

**EFFECT OF CERTAIN CULTURAL PRACTICES ON THE
POPULATION DENSITY OF *EPILACHNA CHRYSOMELINA* F.
(COLEOPTERA-COCCINELLIDAE) AT THE NEW VALLEY
GOVERNORATE IN EGYPT**

GAMEEL, S. M. M. AND BADR EL- SABAH A. FETOH

Plant Protection Research Institute, ARC, Dokki, Giza

(Manuscript received 9 August 2009)

Abstract

Field experiments were carried out to study the effect of three cucurbit crops, five planting dates and three levels of fertilization rates on the population densities of *Epilachna chrysomelina* F. (Coleoptera: Coccinellidae) during 2007 and 2008 seasons. The results indicated that, the two variables (cucurbit crops and planting dates) had pronounced effects on the numbers of *E. chrysomelina* on cucurbit plants. Regardless the effect of planting dates and fertilizer rates, sweet melon was more susceptible to the *E. chrysomelina* infestation than cantaloupe and watermelon harboring the highest population of the pest (75.95 and 105.73 individuals / m²) during 2007 and 2008 seasons, respectively. Cucurbit plants cultivated in the late times (end of May and August) harbored relatively higher number of *E. chrysomelina* (larva and adults). Meanwhile, the plants of the early planting dates (end of March, middle of April and beginning of May) harbored relatively lower numbers of the pest.

Insignificant differences were found between the numbers of the pest on cucurbit crops under different levels of NPK rates during 2007 and 2008 seasons. In 2007 season, the highest population densities of the pest were recorded on sweet melon plants (228.33, 152.67 and 143.00 individuals / m²) during the fourth planting date (end of May) when the plants received double recommended, check and recommended dose of NPK, respectively. During 2008 season, unfertilized sweet melon plants recorded the maximum number of the pest (296.33 individuals / m²) during the fourth planting date followed by cantaloupe plants (296.00 individuals / m²) when cultivated during the fifth planting date and received double recommended dose of NPK.

INTRODUCTION

The melon ladybird beetle *Epilachna chrysomelina* F. (Coleoptera: Coccinellidae) is considered a serious pest of cucurbit plants in the New Valley (Bohlen and Freidel, 1979, Gameel, 2004, Gameel and Abdel-Gaid 2007 and Sayed and Gameel 2008) and is widely distributed in Egypt (Ghabn, 1951, El-Saeedy, 1978, Ali and El-Saeedy, 1986 and Abdel-Moniem *et al.*, 2004). Both larvae and adults cause great damage in a short

time. Its feeding habits are phytophagous and injurious. It feeds on leaves, flowers and fruits of their host-plants, belonging mainly to the family cucurbitaceae. The damage to the leaves reduces the vegetative production of the host-plant, the result of which is a great loss in marketable crop yield. By feeding on the fruits, the beetles make large holes on which patches of rotten tissue appear later on. In case of heavy attack, the plants stop their growth, and even the whole plant may be entirely defoliate. Hence the quality and amount of yield are considerably reduced (Ghabn, 1951 El-Saeedy, 1978, Bohlen and Freidel, 1979 and Nazarov, 1988). The cultural practices such as cucurbit crops, planting seasons and fertilization rates play an important role in the change of the population density levels of pests attacking the plants. The growing of crop varieties which are less attacked than others or yield well in spite of attack is a very good pest control measure. Once such varieties are available, the control requires no extra labor and is therefore economical, moreover, the environment does not suffer from side-effects of the control measure (van Emden, 1977). As well as the planting date can be an effective pest management tactic because it results in a synchrony between the pests and crop (Albuquerque, 1993).

Little information were available in the literature concerning the effect of the cultural practices on the population density of *E. chrysomelina* and its importance. Therefore, the present study was conducted to evaluate the effect of certain cultural practices on the population density of the pest.

