

Journal of Plant Protection and Pathology

Journal homepage: www.jppp.mans.edu.eg
Available online at: www.jppp.journals.ekb.eg

Ecological Studies on Certain Lepidopterous Insects Attacking Potato Plants at Dakhlia Governorate

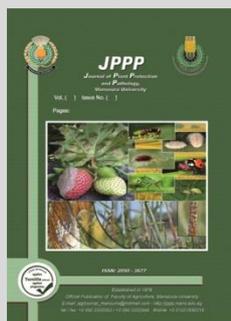
Ghanim A. A.^{1*}; Hala A. El-Serafy¹; Horia A. Hassan² and Faten B. Abu El Matti²

¹Econ. Entomol. Dept, Fac. of Agric., Mansoura Univ., Egypt

²Plant prot. Res. Inst., Agric. Res. Center, Dokki, Giza



Cross Mark



ABSTRACT

Experiments in the field conducted to evaluate population density and effect of temperature and relative humidity of five lepidopterous insect species attacking potato plants during the two successive seasons 2017 – 2018 at Meniat El-Naser region Dakhlia Governorate. The results showed that *Phthorimaea operculella* (Zeller) had four peaks in summer plantation and the highest peak was found in the first week of May, while in the winter plantation this insect recorded two peaks and the high peak was found during 4th week of October, during tested seasons 2017 and 2018. Data revealed that *Euzophora osseatella* Treitske characterized by two peaks in the two potato plantations. The results revealed that, *Tuta absoluta* Povolony had three peaks in each summer and winter potato plantations, respectively. The obtained data assured that *Spodoptera littoralis* (Boisd) had three peaks in the summer and winter plantations and the highest peak were found during late of March, throughout summer plantation and in the winter plantation during 3rd week from September month. Three peaks during summer seasons plantation were recorded on *Spodoptera exiguae* (H) while in winter seasons plantation recorded two peaks during the two tested years. Population density during the tested successive years, data obtained of "temperature degrees" and "relative humidity" resulted that, the correlation degree differed from slightly positive or negative to highly significant positive.

Keywords: Ecological studies; Lepidopterous species; Summer and winter potato plantations; Meniat El-Naser.

INTRODUCTION

Potato occupies an important position among food crops since it represents an important element in the human food and nutrition's. Potatoes are usually cultivated in Egypt in three seasons, summer cultivation, the early crop which is usually planted during December mainly for exportation, while the majority is usually cultivated during January till mid-February, autumn plantation "Nile" which is planted at the beginning of August till mid- October and winter cultivation which is usually planted in between "Nile" and summer season, from mid-October till end of November. At present, about 400000 Feddans of land are under cultivation with potatoes which produced 3000000 tons of tubers to cover local and export demands. (Anonymous (2013).

In Egypt the most serious insect pests of potato plants are in *Phthorimaea operculella* (Zeller) (Gelechiidae: Lepidoptera), *Spodoptera littoralis* (Boisd.) and *Spodoptera exigua* (Hb.) (Noctuidae: Lepidoptera) *Euzophora osseatella* Treitsche (Pyralidae: Lepidoptera); *Tuta absoluta*; *Myzus persicae* (Sulker) (Aphididae: Hemiptera) *Bemisia tabaci* (Gennadius) (Aleurodidae: Hemiptera); *Empoasca descipiens* Paoli and *Empoasca lybica* de Berg (Jassidae:Hemiptera).

Some studies were conducted all over world on insect population fluctuations which infesting potato plant and their natural enemies, e.g. lloyd, 1972; Mesbah, et al 1982; Lal, 1988; Calskaner, et al 1989; Singh, et al. 1990; Abbas, et al. 1993; Chanadla , et al. 2003 ; Musa et al. 2003; Buxton et al. 2005; Abass and Abdel-Samed, 2006; Sayama

et al. 2006; Tiwari, et al. 2006; Were et al. 2013; Afsah, 2015; Uwaidem et al. 2018 ; Djaman et al. 2019 ; Kroschel, et al. 2020.

Therefore, the current experiments were conducted to study survey and population density of some lepidopterous insect pests investing potato plants, including, *Phthorimaea operculella* Zeller; *Euzophora osseatella* Treitske; *Tuta absoluta* Povolony; *Spodoptera littoralis* Boisd and *Spodoptera exiguae* H., and the effects of "temperature and relative humidity" on populations.

MATERIALS AND METHODS

1- Survey and population density.

A survey and population density of potato insects was carried out to evaluate their occurrence and abundance of these insects on the infesting plants. This investigation was conducted through the two successive seasons 2017 and 2018. An area of about ½ feddan at Meniat El-Naser region Dakhlia Governorate was selected for this purpose. Completely randomized block design (CRBD) with 4 replicates, each with 250 m² was adopted and planted with potato plants in summer plantation (Draga cultivars) on 21 January during the two seasons of the study. The winter plantation planted on beginning of September the normal agriculture practices were followed and no insecticidal treatments were applied during the whole experimental period.

To determine the lepidopterous insects infesting potato plants two methods for determinations were taken into account.

* Corresponding author.

