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Ecological Studies on the Main Piercing-Sucking Insect Pests that Infesting Sweet Pea Plants in Dakahlia Governorate, Egypt

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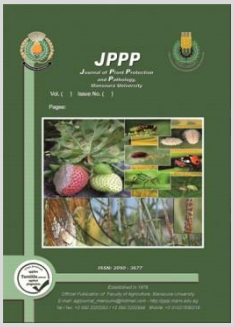

ABSTRACT

Field experiments were conducted to estimate population density of six Hemiptereous insect species thatt attacking sweet pea plants during two winter seasons of 2018 and 2019 at Dekernce region, Dakhlia Governorate. As well, to determine the impact of temperature and relative humidity on their populations. The results showed that, *Myzus persica* (Zeller) had two peaks during winter plantation that was recorded during 26th of November of both seasons. Data revealed that *Aphis carccivora* (Koch) and *Acrythosiphn pisum* (Koch) had only one peak for each during each season of plantation. Counts showed that *Empoasca descipiens* had one peak in the winter plantation during 17th of March. Three peaks during winter seasons plantations were recorded for *Empoasca decedens*. On the other hand, *Nezara viridula* had two population peaks in each of the two sweet pea seasons. The correlation between population density of the recorded insects and each of temperature or relative humidity had various degrees of significance that differed from positive to negative and from non-significant to highly significant.

Keywords: Sweet pea, Ecological studies, piercing-sucking and insect pests

INTRODUCTION

During the winter season, the sweet pea (*Pisum sativum* L.) considers one of the most important vegetable crops in Egypt that used either for local consumption or for exportation. This crop characterized by highly nutritive value that containing high percentiles of protein, carbohydrates, phosphorous, vitamin A and C, Ca, and high levels of lysin and tryptophan amino acids (Bhat *et al*., 2013). In addition, its keeps soil fertility through fixation process of nitrogen in soil by aid of symbiotic rhizobium living in its root nodules. In Egypt, the total growing area is 43281 fed., which produced 189.539 tons with an average yield of 4.379 ton/fed, while the total area of dry peas is 138.1 fed. which produced 166 tons with average of 1.202 tons/ feddan (FAO-State, 2017).

As a result of the expansion of cultivated leguminous plants the problems of insect pests have been increased in the last years subjected to attack by a large number of insect pests throughout the growing seasons (Hegab, 1988; Billen, 1999; Hegab *et al*. 2005; Shalaby *et al.* 2012; Awadalla *et al*. 2013 and 2014; Hegab, 2016). Among these pests, the economic importance of piercing–sucking insects particularly aphids and planthoppers are great which causes serious damages either directly by sucking plant juice or indirectly by transmitting the plant virsus (Maramorosch, 1969; Damsteegt *et. al.* 1995; Hegab and Hegab, 2009; Hegab, 2015).

Several investigators studied the influence of some weather factors on the population density of some insect pests attacking cowpea plants and their predatory insects (Annan *et al.* 1999; Bharathimeena *et al.* 2008; Saleh *et al*. 2009 and Patel *et al.* 2010).

Therefore, the current experiments were conducted to investigate the relative abundance of the main piercing-sucking insects that attacking sweet pea plants in Dakahlia Governorate and the effect of some weather factors on populations of these insects.

MATERIALS AND METHODS

1- Survey and the population density.

The occurrence and population of insects that attacking sweet pea insects was conducted through two successive seasons (2018 and 2019) at Dekerence region, Dakahlia Governorate. An area of about half feddan was prepared for this study. Completely randomized block design with 4 replicates, each consisted of 250 m^2 was cultivated with sweet pea plants with variety Master-B on last week of Septemper (i.e. winter plantation) during the two seasons of the study. The samples began on 15th October. The normal agriculture practices were followed and no insecticidal treatments were applied during the whole period of investigations.

Sampling started 21 days after plantation and weekly samples were collected continuously until end of crop in the field. Each sample consisted of 100 leaves with 25 leaflets were randomly taken from each plot in the early morning. The leaflets were collected from the different plant heights (2, 1 and 2 leaflets/ plant from upper, middle and lower plant levels, respectively). The collected samples were transferred to the laboratory in paper bags for examination. Both sides of each leaflet were examined carefully using binocular microscope. The number of insects and natural enemies which found were counted and recorded. Samples counting continued for period of investigation.

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The unknown insects were collected, preserved and sent to Plant Protection Research Institute, Cairo for identification.

