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Bioefficacy of some indigenous plant extracts against epilachna beetle (*Henosepilachna vigintioctopunctata* Fabr.) infesting cucumber

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A B S T R A C T

A field trial was conducted on 'Barapata' variety of cucumber in a replicated Randomized Block Design at Viswavidyalaya Instructional Farm during 2004–05 to find out the impact of plant derived pesticides viz; Neem Azal, Rhizome extracts of *Acorus calamus* with petroleum ether as solvent and seed extracts of *Annona squamosa* with methanol as solvent in controlling epilachna beetle, *Henosepilachna vigintioctopunctata*, Fabr; Both Neem Azal and seed extracts of *Annona squamosa* were used at 4ml, 5ml and 6ml (per Lt. of water) while this was 1ml, 2ml and 3ml (per Lt. of water) in case of petroleum ether extract of rhizome of *Acorus calamus*. Endosulfan 35 EC was used at 1ml, 1.5ml and 2ml (per Lt. of water) to compare the efficacy of plant products. Results of the experiment revealed that Endosulfan 35 EC at $2mL^{-1}$ of water performed very well in reducing population build up of *Henosepilachna vigintioctopunctata*, Fabr. to the extent of 75.00%, while among the botanical pesticides, this was highest (76.37%) in seed extracts of *Annona squamosa* at $3mL^{-1}$ of water followed by 64.00% in Neem Azal at $5mL^{-1}$ of water and 57.00% in petroleum ether extracts of rhizome of *Acorus calamus* at $2mL^{-1}$ of water.

Introduction

Cucumber is a thermophilic and frost sensitive crop. It is essentially a warm season crop growing mainly in the tropics and subtropics. A well-drained loamy soil is preferred for cucumber. It prefers a pH of 5.5 to 6.8. Soil temperature is a determining factor for quick germination and early maturity.

Cucumber is cultivated for fresh consumption or as pickling cucumber for preservation, marinated with vinegar, salt and other spices. India is considered the home of cucumber. It is an important salad crop cultivated both in north and south and lower as well as higher hills of India. Cucumber has been cultivated in India for at least 3000 years. From India it spreads to China and even earlier and more rapidly to the West. It has now spread all over the world.

Number of pests attack cucumber. Among them, epilachna beetle is the most important one. Srivastava and Butani (1998) reported that both adults and grubs feed voraciously by scrapping the chlorophyll of the leaves, causing characteristics skeletonization of leaf lamina. Affected leaves gradually dry and drop down. A severe infestation kills the young plants overnight. The adult beetles are medium sized, yellowish brown globular insect bearing 12 – 28 black spots on the elytra. The eggs are laid in clusters on the undersurface of the leaves which hatch into yellowish larvae (grub) bearing spines all over the body. Full-grown larvae pupate below the leaf or at the base of the stems. Adults and grubs both feed on the leaves voraciously. Scrapping of the epidermis indicates the feeding manner of the grubs while semicircular cuts in rows, of the adults.

One of the most important factors that are limiting the vegetable production is the presence of pests, especially insects, mites and nematodes that cause regular loss qualitative as well as quantitative. To check the nefarious activities of these relentless enemies and to reduce the avoidable losses, research on the insect-pests and their control in vegetable crops was initiated by various state governments but later by the Agricultural Universities. But, sadly, the results obtained during the last half-century are lying scattered in annual reports and thesis or publications in various scientific journals (Swaminathan, 1998).

It is very difficult task to get better results from the single method of insect control. Thus, the integrated control measures come into lime-light. Synthetic chemicals have been widely preferred to combat this pest problem because of their quick knock-down effect. But, due to some ill effects raising up by the synthetic chemicals, the botanical and bio-pesticides are used now-a-days for environmental safety.

Considering the seriousness of this pest in cucumber and

ill-effects of using synthetic chemicals, an attempt was made to find out the bioefficacy of the extracts of neem (*Azadirachta indica*), Sweet flag (*Acorus calamus*) and Custard apple (*Annona squamosa*) against epilachna beetle of cucumber. The results obtained were subjected to statistical analysis (Table 1, 2 & 3).

