THE POPULATION FLUCTUATIONS OF CAROB MOTH, APOMYELOIS CERATONIAE (ZELL.) (LEPIDOPTERA: PYRALIDAE) AND HONEYDEW MOTH CRYPTOBLABES GNIDIELLA MILL. (LEPIDOPTERA: PYRALIDAE), AND INVESTIGATON ON THEIR DAMAGE AND NATURAL ENEMIES ON POMEGRANATE IN WEST AEGEAN REGION OF TURKEY

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Abstract

The study was conducted in Karacasu, Nazilli and Sultanhisar towns in Aydın province in 2012 and 2013. The population fluctuations of Apomyelois ceratoniae and Cryptoblabes gnidiella, and their damage and natural enemies on pomegranate were studied.As a result, it was determined that both of the pests were present between May and November in the orchards. The adult population of A. ceratoniae, was reached its peak in August, whereas the population of C. gnidiella peaked between mid August and end of September. Predators, Coccinella semptempunctata, Adelia decempunctata, Scymnus apetzi (Coleoptera: Coccinellidae), Chrysoperla carnea (Neuroptera: Chrysopidae), Forficula auricolaria (Dermaptera: Forficulidae), Orius sp. (Hemiptera: Anthocoridae), and the parasitoid Pachycrepoideus vindemmiae (Hymenoptera: Pteromalidae) were found to be natural enemies of the pests. Additionally, it was found that the damage of C. gnidiella was higher than of A. ceratoniae on fruits.

Key words: *apomyleois ceratoniae, cryptoblabes gnidiella, natural enemies, pomegranate*

1. INTRODUCTION

Turkey is one of the most important countries called motherlands of pomegranate, and the production ranks of the first in the world because pomegranate farming areas have increased recently (Özgüven and Yılmaz, 2000). Turkey produces 383.085 ton of pomegranate across the land of 283.991 da in total, and Aydın province greatly contribute to national economy by 15483 tons of progmenate in an area of 16191 da (Anonymous, 2013). There are economically significant problems caused by pests in pomegranate, not only because natural balance has been upset in farming areas but also pomegranate farming areas have been increased as well (Öztürk et al., 2005).

Generally, there are few studies conducted related to pomogrenate pests across the world. Mani and Krishnamoorthy (2000) reported that parasitoids of *Leptomastix dactylopii* and *Coccidoxenoides peregrinus* were effective in biological control of *Planococcus citri* (Risso) (Hemiptera: Pseudococcidae) in pomogranate orchards in India. Mozaffarian et al. (2007) compared the sizes of wings and body of *A. ceratoniae* collected in pomegranate, fig, pistachio and wallnut, and reported that the smallest individuals were found in pomegranate, which was reported not to be caused by its genetic aspects but by nutrient content in pomegranate itself. Juan et al. (2004) reported general problems appear in pomegranate orchards in Spain. He determined that many common pests such as aphid, Lepidoptera, diptera, nematodes and mites which affect the growth of pomegranate. Wohlfarter et al. (2010) studied general pomegranate pests in South Africa and Giliomee and Millar (2009) investigated on pomegranate whitefly.

In Turkey, Mart and Altın (1992) found many species of insects and mites which affect pomegranate areas in South-East Anatolian region, where Mart and Kılınçer (1993) also studied population fluctuation and the number of generation of *A.ceratoniae*, and he consequently found that the adults were captured by sex pheromone traps in between the second half of April and the first half of May and its population never reached economical injury level. However, it was determined that *A.ceratoniae* was active in about 6 or 7 months in nature and overwinter in different larval stages in

