

An Introduction to Integrated Control of Some Greenhouse Pests in Egypt

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Abstract. Tomato plants in the greenhouses were liable to be infested with 3 pests, the whitefly, *Bemisia tabaci*, the green peach aphid, *Myzus persicae* and the two-spotted spider mite, *Tetranychus urticae*. Both the whitefly and aphid proved to be the most populated pests. Therefore, the present study aimed to develop an integral control programme for these pests. The coccinellid predator, *Coccinella septempunctata* was mass reared on an artificial diet and then introduced throughout the experimental greenhouses over aphid-infested plants. From the second week onward, aphid population began to decrease in number, while coccinellid population was noticeably increased. Considerable numbers of whiteflies were trapped by using sticky, plastic, yellow cellophane sheets hanged on wooden poles and placed between tomato plants in greenhouses. The average number of trapped whiteflies increased continuously till the 7th week. Susceptibility of *M. persicae* to two selective organophosphorus insecticides (dimethoate and monocrotophos) was evaluated. *M. persicae* was more susceptible to dimethoate followed by monocrotophos where the estimated LC₅₀ values for both insecticides were 5.8; 17.1 ppm (at 24 hrs post-treatment), and 4.5; 9.1 ppm (at 48 hrs post-treatment), respectively.

Introduction

Biological control against greenhouses pests induce many advantages such as the reduced exposure of producer and applier to toxic pesticides, the lack of residues on the marketed product, and the extremely low risk of environmental pollution [1].

Growers working in greenhouses also prefer biological control for more specific reasons. For example, young plants are susceptible to the toxic effects of pesticides, especially in winter when the plants are weak. Pesticides can also cause abortion of flowers and young fruits. When biological control is applied, no harmful effects are present and yields are reported to be higher than under chemical control. Moreover,

chemical control of the major pests (whiteflies, spider mites, and leafminers) is difficult due to resistance problems. More time is also required to apply pesticides than to distribute and check natural enemies. Besides that, biological control is cheaper than chemical control. Therefore, the application of biological and integrated pest control programmes in greenhouses is essential and significant.

The present work was directed to survey the pests associated with tomato in certain greenhouses and to evaluate the efficiency of the predator *Coccinella septempunctata* L. in controlling the green peach aphid, *Myzus persicae*.

The susceptibility of *M. persicae* to monocrotophos and dimethoate was also considered. The present study was also aimed to control the whitefly, *Bemisia tabaci* Gennadius by using sticky, plastic and yellow cellophane sheet traps.

Materials and Methods

Tomato plant variety Alex. 36 was used to achieve the present investigation. The plants were grown till they were about 35 cm high (38 days old) and then transferred to six experimental greenhouses running at 25°C where they were kept in pots. The greenhouse measured 55 m, and the plants were placed in 5 rows of 25 plants each. This experiment was carried out in three greenhouses to survey the greenhouse pests of tomato. Tomato plants (5 plants/row) were examined weekly for 14 weeks to record the number of pests associated with the plants.

Another set of experiments was conducted to evaluate the efficiency of the seven spotted ladybird beetle, *C. septempunctata* in controlling the green peach aphid using two experimental greenhouses. The test ladybird beetle was mass reared on lyophilized drone honeybee brood (DP), as an artificial diet [2,3]. A total of 25 pairs were introduced each to an experimental plant. The tomato plants were previously infested with a well-known number of the tested aphids. Changes in population density of aphids, in the presence of the coccinellid predator, were weekly recorded for a period of 12 weeks.

The efficiency of two recommended organophosphorous pesticides against aphids was also considered. The used pesticides were dimethoate 40% (EC) and monocrotophos 40% (EC). Each experimental plant was previously infested with 30 individuals of the tested aphids. Four concentrations (5, 10, 15 and 20 ppm for dimethoate and 5, 10, 20 and 30 ppm for monocrotophos) for each test insecticide (plus control), were sprayed on test plants. Each concentration was replicated three times. Aphid-Mortality counts were recorded 24 and 48 hrs post-treatment. The LC

value for each test pesticide was estimated by using the probit analysis statistical method of Finney [4, p. 318].

Depending on the previous observations of Vaishampayan *et al* [5] and El Helay *et al* [6] on attraction of whiteflies to certain colours or wavelengths of light; the yellow, plastic, cellophane sheets were used as a nonconventional and safe method to control the whitefly, *Bemisia tabaci* Gennadius in greenhouses. Yellow cellophane sheets with 500-600 nm wavelength were selected for this purpose. This wavelength represents the most attractive region for trapping whitefly adults [5].

