

Seasonal Population Fluctuations and Damage Rates of *Ceratitis capitata* (Wiedemann) (Diptera: Tephritidae) on Pomegranate Orchards in Osmaniye Province

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ABSTRACT

The Mediterranean fruit fly (Medfly), *Ceratitis capitata* (Wiedemann) (Diptera: Tephritidae), is one of the important pests of pomegranate in Turkey. The studies were conducted in 2012-2013 to determine seasonal population fluctuations and damage rates of medfly at pomegranate orchards in Osmaniye province. The study was carried out using the Econex yellow traps and pheromones (%95 trimedlure) and DDVP at four different pomegranate orchards in 2012 (11 August to 21 December), and at four different pomegranate orchards in 2013 (11 August to 30 November) all of which were 'Hicaz' variety. The pheromone traps were weekly checked and captured medfly adults were counted and then cleaned. During the harvest time, except from pheromone trap hanging tree, 300 pomegranate fruits were randomly selected to evaluate the number of the damaged fruits in the each orchard. In 2012, the medfly adults caught by traps at two orchards and the highest number of them was recorded on 26 October, followed on 09-23 November and 15 September. The largest percentages of medfly was observed in November (45.8), followed September (23.8), October (20.8), August (8.3) and December (1.19). In 2013, the medfly adults caught by traps at all orchards and the highest number of them was recorded on 10 November, followed on 3 November and 13 October. The largest percentages of medfly was observed in November (35.4), followed September (32.85), October (28.83) and August (2.92). In 2012, the highest percentages of damage rates was observed at orchard II (7.33), followed orchard I (5.66). In 2013, the highest percentages of damage rates was observed at orchard I (10.33), followed at orchard IV (10), orchard III (6.66), and orchard II (5.66).

Research Article

Article History

Received : 28.05.2020

Accepted : 09.07.2020

Keywords

Mediterranean fruit fly

Trimedlure

Damages rates

Pomegranate

Osmaniye ili Nar Bahçeleri'nde *Ceratitis capitata* (Wiedemann) (Diptera: Tephritidae)'nin Mevsimsel Popülasyon Dalgalanmaları ve Zarar oranları

ÖZET

Akdeniz meyve sineği (AMS), *Ceratitis capitata* (Wiedemann) (Diptera: Tephritidae), ülkemizde narın önemli bir zararlısıdır. Çalışma 2012-2013 yıllarında Osmaniye ilinde bulunan nar bahçelerinde Akdeniz meyve sineğinin mevsimsel popülasyon dalgalanmaları ve zarar oranının belirlenmesi için yapılmıştır. Çalışma Econex sarı tuzak + feromon (% 95 trimedlure) ve DDVP kullanılarak birinci yılda (11 Ağustos-21 Aralık) Hicaz çeşidi bulunan dört nar bahçesinde, ikinci yılda (11 Ağustos-30 Kasım) Hicaz çeşitleri bulunan dört nar bahçesinde yapılmıştır. Feromon tuzakları haftalık olarak kontrol edilmiş ve yakalanan erginler sayılmış ve temizlenmiştir. Hasat zamanı feromon tuzaklarının kurulduğu nar ağacı hariç, her bahçeden rastgele seçilen 300 meyve kontrol edilerek vuruklu nar meyvesi sayısı kaydedilmiştir. 2012 yılında yalnızca iki bahçede AMS ergini belirlenmiş olup en fazla ergin 26 Ekim'de yakalanmış, bunu 9-23 Kasım, 15 Eylül tarihleri takip etmiştir. Yüzdese olarak en fazla ergin kasım (45.8) ayında yakalanmış olup, bunu eylül (23.8), ekim (20.8), ağustos (8.3) ve aralık (1.19) ayları

