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Monitoring the Honeydew Moth, *Cryptoblabes gnidiella* Millière (Lepidoptera: Pyralidae) in Pomegranate Orchards in the Northwestern Region of Egypt.

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ABSTRACT

Cryptoblabes gnidiella is a polyphagous serious species attacking fruits/pods, leaves and stems. *C. gnidiella* population level in a pomegranate orchard were studied during two successive years (2015 and 2016) at El-Alamain district in the Northwestern of Egypt (Matrouh Governorate). Moths started to emerge two weeks earlier in 2016 (1st half of March) than 2015 season (2nd half of March). Moths` activity continued until the 2nd half of November 2016 or 1st half of December 2015. Three peaks were detected during the 1st half of May, 1st half of July and 2nd half of August, 2015. But four peaks were detected during 2016 season on the 1st half of May, 2nd half of June, 1st half of August and 2nd half of September. Summer months recorded the maximum flight activity, (5.01 - 6.05 moths). Spring and autumn recorded 1.30 - 1.12 moths and 1.63 - 0.72 moths. During winter, moths almost ceased to emerge (0.02 - 0.06 moths). Data showed one brood of the insect activity from mid-March to late November, with only one distinct peak of moth activity during August. The seasonal cycle consisted of an activity season prevailing of about 9 months (from March to November) followed by an inactive season of about 3 months. The majority of moths emerged from the southeastern direction with the most preferred from the south (38.93 – 47.63%), east (40.40 – 40.43%), and least from west (10.64 - 12.62%) and North (1.30 – 8.05%) directions in two successive seasons 2015 and 2016. The direct effect "simple correlation: r" of the temperature (Day Maximum Temp., Day Minimum Temp. and Day Mean Temp.) on the moth activity was significant during the two seasons of study, while the Day Relative Humidity was less effective.

INTRODUCTION

Pomegranate *Punica granatum* L. (Punicaceae: Myrtiflorae) is a profitable crop in recent years, either local or exporting. Therefore, pomegranate cultivation is increasing year after another, especially in the new reclaimed lands. Pomegranate trees however attack with several insect pests mainly aphids, whitefly, jassid, mealy bugs, fruit flies and fruit moths (mainly: *Deudorix* (*Virachola*) *livia, Ectomyelois* (*Apomyelois) ceratoniae* and *Cryptoblades gnidiella* (Cocuzza, *et al.*, 2016). Moreover the most economic pests are the stem borers such as the leopard moth *Zeuzera pyrina* (Mesbah, *et al.*, 1994, Tadros, *et al.*, 2003 and Abdel Azim, *et al.*, 2009).

C. gnidiella distributed all over the world, in Europe, Asia, Africa (Egypt), Australia and America. It is a polyphagous species attacking pomegranate, grapes, citrus, avocado, figs, mango, mulberry, as wellas field crops (Hashem, *et al.*, 1996).

In Egypt, Swailem and Ismail (1972) reared *C. gnidiella* on maize leaves at 25°C and 62% RH, and found that the pre-oviposition period was 2-3 days. The egg, larval, pre-pupal and pupal stages averaged 3, 12-14, 1 and 5-7 days, respectively. Carter (1984) recorded 4-7 days for the egg stage on the fruit or foliage.

C. gnidiella overwinters as larvae, on fresh or dry fruits or leaves, or on other dry fruits, and recently in stem tunnels (Zimmerman, 1958 and Wysoki *et al.,* 1993) and moths emerge in March-April and produce 5-6 annual generations.

In pomegranate orchards, Demirel (2016) in Turkey, recorded *C. gnidiella* moths from May to November, with the majority caught in July to September (54-63%), with four overlapping generations per year. In Israel, (Ben-Yehuda *et al.,* 1992) caught moths in pheromone traps in March-April (5%), June-September (75%) and October-December (20%).

During September to November larvae of *C. gnidiella* bore into pomegranate fruits. From December to August larvae obligated to bore in the crown of pomegranate tree stem. Boring larvae were collected, reared and moths were identified as *C. gnidiella* in the classification department, Plant Protection Research Institute, ARC, MOA, Dokki, Giza, Egypt.

In the northwestern new reclaimed lands of Egypt *C. gnidiella* recently became a major insect borer and attacks the stem, threatening young pomegranate orchards owing to the lack of fruit hosts after harvesting the crop.

