

**DETERMINING THE EFFICACY OF FLUMETHRIN (VAROSTOP®)  
AGAINST TO *VARROA DESTRUCTOR* IN HONEY BEE COLONIES IN  
FALL SEASON**

**Bal Arılarındaki *Varroa destructor*'a Karşı Flumetrim'in (Varostop®) Sonbahar Sezonundaki Etkisinin Belirlenmesi**

**Ahmet Onur GİRİŞGİN, Levent AYDIN**

(Geniştirilmiş Türkçe Özet Makalenin Sonunda Verilmiştir)

Department of Parasitology, Faculty of Veterinary Medicine, University of Uludağ, Bursa – TURKEY

E-mail: onurgirisgin@gmail.com

**Key Words:** Efficacy, flumethrin, Turkey, *Varroa destructor*.

**Anahtar Kelimeler:** Etkinlik, flumetrim, Türkiye, *Varroa destructor*.

**ABSTRACT:** This study was conducted to determine the efficacy of flumethrin (Varostop®) preparation against the honey bee parasite *Varroa destructor*, in an apiary located in Bursa province of Turkey, during September and November 2009. Study was covered totally 14 colonies living in Langstroth type hives which 7 of which were treatment and 7 untreated control. Varroacidal effectiveness of flumethrin (Varostop®) was determined with Henderson-Tilton's Formula based on the difference of mite burden on bees before and after treatments at the end of four weeks. The treatment resulted a 94.9 % efficacy in infested colonies when compared with control ones and efficacy indicates that Varostop® is effective to Varroosis in naturally infested honey bee colonies in fall season.

## INTRODUCTION

*Varroa destructor* is a damaging parasite of the European honey bee (*Apis mellifera* L.) in Turkey and all over the world. Parasitism can result in a loss of up to 25 % of adult weight, severe deformations of the wing, transmission of bacterial/viral pathogens and reduced longevity of worker and drone honey bees (De Jong et al., 1982; Colin et al., 1999). If left untreated, colonies normally die within a few years. Varroosis reached Turkey through the Trakia region in 1978 and spreaded to entire country and 600 000 colony's death (Tutkun and İnci, 1985).

A suitable anti-Varroa treatment in fall plays a central role in the Varroa control strategy. Nonbreeding period occurs in many regions during the late fall due to the geographical location and climate conditions in Turkey.

Presence of *V. destructor* in Turkey was realized via genetically and morphometrical analyses which were arranged with collected Varroa specimens

from various regions in Turkey (Warrit et al, 2004; Aydın et al, 2007).

Different chemical compounds as fluvalinate, amitraz and coumaphos are used by Turkish beekeepers to Varroa mite and prevention of economical losses.

The aim of this study was to determine the efficacy of new brand Varostop® (Lavita, Turkey: 3.6 mg flumethrin soaked plywood stripes) preparation in the naturally infested honey bee colonies in Bursa province of Turkey at the fall season.

## MATERIALS AND METHODS

Fourteen honey bee colonies, populated in standart Langstroth hive with 8 frames were located in Bursa province, which has a humid Marmara climate.

Colonies were divided in two groups having seven hives each, randomly. The flumethrin (Varostop: Lavita, Turkey) product was in a form of plywood stripes which 3.6 mg active ingredient per stripe. The flumethrin treatment was applied on seven

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hives naturally infested with *Varroa destructor* with four stripes per hive by hanging on the top bar among the frames as suggested. Other seven hives were served as untreated control. Trials were carried out in September and November 2009. The average temperature during this period was 16°C (range 12-20°C).

Varroa infestation rate of the two groups were determined by collecting about 200 adult bees from outer frames in to jars containing cotton with diethyl ether, before and four weeks after treatment (Shimanuki and Knox, 2000). Aliquoted bees and

mites were collected and counted to verify that no parasite remained fixed on honey bees.

All stripes in the hives were removed on fourth week as recommended on prospectus sheet.

