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Research Article

EFFECT OF DIFFERENT DIETS ON BIOLOGY OF *Corcyra cephalonica* (STAINTON) UNDER LABORATORY CONDITION IN CHITWAN, NEPAL

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Abstract

The experiments were conducted from 10th October, 2013 to 10th January, 2014 in Entomology Laboratory of National Maize Research Program, Rampur, Chitwan, Nepal at 26±2ºC and 70±5% RH in order to assess diet performance on the biological parameters of *Corcyra cephalonica* (Stainton). Four cereals namely corn, rice, millet and wheat were tested solely and mixed with groundnut. Among the eight treatments, corn + groundnut was superior diet in almost biological parameters of *C. cephalonica* followed by millet + groundnut. The experiment showed that the corn + groundnut are biologically better option for production of robust eggs of *C. cephalonica.*

Key words: Diet; biology; *Corcyra cephalonica*

Introduction

Corcyra cephalonica (Stainton) (Lepidoptera Pyralidae) is economically an important stored grain pest in Asia, Africa, North America and Europe (Atwal and Dhaliwal, 2008). It attacks rice, wheat, corn, sorghum, groundnut, cottonseeds, coffee, spices and cocoa beans at storage condition (Allotey, 1986; Kumar and Kumar, 2001; Ayyar, 1934). The moths are nocturnal and each female lays 90-200 eggs having 5 days incubation period, 23-25 larval period, 10 days of pupal period and adult life span of 1 week (Fenemone and Prakash, 2009). Highly nutritious plant may support development of nutritionally quality herbivores that finally result production of high quality parasitoids (Van Huis and De Roy, 1998) or predator (Shahayaraj and Sathiamoorthi, 2002). Rearing *Corcyra* on efficient food media resulted in production of robust moths and robust eggs. The size of the egg considered as one of the criteria for assessing the health of the insect. For rearing of egg parasitoids utilization of robust host eggs is important (Pathak *et al.,* 2010).

Cereal based media supplemented with groundnut (*Arachis hypogaea* L.) enhanced fecundity and other biological parameters compared to the yeast-fortified media (Sathpathy *et al.,* 2003). The rearing host diet is potentially importance to the nutritional quality of host eggs and the survival of parasitoids released into the environment as biological control agent (Hunter, 2003). *C. cephalonica* is industrialized for many of the natural enemies mass-bred in the laboratory for use in field against crop pests, which are dependent on either egg or larval stages of *C. cephalonica* because it is easier and cheaper to produce natural enemies on different stages of *C. cephalonica* than on their original hosts (Kumar and Murthy, 2000).

Materials and Methods

Four different cereals, viz: corn *(Zea mays* L.), rice (*Oryza sativa* L.), finger millet ((*Eleusine coracana* L. Gaertn), and wheat (*Triticum aestivum* L.), were milled separately and legume, i.e. groundnut (*Arachis hypogaea* L.) was grinded using home milling machine (grinder). Then, these materials were kept in muslin sack for oven sterilization at 100ºC for about one hour separately. These materials were used solo (1.5 kg cereals only) or mixed (1375 gm cereal + 125 gm groundnut) forming total eight treatments. Each diet was fortified with 5 gm yeast extract and 0.5 gm streptomycin sulphate and kept in a small plastic trough (9cm depth and 25 cm diameter). 100 eggs of *C. cephalonica* obtained from the mass-rearing culture at 26±2º C, 70±5% RH, laboratory condition in corn flour fortified with yeast extract and streptomycin sulphate were inoculated in each eight treatments and kept in room condition in the entomology laboratory of National Maize Research Program (NMRP), Rampur, Chitwan, Nepal. The experiment was layout in completely randomized design with eight treatments and three replications. Observations were recorded at 12 AM daily and were continued until all moth emergences. Male and female moths were identified with the help of labial palp and body size. To study the pupa period of *C. cephalonica*, twelve larvae of fifth instars (four from each replication) kept in each 18 small Petri-dishes (1.5cm deep and 5.5 cm diameter) and observed daily. The

same diets were provided as experiment. After 12 days, recording of pupa period and number of emerged adults were counted. To study the effect of diet on adult body weight and wingspan, 20 males and 20 females from each experimental unit were taken and weight was taken on an electronic balance. Similarly wingspan and body length of moths were also measured. Data were analyzed using Gen-Stat Discovery Edition 4. Mean comparison of were done by DMRT at 5% probability level.

