

## MASS REARING OF *SITOTROGA CEREALELLA* (OLIVIER) (LEPIDOPTERA: GELECHIIDAE) IN NEWLY DESIGNED CHAMBERS

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Mass rearing of *Sitotroga cerealella* (Olivier) (Lepidoptera: Gelechiidae) a factitious host of *Trichogramma chilonis* (Hymenoptera: Trichogrammatidae) commonly used in the laboratory was compared with small scale rearing in glass jars. In mass rearing of host, *S. cerealella* eggs measuring 0.4, 2.5, 3.3, 4.1 and 5.0 g after seeding on 3, 4, 5 and 6 kg of wheat grains on three trays inside each tin chamber gave 43.7, 52.4, 59.6 and 77.9 g of eggs, enough to prepare 991, 1179, 1326 and 1756 number of *Trichogramma* cards, respectively as compared to small scale rearing by the use of glass jars, where 3.7 g of eggs were obtained to produce 84.4 cards of *Trichogramma*. Mass rearing in tin chambers, where 6 kg grains were used, gave 21% more eggs production than glass jars to get enhanced production of the reared insects.

**Keywords:** Mass rearing, *Sitotroga*, *Trichogramma*, Tin chambers

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### 1. Introduction

*Sitotroga cerealella* (Lepidoptera: Gelechiidae) is a major factitious host for mass production of *Trichogramma* in insectaries for commercial use in field because of its easy and inexpensive rearing [1, 2]. *Trichogramma* have been used in pest controlling since long. During past few years its use gained importance in integrated pest management of cotton bollworms in Pakistan [5]. Different species of *Trichogramma* are reported to parasitize eggs of hosts in order lepidoptera, coleoptera and neuroptera [3, 4]. Therefore, being lepidopterous insect, rearing of *Trichogramma* on *S. cerealella* has been successful. Mass rearing of *Trichogramma* has increased its use in pest management against different pests. The mass rearing of bio-control agents leads towards the commercialization that depends upon the frequent availability of insectaries for efficient, reliable and inexpensive supply of factitious host and their natural enemies. To meet the challenges of commercialization, the mass production of factitious host needs quality parasitoids to meet in the ecological conditions of field. It requires efficient and standardized mass rearing procedures i.e., mechanized and spaced efficient production system, use of available

cheapest rearing media and evaluation of quality. Integrated pest management by natural enemies needs the mass scale availability of biocontrol agents and their mass rearing requires factitious host capable of producing many generations successfully [6, 7]. Flander was the first who used the mass rearing of *Trichogramma* in 1929 by using the factitious host *Sitotroga cerealella* [8]. Rearing hosts are potentially important from the nutritional quality point of view of host eggs and survival of *Trichogramma* and other egg parasitoids released into the crops as a biological control agent [9]. In Pakistan common host to rear biocontrol agents in laboratories is *Sitotroga cerealella* whose rearing are in practice by using wheat grains. Its rearing is in practice by using glass jars that are insufficient to meet the demand of insectaries. This method needs much labour and give less production of eggs insufficient to meet the demand of parasitoids rearing on mass scale. Modified tin chambers were fabricated from local market and installed in bio-control laboratories at NIAB, Faisalabad. Nathan *et al.* (2006) [10] has conducted experiments on nutritional indices for wheat and rice reared factitious host (*Corcyra cephalonica*), larvae were intermediate between the indices for the larvae that were reared on sorghum and millet. McLaren and Rye, (1983), [11]

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has developed an efficient method for mass rearing of *Trichogramma* wasps on eggs of *Sitotroga cerealella* (Olivier). Parasitoid eggs incubated for 6 days at 27°C with artificial illumination (12:12) and then for 6-7 days at 15°C in darkness yielded active adult parasites after 2 or 1 hour respectively followed by weekly released exposure to 23°C. Parasitoids quality that reared from factitious host can be evaluated using fitness parameters as emergence rate, fecundity, activity and parasitism rate [12]. Present study was therefore, planned to get quality eggs of host, *S. cerealella* to rear egg parasitoid *T. chilonis* by introducing locally fabricated tin chambers and compare with rearing in glass jars through manual handling.

## 2. Materials and Methods

The experiments were conducted at mass rearing laboratories of beneficial insects at Nuclear Institute for Agriculture and Biology (NIAB), Jhang Road, Faisalabad, Pakistan, at 25±2°C temperature, 65±5 % humidity with 10:14 light and dark period. Tin chambers of size 55.88 × 45.72 × 45.72 cm with three trays each of size 45.72×35.56 × 3.81 cm (length, width and height respectively) inside the chambers and two funnels at lower end for the collection of adults were used for mass rearing of *Sitotroga cerealella* (Figs. 1, 2). These chambers were kept on stands 213.36 cm high and 124.46 cm wide accommodating six such cages on a stand. Three trays inside the cages were filled with wheat grains free of mites and contamination after hot water treatment for about five minutes at boiling point and sun dried upto 8% moisture retained inside the grains and then chilling treatment in freezer below 0°C. The top of chambers was covered with thick black cloth to avoid the escape of moths. Both funnels on lower ends of each rearing chamber were fitted with plastic jars of 5 lit. capacity for adult collection. Moths were collected automatically in plastic jars through funnels on lower ends of chambers. After collection of adults, plastic jars with adults were shifted to trays of size 32.29×25.40 cm for egg laying. Eggs were collected at 24 hrs intervals until the mortality of adult hosts. Experiment was divided into four treatments having 3, 4, 5 and 6 kg wheat grains inside the three trays, seeded 2.5, 3.3, 4.1 and 5.0 g of eggs respectively having 96% viability. Wheat grains of variety Inqulab 90 were used in the present experimentation.