Larvae of *C. gnidiella* bore destructive tunnels in the crown area of the stem. The infested trees strangled, weakened, withered, rotten and finally die. At least, in this area, this stem borer will be the main reason of eliminating the newly cultivated pomegranate area.

Monitoring the target pest is a fundamental knowledge to integrated control programs through determination of the dates of adults` commencement, last and peak dates as well as the active annual broods. Therefore, the population fluctuation of *C. gnidiella* was studied in pomegranate orchards through two successive years (from January 2015 to December 2016) at El-Alamain district (Matrouh Governorate) in the northwestern of Egypt.

MATERIALS AND METHODS

Studies on *Cryptoblades gnidiella* population level in a pomegranate orchard were conducted in a newly reclaimed land at El-Alamain district in the Northwestern of Egypt (Matrouh Governorate) during two successive years (from January 2015 to December 2016).

A pomegranate orchard (about 25 feddans and 10 years old), severely infested with *C. gnidiella* borer was chosen. About 3 feddans, untreated with insecticides were set for the monitoring studies.

During December 2014, 100 randomly distributed trees in the selected area of the orchard were marked with spray paint. The old empty pupal skins of *C. gnidiella* were removed. From January 1st, 2015 until December 31st, 2016, the orchard was inspected at 2 weeks intervals. New pupal skins indicating moth emergence were counted and removed to avoid repeated counting.

C. gnidiella adults commencement, last and peak dates as well as the active annual broods were determined during the two years of study. The height of infestation from the ground surface as well as the direction of adult emergence was also considered.

The direct effect of daily-mean maximum and minimum temperatures and relative humidity on moths' flight of *C. gnidiella* was studied through the simple correlation "r". The weather factors were obtained from the Meteorology Dept., Ministry of Agric., Egypt.

RESULTS AND DISCUSSION

1. Population Fluctuation and Seasonal Abundance:

Tables (1, 2, and 3) and Figure (1) showed the pattern of the seasonal distribution of *C. gnidiella* moth emergence in pomegranate orchard as commencement, peaks and last dates of adult flight at El-Alamain district (Matrouh Governorate) in the Northwestern region of Egypt during 2015 and 2016 seasons.

Data indicated that moths started to emerge two weeks earlier in 2016 than 2015 season (1st half of March 2016 and 2nd half of March 2015). Moths` activity continued until the 2nd half of November 2016 or 1st half of December 2015. Three peaks of *C. gnidiella* moths` flight was detected during 2015 season on the 1st half of May, 1st half of July and 2nd half of August. However, four peaks of *C. gnidiella* moths` flight was detected during 2016 season on the 1st half of May, 2nd half of June, 1st half of August and 2nd half of September.

The maximum flight activity was recorded during summer months (5.01 and 6.05 moths during 2015 and 2016, respectively). Spring and autumn months recorded 1.30 and 1.12 moths during 2015 and 1.63 and 0.72 moths during 2016, respectively. However, during winter months, moths almost ceased to emerge (0.02 and 0.06 moth in 2015 and 2016, respectively. Smoothed data of *C. gnidiella* moths' activity showed that there were only one brood of the insect activity from late March to late December, 2015 and from early March to late November, 2016. Smoothed data also showed only one distinct peak of moth activity during the 2nd half of August, 2015 and the 1st half of August, 2016 seasons.

2. The seasonal cycle:

Tables (1 and 2) and Figure (1) illustrated the seasonal cycle of *C. gnidiella* moths in pomegranate orchards at the Northwestern of Egypt. It consisted of an activity season prevailing of about 9 months (from March to early or late November) followed by an inactive season of about 3 months from late December to February.

Table 1. Mean number of adult moths of *C. gnidiella* in pomegranate orchards during 2015 season together with the corresponding weather factors.

