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EGYPTIAN ACADEMIC JOURNAL OF
BIOLOGICAL SCIENCES
ENTOMOLOGY

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ISSN
1687-8809

WWW.EAJBS.EG.NET

Vol. 7 No. 2 (2014)

Egyptian Academic Journal of Biological Sciences is the official English language journal of the Egyptian Society for Biological Sciences, Department of Entomology, Faculty of Sciences Ain Shams University.

Entomology Journal publishes original research papers and reviews from any entomological discipline or from directly allied fields in ecology, behavioral biology, physiology, biochemistry, development, genetics, systematics, morphology, evolution, control of insects, arachnids, and general entomology.

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Effect of planting date on seasonal abundance of the *Aphis craccivora* Koch and the associated predators in the new Valley-Egypt

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ABSTRACT

The population density of *A. craccivora* on broad bean plants of the recommended sowing date fluctuated in scarcely numbers to attain the peak (17.50 and 3.00 individuals/plant) during the third week of November of 2012/2013 and 2013/2014 seasons, respectively. On the other hand, the highest numbers (0.27 and 0.06 individuals/plant) of the coccinellid beetles included the larvae and adults of *C. undecimpunctata* and *C. septempunctata* were recorded during the second week of December and the third week of November of the two successive seasons, respectively. There was an insignificant positive and / or negative simple correlation (r) between the number of the pest and the population density of the coccinellid beetles.

The plants cultivated in the early planting date (first of October) harbored the highest number of the pest with an average of (22.72 individuals/plant). Meanwhile, the plants of the late planting date (end of October) harbored the lowest number of the pest with an average of (2.55 individuals/plant).

Broad bean plants of the early and recommended sowing date which harbored the high levels of infestation with *A. craccivora* recorded the high yields (gm)/plant. Meanwhile the plants of the late planting date which harbored the minimum number of the pest recorded the lowest yield (gm)/plant during 2012/2013 and 2013/2014 seasons.

Keywords: *Aphis craccivora* . predators , the new Valley-Egypt

INTRODUCTION

Faba bean, *Vicia faba* L. is one of the most important crops in Egypt, providing consumers with a cheap and high quality protein, used for the consumption of both human and animals. Faba bean, are subjected to severe infestation by sucking pests, especially the cowpea aphid, *A. craccivora* Koch (Aphididae: Homoptera), which cause serious damage, either by sucking plant juices or indirectly as vectors of plant virus diseases (Saleh *et al.*, 1972; Selim *et al.*, 1987; El-Arnaouty *et al.*, 2000; El-Defrawi *et al.*, 2000; Mohamed, 2003 and Aly, 2014). Ali and Rizk (1980) under the New Valley conditions, reported that the most important pests infesting broad bean were *A. craccivora* and *Tetranychus* spp. The population density of *A. craccivora* began to appear in the field with the beginning of the vegetative stage and reached its

maximum during the pod developmental stage and diminished during the harvest stage. El-Heneidy *et al.*, (1998) found that the population of aphid on broad bean was relatively greater in early planted crops than in the late once.

The common predators observed in faba bean fields were *Coccinellau-ndecimpunctata*, *Chrysoperlacarnea*, *Syrphuscorollae* *Phaenobremiaaphidivora* and *Scymnusinterruptus*. *Coccinellaseptempunctata*, *Labidurariparia*, *Paederusalferri* and *Orius* sp. (Mohammad and Mahmoud, 1986; El-Heneidy *et al.*, 1998; El-Defrawi *et al.*, 2000 Mohamed, 2003.

The present study was conducted with the following objectives to evaluate the effect of the sowing date on the population density of the pest and its predators as well as the relationship between them.

MATERIALS AND METHODS

Field experiments were conducted in the farm near from El-Kharga Oasis - New Valley to study the impact of sowing dates on the population size of cowpea aphid *A. craccivora* and the associated predators inhabiting broad bean plants. The cultivar (Wadi 1) was planted in four replicates (each one was 42 m²) during three sowing date (first, midday and end of October) of 2012/2013 and 2013/2014 seasons. The conventional cultural practices were applied and no chemical pesticides were applied during the present study period.

