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SHORT NOTE

Pests of Honeybee Colonies (*Apis mellifera*) in Türkiye: Focus on *Aethina tumida* (Coleoptera: Nitidulidae, Latreille 1802)

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Abstract

Various bee pests that cause yield losses in honey bees and/or hive collapse. The most important is the small hive beetle (*Aethina tumida*), which has become one of the biggest problems of today's beekeeping. The national study investigated small hive beetles in honey bee hives for the first time in Türkiye. In addition, the distribution of moths, oil beetles, and bee lice was examined. As research material, worker bee and honeycomb samples were taken from 401 apiaries in 40 provinces throughout Türkiye. A total of 1199 healthy hives were examined parasitologically in terms of larvae and adult forms of bee pests. It has been observed that no adult small hive beetle, however, pest larvae were found in 13 hives. After morphological examination, all larval forms were identified as the great wax moth, *Galleria mellonella*. In conclusion, the small hive beetle, which is spreading rapidly worldwide, has not yet been found in Türkiye. Therefore, Türkiye has not yet posed a threat to the pest to spread to Eastern Europe or Central Asia.

There are some insects considered bee pests that reside within the honey bee hive for part of their life cycle. They feed on honey, beeswax, royal jelly, and bee larvae or they damage the honeycombs with brood/honey, causing severe yield losses and even extinction of the hive (Ellis & Munn, 2005; Gupta et al., 2014)

The larvae of some beetle species are known as pests of honey bee colonies. The most notable species for beekeeping is the small hive beetle (*Aethina tumida*, Murray 1867) which is a fruit pest originally found in Africa and causes little harm to local honey bee colonies. However, it has spread worldwide in the last 30 years and become the most invasive pest species threatening world beekeeping today (Giangapero & Turno, 2015). It is a notifiable disease in Türkiye, but has not been reported yet.

Other beetles, which cause damage in hives, are especially found in the genus *Meloe*. Eighteen different *Meloe* species have been identified in Türkiye, including *M. brevicollis* (Panzer, 1793), *M. cicatricosus* (Leach, 1815), *M. variegatus* (Donovan, 1793) and *M. violaceus* (Marsham, 1802),

which are known to be harmful in honey bee colonies. As a case, after an outbreak of *M. violaceus* in Türkiye, a high level of infection was reported in some apiaries (Özbek & Szaloki, 1998; Demir & Kabalak, 2017).

Some moth species have been identified as hive pests. The greater wax moths' larvae (*Galleria mellonella*, Linnaeus 1758) is the most harmful and widespread species. In Türkiye, it was found at 3% in hives (Çakmak et al., 2003), and recorded between 5.5-14.7% in apiaries in two survey studies (Sıralı & Doğaroğlu, 2005; Seven & Yeninar, 2010). Beekeepers are fighting against the great wax moth in Türkiye (Akyol, 2013). In addition, other moth species are found in Türkiye, which are known bee pests; small wax moth (*Achroia grisella*, Fabricius 1764), driefruit moth (*Vitula edmandsae*, Packard 1865), Indian meal moth (*Plodia intepuntella*, Hubner 1813), Mediterranean flour moth (*Ephestia kuehniella*, Zeller 1879), death's head hawk moth (*Acherontia atropos*, Linnaeus 1758), bumble bee moth (*Aphomia sociella*, Linnaeus 1758) (Aydın & Selçuk, 2012). However, there is no record of these moth species in honey bee colonies in Türkiye.

There are five species known as bee pests under the genus *Braula*. *Braula coeca* (Nitzsch, 1818) and *B. schmitzi* (Orosi Pal, 1939) are the common species (Zapata-Carvajal et al., 2017). Adult pests are found on the queen and worker bees, and they steal and feed on foods such as royal jelly and honey by standing close to the bee's mouth. The larvae of the bee louse feed on royal jelly, honey, and pollen in honeycomb, causing the bee larvae to die of starvation. They also reduce the egg productivity of the queen bee in high infestations (Uygur and Girişgin, 2008; Gupta et al., 2014). While it has a worldwide distribution (Ellis & Munn, 2005), there were only two cases reports on *Braula* sp. infestation in Türkiye (Oytun, 1963; Oğuz, 1976). Although there were many local studies on beekeeping after *Varroa* sp. outbreak in the 1980s, no *Braula* sp. was detected in any of them (Çakmak et al., 2003; Aydın et al., 2007; Ütük et al., 2011).

