

**SEASONAL INCIDENCE OF SOME ECONOMIC BEE DISEASES
(VARROOSIS, NOSEMOSIS AND AMERICAN FOULBROOD) IN
HONEY BEE COLONIES OF NORTHWESTERN IRAN**

**İran'ın Kuzeybatısındaki Balarısı Kolonilerinde Bazı Ekonomik Arı Hastalıkları
(Varroosis, Nosemosis ve Amerikan Yavru Çürüklüğü)'nin Mevsimlere Göre
Enfeksiyon Oranları**

(Genişletilmiş Türkçe Özet Makalenin Sonunda Verilmiştir)

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Received date/Geliş tarihi: 20.10.2010

Key words: Bee disease, Varroa, Nosema, American foulbrood, Iran.

Anahtar kelimeler: Arı hastalığı, Varroa, Nosema, Amerikan Yavru çürüklüğü, Iran

ABSTRACT

The aim of this review is to inform about the status of three economic bee diseases (Varroosis, Nosemosis and American foulbrood) in an important honey producing region, eastern Azerbaijan province (Northwestern Iran). These reports are based on colonies analysed for possible occurrence of these diseases. The major bee disease in the region is varroosis. Lowest rate of varroosis spread was in spring (7.72%) and it increases in the following seasons respectively and the highest rate was occurred in March (44%). Because of cold and semi-arid climate in northwestern Iran (such as eastern Azerbaijan province), *Nosema apis* has lower prevalence, but it can be hazardous at spring with about 59% incidence rate. About American foulbrood (AFB) 5.8% total infection rate was observed, AFB infection was started in May with highest incidence rate (17.3% of apiaries) and finished in July with 1%. With attention to these findings and reports of local veterinary organization, *varroosis* as the major bee disease in this region via impairing of bee population and stability in the colony, make susceptible conditions for secondary infection with *Nosema apis* at next spring.

INTRODUCTION

Iran, with high potential and productivity of beekeeping, yearly 40000 tons honey production by three millions and seven hundred hives is one of ten honey producing countries of the world in 2009 (Iranian eco-news agency, 2009). But at 2010, with attention to reports of Iranian Beekeeping cooperation serious decrease in Iranian honey

production (about 80% lower than 2009) was occurred. In other words at 2009 mean honey production/hive was 13.5-14 kg, but now it decreased to 2-5 kg (Kermanema.com, 2010). Iranian honeybee specialists believe that prevalence of bee diseases (such as Varroosis, Nosemosis and American Foulbrood) were the

main reason of this current decrease in honey production (Kermanema.com, 2010).

In this review, we will discuss about the incidence of three economic honey bee diseases namely *Varroosis*, *Nosemosis* and *American Foulbrood* in Northwestern Iran.

Varroosis (Varroa) in Northwestern Iran

Varroa is known to be the most serious problem in beekeeping all over the world (Fakkimzadeh, 2001; Baggio et al., 2004). Because of the damages caused by *Varroa*, beekeepers lose a great number of colonies in winter or start with an unhealthy, weak colony in the spring season (Imdorf and Carriere, 1996; Akyol and Özkök, 2005).