Direct count method was used to determine the seasonal abundance of the insect pest and the associated predators. The counts, in each sowing date were started after 3-week of plant emergence and continued till the harvest time. For counting individuals of cowpea aphid *A. craccivora* (nymphs and adults) and its predators (all developmental stages), ten plants were randomly selected from each replicate and inspected in the fields (Mohamed 2003). The yield/plant was recorded during the harvest stage of the broad bean plants. Samples were taken at random weekly from each plot. Data were statistically analyzed by F-test and the means were compared according to (Snedecor and Cochran 1971)

RESULTS AND DISCUSSION

1- Seasonal abundance of the cowpea aphid and its coccinellid beetles

Data illustrated in Figures 1 and 2 summarize the changes in the population densities of number of both (nymphs and adults) of *A. craccivora* and the population density of the coccinellid beetles included the larvae and adults of *C. undecimpunctata* and *C. septempunctata* (the common recorded predators) during the different sowing dates in the two successive seasons of 2012/2013 and 2013/2014.

During the early sowing date, the population of *A. craccivora* (Figs. 1 and 2) began to appear in the field of the broad bean plants (14.25 and 10.07 individuals/plant) during the end week of October of 2012/2013 and 2013/2014 seasons, respectively. The number of the pest increased gradually reaching a peak of 43.37 and 76.40 individuals/plant during the second week of November of the two successive seasons, respectively.

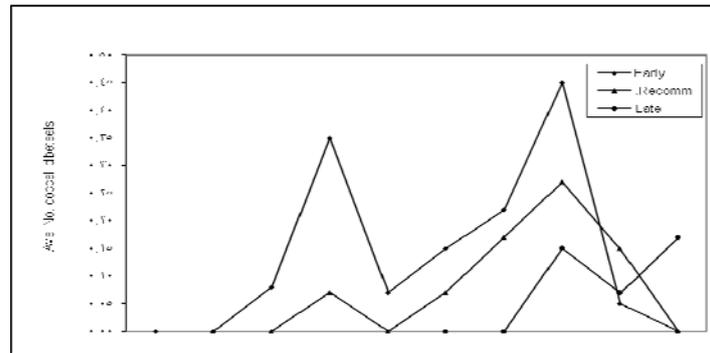


Fig. 1. Seasonal fluctuations of *A. craccivora* and its coccinellid beetles during 2012/ 2013 seasons

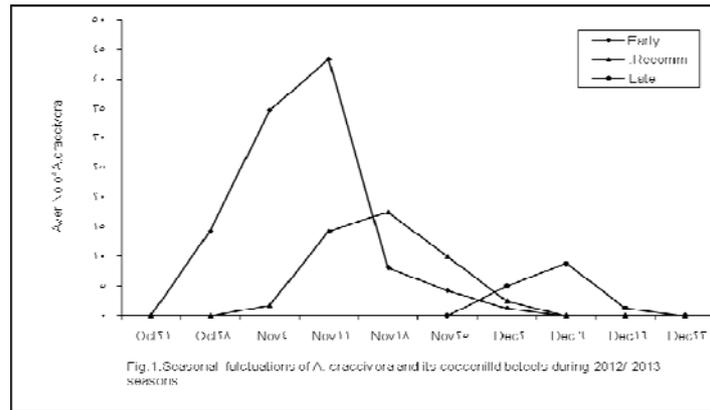
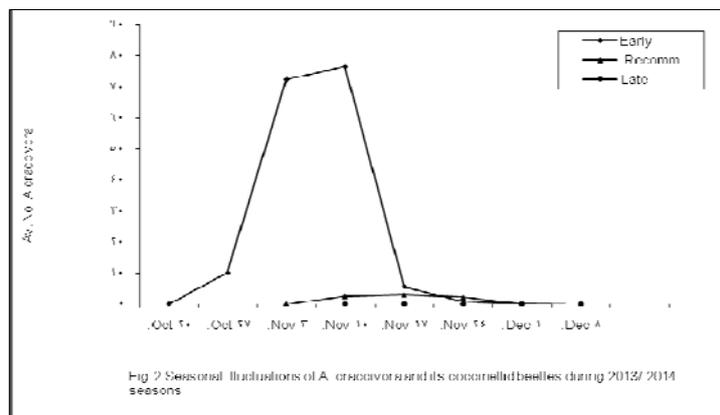
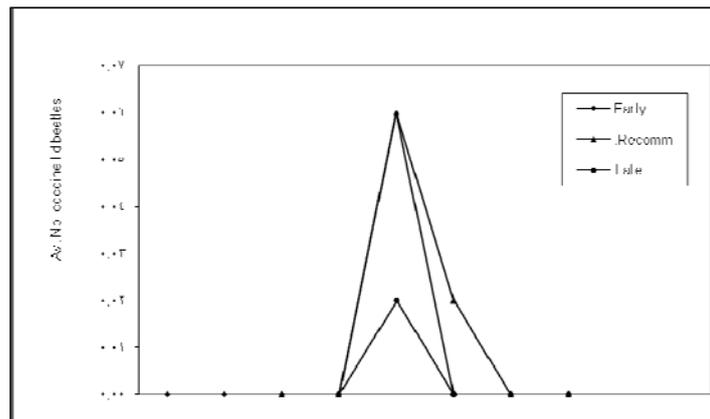


