REDUCTION OF THE BYMV INSIDENCE ON FABA BEAN BY THE INTRODUCTION OF CHRYSOPA CARNEA AS A BIOCONTROL AGENT AGAINST APHIS FABAE

Mohga A. El-Tahlawy* and S. A. El-Arnaouty**

* Virus Research Department, Institute of Plant Pathology, ARC

**Department of Economic Entomology and Pesticides, Faculty of Agriculture, Cairo University

ABSTRACT:

The impact of healthy aphids, BYMV viruliferous aphid on faba bean plants, and the combined effect by releasing *Chrysopa carnea* larvae was tested during the stages of plant development: seedling stage, flowering stage and the podsiting stage. The parameters of the treatment evaluation were the number of seeds/pod, the number of seeds/plant, the weight of seeds/plant and the weight of 100 seeds. No obvious effect was observed on the number of seeds per pod among all treatments. The effect of the virus infected aphids was drastic on the infected plants. The release of *Chrysopa* larvae on the infected plants (either by healthy or by viruliferous aphid) was significant in increasing the number and weight of seeds whatever the stage of plant development. The release of *C. carnea* has to be carried out in the early phonological stage of the plants, as soon as aphids appear in order to prevent virus infestation.

Key words: Faba bean – BYMV – *Aphis fabae* – *Chrysopa* – virus transmission – seed production.

INTRODUCTION:

Faba bean (*Vicia faba* L.) is known as the target of world-wide range of virus diseases **(Boss *et al.*, 1988).** Several viruses were recorded in Egypt, Bean Yellow Mosaic Virus is considered among the most important seed-borne virus affecting this economic crop **(Fawzy, 1973; Gamal Eldin *et al*, 1981).** BYMV was firstly isolated and described by **Pierce (1934),** several isolates were then identified. The main symptoms of the BYMV infection are the flower colour break malformation and stunting of the florets **(Kamaran and Izadpanah, 1981; Randles and Barnett, 1984).** BYMV has reported to be transmissible by several species of aphids such as *Aphis fabae, A. gossypii, Brevicoryne brassicae and Myzus persicae* **(Hobbs and Mclaughiln, 1990; Neeraj *et al.*, 1999).**

The lacewing *Chrysopa carnea* is an important multi-host insect predator by its larval instars, the aphids are the major host of this bio-control predator. *Chrysopa carnea* could be used as a biocontrol predator in case of vegetable crops, fruits and ornamentals against different kinds of aphids, especially high temperature variations,which *Chrysopa* will not have any problems. As the larvae cannot fly, they need to be able to reach their prey via the shortest way. It is therefore important to introduce the larvae near the aphids. The advantage of using larvae is the fact that they work immediately. With *Chrysopa*, only the hot spots or the entire greenhouse can be treated. If hot spots are controlled in an early stage, there is less probability of infestation of the entire crop.

The first proposed, the idea of colonization and mass release of lacewing, and since then several experiments have been concluded in the open field and under greenhouse conditions. Many species have been used, *C. carnea* **(Scopes, 1969; Beglyarov and Ushchekov, 1974; Bondarenko, 1975; Hassan, 1977and 1978; Beglyarov *et al,* 1980), *Ch. perla* (Kowalska, 1976)** and *Ch. formosa* **(Lyon, 1979).** The authors used the predator against several pests on various vegetable crops: pepper, cucumber, celery, lettuce and eggplant.

In greenhouse, most investigations were concentrated on *C. carnea* as the mass rearing techniques were relatively developed. This predator has mainly been used against aphids, where the green lacewings can be transferred to the greenhouse either as eggs or as second instar larvae **(El Arnaouty *et al.,* 1993).** The efficiency of lacewings depended on the date of the first release, and the larvae needed to be present before the first winged aphids **(Collet *et al.,* 1998). Daane *et al.* (1996)** recorded that the leafhopper densities of the species *Erythroneura variabilis* and *E. elegantula* were significantly reduced by 23.5 and 30.3% in plots that received 29.7 and 89 *C. carnea* larvae/hectar, respectively.

