Impact of egg retention on walking behavior of *Trichogramma chilonis* (Hymenoptera: Trichogrammatidae)

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Abstract

In the present study effect of egg retention on walking behavior of females of *Trichogramma chilonis* (Hymenoptera: Trichogrammatidae) was investigated under laboratory conditions by using a computer based, Abid's trackmove software. Results revealed that 3 days old wasps showed significant increase in their walking activity for searching host eggs as compared to 1 day and 2 days old wasps respectively.

Keywords: *Trichogramma, Hymenoptera, Trichogrammatidae, Walking behaviour, Egg retention.*

Introduction

Egg parasitiods of genus *Trichogramma* are employed worldwide for biological control of insect pests (Smith, 1996). Searching for their host under natural conditions, long-range dispersal and delayed oviposition is often noticed in *Trichogramma* females (Wright *et al.,* 2001; Kuske *et al*., 2003). In many field and laboratory studies recorded range of dispersal is even several meters (Brar *et al.,* 2000; McGregor *et al.,* 2000; Mehetre and Salunkhe, 2000; Wang *et al.,* 2000). For host oriented search, dispersal is mainly achieved by walking (Noldus *et al.,* 1991).

Egg retention or delayed oviposition is demonstrated as refusal to oviposit (Monje *et al.,* 1999; Silva and Stouthamer, 1999; Carriere and Boivin, 2001; Hoffmann *et al.,* 2001; Hansen and Jensen, 2002). Dissections and behavioral observations have showed that such females had a lot of mature ovarial eggs but parasitization was blocked at the stage of arrestment and host recognition (Pavlik, 1993; Reznik *et al.,* 1997, 1998). Earlier studies suggest that percentage of time spent in movement by *Trichogramma* females, delaying oviposition due to unavailability of suitable host eggs was slightly higher, than those for ovipositing females with readily available host eggs (Reznik and Umaraova, 1991).

In all previous studies movement activity was only recorded in the presence of host eggs. Thus the increase in time spent during movement could be assessed by time expenditure for parasitization. Besides host, stimuli also had a strong direct influence on the female's behavior (Gardner and Lenteren, 1986; Nordlund, 1994; Schmidt, 1994). Reznik *et al*., (2001) demonstrated that oviposition by a group of simultaneously emerged *Trichogramma* females was observed to be uniformly distributed in time because of egg retention. Egg retention is thus accompanied with intensive movement activity and this mechanism seems to be even more adaptive when hosts are unavailable.

Relationships between walking behaviour and reproduction has never been investigated in the past. According to Dingle and Winchell (1997) spontaneous movement activity is better option for measure of dispersal. In view of this, present study has been designed to study walking behavior in females of *Trichogramma chilonis* during egg retention without providing host eggs.

Materials and Methods

Females of *Trichogramma chilonis* of age 1, 2 and 3 days were set to walk separately over specially designed grids made on an arena in order to observe their search for hosts (no host eggs were provided). Accuracy of the result depends upon size of grids. Smaller the grid size, accurate will be the results. Grids were numbered in a specific pattern on which computer operates the software (Abid's Trackmove). Grids on which data could be taken easily were selected and a transparent cover slip of 6.6 x 6.7cm with thin boundaries was used to avoid escape of wasps out of the grids. Each day 10 wasps were released singly and observation time for every replication was kept constant i.e. 3 minutes. As the wasps start moving over the grids, software was started and numbers of grids traveled were entered. The whole experiment was carried out under controlled laboratory conditions for temperature, humidity and uniform diet etc.

Results and Discussion

Table 1 shows that all the ten replications for 1 day old wasps have significantly less waking activity than those of 2 and 3 days old wasps respectively. The total distance covered and velocity attained by 2 days old wasps was higher than those of 1 day old ones and they even stayed for less time in the grids and their velocity without stay points was also greater. Same is the case with 3 days old wasps; they showed more higher velocity and covered more distance than those of 2 days old wasps. Their stay inside the gird was least and the velocity without stay points was maximum as compared to 1 day and 2 days old wasps.

Increased walking activity of *Trichogramma chilonis* wasps on each successive day was observed as to be a reaction for host search for parasitization and it increased with the passage of time due to egg retention resulting pressure build up in ovaries. Therefore, 3 days old wasps showed greater walking activity over 2 days and 1 day old wasps respectively.

Present study clarifies and confirms some queries of the previous studies, e.g. a study on the walking behaviour of *Trichogramma* females suggests that walking behavior of *Trichogramma* species (average speed, percentage of time spent moving etc.) and their movement only depends on environmental conditions, primarily on temperature (Fournier and Boivin 2000; Suverkropp *et al.,* 2001). However in the current study it was observed that physiological state of female can also be important. As all observations were collected under controlled conditions (temperature, humidity, diet, etc.) so difference in velocity and distance covered was observed as direct effect of egg retention. In another study with provision of non preferred hosts among preferred

Table-1: Walking behavior of *Trichogramma chilonis* females observed in relation to egg retention.

Replications (Wasps Released/Day)	Wasps Age	Observation Time	Total Distance Covered	Total Average Velocity	Velocity Without Stay	Total Stay Time
10	1 day	3 minutes	233.4 cm	2.013 cm/sec	3.216 cm/sec	43.29 sec
10	2 days old	3 minutes	274.2 cm	2.366 cm/sec	3.531 cm/sec	39.67 sec
10	3 days old	3 minutes	354.2 cm	2.94 cm/sec	3.804 cm/sec	23.41 sec

ones, it was observed that increase in movement and dispersal in parasitizing *Trichogramma* females was a direct consequence of their search for appropriate host. In accordance to it, present study without provision of any host eggs suggests that increased movement was due to the direct effect of pressure build up in ovaries of female wasps due to egg retention and in result of this, females accelerate their search for host eggs. Each next day this search was increased because the eggs get mature in the ovaries and were needed to oviposit at the earliest.

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