

# BEE DISEASES, TREATMENTS, AND PREVENTION IN THE FOLKLORE OF THE ORDU-GIRESUN REGION IN TÜRKIYE

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## ABSTRACT

The Eastern Black Sea Region, which has a very important position in honeybee breeding, stands out with its valuable nectar and pollen resources for bees, thanks to its rich plant species. In this region, beekeeping is carried out intensively and traditional knowledge is also used. This research aimed to reveal the folkloric data related to bee diseases, their treatments, and prevention from the disease in Ordu-Giresun Region, evaluate the obtained data with rational data, and contribute to veterinary medicine folklore, in particular beekeeping. The study material consisted of the data obtained from 39 volunteers, who were determined to have good knowledge about beekeeping in Ordu-Giresun Region, between 26 August 2017 and 20 September 2018. The data obtained from the participants were specified in the results section as a superscript at the end of each data. The information compiled using the information compilation form was analyzed under “*bee diseases, treatments and prevention*” and “*hive disinfection and bee immunity*”. The study determined that the data obtained on six different bee diseases and food poisoning in bees were generally compatible with the literature on the subject. As a result, it can be stated that the folkloric medicine based on experience regarding bee diseases, treatments, and protection from diseases continues to be practiced today in Ordu-Giresun Region, but the source persons could not provide or have no knowledge about viral diseases of bees and poisoning caused by pesticides; however, folkloric methods applied in beekeeping are sensible and rational in the light of scientific data.

*Keywords:* Bee, Folklore, Ordu-Giresun Region, Türkiye.

## INTRODUCTION

About 3/4 of the plant species known to be used by bees worldwide grow in Anatolia. Especially in the Eastern Black Sea Region of Türkiye, the plant species that bees can benefit from as a source of nectar and pollen are quite rich. White clover (*Trifolium repens*), cherry laurel (*Prunus laurocerasus*), dandelion (*Taraxacum officinale*), veronica prostrata (*Asteraceae absinthium*), sage (*Salvia officinalis*), and wild mustard (*Sinapis arvensis*) plants are essential sources of pollen in the region (Deveci *et al.*, 2015: 6). The Eastern Black Sea Region also has significant potential in the number of hives and

honey production (Kuvancı *et al.*, 2017: 54) (Figure 1). While the number of beekeeping establishments (breeders) of 81,000 in Türkiye is 3021 in Ordu, it is 1851 in Giresun. While the number of active hives is 579,367 in Ordu, it is 122,021 in Giresun (TOB, 2021).



Figure 1: Map showing the regions studied in the Black Sea. Painted areas show the Black Sea region

Information on bee diseases is based on ancient times (Marcus Tarentius Varro, 1st century BC, Rome) (Erk, 1966: 40). According to Kurt (2008: 1), in bees, five bacterial, 11 viral, four Protozoal, six Varroa, six Lepidoptera, four fungal and yeast-related diseases and small hive beetle (*Aethina tumida*), bee lice (*Braula coeca*), and trachea mite (*Acarapis woodi*) can be seen. In addition, diseases caused by care and feeding and pesticide poisoning are reported (İnal and Güçlü, 1998: 72-78). Honeybee pests and diseases negatively affect the development of beekeeping in our country (Şahinler and Gül, 2005: 27). It is a known fact by today's breeders that some factors cause damage by settling in the honeycomb and hive (İnal and Güçlü, 1998: 48).

It is known that breeders seek alternative methods for bee diseases and preventive treatment to eliminate the problems they encounter in beekeeping; thus, folklorically used plants and homoeopathic medicines are on the agenda (Taçbaşı and Baydan, 2018: 122). Although technical beekeeping principles are known in the Eastern Black Sea Region, it is reported that the traditional habits of benefiting from experience continue (Kuvancı *et al.*, 2017: 54).

This research aimed to reveal the folkloric data related to bee diseases, their treatments, and prevention from the disease in Ordu-Giresun Region, evaluate the obtained data with rational data, and contribute to veterinary medicine folklore, in particular beekeeping.

