STUDY ON THE LIFE CYCLE AND CONTROL OF SITOPHILUS GRANARIUS (COLEOPTERA: CURCULIONIDAE) ON WHEAT GRAIN (TRITICUM AESTIVUM) IN LABORATORY CONDITION

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ABSTRACT

Sitophilus granarius a major stored grain pest infesting many grains (both adult and larva cause damage to grains) in storage but wheat grain is its main target of attack. It has been seen that the life cycle of insect depends upon many factors such as ambient temperature, humidity, water content of the grain etc. But the ease with which the life cycle is completed also depends on the type/variety of wheat grain on which the insect is thriving. So it is desirable to study the life cycle on different cultivars of common wheat grain (Tritium aestivum). Understanding of life cycle helps in management of pest in a better way.

KEY WORDS:

Sitophilus granarius, life cycle, common wheat grains (Triticum aestivum).

INTRODUCTION

Sitophilus granarius also known as grain weevil and breeding period of this pest is from April to October. The adult hibernate in winter inside the cracks and crevices in storage grains houses, during breeding period, the female make depression on the grain with the help of their mandibles and lay eggs in it, on egg is laid in one grain. After egg laying the hole is sealed with a gelatinous secretion. A single female may lay as many as 250-400 eggs in a season. The egg is hatch 6-7 days and the young larvae bore directly in to the grain is kept intact. At the end of the larval stage they become covered by a covering, called puparium inside the grain. The pupa stage starts with the cessation of eating. The pupa stage persists for 6 to 14 days to become an adult. On emergence, the adult weevil cuts its way out of the grain and live for about 4 - 5 months. The weevil completes 3 - 4 generation in a year.

It has been estimated that pests devour about 6.5% of total grains stored in India (Raju, 1984). Even though ultramodern storage facilities are available, farmers in rural India due to their ignorance and lack of extension facilities in the hinterland, still depend upon traditional techniques of storage of food grains, thereby making their grains prone to the infestations of pests during storage (Aslam et al., 2004). Devising methods of storage and assessing the susceptibility of a particular cultivar to a pest requires the study of the life cycle of the pest in different conditions of temperature and relative humidity. A number of workers have delved into the life cycle of Sitophilus oryzae (Wille 1923; Bheemanna 1986; Barbuiya et al., 2002) but results do not show uniformity as far as the time taken in completion of life cycle (Wille, 1923), the features of different developmental stages encountered (Barbuiya et al. 2002) and the generations completed per year (Bheemanna 1986) are concerned. It was not only the type of food grain but the prevailing agro-climatic which has left their imprint on various aspects of growth and development of the infesting pest.

In the district Balrampur area of Uttar Pradesh a number of wheat grain varieties are cultivated of which common wheat (Triticum aestivum) is an important one. It is subjected to large scale damage by Sitophilus granarius during warehousing particularly during storage by small farmers who do not afford highly sophisticated storage facilities.

The present work intends to study the life cycle and control of Sitophilus granarius with special reference to observation on time taken to complete different development stages in the local agro-climatic region.

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MATERIALS AND METHODS

Studies on the life cycle and control of Sitophilus granarius on common wheat (Triticum aestivum) were conducted for the period of 7 months, i.e., from April to October 2018.

Laboratory conditions: The entire study was conducted in the laboratory of the department of Zoology, M.L.K.P.G. College Balrampur (U.P.), India. During experiment the average temperature (minimum & maximum) varied from 24.05°C to 35.08°C and the range of relative humidity was recorded between 68.38% to 86.32%.

Collection of samples

Wheat sampling: For this study fresh wheat grains were purchased from the local market of district Balrampur called Utraula market. The wheat grains were dried under sunlight and stored in air tight jars. Only un-infested intact grains were selected.

Insect sampling: The adult wheat weevils were collected from infested wheat grains. The infested wheat grains were purchased from the local retail market of Utraula Balrampur, popularly called Utraula market. The culture was maintained in glass bottle of 2.5 liter capacity containing wheat grains. For proper aeration mouth of bottle was covered with piece of cotton cloth. Clean and fresh grains were given to ensure proper growth of the weevil. Pure culture weevil was prepared by infesting properly cleaned pre-weighted insect free wheat grains with freshly emerged single mating pair. The culture was maintained in the plastic jars each of which contained 30 wheat grains. The temperature of plastic vial is measured with the help of digital probe thermometer and accordingly recorded. Micrometer and slide caliper were used for morphometric observations.

RESULTS AND DISCUSSION

Ten male and female insects with food grains were placed in ten separate vials each containing fifty grams of wheat grains and their lifespan was observed in each of them at room temperature and humidity. Damaged grains were replaced every day by fresh grains, the former were carefully observed under microscope to isolate grains having eggs. The egg of S. granarius measures 0.71±0.04 mm in length. The average length of adult male and female was 3.2±0.6 mm and 2.9±0.6mm respectively. Whereas the adult female with continuous food supply survives for 120 to 150 days, the adult male remains alive for 90-120 days.