Twelve cellophane sheets covered with a sticky material (to capture the target insects) were placed between tomato plants in the two previously mentioned experimental greenhouses (Exp. II). Each sheet was hanged on the top of a wooden pole about 50 cm above the soil, the distance between each two traps was about 2 meters. Each sheet was used for one week and then replaced by another one. Two replicates, 12 tested sheets each, were established, 3 meters were left between each two replicates. The average number of the weekly trapped whitefly adults was calculated for 12 weeks.

Results and Discussion

Three greenhouse pests were observed on tomato plants i.e. the whitefly *Bemisia tabaci* Gennadius, the green peach aphid *Myzus persicae* Sulz., and the two-spotted spider mite, *Tetranychus urticae*.

Figure 1 shows the weekly number of these pests during the study period which lasted for 14 weeks. Results indicated that both whitefly and aphid proved to be the most serious pests infesting tomato plants in the tested greenhouses. One week after the plants were transferred to the greenhouses, the average number of the spider mite, aphid and whitefly was increased to reach 75, 300 and 422 individuals, respectively. At the second week, the population density of whitefly was higher than those of aphid or spider mite (Fig. 1). The maximal increase in number for either whitefly or spider mite was recorded at the 11th week (1275 and 462 individuals, respectively). The peak for aphid was recorded, at the 10th week (475 individuals). Generally the number of the three pests started to decrease by the 10th or the 11th week. This may be due to the damage caused by a fungal of the disease to tomato plants.

Figure 2 indicates that, in the first week of introducing the coccinellid predator to aphid-infested plants, the plants were heavily infested with aphids (average of 450 aphids) where there were only 50 coccinellid adults. From the second week onwards,

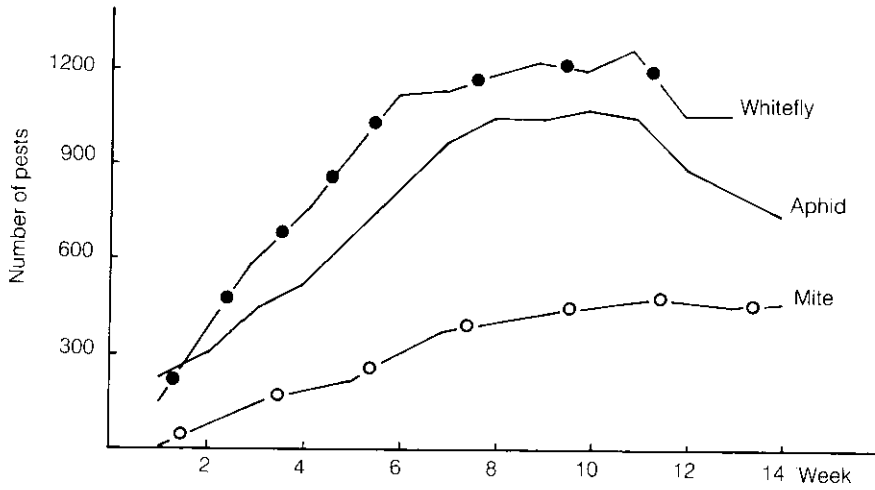


Fig. 1. Weekly numbers of greenhouse pests associated with tomato plants.

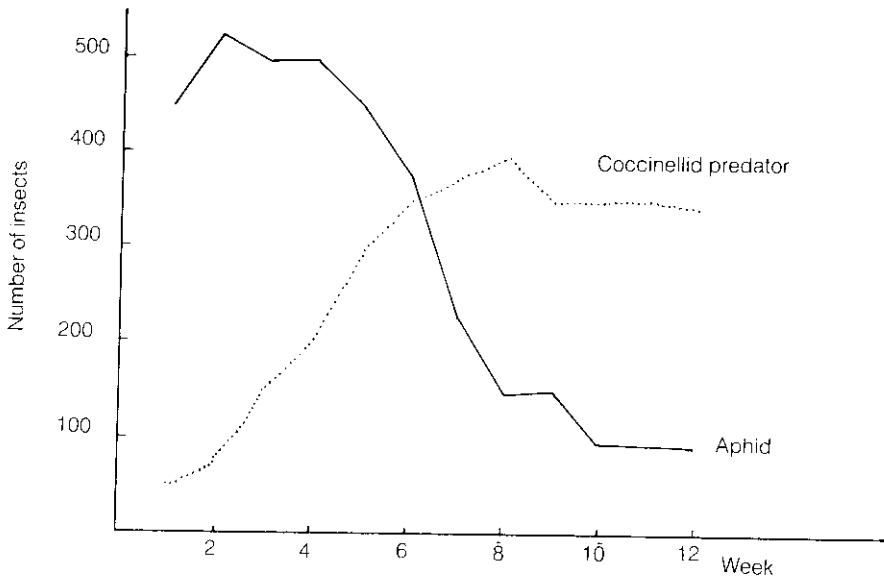


Fig. 2. Weekly changes in population density of the greenhouse aphid, *M. persicae* in the presence of coccinellid predator, *C. septempunctata*.

aphid population began to decrease in number while coccinellid population was progressively increased. From the 7th week, the number of coccinellids was higher than that of aphids (375 and 225 individuals, respectively). The increase in coccinellid population is in agreement with that of Matsuka *et al* [7] who mentioned that feeding on aphids had stimulated ladybird beetles to lay eggs.

