

## Varietal Preference and Feeding Behaviour of Tea Mosquito Bug (*Helopeltis theivora* Waterhouse) on Tea Plants (*Camellia sinensis*)

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**Abstract:** Number of lesions in the form of "fluid-soaked feeding spots" on the upper surface of tea leaves produced by nymphs and adults per day were in the order of: -female (104.57) > 2<sup>nd</sup> instar (88.29) > 3<sup>rd</sup> instar (80.21) > 4<sup>th</sup> instar (68.87) > 1<sup>st</sup> instar (66.66) > male (65.72) > 5<sup>th</sup> instar (60.24). But on the basis of total feeding spots made during different stages these were in the order of female (4682.2) > male (1407.0) > 3<sup>rd</sup> instar (287.8) > 2<sup>nd</sup> instar (270.8) > 1<sup>st</sup> instar (186.6) > 4<sup>th</sup> instar (180.6) > 5<sup>th</sup> instar (90.35). There was a direct correlation between the age of the instar and diameter of the feeding puncture. The diameter of the spot of female was significantly larger than those made by male. The 2<sup>nd</sup> leaf was the most preferred site by the third and fourth instars and adults. On the other hand, the first and second instars preferred the 1<sup>st</sup> leaf. Amongst the 28 tea cultivars screened TV1, TV12, TV23, TS653 and TV16 were the most susceptible to *H. theivora* infestation. TV4, TV11, TV28, TV29 and ST449 were less susceptible and TV2, TV9, TV17, TV18, TV20, TV25, TV26, TV30, Teenali 17, TS652, TS491, P126, TV7, TV10, TV14, TV19, TV22 and TS426 were moderately susceptible. No clone was immune to infestation by *H. theivora*.

**Key words:** Tea mosquito bug • Feeding preference • Tea clones

### INTRODUCTION

Tea mosquito bug, *Helopeltis theivora* Waterhouse (Heteroptera: miridae) is considered as one of the major pests of tea in Assam, Dooars, Terai and Darjeeling because it attacks only to the young shoots that is the actual crop of tea. Many Tocklai released clones, garden released clones and seed jats are susceptible to *H. theivora* attack at varying degree. It was estimated that 80% of the tea plantations area are being affected by this pest alone which in turn reducing the productivity to the tune of 10-50% [7]. The nymphs and adults of *H. theivora* suck the sap of the young leaves, buds and tender stems and while doing so, it injects toxic saliva which causes the breakdown of tissues surrounding the puncture, which becomes dark brown shrunken spots after 24 h. The badly affected leaves became deformed and even curl-up. In addition, due to oviposition, the tender stems develop cracks and over-callousing which led to blockage of vascular bundles thereby affecting the physiology causing stunted growth and sometimes die-back of the stems [10]. The present papers

provides detailed information on feeding preference of different Tocklai released tea clones, garden released tea clones and seed jats which commonly cultivated in North Bengal tea gardens and feeding behaviour of *Helopeltis theivora*.

### MATERIALS AND METHODS

For the study on feeding behaviour in laboratory the tea mosquito bug immediately after hatching one nymph was released to feed on five shoots kept inside a reagent bottle and was covered with a glass chimney whose upper end was closed with muslin cloth. The shoots were changed daily and the number of spot (feeding spots were counted in buds, 1<sup>st</sup> leaf, 2<sup>nd</sup> leaf and 3<sup>rd</sup> leaf separately for each), total puncture marks of different instars and adults were recorded. The diameter of the spot was measured with stage ocular micrometer under binocular microscope. Total experiment was conducted on TV1 tea clone during September to October 2006 to 2007.

Twenty eight different tea clones or varieties in the tea fields available in Dooars area were chosen for this

study for feeding experiment. A five tea shoot of the respective cultivar was kept in a reagent bottle filled with water and placed inside the rearing cage (15x30x15 cm). For each treatment five numbers of male and females of *H. theivora* were introduced separately. Observations were taken for 24 h and feeding spots were counted.

## RESULTS AND DISCUSSION

**Assessment of Feeding Potential and Site Preference of Different Stages of *H. Theivora* Bug:** The nymphs and adults of *Helopeltis theivora* sucked plant sap from tender stems, shoots, young leaves, petioles and buds by its sucking mouthparts. The part of the plant where a mosquito bug had sucked developed a circular stain that was initially of coppery translucent appearance, subsequently turning dark brown or black. The feeding rate of nymphs and adult was calculated from the feeding spots produced by an individual per day or in total life stages under laboratory condition on TV1 tea shoots. Significantly more number of spots could be seen when a female fed as compared to male individual per day. A female in its total life span produced as high as 5698.39 punctures with an average of 104.57 punctures per day (Table 1). On the basis of total feeding spots/individual of different stages, these were found in the order of: female (4682.2) > male (1407.0) > 3<sup>rd</sup> instar (287.8) > 2<sup>nd</sup> instar (270.8) > 1<sup>st</sup> instar (186.6) > 4<sup>th</sup> instar (180.6) > 5<sup>th</sup> instar (90.35).

