European Journal of Medicinal Plants

Volume 35, Issue 5, Page 42-49, 2024; Article no.EJMP.120009
ISSN: 2231-0894, NLM ID: 101583475

A Study of Insecticidal Effects of Leaf Extracts of *Aegle marmelos* L. Correa and *Ricinus communis* L. on *Callosobruchus chinensis* L

Kransi Gautam [a*], Arti Saxena [a] and Rita Mishra [a]

[a] Department of Zoology, Government Model Science College, Rewa, Madhya Pradesh, India.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: https://doi.org/10.9734/ejmp/2024/v35i51202

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/120009

Original Research Article

Received: 28/05/2024
Accepted: 30/07/2024
Published: 13/08/2024

ABSTRACT

Laboratory experiments were conducted to evaluate the efficiency of leaf powders of *Aegle marmelos* and *Ricinus communis* against the pulse beetle, *Callosobruchus chinensis.* which infests stored pulse seeds. Stored pulses are primarily attacks by major insect pest particularly the pulse beetle, *Callosobruchus chinensis.* Though chemicals provide effective control of *Callosobruchus* sp., but the efficiency of the chemicals mostly depends on the mode of exposure. The maximum effectiveness is given when the insecticides are provided by gustatory a method, but majority of these are toxic to human. Stored product to be many synthetic insecticides have been found effective against pests, but proved to be hazardous to men and domestic animals. These chemical compounds pose a serious risk to human health, so these chemical compounds should note used in stored pulses that are consumed. The over reliance on and non judicious use of synthetic

**Corresponding author: E-mail: kranshipandey@gmail.com;*

Cite as: *Gautam, Kransi, Arti Saxena, and Rita Mishra. 2024. "A Study of Insecticidal Effects of Leaf Extracts of Aegle Marmelos L. Correa and Ricinus Communis L. On Callosobruchus Chinensis L". European Journal of Medicinal Plants 35 (5):42-49. https://doi.org/10.9734/ejmp/2024/v35i51202.*

pesticides, especially insecticides since last four decades led to wide the spectrum of pests resistance to chemicals, resurgence an of pests, Pulse beetles cause losses of more than 50% of protected grains, control of which generally depends on synthetic bio pesticides involving fumigants, this result in residual and unintended contamination of food and soil which can prove hazardous to human and animal health. The extracts of the different fraction of bio insecticides may play a key role in troublesome insect pests controlling program in nearing time to come. The leaves of the plants *Aegle marmelos* and *Ricinus communis* have proven to be well effective for the control of *Callosobruchus chinensis*, by using methanol and chloroform solvents.

Keywords: Aegle marmelos and Ricinus communis; leaf powders; Callosobruchus chinensis; pulse protection; biopesticides.

1. INTRODUCTION

Pulses are an important source of nutrition for billions of people around the world Providing abundant protein. The terms beans and pulses are interchangeable because all pulses can be called legumes but be cannot all beans as pulses.

Pulses, usually in the form of stored grains, belongs to the leguminoseae family and do not include oilseed pulses or legume, mainly peanuts and soybeans. In this, such species are kept which can be mainly included in the edible form of humans. The International and protein benefits of pulses were announced by the united nation and the agricultural organisation in 2016, with the aim of human food security and nutrition.

Pulses can provide sufficient quantity of minerals (iron, zinc, calcium, magnesium), to human through nutrition [1] deficiency of minerals world led to various type of cardiovascular disease and imbalance in biological pathways in human [2]. Adequate minerals include a group of essential compounds that include phenolic acids, tannins and flavonoids [3,4] various pulses varieties contain high lavels of Phenolic compounds and antioxidant activity [5]. In countries around the world including India, pulses are being produced to supplyment the nutrition whose use is increasing day by day in our lives [6]. High yielding varieties having high yield in terms of processing efficiency and raw yield were given first priority for thermal processing by the processors [7,8].

Varieties of Pulses which have uniform size and low water holding capacity should be used for canning during which their growth can be faster. on the basis of anti-nutritional factors like protein inhibition, phenolics tannin lectins, saponins etc, conventional processing methods like soaking, soaking, should be evaluated on a larger scale and new methods should be used to development [9]. Pulses are produced in many countries, but due to keeping them in plastic containers, a decrease in their phenolic content has been observed [10].

