

Parasitism of *Bemisia tabaci* (Genn.) (Hemiptera: Aleyrodidae) by *Eretmocerus mundus* Mercet (Hymenoptera: Aphelinidae) on different crops¹

Amir Abdullahi Yousif MALIK², Kamil KARUT³

***Bemisia tabaci* (Genn.) (Hemiptera: Aleyrodidae)'nin farklı kültür bitkilerinde *Eretmocerus mundus* Mercet (Hymenoptera: Aphelinidae) tarafından parazitlenmesi**

Özet: Bu çalışmada Çukurova'da yetiştirilen bazı kültür bitkilerinde (hıyar, pamuk, patlıcan ve soya) *Bemisia tabaci* (Genn.) (Hemiptera: Aleyrodidae)'nin *Eretmocerus mundus* Mercet (Hymenoptera: Aphelinidae) tarafından parazitlenme durumunun kafes denemeleri ile belirlenmesi amaçlanmıştır. Denemeler, Çukurova Üniversitesi, Ziraat Fakültesi, Bitki Koruma Bölümü Araştırma ve Uygulama arazisinde bulunan yarı kontrollü cam seralarda 2009 ve 2010 yıllarında yürütülmüştür. Denemeler tercihli ve tercihsiz olacak şekilde, 4 tekrarlı olarak tesadüf blokları deneme deseninde kurulmuştur. Tercihli testte, kafes içerisine hıyar, pamuk, patlıcan ve soya bitkilerinin her birinden birer adet yerleştirilmiştir. Tercihsiz testte ise kafes içerisine aynı bitkiden 4 adet yerleştirilmiştir. Bitkilerin 3. yaprağına, klips kafesler yardımıyla 40 adet ergin beyazsinek salınmıştır. Beyazsinek larvaları 2. ve 3. döneme geldiklerinde her kafese 12 adet ergin dişi parazitoid salınmıştır. Parazitoid salımından 10-12 gün sonra yapılan sayımlarla parazitli ve parazitli olmayan *B. tabaci* larvaları kaydedilmiştir. Tercihli testte en yüksek parazitlenme oranı % 53.4 ile hıyar bitkisinde elde edilmiş, bunu % 38.9 ve % 30.3 ile sırasıyla soya ve patlıcan bitkilerinde elde edilen oranlar izlemiştir. Tercihli testte en düşük parazitlenme oranı % 6.9 ile pamuk bitkisinden elde edilmiştir. Tercihsiz testte ise en yüksek parazitlenme oranı % 26.6 ile pamuk bitkisinde elde edilmiş, bunu % 21.9 ve % 18.5 ile hıyar ve soya bitkilerinde elde edilen değerler izlemiştir. Tercihsiz testte en düşük parazitlenme oranı % 9.5 ile patlıcan bitkisinde elde edilmiştir.

Anahtar sözcükler: Kültür bitkisi, *Bemisia tabaci*, *Eretmocerus mundus*, hıyar, pamuk, patlıcan, soya

Abstract: The study was carried out in cage experiments in semi-controlled greenhouse at the Department of Plant Protection research area, Agricultural Faculty, Çukurova University, Turkey, during 2009-2010. It targeted determination of parasitism status of *Eretmocerus mundus* Mercet (Hymenoptera: Aphelinidae) on *Bemisia tabaci* (Genn.) (Hemiptera: Aleyrodidae) infesting cucumber, cotton, eggplant and soybean crops. The

¹This study was presented as a poster at the IV. Plant Protection Congress of Turkey, 28-30 June 2011, Kahramanmaraş, and printed as abstract.