Figure 3 illustrates the importance of using another safe method to control the whitefly *B. tabaci*, using sticky, plastic, yellow cellophane sheets for trapping this pest. Results show that, from the first week of introducing yellow cellophane sheets, the average number of trapped whiteflies increased continuously till the 7th week (475 individuals), then the number started to decrease (due to accidental use of fungicides for controlling a fungal disease). Vaishampayan *et al* [5] reported that adults of whitefly show strongly positive response to surfaces in the yellow region. This observation may support the present results. It appears that using cellophane yellow sheets for trapping a considerable number of whitefly, *B. tabaci* adults, might share in initiating a good integrated control program for controlling greenhouse whiteflies.

In spite of the great demand for applying biological and nonconventional pest-control methods in greenhouses, greenhouse growers will certainly use chemical control if the latter is more effective as they cannot tolerate any damage from insects [1].

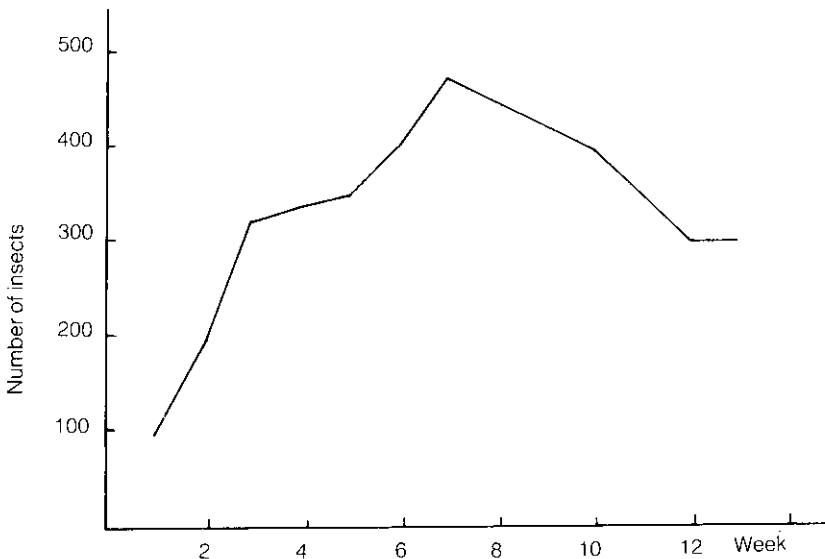


Fig. 3. Weekly number of whitefly trapped by using cellophane yellow sheets in tomato greenhouses.

Therefore it was necessary to study the susceptibility of green peach aphid, *M. persicae* to two recommended organophosphorous insecticides (dimethoate and monocrotophos) in greenhouses.

Data in Table 1 show the LC₅₀ values (ppm) with 95% fiducial limits and slope of regression lines for *M. persicae* on tomato plants sprayed with dimethoate and monocrotophos at 24 and 48 hrs post-treatment. Based on LC's data proved that *M. persicae* was more susceptible to dimethoate than to monocrotophos. The estimated LC₅₀ values for both tested insecticides were 5.8; 17.1 ppm (at 24 hrs post-treatment) and 4.5; 9.1 ppm (at 48 hrs post-treatment), respectively (Table 1). Meng and Wang

Table 1. The LC₅₀ values (ppm) with 95% fiducial limits and slope of regression lines for aphid, *M. persicae* at 24 and 48 hr post treatment on tomato plants sprayed with dimethoate and monocrotophos.

Insecticide	Post-treatment period (hrs)	LC ₅₀ (ppm)	95% Fiducial limits		Slope (b)
			Lower	Upper	
Dimethoate	24	5.8	3.1	10.5	1.40
	48	4.5	2.8	7.0	2.40
Monocrotophos	24	17.1	9.6	31.3	0.96
	48	9.1	5.6	14.6	1.30

[8] mentioned that dimethoate had a good killing effect on cotton aphid, *Aphis gossypii*. On doubling the post-treatment period (from 24 to 48 hrs), the efficiency of the subject insecticides (especially for monocrotophos) and the susceptibility of aphids to these insecticides increased. The increase in the slope value of the obtained LC-p lines (Table 1 and Fig. 4) at 48 hrs post-treatment, and the decrease of the calculated LC₅₀ values, may support the present findings.

