



## Population dynamics of red ant, *Oecophylla smaragdina* in cashew orchards and its augmentation for biological control

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**ABSTRACT:** Augmentation of red ant (*Oecophylla smaragdina*) in cashew orchard was found to effectively reduce tea mosquito bug *Helopeltis antonii* population but information on the population dynamics of it is lacking at present. The population of red ant in different seasons was assessed by observing the presence and counting the live nests constructed on host plants. Augmentation by providing food was also assessed. Only less than 50 % of the cashew trees were harboured by red ants in different orchards and during rainy season, there was a further reduction in ant population and then a gradual increase during post rainy season. Food provision resulted in 10.3 fold increase in number of nests compared to 1.35 fold increases in control over a period of just 33 days. The results show that we can move from natural control to augmentative biological control for successful management of Tea mosquito bug in cashew.

**Keywords:** Red ant, cashew, tea mosquito bug, biocontrol, population dynamics, *Oecophylla smaragdina*

### INTRODUCTION

Cashew is a major foreign exchange earning crop in India. Tea Mosquito Bug (TMB) (*Helopeltis antonii*) is the most serious pest of cashew (Sundararaju *et al.*, 1999). Both nymphs and adults suck sap from tender shoots, panicles, immature nuts and apples, causing up to 50% damage. The feeding injury by the bug further leads to die back disease caused by *Colleotrichum gloeosporioides* and *Botryodiplodia theobromae*, often resulting in 95-100% yield loss. Sundararaju (2004) observed that red ant harboured cashew plants recorded 10-50 per cent tea mosquito damage while trees without red ants suffered more than 50 percent damage. The first written record of biological control dating from 304 AD is the use of red ant, *Oecophylla smaragdina* in citrus (Huang and Yang, 1987). *Oecophylla* plays a crucial role in protecting tree crops against pests and enhancing the quality of fruits and nuts in Tanzania (Seguni *et al.*, 2011) Sreekumar *et al.*, (2010) reported that red ant/weaver ant *Oecophylla smaragdina* can be effectively utilized for managing TMB. So it is important to study the population dynamics of red ant in different seasons of the year. Cashew plants put forth new fleshes after the cessation of the monsoon, immediately followed by flowering and fruiting. These three stages are critical which warrant protection from TMB. So augmenting the red ant population by providing food also has been examined in this study.

### MATERIALS AND METHODS

#### Seasonal variation in population

Variations in the population of red ant in different seasons were studied by counting the live nests constructed on host plants. The number of live nests present on ten host plants was counted throughout the year at 15 days interval. The host plants include three mango and seven cinnamon trees. The observations were taken from 15<sup>th</sup> March 2014 to 30<sup>th</sup> March 2015 at the campus of College of Agriculture, Padannakkad, Kasaragod.

#### The seasonal variation in population by red ants on host plants

The seasonal variation in population of red ants on cashew plants in cashew orchard of CoA, Padannakkad was observed for 3 years at monthly interval. Also, observations were taken from Periy and Cheemeni Estates of Plantation Corporation of Kerala (PCK) and a farmer's plot in Karindalam, Kasaragod district from September 2011- June 2012. Observations were also taken from Cashew Research Station, Madakkathara, Thrissur during 2012-13.

**Table 1. Mean number of live nests constructed on 10 trees in different months (March 2014 to March 2015)**

Month	Range of no. of live nests per host plant	Mean no. of live nests per host plant	SD	CV
March 2014	2-26	9.30	7.17	77.09
April 2014	1-25	9.65	7.08	73.36
May 2014	0-21	6.70	6.03	90
June 2014	0-18	5.65	5.84	103.36
July 2014	0-14	4.00	5.11	127.75
August 2014	0-13	2.95	4.88	165.42
September 2014	0-11	2.55	3.99	156.47
October 2014	0-15	3.25	5.03	154.76
November 2014	0-17	3.55	5.49	154.64
December 2014	0-21	4.65	6.58	141.50
January 2015	0-19	4.70	6.11	130.00
February 2015	0-15	3.20	5.10	159.37
March 2015	0-14	3.05	4.69	153.77

**Table 2. Dynamics of harbouring of red ants on cashew plants at PCK estates of Periy, Cheemeni and Farmers plot at Karindalam**

