The Asian Journal of Animal Science (December 2009 to May 2010) Vol. 4 Issue 2 : 167-170

RESEARCH PAPER

Insectisidal activity of *Euphorbia hirta* against *Callsobruchus chinensis*

R.K. DIWAN AND R.C. SAXENA

Accepted : August, 2009

See end of the article for authors' affiliations

Correspondence to :
R.K. DIWAN
Ayurvedic Drug Research Laboratory, S.S.L.Jain P.G. College, VIDISHA (M.P.) INDIA

ABSTRACT

Euphorbia hirta which is commonly known as "Dhoodhi" is small herb which gives milky latex. The plant extract in water and alcohol gave 24hr. LC50 value against *Callsobruchus chinensis* as 1.05 and 1.33%.Lethal concentration which caused 100% mortality 3% and above. The grub of *Callsobruchus chinensis* infesting *Cajanus cajan* seed when treated with five different concentrations ranging from 1 to 5% protected the loss in seed weight from the larvae of *Callsobruchus chinensis* which is the most feeding stage of stored grain pest.

Key words : Insecticidal activity, *Euphorbia hirta*, Phytopharmacology, Chromatographic separation, *Callsobruchus chinensis*

The attack on the stored grains by the insects results grains damage when the pulses and grains are kept in the godowns. This damage is considered detrimental to mankind. With the invention of synthetic insecticides in late 1940, attempts were made to irradiate pest species but due to excessive use of synthetic pesticides and there side-effects to the human population, it was thought important to work out some botanical insecticides as an alternative to synthetic pesticides. The major advantage of botanical derivatives is being biodegradable and safe to the non-target organism. Islam (1987), Singh and Agrawal (1988), Kamal and Mangla (1988), Mishra (1996), Dwivedi and Bhati (2006) and Diwan and Saxena (2008) have reported the effect of various plant products against *Callsobruchus chinensis*. Pulses, the essential constituents of human diet, are major sufferer of attack of stored grain pests. The female lays eggs on the surface of the pulse grain and after hatching, the grub bores inside the seeds. The damage of seed is caused by the grub which feeds upon cotyledons and therefore depleting the quantity and quality of the economically important grains of the human food. Therefore, in the present study, an effect was made to isolate a biologically active principle and to test its efficacy for insecticidal property against important and serious pest of *Cajanus canjan* (pigeonpea), *Cicer arietinum* (chickpea) and other pulses.

MATERIALS AND METHODS

Plant material :

Ephorbia hirta L. of family Ephorbiaceae was collected from near the railway line at Rangai, Vidisha district of M.P. The collection was made in winter season. The plant parts were dried in shed for 30 days at Pest Control Laboratory, S.S.L. Jain P.G. College, Vidisha. After identification from the Botany deptt. of S.S.L. Jain P.G. College, Vidisha, a voucher specimen was preserved in the laboratory.

The whole plants of *Euphorbia hirta* were washed thoroughly and then air dried at room temperature (30 $+2^0$ C) for more than a month. The thoroughly air dried plants grinded to powder about 40 – 60 mesh size, weighed and stored in plastic bottles for further use.

Culture of bruchus :

The initial culture of experimental insect, *Callsobruchus chinensis* was obtained from laboratory stock. The insects were reared in the pre- sterilized jars containing disinfected green gram seeds in a glass jar (15.5 ×10.5 cm) under controlled conditions (temp. 26±1^{0}C and RH 60±5 %) in the insectary at Pest Control Research Laboratory, Vidisha.

Experimental bioassay:

For insecticidal activity to the pulse beetles, 5 different concentrations of acetone, petroleum ether and alcohol extract of *Euphorbia hirta* was used against newly emerged beetles in a glass vial of 100ml capacity. A uniform film of the extract was made by rolling the vials. The observations were recorded every 24 hrs. duration and mortality was counted and biostatical analysis was carried out (Finny, 1971).

RESULTS AND DISCUSSION

The results obtained from the present investigation

are summarized below :

Phytopharmocological observations:

The plant (*Euphorbia hirta*) after shed drying showed 20% loss in weight as indicated in Table 1. The powdered material when soxhalated in different solvents of increasing order of polarity gave maximum yield of crude material in water extract which accounted 7.66%. This was followed by chloroform extract where the yield recorded 3.21%. The alcoholic and n-hexagane extract showed 2.6% yield in each (Table 2).

Ash content value was also determined which is mentioned in Table 3. The chromatographic separation of alcoholic extract of *Euphorbia hirta* was also carried out and R*f* value of each spot obtained was recorded and compared with authentic marker (Table 4). The detail structure of the compound could not be determined.

