Biological Forum – An International Journal **13(3): 327-331(2021)**

ISSN No. (Print): 0975-1130
ISSN No. (Online): 2249-3239

Effect of Magnetic Field and Different Diet on Biological Parameter of Rice Moth, *Corcyra cephalonica*

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(Received 01 June 2021, Accepted 05 August, 2021)
(Published by Research Trend, Website: www.researchtrend.net)

ABSTRACT: The present experiment was conducted in the laboratory of Entomology, Dr. PDKV Akola, during August 2017-18 and 2018-19. The nine main treatments were the exposure of *Corcyra* larvae to the magnetic field for 0 hrs, 24 hrs, 12 hrs, 6 hrs, 3 hrs, 2 hrs, 1½ hrs, 1 hrs and ½ hrs duration and four sub treatments were rearing of the larvae on diet CSH-35 (D_1), Maldandi 35-1 (D_2), Swati (D_3) and CSH-9 (D_4) variety of sorghum. Observations were recorded based on pooled data, after 16 days and 24 days on weight and length of *Corcyra* larvae. The result indicates that, rearing of *Corcyra* in the magnetic field for 12 hrs recorded maximum weight and length 14.91 mg and 12.27 mm and after 24 days on maximum weight and length of *Corcyra* larvae was observed in 46.31 mg and 16.41 mm in magnetic field treatment for 12 hrs.

Keywords: *Corcyra cephalonica*, magnetic field exposure, diets, factorial complete randomized design.

INTRODUCTION

Corcyra also called as "Rice moth'' or the "Flour moth" is the only recognized species of *cephalonica* order Lepidoptera, family *Pyralidae*, sub – family Galleriinae, Tribe Tirathabini and Genus *Corcyra*. *Corcyra* was known to the scientific word since 1866, Stainton. *Corcyra cephalonica* (Stainton) a primary and secondary stored grain pest has origin in Greece Island known as Corfu (Rogonot, 1985), from where it has been migrated to Europe and elsewhere through rice trade. Today it has become one of the predominant polyphagous stored grain pests (Durant and Beveridge, 1913). It has been said that from causing heavy losses to stored grain in England. From England through grain trade it was distributed throughout the world and has acquired the status of cosmopolitan pest. After causing damage in West Africa through imported rice in 1960's it has spread to other important food commodities in West African sub region (Allotey, 1986). At present it has been found to cause damage to rice, wheat, corn, sorghum, groundnut, cotton seed, coffee, spices, cocoa etc (Ayyar, 1934).

It is very easy to rear *Corcyra* on artificial diet which has been prepared by various scientists to produce healthy eggs of *Corcyra* which are found most suitable to rear natural enemies on it (Kumar and Murthy, 2000). *Corcyra* is having short life cycle with egg period of 3 to 6 days, larval period 32.37 days pupal period 6.67 days and adult longevity male 5.67 days and female 6.67 days with fecundity of 268.33 eggs. (Deulkar *et al.*, 2012). Among the different diet studied for rearing of *Corcyra*, sorghum diet is found to be cheaper, easily available and widely used for mass multiplication of *Corcyra*. Development of *Corcyra* depends on food substrate provided. There are many varieties of sorghum among them which one is more suitable and nutritious for *Corcyra* has to be evaluated (Oberoi, 1967).

Though it is a pest on stored grain but has been found to the mass cultured on artificial diet and good healthy eggs of *Corcyra* can be produced and the eggs of *Corcyra* are found to the most suitable host for many parasite and predator production and larval stages to multiply Nematodes, larval parasite and predator in laboratory for field release. *Corcyra* is one of the factitious host for mass multiplication of *Trichogramma* in several countries of the world (Parra, 1997). In India also *Corcyra* has been reared commercially in various

bio-control laboratories of research and extension for production of natural enemies (Jalali and Singh, 1992).

