each frame interval with bee.

In each experimental sector (batch) have been studied:

- the frequency intensity of the bee at 9 representative trees of each experimental orchard batch, where was registered, while 5

minutes, the bees number, visiting the flowers of the tree branch sector with 1000 flowers;

- the quantity and types of pollen, collected by a bee family, during one day of experiment, registering the data of pollen collector, at 30 bee families from each experimental batch of the orchard;

- the flight intensity of the bee family was assessed by the bees number (with, or without pollen balls) arrived to the beehive while 10 minutes;

- the share of entomophily pollination of the trees inflorescence, in the total pollination, for which, in every experimental batch of orchard, was isolated a crown of a the representative tree with an impenetrable net (gauze) for insects;

- the degree of flowers fertilization (fruits binding)-through appreciation, after 18-20 days after flowering, of pollination results and recording the number of fertile and sterile flowers at 1000 inflorescences.

Data obtained, in all experiences, were processed statistically using computer software „STATISTICA - 6” and appreciated their certainty, according to the biometric variation statistics, by the methods of Плохинский Н. А. 1969 (Petcov, 1973).

RESULTS AND DISCUSSIONS

Analysis of the data, obtained in the experiment of apple trees pollination in orchards, demonstrates that, honeybees *Apis mellifera* are attending the flowers quite intensive, starting even in first days of placing the beehives on the orchard's lands (Table 1).

Table 1. The frequency of bees visits at apple tree flowers, on a compact sector of branches with 1000 flowers, bees/5 minutes

No of the day	Air temperature, t°C	I st batch (N=9)	II nd batch (N = 9)				III rd batch (N = 9)		
		M ± m	M ± m	d	td	M ± m	d	td	
1	17°	10.4 ± 1.0	18.3 ± 2.2	+7.9**	3.2	35.4 ± 1.6	+25.0***	13.2	
2	18°	14.3 ± 0.9	18.0 ± 0.8	+3.7**	3.1	33.2 ± 1.8	+18.9***	9.4	
3	19°	15.2 ± 1.1	18.2 ± 1.9	+3.0	1.4	31.6 ± 1.6	+16.4***	8.4	
4	17°	13.0 ± 1.3	18.1 ± 1.2	+5.1*	2.8	29.3 ± 1.6	+16.3***	7.9	
5	19°	16.1 ± 0.8	22.7 ± 1.6	+6.6**	3.6	35.7 ± 1.8	+19.6***	9.9	
6	15°	10.9 ± 1.0	15.2 ± 1.6	+4.3*	2.3	26.9 ± 1.5	+16.0***	8.8	
Average	17.5°	13.3 ± 0.5	18.4 ± 0.7	+5.1***	5.9	32.1 ± 0.8	+18.8***	20.0	

Notice: * $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$

We have found that, the bees frequency intensity to the flowers, depends on the day of the pollination period, air temperature, as well

of the way or technique of the hives placement, at the orchard pollination.

Thus, the bees frequency visiting of the tree flowers, by the first batch is weaker in first

days of bees location on the field, increasing with 46.1% at 3rd day, then dropping with 28.3% in the last (6th) day of pollination. Experimental batches II and III, in which the bee families were located closer to trees from respective orchard sector, the bees frequency visiting of the trees flowers, was high enough, even on the first day of placement of the beehives with bees.

With the increase of air temperature in all experimental batches, has been registered a concomitant rising tendency, in the frequency of bees visit to the apple flowers.

Thus, with increasing of air temperature from 15 – to 19°C, the frequency of bees visits to flowers increases, in Ist batch, from 10.4 to 16.1 bees/5 minutes; or 54.8% ($P < 0.001$) in IInd batch - from 15,2 to 22.7 bees/5 minutes or 49.3% ($P < 0.001$) and in IIIrd batch from 26,9 to 35.7 bees/5 minutes, or 32.7% ($P < 0.001$).

This rise tendency of the flowers bees visits frequency, depending on the air temperature, can be reflected more clearly in the chart from Figure 1.