Effectiveness of drugs was estimated by Henderson-Tilton's Formula which based on the difference of mite burden on bees before and four weeks after treatment (Henderson and Tilton, 1955):

$$\text{Corrected \%} = \left(1 - \frac{n \text{ in Co before treatment} \times n \text{ in T after treatment}}{n \text{ in Co after treatment} \times n \text{ in T before treatment}}\right) \times 100$$

Where n = mite population, T = treated, Co = control

### RESULTS

The efficacy of the Varostop® treatment in Varroa control was determined by Henderson-Tilton's Formula. Varroa numbers of two groups were calculated, datas and the result are presented in table 1.

The effectiveness of Varostop was 94.5% as shown in table and this is a high efficacy for four weeks

treatment result. There was an increase of Varroa rate in the untreated control group. Significant decrease of mites on bees can be detected in Varostop® group.

No queenlessness or side effect was recorded and worker bee mortality was not observed in all treated and control colonies.

**Table 1:** Numeric datas of mites and mean efficacy of Varostop® according to Henderson-Tilton's formula at the end of treatments

Groups	n (Varroa) before treatment	n (Varroa) after treatment	% Mean efficacy
Varostop®	89	6	94.9
Control	106	142	

### DISCUSSION

Varroosis was first observed in 1978 and then several outbreaks were discovered on all over Turkey (Tutkun and İnci, 1985). The struggle against this disease permitted the use of natural products, chemical products and biological techniques (Mutinelli and Rademacher, 2003; Mutinelli and Baggio, 2004).

Pyrethroids kill the individual by prolonging the opening of the cells' sodium channels, which leads to paralysis and death (Martin, 2004). Chemical acaricides (amitraz, fluvalinate, coumaphos, flumethrin etc.) have been applied to mites but

unfortunately a chemical resistance of the parasite to pyrethroids has been observed in some countries, but not in Turkey, yet. Possibility of cross resistance between pyrethroid substances was expected due to extremely close chemical similarity between these compounds (Martin, 2004; Lodesani and Costa, 2005).

Alloui et al. (2002) have found 99.1% efficacy using flumethrin soaked stripes on November in Algeria, at the end of six weeks. But they noted a significant fall of Varroas in the first week.

Gregorc and Skerl (2007) have found 94.3% efficacy in highly infested colonies and 19.11% in

slightly infested colonies after 40 days flumethrin treatment.

Some chemicals' efficacies have been investigated for *Varroa* and obtained 83.4% to 100.0% rates in Turkey (Akkaya and Vuruşaner, 1996; Kumova, 2001).

Trials about another commercial product which contains flumethrin were performed in Turkey and detected 87.7% and 100.0% efficacies in broodless period in fall season (Akkaya and Vuruşaner, 1996 and 1997). However, climatic, colony, brood and other conditions can affect the efficacy rates (Bacandritsos et al, 2007). Difference of other product was arisen from its plastic structure.

We estimated the effectiveness for four week countings in our experiment. Presence of stripes during at least four weeks was recommended and we thought that most of chemical Varroacide drugs might show their effect especially in the first week, because of the intensive parasite burden on bees. Nonetheless chemical acaricides must be kept in hive at least four weeks for a whole treatment.

### CONCLUSION

Eventually Varostop® is a good alternative for *Varroa* control in honey bees with one application to hives. It is easy to use and presents low variability between colonies in its final efficacy. No case of honey bee toxicity, loss of queens and/or brood or adult honey bee mortality, disturbance and robbing was recorded from the product. It can be used on highly or slightly infested colonies in fall and possibly spring seasons.

It is the remarkable point that none of chemical compounds should be applied on every following years because of the possible mite resistance development hazard.

### REFERENCES

- Akkaya, A., Vuruşaner, C. 1996. Field experiment to determine the efficacy of flumethrin (Bayvarol-Strips) and fluvalinate (Apistan Strips) against varroosis of the honey bee colonies. *Acta Parasitologica Turcica*. 20(3-4): 457-460.
- Akkaya, A., Vuruşaner, C. 1997. Field experiment to determine the efficacy of flumethrin and coumaphos against varroosis according to the state of the honey bee colonies. *Acta Parasitologica Turcica*. 21(1): 83-86.

