

INVESTIGATIONS ON INSECT PESTS INFESTATION LEVELS OF DRIED FIG IN AYDIN AND IZMIR PROVINCES

Ferit Turanlı¹

Abstract

This study was carried out to determine the infestation level of dried fig pests during the year 2001 and 2002. The samples were collected from Aydin and Izmir provinces and villages where the production is extensively made and were kept in dark room with $25\pm 3^{\circ}\text{C}$ and 60-80% relative humidity. The infestation levels of each fig samples in relation to pest emerging were measured periodically.

According to the findings; fig moth, *Ephestia cautella* (Walker) (Lepidoptera: Pyralidae), Indian meal moth, *Plodia interpunctella* (Hübner) (Lepidoptera: Pyralidae), and dried fruit beetle, *Carpophilus* spp. (Coleoptera: Nitidulidae), were determined as the most important pests of all regions. The results of infestation levels of the pests are given separately for both in Aydin and Izmir provinces.

Key words: *Ficus carica* cv. calimyrna, *Ephestia cautella*, *Plodia interpunctella*, *Carpophilus* spp., Turkey

Introduction

Fig is a native plant of the Middle East. Its cultivation was first realized in the fertile valleys of the Arabic peninsula. Through the aquatic tribes, it was distributed first around the Mediterranean Sea and then to United State of America. Its movement towards the east was rather slow due to the rainy and humid climate of southern and southeastern Asia. Fig tree is tolerant to marginal soil conditions such as calcium content, salinity and drought and other unfavorable soil conditions. Beside Turkey, Greece, United State of America and Brazil also are the most important fig producers in the World. It is one of the most important export goods of Turkish Economy (Aksoy, 1998). Turkey has approximately 240,000 tons of fig production per year and almost 60,000 tons of annual production is processed as dried fig. Ninety percent of that production is exported abroad and that cover the 55% percent of World fig market (Anonymous, 2001).

Problems faced during production of dried fig and measures that are taken for solving these problems need careful study of the pests of dried fig which affect the quality and quantity of dried fig production in Turkey.

In this study, the purpose was to determine the infestation rate of insect pests in the most important fig producing provinces of Turkey i.e. Aydin and Izmir.

Material and Method

Sample Collection

Dried fig (sarilop variety) samples were taken randomly from the drying tray and farmer stores in districts and villages of Aydin and Izmir provinces in year 2001 and year

¹ Ege University, Faculty of Agriculture, Department of Plant Protection, 35100 Bornova, Izmir, Turkey.

2002. Sampling was done two times in each year. Once was at the beginning of harvest in September and the second was in October at the end of harvest. Each sample contained 25 fig fruit (approximately ½ kg) and was transferred to the laboratory in paper packages.

Sampling places in Aydin provinces were Centre, Germencik, Incirliova, Kuyucak, Nazilli. In Izmir provinces were Odemis, Selcuk and Tire. The numbers of the samples according to districts in Aydin provinces were 16 from Germencik, 11 from Centre, 9 from Kuyucak, 6 from Incirliova and 5 from Nazilli. In Izmir. 11 samples were taken from Tire, 5 from Odemis and 5 from Selcuk. The total numbers of the sample were 68 from both provinces. Name of the growers, sampling places and the sampling date were recorded for each sample.

Samples Evaluation

All samples were kept in culture jar until the adults emerged in dark room with $25\pm 3^{\circ}\text{C}$ and 60-80% relative humidity. After one month from the sampling date, each sample was checked for the emerged adults daily.

Infestation level of moths for each sample was calculated according to the number of adults that emerged from the sample. Numbers of adults are defined as a number of infested fig fruits because, each larva feeds generally only with one fruit. After the emerging of adults, each fruit in samples examined for the confirmation between damaged fruit and number of adult moths. During the last examination of fruits, when the adults or larvae of dried fruit beetles were found in them, that fruits counted as infested by dried fruit beetle.

Results and Discussion

Results on infestation levels (table 1 & 2) showed that *E. cautella*, *P. interpunctella* and *Carpophilus* spp. were the most common pest species on dried fig in the provinces under study. These results confirmed the previous studies. (Iyriboz, 1940; Ulkumen and Ozbek, 1948; Tuncyurek, 1972; Erakay and Ozar, 1979; Ozar *et al.*, 1986; Urel and Sahin, 1993; Duzbastilar, 1997).