Fig. 2. Seasonal fluctuations of *A. craccivora* and its coccinellid beetles during 2012/ 2014 seasons



Thereafter the number of the pest decreased gradually to disappear from the field during the beginning of December. In 2012/2013 season, the maximum peaks the coccinellid beetles (0.35 and 0.45 individuals/plant) were recorded during the second week November and December, respectively. Scarcely number of the predators was observed during the second season recording 0.06 individuals/plant in

the third week of November. During the recommended sowing date (Figs. 1 and 2), the population density of the pest fluctuated in scarcely numbers to attain the peak (17.50 and 3.00 individuals/plant) during the third week of November of 2012/2013 and 2013/2014 seasons, respectively. Meanwhile, the highest numbers of the coccinellid beetles (0.27 and 0.06 individuals/plant) were recorded during the second week of December and the third week of November of the two seasons, respectively.

In the late sowing date of 2012/2013 season (Figs. 1 and 2), the population of *A. craccivora* reach to the maximum peak (8.82 individuals/plant) during the second week of December. This period coincided with a maximum peak of the coccinellid beetles (0.15 individuals/plant). Meanwhile, the population densities of the pest and its predators was observed in a scarcely numbers during 2013/2014 season. It could be generally observed that, the high peaks of the nymphs and adults of *A. craccivora* (43.37 & 76.40 and 17.50 & 3.00 individuals/plant) were recorded on the plants of the early and recommended sowing dates during the period from first to third week of November of the two successive seasons, respectively. Meanwhile, the low peaks were obtained in the late planting date. These results disagreement with many investigator who found that, the population density of *A. craccivora* on board bean reached its maximum during the last week of March, then declined gradually and almost disappeared at the end of April (Saleh *et al.*, 1972). Ali and Rizk (1980) under the New Valley conditions reported that the population density of *A. craccivora* began to appear in the field with the beginning of the vegetative stage and reached its maximum during the pod developmental stage and diminished during the harvest stage. El-Defrawi *et al.*, (2000) recorded that, the population density of the cowpea aphid *A. craccivora* had 2 main periods of activity, with highest counts during the third week of December and February in 1995-96, and during the fourth week of December and third week of March in 1996-97. On the other hand, the coccinellid beetles included the larvae and adults of *C. undecimpunctata* and *C. septempunctata* fluctuated in a small numbers ranged between (0.00 and 0.45 individuals/plant) during the different sowing dates of the two successive seasons of 2012/2013 and 2013/2014.

The common observed predators in faba bean fields were *C. undecimpunctata*, and *C. septempunctata* as recorded by (Mohammad and Mahmoud, 1986; El-Defrawi *et al.*, 2000 and Mohamed, 2003). El-Heneidy *et al.*, 1998; recorded six species of aphidophagous predators associated with the aphids on faba bean plants. Predator population reaches its maximum (43 and 96 individuals / 100 plants) during the half of March.

