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Foraging Activity of *Coptotermes heimi* (Wasmann) in Coconut Garden

K. Premalatha[1], D.S. Rajavel* and R.K. Murali Baskaran*
[1]Horticultural Research Station, Kodaikanal
*Agricultural College and Research Institute, Madurai

A marker recapture study was conducted in a coconut garden at Sukkampatti village of Madurai district, Tamil Nadu, India to estimate the foraging populations of *Coptotermes heimi* (Wasmann), one of the most destructive, polyphagous termite species in India. Foraging activity of this termite was monitored by estimation of number of worker termites and cow dung consumption in the monitoring stations. The results revealed that foraging population of *C. heimi* in coconut garden at Sukkampatti varied from of 14,659.90 + 26.09 to 15,045.66 + 29.34 with a foraging area of 59.33m^2 to 65.23m^2. The foraging population and bait matrix consumption decreased significantly after baiting with chlorpyriphos 20 EC at 7.5 ppm.

Key words: *Coptotermes heimi*, cow dung bait, triple marker capture.

Coptotermes heimi is a wood inhabiting termite species that causes serious damage to wooden material as well as a number of tree species in Rajasthan (Rathore and Bhattacharya, 2004). It is a very common species causing extensive damage to structural timber, wood work, packing cases, stored materials of cellulosic nature, sugarcane, fruit trees and forestry. Its nests are in soil as well as in dead portions of trees, logs of wood and structural timber in houses and buildings. Economically, the species is of great importance as it destroys wood in its many form throughout India.

The newest and the most effective management approach in termite control is the use of low toxicity baits. Termite baits deliver toxicants through ingestion and their effectiveness depends on feeding preference of termites to consume the bait when presented with choices of other cellulosic food sources. Recent studies involving the use of baits containing Insect Growth Regulators, hexaflumuron have demonstrated that they are safe and effective in protecting buildings and structures against subterranean termites with no adverse effect upon the cultural/surrounding natural resources. In the present study, chlorpyriphos was used in the bait. Higher efficacy of chlorpyriphos against termites was reported by Mishra (1999).

Materials and Methods

Foraging activity of termite species was studied by the method of Qui-Ying Huang *et al.* (2006) with slight modifications. A coconut garden at Sukkampatti, Madurai district, Tamil Nadu was selected for this study. Four colonies of *C. heimi* were selected at this site. Cow dung bait surveys were conducted in areas of known termite activity. Survey material (500g of dry cow dung) was placed on soil adjacent to the coconut trees infested with termites and were examined at weekly intervals for four months (August - November, 2006). After four months, infested cow dung lump was brought to the laboratory and termites were removed by gently tapping the lump in a plastic basin. Recovered termite workers were counted directly. Cow dung remnants were also weighed to compute consumption. The number of termite workers and quantity of cow dung consumed were determined to assess the foraging activity of termite species.

After the establishment of each colony, a triple marker- recapture programme was used to estimate the foraging territory and population. Worker termites collected from a station with high activity (>1000 termites collected) were placed in several 15.0 cm diameter glass petridishes with three filter papers (Whatman No1, 9.0 cm diameter) stained with 0.05 % methylene blue.

The number of termites in each glass petridish did not exceed 500. All the dishes were then placed in BOD incubator maintained in 27± 2°C. The termites were forced to feed on the stained filter papers for three days. Active and stained individuals were released back in the same monitoring station. Termites collected from stations containing marked termites from the first release were counted directly and again stained and released to their respective stations. The mark-release-recapture cycle was repeated three times for each colony during September 2006. The numbers of marked and unmarked workers were recorded for each cycle. Colony population was estimated using a weighted mean model (Nan-Yao Su *et al.,* 1993 and Stansly *et al.,* 2001).

[1]Corresponding author email: kpremalatha2003@yahoo.co.in

Two bait matrices with chlorpyriphos 7.5 ppm were placed symmetrically 20 cm away from an infested monitoring station. Bait matrices were examined at weekly intervals from November to December 2006. The bait matrix was separated from debris and reweighed to determine bait matrix consumption

$$N = \frac{\Sigma M_i n_i}{\Sigma m_i + 1}$$

$$SE = N \left\{ \frac{1}{\Sigma m_i + 1} + \frac{2}{(\Sigma m_i + 1)^2} + \frac{6}{(\Sigma m_i + 1)^3} \right\}^{1/2}$$

Where ,

N = Mean foraging population

E = Associated standard error

M_i = Total number of marked individuals upon the i^{th} cycle.

n_i = Number captured

m_i = Number of marked individuals among the captured termites.

Results and Discussion

Colony I

The foraging population of this colony was estimated as 15, 045.66 ± 29.34 from August to November 2006. Since August 2006 at Sukkampatti territory covered was 59.23m², with seven active monitoring stations. During the baiting period 21 bait matrices were used and 345.55 g of matrix was consumed (Table 1).

