International Journal of Entomology Research
www.entomologyjournals.com
ISSN: 2455-4758
Received: 21-11-2024, Accepted: 22-12-2024, Published: 06-01-2025
Volume 10, Issue 1, 2025, Page No. 42-45

Effect of *Argemone Mexicana* plant extracts on larval mortality of *Helicoverpa armigera* (Hubner)

V Mirunaliniraj[1], G Sundararajan[2]
[1] Research Scholar, Department of Botany, Govt. Arts College, Dharmapuri, Tamil Nadu, India
[2] Department of Botany, Govt. Arts College, Dharmapuri, Tamil Nadu, India

Abstract
Helicoverpa armigera larvae in their third instar were utilized to test the larvicidal activity of ethanolic as well as aqueous extracts of *Argemone Mexicana* leaves at several concentrations (5, 10, 15, 20, & 25mg/ml). Leaves of plant had been dried, ground into a powder, and then extracted over course of a day in an ethanol and aqueous solvent employing a Soxhlet system. Third-instar *H. armigera* larvae have been exposed to varying concentrations, and after 96hours, mortality rate was noted. In ethanol, larvicidal activity of *A. mexicana* leaf extract had been LD10=7.65mg/ml, LD50=20.54mg/ml, while in water, it was LD10=10.17mg/ml, LD50=31.55mg/ml. Findings demonstrated that mortality rose as plant extract content rose. Greater larvicidal effects against *H. armigera* larvae in their third instar were demonstrated by ethanolic solvent extract of *A. mexicana*. Regression equations, variance statistics, along with 95 percent confidence limits have been displayed.

Keywords: *Helicoverpa armigera*, *Argemone Mexicana*, larval mortality

Introduction

One of the major, as well as prevalent polyphagous pests of cotton, soybeans, and numerous other field crops, tobacco caterpillar *Helicoverpa armigera* (Hubner), has harmed a lot of crops and reduced agricultural output (Balaraju *et al*., 2011) [5]. In 51 nations, comprising India, China, Japan, along with other Southeast Asian nations, it has been also among most economically significant insect pests. It infects 112 plant species from 44 families, including peanut, pepper, cotton, tomato, tobacco, as well as soy (Chari and Patel, 1983) [9]. *Helicoverpa armigera* is found in India and consumes 74 different types of cultivated crops as well as certain wild plants (Rao *et al*., 2008) [26]. Approximately 60% of potential productivity of crops is lost globally as a result of pests and illnesses. Because of their ability to kill pests quickly, chemical insecticides have been utilized for many years. To defend cotton fields and other commercially essential crops from insect attacks, synthetic pesticides are applied in massive quantities. Nevertheless, the careless application of synthetic pesticides has resulted in a number of issues, that includes pesticide resistance, pest resurgence, natural enemy eradication, and harmful residues in water, air, soil, food that harm human health along with disturb ecosystem. Continued use which can also harm atmosphere. As knowledge of hazards linked to synthetic pesticides grows, it has been more essential to investigate appropriate alternative pest management approaches. A variety of plant materials have been employed by farmers to keep pests away from their crops. Plant extracts or natural products in their unprocessed state provide countless potential applications as botanical insecticides. Investigation into the creation of pesticides derived from plants has been documented in recent years. For crop protection, botanical insecticides are a more secure and environmentally friendly option (Mansour *et al*., 2011; Kabili *et al*., 2012; Abbad and Basheli, 2013) [22, 16, 1]. Over two thousand plant species have been known to have some insecticidal qualities, and several plant derivatives are poisonous to different kinds of insects. Promising sources of insecticidal qualities include several plants belonging to Asteriaceae, Rutaceae, Convolvulaceae, Labiatae, Pedaliaceae, and Meliaceae families (Schutterer, 1990; Isman, 1995; Sujatha *et al*., 2010) [32]. Thangarasu *et al*. (2015) [33] investigated ovicidal, oviposition deterrent, anti-feeding, as well as larvicidal properties of many extracts of *Abrus precatorius* against various life stages of certain agricultural field pests, *H. armigera*. The findings of an investigation on effectiveness of *Argemone Mexicana* L. plant extracts against *H. armigera* larvae are presented in this article.

Insect culture

H. armigera eggs (NBAII-MP-NOC-02: *H. armigera*) had been acquired from the National Bureau of Agricultural Insect Resources in Bangalore. They had beensurface sterilized employing a solution of 0.02% sodium hypochlorite, dried, and then cleaned to eliminate any remaining bacteria. Larvae have been raised on tomato leaves as their regular food after hatching. For additional research, third-instar larvae have been employed to reduce the impact of treatment.

