J. Plant Prot. and Path., Mansoura Univ., Vol.9 (5): 297 - 299, 2018

Assessment of Dispersal and Parasitism of the Laboratory Reared *Trichogramma evanescens* West. under Field Conditions

Hassan, K. A.[1]; S. M. Hashim[1]; Inas M. Y. Mostafa[1]; A. S. Sanad[1] and Naglaa F. Abdel-Hameid[2]

[1]Plant Protection Research Institute, Agric. Res. Center, MOA, Giza, Egypt.

[2]Plant Protection Dep., Faculty of Agriculture, Benha Univ., Egypt.

ABSTRACT

Trials were conducted in a cotton field at Qaha Research Station, Qaluobia governorate, Egypt, to evaluate the dispersal ability and parasitism rate by the egg parasitoid *Trichogramma evanescens* West. (Hymenoptera: Trichogrammatidae), as well, to estimate the effect of parasitoid density from the releasing site on parasitism rate. Obtained data showed a limited dispersal ability for the parasitoid. The parasitism rates at 0, 50, 100, 150 and 200 cm. differed statistically from each other, being highest in the *S. cerealella* eggs placed at the shortest distance (43.03, 18.12, 10.92, 8.77 and 5.6%, respectively). The effect of releasing point and density on parasitism rate were also estimated. Increasing parasitoid density raised the rate of parasitism. When 2000, 3000 and 4000 parasitoids were released from the release point, the parasitism rates (mean percent ages for the whole 5 distances), were 33.21, 38.13 and 42.65%, respectively.

Keywords: *Trichogramma evanescens*, Dispersal ability, parasitism.

INTRODUCTION

Trichogramma species (Hymenoptera: Tricho - grammatidae) are widely used egg parasitoids for biological control of insect pest species on different crops through augmentation and release. It is a natural enemy of many harmful lepidopteran insect pest species on crops and vegetables (Jalali and Singh, 1993). *Trichogramma* has been used against the lepidopteran pests of cotton, cabbage, apple and tomato (Smith, 1996).

Dispersal ability and parasitization rate of parasitoid wasps under field conditions are desired characteristics for success of biological control programs. Determining the dispersal ability of *Trichogramma evanescens* West. in the field is important for developing effective releasing techniques and for predicting the efficiency of such releases. Dispersal ability not only ensures that insects become uniformly distributed within the releasing areas, but can also reduce the number of release points per unit area, (Wright *et al.* 2001).

One of the factors which has a clear influence on the efficiency of bio-control release systems is the dispersal and host-location behavior of the released wasps (e.g. Bigler, 1994). From the behavior factors; walking or flying, is most important for dispersal of *Trichogramma*, is still a matter of controversy (Flanders, 1937; Smits, 1982; Pak *et al.*, 1985). After mating at the site of emergence, which is the first priority for arrhenothokous, Trichogramma, the female starts searching for hosts. If suitable hosts are not present in the immediate vicinity, the parasitoid has to move away from the place of emergence in order to locate a host patch. After the females have mated and left, the males will also have to disperse if they are to mate again (Keller *et al*., 1985).

Many factors influence the speed of *Trichogramma* dispersal, such as wind speed, crop type and total leaf area of the crop (Bigler, 1983).

The distance from the release point at which a sufficient level of parasitism is found varies from 5 to 50 m, depending on the *Trichogramma* species and the crop (Franz and Voegelé, 1974).

The present study aimed to estimate the *T. evanescens* dispersal under field conditions, as indicator of searching capacity. As well, the rates of parasitism were compared with at various densities from release points.

MATERIALS AND METHODS

1. Rearing of the parasitoid and hosts:

The eggs of Angoumois grain moth *Sitotroga cerealella* (Oliver), used as a rearing host for *Trichogramma* , were obtained from its rearing laboratory in the Plant Protection Research Institute, Agricultural Research Center, Giza, Egypt. The parasitoid *T. evanescens* was reared on *S. cerealella* eggs (<24 hrs. age); eggs were glued on cardboard stripes and then offered for *Trichogramma* adults at the ratio of one parasitoid card to three host egg cards in glass jars (2-liter capacity). Egg cards were renewed daily to avoid super-parasitism.

A preliminary experiment was carried out in a cotton field of about 1/2 a feddan located at Qaha Agricultural Research station, Qalubiya governorate in order to determine the flying distance of *Trichogramma* adults. Within this area, a total of 60 replicates of about 4x4m. each were chosen for receiving the desired treatments (15 for dispersal) of *Trichogramma* adults and 45 for studying the effect of density of released adults. Generally, no parasitism was observed to occur at 300 cm. distance from releasing center.

