

## Biology of Citrus Trunk Borer (*Anoplophora versteegi* Rits.) (Coleoptera : Cerambycidae) under Laboratory Conditions

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### Abstract

The male beetle of citrus trunk borer (*Anoplophora versteegi*) lived slightly longer than female beetle. The adult female beetle lays  $170.6 \pm 57.46$  eggs, which hatched in 5-7 days. The eggs laid in the first half (84.6 eggs /female) of their life were slightly less than in the second half (86 eggs /female). The frequency of egg laying per day per female varied from 0 to 11 eggs with the mean egg deposition frequency of 2.90 eggs per female. The egg hatching percentage was found to vary from 90 to 100 per cent with an average of 92.86%. *A. versteegi* grub completed larval period in 240 to 310 days and adult emerged from pupa in 23-31 days. Freshly emerged beetle takes 3-5 days for hardening of body parts and thereafter starts feeding on citrus leaves and bark.

**Key words :** Citrus, trunk borer, biology

### Introduction

Citrus trunk borer, *Anoplophora versteegi* Ritsema (Coleoptera: Cerambycidae) is the most destructive pest of citrus in the entire north eastern region of India (Hayes 1945, Sachan and Gangwar 1982). Male beetle of this species was originally described by Ritsema (1881) as *Monohammus versteegi* and he named this species after Mr. W.F. Versteeg, one of the member of the Committee for the Scientific Sumatra-Expedition. The beetle lays eggs on the base of the trunk of the tree and on hatching, grubs bore into the living trunk through the egg laying site. The grub destroys the xylem and phloem during their long development period, causing the deterioration or death of the tree and resulting in serious economic losses. Nath and Basu (1969) reported the larval stage of citrus trunk borer lasted for 9 months and 12 days and the pupa stage for 1 month and 23 days. Similarly, David and Ananthakrishnan (2004) also reported that the larval stage lasted for an average of 282 days and

the adult emerged from pupa in about 53 days. Control measures for this pest are difficult because of the cryptic habit of the grubs and the activemigration of the adult beetles. Biological information on a pest is important for planning strategies to control the pest. Considering the importance of the pest, an experiment was conducted to study the biology of the beetle under laboratory conditions.

### Materials and methods

Five pairs of freshly emerged male and female beetles were collected from khasi mandarin orchard of Division of Entomology, ICAR Research Complex for NEH Region during Mid-April, 2009. Each pair was reared separately inside rearing cages under laboratory conditions and twigs of khasi mandarin plant were provided as food. Logs (20 cm long and 3-5 cm in diameter) cut from a living khasi mandarin tree were supplied for oviposition and replaced every day. Whenever an adult male died before the death of his paired female, another adult male was supplied. The pre-oviposition period, oviposition period, fecundity and adult longevity were recorded. Freshly laid eggs at night were taken out from the khasi mandarin log in the next morning. The bark around the oviposition site was removed gently using a sterilized sharp paper cutter/ knife without much disturbance to the underneath eggs. The eggs were removed from the wooden log by using a thin wood section of about 10cm long. The thin wood section after dipping in water was slid gently below the eggs. Ten numbers of eggs were placed in a petri dish (3 cm in diameter and 1 cm depth) with moist filter paper. The petri dishes containing eggs were placed inside a plastic container (15 cm in diameter and 20 cm in depth) whose mouth was covered with moistened muslin cloth and kept inside a Humidity Chamber at  $20 \pm 5^\circ\text{C}$  and  $70 \pm 5\%$  Relative Humidity. Egg hatching percentage was calculated from seven replications with ten eggs per replication. Eggs were observed daily for the hatching of grubs.

After hatching, the grubs were individually transferred to a plastic cup (80 ml capacity) in a premade hole on the surface of saw dust based

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artificial diet. Rearing was done under room temperature under dark conditions. Food was replaced weekly for the first month and then replaced at monthly intervals. After pupation, pupae were separated from artificial diet and were kept inside the empty plastic cup (80 ml capacity) with aluminium foil covering. Then the pupae were kept inside a BOD incubator at  $20 \pm 5^\circ\text{C}$  for emergence of adult beetles. The duration of larval and pupal period were recorded. The emerged male and female beetles were fed with leaves and twigs in the laboratory to observe their longevity.