Results for Aydin Province

Considering the infestation level (Table 1 and 2) of pest species, *E. cautella* was the key pest at sampling places such as in Centre, Germencik, Incirliova, Kuyucak, Nazilli in Aydin province and also in Izmir province at Selcuk, Tire and Odemis. This result was compatible with previous studies which were done in same provinces by Erakay *et al.*, 1978 and Erakay and Ozar, 1979.

E. cautella

The results of insect infestation on dried fig in 2001 indicated that the highest infestation level was 15.4% in Kuyucak and the second height at level (12.7%) was in

Nazilli, Aydin Centre (%11.1), Germencik (%11.1) and Incirlioiva (%8.1) were following in descending order. At the beginning of the harvest season, the average infestation level of all districts was 11.7%.

In a previous study done by Erakay and Ozar (1979) in Germencik, Kuyucak and Centre districts, the average infestation level was 12.1% for Germencik, 9.4% for Centre and 6.5% for Kuyucak while the average infestation level for the beginning of harvest season was 9.4% for whole three districts.

According to infestation levels for the end of harvest season, Nazilli and Kuyucak were the most infested sampling sites with 7.9% and 5.2% infestation levels respectively. Infestation levels at centre, Germencik and Incirlioiva were 3.4%, 3.1% and 1.3% respectively. The average infestation level at the end of the harvest season for all five sampling sides was 4.2%. In an earlier study (Erakay and Ozar, 1979), infestation level for Germencik was 2.1%, 1.9% in Centre and 1.5% in Kuyucak. The average infestation levels for these three districts was 1.8%.

P. interpunctella

In Aydin province, at the beginning of harvest season infestation levels of *P. interpunctella* were highest in Kuyucak with 3.4% value and in Incirlioiva with 3.2%. Centre, Nazilli and Germencik followed these two sampling sites with the lower infestation levels of 1.6%, 1.3% and 0.5% respectively. The average infestation level of all sites at the beginning of harvest season was 1.9%. In previous study in same province (Erakay and Ozar, 1979) infestation levels at the beginning of harvest season were 2.0%, 1.7% and 1.4% in Germencik, Kuyucak and Centre respectively. The average of all infestation levels for the sampling sites was 1.7%.

Infestation level for the end of harvest season was highest in Nazilli with 2.1%. It was followed by Kuyucak 1.7%, Centre 1.2% and Incirlioiva %0.6. The average infestation level for the end of harvest season for this pest was found as 1.1%. Erakay and Ozar (1979) found 2.7% for the average infestation level at the end of harvest season and the individual infestation level for each sampling site were 3.0% in Kuyucak, 2.9% in Germencik and 2.2% in Centre.

Carpophilus spp.

Infestation levels of *Carpophilus spp.* mostly depend on the humidity of fruit and growing region. Infestation level was the highest in Nazilli with 25.8% for the beginning of the growing season. Kuyucak, Germencik, Centre and Incirlioiva were following with the infestation levels of 21.2%, 18.3%, 16.7% and 9.6%, respectively. In previous study, the numbers for infestation level were 7.0% in Germencik, 3.5% in Centre and 1.0% in Kuyucak. In this study, the average of the infestation levels for *Carpophilus spp.* was found to be 18.3% for the beginning of harvest but it was 4.5% in previous study (Erakay and Özar, 1979)

At the end of the harvest season, the highest infestation level was determined in Nazilli (20.5%) and Centre (18.3%). Germencik, Kuyucak and Incirliova were following with the infestation levels of 17.8%, 11.0% and 9.8% respectively (Table 1). At the end of the harvest, the average infestation level was 15.5%. According to the study of Erakay and Özar (1979) the infestation levels were determined as 7.5% in Centre, 4.2% in Germencik and 1.5% in Kuyucak, with the average infestation level of 4.4%.