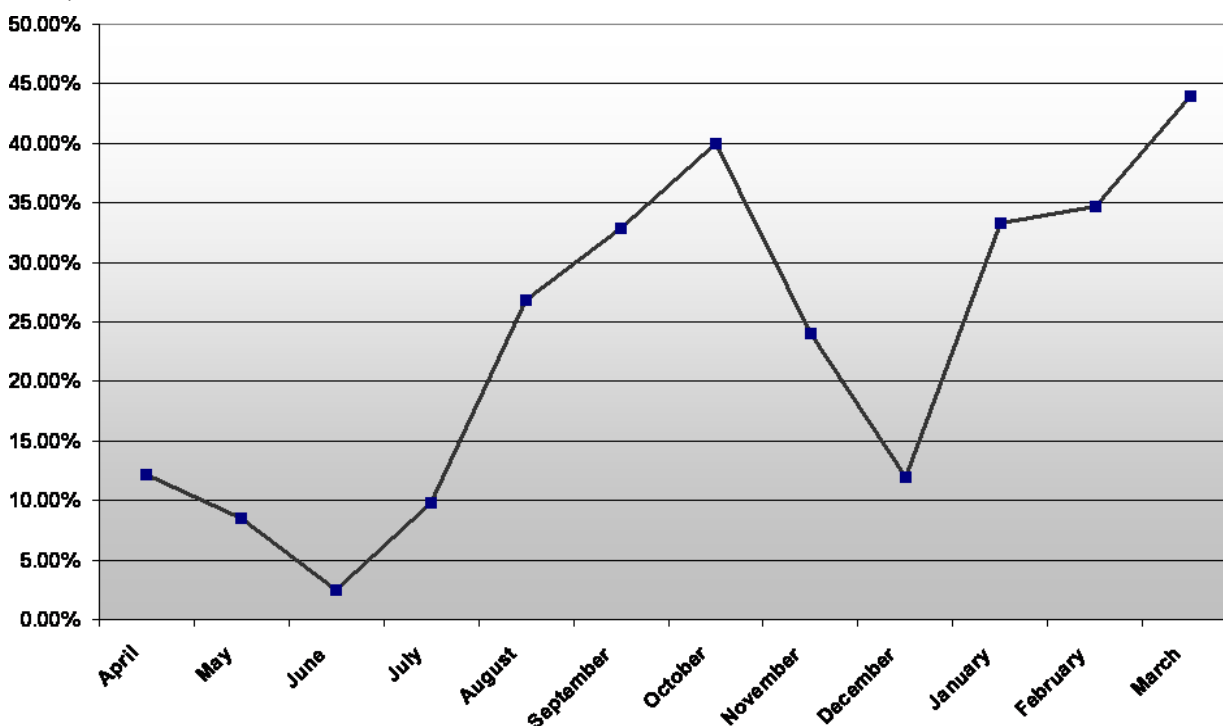
The prevalence of varroa in high levels can lead to certain damages. For instance, the spread of varroosis in its first years in Turkey was the main factor in the loss of 600 honey bee colonies and 7000-7500 tons of products (Akyol and Korkmaz, 2005). The statistics published in relation to the infection of varroosis in Iran is limited (Eilami et al., 2005; Rahmani et al., 2006). In addition, the limited statistics concerning the spread of varroosis in

Iranian apiaries are often without climatic and seasonal information of the infestation.

In our investigations (Jamshidi et al., 2009) seasonal varroosis rate in Eastern-Azerbaijan province is presented Table 1. The lowest rate of varroosis spread was in spring (7.72%) and it increases in the following seasons respectively. In a way that the highest rate of varroosis spread in the hives was recorded in winter (37.33%). The lowest rate of incidence in June (7.72%) and the highest rate in March (44%) was recorded. The annual average of varroosis incidence was 23.39 %.

The Varroosis infestation in the hives of the area in honey production season during summer and the beginning of fall demonstrated an increasing procedure, in a way that in July, August, September and October the percentage of the infested hives was respectively 9.76%, 26.82%, 32.92% and 40% (Figure.1). Also, in the resting season of the bees (winter), the highest rate of incidence of varroosis was recorded; in a way that in January, February and March, the peak of infestation was respectively witnessed to be: 33.33%, 34.66% and 44% (Figure1).

Figure 1. Incidence rate of Varroosis in different months at Eastern Azerbaijan province (Jamshidi et. al., 2009)



In the study conducted in two subsequent years in 8 localities of Elazığ province in Turkey, 25.61% of the hives were infested by varroosis (Şimsek, 2005). In Poland 30% of the hives (Irzyk and Skrobut, 1987) and in Serbia 21.5% of the hives (Debeljak et al., 1991) were reported as infested. There are limited references concerning seasonal varroosis spread. The study of varroosis in two subsequent years in Egypt demonstrated that varroa spread in fall and winter is in a high level (respectively: 10.2% and 13.2%) and in spring and summer in a low level (respectively: 5.1% and 5.3%) (Ghoniemy et al., 2005). The seasonal order of the spread of the disease is in relation with the observations of the study of varroosis in Eastern Azerbaijan province (Table 1).