## Results and discussions

The male beetle of citrus trunk borer (*A. versteegi*) lived slightly longer ( $73.2 \pm 9.15$  days) than female beetle ( $69.8 \pm 9.98$  days) (Table 1). The female beetle passed a pre-oviposition period of 9 to 12 days for sexual maturation. Most of the female beetles started egg laying at 11 days after emergence during night time (7:30 pm – 9:30 pm). However, Nath and Basu (1969) observed the egg laying of *A. versteegi* late in the afternoon, in the incisions on the bark. The ovipositional period of citrus trunk borer was found to last for 42 to 68 days and the fecundity was found to range from 114 to 258 eggs/ female. The mean number of eggs laid during the life of a female was  $170.6 \pm 57.46$  eggs. However, Azad Thakur and Shylesha (1996) reported that the adult female lays 40-50 eggs and Chatterjee and Ghosh (2001) reported 68.96 eggs on an average.

Fecundity curve of citrus trunk borer was determined from the number of eggs laid by a single female every day after emergence (Fig.1). The female was found to lay eggs nine days after emergence. The fecundity rapidly increased in successive days and reached its peak (6.4 eggs/female/ day) on 13<sup>th</sup> days after emergence. The fecundity curve of citrus trunk borer was an irregular-shaped curve. It was observed that the eggs laid in the first half (84.6 eggs /female) of life cycle was slightly less than in the second half (86 eggs /female).

The egg deposition frequency curve of female was determined from the frequency of eggs laid by a female every day after emergence (Fig 2). The frequency of egg laying per day per female varied from 0 to 11 eggs. However, Azad Thakur and Shylesha (1996) reported that a female lays 8-15 eggs near the collar region of khasi mandarin plant. The mean egg deposition frequency per female was 2.90 eggs. The mean length of no egg deposited by a female before her death was 3 days and the post-

ovipositional period ranged from 1 to 5 days. The number of eggs deposited by a female beetle found to be positively correlated with ovipositional period ( $r = 0.90$ ) and longevity ( $r = 0.88$ ), whereas it was negatively correlated with the pre-ovipositional period ( $r = -0.81$ ). Fecundity was not related with the post-ovipositional period of female. It was observed that male survived (73.2 days) little longer than female beetle (69.8 days).

The incubation period of citrus trunk borer eggs ranged from 5-7 days (Table 1). The egg hatching percentage was found to vary from 90 to 100 per cent with an average of 92.86%. The present study showed that *A. versteegi* grub completed larval period in 240 to 310 days (Table 1) which is similar with the findings of Nath and Basu (1969) David and Ananthakrishnan (2004). It was observed that the adult of citrus trunk borer starts emerging at 20-31 days after pupation (Table 1). However, Nath and Basu (1969) and David and Ananthakrishnan (2004) reported that the *A. versteegi* adult emerged from pupa in about 53 days. Freshly emerged beetle of citrus trunk borer takes 3-5 days for hardening of body parts and thereafter start feeding on citrus leaves and bark.

