

Epizootology of Some Infectious and Invasive Diseases of Bees in the Republic of Tatarstan of the Russian Federation

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Abstract: Beekeeping is very important in order to obtain a high-value food product which is honey and as a means to increase the yield and develop seed production of many crops. Adults of the bee family and the brood at all stages of its development can be exposed to various diseases that cause great damage to the apiaries. Sick bee families demonstrate premature death of a significant number of adult bees and reduced number of grown brood. Soon after the disease bee families become weak and may die, if not to take urgent measures to improve their health. Successful development of beekeeping in the Republic of Tatarstan is constrained by the presence and negative impact of infectious and invasive bee diseases. The subject of study in this study, is the analysis of epizootology of varroosis, nosematosis and ascospherosis of bees in the Republic of Tatarstan. The research determines the degree of bee affection with infectious and invasive diseases in 43 districts during 3 years, measures of their prevention, treatment and elimination.

Key words: Infectious, invasive diseases, bees, epizootology, successful development, treatment and elimination

INTRODUCTION

Sustainable development of agriculture and improvement of food supply to the population is associated with solving the problem of increasing the efficiency of agricultural production of the country, region and enterprise. Its constituent part is the development of the beekeeping industry which is of independent importance in terms of identifying the reserves to increase the volume of production of its outputs and substantiating the ways of more rational use of bees in various fields of human activity (Khristoforovich *et al.*, 2016; Kabanova *et al.*, 2016; Smolentsev *et al.*, 2018).

Beekeeping is a separate industry that forms a qualitatively homogeneous group of economic units is characterized by appropriate conditions of production in the system of social division of labour and performs certain functions in the process of reproduction (Semenov *et al.*, 2018). Main products of beekeeping include honey, wax, propolis, pollen, royal jelly, bee venom, new bee families and others. Their value is high

due to the products obtained. Bees are also used in the pollination of honey plants of open and protected ground (Egorov *et al.*, 2018).

The transition of the agricultural sector to market relations had a negative impact on the economic situation of beekeeping and on the formation of the domestic market of its products (Matveeva *et al.*, 2015; Dmitriyevich *et al.*, 2016). It was accompanied by a reduction in the number of bee families, a decrease in labour productivity an increase in production costs and as a consequence, a decrease in the production of most types of products in the industry (Popov *et al.*, 2018; Tsaregorodtseva *et al.*, 2019). Beekeeping as one of the relatively small industries of agriculture has a number of features that must be taken into account when determining the efficiency of production. The impact of natural, economic, social, environmental and some other conditions has its own specific character. As a result of economic activity, beekeeping does not absorb but multiplies natural resources. Bee pollination of cultivated and wild-growing honey plants is an indispensable

condition for its full development and reproduction. Raising and keeping bees as well as honey products has a healing and therapeutic effect on the human body (Valiullin *et al.*, 2017).

The present research carries out the epizootological analysis of the incidence of certain infectious and invasive diseases among bees in the Republic of Tatarstan including the Sabinsky District and studies therapeutic and preventive measures.

MATERIALS AND METHODS

The researchers carried out statistical observation and data analysis of veterinary and zootechnical bookkeeping and accounting in the state budgetary institution "Department of Beekeeping in the Republic of Tatarstan", the Republican Veterinary Laboratory of the Republic of Tatarstan, the Sabinsky District State Veterinary Association, beekeeping farms of the Sabinsky District of the Republic of Tatarstan during 2013-2015. When studying epizootology, diagnostics, prevention and elimination of infectious and invasive diseases of bees, the apiary veterinary service organizations were bound by the law of the Russian Federation dated May 14, 1993 "On Veterinary Medicine", amended and revised and the law of the Republic of Tatarstan dated July 13, 1993 "On Veterinary Affairs in the Republic of Tatarstan", amended and revised.

The study used methods of statistical analysis including data collection, grouping as well as monographic, epizootological, clinical and laboratory methods.

RESULTS AND DISCUSSION

During 2002-2015 the Republic of Tatarstan experienced intensive development of beekeeping: the number of bee families increased by 78.3% (reached 250 thou.) the weight collection of honey in 2015 amounted to 11.75 thou. tons and marketable honey 6.5, 000, 000 tons. Studies of veterinary laboratories in 2013-2015 recorded varroosis, nosematosis and ascospherosis. The results of the statistical analysis of the incidence of the listed invasive and infectious diseases among bees are presented in Table 1.