2- Effects of temperature and relative humidity on insect population.

Correlation and regression coefficients between average insect numbers of weekly counts and each of average temperature and relative humidity were determined during both seasons of the study.

3- Statistical analysis.

Data were analyzed by using one-way ANOVA and correlation and regression coefficients using Costat software program (Costat, 2004).

RESULTS AND DISCUSSION

1. The peach aphid *Myzus persicae*

Population density

The obtained results in Figure (1) show that the population density of *M. persica* during the two seasons of study. The weakly samples showed that the infestation started early at the time of plant sprouting. The infestation started by high population in the second week of October and fluctuated till the third week of November characterized by two peaks at 26th of Nov. (38 indiv. / 100 leaflets) in 2018 and 2019 seasons. The population density then decreased gradually to reach its minimum at the end of the seasons. The present results agreed with those obtained El-Khayat *et al.*, (2017) who found that the aphids *M. persica* infesting cowpea plants.

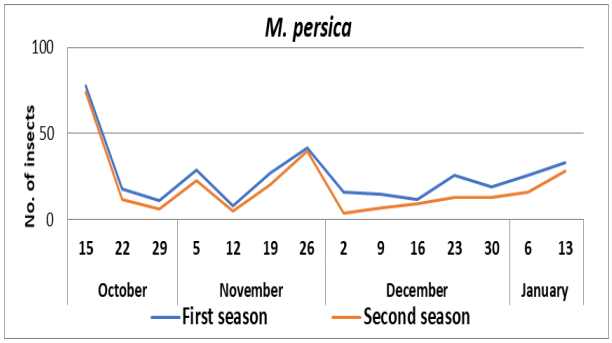

Fig. 1. Relative abundance of *M. persica* on sweet pea plants during 2018/19 and 2019/20 seasons in Dekernce region, Dakahlia Governorate.

Effect of temperature and relative humidity on insect population

Data in Table (1) present that the values of correlation and regression coefficients between the population density of *M. persicae* and either temperature or relative humidity during the two seasons of study (2018 and 2019). These values of correlation coefficient were significantly positive for temperature during both seasons of study. Meanwhile, the effect of relative humidity exhibited varying impacts ranged from slight to insignificant correlation during the whole period of examination. The values of proportional effect (explain variance) of temperature ranged between 28% to 29% and that for relative humidity ranged from 13% to 15% during the first and second seasons, respectively (Table 1). El-khayat *et al.* (2017) proved similar results as the obtained results that *M. persicae* population was affected by temperature and humidity.

Table 1. Correlation and regression coefficients between population density of *Myzus persicae* and temperature or relative humidity (R.H) during 2018 and 2019 seasons.

Year	Simple correlation coefficient (r)		Mean temperature		Mean R.H.	
	Mean temperature	Mean R.H.	(R^2)	E.V	(R^2)	E.V
2018	0.52±0.06*	0.29±0.06 ns	0.28	28.0	0.15	15.0
2019	0.55±0.11*	0.27±0.05 ns	0.29	29.0	0.13	13.0

ns= non-significant * = significant

2- The cowpea aphid *Aphis carccivora:*

Population density

Data presented in Figure (2) show the population density of *A. carccivora* during the two seasons of study. The weakly counts cleared that the infestation started early at the time of plant sprouting. The infestation started by highly population and fluctuated till the last week of October and recorded one peak at 5th November (87 indiv./ 100 leaflets) in 2018 seasons. The population density then increased gradually to reach its minimum at the end of the seasons. The results of El-Gindy (2002) was agreed with the obtained results who found that *A. craccivora* infesting cowpea plants.

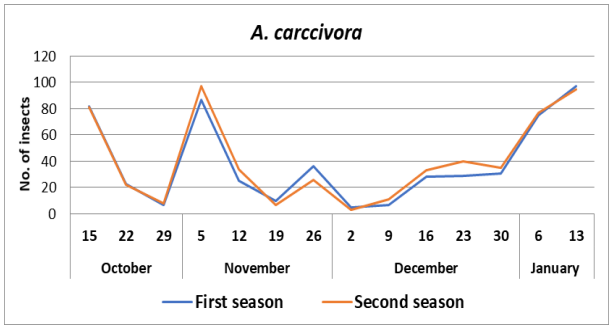

Fig. 2. Population abundance of *A. craccivora* infesting sweet pea plants during 2018/19 and 2019/20 seasons in Dekernce region, Dakahlia Governorate.

