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EPIZOOTOLOGICAL STATE OF SALMONELLA-INFECTED HONEYBEE COLONIES IN THE SOUTHERN REGION OF AZERBAIJAN

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ЭПИЗООТОЛОГИЧЕСКОЕ СОСТОЯНИЕ ПЧЕЛИНЫХ СЕМЕЙ, ЗАРАЖЕННЫХ САЛЬМОНЕЛЛАМИ В ЮЖНОМ РЕГИОНЕ АЗЕРБАЙДЖАНА

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Abstract. In 2020–2021, the number of apiaries and honeybee colonies in villages located in 3 regions of the Masalli district (lowland, foothill and mountainous territories) and the degree of their infection with salmonellae were determined. Salmonellosis is one of the characteristic diseases of honeybee colonies, widespread throughout the Masalli district. Infection of honeybee colonies with salmonellae led to a slowdown in the activity of colony, a decrease in productivity, and even the death of the honeybee colony. As a result of the conducted studies, the epizootological state and the degree of salmonella infection were detected in the lowland (24.1%), foothill (38.0%) and mountainous (45.8%) areas.

Аннотация. В 2020–2021 гг. определено количество пасек и пчелиных семей в селах, расположенных в 3-х зонах Масаллинского района (равнинной, среднегорной и горной), и степень их зараженности сальмонеллезом. Сальмонеллез — одно из характерных заболеваний пчелиных семей, распространенное во всех пасеках Масаллинского района. Заражение пчелиных семей сальмонеллами привело к задержке семейной активности, снижению продуктивности и даже потере пчелиных семей. В результате исследований была изучена эпизоотологическая ситуация по сальмонелле. Выявлена степень зараженности на равнинах (24,1%), среднегорьях (38,0%), и в горной местности (45,8%).

Keywords: salmonellosis, honeybee, honey, productivity, infection, disease, causative agent.

Ключевые слова: сальмонеллез, пчелы, мед, продуктивность, заражение, заболевания, возбудитель.

Introduction

Depending on the natural and climatic conditions and geographical location of apiaries in different regions of the Masalli district, the development of salmonellae in honeybee families proceeds in various forms. The time of onset, duration and degree of infection with salmonella largely depend both on the condition of honeybee colonies and on the geographical conditions, where the apiary is located. For this reason, one of the important issues is to determine the epizootological situation by factors and clinical signs that determine the dynamics of the spread of salmonellas in (lowland, foothill and mountainous) territories.

Prior to our research, the epizootological state of salmonella in Azerbaijan and other countries

and measures to combat it were studied by a number of researchers [1–7].

Material and Research Methods

In 2020–2021, the number of apiaries and honeybee colonies in villages located in 3 regions of the Masalli district (lowland, foothill and mountainous areas) and the rate of their infection with salmonellae were determined. The studies were carried out on pathological materials collected from beekeeping farms (a total of 586 bee colonies). During microscopic studies, the rate of infection with salmonellas was established. In order to study the cultural and biological features of honeybee salmonellae, inoculations were performed using generally accepted bacteriological methods and various nutrient media (MPB, MPA, Bismuth-sulfite agar, etc.).

Inoculations were stored in a thermostat at a temperature of +37 °C for 2–5 days. Smears for microscopic studies were prepared from the cultures that sprouted [8, 9].

Results and discussion

6819 honeybee colonies were placed in 417 apiaries located on the lowland territory, and in the foothill area, 2856 honeybee colonies were placed in 115 apiaries, 1343 honeybee colonies were placed in 54 apiaries in the mountainous territory. 71.2% of the apiaries existing in the district and 61.9% of honeybee colonies are located mainly in the lowland region. This indicates that beekeeping is best developed mainly in lowland areas, that is, in places with a more dense population. As a result of the observations, it was found out that only up to 30–35% of the apiaries existing in the Masalli district are relocated once or twice per season. Due to non-compliance with existing recommendations for the relocation of apiaries at least 4–5 times, depending on the plants flowering period owing to the season, the development of honeybee colonies weakens, and as a result, mainly weak honeybee colonies are placed for wintering. Table 1 shows that in various regions of the Masalli district in the winter months of 2021, there were 11018 honeybee colonies in 586 apiaries.