Figure 1. A single host rearing chamber.



Figure 2. Rearing chambers on stand.

This mass rearing of host was compared to small scale rearing conducted in same laboratory under same conditions by using glass jars of 5 kg capacity having 500 g of wheat grains seeded with 0.4 g of host eggs. Adults of host were collected by using suction pumps from glass jars. In both the experiments host eggs were seeded on wheat grains by 1:1.5 ratios of eggs to grains. Treatments

Table 1. Comparison of *S. cerealella* rearing by using different combinations of grains in tin chambers.

Weight of wheat grains (Kg)	Period of <i>S.c.</i> development (Days)	<i>S.c.</i> eggs seeded (g)	<i>S.c.</i> eggs received (g)	Increases of <i>S.c.</i> egg production over control (%)	<i>T.c.</i> cards prepared (no.)	Parasitism by <i>T.c.</i> on <i>S.c.</i> eggs (%)	Emergence of <i>T.c.</i> adults (%)
3	27 NS	2.5	43.7±2.44 d	+11.8	0912.0±23.67 <sub>c</sub>	88.8±1.13 NS	90.1±1.45NS
4	27	3.3	52.4±2.47 c	+14.1	1179.0±55.3 b	89.9±2.36	89.2±1.30
5	27	4.1	59.6±1.94 b	+16.1	1326.6±56.3 b	90.3±1.16	90.4±0.97
6	27	5.0	77.9±1.53 a	+21.0	1756.6±34.84 <sub>a</sub>	90.2±0.69	91.2±1.66
0.5 (Control)	27	0.4	03.7±0.30 e	-	0084.3±6.34 d	90.0±1.04	89.3±1.23

Means ±SE, sharing common alphabets are statistically similar at  $P < 0.05$  using DMRT test.

in all the experiments were replicated thrice. Host eggs received from both the methods of rearing were measured and compared. Eggs were used in preparation of *Trichogramma* cards and each card contained 2000 host eggs. Weight of 100 g of wheat was counted as 2500 number of grains and 1 g of eggs of host were counted as 45000 numbers, measured by four digit electronic balance. Data on host developmental period, adult emergence and percent parasitization were recorded and statistically analyzed following Steel and Torrie (1980) [13] and significance of results was tested by using DMRT.

### 3. Results and Discussion

Result showed significant differences among the four treatments having 3, 4, 5 and 6 kg of wheat grains inside each rearing chamber (Table 1). In treatment where 3 kg grains were offered against 2.5 g of host eggs seeded gave 43.7 g of eggs that produced 912 number of parasitoid cards with 88.8% parasitism having 90.1% emergence with 11.8% increased egg production as compared to control. In treatment, where 4 kg of wheat grains were offered to host eggs, we received 52.4 g host eggs sufficient to prepare 1179.0 number of *Trichogramma* cards with 89.9 parasitism and 89.2% emergence of these parasitoids were recorded. By using 5 kg wheat grains we got 59.6 g of host eggs used to prepare 1326.6 cards, 90.3 and 90.4% parasitism and emergence of parasitoids, respectively with 16.1% more egg production in comparison to control. While in treatment, where 6 kg of grains

were used against 5 g of host eggs in culture that produced 77.9 g eggs, sufficient to prepare 1756.6 *Trichogramma* cards yielded 21.0% more egg production as compared to control, with 90.2% parasitism and 91.2% emergence. Here it was inferred from the results that among the four treatments, where 6 kg combination of grains in tin chamber were used gave best suited results in mass rearing of host to get maximum population of adults that gave highest eggs as compared to other treatments. Parasitism and emergence was remained at par in all treatments. In control treatment, result showed that 3.7 g eggs were received to prepare 84.3 number of *Trichogramma* cards. Parasitization of *Trichogramma* wasps on these host eggs were observed as 90.0% with 89.3% emergence of parasitoids. Our results in present study are in line to the work reported by the previous workers as McLaren and Rye (1983) [11] who had successfully reared *S. cerealella* for *Trichogramma* and quality was maintained by observing different developmental parameters as reported in this study. An increase in performance of wasps reared on *S. cerealella* and *Ephesia kuehniella* was reported by Hoffmann *et al.* (2001) [14] that agreed to our work.

### 4. Conclusion

From the present study it is concluded that mass rearing of *S. cerealella* in tin modified rearing chambers are 21% more capacious than that of rearing in glass jars to get quantity host eggs of 77.9 g and with a parasitism of 90.2% by adult parasitoid of *T. chilonis* on these host eggs.

Moreover by using these mass rearing chambers we can also save time with quick handling and easy sanitation in insectaries.

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