In the study, which is a comprehensive research covering all of Türkiye, the presence of bee pests, including small hive beetles, in the honey bee hives was investigated.

Four hundred and one apiaries in 40 provinces throughout Türkiye were examined for bee pests (Figure). Three randomly selected healthy hives in all apiaries were opened and examined visually. All hives were checked for adult or larva forms of bee pests, tunneling through combs, and white webbing. In addition, at least two hundred adult bee samples and 10 square centimeters capped brood combs were collected from almost all examined hives. After keeping at -20 °C overnight, capped brood samples were examined for bee pest larvae. Adult worker bee samples were examined for adult *Braula* sp. under stereo-microscope. The collected parasite forms were placed in separate petri dishes and identified under a stereo/light microscope by morphological criteria (Ellis et al., 2013; Neuman et al., 2013).

Larval forms of bee pests and tunnels were found in some brood com samples in the macroscopic examination. However, no adult *A. tumida* was seen in the hives. Also, no adult *Braula* sp. was found on adult bee samples under the stereo-microscope.

In total, bee pest larvae were recorded in 13 (1.0%) of 1199 examined hives, 10 (2.5%) of 401 apiaries, and 4 (10%) of 40 provinces in Türkiye (Figure).

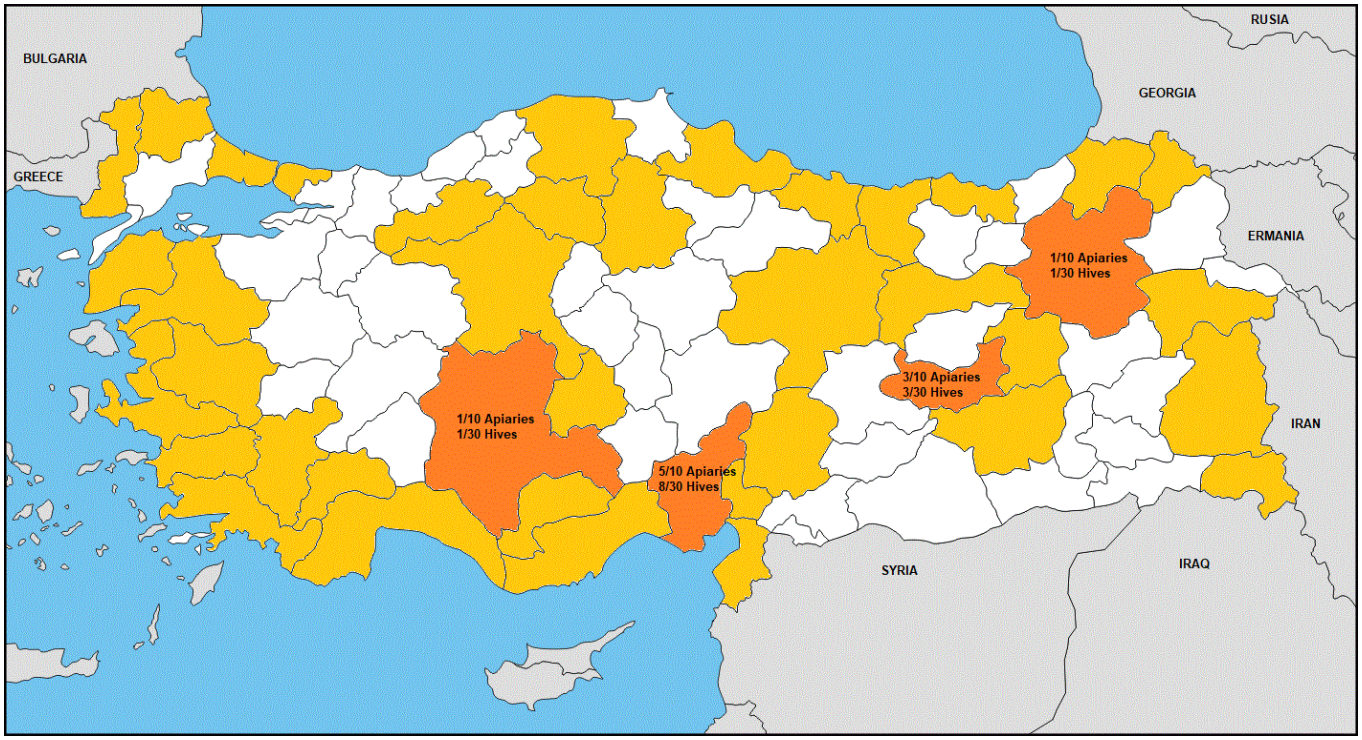

Fig 1. Sample collected provinces and infested locations in Türkiye (Yellow painted examined, orange painted infected, white painted non-examined provinces).