Since November 2006, both number of termite workers and bait matrix with chlorpyriphos consumption declined rapidly (Table 2) almost in all the colonies. Initially the worker population was 2202.50 ± 0.55 and at the end of the baiting period, the population was 419.50 ± 0.61 in Colony I. Similarly the bait matrix consumption decreased from 97.65g to 60.33g. At the beginning of the baiting period the per cent reduction in worker population was only 3.51. At the end of baiting period, the per cent reduction in worker population was 55.46. The per cent reduction in bait matrix consumption increased from 80.47 to 87.93 per cent. Thus, it was concluded that the foraging activity of Colony I of 15, 045.66 termites was suppressed by the consumption of 7.5 ppm of chlorpyriphos.

(Table 1) termite activity was limited to an area of 65.23 m², delineated by six monitoring stations, all of which eventually captured marked termites. The bait matrix consumed during the baiting period was 387.13 g.

Colony II

The foraging population of this colony was estimated as 14,887.94 ± 29.03 in August 2006. The colony activity was limited to an area of 60.67m² delineated by six monitoring stations, all of which finally captured marked termites (Table 1). During the baiting period, the bait matrix consumed was 372.00g.

Colony III

The foraging population of Colony III was estimated to be 14,850.00 ± 29.03 (Table 1). Foraging activity of *C. heimi* Colony III had been found since August 2006 where coconut trees had been harmed severely by this termite species. The foraging area covered by the termites was 60.33m². During the baiting period from August – December 2006, 21 bait matrix were used and 379.80g of matrix was consumed.

Colony IV

The foraging population Colony IV was estimated as 14,659.90 + 26.09 in August 2006. The foraging

Table 1. Foraging population of *Coptotermes heimi* (Wasmann) before the introduction of chlorpyriphos bait and summary of baiting programme in coconut gardens, Sukkampatti, Madurai District, August - November 2006

Colony No.	No. of active monitoring Stations	Estimated foraging population	Foraging territory (m²)	No. of bait matrix used	Bait matrix consumed (g)	Baiting period (months)
I	6	15,045.66±29.34	65.23	21	387.13	4
II	6	14,887.94± 29.03	60.67	21	372.00	4
III	6	14,850.00±29.03	60.33	21	379.80	4
IV	7	14,659.90± 26.09	59.23	21	345.55	4

The effect of bait matrix containing chlorpyriphos for Colony II of *C. heimi* showed that initially, the mean worker population was 2174.00 ± 0.52. This population was reduced to 511.00 ± 0.52 at the end of baiting period.

The per cent decrease in worker population after the baiting period was 40.99. The bait matrix consumption gradually decreased from 91.33g to 57.45g. The per cent decrease was from 81.73 to 88.51 at the end of baiting period.

In Colony III the initial mean worker population estimated was 2215.00 ± 0.52. This population was reduced to 319.50 ± 0.52 because of bait matrix consumption containing chlorpyriphos at 7.5 ppm. At the beginning the bait matrix consumption was 89.65g and it decreased to 55.23g. Per cent decrease in worker population was from 6.99 to 64.59. The per cent decrease in consumption rate was from 82.07 to 88.95 during the baiting period.

Table 2. Mean population of *Coptotermes heimi* (Wasmann) and bait matrix consumption during baiting period

Period	Colony I				Colony II				Colony III				Colony IV			
	Mean no.of workers	Chlorpyriphos bait matrix consumed (g)	< in population (%)	< in consumption rate (%)	Mean no.of workers	Chlorpyriphos bait matrix consumed (g)	< in population (%)	< in consumption rate (%)	Mean no.of workers	Chlorpyriphos bait matrix consumed (g)	< in population (%)	< in consumption rate (%)	Mean no.of workers	Chlorpyriphos bait matrix consumed (g)	< in population (%)	< in consumption rate (%)
Iweek	2202.5	97.65 ±0.55	0.00	80.47	2174.00	91.33 ±0.52	0.00	81.73	2215.00	89.65 ±0.52	0.00	82.07	2564.50	88.75 ±0.54	0.00	82.25
IIweek	2125.00	94.35 ±0.52	3.51	81.13	2124.00	89.55 ±0.512	2.29	82.09	2060.00	87.33 ±0.52	6.99	82.53	2322.00	85.33 ±0.54	9.45	82.93
IIIweek	1775.0	82.25 ±0.49	16.47	83.55	1806.50	85.43 ±0.49	14.94	82.91	1752.50	80.25 ±0.42	14.92	83.95	1274.70	80.25 ±0.54	45.10	83.95
IV week	1700.0	76.25 ±0.40	4.22	84.75	1698.50	80.25 ±0.42	5.97	83.95	1285.00	73.23 ±0.52	26.68	85.35	1525.00	74.33 ±0.54	19.59	85.13
Vweek	1388.0	73.50 ±0.25	18.35	85.30	1375.00	75.65 ±0.47	19.04	84.87	712.50	65.45 ±0.42	44.55	86.91	906.00	67.25 ±0.45	42.82	86.55
VI week	942.00	69.25 ±0.49	32.13	86.15	866.00	62.32 ±0.47	37.00	87.54	637.50	58.63 ±0.41	52.63	88.27	723.00	59.75 ±0.63	44.88	88.05
VIIweek	419.50	60.33 ±0.61	55.46	87.93	511.00	57.45 ±0.52	40.99	88.51	319.50	55.23 ±0.52	64.59	88.95	406.50	55.13 ±0.45	67.02	88.97

