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Infestation Rate of Varrosis at *Apis mellifera* Apiary in Central Java, Indonesia

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Abstract | Varroosis is a disease caused by the ectoparasite which infects *Apis mellifera* worker, drone, queen, larvae, and pupae, causing lower survival rates and colony density. Varroa mite is the most destructive parasite of honey bees worldwide, inflicting much greater damage and higher economic costs than all other known apicultural diseases. The aim of this work was to estimate the level of infestation of bee samples infested with Varroa in *Apis mellifera* apiary. Sample collection and investigation in the area were carried out in Central Java province, Indonesia. The results showed that the highest level of mite infestation in positive samples was 14%. Most of the bee samples had a low degree of invasion, less than 5% in 71%, and between 5 to 20% were in 29%. Varroa mite infestation is a serious threat to honey bee colonies worldwide. Bees infested with Varroa mites are often weakened and less able to perform essential tasks such as foraging, brood rearing, and defense. Understanding the mite's level infestation spread is crucial for beekeepers to implement effective monitoring and control strategies.

Keywords | Varroa, Varrosis, Infestation rate, *Apis mellifera*

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INTRODUCTION

The Varroa is an external parasitic mite that infest honey bee colonies. It causes Varroosis disease of larvae, pupae, and adults of honeybee *Apis mellifera*. Varroosis is considered a major disease that threatens beekeeping worldwide. This mite causes the weakening of bees and the decline in the health of bee colonies and wounds caused by this ectoparasite are the entry point for other pathogenic agents (Lannutti *et al*., 2022). Varroosis increases the risk

of honeybee collapse. Colony collapse disorder is a major problem for agriculture and beekeepers because it mostly affects honey production and pollination (Shah *et al*., 2025).

Four different species of the new genus Varroa were identified in many countries that affect honey bee species in most regions of the world (Dietemann *et al*., 2013). There are *Varroa jacobsoni*, *Varroa underwoodi*, *Varroa rindereri* and *Varroa destructor* (Fanelli and Tizzani, 2020). *Varroa destructor* is the most destructive mite to *Apis mellifera* honeybee colonies worldwide (Abou-Shaara and Tabikha, 2017). Varroa mite invasion has detrimental physical, physiological and immune-depleting effects that allow pathogens to invade and multiply, and bee colonies infested with varroa mite will eventually collapse if left untreated (Zhu *et al*., 2022). Varroa mites parasitize both developing and adult bees and harm their hosts by feeding on their fat bodies (Ramsey et al., 2019).

Infestations of mite colonies can cause bees to lose weight, become deformed, or lose limbs, and sometimes even kill young bees. Varroa is one of the most important hive pests and causes irreparable damage to the beekeeping industry (llabergenova *et al*., 2021). Varroa is biological vectors for several important viruses that infect honeybee, including Deformed Wing Virus (DWV), Kashmir Bee Virus (KBV), Acute Bee Paralytic Virus (ABPV), and Slow Bee Paralysis Virus (SBPV). The most well-known DWV infection causes characteristic wing paralysis and a shortened abdomen (Lannutti *et al*., 2022). Varroa are the most destructive ectoparasites of honeybees. Varroa mite infestation has detrimental physical, physiological, and immune-suppressing effects that allow pathogens to attack and multiply, and bee colonies infested with varroa mites will eventually collapse if left untreated (Zhu *et al*., 2022). Honeybees infected with parasites often show signs of weight loss, reduced body size, shorter life expectancy, behavioral changes, and wing defects (Bava *et al*., 2022).

The *Varroa destructor* greatly impacts the pollination and beekeeping industries as a decrease in honey production (Shah *et al*., 2025). Honey has some effect, it has the highest antimicrobial activity (Wardani *et al*., 2024). Honey also have exhibited cytotoxicity effect in cancer cell lines (Arung *et al*., 2021). Researchers prove that honey can have a positive effect on malnourished male rats (Erlangga *et al*., 2023), has the potential to increase the intestinal villi due nutritional deficiencies (Listyorini *et al*., 2021), can maintain the leydig cells as a preventive substance against Toxoplasma gondii (Fitri *et al*., 2019), had a significant effect on the growth of white snapper seeds (Listyorini *et al*., 2021) and the bee propolis can repair hepatocyte cells (Rahmani *et al*. 2019) but honey could not maintain the calcium level of Wistar rats (Rohmah *et al*., 2023).