Table 1. Seasonal incidence rate of Varroosis in Eastern Azerbaijan province (Jamshidi et al., 2009).

Season	Number (colony) Inspected	Number positive	Incidence rate (%)
Spring	246	19	7.72
Summer	246	57	23.17
Autumn	225	57	25.33
Winter	225	84	37.33
Total	942	217	23.39

The average incidence rate of varroosis in northwestern Iran (23.39%) was lower than the reported infestation rate in Turkey (Şimsek, 2005), Poland (Irzyk and Skrobut, 1987) and Chile (Hinojosa and Gonzalez, 2004), and higher than the reported infestation in Egypt and Serbia (Debeljak et al., 1991). The studies conducted by De Jong et al. (1984) demonstrated that prevalence of varroosis is usually more common in cold regions rather than warm climates. Eastern Azerbaijan province is a cold region and moreover, high spread of varroosis during the year (23.39 %) and the highest level of infestation is reported in winter (37.33 %). On the other hand the statistics reported in Fars province (one of central and hot regions in Iran) varroa infestation during the year is less than 4 % of the hives, which in the hottest areas of Fars province and it decreases to even 0.34% (Eilami et al., 2005). The results from Eastern Azerbaijan province showed the high rate of varroosis incidence in this province comparing with the results of Eliami et al. (2005) in Fars province

(warm climate) and also, the high rate of its incidence in winter in Eastern Azerbaijan, confirms the results of De Jong et al. (1984). In the study conducted by Eliami et al. (2005), significant association was witnessed between climate and the rate of varroosis incidence; and in the cold regions, the rate of infestation was reported to be higher. This section of their results was in accordance with the statistics of eastern Azerbaijan province and the study conducted by Ghoniemy et al. (2005). According to our studies and examinations of the reported statistics, honey bees of the region are struggling with parasitic infestation of varroosis in both productivity and inactivity seasons. It is proposed that varroa infestation in cold climates is more than that of warm climates and varroa rate of incidence in cold seasons (fall and winter) is more than warm and hot seasons (spring and summer). Regarding high rate of infestation and incidence of varroosis in the Apiaries of Eastern Azerbaijan province during the year, it seems necessary to have a regular control program in order to decrease the rate of infestation in this region.

Nosemosis (*Nosema apis*) in Northwestern Iran

Infection of nosema in Iranian apiaries has a long history. Spread of disease in Northern provinces (Caspian lake region) because of rainy and wet climate is more than other part of Iran. But, in northwestern Iran (such as eastern Azerbaijan province), because of cold and semi-arid climate nosema has lower importance or lower hazards (Pourelmi and Pourfooladchi, 2009).

In our study in Arasbaran (one of beekeeping centre in northwestern Iran), high level of infection has been recorded in the spring (59.5% of investigated colonies). However the amount was considered to be low in the summer and no infection was observed during the fall (Lotfi et al., 2009). Monthly prevalence of nosemosis in Arasbaran Region is presented in Table 2.

The study conducted on the bee keeping areas in Kars, Northeast of Turkey that is a neighboring country of Iran, in eight different Northeastern cities, the infection rate was reported as the highest in the spring (23.91%) and the lowest in the summer and fall (Topçu and Arslan, 2004) which is in correspondence with the statistical results of Nosemosis in Arasbaran (neighboring region of Northwestern Turkey) (Lotfi et al., 2009). Generally, the spreads of nosemosis in the colonies of Arasbaran were observed to be high merely in

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the spring and in the other periods of the year are very low and insignificant (Lotfi et al., 2009).

Table 2. Prevalence of *Nosema apis* in different months (spring, summer, autumn) in honey bee colonies of Arasbaran region (northwestern Iran).