## MATERIALS AND METHODS

### *Questionnaire Design, Data Collection, and Analysis*

The study material consisted of the data obtained from face-to-face interviews with 39 volunteer participants known to have good folkloric knowledge levels related to beekeeping from the settlements where intensive beekeeping activities were carried out in Ordu-Giresun Region between 26 August 2017 and 20 September 2018.

During the face-to-face interviews, the participants were informed about the study, and their permission was obtained. Written and/or visual data were collected by asking 15 questions through the information compilation form. Finally, the findings were evaluated with the “content analysis” method.

A code number was used for each participant. These code numbers (P1, P2, ..., P39) used in the representation of the participants were presented in detail in the participants' section and were numbered as superscripts at the end of each data in the findings section.

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*Ethical Approval:* Ethics Committee Approval was obtained with the date of 21.09.2016 and the number 17202031, following the application made to the Selçuk University Faculty of Veterinary Ethics Committee during the project phase.

## RESULTS: BEE DISEASES, TREATMENTS, AND PREVENTION

The information compiled using the information compilation form in the folklore of the Ordu-Giresun region was analyzed under the headings of “*bee diseases*” and “*hive disinfection and bee immunity*”. Among bee diseases, ten were related to American foulbrood (*Paenibacillus larvae*), 31 to Varroaosis (*Varroa destructor*), one to Nosemosis (*Nosema apis*), eight to Butterfly (*Galleria mellonella* L.) disease, three to lime disease (*Ascospaera apis*), six to bee diarrhoea, and 60 in total, including one to food poisoning in bees. Also, data were collected from six different participants on hive disinfection and bee immunity.

### **Bacterial Diseases of Bees**

#### *American Foulbrood (Paenibacillus larvae)*

Folkloric statements:

American Foulbrood began to be seen in the region after 1990<sup>1</sup> along with modern hives.<sup>2,3</sup> This disease occurs when the sick and weak colonies take honey from other hives (robbing) and may cause the hives to die out.<sup>1</sup> While the bee is producing wax, the temperature and humidity inside the hive increase, which can

cause American foulbrood. In order to maintain the humidity-temperature balance, the hive should be ventilated and controlled.<sup>2,3</sup> It is also reported that the fig, which grows in the region and rots prematurely due to humidity, causes disease by being transported to the hive with the bees, undergoing fermentation, and sticking to the beeswax.<sup>3</sup>

Although it is not common in the region, factors such as the bees not getting cold, the number of bees in the hive, and the balance of the temperature in the hive are essential for the preventing of this disease.<sup>4,5</sup>

In the struggle, the temperature inside the hive is kept in balance and the rotting of the immature bees is prevented. This method is popularly known as “*keeping the hive tight*”. Veterinary drugs are also used.<sup>6,7</sup> In order to prevent this disease, the hive is cleaned and when the bee is taken to a new hive, the cluster is taken as a bee.<sup>8</sup> Frames in contaminated hives are destroyed.<sup>1</sup> Combs are used according to the density of the bees in the hive and these frames are placed at close intervals.<sup>4,5</sup>

### **Parasitic Diseases of Bees**

#### *Bee Lice Disease (Varroaosis)*

Folkloric statements:

In recent years, the most common bee lice disease has been seen in bees in the region.<sup>9</sup> This disease is also known as “*arı sakkısı*” or “*arı sakırtlağı*” among the people.<sup>10-12</sup> Especially with migratory beekeeping, the bees bringing bee lice from different regions and the swarm carrying the disease agent over Europe are essential factors in the transmission of the disease.<sup>9</sup> It is reported that bee lice disease started to appear in the region after the cultivation of cannabis plants was banned.<sup>13</sup> It is reported that 80% of the agricultural lands are cornfields and especially the planting of cannabis plants in the cornfields is one of the most important reasons why bee lice are not seen much in Giresun. Also, it is reported that when the bee is placed on a blooming cannabis plant, the louse on the bee is poisoned and leaves the bee.<sup>14</sup>

