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Original Research Article

Studies on the Biology of Tea Mosquito Bug, *Helopeltis antonii* Signoret (Hemiptera: Miridae) on Cashew

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ABSTRACT

Helopeltis antonii Signoret is an important pest of cashew causing significant economic damage in India. Biology of *H. antonii* was studied under laboratory conditions on cashew. The length and breadth of freshly laid eggs were measured as 1.15 ± 0.05 mm and 0.36 ± 0.02 mm, respectively. The incubation period of eggs was ranged from 8 to 11 days and hatchability of eggs found as 65.18 ± 5.77 per cent. Nymphs passed through five instars. Total nymphal duration was 13.20 ± 1.04 days. The sex ratio (Female:Male) was calculated as 1:0.39. Pre-oviposition, oviposition and post oviposition period were 2.88 ± 0.83, 6.40 ± 1.41 and 2.80 ± 0.96 days, respectively. Fecundity of the female recorded as 29.64 ± 5.65 eggs/female. Longevity of female was 12.08 ± 1.71 days, while that of male was 9.20 ± 1.66 days. Total life cycle of female completed in 29 to 37 days and that of male in 28 to 33 days.

Keywords

Biology, Cashew, *Helopeltis antonii*, Tea mosquito bug

Introduction

Tea Mosquito Bug (TMB) is one of the major pest of cashew. Three species of TMB, *viz.*, *Helopeltis antonii* Signoret, *Helopeltis bradyi* Waterhouse and *Helopeltis theivora* Waterhouse are found in India. Among them, *H. antonii* is the dominant species. The genus *Helopeltis* was upgraded mainly to differentiate it from the closely resembling genus *Pachypeltis*. In early records, these pests especially in tea commonly called as 'tea bug' and 'tea mosquito' and the damage was reported as 'tea blight', 'mosquito blight' and 'spot blight'. The same common terminologies are in usage even now [1].

The population of TMB reaches its peak during flushing, flowering and fruiting season in cashew, *i.e.* from November to February. Both nymphs and adults suck sap from tender shoots and leaves, floral branches and from developing nuts and apples by making a number of feeding lesions. They feed by sucking the plant parts injecting poly-phenoloxydase from their salivary glands [2].

Typical feeding damage by *Helopeltis* spp. appears as a discoloured necrotic area or a lesion around the point of entry of the labial stylets inside the plant tissue. The infestation of inflorescence results in "blossom blight". Each insect can damage 3 to 4 shoots or panicles leading to heavy loss in yield [3]. Recently, much of the emphases is being given on sustainable agriculture based on suitable integrated pest management strategies. Therefore, present investigation was carried out to study the biology of *H. antonii*on cashew, which may help to develop time bound control measures to manage the pest.

Materials and Methods

The detailed biology of *H. antonii* was studied under laboratory conditions at room temperature in the Department of Entomology, College of Agriculture, Navsari Agricultural University, Waghai during November-2018 to February-2019.

Mass rearing techniques for tea mosquito bug

The mass rearing techniques adopted by Sundararaju and John (1992)[4] was adopted with slight modification for rearing the tea mosquito bug. Cashew twigs were used as feeding material. The tender shoots and seedlings of cashew were supplied continuously for feeding and development of tea mosquito bug. The mother culture of tea mosquito bug was collected from farmer's cashew orchards of the Dangs, Gujarat, India which were then released into the glass jar containing cashew twigs of 10-12 cm long with few leaves. The cut ends of the twigs were kept immersed in water in small vials (5 ml) to maintain turgidity. The twigs were hold firmly by plugging cotton to the mouth of the vials. The mouth of the jar covered with muslin cloth was hold tightly by the rubber bands. The twigs were replaced everyday morning with fresh twigs as food. Twelve jars with one pairs of adult bug in each jar were maintained. Three gravid females were transferred to each oviposition cage and allowed to lay eggs on potted cashew seedling. Only tender shoot of potted seedling was kept in oviposition cage through cloth window, while remaining part of the seedling was kept outside the oviposition cage. After seven days of oviposition, the shoots of the potted seedling containing eggs were cut off from the potted seedling and kept individually in glass vial and placed in aluminum nymphal rearing cage. As a prophylactic measure, water in the vials was mixed with carbendazim 0.1 per cent to prevent fungal growth on the shoots. Fresh tender shoots were kept as food to the newly emerged nymphs in glass vial and were replaced till the commencement of emergence of nymphs. From the third day onwards, the number of nymphs was restricted to 15-20 in each nymphal rearing cage. One tender shoot was kept erect inside each vial filled with water and mouth of the vial was closed with wet absorbent cotton. Four tender shoots was placed inside the nymphal rearing cage. On the second day, another four fresh tender shoot was placed adjacent to the already existing tender shoot without disturbing the nymph feeding on the shoots kept on the previous day. This process was repeated every day, allowing the nymph to migrate to the new tender shoots with least disturbance. On every third day, the tender shoots kept on the first day along with glass vials were removed after examining the shoots for the absence of the nymph and this process was repeated daily till emergence of adult.

