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Biology of *Sitophilus oryzae* (L.) (Coleoptera: Curculionidae) on Four Different Germplasms of Stored Wheat Grains

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A B S T R A C T

Laboratory experiments were carried out to study the biology of *Sitophilus oryzae* on four different wheat germplasms such as (DPW-62150, DBW-39, GW-322, and K-0307). It was found that the different developmental stages of rice weevil were longer during the winter season as compared to the summer season. As lowest incubation period of 3±0.47 days was recorded from DPW-62150 while the longest one from DBW-39 with 5.44±0.42 days. The lowest total larval and pupal period was registered in germplasm DPW-62150 (23 days) while it was highest (34.44±0.42days) in DBW-39. Total life cycle of male with food was lowest in GW-322 with 84.10±0.83 days while it was highest with 95.43±0.80 days in DBW-39; similarly for female with food the lowest and longest of life cycle was noted on the same germplasm with 110±0.82 days and 123.10±0.83 days respectively. When the male and female adults were devoid of food, the life cycle of male and female was lowest on DPW-62150 and highest on DBW-39 with 40.00±0.82 days and 44.33±0.94 days and 53.43±0.61 days and 60.43±0.8 days respectively during summer and that of winter with incubation period of 7.67±0.47 days in DPW-62150 to 11.00±0.82 days in DBW-39. Total larval and pupal period varied from 34.67±0.47 days to 42.33±0.47 days in DPW-62150 and K-0307 respectively. Total life cycle of male with food ranged from 104±0.94 days (DPW-62150) to 110.33±0.94 days (DBW-39) while for the female the range was form 128.00±0.82 days (GW-322) to 137.33±1.25 days (K-0307). On the other hand total life cycle of the male devoid of food to adult, ranged from 56±0.82 days to 66.67±0.94 days while the same for female was from 60.33±0.47 days to 73.67±0.94 days.

Introduction

Wheat (*Triticum aestivum* L.) is the most important staple food for human and is grown on more land than any other commercial crops in the world. Approximately 1/6th of the total arable land in the world is under wheat cultivation (Slafer and Satorre, 1999). It is the most important staple food of about two billion people (36% of the world's population).Worldwide, wheat provides nearly 55% of the carbohydrates and 20% of the food calories consumed globally (Breiman and Graur, 1995). Wheat has higher protein content than either maize or rice or any other cereals and related to human food globally. Increased wheat demand is driven by a rapidly growing population and a change in food

preference away from traditional cereals and towards wheat and wheat products (World Bank, 1989). Wheat occupies an important place in the economy of our country (Chowdhury *et al*., 1998).The intensification of food production has led to several problems in the post-harvest phase including the major concern of pest infestation during storage (Khalequzzaman and Khanom, 2006). Every year about 25-30% crop yields are damaged in field and stores by different insect pests (Lal and Srivastava, 1996). Although wheat has only few insect-pests under field conditions, but it is susceptible to storage pests which cause substantial qualitative / nutritional and quantitative losses of various magnitudes depending on the pest species and duration of storage (De Lima, 1979; Sighamony *et al.*,1985). Deterioration of storage grain is influenced by physical (temperature, humidity), biological (micro flora, arthropod, vertebrates) and technical (storage conditions, methods and duration) factors and the most damaging species of storage insect are in the genera *Sitophilus* and *Tribolium* (Marsans, 1987; Khan and Suleman, 1988; Pinto et al., 1997). Among the various insect pests rice weevil, *Sitophilus oryzae* (L.) is the most destructive pest of stored grains in wheat (Cotton, 1920). It is originated in India and distributed worldwide (Cotton, 1920). It causes 18.30% losses to stored grain (Adams, 1976). This species has a relatively short developmental period and high populations can easily build up (Aitken, 1975). *S. oryzae* is small and stout in appearance with reddish brown to black in colour. The adult gathers and reproduces in stored grains. Female weevil may bore at several parts of grain but only one egg is laid down in a single grain and seals the hole with gelatinous fluid. The grub feed inside the grain kernels for an average of 18 to 34 days. A larva of *Sitophilus oryzae* consumes 14 mg grain / day (Giolebiowska, 1968). They feed on its starchy content and hallowing it out leaves the shell intact. The two sexes of *Sitophilus oryzae* look apparently alike but when carefully examined the male can be distinguished from female by the form of rostrum which is shorter in male than in female. It has been reported to fly towards wind direction (Khare and Agrawal, 1970). In West Bengal total 960 tonne wheat was produced in 340 hectare of land during (2015-2016). Productivity of wheat was 2825kg/ha. during (2015-2016). Wheat is an important crop in West Bengal. In North Bengal condition wheat is considered as a main winter crop in the cropping system followed by a vast majority of the farmers. Procement and storage of wheat is done by private and government agencies to meet the food requirement of the population round the year. After the harvest of the crop, the stored grains are subjected to insect attack, causing considerable loss. For management of pests we still rely on pesticides.

