Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

E-ISSN: 2320-7078
P-ISSN: 2349-6800
www.entomoljournal.com
JEZS 2020; 8(3): 999-1001

Received: 19-03-2020
Accepted: 21-04-2020

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Effect of magnetic field on eggs of rice moth, *Corcyra cephalonica* (Stainton)

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Abstract
Experiment conducted during 2018-19, to determine the effect of magnetic field on *Corcyra cephalonica* eggs. Exposure of *Corcyra* eggs to magnetic field for gradually increasing time durations. Observations were recorded on *Corcyra* eggs hatching per cent on 4th, 5th and 6th day of magnetic treatment. The result showed that, exposure of *Corcyra* egg for 2 h to 2½ hour increases eggs hatching which will be useful in the laboratory for rearing of *Corcyra* eggs, whereas as the time of exposure to magnetic field increases then there is gradual decrease in egg hatching per cent. At 24 hour of magnetic treatment, it reduces the egg hatching of *Corcyra.* This can be implicated in storage structure to control the infestation of *Corcyra* in store grains.

Keywords: *Corcyra cephalonica*, magnetic field, complete randomized design

1. Introduction
Corcyra cephalonica (Stainton) popularly known as the "Rice meal moth" or the "Flour moth", belongs to Family Pyralidae of Order Lepidoptera. It is one of the important stored grain pests in Asia, Africa, North America and Europe. In India Rice moth is utilized in various biocontrol laboratories and developmental units. *Corcyra* production is cheaper and the cost required to multiplying the parasite and predator is less, as the parasitized egg and larval stages can be easily released with bio agents in the field to control crop pest (Kumar and Murthy, 2000).
Recent research emphasizes the mass rearing of bio control agents for augmentation and field releases. Bio-agents occupy a premier position in the crop protection sector and constitute an important component of IPM.
Present study is to evaluate the influence of magnetic field on *Corcyra* eggs along with the information about performance on non-magnetic field treatments. Any positive and negative effect if observed will help to enhance or reduce the production of *Corcyra* eggs in the laboratory and will help to develop the strategies for mass multiplication of *Trichogramma.*

2. Materials and method
The present experiment was conducted at laboratory of Entomology, Dr. PDKV Akola, during August 2018-19. The experiment was carried out in Completely Randomized Design (CRD) with fourteen different treatments and four repetitions with objectives to know the effect of exposure of magnetic field on *Corcyra* eggs.
The materials used and the method followed to carry out these investigations are described below.

Rearing of *Corcyra* in the laboratory
Corcyra eggs were produced in the laboratory on the most popular diet to rear *Corcyra* for production of *Corcyra* eggs. Diet included 10 kg good quality Sorghum to which 400 gm of crushed groundnut, 20 gm of Yeast powder, 20 gm wettable sulphur, 0.5 gm Streptomycin sulphate in 100 ml of distilled water (Gandhi., 2014)[5]. The eggs produced in the laboratory every day were used for the experiment. Eggs laid by the female within 24 hrs were collected from the egg laying chamber. Collected eggs were cleaned by removing the scales and other body parts of *Corcyra*. After cleaning the *Corcyra* eggs, whenever required they were used for preparation of egg-card.

Egg card

Corcyra egg card prepared by using yellow colored card sheet on which thin layer of glue was applied then freshly laid *Corcyra* eggs were evenly sprinkled with the help of hair brush. Each card exposed to the magnetic field for different duration of time as per treatment and replication.

Magnetic field is created by fixing permanent magnet around the box. The magnet were fixed in such a way that the North Pole was facing towards the *Corcyra* eggs kept in the containers. *Corcyra* egg hatching starts from fourth day. Observations were recorded on per cent *Corcyra* egg hatching at 4th day, 5th day and 6th day of egg laying.

Treatments

Table 1: Exposure of *Corcyra* eggs to magnetic field

Sr. No.	Treatment	Treatment details
1	T_0	Zero Hour
2	T_1	15 min
3	T_2	30 min
4	T_3	45 min
5	T_4	1 Hour
6	T_5	1½ Hour
7	T_6	2 Hour
8	T_7	2½ Hour
9	T_8	3 Hour
10	T_9	4 Hour
11	T_{10}.	5 Hour
12	T_{11}	6 Hour
13	T_{12}	12 Hour
14	T_{13}	24 Hour

The data collected on egg hatching were subjected to the statistical analysis, for the test of significance after appropriate transformations [6].

4. Results and Discussion

Effect of magnetic field on *Corcyra* egg hatching at 4th, 5th and 6th day of magnetic treatment

Data recorded on *Corcyra* egg hatching was presented in table no. 2. Magnetic field had significant impact on egg hatching on:

Fourth day

Maximum hatching percentage of *Corcyra* on fourth day over all treatments was observed in the treatment T_7 (2½ hrs) recording 99.68 % and was found at par with treatment T_6 (2 hrs) recording 99.18 %. In treatment T_0 control (0 hrs) recoding 97.19 % and was significantly low over above two treatments but was significantly superior to rest of all treatments.