Plot	Total number of plants	Red ant harboured plants (%)		
		September 2011	February 2012	June 2012
Periy I block	309	14.89	30.09	16.21
Periy II block	353	3.12	51.27	21.53
Periy III block	195	4.10	2.56	3.2
PCK estate Cheemeni	220	11	14.41	13
Farmer's plot in Karindalam	72	39	63.89	45



**Plate 1. Red ant feeding tea mosquito bug**

**Effect of food provisioning on the population of red ants in cashew**

The study on food provision was done in six selected cashew trees in Nov-Dec. 2015. The number of live nests constructed on 3 trees which were provided with artificial food such as fish offal or chicken shank (lower part of leg without meat and with spur, claw and skin) was counted and compared with that of 3 trees which were not provided with food over a period of two months.

**RESULTS AND DISCUSSION**

**Live nest counting**

The numbers of live nests constructed on ten host plants were counted throughout the year at 15 days interval and the monthly average is presented in the table 1. The table shows that there is a general tendency of decrease in the number of nests during monsoon period. At the beginning, the average numbers of live nests were 9.3 per host plant which increased to 9.65 in April which then decreased to 6.7 in May 2014. Thereafter, a decreasing tendency was observed till September 2014. Then onwards increasing trend was seen. Building new nests depends on the population of the red ants as well as the availability of tender leaves of the host plants. The number of weaver ant nests per tree has often been used as a measure of ant abundance in plantation crops (Rapp and Salurn 1995). Cinnamon and Mango put forth new flushes after the cessation of the monsoon. These new flushes attract herbivores which is the food source of the red ants.

**The seasonal variation in population by observing presence of red ants on host plants**

The observation was taken during 2014-16 at Cashew orchard, College of Agriculture, Padannakkad,

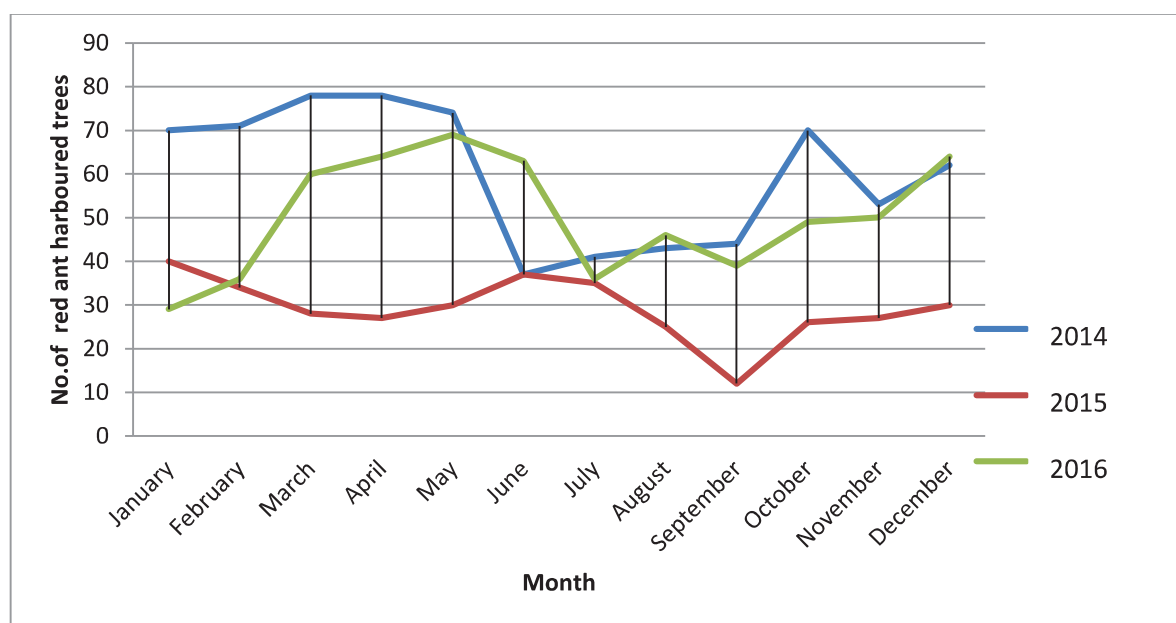
is depicted in Fig.1. The observation taken from Periy and Cheemeni estates of PCK and farmers plot in Karindalam are presented in table 2. The Observation taken from different fields at Cashew Research Station Madakkathara is presented in Table 3. From the table 1, it can be discerned that there is wide variation in the number of trees harboured by red ants. There is variation in the month across the years. For example, in January, 2014, 44 per cent trees were harboured with red ants which reduced to 25 per cent in 2015 which was further reduced to 18 percent in 2016. This trend was observed in February also. But March onwards, till December there was reduction in the number of trees harboured in 2015, but increased in 2016. A reduction in rainfall must have contributed to an increase in the number of trees harboured by ants in 2016 during the rainy months. The percentage of red ant harboured plants showed a definite trend as discernable from table 2. There is a gradual increase from September to February and then a decrease in June. After the cessation of the monsoon rains, the population increases evidenced by the data in February 2012, but showed a reduction in June 2012 due to monsoon rains. Among the experimental plots, cashew plants under coconut intercropping system showed maximum percentage of trees harboured by red ants (73.33% in flushing stages to 90% in the nut initiation stages).