The S. granarius larvae were fed individually inside a specimen tube of 7.00 cm x 2.00 cm size with seven gram wheat grains in each. Ten grains per day were dissected out to observe different larval stages. The process was continued till the appearance of pupal stage begun in the dissection. The time taken between hatching and pupation was length of larval period. Larval stage lasted for 21-35 days. The average length of the larva was 2.5-3.0mm.

The larvae thus emerged earlier were continuously fed upon and they pupated. The length of time consumed between pupation and emergence of adult indicated the pupation period which varied between 7-8 days. Total length of life cycle starting from egg to adult ranges between 32-49 days during study period.
Ovipositional studies: Newly emerged pairs of weevils were allowed to grow in specimen tube (7.5 cm x 2.5 cm) and ten replication of such tubes were maintained. Mating commenced after 4-6 days and oviposition followed.

Incubation period: Wheat grains on which eggs were laid were further maintained in a glass vial to study the incubation period. Twenty grains were dissected daily to ascertain the hatching. As per the experiment conducted, the incubation period turned out to be 5-7 days on wheat.

While the result of present study confirmed some of the observations made by earlier workers in this regard (Lefèvre 1953, Sattigi 1982, Bhuiyain1990, Shaaya 1991, Park 2003 Singh 2010), it was contrast to some others. It is consonance with the observations of Barbuiya et al (2002) who found an incubation period of 5 to 7 days on wheat grains.

Table 1 Variations in temperature & humidity of Practical room during the study period. (Data April to October 2018)

<table>
<thead>
<tr>
<th>Room Climate</th>
<th>April, May &amp; June</th>
<th>July &amp; August</th>
<th>September &amp; October</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature (°C)</td>
<td>Maximum</td>
<td>Minimum</td>
<td>Range</td>
</tr>
<tr>
<td>Maximum</td>
<td>33.08</td>
<td>25.53</td>
<td>33.08° to 25.53°</td>
</tr>
<tr>
<td>Minimum</td>
<td>25.53</td>
<td>25.53</td>
<td>25.82° to 25.53°</td>
</tr>
<tr>
<td>Humidity (RH%)</td>
<td>Range</td>
<td>Minimum</td>
<td>Maximum</td>
</tr>
<tr>
<td>Range</td>
<td>86.32</td>
<td>86.32° to 70.50°</td>
<td>88.50°</td>
</tr>
<tr>
<td>Maximum</td>
<td>86.32</td>
<td>86.32° to 70.50°</td>
<td>88.50°</td>
</tr>
<tr>
<td>Minimum</td>
<td>68.38</td>
<td>68.38° to 70.50°</td>
<td>70.50°</td>
</tr>
</tbody>
</table>

Table 2 Description of different growth stages of S. granarius

<table>
<thead>
<tr>
<th>Growth stages</th>
<th>Mean (mm)</th>
<th>Standard deviation (mm)</th>
<th>Range (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adult</td>
<td>Male</td>
<td>3.2</td>
<td>3.2 ± 0.6</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>2.9</td>
<td>2.9 ± 0.6</td>
</tr>
<tr>
<td>Egg</td>
<td>0.71</td>
<td>0.71 ± 0.04</td>
<td>0.68-0.70</td>
</tr>
<tr>
<td>Larva</td>
<td>2.9</td>
<td>2.9 ± 0.2</td>
<td>2.6-3.1</td>
</tr>
<tr>
<td>Pupa</td>
<td>2.5</td>
<td>2.5 ± 0.1</td>
<td>2.3-2.5</td>
</tr>
</tbody>
</table>

An incubation period of 5 days was observed on maize grains by Yevoor (2003), at 14 to 34°C temperature and 55 to 88 % relative humidity (RH). But Wille (1923) contradicted present study by the observation that during summer the egg stage of Calandra oryzae (L.) on husked rice lasts for six to nine days. While Okuni (1924) had observed 5 to 20 days of pupal period, Wille (1923) has recorded 7 to 11 days of pupal period. Wille (1923) reported variable duration of life cycle with 45 days in summer but taking as long as five months in cool weather of autumn and winter for completion of one generation. While it takes 42 days to complete the full life cycle as per the present observation, contrary to this, Okuni (1924) reported eight generations of S. oryzae in a year with the adult average longevity for 160 days. The duration of incubation period in the present observation is far above the observation of Okuni (1924) who had noted that the incubation period under normal condition extends up to three to four days. Newman (1927) from Australia had registered three to five days of egg stage and had recorded 20 to 30 days of larval period of rice weevil.

Control measure: The weakest point of the life cycle of this pest is that it is unable to breed in the grain if the grain moisture content is less than 9 %. Therefore, keeping the grain in dry condition is the best way of controlling the pest. If keeping the grain in dry condition is not practicable, then fumigation is the other alternative proposition as soon as the infestation reaches an in tolerable level. The common fumigant used is methyl bromide, ethylene bromide, ethylene dichloride and carbon tetrachloride during study period recommended.

References