2. Dispersal ability of *Trichogramma* on cotton plants:

The center of each plot was the site of starting release. At this site, a card containing 1000 parasitised blackish eggs just before emergence or of few adults emerged was stapled to plant leaves at 50 cm. height from the ground. A card containing 500 unparasitised *S. cerealella* eggs was stapled to cotton leaves (at 50 cm. height from the ground at any of the experimented distances (0, 50, 100, 150 and 200 cm. from the releasing center. Another 9 cards were stapled around the releasing point at the same distance (Fig. 1).

After 24 h of release, *S. cerealella* cards were collected and incubated at 25 °C. Parasitism was assessed by checking for the presence of blackened eggs, and the number of parasitized eggs was counted on each egg card.

3. Effect of density of parasitoid at the releasing point on parasitism percent :

In the second experiment, the parasitized eggs card of the desired density (2000, 3000 or 4000 eggs just

before adults emergence or of few adults emerged) were stapled, each eggs density at the same mentioned distances.

Analysis of variance was done on all data (one and two ways ANOVA) and Duncan's multiple range test was used to separate the means (Snedecor & Cochran 1980**).**

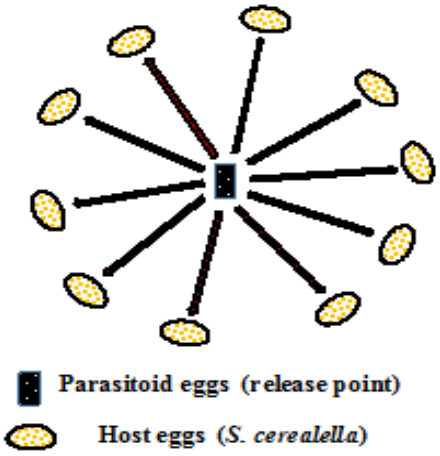

Fig. 1. Diagram showing the release point (Parasitoid egg cards) surrounded by the host eggs.

RESULTS AND DISCUSSION

a. Dispersal ability of *Trichogramma* on cotton plants:

Data given in Table1(1), indicated that the parasitism rate by *Trichogramma* in *S. cerealella* eggs decreased as the pest eggs were farther from the parasitoid releasing sites. The parasitism rates at 0, 50 100, 150 and 200 cm from releasing site differed statistically from each other, being highest in the *S. cerealella* eggs placed at the shortest distance (43.03, 18.12, 10.92, 8.77 and 5.6%, respectively). The distance at which the emerging parasitoid adults can disperse from a release point is one of the most important factors in a *Trichogramma* program, (McDougall *et al.* 1997). Decreases in the parasitization rate by *Trichogramma* were reported to be dependent on the distance from release points in crop fields, fruit orchards, and forest stands (Bigler et al. 1988; Smith 1988; Castaneda 1990 and Wang and Ship 2004). In the present study, decreases in parasitism rates were also recorded on cotton plants as the distance from the release points was longer. The results in this trial showed that the parasitism rate for all designed distances during the 1st day after release was 25.9%, while in the 2nd day it was 16.2% and finally during the 3rd day it was 9.4%.

Table 1. Parasitization of *Trichogramma evanescens* at different distances from the elease points during 3 days in the cotton field.

Distance from release point (Cm	N	Days after release: 1st day M. Number of parasitized eggs	1st day % parasitism	2nd day M. Number of parasitized eggs	2nd day % parasitism	3th day M. Number of parasitized eggs	3th day % parasitism	Mean of total parasitized eggs	% of total parasitism
Zero (0)	500	344.4±35.9[a]	68.9	203.4 ± 5.1[a]	40.68	97.6 ± 7.1 [a]	19.52	645.4	43.03
50	500	116.0 ± 5.7 [b]	23.2	93.6 ± 5.3 [b]	18.72	62.2 ± 8.2 [b]	12.44	271.8	18.12
100	500	74.0 ± 6.4 [c]	14.8	46.4 ± 6.2 [c]	9.28	34.0 ± 4.2 [c]	6.8	154.4	10.29
150	500	64.0 ± 4.9 [c]	12.8	38.0 ± 3.8 [d]	7.6	29.6 ± 3.9 [c]	5.92	131.6	8.77
200	500	49.8 ± 4.8 [c]	9.96	22.6 ± 3.4 [e]	4.52	11.6 ± 2.2 [e]	2.32	84.0	5.6
300	500	0	0	0	0	0	0	0	0
Mean%parasitism			25.9		16.2		9.4		
L.S.D		22.17		6.41		7.30			

Means followed by the same small litter at the same column are not significantly different

