The Bioscan 9(1): 301-306, 2014 (Supplement on Plant Pathology)
AN INTERNATIONAL QUARTERLY JOURNAL OF LIFE SCIENCES
www.thebioscan.in

EVALUATION OF DIFFERENT REARING MEDIA FOR *CORCYRA CEPHALONICA* (STAINTON) UNDER LABORATORY CONDITION

S. K. MEHENDALE, M. B. PATEL AND C. U. SHINDE*
Biocontrol Laboratory, Department of Entomology, N.M. College of Agriculture,
Navsari Agricultural University, Navsari – 396450, Gujarat, INDIA
e-mail: shinde.3112@nau.in

KEYWORDS
Corcyra cephalonica
Trichogramma chilonis
Rearing media

Received on :
24.09.2013

Accepted on :
14.01.2014

***Corresponding author**

ABSTRACT
The rearing media to improve the mass production of *C. cephalonica* as a factitious host revealed three promising media *viz.,* T_3 (sorghum + groundnut + powdered yeast), T_4 (sorghum + gram + powdered yeast) and T_6 (sorghum + cowpea + powdered yeast) with heavier larvae in T_3 (53.33 mg), T_4 (52.50 mg) and T_6 (54.50 mg). The heavier pupae were also recorded in T_4 (34.67 mg), T_6 (34.17 mg) and T_3 (33.17 mg) while heavier female moths were recorded in T_3 (39.33 mg), T_4 (34.83 mg) and T_6 (34.0 mg). The maximum moth emergence were in T_3 (523.84), T_4 (476.34) and T_6 (470.0). Whereas, the maximum total females were noticed in T_3 (266.17), T_6 (251.50) and T_4 (243.34). The maximum fecundity was recorded in *Corcyra* females emerged from T_3 (611.54), T_4 (494.28) and T_6 (481.08). Moreover, the maximum projected egg laying was realized from the females emerged from T_3 (8.14 cc), T_6 (6.10 cc) and T_4 (6.01 cc). The significantly maximum weight of 100 *Corcyra* egg was exhibited with females emerged from T_4 (3.73 mg), T_6 (3.70 mg). The maximum length and breadth of egg was obtained from females emerged from T_4 (0.70 and 0.40 mm), T_6 (0.62 and 0.39 mm) and T_3 (0.56 and 0.35 mm), respectively. However, no much detrimental impact on the life cycle of *C. cephalonica* were exhibited through modification of rearing media though the female preponderance (sex ratio as M: F) was noticed in T_3 (0.97:1), T_4 (0.96:1) and T_6 (0.87:1).

INTRODUCTION

Global warming has cautioned us and the adverse consequences of insecticide use are always alarming and also inducing pest out break because of pest resistance. These entomological backlashes have compelled the scientists to be concerned with entomologically compatible pest management programme (Shukla and Jadhav, 2014). Now days, Integrated Pest Management (IPM) is well known to all of us where all the suitable pest control techniques are being used to find ecologically sound and environmentally safe ways of pest control. Biological control should be regarded as the backbone of any IPM programme and about 90% of all potential pests are already under biological control (Shukla and Jadhav, 2014). The biological control is one of the most effective means of achieving insect control. The fundamental aim in mass production of natural enemies viz., *Trichogramma chilonis* (Ishii) in is their quality production at faster and cheaper rate. The quality of the natural enemies in the laboratory mostly depends on the quality of the host, which ultimately depends on the host nourishment. Therefore, the diet of the host is potentially of importance to the nutritional quality of host and the survival of *Trichogramma chilonis* Ishii and other egg parasitoids released in the environment as biological control agents (Finney and Fisher, 1964 and Hunter, 2003). Several food materials *viz.,* rice (*Oryza sativa* L.), sorghum [*Sorghum bicolor* (L.) Moench], groundnut (*Arachis hypogaea* L.), maize (*Zea mays* L.), castor (*Ricinus communis* L.), cashew nut (*Anacardium occidental* L.), wheat (*Triticum aestivum* L.), finger millet (*Eleusine coracana* Gaertn) and bajra (*Pennisetum typhoides* L.) etc. have been tried in India for the mass production of *C. cephalonica* and workers expressed different views regarding their suitability (Ambika, *et al*., 1981; Sharma, *et al*., 1982; Solayappan, 1991; Singh and Jalali, 1991; 1994 and Kumar and Shenhmar, 2001). The results of the experiments conducted by Nathen *et al*. (2006) revealed that rearing *C. cephalonica* on a high quality nutrient source resulted in high quality eggs, which ultimately resulted in high quality production of *T. chilonis* reared on such host eggs. The present investigation was therefore formulated with the aim of manipulation of *Corcyra* rearing medium for testing its suitability in getting good quality eggs through enhanced nourishment of *Corcyra* larvae. Thus, good quality egg parasitoid, *T. chilonis* could be utilized through inundative release for the management of many lepidopterous insect pest (Bhushan *et al*., 2012 and Fand *et al*., 2013).