²Agricultural Research Corporation (ARC), Wad Medani, Sudan

³Çukurova University, Agricultural Faculty, Department of Plant Protection, Adana, Turkey

Sorumlu yazar (Corresponding author) e-mail: karuti@cu.edu.tr

Alınış (Received): 05.04.2012

Kabul edilmiş (Accepted): 09.05.2012

experiments comprised choice and non-choice tests arranged in a randomized block design with four replications. In the choice test, four plants of different hosts were located in one cage. In the non-choice test four plants of one host were located in one cage. Forty whitefly adults were released on the 3rd true leaf by using clip cage. Twelve parasitoid females were released into the cages when the whitefly larvae reached the 2nd-3rd stages. After ten days from the release of the parasitoids, parasitized and non-parasitized whitefly larvae were recorded. In the choice test, the highest rate of parasitism 53.4% was found on cucumber, followed by 38.9% on soybean, and 30.3% on eggplant. The lowest rate of parasitism 6.9% was reported on cotton in the choice test. In the non-choice test, the highest rate of parasitism was found on cotton 26.6%, followed by 21.9% on cucumber and 18.5% on soybean. The lowest rate of parasitism was 9.5% reported on eggplant in the non-choice test.

Key words: Parasitism, *Eretmocerus mundus*, *Bemisia tabaci*, cucumber, cotton, eggplant, soybean

Introduction

Çukurova plain is one of the big agricultural production areas of Turkey with multi crops production the year around. Cotton, eggplant, soybean and cucumber are important crops grown in this region. Many pests attack these crops during the growing season; *Bemisia tabaci* (Genn.) (Hemiptera: Aleyrodidae) is the disastrous one that cause significant losses through its direct and indirect damages (Şekeroglu et al. 2000). *Eretmocerus mundus* Mercet (Hymenoptera: Aphelinidae) is an important natural enemy of *B. tabaci* in Çukurova region on different crops. Karut & Akdağcık (2006) reported high and apparent rates of parasitism by *E. mundus* on cotton fields. The total rates of parasitism were 39.4 and 51.5% in sprayed and unsprayed plots, respectively. Similarly, high rates of parasitism were reported by Karut (2006) on tomato, eggplant and cucumber grown in greenhouses and field-grown melon on fields. The rates of parasitism varied between 49.7-76.7% and the highest was found on cucumber. Malik & Karut (2012) had also found high and different parasitism levels on soybean and cotton grown in fields. The higher rate of parasitism was 73.94% obtained on soybean and 50% obtained on cotton. Similar to Malik & Karut (2012) many studies had shown that host plant species can affect the abundance of whiteflies as well as parasitoid and rate of parasitism (Stansly et al., 1997; Simmons et al. 2002; Qiu et al. 2005).

The objective of this study was to determine the rates of parasitism of *E. mundus* on *B. tabaci* infesting cucumber, cotton, eggplant and soybean crops under semi-controlled greenhouse conditions without any insecticides application.

Materials and methods

Plant culture

Cucumber (*Cucumis sativus* L.), eggplant (*Solanum melongena* L.), cotton (*Gossypium hirsutum* L.) and soybean (*Glycine max* (L.) Merr.) were used to host *B. tabaci* in all experiments.

***Bemisia tabaci* and *Eretmocerus mundus* cultures**

The *B. tabaci* adults were collected from cotton fields in Balcalı (Adana) by sucking tube and then released and reared in a whitefly rearing room in the Department of Plant Protection, Agricultural Faculty, Çukurova University. Similarly, the native *E. mundus* was collected from cotton fields and reared on *B. tabaci*-infested cotton and eggplants in a parasitoid rearing room. Both cultures were maintained at a constant temperature of 25 ± 1 °C, relative humidity of $70\pm 10\%$ and 16:8 (L: D) photoperiod regimen using methodology described by Foltyn & Gerling (1985).

Parasitism of *Bemisia tabaci* on different crops

The experiments were carried out in semi-controlled greenhouses located at the Department of Plant Protection research area. Cages of 90 cm length and 75 cm width, covered with thick weaved net were used in the experiments. The experiments were set up in choice and non-choice tests in randomized block design with four replications. In choice test, four plants of different hosts were located in one cage. In non-choice test four plants of the same host were located in one cage.

