Indian Journal of Entomology, 81(4): 000-000 (2019) DoI No.:

# BIOLOGY OF RICE WEEVIL *SITOPHILUS ORYZAE* (L.)

**A. D. Rojasara and D.R. Patel***

Department of Entomology, N.M. College of Agriculture,
Navsari Agricultural University, Navsari 396450
*Email: patel.devendra2829@yahoo.com

**ABSTRACT**

**Biology of the rice weevil *Sitophilus oryzae* (L.) was studied on the rive variety Jaya under laboratory condition at the P.G. Research Laboratory, Department of Agricultural Entomology, N. M. College of Agriculture, Navsari Agricultural University, Navsari. The duration of first, second, third, fourth instar larvae and pupa was 5.92 ± 0.70, 6.64 ± 0.49, 8.04 ± 0.73, 5.36 ± 0.70 and 6.48 ± 0.51 days, respectively. The preoviposition, oviposition and postoviposition periods were 3.79 ± 0.66, 54.80 ± 3.93, 19.88 ± 2.62 days, respectively; and fecundity at 288 to 389 (352.68 ± 28.84). The adult females survived for 72.36 ± 3.54 days while, males survived for 50.68 ± 2.97 days with food; without food it was 8.6 ± 0.82 and 5.8 ± 0.82 days, respectively. The total lifecycle was 83.12 ± 4.43 days (male) and 110.8 ± 3.35 days (female), with food.**

**Key words:** *Sitophilus oryzae,* **rice, biology, incubation period, oviposition, egg, grub, instars, pupa, adult, male, female**

In India, the damage to stored grains by insect pests was estimated to be around 6.5% (Raju, 1984). Rice weevil, *Sitophilus oryzae* (L.) is the most destructive insect pest of the stored raw cereal grains (Champ and Dyte, 1976), and rice is its main target (Singh et al., 2017). Rice weevil mainly attacks whole grains such as wheat, corn, barley and rice and have been found actively breeding in such foods. Its host range now extended to split legumes (Deepthi and Manjunatha, 2015), and it causes losses up to 100% in stored maize (Irabagon, 1959; Singh et al., 1974). The adults and larva are internal feeder and causes great losses in the grain both in quality and quantity. For evaluating an effective management strategy, the adequate information on biology is essential. Hence, this study on the biology of *S. oryzae* on rice.

## MATERIALS AND METHODS

Studies on the biology of *S. oryzae* was carried out on rice variety Jaya under laboratory 27± 1˚C, and 70± 5% RH, during 2018-19 at the Biological control Laboratory and P.G. Research Laboratory, Department of Agricultural Entomology, N. M. College of Agriculture, Navsari Agricultural University, Navsari. The required quantities of rice grains were collected, and sterilized at 55˚C in an oven for 4 hr before culturing. Twenty five pairs of one to two days old adults from pure culture were released for egg laying in single jar containing 100gm of rice seeds. The grain was stained next day morning to see eggs. Stained eggs were counted. Supplementary set of culture was used to observe the egg period. The eggs were considered as hatched, when larva emerges out from the egg. Hatching % was calculated from the number of eggs hatching out from total number of eggs kept under observation. Eggs were examined under microscope for studying their shape and size. For measuring length and breadth of eggs, the ocular micrometer was used.

Dye was used in testing for weevil infestation in grains, which was prepared with- acid fuchsin: 0.5g, glacial acetic acid: 50.0cc, and distilled water: 950 cc (According to requirement solution was made). Mix the distilled water and glacial acetic acid and then add the acid fuchsin which dissolve readily in this solution. The samples of seed to be tested was placed in suitable container, preferably a shallow dish larger to adequately hold the sample and solution. Enough of the solution was used to cover the sample completely. The grain is left in this solution from 2 to 5 min, poured off the dye and grain washed in tap water until all the excess dye has been removed. Then examined under or drained and on a glass plate or similar surface for examination. The acid fuchsin stains the gelatinous egg-plug a deep cherry red, whereas feeding punctures and mechanical injury are stained a light pink colour (Frankenfeld, 1948).