MATERIALS AND METHODS

The present investigation was carried out at 26.0 ± 2ºC and 66.0 ± 13 per cent relative humidity (Yadav and Pathak, 2010) in the Bio-control Laboratory, Department of Agricultural Entomology, N. M. College of Agriculture, Navsari Agricultural University, Navsari, during the period from June 2007 to March 2008 and it was repeated twice.

The bold, clean grains of sorghum, maize and other pulses were milled in a domestic milling machine by making 2 to 3 pieces of each grain. These grains were then heat sterilized in hot air oven at 100ºC for 30 minutes to make them free from any secondary infestation. Similarly, material was treated with

streptomycin sulphate @ 0.2 g per kg to prevent the bacterial infection (Rao *et al*., 1980). Material of each treatment was mixed in the proportion of the ingredients in a galvanized tray (35 cm diameter x 12 cm height). Before adding of *Corcyra* eggs, 5 g dry powdered yeast was added in all combinations except in sorghum alone. Freshly laid 1000 eggs of *Corcyra* were added in each tray and contents mixed thoroughly for uniform distribution (Solayappan, 1991). Each tray was then covered with white muslin cloth and tied firmly with a tight rubber band. These trays were arranged in metal shelves, provided with ant wells at all pillars. All the trays were kept undisturbed for 30 days. After 30 days, all trays were daily checked for moth emergence. Emerged moths were collected separately as per respective treatment in the net house daily in the morning (Ingle *et al*., 2000). The number of moths emerged were recorded, differentiated in to males and females based on sexual dimorphism to record sex ratio. Regarding the effects of rearing media on some biological parameters of *C. cephalonica* following observations were recorded. Larval weight: Twenty days after charging the trays with eggs, 20 larvae per treatment were randomly weighed on precision balance (accuracy 0.001g). Thus, the mean larval weight was worked out. Pupal weight: Twenty pupae were randomly selected from each treatment tray and weighed on precision balance, thus mean pupal weight was worked out. Female weight: From each treatment tray, twenty adult females were randomly selected at moth emergence and kept in a separate small plastic bottle (2.5 x 6 cm). The selected females were immediately kept in refrigerator for about 15 minutes at 0 ^{0}C for immobilization. Each female was weighed separately on precision balance and the mean female weight was worked out. Total number of moths emerged: The moths were collected from each cage until the emergence of the last month and summed up to get the total number of moths (Sathpathy *et al*., 2003). Number of female moths emerged (Female preponderance): Only female moths from total moths emerged were computed to know the female preponderance. Fecundity: Five newly emerged pairs were randomly selected from each rearing media combinations and were caged individually in a separate plastic vial (2.5 x 6 cm), without any extra food and fixed with a rectangular 60-mesh mosquito net at free end to collect the eggs lying. Eggs glued to the sieve were gently separated with the help of soft camel hairbrush. Eggs laid by each female were weighed daily, on precision balance till the death of the female. The number of eggs per female was worked out based on 100 eggs weight of a female from respective treatment. Projected egg laying: Projected egg laying was judged on the basis of the product of mean fecundity and mean female moths emerged from respective rearing media (Tiwari and Khan, 2003). Hundred-egg weight: Hundred eggs were randomly selected from respective *Corcyra* female emerged from each rearing media and weighed on precision balance in a set of five from each repetition to know 100 eggs weight of *Corcyra*. Morphometrics of *Corcyra* eggs: The quality of the eggs obtained from females reared on different rearing media was determined by taking observations on length and breadth of 20 randomly selected eggs per female in respective rearing media per repetition with the help of a stage- occulometer. Eggs having the highest length and breadth with maximum weight of 100-eggs were considered as the best quality eggs. Life cycle of *C. cephalonica*: The life cycle of *C. cephalonica* was worked out on the basis of date of charging the galvanized trays up to the date of first moth emergence from each treatment. Sex ratio of *C. cephalonica* (M: F): At the time of moth collection, all moths from respective media were sexed based on morphological characters in to male and female to work out sex ratio (Kumar and Shenhmar, 2001).

