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Effect of cereals diet on the life cycle of Corcyra Cephalonia under laboratory condition in Rajnandgaon

M. K. Chandrakar
bsahorti@gmail.com
Pt. KLS College of Horticulture and Research Station, Rajnandgaon, Chhattisgarh

B. S. Asati
bsa_horti@yahoo.co.in
Pt. KLS College of Horticulture and Research Station, Rajnandgaon, Chhattisgarh

S. Sahu
sssahu0084@yahoo.com
Pt. KLS College of Horticulture and Research Station, Rajnandgaon, Chhattisgarh

ABSTRACT

An experiment was conducted from December 2018 to March 2019 in the Biological Control laboratory, CHRS, Rajnandgaon at 26 ± 1ºC, RH 60 ± 10%. The studies on the life cycle of *C. cephalonica* reared on different cereals diets were observed in the terms of fecundity, Incubation period, larval period, pupal period, longevity, total life cycle and morphological measurement of full-grown larvae. The results observed that the diet media sweet corn (100%) was the best media for mass production of *C. cephalonica* due to their short incubation period, short larval period, short pupal period, short male and female longevity and short male and female total life cycle with 4.73, 24.20, 8.27, (3.00 and 4.67) and (40.20 and 41.87) days and followed by the second best and cheapest diet media maize (100%) with 5.20, 32.00, 8.53,(3.07 and 5.33) and (48.80 and 51.06) days, respectively. High fecundity (255.60 no. of eggs/female), maximum larval length (12.75 mm) and weight (26.07 mg) was observed in sweet corn (100%) followed by maize (100%) with fecundity 250 no. of eggs/female, 12.15 mm larval length and 21.93 mg larval weight.

Keywords: *Corcyra, Rice, Wheat, and Maize*

1. INTRODUCTION

The rice moth *Corcyra cephalonica* is the major pest of rice, wheat, sorghum, corn (maize), cocoa, peanuts, almonds, dates, groundnut, cotton seeds, coffee, spices and cocoa beans, cashews, raisins and millet (Locatelli and Limnota, 1998; Harita *et al.*, 2000) The moth *C. cephalonica* is one of the most used factitious hosts for bio-control agents production in several countries of the world. In India, Rice meal moth is being utilized in various biocontrol research, developmental and extension units for mass production of a number of natural enemies (Jalali and Singh, 1992). In India, the rice meal moth is mass-produced as a laboratory host for rearing several natural enemies (Lalitha and Ballal, 2015). Improved knowledge of the nutritional ecology of parasitoids and hosts can lead to improved understanding of the host plant, host, and parasitoid abundance, as well as to improved efficiency and quality of natural enemies production in mass-rearing programs (Senthil *et al.* 2006). The rearing host diet is potentially important to the nutritional quality of host eggs and the survival of bio-agents released into the environment as a biological control agent (Hunter, 2003). Minimize the cost of production by optimizing the grain utilization by *C. cephalonica* and healthy production is needed for mass production of Bio-control agents. Therefore, an attempt has been made to study the biology of rice meal moth, *Corcyra cephalonica* reared on different solo cereal diets and their combination under laboratory conditions.

2. MATERIALS AND METHODS

The research was carried out at the biological control laboratory, CHRS, Rajnandgaon and the research was conducted at 26 ± 1ºC, RH 60 ± 10%. Thirteen treatments of host diets were prepared under three replications and CRD designed each as mentioned in the table given below.

Table:1 13 different diets combinations (treatmens) for rearing of *C. cephalonica*

S no.	Treatment	Notation
1.	Rice (100%)	T_1
2.	Wheat (100%)	T_2
3.	Maize (100%)	T_3
4.	Rice+Wheat (50%+50%)	T_4
5.	Rice+Maize (50%+50%)	T_5

6.	Wheat+Maize (50%+50%)	T_6
7.	Rice+Wheat (75%+25%)	T_7
8.	Rice+Maize (75%+25%)	T_8
9.	Wheat+Maize (75%+25%)	T_9
10.	Rice+Wheat (25%+75%)	T_{10}
11.	Rice+Maize (25%+75%)	T_{11}
12.	Wheat+Maize (25%+75%)	T_{12}
13.	Sweet corn (100%)	T_{13}