Table 1

EPIZOOTOLOGICAL SITUATION OF INFECTION OF HONEYBEE COLONIES WITH SALMONELLA IN VARIOUS REGIONS OF MASALLI DISTRICT (January 2021)

<i>Lowland</i>				
No.	Name of territory	Number of apiaries (in pieces)	Number of honeybee colonies (family)	Infection rate (in %)
1	Bedelan	8	201	30.1
2	Kyzilavar	14	270	26.2
3	Banbusi	7	101	20.3
4	Kohne Alvady	6	103	18.3
5	Teze alvady	15	261	22.4
6	Tekle	20	357	27.2
7	Chakhirly	22	377	26.5
8	Sherefe	24	371	23.1
9	Shamidkhan	11	127	27.3
10	Hasanly	24	290	25.1
11	Khirmandaly	26	462	26.3
12	Gazgalyg	28	396	27.3
13	Kyzilaghaj	11	158	28.4
14	Vilesh	14	231	26.3

<i>Lowland</i>				
No.	Name of territory	Number of apiaries (in pieces)	Number of honeybee colonies (family)	Infection rate (in %)
15	Onjegahala	11	173	25.7
16	Yeddiyomak	37	521	22.5
17	Shikhlar	13	177	24.3
18	Terekent	15	181	28.3
19	Sharjuvar	47	1366	22.1
20	Khil	16	158	24.3
21	Chogechol	18	247	25.9
22	Musakuche	24	239	26.3
23	Lyuzan	6	52	28.8
	<i>Total</i>	<i>417</i>	<i>6819</i>	<i>24.1</i>
<i>Foothill</i>				
1	Masalli	25	412	41.3
2	Mahmudvar	17	425	41.6
3	Turkoba	3	22	38.7
4	Tukle	7	193	36.3
5	Hishkedere	6	146	34.3
6	Miyanki	4	389	32.5
7	Godman	8	150	38.6
8	Azkivan	38	999	40.2
9	Tiyakent	7	120	38.3
	<i>Total</i>	<i>115</i>	<i>2856</i>	<i>38.0</i>
<i>Mountainous</i>				
1	Boradighah	9	191	43.2
2	Kolotan	3	23	40.3
3	Sigdah	7	355	51.6
4	Gariblarr	16	389	43.2
5	Gullutepe	19	385	47.2
	<i>Total</i>	<i>54</i>	<i>1343</i>	<i>45.8</i>

On the basis of studies conducted, it was found that, due to the fact that weak bee colonies were placed for wintering. 24.1% of bee colonies located on a lowland territory 38.0% — in foothill territories and 45.8% — in mountainous territories, were infected with salmonellae, respectively. It also affects the development and future productivity of honeybee colonies. In the autumn of 2020 and in the spring of 2021, the epizootological conditions of honeybee colonies have been determined. For this purpose, 3 experimental groups were formed, consisting of 15 similar honeybee colonies from each lowland, foothill and mountainous territories.

In the experimental group, out of 15 honeybee colonies, 1/3 consisted of weak honeybee families, 1/3 — of medium-strength honeybee families and 1/3 — of strong honeybee families. The experimental group took samples of honeybees from bee colonies (50 honeybees in each family) 2 weeks after leaving the wintering, and after the adult honeybees went on cleansing flights. On the samples taken, the infection rate of honeybees was determined. In experimental groups, the rate of infection of honeybees with salmonella was determined after the release of honeybee colonies from wintering. The results of the experiment are provided in Table 2.

From the Table 2, it is seen that in weak honeybee colonies settled in lowland, foothill and

mountainous regions, the rate of infection of honeybees with the salmonella was 26.0%, 31.3% and 38.2%, respectively. In apiaries consisting of weak families located on a lowland territory, the rate of infection of honeybees with the salmonella in honeybee colonies was 30.0% and 58.5% lower, in comparison with the honeybees from the foothill and mountainous territories, respectively. These indicators were 18.2% and 46.1% lower in the foothill and mountainous regions, respectively, compared with weak honeybee colonies settled in the foothill region.

Table 2

THEIR STRENGTH AND RATE OF INFECTION WITH SALMONELLA OF HONEYBEE COLONIES
 WHEN PLACING THEM FOR WINTERING AND AFTER WINTERING
 IN VARIOUS REGIONS OF THE MASALLI DISTRICT

<i>O/N</i>	<i>Regions where experiments were conducted</i>	<i>Experimental groups</i>	<i>The strength of honeybee colonies when placed for the wintering (October 1, 2020), kg</i>	<i>The strength of honeybee colonies after leaving the wintering (March 1, 2020), kg</i>	<i>Infection rate bees with salmonella, %</i>
I	lowland	weak	1.19±0.12	0.75±0.06	33.5
		medium	1.60±0.18	1.21±0.12	27.1
		strong	2.19±0.20	1.45±0.17	17.5
		on the average	1.66±0.17	1.13±0.12	26.0
II	foothill	weak	1.31±0.15	0.85±0.09	41.2
		medium	1.81±0.19	1.23±0.16	32.4
		strong	2.28±0.24	1.71±0.19	20.4
		on the average	1.80±0.19	1.26±0.15	31.3
III	mountainous	weak	1.37±0.14	0.70±0.09	53.1
		medium	1.72±0.17	1.15±0.14	39.6
		strong	2.15±0.21	1.20±0.21	27.1
		on the average	1.75±0.18	1.05±0.15	38.2

From this, it can be seen that regardless of which region they are placed in, honeybees in weak families are infected with the salmonellae (33.5%, 41.2% and 53.1%), 30.0% and 58.5% more often than honeybees from families with medium strength (27.1%, 32.4%, 39.6%) and honeybees from strong families (17.5%, 20.4% and 22.1%). On the territory of the Masalli district, regardless of the region where bees from strong honeybee families are located, infection with the salmonella is 16.5% and 26.3% less, compared with honeybee families with weak and medium strength. In conditions when, during the wintering period on a lowland area, the weather is sometimes warm when bees going on for cleansing flight, the rate of infection with salmonella, on the contrary, was 20.4% and 46.0% less than honeybees from foothill and mountainous regions.