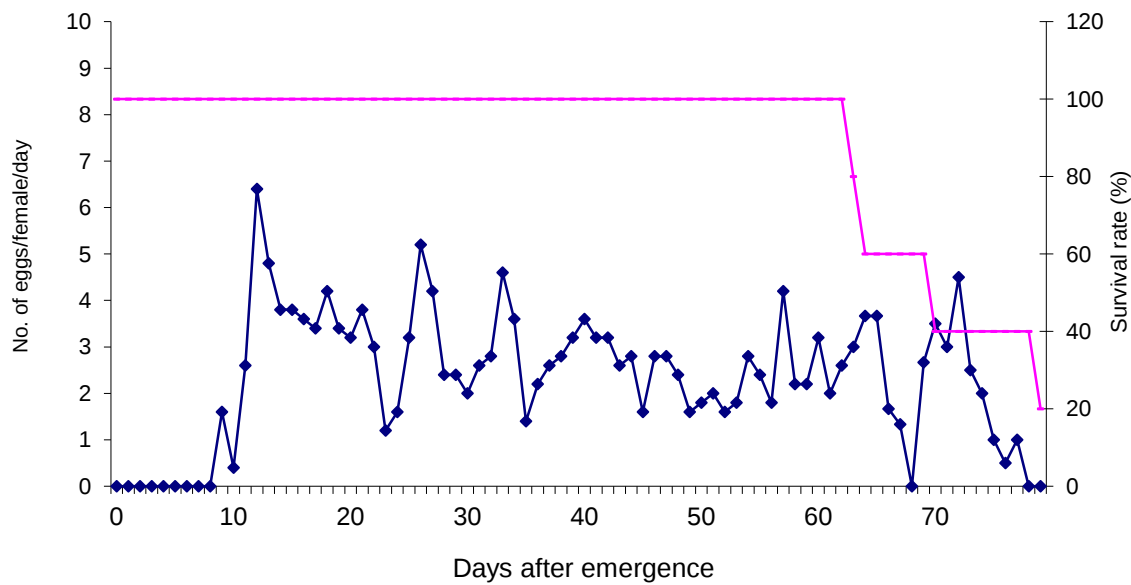
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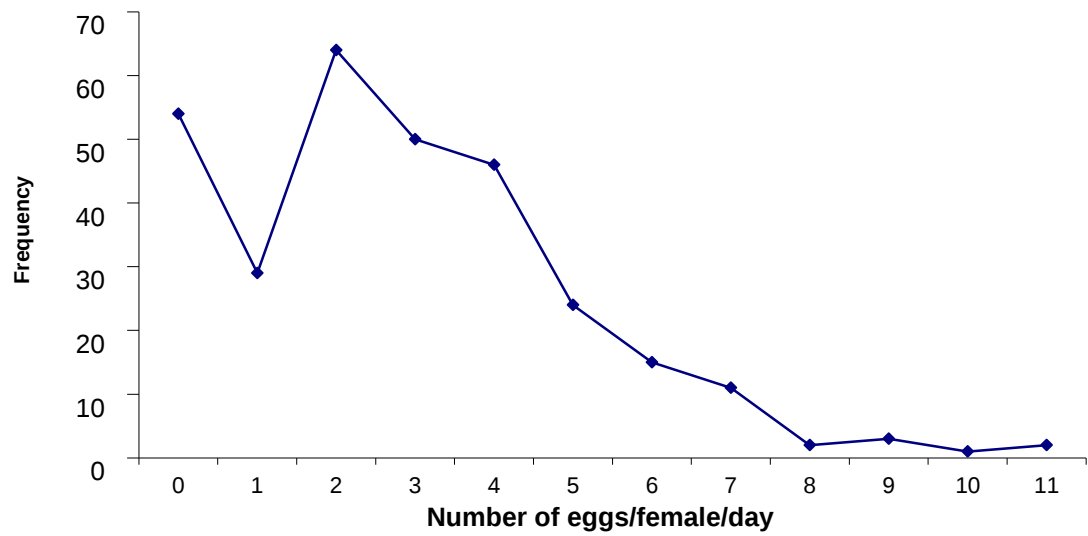
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**Table 1:** Life cycle of *Anoplophora versteegi* under laboratory conditions

| Life stages             | Developmental period (days) |         |
|-------------------------|-----------------------------|---------|
|                         | Mean $\pm$ SD               | Range   |
| Egg                     | 6.0 $\pm$ 1.00              | 5-7     |
| Larva                   | 263.0 $\pm$ 22.64           | 240-310 |
| Pupa                    | 25.76 $\pm$ 2.77            | 20-31   |
| Adult                   | 71.5 $\pm$ 2.91             | 57-84   |
| Male                    | 73.2 $\pm$ 9.15             | 60-84   |
| Female                  | 69.8 $\pm$ 9.98             | 57-80   |
| Pre-oviposition period  | 11.0 $\pm$ 1.22             | 9-12    |
| Oviposition period      | 55.8 $\pm$ 11.65            | 42-68   |
| Post oviposition period | 3.0 $\pm$ 1.41              | 1-5     |



**Fig. 1.** Frequency and survival rate of citrus trunk borer adult females after emergence



**Fig. 2.** Egg depositing frequency of citrus trunk borer adult females after emergence