EFFECT OF NEEM KERNAL AQUEOUS EXTRACT (NKAE) IN TEA MOSQUITO BUG *HELOPELTIS THEIVORA* (WATERHOUSE, 1886) (HETEROPTERA: MIRIDAE)

Palash Dutta*, S. G. E. Reddy and B. K. Borthakur*****

* Central Muga Eri Research & Training Institute, Central Silk Board, Jorhat-785700, Assam, INDIA. E-mail: pdutta_1@yahoo.com
** Entomology & Pesticide Residue Laboratory Hill Area Tea Science Division CSIR-Institute of Himalayan Bioresource Technology (IHBT) Council of Scientific and Industrial Research Post Box No.6,Palampur-176 061, Kangra Dt (HP), INDIA.
*** Entomology Department Plant Protection Division, Tocklai Experimental station Tea Research Association, Jorhat- 785008 Assam, INDIA.

[Dutta, P., Reddy, S. G. E. & Borthakur, B. K. 2013. Effect of neem kernal aqueous extract (NKAE) in Tea Mosquito Bug, *Helopeltis theivora* (Waterhouse, 1886) (Heteroptera: Miridae). Munis Entomology & Zoology, 8 (1): 213-218**]**

ABSTRACT: Aqueous extract of neem seed kernel (NKAE) was tested in laboratory condition to evaluate its antifeedant, ovicidal, nymphl duration and hatching performance on tea mosquito bug (*Helopeltis theivora*).Different concentrations of NKAE used were 1,2,3,4and 5%. In F1 population NKAE was significantly superior in antifeedant activity, hatching percentage ,oviposition period and nymphal duration @ 5% (248.2), (50%) , (8days) (5 day in 4th inster). The number of eggs laid by female was significantly less in 5% (23.33 Nos.) compared to other treatments.

KEY WORDS: Antifeedant, Ovicidal, *Helopeltis theivora*

Pests of tea are important among the biological components of the ecosystem, which are responsible for considerable crop loss (Muraleedharan, 1991). More than 167 species of insect pests have been reported to inflict damage to the tea plant (Das, 1965). All parts of the plant, leaf, stem, root, flower and seed are feed upon by at least one pest resulting in an 11-55% loss of yield if left unchecked. China (4.73 million tones) is the largest producers of tea followed by the, India (805,180 tones in 2008) Kenya, Sri Lanka, and Turkey. The reduction of productivity is due to destruction by different tea pests like tea mosquito bug, *Helopeltis theivora* (Hemiptera: Miridae).

Assam is crucial to India's US $1.5 billion tea industry and accounts for about 55 per cent of the total annual production. India's tea industry was facing a crisis with prices dropping in the weekly auctions since 1998 and exports plummeting as well.

Tea production has been hit with rampant pests eating away the crop, adding to the woes of the cash-strapped tea industry in the North eastern state of Assam. As per the tea planters and industry officials, tea mosquito bug, *Helopeltis theivora* (Hemiptera: Miridae) was observed in 200 plantations out of 800 in Assam. There has been a sudden outbreak of blisters on tea plants and the attack has been spread like a wild fire to scores of gardens in Eastern Assam causing 10-15% loss in the tea production was reported during main production season (May-July).

Among different insects pests reported in tea, tea mosquito bug, *Helopeltis theivora* (Hemiptera: Miridae) is most destructive sucking pest of tea causing significant reduction in the production and productivity of tea in North East India.Bugs tend to attack plantations during the winter when the young leaves are brown.

Neem based pesticides have excellent potential in view of the low cost, abundant availability of raw material and eco-friendly nature of the product. Neem with its multifaceted biological activity coupled with its discriminative, preventive and efficient eco-friendly nature offers a viable alternative to chemical pesticide. The usage of neem based pesticides which manage the pests successfully. In order to reduce the pesticide load and their residues on tea ecosystem, this study was carried out in the laboratory to evaluate different dose of Neem Kernel Aqueous Extract against *H. theivora*.

MATERIALS AND METHODS

The Study Area: Assam is the world's largest tea-growing region, lying on either side of the Brahmaputra River, and bordering Bangladesh and Burma (Myanmar). This part of India experiences high precipitation; during the monsoon period as much as 10 to 12 inches (250-300 mm) of rain per day. The daytime temperature rises to about 103F (40 °C), creating greenhouse-like conditions of extreme humidity and heat. This tropical climate contributes to Assam's unique malty taste, a feature for which this tea is well known.

Mass culture of test insect: The field collected tea mosquito bug, *Helopeltis theivora* was reared under the laboratory condition at the room temperature (28 ± 4°C) and relative humidity (80-90%) on tea shoots inside the rearing cages for experimental purpose.