Many studies have shown that parasitism by *T. evanescens* decreased with a distance of (4-50 m) from the release point in field crops, fruit orchards, or forest stands (Yu *et al*., 1984; Bigler *et al*., 1988; Smith, 1988). Wang *et al.* **(**1996**)** found that most *Trichogramma ostriniae* dispersed only 2 m from the release point in greenhouses, which is similar to the results from the present study for *T. evanescens.* The limited ability of dispersal in the current study was unexpected as the trial was conducted in open cotton field with fully developed plant canopy, the plant canopy was continuous from plant to another (i.e., plants touch each other), also, the released species was *T. evanescens* which is the Egyptian local strain known to be used in the Egyptian cotton plantations. The limited ability of dispersal for *T. evanescens* in the present work may be attributed to its rearing for decades in the laboratory, so more research studies should be implemented upon other crop host plants as well in fruit orchards to determine the reason and to design other trials to improve the parasitoid dispersal capacity.

b. Effect of release point density:

Data presented in Table 2, confirmed that increased parasitoid density caused an increase in the rate of parasitism in *S. cerealella* eggs.

Means followed by the same small litter at the same raw are not significantly different Data showed that when 2000, 3000 and 4000 parasitoids were released from the release point, the parasitism rates (mean percentages for the overall mean of 5 distances), were 33.21, 38.13 and 42.65%, respectively . The results confirmed that the highest rate of parasitism (87.76%) was recorded at zero distance when the parasitoid density was 4000. On the other hand, the lowest percentage of parasitism (14.64%) occurred at 200 cm distance when the parasitoid density was 2000. Slight (nonsignificant) changes were observed for parasitism rates between the two distances 100 and 150 cm with the same parasitoid density, those were (20.88 and 19.44%), (25.08 and 24.6) and (31.04 and 28.2%) for the parasitoid densities 2000, 3000, and 4000 respectively for the two mentioned distances 100 and 150 cm., respectively .

Table 2. Parasitism rate with *T. evanescens* according to parasitoid density at different distances from the release point in cotton plantations

Distance from release point (cm.)	Number of parasitized eggs at different parasitoid densities			
	2000	3000	4000	L.S.D
Zero (0)	399.8±8.35^{c}	421.2±7.19^{b}	438.8±4.21^{a}	9.38
% Parasitizatism	79.96	84.24	87.76	
50	155.6±5.41^{c}	192.6±5.13^{b}	223.4±12,42^{a}	11.53
% Parasitizatism	31.12	38.52	44.68	
100	104.4±4.98^{c}	125.4±7.96^{b}	155.2±8.26^{a}	9.95
% Parasitizatism	20.88	25.08	31.04	
150	97.2±5.40^{c}	123.0±6.86^{b}	141.0±8.32^{a}	9.59
% Parasitizatism	19.44	24.6	28.2	
200	73.2±6.38^{c}	91.0±7.01^{b}	107.8±5.40^{a}	8.98
% Parasitizatism	14.64	18.2	21.56	
Total No. of host eggs	2500	2500	2500	
Overall%Parasitizatism	33.21	38.13	42.65	

CONCLUSION

It could be concluded that the local strain of the laboratory reared *T. evanescens* showed a limited ability of dispersal in cotton plantations. Also, results showed a low parasitism rate that slightly increased in case of increasing the parasitoid density. Furthermore, other research projects should be conducted for improving both dispersal ability and parasitism rate by introducing naturally occurring parasitoid individuals to be involved in laboratory rearing. Moreover, cytogenetic studies have to be conducted to search for the best methods of improving the dispersal ability and parasitism rate by *T. evanescens* parasitoids, in order to be recommended**.**

REFERENCES

Bigler F., 1983: Erfahrungen bei der Biologischen Bekämpfung des Maiszünslers mit *Trichogramma*. Schlupfwespen in der Schweiz.- *Mitteilungen für die Schweizerische Landwirtschaft, 31: 14-22.*

Bigler F., 1994: Quality control in *Trichogramma* production, PP. 93-111. In: *Biological Control with Egg Parasitoids* (WAJNBERG E., HASSAN S. A., Eds).- CAB International, Wallingford, UK.

Bigler F, Bieri M, Fritschy A. and Seidel K., 1988: Variation in locomotion between laboratory strains of *Trichogramma maidis* and its impact on parasitism of eggs of *Ostrinia nubilalis* in the field. Entomol . Exp. Appl .49: 283-290.

Castaneda, O., 1990: Unterschungen zur parasitierung der traubenwickler durch eiparasitoiden der gattung *Trichogramma* . PhD Thesis, FA-Geishenheim Univ Hohenhei .111 PP.

Flanders, S. E., 1937: Habitat selection by *Trichogramma*.Annals of the Entomological Society of America , 30: 208 – 210 .

Franz, J.M. and Voegele J., 1974: Les *Trichogrammes* en vergers.- Les organismes auxiliaires en verger de pommiers, OILB/ srop, 1974: 201-210.

