International Journal of Biotechnology and Biochemistry
ISSN 0973-2691 Volume 5 Number 4 (2009) pp. 451-458

http://www.ripublication.com/ijbb.htm

Evaluation of *Adhatoda vasica, Acorus calamus and Vitex nugendo* as a source of phago-antifeedant against cabbage butterfly, *Pieris brassicae* Linn. (Lepidoptera: Pieridae) on mustard, *Brassic campestris* (Linn.)

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*(*A part of Ph.D. of Candidate)*

Abstract

Experiments were conducted under laboratory and field conditions to find out the antifeeding, repellent and insecticidal efficacy of ten naturally occurring indigenous plant extracts Viz., alcoholic extract of *Acorus calamus* Linn.,*Adhatoda vasica* Nees. *Allium sativum* Linn.,*Cleome monophylla* Linn.. *Curcuma domestica* Val. *Lantana camara* Linn., *Momordica charantia* Linn.., *Nigella sativa* Linn., *Ricinus communis* Linn.and *Vitex nugendo* Linn,. with control (benzene + emulsified water) were tested to find out their comparative phagoantifeeding effects was worked against third instars larvae of cabbage butterfly, *Pieris brassicae* Linn. It is evident that *Adhatoda vasica* . was more effective and *Lantana camara*, the least. On the basis of their order of merit and Ec_{50} phagoantifeeding result is summarized as under viz., *Adhatoda vasica > Acorus calamus >Vitex nugendo >Nigella sativa > Ricinus communis > Momordica charantia > Curcuma domestica > Cleome monophylla> Allium sativum >Lantana camara* and the order of merit being : 1.000 > 1.332 > 1.473 > 1.576 > 1.728 > 2.332 > 2.805 > 3.134 > 3.218 > 3.233 , times less protective, respectively as *Adhatoda vasica* taken as unit.It is evident that *Adhatoda vasica* . was more effective and *Lantana camara*, the least.

Keywords: phagoantifeedant, *Adhatoda vasica, Acorus calamus, Vitex nuge, Pieris brassicae*

Introduction

The cabbage butterfly, *Pieries brassicae* Linn. is sporadic in nature has been in regular occurrence in northern Indo- Gangatic reigion , causing considerable damage to cruciferous crops and vegetables in our country (Atwal and Pazni 1964, Marini-Bettolo 1977, Butani *et al.* 1977, Ahmed and Bhattacharya 1991). The pest is distractive in its nymphal and adult stages. The damaged plant shows stunty growth and results in deterioration of yield. cabbage butterfly, *Pieries brassicae* Linn. is a most damaging pest of cruciferous plants, viz. mustard, cabbage, cauliflower, turnip, radish, rapeseed etc. The larvae feed and causing enormous destruction by making holes in the leaves (Wawrzyniak, M. (1996). *P. brassicae* with other pest of cole crops cause damaged which costing up to 1 billion US$ per year in damage and control costs.

1. Introduction:

Insecticide application against the larval stage of *P. brassicae* is the primary method of control, but high tolerance to most insecticides and associated environmental problems may jeopardize their continued use. Long-term use of broad-spectrum pesticides may result in outbreaks of pests by destruction of their natural enemies. These drawbacks of synthetic pesticides have increased consumers" and growers" interest in natural insecticides originating from plants and their usage has increased in recent years. Hence, it is needed to be control to this pest through indigenous naturally occurring ecofriendly plant origin insecticides. This paper, therefore, provides information of effectiveness of various cole crops and plant extracts concentrations on this pest.

Table : List of Plants extract for their use in proposed study

Sr. No.	Botanical Name	Common Names	Family	Part Used
1.	*Acorus calamus* Linn.	Sweet rush	Araceae	Rhizome
2.	*Adhatoda vasica* Nees.	Pavettia	Acanthaceae	Leaves
3.	*Allium sativum* Linn.	Garlic	Liliaceae	Leaves
4.	*Cleome monophylla* Linn..	Hulhul	Capridaceae	Seeds
5.	*Curcuma domesticus* Val.	Turmeric	Zingeberaceae	Rhizome
6.	*Lantana camara* Linn.	Aripple	Verbenaceae	Aerial Part
7.	*Momordica charantia* Linn.	Bittar Guard	Cucurbitaceae	Unripe fruit
8.	*Nigella sativa* Linn.	Cumin	Ranunculaceae	Seeds
9.	*Ricinus communis* Linn.	Castor Bean	Euphorbiaceae	Seeds
10.	*Vitex nugendo* Linn.	Lagundi	Verbenaceae	Leaves

2. Materials and Methods:

2.1. Extraction of Selected Plant Materials:

In the present investigation alcoholic extract of Acorus calamus Linn.,Adhatoda vasica Nees. *Allium sativum* Linn.,*Cleome monophy*lla Linn.. *Curcuma* domesticus Val. *Lantana camara* Linn., *Momordica charantia* Linn.., *Nigella sativa* Linn., *Ricinus communis* Linn.and *Vitex nugendo* Linn,. were prepared with the help of the soxhlet apparatus under the laboratory conditions.