In countries like India, pulses are considered the best source for diet and they also play an effective role, pulses are also considered an important source of protein, minerals and fiber. Green gram, chickpea and all varieties of pulses contain twice as much protein as wheat and three times more than rice. It is very important to think about reaching the pulses among the poor class because the consumption of dairy and animal products among the poor class people is relatively low due to which adequate amount of protein and minerals are not available to them, Nahar, [11]. To improve the health of soil, pulses cultivation of pulses should be provided through inter cropping system so that it can contribute in increasing the crop production [12].

Commodity group contributes to all topics of future Initiative towards eradicating poverty and hunger, enhancing their nutritional status and protecting the environment [13].

Major pulses are grown chickpeas (Gram/Chana), pigeon pea (Tur/Arhar), Mungbeans, Urad beans (Blackgram), Masur (lentil), Peas and various kinds of beans (minor pulses). · The main regions with high productivity are Madhya Pradesh, Rajasthan, Maharashtra, Karnataka, Uttar Pradesh, Coastal Andhra Pradesh, Gujarat, Tamil Nadu, Jharkhand, Odisha, Chhattisgarh, Telangana, Bihar and West Bengal delta region.

According to the Indian Council of Medical Research, the consumption of pulses should be 50 gm per person per day which has reached only 48 gm per person in India till 2019. The production of main crop like pulses and other legumes can be increased only when farmers

should be made self reliant with good fertilizers and irrigation facilities, [14].

2. MATERIALS AND METHODS

2.1 Insect (*Callosobruchus chinensis)*

Callosobruchus chinensis (L.) (Coleoptera: Chrysomelidae) is a serious internal feeder of seeds of several legume species and an economically important insect pest [15]. This Insect cause maximum damage during February to August, it hibernates between March to November. The entire life span of *C.chinensis* is 29 to 39 days. The incubation period is from 4 to 6 days depending on the pulses in which they grow [16]. Its life span ranges from larva to adult stage, its shape is oval shaped and its antennae are about 3 to 4 mm in length, and chocolate brown colour [16].

2.2 Select of the Plant

Aegle marmelos and *Ricinus communis* ware selected due to their bio pesticides. in these plants, medicinal qualities, and are found in good abundance in the field of study.

2.3 Collect of Materials

Leaves of native plants *Aegle marmelos* family Rutaceae and plant *Ricinus communis* family Euphorbiaceae collected from laharpur roadside in Bhopal, in the month of January.

2.4 Categorisation of the Plants

Research institute Govt model science college Rewa (M.P.) the collected plants received recognition from the Branch of Botany.

2.5 *Aegle Marmelos* (Bael)

Kingdom	-	Plantae
Order	-	Sopindales
Family	-	Rutaceae
Sub family	-	Aurantioideae
Genus	-	*Aegle*
Species	-	*marmelos*

Bael leaf extract are insecticidal contains several active compounds, alkaloids, terpenoids, cumerins, phenylpropenoids, tannins the pesticidal activities of the leaves of *Aegle marmelos* are aegle in marmesin and ethyl p-cumerate. The compound obtained from the constituents of *Aegle* are used for heart diseases as these compounds contain toxic less or non toxic plant hence the demand of these compounds is increasing across the world due to its efficacy and trust [17]. Whole of plants of the world or their parts are being used medicines because about 72-95% of the world's population has been following these traditional remedies and this is also true because no poisonous substance is found in the plants [18].

2.6 *Ricinus communis* (castor)

Kingdom	-	Plantae
Division	-	Magnoliophyta
Class	-	Magnoliopsida
Subclass	-	Rosidae
Order	-	Euphorbiales
Family	-	Euphorbiaceae
Genus	-	*Ricinus*
Species	-	*communis*

The leave is applied to boils and swelling and leaves promote menstrual flow in women. Tender leaves are cure pain in bladder, leaves are also recommended to relieve headache and joints pains [19].