In 35-37 districts (81.4-86%) varroosis was not registered or a weak degree of affection was observed during 3 years. There was success as for varroosis in the Agryz, Aktanysh, Atninsky, Verkhny Uslon, Kamskoe Ustye, Rybnaya Sloboda, Spassky, Cheremshan Districts

in 2013 in the Alekseevskoe, Alkeevsky, Muslyumovo, Nizhnekamsk, Yutazinsky Districts in 2014 additionally, in the Kukmor, Menzelinsk and Sarmanovo Districts in 2015. A high degree of bees affection with varroosis (within 41-100% of the investigated samples) was observed in the Tetyushi, Buinsk, Mendeleevsk, Menzelinsk, Bugulma districts.

In 34 districts (79%) there were no cases of nosematosis or registered occasional positive results. The Aktanysh, Alekseevskoe, Alkeevsky, Apastovo, Arsk, Atninsky, Baltasi, Verkhny Uslon, Drozhzhano, Zainsk, Kaybitsy, Muslyumovo, Nizhnekamsk, Novosheshminsk, Rybnaya Sloboda, Spassky, Tukayevsky and Cheremshan Districts in 2013, additionally the Agryz, Bavly, Bugulma, Zelenodolsk, Kukmor, Leninogorsk, Mamadysh, Pestretsy, Tetyushi, Chistopol and Yutazinsky Districts in 2015 were satisfactory as for nosematosis. A high degree of bees affection in the studied samples was observed in the Almetevsk, Menzelinsk, Muslyumovo, Sabinsky, Aznakaev, Buinsk and Elabuga Districts.

The 34-37 districts (79-86%) were successful as for ascospherosis during the observation period and only the Bugulma District had a high degree of bees affection (within 41-80% of the investigated samples).

The incidence of varroosis, nosematosis, ascospherosis among bees in the Sabinsky District of the Republic of Tatarstan during 2013-2015 is presented in Table 2.

In 2013 the Sabinsky District of the Republic of Tatarstan registered the incidence of varroosis among bees in the apiary of LLC "Sabinsky Med" (Sabinsky Haney) (positive results were obtained in 9% of the investigated samples from this apiary and in 3.3% from 9 agricultural enterprises) in the apiaries of other organizations-17%, private sector-20% of the investigated samples. In 2014 varroosis was found in the apiary of LLC "Sabinsky Med" (13% of the investigated samples), LLC "Tugan Yak" (50.5%), "Satyshevo" (33.5%), private sector (35%); in 2015-in LLC "Sabinsky Med" (70%), OOO "Tugan Yak" (90%), "Satyshevo" (73.5) and private sector (66 %).

Nosematosis was recorded in the apiaries of "Satyshevo" (60% of samples), "Michan" (9%) private sector (13%) in 2013; in LLC "Sabinsky Med" (15%), LLC "Tugan Yak" (40%), "Satyshevo" (40%), "Michan" (8%) and private sector (22%) in 2014; in all agricultural enterprises (100% of the investigated samples) private sector (63.5%).

Ascospherosis was registered only in the apiaries of the private sector in 2013 (60%). Special epizootological studies have established that in the conditions of

Table 1: The incidence of infectious diseases among bees in the municipal districts of the Republic of Tatarstan (according to the results of laboratory studies)

Grouping characteristics of positive results (%)	2013		2014		2015	
	No. of districts	No. of bee families	No. of districts	No. of bee families	No. of districts	No. of bee families
The incidence of varroosis						
0-00	12	34.077	8	30.542	7	20.693
1-20	25	95.044	28	125.182	28	131.142
21-40	2	4.100	4	18.249	7	17.021
41-60	1	5.600	1	5.29	1	2.271
61-80	1	1.901	0	0.00	0	0.00
81-100	2	2.856	2	2981	0	0.00
The incidence of nosematosis						
0-00	19	66.193	13	55.639	18	74.480
1- 20	15	57.758	21	93.351	16	69.842
21-40	6	15.768	4	12.191	5	15.427
41- 60	2	2.401	4	14.719	2	8.595
61-80	0	0.00	0	0.00	1	512
81-100	1	1.458	1	1.583	1	2.271
The incidence of ascospherosis						
0-00	34	11.071	35	150.865	37	152.199
1-20	8	31.109	7	25.220	5	15.042
2140	0	0.00	0	0.00	1	3.886
41-60	1	1398	1	1398	0	0.00
61-80	0	0.00	0	0.00	0	0.00
81-100	0	0.00	0	0.00	0	0.00

