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EFFICACY OF BOTANICAL EXTRACTS AGAINST THE HOUSEHOLD PEST, CARPENTER ANT, *Camponotus compressus* (FABRICIUS)

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ABSTRACT

Methanolic leaf extracts (4,6,8,10 and 12%) of *Pongamia glabra* (Karanj). *Tridax procumbens* (Kambarmodi), *Azadirachta indica* (Neem), *Vitex negundo* (Nirgud) and *Ipomoea camea* (Beshram) were evaluated for bioefficacy in comparison to synthetic insecticide Lindane against the commonly occurring house hold pest, carpenter ant, *Camponotus compressus* in field experiment during the rainy season, 2006-2007. None of the leaf extracts was significantly superior to Linadane, although they performed significantly superior over the untreated control. Among the leaf extracts, less infestation and higher mortality were recorded in spraying treatment on the baits with *Ipomoea camea* followed by *Vitex negundo*. Extract of *Ipomoea camea* was relatively better than rest of leaf extracts which can further be arranged in diminshing order of their relative toxicity as *Azadirachta indica, Tridax procumbens, Pongamia glabra*.

(Key words: *Camponotus compressus*, botanical extracts, efficacy)

INTRODUCTION

The Carpenter ant, *Camponotus compressus* Fabricius (Hymenoptera : Formicidae) is a delicate insect characterized with shining black abdomen and commonly known as the carpenter ant, because of its habit of excavating a nest in the wood, timber and house-hold furniture (Krombein *et al.*, 1979). The wide variety of house hold foods, stored grains, sweet food, fungi and honey-dew material are generally consumed by the carpenter ant (Smith *et al.*, 1996).

The carpenter ant is a social insect forming a large colony consisting of reporductive and sterile castes. The fertile queen and male are concealed together in the royal chamber while numerous sterile workers and soldiers attack, mainly sugar, molasses, sweet, all kind of human food, stored grains and wood furniture of old buildings. The carpenter ant damages wood by hollowing it for nesting, some times the nest is also located outside the buildings and can be recognized from the fine outlets or holes in the soil (Pruthi, 1969). The carpenter ants are also the pest of some economically important crops and wood (Krombein *et al.* 1979). These ants are also responsible for economic losses beyond the furniture damages. The carpenter ants are konwn to mine any kind of hard wood (Knight and Heikenann, 1980). In addition to damaging timber, carpenter ants significantly damage utility poles, shade trees and lawns (Akre and Hansen, 1990). They form a clear ground level trail to their more persistent foraging site and become nuisance pest, when forager ants invade houses in search for food and nesting sites (Hansen and Akre, 1993 and Narendra and Sunilkumar, 2006). Because of polymorphism and social behavior as well as well-established pheromonal communication, it is very difficult to control this cosmopolitan, polyphagous household pest. In order to control and eracdicate the pest, complete control of the population of workers is not enough, but killing of the queen is also equally essential.

The chemical control is failure in controlling the carpenter ant *Camponotus compressus* because of concealed habit of the reproductive caste (Gunathilagaraj and Sundarababu, 1987).

To control the household pests, the use of chemical pesticides is hazardous and unsafe from environmental pollution point of view. Therefore, it is envisaged to use the appropriate plants extracts against carpenter ant, *Camponotus compressus* because these are supposed to be safer, cheaper and having good effect on controlling the pests and protecting the natural enemies.

MATERIALS AND METHODS

The extensive survey of highly infested areas as the nesting sites, under the tree, lawn,

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garden, hotels, household regions, temple and marts was carried out during 2006-2007. The adult polymorphic forms were collected at the depth of 18-25 cm (1-1½ ft) underground of the nesting sites with the help of net and sweet baits.