1000 g of grains were kept in each plastic basin of size diameter (30 cm) height (20 cm). The grains were sterilized in a hot air oven for one hour at 100^0C. After cooling the grains were powdered coarsely. 5 ml of 10% honey solution along with 5g of yeast and a pinch of Streptomycin were mixed in each container. Finally, the containers were charged with 0.4 cc (about 7500 eggs) of *C. cephalonica.* Every container was covered with a fine muslin cloth and secured tightly with the help of a plastic cord. Observations were recorded after two days onwards to note the hatching of the eggs. A small representative sample from each treatment was kept separately in a small Petri dish to observe and to record the length and weight of the full-grown larvae. For studying the difference in fecundity a pair of newly emerged males and females from each treatment were kept in separate beakers in three replications. A cotton swab soaked in 10% honey solution was provided for moths stuck to the base wall of the beaker. Fecundity (No. of eggs, incubation period, larval period, pupal period, the longevity of adults and total life cycle (days) were recorded on different diets per treatment.

3. STATISTICAL ANALYSIS

The experimental design was a complete randomized block design with three replications. The calculation was made on the mean data (with transformation wherever needed) of the study. Entire Statistical Analysis was done using the Statistical Analysis System SAS (Version: 9.2).

4. RESULTS AND DISCUSSION

The experiment was conducted with cereals (rice, wheat, maize and sweet corn) as solo diets along with their combinations comprising thirteen treatments.

4.1 Effects on the fecundity of *C. cephalonica* reared on different diets.

The fecundity of rice meal moth, *C. cephalonica* varied significantly (Table no.2 & Fig no.1) according to different treatments where T_{13} (sweet corn100 percent) recorded the highest number of eggs laid per female (255.60 eggs/female) followed by T3 (wheat 100 percent) (250.47 eggs/female). the least number of eggs were laid in T_1 (rice100 percent) (114.80 eggs/ female). Bhardwaj *et al.*, (2017) recorded the fecundity of rice meal moth *C. cephalonica* varied significantly according to different treatments T11 (rice+jowar+maize) recorded the highest number of eggs laid per female (348.00 eggs/female) and the least number of eggs were laid in T1 (rice) (101.67 eggs/female).

4.2 Effect on the incubation period, larval development period, pupal development period and adult longevity of *C. cephalonica* reared on different diets.

The studies show (Table No.2 and Fig No. 2.& 3) that the incubation period was longest in (sweet corn 100 percent) T_{13} (4.73 days) and the shortest incubation period found in T_1 (rice100percent) (6.40 days). Osman *et al.* (1983) documented a similar trend of incubation period ranging from 5.2 and 6.2 days at 28±1 ºC and 30±1ºC temperature, respectively.

The longest larval period was found again in rice100 percent T_1 (42.80 days) followed by T_7 (rice75+wheat25 percent) and the shortest larval period was T_{13} (sweet corn 100 percent) (24.20 days) followed by Maize 100 percent (32.00 days). These results are in close agreement with Kumar and Murthy (2002) who documented a larval period of 23 days on maize, 26 days on sorghum, 33 days on wheat and 35 days on rice. Mbata (1989) also reported larval development period of 23.48 and 35.75 days on maize and rice respectively. The longest pupal period was seen on rice T_1 (11.60 days) and the shortest pupal period seen in T_{13} (sweet corn) (8.27 days) followed by T_3 (maize 100 percent) (8.53 days). Concurrent variations were documented by Kumar and Murthy (2002) as he observed pupal period was 7.75 days on maize, 7.78 days on sorghum, 8.02 days on wheat and 8.23 days on rice.

In longevity of *C. cephalonica* adults, the experiment showed that males emerged 2-4 days prior to the female, Similar conclusion was also drawn by Etman *et al.,* (2009). The short male and female longevity with 3.00 and 4.67 in sweet corn 100 percent diet and followed by the second diet media maize (100%) with 3.07 and 5.33 and (48.80 and 51.06) days, respectively. The shortest adult longevity found inT_1 (rice100 percent).