On hatching, the larvae were allowed to feed on rice in specimen tube (1.5 x 7.5 cm). Two days later, grains were dissected carefully to see the stages of the larvae. The dissection of grains was made till larva

Table 1. Biology and morphometrics of *S. oryzae* on rice

| Stage | | No. of observations | Developmental period (days) | | Mean |
|---|---|---|---|---|---|
| | | | Min. | Max. | |
| Egg | | 25 | 3.50 | 6.00 | 4.47 ± 0.8 |
| Egg hatching (%) | | 25 | 62.50 | 83.33 | 73.37 ± 5.14 |
| Larva | | | | | |
| I Instar | | 25 | 5.00 | 7.00 | 5.92 ± 0.70 |
| II Instar | | 25 | 6.00 | 7.00 | 6.64 ± 0.49 |
| III Instar | | 25 | 7.00 | 9.00 | 8.04 ± 0.73 |
| IV Instar | | 25 | 4.00 | 6.00 | 5.36 ± 0.70 |
| Total larval period | | 25 | 24.00 | 28.00 | 25.96 ± 1.13 |
| Pupa | | 25 | 6.00 | 7.00 | 6.48 ± 0.51 |
| Adult longevity | | | | | |
| With food | Female | 25 | 68.00 | 80.00 | 72.36 ± 3.54 |
| | Male | 25 | 45.00 | 55.00 | 50.68 ± 2.97 |
| Without food | Female | 25 | 8.00 | 10.00 | 8.6 ± 0.82 |
| | Male | 25 | 5.00 | 7.00 | 5.8 ± 0.82 |
| Pre- oviposition | | 25 | 3.00 | 5.00 | 3.79 ± 0.66 |
| Oviposition | | 25 | 48.00 | 62.00 | 54.80 ± 3.93 |
| Post-oviposition | | 25 | 15.00 | 25.00 | 19.88 ± 2.62 |
| Fecundity | | 25 | 288.00 | 389.00 | 352.68 ± 28.84 |
| Sex ratio (male: female) | | 75 | 1:1.07 | 1:2.00 | 1:1.4 |
| Total life cycle | | | | | |
| With food | | | | | |
| Female | | 25 | 101.00 | 121.00 | 110.8 ± 3.35 |
| Male | | 25 | 76.00 | 89.00 | 83.12 ± 4.43 |
| Morphometrics | | | | | |

| Stages | No. of observations | Length (mm) | | Av. ± SD | Breadth (mm) | | Av. ± SD |
|---|---|---|---|---|---|---|---|
| | | Min. | Max. | | Min. | Max. | |
| Egg | 25 | 0.65 | 0.71 | 0.69 ± 0.01 | 0.30 | 0.35 | 0.33 ± 0.01 |
| Larva | | | | | | | |
| | | Length (mm) | | | Head capsule width (mm) | | |
| I Instar | 25 | 0.54 | 0.59 | 0.56 ± 0.01 | 0.41 | 0.46 | 0.44 ± 0.01 |
| II Instar | 25 | 0.85 | 0.88 | 0.86 ± 0.09 | 0.48 | 0.55 | 0.51 ± 0.02 |
| III Instar | 25 | 1.23 | 1.28 | 1.26 ± 0.02 | 0.54 | 0.56 | 0.55 ± 0.05 |
| IV Instar | 25 | 2.16 | 2.19 | 2.18 ± 0.01 | 0.57 | 0.59 | 0.57 ± 0.006 |
| | | Length (mm) | | | Breadth (mm) | | |
| Pupa | 25 | 2.24 | 2.40 | 2.33 ± 0.04 | 1.53 | 1.68 | 1.64 ± 0.03 |
| Adult | | | | | | | |
| Female | 25 | 3.60 | 3.76 | 3.68 ± 0.05 | 1.40 | 1.48 | 1.43 ± 0.02 |
| Male | 25 | 3.20 | 3.45 | 3.29 ± 0.07 | 1.20 | 1.32 | 1.25 ± 0.03 |

reached the pupal stage. The period between egg hatching and pupation was recorded as larval period. To determine the number of larval instars, the size of head capsule was measured daily. The moulting was confirmed with presence of casted head capsule of subsequent instars and those colour and sizes appeared. The larvae in each instar were studied for their colour and size. Observations on number of instars, duration of instars and total larval period were recorded. The body measurement of instars was recorded under microscope with ocular micrometer. The pupal period, ovipositional studies, adult longevity, sex ratio (male: female) and life span were observed.

