Research Article

Bio Efficacy of Certain *Acorus Calamus* Products against *Leucinodes Orbonalis* in Brinjal

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Abstract

Brinjal, *Solanum melongena* L. is one such typical vegetable and its commercial cultivation not only helps to improve human nutrition, but also increase income generation for the growers. *S. melongena* is attacked by many insect pests at different stages of its growth. *Leucinodes orbonalis* G. (Lepidoptera: Pyralidae) is the key pest of brinjal. The *Acorus calamus* products namely Aqueous rhizome extract 1.0 %, *A.calamus* oil 0.2 %, *A.calamus* leaf extract 0.5%, Rhizome powder and Vasambu dust 10 D 25kg/ha were used against this pest aiming at its control under field condition. Among *A. calamus* products minimum per cent shoot infestation was observed in aqueous rhizome extract 1% (9.17 %). The next effective treatments were rhizome powder 25kg/ha and vasambu dust 10 D 25kg/ha which recorded 15.56 and 14.44 per cent shoot damage respectively. Similarly aqueous rhizome extract 1% recorded low fruit damage by number 13.07 and weight 3.91. Results of this study indicate that *A. calamus* products can serve as a novel alternative source of organic pesticide.

Keywords: *Acorus calamus*, Brinjal, *Leucinodes orbonalis*

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Introduction

Brinjal is one of the widely used vegetable crops by most of the people and is popular in many countries *viz.*, Central, South and South East Asia, some parts of Africa and Central America [1]. It is native of India and is grown throughout the country. Though brinjal is a summer crop, it is being grown throughout the year under irrigated condition. The cultivation of brinjal is more than 16,00,000 ha producing around 50 million metric tonnes throughout the world, among which, 90 per cent of production is from five countries, of which China shares 58 per cent of output, India, 25 per cent and the rest by Iran, Egypt and Turkey [2]. Brinjal, *Solanum melongena* L. is one such typical vegetable and its commercial cultivation not only helps to improve human nutrition, but also increase income generation for the growers. The higher yield and prolonged fruiting period lure the farmers on brinjal production. Shoot and fruit borer, *Leucinodes orbonalis* G. (Lepidoptera: Pyralidae) is the key pest of brinjal [3]. There is a tremendous misuse of insecticides in an attempt to produce damage-free marketable brinjal fruits. The frequent and indiscriminate application of pesticides had resulted into widespread development of resistance, undesirable effects on non-target organisms, presence of toxic residues in food and environmental and health hazards [4]. As the fruits are being consumed, development of a eco-friendly and safe pest management recommendation is very much essential. In nature, certain plants and their derivatives have shown insecticidal activities and hence these botanical pesticides have been receiving global attention and do not leave any toxic residues in the environment and selectively toxic to insects [5]. Plants synthesize countless products which can partially be considered as weapons to defend plants against pests. Plant products have several uses in insect control. The usage of plant products and its biologically active compounds are being considered as the best alternative to synthetic insecticides [6].

Hence, the present investigation deals with botanical insecticide made from perennial wetland monocot plant sweet flag, Acorus *calamus* L.

Methods

A field experiment was conducted at D block in AC & RI, Killikulam under randomized block design (RBD) of plot size 20 m^2 with seven treatments and three replications. Brinjal variety KKM 1 was used as the test variety. The following treatments were applied using hand operated high volume knapsack sprayer at 15 days interval for three

times and the dust formulations were applied using muslin cloth. T_1 - Aqueous rhizome extract 1.0 %, T_2 - Rhizome powder 25 kg /ha, T_3- *A. calamus* oil 0.2 %, T_4- Vasambu dust 10 D 25 kg /ha, T_5- *A. calamus* leaf extract 0.5%, T_6- Chlorpyriphos 20 EC 0.25 % and T_7 - Control. Observations were recorded on 1, 3, 7 and 14 days after application. Pre treatment count was also taken before applying the treatments. Healthy and damaged shoots were recorded on ten randomly selected plants in each plot to work out per cent shoot infestation.

$$\text{Per cent shoot infestation} = \frac{\text{Number of infested shoots}}{\text{Number of total shoots}} \times 100$$

Similarly per cent fruit infestation by number and weight basis at each harvest was also calculated.