Araştırma Makelesi

Makale Tarihi

Geliş Tarihi : 28.05.2020

Kabul Tarihi : 09.07.2020

Anahtar Kelimeler

Akdeniz meyve sineği

Trimedlure

Zarar oranı

Nar

takip etmiştir. 2013 yılında bütün bahçelerde AMS ergini belirlenmiş olup en fazla ergin 10 Kasım'da yakalanmış, bunu 3 Kasım ve 13 Ekim tarihleri takip etmiştir. Yüzdesel olarak en fazla ergin kasım (35.40) ayında yakalanmış, bunu eylül (32.85), ekim (28.83) ve ağustos (2.92) ayları takip etmiştir. 2012 yılında yüzdesel olarak AMS'nin en fazla zararı Bahçe II (7.33)'de gözlenmiş, bunu Bahçe I (5.66) takip etmiştir. 2013 yılında yüzdesel olarak AMS'nin en fazla zararı Bahçe I (10.33)'de gözlenmiş, bunu Bahçe IV (10.0), Bahçe III (6.66) ve Bahçe II (5.66) takip etmiştir.

To Cite : Demirel N, Çardak M 2021. Seasonal Population Fluctuations and Damage Rates of *Ceratitis capitata* (Wiedemann) (Diptera: Tephritidae) on Pomegranate Orchards in Osmaniye Province. KSU J. Agric Nat 24 (1): 171-176. <https://doi.org/10.18016/ksutarimdog.a.vi.744349>.

INTRODUCTION

Pomegranate, *Punica granatum* L. (Punicaceae: Myrtiflorae), is an important tropical and subtropical fruit tree (Morton, 1987). The Mediterranean fruit fly (Medfly), *Ceratitis capitata* (Wiedemann) (Diptera: Tephritidae), is a significant fruit pests in the world (Fimiani, 1989; White and Elson-Haris, 1994). This pest is a polyphagous species attacking over 350 different hosts (Liquido et al., 1991). The pests can overwinter as pupa in the soil under the host plant (White and Elson-Haris, 1994). They appear on apricot and peach from June to July (Christenson and Foote, 1960), on pomegranate from late July to August if they are available (Demirel, 2016; Demirel et al., 2018; Demirel, 2019a). The pomegranate fruits are destroyed by larval feeding and caused significant damages if not controlled (White and Elson-Haris, 1994). Trimedlure is important tools for detection, monitoring and controlling of the medfly (Leonhardt et al., 1989; Warthen et al., 1997; IAEA, 2003; Çalıklı, 2015; Demirel, 2016; Demirel and Akyol, 2017; Kılıç and Demirel, 2018; Demirel et al., 2018; Demirel, 2019a;b). Traps baited with lures are also used to monitor population size (Niccoli et al., 1991; IAEA, 2003). The purpose of the current study was to determine seasonal population fluctuations and damage rates of medfly, *Ceratitis capitata* (Wiedemann) (Diptera: Tephritidae) in pomegranate orchards in Osmaniye province of Turkey. [Century12 regular].

MATERIALS and METHODS

The study was conducted in 2012-2013 at eight pomegranate orchards in Osmaniye province of Turkey. The study was carried out using the Eostrap® invaginada traps (Sanidad Agricola Econex, Santomera, Murcia, Spain) baited with % 95 Trimedlure, (formulated in a polymeric plug-type dispenser) (Sanidad Agricola Econex, Santomera, Murcia, Spain) and dichlorvos or 2.2- dichlorovinyl dimethyl phosphate (DDVP) tablet (Sanidad Agricola Econex, Santomera, Murcia, Spain). The first study was conducted at four different pomegranate orchards of the villages Çona (orchard I), Akarca (orchard II),

Şekerdere (orchard III), and Aydınlar (orchard IV) of Osmaniye province. All pomegranate orchards contain 'Hicaz' variety and conducted from 11 August to 21 December 2012. The second study was carried out at four different pomegranate orchards of the villages Alhanlı (orchard I), Çardak (orchard II), Çona (orchard III), and Aydınlar (orchard IV) of Osmaniye province. All pomegranate orchards contain 'Hicaz' variety and conducted from 11 August to 30 November 2013. In both years, one trap for each orchard was used. The traps were placed 1.5 m above ground and checked weekly, trapped medfly were counted and removed from the traps. The trimedlure and DDVP tablet in traps were replaced with the new ones in every 90 days.

