Epizootic process in quarantine bee diseases

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Abstract. Honey bees perform 80-95% of all pollination work. Among many species of pollinating insects, honey bees are the main ones in pollination of plants. Bees live in families consisting of many thousands of individuals. They are adapted to highly specialized food, consuming only two main types of food - nectar and pollen, collecting them from the flowers of plants. Bees not only collect food for themselves, but also process it for long-term storage, protect it from enemies and pests, and regulate its consumption in summer and winter. Families of bees can live and breed in the hollows of trees without human influence. It is necessary to change the strategy and tactics of combating quarantine diseases of bees. The most favorable for medical and recreational activities is the autumn period and the beginning of wintering. During this period, in the natural focus, the mechanisms of transmission of pathogens and their distribution are reduced to a minimum, except for the transmission of pathogens through food (honey, candi). But it is possible to eliminate. Work with bee families in winter is possible, does not adversely affect their livelihoods. Currently, work is underway at the Federal State Budgetary Scientific Institution of the Federal Research Center of the Physics and Power Engineering Institute of the Russian Academy of Sciences on the treatment of quarantine diseases of bees. Considering that the epizootic process does not stop under the conditions of quarantine of bee diseases, we propose to ensure strict isolation of infected bee families during treatment, which significantly increases the effect of veterinary measures in the treatment of quarantine bee diseases using artificial feed with medical preparations in the summer. This article discusses aspects of the epizootic process in quarantine bee diseases. On the example of bee varroosis, a strategy and tactics for combating quarantine bee diseases are proposed.

1. Introduction
Honey bees perform 80-95% of all pollination work. Among many species of pollinating insects, honey bees are the main ones in pollination of plants.

Bees live in families consisting of many thousands of individuals. They are adapted to highly specialized food, consuming only two main types of food - nectar and pollen, collecting them from the flowers of plants [1, 2, 3].

Thus, flowers attract bees and other insects by delivering food to them, and insects, collecting nectar and pollen, cross-pollinate the flowers.

Bees not only collect food for themselves, but also process it for long-term storage, protect it from enemies and pests, and regulate its consumption in summer and winter. Families of bees can live and breed in the hollows of trees without human influence.

Bees process nectar into honey and pollen into bee bread, creating well-preserved stocks of concentrated feed [4].
Bee honey is a carbohydrate food of bees. It is a valuable dietary product for human nutrition. In recent years, humans have also used bee protein - bee bread - for their nutrition.

At the dawn of the development of beekeeping, honey was extracted very simply: in autumn, some honey was taken from a nest of all the honey from the nest, destroying the bees or condemning them to starvation (swarm system).

Against the swarm system made P.I. Prokopovič. He wrote: “Killing bees for honey is an unreasonable act. This general misconception is harmful both for trade and in state relations”. He was offered a frame hive [5].

In 1857, the German beekeeper I. Mering invented wax - sheets of wax in which the bottoms of the cells were extruded.

In 1865, the Czech beekeeper F. Grushka invented the honey extractor - a device that sprays (pumps out) honey from honeycombs using centrifugal force without destroying them. After the honey was pumped out, the cells began to be returned to the hives for refilling with honey.

From this moment, a person began to infect bees with infectious diseases, rearranging the honeycomb from a sick family to a healthy one, and also using one honey extractor for honeycombs from a sick family, and a healthy one [6].

Beekeepers learned the instincts of bees, learned to build up the strength of families, transport them over long distances for pollination of crops.

But the bee, from a biological point of view, is not domesticated, but is still a wild animal, because it is looking for food not in the stall, but in the expanses of nature, like other wild animals and insects. In search of food, bees have access to all kinds of sources that can bring both life and death to the bee family (pesticides, insecticides, herbicides, as well as poisons of natural origin).

There is currently no doubt that beekeeping is at risk worldwide. In all countries, bees are primarily threatened by the tick of varroa and many other pathogens of which it is a carrier, as well as environmental and other factors [7, 8, 9].

2. Epizootic process in quarantine bee diseases
Health and harmony in the bee colony and its survival require not only the efforts of the bees, but also the correct actions of the beekeeper, state assistance, which ultimately depends on the “be” or “not be” beekeeping, as well as the food security of the state.

Diseases of bees violate the normal life of the bee family, due to changes in the functional processes in bees. They cause the death of individual individuals, brood, weakening and decrease in flight activity of bees on pollination of entomophilous plants, which means productivity. The amount of honey from sick families is reduced by 20-80%, wax 2 times. The death of bee colonies in apiaries from diseases can reach 100%.

Distinguish infectious (infectious and invasive diseases) and non-communicable diseases.