**Effect of food provision**

Observation taken from Cashew Orchard at College of Agriculture, Padannakkad is presented in Fig. 2. Food provision greatly increases the multiplication potential of red ant evidenced by the 10.3 fold increase in the number of nests compared to 1.35 fold increase in control over a period of just 33 days. Chicken shank which was usually discarded by chicken shop was used in the experiment. Meat, dead rats and fish offal are also effective as a proteinaceous food source as reported by Mele and Cuc (2007). This is in line with the results by Sreekumar (2010) who reported that the provision of food in the initial days helps in the early establishment of new colony and connecting the plants harboured by red ants using nylon ropes is found to be easy, if the colonies found to be nearby. It was observed that once provided, these materials act as a source of food for about a month. The food material is not decayed because of the antibacterial activity of ant secretions. Das (2013) reported that the gastric secretions of *Oecophylla* have strong antibacterial activity against a range of gram negative and gram positive bacteria.

**Table 3. Population dynamics of red ants at CRS Madakkathara orchard.**

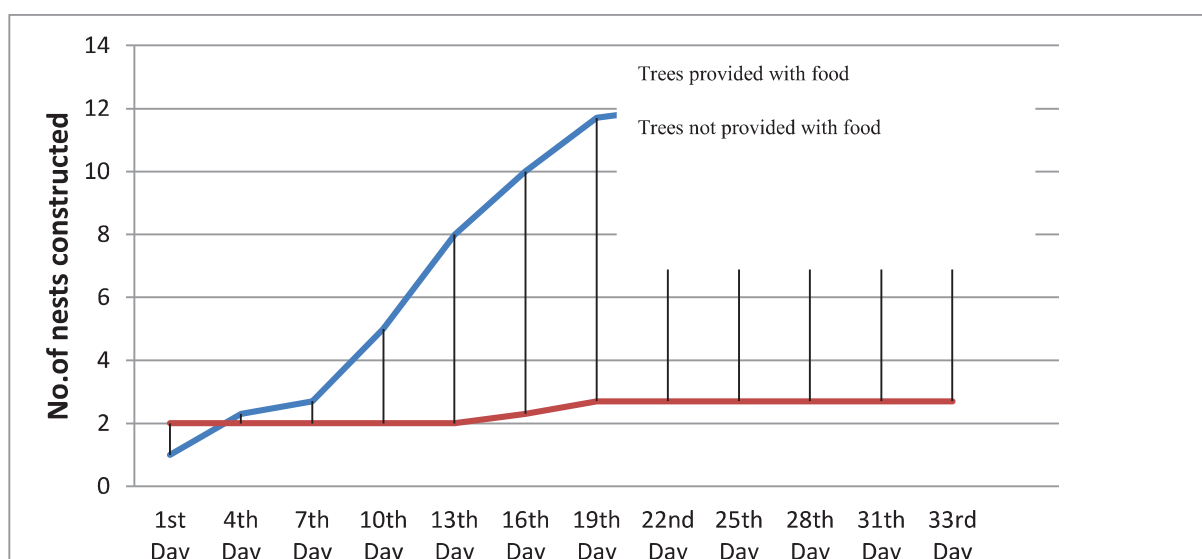
Name of the plot	Total No. of plants	Percentage of trees harboured by red ants through the months (2012-13)						
		December	January	February	March	April	May	June
Priyanka	260	16.92	20.38	21.92	25.76	21.92	22.30	14.61
MLT 2	134	8.20	8.20	9.70	10.44	8.95	8.95	5.970
NPK plot	155	18.06	6.45	12.25	33.54	33.54	32.90	26.45
Intercropping	60	73.33	73.33	73.33	90	83.33	81.66	81.66
Germplasm	44	25	27.27	31.81	31.81	38.63	36.36	15.90

