



Determination of the Prevalence and Economic Importance of Bee Parasitic Diseases in Devrekani District of Kastamonu Province

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Abstract

Beekeeping activities, widely carried out around the world, hold significant importance in our country due to its rich vegetation and climate characteristics. There are parasitic, bacterial, viral, and fungal diseases that are crucial in beekeeping. Parasitic infestations such as Nosemosis, Varroasis, *Aethina tumida*, *Tropiaelaps* spp., and *Acarapis woodi* are notable among bee parasites. However, when reviewing the literature, it was noted that there are insufficient studies on bee parasitic diseases. Furthermore, there are no studies on bee parasitic diseases in the Devrekani district. The primary source of income for the people living in the Devrekâni district, where the study took place, is animal husbandry and agriculture. The aim of the study is to determine the prevalence and seasonal distribution of bee parasitic diseases in the Devrekani district, to provide information to beekeepers about bee farming, to identify ways to protect against diseases observed in bees, to minimize veterinary health costs with the precautions to be taken, and to prevent the spread of bee parasitic diseases seen in the district to neighboring provinces through migratory beekeeping. Additionally, the aim is to determine the economic loss due to the decrease in honey sales resulting from hive deaths due to parasitic diseases and the cost of establishing new hives. The research material consisted of samples suspected of parasitic diseases taken from 21 different beekeeping enterprises registered with the Devrekani District Directorate of Agriculture between May 2023 and January 2024. Samples were collected from the hives and placed in sterile sample bags. Diagnosis of samples suspected of parasitic diseases was conducted in the parasitology laboratory using a Nikon brand SMZ 745T model stereo microscope and NIS Elements-D software imaging program. As a result of the diagnosis, no bee parasitic diseases were found. The absence of bee parasitic diseases indicates the possibility of bee deaths due to bacterial, fungal, and viral diseases, and suggests that multidisciplinary studies can be conducted on this issue.

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1. Introduction

Beekeeping in Turkey and around the world has experienced a significant rise in recent years. When examined statistically, there is an increase in the number of hives, the number of beekeepers, and total honey production. Turkey has become an important region in beekeeping due to its surface area, climate, vegetation, and topographic characteristics. However, honey yield in Turkey is lower compared to developed countries. Among the factors causing low productivity are: lack of awareness of bee diseases and pests, insufficient care and feeding, limited technical knowledge and queen bee production, inadequate understanding of wintering, and lack of timely diagnosis, treatment, and protection methods (Doğanay, 1997; Borum, 2014).

With the transition of beekeeping from traditional production to modern methods, there has been a rapid increase in the world's bee population. Alongside the rise in the number of bee colonies, factors such as disruptions in queen bee production, lack of control over queen bee sales, buying and selling of bees between countries, an increase in migratory beekeeping, industrial development, shrinking beekeeping areas, and the widespread use of pesticides, particularly agricultural pesticides, have led to an increase in problems in the beekeeping sector. While some of these effects are partially mitigated, beekeeping has been exposed to another threat with global warming, which has become increasingly significant in recent years (Kurt, 2023).

Bee diseases are classified according to the factor causing the disease: bacterial (American and European Foulbrood, Septicemia), fungal (Chalkbrood and Stonebrood), viral (Bee Paralysis and Sacbrood), parasitic (*Varroa destructor*, *Acarapis woodi*), and protozoan (*Nosema apis*). Alternatively, depending on the host where the disease occurs, they can be classified as adult and brood bee diseases (Uygur and Girişgin, 2008).

Bee diseases and pests are very important as they reduce colony population development

and productivity and cause product and colony losses if not intervened in time. It is reported that varroosis, noseiosis, and arthritis diseases have become significantly more common in Turkey and around the World (Aydın et al., 2003a; Aydın et al., 2003b).

Nosema disease is one of the diseases affecting adult bees, and the disease agent is a protozoan called *Nosema apis*. *Nosema apis* spores are generally oval in shape, 4-6 µm long, and 2-4 µm wide (Shimanuki and Knox, 2000). *Nosema apis* spores were first detected by Zander in Germany in 1909. *Nosema apis* spores are widespread throughout the world, except for Central Africa (Genç and Dodoloğlu, 2002). The first information about infection caused by *Nosema apis* in our country was provided in 1952, and the first diagnosis of the disease was made in the Turkish Development Foundation Bee Diseases Laboratory, established in 1986 (Tutkun and İnci, 1992). Nosema disease, which is common in Turkey, especially in the Black Sea and Marmara Regions, is most prevalent in the spring months. In order to eradicate the disease, it is necessary to control humidity; otherwise, colony death is possible (Aydın et al., 2005). Since Nosema disease exhibits symptoms similar to those of pesticide poisoning and other diseases causing paralysis in bees, a definitive diagnosis is made after examining diseased bee samples in the laboratory (Uygur and Girişgin, 2008). The definitive diagnosis of the disease is made by observing Nosema spores under a microscope (Aydın et al., 2001).

