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Effect of bitter tree (*Holarrhena antidysenterica*) on the incidence of cashew stem and root borer (*Plocaederus ferrugineus*)*

S CHAKRABORTI[1]

Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal 741 252

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Cashew (*Anacardium occidentale* L.) is a high-value commercial crop and an important contributor to the national exchequer as a foreign money earning crop. Cashew stem and root borer *(Plocaederus ferrugineus* L.) (Cerambycidae: Coleoptera) is a very serious nationally important pest of cashew and on an average, kills 5% of productive trees every year. About 30–35% damaged trees were reported from Kerala and Tamil Nadu (Misra and Basu Choudhury 1985) and as high as 40% infested trees were reported from Andhra Pradesh (Ayyanna and Ramadebi 1986). Infested cashew trees emit volatile chemicals or allelochemicals and for this reason, these trees act as sources of inoculums (Misra and Basu Choudhury 1985) and invite re-infestation and/or fresh infestation. In the present study, an effort was made to asses the effect of the presence of bitter trees in cashew plantations on the incidence and damage of cashew stem and root borer. A laboratory study of no-choice feeding-response was also undertaken to see whether host barks treated with aqueous extracts of different parts of bitter tree can affect the feeding response of cashew stem and root borer adults or not.

Cashew (*Anacardium occidentale* L.) plantations having naturally occurring bitter trees (also known as: *kurchi, conessi bark, kutaja, tellicherry* etc.) (*Holarrhena antidysenterica* Wall. F – Apocynaceae) in it.

The experiment was carried out in farmers' plantations in Contai, East Midnapur District, West Bengal during March–December 2006–08, more or less coinciding with the blooming period of bitter tree: March–August and October–November. Observations were taken from all the plants of all the plantations on the incidence and damage of the borer at fortnight intervals. Observations were also taken from the surrounding 20 plants of an infested cashew tree, with/without a bitter tree paired with it each year. Collected data were then converted into mean per cent values.

Laboratory study of no-choice feeding-response was carried out at 24–30°C and 60–80% relative humidity, 100 g of fresh bitter tree flowers were added to 500 ml of water and ground with the help of a grinder. Likewise, leaves and bark pieces were also ground in 1: 5 (w/v) ratio. Clear extracts were obtained by sieving through a fine-mess nylon net. Fresh cashew bark pieces were dipped in water extract of fresh bitter tree flowers, leaves and barks for 5 min and then placed separately at the distal end of each tunnel as no-choice foods. The experiment was set out in completely randomized design with 4 treatments, including check, 4 replications and 5 adults composed a replication. Adults were released in glass boxes (30 cm × 10 cm × 8 cm) and air was blown through the distal end of the tunnels by an electric fan. Observations were taken on the number of adults which were attracted to food in the next 24 hr. Data were collected and subjected to analysis of variance.

Results indicated that presence of bitter tree plants in cashew plantations (P_I, P_{II} and P_{III}) strongly and adversely affected the incidence and damage of cashew stem and root borer in all the plantations (Table 1). Cashew stem and root borer infestation was either nil or very low (0.33–1.97%) in these mixed plantations, while in sole cashew plantations (P_{IV}, P_V and P_{VI}) it varied between 4.83 and 11.34%. Small number of plants in mixed plantations were infested by cashew stem and root borer but none had re-infestation like that in the sole plantations. In sole cashew plantations, 2.83–5.14%, 3.88–4.33% and 4.71–5.15% trees died during 2006, 2007 and 2008, respectively, but in mixed plantations, not even a single tree died. In mixed plantations, many of the infested trees were in advanced stage of attack, grubs had either moved deep inside the root or in the heart-wood region affecting the vascular systems and canopy yellowing started in those plants with visibly reduced vitality. Eventually, all of these trees died. In mixed plantations, infestation was noticed in stem portions in most of the cases, while in the sole plantations, collar and root regions were frequented. Bitter tree flowers are known to contain strong aromatic

* Short note

[1]Associate Professor (e mail: sudarshan.chakraborti @gmail.com; cs_ento @rediffmail.com), Department of Agricultural Entomology

Table 1 Effect of bitter tree flowers on the incidence and damage of CSRB in cashew plantations during 2006–08