Date of inspection		Mean No. of moths /tree		Mean max. temp. ºC	Mean temp. ºC	Mean min. temp. ºC	Mean R.H.%
		actual	smoothed				
Jan.	1-15/1	0.00	0.00	17.0	13.4	9.8	71
	16-31/1	0.00	0.00	16.4	12.5	8.5	64
Feb.	1-15/2	0.00	0.00	17.5	13.1	8.6	69
	16-28/2	0.00	0.00	17.7	13.5	9.3	55
Mar.	1-15/3	0.00	0.00	18.0	13.8	9.6	59
	16-31/3	0.02	0.02	20.9	15.6	10.2	61
Winter		0.02					
Apr.	1-15/4	0.05	0.05	22.9	18.9	14.9	60
	16-30/4	0.09	0.12	23.6	19.3	15.0	53
May	1-15/5	0.25	0.18	24.8	21.4	17.9	57
	16-31/5	0.12	0.21	26.1	22.2	18.2	49
Jun.	1-15/6	0.35	0.32	27.6	24.3	20.9	48
	16-30/6	0.44	0.46	27.8	25.6	23.4	59
Spring		1.30					
Jul.	1-15/7	0.61	0.54	30.0	27.1	24.1	67
	16-31/7	0.50	0.65	31.9	28.5	25.0	72
Aug.	1-15/8	0.97	0.82	31.2	28.4	25.6	75
	16-30/8	1.36	1.14	30.9	27.0	23.0	73
Sep.	1-15/9	0.86	0.95	29.8	25.8	21.7	81
	16-31/9	0.71	0.71	29.0	24.8	20.5	71
Summer		5.01					
Oct.	1-15/10	0.55	0.52	27.9	23.5	19.1	69
	16-30/10	0.28	0.43	25.0	23.2	18.4	58
Nov.	1-15/11	0.16	0.18	24.2	20.3	16.3	70
	16-30/11	0.10	0.10	21.9	18.4	14.9	75
Dec.	1-15/12	0.03	0.04	20.2	16.7	13.2	69
	16-31/12	0.00	0.01	18.9	13.9	8.9	66
Autumn		1.12					
Total		7.45					

Table 2. Mean number of adult moths of *C. gnidiella* in pomegranate orchards during 2016 season together with the corresponding weather factors.

Date of inspection		Mean No. of moths /tree actual	Mean No. of moths /tree smoothed	Mean max. temp. C	Mean temp. C	Mean min. temp. C	Mean R.H.%
Jan.	1-15/1	0.00	0.00	19.1	14.7	10.3	70
	16/31/1	0.00	0.00	19.2	14.3	9.3	56
Feb.	1-15/2	0.00	0.00	19.1	14.3	9.4	52
	16-28/2	0.00	0.00	19.5	13.8	8.1	44
Mar.	1-15/3	0.01	0.02	21.1	16.2	11.3	69
	16-31/3	0.05	0.05	24.3	18.8	13.3	69
Winter		0.06					
Apr.	1-15/4	0.09	0.09	23.3	18.3	13.2	59
	16-30/4	0.14	0.15	26.1	20.9	15.6	62
May	1-15/5	0.23	0.18	25.3	21.2	17.1	66
	16-31/5	0.11	0.19	28.3	24.3	20.2	70
Jun.	1-15/6	0.32	0.37	27.0	24.3	21.6	77
	16-30/6	0.74	0.56	28.0	24.7	21.3	75
Spring		1.63					
Jul.	1-15/7	0.45	0.70	29.2	26.1	23.0	78
	16-31/7	1.17	1.07	30.5	27.9	25.3	78
Aug.	1-15/8	1.48	1.29	31.4	28.4	25.3	79
	16-30/8	1.03	1.10	31.4	27.8	24.2	75
Sep.	1-15/9	0.86	0.95	31.3	27.3	23.3	74
	16-31/9	1.06	0.87	29.5	26.4	23.3	73
Summer		6.05					
Oct.	1-15/10	0.51	0.55	28.1	23.9	19.6	73
	16-30/10	0.13	0.20	25.5	22.7	19.8	66
Nov.	1-15/11	0.06	0.07	25.3	20.2	15.0	68
	16-30/11	0.02	0.01	22.1	17.6	13.0	61
Dec.	1-15/12	0.00	0.00	21.1	17.1	13.1	70
	16-31/12	0.00	0.00	19.3	14.1	8.8	61
Autumn		0.72					
Total		8.46					

Table 3. Commencement, peak, last dates, and broods of *C. gnidiella* adult moths in pomegranate orchards during 2015 and 2016 seasons.

