Short Communication

Prevalence and Epizootical Aspects of Varroasis in Golestan Province, Northern Iran

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Abstract

Background: The *Varroa destructor* mite is considered as a major pest of honey bees *Apis mellifera*. The rapid spread of *Varroa* mites among bee colonies may be due to several factors, including drifting of infested bees, movement of bee swarms, and robbing of weakened colonies. Disease spread and predisposing the infested bees to other diseases lead to high economic losses in beekeeping industries. The aim of this study was to determine the prevalence of and evaluate some managing factors in Golestan Province in Iran in 2008.
Methods: According to the records of Agricultural Research Center, 80 infested beekeeping centers identified and a questionnaire consists of managing factors for each center has been designed. All data were recorded and analyzed by SPSS software to calculate χ^2 test.
Results: Among 80 apiculture centers, 72 centers (92%) were infested to *Varroa* and hive density of 90.6% of the centers was 31–60 hives in one center (P= 0.324). All of the apiculture centers had more than 6 km distance to nearest beekeeping center (P= 0.687). Amongst bee keepers 15(93.8%) had low literacy level (P= 0.479) and 26(89.7%) had 5–10 years experience in beekeeping (P= 0.953).
Conclusion: We can conclude that because of the high prevalence of the disease, the usual methods of prevention are not effective. This high prevalence emphasizes that we are very far from a solution for *Varroa* infestation and extra researches on mite biology, tolerance breeding, and *Varroa* treatment is immediately required.

Keywords: *Apis mellifera*, *Varroa destructor*, Honey bee, Iran

Introduction

The new worldwide distributed and hemophagous mite *Varroa destructor* is considered as a main pest of honey bees *Apis mellifera*. Before year 2000, *V. destructor* was understood to be *Varroa jacobsoni* (Anderson and Trueman 2000) which successfully shifted from the original host, *A. cerana* to the Western honey bee, *A. mellifera*. (Rath 1999). The details of the host shifting phenomenon are unclear. *Varroa destructor* acts as a vector of different bee viruses. Until now 18 different viruses have been identified in honey bees (Chen and Siede 2007). Numerous of bee viruses can be transmitted by *V. destructor* such as Acute Bee Paralysis Virus (ABPV), Israeli Acute Paralysis Virus (IAPV), Kashmir Bee Virus (KBV), Sacbrood Virus (SBV), and Deformed Wing Virus (DWV) (Boecking and Genersch 2008). Before the appearance of *Varroa* mites in *A. melifera*, viral diseases were minor troubles for honey bee health (Allen et al. 1986, Bailey and Ball 1991, Bowen-Walker et al. 1999, Yue and Genersch 2005). At a short time *V. destructor* has worldwide geographical distribution and we can not find a country free of this disease rather than Australia. The economic burden of this ectoparasite is high. Disease

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distribution and predisposing the infested bees to other diseases lead to high economic losses in beekeeping industries. In addition, *Varroa* mite may intensify the problems of pollination in future time (De la Rua et al. 2009).

Varroa females start to reproduce by entering the brood cells of last-stage worker or drone larvae, normally within 20–40 hours before the cells are sealed (Boot et al. 1992). About 60 h after the bee cell is capped; the adult female mite puts her first egg and can produce over 10 progeny (Sammataro et al. 2000). The adult female mite and progeny feed on the hemolymph of pupae from a single feeding site (Kanbar and Engels 2003). All reproduction of *Varroa* occurs in the brood cells, and only the adult females survive after the bee emerges. Some immature females, eggs (rarely), and males are left and removed by the nurse bees when the bee emerges. *Varroa* mites suck the hemolymph from adults and developing pupae of honey bees, thereby weakening the bees and reduction their life length. The rapid spread of *Varroa* mites among bee colonies is due to a number of factors such as drifting of diseased bees, movement of bee swarms, and robbing of weakened colonies (de Jong 1997). In addition, migratory beekeeping practices and the importation of infested bees lead to rapid distribution of *Varroa* mites (Sammataro et al. 2000).

Application of synthetic acaricides has been the main way for controlling the pest. But the intensive use of many chemical substances against the mites resulted in the increase of resistance and decrease of their efficiency (Milani 1999) and contamination of products such as honey and beeswax (Wallner 1999). The problems of chemical acaricides encourage the scientists to find new and safer ways control of *Varroa*. Natural products such as essential oils offer a highly desirable alternative to synthetic products. These substances are used increasingly because they are generally inexpensive and have fewer health hazards to both man and honeybees (Isman 2000). Various alternative ways for managing the mite have been investigated (Imdorf et al. 1995, Fries 1997, Thomas 1997, Calderone 2005). Most of them are suggesting non-chemical methods for reaching lower occurrence of mite infestation in beehives (Imdorf et al. 1999). One of these non-chemical methods is use of formic acid that has received great consideration because of its activity against *V. destructor* (Calderone 2000, Currie and Gatien 2006).

Based on the veterinary organization protocol in Iran the bee hives with ≤ 5% infestation of *V. destructor* must be treated with standard treatments such as Formic Acid®, Api Life Var®, Apiguard®, Apistan® and Apivar®.

The objectives of this study were to determine the prevalence of *V. destructor* and evaluating the effect of the hygienic factors in infestation rate in Golestan Province of Iran. This province with temperate and wet macro climate is one of the most important sites of beekeeping industry in Iran.