Results and Discussion

Mean fecundities of *C. cephalonica* on different diets were highly significant ($p< 0.05$) ranging from 107 in rice to 293 in corn + groundnut, respectively. While, fecundity is intermediate in millet (192.7) and wheat (192) (Fig 1). Aswini Kumar *et al.* (2000) reported 321, 298, 285 and 226 eggs production on maize, sorghum, wheat and rice, respectively. Similarly, Kumar and Shenhamer (2001) reported egg production of 4.20 cc on rice, 6.60 cc on wheat, 9.40 cc on sorghum and 10.90 cc on maize. Allotey and Azalekor (2000) documented mean fecundity 157 (105 to 200) in groundnut and 146 (95 to 167) in cowpea while Urs and Mookherjee (1966) reported 255 and 159 eggs laid per female in groundnut (*Arachis hypogea* L.) and Sesamum (Sesamum indicum L.), respectively. Allotey (1985) found more fecundity in pulse in comparison to cereals i.e.154±9 and 210±10 on maize and groundnut, respectively (Table 1).

The experiments showed that incubation period ranged from 5.13 (Corn+groundnut) to 5.73 days (rice) on different diets. Osman *et al*. (1983) documented similar trend of incubation period ranging from 5.2 and 6.2 days at 28±1 ºC and 30±1ºC temperature, respectively. Larval development period ranged from 29 to 41 days on different diets with longer duration on rice (41.08) and shorter duration on Corn + groundnut (29.58). These results are in close agreement with Ashwini Kumar *et al.* (2002) who documented 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. Jagadish *et al.* (2009) found larval development period ranging from 28 to 36 days on foxtail millet. Similar trend of 28 to 36 days of larval duration was reported by Manjunath (1993). Ayyar (1934) documented larval period of 38 days in ragi and maize, 42 days on wheat, 57 days on sorghum and 53 days on paddy, which is slightly longer.

Table 1: Effect of different diets on fecundity, incubation period, larval development and pupal development period of *C. cephalonica*, under laboratory condition, NMRP, Rampur, Chitwan, 2013/2014

Treatments (T)	Fecundity (Egg No.)	Incubation period (Days)	Larval Development Period (Days)	Pupal development period (Days)
Milled Corn	193.0^{b}	5.24^{b}	33.08^{c}	9.02
Milled Corn + Grinded Groundnut	239.7^{a}	5.13^{b}	29.58^{d}	8.77
Milled Rice	107.3^{c}	5.73^{a}	41.08^{a}	10.33
Milled Rice + Grinded Groundnut	192.0^{b}	5.16^{b}	33.08^{c}	9.11
Milled Millet	192.7^{b}	5.66^{a}	35.42^{bc}	9.16
Milled Millet + Grinded Groundnut	206.0^{ab}	5.24^{b}	32.50^{c}	8.99
Milled Wheat	192.0^{b}	5.66^{a}	37.33^{b}	9.19
Milled Wheat + Grinded Groundnut	195.3^{b}	5.19^{b}	32.75^{c}	9.05
SEM (±)	13.19	0.12	0.90	0.31
CV%	12	3.9	4.6	6
$LSD_{0.05}$	40.02	0.36	2.75	Ns

Means followed by the same alphabets/letters on superscript are not significant by DMRT at 0.05 levels.

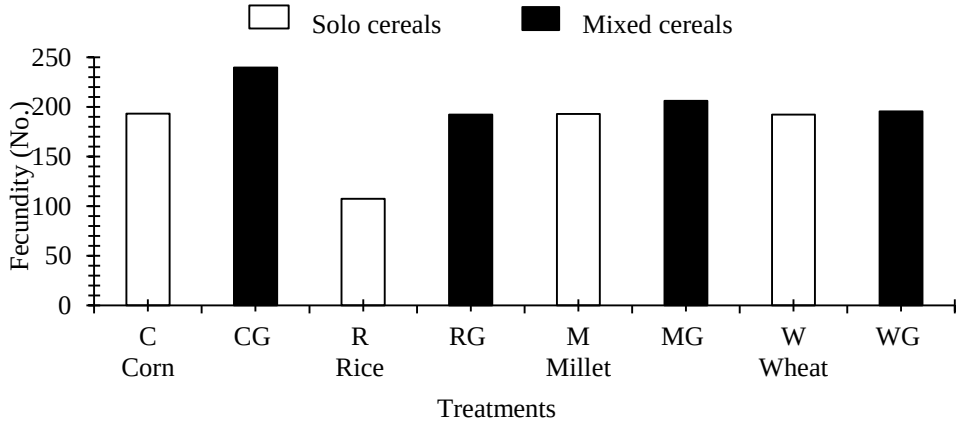

Fig.1: Comparison on different solo and mixed diets on fecundity of *C. cephalonica* in Chitwan, 2014

