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Seasonal flight patterns of the honeydew moth, *Cryptoblabes gnidiella* Millière (Lepidoptera: Pyralidae) in pomegranate orchards as observed using pheromone traps

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ABSTRACT

The honeydew moth (HM), Cryptoblabes gnidiella Mill. (Lepidoptera: Pyralidae) is a serious pest on pomegranate in Turkey. Pheromone traps, baited with 1 mg (Z)-11-hexadecenal (Z11-16:Ald), (E)-11-hexadecenal (E11-16:Ald), (Z)-13-octadecenal (Z13-18:Ald), and (E)-13-octadecenal (E13-18:Ald) impregnated in rubber septa were used for determination of the seasonal flight activity of this pest in two districts of Hatay province, Turkey. After two years of the study, the pest was found in ten sampled sites. The seasonal activity of the pest was low in May and November, while it increased from June to October in both years. The percentages of the total caught over this period were in May to June (22%), July to September (54%) and October to December (24%) in 2010, and in May to June (25%), July to September (63%) and October to December (12%) in 2011. The seasonal flight activity of this pest was recorded from May through December and thus the pest has considered to have four overlapping generations per year; the first in May to June, the second in July, the third in August-September and the fourth in October-November on pomegranate orchards in Hatay province of Turkey.

Key words: honeydew moth, pheromones traps, pomegranate, Turkey.

INTRODUCTION

Pomegranate, *Punica granatum* L. (Punicaceae: Myrtiflorae), is an important tropical and subtropical fruit [15]. Pomegranate production is consisting of approximately 307.511 ha with a total produce of 445.750 tons of fruit per annum in Turkey, and Hatay province's share is 12.239 ha and 20.769 tons [1]. The honeydew moth (HM), *Cryptoblabes gnidiella* Mill. (Lepidoptera: Pyralidae), is a polyphagous species [19,24] and a serious pest of many fruits all over world and in Turkey [3,7,10,11,13,14,17-24]. The pest can overwinter as either larva or pupa, close to the larval feding site [4,11,16,21]. Overwintering moths appear on pomegranate orchards from late April to May [17] and May [21], active at night [4], mate on the same night of emergence and females begin oviposition the following day [5]. The females lay eggs on calyx of pomegranate fruit [16,21]. The larvae feed inside the fruit and seriously affect fruit quality [16,21]. This pest cause significant damage to pomegranate fruits in Turkey, where the damage rates were observed from 6.4 to 41.2% in 2008-2009 [16] and from 4.5 to 9.5% in 2012 and 6.75 to 12.25% in 2013 [21]. The damage rates reported to increase if the harvest delayed and the harvested fruits stored in unsuitable conditions [20,21].

The female sex pheromones could provide a reliable tool for detecting and monitoring of honeydew moth adult. The female sex pheromone components of *C. gnidiella* was identified as (Z)-11-hexadecenal (Z11-16:Ald), (E)-11-hexadecenal (E11-16:Ald), (Z)-13-octadecenal (Z13-18:Ald), and (E)-13-octadecenal (E13-18:Ald) [9]. Subsequently, the sex pheromone of this pest is widely used to provide a detecting and monitoring tool for adult males [2,16,18,21,24], in some cases, for mating disruption [12,13]. The study was to determine the seasonal flight periods of *C. gnidiella* on pomegranate orchards in Hatay province of Turkey.

MATERIALS AND METHODS

The study was conducted in 2010-2011 in ten pomegranate orchards in Antakya and Kırıkhan districts of Hatay province, Turkey. The seasonal flight patterns of this pest were monitored by delta traps (Sanidad agricola Econex, S.L/Spain) baited with 1 mg of synthetic sex pheromone (Z11-16: Ald and Z13-18: Ald, 1:1 Maavit Products, Tel Aviv, Israel). Traps were placed 1.5 m above ground and checked weekly, trapped moths were counted and removed from the traps. In both years, the traps were placed in the field in May. The pheromone lures were replaced with fresh ones every four weeks. The sticky bottom of delta traps were also changed whenever necessary. In both years, traps were removed in December (Table 1).

RESULTS

The seasonal flight activity of *C. gnidiella* were recorded from May through December in both years. In the first year, four pomegranate orchards in Antakya district were sampled and a total of 410 adult moths were caught by pheromone traps (Figure 1). The activity of this pest was low in May, while it increased from June to October. The largest mean catches per traps were recorded on 29 September (18.0 moths per trap), following on 12 August (13.0 moths per trap), 13 October (9.0 moths per trap) and 16 June (7.0 moths per trap). Four pomegranate orchards in Kırıkhan district were sampled and a total of 466 adult moths were caught by pheromone traps (Figure 2). The activity of this pest was low in May, while it increased from June to October. The largest mean catches per traps were occurred on 12 August (9.0 moths per trap), following on 6 October (8.3 moths per trap), 15 September (7.8 moths per trap), 7 July (6.5 moths per trap) and 16 June (5.8 moths per trap).

