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Antifeedant Biopotency of certain indigenous naturally occurring plant extractives against Bihar hairy caterpillar, *Spilarctia obliqua* Walk. (Lepidoptera: Arctiidae).

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*(*A part of Ph.D. Thesis of the candidate)*

Abstract:

Experiments were carried out for testing the antifeeding effect of different plant extracts viz: leaves of *Adhaloda vasica* Nees, *Annona reticulata* Linn, *Momordica charantia* Linn, *Ocimum canam* Sims, *Pongamia* glabra Vent, *Solanum nigr*um Linn, *Withamnia somnifua* Deen, Bulb of *Allium salivum* Linn, Seeds of *Cleome monoplylla* Linn, Rhizome of *Curcuma domesticus* Val., *Zingiber officinatis* Rose, Arial parts of *Lantana camara* Linn, Unripe fruits of *Piper nigram* Linn. against third instar, 24 hrs. starved *Spilarctia obliqua* larvae under laboratory trial. Fifteen square centimeters area of mustard leaves were cut and dipped in the desired concentration (0.5 per cent, 1.0 per cent, and 2.0 per cent) of each extract and one control was introduced, where leaf pieces were dipped in benzene + emulsified water. The treated leaf pieces were kept in petridishes on moist filter paper and the larvae were released for 24 hours. The leaf area consumed by the larvae in each replication was measured. It is obvious from the results, that all the used extracts for the antifeeding have good protection power against the larvae of *Spilarctia obliqua*, when compared with the control. However, they varied greatly among themselves for their effectiveness. Among all thirteen plant extracts, *Adhatoda vasica* Linn. and *Cleoma monophylla* Linn. had promising protective power than the other plant origin insecticide. The sequence of protection can be arranged in the following descending order on the basis of their respective EC_{50} values i.e. *Adhatoda vasica* > *Cleoma monophylla* > *Momodica charantia* > *Annona reticulata* > *Pongamia glabra* > *Withamnia somnisera* > *Solanum nigrum* > *Lantana camara* > *Zingeber officianalis* > *Allium sitivum* > *Ocimum canum* > *Curcuma domesticus* and their order of merit of EC_{50} being: 0.0182 > 0.0218 > 0.1622 > 0.1894 > 0.2188 > 0.2399 > 0.3236 > 0.3454 > 0.3455 > 0.3754 > 0.4744 > 0.4571 > 0.9451 respectively ,

as *Curcuma domesticus* was taken as unit.

Keywords: *Adhatoda vasica, Cleoma monophyl*la, Antifeedant biopotncy and *Momodica charantia*

INTRODUCTION:

Indians are mostly vegetarian and vegetables play an Important role in human diet, supplying some of nutrients, which are important source of mineral elements and vitamins. Family cruciferae and malvaceae provides some valuable vegetable and oil yielding crop like

mustard, *Brassica juncia* (Linn.) Czern & Cross*, Brassica carinata* Braun. *Brassica campestris* Linn., *Brassica napus* Linn., raddish, *Raphnous sativous* Linn.*,* cabbage, *Brassica oleracea* var. *capitata,* okra, *Abelmoschous esculentous* Linn. brinjal, *Solanum melongena* Linn. etc. particularly in all places. (Rai, 1976, DOR, 2003, Jha and Siddiqui 2005). The Bihar hairy caterpillar, *Spilarctia obliqua* Walk.. though sporadic in nature has been in regular occurrence, causing considerable damage to cruciferous crops and vegetables in our country (Arun Kumar *et al*. 1979, , Pandey *et al.* 1982, Ahmed and Epen 1991, Parmar and Devaumar 1993, Khan and Patel 2002, Chandel, *et al.* 2004, Dubey *et al.*2004).

Application of synthetic insecticides played a significant role in restricting, many pest problems. But excessive use of pesticides promotes faster evolution of resistant forms of pests, destroys natural enemies, turns formerly innocuous species in to pests, harms other non-target organisms and contaminates food. (Parmar and Deva Kumar, 1993; Marini-Bettolo, 1977).World health organization estimated about one million pesticides because poisoning to human and domestic cattle and twenty thousand deaths over every year globally.