Effect of temperature and relative humidity on insect population

Data in Table (2) refer to the values of correlation coefficient and coefficient of determination between population density of *A. craccivora* and average temperature or relative humidity during 2018 and 2019. The significance of correlation values for temperature was significantly positive during the second season of study. Meanwhile, the impact of relative humidity varied was non-significant during both seasons of study.

Table 2. Correlation coefficient and coefficient of determination between population density of *Aphis craccivora* and temperature or relative humidity (R.H.) during 2018 and 2019 seasons.

Year	Simple correlation coefficient (r)		Mean temperature		Mean R.H.	
	Mean temperature	Mean R.H.	(R^2)	E.V	(R^2)	E.V
2018	0.42±0.03ns	0.23±0.05ns	0.38	38.0	0.18	18.0
2019	0.65±0.05**	0.36±0.07 ns	0.43	43.0	0.20	20.0

ns= non-significant ** = highly significant

The values of proportional effect (explain variance) of temperature ranged from 38 to 43% and that for relative humidity ranged from 18 to 20% during the first and second seasons, respectively (Table 2). Ali *et al.* (2013) mentioned

the effect of temperature and humidity on the population density of *A. craccivora*.

3. *Aphis pisum*

Population density

Data found in Figure (3) indicated that the population density of *A. pisum* during the two seasons of study. The weakly counts showed that the infestation started early at the time of plant sprouting. The infestation started by highly population and fluctuated till the third week of November and recorded one peak at 26th of November (57 indiv. / 100 leaflets) in 2019 seasons. The population density then decreased gradually to reach its minimum at the end of the seasons. Abd-Elsamed (2006) observed that *A. pisum* was from pests of sweet pea.

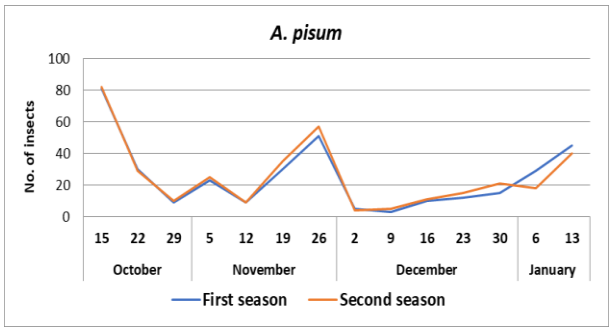

Fig. 3. Population abundance of *Aphis pisum* that infesting sweet pea plants during 2018/19 and 2019/20 seasons in Dekernce region, Dakahlia Governorate.

Effect of temperature and relative humidity on insect population

Data in Table (3) refer to the values of correlation coefficient and coefficient of determination between population density of *A. pisum* and mean temperature or relative humidity during 2018 and 2019. These significance of correlation values for temperature was significantly positive only during the second season of study. Meanwhile, the impact of relative humidity had non-significant effect during the period of study. The values of proportional effect (explain variance) of temperature ranged from 35 to 41% and that for relative humidity ranged from 16 to 18% during the first and second seasons, respectively (Table 3). Also, Abd-Elsamed, (2006) found the correlation between *A. pisum* and humidity and temperature.

Table 3. Correlation coefficient and regression between the population density of *Aphis pisum*, and temperature or relative humidity (R.H.) during 2018 and 2019 seasons.

Year	Simple correlation coefficient (r)		Mean temperature		Mean R.H.	
	Mean temperature	Mean R.H.	(R^2)	E.V	(R^2)	E.V
2018	0.41±0.02ns	0.21±0.03ns	0.35	35.0	0.16	16.0
2019	0.63±0.08**	0.34±0.05 ns	0.41	41.0	0.18	18.0

ns= non-significant ** = highly significant

4. *Empoasca descipiens*

Population density

The results in Figure (4) show that the population density of *E. descipiens* during the two seasons of study. The weakly counts showed that the infestation started early at the time of plant spr0uting. The infestation started by high population and fluctuated till the first week of January recorded by one peak at 17th of March (32 indiv. / 100 leaflets) and 13th of January (20 indiv. / 100 leaflets) in 2018 seasons. The population density then decreased gradually to reach its minimum at the end of the seasons. Our results were in agreement with El- Gindy (2002) and Abd El-Samed (2006) who surveyed the hemipterous insects on leguminous plants.