There was a direct correlation between the age of the instar and diameter of the feeding puncture. The diameter of the spot of female was significantly larger than those made by male.

Feeding by early instar nymphs resulted in smaller spots i.e. 0.391 mm to 1.735 mm diameter whereas 5<sup>th</sup> instar

and adult produced larger spots of 3.56 to 5.03 mm. All the punctures produced by *H. theivora* were almost circular. Structure and size of puncture marks also varied with maturity of the tea shoot and clones. The area damaged by the female was the maximum, which was followed by that of male, fourth, third, second and first instar nymphs. This result is similar to the observation made in the Das [4], Anonymous [1], Kalita *et al.* [8] and Sudhakaran [14].

It was clear from the study that *H. theivora* of the Dooars population produces comparatively larger feeding puncture marks than the *H. theivora* of South Indian population as reported by Sudhakaran [14].

During growth of insect digestive performance value changes and the values for approximate digestibility tend to decrease from early to late instars. This is probably related to increase feeding rate and increased gut size when nymphs get older [13]. The total area of the leaf tissue consumed by the advancing instars and adults, which was reflected by the total area of leaf damaged (Table 1, column 4(a x b)) agrees well with the above. The order of feeding spots (number) produced by nymphs and adults also agrees with previous studies by Sudhakaran [14] who reported more or less the same order where as Das [5] observed that a single late instar nymph of *H. theivora* could produce a maximum of 80 feeding spots in 24 h under laboratory conditions. Number of feeding spots produced by nymphs and adults of *H. theivora* were noted by Kalita *et al.* [8] which were much less than that observed in the present study.

A single female of *H. theivora* was found capable of producing an average of 104.57 punctures per day on TV1 clone under laboratory conditions while *H. theivora* female made as high as 179 puncture per day on UPASI clones of South India [14]. Compared to the earlier studies on *H. theivora* in N.E. Indian tea by Das [5]

Table 1: Assessment of damage potential of nymphal stage and adult of tea mosquito bug in the laboratory condition during September to October

Life cycle stages	Mean diameter feeding		Total leaf area (mm <sup>2</sup> ) damaged (necrosed) by feeding/individual/day (a x b)	Total Average Feeding spots during different stages (c)	Cumulative Feeding spot during development (d)
	spot (mm <sup>2</sup> ) (a)	Feeding spots/ individual/day (b)			
1 <sup>st</sup> instar	0.391	66.600 (8.116)	26.04	186.64 (13.55)	186.64
2 <sup>nd</sup> instar	0.785	88.294(9.246)	69.31	270.8(16.42)	475.44
3 <sup>rd</sup> instar	1.753	80.211(8.964)	140.61	287.8(16.89)	745.24
4 <sup>th</sup> instar	2.975	68.875(8.300)	204.90	180.6(13.39)	925.84
5 <sup>th</sup> instar	3.564	60.245(7.825)	214.73	90.354(9.557)	1016.19
Adult	Male	4.087	65.721 (8.069)	1407.0 (37.51)	2423.19
	Female	5.029	104.575(10.170)	4682.2(67.95)	5698.394
CD (P=0.05)	0.560	1.436		6.6835	

Data within the parentheses are vn+1 transformed values which were used for statistical analysis

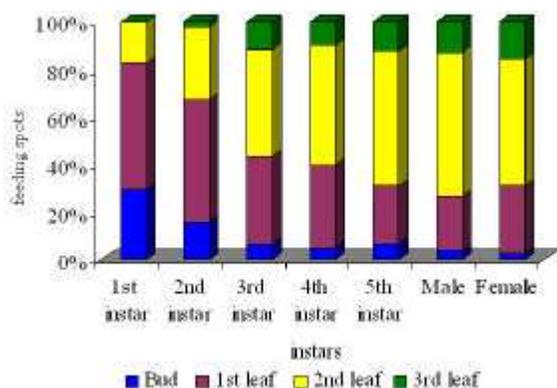


Fig. 1: Feeding site preference of different stages of *Helopeltis theivora* on tea

and Kalita *et al.* [8], the feeding rate of the species seems to hence comparatively increase after a span of a decade and two, indicating a better trophic adaptation to tea.