The leaves are mixed with alcohol, rectified spirit and water respectively after which the leaves are dried in the shade and made into powder then the collected material is used for chemical analysis of the plants the collected material after recognition was used for phytochemical analysis of plants.

First the leaves were dried at room temperature, after then the leaves were ground finely with the help of a mixer. After that 450 ml of n- hexane was mixed in 500 gm of powder and kept for 72 hours so that the powder could be defatted properly. After that the solution was filtered through whatman's filter paper no. 1 and stored in the reagent bottle. And then 400ml chloroform and300 ml methanol solvent is added to the dried powder and kept for 72 hours. To conduct bio test against *C. chinensis*, first of all the semi-solid extract is kept in the refrigerator at room temperature about 40^0C and working pressure 25-30 mm until it is used and then through water bath, it is evaporated and filtered through filter paper [20].

2.7 Indentifying Compounds through Chemical Analysis

First of all, the crude extract of the plant was defatted by added n- hexane, then after adding concentrated chloroform and methanol it obtained a greenish yellow colour. The sample of pure leaf extract was sent to central drug

Table 1. Percentage loss in weight of the plant materials

S. No.	Name an of the Plant	Wet weight of Plant Material in (gms)	Weight on Drying of the Plant Material (gms)	Loss in Weight on Drying (gms)	Percentage Loss in Weight
1.	*Aegle marmelos*	2000	180	1920	96.2%
2.	*Ricinuscommunis*	2000	190	1932	98.4%

research institute, Lucknow so that the spectral analysis of this sample could be identified.

2.7.1 Studying *Callosobruchus chinensis* through the plant *Aegle marmelos* and *Ricinus communis* leaf extracts

Callosobruchus chinensis was the first collected from infested grains. After collecting insects from various types of pulses, wash 20 beakers washed with distilled water, dry them and then put 100 grains of black gram in it.

Two drops of chemical with different fractions are added to the beaker, such as 50 ppm fractions 50 ppm, 100 ppm, 150 ppm, 200 ppm, 250 ppm.

Three pairs of *C. chinensis* (3 males and 3 females) were placed in each beaker was covered with muslin cloth and tightly with a rubber band, so that the pest could be controlled.

After a week, open the beaker and take out the insect.

After counting the eggs of insects inserted, the beaker was covered with muslim cloth as before.

After 7 days, the beaker is opened and the number of larvae hatched from the eggs is counted and the beaker is closed again.

After 7 days, the beaker is opened to count the pupae and after counting the beaker is covered again with muslin cloth.

After 7 days, after opening the beaker and counting the adult insects that have emerged from the pupae, the beaker is closed again.

To observe germination, remove the seeds from each beaker into a petri dish with water.

The number of seeds germinated was counted and noted.

The same experiment was also done with wrinkled seeds.

3. RESULTS AND DISCUSSION

Hemantha piris et al. [21], reported highly significant repellency 96.91% and 98.99% of dried leaf and seed kernel to be extract of *C. thevetia* and *O. tenuiflorum* against pulse beetle after 24 hour of exposure which indicates that botanicals have high repellency qualities, [22].

Elhag [23], tested the extracts of plant species against *Callosobruchus chinensis* and resulted that highest repellency was found in *Rhazya stricta* leaves (76.8%) followed by Azadirachta indica (76.8%), Heliotropium bacciferrum (59.2%) and citrus peel (58.6%). Repellent action of plants was also reported by Kokate and Chintalwar [24], Dwivedi and Shekhawat [25] and Kachhwaha et.al. [26].

The repellent activity of *C. chinensis* was controlled by adding *Aegle marmelos* leaf extract to a minimum concentration of five in a solution of methanol and chloroform. In the present investigation of the methanol and chloroform and minimum in the controlled the repellent activity of *C. chinensis* by *Aegle marmelos* leaf extract in five concentrations.

Aliyu and Ahmed [27], reported that non-edible oils, it was observed that larval mortality of *callosobruchus chinensis* reached 100% in the presence of ovipositional deterrence,control using oils extracted from some plants revealed that peanut and *Mentha arvensis* (L), *M. spicata* (L), *M. piperata* (L) and *Cymbopogon nardus* (L) oil have an effect on *C.chinensis.*

In the present work to control the mortality of larval *callosobruchus chinensis* by using chloroform and methanol extracts, of *Aegle marmelos* and *Ricinus communis* leaf of minimum in the control.

