

**DISTRIBUTION AND INFESTATION OF
MEDITERRANEAN FRUIT FLY (*CERATITIS CAPITATA*
WIED.) (DIPTERA: TEPHRITIDAE) ON POME AND
STONE FRUITS IN ISPARTA AND BURDUR
PROVINCES (TURKEY)**

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ABSTRACT: Investigations on the distribution and the infestation ratio of *Ceratitidis capitata* on pome and stone fruits were carried out between 2000-2002 in Isparta and Burdur provinces, Turkey. The localities and the crops that the adults of the pest were captured by traps as follows: Isparta: Peach: Tepeli, Yukarıgökdere, Gönen; peach and apple: Büyükgökçeli, Yazısöğüt and Sav; Burdur: peach, pear, apple and quince: Gündoğdu, apple: Karapınar, peach: Kuruçay and Düğer. The pest was not found in any other localities surveyed. Emerging period of the adults was coinciding with the harvest time. Therefore there was no damage and hence no economic loss on the harvested fruits. On the other hand, fruits could not be picked from the 50 % of the ungrafted peach plants and 40 % of the fruits left on the trees after harvest were found to be infested with *C. capitata* larvae. This ratio was determined to be 80-100 % on the fallen fruits. It was determined with this study that Golden apple was suitable host for laying eggs, developing larvae and also forming generations for *C. capitata* in laboratory conditions. It was put forward with this study that, as the adult population increases on the fruit maturing period no economic damage occurs if the fruits are harvested on time without any delay. It was also determined that, it is better to pick and eradicate the left peach, apple and pear fruits on trees and fallen ones which serve as infection sources in order to reduce the adult population.

KEY WORDS: *Ceratitidis capitata*, pome and stone fruits, distribution, infestation, Isparta, Burdur, Turkey.

The Mediterrenean fruit fly (medfly), *Ceratitidis capitata* Wiedemann is one of the most important and most researched pests in the world in the past as well as in the present. It becomes more important for its polyphagous species, distribution in all tropic and subtropic areas in world, and inclusion in outer quarantine lists. It exists in all the costal areas from North Aegean towards East Mediterranean in citrus orchards in Turkey. Besides citrus, it also causes epidemics in various stone fruits (peach, apricot), and pome fruits (apple, pear, quince).

According to 2003 agricultural statistics, the number of trees and production for pome fruits (apple, pear, quince) in Isparta is 3.046.321 and 491.406 tons. For stone fruits (peach, apricot, prune) it is surveyed to be as 396.980 and 21.074 tons. The statistics for Burdur province are 402.528 and 21.380 tons for pome fruits, and 174.226 and 4.648 tons for stone fruits (Anonymous, 2005). The medfly has been found to make damage in some years in apple and peach, in both provinces since 1994.

This study was carried out to determine the distribution and infection rates in crop basis in Isparta and Burdur provinces.

MATERIALS AND METHODS

The study material consists stone fruits (peach, apricot), pome fruits (apple, pear, quince), pheromone traps: Trece Pherocon JT (Jakson Trap), Pherocon MFF Lure (tert- Butyl 5 and 5 chloro-trans-2-methyl cyclohexane arboxylate), Visual Traps- Rebell + Ammonium salt .

Field Trials

Studies were carried out in districts of Merkez, Eğirdir, Sav, Senirkent, Gelendost, Gönen, Uluborlu of Isparta Province, and districts of Merkez, Kemer, Çeltikçi and Bucak of Burdur Province. Sexual attractive traps were hanged on trees in selected orchards caring the manforce, number of trees exists and ripening time of the fruits. In order to determine the existence of the pest, generally 2 traps were hung on each selected orchard. In addition to sexual traps, in some orchards visual traps had been used also. Traps were hung in southern part of the tree, in the 1/2 - 1/3 part of the tree canopy or on a branch that contain fruits before the emergence of the adults. Traps were inspected once a week and adults were counted and taken out of the traps. Trap capsules were replaced with a new one in every 6 week. From the orchards adults determined in traps, 100 fruit on the tree or on the bottom soil were randomly taken and inspected for the pest larvae. The fruits were reported to be infected or healthy and the infection rates were determined.

In order to determine if the pest overwinters in Gündoğdu village (Bucak), soil samples were taken. For sampling, cylinder cups made from steel with 15 cm diameter and 5 cm height with the ends open were used. Sampling were made according to the method of Boller and Remund (Boller and Remund 1987). Soil samples were taken from a peach orchard at the south, north, east and west side of 10 trees within the canopy on 18.04.2002. The samples were brought to the laboratory and sieved through 60 mesh sieves to determine the pupae of the pest.