RESULTS AND DISCUSSION

The effects of different rearing media on some biological parameters of factitious host, *C. cephalonica* are based on pooled results are presented and discussed hereunder with different subheadings (Table 2). Larval weight (mg): The mean larval weight of 20-day-old *C. cephalonica* larvae on different rearing media in pooled data of the two trials affirmed that T_6 (sorghum + cowpea + powdered yeast) recorded significantly the highest larval weight (54.50 mg) and remained at par with T_3 (sorghum + groundnut + powdered yeast) and T_4 (sorghum + gram + powdered yeast) with 53.33 and 52.50 mg larval weights, respectively. However, T_1 (sorghum + black gram + powdered yeast) recorded the lowest larval weight (43.50 mg) and stood at par with T_8 (sorghum alone) and T_2 (sorghum + green gram + powdered yeast) with 45.50 and 45.17 mg larval weights, respectively. Interaction effect was non-significant indicating consistent performance of various treatments over period. From the above results, it was indicated that rearing media where pulses *viz.,* gram, cowpea and oilseed like groundnut in combination with sorghum were used and imply that the larval weight of *Corcyra* increased significantly as compared to sorghum alone or in combination with maize, black gram or green gram. Earlier, Rao *et al*. (1980) reported that sorghum flour in combination with glucose at 3.0, 3.5 and 4.0 per cent recorded 22.75, 23.40, and 23.89 mg larval weight, respectively; followed by sorghum flour + protein at 50, 55 and 60 per cent with 21.16, 22.69 and 22.19 mg larval weight, respectively. They also concluded that sugar and protein act as phagostimulants and adding them with sorghum than rice bran or groundnut cake powder increased the larval weight, because sorghum was poor in protein (9.13 %) and total sugar (0.49 %). Thus, supplementing sorghum with sugar or protein increased the efficiencies of the media. In present studies also, sorghum in combination with protein sources like gram, cowpea and oilseed like groundnut along with yeast have produced the maximum larval weight. Thereafter, Ingle *et al*. (2000) reported maximum weight of larvae in case of *Corcyra* reared in bajra + groundnut (61.1 mg), bajra + mustard (58.9 mg) and bajra + cotton (57.1 mg). Medium larval weight was recorded in sorghum + groundnut (55.7 mg), sorghum + mustard (53.7 mg) and sorghum + cotton (51.7 mg). Further, they also recorded lowest larval weight in maize + groundnut (49.7 mg), maize + mustard (48.9 mg) and maize + cotton (46.2 mg). Satpathy *et al*. (2003) studied the effect of various rearing media on the biological parameters of *Corcyra*. They reported minimum larval weight (14.28mg) in rice + yeast medium and highest (56.51 mg) in sorghum + yeast medium. The present findings are corroborate with the above workers. Pupal weight (mg): The mean pupal weight in pooled analysis revealed that media T_4 (sorghum + gram + powdered yeast) and T_6 (sorghum + cowpea + powdered

Table 1: Different rearing media used for *C. cephalonica*

Treatment	Treatment combination	Proportion
T_1	Sorghum + Black gram + Powdered yeast	(70:30 + 5 g yeast)
T_2	Sorghum + Green gram + Powdered yeast	(70:30 + 5 g yeast)
T_3	Sorghum + Ground nut + Powdered yeast	(70:30 + 5 g yeast)
T_4	Sorghum + Gram + Powdered yeast	(70:30 + 5 g yeast)
T_5	Sorghum + Soybean + Powdered yeast	(70:30 + 5 g yeast)
T_6	Sorghum + Cow pea + Powdered yeast	(70:30 + 5 g yeast)
T_7	Sorghum + Maize + Powdered yeast	(70:30 + 5 g yeast)
T_8	Sorghum alone (Check)	(100)