Keeping aforesaid discussion into focus, attempts have been made to review the insect pest problems of vegetables and crop critically, assemble and consolidate available information together to synthesize integrated management modules with particulars emphasis on the search of new alternative to the synthetic chemicals with satisfactory properties, concerning their effect on the target pest as well as environment. The phytochemicals, which are having antifeeding, repellent, host preference and insecticidal activity, is preferred over synthetic insecticides.

Therefore, the present investigation was aimed to understand the antifeedant bioefficacy of the certain indigenous plant extract against polyphagous insect, Bihar hairy caterpillar of *Spilarctia obliqua* Walk. (Lepidoptera: Arctiidae) as this information will help to develop a sowed insect pest management programme.

MATERIALS AND METHODS:

In the laboratory, the experiments were carried out for testing the antifeeding effect of thirteen different plant extracts to third instar, 24 hrs. starved *Spilarctia obliqua*

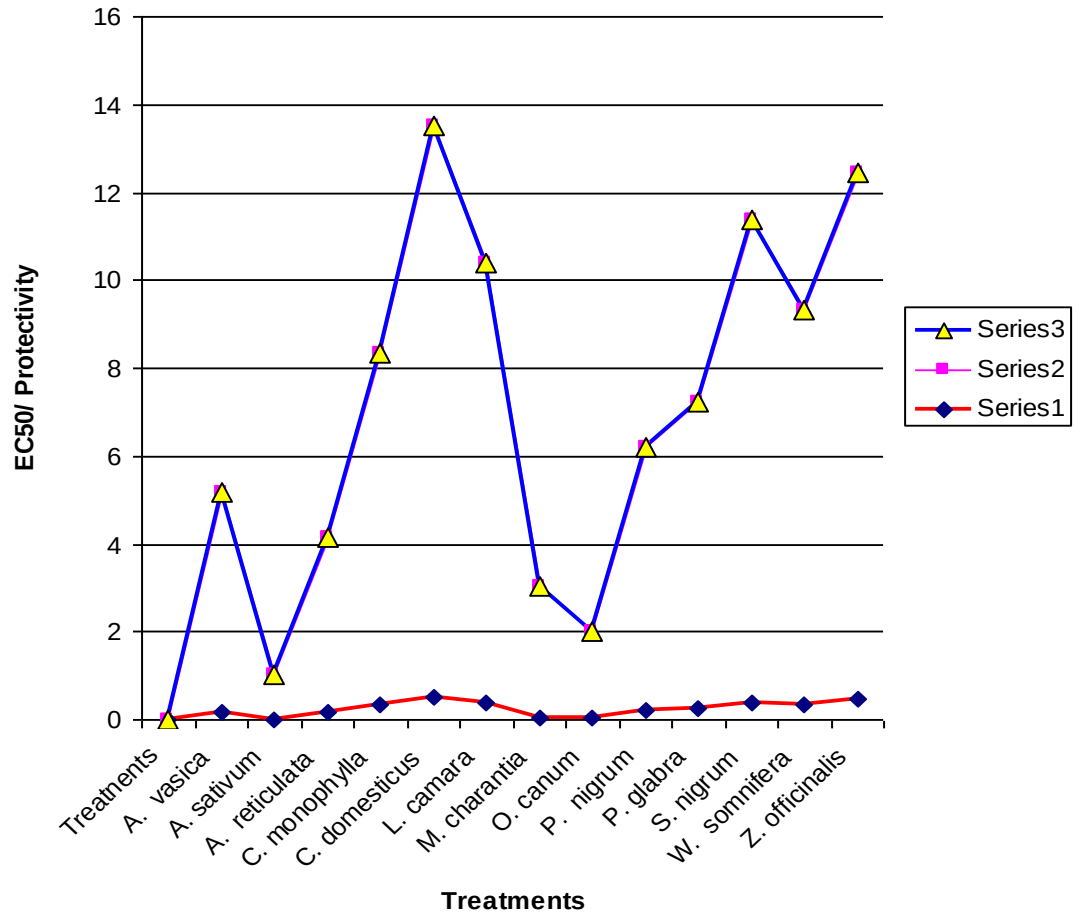
larvae. Fifteen square centimeters area of mustard leaves were cut and dipped in the desired concentration (0.5 per cent, 1.0 per cent, and 2.0 per cent) of each extract. The leaf pieces were fastened with the help of clips and left under electric fan for half an hour so as to dry up completely. In each set of different extracts, and one control was introduced, where leaf pieces were dipped in benzene + emulsified water. The treated leaf pieces were kept in petridishes on moist filter paper and the larvae were released for 24 hours. The leaf area consumed by the larvae in each replication was measured with the help of "planimeter" The EC_{50} values on the basis of leaf area protected over control was calculated in each treatment.

