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Efficacy of Insecticides for the Management of Cashew Stem and Root Borer, *Plocaederus ferrugineus* L (Coleoptera: Cerambycidae) in Bapatla Andhra Pradesh

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ABSTRACT

Background: Cashew is one of the important foreign exchange earning plantation crops of the country. The production and productivity of crop is impeded by several insect pests. Among them, cashew stem and root borer (CSRB) (*Plocaederus ferrugineus* L) a noxious pest of cashew leads to death of the trees, thereby reducing the optimum tree population per unit area in the cashew orchards.

Methods: The study on curative control measures of cashew stem and root borer (CSRB) *i.e.* Post Extraction Prophylaxis (PEP) trial was conducted from 2015-16 to 2020-21 at Cashew Research Station, Bapatla, AICRP on Cashew, Dr. YSR Horticultural University Andhra Pradesh. The experiment was laid out in completely randomized block design with four replications and for each replication five infested trees were selected.

Result: The data on efficacy of insecticides against CSRB (Post Extraction Prophylaxis) indicated that Imidacloprid 17.8 SL @ 2.0 ml/litre was found superior over other treatments, with 78.1 per cent trees free from re-infestation after post extraction prophylaxis (PEP), followed by fipronil 5%SC @ 2 ml/ liter and chlorpyrifos 20 EC @10 ml/ liter were recorded 68.5 and 65.6 per cent, respectively. The preferential zone of attack of cashew stem and root borer on cashew trees was stem + collar + root zone, followed by collar zone and collar + root zone.

Key words: Cashew, *Plocaederus ferrugineus*, Post extraction prophylaxis, Root borer, Stem.

INTRODUCTION

Cashew (*Anacardium occidentale* L.) an important foreign exchange earning horticultural crops in India, with an annual production of 7.73 lakh tonnes of raw nuts (Anon., 2021-22, Erasadappa and Mohana, 2016 and Jena *et al.* 2024). India is the largest exporter of cashew kernel (48574 MT) with a value of 2840.39 crores (Anon., 2020-21,). The productivity of the crop is threatened by several insect pests. Globally, more than 400 species of arthropods are known to infest cashew and in India there are 200 insect pests reported on cashew (Anon., 2015). Depending on the climate, location, tree age, geographic region distinctive pest complex are noticed and in all growing regions, majorly, stem and root borer (*Plocaederus ferrugineus* L.) is the deadliest insect in all the cashew growing areas of the country as well as the world (Ayyanna and Ramadevi, 1986). The intensity of infestation and extent of damage may vary widely across the regions. On an average this borer kills about 2-5 per cent productive trees every year (Rai, 1984 and Reddy *et al.* 2013a). The CSRB infestation went up to 40 per cent in different periods at Guntur (Arjunarao, 1978) and Prakasm (Ayyanna and Ramadevi, 1986) districts of Andhra Pradesh. The pest is very severe in nature having potential of causing even up to total yield loss, if proper management measures are not taken up timely. Severely infested trees die within a period of two years causing capital loss to the growers.

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For the management of cashew stem and root borer, periodical monitoring of the crop is very essential to prevent the infestation by cashew stem and root borer. Trees with symptoms of yellowing, dried and dead trees should be removed immediately along with roots by digging pit of two feet around the base of the trunk and disposed off (Phytosanitation). Tree base must be kept clean and weed free so as to observe the frass and gum exudation as early symptom of borer attack. Currently, management of CSRB infestation is through adoption of post extraction prophylaxis (PEP), wherein the different pest stages like grubs, pupa

and adults are extracted by chiseling carefully from infested cashew trees. Further treated by swabbing and drenching the infested trees with chlorpyriphos 20EC @ 0.2% to prevent further oviposition, but still effective management is very challenging due to cryptic nature of the pest. In view of the existing practices, efficacy of newer insecticides as curative control measures against Cashew Stem and Root Borer, *Plocaederus ferrugineus* L. is needed for effective control, hence the present study has been taken up at AICRP on Cashew, Cashew Research Station, Bapatla, Dr. YSR Horticultural University Andhra Pradesh.