Bioassay for insecticides

For insecticide testing, *H. armigera* larvae in their third instar were taken into account. Fresh tomato leaves were taken out of each plastic container and subjected to varying concentrations of ethanol and *A. mexicana* aqueous extract. Extract had been combined with appropriate solvent to create dose, which was then sprayed over tomato leaves. Only fresh tomato leaves treated with appropriate solvent had been preserved in a control jar. Solvent was allowed to evaporate from treated tomato leaves. In each plastic container containing fresh tomato leaves, 10 newly emerged larvae in their third instar have been released. For every solvent, 3 duplicates had been carried out. After 96 hours, percentage of deaths had been determined, probit analysis had been conducted on observed data (Finney, 1947; Busvine, 1971) [13, 7].

Plate 1: Natural Habit and Flowering twig of *Argemone Mexicana* (Papaveraceae)

Plate 2: Host plant of *Helicoverpa armigera* (Hubner)

Results

H. armigera has been employed to test harmful effects of *A. mexicana* leaf extract. After 24, 48, 72, & 96 hrs, number of *H. armigera* deaths had been calculated at ethanol and aqueous extract dosages of 5, 10, 15, 20, & 25mg/ml. After 96h, percentage of overall mortality had been noted. Abbott's formula was subsequently applied to get adjusted mortality, as well as outcomes are illustrated. According to findings, mortality went up as concentrations dose (Figures and Tables). Findings of 96-hour regression equation for the mortality of third-instar army worm larvae, as well as the determination of LD10, LD50, variance, along with 95 percent confidence limits, are displayed in Table 2. LD10=7.65mg/ml as well as DL50=20.54mg/ml, while LD10=10.17mg/ml and LD50=31.55mg/ml have been identified in the aqueous extract of *Argemone Mexicana*. $\chi 2$ values for regression coefficients illustrate homogeneity of data among several regression-based probit analysis estimates.

Table 1: Mortality rate of *H. armigera* treated with leaf extracts of *Argemone Mexicana*

S. No.	Dose in mg/ml	No. of insects used	Mortality after 96 hrs. (Ethanol)	Mortality after 96 hrs (Aqueous)
1.	Control	10	-	-
2.	5	10	-	-
3.	10	10	20	10
4.	15	10	30	20
5.	20	10	50	30
6.	25	10	60	40

Table 2: "LD10, LD50 values with variance, 95% confidence limits and probit analysis parameters for larvae of *H. armigera* after 96 h of exposure

Solvent	LD10	LD50	Variance	95%CL		Regression equations	χ2
				Lower	Upper		
Ethanol	7.65	20.54	0.003658	1.1942	1.4312	Y=2.9876x+1.0779	0.043
Aqueous	10.17	31.55	0.002168	1.4077	1.590	Y=2.6048x+1.101	0.538"

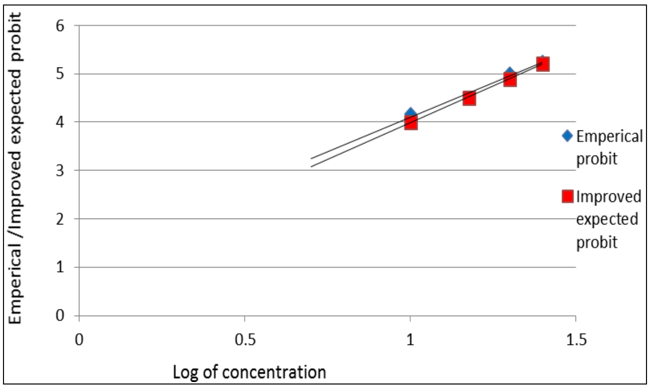

Fig 1: Regression and provision allines for *H. armigera* reveal to ethanol leaf extract of *Argemone mexicana* after 96 h

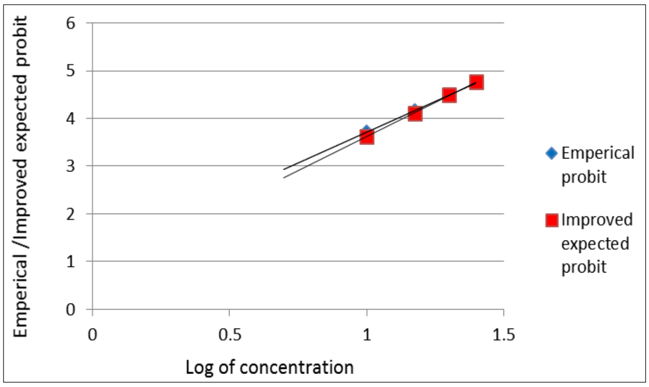

Fig 2: Regression and provision allines for *Helicoverpa armigera* exposed to aqueous leaf extract of *Argemone Mexicana* after 96 h