E-mail address: Hsbshxbdbd@gmail.com/abdelbadieghanim@gmail.com

DOI: 10.21608/jppp.2021.149517

2- Plant samples.

Sampling of the plant leaves were taken after (21) days from planting date. 100 leaves from the experimental area (25 leaflets from each plot) were randomly taken in the early morning, from different level of the plant (2,1 and 2 leaves/ plant from upper, middle and lower level, respectively). The collected samples were transferred to the laboratory in paper bags for inspections. The upper and lower surfaces of each leaf were examined carefully by using binocular microscope and the number of insects and natural enemies which found were counted and recorded. These samples were taken weekly for summer plantation. by inverting the leaves carefully.. Samples counting continued for period of investigation.

The insects which were unknown were collected and sent to Plant Protection Research Institute for identification.

3- Effects of "temperature and relative humidity" on the five tested pests.

Correlation coefficient between average numbers of tested insect "biweekly" and average numbers of (temperature and relative humidity degrees), were calculated statistically, for each tested insect-pest attacking potato plants.

4- Statistical analysis.

Data were statically analyzed by using two ways of variance "ANOVA", the correlation coefficients and equation of the multiple regressions by using computer advanced statistical program, Costat 2004.

RESULTS AND DISSECTION

1. Population density and effect of "temperature and relative humidity" on some lepidopterous insect pests attacking summer potato plantation during 2017 and 2018 seasons.

a. *Phthorimia operculella*:

a¹. Population density of *Phthorimia operculella*.

The obtained results in Fig. (1), illustrated, the population densities of *P. operculella*, through the two tested seasons 2017 and 2018. Data showed that, the biweekly catches of infestation started early at the time of plant sprouting.

The infestation started by low population and fluctuated till the fourth week of February characterized by four peaks at 25th of February (32 individuals / 100 leaves), 17th of March (45 individuals / 100 leaves), 7th of April (52 individuals / 100 leaves) and 5th of May (62 individuals / 100 leaves) in 2017 seasons. The population density then decreased gradually to reach its minimum at the end of the seasons.

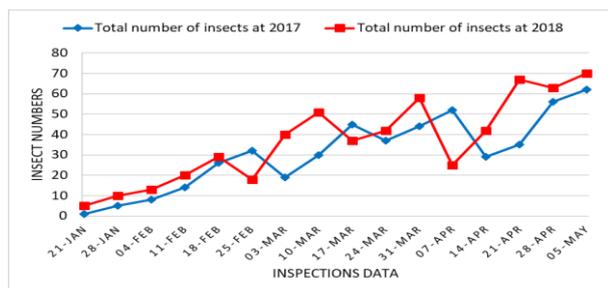


Fig. 1. Relative Abundance of *P. operculella* on summer potato plantation during the two seasons of study at Meniat El-Naser Dakhliya Governorate.

a². The effect of "temperature and relative humidity" on population density of *P. operculella*.

Data obtained in (Table, 1) cleared that, the correlation coefficient and regression values between average of "temperature and relative humidity" on population density of *P. operculella*, during the tested seasons 2017 and 2018.

Correlation coefficient values were described the relationship between temp., degrees parameters and population density of the tested insect, showed the correlation was positively significant during the tested seasons, on the other hand, relative humidity effects resulted values variations ranged from soft to insignificant correlations throughout the experiments period . Data in these table cleared that, the proportional effect values "explain variance" recorded (36% to 32%), and (21% to 26%) for temp., degrees and RH. during the tested seasons, 2017 and 2018, respectively.

Previously data are disagreement with those of El-Bakoury (1993) stated that *P. operculella* recorded eight peaks per year in Egypt.

Chandla et al. (2003) found that larval population remained low throughout the cropping period from January to May under field condition.

Table 1. Correlations coefficients and regressions between temperature degrees and relative humidity on population density of *P. operculella*, during 2017 - 2018 seasons

Year	(r) Simple correlation coefficient		(R ²) Regression	
	Temperature average	R.H. average	Temperature average	R.H. average
2017	0.65±0.08**	0.42±0.04ns	0.36±0.05	0.21±0.06
2018	0.58±0.07**	0.37±0.03ns	0.32±0.02	0.26±0.07

ns = no significant, * = significant with varied degree, where r = correlation coefficient, p = probability, s = significant sign

b. *Euzophora osseatella*:

b¹. Population density of *Euzophora osseatella*.

The obtained results illustrated in (Fig. 2), revealed that, population density of *E. osseatella*, on summer plantations during the two tested seasons. The biweekly catch revealed that the infestation started early at the time of plant sprouting.

The infestation started by low population and fluctuated till the second week of March recorded two peaks at 10th of March (16 indiv./100 leaflets) and 14th of April (21 indiv./ 100 leaflets) in 2017 seasons. The population density then decreased gradually to reach its minimum infestation at the end of the seasons.