MATERIAL AND METHODOLOGY

The present experiment was conducted by during the year 2017-18 and 2018-19 in the laboratory of Entomology Department, College of Agriculture, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola. The experiment was laid out in Factorial Complete Randomized Design with six replication and nine treatment and diet i.e. four sorghum varities. The influence of magnetic field on *Corcyra* when reared for different exposure time like 0 hrs, 24 hrs, 12 hrs, 6 hrs, 3 hrs, 2 hrs, 1½ hrs, 1 hrs and ½ hrs and different diet on four varieties of sorghum i.e. CSH-35, Maldandi 35-1, Swati and CSH-9. Then 30 gm prepared diet was filled in each container, treatment wise. There was six replications and total 224 containers were used for the experiment. In each container 20 larvae were released. To rear the *Corcyra* larvae in the permanent magnetic field and non magnetic field, magnetic chambers were prepared by fixing magnets around the box. The magnets were fixed in such a way that the North pole was facing an upward direction and the South pole downward toward the diet kept in the containers. After hatching of the eggs rearing of larvae was under taken as per the schedule treatments daily till larvae pupates.

Statistical Analysis

The data collected on larval weight and length after 16 days and 24 days were subjected to the statistical analysis (Opistat), for the test of significance after appropriate transformations.

RESULT AND DISCUSSION

A. Effect of magnetic field on weight of Corcyra larvae after 16 days (Factor A)

Significantly maximum larval weight over all the treatments was recorded in the treatment M_{12} (keeping *Corcyra* larvae in magnetic field for 12 hrs) recording 14.91 mg larval weight. Significantly least larval weight over all the treatments was observed in treatment $M_{½}$ recording 13.65 mg larval weight and was at par with treatments M_1, $M_{1½}$, M_0, M_2 and M_{24} recording 13.80, 13.90, 13.93, 13.94 and 13.99 mg larval weight, respectively (Table 1).

B. Effect of diet on weight of Corcyra larvae (Factor B)

In the study with diet maximum larval weight over all the treatment was observed in diet D_2 i.e. 14.30 mg and was at par with the diet D_1 and D_3 recording 14.11 and 14.09 mg larval weight, respectively. Significantly least larval weight was observed in diet D_4 recorded 13.78 mg larval weight, respectively.

Table 1: Effect of magnetic field and diet on weight of *Corcyra* larvae after 16 days from egg hatching (mg) (pooled result).

Magnetic treatment (hrs)	Pooled				
	CSH-35 (D_1)	Maldandi-35-1 D_2	Swati D_3	CSH-9 D_4	Factor A
Mean Interaction A × B					
Control	14.13	13.86	14.00	13.75	13.93
24	14.00	14.10	14.02	13.85	13.99
12	15.11	15.50	15.21	13.83	14.91
6	13.91	14.76	13.83	14.41	14.23
3	13.98	14.43	14.37	14.25	14.26
2	14.54	14.38	13.10	13.75	13.94
1½	13.60	14.10	14.50	13.41	13.90
1	13.87	14.00	14.00	13.33	13.80
½	13.83	13.59	13.76	13.41	13.65
Factor B	14.11	14.30	14.09	13.78	

	A Fact	B Fact	A × B Fact
'F' test	Sig.	Sig.	Sig.
S.E.(m)±	0.12	0.08	0.25
C.D. at 5 %	0.35	0.23	0.71

C. Cumulative effect of magnetic field and diet on weight of Corcyra larvae (Factor A × B)

In the interaction study of magnetic field and diet significantly maximum larval weight after 16 days over all the treatments was observed in $M_{12}D_2$ recording 15.50 mg larval weight and were also at par with the treatments $M_{12}D_3$ and $M_{12}D_1$ recording 15.21 and 15.11 mg larval weight, respectively. However later treatment was also at par with M_6D_2, M_2D_1 and $M_{1½}D_3$ recording 14.76, 14.54 and 14.50 mg larval weight, respectively. Significantly least larval weight over all treatment was observed in M_2D_3 in which 13.10 mg larval weight was observed and was at par with treatments M_1D_4, $M_{½}D_4$, $M_{1½}D_4$, $M_{½}D_2$, $M_{1½}D_1$, M_0D_4 and $M_{½}D_3$ recording 13.33, 13.41, 13.41, 13.59, 13.60, 13.75, 13.75 and 13.76 mg larval weight, respectively.