2.2. Preparation of 50 Percent Stock Solution From Pure Extract:

50ml. Extract in each case was taken into reagent bottle and 50ml. Benzene was added in it to dissolve the constituents of the materials. This was the 50 percent stock solution, the mouth of the bottles were stopped with airtight corks and kept in refrigerator.

2.3. The Insecticidal Formulations:

The different concentrations of the insecticides were prepared from the stock solution using benzene as solvent and Triton X-100 as emulsifier. The level of solvents and emulsifier were kept constant at the rate of 5 per cent and 0.5 per cent, respectively, in the final spray.

2.4. Preparation of 0.5 Per cent Emulsifiable Water:

0.5 ml. of Triton X-100 was accurately measured into a large bottle with the help of a measuring cylinder, then 99.5 ml of distilled water was added and bottle was shaken well to dissolve the emulsifier. Thus emulsifiable water of 0.5 per cent strength was obtained and used for the preparation of different concentrations of the extracted materials (Schmidt and El ,1997).

2.5.Preparation of Concentrations :

To make various concentration of extract the required quantity of the 50 percent stock solution was calculated with the help of following formula:

$$\text{Amount of Stock} = \frac{\text{Amount required} \times \text{Concentration required}}{\text{Concentration of Stock Solution}}$$

Solution

The calculated amount of various ingredients required to make different concentrations from the 50 per cent stock solution and amount of ingredients taken are presented in the following table:

Table No. 2: Preparation of different formulations of the selected plant materials:

Concentration (%)	Amount of Stock Solution (ml)	Amount of Benzene (ml)	Amount of Emulsifiable Water (ml)	Total Amount (ml)
0.25	2.50	22.50	475.00	500.00
0.50	5.00	20.00	475.00	500.00
1.00	10.00	15.00	475.00	00.00
1.50	15.00	10.00	475.00	500.00
2.00	20.00	5.00	475.00	500.00

2.5.Experimental Protocol:

For phagoantifeedant assessment five square cm. area of mustard / cabbage leaves was cut and dipped in the different concentrations of the extracts. The leaf pieces fastened under clip and left under electric fan for about thirty minutes, so as to complete dry up the extract. In each set of extract, one control was kept in which the leaf pieces were dipped in Benzene + emulsified water only. The treated pieces were kept in petridishes on moist filter papers and 3^{rd} instar 24 hrs. starved larvae of cabbage butterfly, *Pieris brassicae* Linn. were released in each petridish to feed for 24 hours. The area consumed by the larvae in each replication was measured with the help of "Plainimeter". All the comparisons were made with control. Three replications of each treatment were done.

2.6. Statistical Analysis:

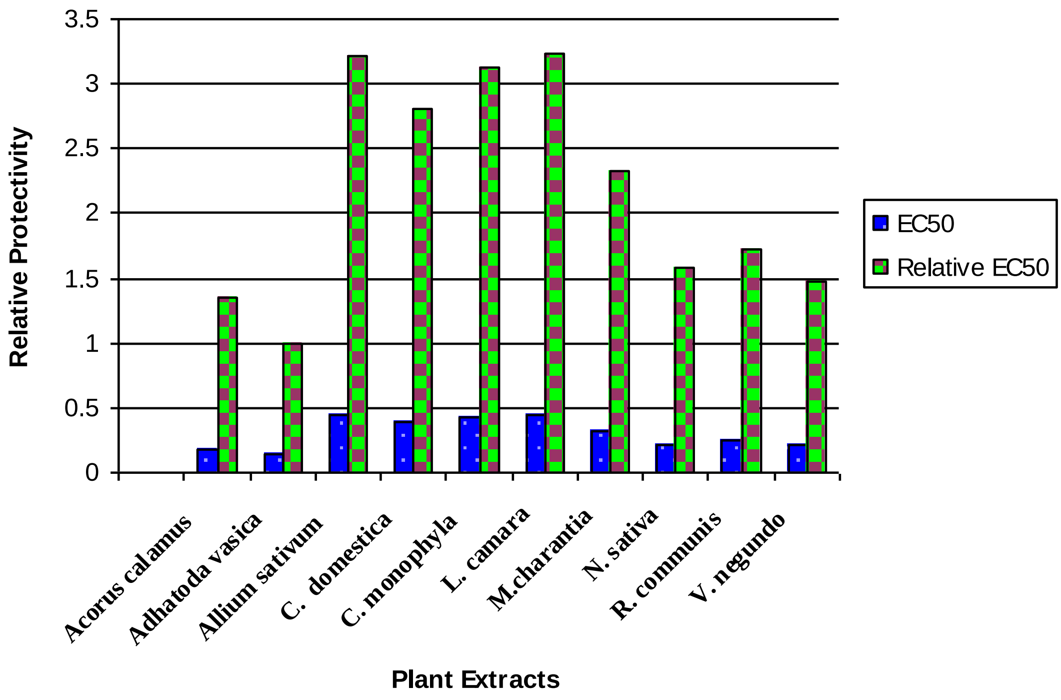
The data of leaf area consumed by the starved larvae in each replication was bulked. From these value the percentage of leaf area protected over control was calculated with Abbott formula (1925). For each treatment, the data then was subjected to Probit analysis (Finney, 1952) and the results were compared on the basis of respective, EC_{50} values (Godin *et al.*1965).

