Türk Bilimsel Derlemeler Dergisi 6 (2): 33-37, 2013
ISSN: 1308-0040, E-ISSN: 2146-0132, www.nobel.gen.tr

Fruit Flies of Economic Importance in Turkey, With Special Reference to Mediterranean Fruit Fly, *Ceratitis capitata* (Wied.) [1]

Naime Z. ELEKÇIOĞLU
Biological Control Research Station, 01321, Yüreğir/Adana/TURKEY

***Sorumlu Yazar:**
E-posta: nelekcioglu@yahoo.com

Geliş Tarihi : 11 Ağustos 2012
Kabul Tarihi : 22 Eylül 2012

Abstract

Three fruit fly species occur in Turkey that can be considered as important pests of agricultural crops; The Mediterranean fruit fly (Medfly), *Ceratitis capitata* Wied., the olive fruit fly *Bactrocera oleae* Gmel. and the cherry fruit fly, *Rhagoletis cerasi* L. (Diptera: Tephritidae). Mediterranean fruit fly is by far the most important fruit fly species, due to its considerable number of hosts. Citrus species are of main importance among the hosts because of the export limitations. Due to the mild winter and the widespread of host crops, population of the pest is very high, having 4-8 generations throughout the year in Turkey. Yield losses can reach up to 80%, if proper control measurements are not applied. The control of the pest is based mainly on insecticide treatments. The only application recommended is bait spraying. There is very little mass trapping, but some growers do rely on monitoring traps. Olive fruit fly is the most significant olive fruit pest and found at almost all olive growing areas. If it is not controlled, it causes a damage of 15-30%. The impact of the damage can vary considerably depending on whether the fruit is for oil extraction or for table consumption. Mass trapping, bait and cover sprayings are the most preferred control methods. Cherry fruit fly is the most economically important pest of sweet and sour cherry. The mid and late ripening cultivars are highly affected. The control of the pest is based mainly on 1-2 insecticide treatments either by bait or cover spraying. Mass trapping with the combination of chemical treatments also gives good results.

Key Words: Mediterranean fruit fly, *Ceratitis capitata*, *Bactrocera oleae*, *Rhagoletis cerasi*, management

Türkiye'de Ekonomik Öneme Sahip Meyvesinekleri, Akdeniz Meyvesineği, *Ceratitis capitata* (Wied.)'ne Özel Bir Bakış

Özet

Türkiye'de tarımsal ürünlerde zararlı önemli üç meyvesineği türü bulunmaktadır; Akdeniz meyvesineği, *Ceratitis capitata* (Wied.), Zeytin sineği *Bactrocera oleae* Gmel. ve Kiraz sineği, *Rhagoletis cerasi* L. (Diptera: Tephritidae). Bu türlerden Akdeniz meyvesineği oldukça çok konukçusunun bulunması nedeniyle en önemlisidir. Bu konukçulardan turunçgillerin ihracatında zararlı önemli sorunlara neden olmaktadır. Ilıman kış koşulları ve konukçu bitkilerinin yaygınlığı nedeniyle Türkiye'de Akdeniz meyvesineği populasyonu yüksek olmakta ve zararlı yılda 4-8 döl vermektedir. Mücadelenin düzenli yapılmadığı durumlarda ürün kaybı %80'e kadar çıkabilmektedir. Zararlının mücadelesi daha çok kimyasal mücadele yöntemiyle olup, önerilen tek uygulama kısmi dal ilaçlama yöntemidir. Kitle halinde tuzakla yakalama yöntemi az bir alanda uygulanmakta ancak bazı üreticiler monitör amaçlı tuzaklar kullanmaktadırlar. Zeytin sineği ülkemizin en önemli zeytin zararlısı olup hemen hemen tüm zeytin yetiştirilen alanlarda bulunmaktadır. Mücadele edilmediği durumlarda %15-30 zarara neden olmaktadır. Zararın etkisi zeytinin yağlık veya sofralık olma durumuna göre değişmektedir. Mücadelesinde kitle halinde tuzakla yakalama, kısmi dal ve kaplama ilaçlama yöntemleri tercih edilmektedir. Kiraz sineği, kiraz ve vişnenin en önemli zararlılarından birisidir. Orta ve geçci çeşitlerde zarar daha fazla olmaktadır. Zararlının mücadelesi 1-2 defa yapılan kısmi dal veya kaplama ilaçlama şeklindedir. Kitle halinde tuzakla yakalama yöntemi ile kimyasal mücadelenin kombine edildiği durumlarda mücadelenin etkinliği artmaktadır.