Materials and Methods

The experiment was conducted during 2004–05 at Jaguli Instructional Farm, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal, to evaluate the bio-efficacy of 3 organic formulations, viz., Neem Azal, petroleum ether extract of rhizome of *A. calamus* and *A. squamosa*, seed extracts with methanol solvent against epilachna beetle, Fabr. on preferred 'Barapata' variety of cucumber, following Randomized Block Design. The bio-efficacy of the test products were compared with untreated control and Endosulfan 35 EC, being widely used against epilachna beetle. The doses of Neem Azal, used in the experiment were 4, 5 and 6ml.L^{-1} of water, while for both of petroleum ether extract of rhizome of *A. calamus* and seed extracts of *Annona squamosa* (methanolic extract), these were 1, 2 and 3ml.L^{-1}. of water and for Endosulfan 35 EC, these comprised of 1ml, l.5ml and 2ml.L^{-1} of water. The spraying was done with the help of knapsack polythene sprayer. Total no. of treatments were 13 and number of replication for each dose was three. The first spraying was given at 45 days after sowing (DAS) followed by two subsequent sprayings were given at 15 days interval.

Observations on the bioefficacy of the 4 products in inducing mortality vis-à-vis decreasing population build up of *H. vigintioctopunctata* was recorded at 1, 2, 3, 5, 7 and 10 days after treatment (DAT) along with pre-treatment counting from 5 randomly selected plants from each plot. The data thus obtained was subjected to square root transformed value for statistical calculation to ascertain the test of significance of different treatments.

Results and Discussion

The results achieved on the bioefficacy of all the pesticides tested showed in (Table 1). The reduction of population buildup of *H. vigintioctopunctata* ranged from 12.00% – 76.37% over control; owing 1st application of Neem Azal, seed extract (methanolic) of *Annona squamosa,* petroleum ether extract of rhizome of *A. calamus* and Endosulfan 35 EC with doses varying from 1.0 ml to 6.0 ml.L^{-1}.

Seed extract of *A. squamosa* was found to produce higher reduction at all doses, exerted lethality on nymphal and adult stages of *H. vigintioctopunctata,* ranging from 67.12 to 76.37% over control. Neem Azal, was found to be rather less effective ranging from 32.00 to 64.00%. Again, petroleum ether extract of rhizome of *A. calamus* was found to be less effective too ranging from 12.00 to 33.00%. Results achieved through these products were found to be at par with the synthetic pesticide, Endosulfan 35 EC. However, neither the pesticides nor the doses were found to differ significantly in expressing their bio-efficacy against the target pest.

The results of the 2nd application with the same products revealed that the impact of all the products with their respective doses, in reducing the population buildup of *H. vigintioctopunctata* followed the same trend as in the 1st application; with no significant difference between the treatments used (Table 2).

The results achieved from the 3rd application was more encouraging where both the synthetic and organic pesticides afforded appreciable checks against population buildup of the pest to the extent of 25.00 to 75.33%.

The impact of all the pesticide molecules tested, was found to be more pronounced with the passage of time (1 to 10 DAT) exhibiting remarkable reduction in population buildup on 'Barapata' variety of cucumber.

As cucumber is consumed by human beings either as fresh (green fruit, salad etc.) material or as cooked vegetable, the control measures need to be taken up for different pests very carefully.

No much works on the subject were undertaken and from this work, it can be concluded that there is immense scope for further research on the line in future.

Literature Cited

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Swaminathan MS. 1998 Strategies in crop production and productivity. *Journal of Entomological Research,* pp. 120–125.

Table 1

Effect of different doses of insecticides against *H. vigintioctopunctata* of cucumber