Discussion

A most hazardous agricultural pest has been *Helicoverpa armigera*. According to Schoonhoven *et al*. (1998) [29], insects frequently have special adaptations to their host plants that allow them to find and choose plants based on optical, chemical, and mechanical cues. Mustaparta (2002) [23] claims that maladapted plants evade detection of additional chemical cues, which may be poisonous or repulsive to insects. It served as foundation for the development of botanical pesticides, which may be utilized to manage dangerous insects. It has been observed that stems, roots, leaves, along with seed crude extracts of several plant species contain antinutritional, insecticidal, or growth inhibiting properties (Ekesi, 2000) [11]. The synergistic impact of complex combinations (crude extracts) of phytochemicals has been additionally believed to be essential to plants' defence against herbivorous insects, according to Hummel and Isman (2001) [14]. Current investigation examined toxicity of *Argemone Mexicana* leaf ethanol along with aqueous extract against *H. armigera* larvae in their third instar. Up to 96 hours of exposure, mortality elevates in our investigation as concentration rises at all dosages. The insecticidal action of *A. mexicana* on a variety of pests has been reported in a number of investigations, that include this one. According to Malarvannan *et al*. (2008, 2008a) [19, 20], A. maxicana crude leaf extracts were poisonous and inhibited growth of *H. armigera*. Results of this investigation demonstrated that metabolites of *H. armigera* were altered as adult's life span had been shortened. The nymph weight declined in the chloroform and acetone fractions of these plant extracts. Bosch (2007) [6] investigated how an antifeedant crude extract of *A. mexicana* affected *H. armigera larvae*. Kinds of organic solvent for metabolite extraction have been crucial; identical concentrations (≤2mL/kg) of leaf extracts of *A. mexicana* resulted in varying mortality rates among 4th instar *Corcyra cephalonica* larvae when extracted utilizing distinct solvents: 10–20 percent methanolic extracts, 10–70 percent acetone extracts, 20–90percent ethanolic extracts, as well as 10–10percent chloroform extracts had been evaluated alongside 10percent Zambare (2013) [17]. Zeinab and Abou (2015) [36] illustrated crude extract's toxic impact from leaves along with seeds of *A. mexicana*, employing chloroform along with methanol, against vital vectors Cx. pipiens and Ae. aegypti. Majeed and Abidunnisa (2011) [18] documented that ultra-low doses (0.5-0.80g/cm2) of crude aqueous extract from *A. mexicana* leaves induced 80-96percent repulsion of adult T. castaneum and rice fungus *Sitophilus oryzae* (L.) 1hour post-application. French 90percent of adults of stink bug Oebalus insularis died 48hours subsequently a field application of a 50percent concentration of *A. mexicana* (Cepero, 1994) [8]. Nymphal mortality in laboratory settings had been as elevated as 40percent when C. cephalonica larvae had been fed rice grains coated with various organic extracts of *A. mexicana* at dosages of 1.5-2.0mL/kg (Kangade and Zambare 2013) [17]. After 24-96hours of treatment, *H. armigera* (Hub.) exhibited substantial harm to epithelial cell wall epithelium with vacuoles in certain areas, as demonstrated by Sharma *et al*. (2016) [31], who examined impact of leaf extract of *A. mexicana* of various solvents on intestinal tissue. In 2017, Ashwini *et al*. [4] discovered that bioassay of toxicity A. In comparison to C. inerme (LD50=7.26mg-1), extracts of C. mexicana resulted in greater mortality in third-instar larvae (LD50=5.33mg-1). Researchers have been searching for ecological pesticides from plant world because farmers in several nations have been utilizing plant-derived chemicals since ancient times. Insect attractants, repellents, insecticides, antifeedants, along with ovipositors have been identified in several hundred plants (Arnason *et al*., 1992; Ewete *et al*., 1996) [3, 12]. Insecticidal activity of *Annona squamosa* seed extracts in hexane as well as ethanol against *H. armigera* stage III larvae has been demonstrated by Vetal and Pardeshi (2019) [34]. They discovered LD10 (5.91mg/mL and 11.72mg/mL) LD950mg/mL and 22.48 mg/mL). Alkaloids with antiparasitic as well as pharmacological qualities have been abundant in the genus Argemone. Because of its antimalarial, neurological, cytotoxic, antibacterial, as well as antiparasitic qualities, this species has been utilized to treat a variety of human illnesses (Rubio-Pina and Vazquez-Flota 2013) [27]. Sanguinarine, Berberine, along withPalmatine, among other compounds, have been investigated found to have anti-nutritional and pest-repelling properties, making organic along with aqueous extracts of *Argemone Mexicana* effective in reducing crop damage (Malikova *et al*., 2006 Schmeller *et al*. 1997) [21, 28]. Investigation's findings demonstrated exceptional insecticidal ability of *A. mexicana* leaf extract against *H. armigera*. In ethanol, DL10=7.65mg/ml, stated LD50=20.54mg/ml, along with water, LD10=10.17mg/ml, stated LD50=31.55mg/ml. To determine active components causing *A. mexicana's* insecticidal impacts along with making final recommendations, additional investigation is required.