pomegranate fruits on the tree or on the ground. Satar et al. (1999) studied *Siphoninus phillyreae* (Haliday) (Hemiptera.: Aleyrodidae), Öztop et al. (2002) and Öztürk et al. (2005) conducted studies on the pests of pomegranate and their natural enemies in mediterranean region of Turkey. Bayhan et al. (2005) studied biology of *Aphis punicae* at five different temperatures under laboratory conditions, whereas Öztürk et al. (2009) conducted a prelimenary study on [Aceria granati (Canestrini and Massalongo) (Acarina: Eriophyidae)] in South-East Mediteranean region of Turkey and concluded that 79.6% of pomegranate fruits were contaminated by the pest. It was found in Aydın province that *A.ceratoniae* and *C. capitata* could lead to significant damages in pomegranate fruits (Yıldırım and Başpınar, 2011). In the same year, another study in East Mediteranean region reported that *Cryptoblabes gnidiella* Mill., 1867 (Lepidoptera: Pyralidae) was the host of pomegranate and could cause damage ranging from 6 to 41% yearly (Öztürk and Ulusoy, 2011a; Öztürk and Ulusoy, 2011b). It is known that *C. gnidiella* feeds on pomegranate fruits causing premature fruit formation, fall into decay, get infested by worms and therefore lost its marked value (Öztop et al., 2002; Öztürk and Ulusoy, 2011a). It is clear that *A ceratoniae* is an important pest in pomogranate orchards in other provinces and pomegranates are infested by this pest (Yıldırım and Başpınar, 2011; Mamay ve et al., 2014). Pomegranate producers tend to confuse with the damages of *A. ceratoniae* and C. *gnidiella*, and they are often not aware of *C. gnidiella.* The present study determined the population density, rate of damage and natural enemies of both species in orchards in three different counties in Aydın (West Aegean Region).

2.MATERIALS AND METHODS

2.1.The adult population fluctuations of C. gnidiella and A. ceratoniae

Follow up of the adult population fluctuations of *C. gnidiella* and *A. ceratoniae* were monitored by delta type sex pheromones traps purchased from Vit-Verim Ltd. [*C. gnidiella*: 0.5 mg Z11-Hexadecenal+ 0.5 mg Z13- Octadecenal; *A. ceratoniae* : 1mg (Z,E) 7, 9,11- Dodecatrienyl formate]. Two traps were set up 1.5- 2 m high above the ground in the south of the trees, and twelve traps were placed for each pest in total in Karacasu (37 K, 8356° ; 28 D, 5638°), Nazilli (37 K, 9146°; 28 D, 3672°) and Sultanhisar counties (37 K, 8673°; 28 D, 1982°). The traps were set up in the gardens when the buds began to appear in orchards. The traps were checked twice a week until the first adult was captured and then the adults were counted on the traps.

Pheromone capcules were replaced every 4-5 week and the used ones were removed from the orchards.

2.2. Determination of the rates of damage and natural enemies

In order to establish to the rate of damage, at least 20 trees were randomly chosen from every garden in the three counties and every branch of four directions was examined by naked eye and a total of 200 fruits of every garden were separately studied (20 fruits X 10 plots) in terms of infestation and larval control. Afterwards, number of infested fruits was compared with that of uninfested ones with ratio of damage being separately found for *A. ceratoniae* and *C. gnidiella* (Öztürk and Ulusoy, 2011a; Yıldırım ve Başpınar, 2011). On the other hand, infested fruits were brought to laboratory and put in to jars in long day (16:8) ilimunated climatic chambers at 25±1 ºC and %65 ±5 humidity to obtain parasitoids. In addition, determination of predators in the orchards required that every branch of randomly choosen 20 trees in every orchard was knocked for three times without harming it to finally determine natural enemies dropped on the sheet. The collected samples were taken to laboratory to be prepared for identification.

3. RESULT AND DİSCUSSION

3.1. Population fluctutations of C. gnidiella ve A. ceratoniae

Figure 1 and Figure 2 present adult population fluctations of *A. ceratoniae* and *C. gnidiella* in 2012 and 2013, respectively.