Anahtar Kelimeler: Akdeniz meyvesineği, *Ceratitis capitata*, *Bactrocera oleae*, *Rhagoletis cerasi*, mücadele

INTRODUCTION

Fruit flies (Diptera: Tephritidae) are of major economic importance in agriculture. Besides causing direct losses to a wide variety of fruit, vegetable and flower crops (e.g., citrus, apple, mango, sunflower), they limit the development of agriculture in many countries because of the strict trade quarantines imposed to prevent their spread. Of the more than 4,400 species known worldwide [1], nearly 200 are considered pests. In Turkey, 94 species of fruit flies were reported in 2003 [2], while this number reached to 117 in 2012 [3]. Three economically significant tephritid fruit fly species occur in Turkey; the olive fly, *Bactrocera oleae* Gmel., the cherry fruit fly, *Rhagoletis cerasi* L., and the Mediterranean fruit fly, *Ceratitis capitata* (Wied.).

This presentation illustrates and discusses the economically important fruit flies in Turkey with special reference to *C. capitata*.

Olive Fly, *Bactrocera oleae* Gmel.

Olive growing areas in Turkey are located along the Aegean region (55.11%), the Marmara region (27.72%) and the Mediterranean region (14.94%) [4]. *Bactrocera oleae* Gmel. (Dip.: Tephritidae) is the most significant olive fruit pest at almost all Turkish olive growing areas. The wild or commercially cultivated olive, *Olea europaea* L. is its main host. It gives 3-5 generations at different regions. If it is not controlled, it causes a damage of 15-30% which reaches up to 80% at the invasions. In the orchards where the proper cultural practices are followed and harvest earlier, the damage is lower. *B. oleae* is associated with 1 predator and 11 parasitoid species which *Psyttalia (Opius) concolor* Szelp. (Hym.: Braconidae) is the most effective one on the pest. *P. concolor* is mass reared and released to some orchards. At the orchards more than 5-10 ha., where the pest population is lower, mass trapping with the combination of biological control gives good results. When the natural enemies do not able to keep the pest population at low levels, well-timed applications are recommended. This pest is managed by bait spraying with a mixture of protein and organophosphate insecticide, by cover spraying the entire tree or aerial spraying which is acceptable with integrated pest management (IPM) strategies [5]. *B. oleae* was the only pest that aerial control was permitted in Turkey (only in Aegean region) due to the geographical conditions of the region. In June 2012, this type of treatment was forbidden in this region also.

Cherry Fruit Fly, *Rhagoletis cerasi* L.

Rhagoletis cerasi is the main pest of sweet cherry and sour cherry and present in all areas where they are grown. *Lonicera* spp. and wild cherry are the other hosts of the pest. It gives one generation a year. It does not cause any damage at early varieties. Mid and late varieties which matures in June are highly infected. The damage reaches up to 80% at the invasions. The threshold of tolerance at export is zero. The common recommendations as cultural practices, include collection of all fruits on the tree and infested fruits on the floor at harvest, ploughing during autumn and not planting host plants in the orchards. Mass trapping with the combination of yellow sticky Rebell traps and ammonium carbonate traps results 95.99-97.41% control. Hanging four of these trap combinations per tree at the cardinal directions with a rate of 0.2 per ha is sufficient [6]. Mass trapping can be combined with chemical control at orchards of mid and late varieties when the pest population is high. Chemical control for this pest is as either ground bait or cover spraying [5].

The Citrus Industry in Turkey

Citrus growing areas of Turkey are situated in the northern hemisphere of the citrus belt. Turkey has very suitable ecological conditions and potential for citrus production. Important citrus production areas are located along the Mediterranean coast and coastal parts of the Aegean and the Eastern Black Sea Regions. In these regions, major citrus species and cultivars are economically grown with very high fruit quality. Turkey's total citrus production is 3,220,450 tons. This amount consists of 1,535,800 tons of oranges, (*Citrus sinensis* (L.) Osb.), 791,255 tons of mandarins (*C. reticulata* Blanco), 710,400 tons of lemons (*Citrus limon* Burm. F.) and 180,000 tons of grapefruit (*Citrus paradise* Macf.). Turkey is the second in the Mediterranean Basin after Spain by almost 950,000 tones of citrus exportation [7]. The production of all citrus in Turkey has been increasing steadily in the past 20 years, but especially since the year 2000. This is mainly due to increasing number of citrus orchards, better varieties and increasing awareness of the producers. The Mediterranean Region accounts for about 90 percent of all citrus grown in Turkey, and the Aegean Region counts for most of the rest. The primary production zone is East Mediterranean Region (Çukurova- southern border of Turkey) which produces 70 percent of all citrus grown in Turkey (Figure 1). The three provinces that make up Çukurova specialize as follows:

1- Hatay Province-southern part and specializes in oranges,

2- Adana Province-central part and specializes in oranges, mandarins and grapefruits,

3- Mersin Province-western part and specializes in lemons.