The management of the plant virus diseases is limited within the preventive measurements. The early control of the viruliferous aphid is the effective alternative for the suppression of the virus incidence.

The impact of *Chrysopa carnea* release on controlling the populations of Aphis fabae during three stages of faba bean plantation is investigated.

MATERIAL AND METHODS:

Four treatments were conducted using faba bean cv. Giza 843. Each series of treatments was carried out during faba bean seedling stage (A), flowering stage (B) and during the podsiting stage (C). For each treatment, 8 of replicates pots (No 50) were prepared and arranged in the greenhouse located at Virus Department- Institute of Plant Pathology (ARC). The greenhouse temperature was maintained at 25^{o}C. In each pot, 8 faba bean seeds/pot were planted and maintained till the appropriate stage of treatment.

At each stage of plant development: A, B and C, four treatments were designed as follows:

- Treatment 1: healthy aphids (50 aphid/pot).
- Treatment 2: healthy aphids + C (10 larvae/pot)
- Treatment 3: viruliferous aphids
- Treatment 4: viruliferous aphids + C.

The pots were daily observed starting by the 10th day of the insects introduction. At the end of the plants development, the number and the weights of harvested faba bean pods and seeds were recorded.

RESULTS AND DISCUSSION:

The significance of variation ranged according to the defined parameters in relation to the treatments. Concerning the group A (treatments on seedling stage), as shown in Table-Fig. 1a, the treatment 1 where only healthy aphids were exposed to the plants, the average number of seeds/pod was 3 seeds (varied between 1 and 5), while the number of seeds /plant varied between 47 and 53 with an average of 50

seed /plant. The average weight of total seed/plant was 10 g (8 – 12), while the average weight of 100 seeds was 20 g (17 – 23).

When the healthy aphids plus *C.* were exposed to the plants (treatment 2), as shown in Table-fig. 1b, the average number of seeds/pod was 3 (1-4), the average of 55 seeds/plant (53-57) was observed. The average weight of total seeds was 16 gm (15-18), while the weight of 100 seeds was 25 gm (23-27).

For the treatment 3 where only the viruliferous aphid were exposed to faba bean plants, and as shown in Fig.2a, the number of seeds/pod was 2 in average (1-3), while the average number of seeds per plant was 35 seeds (33-37). Concerning the weight of seeds, the average of total weight of seeds was 2 g (1-3) compared with 5 g (3-7) for the weight of 100 seeds. When the viruliferous aphid plus Chrysopa were exposed to faba bean plants, Table- fig. 2b indicate that the average number of seeds/ pod was 3 (1-4), while 60 (57-63) seeds/plant were observed. The total weight of seeds/plant was 21 (19-23) and the weight of 100 seeds was 31 (28-32).

Concerning the group B (treatments on flowering stage), Table- fig. 3a (where the viruliferous aphid were exposed to the plants, the pod gave only 2 seeds in average and 40 (38-42) seeds per plant. The weight of total seeds per plant was 5g (3-7), while the weight of 100 seeds was 10 g(8-12). When the Chrysopa were added to the virus-infected aphids (Table-Fig 3b), the number of seeds/pod was 3g (2-4), while the number of seeds/plant was 65 (63-67). The weight of total seeds was 26g (24-28), while the weight of 100 seeds was 35 (33-37) gm.

The results of group C (treatments on podsiting stage), when the viruliferous aphid only were exposed to the plants, Table-Fig 4a show that the number of seeds/pod was 3 (2-4) and the number of seeds/plant was 45 (43-47). The weight of total seeds was 7 g(6-8) gm while the weight of 100 seeds was 14g (13-15).

When the Chrysopa were added to the viruliferous aphid during the flowering stage (Table-fig 4b), the number of seeds/ pod was 3 (2-4) and the number of seeds/ plant was 71 (69-73), the total weight of seeds was 31 g(29-32) and weight of 100 seeds was 40g (38-42).