The fruit damage assessment was measured by the percentage of medfly punctures during the harvest. For this purpose, during the harvest time, except from the trap baited with trimedlure hanging tree, three-hundred fruits were chosen randomly from thirty trees in each of the orchards and checked for medfly punctures and infested fruits were counted. The percentage of fruit damage was calculated by dividing the number of infested fruits by the total number of sampled fruits in each orchards to evaluate the percentage of the damaged fruits in each of the orchard. [Century12 regular].

RESULTS and DISCUSSION

A seasonal population fluctuations of the medfly varied in each of the sampled orchards. In 2012, a four 'Hicaz' pomegranate orchards were sampled and medfly were recorded in two of them, while they were not found in other two. A population fluctuations of this pest varied during the sampling period. A total of 168 medfly adults were caught by traps baited with trimedlure (Figure 1). The first adults were caught by traps on 17 August. The largest mean of catches were recorded on 26 October (11.0), 9 November (11.0), followed by 23 November (10.5) and 15 September (8.5), respectively. In 2013, the medfly were found in all pomegranate orchards and population fluctuations varied during the sampling period. A total of 274 medfly adults were caught by traps baited with trimedlure (Figure 2). The

first adults were caught by traps on 18 August. The largest mean of catches were recorded on 10 November (8.75), followed by 3 November (7.75), 13 October (7.0) and 22 September (6.25), respectively. In addition, the percentage of the total caught over this period varied for each of the sampling month. In 2012, the highest percentage of the medfly was observed in November

(45.29), followed in October (21.76), September (17.65), August (8.3) and December (1.17) (Figure 3). In 2013, the highest percentage of the medfly was observed in November (35.4), followed in September (32.85), October (28.83) and August (2.92) (Figure 3).