Chakraborty et al., [28], it is clear from the literature that on the basis of overall life span of *C. chinensis* on different pulses, the order of pulses was for larger sized seeds like chickpea, black gram and green gram, while higher seed

weight and thick layer reduced the time of growth period despite higher nutrition [29]. Which slow down development of the seed coat which hinders entry of young larvae into the seed and emergence of the insect adult stage from the seed.

Table 2. Statistical data of purified fraction of *Aegle marmelos* CH_3OH extract against pulse beetle *(Collosobruchus chinensis)* on fresh Urad bean seeds

Concentration	24 hr. Larval Mortality	Regression Equation (y = a±bx)	Chi - Square $x^2(n-1)$	LC_{50} (ppm)	Variance (V)	S.E.	Fiducial Limits (ppm)
50	68						
100	92						
150	145						L = 89.224
200	158	-3.669±1.773	6.347	117.372	0.0243	0.156	
250	175	x					U = 147.830

Table 3. Statistical data of purified fraction of *Aegle marmelos* CHCL3 extract against pulse beetle *(Collosobruchus chinensis)* on fresh Urad bean seeds

Concentration	24 hr. Larval Mortality	Regression Equation (y = a±bx)	Chi - SQUARE $x^2(n-1)$	LC_{50} (ppm)	Variance (V)	S.E.	Fiducial Limits (ppm)
50	73						
100	99						
150	119						L = 56.150
200	159	-3.775±1.832	20.703	115.082	0.0243	0.156	
250	195	x					U = 183.278
Control	6						

Table 4. Statistical data of purified fraction of *Aegle marmelos* CH_3OH extract against pulse beetle *(Collosobruchus chinensis)* on Wrinkled Urad bean seeds

Concentration	24 hr. Larval Mortality	Regression Equation (y = a±bx)	Chi - Square $x^2(n-1)$	LC_{50} (ppm)	Variance (V)	S.E.	Fiducial Limits (ppm)
50	79						
100	104						
150	149						L = 66.191
200	173	-3.82±1.922	9.606	98.665	0.0246	0.157	
250	197	x					U = 127.892
Control	6						

Table 5. Statistical data of purified fraction of *Aegle marmelos* $CHCL_3$ extract against pulse beetle *(Collosobruchus chinensis)* on Wrinkled Urad bean seeds

Concentration	24 hr. Larval Mortality	Regression Equation (y = a±bx)	Chi - Square $x^2(n-1)$	LC_{50} (ppm)	Variance (V)	S.E.	Fiducial Limits (ppm)
50	71						
100	99						
150	142						L = 71.848
200	176	-4.262±2.109	11.656	104.906	0.0252	0.159	
250	199	x					U = 136.552
Control	6						

Table 6. Statistical data of purified fraction of *Ricinus Communis* CH_3OH extract against pulse beetle *(Collosobruchus chinensis)* on fresh Gram/chickpea seeds

Concentration	24 hr. Larval Mortality	Regression Equation (y = a±bx)	Chi - SQUARE $x^2(n-1)$	LC_{50} (ppm)	Variance (V)	S.E.	Fiducial Limits (ppm)
50	79						
100	99						
150	144						L = 58.895
200	170	-3.873±1.929	14.774	101.805	0.0246	0.157	
250	199	x					U = 140.919
Control	9						

Table 7. Statistical data of purified fraction of *Ricinus Communis* $CHCL_3$ extract against pulse beetle *(Collosobruchus chinensis)* on fresh Gram/chickpea seeds

Concentration	24 hr. larval mortality	Regression equation (y = a±bx)	Chi - Square $x^2(n-1)$	LC_{50} (ppm)	Variance (V)	S.E.	Fiducial limits (ppm)
50	60						
100	79						
150	128						L = 62.022
200	166	-5.018±2.416	32.378	119.360	0.02689	0.164	
250	209	x					U = 190.732
Control	9						