Month	Number investigated	Number infected			Infection percent (%)
		chronic	medium	acute	
April	42	19			45.2
		0	2	17	
May	42	35			83.3
		2	10	23	
June	30	15			50
		8	5	2	
July	30	3			10
		1	2	0	
August	30	0			0
		-	-	-	
September	30	0			0
		-	-	-	
October	30	0			0
		-	-	-	
November	30	0			0
		-	-	-	
December	30	0			0
		-	-	-	
Total infection rate: Spring: 59.5%, Summer: 3.33%, Autumn: 0%					

Also, subsequently Razmaraii and Karimi (2010), reported noseimos data from apiaries sampled from 17 cities and towns at northwestern Iran (Eastern Azerbaijan province) in spring and summer (Table 3).

With attention to two reports from this region (Lotfi et. al., 2009; Razmaraii and Karimi, 2010), noseimos is serious bee disease only in spring, not other season (59.5% or 46% of colonies). It is likely that the lack of humidity in mountainous regions such as northwestern Iran in the summer and the high population of the colonies' bees in the summer and fall are the main causes for the

resistance of the bees to noseimos and the low level of infection (Lotfi et al., 2009; Razmaraii and Karimi, 2010).

American Foulbrood in Northwestern Iran

American foulbrood (AFB) is a lethal disease of honey bee colonies (*Apis mellifera* L.) caused by the spore-forming, Gram-positive bacterium *Paenibacillus larvae* subsp. *Larvae* (Heyndrickx et al., 1996). It is considered to be the most serious disease of bacterial origin that affects honey bees, which are only susceptible to infection by the pathogen at less than 48h of larval age (Hansen and Brødsgaard, 1999).

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Table3. Incidence rate of *Nosemosis* in colonies of 17 cities or towns at northwestern Iran.

Location	No. of analyzed/ positive	No. of total sample	No. of infected samples
Osko	10.0	5	5.0
Ahar	12.6	7	7.3
Bostan abad	14.7	6	6.5
Bonab	10.0	4	4.0
Tabriz	18.4	8	8.3
Jolfa	10.2	4	4.2
Charomagh	11.5	4	4.2
Sarab	16.9	5	5.4
Shabestar	12.5	6	6.3
Kaleibar	15.6	7	7.5
Marageh	15.3	9	9.2
Malekan	11.2	6	6.1
Marand	12.2	5	5.1
Mianeh	14.8	7	7.6
Varzghan	11.5	7	7.6
Hashtrood	12.8	5	5.4
Heris	12.7	6	6.4
Total	215.79	101	101.47

*Total infection rate in spring and summer were 46 and 1.3% respectively.

* This table is adapted from Razmaraii and Karimi (2010)

Results obtained by two continuous year (2008-2009) on AFB incidence in honey bee colonies at eastern Azerbaijan province are presented in Table 4 (Yusefkhani and Lotfi, 2010).

Table 4. Incidence of American foulbrood (AFB) in honey bee colonies of Eastern Azerbaijan province during spring and summer 2008-2009 (Yusefkhani and Lotfi, 2010).

Month	Investigated colony	Infected colony	Infection rate (%)
April	100	0	0
May	150	26	17.3
June	100	11	11
July	100	1	1
August	100	0	0
September	100	0	0
Total	650	38	5.8

By examination of bee larva and honey samples collected from 650 apiaries during two year, 5.8% total infection rate was recorded. May and June are two main months with AFB incidence, respectively by 17.3 and 11% (Yusefkhani and Lotfi, 2010).

AFB is a serious bee disease in Middle East. Beekeepers expressed that AFB is second harmful bee disease with serious economic losses (Aydın et al., 2003). In Eastern Azerbaijan province 5.8% total infection rate was observed, AFB infection was started at May with highest incidence rate (17.3% of apiaries) and finished July with 1%. With attention to our previous study at region (Lotfi et al., 2009), May and June are suitable months for high incidence of noseamosis and also incidence of AFB in honey bee colonies of eastern Azerbaijan province.