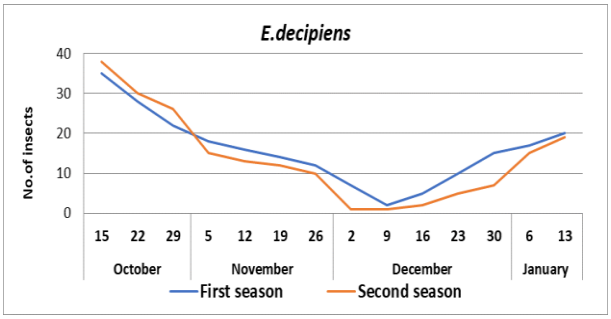

Fig. 4. Population abundance of *E. decipiens* infesting sweet pea plants during 2018/19 and 2019/20 seasons in Dekernce region, Dakahlia Governorate.

Effect of temperature and relative humidity on insect population

Data in Table (4) refer to the values of correlation coefficient and coefficient of determination between population density of *E. descipiens* and mean temperature or relative humidity during 2018 and 2019. These significance of correlation values was non-significant for temperature during both seasons of study. Similarity, the impact of relative humidity had non-significant impacts on insect population during the period of study. The values of proportional effect (explain variance) of temperature ranged from 19 to 28% and that for relative humidity ranged from 16 to 21% during the first and second seasons, respectively (Table 4). Similarity, AbdElsamed, (2006) showed the same relation between *E. descipiens* and temperature and humidity.

Table 4. Correlation coefficient and coefficient of determination between population density of *Empoasca descipiens* and temperature or relative humidity during 2018 and 2019 seasons.

Year	Simple correlation coefficient (r)		Mean temperature		Mean R.H.	
	Mean temperature	Mean R.H.	(R^2)	E.V	(R^2)	E.V
2018	0.33±0.02 ns	0.17±0.02 ns	0.19	19.0	0.16	16.0
2019	0.45±0.05 ns	0.25±0.01 ns	0.28	28.0	0.21	21.0

ns= non-significant

5- *Empoasca decedens*

Population density

The results in Figure (5) show the population density of *E. decedens* during the two seasons of study. The weakly counts showed that the infestation started early at the time of plant sprouting. The infestation started by high population and fluctuated till the first week of January recorded by three peaks at 15th October; 12th of November (10 indiv. / 100 leaflets) and 13th of January (19 indiv. / 100 leaflets) in 2019 seasons. The population density then decreased gradually to reach its minimum at the end of the seasons. Hashem (1997) and El-Gindy (2002) reported that, *E. decedens* was among the pests that attacking sweet pea plants.

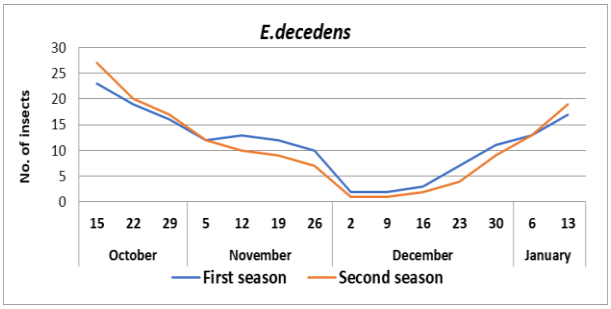

Fig. 5. Population abundance of *E. decedens* infesting sweet pea plants during 2018/19 and 2019/20 seasons at Dekernce region, Dakahlia Governorate.

Effect of temperature and relative humidity on insect population

Data in Table (5) show the values of correlation coefficient and coefficient of determination between population density of *E. decedens* and mean temperature or relative humidity during 2018 and 2019. These significance of correlation values was non-significant for temperature during both seasons of study. Similarity, the same impact was obtained for relative humidity on insect population during the period of study. The values of proportional effect (explain variance) of temperature ranged from 18 to 28% and that for relative humidity ranged from 13 to 17% during the first and second seasons, respectively (Table 5). El-Gindy, (2002), Hashem, (2005) and Abd-Elsamed, (2006), mentioned two peaks on leguminous and solanaceous plants in summer plantation and effectiveness of humidity and temperature on *E. decedens.*

Table 5. Correlation coefficient and coefficient of determination between population density of *Empoasca decedens* and temperature or relative humidity (R.H.) during 2018 and 2019 seasons.

Year	Simple correlation coefficient (r)		Mean temperature		Mean R.H.	
	Mean temperature	Mean R.H.	(R^2)	E.V	(R^2)	E.V
2018	0.30±0.01 ns	0.13±0.02 ns	0.18	18.0	0.13	13.0
2019	0.41±0.03 ns	0.22±0.03 ns	0.24	24.0	0.17	17.0

ns= non-significant

6. *Nezara viridula*

Population density

Results in Figure (6) show the population density of *N. viridula* during the two seasons of study.