- Alloui, N., Boucherit, MR., Nouicer, F. 2002. Effect of flumethrin on *Varroa destructor* in honey bee colonies. *Bulletin of the Veterinary Institute in Pulawy*, 46: 233-237.
- Aydin L, Gülegen E, Cakmak I, Girisgin AO. 2007. The occurrence of *Varroa destructor* Anderson and Trueman, 2000 on Honey Bees (*Apis mellifera*) in Turkey. *Turkish Journal of Veterinary and Animal Science*, 31: 189-191.
- Bacandritsos, N., Papanastasiou, I., Saitanis, C., Nanetti, A., Roinioti, E. 2007. Efficacy of repeated trickle applications of oxalic acid in syrup for varroosis control in *Apis mellifera*: Influence of meteorological conditions and presence of brood. *Veterinary Parasitology*. 148: 174-178.
- Colin, M.E., Fernandez, P.G., Hamida T.B. 1999. Varroosis. In Colin, M.E. (Ed), Ball, B.V., (Ed), Kilani, M. (Ed): Bee Disease Diagnosis Seminar Notes, Zaragoza: CIHEAM-IAMZ, 121-142.
- De Jong, D., De Jong, P.H., Goncalves, L.S. 1982. Weight loss and other damage to developing worker honey bees from infestation with *Varroa jacobsoni*. *Journal of Apicultural Research*, 21: 165-167.
- Gregorc, A., Skerl, M.I.S. 2007. Combating *Varroa destructor* in honeybee colonies using flumethrin or fluvalinate. *Acta Veterinaria Brno*, 76: 309-314.
- Henderson, C.F., Tilton, E.W. 1955. Tests with acaricides against the brown wheat mite. *Journal of Economical Entomology*, 48: 157-161.
- Kumova, U. 2001. The investigation on the effects of some chemicals used to control *Varroa jacobsoni* in Turkey. *Turkish Journal of Veterinary and Animal Science*, 25: 597-602.
- Lodesani, M., Costa, C. 2005. Limits of chemotherapy in beekeeping: development of resistance and the problem of residues. *Bee World*, 86(4): 102-109.
- Martin, S.J. 2004. Acaricide (pyrethroid) resistance in *Varroa destructor*. *Bee World*, 85(4): 67-69.
- Mutinelli, F., Baggio, A. 2004. Use of medical drugs against Varroosis. *Apiacta*, 39: 53-62.
- Mutinelli, F., Rademacher, E. 2003. The use of drugs to control Varroosis in honey bee colonies and European legislation: the current situation. *Bee World*, 84(2): 55-59.

## ARI BİLİMİ / BEE SCIENCE

- Shimanuki, H., Knox, D.A. 2000. Diagnosis of honeybee diseases. United States Department of Agriculture, Agriculture Handbook No: 690.
- Tutkun, E., (Ed), Inci, A. (Ed). 1985. Balarılarında Zarar Yapan Arı Akarı (*Varroa jacobsoni* Oudemans)'nın Tanınması, Yayılışı, Biyolojisi ve Mücadelesi. Türkiye Kalkınma Vakfı Entegre Arıcılık Projesi Yayın No. 1, Yenigün Matbaası, Ankara.
- Warrit, N., Hagen, T.A.R., Smith, D.R., Çakmak, İ. 2004. A survey of *Varroa destructor* strains on *Apis mellifera* in Turkey. *Journal of Apicultural Research*, 43 (4): 190-191.

### GENİŞLETİLMİŞ ÖZET

**Amaç:** *Varroa destructor*, ülkemizde ve dünyada bal arılarına en fazla zarar veren bir dış parazittir. Parazitin neden olduğu Varroosis hastalığı sonucunda, ergin arılarda %25'e varan ağırlık kaybı, bakteri ve virüslere duyarlılık, yeni çıkan yavrularda kanat bozuklukları - karın kısalıkları, tedavi edilmediğinde ise kovanın sönmesine neden olmaktadır. Bu çalışmada, arılara yukarıda bahsedilen zararları veren dış parazit *Varroa destructor*'a karşı, sonbahar sezonunda, flumetrimin

(Varostop® : Lavita, Türkiye) preparatının etkinliğinin belirlenmesi amaçlanmıştır.