yeast) were superior over rest of the media with 34.67 and 34.17 mg pupal weight, respectively and remained at par with each other. The minimum pupal weights recorded with media T_8 (sorghum alone), T_1 (sorghum + black gram + powdered yeast) and T_2 (sorghum + green gram + powdered yeast) were 24.17, 23.0 and 22.83 mg, respectively. Interaction effect was non-significant indicating consistent performance of different treatments over period. The present findings are in accordance with Ingle *et al*. (2000) who recorded the maximum pupal weight of *Corcyra* reared on bajra + groundnut (47.1 mg), bajra + mustard (45.4 mg) and bajra + cotton (43.1 mg), medium weight in sorghum + groundnut (42.5 mg), sorghum + mustard (41.0 mg) and sorghum + cotton (38.7 mg) and minimum weight of 37.3, 35.8 and 34.1 mg, respectively in the same combinations with maize. The present findings are more or less similar with the findings of Ingle *et al*. (2000). Female weight (mg): The data on mean weight of *C. cephalonica* female in pooled data showed that T_3 (sorghum + groundnut + powdered yeast) exhibited the highest female weight (39.33 mg) and significantly superior over rest of the rearing media. This was followed by T_4 (sorghum + gram + powdered yeast) [34.83 mg] and T_6 (sorghum + cowpea + powdered yeast) [34.0 mg]. The lowest female weight (24.50 mg) was recorded in T_7 (sorghum + maize + powdered yeast) and remained at par with T_1 (sorghum + black gram + powdered yeast) and T_8 (sorghum alone) with 25.33 and 24.83 mg mean female weight, respectively. Interaction effect was non-significant indicating consistent performance of various treatments over period. Thus, results revealed that better nourishment of the larva in media T_3 (sorghum + groundnut + powdered yeast), T_4 (sorghum + gram + powdered yeast) and T_6 (sorghum + cowpea + powdered yeast) might have produced heavier female moths. Ingle *et al*. (2000) noticed a similar trend of higher weight of *Corcyra* females in media combinations of bajra with cotton (36.77 mg), mustard (35.97 mg) and groundnut (33.22 mg), which they contributed to better larval development in these media combinations that further produced heavier females. The results of present investigation are in accordance with the above findings. *Corcyra* moths emerged (Nos.): The mean total number of moths emerged in different rearing media of pooled data revealed that all the rearing media except T_7 (sorghum + maize + powdered yeast) recorded the significant moth emergence. The media T_3 (sorghum + groundnut + powdered yeast) was the best medium, which recorded the highest moth emergence (523.84) over the others. This was followed by T_5 (sorghum + soybean + powdered yeast) with a mean of 500.67 moths. Media T_4 (sorghum + gram + powdered yeast), T_6 (sorghum + cowpea + powdered yeast) and T_1 (sorghum + black gram + powdered yeast) were the next effective treatments, respectively which remained at par with each other. The lowest moth emergence (358.50) was recorded in T_7 (sorghum + maize + powdered yeast). Interaction effect was non-significant indicating consistent performance of various treatments over period. Earlier, Ingle *et al*. (2000) reported the maximum moth emergence out of 1000 eggs of *Corcyra* from bajra in combination with mustard (307.0), groundnut (298.0) and cotton (291.0). The discrepancy in the number of moths from above work and present study may be due to the less quantity of media used by them (500g for 1000 eggs) as compared to 1000 g in present experiment along with yeast 5 g which was absent in their study. The present media combinations especially with groundnut, gram and cowpea might have nourished the larvae with sufficient availability of food and thus produced more number of moths. Thus, the present findings are in partial alliance with Ingle *et al*. (2000). Similarly, Kumar and Kumar (2002) recorded 37.04 per cent moth emergence from sorghum (2 kg) with 4000 *Corcyra* eggs and 31.99 per cent in pearl millet. Tiwari and Khan (2003) recorded maximum number of moths and indicated complimentary role of pulses and yeast in producing the maximum number of moths. Female *Corcyra* moths emerged (Nos.): Perusal of data on the mean number of female *Corcyra* moths in pooled analysis revealed that T_3 (sorghum + groundnut + powdered yeast) recorded the significantly highest female moths (266.17) over rest of the media followed by T_6 (sorghum + cowpea + powdered yeast) with 251.50 female moths. The media T_4 (sorghum + gram + powdered yeast) and T_5 (sorghum + soybean + powdered yeast) exhibited 243.34 and 238.67 female moths, respectively. The lowest female moths were 175.67 and 172.17 in T_7 (sorghum + maize + powdered yeast) and T_8 (sorghum alone), respectively. Interaction effect was non-significant indicating consistent performance of various treatments over period. The earlier findings of Tiwari and Khan (2003) revealed that maize + yeast produced 985 female moths out of total 2211 moths followed by maize + proteinex 692 out of total 1359 moths, while lower number of females, 460 emerged out of 1026 moths from maize alone. They concluded that yeast besides having some ovipositional stimulus also helped in more female moth emergence. In past, Uberoi (1961) reported yeast as adequate source of protein, minerals, sterols, fat-soluble factors and vitamin B, all essential for normal growth of *Corcyra*. In present findings more number of female moths were also recorded in T_3 (sorghum + groundnut + powdered yeast) followed by T_4 (sorghum + gram + powdered yeast) and T_6 (sorghum + cowpea + powdered yeast), which might be due to the additive effect of pulse protein and yeast. However, in