MATERIALS AND METHODS

The studies on efficacy of newer insecticides against Cashew Stem and Root Borer (CSRB) as curative control measures *i.e.* Post Extraction Prophylaxis (PEP) was conducted from 2015-16 to 2020-21 at AICRP on Cashew, Cashew Research Station, Bapatla, Dr. YSR Horticultural University Andhra Pradesh. The experiments were laid out in completely randomized block design with four replications and for each replication five infested trees were selected randomly. The infested cashew trees were identified based on the external symptoms *viz*., oozing of the frass and gum from the bored hole at collar, stem and exposed roots or fork region. The pest stages (grubs, pupae and adults) present in selected infested trees were traced and extracted skillfully by chiseling the infested portion of the tree. The frass and chipped materials from such trees were collected and disposed off. Later, the chiseled portion on main stem up to 1 m height from the ground surface and on the exposed roots and fork of branches was swabbed with the insecticidal solution to be evaluated. The same solution (5.0 liter insecticidal solution) was drenched to the root zone, in case of root infestation.

The insecticides evaluated were Fipronil 5%SC @ 2 ml/l, Neem oil @ 5%, Imidacloprid 17.8 SL @ 2ml/l, Chlorpyriphos 20% EC @ 10 ml/l and the untreated check (only removal of CSRB grubs) without application of insecticide. The treatments were applied sequentially as swabbing and drenching after manual removal of CSRB grubs on infested trees as and when infested trees were available. The treatments were applied three times during October - November, January - February, April - May (Reddy *et al.* 2013b and Anon. 2016).

The observations on the fresh infestation of CSRB infestation was checked based on the external symptoms of the damage at monthly intervals both on the treated and uninfested trees. The data on number of trees without re-infestation was recorded and later per cent of trees without re infestation was worked out. The physical parameters of the infested trees such as stem girth (stem diameter), age of the tree, per cent of bark circumference damage, zone of attack and canopy yellowing was also recorded simultaneously to infer the parameter favours CSRB infestation. (Raviprasad, 2005).

RESULTS AND DISCUSSION

The experiments on evaluation of efficacy of newer insecticides against Cashew Stem and Root Borer (CSRB) as curative control measures was initiated during 2015-16 and continued up to 2021. The results indicated that all the treatments were superior over the untreated check in reducing the cashew stem and root borer re-infestation throughout the experimental period. However, the treatments applied as Post Extraction Prophylaxis (PEP) revealed that Imidacloprid 17.8 SL @ 2ml/l was found more effective in reducing the re-infestation of CSRB throughout the experimental period with pooled average of 21.90 per cent of trees with re-infestation. Whereas fipronil 5% SC @ 2 ml/l has recorded next best treatment with 31.5 per cent trees with re infestation, followed by Chlorpyrifos 20% EC @ 10 ml/l *i.e.* treated check with 34.4 per cent of trees with re-infestation and which was on par with Fipronil 5% SC @ 2 ml/l treatment. These findings were in line with the findings of Zote at al. 2018, they reported that fipronil was found effective and reduced the re-infestation of CSRB and reported that 93.33 per cent of trees without re-infestation. Further they reported that imidacloprid swabbing and drenching was found 76.66 per cent of trees without re-infestation. According to the Ravi Prasad and Co-workers

Table 1: Insecticides effect as post extraction prophylaxis (PEP) against cashew stem and root borer.