Adults

Twenty five newly emerged male and female adults were collected in plastic dish and were

transferred to separate glass jars for mating and egg laying. Fresh tender shoots with few leaves were provided daily for food and oviposition. The shoots containing eggs were collected and fresh tender shoots were placed in rearing jar. The eggs were examined under trinocular microscope and were used to study the biology of tea mosquito bug.

Egg and site of oviposition

Eggs laid in shoot were closely observed under magnifying glass for site of oviposition. Shoot containing eggs were dissected under dissecting microscope and eggs were collected gently with the help of fine camel hair brush. Eggs were observed under trinocular microscope for their size, shape and colour. The size of eggs was measured under the microscope with the help of ocular micrometer after calibrating with stage micrometer.

Nymphs

Freshly hatched nymphs were transferred to glass jar covered with muslin cloth using a soft camel hair brush. The glass jars were provided with fresh tender shoots along with wet cotton. Food was changed every day in the morning. Observations were made daily morning for moulting which indicated by the presence of moulted skin. Shedding of moulted skin for every moulting indicated the number of instars passed through by the nymph in the course of its development period. Nymphal measurement, general morphological features associated with different stages of nymphs were recorded. The duration of each instar was considered between two successive moulting. While, the total nymphal period was calculated from the date of egg hatching to the date of adult emergence. Further observations were recorded on sex ratio, pre-oviposition, oviposition, fecundity, incubation, post oviposition, adult longevity and total life period.

The data obtained were subjected to one-way analysis of variance (ANOVA) by using Web Based Agricultural Statistics Software Package 2. All the data derived from the experiments were expressed as mean ± SD.

Results and Discussion

The female of *H. antonii* found to lay eggs on tender shoots, leaf petioles and rarely in the ventral midribs of leaves under laboratory condition. Eggs were laid most often singly, sometimes laid in groups of 4 to 6 on tender shoots in two rows. The eggs are inserted in plant tissue usually with operculum and respiratory horns exposed. The place of oviposition was known by the presence of a pair of silvery white thread like chorionic processes of unequal size that projects outside the plant tissue (Fig. 1). Similar observations regarding the site and pattern of oviposition were also reported[5].

The freshly laid eggs of *H. antonii* were white, ovoelongate, slightly narrower apically and laterally compressed. Two to three days after egg laying an orange band appeared on the upper half of the fertilized egg. When the eggs were ready to hatch, they changed to dark orange at the distal region. During hatching, the nymphs made a hole in the chorion and pushed its head out. The unfertilized eggs remained white and there was no change in the colour, such eggs gradually shrivelled. The findings are in close agreement with the earlier findings [6].The average length and breadth of freshly laid egg were 1.15 ± 0.05 mm (1.08 to 1.25 mm) and 0.36 ± 0.02 mm (0.33 to 0.40 mm), respectively (Table 1). The incubation period under laboratory condition varied from 8 to 11 days with an average of 8.92 ±1.15 days. The hatching percentage of *H. antonii* found

varied from 55.17 to 86.36 per cent with an average of 65.18±5.77 under laboratory condition (Table 2). Thus present finding on incubation period is more or less similar with earlier workers[5].

The first instar nymph was orange yellow colour with red eyes and maroon antennae. The head, legs and abdomen were dull light orange colour. The thorax lacking a scuttellar horn and wing pad. Appendages were fringed with hair (Fig. 2). The length of first instar nymph ranged from 1.30 to 1.58 mm (1.42 ± 0.09 mm) while, breadth varied from 0.25 to 0.35 mm (0.30 ± 0.03 mm) (Table 1). The duration of first nymphal instar varied from 2 to 3 day with an average of 2.48 ± 0.51 (Table 2) on cashew. The present findings are in close occurrence with earlier workers[7].