Table 2: Performance of *C. cephalonica* on different rearing media (Based on pooled data of two trials)

Treatments	Mean larval weight (mg)#	Mean pupal weight (mg) #	Mean female weight (mg) #	Mean number of moths emerged	Mean number of females emerged	Mean number of eggs laid per female@	Mean 100 egg wt. (mg) $	Life cycle of *Corcyra* (Days)	Mean Projected egg laying (cc)	Mean egg length (mm)	Mean egg breadth (mm)	Sex ratio (M:F)
T_1	43.50	23.00	25.33	21.52(462.67)*	14.73(216.50)	20.46(418.18)	3.30	28.0	4.52	0.55	0.36	1.14:1
T_2	45.17	22.83	29.67	19.90(395.67)	13.86(191.67)	20.96(438.89)	3.00	28.00	4.20	0.54	0.37	1.06:1
T_3	53.33	33.17	39.33	22.90(523.84)	16.33(266.17)	24.73(611.54)	2.60	27.00	8.14	0.56	0.35	0.97:1
T_4	52.50	34.67	34.83	21.84(476.34)	15.62(243.34)	22.24(494.28)	3.73	28.00	6.01	0.70	0.40	0.96:1
T_5	50.50	26.83	29.00	22.39(500.67)	15.47(238.67)	21.03(442.01)	3.20	28.00	5.22	0.55	0.35	1.09:1
T_6	54.50	34.17	34.00	21.69(470.0)	15.87(251.50)	21.94(481.08)	3.70	28.0	6.10	0.62	0.39	0.87:1
T_7	48.17	25.67	24.50	18.94(358.50)	13.27(175.67)	21.41(458.62)	2.87	28.00	4.02	0.55	0.35	1.04:1
T_8	45.50	24.17	24.83	19.80(391.67)	13.14(172.17)	19.22(368.89)	2.47	27.67	3.18	0.52	0.32	1.27:1
Treatments (T)												
S. Em ±	0.71	0.47	0.61	0.10	0.08	0.24	0.05	0.08	0.12	0.003	0.002	-
C.D. @ 5%	2.04	1.35	1.74	0.28	0.23	0.68	0.15	0.22	0.35	0.01	0.01	-
Interaction (P x T)												
S. Em ±	-	-	-	-	-	-	-	-	-	-	-	
C.D. @ 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
C.V. (%)	3.69	4.45	5.06	1.13	1.41	2.88	4.15	4.73	6.12	1.13	1.33	-

* Figures inside the parentheses are original values while out side are $\sqrt{n+0.5}$ values. # Mean of 20 observations @ Mean of 5 females $ Mean of 5 sets of 100 eggs each.

case of T_7 (sorghum + maize + powdered yeast) in- adequate source of protein in the form of only yeast (5 g) might have resulted in less number of female moths. Similarly, in T_8 (sorghum alone) which itself was poor in protein and further no protein source either in pulse or yeast form was added in the medium which might have resulted in poor female emergence.

Fecundity of *Corcyra* moth (Nos.)