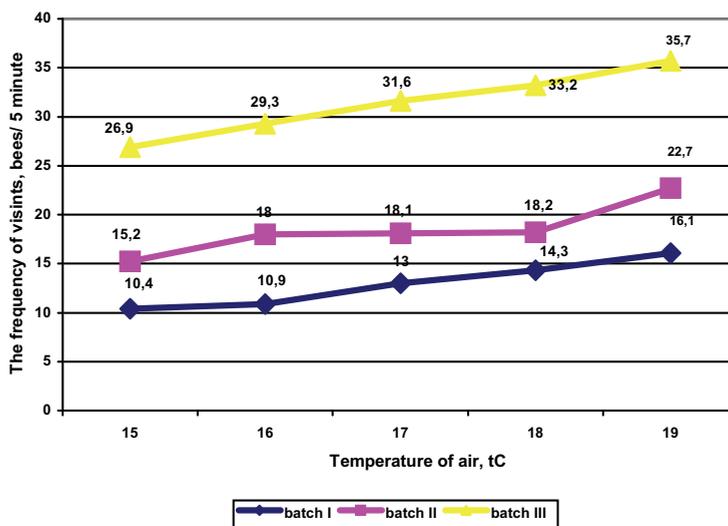


Figure 1. Bees frequency of visiting apple flowers

The results obtained by us, on the bees frequency of visiting apple flowers, are in accordance with the data of Langridge (1973), who mentioned, that, there is clearly a connection between environmental temperature and flight activity of the bees. If would be made a chart, we would notice that, under 13°C – the flying activity is weak, between 13^o and 16^oC – the curve rises suddenly, and between 16^o and 26^oC - maintains at a high level.

At the same time, the greatest influence on the frequency of visits bees to flowers, in our experiment, is the technique (way) to place hives with bee families on the land of fruit trees orchards.

The data in Table 1 shows that, the traditional way of bee hives placement on the edge of the orchard (Ist batch) is overcome, because the bees frequency to the fruit trees from orchard is

the lowest. The placement of the bee families on the technological roads (IInd batch) of orchard (according to the recommendations of the Institute of Zoology of the ASM, 1990), the frequency of bee visits to apple flowers is growing, on average, from 13.3 ± 0.5 up to 18.4 ± 0.7 bees/5 minutes, or with 38.3 % ($td = 5.9$; $P < 0.001$).

The highest frequency of bee visits to tree flowers was recorded in IIIrd experimental batch, in which bee families were placed uniformly between tree rows, at a distance of 100 m of each other, and over every 7 rows. This technique (way) of bee hives placement for pollination, ensure a substantial increase of the bees visit frequency to the apple flowers, compared to the witness batch, with 18.8 bees/5 minutes, or 141.3% (2.41 times; $td = 20.0$; $P < 0.001$) and, compared to IInd batch -

with 13.7 bees/ 5 minutes, or 74.4% (td = 13.5; P < 0.001).

Based on the analysis of the data obtained in the experiment, we can conclude that, the more uniform and proportional the placement of bee hives between the tree rows is, as higher is the bees visit frequency to the flowers. This is due to the fact that the bees are finding at a smaller distance the source of picking, making less

effort in search of food and making more flights in a period of time.

Increasing of the bees visits frequency to the flowers, contributes to the quality improvement of the apple culture pollination. It can be found in the analysis of the pollen amount, collected by the bees and their intensity of flight (Table 2).

Table 2. The collected pollen amount and the bees flight intensity during full swing flowering of the apple culture in intensive orchards

The Indicators	I st batch (N=30)	II nd batch (N = 30)			III rd batch (N = 30)		
	M ± m	M ± m	d	td	M ± m	d	td
The pollen amount totally collected, g/day	173 ± 16	233 ± 11	+60**	3,1	253 ± 23	+80**	2,8
including: apple	131 ± 20	212 ± 14	+81**	3,3	249 ± 6	+118***	5,6
The share of apple pollen in total amount, %	75.7 ± 8.0	91.0 ± 5.3	+15.3	1.6	98.4 ± 2.3	+22.7	2.7
The flying intensity, bees/10 minutes:	x	x	x	x	x	x	x
Without pollen balls	118 ± 3	137 ± 13	+19	1.4	148 ± 8	+30***	3.5
with pollen balls	75 ± 2	101 ± 15	+26	1.7	115 ± 8	+40***	4.8
The share of bees with balls towards total, %	65.6 ± 8.8	73.7 ± 8.1	+8.1	0.7	77.7 ± 7.7	+12.1	1.0

Notice: * P < 0.05; ** P < 0.01; *** P < 0.001

It was found that, during one day the bees bring to collector 173-253 g of pollen. Most of the pollen collected by bees (75.7 – 98.4%) is of apple. At the same time, bee families from the Ist batch, which were placed on the edge of the orchard, have collected a noticeable amount (131 g, or 24.3%) of polyfloral pollen.

The experimental data have shown that the bee hives location of hives at apple pollination, influences all the characters related to the quantity and quality of the pollen collected by the bees, and to the intensity of their flight.

Thus, the smallest amount of pollen, gained from a bee family, on average per day, being at pollination of apple culture, was recorded in Ist batch, where bee hives were located at one side (edge) of the orchard. With a more uniform and proportional placement of bee hives inside the orchard, the pollen amount collected per day from a bee family grows from 173 ± 16 g/day in Ist batch, up to 233 ± 11 g/day in IInd batch, with 60 g/day, or 34.7% (td = 3.1; P < 0.01) .