Table 8. Statistical data of purified fraction of *Ricinus Communis* CH_3OH extract against pulse beetle *(Collosobruchus chinensis)* on Wrinkled Gram/chickpea seeds

Concentration	24 hr. Larval Mortality	Regression Equation (y = a±bx)	Chi - Square $x^2(n-1)$	LC_{50} (ppm)	Variance (V)	S.E.	Fiducial Limits (ppm)
50	89						
100	110						
150	149						L = 18.279
200	189	-4.317±2.224	35.106	87.411	0.0259	0.161	
250	223	x					U = 137.155
Control	9						

Table 9. Statistical data of purified fraction of *Ricinus Communis* $CHCL_3$ extract against pulse beetle *(Collosobruchus chinensis)* on Wrinkled Gram/chickpea seeds

Concentration	24 hr. Larval Mortality	Regression Equation (y = a±bx)	Chi - Square $x^2(n-1)$	LC_{50} (ppm)	Variance (V)	S.E.	Fiducial Limits (ppm)
50	63						
100	94						
150	134						L = 55.138
200	165	-4.880±2.386	30.443	111.045	0.0268	0.164	
250	216	x					U = 169.725
Control	9						

In the present study, we observed that the adult emergence of *C. chinensis* was well controlled by adding chloroform and methanol at a concentration of 250 ppm to the leaf extracts.

4. CONCLUSION

Intensive studies are essential to discover eco-friendly and safe methods for controlling

Bruchids and other pests. By conducting thorough research, we can identify effective strategies that minimize environmental impact and ensure the safety of agricultural practices. This pursuit is critical for developing sustainable pest management solutions that support both crop health and ecosystem well-being.

The objective of the present research is to make farmers aware about the damage caused by beetles and the safety of pulses and pave the way to provide them new technical facilities, and to make new pest controls easily accessible to the farmers.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Tiwari BK, Singh N. Pulse chemistry and technology. Royal Society of Chemistry, Cambridge; 2012.
2. Dahl WJ, Foster LM, Tyler RT. Review of the health benefits of peas (*Pisum sativum* L.). Br J Nutr. 2012;108:3–10
3. Casey RC, Domoney C, Forster C, Hedley C, Hitchin E, Wang T. The effect of modifying carbohydrate metabolism on seed protein gene expression in peas. J Plant Physiol. 1998;152:636–640
4. Machuca J. Characterization of the seed proteins of Velvet Bean (Mucunapruriens) from Nigeria. Food Chem. 2000;68:421–427.
5. Vazquez G, Fontenla E, Santos J, Freire MS, Gonzalez-Alvarez J, Antorrena G. Antioxidant activity and phenolic content of chestnut (Castanea sativa) shell and eucalyptus (Eucalyptus globulus) bark extracts. Ind Crops Prod. 2008;28:279–285
6. Warsame, AO, Kimani PM. Canning quality of new droughttolerant dry bean (*Phaseolus vulgaris* L) lines. Am J Food Tech. 2014;9(6):311–317.
7. Wassimi, NN, Hosfield GL, Uebersax MA. Inheritance of physico-chemical seed characters related to culinary quality in dry bean. J Am Soc Hortic Sci. 1990;115:492–499.
8. Hosfield GL, Uebersax MA, Occena LG. Technological and genetic improvements in dry bean quality and utilization. In: Proceedings of the Idaho Bean Workshop, University of Idaho, Moscow. 2000;135–152.
9. Patterson, CA, Curran J, Der T. Effect of processing on antinutrient compounds in pulses. Cereal Chem. 2017;94:2–10.
10. Parmar, N, Singh N, Kaur A, Virdi AS, Thakur S. Effect of canning on color, protein and phenolic profile of grains from kidney bean, field pea and chickpea. Food Res Int. 2016;89:526–532.
11. Nahar Q, Choudhury S, Faruque MO, Sultana SSS, Siddiquee MA. Desirable Dietary Pattern for Bangladesh. Bangladesh Institute of Research and Rehabilitation in Diabetes, Endocrine and Metabolic Disorders (BIRDEM), National Food Policy Capacity Strengthening Programme, Ministry of Food, Bangladesh; 2013.
12. Rawal V, Navarro DK eds. The global economy of pulses. Rome, FAO; 2019.
13. Maredia M. Global pulse production and consumption trends: The potential of pulses to achieve ‘Feed the Future’ food and nutritional security. In: Presented at Global Pulse Researchers Meeting, Rwanda. 2012;13–19.
14. FAO, /IAEA. Guidelines for Mass Rearing Aedes Mosquitoes. Version 1.0; IAEA: Vienna, Austria; 2020.
15. Tuda M, Chou LY, Niyomdham C, Buranapanichpan S, Tateishi Y. Ecological factors associated with pest status in Callosobruchus (*Coleoptera: Bruchidae*): high host specificity of non-pests to Cajaninae (Fabaceae). J. Stored Prod. Res. 2005;41:31–45.
16. Johnson CD. (Seed beetle host specificity and the systematics of the Leguminosae. In Advances in Legume Systematics Part 2 (R. M. Polhill and P. H. Raven eds.). Royal Botanical Gardens, Kew, England. 1981; 995–1027.

