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Infestation Behavior and Nature of Damage by Rice Meal Moth *Corcyra cephalonica* Stainton (Lepidoptera : Pyralidae) on Proso Millet (*Panicum miliaceum* L.)

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Abstract

The complete larval development of *C. cephalonica* studied at 25 C and 70—80% RH took place within the grain cluster or gallery formed by the larva on the consumption of broken grains. The amount of food required by each larva during its life cycle was 0.23 g. The larval density was influenced by the available limited space, they were able to multiply rapidly without any stress effect. A release of ten larvae warranted the operation of crowding effect resulting in reduction in larval and pupal weight. In the studies on the influence of different grain properties on the infestation of *C. cephalonica,* whole grains and grains with glumes were least preferred and the broken grains and flour of proso millet were most preferred for growth and development.

Key words : *Corcyra cephalonica,* Proso millet, Infestation behavior, Damage.

Proso millet, *Panicum miliaceum* (L.) is a small millet and quick growing crop, particularly suited to a dry continental climate. This is widely grown in USSR, Central Asia, Arabia, Iran, Iraq and Afghanistan, constituting a staple food. Proso millet grains are commonly infested by store pest like the rice meal moth *Corcyra cephalonica* Stainton which is also known to infest cereals like rice, wheat, ragi, maize, sorghum, millets, oil seeds like groundnut, sesamum and oilcakes, cottonseed and pulses like red gram, black gram, cowpea, with a wide distribution in tropical and sub-tropical countries (1). Stainton (2) first described the adult rice moth from the specimen recorded on dried currants and named it as *Melissoblaptes cephalonica*. Later, new genus *Corcyra* was erected by (3) to accommodate this insect. Rice moth is recorded not only in India but throughout the world. The first record of its occurrence in India was by Ramakrishna Ayyar (4). Some workers observed that *C. cephalonica* was a secondary pest, which needed damaged grain for successful establishment (5). There have been no reports of this pest on proso millet even though their incidence is noticed. Since millets are important crops in certain regions and serve as food security for the population, it was felt essential to work out basic studies on this pest which would pave way in developing a management program. A study was undertaken with the objective to assess the nature of damage and infestation behavior of *C. cephalonica* on proso millet and to study the influence of grain properties of proso millet on *C. cephalonica* infestation.

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Methods

Feeding Behavior

Larva of *C. cephalonica* usually bore into the grain by forming silken web and completes immature development (1). In proso millet even though the grain size is small, the infestation by *C. cephalonica* was noticed. Constant observations were recorded on nature of feeding, growth and development of *C. cephalonica* on proso millet and cluster formation.

Amount of Food Required by Individual Larva

Twenty five tubes (6 cm × 2 cm) each with three gram of broken proso millet grain with moisture content of 12.35% measured by adopting hot air oven method. Two such sets were maintained throughout

Table 1. Consumption pattern of proso millet by *C. cephalonica.* Three g broken proso millet grain per vial.

	Weight of grain (g) consumed by each larva		Weight of grain (g) consumed by each larva
1	0.23	16	0.25
2	0.24	17	0.20
3	0.29	18	0.26
4	0.17	19	0.19
5	0.20	20	0.17
6	0.21	21	0.20
7	0.23	22	0.27
8	0.16	23	0.28
9	0.20	24	0.28
10	0.27	25	0.27
11	0.23	26	0.30
12	0.28	27	0.19
13	0.30	28	0.26
14	0.23	Mean	0.236
15	0.26	SD ±	0.040

the study period. These sets were used to determine the amount of food required by single larva. Observations on amount of food required for individual larva was recorded. The excreta and silken cocoon formed was removed after pupal formation with the help of forceps and then left out food weight was recorded as final weight. Amount of food required for individual larva was recorded by subtracting final weight from initial weight.

Effect of Various Larval Densities on Growth and Development

To accomplish this, 5 g of broken proso millet grains with various numbers of larvae (2,4,6,8,10) of *C.cephalonica* and control set was maintained where no larvae were released. Observations were recorded

Table 2. Larval density influence on *Corcyra cephalonica* development. Five g of broken proso millet grain each.

No. Larva released	Larval weight (g)	Pupal weight (g)	Loss in grain weight (g)
2	0.053	0.043	0.472
4	0.046	0.038	0.944
6	0.040	0.032	1.416
8	0.035	0.026	1.888
10	0.030	0.018	2.360

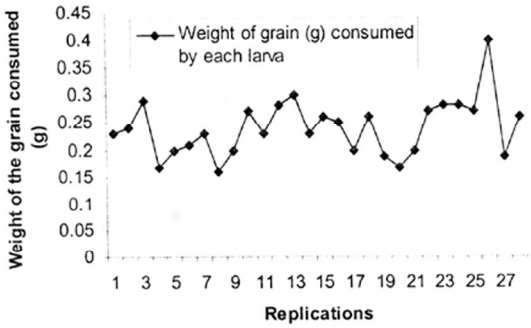

Figure 1. Consumption pattern of proso millet by *C. cephalonica.* Average consumption per larva = 0.23 g; 28 larva were maintained separately. Three grams of proso millet were given to each larva.

on the parameters viz. larval weight, pupal weight and amount of grain weight lost due to feeding.