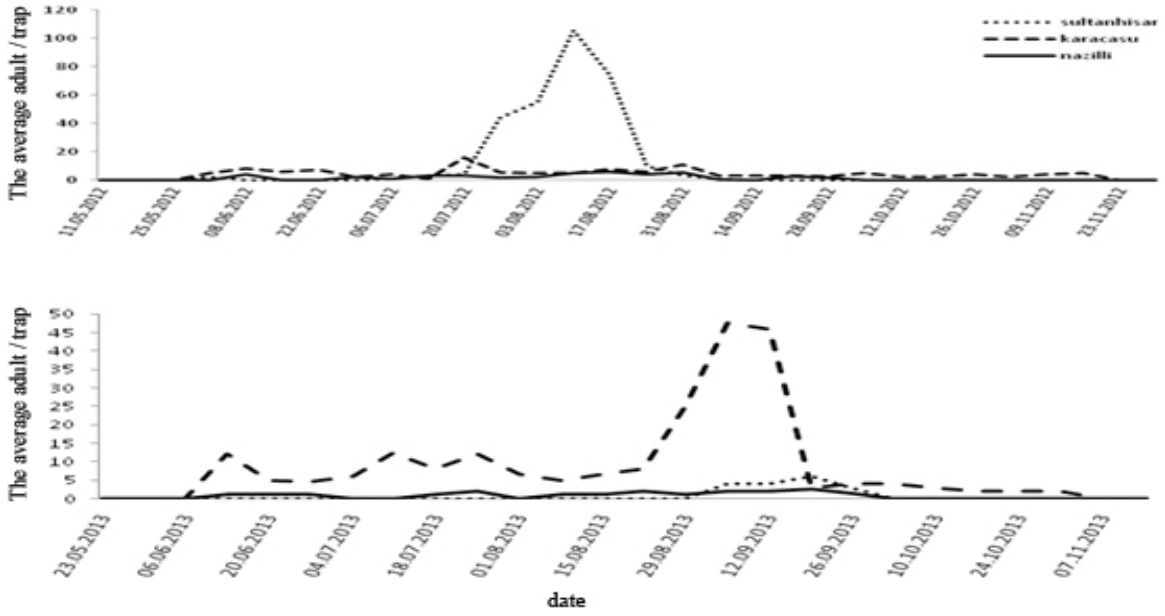

Figure 1. The population fluctuation of *A. ceratoniae* in 2012 and 2013.

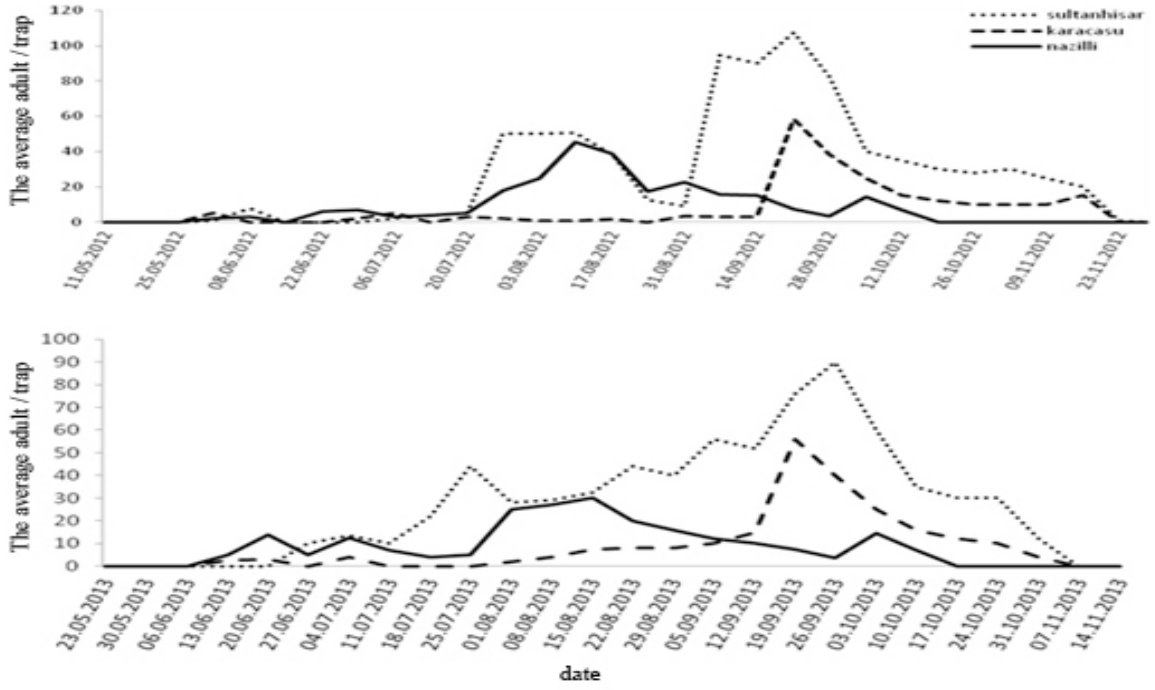

Figure 2. The population fluctuation of *C. gnidiella* in 2012 and 2013.

