



LEAF EXTRACT OF SOME PLANTS IN BIOINTENSIVE MANAGEMENT OF INSECT PESTS ON BLACK GRAM

ABUL FAIZ* AND REZINA AHMED¹

Department of Zoology, Barama College, Barama 781346, Assam, India

¹Department of Zoology, Cotton University, Guwahati 781001, Assam, India

*Email: itzfaizhere@gmail.com (corresponding author)

ABSTRACT

This study evaluates the insecticidal potential of three locally available, less utilized plants viz. *Ipomea fistulosa*, *Annona reticulata* and *Polygonum hydropiper*. Leaf extracts of these were evaluated against four insect pests of black gram viz. *Aphis craccivora*, *Apion clavipes*, *Maruca vitrata* and *Omiodes indicata*. The results revealed that these extracts had both antifeedant activity and lethal effect. Extracts of *I. fistulosa* and *A. reticulata* were more effective.

Key words: *Vigna mungo*, *Aphis craccivora*, *Apion clavipes*, *Maruca vitrata*, *Omiodes indicata*, *Annona reticulata*, *Ipomea fistulosa*, *Polygonum hydropiper*, leaf extract, mortality, residual mortality

The North Eastern part of India including Assam is very rich in biodiversity. The tribal people and some of the rural folks of this region have developed the knowledge system of utilization of the plant resources to manage the insect pests (Barman et al., 2014; Deka et al., 2006). At present to protect the crops from the insect pests heavy use of pesticide is advocated but these often leads to hazards to plants and animals including man. Ecofriendly IPM revolves in and around the use of plant leaf extracts because these extracts are ecofriendly. The black gram (*Vigna mungo* L.) is affected by a number of insect pests in the field at all stages of growth. Information on efficacy of botanicals against insect pests of black gram is very little. Hence, this study on the efficacy of the leaf extracts of *Annona reticulata*, *Ipomea fistulosa* and *Polygonum hydropiper* leading to data on the residual and direct mortality of the four selected insect pests viz. *Aphis craccivora*, *Apion clavipes*, *Maruca vitrata* and *Omiodes indicata*.

MATERIALS AND METHODS

The experiment was carried out in a field located in the Village Dehar Kuriha in the District Kamrup (Rural) of Assam (26.3303°N, 91.5148°E) during September to November, 2016 and September to November, 2017. It was seen that some people cultivate the local variety of black gram called "Saonia mah" in paddy nursery just before few days of transplantation of rice. When the rice plant gets transplanted, only the black gram remains and thereby a mixed and sequential cropping is done which helps to fertilize the nursery field naturally by

the roots of the black gram. Such a plot was used for the experiment where no chemical fertilizer, pesticide or irrigation was practiced. The experiment was laid out in a randomized block design with 4 treatments and 5 replications. The field was divided into 5 plots and each of these subdivided into 4 blocks (4x 5 m each). The treatments were- T₁ = Leaf extract of *A. reticulata*, T₂ = Leaf extract of *I. fistulosa*, T₃ = Leaf extract of *P. hydropiper* and T₄ = Control, untreated. For extract preparation, the plants were collected locally with fresh leaves, 1 kg each, and surface dried in sun shade. These dried leaves were ground by electric grinder, then soaked in 5 l of water for 72 hr at room temperature. Then it was filtered through muslin cloth to get aqueous filtrate (Centre for Indian Knowledge system, 2011).

The efficacy of the extracts was tested for residual and direct mortality of the selected insect pests. For residual mortality test, the plots were sprayed with 1 l/ replication of the three extracts (@1 kg/ 5 l) by a sprayer, ensuring uniform coverage of the area and thus five replications were treated by each leaf extract. The field spray was done in 38th standard week, after 35 days from sowing. Data were taken from five plants from each replication by visual counting of *A. craccivora*, *A. clavipes*, *M. vitrata* and *O. indicata*, before 24 hr of spray, after 24 and after 48 hr. For direct mortality, 10 individuals of *A. clavipes* and of *O. indicata* were collected from the untreated field manually; these refrigerated for 10 min and immobilized before treating them with 1 ml solution (concentration@1 kg/ 5l) by applying on the dorsal surface of the thorax using

capillary tube. Then the insects were transferred to 9 cm dia plastic container. The experiment was replicated five times and mortality observed after 24 and 48 hr of treatment. Insects were examined daily and those that do not move or respond to gentle touch were considered dead. The data obtained were statistically analyzed, and the mean reduction of the insect pests was calculated following Fowler et al. (1998). The data obtained for residual mortality and direct mortality were analyzed in SPSS, version 24, and mean values compared by ANOVA.

