

Characteristics of honey bee colonies in Iran surviving Varroa destructor infestation

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Varroa mite an external parasite found throughout most of the world that attacks all life cycle stages of a broad range of bees. Varroa destructor sucks the blood from both the adults and the developing brood, weakening and shortening the life span of bees upon which they feed. until recently. Varroa destructor was thought to be a closely related mite species called Varroa jacobsoni. Both species mite the Asian honey bee, Apis cerana.

However, the species originally described as Varroa jacobsoni by Oudemans in 1904 is not the same species that also attacks Apis mellifera. The first report to Apis mellifera probably took place in the Philippines in the early 1960s, where imported Apis mellifera came into close contact with infected Apis cerana. In 2000, Anderson and Trueman had not identified Varroa destructor as a separate species. This late identification corrected some previous confusion and mislabeling in the Scientific literature Varroa destructor distributed on most continents in less than four decades.

Adult female mite are reddish-brown in colour, have eight legs and a flattened oval shape. Denmark et al. (2000) reports that the females measure 1.00-1.77mm long and 1.50-1.99mm wide. Their curved bodies fit into abdominal folds of the adult bee and are held there by the shape and arrangement of ventral setae (the stiff hairs on the abdomen). This protects them from the bee's normal cleaning habits. Adult males only occur in sealed brood and are yellowish with lightly tanned legs, a spherical body shape, and measure 0.75-0.91mm long and 0.71-0.88.

Scientific classification

Kingdom: Animalia

Phylum : Arthropoda

Class : Arachnida

Subclass : Acari

Order : Parasitiformes

Suborder : Mesostigmata

Family : Varroidae

Genus : Varroa

Species : Varroa destructor



Varroa destructor Female



Varroa destructor male

It was in 1978 that D.DE Jong, R.A.Mors and G.C Eickwort of the Department Entomology of the University Cornell in the USA published a title article: Mite pest of honey bees.Iran was' contaminated by Varroa mite, shortly after the beekeepers did not care about this parasite .In 1983, I wrote an article on varroa, filed with the Iranian veterinary organization to warn them of the risks involved. The following year, the sanitary or livestock status (with hive losses) decided the Ministry to initiate the fight against Varroa,for five decades Iranian beekeepers have had to deal with Vorroa mite.Various treatment were evaluated and Apistan® resistance population of Varroa emerged.

Varroa destructor is well known to beekeepers because in many countries it is the most common cause of death of Apis mellifera colonies.It was first found in Iran in the 1978,and we have been faced with this problem for five decades.Methods of controlling the Varroa mite have been investigated and several products are now approved for use.Since 1996 to up today difficulty in Iran as well as in other countries has been the development of resistance in Varroa to pyrethroids.This has led to high mortality of colonies worldwide,and we have therefore investigated various new control products on sale.

Iranian veterinary Organization purchased treatments for varroa destructor infestation from different firms(Bayer Healthcare AG ,Ciba-Geigy, Sandoz, Farmak-Achim, Alvetra,Vita Europe, Elanco,Veto-Pharma, Chemicals Laif.S.P.A,Primavet,BioVet AG,Bee Vital).in order to test their action on the parasites and effectiveness of different types of treatment: By inhalation (fumigation),absorption (systemic action) and contact (slow release) evaporation.Varroa infestation in Iran is serious,and table 1 lists the results of the treatment since 1983 to 2025.



Varroa destructor



Varroa destructor&Tropilaelaps mercedesae

Table 1. Results of different treatment on bee colonies infested with Varroa destructorA; number of treatment at weekly intervals ,B ; efficacy,1985 and 2003; C ; resistance.D;bee mortality.E;efficacy 2003 and 2025

Commercial name	Active ingredient	A	B	C	D	E	Action
Folbex® VA	Bromoproplate	4-6	80-90%	Yes	No		Fumigation
Varroazine®	Phenotiazin	3-4	80-90%	yes	No		Fumigation
Varrostan®		2	70-80%	Yes	Yes		Fumigation
Taktic®	Amitraz	2	80-90%	yes	Yes		Systemic
Apitol®	Cymiazole	2	80-90%	No	Yes		Systemic
Perizin®	Coumaphos	2	90-98%	Yes	No		Systemic
Apistan® Strips	Fluvalinate	1	95-99%	Yes	No	0-30%	Contact
Bayvarol ®Strips	Flumethrine	1	95-99%	yes	No	0-30%	Contact
Apivar® Strips	Amitraz	1	95-99%	No	No		Contact
Apiguard®	Thymol	2x Double doses		No	Yes	50-80%	Evaporation
Apilife Var®	Thymol Camphor Menthol Eucalyptus	2-4		No	No	80-92%	Evaporation
Ecostop® (Ekocoton)	Thymolum Oleum Menthae Piperithae	1		No	Yes	60-80%	Evaporation
Hive Clean	Oxalic-acid Citric acid Propolis Essential oils	3		Yes	Yes	60-80%	Evaporation
Formic-acid plates	Formic -acid	2-3		No	No	60-70%	Evaporation
Thymovar®	Thymol	2-4		No	No	85-95%	Evaporation
OXuvar®	Oxalic-acid	1		No	No	95-99%	Evaporation

