Episotological Characteristics of The European Rot Disease of Bees and Measures to Control It

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Abstract: The research work was carried out in the private farm of Chaldash village of Gadabay district, in the laboratory of the "Epizootiology, microbiology and parasitology" department of the "Veterinary Medicine" faculty of the Azerbaijan State Agricultural University. During the study, a high yield was obtained during the improvement of the epizootiology features of the European rot disease of bees and the improvement of control measures in the Ganja-Gazakh zone. The dynamics of the mixing of European rot with American rot, the degree of infection and lethality of the disease, the months of the year when these diseases occur and the duration of infection, and the effect of varroosis on the course of these diseases were studied. The main goal of our research work is to investigate the real epizootiology situation of European rot disease among bee families belonging to different breeds and populations, clarify the characteristics of the infectious process in them, prevention of beekeeping tools, equipment, beehive and hive plots, hives, winter beehives used in beekeeping and A system of complex veterinary-sanitary measures against this disease was developed to test sodium hypochlorite, calcium soda, and formaldehyde produced by the local chemical industry for compulsory disinfection.

Keywords: bee, disease, European rot, epizootiology, control measures, formaldehyde, sodium alkali, calcium soda

1. Introduction

Beekeeping is one of the important areas of animal husbandry. Beekeeping has a special importance in ensuring food security and protecting human health. The geographical position of our country, favorable natural conditions, relief structure, diverse and productive soil cover, and relatively mild climate have created the foundation for the emergence and development of beekeeping in addition to a number of farm fields in this area since ancient times. In modern times, increasing and improving the quality of beekeeping products in the Republic is one of the most important tasks of the day. The main goal of the development of beekeeping is to provide people with honey, wax, medicine with bee venom, bee milk, tuberculosis, wax and pollen, which are considered valuable dietary and healing food products (Aliyev et al., 2013; Maharramov et al., 2014).

Beekeeping is one of the oldest and most profitable areas of the national economy. In ancient times, after people found out that these small creatures make very tasty juice, interest in them gradually increased. Beekeeping has entered the sphere of people's interest and has developed to its present level. Nowadays, beekeeping is not only an economic field that provides honey for humans. The growing development of science and medicine has determined that bees produce a number of medically and economically important products, and beekeeping has become a field that provides raw materials for the pharmaceutical industry. These small creatures, which are a miracle of nature, produce valuable products such as honey, wax, tuber, gum, bee milk, bee venom, and increase their productivity by pollinating entomophilous plants. In this regard, the development of beekeeping is in the center of attention. As in all fields of agriculture in Azerbaijan, they provide great assistance to farmers in developing beekeeping. Fighting bee diseases is one of the measures that help beekeeping to develop more successfully. For the rapid development of beekeeping, the beekeeper should not only know the biology of bees,

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but also be able to prevent the occurrence of diseases, and if the disease occurs, to actively fight it (Mammadov & Mustafayeva , 2018; Mustafayeva & Mammadov, 2019).

The bee family is a whole biological unit. Thus, disruption of the normal life activity of any of the family members (mother, male, worker bee, or larva) causes the family activity to slow down. In infected families, the efficiency of nectar collection and pollination decreases. Keeping sick families in the apiary causes great damage (Seyidov & Ibrahimov, 2013; Yusifov et al., 2006).

Existing diseases are one of the major damaging factors in the production of beekeeping products and the development of beekeeping. Bee diseases are different according to the mechanism of action and the form of spread. Recently, amateur beekeepers found it difficult to treat many diseases, which greatly damages the development of beekeeping (Aliyeva & Ahmadov, 2013; Mammad-ov, 2015).

Therefore, the development of beekeeping is necessary and depends on many factors (storage conditions, level of care, disease control, etc.). Diseases are infectious (contagious), invasion (parasitic), etc. type, causes great damage to beekeeping, slows down the development of beekeeping (Sultanlı, 1999).

The causative agents of infectious diseases are viruses, bacteria, rickettsial, mycoplasmas, algae and fungi, and the causative agents of parasitic diseases are animals of animal origin. Each infectious disease has a specific causative agent. Depending on the characteristics of the causative agent, after entering the bee body in different ways, it causes specific pathologies and causes the weakening and destruction of bee families. Bees infected with an infectious disease have the ability to infect other bee families in the apiary and nearby. European rot is an infectious disease of bee families and is characterized by illness and death of 3-4-day-old larvae. In the study of the etiological factor of the disease, Chshayir, Chayn, N.M. Serbinov, Burri, White, etc. The service of scientists is great. The disease was observed for the first time in European countries. Currently, European rot is common in all beekeeping countries (Klochko, 2013).

