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The effect of some different watermelon varieties on Melon Weevil *Acythopeus curvirostris persicus* population in Sulaimani Governorate

ABSTRACT

This study was conducted during April–August 2020, in an open field at Qularasi Research Station, Sulaimani, Kurdistan Region-Iraq, to determine the effect of watermelon variety on population density of melon weevil Actopeus curvirostris persicus. Results showed that the melon weevil has distinct daily activities. Two activity peaks were observed in late-June and early-July. The general mean of population density on June 28 was (1.611) weevil /week, which was less than July 4 (2.583) weevils/week, the lowest number of weevils were observed at 7:00 am on the variety (Qamar F1) with (0.789) weevil/hour. Whereas, the highest number of weevil was observed at 7:00 am on Crimson Sweet variety with (1.525) weevil/hour. However, at 11:00 am, all varieties (Charleston Gray, Topgun F1, king Charles, Qamar F1, and Crimson Sweet) recorded the highest number of weevil (4.571, 4.238, 4.048, 4.048 and 1.524) weevil/hour, respectively. The population densities of melon weevil were high on all watermelon varieties in the last week of June and first week of July. Temperature, relative humidity, and wind speed correlations showed a great effect on melon weevil population density during the study period. The correlation was negative significant (-0.208) for temperature in the variety Crimson Sweet, while it was positive significant in the other varieties of Charleston Gray, Topgun F1, and King Charles with (0.165, 0.183 and 0.147), respectively. The correlation was positive significantly for relative humidity in the variety Crimson Sweet) with (0.165) however, it was negative significant for wind speed in the variety Topgun F1 with (0.137).

INTRODUCTION

Watermelon *Citrullus lanatus* Thumb belongs to the Cucurbitaceae family which includes about 118 genera and 825 species (Dane and Liu, 2007), other crops of importance in this family include cucumber *Cucumis sativus* L., melons (*C. melo* L.), and squash (*Cucurbita moschata* Duch). The crop is a warm, long-season, trailing, prostrate, annual which has monoecious and/or andro-monoecious sexuality (Boualem *et al.*, 2016). Now, it is found in Tropical and Subtropical climates worldwide Schippers, 2000, this crop has been reportedly cultivated for a long time in Africa, in the Middle East and Egypt Gichimu *et al.*, 2009.

The melon weevil Acytopeus curvirostris persicus Thompson (Coleoptera: Curculionidae) is one of the most important pests of watermelon fruits and flowers in Saudi Arabia (Al-Ahmed, 2010). According to Dane and Liu, 2007, the fruit reportedly contains 95% of water, carbohydrate 5 mg, calcium 8 mg, vitamins 64 mg, phosphorous 9 mg, and ascorbic acid 8 mg per 100g of edible portion. It has immense benefits to man due to its high nutritive (richness in vitamins A, C, potassium, magnesium and iron), therapeutic (possession of diverse antioxidants, diuretic, cancer and hypertension reducing properties) and economic (income generation and valuable contribution

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to national gross domestic product) values 5-7. Watermelon contain a citrulline gets converted to L-arginine, an essential amino acid that helps treat muscle soreness (Abu-Nasser and Abu-Naser, 2018).watermelon crops production in Iraq reached 326,000 tones in 2009, while the production reached 31050 tones in sulaimani/Kurdistan region (FAO 2012). Several problems face watermelon production just from the seedling stage up to harvest such as environmental conditions, diseases, pests, mites, weeds…etc. From an insect point of view, several species of insects attack watermelon plants, for instance, the melon fly (*Myiopardalis pardalina* Big.) is a dangerous pest of melons, watermelon, pumpkin, and cucumber all over the world (Toreniyazov *et al.*, 2010). Melon weevil, *A. curvirostris* persicus Thompson (Coleoptera: Curculionidae), is one of the most important pests of melons that is spread in the Middle East countries (Mohammad pour *et al.*, 2013), the species was first described in 1874 and has been mentioned only twice as a crop pest, it was recorded in Egypt as emerging from watermelon fruits in large numbers (Adair, 1917). The larvae feed on the developing seeds inside the fruit and pupate there in cocoons constructed of small pellets consisting of dried fruit pulp mixed with a fluid, believed to be produced in the Malpighian tubules, that is squeezed from the anus. The preoviposition period lasts about four days, and the adults survive for several weeks. There are three generations per year, or four generations if weather conditions are favorable. (Rivnay, 1960).