Table 1: Log conc./Probit Protection Regression column plant extracts on *Spilarctia obliqua*

Treatments	H*	X^2	Regression Equation	EC_{50}	Fiducial Limit	Relative EC_{50}
Adhatoda vasica	3	1.17	Y=2.8X+0.60	0.1894	M1=0.1608 M2=0.0344	V
Allium sativum	3	0.28	Y=0.61X+4.14	0.0182	M1=1.6295 M2=1.0877	I
Annona reticulata	3	0.35	Y=0.45X+2.96	0.1622	M1=1.7552 M2=0.9345	IV
Cleome monophylla	3	1.17	Y=2.72X+0.58	0.3236	M1=1.6003 M2=0.0336	VII
Curcuma domesticus	3	1.88	Y=0.84X+3.84	0.5020	M1=1.7533 M2=1.0066	XII
Lantana camara	3	0.35	Y=1.8X+2.65	0.3754	M1=0.0102 M2=0.0301	XI
Momordica charantia	3	0.77	Y=0.89X+2.40	0.0398	M1=1.5865 M2=0.0377	III
Ocimum canum	3	0.42	Y=0.53X+1.41	0.0218	M1=1.0234 M2=0.0202	II
Piper nigrum	3	0.40	Y=0.50X+3.17	0.2188	M1=0.1280 M2=1.3265	VI
Pongamia glabra	3	1.52	Y=2.1X+1.36	0.2399	M1=1.5155 M2=0.4061	VII
Solanum nigrum	3	0.77	Y=0.89X+2.40	0.3894	M1=0.2968 M2=0.1390	X
Withamnia somnifera	3	0.23	Y=1.9X+3.471	0.3439	M1=1.8139 M2=1.2065	IX
Zingiber officinalis	3	1.29	Y=1.79X+2.09	0.4571	M1=0.0211 M2=0.0955	XII

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 Line, Antifeeding test against *Spilarctia obliqu* a Walker



RESULT AND DISCUSSIONS:

Findings of antifeeding effect of thirteen different plant extracts against third instar, 24 hrs. starved *Spilarctia obliqua* larvae under laboratory trial. It is obvious from the results, that all the used extracts for the antifeeding have good protection power against the larvae of *Spilarctia obliqua*, when compared with the control. However, they varied greatly among themselves for their effectiveness. Among, thirteen plant extracts, *Adhatoda vasica* Linn. and *Cleoma monophylla* Linn. had promising protective power than the other plant origin insecticide. The sequence of protection can be arranged in the following descending order on the basis of their respective EC_{50} values i.e. *Adhatoda vasica* > *Cleoma monophylla* > *Momodica charantia* > *Annona reticulata* > *Pongamia glabra* > *Withamnia somnisera* > *Solanum nigrum* > *Lantana camara* > *Zingeber officianalis* > *Allium sitivum* > *Ocimum canum* >

Curcuma domesticus and their order of merit of EC_{50} being: 0.0182 > 0.0218 > 0.1622 > 0.1894 > 0.2188 > 0.2399 > 0.3236 > 0.3454 > 0.3455 > 0.3754 > 0.4744 > 0.4571 > 0.9451 respectively , as *Curcuma domesticus* was taken as unit.