Preparation of Neem Kernal Aqueous Extract (NKAE): One day before spraying the neem seeds were decorticated i.e. removal of seed shell to obtain neem kernel. The obtained neem kernels were powdered by an electric grinder. The powder was mixed with water to get required concentrations and soaked overnight. In the next day,the extract was filtrated through muslin cloth then filterate was used for the experimental purpose (Saxena et al., 1980).

Effect of Neem Kernal Aqueous Extract (NKAE) on hatching and oviposition of *Helopeltis theivora* on tea in the laboratory (F1 populations): The experiment was conducted under laboratory conditions at Tocklei Experiment Station; Jorhat, Assam. For each treatment 10-15 fresh tea shoots were inserted in conical flasks containing water and sprayed with different concentrations of NKAE by a pre calibrated atomizer and allowed to dry for about 5 minutes prior to the exposure of experimental insects. Each conical flask was kept inside a chimney and 10 newly hatched nymphs of *H. theivora* were released into treated tea shoots and were changed at 3 days interval till attaining adult stage. The adults laid eggs on tea shoots. The percentage of egg hatching and oviposition period was recorded in F1 populations. The data was analyzed statistically (ANOVA) to draw the conclusion. The per cent reduction in hatching was calculated.

Per cent reduction of hatching = Per cent hatching in control - Per cent hatching in treatment/Per cent egg hatching in control x 100

Antifeedant property of Neem Kernal Aqueous Extract (NKAE): Nymphs of *H. theivora* from F1 generation (treated with different concentrations of NKAE) were selected to study the antifeedant property. Fresh undamaged tea leaves of TV1 genotype were collected from unsprayed tea plantation. For each treatment three fresh tea shoots were inserted in conical flasks containing water.

Each conical flask was kept inside a chimney and one nymph of *H. theivora* was released in each chimney and allowed to feed for 24 hours. The feeding spots produced by the bug were counted visually and presented. There were five treatments and each treatment was replicated five times. The data was analyzed statistically to draw the conclusion.

The percentage of reduction in feeding was calculated with the following formula-

Per cent reduction = No of spots in control - No. of spots in treatment / No. of spots in control X 100

RESULTS

Anti feedent activity of Neem Kernal Aqueous Extract (NKAE) against different instars of *H. theivora:*

First and second instar nymphs: Among different concentrations of NKAE tested against H*elopeltis theivora*. NKAE at 5% was significantly superior to other treatments as compared to control.The no of feeding spots were less in NKAE of 5% both in 1st and 2nd instar (104.20 & 155.00) respectively followed by NKAE at 4% (134.60 & 212.20). NKAE at 3% and 2% the feeding activity was at par as compared to NKAE at 1% & control (Table 1).

Third and fourth instars nymphs: NKAE @ 5% & 4% was significantly superior to other treatments. At NKAE 5% & 4% the number of feeding spots was less (110.6 & 248.2) in III & IV instar nymph respectively followed by NKAE 4% as (131 & 274), NKAE 3% (143.8 & 326.8) and NKAE 2% (155 & 354.8). In control the number of feeding spots was significantly higher compared to other treatments.

Among different concentrations of NKAE tested against nymphs of *H. theivora* in the laboratory, all the concentrations of NKAE showed antifeedent activity against different stages of nymphs. The number of feeding spots were less in different instar of nymph in NKAE at 5% (104.20 to 248.2 spots) as compared to control (265.8 - 460) and was followed by NKAE 4% (131 to 274), NKAE 3% (143.8 to 326.8) NKAE 2% (155 to 354.8). Based on present results NKAE 4% is effective and can be recommended for the management of nymphs of *H. theivora*.

Effect of Neem Kernal Aqueous Extract on oviposition, hatching performance and nymphal duration of *H. theivora*:

Oviposition: Results showed that NKAE had oviposition deterrent effect on nymph of *H. theivora*. The number of eggs laid by female is significantly less in NKAE 5% (23.33 Nos.) and was at par with NKAE at 4% (26.66 Nos.) followed by NKAE 3% (30 Nos.) compared to other treatments. In control the number of eggs laid by the female is significantly higher (40 Nos.). The oviposition period is also prolonged in NKAE at 5% & 4% (8 days) followed by other treatments (7 days) compared to control (6 days) (Table 2).

Hatching performance of eggs: Among different concentrations, the number of eggs hatched in the NKAE at 5% was significantly less (11.66 Nos.) and at par with NKAE 4% (14.33) followed by NKAE 3% (18.33) as compared to other treatments. The number of eggs hatched in control was significantly more (36.0 nos) compared to other treatments (Table 2).

Nymphal duration: Based on the results, it is clearly showed that the nymphal duration of *H. theivora* is almost same in all the treatments (3 days) in first and second instar nymph but in third and fourth instar, the nymphal period is prolonged to five days in NKAE at 5 % and 4% as compared to control (3 days).