Results and discussion

In the field study, the shoot and fruit borer incidence was nil upto 60 days after transplanting in *A. calamus* sprayed plots. The mean of per cent shoot infestation ranged from 2.49 to 42.18. The minimum per cent shoot infestation was observed in standard check chlorpyriphos 0.25% (2.49 %) followed by aqueous rhizome extract 1% (9.17 %). The next effective treatments were rhizome powder 25kg/ha and vasambu dust 10 D 25kg/ha which recorded 15.56 and 14.44 per cent shoot damage respectively. Lower efficacy was recorded in *A. calamus* oil 0.2% (29.17 %) and leaf extract 0.5% (28.34 %). The highest shoot infestation of 42.18 per cent **Table 1** was noticed in the untreated control. Fourty five days after transplanting 4.44 per cent shoot infestation was observed in control and fourteen days after second spraying shoot damage increased to 36.67 per cent. In field experiment, significant reduction in shoot damage by *L. orbonalis* was observed in *A. calamus* treatments when compared to control. The minimum shoot damage of 9.17 per cent was noticed on plants treated with aqueous rhizome extract followed by vasambu dust (14.44%) and rhizome powder (15.56%) and was on par with each other. The present results are in accordance with the work of Meena [7] who reported that only 6.46 per cent of shoot damage was recorded when treated with neem oil against brinjal shoot and fruit borer.

Table 1 Field evaluation of certain *A. calamus* products against by *L.orbonalis* in brinjal (shoot infestation)

S.No	Treatments	Dose	% Shoot infestation*								Overall Mean
			Spray II				Spray III				
			1 DAT**	3 DAT**	7 DAT**	14 DAT**	1 DAT**	3 DAT**	7 DAT**	14 DAT**	
1	Aqueous rhizome extract	1.0 %	0.00 (4.05)	0.00 (4.05)	0.00 (4.05)	0.00 (4.05)	8.89^{b} (17.35)	8.89^{b} (17.35)	8.89^{b} (17.35)	10.00^{b} (18.44)	9.17
2	Rhizome powder	25kg/ha	0.00 (4.05)	0.00 (4.05)	0.00 (4.05)	0.00 (4.05)	15.56^{c} (23.33)	15.56^{c} (23.33)	15.56^{c} (23.33)	15.56^{c} (23.33)	15.56
3	*A.calamus* oil	0.2 %	0.00 (4.05)	0.00 (4.05)	0.00 (4.05)	0.00 (4.05)	28.89^{d} (32.51)	28.89^{d} (32.51)	28.89^{d} (32.51)	30.00^{d} (33.21)	29.17
4	Vasambu dust 10 D	25kg/ha	0.00 (4.05)	0.00 (4.05)	0.00 (4.05)	0.00 (4.05)	14.44^{c} (22.33)	14.44^{c} (22.33)	14.44^{c} (22.33)	14.44^{c} (22.33)	14.44
5	*A.calamus* leaf extract	0.5 %	0.00 (4.05)	0.00 (4.05)	0.00 (4.05)	0.00 (4.05)	27.78^{d} (31.81)	27.78^{d} (31.81)	27.78^{d} (31.81)	30.00^{d} (33.21)	28.34
6	Chlorpyriphos 20 EC	0.25 %	0.00 (4.05)	0.00 (4.05)	0.00 (4.05)	0.00 (4.05)	2.22^{a} (8.57)	2.22^{a} (8.57)	2.22^{a} (8.57)	3.33^{a} (10.51)	2.49
7	Control	-	4.44 (12.16)	11.11 (19.47)	22.22 (28.12)	36.67 (37.27)	55.56^{e} (48.19)	61.11^{e} (51.42)	70.00^{e} (56.79)	76.29^{e} (60.86)	42.18
SEd							2.14	1.57	1.78	1.55	
CD(p=0.05)							4.58	3.36	3.81	3.31	

*Mean of 3 replications
**DAT-Days After Treatment
Figures in parentheses are x + 0.5 arc sin transformed values
Means followed by same letter(s) are not significantly different at 5% level by DMRT

During third spray the per cent shoot infestation recorded on chlorpyriphos 0.25% ranged from 2.22 per cent (1, 3, 7 DAT) and 3.33 per cent (14 DAT) followed by aqueous rhizome extract 1% registered on range of 8.89 per cent from one to seven days after treatment, whereas 10.00 per cent infestation was observed after fourteen days. Maximum shoot infestation range of 55.56 per cent (1DAT) to 76.29 per cent (14 DAT) was recorded in control.

The results on fruit damage caused by shoot and fruit borer are presented in **Table 2** Mean per cent fruit infestation by number ranges from 1.78 to 79.05 and by weight ranges from 0.65 to 40.86. Standard check recorded low fruit damage by number 1.78 and weight 0.65 followed by aqueous rhizome extract 1% recorded low fruit damage by number 13.07 and weight 3.91. Maximum fruit infestation observed in control 79.05 by number and 40.86 by weight.