In the second year, two pomegranate orchards in Antakya district were sampled and a total of 341 adult moths were caught by pheromone traps (Figure 3). The activity of this pest was low in May, while it increased from June to October. The largest mean catches per traps were recorded on 13 June (20.5 moths per trap), following on 25 July (16.5 moths per trap), 18 July (13.0 moths per trap), 12 September (11.5 moths per trap) and 24 October (11.0 moths per trap).

In both years, the percentage of the total caught over this period varied for each of the sampling month. In the first year, the distribution of the total caught of the pest according to the months as percentages were May (1.87%), June (20.05%), July (18.64%), August (13.79%), September (21.60%), October (19.59%) and November (4.48%) (Figures 1-2). In the second year, these percentages were May (1.76%), June (22.87%), July (28.74%), August (14.37%), September (20.23 %), October (11.73 %) and November (0.29%) (Figure 3). Therefore, in both years, the results obtained peaked four times which might be considered four overlapping generations per year; the first in May to June (overwintering population), the second in July, the third in August-September and the fourth in October-November on pomegranate orchards in Hatay province of Turkey (Figures 1-3). Moreover, the percentage of the total of the pest caught over this period varied each of the sampling month in both years. In the first year, the percentage of total males captured in all groves were May to June (22%), July to September (54%) and October to December (24%). In the second year, the percentage of total males captured in all groves were May to June (25%), July to September (63%) and October to December (12%).

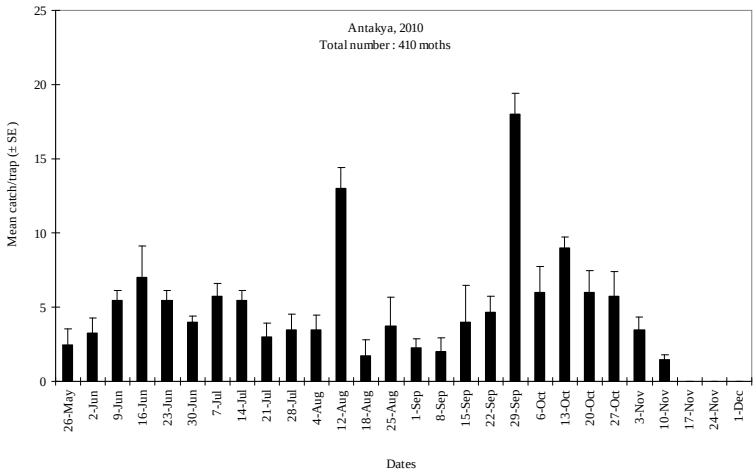

Figure 1. Mean (±SE) catches of honeydew moth males in traps baited with septa loaded pheromone dosage (19 May–1 December, 2010) at pomegranate orchards in Antakya district

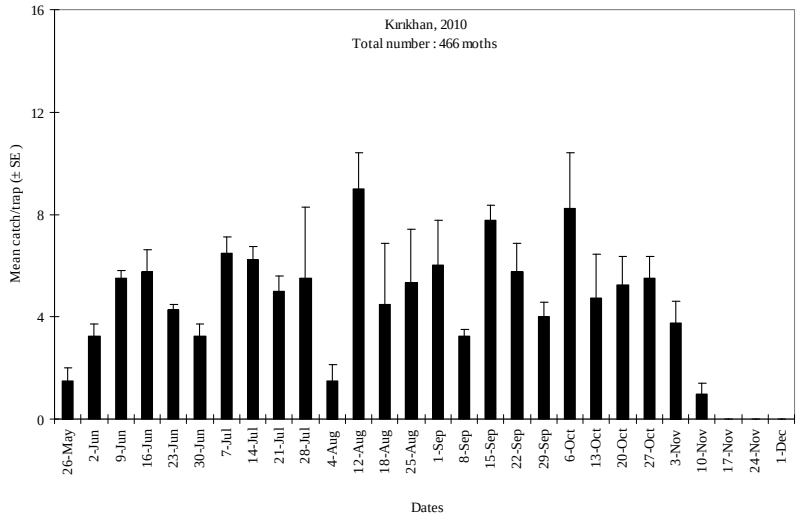

Figure 2. Mean (±SE) catches of honeydew moth males in traps baited with septa loaded pheromone dosage (19 May–1 December, 2010) at pomegranate orchards in Kırıkhan district