RESULTS AND DISCUSSION

The mortality data shown in Table 1 reveals that extract of *A. reticulata* results in reducing *A. clavipes* by 75.51%, *A. craccivora* by 94.21%, *O. indicata* by 92.59% and *M. vitrata* by 81.25% and in a significant manner; these observations on *A. reticulata* agree with those of Rosaiah (2001) that it is highly effective against the aphids on bhendi. Ether extract of *A. reticulata* leaf against cotton aphid *A. gossypii* at Tirupathi gave 88.81 to 90.06% reduction (Chitra et al., 1997). The phytochemical screening of *A. reticulata* leaves revealed

the presence of alkaloids, tannins, steroids, terpenoids and coumarin (Rani, 2013); and these provide protection against insect attacks and plant diseases (Nithya et al., 2011). The leaf extract of *I. fistulosa* with *A. clavipes* led to 77.55% reduction and with *A. craccivora* by 95.04%, *O. indicata* by 88.89% and *M. vitrata* by 87.50%. The toxic effects of *I. fistulosa* are known (Gupta et al., 2010); it reduced the incidence of nematodes (Siddiqui et al. 1987), mosquitoes (Saxena and Sumithra, 1985) and bruchids (Pandey et al. 1976). Pandey (2015) also studied on the mortality of *Helicoverpa armigera* larvae with leaf extract of *I. fistulosa*. The leaf extracts of *P. hydro Piper* also led to such significant reductions from 62.50 to 77.78% with the four pests; and Ayaz et al. (2016) studied its chemical profiling and insecticidal properties.

After 48 hr the effect of *A. reticulata* on *A. clavipes* was 94.87% mortality and in *O. indicata* it was 97.14%, with *I. fistulosa* it was 94.87%, in *O. indicata* it was 97.14%; and with *P. hydro Piper*, on *A. clavipes*, it was 64.10% and in *O. indicata* by 60.00% (Table 1); thus *A. reticulata* and *I. fistulosa* leaf extract resulted high in mortality in comparison to *P. hydro Piper*. In a field experiment of Karkar, Korat and Dabhi (2014) observed