Significantly minimum 52.54 and 55.89 per cent egg hatching over all the treatments was recorded in T_{13} (24 hrs) and T_{12} (12 hrs), respectively.

In next group of treatments, treatment T_5 (1½ hrs), T_4 (1 hrs), T_3 (45 min) recorded 93.98 %, 92.95 %, 92.29 % and were at par with each other. Latter two treatment T_2 (30 min) and T_1 (15 min) were also at par with each other recording 90.98 % and 90.77 % respectively. In group of treatments T_8 (3 hrs), T_9 (4 hrs), T_{10} (5 hrs) were at par with each other recording 68.79 %, 67.18 % and 66.07 %, respectively. However all these treatments were significantly superior to treatment T_{11} (6 hrs) in which 62.01 % was recorded. (fig. no.1)

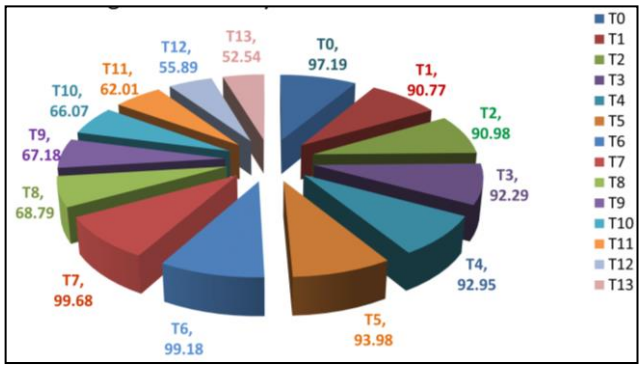

Fig 1: Effect of magnetic field on *Corcyra* eggs hatching on fourth day

Fifth day

Magnetic field had significant impact on *Corcyra* egg hatching. Significantly maximum per cent egg hatching of *Corcyra* on fifth day over all treatments was observed in T_7 (2½ hrs) recording 99.24 % which was at par with treatment T_6 (2 hrs) recording 98.89 %. Both the treatment were significantly superior to treatment T_0 control (0 hrs) recording 95.74 % but was significantly superior over rest of all the treatments.

Significantly minimum 51.43 % and 54.02 % over all the treatments was recorded in treatment T_{13} (24 hrs) and T_{12} (12 hrs), respectively and were at par with each other.

In next group of treatments, treatment T_5 (1½ hrs), T_4 (1 hrs), T_3 (45 min) recording 92.05 %, 91.37 % and 90.98 % and were at par with each other. Latter two treatments were also at par with each other. Treatment T_2 (30 min) recoding 89.19 % and was at par with treatment T_1 (15 min) with 88.29 %, the group of treatments T_8 (3 hrs), T_9 (4 hrs), and T_{10} (5 hrs) recorded 67.66 %, 66.87 %, and 64.23 %, respectively. Latter treatment T_{10} was at par with T_{11} (6 hrs) 61.77 % was recorded. (Fig. no. 2)

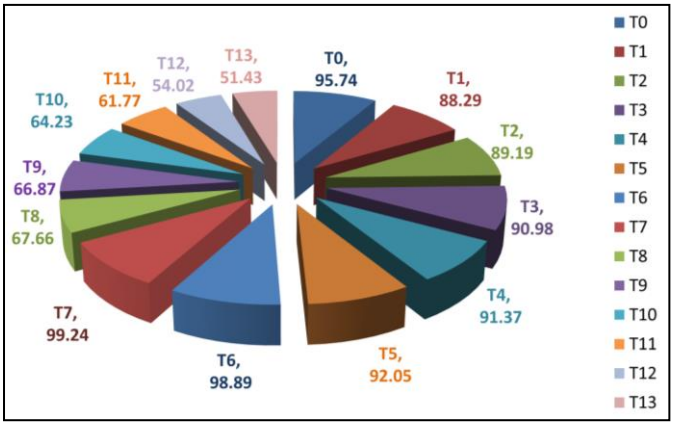

Fig 2: Effect of magnetic field on *Corcyra* eggs hatching on fifth day

Sixth day

Magnetic field had significant effect on *Corcyra* eggs. Significantly maximum number of *Corcyra* egg hatching on sixth day was observed in the treatment T_7 (2½ hrs) 96.19 % was at par with treatment T_6 (2 hrs) 95.47%, both the treatments were significantly superior over rest of all treatments. However latter treatment T_6 was also at par with treatment T_0 control (92.99 %) and T_5 (1½ hrs) in which 91.20 % was recorded.

Significantly least egg hatching over all the treatments 47.83 % and 50.54 % was recorded in treatment T_{13} (24 hrs) and T_{12}

(12 hrs), respectively. Both the treatments were at par with each other.