Jalali, S.K. and Singh, S.P., 1993: Superior strain selection of the egg parasitoid *Trichogramma chilonis* (Ishii), biological parameters. J. Biol. Control, 7: 57-60**.**

Keller, M.A., Lewis W.J. and Stinner, E., 1985: Biological and practical significance of movement by *Trichogramma* species: a review.- The Southwestern Entomologist, Suppl. 8: 138-155.

McDougall, SJ. and Mills NJ. 1997: Dispersal of *Trichogramma platnery* Nagarkatti (Hym., Trichogrammatidae) from point-source releases in an apple orchard in California. J Appl Entomol 121: 205-209.

Pak, G. A., Van Halder I., Lindeboom R. and Stroet, J. J. G., 1985: Ovarian egg supply, female age and plant spacing as factors influencing searching activity in the egg parasite *Trichogramma* sp..- Mededelingen van de Faculteit der Landbouwwetenschappen Rijksuniversiteit Gent, 50: 369-378.

Smith, SM., 1988: Pattern of attack on spruce budworm egg masses by *Trichogramma minutum* (Hymenoptera: Trichogrammatidae) release in forest stands. Environ Entomol . 17: 1009-1015.

Smith, S.M., 1996: Biological control with *Trichogramma*: advances, successes, and potential of their use. Ann. Rev. Entomol., 41: 375-406.

Smits, P. H., 1982: The influence of kairomones of *Mamestra brassicae* on the searching behaviour of *Trichogramma evanescens* Westwood.- Les Trichogrammes, Antibes, Les colloques de l'INRA, 9: 139-150.

Snedecor, G. W. and Cochran W. G. (1980): Statistical methods, 2nd ed. The Iowa State University Press, Ames, Iowa, 318 PP.

Wang, Z.Y., Zh, D.R. and Hassan, S.A., 1996: The dispersal behaviour of *Trichogramma ostriniae* in greenhouse, A Progress of Research on Plant Protection in China. Proceedings of the Third National Conference of Integrated Pest Management, Beijing, China, PP. 400-404.

Wang, K. and Ship, JL, 2004: Effect of release point density of *Trichogramma pretiosum* Riley (Hymenoptera: Trichogrammatidae) on control efficacy of *Keiferia lycopersicella* (Walsingham) (Lepidoptera: Gelechiidae) in greenhouse tomato. Biol , Control 30: 323-329.

Wright, MG, MP. Hoffmann, SA. Chenus and J. Gardner, 2001: Dispersal behavior of *Trichogramma ostriniae* (Hymenoptera: Trichogrammatidae) in sweet corn fields: Implications for Augmentative releases against *Ostrinia nubilalis* (Lepidoptera: Crambidae). Biol Control 22: 29-37.

Yu, DSK, JE. Laing and EAC. Hagley (1984): Dispersal of *Trichogramma* spp. (Hymenoptera: Trichogrammatidae) in an apple orchard after inundative release. Environ Entomol 13: 371-374.

Trichogramma evanescens West. قياس قدرة الانتشار والتطفل تحت الظروف الحقلية لطفيل الترايكوجراما المربى معمليا

كارم أبو زيد حسن[١] ، صلاح محروس هاشم[١] ، إيناس مصطفى يحى[١] ، أحمد سعيد سند[١] و نجلاء فكرى عبدالحميد[٢]

[١]معهد بحوث وقاية النباتات – مركز البحوث الزراعية – دقى – جيزة – مصر

[٢]قسم وقاية النبات – كلية الزراعة – جامعة بنها - مصر

اجريت التجارب على محصول القطن في محطة بحوث قها محافظة القليوبية لتقييم قدرة الانتشار ومعدل التطفل لطفيل البيض الترايكوجراما وكذلك لتقييم زيادة كثافة الطفيليات من مكان الاطلاق على معدل التطفل . وقد اظهرت النتائج المتحصل عليها قدرة محدودة للطفيل على الانتشار وكذلك اختلفت معدلات التطفل عند مسافات الاطلاق صفر، ٥٠، ١٠٠، ١٥٠ و ٢٠٠ سم ، حيث كانت اعلى نسبة تطفل على بيض فراش الحبوب عندما وضعن على اقل مسافة (٤٣.٠٣ ، ٣٨.١٢ ، ٣٢.٩٢ ، ٢٧.٨ و ٢٥.٦ % على التوالى) . تمت ايضا دراسة تاثير زيادة كثافة الطفيل عند نقطة الاطلاق على معدل التطفل وأدت زيادة الطفيليات من نقطة الاطلاق الى زيادة معدل التطفل عندما تم الاطلاق بكثافات ٢٠٠٠ ، ٣٠٠٠ و ٤٠٠٠ طفيل وكانت معدلات التطفل بالنسبة للمسافات الخمسة (متوسط النسبة المئوية للمسافات الخمسة كلها) ٣٣.٢١ ، ٣٨.١٣ و ٤٢.٦٥ % على التوالى.