When the data from this study were analyzed according to sampling years, it showed that the infestation level of *E. cautella* increased in the year 2002 except in Kuyucak and in Incirliova districts. It was determined that *P. interpunctella* and *Carpophilus* spp.'s infestation levels also increased in all sampling districts in year 2002 as compared with 2001. It may be attributed to rainfall in the harvest season of 2002 which resulted in loss of fruit quality.

Results for Izmir Province

The results from the sampling that was done at the beginning and at the end of the harvest season 2001 and 2002 in Izmir province are presented Table 2. Sampling districts of Izmir province were included Selcuk, Tire and Odemis where fig is grown for commercial purpose. In 2002 sampling could not be done in Odemis.

E. cautella

Results presented in Table 2 indicated that infestation level of *E. cautella* at the beginning of the harvest season was 16.8% in Tire (highest in both years.) Odemis and Selcuk followed this with infestation levels of 9.6% and 6.0%. The average infestation level of all provinces was 10.8% at the beginning of harvest. It can be visualized from table-2 that infestation levels for the end of harvest season in Tire district was maximum i.e. 3.4%. Odemis and Selcuk were following this with 2.3% and 0.9% infestation levels, respectively.

Table 1. Infestation levels of dried fig pests in districts of Aydin Province during 2001 and 2002

Pest Species	District	Sampling year	Infestation level	
			Beginning of harvest	End of harvest
<i>Ephestia Cautella</i>	Aydin (Centre)	2001	8	2.8
		2002	14.2	4
		Average	11.1	3.4
	Germencik	2001	8.5	2.5
		2002	13.8	3.8
		Average	11.1	3.1
	Incirliova	2001	5.6	2.6
		2002	10.6	0
		Average	8.1	1.3
	Kuyucak	2001	18.8	4.5
		2002	12	6
		Average	15.4	5.2
	Nazilli	2001	10.6	2.6

Pest Species	District	Sampling year	Infestation level	
			Beginning of harvest	End of harvest
		2002	14.9	13.2
		Average	12.7	7.9
		Average	2001	10.3
	Average	2002	13.1	5.4
		General average	11.7	4.2
<i>Plodia interpunctella</i>	Aydin (Centre)	2001	1.2	0.5
		2002	2	2
		Average	1.6	1.2
	Germencik	2001	0	0
		2002	1	0
		Average	0.5	0
	Incirliova	2001	2.6	0
		2002	3.8	1.3
		Average	3.2	0.6
	Kuyucak	2001	2.9	0.2
		2002	4	3.2
		Average	3.4	1.7
	Nazilli	2001	2.7	0.3
		2002	0	4
		Average	1.3	2.1
Average	2001	1.8	0.2	
	2002	2.1	2.1	
General average		1.9	1.1	
<i>Carpophilus spp.</i>	Aydin (Centre)	2001	3.4	0.5
		2002	30	36.2
		Average	16.7	18.3
	Germencik	2001	5	1.1
		2002	31.7	34.5
		Average	18.3	17.8
	Incirliova	2001	2.6	0.4
		2002	16.6	19.3
		Average	9.6	9.8
	Kuyucak	2001	7.4	0.5
		2002	35	21.5
		Average	21.2	11
	Nazilli	2001	6.6	0.5
		2002	45	41
		Average	25.8	20.5
Average	2001	5	0.6	
	2002	31.6	30.5	
General average		18.3	15.5	

P. interpunctella

Results obtained showed that *P.interpunctella* was harmful only at the beginning of harvest season in Izmir. There wasn't any infestation at the end of harvest season. When the infestation levels were analyzed, as an average of these two years, Selcuk

district had the highest infestation with the number 1.6% (Table2). The infestation levels at the beginning of the harvest, this pest had highest density in Selcuk (2.6%) in year 2001, but it was at 0 level in the year 2002. In Tire district the highest infestation level of 1.6% was observed in 2002.

Carpophilus spp.

Infestation levels of *Carpophilus spp* were also higher in Izmir province (Aydın) in year 2001 and 2002, because of the rainfall at harvesting time (Table 2). When examined the infestation levels for both beginning and end of harvest, Selcuk district had the heavy infestation of 19.6% and 12.8% respectively. Tire and Odemis followed it with 10.5% infestation level for the beginning of harvest and 2.5% infestation for the end of harvest.