Treatment	Dose (ml/L^{-1} of water)	Pre-treatment	Mean no. of population at different DAT*						% reduction over control
			1	2	3	5	7	10	
Neem Azal	4.0	10.33 (3.21)	5.33 (2.31)	5.00 (2.24)	4.67 (2.16)	4.00 (2.00)	3.33 (1.82)	3.00 (1.73)**	32.00
	5.0	12.33 (3.51)	4.67 (2.16)	3.00 (1.73)	2.67 (1.63)	2.33 (1.53)	1.67 (1.29)	1.00 (1.00)	64.00
	6.0	8.00 (2.83)	4.00 (2.00)	3.67 (1.91)	3.00 (1.73)	2.33 (1.53)	1.67 (1.29)	0.67 (0.82)	63.00
A. squamosa *(Seed extract)*	1.0	10.00 (3.16)	5.33 (2.31)	3.33 (1.82)	2.67 (1.63)	1.67 (1.29)	1.00 (1.00)	0.67 (0.82)	67.12
	2.0	11.33 (3.37)	4.67 (2.16)	3.00 (1.73)	2.67 (1.63)	1.67 (1.29)	1.00 (1.00)	0.67 (0.82)	69.17
	3.0	9.67 (3.11)	4.33 (2.08)	2.67 (1.63)	2.00 (1.41)	1.33 (1.15)	1.00 (1.00)	0.33 (0.58)	76.37
A. calamus (Rhizome extract)	1.0	10.33 (3.21)	5.67 (2.38)	5.00 (2.24)	3.67 (1.91)	4.67 (2.16)	4.00 (2.09)	5.00 (2.24)	12.00
	2.0	10.67 (3.27)	4.33 (2.08)	4.00 (2.00)	3.67 (1.92)	4.00 (2.00)	2.67 (1.63)	3.00 (1.73)	33.00
	3.0	8.33 (2.89)	4.67 (2.16)	3.33 (1.82)	3.00 (1.73)	3.67 (1.91)	2.33 (1.53)	3.00 (1.73)	24.00
Endosulfan 35 EC	1.0	10.00 (3.16)	5.00 (2.24)	4.33 (2.08)	3.00 (1.73)	2.33 (1.53)	2.00 (1.41)	1.00 (1.00)	60.00
	1.5	9.33 (3.05)	4.33 (2.08)	3.00 (1.73)	2.33 (1.53)	1.67 (1.29)	1.00 (1.00)	0.67 (0.82)	66.00
	2.0	7.00 (2.65)	2.67 (1.63)	2.33 (1.53)	2.00 (1.41)	1.67 (1.29)	1.00 (1.00)	0.67 (0.82)	61.00
Untreated control	–	6.33 (2.52)	6.67 (2.58)	7.00 (2.65)	7.33 (2.71)	6.33 (2.51)	8.33 (2.89)	7.67 (2.77)	–
S.Em (±)	–	0.30	0.24	0.29	0.37	0.23	0.33	0.28	–
CD at 5%	–	(0.92)	(0.83)	(0.91)	(1.03)	(0.81)	(0.97)	(0.89)	–

* DAT – Days After Treatment.

** – Figures in parentheses indicate square-root transformed values.

Table 2

Effect of different doses of insecticides against *H. vigintioctopunctata* of cucumber

Treatment	Dose (ml/L^{-1} of water)	Pre-treatment	Mean no. of population at different DAT*						% reduction over control
			1	2	3	5	7	10	
Neem Azal	4.0	16.33 (4.04)	11.00 (3.32)	9.00 (3.00)	8.00 (2.83)	6.67 (2.58)	6.33 (2.51)	7.00 (2.64)**	32.00
	5.0	12.67 (3.56)	9.67 (3.11)	8.67 (2.94)	6.67 (2.58)	4.00 (2.00)	3.00 (1.73)	1.67 (1.29)	62.00
	6.0	12.00 (3.46)	8.33 (2.89)	6.67 (2.58)	5.67 (2.38)	4.00 (2.00)	2.67 (1.63)	2.00 (1.41)	58.00
A. squamosa (Seed extract)	1.0	14.33 (3.78)	8.00 (2.83)	5.33 (2.31)	3.67 (1.91)	3.00 (1.73)	2.00 (1.41)	1.33 (1.15)	68.40
	2.0	12.67 (3.56)	6.67 (2.58)	4.00 (2.00)	3.00 (1.73)	2.33 (1.53)	1.33 (1.15)	1.00 (1.00)	70.82
	3.0	14.33 (3.79)	8.67 (2.94)	6.00 (2.45)	4.33 (2.08)	3.67 (1.91)	2.33 (1.53)	1.33 (1.15)	68.48
A. calamus (Rhizome extract)	1.0	12.33 (3.51)	9.67 (3.11)	8.67 (2.94)	7.33 (2.71)	7.33 (2.71)	6.33 (2.52)	6.00 (2.45)	28.00
	2.0	14.00 (3.74)	9.33 (3.05)	8.33 (2.89)	8.00 (2.83)	5.33 (2.31)	4.67 (2.16)	3.67 (1.91)	47.00
	3.0	13.33 (3.65)	10.67 (3.27)	9.00 (3.00)	8.33 (2.89)	5.67 (2.38)	4.33 (2.08)	2.33 (1.53)	57.00
Endosulfan 35 EC	1.0	10.67 (3.27)	5.33 (2.31)	4.00 (2.00)	3.00 (1.73)	2.33 (1.53)	1.67 (1.29)	0.67 (0.82)	74.00
	1.5	11.00 (3.32)	5.67 (2.38)	4.33 (2.08)	4.00 (2.00)	3.33 (1.82)	2.00 (1.41)	1.00 (1.00)	69.00
	2.0	9.00 (3.00)	5.00 (2.24)	3.00 (1.73)	3.00 (1.73)	2.33 (1.53)	1.67 (1.29)	0.67 (0.82)	75.00
Untreated control	–	10.33 (3.21)	13.67 (3.70)	14.00 (3.74)	14.67 (3.83)	15.33 (3.91)	16.00 (4.00)	17.00 (4.12)	–
S.Em (±)	–	0.07	0.08	0.08	0.07	0.07	0.06	0.09	–
CD at 5%	–	(0.45)	(0.48)	(0.48)	(0.45)	(0.45)	(0.41)	(0.51)	–