Table 2: The incidence of infectious diseases among bees in the Sabinsky District of the Republic of Tatarstan

		2013		2014		2015	
Owners of apiaries	No. of bee families	Investigated	Percentage of incidence	Investigated	Percentage of incidence	Investigated	Percentage of incidence
The incidence of varroosis							
Agricultural enterprises	1.400	151	3.3	185	1.08	140	39.0
Other organizations	1.500	30	17.0	40	0.00	10	0.0
Private sector	6.200	70	20.0	130	34.6	74	66
Total	9.100	251	9.6	355	18.3	224	50.9
The incidence of nosematosis							
Agricultural enterprises	1.400	151	6.0	185	14.0	140	100
Other organizations	1.500	30	0.0	40	0.0	10	100
Private sector	6.200	70	13	130	22	74	63.5
Total	9.100	251	7.2	355	13	224	88.0
The incidence of ascospherosis							
Agricultural enterprises	1.400	151	0	110	0	100	0
Other organizations	1.500	30	0	30	0	30	0
Private sector	6.200	70	11	60	0	60	0
Total	9.100	251	3.2	200	0	190	0

the Sabinsky District of the Republic of Tatarstan the causes for spreading varroosis mite are the following:

- Wandering of bees and bee robbing
- Integration of secured and disadvantaged families
- Hive transportation for honey gathering into one place not taking into account their epizootic state
- Uncontrolled purchase of bees and queen bees

The spread of ascospherosis among bees was associated with transportation of queen bees, travel of bees from disadvantaged apiaries, bee feeding with pollen or protein paste made of pollen.

Measures for prevention and elimination of infectious diseases of bees in the Republic of Tatarstan

are carried out in accordance with the recommendations of scientists. Ekopol and fluvalidez were used to combat varroosis. The manipulation was carried out in the Spring, Summer and Autumn by placing drug strips in the hive calculated as 2 strips per 10-12 nesting frames. Prevention of varroosis was executed by placing hives at a height of 25 cm from the Earth surface, carrying out cleaning works, removing excess grass, debris, dead bees.

Measures to combat the nosematosis of bees were limited to the early flight of bees, relocation of bees into clean, disinfected hives, removal of contaminated combs, replacement of poor-quality feed, replacement of queen bees. Bees were treated with nozematsid, hives were disinfected by scorching or with 80% acetic acid fumes. The following measures were carried out in the apiaries of the district:

- Systematic control of epizootic state
- Observance of veterinary and sanitary rules of beekeeping
- Measures for the protection of apiaries from bringing the agents of infectious and invasive diseases
- Selection and transfer of pathological material to the veterinary laboratory in accordance with the applicable regulations
- Observance of veterinary and sanitary rules of bee transportation
- Implementation of special measures to combat bee diseases in accordance with the current instruction of the Veterinary Department of the Ministry of Agriculture of the Russian Federation dated August 17, 1998.

CONCLUSION

In bee farms, other organizations and apiaries of the private sector of the Republic of Tatarstan varroosis, nosematosis and ascospherosis of bees are registered with different degree of affection (from 1-100 of the investigated samples). The 2013-2015 were successful as for varroosis in 7-12 districts, nosematosis 13-19 districts, ascospherosis 35-39 districts. Most apiaries of agricultural enterprises in the Sabinsky District were safe from varroosis (6 from 9) nosematosis 0-7, ascospherosis all farms, positive samples were found only in small apiaries of the private sector.

Medical and preventive measures for varroosis, nosematosis and ascospherosis are carried out in accordance with the instructions; in individual apiaries they are incomplete and not always presented timely which does not ensure the elimination of these diseases.

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