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EFFECT OF SEVEN ORGANOPHOSPHORUS INSECTICIDES ON THE LEAFMINER *LIRIOMYZA TRIFOLII* (DIPTERA: AGROMYZIDAE) AND THE PARASITE *DIGLYPHUS ISAEA* (HYMENOPTERA: EULOPHIDAE) IN COMMON BEAN FIELD

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ABSTRACT

Seven organophosphorous insecticides were tested on common bean (*Phasealus vulgaris*) for the control of a serpentine-leafminer (*Liriomyza trifolii*) and the survival of the parasite *Diglyphus isaea*, in a trial to find out insecticides with selective properties for the use in integrated control program. Nasrcidol 20%, nasrcidol 60%, dianon 60%, metazon 60%, detrex 80%, agrothion 57% and profex 72% gave excellent control of leafminer with residual effect lasting for 15 days on treated foliage. Then effect decreased after the 15th day. So a second spray of treatments was done.

An interesting observation was noticed with agrothion 57% spray, that there was increased in pupal formation and lower rate of dead larvae, compared with the other compounds. Also there was a rapid decrease in the number of living parasitoid *Diglyphus isaea* in the treated fields till the 10th day of the first spray, then parasitoids regained its activity on the 15th day. However, detrex 80% has a little effect on parasitoid activity.Also In the second spray the number of mines gradually decreased in the control field and the treated fields reaching the maximum decline on the 15th day. After the second spray there was a marked drop in the number of living parasite reaching the maximum drop on the 15th day. From this study it could be concluded the insecticides applied are effective in controlling leaf-miners population but they reduced its parasitoids population.

Keywords: organophosphorus insecticides. *Liriomyza trifolii*, *Diglyphus isaea*, common bean.

INTRODUCTION

Common bean (*Phaseolus vulgaris*), is a useful legume for its edible green pods as well as for its dry seeds. It is a popular vegetable crop grown in Egypt as well as in many other countries (Shiboob, 2000)

In Egypt, common bean can be grown as a summer and fall crop. According to 1998 statistics, the total cultivated area devoted for green pods and dry seed yield in both the summer and fall crops were about 32949 and 23845 feddans which produced about156. 212 and 30.927 tons, with an average of 4.73 and 1.43 tons per feddan respectively (Shiboob, 2000). Unfortunately the production of common been is affected by many factors including insects suchas, mainly leafminers and whitefly (Karel and Mghogho 1985). The leguminous leafminer *Liriomyza trifolii* (Diptera: Agromyzidae) occurs worldwide and is economically important pest of many agricultural crops (Spencer 1973, Satio *et al.,* 1993b, Srinivasan *et al.,* 1995, Kapadia *et al.,* 1995, Ozawa *et al.,* 1995, Sharaf El- Din *et al.,* 1997, Hawthrone 1999 and Hammad, 2000). The leafminer causes losses of about 50% of this crop,

since larvae and adults cause damage. Larvae primarily mine the leaf layer where chloroplasts are located (Charlton and Allen 1981, Parrella and Bethke 1984, Chandler and Gilstrap 1987) and adult females puncture both upper and lower leaf surfaces to feed and lay eggs (Bethke and Parrella 1985, Robert and Hardman 1986 and Nagata *et al.,* 1998).

The most common parasitoid of *L.trifolii* is *Diglyphus isaea* walker . This parasitoid is a small eulophidae wasp that feeds externally on the developing leafminer larvae within the leafminer tunnels (Charlton and Allen 1981, Johnson 1987, Parrella *et al.,* 1989, Lin and Wang 1992, Qu, Juan and Qu 1997 and Eid, 1998).

Conventional insecticides such as organophosphorus compounds are used for leafminer control. However, resistance usually occurred. Moreover, they disrupt parasitoids of *Liriomyza* spp. and induce pest population to increase (Oatman and Kennedy 1976, and Jhonson *et al.,* 1980). So second application of insecticide treatment becomes obligatory.

The objective of this study was to evaluate the effect of seven organophosphorus insecticides (nasrcidol 20%, nasrcidol 60%, dianon 60%, metazon 60%, detrex 80%, agrothion 57% and profex 72%) on *Liriomyza trifolii* and its primary parasitoid *Diglyphus isaea* in the common bean field.