T. no.	Treatment details	Per cent of trees with re-infestation						
		2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	Cumulative 2015-21
T_1	Fipronil swabbing [2 ml/l]	19.0^{b}	30.0^{bc}	26.1^{bc}	35.0^{b}	40.0^{ab}	35.0^{c}	31.5^{cd}
T_2	Neem oil swabbing [5%]	33.3^{b}	38.1^{b}	39.1^{b}	55.0^{ab}	55.0^{a}	60.0^{ab}	47.7^{b}
T_3	Imidacloprid [2 ml/l] (Swabbing and drenching)	19.0^{b}	12.5^{c}	17.4^{c}	30.0^{b}	25.0^{b}	25.0^{c}	21.9^{d}
T_4	Chlorpyriphos [10 ml/l] (Treated check)	21.7^{b}	16.2^{c}	30.4^{bc}	45.0^{ab}	45.0^{ab}	45.0^{bc}	34.4^{c}
T_5	Un treated check (only removal of CSRB grubs)	66.7^{a}	62.5^{a}	60.9^{a}	70.0^{a}	65.0^{a}	70.0^{a}	66.9^{a}
	SEm	6.4	7.1	8.0	9.0	8.6	6.95	3.9
	CD @ 5%	19.2	21.5	24.0	27.2	25.8	21.2	12.0

(2009) reported that Chlorpyrifos 20% EC (0.2%) was found to be the best PEP treatment with 96.43 per cent trees without re-infestation followed by Monocrotophos (0.20%) with 78.57 per cent trees without re-infestation and both the treatments were on par each other. Further, Mohapatra *et al.* (2004) and Gupta (2020) reported that, 88.13 and 69.75 per cent of trees being free from re-infestation of CSRB with chlorpyrifos (0.20%) respectively. Neem oil @ 5% applied as swabbing and drenching recorded 47.7 per cent of trees with re-infestation and superior over the untreated check (only removal of cashew stem and root borer grubs without any application of insecticides) (Table 1). These findings were in agreement with the findings of Jaya Prabhavathi *et al* (2016), they reported that 35.0 per cent of trees free from re-infestation with neem oil 5% applied as PEP.

Another separate experiment was conducted to study the physical parameters of the infested cashew trees to know the parameter favours CSRB infestation. Several physical parameters like stem girth (Diameter of the stem), age of the tree, zone of attack, yellowing of the tree canopy and per cent of bark circumference damaged by CSRB on infested trees were recorded on 654 infested trees during 2015-16 to 2020-21 (Table 2).

With respect to the diameter of the stem (stem girth), cashew trees were categorized into <60 cm, 60-80 cm, 80-100 cm and >100 cm. Out of the total infested trees observed (654 trees), 8.1, 22.9, 39.5 and 29.5 per cent trees having <60 cm, 60-80 cm, 80-100 and >100 cm of the stem diameter respectively. After the post extraction prophylaxis (PEP) the recovery percentage of trees were not re infested was highest (90.6 per cent) in <60 cm of stem girth trees *i.e.* 48 trees were not re infested out of 53 trees followed by 60-80 cm stem diameter trees (111 trees were not re infested out of 150 trees). 58.9 and 49.2 per cent of trees were not re-infected after PEP with 80-100 cm and >100 cm diameter of the stem respectively. This indicated that as the diameter of the stem (stem girth) increases the infestation and re-infestation by the CSRB also increases.

With respect to the age of the tree, the treated cashew trees age were categorized as <10 years, 10-15 years and >15 years age. Totally 654 infested trees were examined for recording observations. Among them, 44 trees were falls under the category <10 year age, of which 6 trees were infested with CSRB and remaining 38 trees were free from infestation, which constitutes 13.6 per cent (Table 2). Similarly, 204 trees out of 654 trees falls under the category of 10-15 years age, of which 71 trees were infested and remaining 133 trees were free from CSRB infestation, which comprises of 34.8 per cent. Further, 406 trees out of

Table 2: Physical parameters of treated cashew trees under post extraction prophylaxis (PEP) from 2015-16 to 2020-21 (Pooled mean across years).

