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Biology of Mango Pulp Weevil, *Sternochetus gravis* (Fabr.) (Curculionidae: Coleoptera) in the Agro-ecosystem of Manipur

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Abstract

A study was conducted in the laboratory of Entomology, P.G. Department of Zoology, D.M. College of Science, Imphal during February to July, 2009 at $25 \pm 2^\circ\text{C}$ and $75 \pm 5\%$ RH (at room temperature and humidity) to study the biology of mango pulp weevil, *Sternochetus gravis*. The duration of life cycle has been observed to vary from one crop to another crop. Only one crop was observed in a season. The environmental parameters have been observed to play a vital role in the biology of this pest. Adult weevils were nocturnal and began feeding, mating and oviposition at dusk. Male and females mate more than once. The eggs were laid singly by making incisions in the skin of the immature fruits with the help of their ovipositors. These incisions looked like a crescent shaped cut protected by an opaque coating formed by exudation. The eggs hatched in about 7 - 9 days. The five larval instars were observed with four moulting. The larval duration varied from 5 - 8 days in first instar, 6 - 9 days in second instar, 7 - 8 days in the third and fourth instars and 6 to 7 days in the fifth instar respectively. The pupation lasted for about 7 days. The life cycle was completed in 49 - 57 days. The adult emerges during May- July.

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Key Words: *Sternochetus gravis*, humidity, instars, oviposition

Introduction

Mango, *Mangifera indica* Linn. is the most popular fruit in the oriental region. It has a great economic importance in the tropical and subtropical region (Mondal et al, 2004). It is regarded as the King of the fruits of the world (Butani, 1979). It is considered to be the choicest of all indigenous fruit and one of the important fruit in Manipur. It undoubtedly deserved to be the national fruit of India. In area, production, nutritive value and popularity of appeal, no other fruit can compete with it. Over 175 species of insects have been reported damaging mango trees (Fletcher, 1970, Veva, 1969 and Nayar et al 1976). Out of these the mango pulp weevil, *Sternochetus gravis* (Fabr.) is one of the serious and specific pest of mango. Lefroy (1906) was the first to report *Sternochetus gravis* as the pest of mango from India and at present the pest is quite serious in north eastern and southern part of Indian Peninsula. The mango pulp weevil is considered as a major pest as it caused significant damage to the mango pulp contaminating the edible portion. A fragmentary work has been done on biology and control of this pest by different workers like Subramanyam (1925), Balock and Kozuma (1964), Sesagiri Rao et al. (1971), Haruna Braimah and van Emden (2010) and De and Pandey (1988) in different parts of the world. But no work on the biology of this pest is done in Manipur.

Material and Methods

The experiment was conducted under laboratory of Entomology, P.G. Department of Zoology, D.M. College of Science, Imphal during mango fruiting season, February – July 2009 at $25 \pm 2^\circ\text{C}$ and $75 \pm 5\%$ relative humidity at room

temperature. For this study ten pairs of weevil, *Sternochetus gravis* were released inside the cage provided with immature fruits of peanut size. In the laboratory the mating occurred in the evening time. The male chased the female and succeeded in mounting over the female in the super impose position facing the same direction. The mating lasted for 15 – 20 minutes. The eggs were laid singly by making crescent shape incision on the skin of the immature fruit with the help of their ovipositors. The eggs were found near the base and beak of the marble sized fruits. The incubation and hatching periods were noted. After hatching of the first instar grub, the fresh mango fruits were daily changed. The moulting of the instars was noted in each case. The intervals between successive moulting were minutely observed along with the particular temperature and relative humidity of the existing environment. The date and time of emergence were recorded for calculating the periods.

Results and Discussion

Mating behavior

In the laboratory the mating occurred in the evening time. The male chased the female and succeeded in mounting over the female in the super impose position facing the same direction. The female seemed to express its annoyance by moving its abdomen right or left. She work to and fro for one or two hours on the immature fruits and then stop working and now the male insert its last tarsal claws into female genitalia. The mating lasted for 15 – 20 minutes. It usually occurred once or twice but sometimes it occurred as many as five times. After

mating, males crawled. Then the female was observed wandering all over the fruit searching for a suitable spot for oviposition. It then made a shallow depression by injuring the tissues of the fruits and then oviposits the egg. After depositing the egg it emitted brownish exudates from its abdomen over the egg which covered it completely. The incubation period has been observed to be 7 – 10 days.

Developmental Stages:

The egg hatches into tiny grubs. Five larval instars have been observed in the life cycle of mango pulp weevil. The grubs are apodus, sub-cylindrical, soft, wrinkled, C-shaped, whitish in colour and covered with sparse whitish setae. The head capsule is well developed with brownish setae over it. The spiracles are conspicuous. The mid abdominal segments are wider than the thoracic and caudal ones. There are 12 segments in the body. The fresh larval entry to the seed is indicated by a small discolored area. As fruit and seed developed the tunnel and seed entry are completely obliterated. It is impossible to determine the infested seed from the un-infested one unless they are cut open.

Egg:

The eggs are elongated and creamy white. It is covered by a protective brown covering. It measures about 0.68 ± 0.03 mm in length and 0.19 ± 0.01 mm in width. At laying, the weevil cut a very small nick into the fruit and the resulting sap flow covers the egg case. This helps to protect the eggs and adheres them to the fruit. Several eggs may be laid on each fruit and each female can lay up to 15 eggs per day and up to 300 eggs during the season. Incubation period ranged from 7 – 10 days. Seshagiri et al. (1971) observed the incubation period 3.0 – 3.5 days in Andhra Pradesh. He also reported the measurement of the egg as 0.80 – 0.85 mm in length and 0.30 – 0.35 mm in diameter in 1971.