4.3 Effects on the larval length and larval weight of *C. cephalonica* reared on different diets:

The weight of *C.cephalonica* larvae was measured at different instars by an electronic balance. An average of ten full-grown larvae was taken for each observation. The data in Table 2. and Fig 4. indicates that In the full-grown larvae, the larval length was highest in T_{13} (sweet corn 100 percent) (12.75 mm) followed by T_3 (maize 100 percent) (12.15 mm), and T_{12} (wheat 25+maize75 percent) (11.65 mm), T_{11} (rice 25+ maize 75 percent) (11.59 mm) and T_6 (wheat 50+ maize50 percent) (11.30 mm) were at par with T_3 (maize 100 percent). The lowest larval length was again noticed in T_1 (rice100 percent) (09.43 mm). Similar results also found by Bhardwaj *et al.* (2017) reported the maximum larval weight recorded at each instar varied significantly except in 1^{st} instar larvae. In the second, third, fourth, and fifth instars, significant maximum mean larval weights were recorded in the treatment T_{11} comprising of (rice+jowar+maize) with 5.17mg, 46.00 mg, 68.33mg, and 86.00 mg respectively and significantly average minimum larval weight was recorded in the treatment T_1 of solo rice in all the instars. In the second, third, fourth, and fifth in stars, significant maximum mean larval length were recorded in the treatment T_{11} comprising of (rice+jowar+maize) with 7.00mm, 9.33mm, 16.67

mm, and 20.33 mm respectively, while significantly average minimum larval length was recorded in the treatment T_1 of solo rice in all the instars.

4.4 The total life cycle of *C. cephalonica* reared under different diets

The shortest life cycle in males and females both were found in sweet corn (T_{13}) in Table No.2 and Fig. No.03. (40.20 and 41.87 days respectively) and the longest life cycle was seen in rice (T_1) (64.40 and 67.00 respectively). Similar results also found by Bhardwaj *et al.* (2017) who reported the shortest life cycle in males and females both *C. cephalonica* were found in maize and the longest life cycle was seen in rice, respectively.

Table 2: Duration of the life cycle of *C. cephalonica* reared under different diets.

Notation	Treatment	Fecundity (No. of Eggs)	Incubation Period (Days)	Larval Period (Days)	Morphological measurement of *C. cephalonica* FGL* larva		Pupal Period (Days)	Longevity (Days)		Total Life Cycle (Days)	
					Larval length (mm)	Larval wt. (mg)		Male	Female	Male	Female
T_1	Rice (100%)	114.80	6.40	42.80	9.43	11.07	11.60	3.60	6.20	64.40	67.00
T_2	Wheat (100%)	209.27	5.60	35.33	11.07	12.80	9.73	3.33	5.73	53.99	56.39
T_3	Maize (100%)	250.47	5.20	32.00	12.15	21.93	8.53	3.07	5.33	48.80	51.06
T_4	Rice+Wheat (50%+50%)	143.87	5.87	35.93	10.17	11.67	10.87	3.47	6.07	56.14	58.74
T_5	Rice+Maize (50%+50%)	206.80	5.73	35.47	10.50	12.67	10.13	3.33	5.87	54.66	57.20
T_6	Wheat+Maize (50%+50%)	218.00	5.33	33.60	11.30	16.60	9.60	3.13	5.67	51.66	54.20
T_7	Rice+Wheat (75%+25%)	131.27	6.33	42.60	9.91	11.20	10.87	3.53	6.13	63.33	65.93
T_8	Rice+Maize (75%+25%)	175.93	5.80	35.53	10.43	12.20	10.27	3.40	5.93	55.00	57.53
T_9	Wheat+Maize (75%+25%)	217.20	5.53	33.87	11.19	15.40	9.60	3.27	5.60	52.27	54.60
T_{10}	Rice+Wheat (25%+75%)	151.80	5.80	39.53	10.27	11.93	10.60	3.47	6.07	59.40	62.00
T_{11}	Rice+Maize (25%+75%)	222.60	5.27	33.47	11.59	17.27	9.40	3.13	5.67	51.27	53.81
T_{12}	Wheat+Maize (25%+75%)	245.33	5.27	33.13	11.65	21.07	9.40	3.13	5.47	50.93	53.27
T_{13}	Sweet corn (100%)	255.60	4.73	24.20	12.75	26.07	8.27	3.00	4.67	40.20	41.87
SEm±		3.16	0.06	0.12	0.36	0.33	0.09	0.07	0.13	0.16	0.18
CD at 5%		9.34	0.18	0.36	1.05	0.96	0.27	0.20	0.37	0.45	0.51