In group of treatments, treatment T_4 (1 hrs) 88.92 % and was found at par with treatment T_3 (45 min), T_2 (30 min) and T_1 (15 min) recording 87.99 %, 86.25 % and 85.96 %. All these treatments were significantly superior over treatment T_8 (3 hrs) which was at par with treatment T_9 (4 hrs), T_{10} (5 hrs) and T_{11} (6 hrs) recording 64.21%, 63.04%, 61.86 % and 58.28 % egg hatching. (Fig. no. 3)

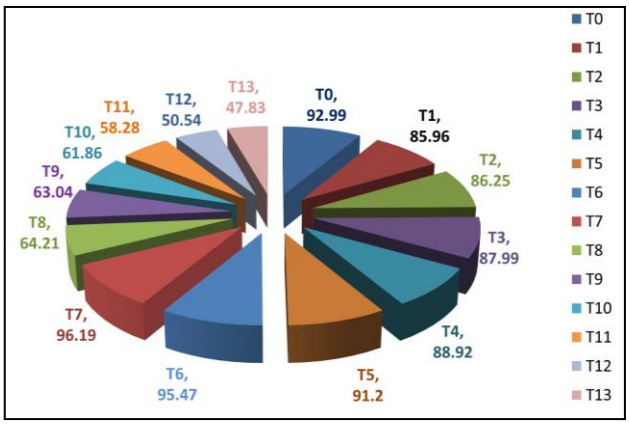

Fig 3: Effect of magnetic field on *Corcyra* eggs hatching on sixth day

Table 2: Effect of magnetic field on *Corcyra* eggs hatching on fourth, fifth and sixth day of treatment

Treatments	Average per cent egg hatching (mean values)		
	Fourth day	Fifth day	Sixth day
T_0 (0 hr)	97.19 (80.67)	95.74 (78.65)	92.99 (74.70)
T_1 (15 min)	90.77 (72.31)	88.29 (70.00)	85.96 (68.00)
T_2 (30 min)	90.98 (72.54)	89.19 (70.81)	86.25 (68.24)
T_3 (45 min)	92.29 (73.89)	90.98 (72.54)	87.99 (69.73)
T_4 (1 hrs)	92.95 (74.69)	91.37 (72.92)	88.92 (70.57)
T_5 (1½ hrs)	93.98 (75.83)	92.05 (73.66)	91.20 (73.09)
T_6 (2 hrs)	99.18 (85.23)	98.89 (84.07)	95.47 (77.73)
T_7 (2½ hrs)	99.68 (87.01)	99.24 (85.43)	96.19 (78.91)
T_8 (3 hrs)	68.79 (56.03)	67.66 (55.34)	64.21 (53.26)
T_9 (4 hrs)	67.18 (55.05)	66.87 (54.86)	63.04 (52.59)
T_{10} (5 hrs)	66.07 (54.37)	64.23 (53.26)	61.86 (51.92)
T_{11} (6 hrs)	62.01 (51.95)	61.77 (51.80)	58.28 (49.77)
T_{12} (12 hrs)	55.89 (48.38)	54.02 (47.30)	50.54 (45.30)
T_{13} (24 hrs)	52.54 (46.45)	51.43 (45.81)	47.83 (43.75)
F test	Sig.	Sig.	Sig.
SE (M) ±	0.70	0.76	1.16
CD at 5%	2.02	2.20	3.34

(Figures in parentheses are arc sin transformed values)

In present study, From above recorded data at fourth day, fifth day and sixth day of magnetic treatment, it was observed that there was increase in the hatching percentage of *Corcyra* eggs when the eggs were kept for 2½ hrs in magnetic field and it was significantly more than control. Indicating that if we kept *Corcyra* eggs for 2½ hrs in magnetic field had positive effect and if the durations of magnetic field treatment are extended then there is reduction in hatching percentage of *Corcyra* eggs indicating that magnetic field plays important role in enhancing or reducing the hatching percentage of *Corcyra* eggs. This finding can be explored in rearing technique to get maximum egg hatching by exposing *Corcyra* eggs for 2 to 2½ hrs magnetic field. Also the magnetic field can be used for managing *Corcyra* by keeping the stored grain in magnetic field. This finding of present investigation are in close conformity with the finding of Chandrawanshi *et al.*, (2017)[1] who observed that, keeping of *Corcyra* in Magnetic field for 2 hrs had positive effect and more than 4 hrs had negative effect on the biological parameter of *Corcyra* under study. Gandhi (2014) [3] and Dangat (2016) [2] reported that magnetic field for 12 hrs and 24 hrs which were longest duration than the rest of the treatments had negative effect on growth and development of *Corcyra*. Pandir *et al.*, (2013))[5] has reported that long term magnetic fields exposure to eggs of mediterranean flour moth (*Ephistia Kuehniella*) for 3, 6, 12, 24, 48 and 72 hrs magnetic treatment had adverse effect on larval emergence and there was increased in egg mortality. These finding are in line with the present findings and support to present finding.

5. Conclusion

Magnetic field plays important role in enhancing or reducing the hatching percentage of *Corcyra* eggs. This finding can be explored in rearing technique to get maximum egg hatching by exposing *Corcyra* eggs for 2 to 2½ hrs magnetic field. Also the magnetic field can be used as non-chemical control technology for managing *Corcyra* by keeping the stored grain in magnetic field.

6. Acknowledgement

The authors gratefully acknowledge, Biocontrol unit, Department of Entomology, Dr. PDKV, Akola, for providing eggs of *Corcyra* and necessary facilities during the course of my study.

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