It is reported that in the struggle, the cone of the acorn tree (*Quercus Ithaburensis*) (mushroom),<sup>15,16</sup> tobacco in Görele, tinder fungus found in chestnut trees,<sup>17</sup> or sacks made of cannabis (hemp) plant are burned and the fume is given to the hive with a blower. It is reported that in the past, dry spraying (DDT) was used in beehive spraying, and in recent years, wet spraying was used.<sup>18</sup> Butter is applied to the entrance and exit points of the log hives (Figures 2, 3) so that the bees stick to the butter when the bees enter and leave the hive.<sup>19-21</sup> Twenty minutes after incense is made in the hive with corncob fume, the bee louse that is affected by the fume falls and sticks to the butter applied to the floor.<sup>22,23</sup> It is also reported that naphthalene was used in the hive for some periods to kill the bee lice and prevent other insects from harming the bee, but this practice was abandoned over time as it harmed the bee and the hive.<sup>24</sup> If bee lice are seen in the queen, the lice are removed from the queen bee with the help of a thin hazelnut stick on which honey is applied.<sup>14</sup>



Figure 2: The log hive (witch-hazel).<sup>25</sup> A log hive made of witch-hazel, prominent in the folklore of the region

Figure 3: The log hive (Cranberry Tree).<sup>26</sup> A log hive is frequently used in beekeeping in the region and is an important source of income for the people of the region

In addition, in struggle, a mixture of grape root and bay leaf juice is used,<sup>4</sup> plane tree leaves are used in the hives,<sup>27</sup> bee lice are removed with the smell and secretion of juniper tree kindling placed on the bottom and top of the hive, and pesticides used on apple trees are effective in struggling bee lice.<sup>1</sup> In Alucra, it is reported that the water of thyme is applied in the form of drops to the beehives where the disease is seen since the smell of thyme disturbs the bee lice.<sup>9</sup>

In order to protect the hive from bee lice disease, the hive is cleaned with a blowtorch two or three times a year.<sup>28</sup> It is essential to care for and clean the hive against this disease and to ensure the temperature balance.<sup>29</sup> It is reported that the temperature inside the hive should be kept at a certain level and the number of bees is important for this,<sup>10</sup> and when the bee colony is strong and crowded, the bee lice cannot stand the smell and heat and go away.<sup>30</sup>

#### *Bee Cancer (Nosemosis; Nosema apis)*

Folkloric statements:

It is a disease seen in regional beekeeping for some years. It shows symptoms of swelling in the intestines of the bee. As a result, the bee that flies out of the hive cannot return to the hive. With this disease, the number of bees in the hive drops significantly and this decrease begins to show itself within a week. Thyme and thyme oil are used in the treatment.<sup>31</sup>

#### **Bee Pests**

##### *Butterfly (Wax Moth) Disease (Galleria mellonella L.)*

Folkloric statements:

The wax moth disease, known as the butterfly moth eating the wax made by the bee, and which is seen periodically, is also called “*üskelek*”.<sup>32</sup>

The bees carry the flower pollen and the butterfly eggs that the butterflies leave on the pollen to the hive.<sup>33</sup> Butterflies may also lay eggs in the frame around or inside the pollen hive (Figure 4). Butterfly eggs are mixed with honey in the hive with beeswax and the wax moth can feed here and pierce the bee wax.<sup>34</sup>



Figure 4: The Moth Disease in the Hive.<sup>35</sup> Wax moth disease seen periodically in the hive

The sharp smell and secretion that the wet walnut tree leaves (Figure 5) put on the bottom of the hive during the struggle prevent it from causing diseases by removing the moth from the wax and the hive.<sup>36</sup> In Şebinkarahisar, honey that is thought to be contaminated with butterfly eggs is taken out of the hive and kept in the deep freezer section of the refrigerator for 48 hours, and the butterfly eggs are killed during this time.<sup>37</sup> Burning the diseased honeycombs is also seen as a solution.<sup>13</sup>



Figure 5: Applying Walnut Leaf to Moth.<sup>35</sup> A walnut leaf is placed on the base of the hive while it is wet, in order to keep the moth away

It is reported that as a protective measure, the honeycombs are placed on top of each other to prevent the increase in temperature, thus preventing feeding the moth and damaging the wax.<sup>34</sup> It is also important to remove the honey from the hive in a timely manner so that the hive does not get wax moth disease.<sup>36</sup>

