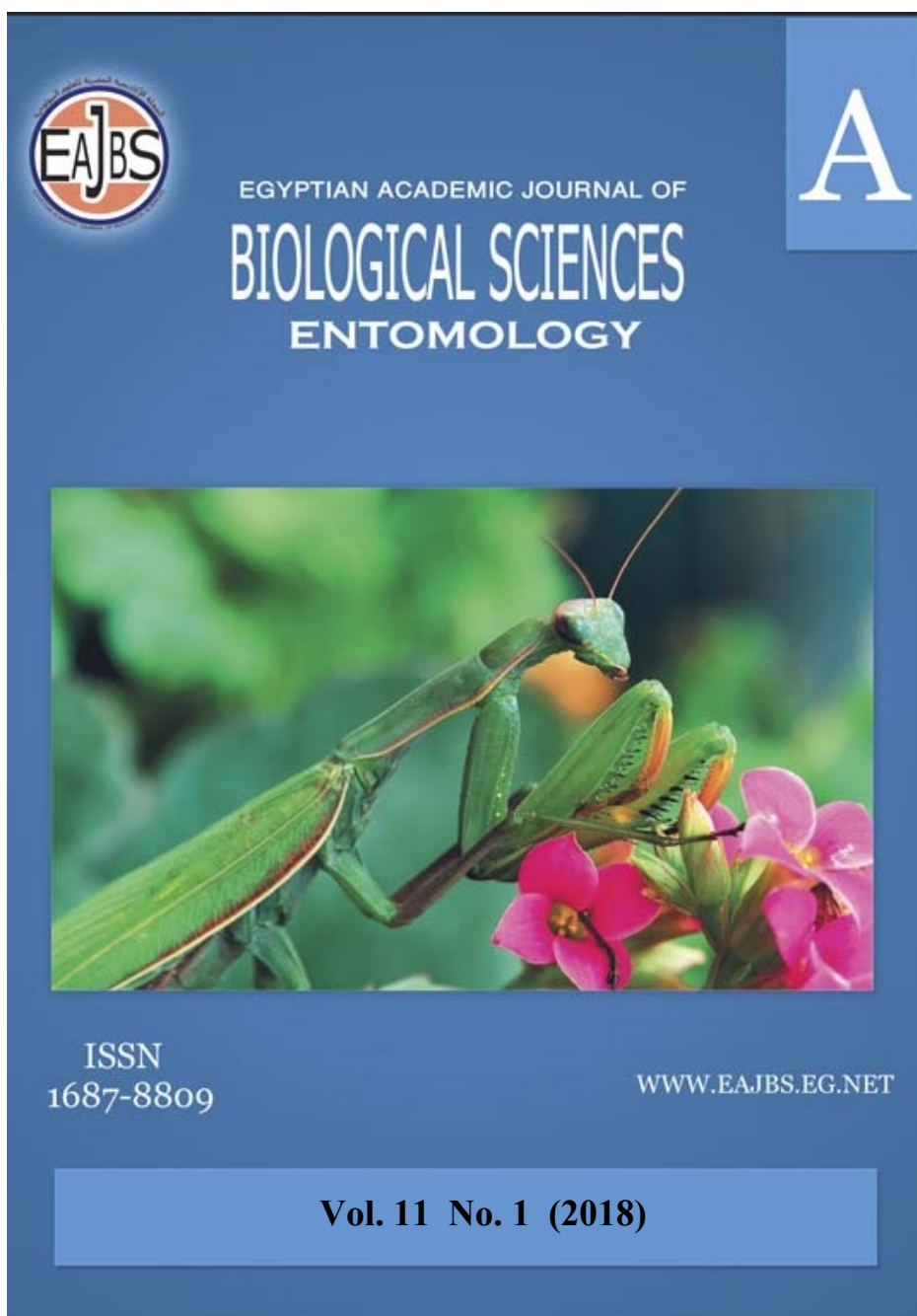


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**Population Density of Potato Tuber Moth, *Phthoremaea operculella* (Zeller)
Lepidoptera : Gelechiidae) Infesting Potato Plants In The Field.**

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ARTICLE INFO

Article History

Received:6/1/2018

Accepted:10/2/2018

Keywords:

Potato.