A. ceratoniae population was observed to appear by late May in the three counties where the trials were conducted both in 2012 and in 2013. Flight of the adult pest occurs late in May, varies in the three counties in the years and lasts by the end of November. *A. ceratoniae* population was first observed to reach at the highest level in Sultanhisar on 10.08.2012 (105.5 adult/trap)in 2012 when those in Karacasu and Nazilli remained lower and flight of adult pest disappeared in Karacasu and Nazilli from October on. The population of the pest was found to decline in all the three counties by the end of August. The period of time when the flight of the pest was the highest in orchards was August and September, which applies for 2013 as well when density of the pest in Karacasu higher than in 2012. The highest population level was found with 47.5 adult/trap in Karacasu on 5.09.2013. It was observed that population of the pest decreased from the early September as in 2012 and flight of the adults ceased by November.

C. gnidiella population was shown to be in highest level particularly in August and September in 2012 and 2103. Unlike *A. ceratoniae*, *C. gnidiella* was more active in the three counties. Flight of the adult pest lasted as in *A. ceratoniae* from May through November during which that of the adult stopped. Population of the pest reached at maximum level with 107. 5 adult/trap in Sultanhisar on 21.09.2012 and it was the highest by 90 adult/trap on 26.09.2013. The highest value was 58.5 adult/trap in Karacasu on 28.09.2012 with the highest by 40 adult/trap on 19.09.2013. Of the three counties, the lowest population was tobserved in the orchard in Nazilli where the highest was 45.5 adult/trap on 10.08.2012 and 30 adult/trap on 15.02.2013.

3.2.Damages rates and natural enemies

Table 1. Rates of the damage in fruits by *C. gnidiella* and *A. ceratoniae*

Counties	**Rate of damage (%)**			
	Apomyelois ceratoniae		***Cryptoblabes gnidiella***	
	2012	***2013***	***2012***	***2013***
Karacasu	9.5	4.5	*17.5*	*18.5*
Nazilli	1.5	1,5	1.5	3.5
Sultanhisar	4.5	2,5	16	19.5

Data of the two years showed that the highest damage caused by *A. ceratoniae* was in the orchard in Karacasu with the rates of damage of 9.5% and %4.5 in 2012 and 2013, respectively. Rate of damage from *A. ceratoniae* did not exceed 5% in the three counties in 2013. The main damage was observed to be due to *C. gnidiella*. Rates of damage were 17.5% and 18.5% in Karacasu in 2012 and 2013, respectively. In Sultanhisar, rates of damage 16.0% and 19.5% in 2012 and 2013, respectively. Rates of damage were found to be insignificant in the orchard of Nazilli in those years.

Table 2. The predator and parasitoids species found in pomogranate orchards.

Order	**Family**	**Species**	**County**
Coleoptera	Coccinellidae	*Coccinella semptempunttata*	All counties
		Adelia decempunctata	Karacasu, Nazilli
		Scymnus apetzi	Nazilli, Sultanhisar
Neuroptera	Chrysopidae	*Chrysoperla carnea*	Tüm ilçeler

Dermaptera	Forficulidae	*Forficula auricularia*	Tüm ilçeler
Hemiptera	Anthocoridae	*Orius* spp.	Sultanhisar
Hymenoptera	Pteromalidae	*Pachycrepoideus vindemmiae*	Karacasu

Table 2 indicates that *Coccinella semptempuntata, Chrysoperla carnea* and *Forficula auricularia* were found in all the counties and *Adelia decempunctata* in Karacasu and Nazilli and *Scymnus apetzi* in Nazilli and Sultanhisar orchards in Aydın.The parasitoid was found to be *Pachycrepoideus vindemmiae* (Hym.: Pteromalidae) in Karacasu.