### **Mycotic Diseases of Bees**

#### *Lime Disease (Ascosphaera apis)*

Folkloric statements:

Lime disease has started to be seen in recent years and is usually seen in immature bees. Malnutrition of young bees and the cold and dampness of the hive play a role in the formation of this disease.<sup>8</sup> It is seen in hives grown in

humid regions with a low bee population.<sup>5</sup> In lime disease, mould growth occurs in the pollen.<sup>8</sup>

As a preventive measure, it is important to keep the colony tight and strong,<sup>5</sup> and to open ventilation holes at the bottom of the hives.<sup>1</sup> It is also stated that cleaning and maintaining the hives is essential, increasing the bee colony's immunity and maintaining the temperature balance inside the hive.<sup>8</sup>

### **Nutritional Disorder Diseases of Bees**

#### *Bee Diarrhea*

Folkloric statements:

Bee diarrhoea is also called “*bee cold*”.<sup>13</sup> Bee diarrhoea periodically creates problems in beekeeping.<sup>12</sup> It is reported that syrup drunk randomly,<sup>35</sup> and watery syrup consumed in cold weather cause bee diarrhoea.<sup>37</sup>

In the treatment, lemon salt is added to the syrup given to bees, and thus it is reported that bee diarrhoea has stopped.<sup>12</sup> If bee diarrhoea is seen, it is ensured that the bee sees the sun in sunny weather.<sup>35</sup>

As a preventive measure, the temperature inside the hive is adjusted or the bees are taken out into the open air in sunny weather. Bees are given a mixture of pear molasses and herbs.<sup>37</sup>

#### **Food Poisoning in Bees**

Folkloric statements:

One of the diseases that should be considered in bees is food poisoning. It is reported that bee lice medicine is given one day after drinking syrup so that the bee does not get food poisoning.<sup>38</sup>

#### **Hive Disinfection and Bee Immunity**

Since the cannabis plant cultivation in the region was high in the past, it is reported that cannabis fume is frequently used in beekeeping for the disinfection of the hives, and it is given to the hives at specific intervals to increase the resistance of the bee colonies with the fumigation method.<sup>39</sup>

In cases where the number of bees in the hive is low and the number of combs is high, bee frostbite can be seen. Therefore, no new combs should be placed between the combs in the beehives. The syrup should not be given to bees in cold weather, especially in winter, and the hive should not be opened below 18 °C, especially in winter, so that the temperature inside the hive does not drop. When the hive is to be opened, its front side should be positioned, so it does not receive wind.<sup>5</sup>

Hive disinfection is done every March against diseases and pests.<sup>38</sup> Baking soda and vinegar are used in hive cleaning.<sup>11</sup> In cleaning the inside of the hive, boiling water is poured from a place such as a ramp and the bee wax is softened, and then removed with the help of a sharp wire brush. In addition, in preparation for the new period, the hive is disinfected by burning it with a blowtorch.<sup>38</sup> In addition, it is reported that alcohol is burned and brought to the consistency of oil and used as a paint on the outside of the beehives. The paint made with this bee wax is absorbed by the logs, thus preventing the bees from getting cold and

protecting the bees from diseases. It is also reported that the paint made with bee wax is applied inside the hive to ensure hive disinfection.<sup>11</sup>

## DISCUSSION

According to Kurt (2008: 1-75), it is stated that 37 diseases related to bacterial, viral, protozoal, fungal, yeast, Varroa and Lepidoptera and small hive beetle, bee lice and trachea mite can be seen in bees. In the study, the fact that folkloric data on only six bee diseases were reported in the Ordu-Giresun Region, where beekeeping is intense, can be explained by the preventive medicine awareness of the people of the region in the context of the data regarding the attention to bee disinfection and bee immunity.