Table 2. Infestation levels of dried fig pests in districts of Izmir Province during 2001 and 2002

Pest Species	District	Sampling year	Infestation level	
			Beginning of harvest	End of harvest
<i>Ephestia cautella</i>	Selcuk	2001	3.4	1.9
		2002	8.7	0
		Average	6.0	0.9
	Odemis	2001	9.6	2.3
		2002	0	0
		Average	4.8	1.1
	Average	2001	6.5	2.1
		2002	4.3	0
	Tire	2001	23.3	3.6
		2002	10.3	3.2
		Average	16.8	3.4
	Ortalama	2001	12.1	2.6
		2002	9.5	1.6
		Average	10.8	2.1
<i>Plodia interpunctella</i>	Selcuk	2001	2.6	0
		2002	0.6	0
		Average	1.6	0
	Odemis	2001	0	0
		2002	0	0
		Average	0	0
	Tire	2001	1	0
		2002	1.6	0
		Average	1.3	0
	Average	2001	1.2	0
		2002	1.1	0
Average		1.1	0	
<i>Carpophilus spp.</i>	Selcuk	2001	5.3	3.4
		2002	33.9	22.2
		Average	19.6	12.8
	Odemis	2001	10.5	2.4

Pest Species	District	Sampling year	Infestation level	
			Beginning of harvest	End of harvest
		2002	0	0
		Average	0	0
	Tire	2001	4.6	2.6
		2002	16.5	24
		Average	10.5	2.5
	Average	2001	6.8	2.8
		2002	25.2	23.1
		Average	16	12.9

The results of this study confirmed the findings of previous studies, *E. cautella* is the key pest of dried fig with high infestation levels in all studies. The average infestation level of fig moth in whole province was 9.4% at the beginning of harvest season and 1.8% at the end in Aydın (Erakay and Ozar, 1979). In the same study, it is indicated that drying yards was the most important source for the infestation. In this study, the average infestation level was found 10.3% at the beginning of harvest and 3.0% at the end of harvest for whole province in year 2001 and 13.1% and 5.4% respectively in year 2002. There was an increase in infestation level of *E. cautella* around 10% in year 2001 and around 40% at the beginning of harvest in year 2002. The infestation level for the end of harvest was increased by about 60% in year 2001 and thus increased three times in year 2002.

The average infestation levels of *P. interpunctella* were found as 1.8% and 0.2% respectively at the beginning and at the end of harvest in year 2001 and 2.1% for both sampling period in year 2002 in Aydın.

Overall infestation level of *Carpophilus* spp damage usually seen in the humid conditions and souring fruit were 4.5% at the beginning of harvest and 4.4% at the end of harvest in Aydın province in previous study (Erakay and Ozar, 1979). However in this study, they were found as 5.0% and 0.6% respectively in year 2001 and 31.6% and 30.5% in 2002. There was an increase of 10% at the beginning of harvest and a dramatic decrease at the end of harvest in year 2001. On the other hand in 2002, there was six times more infestation level than previous study levels for both beginning and end of the harvest.

Infestation level of *Carpophilus* spp. on drying yards was evaluated in another study by Duzbastilar (1997) in Aydın and Izmir provinces. In that study, the level was found about 9.3% for Aydın and 14.6 for Izmir province for whole drying period. Those levels were bigger than the infestation levels of year 2001 and lower than the year 2002. As explained in previous paragraphs, the reason for that increase was thought rainfall at the harvest season in year 2002 and high moisture content of the fruit.

Examination of results for both provinces and sampling years depicted that Tire was the most infested district in respect of *E. cautella* with 16.8% infestation level and Kuyucak district with 15.4% infestation level. The infestation levels of *P. interpunctella*, in

Kuyucak district was highest (3.4%) followed by Incirliova with 3.2% infestation. Infestation level of *Carpophilus* spp. in Nazilli was found highest with 25.8% and Kuyucak was the second most infested district with 21.2% infestation. The results indicate that Kuyucak district was the most infested growing area for all pests of dried fig.

Another result from this study was that infestation levels at the beginning of harvest season were higher than the infestation levels at the end of the harvest season. This necessitates application of various control measures at the beginning of harvest season to obtain high quality dried figs.