Since 2000, use has been made of Thymol, which is the component of Apiguard®, AplifeVar®, Ecostop®, and Thymovar® as well as products based in Thymol. In 2000 and 2018-2024, I tested in Iran and Afghanistan, and also studied many publications from around the world. Thymol has the advantage of being a natural substance, and one with a low toxicity to humans; also Varroa destructor has not been reported as being resistant to it.

However, the use of Thymol, has the following disadvantages:

-Colonies must be given two to three times treatments with Thymol, and the treatment repeated in the autumn. Mites that survive the first treatment reproduce during the bees' active season. So it's necessary to use another acaricide in the autumn (according to J.P. Faucon and Reza Shahrouzi 2003)

-A strong odour is apparent during the three days following treatment, which disturbs the colony and stimulates the bees to clean their hive.

-For two applications the treatment takes 4 or 6 weeks, which is inconvenient for the beekeeper.

-It is necessary to provide a space between the top of the frames in a hive and the hive roof, for instance by inserting an empty super; this reduces the temperature of the bees and increases their honey consumption.

-Temperature variations during the treatment are important. If the temperature is above 35°C, the treatment is more effective (<70%) but causes a higher larval mortality. If the temperature is less than 12°C the treatment is less effective (>60%) and leads to a higher mortality of adult bees.

-When colonies infested with Varroa destructor were treated only with all products based in Thymol, they showed abnormally high winter losses, with clear evidence of mites (J.P. Faucon and Reza Shahrouzi 2003).



Treatment by Thymovar®



Treatment By Oxuvar®

Mite Resistance

Varroa mites' resistance to pesticides is a well-known phenomenon. The first cases of resistance to organophosphates were reported in 1947. (According to Delome and Dacol 1989). Varroa mites may develop resistance to chemicals used in control strategies. This is especially true for mites which, in general, have short life cycles and particularly for Varroa destructor which may have twelve generations per year. There is an increased probability of Varroa mites developing resistance as a result of prolonged contact with an acaricide. This is one of the reasons that manufacturers or producers of products for controlling Varroa advise users to limit frequency and period of application. Despite precautionary measures, it is now evident that acaricides such as fluvalinate (Lodesani et al, 1992) accumulate in the wax, creating conditions for prolonged contact with Varroa, especially inside brood cells where they reproduce. The likelihood of Varroa developing resistance was particularly high, as many other mesostigmatid mites had already been reported to be resistant to synthetic pyrethroids, including fluvalinate. The ineffectiveness of fluvalinate has been reported in Italy and in France and in Iran (Milani 1995, Faucon, 1994, Reza Shahrouzi, 1998). The use of this chemical for Varroa control has become widespread

over the last few years because it is easy to apply and relatively cheap. Nevertheless, the use of Apistan® and Apivar® has often been replaced by wooden strips impregnated with the same active ingredient, made by the beekeepers themselves using Klartan and Mavrik also Taktic.

Two products contain fluvalinate, the third product contains amitraz but are not authorized for use in beekeeping and difficulties in controlling the dose have led to problems of effectiveness.

Since 2008, products from China have been sold on the black market without veterinary authorization in the Middle Eastern countries and also without permission from Bayer AG, Wang's fluvalinate, and Wang's flumethrin has the same active ingredient of pyrethroids, several countries have a serious problem with Wang's fluvalinate and Wang's flumethrin, it has led to the mortality of colonies. There is V. destructor resistance to Wang's fluvalinate and Wang's flumethrin, in Iran, Afghanistan, Pakistan, Tajikistan, Azerbaijan, Iraq, Kurdistan, and others.

Resistance to other acaricides, belonging to different groups of chemicals, has also been reported. Resistance to bromopropylate and chlodimeform was shown to be favoured by under dosing this has been verified in laboratory tests (Ritter and Roth 1988). The presence in different countries, of Varroa destructor populations simultaneously resistant to different pyrethroids, highlights the risk of basing control strategies purely on chemical treatment, particularly when the substances used belong to the same chemical family.

Conclusion

After five decades my experiences in France and Iran, also Afghanistan ...etc. In the use of different types of treatments: by inhalation (fumigation), absorption (systemic action) and contact (slow release), evaporation against Varroa mite agree that the efficacy depends on the local conditions and that some care is needed.