Phthoremaea operculella

a biotic factors.

population density.

relative humidity.

Temperature and Dew

point

ABSTRACT

The present study was conducted during 2014, 2105 and 2016 early summer seasons for potato (kara, variety) was performed under the field conditions , the experimental field was selected at a private farms at Shepa elnakaria village, Zagazig district and new Salhia, Hosinia district, Sharkia governorate. The present study aimed to study the impact of type soils (clay and sandy soil) on population density of *P. operculella* larvae infesting potato plants cultivated during 2014, 2015 and 2016 early summer seasons , evaluation infestation % to potato tubers and the effect of some climatic change on population density under field conditions. The statistical analysis of the total mean number of *P. operculella* larvae showed significant differentiation. The results show that the population density of *P. operculella* larvae was higher on sandy soil (518 individuals / 120 leaves) than the clay soil (332 individual / 120 leaves), These results revealed significant positive effects of maximum and minimum temperature and DP on population density of *P. operculella* during the first season 2014 in clay soil and sand soil . The combined effect (E.V) of these ecological factors on *P. operculella* showed that these factors were responsible as a group for 84 %, 15% and 35 % effects on the population density of *P. operculella* throughout seasons (2014, 2015 and 2016) in clay and sandy soil , also, these factors were responsible as a group for 72 %, 64% and 26 % effects on the population density.

INTRODUCTION

Potato, *Solanum tuberosum* L. is among the most important food crops in Egypt, especially for exportation. Egypt ranks among the world's top potato exporters in 2013, exported more than 380,000 tons of fresh potato and 18,000 tons of cooling potato products. In 2013, total potato production reached 250,000 tons according to the recorded data obtained from the Department of Agricultural Economics and Statistics, Ministry of Agriculture and Land Reclamation (Alaa El-Din, 2008). In Egypt, potatoes are liable to be attack by many insect pests in the field and stores, which reduce yield quantity and quality. Potato tuber moth, *Phthorimaea operculella* (Zeller) (Lepidoptera: Gelechiidae) is considered to be one of the most serious insect. The pest infesting family Solanaceae such as potato, tomato, eggplant and pepper either in filed and in stores (Sarhan, 2004; Mandour *et al.*, 2012). The rate of infestation increases in the summer crops and causes a severe damage in the field, addition to the high infestation and the high damage occur in the stored potato tubers (Shedeed, 2001).

The potato tuber moth *P. operculella* is one of the most important pests on potatoes (Binyam, 2015, 1999, Kroshel, 2006). Over the last few years, the potato tuber moth has been annually at a long year. The control over this species is very difficult owing to its high reproductive capacity, its poly volatility and adaptability towards the seasonal changes of the weather conditions. (Broodryk, 1971, Fenemore, 1988; Chumakov and Kuznetsova. 2009; Gilboa and Podoler, 1995; Coll *et al.*, 2000; Keller, 2003). Damage is caused by larvae living inside the tuber or foliage. Foliage mining larvae create transparent leaf blisters and may also mine the petioles, often resulting destroy of the plant. Tuber mining larvae usually enter through the eye of the tuber and make slender, dirty -looking tunnels mounding frays at the entrance of tunnel. Foliar damage to the potato crop usually does not result in significant yield losses (Graft, 1917) but infested tubers may have reduced market ability and losses in storage may be up to 100% especially in non -refrigerated systems (Joshi, 1989 and Arnone *et al.*, 1998). This pest has become invasive and is today reported in more than 90 countries (Kroschel and Sporleder, 2006). It occurs in almost all tropical and subtropical potato production systems in Africa, Asia, South America and is considered the most damaging potato pest in the developing world (Cisneros and Gregory, 1994). Highest infestation of tubers was found before harvest, and infestation was greater in losses than in sandy fields. Larval density in foliage and tubers were significantly higher at the margins of the fields than in the center (coll *et al.*, 2000).

The present study aimed to study the impact kind of soils (clay and sandy soil) on population density of *P. operculella* larvae infesting potatoes plants cultivated during 2014, 2015 and 2016 summer seasons , infestation % to tubers and the effect of some climatic change on population density under field conditions.