As a result of the study conducted, it was found that on the territory of the Masalli district, depending on the territory of the settling of honeybee colonies and the strength of the honeybee family, infection rate of bees with the salmonellae varies. Due to the fact that strong honeybee colonies during the wintering period and in early spring are less infected with the salmonella, they endure wintering qualitatively and develop rapidly in early spring and collect more honey. During the wintering period, bees from weak honeybee colonies, due to the fact that they are more infected with salmonella, do not endure wintering well and due to the weakening, their development slows down in early spring, and productivity drops by about 2 times. In all apiaries selected for the purposes of the study, the number of honeybee colonies infected with salmonellae, the rate of

infection of families with salmonella, the number of honeybee colonies that died as a result of the disease in the spring period of development (in 2021) after wintering were determined. For calculation the economic damage caused by salmonella to honeybee families, the amount of honey filtered by the district and honey received from each honeybee family was determined. The results of the experiment are provided in Table 3.

Table 3

THE STATE OF SALMONELLA SPREAD IN APIARIES LOCATED
 IN THE MASALLI DISTRICT AND HONEY YIELD (JANUARY 2021)

<i>Indicators</i>		<i>Settling area of honeybee colonies</i>				
		<i>lowland</i>	<i>foothill</i>	<i>mountainous</i>	<i>total</i>	
1	Number of apiaries	family	417	115	54	586
2	Number of honeybee families in apiary	family	6819	2856	1343	11018
3	Number of honeybee colonies infected with Salmonella	family	2825	1085	606	4516
		%	24.1	38.0	45.1	40.9
4	Number of healthy honeybee colonies		3994	1771	737	6502
5	Infection rate of bees with salmonella in honeybee colonies	%	26.0	31.3	38.2	31.8
6	Total amount of commercial honey	ton	63.4	37.4	16.3	117.1
7	Amount of honey filtered from one honeybee colony	kg	9.3	13.1	12.2	10.6

From Table 3, it can be seen that in 2021, 40.9% of honeybee colonies located in the Masalli district, that is, 4516 honeybee colonies, were massively infected with salmonella in the early spring period. According to approximate estimates, 63.4 tons of commercial honeys were filtered from 6819 honeybee colonies located on the lowland territory, and these indicators in the foothill and mountainous areas were 37.4 tons and 16.3 tons, respectively.

Thus, in the lowland area, the amount of filtered honey from one honeybee family was 9.3 kg, in the foothill — 13.1 kg, and in the mountainous — 12.2 kg. According to the district, about 10.6 kg of commercial honey was filtered from each honeybee colony. The reason for the low productivity of honeybee colonies is associated with the weak strength of honeybee colonies, their small relocation in order to meet the need for nectar juice, lack of proper care and keeping conditions.

Considering that, compared with weak honeybee colonies, bees from strong honeybee colonies are infected 95% less often, it is advisable to place in apiaries mainly strong honeybee colonies for wintering.

When organizing the wintering of honeybee colonies in the foothill area, bees in the honeybee colonies wouldn't fly on warm winter days, consume less feed and suffer less bee losses. For ensuring the normal spring development of honeybee colonies, it is advisable to relocate them to the foothill areas of the district in the second decade of February. At this time, honeybee colonies, making an early flight, can get the opportunity to collect flower pollen and nectar juice for their own development.

If beekeepers in the Masalli district follow the results of the study and the current instructions on beekeeping, they will be able to produce 20 kg of commercial honey from each honeybee family during the year, that is, more than 2 times.

Conclusions

1. The rate of infection of bees with salmonella in weak honeybee families settled in lowland, foothill and mountainous areas was 33.5%, 41.2% and 53.1%, respectively.

2. Regardless of which region they are placed in, honeybees in weak families were infected with salmonella for (33.5%, 41.2% and 53.1%) 30.0% and 58.5% more often than honeybees from families with medium strength (27.1%, 32.4%, 39.6%) and honeybees from strong families (17.5%, 20.4% and 22.1%).

3. Only up to 30–35% of the apiaries existing in the Masalli district are relocated once or twice per season. Due to non-compliance with existing recommendations for the relocation of apiaries at least 4–5 times, depending on the plants flowering period owing to the season, the development of honeybee colonies weakens, and as a result, mainly weak honeybee colonies are placed for wintering.

4. As a result of the study conducted, it was determined that on the territory of the Masalli district, depending on the territory of the settling of honeybee colonies and the strength of the honeybee family, the degree of infection of bees with salmonella varies [10].

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