Laboratory Studies

Studies for pest development and for determination of some biological properties were carried out in a climate chamber with constant 26 ± 1 °C temperature and 65 ± 5 relative humidity as 16 hour illuminated, 8 hour dark. Studies were started with the adults obtained from larvae infested peach fruits on 21-22 September 2000. Adults were cultured in glass cages having dimensions of 35x45x50 cm of which one side consisted of door screen. Honey+water and cube sugar were used for nutrition and water absorbed cotton in petri dishes as a water source. For the female individuals to lay eggs, matured Golden apples were put in the cages. Fruits containing developed larvae insides were replaced in plastic trays that contained sand at the bottom for the pupae and adult developments.

RESULTS AND DISCUSSION

Results of Medfly survey studies carried out in Isparta and Burdur Provinces to determine the infected sites and infection levels are given in Figure 1 and Table 1. Table 1 shows that the pest adults exists on peach in Tepeli (Eğirdir), Yukarıgökdere (Eğirdir) and Gönen, on peach and apple in Büyükgökçeli (Central), Yazısöğüt (Sav) and Central (Sav) in Isparta Province. In Burdur Province, pest adults were determined on peach, apple, pear and quince in Gündoğdu (Bucak), on apple in Karapınar (Bucak), on peach in Kuruçay (Central) and Düğer (Central). The pest did not determine in other sites during the survey.

The first adults of the pest were caught in July and August in all three years, and the emergence of the adults were found to continue until November. At sites the pest caught in traps, periodicals inspections were made on fruits. In 2000, no larval damage or egg laying had been seen on peach fruits on trees in Yazısöğüt, since 6 % of the fruits fell on the soil were found to be damaged by the larvae. At the same site, 4 % of the apple fruits "Starking" fell on the soil were also found to be infected by the larvae.

Adults of the pest were caught first on August 21 in 2000 in Gündoğdu (Bucak), and next days had been found in high numbers in sexual and visual traps. At the inspections on October 10, there were 183 adults in one trap. These peach trees were early, middlelate and late varieties. Since the early, middlelate and late varieties' were harvested on July 10, July 20-25 and by the end of August, respectively, and the emergence of the pest happens at this period, there were no damage or eggs laid in the fruits. However, ungrafted peach trees in the orchard had 50 % larval infection on the fruits on trees and 80 % on the others fell on the soil. In each of these fruits an average of 30 larvae were counted. 62 adults were obtained from these larvae cultured in the Laboratory.

At the same site, fruits left on the peach trees after harvest or fell on the soil were found to be infected with the larvae of the pest in the rate of 40 and 78 %, respectively. In Sav District (Merkez and Yazısöğüt), although there were no damage on the fruits harvested, 100 % of the fruits fell on the soil after harvest were found to be infected by the larvae. Kryachko (1979), reports that the females of the pest lay their eggs on many kinds of fruit species, although they prefer much the middlelate and late varieties of peach and late ripening pears which can be found in abundant numbers. He also reports that the infected peach fruits can not be determined before they fall to the soil. Fruits fell to the soil in the pear orchard behind the peach were found to be infected with the pest larvae in the rate of 9 %. During the inspections on the quince trees at the same site, no damage or egg laying could be detected on the fruits, but there were a lot of adults in traps hung on Oct 18. At this date, the quince fruits were not enough ripened to be suitable for the adult egg laying. In

Karapınar (Bucak), there was one adult in visual traps in apple orchard, but no damage or egg laying could be detected on the fruits.

In surveys carried out in 2000 and 2001, most of the peach fruits left on the trees or fell on the soil were have been found highly infected. However, the infection rates on apple were found to be low (Table 1). Demirdere (1961), reports that peach is the most preferable crop species in all countries. In some sites or orchards, although adults were captured by the traps, no damage or infection could be determined. Table 1 shows that there were no infection on pears in Bucak (Gündoğdu) although several adults were captured in traps. This is because the adults come from the neighborhood peach orchards and pear fruits had come to the harvest stage before the insect population increased. It is reported that the Medfly and the other tephritides' adults have a capacity of a long distance fly in order to find food and egg laying areas (Papadopoulos et al. 2001).

Since peach is the most preferable host for the Medfly in all countries (Demirdere 1961), the most important cultural control methods to decrease the population of the pest are not leaving any fruit on trees after harvest, collecting all the fruits fell on the ground every day and bury in 1 m soil depths covered with lime. Papadopoulos et al. (2001), reports that the destruction the collection of the infected apple trees on soil during the winter and results in very low populations in the spring.