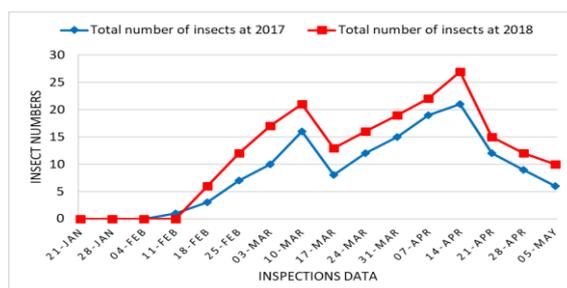


Fig. 2. Relative Abundance of *E. osseatella* on summer potato plantation during the two seasons of study at Meniat El-Naser Dakhliya Governorate.

b². Effect of temperature and relative humidity on the population density of *E. osseatella*.

Data obtained in (Table, 2) cleared that, the correlation coefficient and regression values between average of "temperature and relative humidity" on population density of *E. osseatella*, during the tested seasons 2017 and 2018.

Correlation coefficient values were described the relationship between temp., degrees parameters and population density of the tested insect, showed the correlation was positively significant during the tested seasons, on the other hand, relative humidity effects resulted values variations ranged from soft to insignificant correlations throughout the experiments period. Data in these table cleared that, the proportional effect values "explain variance" recorded (33% to 38%), and (19% to 22%) for temp., degrees and RH. during the tested seasons, 2017 and 2018, respectively.

Table 2. Correlations coefficients and regressions between temperature degrees and relative humidity on population density of *E. osseatella*, on summer plantations during 2017 - 2018 seasons

Year	(r) Simple correlation coefficient		(R ²) Regression	
	Temperature average	R.H. average	Temperature average	R.H. average
2017	0.49±0.01*	0.32±0.04ns	0.33±0.05	0.19±0.01
2018	0.59±0.09**	0.25±.02ns	0.38±0.06	0.22±0.03

ns = no significant, * = significant with varied degree, where r = correlation coefficient, p = probability, s = significant sign

c. *Tuta abslauta*:

c¹. Population density of *Tuta abslauta*.

The obtained results in (Fig. 3) domenstrated the population density of *T. abslauta* in summer plantation ioduring the two seasons of study. The weekly catch revealed that the infestation started early at the time of plant sprouting. The infestation started by low population and fluctuated till the first week of March characterized by three peaks at 3th of March (17indiv. / 100 leaflets), 7th of April (25 indiv./100 leaflets) and 28th of April (20 indiv./100 leaflets) in 2017 seasons. The population density then decreased gradually to reach its minimum infestations at the end of the seasons.

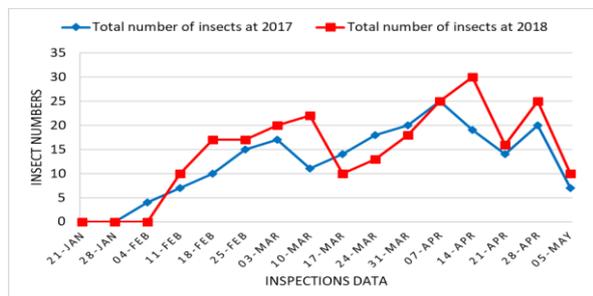


Fig. 3. Relative Abundance of *Tuta abslauta* on summer potato plantation during the two seasons of study at Meniat El-Naser Dakhliia Governorate.

c². Effect of temperature and relative humidity on the population density of *T. abslauta*.

Data obtained in (Table, 3) cleared that, the correlation coefficient and regression values between average of "temperature and relative humidity" on

population density of *T. abslauta*, during the tested seasons 2017 and 2018.

Correlation coefficient values were described the relationship between temp., degrees parameters and population density of the tested insect, showed the correlation was positively significant during the tested seasons, on the other hand, relative humidity effects resulted values variations ranged from soft to insignificant correlations throughout the experiments period. Data in these table cleared that, the proportional effect values "explain variance" recorded (28% to 30%), and (14% to 19%) for temp., degrees and RH. during the tested seasons, 2017 and 2018, respectively.

Table 3. Correlations coefficients and regressions between temperature degrees and relative humidity on population density of *Tuta abslauta*, during 2017 - 2018 seasons

Year	(r) Simple correlation coefficient		(R ²) Regression	
	Temperature average	R.H. average	Temperature average	R.H. average
2017	0.51±0.09*	0.66±0.08***	0.28±0.06	0.14±0.03
2018	0.60±0.05**	0.59±0.1**	0.30±0.07	0.19±0.04

ns = no significant, * = significant with varied degree, where r = correlation coefficient, p = probability, s = significant sign

d. *Spodoptera littoralis*:

d¹. Population density of *Spodoptera littoralis*.

Data cleared in (Fig. 4), indicated that the population density of *S. littoralis* during the two seasons of study. Biweekly catches showed that, the infestation started early at the time of plant sprouting. The infestation started by low population and fluctuated till the fourth week of February characterized by three peaks at 25th of February (17indiv. / leaflets), 31th of March (24 indiv. / 100 leaflets) and 28th of April (23 indiv. / 100 leaflets) in 2017 seasons. The population density then decreased gradually to reach its minimum at the end of the seasons.