Forty whitefly adults were released on the 3rd true leaf using clip cage (Bryne et al. 2003). Twelve parasitoid females were released into the cages when the whitefly larvae reached the 2nd-3rd stages. After ten days from the release of the parasitoids, the parasitized and non-parasitized larvae were recorded. The percentage of parasitism was calculated. The experiments were repeated two times in 2009 and 2010. The data obtained in 2009 and 2010 were combined. The data logger "HOBO" was used to determine the temperature and relative humidity.

Statistical analysis

Data were analyzed using one-way ANOVA. The means were separated with Tukey test at $P = 0.05$ (Microsoft Excel, 2002; MSTAT C, 1989). The percentage values of parasitism were subjected to arcsin transformation.

Results and discussion

The reported ambient average temperature and relative humidity during the experiment, changed between 22.8-30.0 °C and 63.4-72.8% in greenhouse. In the choice test, the highest rate of parasitism 53.4% was found on cucumber followed by 38.9% on soybean and 30.3% on eggplant. The lowest rate of parasitism, 6.9%, was found on cotton. This proved that the parasitism rate of *E. mundus* on *B. tabaci* could differ significantly on different host plants ($P < 0.001$, F: 17.77, df: 3). Similarly, in the non-choice tests, the rates of parasitism were found statistically different on different host plants ($P < 0.001$, F: 9.98, df: 3). The highest rate of parasitism 26.6% was found on cotton, followed by 21.9% on cucumber and 18.5% on soybean. The lowest rate of parasitism 9.5% was on eggplants (Table 1).

Malik & Karut (2012) found high rates of parasitism on cotton, eggplant and soybean than the cucumber fields and they related this to many factors such as

insecticides application and leaf trichomes. The authors found that the parasitism levels of *E. mundus* were almost the same on soybean, eggplant and cotton grown in field conditions. Similarly, in the choice test the rates of parasitism obtained from eggplant and soybean were found very close but differently the rate obtained from cotton which was found very low.

Table 1. Rates of parasitism of *Eretmocerus mundus* on *Bemisia tabaci* infesting different crops in choice and non-choice tests

Host plants	Choice		Non-choice	
	Parasitism Average	(%) Min.-Max.	Parasitism Average	(%) Min.-Max.
Cucumber	53.48 a*	41.0-75.3	21.98 ab	2.4-59.4
Cotton	6.95 c	3.4-11.0	26.64 a	7.6-66.6
Eggplant	30.33 b	12.0-54.6	9.54 c	1.2-29.9
Soybean	38.98 b	16.2-61.5	18.56 b	1.7-47.5

*Means in the same column followed by the same letter do not differ significantly ($P < 0.05$).

The low rates of parasitism recorded on cucumbers were recorded in many studies and were attributed to the negative effect of the leaf hairs on the cucumber plants which constrain walking speed and pattern of the parasitoids (Hulspas-Jordaan & van Lenteren 1978; Van Lenteren et al. 1995; Gruenhagen & Perring 2001; Qiu et al. 2005; Malik & Karut 2012). In contrast the high parasitism of *E. mundus* recorded on cucumber in this study. This might attribute to many factors among which is the semiochemicals released from cucumber than the other host plants when all are found in the same cage. However, more detailed laboratory studies are needed to prove this hypothesis.

In conclusion the rates of parasitism of *E. mundus* on *B. tabaci* infesting cucumber, cotton, eggplant and soybean were changing in semi-controlled greenhouse conditions. The efficiency of *E. mundus*, except for cotton in choice test and eggplant in non-choice test found more promised. The high rate of parasitism of *E. mundus* recorded on cucumber, especially in choice test was interested. Further detailed studies in controlled conditions are needed to figure out the causes of differences on rates of parasitism on different crops.

Acknowledgments

This work is part of the PhD thesis of Amir Abdullahi Yousif MALIK, funded by the University of Çukurova in Turkey. The authors are grateful to Prof. Dr. Cengiz KAZAK and Prof. Dr. Tag Elsir Elamin ABDALLA for revised the manuscript.

