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VARROA MITE BIOLOGY AND FEEDING DAMAGE

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Order: Mesostigmata

Family: Varroidae

Species: *Varroa destructor* (Anderson & Truman)

Varroa mites are one of the greatest threats faced by beekeepers today. This fact sheet will explore the biology, lifecycle, and damage caused by Varroa mites. To learn more information about managing and treating Varroa mite infestations, see the accompanying Varroa Mite Sampling Methods - (https://www.pubs.ext.vt.edu/ENTO/ENTO-332/ENTO-332.html) and Varroa Mite Management Methods - https://www.pubs.ext.vt.edu/ENTO/ENTO-333/ENTO-333.html fact sheets.

DESCRIPTION AND BIOLOGY

Varroa mites are the most destructive pest of European honey bees (*Apis mellifera* L.), and they have become increasingly abundant in the United States since 1987. The Varroa mite lifecycle takes place in two stages: an adult travelling stage and a reproductive stage. The travelling stage is made up of only fertilized adult female mites, which are generally 1.1 mm wide and 1.6 mm long. They are also reddish-brown in color, oval shaped, and covered in small hairs (setae) that help them stay attached to their hosts.

Figure 1. Adult female Varroa mite on the thorax of a worker bee.

During the travelling stage, Varroa mites cling to the body of their host (Figure 1) and prefer to stay on nurse bees, which have the most access to bee brood. This access is important, since Varroa mites lay their eggs in brood cells. The travelling stage can last for months and is believed to be important to the mite reproductive process by allowing for spermatozoa activation. The reproductive stage begins when a travelling female mite drops off of her host and into an uncapped brood cell. This adult female will then hide in brood food at the bottom of the cell and wait 60-70 hours for the cell to be capped. She will then lay one unfertilized male egg. After the male egg, a fertilized female egg is laid approximately 30 hours later. Other female eggs follow at 26-32-hour intervals. The male egg is laid first because males take approximately 6.6 days to mature, while females mature over approximately 5.8 days. After hatching from their eggs, the mites go through two developmental stage (protonymph and deutonymph). During

development, they feed on the fat body of the bee pupa, not the hemolymph (insect blood) as previously thought. The fat body of a bee functions like a human liver and has a vital role in the honey bee immune system, as well as overwinter survival. Once they reach adulthood, the male Varroa mite will mate with its sister mites. Male Varroa mites can be distinguished from females by their more rounded body shape, longer legs, and smaller body size (0.700 mm wide and 0.715 mm long). When the adult bee leaves the cell, mature female mites and the mother mite will exit on their new host. The remaining male and immature female mites die in the abandoned cell. Varroa mite females may reproduce up to seven times, laying 30 eggs throughout their lifetime (Figure 2).