The mite life cycle has two stages: the phoretic phase on the adult bee and the reproductive phase in the capped brood cells (Hlaing *et al*., 2023). The phoretic phase, also known as the dispersal phase (Trynor *et al*., 2020). The phoretic phase only concerns the female mite, which uses the adult bee as a transportation vector and food source. During this phase, bees unintentionally take part in the spreading of Varroa within and between honey bee colonies (Noel *et al*., 2020). The reproductive phase where the mites parasitise drone or worker larvae just before cell-capping and reproduce within the sealed drone and worker brood cells (OIE, 2021). The aim of this study was to estimate the level of infestation of bee samples infested with Varroa mite.

MATERIALS AND METHODS

The methods were used of Chapter 3.2.7 (OIE Terrestrial Manual, 2021) for Varrosis of honeybee. The bees of each sample were removed from the freezer, defrost, placed in a container with industrial alcohol and stirred continuously for around 5–10 minutes. Then the bees were separated from the mites by a sieve with a mesh size of approximately 2–3 mm. The percentage of infestation level was calculated by following formula: % V. destructor = (Number of foretic mites/ number of adult bees) x 100.

Sample collection

Samples were collected from 22 apiaries. The collection of Varroa samples from worker bee colonies was done using sugar roll method, sample of about 300 bees per colony was placed in jars containing sugar and then Varroa mites were separated.

RESULTS

The results of the laboratory analyses are shown in Figure 1. The adult female varroa mite has four pairs of legs and an oval body shape. The mites are brown in color and have setae around the body.

Figure 1: A female Varroa mite.

Table 1: The Varroa infestation level state and regions.

Apiary location	Bee farm	n Mites	Percentage of infestation (%)
Muntilan	A	10	3,3
Gunungkidul	B	7	2,3
Grobogan	C	6	2
Karangjati ungaran	D	18	4,3
Derekan ungaran	E	32	10,3
Gunungpati semarang	F	12	4
Bergas semarang	G	9	3
Nglorog temanggung	H	13	4,3
Guntur temanggung	I	72	14
Nglorog temanggung	J	27	9
Kandangan temanggung	K	14	4,7
Rejosari temanggung	L	16	5,3
Piyatak temanggung	M	6	2
Genting temanggung	N	5	1,7

Infestation of Varroa mite in Apis mellifera apiaries (Table 1) in the phoretic or dispersal phase. The highest degree of colony infestation was on the bee farm (I) in Guntur, Temanggung, with a value of 14% and the lower degree is 1.7% on the bee farm (N) in Genting, Temanggung. Infestation level of Varroa mite in positive bee samples from Apis mellifera apiaries (Figure 2) in Central Java, Indonesia. The number of Varroa infestations is higher by 14%.

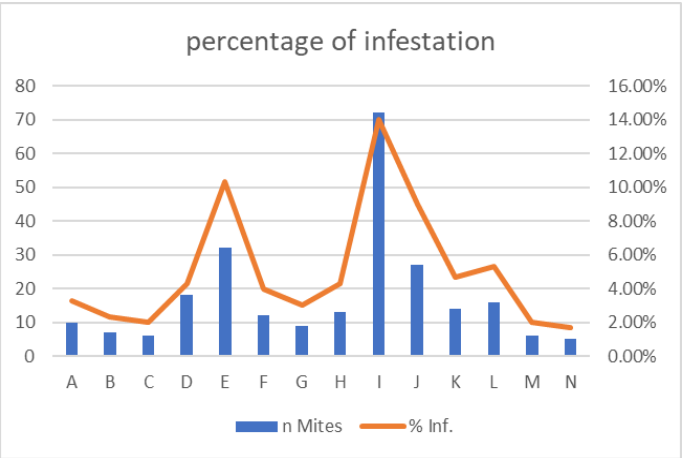

Figure 2: Infestation level of Varroa mite in positive bee samples.

Map of Varrosis in an Apis mellifera bee farm (Figure 3) in Central Java, Indonesia. Blue spot is a low percentage of varrosis, and red spot is a medium percentage of varrosis.

DISCUSSION

In our investigations, it was found that the varroa mite is brown in color and oval body shape. Female mites are reddish-brown in color, large, oval-shaped, 1.1 mm long, 1.6 mm wide, and visible to the naked eye (Hornitzky, 2010). Adult females are about 1.5 mm in width and reddish-brown in colour, whereas males and female nymph stages are smaller and cream or white in colour (Dietemann *et al.*, 2013). Varroa mite also has setae around the body. Setae were distributed along the segments, appearing in two distinct sizes: large setae with a thick, spine-like appearance resembling sensilla chaetica and smaller, thinner setae resembling trichodea sensilla. The Varroa destructor female mite is a dark reddish/brown colour and has a flat, oval-shaped body approximately 1.1 mm in length × 1.5 mm in width × less than 0.5 mm in height, covered with setae (OIE, 2021).