Materials and Methods

All beekeeping centers were identified in Golestan Province according to the information of the Agricultural Research Center. Due to protocol of the Iranian Veterinary Organization, *Varroa* sampling was done every season and 5% of hives in each beekeeping center were investigated. Beehives with less than 5 honey-combs were excluded from sampling. A questionnaire consisted of managing and hygienic factors were filled for each beekeeping center. Questions included distance to the nearest apiculture center, altitude of apiculture center from the sea level, use of guard wall around the beekeeping center, migration situation, numbers of hives, the height of hives from the ground, distance between hives, disinfection procedures, and methods to provision of pollen, wax, apiculture equipments, queen and water supplying. Literacy and experience levels of bee keepers were asked also.

All data were recorded and analyzed by SPSS software version 15 to calculate χ2 test and fisher exact test. *P* values less than 0.05 were considered as significant level.

Results

Among 80 apiculture centers, 72 centers (92%) were infested by *Varroa* mite. The hive density of 90.6% of centers was 31–60 hives/ center (P= 0.324). All of the apiculture centers had more than 6 km distance to nearest beekeeping center (P= 0.687). Fire have been used to disinfect the equipments in 54 (90%) of studied centers (P= 1.000). Fifty eight infected centers (90.6%) had migrated beehives (P= 0.657).

Amongst beekeepers 15(93.8%) had low literacy level (P= 0.479) and 26(89.7%) had 5–10 years experience in beekeeping (P= 0.953).

In Table 1 the association between *Varroa* infestation of beekeeping centers and the altitude of apiculture center from the sea level, the height of beehives from the ground, distance between beehives and use of guard wall around the beekeeping center, have shown.

The methods for provision of pollen, wax, apiculture equipments, queen and water supply have been shown in Table 2 and their relations with varroasis are in the same table.

Table 1. The relations between varroasis and the altitude of apiculture center, the height of hives, distance between hives and use of guard wall

Varroasis	Variables	Positive	Negative	*P* value
Altitude of apiculture center	≤800m	47(90.4%)	5(9.6%)	P= 1.000
	>800m	25(89.2%)	3(10.8%)	
Height of hives from the ground surface	10–25cm	69(89.6%)	8(10.4%)	P= 0.0284*
	26–40cm	3(100%)	0(0%)	
Distance between hives	≤50cm	63(90%)	7(10%)	P= 1.000
	>50cm	9(90%)	1(10%)	
Use of guard wall	Yes	19(79.2%)	5(20.8%)	P= 0.0485*
	No	53(95%)	3(5%)	

*P< 0.05 is significant

Table 2. The relation between varroasis and the use of pollen in apiculture, source of pollen, water, wax, equipments, and queen

Variables	Varroasis	Positive n (%)	Negative n (%)	P value
Use of additional pollen	Yes	62(89.8)	7(10.2)	P= 0.00011*
	No	10(91)	1(9)	
Purchase pollen from other apiculture centers	Yes	65(91.5)	6(8.5)	P= 0.2201
	No	7(77.7)	2(22.3)	
Purchase wax from other apiculture centers	Yes	58(89.2)	7(10.8)	P= 1.000
	No	14(93.3)	1(6.7)	
Purchase second hand equipments from other apiculture centers	Yes	24(92.3)	2(7.7)	P= 1.000
	No	48(88.9)	6(11.1)	
Purchase queen from other apiculture centers	Yes	32(84.2)	6(15.8)	P= 0.1414
	No	40(95.2)	2(4.8)	
Source of water	River	63(88.7)	8(11.3)	P= 0.0008*
	Non river	9(100)	0(0)	

*P< 0.05 is significant

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Discussion

According to the results, this high prevalence of infestation shows the high spread of *V. destructor* in beekeeping centers in Golestan Province. This occurrence is similar to other sites of the world that had reported, the eastern coastal region of the USSR in 1952, Pakistan in 1955, Japan in 1958, China in 1959, Bulgaria in 1967, Paraguay in 1971, Germany in 1977 (Ruttner and Ritter 1980), United States in 1987 (De Guzman and Rinderer 1999). Today, *V. destructor* has global distribution, but according to the reports published by Australian Government (http://www.daff.gov.au/qis/quarantine/pests-diseases/honeybees) it has not yet been found in Australia.

In this study we showed that heights of hive from the ground level associated to varroais prevalence. Distance from the ground surface can affect the humidity of brood cells and influence the mite reproduction. We found a significant relation between varroasis and use of additional pollen for hives in beekeeping centers. In addition we found that the infestation rate of bee-keeping centers that supply their water from the river are less than centers which provide water from other routs also use of guard wall around the apiculture center was related to lower infestation rate of *Varroa*. The micro-climatic conditions inside the colony are affected by outside factors including temperature, humidity or the accessibility of pollen and nectar. This may influence the proportion of non-reproducing mites (Eguaras et al. 1994, Garcia-Fernandez et al. 1995, Kraus and Velthuis 1997, Moretto et al. 1997).

According to the non-significant results of the effect of bee-keepers' literacy and experience level in prevention of disease, inefficiency of hygienic factors such as having suitable distance to other beekeeping centers and decreasing hive density in a center (number of hives), the altitude of apiculture center from the sea level and distance between beehives, it can be concluded that the usual methods of *Varroa* prevention are not effective. However the ways to provision pollen, bee wax, equipments, and queen had not any influence on *Varroa* infestation rate.

Use of *Varroa* tolerant honey bees and chemical and biological methods of *Varroa* treatments are suggested as important controlling ways. The control of mite reproduction is considered the most effective tool for the host to prevent the growth of a *Varroa* population within the colony (Fries et al. 1994).

However further exploration of mite biology in preparing control measures as well as using tolerant types and treatment especially by non-chemical substances are instantly needed.

Conclusion

Because of the high prevalence of the disease (92%), the usual methods of prevention are not effective and we should consider the new methods for *Varroa* control.

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