Influence of Physical Properties of Grain on C. cephalonica Infestation

Proso millet grain parameters like bold, broken grains, grains with glumes, grains with different moisture content and proso millet flour were evaluated for infestation by *C. cephalonica*. The different grain properties were assessed from the bulk stock of proso millet using 90 g of sample per treatment having six replications with the release of three pair of adults. The broken grains were obtained by artificially crushing the grains in a mortar and pestle. Bold grains i. e grains with seed coat intact without any physical damage to seeds were chosen from bulk stock. Grains covered with glumes were chosen from bulk grains. Flour was obtained by grinding the grains in electrical blender. The number of adults emerged at every fortnight were counted from 45 days of release and continued up to 90 day. Also the final weight was noted down from all the grain properties.

Results and Discussion

Newly emerged larva after hatching was active and started crawling in search of food. After reaching the food or grain, it started scraping or webbing the grain. When it was a damaged one, it started feeding on the grain. Subsequently, the fecal pellets were used by the larva to form a cluster of grains and pest was found feeding inside the cluster. Later stage of infestation reveals dense white silken cocoon with dam-

Table 3. Influence of grain properties on *C. cephalonica* infestation.

Grain properties (P)	Mean adult emergence at different intervals (days) 45	60	75	90	Total adult emergence (numbers)
Flour	24.00	33.50	45.25	52.50	155.25
Broken grains	29.00	37.50	50.25	70.50	187.25
Bold grains	10.50	17.00	23.00	29.50	88.00
Grains with glumes	5.50	7.00	9.50	14.5	36.25
F-test	**	**	**	**	**
	0.50	0.80	0.94	1.01	2.6
SE ±	1.48	2.38	2.79	2.98	7.9
CD at 1%					
Interaction effect (P× D)					
F- test	*				
SE ±	3.4				
CD at 5%	3.9				

aged grains, frass and excreta matted together. Pupation was occurred inside the white silken structure.

Food Requirement for Total Larval Development

The entire larval development occurred by feeding on broken proso millet grains. The maximum weight of proso millet grain required for a larval development was 0.30 g and the lowest was 0.16 g with an average of 0.236 g per larva (Table 1).

Studies on Larval Density Stress on C. cephalonica Infestation

In an ecosystem such as stored grain, the space and resource constraint was in course of time exercise profound influence on the population build up of insects. This was studied in *C. cephalonica* population. In control no infestation and weight loss were recorded up to 120 days (Table 2). However, the present findings conforms earlier observations (6) where population of *C. cephalonica* increased in initial phase, followed by a phase of decline after reaching the peak, which was also confirmed in the present study.

Table 4. Influence of grain properties on *Corcyra cephalonica* development.

Grain properties	Egg (d)	Larva (d)	Pupa (d)
Bold grains	7.5	30	11
Broken grains	4.75	26.5	7.0
Flour	6.0	28.0	9.0
Grains with glumes	9.0	33.0	13.0
F-test	*	*	*
SE±	0.52	0.70	0.56
CD 5%	1.2	2.3	1.57

Influence of Grain Properties on C. cephalonica

Number of Adults Observed. The number of moths observed at different intervals in broken grains (29.0, 37.70, 50.25 and 70.50 numbers of adult moths at 45, 60, 75 and 90 days after infestation, respectively), was significantly superior to flour (24, 33.50, 45.25 and 52.5 numbers of months at 45, 60, 75 and 90 days after infestation, respectively) (Table 3). Bold grains recorded 10.5, 17, 23 and 29.5 number of moths at 45, 60, 75 and 90 days after infestation,respectively. In grains with glumes recorded 5.5, 7, 9.5 and 14.5 number of adult moths at 45, 60, 75 and 90 days after infestation, respectively. The adult emergence was highest in broken grains in all the observations from 45 to 90 DAI and the same was lowest in grains with glumes.

Over All Mean Adult Emergence . Over all mean adult moth emergence was observed after 90 days of infestation was significantly highest in broken grains (187.25 moths), which differed significantly from other grain properties viz. flour (155.25 moths),bold grains (88 moths) and significantly less moths in grains with glumes (36.25 moths) (Table 3). Manjunath (6) reported that *C. cephalonica* developed on broken grains more rapidly, with highest fecundity and was

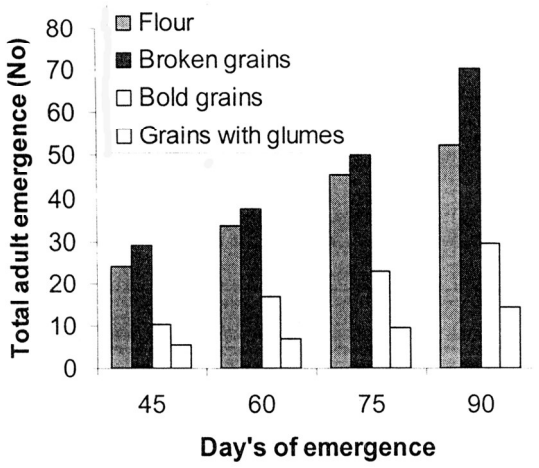

Figure 2. Influence of grain properties on *C. cephalonica* adult emergence.

supportive to fairly good number of adults emerged next to flour substrate in the present investigation.

Total Developmental Period (Egg + Larva + Pupa)

Broken grains were associated with shortest developmental period of 38.25 days followed by flour 42 days and bold grains associated with 46.5 days respectively. However, longest developmental period of 52 days was recorded in the grain with glumes than rest of the grain properties (Table 4). These findings are in accordance with earlier reports (1, 7) where broken grains favored shorter developmental period compared to whole grains.

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