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Dispersal of ^{32}P-labelled *Trichogramma chilonis* in rice field

BADAL BHATTACHARYYA[1] and R.D. GAUTAM

Division of Entomology, Indian Agricultural Research Institute, New Delhi 110012, India.

E-mail: Badal23in@yahoo.com

ABSTRACT: **The dispersal of ^{32}P labelled population of *Trichogramma chilonis* in rice crop was studied during *kharif* 2002 and 2003. In the experiments in *kharif* 2002, radioactivity on the rice leaf folder eggs was detected for a distance of 9-12 metre in southern direction (downwind sector). However, at North (upwind sector), the radioactivity could be detected for up to 3-6 metre range. Likewise, the data on radioactivity of the leaf folder eggs in all four directions clearly indicated that the labelled parasitoids moved more or less evenly for up to a distance of 6-9 metre from the release point during *kharif*, 2003.**

KEY WORDS: Dispersal, radio-labelling, rice leaf folder, *Trichogramma chilonis*, ^{32}P.

INTRODUCTION

Following indiscriminate use of synthetic pesticides, inundative release of biotic agents, particularly the trichogrammatids, as pest management strategy, has become very popular. Egg parasitoids, belonging to *Trichogramma* spp., are commonly distributed worldwide and parasitise over 200 species of insect species belonging to 70 families and 8 orders in diverse habitats from aquatic to arboreal environment (Singh and Jalali, 1994). Due to its amenability to mass production, the trichogrammatids have the distinction of being the maximum produced and frequently released natural enemies in the world (Manjunath, 1988). In many management programmes, they fit as a key component because they are found in a wide climatic range. *Trichogramma chilonis* Ishii is one of the most potent wasps and is extensively used in mass releases against a number of lepidopterous pests in Asia (Tuhan and Pawar, 1983; Yadav *et al.*, 1985; Cheung *et al.*, 1991). Temperature and pesticide tolerant strains of this species have already been recorded (Jayaraj, 2002).

Radioactive isotopes are very versatile tools and are being used all over the world in the field of insect ecology (Sethi and Garg, 1981). Researches with radiations and radioisotopes have added knowledge to the understanding of insect behaviour, physiology, ecology and radiation biology and this knowledge has been employed in developing better control techniques. Radioactive isotopes, when used as markers for insect pests, parasitoids and predators, have helped in obtaining valuable information on their flight range, dispersal pattern, population build up, *etc*. This information is very vital for rationalizing control options for

1. Present address: Department of Entomology, Assam Agricultural University, Jorhat-785013 (Assam), India

integrated pest management. Therefore, efforts were made to tag *T. chilonis* with a radioactive isotope (^{32}P) to collect valuable information on their flight range and dispersal pattern. In view of the lack of information on the above mentioned aspects, the present investigation was undertaken during 2000-2003 in the entomological unit of the Nuclear Research Laboratory of IARI, New Delhi.

MATERIALS AND METHODS

The parasitoid, *Trichogramma chilonis* was maintained in the laboratory and the radioactive isotope (^{32}P) was obtained from Bhaba Atomic Research Centre, Mumbai, as orthophosphoric acid in HCl solution. Radio-labelled food was prepared by adding 0.5 mCi of activity to 50 per cent honey solution. A glass tube (15 cm × 4 cm) open at both ends was placed in an upright position and at the top of the tube a piece of parafilm was spread to the maximum thickness. The radio-labelled food was placed onto the parafilm by means of a glass syringe. A second layer of stretched parafilm was superimposed so as to enable the radio-labelled food to remain intact between the two layers. From the other end of the tube, about 1000 parasitoids, that were likely to emerge, were introduced and the tube was plugged. Then the glass tube was kept on a laboratory table in such a way that the parafilm end was facing the light. The parasitoids were allowed to remain in the tube for about 24 hrs after emergence. After feeding on radio-labelled food for about a day, the parasitoids were carefully separated and transferred to non-labelled food for further development. The radio-labelled populations of the parasitoids were then released in the rice field during *kharif* 2002 and 2003. The dispersal of ^{32}P labelled *T. chilonis* was studied by detecting the radioactivity in the eggs of rice leaf folder two days after the release of the labelled parasitoids. Since the leaf folder eggs were not found to be uniformly distributed in all cardinal compass directions, the mean radioactivity (cpm) of the eggs, collected from four directions (North, South, East and West) at distances of 1-3, 3-6, 6-9 and 9-12 metre away from the point of release was recorded under a G.M. Counter in the laboratory.