2-Relationship between *A. craccivora* and the coccinellid beetles

Statistical analysis show that, there was an insignificant positive and /or negative simple correlation (r) between the number of both (nymphs and adults) of *A. craccivora* and the population density of the coccinellid beetles included the larvae and adults of *C. undecimpunctata* and *C. Septempunctata* (Table 1).

Table 1: Simple correlation (r) analysis between the population density of the *A. craccivora* and the population density of the coccinellid beetles recovered from broad bean fields

Sowing dates	Simple correlation (r)	
	2012/2013	2013/2014
October, 1 st	0.220	-0.183
October, 15 th	-0.215	0.685
October, 30 th	0.190	-0.250
Over all	0.195	-0.113

It could be notified that, there no coincided between the highest appearance of predaceous insect and the highest appearance of the phytophagous insect (*A. craccivora*) during the two growing seasons. Meanwhile, Sharma and Yadav (1994) reported that, there was a highly significant positive association between the population of *A. craccivora* and the coccinellid beetles on faba bean crop.

3-Effect of sowing date on the population density of *A. craccivora*

Data in Table (2) indicated that, there were significant differences between the numbers of *A. craccivora* on the plants of all sowing dates during the two successive seasons of 2012/2013 and 2013/2014.

During 2012/2013 season, the obtained data show that, the plants of the first planting date showed the highest infestation level compared to the plants of the other two planting dates. The highest average number of the individuals/plant (17.66) was recorded during the first sowing date followed by the second and third sowing dates (11.50 and 5.01), respectively. The same trend of results was observed during the second season of 2013 and 2014 where, broad bean plants of the first planting date harbored the maximum number of the pest (27.78 individuals/plant).

Table 2: Population density of the *A. craccivora* (nymphs and adults / plant) as affected by planting time at New Valley in 2012/2013 and 2013/2014 seasons.

Sowing dates	Av. No. individuals (nymphs and adults / plant)		
	2012/2013	2013/2014	Mean
October, 1 st	17.66a	27.78a	22.72
October, 15 th	11.50b	2.65b	7.07
October, 30 th	5.01c	0.10c	2.55
Mean	11.39	10.17	10.78

Means followed by the same letter in each column are not significantly different at 0.05 level of probability .

Meanwhile, the minimum numbers (2.65 and 0.10 individuals/plant) were counted on plants of second and third sowing dates, respectively.

It could be observed that, the broad bean plants cultivated in the early planting date (first of October) harboured the highest number of *A. craccivora* (nymphs and adults) with an average of (22.72 individuals/plant). Meanwhile, the plants of the late planting date (end of October) harboured the lowest number of the pest with an average of (2.55 individuals/plant). These results are in agreement with El-Heneidy *et al.*, (1998) who found that the population of aphid on broad bean was relatively greater in early planted crops than in the late once. Meanwhile, Mannaa *et al.*, (1999) recorded that, faba bean plants of the late sowing date suffered from the cowpea aphid infestation comparing with early ones. The time of planting date can be an effective pest management tactic because it results in asynchrony between the pests and crop (Albuquerque, 1993). Variations of plantation time can control pests, most of which show some seasonal frequency, either by crop avoiding the egg-laying period of the pest or by allowing the plants to have aged to resistant stage by the time the pest appears (van Emden, 1977).

4- Effect of *A. craccivora* infestation on the (Yield/plant).

The obtained data in Table 3 show that, there were differences between the yield/plant in the infested plots of the broad bean plants due to the infestation with the *A. craccivora* is which considered the key pest of these crop in the New Valley in all sowing dates during the two successive seasons.

Although the broad bean plants cultivated in the early planting date (first of October) harboured the highest number of *A. craccivora* followed the recommended sowing date (middle of October) as showed in Table 2, these plants recorded the high yield (gm)/plant. The obtained data show that, the plants of the first and second

sowing date recorded 14.84 & 15.32 and 14.90 & 18.16 yields (gm)/plant with an average of 15.08 and 16.53 (gm)/plant of 2012/2013 and 2013/2014 seasons, respectively.

