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Efficacy of Curative Treatments Using Insecticides Against Cashew Stem and Root Borer, *Plocaederus ferrugenius* L. (Coleoptera: Cerambycidae)

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Abstract: *The Cashew (Anacardium occidentale L.) is an important commercial plantation crop with tremendous potential for foreign currencies. The Cashew Stem and Root Borer (CSRB), Plocaederus ferrugineus L. is one of the serious pests of cashew. The tiny grub of CSRB bores into the fresh tissue and feeds on the food channels of phloem and xylem tissues of the trunk and root by making irregular tunnels, resulting in exudation of gum (gummosis) and extrusion of fibrous frass from damaged portion, subsequently lead to death of trees, thereby reducing the tree population. For the management of CSRB, a field experiment was conducted at Regional Research Station, Vridhachalam to find out the efficacy of different curative treatments using insecticides against cashew stem and root borer (CSRB). The different treatments includes Profenofos 50 EC (1%), Chlorpyriphos 50 EC (0.2%), Triazophos 40 EC (0.2%), Dichlorvos 76 EC (0.2%), Untreated check (only removal of CSRB grubs followed) and Treated check (Neem Oil 5%, the most effective treatment under prophylactic trials). Maximum recovery of 46.15% was noted in chlorpyriphos 50 EC (0.2%) treated trees, which was on par with Triazophos 40 EC (0.2%) treated trees with 45.83% recovery. Treatments with profenofos 50 EC (1.0%), and neem oil (5.0%) lead to 40.00 and 35.00% recovery, respectively as against mere 5.5% recovery in untreated control. The overall results indicated that the chlorpyriphos and Triazophos were at par in reducing the CSRB infestation, with an average cost of protection of Rs.62/tree and Rs.63/tree respectively.*

Keywords*: Cashew, Borer, Efficacy, Insecticides, Stem, Recovery, Root, Xylem, Phloem.*

INTRODUCTION

Cashew stem and root borer (CSRB) *Plocaederus ferrugineus* L. are the major pests of cashew in all cashew growing tracts of India [2], [10] and [5] and a few other cashew growing countries [4] and pose a serious problem in realizing the maximum yield potential of cashew nut. The grubs form irregular tunnels in the cashew bark of the stem and roots, thereby damage vascular tissues resulting in gradual yellowing of the foliage of yielding trees and subsequently lead to death of trees, thereby reducing the tree population. The presence of grubs can be recognized by the exudation of frass and gum in the infested region, usually in the collar zone in early stages and gum as well as coarse frass, yellowing canopy at the later stage of infestation.

Among the various insect pests infesting cashew, cashew stem and root borers (CSRB) are a major source of concern as they seriously damage the yielding trees by tunneling the vital bark and out rightly kill the tree, if timely pest management is not adopted. This has led to severe depletion of tree density in all cashew growing tracts of the country, thereby diminishing the productivity. The CSRB could be managed by application of BHC 0.1% was discussed by [10]. Chemical control of the pest using BHC 500 g/tree and monocrotophos as stem padding 15, 30 and 45 ml/tree was reported from

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Goa [16]. Prophylactic measures such as stem swabbing of carbaryl (0.25%) in mud slurry [9] while, stem swabbing upto 1 m with BHC or using coal tar and kerosene swabbing four times in a year was also suggested as Management measure of CSRB [14]. Placement of phorate granules as curative treatment for this CSRB pest incidence was very effective[11]. Severely attacked trees die within a period of two years causing capital loss to the growers needing to uproot and replace the infested trees. Existing pest management strategies utilizing cultural, mechanical and chemical control methods have met with limited success mainly due to the cryptic life-cycle of the borer inside the trunk and roots [13], [11], [15], [7] and [3]. For the Management of CSRB, field experiment was conducted at Regional Research Station, Vridhachalam under All India Co-ordinated Research Project on Cashew (AICRP-Cashew) to find out efficacy of different curative treatments using insecticides against cashew stem and root borer (CSRB).

MATERIALS AND METHODS

The Post Extraction Prophylaxis trials in Completely Randomized Design(CRD) were conducted during 2014 to 2015 in different experimental plots of Cashew plantations at Regional Research Station, Vridhachalam. The infested cashew trees were identified based on the external symptoms of infestation *viz*., oozing of the frass and gum from the collar, stem, exposed roots or fork region. The different stages of pest present in such trees were extracted by skillfully chiselling the infested portion of the tree and tracing out the pest stages in the tree. The frass and chipped materials from such trees were collected and disposed off. Later, the chiseled portion (main stem upto 1 m and on the exposed roots and fork of branches) was swabbed with the insecticidal solution to be evaluated. The same solution was drenched to the root zone, in case of root infestation. The different insecticide treatments evaluated were as follows:

T_1 : Profenofos 50 EC (1%)

T_2 : Chlorpyriphos 50 EC (0.2%)

T_3 : Triazophos 40 EC (0.2%)

