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Effect of Different Hosts on the Growth and Development of Rice Moth (*Corcyra cephalonica*)

Jitendra Kumar, Pankaj Neog, Biplove Bala, Imtinaro L., Susanta Banik, T. Gohain

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ABSTRACT

The investigation entitled "Effect of different hosts on the growth and development of rice moth (*Corcyra cephalonica*)" was conducted under the laboratory condition at Department of Entomology, School of Agricultural Sciences, Medziphema during 2023-2024. The experiment was carried out to assess the effects of seven hosts viz., rice (Nagaland local), rice (Andhra parimol), maize, foxtail millet, wheat, sorghum and rice bean on the growth and development of *C. cephalonica*. The study indicated that the minimum larval period (31.20 days) was observed on sorghum while, the maximum was on wheat (45.00 days). The maximum larval weight was seen on sorghum (52.67 mg) whereas, the minimum on wheat (41.93 mg). The minimum pupal period was noted on sorghum (9.41 days) and maximum on wheat (10.35 days) while, maximum pupal weight was recorded on sorghum (38.50 mg) and minimum on wheat (33.42 mg). The growth index was maximum on sorghum (1.81) and minimum on wheat (1.13). The minimum developmental period was observed on sorghum (44.78 days) while, the maximum was on wheat (60.92 days). Therefore, the study concluded that among all seven hosts the most preferred host was sorghum followed by rice (Nagaland local), maize, foxtail millet, rice (Andhra parimol), rice bean and wheat respectively, for growth and development of rice moth.

Keywords Rice moth (*Corcyra cephalonica*), Growth and development, Host evaluation, Sorghum and wheat.

Jitendra Kumar[1], Pankaj Neog[2]*, Biplove Bala[3], Imtinaro L.[4], Susanta Banik[5], T. Gohain[6]

[2]Associate Professor, [3]PhD Scholar, [4,5,6]Professor
[1,2,3,4]Department of Entomology, School of Agricultural Sciences, Nagaland University, Medziphema, Nagaland 797106, India

[5]Department of Plant Pathology, School of Agricultural Sciences, Nagaland University, Medziphema, Nagaland 797106, India

[6]Department of Agronomy, School of Agricultural Sciences, Nagaland University, Medziphema, Nagaland 797106, India

Email: pneog@nagalanduniversity.ac.in
*Corresponding author

INTRODUCTION

India is amongst the top producers and consumers of grains worldwide, encompassing rice, wheat, maize and pulses. However, because of its varied agro climatic conditions and the widespread use of conventional storage systems, the nation confronts considerable hurdles in managing storage grain pests. According to Bhargava *et al.* (2007), 10% of India's total food grain output is lost annually owing

to insect damage, microbiological degradation and other reasons during storage after harvest. Traditional methods of food preservation such as rice is stored in bamboo structures coated with mud, maize grains are tied and hung in bunches and soybeans are preserved through a traditional fermentation process (Sanjay *et al.* 2018). Among the stored grain pest rice moth, *Corcyra cephalonica* (Family : Pyralidae, Order : Lepidoptera) is a significant agricultural pest that causes significant economic losses (Atwal and Dhaliwal 2008). It is reported to cause 5–10% of the loss of grains in India (Champ and Dyte 1977, Tooba *et al.* 2005). It is common in several states, including Gujarat, Haryana, Meghalaya, Manipur, Nagaland, Chandigarh, Andhra Pradesh and Gujarat (Allotey and Kumar 1985).

The larvae of *C. cephalonica* damage stored grains by feeding under silken webs (Alam 1972), they leave behind thick, stiff silk threads that seriously harm grains (Ayyar 1934). Because of its adaptability to different rearing conditions, amenability to mass production and positive influence on the progeny of biocontrol agents, *C. cephalonica* is also utilized for the mass cultivation of certain entomophagous insects or parasitoids from the *Hymenoptera* order, specifically within the families Bethylidae, Braconidae, Platygastridae and Trichogrammatidae (Singhamuni *et al.* 2015, Nasrin *et al*. 2016). According to Pathak *et al.* (2010), using strong host eggs is crucial for the growth of egg parasitoids. It is often used to produce large quantities of *Trichogramma* spp. (egg parasitoids). In the laboratory, *C. cephalonica* may be raised in a variety of stored grains alongside *Bracon hebetor*, a larval parasitoid, and *Chrysoperla carnea,* a predator. Strong moths and eggs were produced by rearing *C. cephalonica* on effective feeding material. One criterion used to evaluate the health of the insect is the size of the egg. The knowledge of the biology, behavior, and life cycle of the pest, the development of monitoring and detection tools, the use of integrated pest management strategies, the investigation of grain storage systems, and the tracking of pesticide resistance are the main goals of several research fields.