* DAT – Days After Treatment.

** – Figures in parentheses indicate square-root transformed values.

Table 3

Effect of different doses of insecticides against *H. vigintioctopunctata* of cucumber

Treatment	Dose (ml/L^{-1} of water)	Pre-treatment	Mean no. of population at different DAT*						% reduction over control
			1	2	3	5	7	10	
Neem Azal	4.0	23.67 (4.86)	13.00 (3.60)	10.67 (3.27)	8.00 (2.83)	5.33 (2.31)	5.00 (2.24)	4.67 (2.16)**	51.00
	5.0	12.33 (3.51)	8.00 (2.83)	7.67 (2.77)	6.67 (2.58)	5.67 (2.38)	3.33 (1.82)	2.67 (1.63)	48.00
	6.0	17.67 (4.20)	11.33 (3.37)	10.33 (3.21)	8.67 (2.94)	6.00 (2.45)	3.00 (1.73)	2.67 (1.63)	57.00
A. squamosa (Seed extract)	1.0	20.00 (4.47)	10.00 (3.16)	7.33 (2.71)	5.67 (2.38)	4.67 (2.16)	3.33 (1.82)	2.00 (1.41)	64.89
	2.0	13.67 (3.70)	9.33 (3.05)	6.33 (2.52)	4.67 (2.16)	3.33 (1.82)	2.00 (1.41)	0.67 (0.82)	75.33
	3.0	15.00 (3.87)	10.00 (3.16)	7.33 (2.71)	5.67 (2.38)	4.33 (2.08)	2.67 (1.63)	1.33 (1.15)	66.92
A. calamus (Rhizome extract)	1.0	17.67 (4.20)	14.00 (3.74)	13.33 (3.65)	13.00 (3.60)	10.00 (3.16)	9.00 (3.00)	7.33 (2.71)	28.00
	2.0	13.00 (3.60)	9.33 (3.05)	8.67 (2.94)	8.67 (2.94)	6.33 (2.52)	5.00 (2.24)	4.67 (2.16)	33.00
	3.0	16.67 (4.08)	12.67 (3.56)	12.00 (3.46)	10.67 (3.27)	7.33 (2.71)	8.00 (2.83)	7.67 (2.77)	25.00
Endosulfan 35 EC	1.0	12.00 (3.46)	6.00 (2.45)	5.33 (2.31)	4.67 (2.16)	3.33 (1.82)	2.33 (1.53)	1.67 (1.29)	59.00
	1.5	10.67 (3.27)	3.33 (1.82)	2.67 (1.63)	2.00 (1.41)	1.33 (1.15)	1.00 (1.00)	1.33 (1.15)	61.00
	2.0	11.00 (3.32)	4.00 (2.00)	3.67 (1.91)	2.67 (1.63)	2.33 (1.53)	1.67 (1.29)	0.67 (0.82)	73.00
Untreated control	–	15.67 (3.96)	17.00 (4.12)	15.33 (3.91)	16.00 (4.00)	17.67 (4.20)	17.67 (4.20)	18.00 (4.24)	–
S.Em (±)	–	0.05	0.04	0.05	0.03	0.06	0.06	0.07	–
CD at 5%	–	(0.38)	(0.34)	(0.38)	(0.29)	(0.41)	(0.41)	(0.45)	–

* DAT – Days After Treatment.

** – Figures in parentheses indicate square-root transformed values.