Physical parameters		Total trees treated	No. of trees infested after PEP	% out of total trees	No. of trees Not re-infested after PEP	% out of total trees
Stem girth	< 60 cm	53	5	9.4	48	90.6
	60-80 cm	150	39	26.0	111	74.0
	80-100 cm	258	106	41.1	152	58.9
	>100 cm	193	98	50.8	95	49.2
Total		654	248	37.9	406	62.1
Age of the tree	< 10 years	44	6	13.6	38	86.4
	10-15 years	204	71	34.8	133	65.2
	>15 years	406	171	42.1	235	57.9
Total		654	248	37.9	406	62.1
Zone of attack	C + R	199	72	36.2	127	63.8
	C + S	110	42	38.2	68	61.8
	R	29	9	31.0	20	69.0
	S	116	24	20.7	92	79.3
	C	81	27	33.3	54	66.7
	C + S + R	119	74	62.2	45	37.8
Total		654	248	37.9	406	62.1
Yellowing of	Canopy yellowing	105	91	86.7	14	13.3
canopy	Canopy not yellowing	549	157	28.6	392	71.4
Total		654	248	37.9	406	62.1
% of bark	<25	291	28	9.6	263	90.4
circumference	26-50	174	71	40.8	103	59.2
damaged	51-75	108	79	73.1	29	26.9
	>75	81	70	86.4	11	13.6
Total		654	248	37.9	406	62.1

654 trees were falls under >15 years age category, of which 171 trees were infested and remaining 235 were not infested (42.1%). This revealed that, as age of the cashew trees increases the chance of infestation and re-infestation by CSRB also increases.

The observations were also made to know the preferential zone of attack on the cashew trees by Cashew stem and root borer, generally attacks trees at root zone, stem zone or collar zone. Data revealed that, CSRB mostly prefers collar + root zone (199 trees out of 654 trees), followed by stem + collar+ root zone (119 trees out of 654 trees) (Table 2).

Similarly another parameter was yellowing of canopy *i.e.* advanced stage of infestation by CSRB was also recorded. The trees with full yellow canopy were beyond recovery even after post extraction prophylaxis. During the experimental period (2015-16 to 2020-21), total 105 trees were observed out of 654 infested trees with yellowing canopy, among these only 14 trees (13.3 per cent) were not re-infested remaining 86.7 per cent trees were re-infested by cashew stem and root borer (Table2). These results are in line with the results of Jaya Prabhavathi *et al.* (2016), further they stated that early detection of cashew stem and root borer infestation and simultaneous PEP with insecticides on a community basis is effective in managing the attack on CSRB.

Another physical parameter studied during the period was per cent of stem bark circumference damaged by cashew stem and root borer. If the per cent of bark circumference damage is more than 50 per cent, there is more chance of re-infestation by cashew stem and root borer and also less chance for survival of the tree. During the experimental period total 189 trees showed >50 per cent of bark circumference damage out of these trees 149 trees were re-infested again with cashew stem and root borer. If the circumference damage is less, the recovery of the infested trees from CSRB infestation after PEP (Table 2) increases. These findings are similar with the findings of Ravi Prasad *et al.* (2009), they confirmed that substantial reduction in the pest population in a given location and also reduction in fresh infestation of cashew trees due to Phytosanitation activity *i.e.* removal of pest stages from trees infested by CSRB and removal of trees having more than 50 per cent bark circumference damage by uprooting.

CONCLUSION

From the curative treatments, it is concluded that, among the treatments, imidacloprid 17.8 SL @ 2.0 ml per liter) was found superior with 21.9 per cent of trees were re-infested after post extraction prophylaxis, followed by firponil 5% SC @ 2.0 ml per liter and chlorpyrifos 20% EC @ 10 ml per liter recorded 31.5 and 34.4 per cent of trees were re-infested after post extraction prophylaxis respectively. Among the physical parameters studied, the trees with stem girth of less than 60 cm were less infested by CSRB, it might be due to smooth stem surface may not supports oviposition of the beetle and vice versa. With respect to the age of the tree, very less infestation observed on below 10 years age trees and the infestation and re-infestation by CSRB increased over increasing the age of the tree. The preferential zone of attack of CSRB on cashew tree was collar + root zone, followed by stem + collar + root zone. The tree canopy was yellowing due to severe infestation of CSRB can't be recovered from the infestation. If the per cent of bark circumference damage is more than 50 per cent, recovery per cent of such trees were very difficult and vice versa. Hence such tree should be removed along with roots to reduce further spread of the insect.

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Conflict of interest

All authors declared that there is no conflict of interest.