Neumerous plants have been screened for their insecticidal property. Among them more than five hundred plant species, exhibit the biological activity (Jacobson 1958, Crosby 1966, Bhuyan 1968, Jacobson 1975, Ahuja and Sehgal 1982, Secoy and Smith 1983, Bhuyan 1971, Gakuru and Roua 1996,Valladares and Defago 1997, Pitaswat and Choochote 1998, Banjo and Mobogunje 1999, Landolf and Hofstetter 1999, Ekesi 2000, El and El 2000, Gahukar 2000, Gupta *et al*. 2000, Jannet and Harzallah 2000, Keita and Vincent, 2000, Lale and Mustpha 2000, Misra and Singh, 2000, Musabyimana and Saxena 2000, Owalado and Osikanlu 2000, Agarwal *et al.* 2001, Kilonzo *et al.* 2001, Viji and Bhagat 2001, Bhatt and Patel 2002, Misra and Singh 2002 Rao *et al.* 2003., Anonymous 2004, Brahmaprkash *et al.* 2004, Brahmi *et al.* 2004, Bombawale *et al.* 2004, Dubey *et al.* 2004, Jayanthi and Verghese 2004, Sangwan *et al.*2004, Subhasni 2004, Singh *et al.*2005, Gupta, 2005,Karnatak *et al.* 2006, Khedkar and Gyannath 2006).Amonker and Reeves (1970) evaluated the potential deterrency exists in plants that are commonly grown as crops. Garlic, *Allium sativm* extracts showed appreciable antifeedant responses.

Verma *et al.* (1985) tested antifeeding properties of *Ocimum sanctum, neem* seed oil, *Pongamia pinnata* and rayi, *Brassica comprestis* against larvae of *Amsacta moorei*. Larvae fed only 10.57 per cent when treated with *neem* oil and 10.50 per cent with pongamia oil. Minimum effective concentration of 0.05 per cent gave 87.71 per cent *Ocimum sanctum* and 93.00 per cent larval feeding inhibitory activities.

Chandel *et al.* (1987) tested efficacy of nine plant extract viz., *Acorus calamus, Centratherum anthelmiticum, Cyprus rotundus, Gynandropsis gynandra, Nigella sativa, S. mukorasi, Solanum indicum, Strychnos nuxvomica* and *Xeromphis spinosa* against the adults of *Eplichna vigintioctopuntata. Gynandropsis gynandra* extract was found to be 20.61 times more toxic, the order of the efficacy being *A. calamus* (10.31) *C. rotundus* (4.91), *S. nuxvomica* (3.61), *S. indicum* (3.50), *N. sativa*(3.28), *X. spinosa* (1.00) and *S. mukorasi* (0.526). Rao *et al.* (1990) tested fifteen naturally occurring indigenous plant materials as antifeedant against the larvae of *H. vigintioctopunctata* Fabr. Petroleum ether extract at 0.5 to 1.00 per cent and aqueous extract at 1.00 to 5.00 per cent of the test plants and *Annona squamosa, Argemone maxicana, Calotropis gigantica, R. communis* were gave cent-percent leaf protection. Mehta and Sandhu (1992) tested the bitter guard *Momordica charantia* leaves extract against adults of red pumpkin beetle, *Aulacophora foveicollis* Lucas. In various cucurbits and were seen to be better antifeedant activity. Muthukrishanan *et al.* (1997) conducted an experiment to test the biological efficacy of partially purified extract of *Solanum suratense, Abrus precatorius, Solenum trilobatum* and *Leucas aspera* against Juveniles of *Culex quinquefasciatus*. Out of them *Solanum trilobatum* and *Lucas aspera* showed highly antifeeding and insecticidal activities. Ignacimuthu *et al.* (2006). Tested methnolic extract of *Sphaeranthus indicus* Linn. against 4^{rth} instar twenty four hours starved larvae of *Spodoptera litura* Fabr.Among the all

fractctions ,7-hydroxyfrullanoide had high antifeedant activity at 100ppm Deformities in larvae ,pupae and adults were also observe.

Pavunraj *et al.* (2006) reported that 5.00 percent hexane extract of *Exocoecaria agallocha* leaf showed the 73.08% antefeedant 83.71% oviposition deterrent and 65.0% ovicidal activities against 3rd instar larvae of *Spodoptera litura* .

