

***Varroa destructor* (Acari: varroidae): Prevalence in three Peasant Associations of Wukro District, Tigray Region, Northern Ethiopia**

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Abstract: A cross sectional study was conducted from November 2008 to March 2009 to determine the occurrence and infestation rate of varroa mite on bee colonies of three peasant associations (PAs) of Wukro District: Genfel, Adikisandid and Aynalem containing 51 households and owning about 805 honeybee colonies. The total sample size was determined to be 384, which was proportionally allocated to the studied PAs. The overall prevalence of *Varroa destructor* infestation recorded were 40% in the brood and 35% in adult honey bees. The rate of mite infestation in the brood and adult bees of the three peasant associations were 40%, 35% at Genfel, 42.7%, 37.8% at Adikisandid and 38%, 33% at Aynalem, respectively. Statistically no significant variation was observed in the prevalence of varroa infestation between brood and adult bees as well as among the three PAs ($p > 0.05$, $\chi^2=0.279$). The high prevalence of varroa infestation on both brood and adult bees at all the three PAs need to be considered a huge threat to beekeeping, honey production and crop production of the area unless an appropriate management practices is immediately instituted to minimize the well-known weakening and devastating effect of varroa mite on honey bee colonies, honey production and crop pollination dependent on honey bees.

Key words: Prevalence • *Varroa destructor* • Honey Bee Colony

INTRODUCTION

Diseases and parasites are causing major problems in beekeeping all over the world [1]. One of the most economically important parasitic mites with great damage to bees and beekeeping was *Varroa destructor* [2]. The varroa mite had infested European honey bees (*Apis mellifera*) almost world-wide, after it had switched-host from its native Asian bee host (*Apis cerana*) some 50 years earlier [1]. The varroa mite is an external parasite that feed on adult bees by puncturing the abdominal integument and sucking hemolymph (blood) [2, 3]. In addition to the obvious effects of mites feeding on developing and adult bees, the mites can also serve as transmitters of several viruses that can kill the bees. These secondary infections are facilitated when the mites compromise immune system of the bees. They can cause condition known as parasitic mite syndrome which can kill

colonies within months of infection [2]. Heavy *Varroa destructor* infestation may cause absconding and if left untreated will eventually kill all bee colonies [2, 4]. In addition to honey production, honey bees serve as pollinators, which is considered to be extremely important and without honey bees the range of food products will dramatically diminish [5]. The huge negative impact of varroa on honey bee colonies with a serious consequence in reduction of honey production and a decrease in pollination of a range of horticultural crop and plants, calls for very careful vigilance and management to detect and prevent spread of mites before their population increases to detrimental levels. However, despite huge economic losses due to honey bee mites, published studies on honey bee mites are very few in Ethiopia. Therefore, the objective of this paper was to determine the prevalence of mite infestation on honey bees of selected PAs of Wukro District.

MATERIALS AND METHODS

Study Area: The study was conducted at three peasant associations found in Wukro District of Eastern Zone of Tigray Regional State: Genfel, Adikisandid and Aynalem. The peasant associations were selected based on accessibility and practicing bee keeping. Wukro District also known as Kilde Awlaelo is one of the 36 Districts in Tigray Region of Ethiopia. Wukro, the District town, is located at a distance of 825 km North of Addis Ababa and 45 km far from the regional city. The District is located in the area stretching from 13°33'–13°58' North latitude and 39°18'–39°41' East longitude with elevation ranging from 1760 to 2720 meters above sea level. The District has two main rainfall seasons: The short rains from April to May and the main rains from June to Mid September. The average rainfall is 450 mm per annum with a range of 217.3 to 638.4 mm per year. The mean annual temperature ranges from 17 to 23 degree centigrade. The District is made up of 17 Peasant Associations [6].

Study Design and Population: Across sectional study was conducted from November 2008 to March 2009 in Wukro district to determine the prevalence of mite infestation on bee colonies of the area. From 17 peasant associations, three peasant associations containing 51 households and owning about 805 honeybee colonies were selected purposively. Proportional sampling method was used to fix sample size for each peasant association.