Infectious disease can exist only if the pathogen is continuously transmitted from sick bees or carriers to the external environment, and from it to a new susceptible organism.

This sequential chain of infections and the diseases that arise behind them, alternating with the release of the pathogen into the external environment, is called the epizootic process.

The links in the occurrence and course of the epizootic process are: the source of the pathogen, the transmission mechanism, and susceptible organisms.

Infected bees pose the greatest danger during a period of severe clinical illness, when they secrete a large amount of the pathogen into the external environment.

In chronic diseases, bees are more dangerous during an exacerbation of infection.

Carriers pose a lesser danger with respect to the intensity and constancy of the release of pathogens into the external environment than sick bees, but remaining undetected, they create the stationarity of an infectious disease in epizootic foci and spread pathogens to safe apiaries.

The totality of various representatives of the animal world, which are the natural hosts of certain pathogenic microorganisms that ensure their existence in nature, is called the reservoir of infection.
Bloodthirsty arthropods, such as bee mites, occupy a special place as a reservoir of infectious disease agents.

In the body of ticks, viruses that cause infectious diseases of bees can multiply and persist for several years, transmitted from generation to generation transovarially (through the egg).

Dwellings (beehives), territory (apiary) and areas of crops and forests that are visited by sick bees, from where the pathogen can be transmitted to healthy bees, are an epizootic focus covering the flight radius of the bees (5 km).

The natural focus represents a certain natural territory (biotope) of the geographical landscape, on which the spread of an infectious disease through various contacts, including with the participation of ticks and other vectors, is observed among the wild bees constantly living here.

The existence of a natural focus is supported by the continuous transmission of the pathogen from patients to healthy bees. When this process stops, the focus of the disease fades.

The course and intensity of the epizootic process in the natural focus depends on the density of the bee colonies inhabiting the biotope, the time of their greatest activity.

The mechanism of transmission and the spread of infectious diseases:

- Through the air (aerogenic);
- Through food and water (alimentary);
- Live carriers (transmission);
- Through items used in caring for bees (contact);
- Through beekeeping products and insect corpses (contact).

The widespread spread of infectious diseases in large areas is favored by the mass movement of nomad apiaries.

In the spread of infectious diseases beyond epizootic foci, beekeeping products obtained from sick bees that are not subject to research and disinfection are of some importance.

All infectious diseases of bees are quarantine diseases. Veterinary and sanitary measures for all diseases are described and set out in the code of terrestrial animals, which are aimed at the destruction of pathogens in beekeeping products. It is recommended to use gamma radiation and methyl bromide treatment of bee products.

Our research on the processing of pollen by gamma irradiation shows that pollen, of course, becomes sterile, but its nutritional qualities are irreversibly lost.

Methyl bromide is the strongest mutagen. Currently, its use has been abandoned in the milling industry in the processing of grain and flour. Flour treated with methyl bromide causes mutations in humans and animals.

The treatment of bee colonies in epizootic foci is carried out using specific agents, acting on the causative agents of the disease (etiological therapy), which are used in the areas where the bees live, thereby creating a real risk of these specific agents entering the beekeeping products.

The sick families themselves being treated are not isolated from the external environment: the bees throw sick larvae from the hive to the pre-test site; the ants pick up this pathological material. Not considering that there is a natural focus, and wild bees are not treated. Bees are constantly being infected in flowers, near water bodies, etc. The epizootic process continues permanently, ongoing veterinary and sanitary measures do not give the desired results.

Our own data on the treatment of bee varroosis confirms these findings. So, a group of families was processed in the month of July at one of the institute’s apiaries and the result of anti-varroic efficiency of 99.5-99.9% was obtained. Experienced families remained among the untreated during this period.

In an autumn study in October, an experimental group of families revealed a bee affection rate of 20-27%. As can be seen from these experiments, re-infection of bee colonies is observed.

Considering that the epizootic process does not stop under the conditions of quarantine of bee diseases, we propose to ensure strict isolation of infected bee families during treatment, which
significantly increases the effect of veterinary measures in the treatment of quarantine bee diseases using artificial feed with medical preparations in the summer [10-14].

3. Conclusion
It is necessary to change the strategy and tactics of combating quarantine diseases of bees. The most favorable for medical and recreational activities is the autumn period and the beginning of wintering. During this period, in the natural focus, the mechanisms of transmission of pathogens and their distribution are reduced to a minimum, except for the transmission of pathogens through food (honey, candi). But it is possible to eliminate. Work with bee families in winter is possible, does not adversely affect their livelihoods. Currently, work is underway at the Federal State Budgetary Scientific Institution of the Federal Research Center of the Physics and Power Engineering Institute of the Russian Academy of Sciences on the treatment of quarantine diseases of bees.

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