Infection occurs even after 30 years in a hive contaminated with spores, the presence of spores in soil and similar environments changes depending on external factors (Solmaz *et al.*, 2021: 38). American foulbrood is a notifiable disease in many countries, and the destruction of contaminated beehives and contact materials by burning is the most successful control method. However, developing practical approaches to combat this severe epizootic is difficult, as the infection's molecular features are broadly not understood (Müller *et al.*, 2015: 765). It usually occurs in early spring, especially at night. Exposure to unexpected and sudden cold weather conditions, not having enough healthy adult bees to wrap the brood combs, not compacting the bees well enough, not using a dividing board when necessary, and insufficient heat preservation of the colonies with new brood cause serious problems (Solmaz *et al.*, 2021: 43). In the study, it was stated that the temperature inside the hive is an essential factor in the prevention of this disease, with findings such as the bees not getting cold, the number of bees in the hive (Figures 2, 3) and the temperature in the hive being in balance, and revealing the information that the combs in the contaminated beehives should be destroyed in the fight are similar to the study data of Müller *et al.*, and Solmaz *et al.* Also, it can be said that the people of the region resort to rational methods in the fight against American foulbrood, which is one of the epidemic diseases of bees.

It is reported that nicotine, which is found in 2.5-3% of tobacco leaves, has an acaricidal effect and its fume is effective at approximately 75% (Sönmez, 2010: 45; Mucsi, 2020); especially in the fight against bee lice especially seen in honeybees, hair rag or fragrant plants (thyme, tobacco, mint, etc.) are burned and fume is sprayed into the beehive with a blower (Sinmez, 2011: 78). In the study, in the fight against bee lice, burning the acorn cones or sacks made from cannabis plants, tobacco, and tinder fungus found in chestnut trees and spraying the fume inside the beehive with a blower is similar to the work of Sinmez. This shows that fumigation technique has been applied in the fight against bee lice from the past to the present and that the folkloric veterinary medicine practices of the Anatolian people are generally compatible and rational with scientific data. It can also be stated that in the fight against varroa, the region's people apply traditional techniques by using the plant-based materials they obtained from the region and animal-based materials such as honey and butter.



In the Nosemosis disease seen in honeybee adults, the increase of undigested nutrients accumulated in the intestine causes the abdominal region of the sick bee to swell. If preventive spraying is neglected, colonies begin to develop weakly in the spring, and significant yield losses occur in colonies whose development slows down or stops (Öztürk, 2014: 29). In order to protect honeybees against Nosemosis, 1 litre of thyme juice (black thyme, *Thymbra spicata*) containing thymol compound is added to 8 litres of sugar syrup (prepared at the rate of 2 parts sugar: 1 part water) and given 0.5 litres per hive twice with one week interval (Özüüçli and Aydın, 2018: 155). In the study, similar to Öztürk's data, it can be said that bloating is seen in the intestines of the bees and that the number of bees in the hive has decreased significantly observed correctly by the people of the region. Therefore, the use of thyme and thyme oil in the treatment can be stated as a rational treatment method that is generally compatible with the work of Özüüçli and Aydın.

Physical heat applications are tried to protect the honeycombs against the damages caused by the wax moth in the hive. Among them, the cooling application is a convenient and inexpensive method, it can be used comfortably and safely, and it can be used for wax moths in all stages from egg to adult die in honeycombs kept for 2 hours at  $-15^{\circ}\text{C}$ , 3 hours at  $-12^{\circ}\text{C}$  and 4.5 hours at  $-7^{\circ}\text{C}$ . It is reported that it dies, and high temperatures such as  $70-80^{\circ}\text{C}$  are sufficient for the death of all stages of the pest (Akyol, 2013: 4). In a study investigating the effect of cold application at  $-5^{\circ}\text{C}$  on the protection of honeycombs against wax moth, it is stated that the impact of the cold application on the amount of honeycomb is unaffected by wax moths is statistically significant ( $P<0.01$ ). It is stated that even moth-infested honeycombs can be preserved for a while in general-purpose cold storage after harvest at the end of the season (Akyol and Korkmaz, 2008: 28). The study shows that the physical methods applied to protect the hives from moths are in parallel with the studies mentioned above. Therefore, it can be said that physical applications such as preventing temperature increase by placing the honeycombs on top of each other, burning the diseased combs, and keeping the moth-infested honey at  $-20^{\circ}\text{C}$  (Figure 4) are the rational methods preferred by the people of the region in terms of being cheap, not leaving any residue in the honey and not adversely affecting the health of the honeybees.