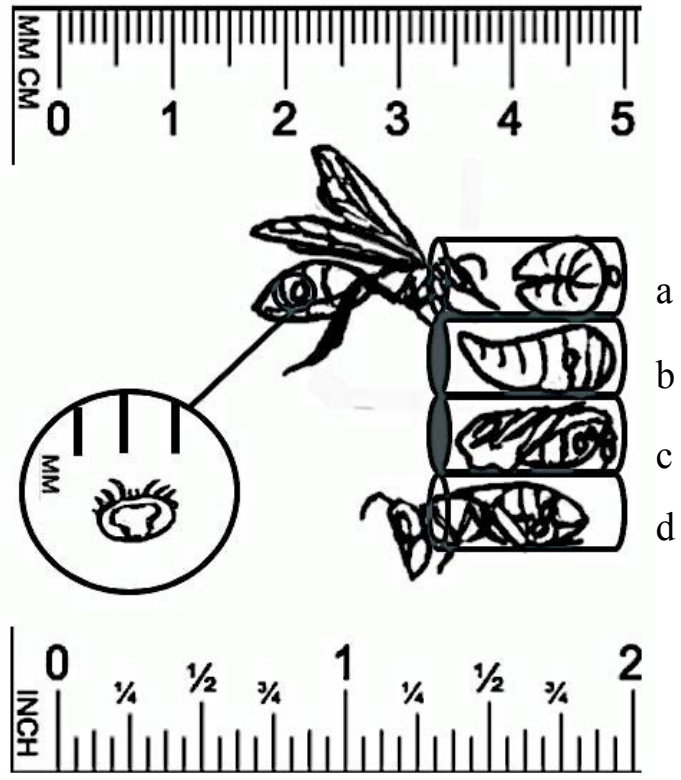

Figure 2. The Varroa mite life cycle occurs in conjunction with the honey bee reproductive cycle. The mother mite enters an uncapped brood cell via a nurse bee (a). She then begins to feed (b) and lays her eggs, which mature and mate (c). As the adult bee emerges, the mother mite and mated adult females exit on their host (d).

HOST PREFERENCE AND DAMAGE

The original hosts of Varroa mites were Asian honey bees (*Apis cerana*), which are better able to resist to these mites than the European honey bees. This difference stems from the fact that the Asian honey bees interacted with Varroa mites for many years, allowing them to develop defenses that are absent in European honey bees. Asian honey bees efficiently groom off and remove mites from their hives. They also successfully uncap, remove, and entomb infested brood during mite reproduction. Additionally, Varroa mites are highly limited in reproductive ability when residing in Asian honey bee colonies, as they can only successfully reproduce in Asian honey bee drone brood. It is suspected that Varroa mites spread to European honey bees through queen and colony transport from Asia into Europe in the early 1970s. Varroa mite damage was observed in eastern and western Europe, North Africa, and most of South America, by 1975.

Figure 3. Apparent symptoms of deformed wing virus (DWV), which is one of the many viruses transmitted to bees through Varroa Mites. The worker on the left does not show any outward symptoms but is from the same hive as the other two bees with obvious symptoms.

Varroa mites feed on the honey bee fat body, which weakens host immunity and ultimately impacts bee nutrition, playing an important role in colony overwintering success. Additionally, Varroa mites are also known to transmit numerous viruses. Of the 18 known honey bee viruses, six are of primary concern, including: Deformed Wing Virus (DWV), Black queen cell virus

(BQCV), Sac brood virus (SBV), Kashmir bee virus (KBV), Acute bee paralysis virus (ABPV), and Chronic bee paralysis virus (CBPV). However, DWV is now the most frequently observed of these viruses. The prevalence of DWV has caused the identification of European honey bees with symptomatic DWV to be a key indicator of Varroa mite infestation. Aside from the wing deformities that characterize this virus, symptoms of DWV can also include paralysis, abdominal bloating, early death, and learning deficiencies. However, it has been observed that over 99% of bees with DWV are asymptomatic (no wing deformities), making it difficult to grasp disease prevalence in the hive until it is too late. Because DWV can also replicate in European honey bees, it can be passed to eggs through the ovaries and spermatheca of infected queens and drones, and to larval stages through contact with infected nurse bees. Visible infection with DWV is significantly more prevalent in temperate climates, and this virus is thought to be generally responsible for heavy overwintering colony losses. In order to most effectively monitor and control Varroa infestations, it is important to sample to test the severity of the infestation (see Varroa Mite Sampling Methods fact sheet - https://www.pubs.ext.vt.edu/ENTO/ENTO-332/ENTO-332.html) and follow this information with informed management decisions (see Varroa Mite Management Methods fact sheet - https://www.pubs.ext.vt.edu/ENTO/ENTO-333/ENTO-333.html).

USEFUL REFERENCES

Ramsey, S.D., Ochoa, R., Bauchan, G., Gulbronson, C., Mowery, J.D., Cohon, A., Lim, Joklik, J., Cicero, J.M., Ellis, J.D., Hawthorne, D., & vanEngelsdorp, D. 2018. *Varroa destructor* feeds primarily on honey bee fat body tissue and not hemolymph. *Proceedings of the National Academy of Sciences of the United States of America*, https://www.pnas.org/content/116/5/1792.

Honey Bee Health Coalition. 2018. Tools for Varroa Management a Guide To Effective Varroa Sampling & Control, 24. https://honeybeehealthcoalition.org/wp- content/uploads/2018/06/HBHC-Guide_Varroa_Interactive_7thEdition_June2018.pdf.

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