In general, the above mentioned results may suggest the possibility for using dimethoate and monocrotophos as selective insecticides for controlling greenhouse aphids in integrated pest management programme. Application of chemicals at a time when natural enemies can not be seriously affected (proper timing) or spraying individual plants or groups of plants in the most seriously infested zones (selective spraying), may reduce the adverse effects of pesticides to natural enemies. Further investigations seem to be necessary to confirm these suggestions.

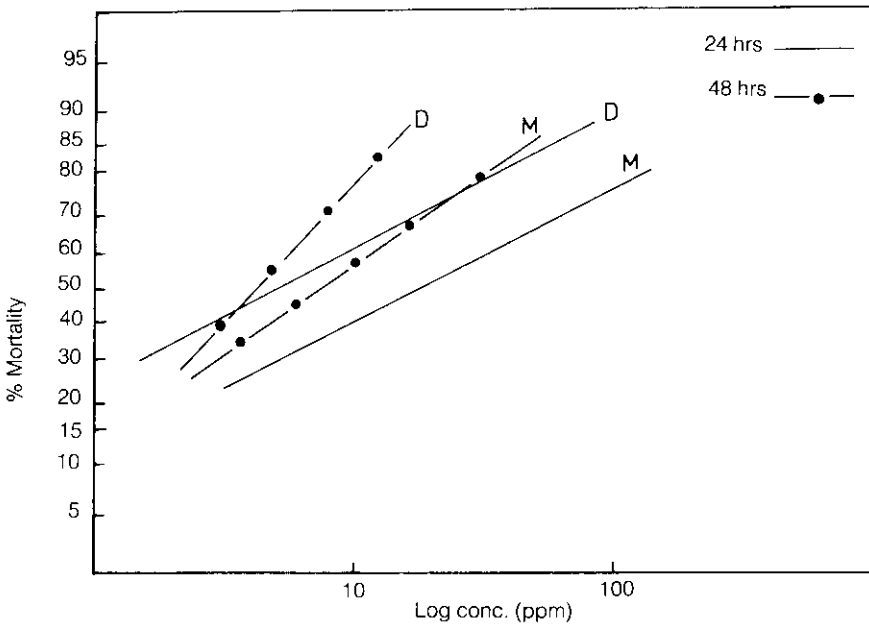


Fig. 4. LC-P lines of the aphid, *M. persicae* fed on tomato plants sprayed with dimethoate (D) and non-crotophos (M).

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المكافحة المتكاملة لبعض آفات الصوب في مصر

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ملخص البحث . تزداد بإضطراب المساحات التي تستخدم فيها الزراعة المحمية . ومن المعروف أن نجاح الزراعة في الصوب المحمية يعني في المقام الأول عدم تعرضها لمخاطر الآفات . وباستخدام المبيدات في مكافحتها يعرض الإنسان لمخاطر كبيرة . ولهذا فإن الرجوع إلى المقاومة الأحيائية والطبيعية هي الأفضل ولهذا فإن استخدام المكافحة المتكاملة أمكن إنجازه باستخدام الأعداء الطبيعية والمصائد الضوئية اللونية في جذب الحشرات لألوانها المفضلة جنباً إلى جنب مع تحديد استخدام المبيدات المناسبة في الأوقات المناسبة .

وأجرى البحث على الطماطم في الصوب وتم حصر أهم الآفات ومنها الذباب الأبيض والمن وبعض الأكاروسات التي تصيب الطماطم . ووجد من الحصر أن أهم الآفات الأكثر انتشاراً هي المن والذباب الأبيض . وقد استخدم أبو العيد ذو السبع نقطاً في المقاومة الأحيائية بعد تربيته على بيئة غذائية ثبت نجاحها بطريقة كبيرة وهي مسحوق ذكور نحل العسل . وقد أدخل للصوب لمكافحة المن حيث قلت أعداد المن بسرعة من الأسبوع الثاني مع زيادة في أعداد أبو العيد .

ومن ناحية أخرى باستخدام المصائد اللونية الصفراء من ورق السلوفان وبها مادة لاصقة والتي وضعت بين النباتات ، تم جذب أعداد كبيرة من الذباب الأبيض خلال فترة المعاملة . علاوة على ذلك تم تحديد نوعين من المبيدات المناسبة لمكافحة المن في الصوب وهما الدايمثويت والنوفاكرون . وقد أثبتت التجارب أن المن أكثر حساسية للدايمثويت عن النوفاكرون . ونأمل من هذه الدراسة أن تكون أساساً في مجال المكافحة المتكاملة في الزراعات المحمية .