D. Effect of magnetic field on length of Corcyra larvae after 16 days (Factor A)

Significantly maximum larval length over all the treatments was recorded in treatment M_{12} (keeping *Corcyra* larvae in magnetic field for 12 hrs) recording 12.27 mm larval length. Significantly least larval length over all the treatments 10.31 mm was recorded in treatment $M_{½}$ hrs and was at par with M_1 recording 10.48 mm larval length (Table 2).

Table 2: Effect of magnetic field and diet on length of *Corcyra* larvae after 16 days from egg hatching (mm) (pooled result).

Magnetic treatment (hrs)	Pooled				
	CSH-35 (D_1)	Maldandi-35-1 D_2	Swati D_3	CSH-9 D_4	Factor A
Mean Interaction A × B					
Control	11.25	10.85	10.53	10.35	10.74
24	11.58	11.00	10.83	11.33	11.18
12	12.41	12.35	12.44	11.87	12.27
6	11.66	11.50	10.33	10.50	11.00
3	10.85	11.08	10.70	10.76	10.85
2	10.50	11.66	11.04	10.38	10.89
1½	10.50	11.18	10.54	10.52	10.68
1	10.43	10.58	10.50	10.41	10.48
½	10.16	10.41	10.25	10.41	10.31
Factor B	11.04	11.18	10.79	10.73	

	A Fact	B Fact	A × B Fact
'F' test	Sig.	Sig.	Sig.
S.E.(m)±	0.12	0.08	0.25
C.D. at 5 %	0.35	0.23	0.71

E. Effect of diet on length of Corcyra larvae (Factor B)

In the study with diet maximum larval length over all the treatment was observed in diet D_2 recording 11.18 mm larval length and was at par with diet D_1 recording 11.04 mm larval length. Significantly least larval length was observed in D_4 with 10.73 mm larval length and was at par with D_3 recording 10.79 mm larval length.

F. Cumulative effect of magnetic field and diet on length of Corcyra larvae (Factor A × B)

In the interaction study of magnetic field and diet significantly maximum larval length after 16 days over all the treatments was observed in treatment $M_{12}D_3$ recording 12.44 mm larval length and was at par with the treatments $M_{12}D_1$, $M_{12}D_2$ and $M_{12}D_4$ recording 12.41, 12.35, and 11.87 mm larval length, respectively. Significantly least larval length over all the treatment 10.16 mm was observed in the treatment $M_{½}D_1$ and was at par with treatments $M_{½}D_3$, M_6D_3, M_0D_4, M_2D_4, $M_{½}D_4$, $M_{½}D_2$, M_1D_4, M_1D_1, M_1D_3, $M_{1½}D_1$, M_2D_1, M_6D_4, $M_{1½}D4$, M_0D_3, $M_{1½}D_3$, M_1D_2, M_3D_3, M_3D_4, $M_{24}D_3$, M_3D_1 and M_0D_2 recording 10.25, 10.33, 10.35, 10.38, 10.41, 10.41, 10.41, 10.43, 10.50, 10.50, 10.50, 10.50, 10.52, 10.53, 10.54, 10.58, 10.70, 10.76, 10.83, 10.85 and 10.85 mm larval length, respectively

G. Effect of magnetic field on weight of Corcyra larvae after 24 days (Factor A)

Significantly maximum larval weight 46.26 mg over all the treatments was recorded in treatment M_{12} and was at par with M_6 recording 45.77 mg larval weight. Significantly least larval weight 44.03 mg was recorded in treatments M_1 and $M_{½}$ (Table 3).