DISCUSSION

Today, the environmental safety of an insecticide is considered to be of paramount importance due to their biodegradable nature (Bhattacharya, 1994). An insecticide does not have to cause high mortality on target organisms in order to be acceptable. Antifeedant activity reduces pest damages to products even without killing the pest. This antifeedant activity can therefore be incorporated into other insect control techniques in the strategy of integrated pest management (IPM).

Neem trees are found throughout India with a myriad of uses in medicine, as well as pest control (D.C 1992).Neem-based pesticides are now extensively used in agriculture practices all over the world. It contains azadirachtin, which is a predominant insecticidal active ingredient, having antefeedent, ovipositional deterrence repellency, growth disruption, sterility and larvicidal action against insects (Schmutterer, 1990).Similar result were found in case of *H. theivora* after applying NKAE in F1 population mostly effective on antifeedent, ovipositional and larval duration.

Kreutzweiser (1997) and Goektepe et al. (2004) find out that neem-based biopesticides and neem extracts have a wide range of effects against insect pests including repellence, feeding, toxicity, sterility and growth regulator activity and present result corroborate the foregoing observation, and possibly that is why a reduction in infestation, hatching in higher concentration of NKAE in *H. theivora* was evident.

Further study is required to isolate antifeedant compound from *Heliotropium indicum* and Spilanthes calva which may be similar to antifeedunt compounds present in *Azadirachta indica* (Rembold, 1984; Schmutterrer, 1995).

ACKNOWLEDGEMENT

Authors are thankful to Dr M. Hazarika Director Tocklai Experimental Station, Tea Research Association Jorhat for worked out the study.

LITERATURE CITED

Bhattacharya, U. 1994. Attributes of botanical Pesticides. The Assam Review and Tea News, 83: 16-17.

Das, G. M. 1965. Pests of tea in North East India and their control. Tocklai Experimental Station Memo, No 27: 115.

Goektepe, I., Portier, R. & Ahmedna, M. 2004. Ecological risk assessment of neem based pesticides. J. Env .Sci. Hlth. B.39, 311–320. doi: 10.1081/PFC-120030244.

Kreutzweiser, D. P. 1997. Non-target effects of neem based insecticides on aquatic invertebrates. Ecotoxicol. Env. Safety, 36: 109-117. doi: 10.1006/eesa.1996.1485.

Muraleedharan, N. 1991. In 'Pest Management in Tea' (ed. Muraleedharan), UPASI Tea Research Institute Publication, 1-130.

Rembold, H. 1984. Secondary plant compounds in insect control with special reference to azadirachtins. Adv. In Inverte. Reprod., 481-489.

Saxena, R. C., Waldbauer, G. P., Liquido, N. J. & Purma, B. C. 1980. Effect of Neem seed oil on the rice leaf folder, *Cnaphalocrosis medinalis*. Proc. 1st Int. Neem Conf. Rottach-Egern, 190-204.

Schmutterrer, H. 1995. The neem tree *Azadirachta indica* A. Juss. And other Meliaceous plants. VCH Publishers. Weinheim, Germany, 696.

Schmutterer, H. 1990. Properties of natural pesticides from the neem tree, *Azadirachta indica*. Ann. Rev. Entomol., 271-297. doi:10.1146/annurev.en.35.010190.001415.

Washington, D. C. 1992. Neem: a tree for solving global problems National Research Council Report of an adhoc panel of the Board on Science and Technology for International Development, National Academy Press.

Table 1. Antifeedent properties of Neem Kernal Aqueous Extract against nymphs of *H. theivora* under laboratory conditions.

Treatments	1st instar	2nd instar	3rd instar	4th instar
NKAE 1%	249.00	284.20	169.4	382.6
NKAE 2%	199.80	262.00	155	354.8
NKAE 3%	178.80	246.60	143.8	326.8
NKAE 4%	134.60	212.20	131	274.0
NKAE 5%	104.20	155.00	110.6	248.2
Control	265.80	441.40	170	460.0
CD at 5% (P=0.05)	26.52	35.17	10.79	57.31

Table 2. Effect of Neem Kernal Aqueous Extract on hatching and oviposition of *H. theivora* on tea in the laboratory (F1 populations).

Treatments	Oviposition	Hatching	Percentage of hatching	Percentage of un hatched eggs	Oviposition period (Days)
NKAE 1%	35.00	29.33	83.80	16.20	7
NKAE 2%	31.00	22.66	73.09	26.91	7
NKAE 3%	30.00	18.33	61.10	46.25	7
NKAE 4%	26.66	14.33	53.75	46.25	8
NKAE 5%	23.33	11.66	50.00	50.00	8
Control	40.00	36.00	90.00	10.00	6

Figure 1. Life stages of Tea Mosquito bug, *Helopeltis theivora*.

Figure 2. Antifeedent properties of Neem Kernal Aqueous Extract against nymphs of *H. theivora* of different concentration under laboratory conditions.