REFERENCES

Arun Kumar, Tiwari, G.D. and Pandey, N.D. 1979. "Antifeeding and insecticidal properties of bitterguard, *M. charantia* against *A. proxima* Klug." *Indian J. Ent. 41* (2): 103-106.

Buiyah, I.M. and Quiniones, A.C. 1990. "Use of leaves of Lagundi, *Vitex negundo* Linn. as corn seed protectants against the corn weevil, *Sitophilus zeamais* Motsch." *Bangladesh J. Zoology, 18* (1): 127-129.

Chandel *et al.* (1987)

Faknath, S. and Kawal, D. 1993. "Antifeedant and insecticidal effect of some plant extracts on cabbage webworm, *Crocidolomia binotalis*." *Insect Sci. Applic.* 14 (5): 571-574.

Govindachari, T.R. and Suresh, G. 2000. "Insect antifeedant and growth regulating activities of neem seed oil. The roll of major tetranortriterpenoids." *Jour. Applied. Entomol.* 124 (7/8): 287-291.

Huang, R.C. and Okamura, H. 1995. "Azadirachtin, a limonoid antifeedant from *Melia azadirach." Phychemistry oxford, 38* (3): 593-594.

Huang, R.C. and Zhou, J.B. 1995. "Insect antifeedant properties of limonoides from Okinawan and Chinese, *Melia azadirach* Linn. and from Chinese *Melia too sendan (*Meliaceau)." *Bioscience biotechnology and biochemistry,* 59 (9): 1755-1757.

Ignacimuthu, S. and Paciam, S.M., Pavunraj and Selvarani, N. (2006). "Antifeedant of *Sphaeranthus indicus* Linn.against *Spodoptera litura* Fabr. " *Entomon 31* (3)37-40.

Jacob, S. and Sheila, M.K. 1994. "Studies on the antifeedant activity of some plant products against the leaf caterpillar *Selepa docilis* Bull. on brijal and wooly bear, *Pericallia ricini* Fabr. on castor." *Indian J. Ent. 56* (3): 276-279

Joshi, P.C. and Lockwood, J.A. 2000. "Antifeedant effect of aqueous extract of *neem, Azadirachta indica* A.Juss. leaves on *Oxya velox* Fabr. (Orthoptera: Acrididae)," *Jour. Agric. Urban Entomol. 17* (1): 21-26.

Juan, A. and Sans, A. 2000. "Antifeedant activity of fruit and seed extracts of *Melia azadirach* and *Azadirachta indica* on larvae of *Sesamia* nonagriodes*." Phytoparasitica, 28* (4): 311-319.

Koul, O. and M. B. Isman (1990). "Antifeedant and growth inhibitory effects of sweetflag, *Acorus calamus* Linn. oil on *Peridroma saucia* (Lepidoptera: Noctuidae)". *Insect Science And Its Application* 11(1): 47-54.

Kubo, I. and Nakanishi, K. 1979. "Insects antifeedants and repellents from African plants. In Hedin P.A. Ed. Host, plant resistance to pests. " *Acs. Symp. Ser. 62 Washington D.C.* pp. 165-179.

Meshram, P.B. and Kulkarni, N. 1996. "Antifeedant activity of *Azadirachta indica* and *Jatropha curcus* against *Papelio demaleus* Linn." *Jour. Environ. Biol. 17* (4): 295-298.

Misra, P.K. and Singh, R.P. 1992. "Antifeedant efficacy of *neem* (*Azedirachta indica A Juss.)* seed kernel, seed coat and fallen leaves extract against desert locust, *Schistocerca gragaria* Fabr." *Indian J. Ent. 54* (1): 89-96.

Muralikrishna, R. Chitra, K.C., Gunesekhar, D. and Rao., P.K. 1990. "Antifeedant properties of certain plant extract against second stage larva of *H. vigintioctopunctata* Fabr." *Indian J. Ent. 52 (*4): 681-685.