Sample Size Determination: Sample size was calculated according to the formula of Thrusfield [7] taking 50% expected prevalence, Z value of 1.96 at 95% CI and 5% margin of error that gives the maximum possible sample size for an area where there is no prior information with regard to varroa mite infestation rate on honey bee colonies of the area. Accordingly, the sample size was determined as:

$$n = \frac{1.96^2_{(p)(1-P)}}{d^2}$$

where, n=sample size, P=50% expected prevalence, d=5% margin of error. Therefore, the study was conducted on 384 honey bee colonies. Proportional sampling method was used to allocate sample size for

each PAs based on the total honey bee colonies found in each PAs and then farmers were sampled by simple random sampling method.

Sample Collection and Examination: Fifty to hundred adult honey bees from each hive (bee colonies) were collected by brushing the bees off the comb through a large mouthed funnel or directly in universal bottle and brought to Mekelle Regional Laboratory, Parasitology Department. Mites were then collected from adult bees by shaking the bees with 70% ethanol to dislodge them from the bee as recommended by De jong *et al.* [8]. The alcohol killed the bees and preserved the mites for the purpose of the study. The mites were separated from the bees by sieving out the bees through a wire screen of 8-12 mm mesh size and strain the alcohol through cotton cloth. The cloth was then examined for mites. Brood examinations were done by random opening of 50 to 100 brood cells. The brood was removed from the cell with some forceps and the cell was inspected for the presence of mites using hand lenses or by naked eye. Finally, the mites were examined under a microscope at lower magnification setting to differentiate mites from lice. Bee louse (*Bruala coeca*) resembles *Varroa destructor* in size and color; however, being an insect, *Bruala* has six legs that extend to the side. *Varroa* mites look like small brown sesame seeds with eight legs [5].

Data Analysis: Collected data were analyzed using descriptive statistics and chi square test by SPSS version 16 software.

RESULTS

Prevalence of *Varroa destructor*: The study was conducted on the prevalence of mite infestation of brood and adult bee in the three peasant association of Wukro District. The overall prevalence of mite infestation recorded were 40% in brood and 35% in adult honey bees. The mite species identified from external body of bees was *Varroa destructor*. The rate of mite infestation in the brood and adult bees of the three peasant associations of Wukro District were 40%, 35% in Genfel, 42.7%, 37.8% in Adikisandid and 38%, 33% in Aynalem, respectively. There was no statistically significant variation in mite infestation either between brood and adult bees or among the three PAs ($P > 0.05$).

Table 1: The prevalence of varroa mite infestation of brood and adult honey bees in Wukro District

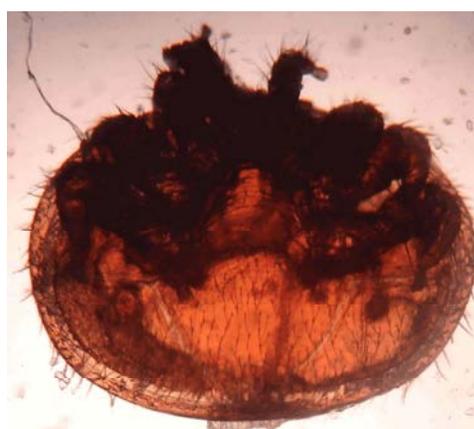
Types of bee	Total No of hives examined	No (%) positive	Statistical test
Brood	384	156/384(40)	$\chi^2=0.279, p>0.05$
Adult	384	136/384(35)	

Table 2: Prevalence of varroa mite infestation of brood and adult bee in each peasant association of the study area

Study site	No of total hives examined	No (%) positive	$\chi^2 =0.279, p > 0.05$
Genfel	Brood = 120	48/120 (40)	
	Adult =120	42/120 (35)	
Adiksandid	Brood = 164	70/164 (42.7)	
	Adult =164	62/164 (37.8)	
Aynalem	Brood =100	38/100 (38.0)	
	Adult =100	33/100 (33)	