MATERIALS AND METHODS

The experiment area were distributed in two regions in (clay and sandy soil), each area was half faddan cultivated by potato (kara, variety) was performed under the field conditions, the experimental field was selected at a private farms at Shepa elnakaria village, Zagazig district and new Salhia, Hosinia district, Sharkia governorate . The potato tubers were planted in the first week of Feb. 2014, 2015 and 2016 seasons. Monitoring of the population of potato tuber moth larvae was examined from planting till final May per seasons. Each area was divided into three times. Ten leaves were collected randomly from ten plant / replicate / week. The samples of plant leaves were selected and put in paper bags then transferred to the laboratory and examined under binocular to a count and recorded the number of larvae on all leaves. The results are presented as the population density of larvae at a long month. The total numbers were registered and the mean were calculated as mean number of larvae on potato leaves to study the effect mean air temperature, Dew point and relative humidity (R.H %) on population density of pest, the simple correlation (r) and the partial regression (b) were calculated between each of the above mentioned factors (Xs) and the weekly mean numbers of the *P. operculella* larvae. Analysis of variance (ANOVA) was performed on infesting pest and two locations (SAS, 1999) and appropriate error terms for the F tests of interactions were calculated separately. Comparisons of means were performed using the Duncan's multiple range test (= 0.05).

RESULTS AND DISCUSSIONS

Population Density of the *P. operculella* Larvae Infesting Potato Leaves :

At the first, the population density of *P. operculella* larvae was higher on sandy soil (518 individuals / 120 leaves) than in clay soil (332 individual / 120 leaves), irrespective of years and months, the statistical analysis revealed that there are significant differences between type of soil (clay and sand) Whereas F value = 3.03* and L.S.D. = 2.2 individuals/ 120 leaves. According to L.S.D. value between means, *P. operculella* larvae should be divided into 2 groups. The statistical analysis of the total mean number of *P. operculella* larvae showed significant differentiation (F value= 7.50* and L.S.D. = 5.01 individuals/ 360 leaves) for three successive seasons. According to L.S.D. value between means, *P. operculella* larvae should be divided into three groups, Table (1) Fig. (1). On the other hand, the population density of the *P. operculella* larvae was higher abundant on 2014 (349 and 227 individuals / leaves) than these recorded on 2015 (44 and 83 individuals / leaves) and (61 and 86) on 2016 summer season, irrespective of soil type and months). As well as, found higher abundant of May 2014 on sandy soil (146 individuals / leaves) and the lowest abundant of March 2015 on clay soil (11 individuals / leaves).

Table 1: Population density of the *P. operculella* larvae infesting potato leaves cultivated in clay and sandy soil during 2014, 2015 and 2016 summer seasons at Sharkia governorate.

Seasons	Type of soil	March	Apr	May	Total No.
		No. of larvae/120 leaves			
2014	Clay	44	73	110	227
	Sandy	93	110	146	349
2015	Clay	11	12	21	44
	Sandy	17	28	38	83
2016	Clay	15	21	25	61
	Sandy	22	30	34	86

F value between type of soil (clay and sand) = 3.03 * and L.S.D. = 2.2 individuals/ leaves , F value between years (2014, 2015, 2016) = 7.50* and L.S.D. = 5.01 individuals/ leaves

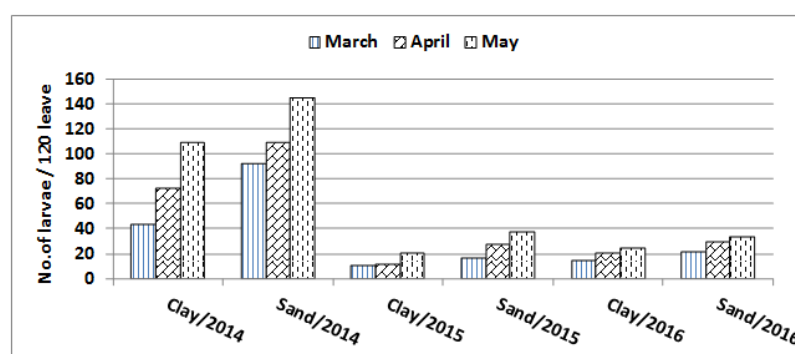


Fig. 1: population density of the *P. operculella* larvae infesting potato leaves cultivated in clay and sandy soil during summer season / 2014, 2015 and 2016 seasons at Sharkia governorate.