Dates	Seasons	
	2015	2016
Flight commencement	2nd half of March	1st half of March
Peak(s)	(1) 1st half of May (2) 1st half of July (3) 2nd half of August	1) 1st half of May 2) 2nd half of June 3) 1st half of August 4) 2nd half of September
Last flight	1st half of December	2nd half of November
Broods	One brood from late March to late December, with one peak on the 2nd half of August	One brood from early March to late November, with one peak on the 1st half of August

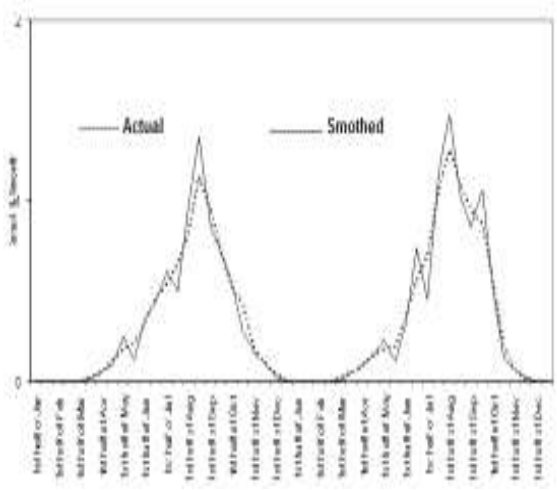

Fig. 1. Mean number of C. gnidiella moths in pomegranate orchards at the northwestern region of Egypt during 2015 and 2016 seasons

Such results were somewhat in agreement with those recorded by Zimmerman (1958) and Wysoki *et al.* (1993). He reported that moths' activity started in March-April. In Israel, (Ben-Yehuda *et al.,* 1992) they ststed that moths were caught in pheromone traps in March-April (5%), June-September (75%) and October-December (20%). However, the present study disagree with Zimmerman (1958) and Wysoki *et al.* (1993) they recorded 5-6 annual generations each year. Also disagree with Ben-Yehuda *et al.,* (1992) in Israel, who recorded five generations in the field. Demirel (2016) in Turkey, recorded the seasonal activity of *C. gnidiella* from May to November, and the pest may have four overlapping generations per year; in pomegranate orchards

3. Direction of infestation:

Table (4) indicated that the majority of *C. gnidiella* moths preferred to emerge in pomegranate orchards from the east and south directions in the two seasons, showing 3.01 and 2.90 moths per tree in 2015

activity seasons, respectively. The respective moth emergence from south and east directions in 2016 recorded 4.03 and 3.42 moths. Less moths emerged from the west direction recorded 0.94 and 0.90 moths per tree in 2015 and 2016 seasons, respectively. Only 0.6 and 0.11 moths emerged from each tree at the north direction during 2015 and 2016 seasons, respectively.

Table 4. Direction of *C. gnidiella* moths emerged from pomegranate orchards during 2015 and 2016 seasons.

Season	Direction	No. moths/tree	Emergency %
2015	North	0.60	08.05
	East	3.01	40.40
	West	0.94	12.62
	South	2.90	38.93
Total		7.45	100 %
2016	North	0.11	01.30
	East	3.42	40.43
	West	0.90	10.64
	South	4.03	47.63
Total		8.46	100 %

The scending percentage of moths emerging from the South, East, West and north directions in two successive seasons 2015 and 2016 were 38.93 – 47.63, 40.40 – 40.43, 10.64 - 12.62 and 1.30 – 8.05%, respectively. Therefore, the Southeastern direction was the most preferred for moth emergence in pomegranate orchards at the Northwestern region of Egypt.

4. Effect of weather factors on moths activity:

The prevailing weather factors, day maximum (DMxT), minimum (DMnT) mean temperature (DMT), and mean relative humidity (DMRH) dominating in the northwestern region (Matrouh Governorate) were studied for their effectiveness on *C. gnidiella* moths activity during 2015 and 2016 seasons.

Table (5) indicated that the direct effect of DMxT on the moth activity from late March to early December, 2015 was highly significant (r: 0.765) but during 2016 (from early March to late November) was significant (r: 0.653).

The direct effect (simple correlation) of DMnT on the moth activity period was highly significant during 2015 season (r: 0.839) and significant during 2016 (r: 0.637).

The direct effect (simple correlation) of DMT on the moth activity period was highly significant during 2015 season (r: 0.788) and significant during 2016 (r: 0.641).

The direct effect of DMRH on the moth activity period was insignificant during 2015 (r: 0.401) and significant during 2016 (r: 0.602).

Moths highly affected with the temperature but somewhat with the relative humidity.

Table 5. Simple correlation "r" between the mean numbers of *C. gnidiella* moths emerged from pomegranate orchards and the prevailing weather factors during 2015 and 2016 seasons together with their probability values "P".

