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Studies on the biological parameters of *Helopeltis antonii* Sign (Hemiptera: Miridae) on *Psidium guajava* L.

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ABSTRACT: A study was carried out on the biological parameters of Tea mosquito bug, *Helopeltis antonii* Sign. on guava. The development of *H. anotnii* on guava was completed within a period of 25.2 days with an incubation period of 12.8 and nymphal period consisting of five instars with 12.4 days respectively. Females had longevity of 25.2 days with pre- oviposition and oviposition periods of 5.5 and 14.7days respectively. Egg laying was recorded in all stage of fruits. Eggs were inserted into the tissues or laid externally on fruits singly or in groups. The per cent survival of different nymphal instars ranged from 82.3 to 94.3. Immature fruits were the most preferred for feeding by the pest. The feeding scars made by the pest were initially dotted black spots that enlarge in area and merge with increase in fruit age. Immature fruits dry and fall while mature fruits develop scabby appearance of unmarketable value.

Keywords: Biology, guava, *Helopeltis antonii*

INTRODUCTION

Tea mosquito bug, *Helopeltis antonii* Sign. is an important pest on guava (*Psidium guajava*). In addition to guava, the pest is also reported from other horticultural crops such as annona, Singapore cherry, mango, pomegranate, beetel, moringa, cashew, cacao, neem etc. (Kamala jayanthi, 2016, Reddy, 2000, Devasahayam and Nair 1986, Sundararaju and Babu, 1996). On guava, the pest causes more than 60 per cent yield loss. The injury made by sucking mouth parts of the insect causes the tender shoots and fruits to dry and drop. The typical damage symptom is the formation of necrotic lesions around the point of stylet insertion by the bug. The nuts infested by this pest develop characteristic black wart eruptions that are unmarketable. The damage in the early stages of the crop often goes unnoticed till maturation of fruit. The buildup of the pest population commenced from May synchronizing with the emergence of new flushes and fruit set reaching to a peak in September. Taking into consideration the importance of host plant on the pestilence of an insect, a study was carried out on the biological parameters of *H.anotnii* on guava to develop time bound control measures to manage the pest.

MATERIALS AND METHODS

Biology of *H. antonii* was studied under laboratory conditions at the Division of Entomology and Nematology, ICAR-Indian Institute of Horticultural research (IIHR), Bengaluru, India. For establishment of initial culture of the insect, *H.antonii* adults were collected indiduallay in glass test tubes from guava fields of ICAR-IIHR and brought to the laboratory. The collected adults were identified into females and males based on the external character. Female bugs had a whitish ventral bulged abdomen with the ovipositor and normally bigger in size.

Establishment of a laboratory culture for the study

Preliminary studies indicated that female laid eggs only on turgid plant parts. Tender twigs with immature fruits of pea nut size were selected. The twig was passed though a nylon mesh sleeve (170 cm height × 30 cm diameter) open at both ends. The inserted end of the sleeve was tied tightly along with the twig with a thread. A pair of adults was released through the distal end and the end was closed tightly with a thread. After two days the released adults from the nylon mesh cage was recovered by opening the distal end of the cage. The nylon mesh was closed to prevent entry of predators or parasitoids. This process is repeated for every 2 days in different twigs till the exposed females were dead. The exposed twigs were kept in closed stage by netting with the nylon sleeve for nearly 10-15days. Regular checking was made at once in two days for the presence of hatched nymphs. The hatched nymphs were collected carefully with a fine haired camel brush, brought to the laboratory and reared as on guava fruits as described below.

Rearing of nymphs

Rearing of nymphs to adult was carried out under laboratory on guava fruits. Guava twigs with fruits of pea nut stage were collected from biological control guava orchard of Indian Institute of Horticultural

Research, Bangalore and washed thoroughly in running water and air-dried. Two-three twig were collected together to make a bouquet. The base of the bouquet was inserted into a narrow mouthed conical flask of 20 ml capacity containing water. The space between the rim of the flask and the inserted bouquet was closed with a non- absorbent cotton plug to prevent drowning of insects. The conical flask was placed in rearing glass chimneys as shown in the below (Figure-1). The mouth of the chimney is covered with a muslin cloth held tight by rubber bands. The hatched nymphs collected from the oviposition cage in the field were released singly into the rearing cage. The nymphs were supplied with fresh guava fruits till they completed development the experiment was carried out with 20 first instars nymph of 0-1day old where each nymph was considered as a replicate. Observations on the different stages of the insect from egg to adult, duration, percent survival, feeding behavior, damage were recorded. Laboratory reared 0 day old adults were used to determine the longevity, pre- oviposition, oviposition period etc. Temperature and Relative Humidity in the laboratory ranged from 25 to 30°C and 60 to 70% during the study period.