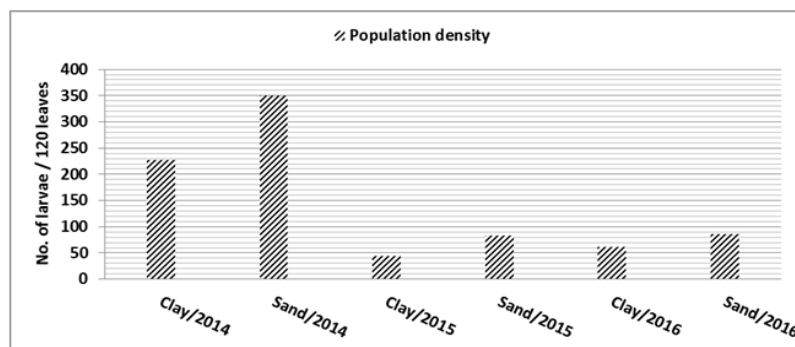


Fig. 2: population density of the *P. operculella* larvae infesting potato leaves cultivated in clay and sandy soil during 2014, 2015 and 2016 summer seasons at Sharkia governorate.

Infestation % to Tubers of Potato:

Data in Fig. 3 showed that infestation % during three summer seasons, the higher infestation were during 2014 followed by 2015 and 2016, respectively. Sandy soil was greater higher compared with clay soil 41.06 and 26.71 infested % during 2014 season.

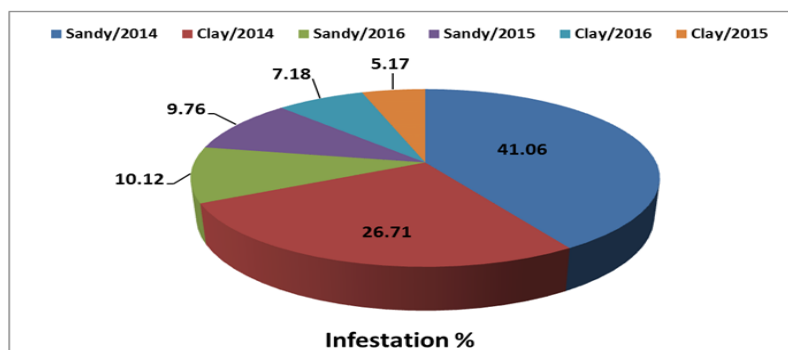


Fig. 3: Infesting tubers % with *P. operculella* larvae, to potato cultivated in clay and sandy soil during 2014, 2015 and 2016 summer seasons at Sharkia governorate.

The Combined Effect of Some Weather Factors:

Statistical analysis for the effects of the four selected weather factors (Max. temp., Min. temp., Dew point (DP) and relative humidity (R. H %)) on the population density of *P. operculella* larvae during seasons at Sharkia governorate are given in Table (2). These results revealed significant positive effects of maximum and minimum temperature and DP on the population of *P. operculella* throughout in first season 2014 in clay and sandy soil where “r” values were (0.67, 0.771 and 0.809), (0.732, 0.787 and 0.714) during 2014, respectively. As well as, the mean percentages of relative humidity had insignificant negative effect where “r” values = -0.316 and -0.395, respectively. While in the second season 2015 found insignificant positive effects of maximum temperature, minimum temperature, DP in clay soil where “r” values were 0.282, 0.349 and 0.195, mean percentages of relative humidity had insignificant negative effects -0.239. But in sand soil found significant positive effects of maximum temperature, minimum temperature, DP where “r” values were 0.602, 0.604 and 0.651 and mean percentages of relative humidity had insignificant positive effects 0.035. as well as, in third season 2016 revealed insignificant positive effects of maximum temperature, minimum temperature, DP in clay soil where “r” values were 0.383, 0.373 and 0.335, mean percentages of relative humidity had insignificant negative effects -0.303. But in sand soil found insignificant negative

effects of maximum temperature and minimum temperature where “r” values were - 0.218 and- 0.021, while in DP and mean percentages of relative humidity had insignificant positive effects where “r” values were 0.179 and 0.030, respectively. These results agreement with (Sporleder 2007). The combined effect (E.V) of these ecological factors on *P. operculella* showed that these factors were responsible as a group for 84 %, 15% and 35 % effects on the population density of *P. operculella* throughout seasons (2014, 2015 and 2016) in clay soil and found in sand soil these factors were responsible as a group for 72 %, 64% and 26 % effects on the population density of *P. operculella* throughout seasons (2014, 2015 and 2016), respectively.