MATERIALS AND METHODS

Field trials

The field trials were conducted on common bean (*Phaseolus vulgaris*) during the Nili plantation of year 2000 at the Agricultural Experimental Farm of Sabahia, Alexandria. The experimental area was divided into plots of about 5x6m each. Treatments with seven organophosphorus insecticides were applied with knapsack sprayer at the rate of 200 liters/feddan. The rates of spray/feddan of insecticides are shown in Table (1). Each insecticide was replicated 3 times. Seven plots were left without spraying and considered as control. Plant leaves per plot were randomly sampled before spray and after 48 hr, 5 days, 7 days, 10 days and 15 days to determine the insecticide activity on leafminer control and parasite survival.

Laboratory assay

The leaves were placed in paper bags transferred to the laboratory and observed through a binocular microscope where a number of a live larvae, dead larvae (no evidence of parasitism) and moribund larvae (externally parasitized) were recorded before treatment and after 48hr, 5 days, 7 days, 10 days and 15 days.

Another spray treatment by the same organophosphorus insecticides were applied to the same area at the 15th day from the first treatment and the same procedure was undertaken as before.

Statistical analysis of data collected were carried out according to Cohort, Software, Inc. (1986)

Table (1): The tested insecticides treatments, their rate of spray and concentration per 100 liter water.

Insecticides treatment		Conc./100 L water	Rate / Feddan
Nasrcidol 20%	(Diazinon)	1500 Cm^3	3 L
Nasrcidol 60%	(Diazinon)	500 Cm^3	1 L
Dianon 60%	(Diazinon)	500 Cm^3	1 L
Metazon 60%	(Diazinon)	500 Cm^3	1 L
Detrex 80%	(trichlorophos)	500 gm	1 kg
Agrothion 57%	(Malathion)	500 Cm^3	1 L
Profex 72 %	(Profenofose)	375 Cm^3	0.75 L
Control	-	100% water	-

The insecticides used were recommended and supplied by the Ministry of Agriculture to be applied against the leafminers.

RESULTS AND DISCUSSION

Seven organophosphorus insecticide (O.P) formulations were tested on common bean (*Phaseolus vulgaris* L.) for control of a serpentine–leafminer *Liriomyza trifolii* and survival of its primary parasitoid *Diglyphus isaea*. The obtained data in Figure (1A) and Figure (1B) illustrated the results of treatments (nasrcidol 20%, nasrcidol 60%, dianon 60%, metazon 60%, detrex 80%, agrothion 57% and profex 72%). There was no significant differences among control and the seven treatments before the spray .

There were significant differences among the treatments by nasrcidol 20%, metazon 60% and detrex 80% where they decreased the number of mines gradually, until reached its maximum decline of infestation after 48hr of treatments by nasrcidol 20% and metazon 60% and at the 5th day for detrex 80%. On the other hand there were significant slight increase in number of mines for the treatments by nasrcidol 60%, dianon 60%, agrothion 57% and profex 72% after treatment then decreased significantly.

The number of mines increased again reaching maximum on the 15th day for all treatments, which are considered the pre treatments date for the second spray where the number of mines per six counts were 195, 154, 115, 133, 132, 160, 166 and 133 for control, nasrcidol 20%, nasrcidol 60%, dianon 60%, metazon 60%, detrex 80%, agrothion 57% and profex 72% respectively.

These results indicated that the residual effect of O.P insecticides gradually decreased after the 15th, day therefore a second spray may be needed.

Fig. (1A) : Effect of tested organophosphorus insecticides (nasrcidol 20%, nasrcidol 60% and dianon 60%) on the leafminer *Liriomyza trifolii* and its parasite *Diglyphus isaea* population in common bean field.

Fig. (1B) : Effect of tested organophosphorus insecticides (metazon 60%,detrex 80%, agrothion 57% and profex 72%) on the leafminer *Liriomyza trifolii* and its parasite *Diglyphus isaea* population in common bean field.

The results was in agreement with (Libee, 1981, Parrella and Keil 1984 and Cox *et al.,* 1995) who stated that as a result of intensive chemical use *L.trifolii* has developed resistance to all classes of registered insecticides.

number. This could be due to the presence of living parasites, which destroyed living larvae. While the number of living larvae in the fields treated with the insecticides showed significant decrease befor treatment then gradually increase in living larvae till the 15th day. This could be explained that the insecticides had lethal effect on the living larvae reaching the maximum effect between 48 hr to 7 days. Then the residual effect of insecticide started to sharp decrease so the infestation of all fields by leafminer *L.trifolii* became higher so a second spray is needed to control the infestation.