Pooled data indicated that the significantly maximum fecundity of 611.54 eggs per female in T_3 (sorghum + groundnut + powdered yeast) followed by T_4 (sorghum + gram + powdered yeast) with 494.28 eggs per female and T_6 (sorghum + maize + powdered yeast) with 481.08 eggs per female. The lowest fecundity (368.89) was recorded in medium T_8 (sorghum alone). Interaction effect was non-significant indicating consistent performance of various treatments over period. The findings thus revealed that rearing media fortified with pulse and yeast was responsible to increase the fecundity of female as compared with sorghum alone. The maximum fecundity was recorded in media *viz.,* T_3 followed by T_4 and T_6 where female moths were heavier. This clearly indicated that along with carbohydrates, when protein was provided in rearing media, healthier and heavier female moths could be produced which further could produce maximum eggs. Jacob *et al.* (1966) reported increased fecundity in *Corcyra* moths reared on protein rich diets like pulses over low protein diets like cereals. Kumar (1991) recorded the fecundity of 364.4, 160.2, 111.2, 438.2, 438, 384.4 and 329.6 eggs per female in case of *Corcyra* reared on gram, sorghum, wheat, mustard, cotton, sesamum and groundnut, respectively indicating higher egg laying in protein rich media than in cereals alone. Haritha *et al.* (2000) recorded average fecundity of 211 eggs per female in case of groundnut. This might be due to the absence of yeast as a protein source, which was present in current rearing media except T_8 (sorghum alone). Thus their conclusion regarding female moth weight and fecundity supports the present investigation.

Projected egg laying (Nos.)

The mean projected egg laying (assumed from total female moths emerged) of *Corcyra* females emerged from different rearing media in pooled showed that significantly the highest projected egg laying (8.14 cc) was recorded in T_3 (sorghum + groundnut + powdered yeast) medium T_6 (sorghum + cowpea + powdered yeast) and T_4 (sorghum + gram + powdered yeast), respectively with 6.1 and 6.01cc remained at par. The lowest projected egg laying (3.18 cc) was recorded in T_8 (sorghum alone). Interaction effect was non-significant indicating consistent performance of various treatments over period. The findings of the study revealed that maximum egg laying was noticed in case of those media where more number of females and higher eggs per female were noticed. The maximum production of eggs is one of the basic requirements of the *Corcyra* mass production in bio-control unit, which was expressed by three media *viz.,* T_3, T_6 and T_4 and thus proved to be highly suitable in *Corcyra* mass production. Tiwari and Khan (2003) also reported highest total egg production of 19.56 cc (Total eggs 391882.3) in maize + yeast medium followed by 12.16 cc (Total eggs 243224.2) in maize + proteinex and lowest (8.07cc) in maize alone (Total