During the present investigations in the laboratory, toxicological studies were carried out with five leaf extracts to find out their relative efficacy against the adult workers of carpenter ant, *Camponotus compressus*. Their toxicity was compared among themselves and with that of aqueous suspension of Lindane (0.06, 0.08, 0.10, 0.12 and 0.14 %) as a chemical insecticide. The experiments were carried out at the Toxicology Laboratory of Entomology Section, Agriculture College, Nagpur. The fresh leaves of the respective plants, viz., *Pongamia glabra* (Karanj). *Tridax procumbens* (Kambarmodi), *Azadirachta indica* (Neem), *Vitex negundo* (Nirgudi) and *Ipomoea carnea* (Beshram/ Sadabahar) were chopped into small pieces with a knife and dried in shade. 5 g of dired powder of plant leaves was used to prepare the methanol leaf extract with the help of Soxhlet's apparatus. The methanol extracted ingredient powder was diluted in distilled water to prepare a stock extract of 20 per cent (W/V) for each botanical extract (Mathew, 1997; Govindachari *et al.*, 1999; Nemade, 2000 and Gutlapalli, 2001). The increasing concentrations i.e. 4%, 6%, 8%, 10% and 12% of methanol leaf extracts were used to spray on the food material in petriplates during the treatment including water sprays as control using Potter's tower (Potter, 1952). The experiment was carried out by each set of 30 insects with three replications and the post treatment observations were recorded at the interval of 24, 48 and 72 h after treatment. During the initial treatment after 24 h there was no significant mortality was recorded, so the data collected during 48 and 72 h were considered for testing the efficacy of these botanical extracts. Per cent mortality was calculated by using the following formula (Abbott, 1925):

$$P = \text{Corrected mortality} = \frac{\%\,\text{mortality in treatment} - \%\,\text{mortality in control}}{100 - \%\,\text{Mortality in control}} \times 100$$

All the data were subjected to statistical analysis as per Finney (1971) to calculate the LC_{50} value.

RESULTS AND DISCUSSION

During the present investigation, the methanol extracts of the plants - *Pongamia glabra* (Karanj), *Tridax procumbens* (Kambarmodi), *Aszadirachta indica* (Neem), *Vitex negundo* (Nirgudi) and *Ipomoea carnea* (Beshram/ Sadabahar) were screened and their relative toxicity was compared on the basis of LC_{50} values at the interval of 48 and 72 h (Table 1 and 2) in comparison with the most familiar synthetic insecticide, Lindane. The statistical analysis of data revealed that Lindane (0.14%) was the most effective in minimizing the infestation of carpenter ant but the methanol leaf extract of *Ipomoea carnea* (12%) was also found to be effective and significantly superior over all treatments of other botanical extracts followed by *Vitex negundo*, *Azadirachta indica*, *Tridax procumbeens*, and *Pongamia glabra* against the carpenter ant, *Camponotus compressus*.

During the present study, the LC_{50} values were calculated as the significantly toxicity. The order of relative toxicity on the basis of LC_{50} values for methanol leaf extracts against the adult, *Camponutus compressus*, after 48 h was found to be Lindane (1.,00) > *Ipomoea carnea* (0.02) > *Vitex negundo* (0.017) > *Azadirachta indica* (0.0136) > *Tridax procumbans* (0.0123) > *Pongamia glabra* (0.0099) (Table 1).

The relative toxicity 72 h after treatment was found to be Lindane (1.00)> *Ipomoea carnea* (0.0305) > *Vitex negundo* (0.0261) > *Azadirachta indica* (0.0204) > *Tridax procumbans* (0.0158) > *Pongamia glabra* (0.0110) (Table 2).

Earlier workers (Mathew, 1997; Nemade, 2000; Gutlapalli, 2001) screened various indigenous leaf extracts of the plants, *Pongamia glabra*, *Tridax procumbans*, *Azadirachta indica*, *Vitex negundo*, *Ipomoea carnea*, *Cleisthanthus collinus* and *Acorus calamus* and tested against some insect pests which were found significantly effective. The chemical nature and mode of action of different indigenous plants showed promising results as juvenile hormone analogues, pheromones, insecticides, synergists and reproduction inhibitors (Chiu, 1985; Ahmed *et al.*, 1984; Gunathilagaraj and Sundara Babu, 1987).