Table 2 Field evaluation of certain *A. calamus* products against by *L.orbonalis* in brinjal (Fruit infestation)

S. No.	Treatments	Dose	% Fruit infestation*								Overall Mean	
			I Harvest		II Harvest		III Harvest		IV Harvest			
			A	B	A	B	A	B	A	B	A	B
1	Aqueous rhizome extract	1.0 %	16.08^{b} (23.64)	4.81^{b} (12.67)	12.58^{b} (20.78)	4.09^{a} (11.67)	12.11^{b} (20.37)	3.36^{a} (10.56)	11.51^{b} (19.83)	3.36^{a} (10.56)	13.07 (21.19)	3.91 (11.41)
2	Rhizome powder	25 kg/ha	25.34^{c} (30.23)	8.67^{c} (17.12)	27.19^{c} (31.43)	9.18^{b} (17.64)	26.71^{c} (31.12)	9.63^{a} (18.08)	28.46^{c} (32.24)	9.63^{a} (18.08)	26.93 (31.26)	9.28 (17.74)
3	*A.calamus* oil	0.20%	39.54^{d} (38.96)	14.11^{d} (22.06)	41.04^{d} (39.84)	17.75^{c} (24.93)	43.74^{d} (41.41)	19.73^{b} (26.37)	45.83^{d} (42.61)	19.73^{b} (26.37)	42.54 (40.71)	17.83 (24.98)
4	Vasambu dust 10 D	25kg/ha	25.44^{c} (30.29)	8.19^{bc} (16.63)	25.44^{c} (30.29)	8.67^{b} (17.12)	27.29^{c} (31.49)	9.1833^{a} (17.64)	26.80^{c} (31.18)	9.18^{a} (17.64)	26.24 (30.81)	8.81 (17.27)
5	*A.calamus* leaf extract	0.5 %	47.92^{e} (43.81)	22.49^{e} (28.31)	50.98^{e} (45.56)	23.72^{d} (29.15)	51.96^{d} (46.12)	23.17^{b} (28.78)	51.96^{d} (46.12)	23.17^{b} (28.77)	50.71 (45.41)	23.14 (28.75)
6	Chlorpyriphos 20 EC	0.25 %	1.85^{a} (7.82)	1.14^{a} (6.13)	1.75^{a} (7.60)	0.72^{a} (4.87)	1.75^{a} (7.60)	0.37^{a} (3.49)	1.75^{a} (7.60)	0.37^{a} (3.49)	1.78 (7.67)	0.65 (4.62)
7	Control	-	72.99^{f} (58.69)	36.34^{f} (37.07)	79.30^{f} (62.94)	41.23^{e} (39.95)	81.85^{e} (64.79)	42.93^{c} (40.94)	82.04^{e} (64.93)	42.93^{c} (40.94)	79.05 (62.76)	40.86 (39.73)
	SEd		3.21	1.67	3.16	1.91	4.79	4.28	4.06	4.28		
	CD(P=0.05)		6.87	3.58	6.77	4.09	10.24	9.15	8.69	9.15		

A= Number, B= weight
*Mean of 3 replications
Figures in parentheses are arc sin transformed values
Means followed by same letter(s) are not significantly different at 5% level by DMRT

The data on bioefficacy of *A. calamus* on brinjal in field trials revealed that aqueous rhizome extract showed marked reduction in the fruit damage caused by shoot and fruit borer. The per cent fruit damage ranged between 13.07 to 50.71%, in which aqueous rhizome extract performed well (13.07%) and the least by leaf extract. However the chemical check chlorpyriphos performed far better with fruit damage (1.78%) than the *A. calamus* products. The insecticidal properties of *A. calamus* were previously documented by various workers [8], [9] and [10]. The results obtained in the present study also goes on hand with the findings of Thangapandian *et al*., [11]on the control of *Spodoptera litura* and storage pests by *A. calamus* extracts. The significant reduction of shoot and fruit borer infestation in the present investigation might be due to the repellent activity of *A. calamus* against *L. orbonalis*. The effect of sweet flag rhizome extract will persist even after sixty days and repel the insect from egg laying and feeding the brinjal shoots. Among the treatments, *A. calamus* leaf extract recorded low reduction in fruit damage despite the presence of an insecticidal compound Z- asarone.

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