It is clear from the obtained that both the viruliferous aphid and the added Chrysopa have a significant impact on the number of seeds per pod (Table-Fig 5). This observation is also recorded in the treatments conducted on all stages of plant development (seedling, flowering and podsiting). During the seedling stage, the viruliferous aphid have an impact on the number of seeds/plant (average of 35 compared with 50 for the healthy aphids), concerning the same parameter, the role of *Chrysopa* was more important on the viruliferous aphid (average of 60 seeds/plant) than on the healthy aphids (average of 55 seeds/plant). The impact of *Chrysopa* was also important in the treatments during the flowering and podsiting stages, while they increased the average number of seeds/plant from 40 to 65 when the treatment was carried out during the flowering stage, and from 45 to 71 for the treatment in podsiting stage.

For the group A (treatments on seedling stage), the viruliferous aphid have a destructive effect on the weight of total seeds/plant (average of only 2 g., compared with 10 g for the plants infested with healthy aphids), the same tendency was observed on the parameter of the weight of 100 seeds. The impact of *Chrysopa* was important regarding the increase of seed weight to 21 and 16 g

Table & Fig. 1

Table & Fig. 2

Table & Fig. 3

Table & Fig. 4

Table & Fig. 5

for the virus-infected and healthy aphids, respectively. Concerning the treatment during the flowering stage, the exposure of *Chrysopa* is highly important as the total weight of seeds/plant was increased to attain 26 g compared with only 5 g for the plants infested by viruliferous aphid without any release of *Chrysopa*. The same trend was respected for the treatment during the podsiting stage, the average weight of seeds/plant in the faba bean infested with viruliferous aphid in presence of *Chrysopa* was 31 g compared with 7 g for the same treatment without *Chrysopa* release. The average weight of 100 seeds for the same treatment was 40 g and 14 g, respectively.

From the results it can be concluded, that if plants, in an early phonological stage, are infested by aphids carrying virus diseases, high damages

are observed causing a drastic loss in seed yield. Thus, the release of *C. carnea* has to be carried out in the early phonological stage of the plants, as soon as aphids appear in order to prevent virus infestation.

REFERENCES:

Beglyarov, G.A.; A.T. Ushchekov and V.V. Lychkia (1980). Biological protection of green vegetable crops on the Moscow sovkhoz (in Russian). Zashch. Rast. 2: 35-37.

Beglyarov, G.A. and Ushchekov A.T. (1974). Experimention and outlook for the use of Chrysopids (in Russian). Zashch. Rast. 9: 25-27.

Bondarenko, N.V. (1975). Use of aphidophagous for the control of aphids in hot houses. Plant Prot. Congr. Moscow. 5,6 & 7: 24-29.

Bos, L.; Hampton, R. O. and Makkouk, K. (1988). Viruses and virus disease of pea, lentil, faba bean and chickpea In: Summer field, R.J. ed: World crops: Cool season food legumes, pp 591-615. Klumnwer Academic Publishers Dordrecht, the Netherlands.

Collet, J. M.; Maisonneuve J. C.; Couture I. and Mezencev N. (1998). Utilization of Chrysopa (*Chrysoperla lucasina*) larvae against the black artichoke aphid (*Aphis fabae*). First transnational workshop on biological, integrated and rational control: Status and perspective with regard to regional and European experiences, Lille, France, 21-23 January. 29-30.

Daane, K. M.; G. Y. Yokota; Y. Zheng and K. S. Hacer (1996). Inundative release of common green lacewing (Neuroptrea: Chrysopidae) to suppress *Erythroneura variabilis* and *E. elegan* Tula Homoptera: Cicadellidae) in vineyards. Envi. Ent. 25(5): 1224-1234.

El Arnaouty, S. A.; Franco E. and Tawfik M. F. S. (1993). Using *Chrysoperla carnea* Stephens (Neuroptrea: Chrysopidae) against the green peach aphid, *Myzus persicae* Sulzer in greenhouses. J. Biol. Pest Control. 3(2): 177-185.