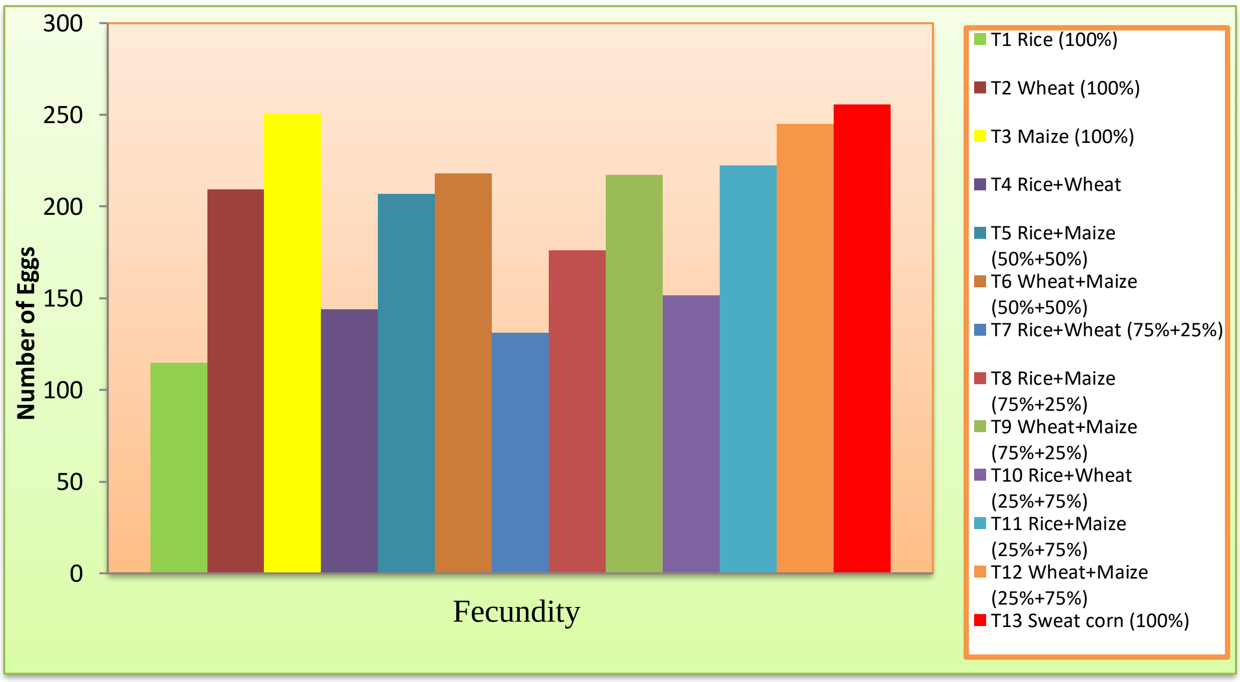

Fig. 1: Effects on the fecundity of *C. cephalonica* reared on different diets.