MATERIALS AND METHODS

Field experiments were conducted in the farm of the New Valley Experimental Station, El-Kharga, to study the effect of cucurbit crops, planting dates and fertilization rates on the population densities of *E. chrysomelina* during 2007 and 2008 seasons. The cultivated cucurbit cultivars were watermelon (*Citrullus lantatus* L.), Giza I, sweet melon (*Cucumis melo* var. *aegytiacus* L.), Balady and cantaloupe (*Cucumis melo* var. *cantaloupensis* L.) California. Each cultivar was planted in three replicates (each was 42 m²) during different five planting dates (end of March, middle of April, beginning and end of May and end of August).

Nitrogen was applied in the form of ammonium sulphate (20.6%N), phosphor was used in the form of calcium superphosphate (15.5%P₂O₅) and potassium was added as potassium sulphate (48%K₂O). Nitrogen fertilizer was added in three equal doses during thinning, flowering and fruit setting stages of the plants while phosphor was only added during the thinning period and potassium was added in two periods, during thinning and flowering stages of the plants. Fertilization rates (Kg / Feddan) were, 1- Without Fertilization (check), 2- Recommended rates of watermelon: (N

250, P 200, K 50) and sweet melon or cantaloupe (N 300, P150, K 100), **3-** Double recommended rates of watermelon (N 500, P 400, K 100) and sweet melon or cantaloupe (N 600, P 300, K 200). The conventional cultural practices were used and no chemical pesticides were applied during the present period. Simple square wooden wire 0.25 m² (50x50 cm) was used as standard sample size. All stages of the pest (eggs , larvae , pupa and adults) were counted directly on the plants in a set of four square wires (one sample =1m²) (El-Saeedy, 1978 and Gameel and Abdel-Gaid 2007). Samples were randomly taken weekly from each plot and continued from the vegetative stage up to the ripening stage of the plants. Data were statistically analyzed by F-test and the means were compared according to Duncan's Multiple Range Test (Snedecor and Cochran 1971).

RESULTS AND DISCUSSION

1. Effect of cucurbit crops

Data in Table (1) show the average number of *E. chrysomelina* (larva and adults) recorded on three cucurbit crops (watermelon, sweet melon and cantaloupe) during 2007 and 2008 seasons regardless the effect of planting dates and fertilization rates.

Table 1. Population density of *Epilachna chrysomelina* (adults and larva / m²) as affected by cucurbit crops.

| Cucurbit crops | No. of individuals (adults and larva / m ²) | |
|----------------|---|----------|
| | 2007 | 2008 |
| Watermelon | 25.93 B | 22.85 C |
| Sweet melon | 75.95 A | 105.73 A |
| Cantaloupe | 20.06 B | 71.13 B |
| LSD (0.05) | 10.19 | 14.45 |

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

There were significant differences between the number of the pest (larva and adults) on the three cucurbit crops during the two studied seasons.

During season 2007, the highest population level of the pest (75.95 individuals / m²) was recorded on sweet melon plants and there no significant differences between the number of insects on watermelon and cantaloupe plants. Sweet melon plants harbored the highest number of the pest (105.73 individuals / m²) followed by

cantaloupe (71.13 individuals / m²) then watermelon (22.85 individuals / m²) during season 2008.

The previous results revealed that (regardless the effect of both planting dates and fertilizer rates) sweet melon was more susceptible to the *E. chrysomelina* infestation harboring the highest population of the pest during 2007 and 2008 seasons. El-Saeedy, 1978 found that, the generation period of *E. chrysomelina* was usually shorter in case of feeding on snake cucumber than feeding on other experimental hosts and Sayed and Gameel 2008 under the New Valley conditions found that, snake cucumber was more susceptible to the pest infestation harboring the highest population of the pest followed by cantaloupe. Meanwhile squash plants were the least susceptible one. This indicates the presence of some sort of resistance as recorded by Knipling (1979) Shukla and Upadhyay (1983) recorded that light had little influence on the attraction of the coccinellid to its host-plants, it was thought that chemical stimuli were involved. Meanwhile, Wilson (1986) found that the development of the first instar larvae of *E. cucurbitae* Richards was delayed by the leaf hairs on pumpkin leaves, which prevented them from reaching the leaf surface to feed.