In the Middle East, Asia region, the optimal conditions are a high and stable external temperature and the absence of worker brood. The main precautions consist of avoiding reinfestation and robbing, in treating outside periods of nectar flow or queen rearing and in verifying the efficacy of the treatment. The alternative to chemical control is thus more than the simple use of a vegetable or animal extract in place of synthetic acaricide. It requires an additional effort from the beekeeper to manage the bee colonies which is more time consuming.

Although we are in the 21st century, Varroa destructor will undoubtedly remain for several years one of the principal agents of the weakening of apian livestock. Varroa destructor is a serious disease.

It is necessary to learn how to live with it. This can be done:

- By preserving only strong colonies in the apiaries
- By systematically changing the queen every two years, by developing a queen selected for resistance to the diseases.
- The first treatment must be carried out in late September or early October in Iran and Afghanistan by acaricide. To give over wintering bees the optimum potential for survival, it must be sufficiently effective to ensure that at the end of the treatment there will be fewer than 50 parasites within treated hives.
- If colonies were treated only with product of base in thymol and essential oils also formic acid, they showed abnormally high winter losses, with clear evidence of mites. So it is necessary to use another acaricide (Oxovar® Apivar ...etc).
- If apiary's colonies are located in an area conducive to the rearing of brood (potential source of development for the parasite), the second treatment must be carried out in early spring.

- Also changing treatment with product of base in pyrethoid every 6 to 8 years, But product of base in pyrethoid, and bromopropylate also chlodimeform have tendency to be resistant after several years of treatment.

Bibliography

- Dr M.E. Colin-1999 Option Mediterraneennes, Bee disease diagnosis P.117-146
- J.P. Faucon-2003 la sante' de l'abeille No 194 Avril 2003.
- Baggio, A.; Piro, R.; Crivalleri, D.; Dainese, N.; Damoolin, O.; Mutinelli, F. (2002) Prodotti a base di timolo per il controllo della varroasi, studio dell'efficacia e dei residui nel miele, L'Ape nostra Amica (4):30-34.
- Martin, S. I. (2004) - Acaricid (pyrethoid) resistance in varroa destructor - Bee World 85, 56, 69.
- Oldroyd, B. P. (2007) - What's killing American honey bees? Plos Biology, 5, (6) 1195-1199.
- Bruneau, E. (2006) Nutrition et malnutrition des abeilles, Biodiversite' des plantes: une cle' pour l'alimentation et la survie des abeilles. Comptes rendus Academie Agriculture de France, Seance du 14 juin 2006, 1, 10.
- Reza, Shahrouzi Control of varroa mite in Iran. 12/01/2015
www.apiculture.com/articles/us/varroa_mite_iran_2015.pdf
- Reza, Shahrouzi Resistance of varroa destructor to wang's flumethrin and wang's fluvalinate in Middle East. 04/02/2014 http://www.beekeeping.com/articles/fr/resistance_varroa_2014_RS.pdf
- Reza, Shahrouzi Causes of bee colony mortality. Bulletins on line OIE, No 4, 2009. page 5-11.
www.oie.int. www.beekeeping.com/articles/us/mortality_bees.pdf.
- Reza, Shahrouzi The efficacy of Apivar® and Bayvarol® and CheckMite+® in the control of varroa destructor in Iran. 22.10.2009 http://www.apiculture.com/articles/us/efficacy_of_bayvarol.pdf
- Reza, Shahrouzi. Efficacy of Thymovar and Oxuvar in Varroa destructor in Iran. 21.06/2020
[file:///C:/Users/arash/Downloads/Efficacy%20of%20Thymovar%C2%AE%20and%20Oxuvar%C2%AE%20in%20Varroa%20destructor%20control%20in%20Iran%20\(3\).pdf](file:///C:/Users/arash/Downloads/Efficacy%20of%20Thymovar%C2%AE%20and%20Oxuvar%C2%AE%20in%20Varroa%20destructor%20control%20in%20Iran%20(3).pdf)
- The efficacy of Oxuvar and Thymovar in the control of varroa destructor and Tropilaelaps mercedesae in Afghanistan. 03.05.2024.
[file:///C:/Users/arash/Downloads/The%20efficacy%20of%20Oxuvar%C2%AE%20and%20Thymovar%C2%AE%20in%20the%20control%20of%20Varroa%20in%20Afghanistan%20\(6\).pdf](file:///C:/Users/arash/Downloads/The%20efficacy%20of%20Oxuvar%C2%AE%20and%20Thymovar%C2%AE%20in%20the%20control%20of%20Varroa%20in%20Afghanistan%20(6).pdf)