H. Effect of diet on weight of Corcyra larvae (Factor B)

The result indicate that significantly maximum larval weight over all treatments was observed in diet D_2 i.e. 45.65 mg larval weight and was at par with the treatment D_1 recording 45.36 mg larval weight. Significantly least larval weight was observed in diet D_4 recording 44.51 mg larval weight and was at par with diet D_3 in which 44.82 mg larval weight was observed.

Table 3: Effect of magnetic field and diet on weight of *Corcyra* larvae after 24 days from egg hatching (mg) (pooled).

Magnetic treatment (hrs)	Pooled				
	CSH-35 (D_1)	Maldandi-35-1 D_2	Swati D_3	CSH-9 D_4	Factor A
Mean Interaction A × B					
Control	44.51	46.25	44.91	43.75	44.85
24	45.50	46.50	45.25	44.50	45.43
12	46.31	46.50	46.19	46.04	46.26
6	45.85	46.29	45.35	45.58	45.77
3	46.03	46.02	45.25	44.25	45.39
2	46.41	44.60	44.53	45.43	45.24
1½	45.78	44.75	44.83	43.75	44.77
1	43.91	44.55	43.90	43.75	44.03
½	43.97	45.41	43.16	43.58	44.03
Factor B	45.36	45.65	44.82	44.51	

	A Fact	B Fact	A × B Fact
'F' test	Sig.	Sig.	Sig.
S.E.(m)±	0.20	0.13	0.41
C.D. at 5 %	0.57	0.38	1.14

I. Cumulative effect of magnetic field and diet on weight of Corcyra larvae (Factor A × B)

In the interaction study of magnetic field and diet significantly maximum larval weight after 24 days over all the treatments was observed in $M_{24}D_2$ and $M_{12}D_2$ recording 46.50 mg larval weight and were at par with treatments M_2D_1, $M_{12}D_1$, M_6D_2, M_0D_2, $M_{12}D_3$, $M_{12}D_4$, M_3D_1, M_3D_2, M_6D_1, $M_{1½}D_1$, M_6D_4, $M_{24}D_1$, M_2D_4 and $M_{½}D_2$ recording 46.41, 46.31, 46.29, 46.25, 46.19, 46.04, 46.03, 46.02, 45.85, 45.78, 45.58, 45.50, 45.43 and 45.41 mg larval weight, respectively. Significantly least larval weight over all the treatments was observed in treatments $M_{½}D_3$ recording 43.16 mg larval weight and were at par with treatments $M_{½}D_4$, M_1D_4, $M_{1½}D_4$, M_0D_4, M_1D_3, M_1D_1, $M_{½}D_1$ and M_3D_4 recording 43.58, 43.75, 43.75, 43.75, 43.90, 43.91, 43.97 and 44.25 mg larval weight, respectively.

I. Effect of magnetic field on length of Corcyra larvae after 24 days (Factor A)

Significantly maximum larval length over all the treatments was recorded in the treatment M_{12} (keeping *Corcyra* larvae in magnetic field for 12 hrs) recording 16.41 mm larval length. Significantly least larval length over all the treatments 14.27 mm was recorded in treatment $M_{½}$ (Table 4).

J. Effect of diet on length of Corcyra larvae (Factor B)

In the study with diet maximum larval length over all the treatment was observed in treatment D_2 recording 15.40 mm larval length and was at par with treatment D_3 in which 15.02 mm larval length was recorded.

Table 4: Effect of magnetic field and diet on length of *Corcyra* larvae after 24 days from egg hatching (mm) (pooled result).