A total of 351 larvae at different developmental stages were collected from infested hives with a minimum of 10 and a maximum of 183 (average 27). Larvae were examined morphologically under a stereo microscope and all samples were identified as the greater wax moth, *Galleria mellonella*. The small hive beetle larvae or *Braula* sp. adults were not found in any hives through Türkiye.

Türkiye has a beekeeping background for its rich plant diversity and thousands of years of culture. With the scientific developments in the twentieth century and the Republican period, technical beekeeping was introduced and a great breakthrough was made in beekeeping. As a result, it has become one of the few leading countries in the world for beekeeping activities. In addition, since Türkiye is at the intersection of Europe, Asia, and the Middle East, its location is important in spreading the parasite (Doğanay, 2017).

Although beekeeping activities are a state-supported livestock production, the yield is still below the world average. The most important factor affecting productivity is disease. Türkiye has almost all important diseases that are a problem for beekeeping in the world, except the small hive beetle and *Tropilaelaps*. However, there are limited studies on detecting of bee diseases in Türkiye (Balkaya et al., 2016; Gürler et al., 2024). A significant part of these articles consisted of survey studies, and the number of studies in which samples were collected from apiaries using scientific methods and diseases investigated using scientific methods in relevant laboratories remained limited (Aydın & Selçuk, 2012; Balkaya et al., 2016; Aydın, 2017; Gürler et al., 2024). Only a few of these provide information about bee pests (Oytun, 1963; Oğuz, 1976; Çakmak et al., 2003). This research is the most comprehensive study to detect bee pests, especially small hive beetles, in apiaries through Türkiye.

The small hive beetle is a common and most harmful bee pest worldwide. After being recorded in the USA in 1996, it has spread throughout the entire American continent until today. Then it moved to Europe (recorded in Portugal in 2004 and Italy in 2014), but it has now been eradicated. The beetles moved to Europe (recording Portugal in 2004 and Italy in 2014), but it is now eradicated. It was first found in Asia in the Philippines in 2014, South Korea in 2016, and China in 2017 (Papach et al., 2023). Türkiye is a gateway spreading bee diseases from Asia to Europe and vice versa. The fact that no small hive beetles were found as a result of this research shows no risk of disease transmission from Türkiye to Europe or Western Asia.

The greater wax moth is a ubiquitous pest of honey bees. Problems occur in neglected hives due to beekeepers taking regular control programs (Akyol, 2013; Kwanda et al., 2017). In Türkiye, survey studies indicate that there are losses due to moths in honeycombs that are not stored under appropriate conditions (Sıralı & Doğaroğlu, 2005; Seven & Yeniar, 2010; Kösoglu et al., 2018). The pest also was recorded in 3% of randomly examined hives (Çakmak et al., 2003). Similarly, *G. mellonella* larvae were detected in 1.0% of healthy hives in the study, while no small wax was found. These results emphasize that in places where intensive beekeeping is practiced, such as Türkiye, galleries can cause severe economic losses if regular control programs are not implemented.

Bee lice have a worldwide distribution (Ellis & Munn, 2005), but it was reported in only two old cases in 1963 and 1976 in Türkiye (Oytun, 1963; Oğuz, 1976). Though there are many studies to detect parasites, especially *Varroa* sp. in Türkiye (Balkaya et al., 2016; Gürler et al, 2024), *Braula* sp. was not found after the 1980s. Similarly, no bee lice were recorded in this national comprehensive study in Türkiye.

In conclusion, it is the first comprehensive national study in Türkiye to determine pests (particularly small hive beetle, *Aethina tumida*) of European honey bee hives. No small hive beetle was found in any 1199 *Apis mellifera* colonies. Only the great wax moth larvae were detected. There is still no risk of Türkiye transmitting small hive beetle to neighboring countries and Europe.

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Authors' Contribution

ATG: conceptualization, methodology, investigation, writing-original draft, writing-review and editing.
RA: writing-original draft, writing-review and editing.
YB, ET, RB, MS, ED, Hİ, ÖT, YC, HTÖ, HU, AS, BMD, GE, YG, SU & HHO: investigation, data curation.

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