## RESULTS AND DISCUSSION

The results on biology of *S. oryzae* are given in Table

1. The females laid the eggs singly inside the cavity on the rice grains, these were oval with one end pointed and other end rounded. Freshly laid eggs translucent and white, became opaque before hatching, with size being 0.69± 0.01 x 0.33 ± 0.01 mm. Incubation period varies with a mean of 4.47± 0.47 days, and hatching % is 73.37± 5.14. These observations agree with those of Chaudhary and Chakraborty (2014. Grub lives within grains, apodous, short, stout, yellowish white and brown coloured head, covered with small setae. The measurements and duration of the larval instars if as given in Table 1. There were three moults with four instars, each stage occupying 5.92, 6.64, 8.04 and 5.36 days, respectively. The total larval period lasted for 25.96± 1.13 days. These observations again corroborate with those of Chaudhary and Chakraborty (2014), Narayana et al. (2014), Bhanderi et al. (2015) and Singh (2017).

Pupation takes place inside the grains. Pupa white to yellowish white, exarate, measure 2.33± 0.04 x 1.64± 0.03 mm, and lasts for 6.48± 0.51 days. These results are in conformity with Bhanderi et al. (2015), but in contrast with Narayana et al. (2014), who reported it as 9.50 days. Newly emerged adults were reddish brown which become black at the time of egg lying. Adults elongate, subcylindrical with four orange patches on elytra. Male and female look alike except for the rostrum of the male comparatively thick, closely punctured, curved, while in female it was elongate, slender, smooth, shining slightly curved and sparsely punctured. Head prolonged into snout at the tip of which mouth parts are situated. Antennae geniculate type. Measurements as given in Table 1. These observations agree with those of Bhanderi et al. (2015) and Singh (2017).

The preoviposition, oviposition and post-oviposition periods last for: 3.79± 0.66, 54.80± 3.93, 19.88± 2.62 days, respectively; and fecundity of 352.68± 28.84 eggs/ female. These are at variation with earlier results (Narayan et al., 2014; Bhanderi et al., 2015). Females survived longer than males with a longevity of 72.36± 3.54 and 50.68± 2.97 days when fed, respectively. Whereas, without food adult females survived for only 8.6± 0.82 days and males for 5.8± 0.82 days. The sex ratio of male: female stood at 1:1.4 observed. These observations are in contrast with those of Narayan et al. (2014) and Choudhary and Chakraborty (2014). The total life cycle of males (83.12± 4.43 days) was shorter for males compared to female (110.8± 3.35 days) with food. Singh (2017) observed that female with continuous food supply survived for 81 to 105 days while, the adult male remained alive for 57 to 63 days.

## REFERENCES

Bhanderi G R, Radadia G G, Patel D R. 2015. Biology of rice weevil, *Sitophilus oryzae* (Linnaeus) on stored sorghum. Indian Journal of Entomology 77(3): 307-310.

Champ B R, Dyte C E. 1976. Report of the FAO global survey of pesticide susceptibility of stored grain pests. pp. 260-297.

Choudhary S. D, Chakraborty K. 2014. Study on both the life cycle and morphometrics of *Sitophilus oryzae* on rice cultivar *Sampa mashuri* in laboratory condition. Journal of Applied Science and Research 2(6): 22-28.

Deepthi N, Manjunatha M. 2015. Comparative development of rice weevil, *Sitophilus oryzae* (L.) in stored split legumes. Journal of Eco-friendly Agriculture 10(2): 180-183.

Frankenfeld J C. 1948. Staining method for detecting weevil infestation in grain. Bureau of Entomology and Plant Quarantine ET-256:1-3.

Irabagon T A. 1959. Rice weevil damage to stored corn. *Journal of Economic Entomology* 52(6): 1130-1136.

Narayana K C, Mutthuraju G P, Jagadeesh E, Thirumalaraju G T. 2014. Biology of *Sitophilus oryzae* (L.) (Coleoptera: Curculionidae) on stored maize grains. Current Biotica 8(1): 76-81.

Raju P. 1984. The staggering storage losses – causes and extent Pesticides 18(1): 35-37.

Singh B K P. 2017. Study on the life of *Sitophilus oryzae* on rice cultivar PUSA 2-21 in laboratory condition. International Journal of Education and Applied Science Research 4(2): 37-42.

Singh K, Agrawal N S, Girish G K. 1974. The oviposition and development of *Sitophilus oryzae* (L.) in different high-yielding varieties of wheat. Journal of Stored Products Research 10(2): 105-111.

Singh S D, Sharma K, Bhatia S, Singh A. 2017. Effect of various plant powders on rice weevil, *S. oryzae* (Linn.) in stored wheat. Journal of Environmental Biology 38: 501-508.

(Manuscript Received: August, 2019; Revised: October, 2019;
Accepted: November, 2019; Online Published: November, 2019)