Depending on number of feeding spots or puncture marks at the different site of tea shoot (bud, 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> leaf) by different stages of *H. theivora*, the trend of feeding site preference was determined. The first instar nymph normally preferred first leaf (53.6%) followed by bud (29.4%) and then second leaf (17.0%) (Fig. 1). In case of second instar the preference could be arranged in the order: 1<sup>st</sup> leaf (51.3%) > 2<sup>nd</sup> leaf (30.5%) > bud (16.0%) > 3<sup>rd</sup> leaf (2.2%). Based on the experiments it was found that the propensity of feeding in rest of the stages (3<sup>rd</sup> instar, 4<sup>th</sup> instar, 5<sup>th</sup> instar and both male and female) was for the second leaf (44.6%-60.5%) followed by first leaf (22.9%-40.0%), then third leaf (10.0%-15.5%) and lastly bud (2.8% to 6.8%). This result was in agreement with the findings of Kalita *et al.* [8] and by and large with findings of Rahaman *et al.* [9]. Leaf surface morphology (trichomes), surface texture and surface wax structure of different tea leaves and their chemical natures may be responsible for differential feeding of *H. theivora* by different stages [12 and 3]. The variation of biochemical profile of the various parts of the tea shoot (bud, leaf, internode) may also play a vital role in influencing the degree of feeding preference of the various stages of *H. theivora* [3].

**Clonal or Varietal Susceptibility of *Helopeltis theivora*:**

All the chosen 28 tea cultivars planted in the Dooars were susceptible to *H. theivora* (Table 2) i.e. no clone was immune to infestation by *Helopeltis theivora*. Among the cultivars TV1, TV12, TV23, TS653 and TV16 were the most susceptible receiving 240 to 286 punctures/5

Table 2: Varietal preferences of tea clones and jats of *Helopeltis theivora*

Clone/Varieties	Average No. of punctures/5 individuals/day
TV1	285.89 (16.93) <sup>a</sup>
TV2	227.25 (15.11) <sup>b</sup>
TV4	77.25 (8.84) <sup>d</sup>
TV7	159.75 (12.67) <sup>c</sup>
TV9	188.83 (13.77) <sup>b</sup>
TV10	153.00 (12.41) <sup>c</sup>
TV11	101.75 (10.13) <sup>d</sup>
TV12	276.25 (16.65) <sup>a</sup>
TV14	143.25 (12.01) <sup>c</sup>
TV16	245.75 (15.71) <sup>a</sup>
TV17	218.75 (14.82) <sup>b</sup>
TV18	210.19 (14.53) <sup>b</sup>
TV19	159.50 (12.66) <sup>c</sup>
TV20	177.00 (13.34) <sup>b</sup>
TV22	150.50 (12.31) <sup>c</sup>
TV23	264.24 (16.28) <sup>a</sup>
TV25	207.00 (14.42) <sup>b</sup>
TV26	184.25 (13.61) <sup>b</sup>
TV28	86.25 (9.34) <sup>d</sup>
TV29	110.75 (10.57) <sup>d</sup>
TV30	198.25 (14.11) <sup>b</sup>
Teenali 17	193.50 (13.94) <sup>b</sup>
TS653	240.00 (15.52) <sup>a</sup>
TS652	193.50 (13.94) <sup>b</sup>
TS426	128.50 (11.37) <sup>c</sup>
TS491	187.50 (13.72) <sup>b</sup>
P126	189.25 (13.79) <sup>b</sup>
ST449	79.00 (8.94) <sup>d</sup>
CD P = 0.05	1.729

•Mean of 10 replications and in each replication five number of *Helopeltis theivora* have introduced.

•Data within the parentheses are vn+1 transformed values which were used for analysis. The same letter at the end of value in the column denotes the value is not significant at 0.05% level

individual/day. The tea cultivars TV2, TV9, TV17, TV18, TV20, TV25, TV26, TV30, Teenali 17, TS652, TS491 and P126 were less susceptible than the preceding group. In this number of feeding punctures varied in between 177 to 227. Third in order of less-susceptibility were TV7, TV10, TV14, TV19, TV22 and TS426 cultivars in which the rate of feeding was 129 to 160. The least susceptible cultivars were TV4, TV11, TV28, TV29 and ST449 the number of puncture in these cultivars ranged from 79 to 111 (Table 2).

The present observation could be corroborated by the findings of Das [5] and Raj [11] who reported that TV1 was the most susceptible clone of *Helopeltis*. The

susceptible of the clones may depend on certain chemicals that which attract *H. theivora*. The significant variability in damage may perhaps be attributed to physical or biochemical attributes of clones. The content of polyphenols, catechins, total carbohydrates and proteins of tea shoots appear to influence the degree of attack by insect. In general, the susceptible clones contained higher amount of total soluble sugars, amino acids and less quality of proteins. Further, young shoots of susceptible clones have a light shiny appearance, which may attract *H. theivora* [14].

In some early works pure Assam indigenous tea was practically immuned to pest attack and in hybrids with greater the proportion of China blood a higher rate of attack especially by *H. theivora* was evident Green [6]. It is generally believed that small-leaved, low jat tea is severely attacked by *H. theivora* compared to a good jat [14]. Even in observation maid by Anstead and Ballard [2] about a century back in South India, China varieties and their hybrids were found most susceptible to attack than the other varieties.

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