The Situation of Mediterranean Fruit Fly (*Ceratitis capitata*) and its Management in Turkey

Mediterranean Fruit Fly (Medfly) [(*Ceratitis capitata* Wied.) (Diptera: Tephritidae)] is of main importance over the last 20-25 years. The main reason for the increase of *C. capitata* damage is that the mild winter and the other host plants of the Mediterranean fruit fly increasingly cultivated close to citrus orchards. The pest population increases dramatically on these fruit trees and moves to citrus in late summer or autumn [8].

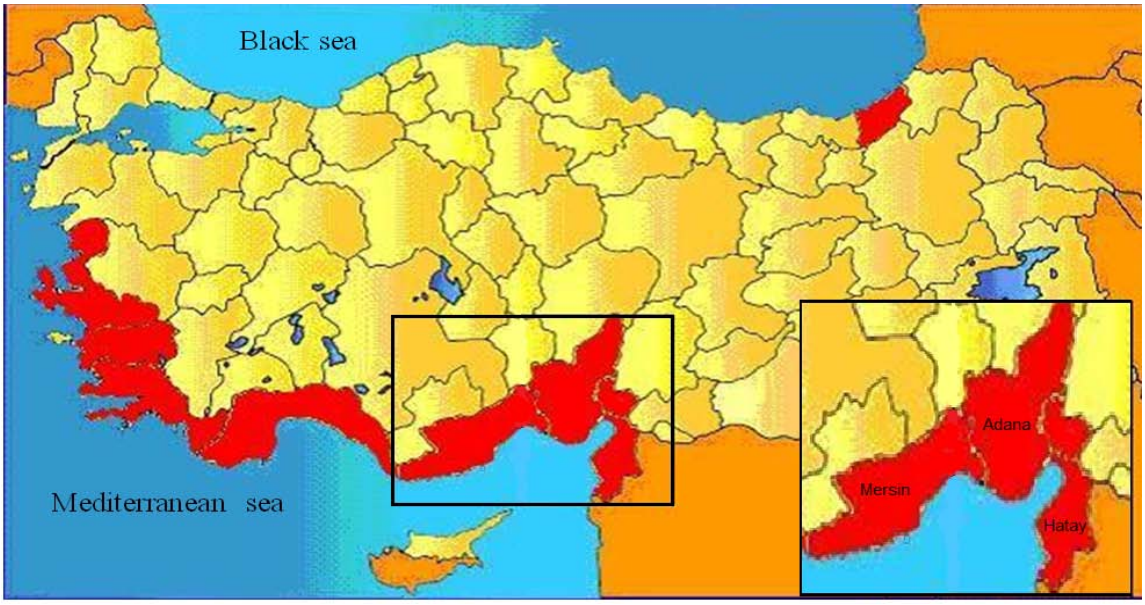

Figure 1. Citrus planting areas of Turkey (red color) with primary production zone, (Hatay, Adana, Mersin).

Biology: *Ceratitis capitata* is a polyphagous insect pest. It overwinters as pupa burrowing into the soil or at the last larval stage in the fruits remaining on trees after harvest of marketable fruits. Adults emerge in May-June; lay their eggs when daily average temperatures exceed 16°C after copulation [9]. In some years when the fruits were left on tree because of commercial reasons, they act as source of the pest. It produces 4-5 generations in Aegean region [10] and 7-8 generations in Mediterranean region per year [9]. Duration of immature stages differs according to different hosts; the shortest was in persimmon with 22.7 days and longest with 33.1 days at 25.7ºC. The development was shortest in Satsuma tangerine among different citrus varieties with 24.5 days at 22.3ºC. The mail: female ratio was 1:1 at all of its 12 hosts tested [11].

Damage: Damage rate of the pest varies between 5.2 and 78.9% [12]. The factors that affects damage rate mostly are climatic conditions and biology of the pest. For example, extremely low and high temperatures shorten life span of the pest. Death of pupae increases in extremely humid soils as in Eastern Black Sea Region [13]. Medfly is obliged to spend its annual life-cycle in a food chain including different fruit hosts. Consequently, if its mature hosts are unavailable during its active periods, it can't survive in that location whatever happens [12].