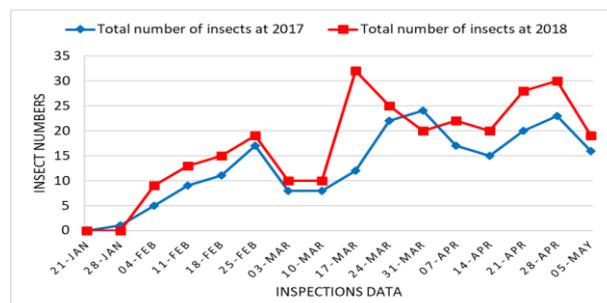


Fig.4. Relative Abundance of *Spodoptera littoralis* on summer potato plantation during the two seasons of study at Meniat El-Naser Dakhliia Governorate.

d². Effect of temperature and relative humidity on the population density of *S. littoralis*.

Data obtained in (Table, 4) cleared that, the correlation coefficient and regression values between average of "temperature and relative humidity" on population density of *S. littoralis*, during the tested seasons 2017 and 2018.

Correlation coefficient values were described the relationship between temp., degrees parameters and population density of the tested insect, showed the correlation was positively significant during the tested

seasons, on the other hand, relative humidity effects resulted values variations ranged from soft to insignificant correlations throughout the experiments period. Data in these table cleared that, the proportional effect values "explain variance" recorded (35% to 30%), and (20% to 16%) for temp., degrees and RH. during the tested seasons, 2017 and 2018, respectively.

Table 4. Correlations coefficients and regressions between temperature degrees and relative humidity on population density of *Spodoptera littoralis*, during 2017 - 2018 seasons

Year	(r) Simple correlation coefficient		(R ²) Regression	
	Temperature average	R.H. average	Temperature average	R.H. average
2017	0.72±0.12***	0.49±0.06*	0.35±0.05	0.20±0.02
2018	0.65±0.1***	0.38±0.05	0.30±0.03	0.16±0.03

ns = no significant, * = significant with varied degree, where r = correlation coefficient, p = probability, s = significant sign

e. *Spodoptera exigua*:

e¹. Population density of *Spodoptera exigua*.

Data obtained in (Fig. 5) showed that, population density of *S. exigua* during the tested seasons. Biweekly catches indicated that, the infestation started early at the time of plant sprouting. The infestation started by low population and fluctuated till the fourth week of February characterized by three peaks at 25th of February (14 indiv. / 100 leaflets), 24th of March (18 indiv. / 100 leaflets) and 21th of April (15 indiv. / 100 leaflets) in 2017 seasons. The population density then decreased gradually to reach its minimum infestation at the end of the season.

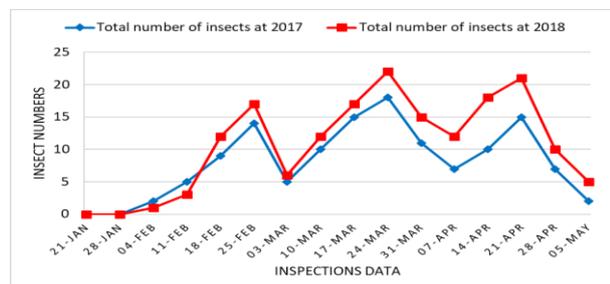


Fig. 5. Population density of *Spodoptera exigua* on summer potato plantation during the two seasons of study at Meniat El-Naser Dakhliya Governorate.

e². Effect of temperature and relative humidity on the population density of *S. exigua*.

Data obtained in (Table, 5) cleared that, the correlation coefficient and regression values between average of "temperature and relative humidity" on population density of *S. exigua*, during the tested seasons 2017 and 2018.

Correlation coefficient values were described the relationship between temp., degrees parameters and population density of the tested insect, showed the correlation was positively significant during the tested seasons, on the other hand, relative humidity effects resulted values variations ranged from soft to insignificant correlations throughout the experiments period. Data in these table cleared that, the proportional effect values "explain variance" recorded (24% to 28%), and (15% to 21%) for temp., degrees and RH. during the tested seasons, 2017 and 2018, respectively.

These results are in agreement with those of Djaman et al (2019) reported that *Spodoptera frugiperda* major insects attacking potato fields.

Table 5. Correlations coefficients and regressions between temperature degrees and relative humidity on population density of *Spodoptera exigua*, during 2017 - 2018 seasons

Year	(r) Simple correlation coefficient		(R ²) Regression	
	Temperature average	R.H. average	Temperature average	R.H. average
2017	0.48±0.09*	0.27±0.02	0.24±0.02	0.15±0.02
2018	0.54±0.01*	0.56±0.06*	0.28±0.03	0.21±0.03

ns = no significant, * = significant with varied degree, where r = correlation coefficient, p = probability, s = significant sign

2- Population density and the effect of temperature and relative humidity on the lepidopterous insect pests attacking winter potato plantation during 2017 and 2018 seasons.

a. *Phthorimia operculella*:

a¹. Population density of *Phthorimia operculella*.

Data in (Fig. 6), illustrated that, population density of *P. operculella* during the study seasons. Biweekly catches indicated that, the infestation started early at the time of plant sprouting. The infestation started by low population and fluctuated till the first week of November characterized by two peaks at 26th of October (29 indiv. / 100 leaflets) and 23th of November (25 indiv. / 100 leaflets) in 2017 seasons. The population density then decreased gradually to reach its minimum at the end of the seasons.