2. Effect of planting dates

Data in Table (2) showed that the effect of planting dates on the population density of the pest during the two successive seasons of 2007 and 2008 regardless the effect of cucurbit crops and fertilization rates. There were significant differences between the numbers of the pest on the plants throughout the different planting dates of 2007 and 2008 seasons.

Table 2. Population density of *Epilachna chrysomelina* (adults and larvae / m²) as affected by planting dates, New Valley.

| Planting dates | No. of individuals (adults and larva / m ²) | |
|------------------------|---|----------|
| | 2007 | 2008 |
| 1st (end of March) | 22.85 BC | 0.15 C |
| 2nd (middle of April) | 9.22 C | 2.59 C |
| 3rd (beginning of May) | 36.59 B | 11.70 C |
| 4th (end of May) | 72.40 A | 104.40 B |
| 5th (end of August) | 62.18 A | 178.00 A |
| LSD (0.05) | 14.39 | 30.20 |

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

The obtained data showed that, during 2007 season, the plants of the fourth and fifth planting dates showed relatively higher infestation levels compared to the plants of the other three planting dates recording 72.40 and 62.18 individuals / m² , respectively.

Nearly the same trend of results was observed during season 2008 where the plants of the fifth and fourth planting dates showed relatively higher infestation levels compared to the plants of the other three planting dates recording 178.00 and 104.20 individuals / m² , respectively. Insignificant difference, however, was found between the numbers of *E. chrysomelina* recorded on the plants of first, second and third planting dates.

Regardless the effect of cucurbit crops and fertilizer rates, it could be observed that, the cucurbit plants cultivated in the late planting date harbored relatively higher number of *E. chrysomelina* (larvae and adults). Meanwhile, the plants of the early planting dates (March and April) harbored relatively lower numbers of the pest. El-Saeady 1978 found that, the greatest numbers of *E. chrysomelina* were recorded at July, September and November. Sayed and Gameel 2008 under the New Valley conditions found that, the cucurbit plants cultivated in the Nili plantation harbored higher numbers of *E. chrysomelina* than summer plantation. Variations of seasonal plantation 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). The time of planting season can be an effective pest management tactic because it results in a synchrony between the pests and crop (Albuquerque, 1993).

3. Effects of fertilization rates

Data in Table (3) show the effect of different levels of NPK regardless to the effect of cucurbit crops and planting dates on the population density of *E. chrysomelina* during 2007 and 2008 seasons.

Table 3. Population density of *Epilachna chrysomelina* (adults and larvae / m²) as affected by fertilization rates, New Valley.

| Fertilization rates | No. of individuals (adults and larva / m ²) | |
|---------------------|---|---------|
| | 2007 | 2008 |
| Check | 29.55 B | 54.69 A |
| Recommended | 44.06 A | 74.62 A |
| Double recon. | 48.33 A | 70.40 A |
| LSD. 0.05 | 14.24 | 20.97 |

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

In season 2007, the highest numbers of the pest (48.33 and 44.06 individuals / m²) were recorded on cucurbit plants received the double and recommended fertilization rates. The lowest number of *E. chrysomelina* (larva and adults) (29.55 individuals / m²) was recorded on the check plants. During season 2008, insignificant differences were found between the numbers of the pest on cucurbit crops under different levels of NPK. Generally, it could be observed that, the infestation rates with *E. chrysomelina* do not affected by the fertilization rates.