In a study carried out in order to determine the pest adults whether overwinters in peach orchards and have a located population in Gündoğdu town, where it exists in huge numbers, soil samples were taken on April 18, 2000 and brought to laboratory for inspection, but, no pupa could be obtained. However, during the inspections carried out on fallen quince fruits on November 22, several alive eggs had been determined just under the peel of a fruit. An amount of 95 quince fruits from this site were brought to the laboratory and put in culture, and 20 adults have obtained. Papadopoulos and Katsoyannos (2002), report that the pest larvae could maintain living from November until spring in spite of many adverse conditions and overwinter within the apple in North Greece, However, it is also reported that there exists a high rate of death in larvae and pupae in the infected fruits on the trees or on the ground fell during the winter period and a very low percentage could have reached to spring and very low number of adults could have developed (Papadopoulos et al. 2001). Since alive larvae in quince fruits at the beginning of winter could have been determined and adults could have been developed in laboratory from the fruits collected from this site and in addition with literature information, it seems possible that the pest can overwinter in quince fruits in this site.

During the inspections made on the fruits on trees or on the ground in three years, 4 % of the apple fruits on the ground in Yazısöğüt (Sav-İsparta) in Oct 2000, 1 % of the apple fruits on the trees at the same site in September and the quince fruits fell on the soil in Gündoğdu (Bucak-Burdur) in Oct 2001 were found to be infected with the pest. In 2002

inspections, no fruit detected to be infected. Infection rates determined at the sites were found to be very lower comparing with the above literature (Papadopoulos et al. 2001).

Laboratorial production of the medfly in constant conditions were carried out on apple, variety Golden, and in the production duration from Sept 2000 to Feb 2003, totally 1420 adults via 14 generation could have been developed on the apple. Through this study, it was determined that the medfly adults could have laid eggs in apples, following feeding within the apple, larvae had become pupae and could have developed new individuals. In literature, most of the pome and stone fruits are reported to be the host of the pest and could have been damaged by the pest, however no study has been met related with the medfly production on these hosts (Demirdere 1961, Zümreoğlu 1979).

Larvae of the pest feed on the flesh part of the fruits of the peach, pear and apple. The color of the damaged fruits become brown from the inner part towards outers and rot soon. It was determined that the larvae damage is at the same type on the peach, pear and apple in nature, and on apple in the laboratory. It was also determined that the adults do not lay eggs in Starking apple variety, but prefers always the Golden variety. In addition, the adults were found to lay their eggs on the apples when they ripen to yellow color and never lay eggs in less developed green ones.

Papadopoulos and Katsoyannos (2002), have researched the effect of apple varieties on the biological parameters prior to adult formation and found out that the Golden Delicious is a suitable variety for the development of the pest larvae, the Granny Smith and Red Delicious are not preferred since the fruit flesh is hard and not suitable for the development of the larvae.

In case of making a total evaluation:

- Mediterranean fruit fly grow populations especially on the peach fruits left on the trees after harvest or those that fell to the ground in Isparta and Burdur Provinces and the adults distribute towards the apple, pear and quince orchards from these sources.

- All in three years, during the inspections made prior or after the harvest, it was determined that there were no damage economically important on the apple, pear, quince, as well as on the peach causing from the pest.

- Since the population increase of the pest adults coincides with the ripening stage of the fruits, without delaying harvesting it will decrease the economically important damage in high rates.

- In order to decrease the adult populations of the pest, the fruits left on the trees after harvest or those that fell to the ground in the peach as well as apple, pear and quince orchards should be immediately collected and destroyed.

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Figure 1. Sites and crops the Mediterranean fruit fly determined during the survey carried out in 2000-2002 in Isparta and Burdur provinces.