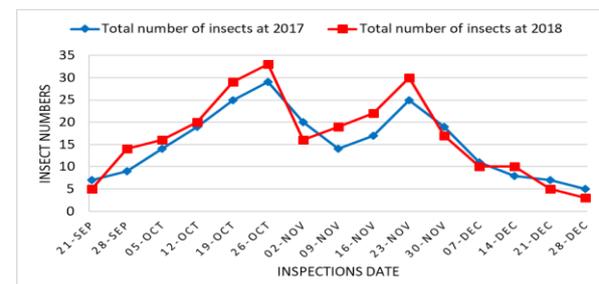


Fig. 6. Relative Abundance of *Phthorimia operculella* on winter potato plantation during the two seasons of study at Meniat El-Naser Dakhliya Governorate.

a². Effect of temperature and relative humidity on the population density of *P. operculella*.

Data obtained in (Table, 6) cleared that, the correlation coefficient and regression values between average of "temperature and relative humidity" on population density of *P. operculella*, during the tested seasons 2017 and 2018.

Correlation coefficient values were described the relationship between temp., degrees parameters and population density of the tested insect, showed the correlation was positively significant during the tested seasons, on the other hand, relative humidity effects resulted values variations ranged from soft to insignificant correlations throughout the experiments period. Data in these table cleared that, the proportional effect values "explain variance" recorded (40% to 44%), and (21% to 27%) for temp., degrees and RH. during the tested seasons, 2017 and 2018, respectively.

Table 6. Correlations coefficients and regressions between temperature degrees and relative humidity on population density of *Phthorimia operculella*, on winter plantations during 2017 - 2018 seasons, at Meniat El-Nasr

Year	(r) Simple correlation coefficient		(R ²) Regression	
	Temperature average	R.H. average	Temperature average	R.H. average
2017	0.59±0.05**	0.49±0.05*	0.40±0.03	0.21±0.02
2018	0.64±0.08***	0.52±0.04*	0.44±0.06	0.27±0.03

ns = no significant, * = significant with varied degree, where r = correlation coefficient, p = probability, s = significant sign

b. *Euzophora osseatella*:

b¹. Population density of *Euzophora osseatella*.

Data illustrated in (Fig. 7), cleared that, population density of *E. osseatella* during the successive years, 2017 - 2018. Biweekly catches indicated that, the infestation started early at the time of plant sprouting. The infestation started by low population and fluctuated till the first week of October characterized by two peaks at 12th of October (18 indiv. / 100 leaflets) and 9th of November (22 indiv. / 100 leaflets) in 2017 seasons. The population density then decreased gradually to reach its minimum at the end of the seasons.

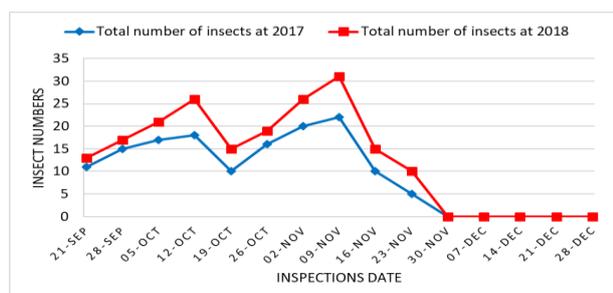


Fig. 7. Relative Abundance of *Euzophora osseatella* on winter potato plantation during the two seasons of study at Meniat El-Naser Dakhliya Governorate.

b². Effect of temperature and relative humidity on the population density of *E. osseatella*.

Data obtained in (Table, 7) cleared that, the correlation coefficient and regression values between average of "temperature and relative humidity" on population density of *E. osseatella*, during the tested seasons 2017 and 2018.

Table 7. Correlations coefficients and regressions between temperature degrees and relative humidity on population density of *Euzophora osseatella*, on winter plantations during 2017 - 2018 seasons, at Meniat El-Nasr

Year	(r) Simple correlation coefficient		(R ²) Regression	
	Temperature average	R.H. average	Temperature average	R.H. average
2017	0.64±0.09	0.38±0.03	0.24±0.06	0.10±0.01
2018	0.53±0.04	0.42±0.04	0.39±0.04	0.17±0.02

ns = no significant, * = significant with varied degree, where r = correlation coefficient, p = probability, s = significant sign

Correlation coefficient values were described the relationship between temp., degrees parameters and population density of the tested insect, showed the correlation was positively significant during the tested seasons, on the other hand, relative humidity effects resulted values variations ranged from soft to insignificant

correlations throughout the experiments period. Data in these table cleared that, the proportional effect values "explain variance" recorded (24% to 39%), and (10% to 17%) for temp., degrees and RH. during the tested seasons, 2017 and 2018, respectively.

c. *Tuta absoluta*:

c¹. Population density of *Tuta absoluta*.