Keeping the above facts in view, investigations were carried out with the study of the life history, habits and habitats which are necessary to have thorough understanding of the situation favourable to the pest which should be taken advantage for the effective management of the pest.

Materials and Methods

Biology of the rice weevil, *Sitophilus oryzae* was carried out on four different wheat germplasms such as DPW-62150, DBW-39, GW-322 and K-0307 under laboratory condition during July to September, 2016 and December to February 2016-2017 at Department of Agricultural Entomology, UBKV, Pundibari. Stock culture of the rice weevil was initiated by collecting the adult weevils from the infested wheat grains from university farm store house. The culture was further maintained in glass jars (of two litre capacity) containing the wheat grains. The mouth of the container was covered with a

muslin cloth. Newly hatched adults were identified based on their rostra following Halstead (1963). After the identification ten pairs of rice weevils were released in 50 g wheat grains in each plastic jar of 250 gm capacity with three replications in each bottle and these bottles were kept in ambient conditions. The experiment was designed in CRD with three replications. Fresh grains were provided periodically for the development of beetles. Damaged grains were removed every morning from the bottles. Grains containing eggs were separated out by examining under binocular and were used for further studies. Five grains from each of the varieties, obtained so, were maintained in glass-vials (one grain in each vial) for incubation. The grains were examined properly by taking out from the vials and dissected the accordingly to determine the incubation period. Larval instars were determined by the presence of moulted skin and range of head capsule width as described by (Sharifi and Mills, 1971). Pupal period was determined by subtracting incubation and larval period from the total period of egg laying to the adult emergence. The ability of the adults of *S. oryzae* to live in the presence or absence of food was determined by enclosing the male and female adults obtained from the culture separately. Three such vials were maintained for each of the varieties. In the 1st vial one male was released with food (wheat grains), in 2nd vial one female was released with food and in the 3rd one a pair of adults were released without food. The same procedures were followed in both the seasons.

Results and Discussion

A perusal data contained in Table 1 revealed that during summer season the lowest incubation period of 3±0.47 days was recorded from DPW-62150 while the longest one from DBW-39 with 5.44±0.42 days. The lowest total larval and pupal period was registered in germplasm DPW-62150 (23 days) while it was highest (34.44±0.42days) in DBW-39. Male and female adults supported with food survived the longest duration of 60.33±0.47 and 90.67±0.94 days respectively on DPW-62150 which was followed by K-0307 (56.00±0.82 and 85.67±0.94 days), DBW-39 (55.67±0.94 and 83.33±0.47 days) and GW-322 (55.00±0.0 and 81.00±0.82 days respectively).When devoid of food, the adult male survived for the lowest duration in DPW-62150 (13.67±0.47 days) while the highest one was in GW-322 (15.67±0.47 days); similarly for adult female, the lowest longevity was recorded in K-0307 (17.67±0.47 days) while the highest one was DBW-39 (20.67±0.94).

Total life cycle of male with food was lowest in GW-322 with 84.10±0.83 days while it was longest with 95.43±0.80 days in DBW-39; similarly for female with food the lowest and longest duration of life cycle was noted on the same germplasm with 110±0.82 days and 123.10±0.83 days respectively. When the male and female adults were devoid of food, the life cycle of male and female was lowest on DPW-62150 and highest on DBW-39 with 40.00±0.82 days and 44.33±0.94 days and 53.43±0.61 days and 60.43±0.8 days respectively.

A perusal data contained in Table 2 revealed that during winter season the duration of different stages was longer in winter season than that of summer months. Incubation period ranged from 7.67±0.47 days in DPW-62150 to 11.00±0.82 days in DBW-39. Total larval and pupal period varied from 34.67±0.47 days to 42.33±0.47 days in DPW-62150 and K-0307 respectively. Adult male without food survived for a minimum of 13.67±0.47 days in DPW-62150 and the maximum of 15.67±0.47 days in GW-322.Adult female without food survived for a minimum and maximum period of 17.67±0.47

days and 20.67±0.94 days in K-0307 and DBW-39 respectively. It was observed that with food the adult male longevity ranged from 56.00±0.82 days to 62.32±0.47 days in K-0307 and DPW-62150 respectively. There was no variation in the female adult longevity with food in winter in all the four germplasms and the result were identical to that of summer season. Total life cycle of male with food ranged from 104±0.94 days (DPW-62150) to 110.33±0.94 days (DBW-39) while for the female the range was form 128.00±0.82 days (GW-322) to 137.33±1.25 days (K-0307). On the other hand total life cycle of the male devoid of food, ranged from 56±0.82 days to 66.67±0.94 days while the same for female varied from 60.33±0.47 days to 73.67±0.94 days.