Table 2: Simple correlation and partial regression values of the four weather factors on *Phthoremaea operculella* and corresponding percentages of explained variance on potato plants at Sharkia Governorate during 2014, 2015 and 2016 seasons.

season	Variables	Clay				E.V%	Sand				E.V%
		Correlation		Regression coefficient			Correlation		Regression coefficient		
		R	p	B	P		R	P	b	P	
2014	Max. temp.	0.675	0.015	-0.238	0.811	84%	0.732	0.0067			72%
	Min. temp.	0.771	0.003	-1.360	0.583		0.787	0.0024			
	DP	0.809	0.001	4.104	0.041		0.714	0.0090			
	RH%	-0.316	0.31	-0.854	0.159		-0.395	0.20			
2015	Max. temp.	0.282	0.373	-0.254	0.649	15%	0.602	0.046	-0.331	0.355	64%
	Min. temp.	0.349	0.265	0.591	0.626		0.604	0.037	1.406	0.094	
	DP	0.195	0.543	-0.039	0.964		0.657	0.020	-0.403	0.496	
	RH%	-0.239	0.451	-0.008	0.970		0.035	0.912	0.208	0.176	
2016	Max. temp.	0.385	0.215	0.717	0.238	35%		0.494			26%
	Min. temp.	0.373	0.232	-1.913	0.261			0.946			
	DP	0.335	0.286	1.143	0.2392			0.577			
	RH%	-0.303	0.337	-0.459	0.209			0.924			

Max. temp. = Maximum temperature
DP = dew point

Min. temp.= Minimum temperature
R.H%= Relative Humidity

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ARABIC SUMMARY

الكثافة العددية لفراشة درنات البطاطس التي تصيب نباتات البطاطس في الحقل

محمد حسن عبدالرحمن سليمان، منى ابراهيم عمار ، عبلة فوزى عبد السلام سعد ، فرحة حسنى فرج الله ،
عبدالرحيم أحمد عبدالرحيم

نفذت الدراسة خلال الموسم الصيفي ٢٠١٤، ٢٠١٥، ٢٠١٦ تحت ظروف الحقل ، اختبرت التجربة الحقلية في مزرعة خاصة في قرية شبيبة النكارية مركز الزقازيق ، الصالحية الجديدة مركز الحسينية محافظة الشرقية . الهدف من الدراسة هو دراسة تأثير نوع التربة (الطينية والرملية) على الكثافة العددية ليرقات فراشة درنات البطاطس التي تصيب نباتات البطاطس المزروعة خلال موسم صيفي مبكر ٢٠١٤ ، ٢٠١٥ ، ٢٠١٦ ، وتقييم نسبة الاصابة للدرنات ، وتأثير بعض التغيرات المناخية على الكثافة العددية لليرقات تحت ظروف الحقل . بينت بنت نتائج التحليل الاحصائي لمتوسط التعداد ليرقات فراشة درنات البطاطس وجود فروق معنوية . أظهرت النتائج ان الكثافة العددية ليرقات فراشة درنات البطاطس كانت عالية في حالة الزراعة في الارض الرملية (٥١٨ يرقة / ١٢٠ ورقة) عن الارض الطينية التي سجلت (٢٣٢ يرقة / ١٢٠ ورقة)، كما أظهرت النتائج وجود تأثير ايجابي لدرجة الحرارة العظمى والصغرى ونقطة الندى على الكثافة العددية ليرقات فراشة درنات البطاطس خلال الموسم الاول ٢٠١٤ في الارض الطينية والرملية. كما انه يوجد تأثير مشترك للعوامل البيئية على يرقات فراشة درنات البطاطس واثرت بنسبة ٨٤ ، ١٥ ، ٣٥ % على الكثافة العددية لليرقات خلال مواسم ٢٠١٤ ، ٢٠١٥ ، ٢٠١٦ على التوالي في الارض الطينية و ٧٢ ، ٦٤ ، ٢٦ % في الكثافة العددية لليرقات في الارض الرملية.