Bee diseases cause great damage to beekeeping. During rotting disease, the yield of honey drops by 20-80%. If measures are not taken in time, bee diseases (mainly infectious) become widespread and subsequently take control measures and a lot of financial resources and manual labor are spent to take control measures, and in some cases it is not possible to eradicate the root of the disease completely. For this reason, bee colonies weaken or completely destroyed [Lampetl Franz , 2012; Tutkun & Boshgelmez, 2003).

2. Material and Methodology

The research works were mainly carried out in beekeeping farms in the plains, foothills and mountainous areas of the regions located in the Ganja-Gazakh economic zone, in the private farm of Chaldash village of Gadabay district, in the laboratory of the Department of "Epizootiology, Microbiology and Parasitology" of the "Veterinary Medicine" faculty of the Azerbaijan State Agricultural University. Experience and theory confirm that veterinary sanitary and therapeutic measures should be implemented to combat European rot disease. We tested the "Vita-Test" serological test system produced by the "Vita" campaign of Great Britain in the diagnosis of European rot disease in the private farm of "Chaldash" village. If an infection is detected in a small part of the horn within the family, that horn, or its infected part is cut off and removed. The nest is reduced, heated well, families of weak bees are united, queen bees should be replaced with healthy ones. The natural and climatic conditions of the Republic of Azerbaijan, the relief structure, the base of rich fodder resources and the bee gene pool with valuable breeds create ample opportunities for the development of this field.

This honeybee disease is found in all climatic zones. It is more common in temperate zones than in hot zones. The main source of the disease is sick bees. The causes of its spread are bee theft, bee straying (a bee mistakenly moving from one colony to another) and hives leaving sick colonies. This disease is not pathogenic to humans and warm-blooded animals. Since bees are in contact with wild bees, the disease spreads more easily and over a wider area. The causative agent of the disease can also be infected by bringing queen bees from other apiaries to the apiary. Within the bee family, the disease agent spreads during the period when the larvae are fed with the help of foraging bees. When healthy families are provided with honey or honey taken from sick families, the disease spreads. If tools and hives are moved from one apiary with a disease to another apiary without disinfection, it can cause the disease to spread. European rot (benign rot, rot of open larvae, sour rot) is an infectious disease of bee families, characterized by the death of 3-4-day-old, sometimes sealed larvae. European rot usually hits bee colonies hard in late spring and summer when colony growth is low. Sufficient larval mortality leads to a sudden

drop in the number of worker bees in the colony. This leads to the weakening of the family and a decrease in productivity.

3. Results Obtained and Their Discussion

From our research, it became clear that European rot is the most common dreaded disease among bees. This disease continues to be severe. Like smallpox, plague, typhus and other diseases observed among humans, rotting disease is also contagious. Rotting disease is characterized by the decay of the bee growth (brood), the disease occurs when the germ falls on the larva in the bladder.

Sometimes, bees seal such a cyst where European rot has occurred. When European rot is touched with a stick or any other means, a dark brown, sticky, wire-like mass extends from it. The smell of this substance is reminiscent of the smell of carpenter's glue.

As a result of the decay of the larvae, gas is produced. Bees pierce the lid of decaying sealed bladders, the lid of the decaying bladder collapses and darkens. Among the decayed larvae and pupae of European rot disease, there are healthy pupal cysts. Sometimes rotting disease has a different feature: the disease appears only in unsealed blisters. This kind of rotting disease is called "uncovered brood" disease. If the disease occurs in covered pups, it is called "covered pups" disease. Therefore, rotting diseases are divided into two parts: the disease of covered chicks and the disease of uncovered chicks. The time of onset of these diseases is not the same. The disease of covered chicks occurs in early summer, and the disease of uncovered chicks occurs in early spring. In the fall, diseases are rooted out.

In the bee colony, rotting disease gradually spreads to the healthy brood in the hive, increasing the number of sick broods there. As a result, the number of young bees decreases and thus, the sick colony weakens and dies day by day, as no new generation is formed to fill the place of the dead bees. Queen bees and old bees do not get decay disease.