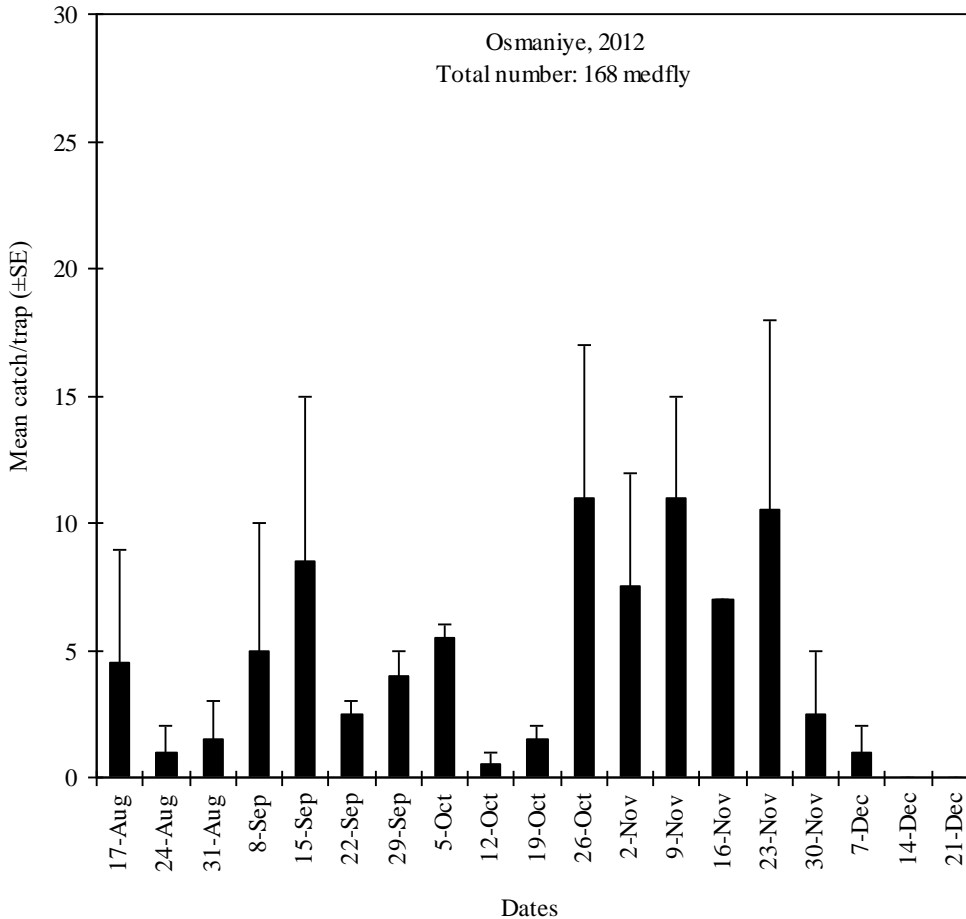


Figure1. Mean (\pm SE) catches of medfly adults in traps baited with trimedlure (17 August–21 December, 2012) at pomegranate orchards in Osmaniye province

Şekil 1. Osmaniye ili nar bahçelerinde 17 Ağustos-21 Aralık 2012 arasında Trimedlure ile beraber kullanılan tuzaklar tarafından yakalanan ortalama (\pm SE) AMS ergin sayıları

The population density of the medfly varied on different host plants. Demirel (2016) reported that the population density of medfly on pomegranate orchards in Hatay province in 2012 and 2014. In 2012, a six pomegranate orchards in Antakya district were sampled. The largest mean of catches/traps were recorded on 4 November (127.50), followed by 28 October (122.33), 18 November (59.67), 11 November (45.0), 14 October (39.67) and 21 October (29.83). Moreover, a four pomegranate orchards in Antakya district were sampled in 2014. The largest mean of catches/traps were recorded on 8 November (69.5), followed by 15 November (67.25), 1 November (53.0), 22 November (33.75), 26 October (32.25), 29 November (20.25) and 19 October (19.0). Demirel and Akyol (2017) reported that the population density of medfly

varied in each of sampling periods on satsuma mandarin. The largest percentages of the medfly were recorded in October (71.32), followed by November (10.13), September (6.54) and August (1.17) in 2011. In addition, the largest percentages of the medfly were recorded in September (32.13), followed by November (26.70), October (16.37) and August (3.67) in 2012. Kılıç and Demirel (2018) studied the population density of medfly on persimmon. The largest percentage of medfly were recorded in July (6.76), August (28.06), September (36.56), October (22.74) and November (5.88) in 2013. In addition, the largest percentage of them were recorded in August (66.12), September (12.86), October (16.30), and November (4.99) in 2014.

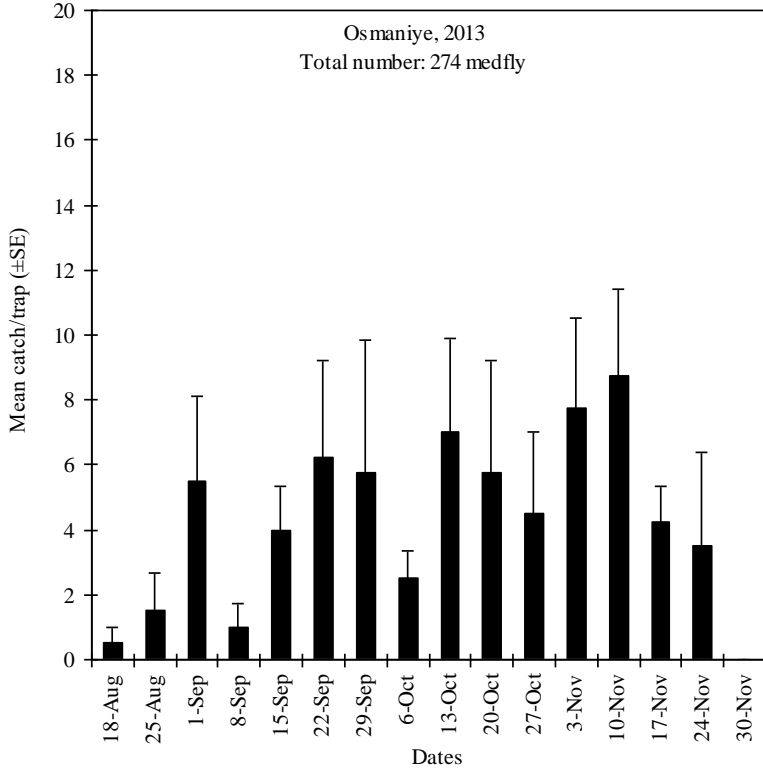


Figure2. Mean (\pm SE) catches of medfly adults in traps baited with trimedlure (18 August–30 November, 2013) at pomegranate orchards in Osmaniye provinc