Data in (Fig. 8) illustrated that, population density of *T. absoluta*, during the study seasons. Biweekly catches concluded that, the infestation started early at the time of plant sprouting. The infestation started by low population and fluctuated till the first week of October recorded three peaks at 5th of October (15 indiv. / 100 leaflets), 2th of November (19 indiv. / 100 leaflets) and 30th of November (21 indiv. / 100 leaflets) in 2017 seasons. The population density then decreased gradually to reach its minimum at the end of the seasons.

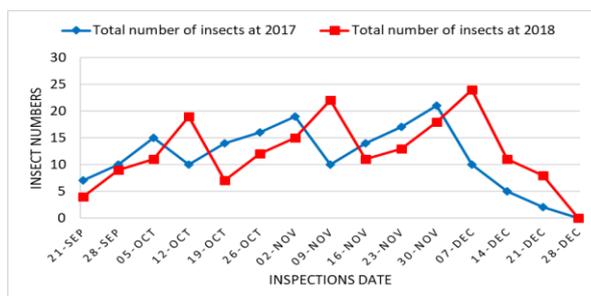


Fig. 8. Relative Abundance of *Tuta absoluta* on winter potato plantation during the two seasons of study at Meniat El-Naser Dakhliya Governorate.

c². Effect of temperature and relative humidity on the population density of *T. absoluta*.

Data obtained in (Table, 8) cleared that, the correlation coefficient and regression values between average of "temperature and relative humidity" on population density of *T. absoluta*, during the tested seasons 2017 and 2018.

Table 8. Correlations coefficients and regressions between temperature degrees and relative humidity on population density of *Tuta absoluta*, on winter plantations during 2017 - 2018 seasons, at Meniat El-Nasr

Year	(r) Simple correlation coefficient		(R ²) Regression	
	Temperature average	R.H. average	Temperature average	R.H. average
2017	0.42±0.04	0.26±0.01	0.29±0.01	0.11±0.01
2018	0.57±0.05	0.35±0.02	0.36±0.02	0.18±0.02

ns = no significant, * = significant with varied degree, where r = correlation coefficient, p = probability, s = significant sign

Correlation coefficient values were described the relationship between temp., degrees parameters and population density of the tested insect, showed the correlation was positively significant during the tested seasons, on the other hand, relative humidity effects resulted values variations ranged from soft to insignificant correlations throughout the experiments period. Data in these table cleared that, the proportional effect values "explain variance" recorded (29% to 36%), and (11% to 18%) for temp., degrees and RH. during the tested seasons, 2017 and 2018, respectively.

d. *Spodoptera littoralis*:

d¹. Population density of *Spodoptera littoralis*:

The obtained results in (Fig. 9), showed that, population density of *S. littoralis* during the two tested seasons. Biweekly catches indicated, the infestation started early at the time of plant sprouting. The infestation started by low population and fluctuated till the fourth week of September characterized by two peaks at 28th of September (15 indiv. / 100 leaflets) and 26th of October (10 indiv. / 100 leaflets) in 2017 seasons and two peaks at 28th of September (19 indiv. / 100 leaflets) and 26th of October (17 indiv. / 100 leaves) in 2018 seasons. The population density then decreased gradually to reach its minimum at the end of the seasons.

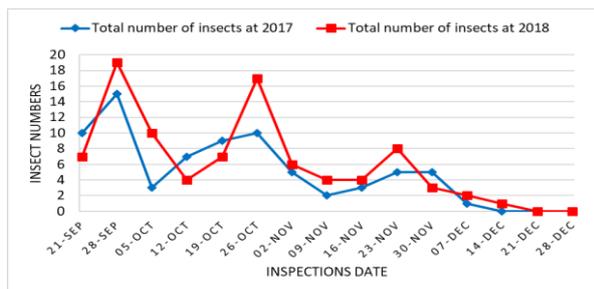


Fig. 9. Relative Abundance of *Spodoptera littoralis* on winter potato plantation during the two seasons of study at Meniat El-Naser Dakhliya Governorate.

d². Effect of temperature and relative humidity on the population density of *S.littoralis*.

Data obtained in (Table, 9) cleared that, the correlation coefficient and regression values between average of "temperature and relative humidity" on population density of *S. littoralis*, during the tested seasons 2017 and 2018.

Table 9. Correlations coefficients and regressions between temperature degrees and relative humidity on population density of *Spodoptera littoralis*, on winter plantations during 2017 - 2018 seasons, at Meniat El-Nasr

Year	(r) Simple correlation coefficient		(R ²) Regression	
	Temperature average	R.H. average	Temperature average	R.H. average
2017	0.62±0.11**	0.40±0.1	0.28±0.07	0.18±0.01
2018	0.54±0.09	0.38±0.06	0.22±0.05	0.22±0.02

ns = no significant, * = significant with varied degree, where r = correlation coefficient, p = probability, s = significant sign

Correlation coefficient values were described the relationship between temp., degrees parameters and population density of the tested insect, showed the correlation was positively significant during the tested seasons, on the other hand, relative humidity effects resulted values variations ranged from soft to insignificant correlations throughout the experiments period. Data in these table cleared that, the proportional effect values "explain variance" recorded (28% to 22%), and (18% to 22%) for temp., degrees and RH. during the tested seasons, 2017 and 2018, respectively.

e. *Spodoptera exigua*:

e¹. Population density of *Spodoptera exigua*.