eggs 161570.4). This affirmed that maximum production of total eggs was reported in case of the rearing media, which were fortified with protein source like yeast or proteinex than non-fortified media like maize alone. Kumar and Shenhmar (2001) also reported that rearing medium maize with 50.11 per cent female moths produced 10.90 cc eggs as compared to rice with 40.31 per cent females with 4.20 cc eggs. Again the fact of insect nutrition through rearing media was high lighted by the authors, which further expressed the conclusion of more number of females and higher fecundity through highly nutritive rearing media like maize as compared to rice. Present findings thus are in accordance with the above ones. Hundred-egg weight (mg): Pooled data on mean 100-eggs weight of the *Corcyra* females emerged out from different rearing media affirmed that rearing media T_4 (sorghum + gram + powdered yeast) and T_6 (sorghum + cowpea + powdered yeast) recorded 3.73 and 3.70 mg 100-eggs weight, respectively. However, the lowest egg weight (2.47 mg) was perceived in T_8 (sorghum alone) which was at par with T_3 (sorghum + groundnut + powdered yeast) recording 2.60 mg 100-eggs weight. Interaction effect was non-significant indicating consistent performance of various treatments over period. During present study the rearing media *viz.,* T_4 and T_6 produced good quality eggs, which may be attributed due to the quality of the protein from gram and cowpea. Hundred eggs weight in T_3 was low and it might be due to the excessive egg laying by females and also may be due to poor quantity of egg yolk. Kumar and Shenhmar (2001) in a study with different cereals as rearing media for *Corcyra* reported the maximum egg weight per cubic centimeter (cc) in maize (601.41 mg /cc = 3.01 mg per 100 eggs) followed by wheat (599.54 mg per cc = 3.0mg / 100 eggs). Kumar and Kumar (2002) studied the effect of rearing media on biological parameters of *Corcyra* and recorded maximum 100-eggs weight in maize (4.57mg), sorghum + rice husk (4.32 mg), sorghum (4.25 mg); maize + rice husk (4.11 mg) and rice (4.08 mg). Present findings are thus in line with the above results. Egg morphometrics: To determine the quality parameters of the *Corcyra* eggs obtained from the females emerged from different rearing media, eggs were evaluated on the basis of the egg length and breadth. Egg length (mm): The data revealed that *Corcyra* eggs obtained from the females emerged from T_4 (sorghum + gram + powdered yeast) recorded the highest egg length of 0.70 mm which was significantly superior over rest of the media, followed by 0.62 mm in case of T_6 (sorghum + cowpea + powdered yeast). The length of the eggs from the females emerged from the remaining media showed similar trend. The lowest egg length (0.52 mm) was noticed in case of the eggs obtained from the females emerged from T_8 (sorghum alone). Interaction effect was non-significant indicating consistent performance of various treatments over period. Egg breadth (mm): The pooled data affirmed that T_4 (sorghum + gram + powdered yeast) recorded the maximum egg breadth (0.40 mm) and remained at par with T_6 (sorghum + cowpea + powdered yeast) which exhibited 0.39 mm. The lowest egg breadth (0.32 mm) was noticed in T_8 (sorghum alone). Interaction effect was non-significant indicating consistent performance of various treatments over period. Life cycle (from egg to first adult emergence) (Days): The data regarding life cycle of *C. cephalonica* from egg to first adult emergence from different rearing media in pooled results revealed that the period from charging the trays till the first moth emerged was shortest (27days) in T_3 (sorghum + groundnut + powdered yeast) while all remaining media were at par with the period ranging from 27.0 to 28.0 days. Interaction effect was non-significant indicating consistent performance of various treatments over period. Different workers have noted varying developmental period of *Corcyra* in different rearing media. Ingle *et al*. (2000) reported the reduced developmental period of *Corcyra* on bajra + mustard (38.33 days) or with bajra + cotton (39.33 days) or bajra + groundnut (40.66 days). However, Rao (1954) and Ray *et al*. (1990) reported lifespan was 48.6 and 62 days on sorghum alone, respectively. Kumar and Kumar (2002) reported earlier moth emergence after 34 days of infesting media in all the treatments except in rice husk and rice where moths emerged on 46 and 48 days, respectively. Tiwari and Khan (2003) reported delayed moth emergence (47 days) when *Corcyra* was reared on maize alone, while it was shortest (36 days) when was reared on maize + yeast. They also concluded that yeast was quite favorable protein source showed fast development in moths (36 days). In present findings also the impact of both the protein sources might have reduced the developmental period in *Corcyra*. Thus, the present investigation is partially tally with the above workers. Sex ratio (M: F): The pooled data revealed that the female preponderance registered (0.97: 1) in T_3 (sorghum + groundnut + powdered yeast) followed by 0.96: 1 in T_4 (sorghum + gram + powdered yeast) and 0.87: 1 in T_6 (sorghum + cowpea + powdered yeast) rearing media. The report of Sathpathy *et al*. (2003) corroborated with the present investigation.

AKNOWLEDGEMENT

The authors are thankful to Director of Research and Dean P.G. Studies, Navsari Agricultural University, Navsari, Gujarat, India for providing the facilities during the present investigation. The help render by Principal and Dean, N.M. College of Agriculture, N.A.U., Navsari is also duly acknowledged.

REFERENCES

Ambika, B., Abraham, C. C. and Dale, D. 1981. Food preference of the rice meal moth, *Corcyra cephalonica* (Stainton) (Lepidoptera: Pyralidae). *Agric. Res. J. Kerala.* **19(2):** 117-118.

Bhushan, S., Singh, R. P. Shankar, R. 2012. Biopesticidal management of yellow stem borer (*Scirpophaga incertulas* Walker) in rice. *The Bioscan*. **7(2):** 317-319.

Fand, B. B., Suroshe, S. S. and Gautam, R. D. 2013. Fortuitous biological control of insect pests and weeds: a critical review. *The Bioscan*. **8(1):** 1-10.

Finney, G. L. and Fisher, T. W. 1964. Culture of entomophagous insects and their hosts. In: Biological control of Insect pests and weeds, Paul Deback (Ed). *Reinhold Publishing Corporation, New* York. p. 84.

Haritha, V., Vijaylakshmi, K. and Murthy, M. M. K. 2000. Biology of rice moth *Corcyra cephalonica* (Stainton) on groundnut pods and kernels under controlled conditions. *J. Appl. Zool. Res*. **11(2-3):** 135-136.