Biostatical analysis was carried out by using probit analysis method of Finney (1971).The results shown in Table 4 gave the biostatical evaluation of experimental data of alcoholic extract of *Euphorbia hirta*. The result showed 24 hrs. LC_{50} value 1.05% whereas the Chi-square test the value was found to be 1.910.

The Regression equation value was 9.32+3.56*. The standard error of the experimental data was found to be ±0.019. The results therefore showed significant difference over control P<0.05.

Lethal concentration as appeared from Table 5 and 6 was 3%. 2% concentration showed 83.3% mortality to the treated insects. Similarly, aqueous extract of the plant gave 1.33% LC_{50} value against *Callosobruchus chinensis*. Present results are quite comparable with the results of Saxena and Saxena (2000) who have repoted 100% mortality at 2% concentration of petroleum ether

Table 1 : Percentage loss in water

Wet weight of the plant	Dryweight of the plant	Total weight loss in after drying	Percentage of weight loss
1550 g	1240 g	310 g	20%

Table 2 : Percentage yield of E*uphorbia hirta* by soxhlet apparatus in different solvents

Sr. No.	Solvent used	Weight of plant material powder	Temperature	Weight of extract	Percentage yield
1.	n-haxane	200 g	40^0 C	5.62 g	2.62 %
2.	Chloroform	200g	40^0 C	6.42 g	3.21 %
3.	Ethyle acetate	200 g	40^0 C	2.85 g	1.42 %
4.	90% alcohol	200g	40^0 C	5.30 g	2.65 %
5.	Water	200g	40^0 C	15.3 g	7.66 %

Table 3 : Showing Ash content of *Euphorbia hirta*

Weight of plant powdered material	After burning weight of ash content	% loss ash content	Acid soluble	Water soluble
250 g	25 g	90 %	18 %	82 %

Table 4 : Different fractions isolated from 90% alcohol extract of *Euphorbia hirta*

Solvent	Fraction code	Weight of fraction(mg)	Characteristic and biological active fraction
MeOH-H_2O (13:7)	A	55.3	On TLC four spot, rechromatographed. Fraction E_1- light yellow green (2 mg) R *f* = 0.60 found effective against the mosquito.
H2O-n-B40H (1:1)	B	25.4	Negligible amount obtained on rechromatography hence, not tested.
EtoAC-acetone (4:1)	C	60.2	On TLC three spots obtained out of which fraction E_3- yellow (6.2 mg) Rf=0.60 found much effective on the mosquito.
Haxane-Me2 O (4:1)	D	12.5	Negligible amount obtained on rechromatography.Hence, not tested.
n-B4OH-H_2O (1:1)	E	20.5	On TLC three spots obtained,rechromatographed. Fraction E_5- light green , Rf =0.55 showed some biological activity as compared to fraction E_1 and E_3.

Amount of crude 90% alcohol extract=500 mg
Amount of silica gel packed in glass column=11.875 g

Table 5 : Statistical analysis of data of alcoholic extract of *Euphorbia hirta* against *Callsobruchus chinensis*

Conc. of JHA%	24 hrs. Adult mortality %	Regression equation (y=a+bx)	Regression Co-efficient (b)	Heterogenicity $X^{2(n-2)}$	LC_{50} %	LC_{90} %	Variance	95% confidence fiducial limit log value
1.0	46.66	Y= -9.32+3.56x	3.56	1.9104 (3)	1.05	2.29	0.001817	Upper = 4.1335 Lower=3.9664
1.5	68.66							
2.0	83.33							
2.5	91.33							
3.0	98.33							
Control	0.00							

SD=√V X^2 = 1.91, P<0.05
SE=SD/ (√n) SE=±0.019, Y = 0.95

Table 6 : Statistical analysis of aqueous extract of *Euphorbia hirta* against *Callsobruchus chinensis*

Conc. of JHA %	24 hrs. adult morality %	Regression equation (y=a+bx)	Regression co-efficient (b)	Heterogenicity $X^{2(n-2)}$	LC_{50} %	LC_{90} %	Variance (v)	95% confidence fiducial limit log value
1.0	31.66	Y= - 10.39+3.73x	3.73	3.389(3)	1.33	2.80	0.001434	Upper = 4.2242 Lower = 4.0757
1.5	53.33							
2.0	71.66							
2.5	83.33							
3.0	95.00							
Control	3.33							

SD=√V X^2 = 3.389, P<0.01
SE=SD/(√n) S.E.= ± 0.0169, Y = 0.96

extract of *Piper nigrum.*

Dilwari *et al.* (1991) have also observed 100% mortality after 4 days when treated with the plant extract. Prakash *et al.* (1990) also showed efficacy of seed oil of *Azadirachta indica* and *Piper nigrum* on reduction of adult population. It was observed in the present study, when seeds of *Cajanus canjan* treated with different concentrations of plant extracts, the egg did not emerge into the larva or grub which is the most voracious stage of *Callsobruchus chinensis* and this reduced the loss in seed weight showing insecticidal and protactant activity.