Table 3: Effect of *A. craccivora* infestation on the yield (gm) /plant of broad bean crop at New Valley in 2012/2013 and 2013/2014 seasons.

Sowing dates	Yield(gm)/plant		
	2012/2013	2013/2014	Mean
October, 1 st	14.84a	15.32b	15.08
October, 15 th	14.90a	18.16a	16.53
October, 30 th	11.30b	11.87c	11.58
Mean	13.68	15.11	14.39

Means followed by the same letter in each column are not significantly different at 0.05 level of probability.

Meanwhile the plants of the late planting date (end of October) harboured the minimum number of the pest; these plants recorded the low yield (gm)/plant (11.30 and 11.87) with an average of (11.58) of 2012/2013 and 2013/2014 seasons, respectively. The plants of the late sowing date may be cultivated in unsuitable time. El-Deeb *et al.*, 2006 studied the effect of sowing date on the yield of certain genotypes of broad bean included Wadi 1 under the New Valley conditions and found that, the yield/ Feddan was significantly decreased by delaying the sowing date to mid November. The present results are in disagreement with those of several investigators who reported that, the infestation of broad bean plants with *A. craccivora* caused severe damage in the yield of this crop. Stutzel (1995) found that, delaying of sowing faba bean increased the infestation by *A. craccivora* which in turn decreased the yield. Generally more studies are needed to discuss the relationship among the infestation levels of *A. craccivora*, sowing date and the yield of broad bean crop under the New Valley conditions.

To increase the yield of broad bean crop, it could be recommended cultivating the cultivar (Wadi 1) in the recommended sowing date (mid. Of October) *A. craccivora* and treatment the plants with different alternative control methods because for environmental and toxicity reasons, Ministry of Agriculture in Egypt banned all conventional insecticides in the New Valley from 1995.

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ARABIC SUMMERY

ملاحظات على حشرة من اللوبيا بمحافظة الوادي الجديد – مصر

صلاح محمود محمد جميل

معهد بحوث وقاية النباتات – مركز البحوث الزراعية – الدقي – الجيزة

أجريت هذه الدراسة في حقول محصول الفول البلدي (صنف وادي 1) بإحدى مزارع مدينه الخارجة – الوادي الجديد خلال موسمي الزراعة 2012/2013؛ 2013/2014.

وأظهرت النتائج ما يلي.

خلال ميعاد الزراعة الموصى به (منتصف أكتوبر) لوحظ أن تعداد كل من الحشرات الكاملة والحوريات لحشرة من اللوبيا وصل إلى قمة التعداد (17,50 و 00,3 فرد/ نبات) خلال الاسبوع الثالث من شهر نوفمبر من موسمي الزراعة على التوالي. وان أعلى تعداد لليرقات والحشرات الكاملة لمقترسات أبو العيد بلغ (0,27 و 0,06 فرد/ نبات) خلال الاسبوع الثاني من ديسمبر والاسبوع الثالث من شهر نوفمبر خلال موسمي الزراعة 2012/2013؛ 2013/2014 على التوالي.

الارتباط البسيط بين الكثافة العددية لحشره المن ومقترساتها من أبو العيد كان غير معنوي وترواح بين السالب والموجب لمواعيد الزراعة الثلاث (أول، منتصف، آخر أكتوبر) خلال موسمي الزراعة.

وجد أن هناك اختلاف معنوي في تعداد هذه الآفة خلال مواعيد الزراعة المختلفة حيث سجل أعلى تعداد للحشرة بمتوسط (22,72 فرد/ نبات) على النباتات المنزرعة مبكرا (أول أكتوبر) بينما سجل أقل تعداد للحشرة (2,55 فرد/ نبات) على النباتات المنزرعة في المواعيد المتأخرة (آخر أكتوبر) وأن نباتات المواعيد المبكرة والموصى بها سجلت أعلى وزن بالجرام لكل نبات بالرغم من تسجيلها أعلى تعداد لأفراد المن بينما نباتات ميعاد الزراعه المتأخر سجلت أقل وزن بالجرام لكل نبات بالرغم من تسجيلها أقل تعداد لهذه الآفة.