This weevil selects cucumber (*Cucumis sativus* L.) fruit, 5–8 cm in diameter, which has a thin, succulent, skin for egg-laying, and after 1 to 2 days of tunneling in fruit and feeding, it begins to lay eggs, a curvirostris persicus subspecies usually lays a single egg in each cavity, the duration of egg-laying is about 3–4 min. Oviposition location AA foam that is countable and a maximum of 38 eggs occurs in each oviposition holes used for feeding are not countable due to high numbers (Mohammadpour *et al.*, 2015). We also studied the occurrence of melon weevil *A.curvirostris* persicus Thompson in different varieties of watermelon combined with climatic factors in Qularasi / Sulaimani Governorate.

MATERIALS AND METHODS

This study was conducted during April–August within the growing season 2020, in an open field at Qularasi Research Station, Sulaimani, Kurdistan Region-Iraq. Qularasi is located on the east of Sulaimani, 10 km from the city center, with 35°61'07.09"N, 45°36'63.92"E and 840 m above mean sea level. The climate of the study area is classified as a semi-arid region, hot and dry in summer and cold in winter (Najmaddin *et al.*, 2017).

Field experiment

Qulqrasi open field, with 19.25 m length, 17.5 m width, with a total area of 336.87M^2 was used in the research, it was divided into three lines, then applied with 3 replications; each replicate was divided into 5 treatments (plots), a total number of 15 plots, each with 3.75 ×1.5 m were used with 2.5 m distance between the plots, 4 m between the replicates, the distance between the seedlings within a plot was 0.75 m and the total number of plants in each plot was 10 watermelon plants, the watermelon varieties (Crimson Sweet, Charleston Gray , Topgun F1, King Charles, Qamar F1) seeds were obtained from the local market, sowing of the seedlings was carried out in the plastic house on April 3, 2020, after then , the emerged seedlings were planted in Qularasi open field, the soil was already prepared .

The Experimental design

A randomized complete block design (RCBD) was applied with 3 blocks; each block was divided into five varieties with a total number of 15 plots.

Statistical analyses

The results were analyzed using a randomized complete block design (RCBD) and means were compared by Duncan's multiple range test ($P \leq 0.05$), using statistical software ready XL-STAT.7. S.2 with a simple correlation analysis (Addinsoft, 2005).

Study of the collected adults

After flowering, all watermelon varieties (Crimson Sweet, Charleston Gray, Topgun F1, King Charles, Qamar F1) grown in the Qularaisi location were studied for one week (June 28-July

4, 2020) every day (from 7:00 AM to 6:00 PM), in which the adults of melon weevil were collected by hand, put in plastic bags and labeled on weekly basis during the research period.

The population density of the adult insects was studied on the different plant parts of the watermelon crop (leaves and stems), to record the number of adults on watermelon plants of the five varieties. The records (number of adult/plant) were repeated on 10 plants for each replicate and each variety separately.

The population density of the watermelon weevil was studied on the five varieties during the insect activity season of 2021, by recording the numbers of adults for the period from April to August and by recording the number of adults on one plant to find out the average number of adults/plant by recording the number of adults on 10 plants in the field for each variety, each replication, and each reading date separately.

Population density of adults was also recorded at the different hours of the day, starting from 7:00 AM until 6:00 PM. The readings included 12 consecutive hours from morning until evening, during seven days. The population densities were also studied on the different parts of the plants of the cultivars, which were the leaves and stems. The adults who existed on each variety were collected separately. The date of collecting the insect specimens was manually caught and placed inside vials, all the necessary and important information and data related to this experiment were recorded to be used in conducting the statistical analyses.

RESULTS AND DISCUSSION

The results shown in Table 1 indicate that the highest population density of the adults of melon weevil 2.194 was recorded on June 28 on the watermelon variety King Charles. While the highest population density of the adults 2.583 was recorded on the variety Topgun F1 on July 4. On the other hand, the results in the same table show that the lowest population density of adults 1.861 was recorded on June 28 on the variety Charleston Gray, meanwhile, and the lowest population density 0.833 of the adults was recorded on July 4 on the variety Crimson Sweet. There were significant differences among sampling data in the number of adults. The general means of population density for June 28 was 1.611 weevil/week, this was less than that of July 4 which was 2.583 weevil/week. These results agree with (Azzam Al-Ahmed. 2000) that was worked on population density of melon weevil (*Acytopeus curvirostris* persicus.) on the plant parts (leaves, stems and flowers).