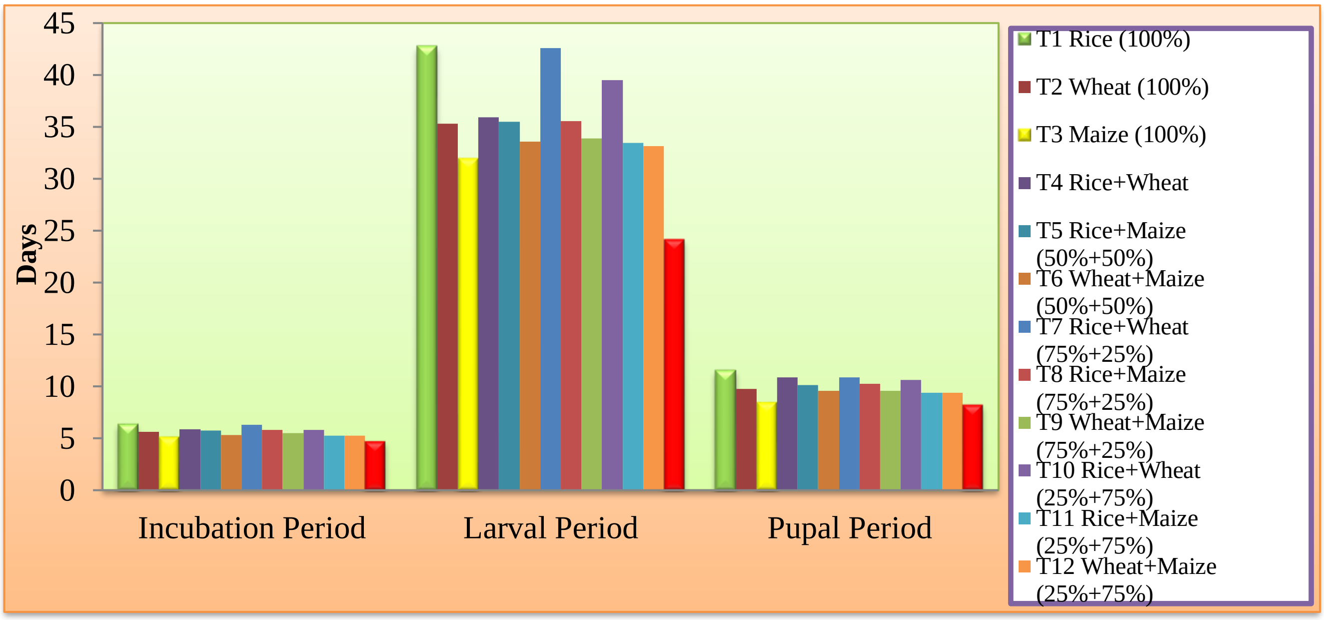

Fig. 2: Effect on the incubation period, larval development period, pupal development period of *C. cephalonica* reared on different diets.