The biggest pollen amount, gathered by bees in the nest was found in the IIIrd batch, where the hives with bee families were placed in series between the tree rows. Thus, the amount of the

accumulated daily pollen, in the nest at apple pollination, at bee families from IIIrd batch exceeded compared to their fellows from Ist batch (control) - with 80 g, or 46.2% (td = 2.8; P < 0.01), and had overcome tendencies toward bee families from IInd batch.

It is important to note that bees from IInd and IIIrd batches ensured the total increase of pollen quantity, collected from the amount of basic culture pollen (apple) submitted to a controlled pollination with the help of the bees.

Thus, the share of apple pollen in the total quantity of collected pollen, bee families from IInd batch had a visible increase tendency, compared to the witness batch, with 15.3 percentage points, or 20.2% (td = 1.6; P = 0.01), and bee families from IIIrd batch exceeded significantly their fellows from the witness batch with 22.4 percentage points, or 30.0% (td = 2.7; P < 0.01). This explains the higher quality pollination in IInd and IIIrd batches, of the basic culture (apple) taken in experiment.

The research results have shown that the bees pollination volume of the apple culture, and its quality is determined also by the intensity of

the bees flight, as of the bees without pollen balls, which bring nectar, as well as of those with balls, which specifically visited the flowers in order to collect pollen.

The data obtained in the experiments demonstrates the fact that, while pollinating the apple in orchards, the IInd batch bee families had a higher intensity flight tendency compared to the control batch, and IIIrd batch bee families, had a higher intensity of flying, compared to those from the witness batch. At the same time, in all experimental groups, the bees flight intensity without pollen balls was higher compared to that of bees with balls.

At the apple pollination, flight intensity of bees without balls in IIIrd batch was higher comparing to the witness batch -30 bees/10 minutes, or 25.4% (td = 3.5; P < 0.001) and, flight intensity of bees with balls of the IIIrd batch was higher compared to the control batch, with 40 bees/10 minutes, or 53.3% (td = 4.8; P < 0.001).

At the same time, it has also been found that IInd and IIIrd batches, in which the hives with bee families were located more uniformly, on the land of pollinated culture, manifested a tendency of share increase of bees with pollen balls, from total number of bees who flew to picking. This shows that the techniques of placement the hives with bee families tested in batches II and III contributes to improve the quantity and quality of pollination and collecting a bigger quantity of trading pollen.

Appreciating, at the end, the result of apple trees pollination with the help of bees and pollination efficiency depending on the technique of hives placement on the land of pollinated culture, we identified the size of the impact of entomophily pollination and its dependency on how are located the hives on the ground (Table 3).

Thus, comparing the number of fertile and sterile flowers, as a result of pollination, as in case of isolated pollination (on branches covered with impenetrable mesh for insect), as well as in case of entomophily free pollination (with access of honeybees and other insects), we found that the fertilization degree of the

flowers is determined predominantly by the insect activity and influenced by the system of bee hives placement in orchard.

The isolated pollination (auto pollination), in all sectors and experimental groups, at a research of a sector of a tree with 1000 flowers, were found just 13-18 fertile flowers, the rest being sterile flowers. This means that the flower fertilization degree (GF) at isolated pollination was very low, and accounted for only $1.3 \pm 0.3 - 1.8 \pm 0.4$ %. In the variant of free entomophily pollination (cross), on a surface of 1000 flowers have been registered, according to the batch and sector, from 210 up to 510 fertile flowers, the fertilization degree representing $21.0 \pm 1.3 - 51.0 \pm 1.6$ %. Therefore, the impact of entomophily pollination consists in an increase, compared to the isolated pollination, with 16.1-30.0 times of the fertilization degree of apple trees flowers.

The lowest degree of flowers fertilization at entomophilypollination, was recorded in Ist batch, where the hives with bee families were located at the edge of the orchard, according to the traditional plan. With the more uniform and proportional location of bee hives on the field of pollinated culture, the flowers fertilization degree increases substantially.

Thus, the flowers fertilization degree in IInd batch, in all researched sectors, was higher compared to the witness batch, on average with 12.5 percentage points, or 56.3% (td = 10.9; P < 0.001).

The highest degree of flowers fertilization at entomophily pollination was found in the IIIrd batch, where the hives with bee families were located, according to the plan elaborated by us – placement in series uniformly, between rows, at a distance of 100 m from each other and over each 7 rows of the orchard sectors. Thus, the fertilization degree of flowers in this group was higher, so compared to the control group – 25.3 percentage points, or 114.0 % (td = 9; P < 0.001) and compared with group II - with 12.8 percentage points, or 36.9% (td = 7.9; P < 0.001).