Conclusion

A. mexicana investigated potential of botanical insecticides along with phytoprotective action against fruit borer *H. armigera*, according to invistigation's findings.

References

1. Abbad MK, Besheli BA. Bioassay of the botanical insecticide on two natural enemies of the common Pistachio psyllid. International Journal of Agronomy and Plant Production,2013:4(6):1191-1196
2. Ambasta SP. The useful plants of India. New Delhi: D, CSIR, 987, 51.
3. Arnason JT, Mackinnon S, Isman MB, Durst S. Insecticides in tropical plants with non-neurotoxic modes of action. Recent Advances Phytochemistry,1992:28:107-131.
4. Ashwini Devarshi A, Yankanchi SR. Ovicidal and toxic effects of certain plant extracts to the tomato semilooper, *Achaea Janata* L. (Noctuidae: Lepidoptera) Indian J Agric. Res,2017:51(4):345-349.
5. Balaraju K, Vendan SE, Ignacimuthu S, Park K. Antifeedant and larvicidal activities of Swertia chirataagainst *Helicoverpa armigera* and *Spodoptera litura* Fab. Social Science,2011:31:1902-1905.
6. Bosch CH. *Argemone Mexicana* L. In Schmelzer GH, Gurib-Fakim A [eds.], Prota 11(1): Medicinal plants/Plantes médicinales 1. [CD-Rom]. PROTA, Wageningen, Netherlands, 2007.
7. Busvine JR. A Critical Review of the Techniques for Testing Insecticides. Common wealth Agricultural Bureau, London, 1971, 345.
8. Cepero J. Preliminary study on the insecticidal effect of botanical extract of *Argemone Mexicana* L. on OebalusinsularesStål (Heteroptera: Pentatomidae). VII Jornada Científica INIFAT-MINAG. Santiago de Las Vegas. La Habana, Cuba. [In Spanish], 1994.
9. Chari MS, Patel NG. Cotton leaf worm *Helicoverpa Armigera* Fab., its biology and integrated control measures. Cotton Dev,1983:13:7-8.
10. Chopra RN, Nayar SL, Chopra IC. Glossary of Indian medicinal plants. New Delhi: NISCOM, CSIR, 1956, 23.
11. Ekesi S. Effect of volatiles and crude extracts of different plant materials on egg viability of Maruca vitrataand *Clavigralla Tomentosicollis*. Phytoparasitica,2000:28:1-6.
12. Ewete FK, Arnason JT, Larson J, Philogene BJR. Biological activities of extracts from traditionally used Nigerian plants against the European corn borer,

Ostrinia nubilalis. Entomologica Experimentalappilicata,1996:80:531-537.