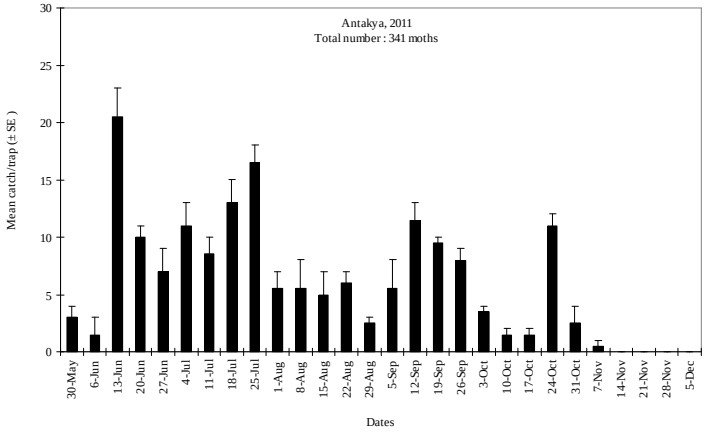

Figure 3. Mean (±SE) catches of honeydew moth males in traps baited with septa loaded pheromone dosage (23 May–5 December, 2011) at pomegranate orchards in Antakya district

Table 1. The details of the study which was carried out in two districts of Hatay province in 2010-2011

District of Hatay province	Number of traps (sites)		Dates of installation of the traps		Dates of changing the baits		Dates of removal of the traps		Variety of the Pomegranate	
	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011
Antakya	4	2	19 May	23 May	16 June 14 July 12 August 8 September 6 October 3 November	20 June 18 July 15 August 12September 10 October 7 November	1December	5December	Hicaz Katırbaşı	Hicaz Katırbaşı
Kırıkhan	4	-	19 May		16 June 14 July 12 August 8 September 6 October 3 November		1December		Karamehmet Katırbaşı	
Total	8	2								

DISCUSSION

The female sex pheromone of this pest has been widely used to provide a detecting and monitoring for adults on various fruits [2,16,18,21,24]. The seasonal flight patterns of this pest in many fruits orchards were established by the use of the pheromone traps in many countries [2,12,13,16,18,21,24]. The number of trapped adults were low in early spring [13, 16,18,21,24] and trapped males greatly increased from June to October [13,16,18,21,24]. Yehuda et al. [24] trapped this pest from March through December on avocado orchards in Israel, where the percentage of the

total moths caught over this time period were March to April (5%), June to September (75%) and October to December (20%). Silva and Mexia [18] also trapped HM males from March through December on sweet orange in Portugal. They observed from March until late May (overwintering population) and trapped males increased from June to November. Therefore, they reported that the percentage of the HM males captured in all groves were March to May (24%), June to September (48%) and October to December (26%). The activity of the honeydew moths' adults changed in different climate conditions. The first activity of this pest appears in May in the Mediterranean climates, when adult flight activity was observed in May to June, July, and August to October [6]. Öztürk [16] trapped this pest from April through December on pomegranate orchards in Adana, Mersin and Osmaniye provinces of Turkey. The population density of HM was low from April to July and began to increase from mid-July and reached to the highest level from October to November. Sürmeli [21] trapped this pest on pomegranate orchards from May to December in Hatay province of Turkey. The seasonal activity of HM was low on May and increased from June to October. The percentage of the HM males captured in all groves were May to June (4%), July to September (72%) and October to December (24%).

The number of generations per year is also dependent on the climate and host plants [4, 8,11,19,21,24]. Avidov and Gothilf [4] stated that this pest requires a minimum temperature of 13°C for development and 500 DD to complete a generation, ranging from five weeks during the summer and five months during the winter. In Israel, this pest has five to six generations per year on citrus [5], three to four generations a year in southern Europe and up to five in North Africa (11). In the Mediterranean climates, Bagnoli and Lucchi [6] stated that this pest has three or four overlapping generations per year on grape varieties; the first in May-June, the second in July, the third in August-September and the fourth in October-November. Moreover, Bisotto-de-Oliveira et al. [8] stated that this pest can have as many as nine generations per year in the northeast Brazil, due to two annual crops in the grapevine-groving areas. Silva and Mexia [18] trapped this pest from March to December on sweet orange in Portugal, where it has three or four distinct peaks of males (e.i., one in March to May, one or two in June to September and one in October to December). Öztürk [16] trapped this pest from April through December on pomegranate orchards in Adana, Mersin and Osmaniye provinces of Turkey, where this pest had four-five peaks during the flying period (e.i., one in April to June, one or two in June to September and one or two in October to November). Sürmeli [21] trapped this pest from May to December on pomegranate orchards in Hatay province, where it has three to four overlapping generations in per year.

CONCLUSION

The present study was conducted by pheromone traps to detect and monitor the seasonal flight activity of honeydew moth on pomegranate orchards in Hatay province of Turkey. As a result of two-year investigations, this pest was found in ten sites which are located in Antakya and Kırıkhan districts of Hatay province. The results also indicated that the seasonal flight activity of this pest was recorded from May through December in 2010-2011, differed according to the year. The seasonal activity of the pest increased from June through October, while it decreased in May and November in both years. Therefore, the honeydew moth is considered to have four overlapping generations per year; the first in May to June, the second in July, the third in August-September and the fourth in October-November on pomegranate orchards in Hatay province of Turkey.

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