4. The interaction effects between cucurbit crops, planting dates and fertilization rates

Data in Tables 4 and 5 show the effect of the three variables on the population density of *E. chrysomelina* during seasons 2007 and 2008. Data in Table (4) indicate that, the highest population densities of the pest were recorded on sweet melon plants (228.33,152.67 and 143.00 individuals / m²) during the fourth planting date (end of May) when the plants received double recommended, check and recommended dose of NPK, respectively. Followed by the cultivated plants during the third and fifth planting dates when received recommended and double recommended dose of NPK where they recorded (111.00 and 109.33 individuals / m²), respectively.

Table 4. Population density of *Epilachna chrysomelina* (adults and larvae / m²) as affected by cucurbit crops, planting dates and fertilization rates, 2007 season, New Valley.

| Planting dates | No. of individuals (nymphs and adults / m ²) | | | | | | | | | Average |
|----------------|--|--------|--------|---------------------|--------|--------|---------------------|--------|--------|---------|
| | Water melon Cantaloupe | | | Sweet melon | | | Cantaloupe | | | |
| | Fertilization rates | | | Fertilization rates | | | Fertilization rates | | | |
| | Check | Recom. | Double | Check | Recom. | Double | Check | Recom. | Double | |
| First | 19.33 | 22.33 | 9.77 | 18.00 | 70.33 | 20.33 | 12.33 | 0.00 | 21.33 | 22.80 |
| Second | 0.33 | 7.33 | 7.33 | 0.33 | 28.00 | 1.00 | 10.77 | 0.00 | 19.00 | 9.22 |
| Third | 1.33 | 22.00 | 21.77 | 22.00 | 111.00 | 80.33 | 28.77 | 27.33 | 0.00 | 37.09 |
| Fourth | 47.77 | 30.33 | 22.77 | 102.77 | 143.00 | 228.33 | 17.33 | 0.33 | 0.33 | 72.40 |
| Fifth | 22.00 | 29.77 | 80.33 | 48.00 | 97.77 | 109.33 | 22.77 | 02.77 | 72.33 | 72.18 |
| Average | 20.93 | 20.23 | 21.33 | 49.20 | 89.80 | 88.77 | 18.02 | 17.87 | 24.79 | 40.70 |
| | 20.93 | | | 70.90 | | | 20.07 | | | |

LSD (0.05) =55.16

The lowest numbers of the pest were recorded on cantaloupe plants (5.00, 0.00 and 0.33 individuals / m²) of the first, second and fourth planting dates when the plants received the recommended dose of NPK, respectively. Also, low numbers of *E. chrysomelina* (1.00 and 1.33 individuals / m²) were observed on sweet melon and watermelon plants when cultivated during the second and third planting dates and received double recommended and check dose of NPK, respectively.

During season 2008, data in Table (5) clearly indicate that, the highest numbers of the pest were observed on sweet melon and cantaloupe plants cultivated during the late planting dates (end of May and August) under different levels of NPK. Unfertilized sweet melon plants recorded the maximum number of the pest (296.33 individuals / m²) during the fourth planting date followed by cantaloupe plants (296.00 individuals / m²) when cultivated during the fifth planting date and received double recommended dose of NPK.

Table 5. Population density of *Epilachna chrysomelina* (adults and larvae / m²) as affected by cucurbit crops, planting dates and fertilization rates, season 2008.

| Planting dates | No. of individuals (nymphs and adults / m ²) ₉₉ | | | | | | | | | Average |
|----------------|--|--------|--------|---------------------|--------|--------|---------------------|--------|--------|---------|
| | Water melon | | | Sweet melon | | | Cantaloupe | | | |
| | Fertilization rates | | | Fertilization rates | | | Fertilization rates | | | |
| | Check | Recom. | Double | Check | Recom. | Double | Check | Recom. | Double | |
| First | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.67 | 0.67 | 0.00 | 0.00 | 0.10 |
| Second | 0.00 | 3.33 | 0.00 | 1.00 | 13.00 | 0.33 | 0.33 | 1.67 | 3.67 | 2.09 |
| Third | 2.00 | 8.67 | 0.00 | 18.33 | 31.00 | 7.33 | 0.00 | 10.33 | 10.67 | 11.70 |
| Fourth | 01.67 | 30.00 | 10.33 | 296.33 | 28.00 | 221.33 | 136.67 | 100.00 | 102.33 | 100.00 |
| Fifth | 60.67 | 70.00 | 111.00 | 170.00 | 209.33 | 283.33 | 8.67 | 277.00 | 296.00 | 178.00 |
| Average | 21.67 | 21.80 | 20.07 | 97.93 | 116.67 | 102.09 | 00.00 | 100.00 | 123.00 | 77.07 |
| | 22.80 | | | 100.73 | | | 71.13 | | | |