Table 3 : Calculation of log conc./Probit Protection Regression column.
(Summary of used plant extracts as phagoantifeedant on *Pieris brassicae* Linn

Plant Extracts	Hetero G genecity	X^2	Regression Equation	LC_{50}	Fiducial Limit	Relative EC_{50}
Acorus calamus	3	0.35	Y=1.8X+2.65	0.1850	M1=0.0102 M2=0.0301	1.342
Adhatoda vasica	3	0.28	Y=0.61X+4.13	0.1378	M1=1.6295 M2=1.0877	1.000
Allium sativum	3	1.17	Y=2.72X+0.58	0.4467	M1=1.6003 M2=0.0336	3.218
C. domestica	3	0.77	Y=0.89X+2.40	0.3894	M1=1.5865 M2=0.1390	2.805
C. monophyla	3	1.29	Y=1.79X+2.09	0.4351	M1=0.0211 M2=0.0955	3.134
L. camara	3	1.17	Y=2.8X+0.60	0.4488	M1=0.1608 M2=0.0344	3.233
M.charantia	3	0.23	Y=1.9X+3.471	0.3238	M1=1.8139 M2=1.2065	2.332
N. sativa	3	0.42	Y=0.53X+1.41	0.2188	M1=1.0234 M2=0.0202	1.576
R. communis	3	0.88	Y=0.84X+3.84	0.2399	M1=1.7533 M2=1.0066	1.728
V. negundo	3	0.35	Y=0.45X+2.96	0.2045	M1=1.7552 M2=0.9345	1.473

In case of X^2 was found non significant heterogeneous at P=0.05, Y=Probit Antifeedancy, X=Log Concentration X 10, D.F.=Degree of Freedom, $E.C._{50}$= Concentration Calculated at given 50% Antifeedancy

Fig. 1 :Log conc./Probit Protection Regression column plant extracts as phagoantifeedant against *Pieris brassicae* Linn



3. Result and discussion:

The summary of result of antifeeding test and relative protectivity on the basis of Ec_{50} values of selected plant extract against third instar larvae of cabbage butterfly, *Pieris brassicae* Linn, is shown in table -1. It is evident that *Adhatoda vasica* . was more effective and *Lantana camara*. the least. The data depicted in table 3 indicated that maximum relative adults repellency was found in following order of effectiveness in descending order as: *Adhatoda vasica > Acorus calamus >Vitex nugendo >,Nigella sativa > Ricinus communis > Momordica charantia > Curcuma domestica > Cleome monophylla> Allium sativum >Lantana camara* and the order of merit being : 1.000 > 1.332 > 1.473 > 1.576 > 1.728 > 2.332 > 2.805 > 3.134 > 3.218 > 3.233 , times less protective, respectively as *Adhatoda vasica* taken as unit.It is evident that *Adhatoda vasica* . was more effective and *Lantana camara*, the least.

Various botanical products and their extractives works as repellent and has been reported by several researchers against pulse beetle. Different oils of neem, coconut, and castor was observed as surface protectants on green gram to check the pulse beetle and among them neem oil was the best surface protectant (Pandey *et al.* 1976, Jilani *et al.* 1988 and Ketker 1989).

Cotton seed, sunflower, groundnut, soybean and mustard oils, when mixed with cowpea, completely suppressed adult emergence of *C. maculatus* (Ramzan, 1994). The edible oils are potential control agents against *C. maculatus* and can play an important role in stored-grain protection (Shaaya *et al.*1997). Neem and sesame oils completely inhibited adult emergence and appeared to be most promising as a seed protectant against *C. chinensis* (Ahmed *et al.* 1999) It has been observed that the volatile oil from the leaves of *Curcuma domestica* could effectively protect the seeds, against *C. chinensis*, at a low concentration (Yalamanchilli and Punukollu 2000) . Neem extractives and their isolates biobit and biolop tested against various crop pest and stored grain insect-pest and reported as promising repellency to the *C. chinensis*, (Sighamony *et al.* 1984, Maredia *et al*. 1992, Won-Sik *et al.*2002) Several workers were tested a number of indigenous plants extractives, derivatives for their repellent activity to their test insect and found significant results when mixed with different varieties of gram seeds against pulse beetle.(Abubakar*et al.*2000, Tripathi *et al.*2000).

4. Acknowledgement:

The authors are thankful to Head, Department of Zoology,and Principal, D.B.S.College, Kanpur for providing the necessary facilities. Prof. R.A.Tripathi, Retd., Head, Division of Entomology, C S Azad University of Agriculture and Technology, Kanpur for rendering their support and help for the completion of this work.

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