Gökçe *et al.* (2002: 21) found that the contagion rate of lime disease for the Black Sea region in 2002 was 7.8%; Cakmak *et al.*, (2003: 33) reported that this disease is a fungal disease that develops in suitable environmental conditions and that it generally occurs seasonally, and beekeepers eliminate this problem with good ventilation at increasing temperatures. In the study, it can be stated that this disease occurs in cold and humid weather, similar to the study data of Çakmak *et al.* and Gökçe *et al.* Therefore, the disease continues to be a threat to the region's beekeeping. In addition, it can be claimed that folkloric methods such as hive cleaning and care applied for preventive medicine for this disease are rational.

There was no report of the viral infection known as bag rot, bag disease, and pickled brood in Türkiye (Tuncer and Yeşilbağ, 2009: 151; Balkaya *et al.*, 2016:

344; Kalaycı *et al.*, 2019: 552). However, data show that chronic bee paralysis virus in Türkiye causes significant losses, especially in the summer months (Tuncer and Yeşilbağ, 2009: 153). In a study conducted in Türkiye in 2010, the presence of the “*chronic bee paralysis virus*” was shown and its prevalence was reported as 53.57% (Okur-Gumusova *et al.*, 2010: 782). Another study in Türkiye stated that the Israeli acute bee paralysis virus was detected in bee colonies in Türkiye (Özkırım and Schiesser, 2013: 56). In the study, in parallel with the above sources, it can be said that the fact that the people of the region do not give any information about the viral diseases of bees indicates the possibility that other viral diseases, especially bag rot, are not seen in the region, and that the people of the region have a strong observation ability regarding bee diseases. In addition, with the current scans to be made in the Black Sea region regarding the bee paralysis virus, which is stated to be seen in Türkiye, the exposure of regional beekeeping to this infection will be evaluated with more precise data.

Borba *et al.*, (2015: 3690), stated that colonies should not be fed with sugar syrup in autumn and all colonies should have enough honey storage to spend the winter. Hives should be made of wood or other natural materials (Uygun, 2005: 105), and natural products such as propolis, beeswax, and plant oils should be used instead of chemical dyes. With the blowtorch, the hives can be disinfected directly with physical applications such as a flame (Uygun, 2005: 106; Cengiz *et al.*, 2010: 54). Other beekeeping materials should be disinfected using boiling water, caustic soda, and natural plant extracts. In addition, water and steam, acetic acid, and sodium carbonate can be preferred for cleaning and disinfecting beekeeping equipment (Cengiz *et al.*, 2010: 56). Wood preservatives and paints used to protect the beehive against deterioration should not contain pesticides and fungicides that could contaminate honey (Bogdanov, 2006: 12). In the study, similar to the data of Borba *et al.*, the syrup was not given to bees in cold weather, especially in winter; Similar to the data of Uygun and Cengiz *et al.*, it is seen that the paint obtained from bee wax is applied to the outside of the log hives (Figures 2, 3) instead of chemical dyes, and carbonate and vinegar are used in the disinfection of the hive, and the hive disinfection is carried out by burning it with a blowtorch. Parallel to Bogdanov’s statements, it can be argued that care was taken to ensure that the wood preservatives and dyes used by the people of the region are free from drugs and other chemicals that can contaminate honey, and that the folkloric techniques they apply are rational practices that are directly effective in bee health and therefore welfare.

## CONCLUSION

As a result, it can be said that folkloric medicine based on experience, which continues to be practiced today, continues to exist in bee diseases, treatments, and protection of the Ordu-Giresun Region; however, the 39 interviewees on the subject could not or did not have any information about viral infections of bees and poisoning caused by pesticides. In addition, while it can be stated that the folkloric methods applied in beekeeping are rational and sensible in the light of scientific

data, it can be said that more scientific research is needed because there are few studies on the effects and safety of alternative methods of protection applied.

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