The second instar nymph was deep orange in colour. The head, antennae, legs, thorax and abdomen are also deep orange in colour. Unlike the preceding instar, body was almost smooth without any prominent fringe of hairs (Fig. 3). The present findings are in close agreement with the earlier workers[7].The length and breadth (Table 1) of second instar nymph varied from 2.15 to 2.48 (2.33 ± 0.10mm) and 0.32 to 0.42 mm (0.37 ± 0.04mm) respectively. The nymphal period of second instar ranged from 2 to 3 days (Table 2) with an average of 2.48 ± 0.51 days on cashew. Earlier, same nymphal period was recorded on cashew[5].

Third instar nymphs were of light brownish and can be differentiated from the preceding instar by presence of scutellar horn in the form of a clubbed structure and the wings pad were rudiment and prominent. A reddish line was observed running laterally from eye to the end of the wing pad. Coxa, femur, tibia of the legs and first antennal segments possessed fuscous marking while rest of the antennal segments were maroon in colour (Fig. 4). The length of third instar nymph was ranged from 2.60 to 2.73 mm (2.67 ± 0.03 mm), while that of breadth ranged from 0.43 to 0.55 mm (0.48 ± 0.04 mm) (Table 1). The duration of third instar nymph varied from 2 to 3 days with an average of 2.44 ± 0.51 days (Table 2). The present findings are more or less similar with earlier findings[5 & 7].

Fourth instar nymph was deep brown in colour with more prominent wing pads which were not overlapping. The scutellar horns were well developed at this stage of the nymph (Fig. 5). These findings are more or less similar with earlier outcomes. The length (Table 1) of fourth instar nymph varied from 3.88 to 4.60 mm (4.34 ± 0.20 mm) while the breadth varied from 0.80 to 1.00 mm (0.88 ± 0.06 mm). The duration of fourth instar nymph varied from 2 to 3 days with an average of 2.64 ± 0.49 days (Table 2) on cashew. The present findings are more or less similar with earlier findings[5 & 7].

The fifth instar nymph was deep brownish, thorax reddish purple, antennae and the appendages being more deeply coloured than abdomen. Wing pads overlap on scuttellar horn, well developed tarsi two segmented (Fig. 6). It can be seen from the Table 1 that the body length of fifth instar nymph varied from 4.85 to 5.38 mm (5.16 ± 0.14 mm) while breadth varied from 1.31 to 1.65 mm (1.48 ± 0.09 mm).The duration (Table 2) of fifth instar nymph reared on cashew varied from 2 to 4 days with an average of 3.16 ± 0.75 days.

During present studies, *H. antonii* was observed to passes through five nymphal instars when reared on cashew[5 & 7]. The data on total nymphal period (Table 2) indicated that, it was ranged from 11 to 16 days with an average of 13.20 ± 1.04 days[5].

Table.1 Morphometrics of *H. antonii* eggs, nymphs and adults

n=25

Stage	Length (mm)	Range (mm)	Breadth (mm)	Range (mm)
egg	1.15 ± 0.05	1.08-1.25	0.36 ± 0.02	0.33-0.40
1st instar	1.42 ± 0.09	1.30-1.58	0.30 ± 0.03	0.25-0.35
2nd instar	2.33 ± 0.10	2.15-2.48	0.37 ± 0.04	0.32-0.42
3rd instar	2.67 ± 0.03	2.60-2.73	0.48 ± 0.04	0.43-0.55
4th instar	4.34 ± 0.20	3.88-4.60	0.88 ± 0.06	0.80-1.00
5th instar	5.16 ± 0.14	4.85-5.38	1.48 ± 0.09	1.31-1.65
Adult female	8.05 ± 0.08	7.92-8.22	1.85 ± 0.07	1.70-1.96
Adult male	7.01± 0.06	6.90-7.10	1.50 ± 0.06	1.40-1.60