Table 1. Effect of leaf extracts on mortality of the selected insect pests

Treatment	Insect pests	Before 24 hr	After 24 hr	After 48 hr	F	P	Mean % reduction
Residual mortality							
1	<i>A. clavipes</i>	10.2± 1.79	3.6 ± 1.4	2.4± 0.55	55.125*	0.000	75.51
1	<i>A. craccivora</i>	26± 1.87	7.2± 0.84	1.4± 0.55	551.244*	0.000	94.21
1	<i>O. indicata</i>	6 ± 1	0.8± 0.84	0.4± 0.55	73.200*	0.000	92.59
1	<i>M. vitrata</i>	3.2± 0.84	1.4± 0.55	0.6± 0.55	20.462*	0.000	81.25
2	<i>A. clavipes</i>	11.2± 1.3	3.4 ± 0.55	2.2± 0.84	132.667*	0.000	77.55
2	<i>A. craccivora</i>	21.8± 3.27	5.8± 1.1	1.2± 0.45	144.942*	0.000	95.04
2	<i>O. indicata</i>	7.2± 0.84	1.6± 0.89	0.6± 0.55	105.444*	0.000	88.89
2	<i>M. vitrata</i>	2.6± 0.55	0.6± 0.55	0.4± 0.55	24.667*	0.000	87.50
3	<i>A. clavipes</i>	9.4± 1.14	4.6± 0.55	3.2± 0.84	68.957*	0.000	67.35
3	<i>A. craccivora</i>	21.2± 2.59	8.4± 1.67	6± 1	95.390*	0.000	75.21
3	<i>O. indicata</i>	5.6± 0.55	1.6± 0.89	1.2± 0.45	68.308*	0.000	77.78
3	<i>M. vitrata</i>	3.8± 0.84	1.6± 0.55	1.2± 0.84	17.294*	0.000	62.50
4	<i>A. clavipes</i>	9.2± 1.3	9.2± 1.48	9.8± 0.84	0.391	0.684	--
4	<i>A. craccivora</i>	25.6± 2.88	24.8± 1.92	24.2± 3.77	0.282	0.759	--
4	<i>O. indicata</i>	5.8± 0.84	5.6± 1.14	5.4± 1.14	0.182	0.836	--
4	<i>M. vitrata</i>	3± 0.71	2.8± 1.3	3.2± 0.84	0.207	0.816	--
Direct mortality							
1	<i>A. clavipes</i>	10± 0	2.6± 1.14	0.4± 0.55	237.125	0.000	94.87
1	<i>O. indicata</i>	10± 0	1.4± 0.55	0.2± 0.45	857.200	0.000	97.14
2	<i>A. clavipes</i>	10± 0	1.8± 0.84	0.4± 0.55	403.400	0.000	94.87
2	<i>O. indicata</i>	10± 0	1.4± 0.55	0.2± 0.45	857.200	0.000	97.14
3	<i>A. clavipes</i>	10± 0	5± 1	2.8± 0.84	120.118	0.000	64.10
3	<i>O. indicata</i>	10± 0	4.6± 1.14	2.8± 0.84	105.300	0.000	60.00
4	<i>A. clavipes</i>	10± 0	8.6± 0.55	7.8± 0.84	18.600	0.000	--
4	<i>O. indicata</i>	10± 0	8.2± 0.84	7± 1	20.118	0.000	--

similar results with *I. fistulosa* and *A. reticulata* against insect pests infesting brinjal. Govindarajulu et al. (2015) obtained 100% larvicidal activity of the leaf extracts of *A. reticulata* against *Aedes aegypti*; also Nayak (2014) reported similar larvicidal activity. Vanichpakorn et al. (2014) tested the ethanol extracts of *A. reticulata* seed and leaf for their toxicity and repellency against *Callosobruchus maculatus*. Kalita and Hazarika (2020) with *Sitophilus oryzae* and *Callosobruchus chinensis* obtained adult mortality with leaf powder of *P. hydropteris*; Ahad et al. (2007) also with *P. hydropteris* observed such results; and against *Tribolium castaneum* (Kundu et al., 2007) and *C. chinensis* (Mollah and Islam, 2005) such toxicity had been known. It is concluded that the leaf extracts of *A. reticulata*, *I. fistulosa* and *P. hydropteris* can be used against insect pests on black gram.

ACKNOWLEDGEMENTS

The authors thank the land owner for providing necessary facilities for conducting the research work and Principal of the College for providing the laboratory support. Dr. Ganasoundari Adikesavan of Rehoboth Academic Services, Bangalore is acknowledged for the statistical analysis.