**Gereç-Yöntem:** Nemli bir iklime sahip Marmara Bölgesindeki Bursa ilinde bulunan bir arılıkta Langstroth tipi, sekiz çerçevesi 14 kovandan yedi tanesinden deneme, diğer yedisinden kontrol grubu oluşturulmuştur. Deneme grubundaki her kovana, her biri 3,6 mg etken madde flumetrimin (Varostop®) içeren ince ahşap striplerden dörder tane, çerçevelerin arasına asılarak konulmuştur. Kontrol kovanlarına ise deneme süresince herhangi bir ilaç uygulanmamıştır. Deneme Eylül - Ekim 2009 aylarında gerçekleştirilmiş ve bu süre zarfında ortalama sıcaklık 16°C (12 - 20°C arasında) olmuştur.

Tedaviden önce ve dört hafta sonra, her gruptaki kovanların en dış çerçevesinden ortalama 200 arı, dietil eterli pamuk içeren kavanozlara alınmıştır. Arılar üzerinde hiçbir akar kalmadığından emin olunana dek kavanoz sallanarak akar sayımları gerçekleştirilmiş ve arılar üzerindeki akar sayıları hesaplanarak kaydedilmiştir. Flumetriminin etkinliği, denemeden önce ve dört hafta sonra arılar üzerindeki akar sayıları arasındaki farka uygulanan Henderson-Tilton formülüyle belirlenmiştir. Uygulanan tüm stripler tedaviden sonra kovandan alınmışlardır. İlacın etkisi şu formülle bulunmuştur:

$$\text{Düzeltilmiş Yüzde} = \left( 1 - \frac{\text{Tedavi öncesi kontroldeki akar say.} \times \text{Tedavi sonrası tedavi gr. akar say}}{\text{Tedavi sonrası kontroldeki akar say.} \times \text{Tedavi öncesi tedavi gr. akar say.}} \right) \times 100$$

**Bulgular:** Kullanılan formüle göre, dört haftalık tedavi sonrası kolonilerdeki yoğun *Varroa* enfestasyonuna karşı flumetriminin (Varostop) etkisi %94.9 olarak bulunmuştur. Kontrol grubunda akar sayılarının artarak devam ettiği görülmüştür. Varroosis mücadelesinde biyolojik teknikler, kimyasal ve doğal ilaçlar kullanılmaktadır. Flumetrimin etken maddesi, piretiroid grubu ilaçlar içinde bulunmakta ve bu gruptaki ilaçlar, akarlarda hücrelerin sodyum kanallarını açarak uzamalarına ve sonuçta ölüme neden olmaktadır. Dünyanın çeşitli bölgelerinden piretiroidlere karşı *Varroa* direnci bildirilmiş, Türkiye'de ise bu konuda bir çalışma henüz yapılmamıştır. Flumetrimin ile ilgili çeşitli ülkelerde yapılan çalışmalarda %94.3 ile %99.1 arasında etkiler bulunmuş, ülkemizde ise flumetrimin içeren başka bir ticari ürünle yapılan çalışmalarda %87.7 ile %100 etki bulunmuştur. Bu

ürünün kullandığımız üründen farkı, etken maddenin plastik striplere emdirilmiş olmasıdır. Çalışmamızda Varostop®'un dört haftalık sonbahar uygulaması sonucu %94.9 etki bulunmuştur. İklim, koloni, yavru durumu gibi bazı koşullar ilaçların etki oranlarını etkileyebilmektedir. Piretiroid gruptaki ilaçların etkileri en az dört haftalık bir uygulama sonucu belirlenmektedir.

**Sonuç:** Sonuçta Varostop® (Lavita, Türkiye), bal arılarındaki *Varroa* parazitin kontrolünde tek bir uygulama gerektiren, kullanımı kolay, yüksek etkili bir ilaçtır. Çalışma boyunca üründen kaynaklanan ana-yavru arı kaybı, ergin arı ölümü, huzursuzluk, yağmacılık gibi olumsuz etkiler görülmemiştir. Muhtemel direnç oluşumuna karşı kimyasal ilaçların birkaç yıl üst üste kullanılmamasına dikkat edilmelidir.