RESULTS AND DISCUSSION

In *kharif* 2002, the radioactivity was detected for up to 9-12 metre distance in Southern direction (downwind sector) (Table 1). The mean radioactivity varied from 10.80 cpm (1-3 m distance) to 2.12 cpm (9-12 m distance). However, in the North (upwind sector), the radioactivity could be detected for up to 3-6 metre range (5.46 cpm). The average wind speed during the period of experimentation was 2.00 and 1.84 m/sec on the 1st and 2nd day of release of the parasitoid. This indicated clearly that the direction of wind has significant influence on the movement of the parasitoids. This might be due to the small size of *Trichogramma* adults (length varies from 0.4-0.7 mm) and probably low flight speed and when the wind blows at a higher speed, they exhibit poor control over the flight direction. Hence, higher

Table 1. Radioactivity (cpm) on the eggs of rice leaf folder after the release of ^{32}P- labelled *T. chilonis* in rice field (kharif 2002-2003)

Position of hosteggs (m)	*Mean radioactivity (cpm)							
	Kharif 2002				*Kharif* 2003			
	North	South	East	West	North	South	East	West
1-3	7.86	10.80	10.39	8.40	9.20	11.87	10.67	10.00
3-6	5.46	9.59	8.26	6.13	6.54	10.14	9.74	8.40
6-9	0.00	4.13	3.46	0.00	2.27	6.54	4.54	3.87
9-12	0.00	2.12	0.00	0.00	0.00	1.20	0.00	0.00

* Average of three replications

recovery of the parasitoids was observed at the downwind sector. This finding is in agreement with Wang *et al.* (1996) who did not observe any significant difference in terms of parasitization between 1-2 metre and 4-6 metre distances from the site of release, when *T. ostriniae* was released in the corn fields. The present findings are in accordance with the work of Schread and Garman (1933) who observed that *Trichogramma* spp. could move to an average of 6.7 metre in an orchard. Similarly, Feng *et al.* (1989) reported that 61.90 per cent of ^{32}P-labelled *T. dendrolimi* dispersed within 5 metre in the first 6 hrs of release in apple orchard. The present information is also in line with the observations of Jaynes and Bynum (1941), Overholt and Smith (1990), Wang *et al.* (2000) and Rachappa and Naik (2000).

In *kharif* 2003, the maximum radioactivity (11.87 cpm) was detected at 1-3 metre the and lowest (1.20 cpm) at 9-12 metre distance in the southern direction from the release point. The maximum mean radioactivities of west, east and north directions were 10.00, 10.67 and 9.2 cpm, respectively, and were detected at 1-3 metre distances. Likewise, the minimum radioactivities in west, east and north directions were 3.87, 4.54 and 2.27 cpm, respectively, and were noticed at 6-9 metre distances from the release point. The data on the radioactivity of the leaf folder eggs in all four directions clearly indicated that the labelled parasitoids moved more or less evenly for up to 6-9 metre range during *kharif*, 2003. The average wind velocity during the period of experimentation was 0.0 and 0.3 kmph on the 1st and 2nd day of release of the parasitoid and the poor impact of insignificant and weak wind currents was observed on the drift of *T. chilonis*. The low wind speed recorded during the experimental period was not strong enough to show a definite direction. The present findings are in agreement with an earlier report where downwind dispersal of *T. chilonis* was observed in a cotton field at an average wind speed ranging from 1.1 to 1.6 m/sec (Wang *et al.*, 1998). However, the present results are contrary to the findings of Chen and Chiu (1986), who noticed that dispersal of *T. chilonis* in rice field was not affected by winds below the speed of 3.6 m/sec. Chiang and Chiang (1993) also observed that the movement of *Trichogramma* spp. within a maize field was basically against the wind. The results of the present experiments are in agreement with the results of Handricks (1967), Yu *et al.* (1984), Singh and Jalali (1992), Greatti and Zandigiacomo (1995), Fournier and Boivin (1999), and Rachappa and Naik (2000). As per their observations, wind seems to have a significant effect on the dispersal of *Trichogramma* and the parasitization was 20-50 per cent less in the upwind sectors.

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