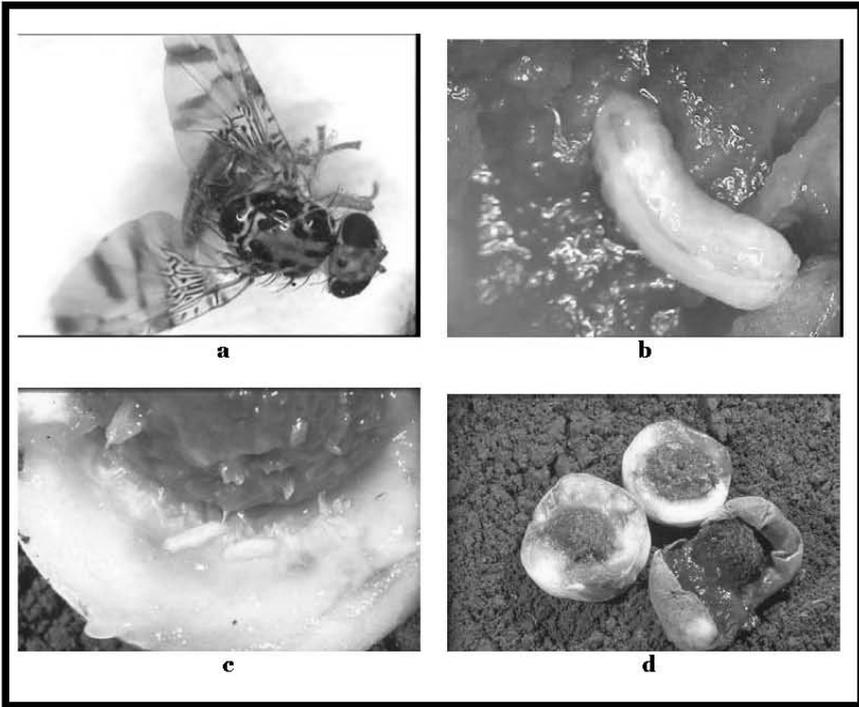


Figure 2. Mediterrenean fruit fly (*C. capitata*), a) Adult, b) larva in apple fruit, c) larva in peach fruit, d) infested peach fruits.

Table 1. Existence sites, adult flying periods and infection rates of *C. capitata* in Isparta and Burdur Provinces during 2000-2002.

Province	County	Village	Host crop	Trap type and number	Adults capture period	Number of captured flies(min.-max.)	Rate of infested fruits(%)	
							On the trees	On fallen fruits
ISPARTA	Eğirdir	Tepeli (950m)	Peach	Jackson Traps(2)	21.8-18.9.00	1-1		
		Y.Gökdere (950m)	Peach	Jackson Trap (1)	24.9.01	2		
	Sav	Merkez (950m)	Peach + Apple	Jackson Trap (1)	12.9-3.10.01	7-20	0	100(Peach), 1(Apple) (19.9.01)
			Peach	Jackson Trap (1)	23.8.02	1		
		Yazısöğüt (920m)	Peach	Jackson Trap (2) Visual Trap (1)	23.8.00 2.10.00	2 1	0	6 (23.8.00)
			Apple	Jackson Trap (3)	17.10-15.11.00	1-16	0	4 (17.10.00)
		Peach + Apple	Jackson Trap (1)	31.7-1.10.01	1-36	1(Apple) (19.9.01)	100(Peach) (19.9.01)	
	Gönen	Merkez (950m)	Peach	Jackson Trap (1)	2.10.01	2		
Merkez	Büyükökçeli (950m)	Peach	Jackson Trap (1)	20.9.01	25			
		Apple	Jackson Trap (1)	24.9-1.10.01	3-10			
BURDUR	Bucak	Gündoğdu (780m)	Peach	Jackson Trap (1) Visual Trap(1 ad)	21.8-4.11.00	7-183	50(Ungrafted peach) (11.9.00)	80(Ungrafted peach) (11.9.00)
			Peach	Jackson Traps (3-5)	20.7-11.10.01	2-800	2(early peach variety) (20.7.01) *40 (20.9.01)	2(early peach variety) (20.7.01)-19 (early peach variety) (9.8.01) 78 (20.9.01)
			Peach	Jackson Traps(6)	28.7-22.11.02	1-144		
			Pear	Jackson Trap(1)	29.10.00	1	0	9(18.10.00)
			Pear	Jackson Traps(2)	3.9-11.10.01	7-327		
			Pear	Jackson Trap(1)	1.9-13.11.02	1-11		
			Quince	Jackson Trap(1)	18.10-21.11.00	2-41		
				Visual Traps (2)	18.10-16.11.00	16-103		
			Quince	Jackson Traps (2)	4.10.01	41	0	1(4.10.00)
				Jackson Traps (2)	11.10.01	35		
	Quince	Jackson Traps(6)	9.10-22.11.02	2-157				
		Visual Traps(15)	1.10-22.11.02	9-168				
	Apple	Jackson Traps(6)	1.9-26.9.02	2-23				
	Merkez	Karapınar (780m)	Apple	Jackson Traps(2) Visual Trap (1)	29.10-16.11.00 18.10-21.11.00	3-108 1-1		
			Peach	Jackson Trap(1)	13.8-27.8.01	1-1		
Düğer (920m)		Peach	Jackson Trap(1)	23.7-3.9.01	1-4	1(6.8.01)	0	

* Rate of the infested fruits left on the trees after harvest.