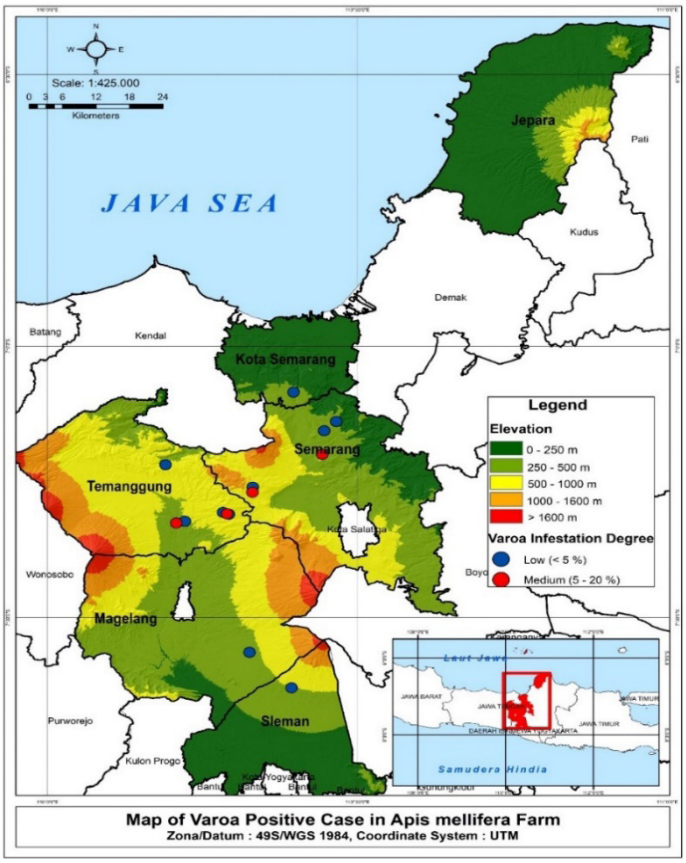

Figure 3: Map of varrosis in *Apis mellifera* bee farm.

Observation of Varroa mites using a microscope it was found that the mite has four pairs of legs at the ventral part of the Varroa mite. They have four pairs of legs with triangular tips. The body of a mite is divided into two parts: there is an idiosoma and gnathosoma on the anterior part of the mite. The idiosoma consists of a dorsal shield and a distinct ventral shield. Female mites have an ellipsoidal idiosoma that is flattened with a width greater than its length. The dorsal and ventral parts of the varroa mite are sclerotized and have a reddish brown color. There is a thin, flexible membrane between the shields that allows the mite to expand during feeding and egg formation (Rosenkranz *et al.*, 2010).

The Varroa Infestation Level (VIL) was described for each sample based on the number of mites identifed, with the results shown in Table 1. The highest colony infestation rate was recorded at (I) bee farm in Guntur, Temanggung, with a value of 14% and 72 mites. The lowest colony infestation rate was recorded at (N) bee farm in Genting, Temanggung, with a value of 1.7% and 5 mites. Other farms reported varying levels of infestation.

The categories of colony infestation levels are divided into three levels there are low (less than 5%), moderate (5-20%), and high more than 20% (Salkova *et al*., 2017). Based on these categories, the degree of varroa infestation level in honey bee farms shows that 10 farms (71%) was the low infestation category and 4 farms (29%) was the moderate infestation category. No farms were found to fall into the high infestation category.

Although most bee samples have low to moderate levels of infestation, beekeepers need to control Varroa infestation of their colonies. Methode control may differ due to variations in the laws governing the use of chemicals (Noel *et al*., 2020) and the use of anti-varroa drugs in accordance with regulations (Salkova *et al*., 2017).

CONCLUSIONS

In conclusion, this study provides valuable information and significant insights into the Varroa mite infestation. Moderate infestation level of varroa mite was 71% and low infestation level was 29%. The highest level of infestation varroa mite in the positive samples is found in Guntur, Temanggung with 14%.

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NOVELTY STATEMENT

Infestation levels of the Varroa mite in this area have never been investigated.

AUTHOR'S CONTRIBUTION

SMPPM and LTS designed the experiment. SMPPM, IR, and LTS conducted the research. AP design the map. PH, MHE, and ES reviewed the final manuscript. All authors approved the final submission of the manuscript.

Generative AI and AI-assisted technology statement

The authors declare that no Genrative AI was used in the creation of this manuscript.

Conflict of interest

The authors have declared no conflict of interest.

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