T_4 : Dichlorvos 76 EC (0.2%)

T_5 : Untreated check (only removal of CSRB grubs followed)

T_6 : Treated check (Neem Oil 5%: the most effective treatment under prophylactic trials)

The experiments were laid out in completely randomized block design with four replications and for each replication two infested trees were selected. Regular agronomic practices were followed as per the Tamil Nadu Agricultural University (TNAU) Crop Production Guide. The untreated check comprised only removal of CSRB grubs without application of any insecticides. The treatments were applied sequentially to the trees from which the pest stages of CSRB were extracted. All the Infested CSRB trees were treated with insecticides and due to negligible recovery in the trees having more than 50% damage of bark circumference and were removed by uprooting as a phytosanitary measure. The trees having less than 50% damage of bark circumference were treated with curative insecticides.

The trees showing symptoms of residual attack were given the earlier treatment after one month of initial treatment. Observations for fresh pest incidence were done at monthly intervals. The number of trees (both healthy and treated) which showed fresh infestation symptoms during different months and the mean number of freshly infested trees were worked out for each month.The frequency of treatment was carried out thrice for all the treatments. The fresh pest incidence was made out by the presence of fresh frass exudation, which was much lighter in colour than the frass from older infestation. The effectiveness of treatments was assessed based on the extent of recovery of infested trees out of the total number of trees treated per treatment over the experimental period of study. Mean and coefficient of variations were worked out and the data were analysed statistically [6]. The recovery per cent for each treatment was worked out using the following formula:

$$\text{Recovery Per cent} = \frac{\text{Number of trees recovered}}{\text{Total number of trees treated}} \times 100$$

RESULTS

Maximum recovery of 46.15% was noted in chlorpyriphos 50 EC (0.2%) treated trees, which was on par with Triazophos 40EC (0.2%) treated trees with 45.83% recovery. Treatments with profenofos 50 EC (1.0%), and neem oil (5.0%) lead to 40.00, and 35.00% recovery respectively as against mere 5.5% recovery in untreated control. The overall results indicate that chlorpyriphos and Triazophos are at par in reducing the CSRB infestation, with an average cost of protection of Rs.62/- and Rs.63/- respectively (Table 1).

Table 1
Efficacy of certain insecticides as curative control against CSRB at Vridhachalam

Treatment		*No. of trees treated*	*No. of trees without reinfestation*	*Mean % recovery of trees from CSRB*	*Frequency of treatment (month)*	*Cost of treatment Rs. / tree*
T_1	Profenofos 50 EC (0.1%)	25	10	40.00 [b]	3	66.0
T_2	Chlorpyriphos 50 EC (0.2%)	26	12	46.15[a]	3	62.0
T_3	Triazophos 40 EC (0.2%)	24	11	45.83 [a]	3	63.0
T_4	Dichlorvos76 EC (0.2%)	20	05	25.00[d]	3	57.0
T_5	Untreated check (removal of grubs)	18	01	05.85[e]	3	30.0
T_6	Treated check (Neem oil 5%)	20	07	35.00[c]	3	61.0
	Total	**133**	**46**	-	-	-

DISCUSSION

Since CSRB were primarily bark feeders. The major destructive stage was the grub stage. The grub and pupa were found within the tunnels and need to be excavated and removed with minimum injury to the infested bark. Under this curative experimental trial on investigating the comparative efficacy of the promising pesticides, the substantial reduction in the pest population in chlorpyriphos 50 EC (0.2%) treated trees was recorded with maximum recovery of 46.15%, followed by Triazophos 40 EC (0.2%) treated trees with 45.83% recovery and profenofos 50 EC (1.0%) with 40.00 % recovery and also a reduction in fresh infestation of cashew trees due to phytosanitation activity. Adopting only removal of CSRB grubs also led to reduced reinfestation, which was significantly the lowest compared to all other treatments. This result findings were confirmed with results of [12] in which Chlorpyriphos (0.2%) showed the best efficacy as Post extraction Prophylaxis treatment having 86.62% of treated trees without reinfestation and also the other result findings revealed that 88.13% of treated trees being free from reinfestation of CSRB with Chlorpyriphos (0.2 %) treatment [9]. Maximum damage with more than 50% bark circumference resulted in nil recovery of treated trees. This implies that early detection of borer infestation and simultaneous prophylaxis treatment on a community basis is very important to mitigate persistent attack of cashew stem and root borer.

CONCLUSION

From the curative treatments of insecticides, it can be concluded that chlorpyriphos (0.2%) could be recommended for Post extraction prophylaxis treatment of CSRB infested trees. This study also proves the need to adopt phytosanitation measures by removal of CSRB infested cashew trees which are beyond recovery, to considerably reduce the pest population in a given area and also minimize the pest load in infested trees. Maintenance of optimal tree density can be achieved through adoption of Post Extraction Prophylaxis followed by application of insecticides, by effectively managing the pest.

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