In Colony IV the mean worker population decreased from 2564.50 ± 0.54 to 406.50 ± 0.45. Similarly the bait matrix consumption also decreased from 88.75g to 55.13g. The per cent reduction in workers population was estimated as 67.02 at the end of baiting period. The per cent decrease in consumption rate was from 82.25 to 88.97.

Present study showed that the population of termite colony was reduced by using bait containing chlorpyriphos 7.5 ppm. During two months of baiting period (November – December, 2006) except in colony II, the population in other colonies decreased significantly. Foraging populations of three colonies of *Odontotermes formosanus* significantly reduced (65-98%) in one year after bait application of A-9248 (diiodomethyl para-tolyl sulfone) (Nan-Yao Su *et al*., 1991). The effects of present study were similar to those of hexaflumuron baits on field colonies of *O. formosanus* (Nan-Yao Su, 1993 and Stansly *et al*., 2001), sulfuramid-treated blocks on field colonies of *O. formosanus* (Nan-Ya Su *et al*., 1995) and fipronil bait on field colonies of *O. formosanus* (Qiu – Ying Huang *et al*., 2006).

Katsuda *et al.* (2004) reported that after one and a half years, the bait formulations containing molybdenum and tungsten compounds eventually eradicated termite colonies of *Macrotermes* and *Odontotermes*.

The lack of termite activity in foraging site may not necessarily be due to the decline of termite activity because termites might have been repelled by a treatment or simply shifted their foraging activities to different sites. Therefore, foraging populations should be estimated before and after the bait application to adequately verify the effects on termite species. In the present study, foraging populations of *C. heimi* were reduced from 40.99 to 67.02 per cent. A toxicant bait, therefore, might provide a long-term control by suppressing subterranean termite foraging populations and hence reduce their damage potentials. However, in order to maximize the efficiency of bait different formulations and delivery systems of a slow-acting toxicant should be developed for application in the field, besides large scale field tests.

References

Katsuda, Y., Nakayama, K. and Vongkaluang, C. 2004. Field tests of molybdenum and tungsten baits for termite control. *In: Thirty fifth annual meeting, The International group on wood preservation, Wood protecting chemicals,* 6-10th June, 2004, Ljubljana, Slovenia. p. 1-5.

Mishra, H.P. 1999. Efficacy of chlorpyriphos against termites in groundnut. *Indian J. Entomol.,* **61**: 326-329.

Nan-Yao-Su., Ban, P.M. and Scheferahn, R.H. 1991. Suppression of foraging populations of the formosan subterranean termite (Isoptera: Rhinotermitidae) by field applications of a slow acting toxicant bait. *J. Econ. Entomol.,* **84**: 1525-1531.

Nan-Yao-Su., Ban, P.M. and Scheffrahn, R.H. 1993. Foraging populations and territories of the eastern subterranean termite (Isoptera:Rhinotermitidae) in south eastern Florida. *Environ. Entomol.,* **22**: 1113-1117.

Nan-Yao Su., Thoms, E.M., Ban, P.M. and Scheffrahn, R.H. 1995. Monitoring / baiting station to detect and eliminate foraging populations of subterranean termites (Isoptera: Rhinotermitidae) near structures. *J. Econ. Entomol.,* **88**: 932-936.

Qiu – Ying Huang., Chao-Liang Lei. and Dong Xue. 2006. Field evaluation of a fipronil bait against subterranean termite *Odontotermes formosanus* (Isoptera: Ter mitidae). *J. Econ. Entomol.,* **99**: 455-461.

Rathore, N.S. and Bhattacharya, A.K. 2004. Termite (Insecta:Isoptera) Fauna of Gujarat and Rajasthan-Present state of Knowledge. *Records of the Zoological Survey of India*, **223**: 73.

Stansly, P.A., Nan-Yao Su. and Conner, J.M. 2001. Management of subterranean termites, *Reticulitermes* spp. (Isoptera: Rhinotermitidae) in a citrus orchard with hexaflumuron bait. *Crop Prot.,* **20**: 199-206.

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