In vitro screening of different botanicals against banana pseudo-stem weevil *Odoiporus longicollis* Oliver (Coleoptera: Curculionidae)

Dr. Ancy Joseph and Jyothy Narayanan

Aromatic and Medicinal Plants Research Station, Odakkali, (Kerala Agricultural University),

Asamannoor PO, Ernakulam, Kerala, India

ABSTRACT

In an attempt to explore the potential of medicinal plants in eco-friendly control of the weevil, *in vitro* screening was carried out at the station using dry powder decoction (10%) of selected plants on the 4th instar grubs and adults. *Quassia indica* and *Curcuma angustifolia* caused 100% mortality in grubs followed by *Curcuma caesia* (93.33%), *Bacopa monnieri* (73.33%) and *Myristica fragrans* (66.67%). *Quassia indica* and *Curcuma caesia* were more effective against adults with 93.33% mortality followed by *Curcuma angustifolia* (73.33%), *Myristica fragrans* (66.67%) and *Bacopa monnieri* (60.00%).

Introduction

Pest and disease incidence is the major biotic factor limiting the bunch yield in banana. Among the few major pests, pseudo-stem weevil, *Odoiporus longicollis* Oliver (Coleoptera: Curculionidae) is monophagous and infest plants at 5 months of age. Majority of the farmers are relying on chemicals for managing this pest. Search for promising botanicals with specific toxicity to the weevil is quite worthy at present as only a handful of botanicals are available in crop protection with few commercially developed products (Isman, 2006).

Results

The result of the study is presented in Table 2. *Q. indica* and *C. angustifolia* caused 100 % mortality in grubs followed by *C. caesia* (93.33%), *B. monnieri* (73.33%) and *M. fragrans* (66.67%) after six days of treatment.

The water extracts of *Q. indica* and *C. caesia* was more effective against adults with 93.33% mortality followed by *C. angustifolia* (73.33%), *M. fragrans* (66.67%) and *B. monnieri* (60.00%).

Dead grubs and adults

Materials and methods

The test insect was reared in cut banana pseudo-stem under controlled condition in the laboratory. The 4th instar grubs and adults were screened *in vitro* using 10% dry powder decoctions of different botanicals enlisted in Table 1. The trial was conducted in Completely Randomized Design with 20 treatments and three replications with five grubs/ adults per replication. The plant parts were thoroughly washed, cleaned, chopped, dried under shade and ground to fine powder. Decoctions were prepared by boiling the dry plant powders and filtering the extract. Healthy banana pseudo-stem of 5 cm length was cut and dipped in the decoctions for one hour and drained for 5 minutes. The treated pseudo-stems were kept in plastic jars and grubs and adults were introduced. The jars were covered using plastic net. Newly treated pseudo-stems were fed daily to the test insects during the entire course of screening. The percentage mortality were noted daily until the cumulative mortality reached 100% in any one of the treatment. The data obtained was subjected to arc sine transformation by using GRAPES version 1.0.0.

Adults fed with treated pseudo-stem

Table 1. List of botanicals used for the *in vitro* screening studies

Sl No.	Common name	Scientific name	Family	Plant part used
1	Greater galangal	*Alpinia galanga*	Zingiberacae	Rhizome
2	Lesser galangal	*Alpinia calcarata*	Zingiberacae	Rhizome
3	Yellow zedoary	*Curcuma zedoaria*	Zingiberacae	Rhizome
4	White ginger lily	*Hedychium coronarium*	Zingiberacae	Rhizome
5	Aromatic ginger	*Kaempferia galanga*.	Zingiberacae	Rhizome
6	Black turmeric	*Curcuma caesia*	Zingiberacae	Rhizome
7	Wild turmeric	*Curcuma aromatica*.	Zingiberacae	Rhizome
8	Sweet Flag	*Acorus calamus*	Zingiberacae	Rhizome
9	White zedoary	*Curcuma angustifolia*	Zingiberacae	Rhizome
10	Lantana	*Lantana camara*	Verbenaceae	Root
11	Brahmi	*Bacopa monnieri*	Plantaginaceae	Whole plant
12	Nutmeg	*Myristica fragrans*	Myristicaceae	Shell
13	Niepa bark tree	*Quassia indica*	Simaroubaceae	Leaf
14	Hill glory bower	*Clerodendrum infortunatum*	Lamiaceae	Leaf
15	Thorn apple	*Datura metel*	Solanaceae	Leaf
16	Danti	*Baliospermum montanum*	Euphorbiaceae	Leaf
17	Bharang	*Clerodendrum serratum*	Lamiaceae	Root and leaf