Fawzy, R. N. (1973). Studies on broad bean virus diseases in Egypt. M.Sc., in Plant Pathology, Faculty of Agriculture, Cairo University, Egypt.

Gamal-Eldin, A. S.; El-Kady, M. S. and El-Amrity, A. A. (1981). Pea mosaic virus (PMV) strain of BYMV isolated from pea. Egypt. J. Phytopathol., 13: 28-32.

Hassan, S. A. (1977). Untersuchungen zur verwendung des predators *Chrysopa carnea* Stephens (Neuroptra: Chrysopidae) zur Bekampfung der Grunen pfirsichblattlaus *Myzus persicae* Sulz. On praprikaim Gewachshaus. Z. angew. Ent. 82: 234-239.

Hassan, S. A. (1978). Release of *Chrysopa carnea* Stephens to control *Myzus persicae* (Sulzer) on eggplant in small greenhouse plots. Z. Pflkrankh. Pflpath. Pfischutz. 85: 118-123.

Hobbs, H.A. and Mclaughlin M.R. (1990). Anon-aphid transmissible isolate of BYMV- scott that is transmissible from mixed infection with peo mosoic virus . Phytopathology 80: 268-278 .

Kamaran, R. and Izadpannah, K. (1981). Isolation and identification of bean yellow mosaic and tobacco ring spot viruses from Gladiolus in Shiraz. Iranian Journal of Plant Pathology, 17: 1-11.

Kowalska, T. (1976). Mass rearing and possible uses of Chrysopidae against aphids in glass-houses. Bull. OILB/SROP. 4 : 80-85.

Neeraj,V., Danish, M., Doomar, S., Naqvi, O.A., Verma, N., Mansoor, D. and Singh, D. (1999). Studies on bean yellow mosaic virus infecting broad bean (Vicia faba L.) inaligorh india Annals plant protection sciences 1 : 51-54.

Lyon, J.P. (1979). Lachers expérimentaux de Chrysopes et d'Hyménoptera parasites sur les pucerons en serres d'aubergines. Annls. Zool. Ecol. Anim. 11: 51-65.

Pierce, W. H. (1934). Virus of the bean. Phytopathology, 24: 488-489.

Randles, J.W. and Barnett, O.W. (1984). Relationship between bean yellow mosaic virus isolates from Australia and USA. Biennial Report of the Waite Agricultural Research Institute. pp150.

Scope, N.E.A. (1969). The Potential of *Chrysopa carnea* as a biological control agent of *Myzus persicae* on glass-house chrysanthemums. Ann. Appl. Biol., 64: 433-439.

الملخص العربى

تسبب الإصابة الفيروسية تدهور في محصول الفول البلدي وقد استخدم في هذه الدراسة طرق بيولوجية للحد من هذا التدهور دون التعرض لمخاطر الطرق الأخرى للمكافحة وقد استخدم أربع معاملات:

المعاملة الأولى: عدوى النبات بحشرة المن الخالية من الفيروس.

المعاملة الثانية: عدوى نبات الفول بحشرة المن الخالية من الفيروس و إطلاق أسد المن معها.

- المعاملة الثالثة: عدوى نبات الفول بحشرة المن الحاملة للفيروس.

- المعاملة الرابعة: عدوى نبات الفول بحشرة المن الحاملة للفيروس و إطلاق أسد المن معها.

وتمت معاملة النبات بهذه المعاملات خلال مراحل نمو النبات المختلفة (مرحلة البادرة، مرحلة التزهير، والعقد) و قد أثبتت النتائج تأثير انتشار أسد المن على حشرة المن و بالتالي على الإصابة الفيروسية وذلك من خلال المقارنة بين المعاملات من خلال (عدد ووزن الحبوب في القرن والنبات) وكان التأثير إيجابيا وأظهرت النتائج :

كلما نشرنا أسد المن مبكرا على النبات في مرحلة البادرة كانت النتائج افضل حيث أن أوضحت النتائج أن القضاء على المن مبكرا يقضى على معظم الإصابة الفيروسية.