REFERENCES

Arjuna, Rao, P. (1978). Pest complex of cashew (*Anacardium occidentale*) in Guntur and Prakasham districts of Andhra Pradesh. Cashew Bulletin. 15(11): 7-11.

Ayyanna, T. and Ramadevi, M. (1986). A study of distribution and status of stem and root borer (*Plocaederus ferrugineus* L.) a dreadful pest on cashew in the coastal districts of Andhra Pradesh and its control. Cashew Causerie. 8: 6-8.

Anon. (2015). Insect pests of cashew and their management, Technical Bulletin No. 27. Published by ICAR- Directorate of Cashew sResearch Puttur.

Anonymous. (2016). Annual report - All India Coordinated Research Project on Cashew. 180-188.

Anon. (2020-21), https://www.dccd.gov.in/Content. aspx? mid= 1077andtid=1.

Anon. (2021-22). https://agriexchange.apeda.gov.in/India% 20 Production/ India_ Productions. aspx? hscode= 1093.

Eradasappa, E. and Mohana, G.S. (2016). Role of Pollination in improving Production of Cashew- A Review. Agriculture Reviews. 37(1): 61-65. doi: 10.18805/ar.v37i1.9266.

Gupta, A.K. (2020). Curative control of cashew stem and root borer, *Plocaederus ferrugineus* L. Journal of Entomology and Zoology studies. 8(4): 1583-1585.

Jaya, Prabhavathi, S., Keisar, Lourdusamy, D., Vincent, S. and Aneesa, Rani, M.S. (2016). Efficacy of curative treatments using insecticides against cashew stem and root borer, *Plocaederus ferrugenius* L. (Coleoptera: Cerambycidae). International Journal of Tropical Agriculture. 34(1): 13-16.

Jena, C., Panda, P.K., Sethi, K., Nayak, R.K., Panda, R.K., Pramanik, K. and Rout, C.K. (2024). Assessement and correlation studies on influence of foliar nutrient management on yield attributing traits and physic-chemical parameters of cashew (*Anacardim occidentale* L) on Cv. Balabhadra. Agriculture Science Digest. 44(4): 657-662.

Mohapatra, L.N. (2004). Management of cashew stem and root borer, *Plocaederus ferrugineus*. Indian J. Pl. Prot. 32(1): 149-150.

Rai, P.S. (1984). Hand book of Cashew Pests. Research Co Publications. New Delhi.

Raviprasad, T.N., P.S. Bhat and D. Sundararaju. (2009). Integrated pest management approaches to minimize incidence of Cashew Stem and Root borers (*Plocaederus* spp.). J. Plantation Crops. 37(3): 185-189.

Raviprasad, T.N. (2005). Cashew stem and root borer (CSRB) in: Experimental manual for cashew. National Research centre for cashew, puttur, Karnataka, India. pp 78-83.

Reddy, A.N., Sreenatha, A., Honnabyraiah, M.K. and Mallikarjuna Gowda, A.P. (2013a). Studies on correlation between incidence of insect pests on cashew and weather factors in Eastern dry zone of Karnataka. Journal of Asian Horticulture. 4: 152-154.

Reddy, A.N., Sreenatha, A., Honnabyraiah, M.K. and Mallikarjuna Gowda, A.P. (2013b). Efficacy of insecticides as post extraction prophylaxis (PEP) against cashew stem and root borer *Plocaederus ferrugineus* L. (Coleoptera: Cerambycidae). Journal of Asian Horticulture. Jul-Sept. 2013. 9(4): 155-159.

Vasanthi. P and Raviprasad, T.N. (2013). Biology and morphometrics of cashew stem and root borers (CSRB) *Plocaederus ferrugenius* and *Plocaederus obesus* (Coleoptera: Cerambycidae) Reared on Cashew Bark. International Journal of Scientific and Research Publications. 3(1): 1-7.

Zote, V.K., Salvi, S.P. and Haldavnekar, P.C. (2018). Efficacy and evaluation of insecticides for the management of stem and root borer in cashew. International Journal of Chemical Studies. 6(4): 495-496.