References

- Byrne F.J, S. Castle, N. Prabhaker & N.C. Toscano 2003. Biochemical study of resistance to imidacloprid in B biotype *Bemisia tabaci* from Guatemala. *Pest Management Science*, 59: 347–352.
- Foltyn S. & D. Gerling 1985. The parasitoids of the aleyrodid *Bemisia tabaci* in Israel: development, host preference and discrimination of the aphelinid wasp *Eretmocerus mundus*. *Entomologia Experimentalis et Applicata*, 38: 255–260.
- Gruenhagen N.M. & T.M. Perring 2001. Impact of leaf trichomes on parasitoid behavior and parasitism of silverleaf whiteflies (Homoptera: Aleyrodidae). *Southwestern Entomologist*, 26 (3): 279-290.
- Hulspas-Jordaan P.M. & J.C. van Lenteren 1978. The relationship between host-plant leaf structure and parasitoid efficiency of parasitic wasp *Encarsia formosa* Gahan (Hymenoptera: Aphelinidae). *Mede-delingen van de Faculteit Landbouwwetenschappen Rijksuniversiteit Gent*, 43: 431- 440.
- Karut K. 2006. Determination of parasitism status of *Bemisia tabaci* (Gennadius) (Homoptera: Aleyrodidae) on greenhouse and field grown cultural plants in Balcalı (Adana). *Turkish Journal of Entomology*, 30 (2): 113-121.
- Karut K & Z. Akdağcık 2006. Determination of parasitism status of *Bemisia tabaci* (Gennadius) (Homoptera: Aleyrodidae) in cotton fields in Çukurova. *Turkish Journal of Entomology*, 30 (1): 33-41.
- Malik A.A.Y & K. Karut 2012. Parasitism status of *Bemisia tabaci* (Gennadius 1889) (Homoptera: Aleyrodidae) on different host-plants in the Çukurova region of Turkey. *Turkish Journal of Entomology*, 36 (1): 59-67.
- Microsoft Excel 2002; Microsoft Office Excel ver. 2003. Microsoft Corporation, Seattle WA.
- Mstat C. 1989. A microcomputer program for the design, management and analyses agronomic research experiments. Michigan State University, East Lansing
- Simmons A.M., S. Abd-Rabou & G.S. McCutcheon 2002. Incidence of parasitoids of *Bemisia tabaci* (Homoptera. Aleyrodidae) in numerous crops. *Environmental Entomology*, 31 (6): 1030-1036.
- Stansly P.A., D.J. Schuster & T.X. Liu 1997. Apparent parasitism of *Bemisia argentifolii* (Homoptera. Aleyrodidae) on vegetable crops and associated weeds in South Florida. *Biological Control*, 9 (1): 49-57.
- Şekeroğlu E., A.F. Özgür, C. Kazak & K. Karut 2000. IPM for cotton in Çukurova region of Turkey. The Inter-regional Cooperative Research Network on Cotton. A joint Workshop and Meeting of the Working Groups (Adana, Turkey), 169-173.
- Qiu B.L., P.J. De Baro & S.X. Ren 2005. Development, survivorship and reproduction of *Eretmocerus* sp. nr *furuhashii* (Hymenoptera: Aphelinidae) parasitizing *Bemisia tabaci* (Homoptera: Aleyrodidae) on glabrous and non-glabrous host plants. *Bulletin of Entomological Research*, 95 (4): 313-319.
- Van Lenteren J.C., L.Z. Hua, J.W. Kamerman & X. Rumei 1995. The parasite-host relationship between *Encarsia formosa* (Hymenoptera: Aphelinidae) and *Trialeurodes vaporariorum* (Homoptera: Aleyrodidae) XXVI. Leaf hairs reduce the capacity of *Encarsia* to control greenhouse whitefly on cucumber. *Journal of Applied Entomology*, 119 (8): 553-559.