LSD (0.05) =81.22

The lowest numbers of *E. chrysomelina* which ranged between 0.00 and 31.00 individuals / m² were recorded on watermelon sweet melon and cantaloupe plants in early planting dates (end of March, middle of April and beginning of May) under different levels of NPK.

From the data of 2007 and 2008 seasons it is clear that, sweet melon was more susceptible to *E. chrysomelina* infestation harboring the highest population of the pest. Cantaloupe crop was moderately susceptible to the pest infestation, whereas watermelon was the least susceptible cucurbit crop. Lower population density of the pest was recorded on the plants of the early planting dates. In conclusion, to reduce the damage caused by the *E. chrysomelina* on the cucurbit plantations in the New Valley it could be recommended to cultivate the cucurbit crops in the early planting dates.

REFERENCES

1. Abdel-Moniem, A. S. H., A. A. Gomaa, N. Z. Dimetry, T. Wetzler and C. Volkmar. 2004. Laboratory evaluation of certain compounds against the melon ladybird, *Epilachna chrysomelina* F. attacking cucurbit plants. Archives of Phytopathology and Plant Protection. 37:71-81.
2. Albuquerque, G. S . 1993. Planting time as a tactic to manage the small rice stink bug, *Oebalus poecilus* (Hemiptera:Pentatomidae) in Rio Grande do Sul, Brazil. Crop Protection, 12:627: 630.
3. Ali, M. A. and A. A. El-Saeedy. 1986. Phenology and population dynamics of the melon ladybird beetle *Epilachna chrysomelina* (F) in Egypt (Coleoptera:Coccinellidae). Agric. Res. Rev. 61:179-191.
4. Bohlen, E. and J. W. Freidel. 1979. Crash Programme – Plant Protection New Valley, Egypt. Consultancy Mission. 14.02.1979 7.03.1979. German Agency for Technical Cooperation (GTZ), 56 pp.
5. El-Saeedy, A. A. 1978. Ecological and physiological studies on melon ladybird beetle *Epilachna chrysomelina*(F.), (Coleoptera–Coccinellidae). Ph. D. Thesis, Fac. of Agric., Al-Azher Univ., 146 pp.
6. Gameel, S. M. M. 2004. Eco-Biological studies on the black melon bug, *Coridius (Aspongopus) viduatus* F. (Hemiptera : Pentatomidae) in the New Valley . Ph. D. Thesis, Fac. of Agric., Assiut Univ., 209 pp
7. Gameel, S. M. M. and Abdel-Gaid. 2007. Relative susceptibility of three cucurbit vegetables to the infestation *Epilachna chrysomelina* F. (Coleoptera–Coccinellidae) at the New Valley - Egypt. The 1st International Conference on Desert Cultivation.27-29March, Minia Univ.85-90.