Şekil 2. Osmaniye ili nar bahçelerinde 18 Ağustos-30 Kasım 2013 arasında Trimedlure ile beraber kullanılan tuzaklar tarafından yakalanan ortalama (\pm SE) AMS sayıları

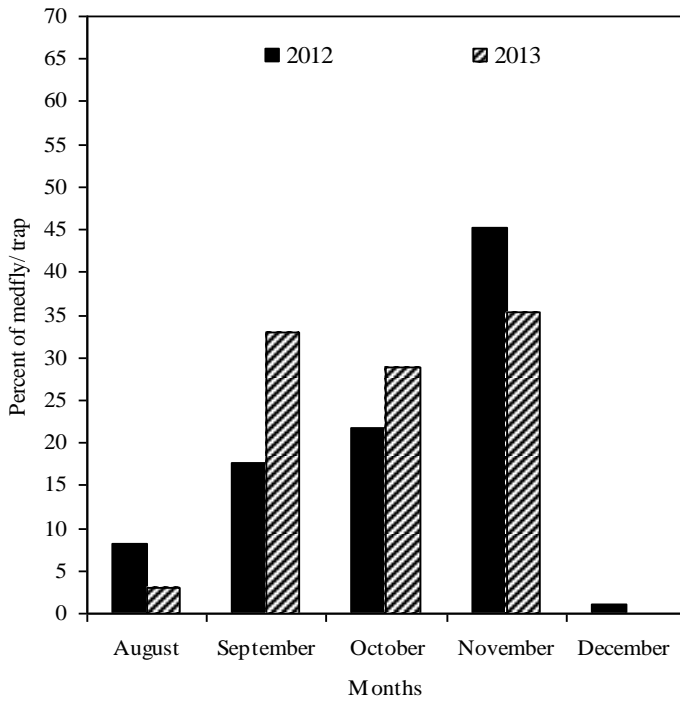


Figure 3. Percentage of the total medfly adults caught over the sampling period at the pomegranate orchards in Osmaniye province in 2012-2013

Şekil 3. 2012-2013 yılları arasında Osmaniye ilindeki nar bahçelerinde örnekleme süresince yakalanan toplam AMS ergin yüzdesi

The current study indicated that damage rates of medfly were observed different in each of the sampled orchards. In 2012, the highest percentages of damage rates were observed at orchard II (7.33), followed orchard I (5.66) (Figure 4). Moreover, in 2013, the highest percentages of damage rates were observed at orchard I (10.33) , followed at orchard IV (10.0), orchard III (6.66), and orchard II (5.66) (Figure 4).