Acknowledgement

The author is grateful to the Technology Development Foundation of Turkey and World Bank for financial support to accomplish under the project this study P2/30.

References

Aksoy, U.,1998. Why Figs? An old taste and new perspective. Proceedings of the First International Symposium on Fig. (Ed.:U. Aksoy, L. Freguson, S. Hepaksoy). Acta Hort .480, 25-26 pp.

Anonymous, 2001. Türkiye İstatistik Yıllığı 2001. T.C. Başbakanlık Devlet İstatistik Enstitüsü Yayınları. Yayın no:2690. 733 s.

Damarlı, E., H. Gün, G. Özay, S. Bülbül and P. Oechsle, 1998. An alternative method instead of Methyl Bromide for insect disinfection of dried figs: Controlled atmosphere. Proceedings of the First International Symposium on Fig. (Ed.:U. Aksoy, L. Freguson, S. Hepaksoy). Acta Hort .480, 209-214 pp.

Düzbastılar, M.,1997. İzmir ve Aydın illerinde incirlerde zararlı *Carpophilus* türlerinin ekonomik önemi üzerinde araştırmalar. Ege Üniversitesi Fen Bilimleri Enstitüsü. (Basılmamış Yüksek Lisans Tezi), 34 s.

Erakay, S. and A.İ. Özar, 1979. Ege Bölgesinde kuru incirlerde zararlı böceklerin bulaşma oranları ve savaş yöntemleri üzerinde ön araştırmalar. Bitki Koruma Bülteni, 19 (3): 159-173.

Erakay, S., O. Kaya, A.İ. Özar and H. Kavut, 1978. Kuru incirde önemli zarar yapan böcekler tanıtılmaları, biyolojileri ve savaş yöntemleri. Gıda- Tarım ve Hayvancılık Bakanlığı Zirai Müc. ve Zirai Karantina Gen. Müd., İzmir Bölge Zirai Mücadele Araştırma Enstitüsü Müdürlüğü. Çiftçi broşürü. No: 69.

Guimaraes, J.A.M., 1967. The control of mite infestation of dried figs in Algarve. Report of the international conference on the protection of stored products. Lisbon, November 27-30.111-115p.

İyriboz, N., 1940. İncir Hastalıkları. Bornova Zirai Mücadele İstasyonu. Kültür Basım evi.

85s.

Özar, A.İ., P. Önder, A. Sarıbay, S. Özkut, M.Gündoğdu, T. Azeri, Y. Ardiç, T. Demir and H. Genç, 1986. Ege Bölgesi incirlerinde görülen hastalık ve zararlılarla savaşım olanaklarının saptanması ve geliştirilmesi üzerine araştırmalar. TÜBİTAK Tarım ve Ormancılık Dergisi,Doğa, 10 (2): 263-277.

Simmons, P. and H.D. Nelson, 1975. Insects on dried fruits. Agriculture handbook 464, U.S.Dept. of Agriculture.26p.

Tunçyürek, C.M., 1972. *Brachon hebetor* Say (Hymenoptera: Braconidae) ile *Cadra cautella* (Walk) ve *Anagasta kuhniella* (Zeller) (Lepidoptera: Pyralidae)' ya Karşı Biyolojik Savaş İmkanları Üzerinde Araştırmalar. Bornova Zirai Mücadele Araştırma Enstitüsü. T.C. Tarım Bakanlığı Zirai Mücadele ve Zirai Karantina Genel Müdürlüğü Araştırma Eserleri, Teknik Bülten No: 20, 78 s.

Ülkümen, L. and S. Özbek, 1948. İncir ve Hastalıkları. İstanbul Mücadele İstasyonu Yayını. Ankara Yüksek Ziraat Enstitüsü Basımevi, 200 s.

Ürel, N. and N. Şahin, 1993. Bazı sofralık ve kurutmalık incir çeşitlerinde Ekşilik böceği (*Carpophilus* spp.) populasyon tespiti ve temiz ürün elde edilmesi. Erbeyli İncir Araştırma Enstitüsü, 111-077-08 nolu proje raporu, Aydın, 7 s.