8. Ghabn, A. A. E. 1951. Studies on the biology and control of *Epilachna chrysomelina* F., in Egypt (Coleoptera – Coccinellidae). Bull. Soc. ent. Egypte. 35:77-108.
9. Knipling, E. F. 1979. The basic principles of insect population suppression and management. USDA Agric. Agriculture- Handbook. 512pp.
10. Nazarov, D. T. 1988. Tests with preparations. Zashchita Rastenii Moskva, 11:31.
11. Sayed, A. A. and S. M. M. Gameel. 2008. Effect of some vegetable cucurbit crops and seasonal plantation on the population densities of *Epilachna chrysomelina* f. (Coleoptera-Coccinellidae), at the New Valley-Egypt. Egyptian J. Agric. Res.86(3):1053-060.
12. Shukla, G. S. and V. B. Upadhyay. 1983. Effect of ecological factors: food preference of *Epilachna dodecastigma* (Coleoptera: Coccinellidae) on vegetable plants. (i) Light. Journal of Advanced Zoology. 1983, 4(1): 49-54.
13. Snedecor, G. W. and W. G. Cochran. 1971. Statistical methods. Iowa state Univ. Press, Ames, Iowa. USA.
14. Van Emden, H. F. 1977. Pest control and its ecology. Edward Arnold (Publishers) Ltd, London. 59 pp.
15. Wilson, L. J. 1986. Movement and feeding patterns of *Epilachna cucurbitae* Richards (Coleoptera : Coccinellidae) on pumpkin and zucchini plants. Australian Journal of Ecology. 11(1): 55-62.

تأثير بعض العمليات الزراعية على الكثافة العددية لحشرة خنفساء القثاء بمحافظة الوادي الجديد في مصر

صلاح محمود محمد جميل ، بدر الصباح عبد المنعم فتوح

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

أجريت هذه الدراسة بمزرعة محطة البحوث الزراعية بالخارجة - الوادي الجديد لمعرفة تأثير كل من بعض المحاصيل القرعية ومواعيد الزراعة وكذلك معدلات التسميد على الكثافة العددية لحشرة خنفساء القثاء خلال موسمي ٢٠٠٧؛ ٢٠٠٨.

أوضحت النتائج ان عاملى المحصول القرعى المنزوع وميعاد الزراعه هما العاملان المحددان لدرجه الاصابه بحشرة خنفساء القثاء.

١ - تأثير المحاصيل القرعية :

أوضحت النتائج وجود اختلاف معنوي في تعداد هذه الآفة على كل من محصول الشامام والكانتلوب والبطيخ. خلال موسمي ٢٠٠٧؛ ٢٠٠٨ كان أعلى تعداد لهذه الآفة (٧٥.٩٥ و ١٠٥.٧٣ فردا / م^٢) تم تسجيله على محصول الشامام على التوالي .

٢ - تأثير عروات الزراعة :

سجلت المحاصيل القرعية المنزوعة فى مواعيد زراعه متأخره (نهايه مايو و نهايه اغسطس) أعلى تعداد لهذه الآفه بينما اقل تعداد لهذه الآفه سجل فى مواعيد الزراعه المبكره(نهايه مارس و منتصف ابريل وبدايه مايو .

٣- تأثير معدلات التسميد:

من خلال النتائج لم تظهر الاختلافات فى معدلات التسميد اى تأثير فى تعداد حشرة خنفساء القثاء خلال موسمى الدراسه.

٤- التأثير المشترك لكل من المحاصيل القرعية و عروات الزراعة و معدلات التسميد على تعداد الآفه:

خلال موسم ٢٠٠٧ وجد ان أعلى تعداد لهذه الآفه(٢٢٨.٣٣؛ ١٥٢.٦٧؛ ١٤٣.٠٠ فردا / م^٢) تم تسجيله على نباتات محصول الشامام المنزوعه فى نهايه مايو و التى تلقت مستوى مضاعف من التسميد ؛ بدون تسميد ؛ تسميد عادى على التوالي. خلال موسم ٢٠٠٨ أظهرت النتائج أن أعلى تعداد لحشره خنفساء القثاء (٢٩٦.٣٣ فردا / م^٢) تم تسجيله على نباتات محصول الشامام المنزوعه فى نهايه مايو و غير مسمده تلاها تعداد الحشرات على محصول الكانتلوب (٢٩٦.٠٠ فردا / م^٢) المنزوع فى نهايه اغسطس و الذى تلقى مستوى مضاعف من التسميد.