An interesting observation was noticed when using agrothion 57%, it was observed that the presence of agrothion 57% on the plant increase the pupae formation of the larvae of *L. trifolii*. Also it was observed that with agrothion 57% the rate of dead larvae decreased in number than the other treatments in the 5th day where it reached mean number 19.0. The explanation to this observations is that agrothion 57%, may have offensive odor and repelled the parasite, but this needs further investigation.

This study revealed that the parasitoid *Diglyphus isaea* increased in number in the control field reaching the maximum on the 15th day while in the fields treated with the insecticides there was a rapid decline in number of living parasitoid till the 10th day then the parasitoid regained its activity except in the field treated with detrex 80% where its effect on the parasitoid activity was minimum. The previous results was in agreement with (Getzin 1960, Oatman and Kennedy 1976, Johnson *et al*., 1980 and Weintraub and Horowitz 1998) who stated that once the insecticide was applied any balance that has existed between parasite and host is disrupted and a continual insecticide control program usually becomes necessary.

In the second spray regarding the number of mines, there was a gradual significant decrease in number of mines in the control and seven treatments reaching maximum decline on the 15th day Also there was a significant decline in the number of the life larvae in control and O.P treatments except the field treated with agrothion 57%. Regarding the number of living parasite in the second spray there was marked drop in its number in control and seven treatments reaching maximum drop on the 15th day where the mean number of life parasites were (77 to 28) , (60 to 3) (51 to 17), (44 to 1) (52 to 7), (83 to 10), (60 to 12), and (43 to 11) for the control and the tested insecticides: nasrcidol 20%, nasrcidol 60%, dianon 60%, metazon 60%, detrex 80%, agrothion 57% and profex 72% respectively.

The results of this work proved that organophosphorus insecticides seriously affect the leafminer parasite relationship. This was in agreement with (Hills and Taylor 1951, Wene 1955, and Oatman 1959).

From this study it could be concluded that although the tested organophosphorus insecticides are effective for controlling leafminer population reducing its number, it also reduces its parasitoids population which is very effective in controlling leaf miner keeping the environment not polluted. So more work is needed to be done to promote parasitoid population.

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تـــأثير اســـتخدام ســـبعة مبيـــدات فوســـفورية عضـــوية علـــي نافقـــات الأوراق (*Liriomyza trifolii*) وطفيل *Diglyphus isaea* علي نبات الفاصوليا

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استخدمت سبعة مبيدات فوسفورية عضوية علي نبات الفاصوليا لدراسة تأثيرها على نافقات الأوراق *Liriomyza trifolii* وعلي الطفيل *Diglyphus isaea* كمحاولة لإيجاد مبيد حشري له خاصية الاختيارية لاستخدامه في برامج المكافحة المتكاملة. وكانت المبيدات الفسفورية المستخدمة هي (نصر سيدول ٢٠%، نصرسيدول ٦٠%، ديانون ٦٠% متيازون ٦٠%، ديتركس ٨٠%، اجروثيون ٥٧% ، بروفكس ٧٢%) وقد وجد ان استخدام هذه المبيدات احدث تأثيراً إيجابياً لمكافحة نافقات الأوراق وظل الأثر الباقى لها مستمراً لمدة ١٥ يوم على اوراق النبات، وقد تناقص هذا التأثير فى اليوم الخامس عشر مما أدى الى الاحتياج إلى رشة ثانية بنفس المعاملات وقد وجد أن الاجرثيون ٥٧% قد أسرع من تكوين العذارى وان معدل موت اليرقات كان اقل منه باستخدام المبيدات الاخرى. وكذلك وجد انخفاض ملحوظ فى أعداد الطفيل مع كل المعاملات حتى اليوم العاشر من الرشة الاولى ثم استعاد الطفيل نشاطه فى اليوم الخامس عشر. وقد لوحظ أن باستخدام ديتركس ٨٠% له اقل تاثير على نشاط الطفيل. وبعد الرشة الثانية تناقص عدد الانفاق تناقصاً ملحوظاً معنوياً حيث وصل الى اقصى انخفاض فى اليوم الخامس عشر للرشة الثانية وأيضاً كان هناك تناقص حاد فى اعداد الطفيل الحى وصل اقصاه فى اليوم الخامس عشر بعد الرشة الثانية. من هذا البحث يمكننا ان نستخلص ان استخدام المبيدات الفوسفورية فعال فى مكافحة صانعات الانفاق ولكنها فى نفس الوقت تقضى على الاعداء الطبيعية.