Table 3. Results of apple flowers pollination, calculated per 1000 inflorescences (12.05.2013)

No. of sector	Indicators	I st batch			II nd batch			III rd batch		
		Pollination type		Free % Isolated	Pollination type		Free % Isolated	Pollination type		Free % Isolated
		isolated	free		Isolated	Free		Isolated	Free	
1	The number of fertile flowers	18	230	1278	15	380	2533	17	510	3000
	The number of sterile flowers	982	770	78.4	985	620	62.9	983	490	49.8
	The degree of fertilization (GF), M + m, %	1.8±0.4	23.0±1.3	1278	1.5±0.4	38.0±1.5	2533	1.7±0.4	51.0±1.6	3000
	The difference (d) GF toward witness	-	-	-	-0.3	+15.0***	-	-0.1	28***	-
	Certainty degree of the difference(td)	-	-	-	0.5	7.5	-	0.2	13.6	-
2	The number of fertile flowers	17	225	1323	15	350	2333	14	485	3464
	The number of sterile flowers	983	775	78.8	985	650	66.0	986	515	52.2
	The degree of fertilization (GF), M + m, %	1.7±0.4	22.5±1.3	1323	1.5±0.4	35.0±1.5	2333	1.4±0.4	48.5±1.6	3464
	The difference (d) GF toward witness	-	-	-	-0.2	+12.5***	-	-0.30	+26***	-
	Certainty degree of the difference(td)	-	-	-	0.3	6.3	-	0.5	12.6	-
3	The number of fertile flowers	13	210	1615	16	310	1937	17	430	2529
	The number of sterile flowers	987	790	80.0	984	690	70.0	983	570	56.0
	The degree of fertilization (GF), M + m, %	1.3±0.4	21.0±1.3	1615	1.6±0.4	31.0±1.5	1937	1.7±0.4	43.0±1.6	2529
	The difference (d) GF toward witness	-	-	-	+0.3	+10.0***	-	-0.4	+22	-
	Certainty degree of the difference(td)	-	-	-	0.5	5.0	-	0.7	10.7	-
To-tal apple	The number of fertile flowers	48	665	1385	46	1040	2261	48	1425	2969
	The number of sterile flowers	2952	2335	79.1	2954	1960	66.3	2952	1575	53.3
	The degree of fertilization (GF), M + m, %	1.6±0.2	22.2±0.7	1385	1.5±0.2	34.7±0.9	2261	1.6±0.2	47.5±1.6	2969
	The difference (d) GF toward witness	-	-	-	-0.1	+12.5***	-	0.0	+25.3***	-
	Certainty degree of the difference(td)	-	-	-	0.4	10.9	-	0.0	14.4	-

Notice: * P < 0.05; ** P < 0.01; *** P < 0.001;

Generalizing in the end the results of testing various techniques of placement the hives at apple pollination in the orchards, we can conclude in full accordance with communications of researchers Cârnu and Cociu, 1971; Roy, 1970, who have mentioned that dispersed placement of bee hives inside the orchard ensures not only a complete and uniform pollination, but also a larger production, due to the fact that bees moving on small distances do not wear out, realizing higher efficiency.

CONCLUSIONS

1. The free (cross) entomophily (with major participation in approximately 90-95% of honeybees) pollination at apple trees in the orchards ensures the flowers fertilization, depending on the beehives location on the ground, at a level of 22.2 – 47.5%, that is 13.8-22.6 times higher, compared to the isolated pollination-auto pollination (1.5-1.6%). Therefore, the participation of honeybees at pollination of apple's culture is an indisputable necessary measure.

2. The uniform and proportional placement of hives with bee families inside the orchard between the rows, in series, at a distance of 100 m from each other, and across each 7th tree row, ensures a significant increase, compared to the control group (located on the edge of the orchard), of frequency of visit of bees to flowers – 2.4 times (td = 20.0; P <0.001), of the intensity of bees flight (with and without pollen balls) with 24.5-53.3% (td = 3.5-4.8; P < 0.001), of quantity of collected pollen with 46.2% (td = 2.8; P <0.01), of flowers fertilizing degree - with 2.1 times (td = 14.4; P < 0.001) and compared to traditional methods of locating the hives (on technological roads of orchard), ensures the increase of frequency of flowers visiting by the bees- with 74.4 % (td = 12.9; P < 0.001), of apple collected pollen quantity - with 17.5% (td = 1.5; P < 0.05) and of the flowers fertilization degree - with 36.9% (td = 7.0; P < 0.001).

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