CONCLUSION

Investigations on these three important bee diseases at region show high incidence rate of Varroosis in January, February and March, high

incidence of Nosemosis at spring but moderate incidence of American Foulbrood in May and June at eastern Azerbaijan Apiaries. With attention to these findings and reports of local veterinary organization, *varroosis* as major bee disease in this region via impairing of bee colony population and stability, make susceptible conditions for secondary infection with *Nosema apis* at next spring.

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GENİŞLETİLMİŞ ÖZET

Amaç: Bu derlemenin amacı İran'ın kuzeybatısında (önemli arıcılık bölgesi) üç ekonomik arı hastalığının mevsimlere göre incelenmesidir. Bu yönde, Varroosis, Nosemosis ve Amerikan Yavru Çürüklüğü hastalıkları ile ilgili bölge daha önce sunulmuş raporlara bakarak bölge kovanlarındaki önemli hastalıklar gözden geçirilerek irdelenmiştir.

Giriş: İran, dünyanın ilk on arı üretici ülkelerinden birisidir. Buna rağmen arıcılık araştırmaları bu üretim kapasitesini karşılamamaktadır. Bölgede arı hastalıkları ile ilgili hazırlanmış raporlarda kısıtlı bilgiler bulunmaktadır. Bu derlemede doğu Azerbaycan ilinde (İrânın kuzeybatısı ve ülkenin ikinci bal üreten ili) üç arı hastalığı ile ilgili yapılmış olan araştırmalar özetlenmiştir.

Varroosis: İran Veteriner Birliği Varroosis hastalığını arı ve koloni hasarlarının ana nedeni olarak vurgu-

lamıştır. Bölgede yapılan araştırmaya göre (900'ün üzerinde koloni), Mart ayında kolonilerin yüzde 44'ünde varroosis hastalığı tespit edilmiştir ve Haziran ayında ise %7.72 ile en düşük orana sahiptir. Çizelgeye bakıldığında bölge kolonilerinin yılın tüm aylarında Varroa ile enfekte olduğu anlaşılmaktadır. Temmuz, Ağustos, Eylül ve Ekim aylarında kolonilerde varroosis oranı sırası ile %9.76, %26.82, %32.92 ve %40 bulunmuştur. Böylelikle bölge kolonileri kışın varroosis bakımından en yüksek düzeydedir.

Nosemosis: bu hastalıkla ilgili bölgede iki farklı deneme yapılmıştır. Bizim yapmış olduğumuz çalışmada en yüksek enfeksiyon oranı %59 ile bahar sezonunda, Mayıs ayında'dır. Buna karşı sonbahar aylarında hiç bir kovanda nosemosis bulunmamıştır. Bölgede yapılan diğer çalışmalarda da bahar sezonunda en yüksek nosemosis oranı tespit edilmiştir (kolonilerin %46 sında).

Amerikan Yavru Çürüklüğü (AYÇ): İki sene süren çalışma sonucunda, bölge kovanlarının %5.8'inde hastalık sporu bulunmuştur. Mayıs ve Haziran aylarında sıra ile %17.3 ve %11 AYÇ kovan ve bal örneklerinde tespit edilmiştir. Nisan, Ağustos ve Eylül'de hiç bir AYÇ sporu ile enfekte örneğe rastlanmamıştır.

Sonuç: Bu üç önemli hastalığın bölgede yayılışına bakarak, Varroosisin Ocak, Şubat ve Martta, Nosemosisin bahar aylarında ve Amerikan Yavru Çürüklüğünü hastalığının Mayıs ve Haziran aylarında Doğu Azerbaycan ilindeki arı kolonilerini önemli derecede enfekte ettiği söylenebilir. Bulgular Varroosisi bölge arı kolonilerinde en önemli ve temel hastalık olarak göstermektedir. Buna karşı Amerikan Yavru Çürüklüğü (Mayıs hariç) düşük seviyededir. Sonuç olarak Varroosisin balarısı kolonilerini kış döneminde zayıflatarak, bu kolonileri gelecek bahar döneminde nosemosise karşı hassas duruma getirdiği anlaşılmaktadır.