**Fig 1. Progress of spread of red ants on cashew trees in orchards at College of Agriculture, Padannakkad**

## CONCLUSION

The study shows that less than fifty percent of the cashew trees were only harboured by red ants in any orchard. During rainy season, there is a further reduction in ant population and then a gradual increase during post rainy seasons. The critical periods in cashew phenology viz. flushing, flowering and fruit setting require high population of red ants for effective TMB management (Sreekumaret.al, 2011). Low population of red ant only

marginally reduces the TMB attack as observed by Sundararaju, 2004. From the food provision experiment, it is clear that within a short period of time, the ant population can be increased many folds as evidenced by the increased number of ant nests. Providing low cost food such as chicken offal or chicken shank which are easily available, at the fag end of the monsoon season in the cashew orchard can greatly increase red ant population thus effectively protecting cashew flushes and inflorescence. Moreover, redant reservoirs can be



**Fig 2. Number of nests constructed by red ant on cashew trees with/without food provision**

made at suitable places in the villages which can cater the need of red ant for crop protection as done in Vietnam, Thailand and Australia reported by Mele and Cuc, 2007. There should be a shift from natural biological control to augmentative biological control.

## REFERENCES

- Das, P., Dileepkumar, R., Krishnan, A., Nair, A.S., and Oommen, O.V. 2013. Antibacterial action of gastric secretions from *Oecophylla smaragdina*, an Asian red weaver ant. *Journal of Entomological Research*, **37**(4): 12-15.
- Huang, H.T. and Yang, P. 1987. The ancient cultured citrus ant. *Bioscience*, **37**: 665-671.
- Mele, P.V. and Cuc, N. T. T. 2007. *Ants as friends*. CAB International, 68p.
- Rapp G and Salurn MS, 1995. Ant fauna, pest damage and yield in relation to the density of weeds in coconut sites in Zanzibar, Tanzania. *Journal of Applied Entomology*, **119**: 45 – 48.
- Seguni, Z.S.K., Way, M.J., and Mele, P.V. 2011. The effect of ground vegetation management on competition between the ants *Oecophylla Longinoda* and *Pheidole Megacephala* and Implications for Conservation Biological Control. *Crop Protection*, **30** (6): 713-717.
- Sreekumar, K.M., Vasavan, N., Madhu, S., Sijila, J., Sreedharan, M.P., Sreelekha, S. 2010. Utilization of red ants (*Oecophylla smaragdina* F.) to manage tea mosquito bug (*Helopeltis antonii* Sign.) in cashew. Proceedings of 22<sup>nd</sup> Kerala Science Congress, 23-31 January 2010, Kerala Forest Research Institute, Peechi. Kerala State Council for Science, Technology and Environment, Government of Kerala, pp. 16-17.
- Sreekumar, K.M., Vasavan, N., Madhu, S., Sijila, J., Sreedharan, M.P., Sreelekha, S. and Cheriyan, T., 2011. Managing tea mosquito bug (*Helopeltis antonii* Sign.) in cashew by augmenting red ants *Oecophylla smaragdina* (F.). *Journal of Plantation Crops*, **39** (1): 110-113.
- Sundararaju 2004. Influence of spiders and insect predators on incidence of tea mosquito bug in cashew. *The cashew*, **18** (1): 9-13.
- Sundararaju D, Sundarababu PC (1999). *Helopeltis* spp. (Heteroptera: Miridae) and their management in plantation and horticultural crops of India. *Journal of Plantation Crops*, **27**(3):155-174.

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