Table.1 Biology of *Sitophilus oryzae* on four different wheat germplasms under laboratory condition during summer season

Sl. no	Parameters	Duration (days) in four different wheat germplasms			
		DPW62150	K-0307	DBW-39	GW-322
1	Incubation period	3±0.47	4.33±0.27	5.44±0.42	4.00±0.27
2	Total larval and pupal period	23	27.44±0.79	34.44±0.42	25.11±0.57
3	Adult longevity of male with food	60.33±0.47	56.00±0.82	55.67±0.94	55.00±0.00
4	adult longevity of female with food	90.67±0.94	85.67±0.94	83.33±0.47	81.00±0.82
5	Adult longevity of male without food	13.67±0.47	14.33±0.94	13.67±1.25	15.67±0.47
6	Adult longevity of female without food	18.00±0.82	17.67±0.47	20.67±0.94	19.67±0.47
7	Total life cycle of male with food	86.67±0.47	87.87±1.14	95.43±0.8	84.10±0.83
8	Total life cycle of female with food	117.00±0.82	117.43±1.8	123.10±0.83	110±0.82
9	Total life cycle of male without food	40.00±0.82	46.10±1.13	53.43±0.61	44.47±1.28
10	Total life cycle of female without food	44.33±0.94	49.43±1.52	60.43±0.8	48.77±0.56

Table.2 Biology of *Sitophilus oryzae* on four different wheat germplasms under laboratory condition during winter season

Sl. No	Parameters	Duration (days) in four different wheat germplasms			
		DPW62150	K-0307	DBW-39	GW-322
1	Incubation period	7.67±0.47	9.33±0.47	11.00±0.82	8.33±0.47
2	Total larval and pupal period	34.67±0.47	42.33±0.47	42.00±0.82	38.67±0.47
3	Adult longevity of male with food	62.32±0.47	56.00±0.82	56.67±0.47	58.33±0.47
4	adult longevity of female with food	90.67±0.94	85.67±0.94	83.33±0.47	81.00±0.82
5	Adult longevity of male without food	13.67±0.47	14.33±0.94	13.67±1.25	15.67±0.47
6	Adult longevity of female without food	18.00±0.82	17.67±0.47	20.67±0.94	19.67±0.47
7	Total life cycle of male with food	104±0.94	110.33±0.94	110.00±1.41	105.33±1.25
8	Total life cycle of female with food	133±0.82	137.33±1.25	137.33±0.83	128.00±0.82
9	Total life cycle of male without food	56.00±0.82	66.00±0.82	66.67±0.94	62.67±1.25
10	Total life cycle of female without food	60.33±0.47	69.33±0.94	73.67±0.47	66.67±0.47

It was summarized that incubation varied among the germplasms. Lowest incubation period of 3±0.47 days was recorded from DPW-62150 while the longest one from DBW-39 with 5.44±0.42 days. The lowest total larval and pupal period was registered in germplasm DPW-62150 (23 days) while it was highest (34.44±0.42days) in DBW-39. Total life cycle of male with food was lowest in GW-322 with 84.10±0.83 days while it was highest with 95.43±0.80 days in DBW-39; similarly for female with food the lowest and longest of life cycle was noted on the same germplasm with 110±0.82 days and 123.10±0.83 days respectively. When the male and female adults were devoid of food, the life cycle of male and female was lowest on DPW-62150 and highest on DBW-39 with 40.00±0.82 days and 44.33±0.94 days and 53.43±0.61 days and 60.43±0.8 days respectively. The duration of different stages was longer in winter season than summer month's incubation period ranged from 7.67±0.47 days in DPW-62150 to 11.00±0.82 days in DBW-39. Total larval and pupal period varied from 34.67±0.47 days to 42.33±0.47 days in DPW-62150 and K-0307 respectively. Total life cycle of male with food ranged from 104±0.94 days (DPW-62150) to 110.33±0.94 days (DBW-39) while for the female the range was form 128.00±0.82 days (GW-322) to 137.33±1.25 days (K-0307). On the other hand total life cycle of the male devoid of food to adult, ranged from 56±0.82 days to 66.67±0.94 days while the same for female was from 60.33±0.47 days to 73.67±0.94 days.

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