These results are in accordance with that of Saxena *et al.* (1992) who have reported insecticidal action *Lantana camara* against *Callsobruchus chinensis*. Babu *et al.* (1989) and Gupta *et al.* (1991) have also similar observations against cowpea seeds protactant activity using *Ricinus communis* extract. Dwivedi and Garg (2001) have also recorded larvicidal properties of *Tagetes indica* against stored grain pest.

On the basis of observation, it may be concluded that *Euphorbia hirta,* which is a medicinal plant also possesses some toxic compounds which are insecticidal in action.

Acknowledgement :

Authors are thankful to the Department of Higher Education, Govt. of M.P. Both the authors express thanks to S.A.I.F., C.D.R.I., Lucknow for spectral analysis.

Authors' affiliations

R.C. SAXENA, Pest Control and Ayurvedic Drug Research Laboratory, S.S.L. Jain P.G. College, VIDISHA (M.P.) INDIA

REFERENCES

Babu,T.R.,Reddy,V.S. and Hussaini, S.H. (1989). Effect of edible and non-edible oils on the development of the pulse beetle (*Callsobruchus chinensis* L.) and on viability and yield of mungbeans (*Vigna radiata*(L) Wilezek). *Tropical Sci.*, **29** : 215-220.

Dilwari,V.K., Dhaliwal,G.S. and Mashal, M.S.(1991). Toxicity of Allylysothiocyanate to rice Weevil *S. oryzae*. *J. Insect Sci.*,**4** (1) : 101-102.

Diwan R.K. and Saxena, R.C. (2008). Effect of Sesquiterpene lectone on the control of *Callsobruchus chinensis* Linn. *Bioscience,Biotech. Res.,Asia.*153-155.

Dwivedi, S.C. and Bhati, Padma Chand (2006). Antifeedent properties of four plant extracts against pulse beetle, *Callsobruchus chinensis* (L). *National J. Life Sci.,* **3**(2) : 159-162.

Dwivedi, S.C. and Garg, S. (2001). Comparative efficacy of various botanical extract as larvidices against rice moth, *Corcyra cephalonica* (Lepidoptera:Pyrilidae): *Indian Envion. & Ecoplan.*, **5**(1): 185-188.

Finney, D.J.(1971). *Probit analysis*,III Edn. London Combridge University Press pp. 1-333.

Gupta, H.C., Bareth, S.S. and Sharma, S.K.(1991). Efficacy of edible and non-edible oils against pulse beetle(*Callsobruchus chinensis* (L))on storage pulses and their effect on germination. *Agric.Biol. Res.*, **7**(2):101-107.

Islam, B.N. (1987). Use of some extracts of Meliaceae and Annonaceae for control of rice hipta, *Dicladispa argimera* and the pulse beetle, *Callsobruchus chinensis*. In Proceeding of third International Neem Conference,Nairobi, Kenya, July 1986 (*ed. Schmutterer, H. and Ascher, K.R.S*) pp. 217-242.

Kamal, R. and Mangla, M.(1988). *In vivo* and *in vitro* investigation on rotenoids from *Indigofera tinctoria* and their bioefficacy against the larvae of *Anopheles stephensi* and adult of *Callsobruchus chinensis*. *J. Biosci.*, **18**(1) : 101.

Mishra, N.C. (1996), Management of *Callsobruchus chinensis* on black gram during storage using botanical insects :*Envr.,* **1**(4) :12-13.

Prakash,A., Rao,J., Gupta,S.P. and Behra, J. (1990). Evaluation of botanical pesticides as grain protactant against rice weevil, *S.oryzae*. Proc, Symp. Botanical Pesticides in IPM Rajahmundry, pp. 360-365.

Saxena, R.C., Dixit, O.P. and Harshan, V.(1992). Insectcidal action of *Lantana Camara* against *Callsobruchus chinensis* (Coleopltera : Bruchidae). *J. Stored Product Res.*, **28**(4) : 279-281.

Singh, Dad and Agrawal, S.K.(1988). Himachalol and beta limchalene insecticidal principles of Himalayan cedarwood oil. *J. Chem. Ecol.,* **14**(4) :1145-1152.

****
*****