Alley (1973) recommended continuous use of an insecticide, Mirex for the control of ants which was subsequently reported to be causing tumour induction and toxic to nontarget fauna (Hill *et al.*, 1994; Klotz *et al.*, 2000). The consistent use of insecticides for the control of ants was found to induce insecticidal resistance and adverse effects on non-targeted species besides seveeral other ill effects (Reid and Klotz, 1992; Klotz *et al.*, 2000; Tripp *et al.*, 2000).

Table 1. Determination of LC_{50} of methanol plant extracts against adult *Camponotus compressus* after 48 h.

Sr. No.	Plant extract	Heterogeneity X^2 (3)	Regression equation $Y = \bar{y} + b(X-\bar{x})$	LC_{50}	Fiducial limits	Relative toxicity
1	*P. glabra*	0.212	$Y= 2.97 + 1.94x$	11.08	7.62 - 16.14	0.0099
2	*T. procubens*	0.426	$Y = 3.37 + 1.72x$	8.91	6.47 - 12.27	0.0123
3	*A. indica*	0.183	$Y = 3.39 + 1.77x$	8.096	6.04 - 10.84	0.0136
4	*V. negundo*	0.045	$Y = 3.64 + 1.71x$	6.22	4.50 - 8.11	0.0170
5	*I. carnea*	0.015	$Y = 3.74 + 1.70x$	5.50	3.76 - 8.04	0.0200
6	Lindane	0.070	$Y = 3.22 + 1.74x$	0.11	0.078 - 0.143	1.000

Table 2. Determination of LC_{50} of methanol plant extracts against adult *Camponotus compressus* after 72 h.

Sr. No.	Plant extract	Heterogeneity X^2 (3)	Regression equation $Y = \bar{y} + b(X-\bar{x})$	LC_{50}	Fiducial limits	Relative toxicity
1	*P. glabra*	0.409	$Y= 3.69 + 1.48x$	7.71	5.51 - 10.94	0.0110
2	*T. procubens*	0.157	$Y = 4.21 + 1.08x$	5.38	2.93 - 9.84	0.0158
3	*A. indica*	0.070	$Y = 4.28 + 1.66x$	4.17	1.92 - 9.06	0.0204
4	*V. negundo*	0.136	$Y = 4.25 + 1.47x$	3.26	1.45 - 7.31	0.0261
5	*I. carnea*	0.34	$Y = 4.30 + 1.56x$	2.79	1.15 - 6.79	0.0305
6	Lindane	0.130	$Y = 2.45 + 2.70x$	0.085	0.068 - 0.103	1.000

Earlier workers reported the significant effect of alcoholic extracts of *Ipomoea carnea* against wooly aphid, *Dactynotus carthamii* and cotton aphid, *Aphis gosypii* (Patil *et al*., 2003), the gram pod borer, *Heliothis armigera* (Raut, 1990) and swarming caterpilar, *Spodoptera litura* and other insect pests (Mathew, 1997; Nemade, 2000). The relative toxicity of *Ipomoea carnea* and *Vitex negundo* was found to be higher as compared to other leaf extracts after 48 and 72 h against armyworm, *S. littura* (Nemade, 2000; Gutlapalli, 2001).

From the results, obtained during the present study, it becomes quite apparent and first time investigated that the methanol extracts of the plant, *Ipomoea carnea* (Beshram/ Sadabahar) showed the highest relative toxicity (0.0305) and can be considered as the most competent bioinsecticide against the carpenter ant, *Camponutus compressus* followed by that of *Vitex negundo, Azadirachta indica, Tridax procumbans* and *Pongamia glabra* respectively.

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