Considering all the point mentioned above, the present study was therefore designed to manipulate the *C. cephalonica* rearing medium for evaluating its efficacy in producing high-quality eggs through improved nutrition of *Corcyra* larvae. In order to determine if *C. cephalonica* rearing media is suitable for producing high-quality eggs by providing *Corcyra* larvae with better nutrition, the current study was designed to manipulate the medium. The following investigation entitled "Effect of different hosts on the growth and development of rice moth (*Corcyra cephalonica*)" was undertaken.

MATERIALS AND METHODS

Experimental details

The study was carried out in the storage laboratory, Department of Entomology, School of Agricultural Sciences, Medziphema campus which is located at 25°45'45" latitude and 93°53'04" longitude at an elevation of 310 m above mean sea level. The experiment was conducted using Completely Randomized Design (CRD) with seven treatments i.e. Rice (Nagaland local), Rice (Andhra parimol), Maize, Foxtail millet, Wheat, Sorghum and Rice bean, and replicated three times.

Maintenance of nucleus culture

The nucleus culture of *C. cephalonica* was collected from the biocontrol laboratory, Medziphema (ESTD 1996-1997) and maintained at storage laboratory. In order to conduct the experiment, adult rice moths were reared in laboratory conditions within 5 kg capacity glass jars, which contained both broken and unbroken rice grains. To kill eggs and certain microbes, the jars were covered with muslin cloth and sterilized for approximately an hour at 100°C. Three kilograms of oven-exposed broken rice were added to each glass jar. A cotton plug soaked up with 5% sucrose solution was placed inside the jars for feeding adult rice moths, additionally enhancing their fertility (Pareek and Kushwaha 1971). Subsequently, each jar received an application of 5 g of yeast extract and 0.5 g of streptomycin sulphate. The majority of the eggs were deposited between the two layers of muslin cloth, from which they were collected daily using a soft brush and afterward placed in individual petri dishes. The egg-laying chambers were maintained at 28±2°C using an incubator.

For studying the effect of different hosts on the growth and development of *Corcyra cephalonica,* 250 g of grain from each host was placed in individual containers. Around 25% of each grains was ground and sterilized by heating in an oven at 60°C for 2 hrs. The grains underwent treatment of 0.1% formaldehyde at a dosage of 2.5 ml per 250 g of grains and were subsequently air dried. Approximately 1000 eggs, aged 0-6 hrs, were placed in a petri dish and covered with blotting paper to facilitate hatching. 20 neonate larvae of *C. cephalonica* were introduced with a wet brush into each container containing different host materials as food sources. Each container was wrapped in muslin cloth and fastened with a rubber band. The containers were monitored and observed systematically.

Larval period (days): The duration from the emergence of the newly hatching larvae to the formation of silken webs in each container was systematically observed and documented.

Larval weight (mg): The weight of fully grown 20 individual larvae was measured using an electronic balance for each replication.

Pupal period (days): The duration from pupa formation or silken web development in grains to adult emergence in each container was observed.

Pupal weight (mg): The weight of fully grown pupae was measured using an electronic balance for each replication.

Total Development period: The interval from egg hatching to adult emergence in each replication of each host was recorded to assess the total development period.

Growth index: It was calculated using the equation provided by Singh and Pant (1995).

$$\text{Growth index} = \frac{\text{Percent adult emergence}}{\text{Average development period (days)}} \times 100$$

Statistical analysis: The data obtained from different treatments was subjected to statistical analysis as per the statistical guidelines by Gomez and Gomez (1984). Wherever appropriate, the findings were converted to sine values. The significance of treatments was determined by a critical difference (CD) test at a 5% level of significance for the comparison of treatments.

RESULTS AND DISCUSSION

Larval period

The larval development was started inside the different grains and observed frass and silken web and caused excessive lumping. The larva was whitish and brownish in color. The data presented in the Table 1 revealed that the larval period ranged between 31.20 days and 45.00 days. The minimum (31.20 days) was recorded in sorghum and maximum (45.00 days) was recorded in Wheat, which was nearly equal to rice bean 43.72 days. According to Jhala *et al.* (2019) the minimum larval period of *C. cephalonica* in sorghum was recorded as 32.40 days. Patel and Mehta (2011) also documented the minimum larval period of *C. cephalonica* in sorghum of 37.34 days. Devi *et al.* (2023) stated that sorghum based diet can be utilized for successful rearing of *C. cephalonica*. Therefore, the finding was in conformity with those of previous research.

Larval weight

The data presented in Table 1 revealed that the range of mean larval weight was recorded between 41.93

Table 1. Effects of various hosts on larval period and weight of *C. cephalonica*.

Hosts	Larval period (days)	Larval weight (mg)
T_1 Rice (Nagaland local)	35.33	50.88
T_2 Rice (Andhra parimol)	42.05	44.83
T_3 Foxtail millet	40.41	47.14
T_4 Maize	37.30	48.85
T_5 Wheat	45.00	41.93
T_6 Sorghum	31.20	52.67
T_7 Rice bean	43.72	44.00
SEm±	0.49	0.35
CD at 5%	1.49	1.08

Table 2. Effects of various hosts on pupal period and weight of *C. cephalonica*.