Plantation	Total no. of cashew plants	No. of CSRB infested plants	Per cent of CSRB infested plants	Total no. of bitter trees	Bitter tree: cashew ratio	Per cent of dead cashew plants (no.)
			March–December 2006			
Cashew + bitter trees (P_I)	287	3	1.05	29	1: 9.9	
Cashew + bitter trees (P_{II})	306			27	1: 11.3	
Cashew + bitter trees (P_{III})	254	5	1.97	24	1: 10.6	
Cashew (P_{IV})	290	14	4.83			3.45(10)
Cashew (P_V)	214	11	5.14			5.14(11)
Cashew (P_{VI})	318	16	5.03			2.83(9)
			March–December 2007			
Cashew + bitter trees (P_I)	287			29	1: 9.9	
Cashew + bitter trees (P_{II})	306			26	1: 11.8	
Cashew + bitter trees (P_{III})	254	2	0.78	24	1: 10.6	
Cashew (P_{IV})	280	19	6.79			3.93(11)
Cashew (P_V)	203	16	7.88			4.33(9)
Cashew (P_{VI})	309	21	6.80			3.88(12)
			March–December 2008			
Cashew + bitter trees (P_I)	287			29	1: 9.9	
Cashew + bitter trees (P_{II})	306	1	0.33	26	1: 11.8	
Cashew + bitter trees (P_{III})	254			24	1: 10.6	
Cashew (P_{IV})	269	24	8.92			4.83(13)
Cashew (P_V)	194	22	11.34			5.15(10)
Cashew (P_{VI})	297	28	9.43			4.71(14)

CSRB, cashew stem and root borer

Table 2 Intensity of CSRB infestation in cashew plantations in presence/absence of bitter trees during 2006–08

Plantation	Mean % CSRB infested trees around a infested cashew tree having a bitter tree beside it			Mean% CSRB infested trees around a infested cashew tree without a bitter tree beside it		
	Total trees observed	Number of infested trees	Mean% infested trees	Total trees observed	Number of infested trees	Mean % infested trees
Cashew + bitter trees (P_I)	60					
Cashew + bitter trees (P_{II})	60	1	1.6			
Cashew + bitter trees (P_{III})	60	1	1.6			
Cashew (P_{IV})				60	12	33.33
Cashew (P_V)				60	9	15.00
Cashew (P_{VI})				60	15	25.00
Overall	180	2	1.11	180	36	20.00

CSRB, cashew stem and root borer

volatile compounds. It appeared that strong aromatic compounds released in air by bitter tree flowers mixed up with volatiles emitted from infested cashew trees and this created confusion in borer adults and their sensory systems failed to detect host plants. This led to 'zero' or very low infestation in mixed plantations. Neem oil and castor oil have been reported to repel cashew stem and root borer adults (Chakraborti 2006) but no plant itself has been reported to deter cashew stem and root borer incidence. Infested cashew trees act as source of inoculums and invite re-infestation and/or fresh infestation (Misra and Basu Choudhury 1985). In the present study, 15.00–33.33% trees were infested around an infested cashew tree but it was 0–1.6% (actually, 2 plants out of 180) when there was a bitter tree beside the infested cashew tree (Table 2). In no-choice feeding-response, not a single cashew stem and root borer adult was attracted to fresh cashew bark pieces treated with aqueous extract of fresh bitter tree flower (Table 3). But, adults were attracted to cashew bark pieces treated with aqueous extract of bitter tree barks and leaves. It indicated that due to presence of some 'non-preferred' factor in bitter tree flowers, adults were not attracted to cashew bark pieces treated with floral extract.

Table 3 Response of CSRB adults in no-choice test for food

Treatment	Total number of CSRB adults released	Total number of CSRB adults attracted	Mean % of CSRB adults attracted
T_1 – fresh cashew bark pieces dipped in water extract of fresh bitter tree flowers	20	0.00	0.00
T_2 – fresh cashew bark pieces dipped in water extract of fresh bitter tree leaves	20	17	85.0 (67.21)
T_3 – fresh cashew bark pieces dipped in water extract of fresh bitter tree bark	20	16	80.0 (63.44)
T_4 (check) – fresh cashew bark pieces	20	18	90.0 (71.56)*
CD (P = 0.05)			9.46

*Figures in parentheses are arcsine √P transformations
CSRB, cashew stem and root borer

It appeared that interplanting bitter tree with cashew in 1: 10 ratio (mean ratio bitter tree : cashew = 1 : 10.6) may be an effective and economic option for cashew stem and root borer management.

SUMMARY

A study was undertaken to asses the effect of the presence of bitter trees (*Holarrhena antidysenterica* Wall.) in cashew (*Anacardium occidentale* L.) plantations on the incidence of cashew stem and root borer. It was found that fresh and/or re-infestation was nil or very low during the blooming period of bitter trees. It appeared that volatile compounds with strong aroma released from bitter tree flowers mixed up with volatiles emitted from cashew stem and root borer infested cashew trees creating confusion among cashew stem and root borer adults and their sensory systems failed to detect host plants. This led to 'zero' fresh and/or re-infestation or very low infestation. In a laboratory study under no-choice condition, not even a single cashew stem and root borer adult was attracted to fresh cashew bark pieces dipped in water extract of fresh bitter tree flowers but were attracted to barks dipped in water extract of fresh bitter tree leaf or bark, indicating the presence of a 'non-preferred' factor in bitter tree flowers.

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