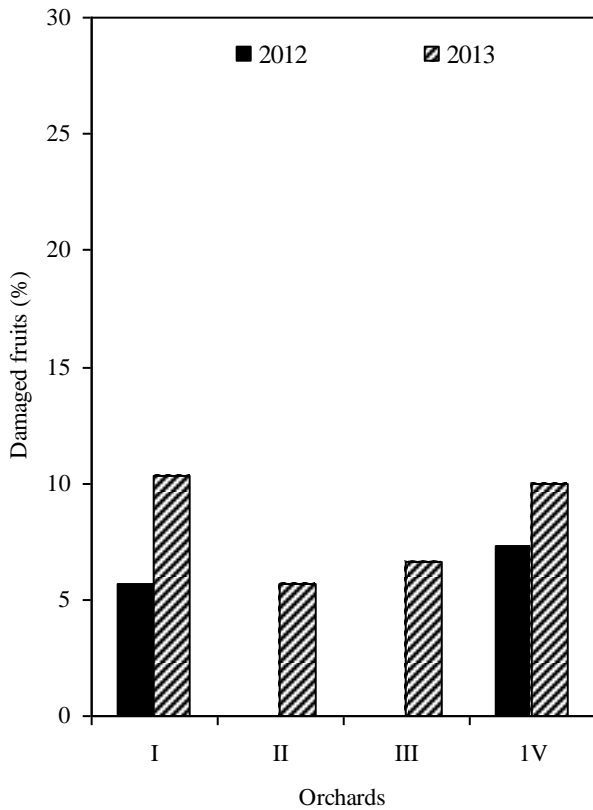


Figure 4. Percentage of the damaged fruits by medfly in pomegranate orchards in Osmaniye province in 2012-2013

Şekil 4. 2012-2013 yıllarında Osmaniye ilindeki nar bahçelerinde AMS tarafından yapılan zararlı meyvelerin yüzdesi

Many studies were conducted to evaluate damage rates of medfly on different fruits. Yıldırım and Başpınar (2011) the percentage of infestation rate at pomegranate orchards was 2.20 percent during harvest time. Demirel (2014) reported that the largest percentage of infestation rate were observed at orchard II (karamehmet+katırbaşı) (42), followed orchard I (karamehmet+katırbaşı) (37), orchard III (katırbaşı) (7) and orchard IV (katırbaşı) (3) in 2010. In addition, the largest percentage of infestation rates were observed at orchard I (katırbaşı) (44) , followed at orchard II (Hicaz) (8) in 2011. Kasap and Aslan (2016) reported that percentage of infestation rates was 5.2 on 'Acco' pomegranate. Demirel (2016) reported that

the percentage of damage rate on 'Hicaz' pomegranate were observed at orchard II (14), followed by orchard VI (12), orchard I (11), orchard IV (9), orchard III (7) and orchard V (7) in 2012. Moreover, the highest percentages of damage ratios were observed at orchard IV (Katırbaşı) (25), followed by orchard III (Katırbaşı) (22), orchard II (Hicaz) (15) and orchard I (Hicaz) (12) in 2014. [Century12 regular].

CONCLUSION

The current study was carried out by traps baited with trimedlure to determine seasonal population fluctuations and damage rates of medfly in pomegranate orchards in Osmaniye province of Turkey. The medfly was found in six sites, while it did not find two sites. The seasonal population fluctuations varied in each of the sampled orchard and sampling period. The highest number of medfly was observed in November, followed by September and October in both years. In 2012, the highest percentage of damage rates were observed at orchard II (7.33), followed orchard I (5.66). In addition, the largest percentage of damage rates were observed at orchard I (10.33) , followed at orchard IV (10), orchard III (6.66), and orchard II (5.66) in 2013. [Century12 regular].

ACKNOWLEDGEMENTS

This project was supported by Univerity of Mustafa Kemal of Scientific Research Projects (BAP) (project number: 9485).

Author's Contributions

The contribution of the authors is equal.

Statement of Conflict of Interest

Authors have declared no conflict of interest.

REFERENCES

- Christenson LD, Foote RH 1960. Biology of fruit flies. Annual Review of Entomol. 5: 171-192.
- Çalık Ş 2015. Akdeniz Meyve Sineği, *Ceratitıs capitata* (Wiedemann) (Diptera: Tephritidae)'nin mücadelesinde farklı cezbedicilerin kullanılması. Mustafa Kemal Üniversitesi. Fen Bilimleri Enstitüsü. Yüksek Lisans Tezi. Hatay, 65 pp.
- Demirel N 2014. Akdeniz Meyve Sineği, *Ceratitıs capitata* (Wiedemann) Diptera: Tephritidae)'nin Populasyon Yoğunluğu ve Zarar Oranının Farklı Çeşitteki Nar Bahçelerinde Belirlenmesi. Türkiye V. Bitki Koruma Kong., 3-5 Şubat 2014, Antalya.
- Demirel, N 2016. Population density and damage ratios of Mediterranean fruit fly *Ceratitıs capitata* Wiedemann Diptera Tephritidae on pomegranate orchards in Turkey. Entomology and Applied Science Letters. 3: 1-7.