Table 2: Effect of different diets on male, female, total development period and total moths' emergence of *C. cephalonica*, Rampur, Chitwan, 2014

Treatments (T)	Male development periods (Days)	Female development periods (Days)	Total Development period (Days)	Total Moth Emergence (%)
Milled Corn	51.31^{bc}	54.36^{abc}	52.56^{bc}	68.67^{cd}
Milled Corn+ Grinded Groundnut	47.02^{d}	49.69^{e}	48.24^{d}	94.67^{a}
Milled Rice	55.69^{a}	58.27^{a}	57.98^{a}	55^{d}
Milled Rice + Grinded Groundnut	50.94^{bc}	53.97^{cd}	50.70^{cd}	77.33^{abc}
Milled Millet	53.05^{b}	56.05^{abc}	54.77^{b}	70^{bcd}
Milled Millet+ Grinded Groundnut	49.39^{c}	52.08^{de}	50.63^{cd}	89.7^{bc}
Milled Wheat	53.22^{b}	57.50^{bc}	55.25^{ab}	64.67^{cd}
Milled Wheat + Grinded Groundnut	50.33^{c}	52.66^{de}	50.90^{cd}	78.3^{abc}
SEM (±)	0.704	1.006	1.00	6.16
CV%	2.4	3.2	3.3	14.13
$LSD_{0.05}$	2.13	3.050	3.04	18.68

Means followed by the same alphabets/letters on superscript are not significant by DMRT at 0.05 levels.

Pupal development period was not significantly different among different diet fed to *C. cephalonica*, however there is slight numerical variation. The maximum duration was found on rice (10.33 days) followed by other diets. Concurrent variations were documented by Ashwini Kumar *et al*. (2002). He observed 7.75 days on maize, 7.78 days on sorghum, 8.02 days on wheat and 8.23 days on rice.

The experiment showed that male emerged 2-4 days prior to the female. Similar conclusion was also drawn by Etman *et al*. (2009) who documented that development of the *C. cephalonica*, from first instar larvae to adults in whole-wheat flour medium was 40.9 for males and 43.5 days for females. The data shown in Table 2 shows that the total development period was maximum in rice (57.98 days) and minimum in corn+groundnut (48.24 days). Ashwini Kumar *et al.* (2000) also reported similar results of 56.15 days in rice, 54.12 days in wheat, 45.82 days in sorghum and 42.12 days in maize.But, Pathak *et al.* (2010) documented 52.01 days on maize, 50.82 days in sorghum and 47.62 days on pearl millet, 50.83 Sorghum + maize (9:1), 47.89 days on pearl millet + maize (9:1), 49.23 days on sorghum + pearl millet (9:1) and 51.23 days on sorghum + maize (8:2).

The moth emergence was 94.67 % on corn + groundnut followed by 89.7 on millet + groundnut and lowest 55% on rice. Nathan *et al.* (2006) documented 92.5% moth recovery on millet, 70.4 on wheat and rice and 68% on sorghum. Similarly, Allotey and Azalekor (2000) found 83.7% moth emergence on cowpea (*Vigna unguiculata* L.), 67.5% on broken groundnut (*Arachis hypogea* L.) and 82.5% on powdered bambara groundnut. (*Voandzeia subterranea* L).

Conclusion

C. cephalonica is polyphagous storage and grocery pest. The mixed diets (cereals + groundnuts) were significantly better than the solo cereals in almost all biological characters of *C. cephalonica*. Among treatment, corn + groundnut were superior to all the other diets followed by millet+groundnut. In some parameters, millet+groundnut were also superior but economically corn+groundnut is cheaper. The fecundity is considered as prime importance because of its utilization on egg parasitoid *T. chilonis*. High quality and quantity of eggs of *C. cephalonica* was obtained on corn + groundnut and millet + groundnut hereby recommended for mass production purpose. Hence, from the study, it is evident that the corn+groundnut is economically and biologically proved better option in production of robust eggs of *C. cephalonica*.

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