First instar larva:

The immediately hatched young larva enters the fruit directly by cutting a hole on the site in contact with the fruit. It measured about 2.0 – 2.2 mm in length and 0.3 – 0.4 mm in breadth. The width of the head capsule measured about 0.08 mm. It is more or less cylindrical in shape and light yellowish in colour. The larva burrowed through the flesh usually directly to the seed. The larval entry to the seed is indicated by a small black area. The duration of the first instar larva varied from 8 – 10 days with an average of 9 days and then developed into the second instar larva.

Second instar larva

The second instar larva is somewhat bigger in size and the body length ranged from 5.2 – 5.9 mm with an average of 5.56 ± 0.07 mm and the breadth was 0.7 – 0.8 with a mean of 0.76 ± 0.01 mm respectively. The width of the head capsule measured 0.30 ± 0.04 mm the colour slightly changed into whitish. When disturbed, it assumes a C-shaped structure. The duration of this instar was observed from 8 – 9 days.

Third instar larva:

The third instar larva becomes a voracious feeder. It measured on an average 7.94 ± 0.07 mm in length and 1.54 ± 0.02 mm in breadth. The width of the head capsule measured about 0.60 ± 0.03 mm. the larval period varied from 7 – 8 days.

Fourth instar larva:

The fourth instar larva was also bit larger and voracious feeder. Its size ranged from 10.84 ± 0.05 mm in length and 1.84 ± 0.05 mm in breadth. The head capsule measured about 1.00 ± 0.05 mm in width. The duration ranged from 8 – 9 days.

Fifth instar larva:

The fifth instar larva is quite peculiar in size and colour. It fed actively and made more tunnels leaving more excreta. The body length measured on an average 14.04 ± 0.17 mm and breadth measured on an average 3.29 ± 0.12 mm width. The duration ranged from 8 – 11 days. The total larval duration ranged from 35 – 40 days. Seshagiri et al. (1971) observed the total larval duration as 30 – 35 days in Andhra Pradesh.

Pre-pupa:

The fifth instar larva was followed by the pre-pupal stage. During this, it stopped feeding and started to search or suitable place for pupation. It measured on an average 11.86 ± 0.10 mm and 4.12 ± 0.02 mm in length and breadth respectively. The width of the head capsule measured 1.77 ± 0.04 mm. the pre-pupal duration lasted for 2 days and then transformed into pupa.

Pupa:

Pupa remained in complete rest. The pupa when first formed was almost pure white and just after pupation the colour changed to slightly dark brown. It measured 8.81 ± 0.30 mm and 4.94 ± 0.17 mm in length and breadth. The width of the head capsule measured 1.3 ± 0.02 mm. The duration was observed to be about 10 days in laboratory condition. Seshagiri et al. (1971) observed the pupal length as 1 – 1.3 mm and 0.3 – 0.5 mm in breadth.

Adult:

After emergence, the adult weevil was found to live for sometimes inside the pulp and came out by cutting through the skin of the fruit. The adult male measured on an average 6.23 ± 0.05 mm in length and 3.48 ± 0.03 mm in breadth. The adult female measured 6.66 ± 0.05 mm in length and 3.98 ± 0.02 mm in breadth. The width of the head capsule remained same as the pupa. The life history of the stone weevil was completed within about 58 to 60 days in laboratory condition. Seshagiri et al. (1971) reported 40 – 50 days as total life cycle of the mango stone weevil. De & Pande (1988) observed the body length of adult male as 6.5 ± 0.65 mm and 3.9 ± 0.45 mm in width while the adult females measured 6.6 ± 0.45 mm in length and 4.0 ± 0.53 mm in width.

Table 1: Numerical data of morphological measurement of different stages of mango pulp weevil

Life stages	No. measured	Length (Mean \pm SE) mm	Breadth (Mean \pm SE) mm
Egg	10	0.68 ± 0.03	0.190 ± 0.007
1 st instar	10	2.10 ± 0.03	0.35 ± 0.02
2 nd instar	10	5.56 ± 0.07	0.76 ± 0.01
3 rd instar	10	7.94 ± 0.07	1.54 ± 0.02

4 th instar	10	10.84 ± 0.05	1.84 ± 0.05
5 th instar	10	14.04 ± 0.17	3.29 ± 0.12
Prepupa	10	11.86 ± 0.10	4.12 ± 0.02
Pupa	10	8.81 ± 0.30	4.94 ± 0.17
Adult female	10	6.23 ± 0.05	3.48 ± 0.03
Adult male	10	6.66 ± 0.05	3.98 ± 0.02

Table 2. Duration of different stages of mango pulp weevil

Sl. No.	Stages of insect	Dates	No. of days	Total no. of days	Temperature Max.- Min. (°C)	Relative humidity Max.-Min. (%)
1	Egg	16-05-2009	6-7			
2	1 st Instar	21-05-2009	5-6			
3	2 nd Instar	28-05-2009	7-8			
4	3 rd Instar	05-06-2009	8-9			
5	4 th Instar	11-06-2009	6-7	50-60	27-14	74-61.6
6	5 th Instar	17-06-2009	6-7			
7	Pre-pupa	19-06-2009	2-3			
8	Pupa	26-06-2009	7-8			
9	Adult	03-07-2009	6-7			

Summary

The life history of *S. gravis* (Fabr.) was studied. The eggs are laid having incubation period from 7 – 10 days. The total larval including five larval instars ranged from 35 – 40 days and the total life cycle from egg to adult varied from 58 – 60 days under laboratory conditions.

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