Hosts		Pupal period (days)	Pupal weight (mg)
T_1	Rice (Nagaland local)	9.59	37.74
T_2	Rice (Andhra parimol)	9.72	36.07
T_3	Foxtail millet	9.67	37.57
T_4	Maize	9.62	37.67
T_5	Wheat	10.35	33.42
T_6	Sorghum	9.41	38.50
T_7	Rice bean	10.14	35.03
	SEm±	0.02	0.27
	CD at 5%	0.06	0.82

mg and 52.67 mg. The minimum larval weight was recorded in wheat 41.93 mg whereas the maximum larval weight was recorded in sorghum 52.67 mg which was closed to rice (Nagaland local) 50.88 mg. Patel and Patel (2007) concluded that sorghum was the best host for larval growth. Jhala *et al.* (2019) also found sorghum as the best host for growth and development of rice moth. Thus the finding confirmed validity of earlier research.

Pupal period

The color of the pupa was dark brown and enclosed in cocoon. The cocoon was more or less elongated and thinly woven, with elliptical space at one end. The pupal period as shown in Table 2 ranged from 9.41 days to 10.35 days. The minimum mean pupal period was recorded, in sorghum, (9.41 days) and maximum mean pupal period was recorded in wheat (10.35 days). Whereas rice (Nagaland local), maize, foxtail millet, rice (Andhra parimol), rice bean were recorded as 9.59 days, 9.62 days, 9.67 days, 9.72 days, 10.14 days respectively which were nearly equal to sorghum. The findings align with the study conducted by Devi *et al.* (2023), Patel and Mehta (2011) and Patel and Patel (2007), which indicated that the shortest pupal period occurred in sorghum. Similarly, Jhala *et al.* (2019) observed minimum pupal period in sorghum 9.45 day and maximum pupal period in wheat 10.20 days.

Pupal weight

The data pertaining to pupal weight as presented in Table 2 revealed that there was significant variation in pupal weight due to different hosts. The minimum mean pupal weight was recorded in wheat (33.42 mg) and the maximum mean pupal weight was recorded in Sorghum (38.50 mg), which was nearly equal to Rice (Nagaland local) 37.74 mg. Whereas mean pupal weight of maize was recorded 37.67 mg which was at par with foxtail millet 37.57 mg. Devi *et al.* (2023) and Jhala *et al.* (2019) also reported that the maximum pupal period was observed in sorghum.

Table 3. Effects of different hosts on total development period and growth index of *C. cephalonica*.

Hosts		Total development period (days)	Growth index
T_1	Rice (Nagaland local)	49.16	1.62
T_2	Rice (Andhra parimol)	55.94	1.27
T_3	Foxtail millet	54.28	1.34
T_4	Maize	51.20	1.47
T_5	Wheat	60.92	1.13
T_6	Sorghum	44.78	1.81
T_7	Rice bean	58.98	1.17
	SEm±	0.52	0.02
	CD at 5%	1.57	0.05

Total development period

The data presented in Table 3 revealed that total developmental period of rice moth was significantly affected due to different hosts. The minimum mean development period was recorded in sorghum (44.78 days) and the maximum mean development period was recorded in wheat (60.92 days), which was nearly equal to rice bean (58.98 days). However, in rice (Andhra parimol) it was recorded as 55.94 days which was at par with foxtail millet 54.28 days. According to Kumar *et al.* (2018), a mixture of Sorghum 1000 g + ground nut 50 g was found to be the best treatment for developmental period by recording minimum developmental period of 47.33 days. The result was consistent with the findings of Devi *et al.* (2023), Jhala *et al.* (2019) and Patel and Mehta (2011), reported that the minimum developmental period was recorded in sorghum.

Growth index

The data presented in Table 3 revealed that the growth

index varied from 1.13 to 1.81 which was significantly influenced by different hosts. The maximum growth index was recorded in sorghum (1.81) whereas the minimum growth index was recorded in wheat (1.13) and the growth index of rice bean (1.17) was at par with wheat. The result was in conformity with the findings of Patel and Patel (2007) and Patel and Mehta (2011), who reported that the higher growth index was found in sorghum. Jhala *et al*. (2019) also reported that the maximum growth index was recorded in sorghum (1.18) and minimum in wheat (1.73).

CONCLUSION

The study concluded that among all the seven hosts of rice moth, the most preferred host was sorghum as the minimum larval and pupal period, maximum total development period, maximum larval and pupal weight and maximum growth index was found in sorghum host which was followed by rice (Nagaland local), maize, foxtail millet, rice (Andhra parimol), rice bean and wheat respectively. Thus it can be recommended that sorghum serve as the best host for the growth and development of rice moth (*Corcyra cephalonica*).

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