During the study, it became clear that the species composition of the causative agents of European rot depends on the location. For example, throughout Russia, good quality rot can be caused only by P. alei, as well as by sour rot (E. faecalis). The mixed form of the disease, which occurs with the participation of M. plutonius and the abovementioned pathogens, is found in the central and southern regions of the country, B. laterosporus is found free or sporadically with other agents. We have set ourselves the goal of scientifically based study of the etiological structure of European decay depending on the regions in the Republic of Azerbaijan. Usually, when 3-4-day-old larvae begin to receive honey and nectar from foraging bees, infection of 5-8-day-old larvae rarely occurs. Surviving larvae export copious amounts of pathogens in saliva and calla inside sealed nests before pupating. We observed that during the subsequent cleaning of nests of this kind by older bees, they became contaminated with oral apparatus and later spread the causative agent within the family. Contamination of bee bodies, combs, and colony food supply was found to occur during transport of dead larvae by older bees. Due to their characteristic cannibalism, insects suck some of the larvae of this species. The source of the infectious agent is sick bee colonies. We found that the transmission of the pathogen occurs due to the flight of male and worker bees, the entry of various arthropods into the hives, wasps and thief bees, ants, and rodents.

Inside the apiary, the causative agents are spread through old empty hives used for colony expansion, hives with larvae, or unsanitary colony feed. It became clear that the unsanitary condition of beehives, long-term operation of hives, keeping bee families in hives that are not changed without cleaning and disinfection, improper organization of migration, and weak veterinary control also allow maintaining unhealthiness. Acid rot is observed mostly in beehives located near livestock farms and pastures.

European rot was recorded mostly in temperate climates, rarely in warm climates. The disease occurs after a cold in a family kept in an extended nest in the spring or summer. It also became clear that usually weakened families are more susceptible to the disease. We observed the disease in 12% of strong families, 32% in medium, and 39.5% in weak families. The occurrence of decay also depends on the supply of food to the bees, it happens very rarely in places that maintain a stable and good honey collection. The quality of the food is of great importance. The exposure of families weakened by pesticide poisoning to the disease was evident.

The degree of persistence of colonies and the intensity of infection also depend on the gender of bees and the individual hygienic ability of bee colonies to remove dead larvae. At the same time, infection with varroa mites, which reduce the resistance of bee families and are mechanical carriers of pathogens of various diseases, should also be considered. We were convinced that Varroa mites, in addition to being a reservoir of the rot agent, also weaken the bees and increase their susceptibility to disease.

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Most of the causative microbes of European rot are not only pathogenic in isolation, but they also act as synergists, enhancing the disease-causing properties of one another. Infection of bees with native material (suspension of dead larvae without rotting) occurs more easily than with cultures raised on solid artificial food media. Experimentally, we determined that 65-85% of larvae are infected with European rot from the age of one day. The causative agents of the European rot disease can remain hidden from bee hives for a long time, and since the disease is caused by a complex of microorganisms, the symptoms of the disease can also be different, and therefore it was not so easy for us to make an accurate diagnosis. Bacteriological diagnosis of decay diseases with different causative factors is also very difficult and requires a relatively long time. In this regard, we developed express diagnostic methods with high specificity and applied the existing ones in beekeeping practice.

Therefore, when we conducted research, we compared the "Vita-Test" diagnostic test kit produced by the Great Britain "Vita" campaign with traditional diagnostic methods and found that it has high specificity in the diagnosis of American and European caries diseases.

In terms of spreading among bees, the disease of covered brood (American rot) takes the first place in our Republic, and the disease of uncovered brood (European rot) takes the second place. Rotting diseases are transmitted from sick bee colonies to healthy bee colonies. As these diseases spread very quickly, they can destroy the entire apiary in a short period of time. It also became clear that if the apiary is properly and carefully maintained, rotting disease does not occur. We have considered that in order to get the mixture of decay disease, it is necessary to always wait for cleanliness in the hive, and to destroy the causative agent of the disease, it is necessary to neutralize the hives with flame or disinfectants (carbolic acid, formalin, etc.). A veterinarian or beekeeping specialist should be consulted when rotting disease occurs. Bees can also be infected with other infectious diseases. Prevention of the disease is aimed at preventing the introduction of the causative agent, its collection and transmission in bee nests, as well as increasing the resistance of families. Prevention of European rot requires strict adherence to sanitary rules in the maintenance of bees, apiary area and auxiliary buildings. During the inspection of families in the spring, they should be transferred to disinfected hives.

From our research, it was clear that every apiary should have at least 15% spare hives. It is very important to renew at least 1/3 of the cells every year. The service life of the wheels should not exceed 2 years. When European rot disease is detected in bees, the apiary, and the area around it in a radius of 5-7 km are declared unhealthy and quarantined. We inspected all bee colonies within the healthy zone and collected honey samples for examination to detect P. alei spores.