Table (1): The appearance of the adult melon weevil (Acytopeus curvirostris persicus.) on the plant parts (leaves, stems and flowers) for a week (June 28-July 4, 2020) in the Qularasi/Sulaymaniyah

Day	Crimson Sweet	Charleston Gray	Topgun f1	King Charles	Qamar F1	Mean Temp. (°C)	Mean Relative Humidity	Mean wind speed km/hr
June 28	1.611 a*	161.8 c	1.861 b	2.194 a	2.111 ab	36.709	11.443	1.209
June 29	1.139 ab	1.806 c	2.139 ab	1.972 a	2.139 ab	36.534	15.917	0.171
June 30	0.890 b	2.254 abc	2.289 ab	1.965 a	2.420 ab	37.289	13.263	0.689
July 1	0.833 b	2.083 bc	2.306 ab	2.056 a	2.667 a	35.214	17.583	0.111
July 2	0.973 b	2.604 a	2.471 a	2.165 a	2.071 ab	36.332	13.362	0.588
July 3	1.139 ab	2.694 a	2.194 ab	2.139 a	2.222 ab	37.926	9.574	0.209
July 4	0.833 b	2.500 ab	2.583 a	2.361 a	1.944 b	38.669	6.337	0.654

* The values in each column with the same letter do not differ significantly (P≤0.05) according to Duncan's Multiple Range Test.

The data presented in Table 2 illustrate that the adults population density of melon weevil varied over the five cultivars of the studied crop. It was found that the highest average density of weevil adults which is 1.619 was recorded at 9.00 am on the first variety Crimson Sweet, while the lowest average density of the watermelon weevil adult was 0.667 recorded at 3:00 and 4:00 pm.

It was also found that the highest population density of weevil adult was 4.571, which was recorded at 11.00 am on the variety Charleston Gray, while the lowest average density of the adult of melon weevil was 0.579 recorded at 6.00 pm.

Thus, it became clear that the highest population density of weevil adults was 4.571, which was recorded at 2.00 pm on the variety Topgun F1, while the lowest average density of the adult was 0.619, recorded at 4.00 pm. These results agree with (Mohammadpour et al., 2013)) who declared that the adult of melon weevil has distinct daily activity. Two activity peaks were observed at 7:00-9:00 am and 5:00-7:00 pm. Maximum flight activity was observed in the afternoon (14:00 hour) in field condition.

Table (3) shows the effect of a variety of watermelon on the total weekly adult melon weevil (A. curvirostris persicus) at Qularasi location during 2020 with the simple correlation between adult/variety and climatic factors.

It was revealed that the population density of adults of melon weevil on the five watermelon varieties in the Qularaisi location was correlated with temperatures, relative humidity, and wind.

The results showed that the infestation started in the last week of June and gradually increased slightly during the next month, as was noted in the data of the previous two tables No. (1) and (2). In general, the highest number of adults was at the end of June and reached a mean value of 2.194 adults on the variety King Charles at average temperature (36.709 oC), relative humidity (11.443), and wind speed 10.209. The last data collection of the first week of July and the highest number of adults was occurred on July 4 and reached a mean value 2.583 adults in the variety Top gun F1 at average temperature (38.669), relative humidity (6.337), and wind speed (0.654).

Table (2): The adult activity of the melon weevil Acytopeus curvirostris persicus. On five watermelon varieties during the day at Qularasi /Sulaymaniyah 2020

Hour	Crimson Sweet		Charleston Gray		Topgun f1		King Charles		Qamar F1		Mean Temp. (°C)	Mean Relative Humidity	Mean wind speed km/hr
7:00 AM	1.525	ab	0.846	ef	0.951	cd	0.901	d	0.789	d	29.791	20.984	0.588
8:00 AM	1.286	abc	1.429	de	1.286	cd	1.048	cd	1.381	cd	31.567	18.638	0.619
9:00 AM	1.619	a	1.571	D	1.619	c	1.762	c	1.810	c	33.386	16.519	0.395
10:00 AM	0.905	bcd	3.143	C	2.619	b	3.095	b	3.00	b	34.995	15.019	0.319
11:00 AM	1.524	ab	4.571	A	4.238	a	4.048	a	4.048	a	36.457	13.010	0.300
12:00 PM	1.33	abc	4.143	ab	4.476	a	4.143	a	4.286	a	37.629	10.695	0.305
1:00 PM	1.143	a-d	3.905	B	4.476	a	3.429	ab	3.857	a	38.467	9.262	0.314
2:00 PM	0.571	d	4.476	ab	4.571	a	4.000	a	4.143	a	38.810	8.786	0.533
3:00 PM	0.667	cd	0.857	ef	0.857	d	1.143	cd	1.048	cd	38.924	7.619	0.924
4:00 PM	0.667	cd	0.667	F	0.619	d	0.571	d	0.762	d	38.943	6.581	0.724
5:00 PM	0.810	cd	0.905	ef	0.762	d	0.619	d	0.810	d	38.471	6.900	0.505
6:00 PM	0.763	cd	0.579	F	0.687	d	0.702	d	0.768	d	33.633	11.204	0.500

* The values in each row with the same letter do not differ significantly (P≤0.05) according to Duncan's Multiple Range Test.