13. Finney DJ. Probit Analysis. Cambridge University Press, London, 1947, 333.
14. Hummel Brunner LA, Isman MB. Acute, sublethal, antifeedant, and synergestic effects of monoterpenoid essential oil compounds on the tobacco cutworm *Helicoverpa Armigera* (Lep., Noctudiae). Journal of Agricultural Food Chemistry,2001:49:715-720.
15. Isman, MB. Leads and Prospects for the Development of New Botanical Insecticides. Reviews in Pesticide Toxicology,1995:3:1-20.
16. Kabiri ML, Besheli B, Basirat M. A comparison of the toxicity of the botanical insecticide, sirinol and two chemical insecticides, mospilan and consult, on two natural enemies of the Pistachio psyllid, Coccinellid predator, Oenopiacon globate and parasitic wasp, Psyllaephagus pistaciae. African Journal of Biotechnology,2012:11(74): 13888-13895.
17. Kangade YP, Zambare SP. Effect of extracts ofArgemonemexicanaleaves on the development of *Corcyra cephalonica* (Stainton) for the protection of the stored grains. Indian Journal of Applied Research,2013:3:20-22.
18. Majeed S, Abidunnisa T. Study on repellent activity of *Argemone Mexicana* on *Tribolium castaneum* and *Sitophilus oryzae*. International Journal of Pharmaceutical Research and Development,2011:3:206-211.
19. Malarvannan S, Giridharan R, Sekar S, Prabavathy VR, Nair S. Bioefficacy of crude and fractions of *Argemone Mexicana* against tobacco caterpillar, *Helicoverpa armigera* (Noctuidae: Lepidoptera). J Biopest,2008:1:55-62.
20. Malarvannan S, Senthil KS, Giridharan R, Nair S. Bioefficacy of *Argemone Mexicana* against American bollworm, *Helicoverpa armigera* (Hubner), (Noctuidae: Lepidoptera). Hexapoda,2008a:15:49-55.
21. Malikova J, Zdarilova A, Hlobilkova A. Effects of sanguinarine and chelerythrine on the cell cycle and apoptosis. Biomedical Papers of the Medical Faculty of the University Palacky, Olomouc, Czechoslovakia,2006:150:5-12.
22. Mansour SA, Bakr RFA, Mohamed RI, Hasaneen NM. Larvicidal activity of some botanical extracts, commercial insecticides and their binary mixtures against the housefly, *Musca domestica* L. The Open Toxinology Journal,2011:4:1-13
23. Mustaparta H. Encoding of plant odor information in insects: peripheral and central mechanisms. Entomologia Experimental Applicata,2002:104:1-13.
24. Prakash A, Rao J. Botanical Pesticides in Agriculture. CRC Press, Boca Raton, Florida, 1997.
25. Rao SRK, Chitra KC. Effect of plant extract on larval weigh and duration of *Helicoverpa armigera* Fabr. Journal of Applied Zoological Research,2000:11:98-100.
26. Ranga Rao, Rabindra RJ, Nandagopal V, Rameswar Rao. In Groundnut Entomology. New Delhi: Satish serial Publishing House. *Helicoverpa armigera* (Fabr.), 2008, 65-99.
27. Rubio-Pina J, Vazquez-Flota F. Pharmaceutical applications of the benzyliso quinoline alkaloids from *Argemone Mexicana* L. Current Topics in Medicinal Chemistry,2013:13:2200-2207.
28. Schmeller T, Latz-Brüning B, Wink M. Biochemical activities of berberine, palmatine and sanguinarine mediating chemical defense against microorganisms and herbivores. Phytochemistry,1997:44:257-266.
29. Schoonhoven LM, Jermy T, Van Loon, JJA. Insect-Plant Biology, Chapman and Hall, London, 1998.
30. Schutterer H. Fecundity reduction and sterilizing effect of neem seed kernel extracts in the Colorado potato beetle, Leptinosara decemlineata. Proceedings of the 3rd International Neem Conference (INC'90), 1990, 351-360.
31. Sharma CT, Patil GP, Sharma NS, Zambare SP. Effect of *Argemone Mexicana* Leaves Extract at Different Solvents on Gut of *Heliothis armigera* (Hub) Int. J Life. Sci. Scienti. Res,2016:2(3):293-296.
32. Sujatha M, Baby Joseph, Sumi SP. Medicinal Plants and its impacts of Ecology, Nutritional Effluents and Incentives of Digestive enzymes on *Helicoverpa armigera* (Fabricious). Asian Journal of Agricultural Research,2010:4(4):204-211.
33. Thangarasu M, Krishnappa K, Elumalai K. Pesticidal activity of *Abrus precatorius* Linn. (fabaceae) against polyphagous field pest *Helicoverpa armigera* (fab.) (Lepidoptera: Noctuidae. International Journal of Current Innovation Research,2015:1(2):41-48.
34. Vetal DS, Pardeshi AB. Insecticidal potential of ethanol and hexane solvent seed extract of *Annona squamosa* against *Spodoptera litura* Fab. Journal of Pharmacognosy and phytochemistry,2019:8(3):842-845.
35. Zambare SP, Kangade YP, Sharma CT, Mali KH. Ovicidal effect of four plant extracts on the eggs of *Corcyra cephalonica* (Stainton). International Multidisciplinary Research Journal,2012:5:26-28.