REFERENCES

- Ahad M A, Haque M F, Akter M M, Islam M N, Rahman S A. 2007. Screening and biological activity of indigenous plant extracts against pulse beetle, *Callosobruchus chinensis* (Bruchidae: Coleoptera). International Journal of Bio-resource and Stress Management 3(2): 196-205.
- Ahad M A, Sayed M A, Siddiqui M N, Haque M M U. 2012. Evaluation of some indigenous plant extracts against pulse beetle, *Callosobruchus chinensis* (Bruchidae: Coleoptera) in stored green gram (*Vigna radiata* L.). Global Journal of Medicinal Plant Research 1(1): 33-41.
- Ayaz M, Junaid M, Ullah F, Sadiq A, Ovais M, Ahmad W, Ahmad S, Zeb A. 2016. Chemical profiling, antimicrobial and insecticidal evaluations of *Polygonum hydropteris*. BMC complementary and Alternative Medicine 16: 502.
- Barman D, Nath N, Rao S, Barman B. 2014. Bio-resource utilization in the management of insect and pest in rice cultivation by Garo Tribe of West Garo Hill District, Meghalaya. International Journal of Pure and Applied Bioscience 2 (3): 298-304.
- Centre for Indian Knowledge System. 2011. Preparation of neem biopesticides at farm level. 165-169 pp.
- Chitra K C, Rao S J, Rao P K. 1997. Efficacy of plant extracts for controlling cotton aphid (*Aphis gossypii*). Indian Journal of Agricultural Sciences 67: 134-135.
- Bhuyan M, Deka M K, Hazarika L K. 2006. Traditional pest management practices of Assam. Indian Journal of Traditional Knowledge 5 (1): 75-78.
- Fowler J, Cohen L, Jarvis P. 1998. Practical statistics for field biology, John Wiley and Sons, 2nd edition, West Sussex, England. 260 pp.
- Govindarajulu B, Srimathi A, Bhuvana R, Karthikeyan J. 2015. Mosquito larvicidal efficacy of the leaf extracts of *Annona reticulata* against *Aedes aegypti*. International Journal of Current Microbiology and Applied Sciences 4: 132-140
- Gupta A, Nayak S, Mallik A. 2010. Preliminary phyto-chemical screening of hydro alcoholic flower extract of *Ipomea fistulosa*. International Journal of Current Trends in Science and Technology 1(3): 37-40.
- Kalita S, Hazarika L K. 2020. Botanicals for management of *Sitophilus oryzae* (L) and *Callosobruchus chinensis* L. Indian Journal of Entomology 82(4): 644-648.
- Karkar D B, Korat D M, Dabhi M R. 2014. Evaluation of botanicals for their bio-efficacy against insect pests of brinjal. Karnataka Journal of Agricultural Science 27(2): 145-147.
- Kundu B R, Ara R, Begum M M, Sarkar Z I. 2007. Effect of Bishkatali, *Polygonum hydropteris* L. plant extracts against the red flour beetle *Tribolium castaneum* Herbst, University Journal Zoology, Rajshahi University 26: 93-97.
- Mollah J U, Islam W. 2005. Effect of *Polygonum hydropteris* L. extracts on the oviposition and egg viability of *Callosobruchus chinensis* F. (Bruchidae: Coleoptera), Journal of Biological Sciences 12: 101-109.
- Nayak J B. 2014. Efficacy of crude extracts of *Annona reticulata* and *Pongamia pinnata* as larvicidal for the management of filarial vector *Culex quinquefasciatus* Say, Diptera: Culicidae. International Journal of Botany 4(1): 1-5.
- Nithya T G, Vidhya V G, Sangeetha K, Prakash V. 2011. Phytochemical screening of a polyherb vallarai chooranam. International Journal of Drug Formulation Research 2: 294-301.
- Pandey R. 2015. Studies on the mortality of *H. armigera* (*Heliothis*) larvae at different treatment with leaves of *Lantana camara* and *Ipomea fistulosa*. World Journal of Pharmaceutical Research 5(2): 712-718.
- Pandey N D, Singh S R, Tewari G C. 1976. Use of some plant powders, oils and extracts as protectants against pulse beetle *Callosobruchus chinensis* Linn. Indian Journal of Entomology 38: 110-113.
- Rani D J. 2013. Phytochemical screening and antimicrobial activity of various solvent extracts of *Annona reticulata* leaves. International Journal of Science Inventions Today 2(5): 347-358.
- Rosaiah B. 2001. Evaluation of different botanicals against pest complex of brinjal. Pestology 25 (4): 14-16.
- Saxena S C, Sumithra L. 1985. Laboratory evaluation of leaf extract of a new plant to suppress the population of malaria vector *Anopheles stephensi* Liston (Diptera: Culicidae). Current Science 54: 201-202.
- Siddiqui M A, Hasseeb A, Alam M M. 1987. Evaluation of nematocidal properties in some latex bearing plants. Indian Journal of Nematology 17: 99-102.
- Vanichpakorn Y, Vanichpakorn P, Kulvijitra R, Ding W. 2014. Toxicity and repellency of ethanol extracts of *Annona reticulata* L. seed and leaf against *Callosobruchus maculatus* (F.) (Coleoptera: Bruchidae), 11th International Working Conference on Stored Product Production 1080-1088.

(Manuscript Received: November, 2020; Revised: January, 2021;
Accepted: January, 2021; Online Published: July, 2021)
Online published (Preview) in www.entosocindia.org Ref. No. e20319