- Demirel N 2019a. Trapping genders of *Ceratitis capitata* (Diptera: Tephritidae) and other Dipteran with various attractants on pomegranate fruits in Turkey. *Fresenius Environmental Bulletin*. 28: 2937-2941.
- Demirel N 2019b. Efficacy of various attractants to Mediterranean fruit fly, *Ceratitis capitata* (Wiedemann) (Diptera: Tephritidae) on persimmon fruits in Turkey. *Fresenius Environmental Bulletin*. 28: 5390-5397.
- Demirel, N, Akyol E 2017. Evaluation of mass trapping for control of Mediterranean fruit fly, *Ceratitis capitata* (Wiedemann) (Diptera: Tephritidae) in Satsuma mandarin in Hatay province of Turkey. *International Journal of Environmental Agriculture Research*. 3: 32-37.
- Demirel, N, Yıldırım AE, Kılıç, G 2018. Effectiveness of various attractants for Mediterranean fruit fly, *Ceratitis capitata* (Wiedemann) (Diptera: Tephritidae) on pomegranate fruits in Turkey. *Fresenius Environmental Bulletin*. 27: 3191-3198.
- Fimiani P 1989. Pest status; Mediterranean region. In: Robinson AS, Hooper G, eds. *Fruit Flies; Their Biology, Natural Enemies and Control*. World Crop Pests, 3(A):37-50. Amsterdam, Netherlands: Elsevier.
- IAEA 2003. Trapping guidelines for area-wide fruit fly programmes. Insect Pest Control Section, International Atomic Energy Agency, Vienna, Austria.
- Kasap A, Aslan MM 2016. The Monitoring the Population and Detection of the Loss Ratio of the Mediterranean Fruit fly (*Ceratitis capitata* Wied.) (Diptera: Tephritidae) By Pheromone Traps in Pomegranate and Persimmon Varieties. *KSU J. Nat. Sci.*, 19:43-50.
- Kılıç G, Demirel N 2018. A population fluctuation and damage rates of *Ceratitis capitata* Wied.) (Diptera: Tephritidae) on persimmon fruits in Turkey. *Fresenius Environmental Bulletin*. 27: 5072-5077.
- Leonhardt BA, Cunningham RT, Rice RE, Harte EM, Hendrichs J 1989. Design, effectiveness, and performance criteria of dispenser formulations of trimedlure, an attractant of the Mediterranean fruit fly (Diptera: Tephritidae). *J.Econ. Entomol.* 82: 860-867.
- Liquido NJ, Shinoda LA, Cunningham RT 1991. Host Plants of the Mediterranean Fruit Fly (Diptera Tephritidae): An annotated world review. *Misc. Publ. Entomol. Soc. Am.* 77:1-52.
- Morton J 1987. Pomegranate. p. 352-355. In: *Fruits of warm climates*. Julia F. Morton, FL. Miami.
- Niccoli A, Sacchetti P, Lupi E 1991. Observations on the capture of *Ceratitis capitata* in peach orchards in Tuscany. *Redia*. 74: 641-658.
- Warthen JD, Cunningham RT, Leonhardt BA, Cook JM, Avery JW, Harte EM 1997. Improved controlled-release formulations for a new trap design for male Mediterranean fruit flies the C&C trap. *J. Chem. Ecol.* 23:1471-1486.
- White IM, Elson-Harris, MM 1994. *Fruit Flies of Economic Significance. Their Identification and Bionomics*. Wallingford, UK, CAB International, 601 pp
- Yıldırım EM, Başpınar H 2011. Aydın ili nar bahçelerinde saptanan zararlı ve predatör türler, yayılışı, zararlı türlerden önemlilerinin popülasyon değişimi ve zararı. *Türk. entomol. Bült.* 1: 169-179.