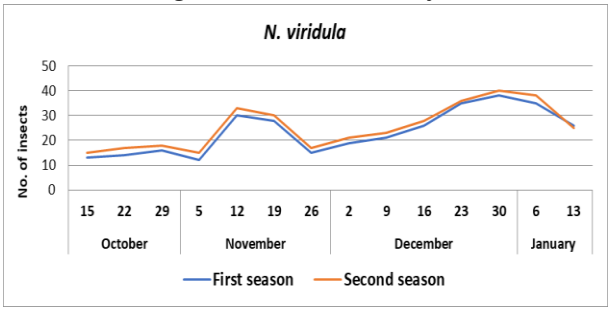

Fig. 6. Population abundance of *N. viridula* that infesting sweet pea plants during 2018/19 and 2019/20 seasons in Dekernce region, Dakahlia Governorate.

The weakly counts showed that the infestation started early at the time of plant sprouting. The infestation started by low population and fluctuated till the second week of November recorded two peaks at 12th of November (30 indiv. / 100 leaflets), and 30th of December (38 indiv. / 100 leaflets) in 2018 season. The population density then decreased gradually to reach its minimum at the end of the seasons.

Effect of temperature and relative humidity on insect population

Data in Table (6) show the values of correlation coefficient and coefficient of determination between population density of *N. viridula* and mean temperature or relative humidity during 2018 and 2019. These significance of correlation values was significantly positive during both season of study for temperature. Meanwhile, the impact of relative humidity had only significant impact on insect population during the second season of study. The values of proportional effect (explain variance) of temperature ranged from 25 to 37% and that for relative humidity ranged from 18 to 20% during both seasons of study (Table 6). Mondal and Gill, (2010) mentioned that *N. viridula* population was severely influenced by weather parameters i.e., temperature, rainfall and relative humidity.

Table 6. Correlation coefficient and regression between the population density of *Nezara viridula*, the temperature and relative humidity components during 2018 and 2019 seasons.

Year	Simple correlation coefficient (r)		Average temperature		Average R.H.	
	Average temperature	Average R.H	(R^2)	E.V	(R^2)	E.V
2018	0.52±0.05*	0.25±0.01 ns	0.37	37.0	0.18	18.0
2019	0.50±0.03*	0.46±0.04*	0.25	25.0	0.20	20.0

ns= non-significant * = significant

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دراسات إيكولوجيه علي أهم الأفات الحشرية الثاقبة الماصة التي تصيب نباتات االبسلة فى منطقة دكرنس محافظة الدقهلية-مصر

مروة محمد شلبي[1] ،عبد البديع عبد الحميد غانم[2] ، هاله أحمد كامل الصيرفى [2] و سمر نعيم عبدالسلام[2]

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اجريت تجارب حقلية لتقييم الكثافة العددية و تأثير بعض العوامل الجوية (الحرارة و الرطوبة) على ثمانية حشرات رتبة نصفية الأجنحة التي تهاجم نباتات البسلة خلال عاميين متتالين ١٩/٢٠١٨ و٢٠/٢٠١٩ فى دكرنس محافظة الدقهلية و أوضحت النتائج المتحصل عليها أن من البسلة له ذروتين من التعداد فى العروة الشتوية سجلت في ٢٦ نوفمبر في عامين متتاليين. أما بالنسبة لمن البقوليات فلقد أظهرت النتائج أن له ذروة واحده من التعداد فى كلا الموسمين خلال عامى الدراسة. كما أظهرت النتائج أن *Aphis pisum* كان له ذروة واحدة من التعداد فى كلا الموسمين على التوالى خلال سنتى الدراسة أما ***Empoasca descipiens*** فكان له ذروة واحدة من التواجد فى كلا الموسمين خلال مدة الدراسة , و كان أعلى تعداد لهذة الحشرة فى منتصف شهر مارس فى الموسمين علي التوالي. أما بالنسبة ***Empoasca decedens*** فتم تسجيل ثلاث ذروات من التعداد فى خلال سنتى الدراسة. وعلي الجانب الاخر سجلت البقة الخضراء. أما بنالنسبة 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 معنوية ايجابية موجبة عالية و أخرى خفيفة أو متوسطة على الكثافة العددية لهذه الحشرات التى تصيب محصول البطاطس.