RESULTS AND DISCUSSION

Egg stage

Eggs were laid singly and in batches. An egg batch consisted of a maximum of 16-18 eggs. Eggs were sub-oval in shape with neck near the anterior end. Two unequal silvery processes arise laterally on either side of the anterior end of the egg that project outside the plant tissue. The mean incubation period was 12.6 days (Table 1).

Plate -1. Oviposition cage

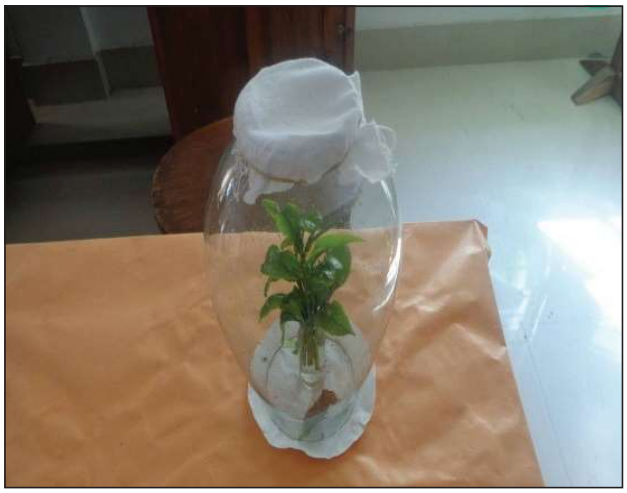

Plate -2. Rearing cage for nymphs

Plate -3 . Eggs inserted on fruits and into tissues

Nymphs

There were five nymphal instars. The total developmental period from 1st to 5th instars was completed by 12.4 days with duration of 2.7, 1.8, 2.1, 2.5 and 3.3 days from 1st, 2nd, 3rd, 4th and 5th instars respectively. First instar nymphs that hatch out from the eggs were minute and light orange in colour, while second instar were deep orange. This stage was of the shortest duration. In third instar nymph, wing buds and scutellar horn were noticeable. In fourth instar the wings pads are prominent externally while in fifth instar the wing pads cover half the abdomen. Sexes could be visible from external characters and the scutellar horn was clearly visible. This was the longest duration.First, second and third instars nymphs have aggregation behavior, remain confined on the fruit it feeds. Fourth and fifth were less active often found in mature parts of the branches and are dispersive. The total life cycle from egg to adult was completed in 25.2 days.

Table 1. Life stage parametrs of *Helopeltis antonii*

Stage	Duration (days)
Egg period	**12.8**
1st instar	2.7
2nd instar	1.8
3rd instar	2.1
4th instar	2.5
5th instar	3.3
Total nymphal period	**12.4**
Total duration (egg to adult)	**25.2**
Male longevity	22.6
Female longevity	25.2
Pre oviposition period	5.5
Oviposition period	14.7
Post oviposition period	4.2
Fecundity	35-42 eggs/female

Adult

The newly emerged adults were light brownish with transparent wings, which turned dark brown. The dorsum of thorax was reddish and the tergum of abdomen turned dull white. The scuttellar horn was reddish brown in both the sexes and it was erect, tapering and funnel shaped. In female, a white patch is present on the fifth abdominal segment. The ovipositor of the female was located on the ventral portion of sixth abdominal segment. The dorsum of the abdominal segment was deep orange. The overlapped hemi-elytra cover the entire abdomen with distal end showing a triangular brownish black colouration. Females had an average longevity of 25.2 days while 22.6 days was reported for males. Thus the total life cycle of female was 50.4 days while it was 47.8 days for males. The pre-oviposition, oviposition and post oviposition period was 5.5, 14.6 and 4.2days respectively. The mean fecundity of *H.antonii* was 37 eggs with a range of 35-42eggs/female.

Survival rate of different nymphal instars stages of *H.antonii*

The per cent nymphal survival rate varied for each instar. The survival percent was 91.4, 92.2, 90.6 for the first, second and third instars while 86.3 and 82.6 percent survival was recorded for fourth and fifth instars respectively. A linear co-relation between the instars and percent survival with a r^2 value of 83 per cent was recorded.