Complex veterinary-sanitary and treatment measures are being taken to fight European rot. When a disease is detected in the family, if there are small numbers of such damaged larvae in the cells, then such cells are removed and thrown away, the nest is shortened and warmed well. If death is recorded in sealed larvae along with damaged open larvae, then the bees are transferred to pre-disinfected hive frames or frames with artificial hives. Untreated bee families should be removed from the apiary, and the hives should be disinfected by soaking them in 2% hydrogen peroxide, 1% ant, or acetic acid for 24 hours. Then the cells should be washed with water and dried. We advised disinfecting the horns by spending 250 ml of 40% formalin per 1 m3 in a special chamber at 50-55 Celsius for 1 hour and in conditions of 80-100% relative humidity. Hives, equipment and supplies, special clothing and apiary area should be disinfected.

During the prevention of the European rot disease of bees, cells with laid eggs and honeydew should be destroyed, honey should be extracted, but it is not allowed to use it for feeding bees. If relapse occurs in treated families, they should be destroyed. It is possible to achieve complete elimination of the disease if organizational-farming, veterinary-sanitary and treatment measures are carried out in a comprehensive manner.

When European rot disease was detected, we first carefully mechanically cleaned the hives, their additions, frames, attached wood and feed containers before disinfection. So, propolis and dirty parts itched and washed with 1% sodium alkali or 3% calcium soda solution at a temperature of 40-50 Celsius. After this preparation, we recommend disinfecting the hives and equipment with one of the substances shown in the table at the rate of 1 liter per 1 sq.m.

The name of the disinfectant.	The concentration of the solution (in %)	The temperature of the solution (in 0C)	Amount of solution spray	Waiting time after last spray (in hours)
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A mixture of hydrogen peroxide and formic or acetic acid	10	-	3	1
Formaldehyde and alkali mixture (formaldehyde 5%, sodium alkali 5%)	3	20-30	2	5
Sodium alkali	2	70-80	-«-	-«-

After using formaldehyde and sodium alkali solutions during the study, we washed the beehive with water. In addition to chemicals, we used a blow torch to disinfect the hive, frames and other wooden parts. For this purpose, after mechanical cleaning, we heated the wooden and iron parts with a soldering lamp until they were evenly brown.

After cleaning the frames, separating mesh and fabric parts from propolis and other contamination, we decontaminated them by boiling them in a 2% sodium alkali solution. With this method, we achieved not only complete disinfection, but also restoration of the sanitary appearance of things.

During the European rot disease, we disinfected combs and other things with a mixture of 3% hydrogen peroxide (perhydrol) and 3% formic acid (or acetic acid) or 5-bichlorine iodine solution in a room where bees cannot enter. We left the tires in a vertical position, wetted both sides, filled the bladders of the tire with a solution, disinfected with the help of a hydropult, LSD, or DUK device, and after 24 hours, the disinfection was completed. Disinfection is also possible by keeping the skin in the indicated products. However, we considered the last method to be less effective.

After disinfection, the solution is released from the bladders of the saddle by shaking it, we wash it with clean water with the help of a hydropult and dried it.

When European rot occurs, bee hives are disinfected using the above method. However, this time we used a mixture of 2% perhydrol and 1% formic acid (or acetic acid). We applied the chlorinated iodine solution in the form of a 5% solution. In European rot diseases, cloth accessories in 3% calcium soda or ash water for 30 minutes; We neutralized it by boiling it in 1% sodium alkali solution for 1 minute.

For soil neutralization, we poured 1 part of soil to 3 parts of chlorinated lime powder containing 25% active chlorine, mixed it and wet it with water. We neutralized beeswax for 2 hours at 1270°C at 1.5 atmospheric pressure in the wax autoclave available for preparation. We burned the old straw and thatch floor, as well as the heating pads.

4. Conclusion

It is clear from the results of the conducted scientific research that the epizootiology situation of this dangerous European rot disease of bees in the beekeeping farms of our country has not been investigated for more than 50 years. The main issues of the research are to study the prevalence of European rot disease in beekeeping farms in the Ganja-Gazakh zone. We tested the characteristics of seasonality and migration between bees of different breeds and populations, and the serological test system of "Vita-Test" (Great Britain) in the individual farmer's farm of "Chaldash" village of Gadabay district. Taking into account the above, we advise beekeepers and private farm owners to use sodium hypochlorite, calcium soda, and formaldehyde to reduce costs incurred during European rot disease control measures, along with extensive development of low-yielding areas.

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