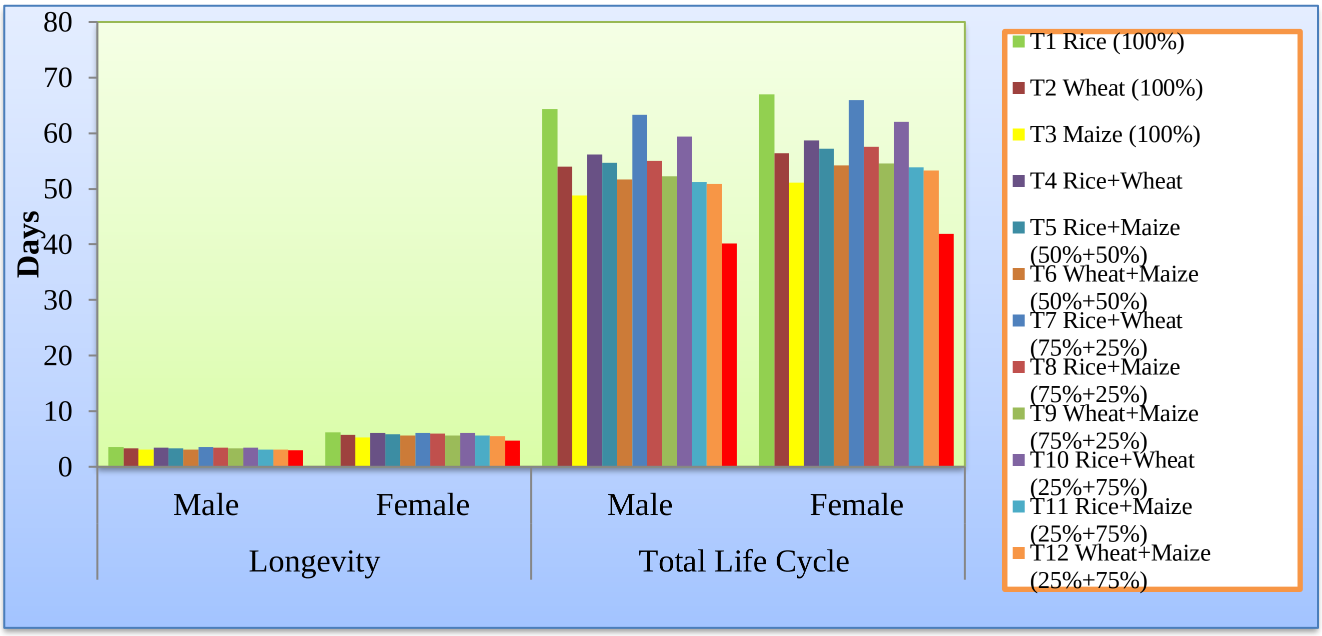

Fig. 3: Effect on adult longevity and total life cycle of *C. cephalonica* reared on different diets.

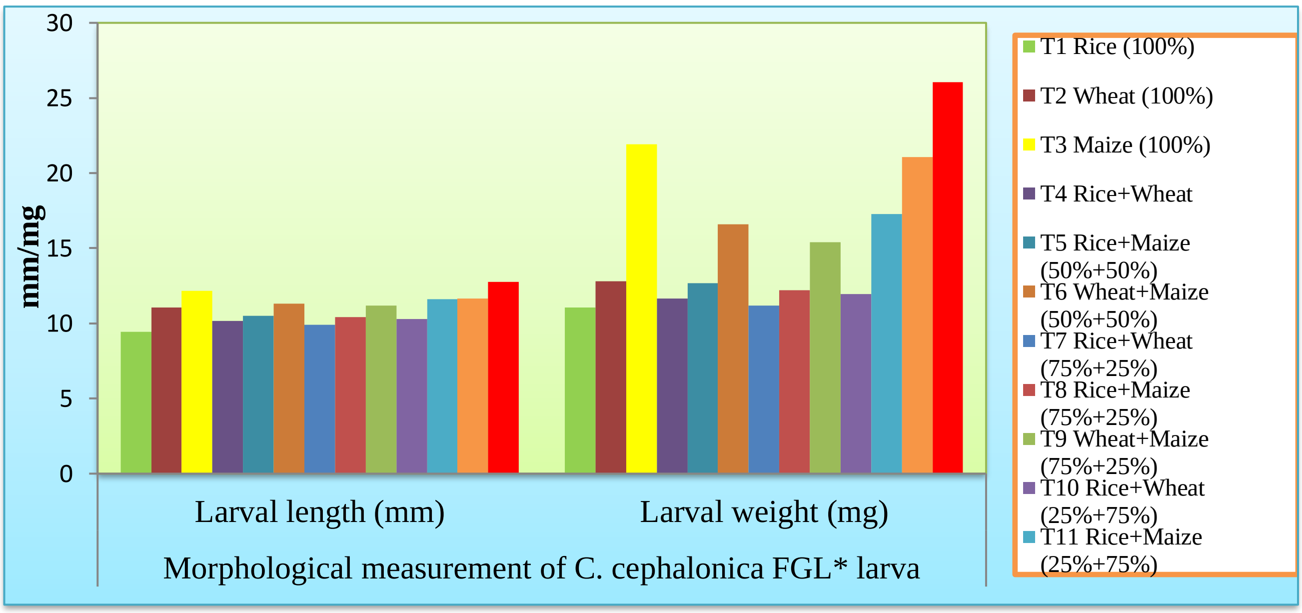

Fig. 4: Effects on the larval length and larval weight of *C. cephalonica* reared on different diets:

5. CONCLUSION

Silent features of the results revealed that Sweet corn (sole diet) was most expensive which exhibited the shortest life cycle followed by maize which was moderately expensive, so maize can be promoted for accelerating the mass production of *Corcyra* for prepare of Tricho-card on a commercial scale.

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