Table 2. Survival of *H.antonii* from egg to adult stage

Stage	Survival from previous stage (%)
1st instar	91.4
2nd instar	92.2
3rd instar	90.6
4th instar	86.3
5th instar	82.6

Feeding habits and nature of damage

Feeding habits of adults and nymphs were similar. Both nymphs and adults insert the rostrum into tender shoots, mid ribs, buds, fruits and sucked the sap. Fruits were preferred than other plant parts. Though feeding was recorded on all stages of fruit including ripened fallen fruits, immature fruits were the most preferred. Feeding of nymphs and adults on the tender fruits, lead to gradual change of color to black, shriveling and dropping prematurely. The feeding punctures were visible as scabby lesions (black spots). The first and second instar restrict their feeding on a single fruit it infests whereby the entire fruit turns black, dries and falls (Fig -2 a).Since the later instars and adults are dispersive, feeding not restricted to a single fruit, their feeding results in development of few to many black spots that enlarge and merge with advancement of fruit age resulting in scabby unmarketable fruits (Fig. 2 b-c)

a b c

Fig. 2 Fruits damaged by *H.anotnii.* A to b: 1st and 2nd instars, C: damaged by late instars and adults; scabby appearance on harvested fruits

The present study shown that *H. antonii* inserts its eggs into the plant tissue singly or in small groups, usually with the filaments exposed. This agrees with the observations reported by earlier studies on oviposiiton of *Helopeltis* spp on other host plants (Srikumar and bhat, 2013), Ambika and Abraham, 1979 and Tan 1979). *H.anotnii* prefers immature fruits for feeding than to other stages. Earlier studies by Jayanthi and Verghese (2007), Reddy et.al (2002) also reported that pea nut stage guava fruits with a soft texture were preferred for feeding by *H.antonii*. Gopalan and perumal (1973) attributed possibility of nutritional differences between shoots and fruits for this feeding preference by *Helopeltis* spp on its host plants. Initially females laid eggs on tender flushes that shifted to buds and set fruits. Newly flushed leaves were reported to be the preferred oviposition site of *H.antonii* on cashew, neem, Singapore cherry etc while pods were reported in cocoa and moringa (Srikumar and Bhat, 2013, sundarraju, 2000).

An incubation period of 12.7days was reported for *H.antonii* on guava. According to Stonedarl (1991) egg incubation period varies with locality, season and host, but it is generally in the range of 6-11 days, although longer durations are observed occasionally. For instance Das, 1984, reported 20-27 days for *H. theivora* in northeast India and 13-16 days for winter populations of *H. bradyi*. Betrem, 1953; Awang *et al*., 1988 reported that the rate of nymphal development of *Helopeltis* spp is affected by climatic conditions and food source. In the present investigation, *H.antonii* raised on tender fruits under ambient conditions completed nymphal stage with 12.4days that is in conformity with the duration reported on cashew (Smith, 1979, Ambika and Abraham, 1979, Devasahayam, 1986). On the other hand, much longer periods have been reported for October - December populations of *H. bradyi* (27-43 days) and *H. cinchonae* (30-54 days) reared on tea in the Cameroon Highlands (Lever, 1949). The longevity of *Helopeltis antonii* on guava ranged from 23 to 25 days. Adult longevity has also been reported to vary with the rearing conditions (Stonedahl, 1991). Tan (1974) recorded a mean adult longevity of 30 days for *H. theivora* on cocoa pods in West Malaysia while only six days was recorded when raised on cocoa shoots by Awang *et al*. (1988). The fecundity of *H. antonii* on guava was reported as 35-42eggs/ female. The fecundity of *H. antonii* on Singapore cherry was also reported to range from 41-53 eggs per female. Host- influenced effects on fecundity, including different hosts as well as different parts (e.g. foliage vs. fruits) of the plant species, are known for *H. antonii* (Sundararaju and Sundarababu, 1999). Infestation by *H.anotnii* on guava results in qualitative and quantitative yield loss. While feeding damage on immature fruits results in drying and dropping of fruits causing quantitative yield loss, scabby appearance on older fruits results in qualitative yield loss. A study on the quantitative yield loss of guava due to *Helopeltis anontii* infestation in the field indicated that more number of fruits dropped in the immature stage that decreased with the maturation of fruits. Similar observations were reported on cashew by Pillai and Pillai (1977). The information generated on the biology, fecundity, feeding preference and behavior, damage potential are very much useful in formulating schedules for effective and sustainable management *H. antonii* on guava.

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