Table.2 Life stage parameters of *H. Antonii*

n=25

Stage	Mean±Standard deviation	Range
Egg incubation period (days)	8.92 ±1.15	8-11
1st instar (days)	2.48 ± 0.51	2-3
2nd instar (days)	2.48 ± 0.51	2-3
3rd instar (days)	2.44 ± 0.51	2-3
4th instar (days)	2.64 ± 0.49	2-3
5th instar (days)	3.16 ± 0.75	2-4
Total nymphal period (days)	13.20 ± 1.04	11-16
Female longevity(days)	12.08 ± 1.71	7-12
Male longevity(days)	9.20 ± 1.66	9-15
Pre oviposition period(days)	2.88 ± 0.83	2-4
Oviposition period(days)	6.40 ± 1.41	4-8
Post oviposition period(days)	2.80 ± 0.96	1-4
Fecundity (No. of eggs)	29.64 ± 5.65	22-45
Hatching percentage	65.18±5.77	55.17- 86.36
Total life cycle of female (days)	34.11 ± 2.25	29-37
Total life cycle of male (days)	30.43 ± 1.72	28-33
Sex ratio (Female: Male)	1:0.39	

Fig.1 Eggs in plant tissue

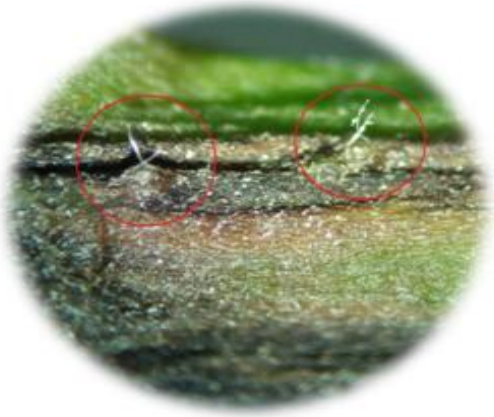

Fig.2 1st instar nymph

Fig.3 2nd instar nymph

Fig.4 3rd instar nymph

Fig.5 4thinstar nymph

Fig.6 5thinstar nymph

Fig.7 Adult

The newly emerged adults were of light brownish in colour with transparent wings, which turned dark brown within 30 to 40 minutes. The dorsum of thorax was reddish and the tergum of abdomen turned dull white. The scuttellar horn was reddish brown and it was erect, tapering and funnel shaped. The abdomen consists of eight segments. The antennae were four segmented. The hemielytra overlapped as in a typical Hemiptera and covered the entire abdomen with distal end showing a triangular brownish black colouration. The femur had irregular deep brownish patches while the entire tibia was brownish black (Fig. 7). The body length of male varied from 6.90 to 7.10 mm (7.01 ± 0.06 mm) and breadth varied from 1.40 to 1.60 mm (1.50 ± 0.06 mm). While the body length of female varied from 7.92 to 8.22 mm (8.05 ± 0.08 mm) and breadth varied from 1.70 to 1.96 mm (1.85 ± 0.07 mm)[7] (Table 1). The pre-oviposition, oviposition and post oviposition period varied from 2 to 4 days (2.88 ± 0.83 days), 4 to 8 days with an average of 6.40 ± 1.41 days and 1 to 4 days with an average of 2.80 ± 0.96 days[5], respectively. The longevity of female varied from 9 to 15 days (12.08 ± 1.71 days) while, that of male varied from 7 to 12 days (9.20 ± 1.66 days)[5].Fecundity was varied from 22 to 45 eggs with an average of 29.64 ± 5.65 eggs per female when reared on cashew. The sex ratio (female to male) achieved during present investigation was 1: 0.39 when the pest was reared on cashew[8].The total life cycle starting from egg to death of adult of female varied from 29 to 37 (34.11 ± 2.25 days)[9]on cashew. While, that of male varied from 28 to 33 days (30.43 ± 1.72 days)[9] (Table 2).

From the present study, it is concluded that, female laid eggs in tender shoots and leaf petioles. The incubation period of eggs was ranged from 8 to 11 days and hatchability of eggs found as 65.18 ± 5.77 per cent. Nymphs passed through five instars with total nymphal duration were 13.20 ± 1.04 days. Female tomalesex ratio of TMB was calculated as 1:0.39. Adults female live longer than male. The knowledge of biology on *H.antonii*, might aid in taking appropriate decision in IPM of this bug in Cashew.

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