(A) Dorsal view



(B) Ventral view

Fig. 1. *Varroa destructor* isolated from honey bees of Wukro District

DISCUSSION

The present study revealed mite infestation rate of 40% on the brood and 35% on adult honey bees in the three peasant association of Wukro District during the period from November 2008 to March 2009. No research finding was reported on the prevalence of mite infestation in Ethiopia before this study period. Survey to investigate the presence of varroa mite in Ethiopia by FAO in collaboration with ministry of agriculture during 1988 revealed that the country was free from the suspected parasitic mite until that period. Recently, Mezgebu *et al.* [9] had reported 100% prevalence of *varroa destructor* infestation in both brood and adult honey bees in a study conducted at six PAs of Walmara District, central Ethiopia. Begna [10] also reported 82% (164/200) in adult bee colonies and 64% (47/73) in brood bee colonies in a study conducted at 10 districts (Alamata, Endamehoni, Enderta, Kilete Awulallo, Atsbi, Ganta Afshum, Aferom, Adwa, Axum and Shire Endasilase) of Tigray region, where all the ten sampled districts and sites were tested positive for varroa mites. In his study, Begna [10] sampled

20 honey bee colonies from two sites (specific area names not mentioned) and recorded 100% infestation of honey bee colonies by *Varroa destructor* at Kilete Awulallo (Wukro) district, which is the same district where this study was conducted. The observed prevalences of 44% in North Carolina [2] and 50% in Tunisia [11] were also slightly higher than the prevalence recorded in this study. The higher prevalence of *Varroa destructor* recorded by Mezgebu *et al.* [9] and Begna [10] as compared to this study might be attributed to the difference in agroecology or the number of honey bees sampled per colony. Begna [10] sampled 150 to 200 adult honeybees from each honey bee colony and Mezgebu *et al.* [9] sampled approximately 200 to 300 worker bees whereas only 50 to 100 adult honey bees and brood cells were sampled for this study. As the number of sampled bees and brood cells increase, the chance of detecting the parasite might increase as the above study findings suggest. Seasonal variation was also recorded in the numbers of mites found in honeybee colonies where fewest mites were found in spring, increasing over the summer to a high point in the fall and then falling off over winter to a low point in the spring [2].

Lower *Varroa spp* mite population recovery was also reported in the drier months of January and March attributed to lower brood rearing during dry season [12]. Begna [10] conducted the study during the fall season from October to November 2010, during which the numbers of mites reach high point whereas this study was conducted from November 2008 to March 2009 extending to a period when the mite number is expected to dwindle down, which might have also contributed to lower detection rate. Although Mezgebu *et al.* [9] conducted almost during the same season as this study and recorded 100% infestation of bee colonies; the agroecology of his study area is quite different in being located at much higher altitude and receiving twice as much rainfall than the current study area. Levels of Varroa mites were positively correlated with elevation, with colonies at higher elevations having significantly higher average numbers of Varroa spp infestation [13]. The high prevalence rate of varroa mite infestation observed in this study as well as by Mezgebu *et al.* [9] and Begna [10] may be suggestive of that the mite might have been introduced long ago either with legally or illegally imported bred queens from foreign countries and now well established itself in Ethiopia undetected.

CONCLUSION

This study conducted to assess the prevalence of mite infestation on brood and adult bees of three selected PAs of Wukro district revealed the presence of real threat to beekeeping and honey production of the area. The high prevalence of *varroa destructor* infestation on both brood and adult bees of the three PAs is terrible problem to beekeeping and honey production practice of the area unless an appropriate management practices is instituted to minimize the well-known weakening and devastating effect of *Varroa spp* mite infestation on bee colonies. The problem of *Varroa destructor* infestation of honey bee colonies will not only affect honey production but it will also negatively affect production of crops dependent on honey bees for pollination. Therefore, further aggressive surveys or researches should be conducted in wider honey producing areas of the country to map infected and free areas in order check and prevent the spread of the mite to unaffected regions. Further studies also need to be conducted on susceptibility and genetic resistance of local honey bee colonies to *Varroa spp* infestation in order to serve generate valuable information to withstand future challenges on beekeeping sector of Ethiopia.

ACKNOWLEDGMENTS

The authors would like to thank Jimma University College of Agriculture and Veterinary Medicine for the provision of the needed financial assistance to conduct the study. The authors would also like to extend their commendation to all bee keepers involved in this study for letting their property be accessed for this research and for sacrificing their valuable time to provide the required information.

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