The obtained results in (Fig. 10) demonstrated that, population density of *S. exigua* during the tested seasons.

Biweekly catches concluded that, the infestation started early at the time of plant sprouting. The infestation started by low population and fluctuated till the first week of October characterized by two peaks at 19th of October (13 indiv. / 100 leaves) and 23th of November (8 indiv. / 100 leaflets) in 2017 seasons and two peaks at 19th of October (16 indiv. / 100 leaflets) and 23th of November (11 indiv. / 100 leaflets) in 2018 seasons. The population density then decreased gradually to reach its minimum at the end of the seasons.

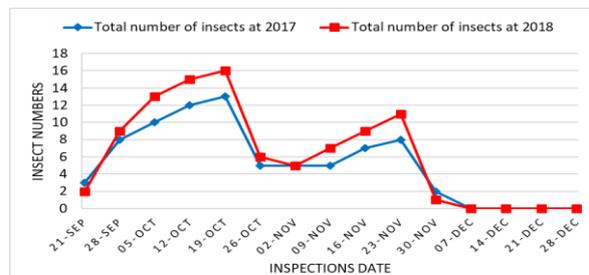


Fig. 10. Relative Abundance of *Spodoptera exigua* on winter potato plantation during the two seasons of study at Meniat El-Naser Dakhliya Governorate.

e². Effect of temperature and relative humidity on the population density of *S. exigua*.

Data obtained in (Table, 10) cleared that, the correlation coefficient and regression values between average of "temperature and relative humidity" on population density of *S. exigua*, during the tested seasons 2017 and 2018.

Correlation coefficient values were described the relationship between temp., degrees parameters and population density of the tested insect, showed the correlation was positively significant during the tested seasons, on the other hand, relative humidity effects resulted values variations ranged from soft to insignificant correlations throughout the experiments period. Data in these table cleared that, the proportional effect values "explain variance" recorded (31% to 25%), and (12% to 19%) for temp., degrees and RH. during the tested seasons, 2017 and 2018, respectively.

Table 10. Correlations coefficients and regressions between temperature degrees and relative humidity on population density of *Spodoptera exigua*, on winter plantations during 2017 - 2018 seasons, at Meniat El-Nasr

Year	(r) Simple correlation coefficient		(R ²) Regression	
	Temperature average	R.H. average	Temperature average	R.H. average
2017	0.59±0.08**	0.37±0.05	0.31±0.04	0.12±0.01
2018	0.35±0.02	0.42±0.07	0.25±0.03	0.19±0.02

ns = no significant, * = significant with varied degree, where r = correlation coefficient, p = probability, s = significant sign

REFERENCES

Abbas, M.S.T. and S.S.M. Abdel-Samad (2006). Larval parasitoids of the potato tuber moth *Phthorimaea operculella* in potato and tomato fields. Arab Universities J. Agric. Sci. 14(1): 439-445.