Hosts: In Turkey, *C. capitata* has wide range of host plants mainly fruits; Citrus, peach, apricot, persimmon, nectarine, pear, fig, pomegranate, kaki, quince, avocado, apple etc. [12, 11]. The damage of the pest starts in May with peach and ends with citrus in autumn [11]. It damages citrus such as orange, mandarin, sour orange and grapefruit. It can't be harmful on sour lemon varieties because of its eggs cannot hatch due to ether oils on fruit skin. Mandarin, is the most preferred variety followed by orange [12]. Citrus species have special site due to export limitations. Medfly tolerance level is 0 which force the exporting site be careful.

Not only citrus but also it is important for other fruit crop to grow without Medfly damage.

There are a number of alternative hosts for Medfly that are grown commercially in Turkey. For example, Turkey has extensive production of stone fruit and pomes, including apricot (55,650 ha), pear (52,550 ha), peaches and nectarine (43,333 ha), plum (29,400 ha), apple (16,500 ha), and loquat (12,200 ha). Persimmon production, covering around 36,700 ha, is also affected by Medfly [4]. New areas of pomegranate production are expanding. Minor Medfly damage to these fruits may be less problematic than to others because of the market potential from dried fruit and juice.

Mediterranean Fruit Fly Control

Cultural practices

Unmarketable fruits on the trees must be picked and destructed in every harvest. Infested fruits on the ground must be collected periodically and destructed. Fruits which are intermediary hosts for the pest should not be planted in or around citrus orchards. Cultural control must be applied even at home gardens.

Biological control

Four natural enemy species of *C. capitata* have been determined; *Orius minutus* (L.) (Hemiptera: Anthocoridae), *Syrphus* spp. (Diptera)., *Habrobracon hebetor* (Say), *Bracon lactus* Wesmael (Hymenoptera: Braconidae). None of these natural enemies are able to control the pest [8].

Cold treatment

Cold treatment is used in storehouses after harvest or during the transportation of products. It has been determined that cold treatment under 1ºC and 90% relative humidity for 13 days results in 100% mortality in all stages of the pest without any loss in quality [14].

Chemical control

The only application recommended for this pest is bait spraying which is acceptable with IPM strategies. Malathion and spinosad has been permitted for Medfly in Turkey. Six to nine sprayings are applied per year in citrus. Growers

determine when to spray based mainly on the time of year and state of the fruit. Some growers do rely on monitoring traps. Pheromone traps are installed in citrus orchards in August to define first captures and to monitor adults. When the first adult is captured and if fruits are at maturation suitable for infestation, sprayings begin. Chemical applications are repeated 7-10 day intervals until harvest if capturing of adults continue in pheromone traps and average temperatures are higher than 16°C. The mixture of insecticide and attractant is sprayed to 1-2 m^2 foliage on the south-east part of trees.

Biotechnological control

Using of biotechnogical control techniques have been continuing since 1970's. The effect of different attractions or trap and attractant combinations on the pest are searched [15, 16, 17]. The control of Medfly by appling SIT was studied in Aegean region and some basic researches were done [18, 19]. Sterile mails were released for only one year with a small amount in Çeşme Peninsula (İzmir) but the release studies didn't continue then.

There is very little mass trapping for Medfly in Turkey because this technique is used recently in big orchards. In a mass trapping study in Adana, in 225 ha, mass trapping and bait application orchards had similar fruit infestation ratios, but averagely nine sprayings were done at bait spraying orchards while the application number was decreased to averagely five in mass trapping orchards [20]. In another study, the effectiveness of mass trapping was over 98% in a citrus orchard [21]. Demonstrations on larger areas and other host plants are needed to further improve the suppressive potential of this technique.

Systematic surveys are regularly carried out by plant protection services in order to establish the necessity, appropriate time and methods for the control of these three fruit flies. Throughout the years, studies are undertaken to examine the best methods to manage.

REFERENCES

[1] Norrborn A, L. 2004. Updates to a biosystematics database of world Diptera for Tephritidae throughout 1999. Diptera Dissemination Disk (CD-ROM) 2.

[2] Kütük M. 2003 a. Investigations on fauna and systematics of fruit flies (Diptera: Tephritidae) of east-western Anatolian region. Department of Plant Protection, Institute of Natural and Applied Sciences, University of Çukurova, PhD Thesis, 217 pp.

[3] Yaran M, Kütük M. 2012. The fruit flies (Diptera: Tephritidae) fauna of Gaziantep province, Turkey. Munis Entomology & Zoology, 7 (2), 957-969.