Hunter, M. D. 2003. Effect of plant quality on the population ecology

of parasitoids. *Agric. Forest Entomol*. **5**: 1-8

Ingle, A. V., Satpute, U. S., Nimbalkar, S. A., Sarnaik, D. N. and Sadawarte, A. K. 2000. Performance of *Corcyra cephalonica* (Stainton) on different diets. *Pestology*. **24(8):** 51-54.

Jacob, A., Dass, N. M. and Nair, M. R. G. K. 1966. Studies on the feeding media for the mass rearing of *Corcyra cephalonica* (Stainton). *Agric. Res. J. Kerala.* **3**: 82-85.

Kumar, A. K. 1991. Rice moth reproduction in relation to quality of stored product present in the insect-breeding environment. *Utter Pradesh. J. Zool*. **11(1):** 59-61.

Kumar, S. A. and Shenhmar, M. 2001. Utilization of different cereal grains for the mass production of *Corcyra cephalonica* (Stainton) (Lepidoptera: Pyralidae). *J. Biol. Control*. **15(2):** 147-150.

Kumar, P. and Kumar, S. 2002. Evaluation of different rearing media for *Corcyra cephalonica* (Stainton). *J. Biol. Control*. **16(2):** 117-120.

Nathan, S. S., Kalaivani, K., Mankin, R. W. and Murugan, K. 2006. Effects of millet, wheat, rice, and sorghum diets on development of *Corcyra cephalonica* (Stainton) (Lepidoptera: Galleriidae) and its suitability as a host for *Trichogramma chilonis* Ishii (Hymenoptera: Trichogrammatidae). *Environ. Entomol*., **35(3):** 784-788.

Rao, S. D. 1954. Notes on rice moth *Corcyra cephalonica* (Stainton). *Indian J. Ent.* **16**: 95-114.

Rao, P. S., Perraju, A. and Rao, K. B. H. 1980. Effect of fortification of natural rearing media with Casein, Cholesterol and Glucose on *Corcyra cephalonica* (Stainton): I Larval growth. *Indian J. Ent.* **42(2):** 218-222.

Ray, R., Shi, N. and Patnaik, H. P. 1990. The life table and intrinsic rate of increase of *Corcyra cephalonica* (Stainton) on Jowar. *Orissa J. Agric. Res.* **3(1):** 22-26.

Sathpathy, S., De, N. and Rai, S. 2003. Suitable rearing medium for rice moth (*Corcyra Cephalonica*) (Pyralidae: Lepidoptera). *Indian J. Agricultural Sciences.* **73(6):** 331-333.

Sharma, G. K., Jain, K. L. and Pareek, B. L. 1982. Food utilization studies of *Corcyra cephalonica* and *Ephestia cautella*. *Entomon*. **7:** 71-74.

Shukla, A and Jadhav, D. S. 2014. Biology of *coccinella transversalis* (fabricius) on different aphid species. *The Bioscan*. **9(1):** 17-22.

Singh, S. P. and Jalali, S. K. 1991. *Trichogrammatids*- Egg parasitoids, their production and use Extension Bulletin No.1. *Project Directorate of Biological Control (ICAR),* Bangalore, India, p. 1-15.

Singh, S. P. and Jalali, S. K. 1994. *Trichogrammatids*. Technical Bulletin No. 7, Project Directorate of Biological Control (ICAR), Bangalore, p. 93.

Solayappan, A. R. 1991. Techniques for mass culturing of *Corcyra cephalonica* (Stainton) In: David H. and Easwarnamoorthy S (Ed.) Bio-control Technology for sugarcane pest management. Sugarcane Breeding Institute, Coimbatore, Tamil Nadu. pp. 141-144.

Tiwari, S. and Khan, M. A. 2003. Growth and development of *Corcyra cephalonica* (Stainton) on natural and fortified diets and dietary effect of age-old eggs on parasitization by *Trichogramma chilonis* Ishii. *J. Biol. Control,* **17(1):** 13-16.

Uberoi, N. K. 1961. Nutritional requirements of the larva of rice moth, *Corcyra cephalonica* (Stainton): Studies on the feeding response to various natural foods. *Proc. Indian Acad. Sci*. **58(6):** 284-297.

Yadav, R. and Pathak, P. H. 2010. Effect of temperature on the consumption capacity of *Chrysoperla carnea* (Stephens) (Neuroptera: Chrysopidae) reared on four aphid species. *The Bioscan*. **5(2):** 271-274.