- Abbas, M.S.T.; N.A. Abu Zeid and M.M. Meahed (1993): The natural enemies of the potato tuber moth *Phthorimaeoeperculella* in Egypt. *Egypt. J. Agric. Res.* 71(4): 943-950.
- Afsah, A.F.E. (2015). Survey of insects & mite associated Cape gooseberry plants (*Physalis peruviana* L.) and impact of some selected safe materials against the main pests. *Annals of Agricultural Sciences* Volume 60, Issue 1, June 2015, Pages 183-191.
- Anonymous (2013). *Agricultural statistics Bulletin*. Central Administration of Economic. Ministry of Agriculture, Egypt, 170 pp.
- Buxton, J.; J. Bennison and L. Wardlow (2005). Survey of aphids and their natural enemies on UK nursery stock. *Bull. OLLB/SROP*; 28(1): 31-34.
- Calskaner, S.; N. Dortbudak and A. Has (1989). Survey studies of the potato tuber moth (*Phthorimaea operculella*) on potatoes in central Anatolia- Bitki Koruma Bulteni; 29(1-2): 65-79.
- Chandla, V.K.; S. Brajesh and R.S. Chanel (2003). Management of potato tuber moth in country stores with CIPC : a possibility under testing .J. Indian Potato Assoc. 30(1/2): 153-154.
- CoHort softwer. (2004). Costs www.cohort.com Monterey, California, USA.
- Djaman, K., Higgins, C., O'Neill, M., Begay, S., Koudahe, K., & Allen, S. (2019). Population Dynamics of Six Major Insect Pests During Multiple Crop Growing Seasons in Northwestern New Mexico. *Insects*, 10 (11), 369.
- El-Bakoury H. M. (1993) Studies on some insect pests effecting potato production in Egypt. M. Sc. Thesis. Fac. Agric. Mansoura Univ. pp 107.
- Kroschel, J., Mujica, N., Okonya, J., & Alyokhin, A. (2020). Insect Pests Affecting Potatoes in Tropical, Subtropical, and Temperate Regions. In *The Potato Crop* (pp. 251-306). Springer, Cham.
- Lal, L. (1988). Potato tuber moth, *Phthorimaea operculella* (Zeller) in north Eastern Hills region and a simple method for its control. *Indian J. Agric. Sci.* 58(2): 130-132.
- Lloyd, D. C. (1972). Some south American parasites of the potato tuber moth *Phthorimaea operculella* (Zeller) and remarks on those in other contents. *Tech. Bull. Of the common wealth Institute of Biol control* (15):35 – 49.
- Mesbah, H.A.; N.A. Hassan.; H.A.S. Radwan.; M.R. Abdel-Mohymen.; and M.S. Abdel-Fattah (1982). Synergism between certain adjuvants and two insect growth regulators against the larvae of the cotton leafworm *Spodoptera littoralis* (Boisd.). *Bulletin .Entomol .Soc . Egypt .Econ . Series. publ. No. 13, 25-30.*
- Musa, F.; C. Carli and N. Karic (2003). Distribution of the aphids in potato crop in the climatic condition of Kosovo. *Radovipoljoprirednogfakulteta Univerziteta Sarajevu works of the Fac. Agric. Univ. Sarajevo*; 48(52): 69-82.
- Sayama, M.; T. Ogawa and Y. Mukaida (2006). Relationship between infection period of potato virus Y and seasonal occurrence of aphid vectors in a potato fields during spring production in the *Shimabara Peninsula*. *Kyushu plant protection Research*; 52: 18-28.
- Singh, M.B.; R.M. Bhagat and D.C. Sharma (1990). Life history and host range of potato tuber moth *Phthorimaea operculella* (Zeller). *Himachal J. Agric. Res.* 16(1-2): 59-62.
- Tiwari, D. B., R. B. Thapa, S. M. Shrestha and S. L. Joshi (2006). Field Survey and Monitoring of Potato Tuber Moth (*Phthorimaea Operculella* (Zeller) (Lepidoptera: Gelechiidae). *J. Inst. Agric. Anim. Sci.* 27:157-160.
- Uwaidem, Y. I. (2018). Insect Pest Complex and Beneficial Insects Associated with Sweet Potato (*Ipomoea batatas*) (Lam.) in Southern Nigeria and Key Pests to Consider in Control Programmes. *Journal of Agriculture and Ecology Research International* 16(2): 1-9.
- Were, H. K. & J. N. Kabira & Z. M. Kinyua & F. M. Olubayo & J. K. Karinga & J. Aura & A. K. Lees & G. H. Cowan and L. Torrance (2013). Occurrence and Distribution of Potato Pests and Diseases in Kenya. *Potato Research* (2013) 56:325–342.

دراسات إيكولوجية لبعض حشرات حرشفية الأجنحة على نباتات البطاطس في منطقة الدقهلية عبد البديع عبد الحميد غاتم¹ ، هاله أحمد كامل الصيرفي¹ ، حورية عبد الوهاب حسن² و فاتن بهلول أبو المعاطي² قسم الحشرات الاقتصادية - كلية الزراعة - جامعة المنصورة معهد بحوث وقاية النباتات - مركز البحوث الزراعية - دقي - جيزة

اجريت تجارب حقلية لتقييم الكثافة العددية وتأثير بعض العوامل الجوية (الحرارة و الرطوبة) على خمس حشرات رتبة حرشفية الاجنحة تهاجم نباتات البطاطس خلال عامين متتاليين 2017 – 2018 في منية النصر محافظة الدقهلية و أوضحت النتائج المتحصل عليها أن فراشة درنات البطاطس لها أربعة ذرات من التعداد في العروة الصيفية و كان أعلى تواجد لها في الاسبوع الاول من شهر مايو بينما سجلت لهذه الحشرة في العروة الشتوية ذروتين كان اعلاها تواجدا في الاسبوع الاخير من شهر اكتوبر أما بالنسبة لحفار ساق البازنجان فلقد أظهرت النتائج أن له ذروتين من التعداد في كلا العروتين الصيفية و الشتوية خلال عامي الدراسة. كما أظهرت النتائج أن حفار أوراق الطماطم *Tuta absiluta* كان له ثلاث ذرات من التعداد في كلا العروتين الصيفية و الشتوية على التوالي خلال سنتي الدراسة أما بالنسبة لدودة ورق القطن فكان لها ثلاثة ذرات من التواجد في كلا العروتين خلال مدة الدراسة , و كان أعلى تعداد لهذه الحشرة في نهاية شهر مارس في العروة الصيفية و في خلال الاسبوع الثالث من شهر سبتمبر في العروة الشتوية. أما بالنسبة لدودة ورق القطن الصغرى فتم تسجيل ثلاث ذرات من التعداد في العروة الصيفية و ذروتان في العروة الشتوية خلال سنتي الدراسة أما بالنسبة لتأثير درجة الحرارة و الرطوبة على الكثافة العددية لهذه الحشرات فلقد أظهرت النتائج أن درجة الحرارة و الرطوبة النسبية أظهرت علاقة ارتباط متباينة بين علاقة ارتباط مغنوية ايجابية موجبة عالية و أخرى خفيفة أو متوسطة على الكثافة العددية لهذه الحشرات التي تصيب محصول البطاطس