Bee mite (*Varroa destructor*) is a very dangerous external parasite that lives on the larvae, pupae, and adults of the honey bee (*Apis mellifera L.*) and multiplies rapidly, causing mass death of bees. The parasite was transmitted to Russia and western countries through migratory beekeeping, queen and swarm trade, and entered Turkey from Bulgaria in 1977 (Kaftanoğlu, 2002). Symptoms known as "Parasitic Mite Syndrome" caused by *Varroa destructor* can also be observed. In colonies affected by Parasitic Mite Syndrome, the adult bee

population decreases, the egg-laying efficiency of the queen bee decreases, symptoms similar to brood rot appear, dotted holes emerge in the eyes of the young bees, and the eyes of the deceased young bees remain in a shape similar to the letter "C" (Uygur and Girişgin, 2008).

Braula coeca, from the order Diptera, known as the bee louse, was first diagnosed in our country in 1977. It is a brown ectoparasite that is 1 mm wide and 1.5 mm long (Uygur and Girişgin, 2008).

Tracheal mite, caused by *Acarapis woodi*, is a bee disease primarily affecting the respiratory system of worker bees. *Acarapis woodi* was first identified by Rennie in England in 1921 (Güleğen, 2002).

2. Material and Methods

The research material consisted of dead bee samples taken from 21 different beekeeping enterprises registered to Devrekani District Directorate of Agriculture between May 2023 and January 2024. Samples were taken from the hives and placed in sterile sample bags (Figure 1).



Figure 1. Examples of bees with suspected parasitic diseases

Identification of dead bee samples in the parasitology laboratory was made using a Nikon brand SMZ 745T model stereo

microscope and NIS Elements-D software imaging program (Figure 2, Figure 3, Figure 4).



Figure 2. Bee samples in sterile sample bags



Figure 3. Bee samples in a petri dish



Figure 4. Diagnosis of samples suspected of parasitic disease

3. Results and Discussion

As a result of the diagnosis of samples from 21 different beekeeping enterprises registered to Devrekani District Directorate of Agriculture, no bee parasitic disease was found. There are a limited number of studies in the literature on parasitic diseases in bees in our country.

In recent years, there have been molecular-based studies for the diagnosis of varroasis

disease (Damayo et al., 2023; Kipkoech et al., 2023). However, our study could not be carried out due to budget and technical impossibilities.

In a study conducted in Elazığ, the prevalence of Nosema infection was found to be 10% in Sivrice district and 4% in Elazığ center and Baskil (Şimşek et al., 2001). The frequency of *Nosema apis* in honey bees in Kars and surrounding areas was found to be 15.74%; in residential areas, it was 87.50%,

and in apiaries, it was 40% (Topçu and Arslan, 2004). In studies evaluating the prevalence of Nosema disease by region, Özbilgin et al. (1999) reported 2% in the Aegean Region; Yaşar et al. (2002) reported 30.4% in the Black Sea Region; Aydın et al. (2003a) found it to be 5% in Southern Marmara, and Sıralı and Doğaroğlu (2005) found it to be 6.5% in Thrace.

In the nationwide varroasis disease research conducted by the Ministry of Agriculture and Forestry between 1979 and 1981, it was determined that varroasis disease was present in 60 provinces except 7 provinces, and in 1983, it was determined that it had spread to all provinces. It has been determined that 41% of the hives in our country and 35% of the hives in the Southern Marmara Region are highly infected with *Varroa destructor* (Uygur and Girişgin, 2008).

In a study investigating enterprises located in Kırşehir province between 2009 and 2011 for bee diseases, it was determined that 65.3% of the enterprises had varroa, 18.4% had chalkbrood, 9.1% had foulbrood, and 5.1% had nosema disease (Tunca and Çimrin, 2012).

In Van province, Bingöl et al. (2014) determined the effect of the Varroa factor on colony losses to be 15.71%. A study conducted in Bingöl found that the colony loss rate in hives infected with varroasis was 25% (Kutlu and Gül, 2020).

As a result of the literature review, nosema infection was found in 2-87.5% and varroasis infection was found in 15.71-65.3% of apiaries in our country. In this study, no parasitic diseases were found in bees. It is thought that the reason for this is that diseases do not occur due to antiparasitic applications with the active ingredient amitraz at the beginning of spring and at the end of autumn, and the deaths seen in beeries may be of viral, bacterial and fungal origin (Anonymous, 2023).

4. Conclusion

As a result, the absence of bee parasitic diseases in the study area does not mean that the disease has been eradicated from that region, but it shows that bee deaths due to

bacterial, fungal and viral diseases are possible and multidisciplinary studies can be carried out on this issue together with other study areas. It is thought that this study may guide future research on varroasis in the Kastamonu region.

Declaration of Author Contributions

The authors declare that they have contributed equally to the article. All authors declare that they have seen/read and approved the final version of the article ready for publication.

Declaration of Conflicts of Interest

All authors declare that there is no conflict of interest related to this article.

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