[4] Anonymous. 2008. Turkish Statistics Institute, Statistics of Plant Production, Ankara, http://www.tuik.gov.tr

[5] Anonymous. 2011. Integrated Control Technical Instructions, General Directorate of Agricultural Research and Policy, Ankara, http://www.tagem.gov.tr

[6] Özdem A, Kılınçer N. 2009. The effectiveness of the trap types and lures used for mass trapping to control Cherry fruit fly, [*Rhagoletis cerasi* (L., 1758)] (Diptera: Tephritidae). Munis Entomology & Zoology, 4 (2), 371-377.

[7] FAO. 2009. Food and Agriculture Organization. FAOSTAT. Statistical Database. http./faostat.fao.org.

[8] Uygun N. 2003. Uygun N. 2003. Las plagas de los citricos y su control mediante metodos de CIP en Turquia. Phytoma Espana, ISSN 1131-8988, No: 153, 155-167.

[9] Demirdere A. 1961. Studies on biology and control of Mediterranean fruit fly in Çukurova Region. Ankara University, Faculty of Agriculture Publication, PhD. Thesis, 118 pp.

[10] Başpınar H, Çakmak İ, Başpınar N, Koçlu T. 2009. Studies on the bio-ecology of Medfly, *Ceratitis capitata* Wied. (Diptera: Tephritidae), and its damage and distribution in citrus orchards in Aydın province. Turkish III. Plant Protection Congress, 15-18 July, Van, P: 32.

[11] Özkan C. 1993. Investigations of host variations of Mediterranean fruit fly, *Ceratitis capitata* Wied. (Diptera; Trypetidae) in eastern Mediterranean region. Department of Plant Protection, Institute of Natural and Applied Sciences, University of Çukurova, MSc Thesis, 54 pp.

[12] Giray H. 1966. Studies on Trypedidae (Fruit flies) family species and their host plants on cultivated crops in Aegean Region. Aegean University, Faculty of Agriculture Publication, No: 26, 61 pp.

[13] Zümreoğlu A. 1986. The importance and factors effected on population dynamics of Mediterranean fruit fly, *Ceratitis capitata* Wied. (Diptera; Trypetidae) injurious on fruit trees and citrus in İzmir province and surroundings. Journal of Aegean University, Faculty of Agriculture, 23 (3), 65-79.

[14] Koçlu T, Altındişli FÖ, Turanlı T, Şen F, Karan M. 2011. Effect of cold treatment against Mediterranean fruit fly, (*Ceratitis capitata* Wied.) (Diptera: Tephritidae). Turkish IV. Plant Protection Congress, 28-30 June, Kahramanmaraş, P: 31.

[15] Zümreoğlu A. 1990. Standardization of trap systems for combine the sterile-male technique Mediterranean fruit fly, *Ceratitis capitata* Wied., two years studies on various trap systems in Aegean region. Turkish Journal of Plant Protection, 14 (3), 155-166.

[16] Elekçioğlu NZ, Uygun N, Bozbuğa R. 2008. Status of Mediterranean fruit fly, *Ceratitis capitata* Wied. (Diptera: Tephritidae), and its control in Turkey. IOBC/WPRS Working Group. Integrated Control in Citrus Fruit Crop, 5-7 November, Italy, 38, 136-141.

[17] Başpınar H, Karsavuran Y, Başpınar N, Kaya Apak F. 2011. The effect of some attractants in mass trapping in controlling of Medfly, *Ceratitis capitata* (Wiedemann) (Diptera: Tephritidae). Turkish IV. Plant Protection Congress, 28-30 June, Kahramanmaraş, P: 7.

[18] Akman K, Zümreoğlu A. 1973. Preliminary laboratory investigations on the labeling the Mediterranean fruit fly (*Ceratitis capitata* Wied.) with radioactive phosphorus for biological information in relation to the sterile-male method. FAO/IAEA Information Circular on Radiation Techniques and Their Application to Insect Pests No:16, 53 pp.

[19] Akman K, Zümreoğlu A. 1978. Effects of gamma radiation on the immature pupae of the Mediterranean fruit fly, *Ceratitis capitata* Wied. (Diptera; Trypetidae): Dose response of laboratory reared and wild strains. Turkish Journal of Plant Protection, 2 (1): 37-42.

[20] Elekçioğlu NZ, Güneş A, Yıldız A. 2011. The population development and mass trapping studies of Mediterranean fruit fly, *Ceratitis capitata* Wied. (Diptera: Tephritidae) in Adana. Turkish IV. Plant Protection Congress, 28-30 June, Kahramanmaraş, P: 244.

[21] Elekçioğlu NZ. 2012. Field evaluation of *Ceratitis capitata* Wied. (Diptera: Tephritidae) mass trapping technique on a Washington navel grove in Turkey. 2nd International Symposium of TEAM, 3-6 July 2012, Kolymbari-Crete/Greece, P: 99.