Murugan, K., Jeyabalan, D., Senthil Kumar, Babu, R.N., Shivarama Krishnan, S. and Senthil Nathan, S. 1998. "Antifeedant and growth- inhibitory properties of *neem* limonoids against the cotton ballworm, *Helicoverpa armigera* Hubner." *Insect. Sci. Applic. 18* (2): 157-162.

Park II, K., Lee, H.S., Lee, S.G., Park, J.D. and Ahn, Y.J. 2000. "Antifeeding activities of isoquinoline alkaloids identified in *Coptis japonica* roots against *Hyphantria cunea* (Lepidoptera: Arctiidae) and *Agetastica coerulea* (Coleoptera: Galerucinal)." *Jour. Econ. Ent. 93* (2): 331-335.

Sandhu, G.S. and Singh, D. 1975. "Studies on the antifeeding and insecticidal properties of *neem, Azadirachta indica* A.Juss. and d*harek, Melia Azedarach* Linn., kernel/fruit powder to *Pieris brassicae* Linn. larvae." *Indian Jour. Plant Prot.* 3 (2): 117-180.

Singh, A.N. and Kanaujia,K.R. 2003. "Residual toxicity of some biopesticides against *spilarctia obliqua* Walker on castor." *Indian J. Ent.,* 65 (2): 297-298.

Srivastava, A.S. and Awasthi, G.P. 1958. "An insecticide from the extract of the plant *Adhatoda vesica* harmless to man." *Proc. 10th Ent. Congr. Exp. 2* : 245-246.

Sudhakar, T.R.; Pandey, N.D. and Tewari, G.C. 1978. "Antifeeding properties of some indigenous plant against mustard sawfly, *Athalia proxima* Klug. (Hymenoptera: Tenthredinidae)." *Indian Jour. Agric. Sci. 48* (1): 16-18.

Suindararajan, G. and Kumuthakalaralli, R. 2001. Antifeedent activity of aqueous extract of *Gnidia glauca* Glig. and *Toddalia aseatica* Lam, on the gram pod borer, *H. armigera*(Hubn.) *J. of Envi. Biol.,* 22 (1) : 11-14.

Tripathi, A.K., Prajapati, V., Jain, D.C. and Saxena, S. 1999. "Antifeeding, oviposition deterrent and growth-inhibitory activity of *Andographis paniculata* against *Spilarctia obliqua." Insect. Sci. Applic. 19* (2): 211-216.

Verma, S.K. and Singh, M.P. 1985. "Antifeedant effects of some plant extract on *Amsacta moorei* Buttler." *Indian Jour. Agric. Sci., 55* (4): 298-299.

Verma, G. S. and U. K. Pandey (1987) "Insect antifeedant property of some indigenous plant products." *Zeitschrift Fuer Angewandte Zoologie.* 74(1): 113-116.

Yano, K. and Kamimura, H. 1993. "Antifeedant activity towards larvae of *Pieris rapae* crucivora of phenol-eather related to methyleugenol isolated from *Artemisia capillaries*." *Biosci. Biotech. And Biochem*., 57 (1) : 129-130.

Dale, D. and Saradamma, K. (1981) Insect antifeedant action of some essential oils. *Pesticides* 15, 21–2.

Jermy, T., Butt, B.A., McDonough, L., Dreyer, D.L. and Rose, A.F. (1981) Antifeedants for the Colorado potato beetle–I. Antifeeding constituents of some plants from the sagebrush community. *Insect Science and its Applications* 1, 237–42.

Table 1: Log conc./Probit Protection Regression Line of Antifeeding test to *Spilarctia obliqua* Walker

Treatments	EC_{50}	Merit of Protectivity
Adhatoda vasica	0.1894	5
Allium sativum	0.0182	1
Annona reticulata	0.1622	4
Cleome monophylla	0.3236	8
Curcuma domesticus	0.5020	13
Lantana camara	0.3754	10
Momordica charantia	0.0398	3
Ocimum canum	0.0218	2
Piper nigrum	0.2188	6
Pongamia glabra	0.2399	7
Solanum nigrum	0.3894	11
Withamnia somnifera	0.3439	9
Zingiber officinalis	0.4571	12