17. Prashant KR, Dolly J, Singh KR, Gupta KR, Watal G : Glycemic properties of *Trichosanthes dioica* leaves. Pharm. Bio. 2008;46(12):894-899.
18. Robinson MM: Classifications, Terminology and Standards, WHO, Geneva:Xiaorui Zhang Traditional Medicines, WHO. traditional medicines: Global situation, issues and challenges. 3rd Edition; 2011.
19. Jena J, Gupta AK. *Ricinus communis* Linn: A phytopharmacological Review. Inter. J. Pharm. Pharmaceut. Sci. 2012;4(4):25-29.
20. Abbott WS. A method of computing the effectiveness of an insecticide. J. Eco. Entomol. 1925;18:265-267.
21. Hemantha, Piris BGB, Pakeerathan K, Sayanthan S. Efficacy of botanical extracts against storage insect pests Tiboliumconfusum (Confused flour beetle) and Sitophilus oryzae (Rice weevil). Proceedings of 1st International Electronic Conference of Entomology. 2021;1-15.
22. Gitahi, SM, Piero MN, Mburu DN, Machocho AK. Repellent effect of selected organic leaf extracts of *Tithonia diversifolia* (Hemsl.) A. Gray and *Vernonia lasiopus* (O. Hoffman) against *Sitophilus zeamaismotschulsky* (*Coleoptera: Curculionidae*). Hindawi. The Scientific World Journal; 2021.
Available?:https://doi.org/10.1155/2021/27718629
23. Elhag EA. Deterrent effects of some botanical products on oviposition of cowpea bruchid, Callosobruchus maculate F. (*Coleoptera: Bruchidae*). Int. J. Pest Manang. 2000;46(2): 109 - 113.
24. Kokate SD, Chintalwar GJ. Insect repellent activity of certain plant extracts against pulse beetle, *Callosobruchus chinensis* (L.). National Academy Sci. Letters. 2003; 26(1-2):44-46.
25. Dwivedi SC, Shekhawat NB. Repellent effect of some indigenous plant extracts against Trogoderma granarium. Asian J. Exp. Sci. 2004;18(1-2):47 - 51.
26. Kachhwaha N, Singhvi PM, Gehlot L, Jain M. Effect of plant extracts on the repellency behaviour of *Oryzaehilus surinamensis*, Ad. Plant Sci. 2008;21(1): 281 - 282.
27. Aliyu M, Ahmed BI. Comparative efficacy of different rates of groundnut oil for the control of cowpea weevils *Callosobruchus maculatus* (F.) in stored cowpea (*Vigna unguiculata* (L) Walp). Global Journal of Agricultural Sciences. 2006;5(2):123–26.
28. Chakraborty, SN. Chaudhar and Senapti. SK. Correlation between seed parameters and relative susceptibility of mungbean genotypes (*Vigna radiata* L.) to Callosobruchus chinensis L. during storage. Annals of Plant Protection Science. 2004;12(1):48-50.
29. Southgate BJ. Biology of the Bruchidae. Annu. Rev. Entomol. 1979;24:449–473.

Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/120009