Table 2. Mean per cent mortality of test insects

Botanicals	Mean % mortality of					
	4th instar grub			Adult weevil		
	2 DAT	4 DAT	6 DAT	2 DAT	4 DAT	6 DAT
A. galanga (Rh)	0.00^{a}	0.00^{a}	13.33^{a}	6.67^{a}	26.67^{a}	26.67^{b}
B. monnieri (WP)	33.33^{bc}	53.33^{d}	73.33^{c}	20.00^{b}	46.67^{b}	60.00^{c}
A. calcarata (Rh)	20.00^{a}	26.67^{c}	26.67^{a}	13.33^{a}	20.00^{a}	33.33^{b}
C. serratum (R)	20.00^{a}	33.33^{c}	40.00^{b}	26.67^{b}	33.33^{b}	46.67^{c}
C. zedoaria (Rh)	13.33^{a}	33.33^{c}	40.00^{b}	20.00^{b}	33.33^{b}	46.67^{c}
C. gigantea (R)	6.67^{a}	26.67^{c}	33.33^{b}	6.67^{a}	13.33^{a}	26.67^{b}
H. coronarium (Rh)	13.33^{a}	26.67^{c}	26.67^{a}	13.33^{a}	20.00^{a}	33.33^{b}
M. fragrans (S)	26.67^{bc}	53.33^{d}	66.67^{c}	20.00^{b}	46.67^{b}	66.67^{c}
Q. indica (L)	53.33^{c}	73.33^{d}	100.00^{d}	33.33^{b}	66.67^{c}	93.33^{e}
K. galanga (Rh)	13.33^{a}	6.67^{a}	13.33^{a}	6.67^{a}	13.33^{a}	26.67^{b}
C. caesia (Rh)	46.67^{c}	53.33^{d}	93.33^{d}	53.33^{c}	73.33^{c}	93.33^{e}
C. aromatica (Rh)	13.33^{a}	20.00^{b}	46.67^{c}	26.67^{b}	33.33^{b}	46.67^{c}
L. camara (R)	13.33^{a}	26.67^{c}	40.00^{b}	20.00^{b}	33.33^{b}	33.33^{b}
A. calamus (Rh)	6.67^{a}	6.67^{a}	33.33^{b}	13.33^{a}	26.67^{a}	33.33^{b}
C. angustifolia (Rh)	53.33^{c}	73.33^{d}	100.00^{d}	33.33^{b}	53.33^{b}	73.33^{d}
C. infortunatum (L)	20.00^{b}	33.33^{c}	46.67^{b}	13.33^{a}	33.33^{b}	46.67^{c}
D. metel (L)	26.67^{bc}	33.33^{c}	46.67^{b}	13.33^{a}	26.67^{a}	46.67^{c}
C. serratum (L)	6.67^{a}	6.67^{a}	13.33^{a}	0.00^{a}	13.33^{a}	13.33^{a}
B. montanum (L)	13.33^{a}	20.00^{b}	46.67^{c}	6.67^{a}	13.33^{a}	20.00^{a}
C. gigantea (L)	0.00^{a}	6.67^{a}	13.33^{a}	6.67^{a}	13.33^{a}	20.00^{a}

(*Rh-Rhizome, WP-Whole plant, R- Root, S- Shell, L- Leaf*)

Replication-3, n-5, Means followed by same alphabet do not significantly differ by LSD at P=0.05%

Discussion

The high oral toxicity of Quassia extracts on different insects including mosquitoes have been reported by Evans and Raj (1988). The efficacy of extracts from different *Curcuma* spp. against a variety of pests and pathogens of food crops has been reviewed by Pandey *et al*. (2021). Different extracts of *B. monnieri* showed significant mortality of pulse beetle, *Callosobruchus chinensis* as reported by Bindhu and Dayanandan (2013). Nutmeg was found to be toxic when incorporated in the diet fed to *Callosobruchus maculatus* larvae as reported by Janzen *et al*. (1977) cited by Su (1988). The present study identifies a few plant sources with promising toxicity to pseudo-stem weevil of banana in *in vitro* studies, establishing the possibility of developing effective botanical formulations from these.

Conclusion

The study identifies *Q. indica*, *C. angustifolia*, *C. caesia*, *B. monnieri* and *M. fragrans* as effective botanicals having toxicity to both grubs and adults of pseudo-stem weevil and indicates the possibility of developing eco-friendly botanical pest control products for managing the weevil.

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