Magnetic treatment (hrs)	Pooled				
	CSH-35 (D1)	Maldandi-35-1 D_2	Swati D_3	CSH-9 D_4	Factor A
Mean Interaction A × B					
Control	14.60	15.41	14.94	15.41	15.09
24	15.41	15.25	16.00	15.55	15.55
12	16.50	17.00	16.50	15.66	16.41
6	14.75	15.50	15.05	14.75	15.01
3	14.25	15.36	14.60	14.75	14.74
2	14.66	15.57	14.50	14.90	14.91
1½	13.75	15.05	14.50	14.56	14.46
1	13.00	15.10	14.35	15.00	14.36
½	13.50	14.41	14.77	14.41	14.27
Factor B	14.49	15.40	15.02	15.00	

	A Fact	B Fact	A × B Fact
'F' test	Sig.	Sig.	Sig.
S.E.(m)±	0.16	0.10	0.32
C.D. at 5 %	0.45	0.30	0.90

Significantly least larval length over all the treatments was observed in D_1 recorded 14.49 mm larval length.

K. Cumulative effect of magnetic field and diet on length of Corcyra larvae (Factor A × B)

In the interaction study of magnetic field and diet significantly maximum larval length after 24 days over all the treatments was observed in treatment $M_{12}D_2$ recording 17.00 mm larval length and was at par with the treatments $M_{12}D_1$ and $M_{12}D_3$ recording 16.50 and 16.50 mm larval length, respectively. Significantly least larval length over all the treatment 13.00 mm was observed in the treatment M_1D_1 and was at par with treatments $M_{½}D_1$ and $M_{1½}D_1$ with 13.50 and 13.75 mm larval length, respectively.

Regarding the effect of magnetic field on weight and length of *Corcyra* larvae Gandhi, (2014) reported that all over the treatments was observed maximum weight and length 11.027 mg and 0.89 cm after 16 days and after 24 days observed in which 47.167 mg and 1.60 cm. Dangat *et al.*, (2016) reported 11.05 mg and 9.62 mm after 16 days larval weight and length and after 24 days observed in which 43.58 mg and 17.62 mm (non magnetic) and 17.01 mm magnetic field. Chandrawanshi (2017) evaluate that 10.66 mg and 10.19 mm larval weight and length was observed in which non magnetic field treatment and after 24 days 45.50 mg and 16.36 mm larval weight and length observed in 2 hrs magnetic field treatment. But similar observations were not observed in the present study of *Corcyra* larvae were exposed to a magnetic field. The finding is quite consistent with the present finding and minor differences in weight and length of *Corcyra* larvae after 16 and 24 days may be due to the difference in diet provided to the larvae during the study.

CONCLUSION

From the present study concluded the exposure of *Corcyra cephalonica* in magnetic field for reared ½ hrs, 1 hrs and 24 hrs period had negative impact on growth and development of larvae. Exposure of *Corcyra cephalonica* to magnetic field for 12 hrs had positive impact on larval weight and length. Amongst different diets tested the best diet for the growth and development of *Corcyra* was observed to be sorghum variety Maldandi 35-1 (D_2). So this variety can be recommended for commercial rearing of *Corcyra*. The interaction effect of magnetic field 12 hrs and Maldandi 35-1 (D_2) diet had good growth of *Corcyra* larvae as compare to non magnetic field. Exposure of larvae for 12 hrs had positive impact on biological parameter can be used for mass multiplication of *Corcyra* and that for 24 hrs can be used in management of *Corcyra* under store condition.

Acknowledgement. The authors gratefully acknowledge, Biocontrol laboratory, Department of Entomology, Dr. PDKV, Akola for providing eggs of *Corcyra cephalonica* and necessary facilities during my research work.

Conflict of interest. Nil.

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How to cite this article: Shendage, S.A., Aherkar, S.K., Kulkarni, U.S., Wadaskar, R.M. and Mohril, M.P. (2021). Effect of Magnetic Field and Different Diet on Biological Parameter of Rice Moth, *Corcyra cephalonica*. *Biological Forum – An International Journal*, *13*(3): 327-331.