The population of *A. ceratoniae* and *C. gnidiella* appeared in Aydın by the end of May. In addition, *A. ceratoniae* population was the highest in August (Sultanhisar 105.05 adult/trap), whereas *C. gnidiella* population was the highest in the middle of August and in September. Adult flights of both pests likely to be ceased by the end of November. Indeed, the previous studies by the authors in Aydın showed the similar results, and the adult flight of the pest could not be determined late in November (Yıldırım and Başpınar, 2011). Öztürk and Ulusoy (2011c) reported in a study of adult population fluctuations of *A. ceratoniae* that the pest was active in east mediterrenean region of Turkey in 6-7 months from April to November. Moreover, it was reported that *C. gnidiella* caused significant damage in pomegranate, completed a generation at 30.1 °C under 69.1 % relative humidity conditions for about 28.90 days and 564.5 day- degree, and ended its adult life cycle in 4.55 days and a female butterfly laid 46.18 eggs during its life span (Öztürk and Ulusoy, 2011d). Pomegranates grown in different regions of Turkey are known to be infested by both pests (Yıldırım and Başpınar, 2011; Öztürk and Ulusoy, 2011a; Mamay et al., 2014), and the pests concerned can be occured in the three counties where the trials conducted in Aydın. *A. ceratoniae* reached 9.5% rate of damage in Karacasu in 2012, but did not show EDT levels in other counties and years (%5 infested or wormed fruits). On the other hand, the main damage in the fruits was accounted for by *C. gnidiella* in particular. Although the rate of damage showed variations and fluctuated by %16-19.5 in the years in Sultanhisar and Karacasu except in Nazilli. Öztürk and Ulusoy (2011b) reported that the rate of damage from *C. gnidiella* ranged from 6.4 to 41.2 % in the provinces of Adana, Mersin and Osmaniye, and the damage from *A. ceratoniae* was not economically significant. However, there was evidence that *A. ceratoniae* could lead to damages of %20-80 in untended orchards and some locations (Al-Izzi et al., 1985).

It was observed that *Coccinella semptempuntata, Chrysoperla carnea* ve *Forficula auricularia* were seen in all counties, *Adelia decempunctata* in Karacasu and Nazilli ,*Scymnus apetzi* in Nazilli and Sultanhisar and *Orius spp.* was in Sultanhisar only in Aydın. *Pachycrepoideus vindemmiae* (Hym.: Pteromalidae) was found in Karacasu as a parasitoid. The obtained predator species are known to be common as natural enemies of *C. gnidiella* and *A. ceratoniae* in Turkey (Öztürk and Ulusoy, 2011b; Yıldırım and Başpınar, 2011). Swailem and Ismail (1973) reported that *Orius* spp. could feed on young larvae of *C. gnidiella.*

In addition, some species such as *Trichogramma evanescens* Westwood (Hymenoptera: Trichogrammatidae), *Bracon hebetor* Say, *Apanteles* sp.(Hym.:Braconidae), *Invreia* sp., *Euchalcidia nigripes* (Hym.: Chalcididae) are known to be parasitoids of *C. gnidiella* and *A. ceratoniae* (Öztürk ve Ulusoy, 2011b). It was found in the present study that *Pachycrepoideus vindemmiae* was to be a parasitoid with only one record previously in Turkey (Öncüer, 1991). Although, *P. vindemmiae* is the parasitoid of insect species from a variety of families, there are findings that it is hyperparasitoid of *Apanteles* spp. (Hym.:Braconidae) as well (Farahani et al., 2010).

4. CONCLUSION

In the light of these assesments, it was concluded that *A. ceratoniae* and *C. gnidiella* were important pests in pomegranate, and their population periodically change, but the damage of *C. gnidiella* in fruits was significantly higher than that of *A.ceratoniae*. Considering the pests spend winter in fruits on the ground, importance of cultural precautions has great importance in the control of the pests. In addition, measures taken to increase effectiveness of natural enemies of the pests and pheromeone trap applications will help control of these pests.

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