Season	Period		Weather	Simple correlation	
	From	To	Factor	"r" value	"p"
2015 (n=18)	Early March	early-December	D. Max. T.	0.765	0.01
			D. Min. T.	0.839	0.01
			D. Mean T.	0.788	0.01
			D. Mean R.H.	0.401	0.00
2016 (n=18)	Late March	late-November	D. Max. T.	0.653	0.05
			D. Min. T.	0.637	0.05
			D. Mean T.	0.641	0.05
			D. Mean R.H.	0.602	0.05

D. Max. T.: Day-maximum temperature.
D. Min. T.: Day-minimum temperature
D. Mean T.: Day-mean temperature
D. Mean R.H.: Day-mean R.H.

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دراسة التعداد الموسمى لحفار ساق الرمان "كريبتوبلابس جنديللا" *Cryptoblabes gnidiella* Millière (Lepidoptera: Pyralidae) فى حدائق الرمان فى الساحل الشمالى الغربى بمصر.

راضي محمدي عبد المعطي ، صلاح محروس هاشم و أنطون ولسن تادرس

معهد بحوث وقاية النباتات – مركز البحوث الزراعية – وزارة الزراعة – الجيزة - مصر

أوضحت النتائج أن نشاط فراشات حفار ساق الرمان " *Cryptoblabes gnidiella* " يبدأ في النصف الأول من مارس ٢٠١٦، أو في النصف الثاني من مارس ٢٠١٥. أستمر خروج الفراشات حتى النصف الثاني من نوفمبر ٢٠١٦ أو النصف الأول من ديسمبر ٢٠١٥. تم تسجيل ثلاث قمم لنشاط الفراشات خلال النصف الأول من شهر مايو، والنصف الأول من شهر يوليو، والنصف الثاني من شهر أغسطس خلال موسم ٢٠١٥. في حين تم رصد أربع قمم لنشاط الفراشات خلال موسم ٢٠١٦ في النصف الأول من شهر مارس، والنصف الثاني من شهر يونيو، والنصف الأول من شهر أغسطس، والنصف الثاني من شهر سبتمبر . سجل موسم الصيف أعلى نسبه نشاط للفراشات (٥.٠١ -٦.٠٥ فراشة / شجرة)، يتبعها فراشات موسم الربيع (١.١٢- ١.٣٠ فراشة / شجرة) والخريف (٠.٧٢- ١.٦٣ فراشة / شجرة)، بينما خلال بداية موسم الشتاء سجل خروج الفراشات أقل معدل (٠.٠٢- ٠.٠٦ فراشة / شجرة) . أوضحت نتائج تمهيد نتائج خروج الفراشات وجود حضنة واحدة لنشاط الفراشات من مارس حتى نوفمبر، وقمة واحدة خلال أغسطس خلال الموسمين ٢٠١٥ و ٢٠١٦ . تشكلت الدورة الموسمية للفراشات من موسم نشاط أمتد حوالي ٩ شهور خلال الفترة من مارس حتى نوفمبر، تتبع هذه الفترة ٣ شهور أخرى من عدم النشاط للفراشات (ديسمبر، يناير، فبراير). وبدراسة الاتجاه المفضل لإصابة الأشجار وجد أن الاتجاه الجنوبي الشرقي هو أكثر الاتجاهات تفضيلا لخروج الفراشات، حيث سجل الإتجاه الجنوبي (٣٨.٩٣ – ٤٧.٦٣%) يليه الاتجاه الشرقي (٤٠.٤٠ – ٤٠.٤٣%)، وسجل الاتجاه الغربي (١٠.٦٤ – ١٢.٦٢%)، أما الإتجاه الشمالي فقد سجل (١.٣٠ – ٨.٠٥%) .ولمعرفة اثر العوامل الجوية على نشاط الحشرات وخروج الفراشات، أوضحت التحاليل الإحصائية للارتباط البسيط أن الأثر المباشر للمتوسط اليومي لدرجات الحرارة القصوى، والصغرى، والمتوسطة، والمتوسط اليومي للرطوبة النسبية على نشاط الفراشات كان معنويا بدرجة كبيرة بالنسبة للحرارة، ومعنويا بدرجة أقل مع الرطوبة النسبية، خلال عامي ٢٠١٥ و ٢٠١٦.