Table (3): Correlations among climatic factors and different varieties of watermelon for the year 2020

Varieties	Crimson Sweet	Charleston Gray	Top gun f1	King Charles	Qamar F1	Mean Temp. (°C)	Mean Relative Humidity	Mean wind speed km/hr
Crimson Sweet	1							
Charleston Gray	0.000	1						
Top gun F1	-0.023	0.707*	1					
King Charles	0.139*	0.662*	0.640*	1				
Qamar F1	0.083	0.653*	0.664*	0.637*	1			
Mean Temp. (°C)	-0.208*	0.165*	0.183*	0.147*	0.116	1		
Relative Humidity	0.165*	-0.011	-0.047	-0.007	0.028	-0.868*	1	
Wind speed km/hr	-0.029	-0.116	-0.137*	-0.077	-0.110	0.031	-0.118	1

* Values in bold are different from 0 with a significance level alpha=0.05 *significant at the level of 0.05.

The present study provides scientific information on the adult melon weevil reaction to different varieties (Crimson Sweet, Charleston Gray, Top gun F1, King Charles, Qamar F1) of watermelon C. lanatus Thumb plants under the specific environmental condition of temperature, humidity, and wind speed. These results agree with (Faraj, 2013) who worked on the correlation between the climatic factors and population density of pomegranate fruit worm adults .

CONCLUSION

According to the results obtained from present study, the following points could be concluded:

1 .The population density of melon weevil is significantly different during the hours of the day.

2 .The climatic factors affect the daily and weekly activities of the adults of melon weevil.

3. It is evident that the climatic factors caused significant differences in the population density of melon weevil.

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تأثير بعض اصناف الرقي في الكثافة العددية لسوسة البطيخ Acythopeus curvirostris persicus في محافظة السليمانية

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الكلمات المفتاحية:
سوسة البطيخ ، صنف البطيخ ، الكثافة السكانية والعوامل المناخية.

الخلاصة

نفذت هذه الدراسة خلال الشهور نيسان-اب، عام 2020 ، في حقل مفتوح تابع لمحطة ابحاث قوله ريسي، السليمانية ، إقليم كوردستان – العراق، وذلك لدراسة تأثير صنف الرقى على الكثافة السكانية لحشرة سوسة البطيخ . Acythopeus curvirostris prsicus لقد أظهرت نتائج الدراسة وجود نشاطات يومية واضحة للحشرة. هناك ذروتان للنشاط فى نهاية حزيران وبداية تموز. كما بينت النتائج ان المعدل العام للكثافة السكانية لسوسة البطيخ في 28 حزيران بلغ (1.611) سوسة/أسبوع والتى كانت أقل من الكثافة المسجلة فى 4 من شهر تموز و مقدارها (2.583) سوسة/أسبوع . وان اقل معدل لعدد سوسة البطيخ سجل في الساعة. 7.00صباحا على الصنف Qamar F1وكان مقداره (0.789) سوسة /ساعة. بينما أعلى معدل لعدد الحشرات الكاملة من سوسة البطيخ الذي شوهد في الساعة.7.00صباحا كان مقداره 1.525 حشرة كاملة /ساعة سجل على صنف الرقي Crimson Sweet ومع ذلك فإن اعلى كثافات عددية للحشرة سجلت عند الساعة 11.00 صباحا على اصناف الرقي Charleston Garyوالصنف Topgun F1والصنف King Charlesوالصنف Qamar F1 والصنف Crimson Sweet وكانت مقاديرها هي 4.571، 4.238، 4.048، 4.048 و1.524 كاملة/ساعة، على التوالي. كما بينت النتائج أيضا ان الكثافة السكانية لسوسة البطيخ كانت عالية على جميع أصناف الرقي التي شملتها الدراسة خلال الأسبوع الاخير من حزيران والاسبوع الأول من تموز. لقد اوضحت نتائج الدراسة أيضا ان كلا من درجة الحرارة والرطوبة النسبية وسرعة الرياح كان لها تأثيرا كبيرا على الكثافة السكانية لسوسة البطيخ فقد تبين بوجود علاقة. سلبية معنوية مقدارها 0.208- مابين درجة الحرارة والصنف Crimson Sweet بينما لوحظ وجود علاقات معنوية موجبة مقدارها 0.165 و0.183 و0.147 مابين درجة الحرارة والاصناف Charleston Gray، Topgun F1و King Charles على التوالي كما بينت نتائج الدراسة بوجود علاقة معنوية موجبة مابين كل من الرطوبة النسبية والصنف Crimson Sweet مقدارها 0.165كما وجدت علاقة معنوية سالبة مقدارها 0.137- مابين سرعة الرياح والصنف Topgun F1