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Investigation of the insecticidal activities of *Carica papaya* Linn. and *Cassia tora* Linn. leaf extracts on *Callosobruchus chinensis Linn.*

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Abstract : Pests are killed with various substances. Although these pesticides frequently have good results, they can pose major issues for people or their pets because they are made to destroy living things. When we use pesticides on our plants or animals, they might enter our bodies and damage the environment and the food we eat. Other organisms besides their target pest are occasionally harmed by them. The potential for pests to develop a resistance to the pesticide is another issue with employing chemicals to manage them. One strategy to stop pests from harming the environment or the economy is biological control. Utilizing live creatures including parasites, viruses, and predators, biological control techniques manage pest populations on agricultural crops. Agricultural fields that sustain robust populations of native predators can benefit from the application of basic land conservation techniques, or biological control agents can be created and bred in vast quantities prior to becoming released to minimize pest populations in crops that are affected (improvement) .*Cassia tora* and *carica papaya* methanol and chloroform fractions were successful in controlling *Callosobruchus chinensis*. According to the results, plant-based biopesticides might soon be used extensively in pest management initiatives.
Keywords: *Callosobruchus chinensis*, insecticides, germination loss, pulses.

Introduction - An significant part of the Indian cuisine and economy, pulses are a great gift from nature. Proteins, a number of amino acids, minerals, and several vitamins are all present in pulses. The world's largest producer of pulses is India.Pulses are leguminous plants; belonging to the family leguminosae and subfamily papilionoideae, they are nutrient –rich crops. In addition to being low in fat and high in dietary fiber, they are a great source of protein and minerals.. A part from this, they play an important role in maintaining and improving soil health.

Within the Indian economic and social framework, pulses hold a special position, especially in the Indian subcontinent, Pulses are an integral protein source. where consumption of animal protein is very low. A part from being a rich and inexpensive source of protein in daily life, pulses also substantial role in improving and maintaining soil productivity due to biological nitrogen fixation and adding huge amounts organic matter. More than a dozen pulse crops are grown in Indian. The common ones are Bengal gram (chickpea), pigeon pea, green gram, black gram, lentil, field pea and lathyrus vugaris. Pulses occupy 22-23 million hectares and contribute 14-15 million tons of grain to the country's food stocks.

It include subtrophical and tropical crops such as lentil, greengra (mung), red gram (pigeanpea), black gram, and Bengal gram. It is a good source of vitamins, minerals, and high-quality carbs. It is also high in protein and fiber. Because they are released more gradually than those found in cereals, the carbohydrates included in pules are highly valuable for preserving ideal blood sugar levels and providing sustained energy after a meal.

About 19% the world pulses production is used as fodder,6% as seeds the remaining 5% is wasted, and 68% pulses are used for food. Aisa has a significant contribution in the world pulses production. In this the production of gram, pigeon pea and lentil is 84.6% and 55.6% respectively. Among Asian countries India has achieved a high position in the production of gram and pigeon pea, in while terms of productivity, china and Philippines got the first place in the production of gram and pigeon pea respectively in 2012-13. As far as world production fingure are concerned, Canada is leading in lentil production during the period under reference, followed by India, while News Zealand is ranked first in productivity.

Callosobruchus chinensis L is a very dangerous insect found in pulses. It reproduces rapidly and has a high fecundity and C*ollosobruchs chinensis* causes a significant decrease in the number of stared grain as well as reduces their nutritional value. Adult pulse beetle do not feed on seeds but they mate and lay eggs on them. They newly hatched larvae bore into the seeds and feed on the contents until. They have consumed all the endosperm damage caused by this pest affects the germination capacity and nutritional value of the seed **(1984, Sharma**). Under normal storage condition *C. cheninsis* cause heavy damage to chickpea, which increase with storage time (**2013, Jait et al.).** During storage, the beetle can causes up to 100% damage to bean feeds. The pulses beetle feeds on the endosperm of the seed and leaves only the seed coat, leading to poor seed germination low seed weight and poor market value. In view of the economic importance of pulse beetle, on attempt was made to assess seed damage, weight loss and germination loss in a local green gram variety during storage.

Materials And Methods

Insect (*Callosobruchus chinesis*)

In India, *Callosobruchus chinesis* is a significant pest of pulses. The larval and pupal phases of this holometabolic insect live inside grains, whereas the adult and egg stages are found on grains. The most harmful stage of the life cycle occurs when the larva consumes the endosperm. Adult beetles have long, upright antennae, are oval in shape, 3–4 mm long, and are chocolate or reddish brown in colour. The female produces scale-like eggs or grins that range in size from 1 to 8. In a different compartment, each larva completes its entire cycle. In India, the insect hibernates in the larval stage during the winter and breeds freely from March to November. January to April is when the adults emerge. The months of February through August are when the bug causes the most damage.

Collection of plant material: *Carica papaya*, a native plant belonging to the Asteraceae family, was gathered from Jayanti Kunj Rewa. The collection was carried out during the winter.

Cassia tora a member of the Caesalpiniaceae family was gathered from the Bichhiya Rewa Lakshaman Bag area. It was collected during the rainy season.

Selection of plant: Carica papaya and Cassia tora were chosen for the study due to their medicinal and insecticidal qualities, as well as the fact that they were abundant in the study area.

Taxonomic position of the plant -

Carica papaya

Phylum – Angiosperm
Division – Magnoliophyta
Order – Brassicales
Family – Caricaceae
Genus –Carica
Species – papaya

The *Carica papaya* is also utilized as an Aboriginal medicine to treat a number of illnesses, including as infectious diseases and cancer. Crushed *Carica papaya* leaves have been used to treat fever and anthelmintic symptoms. The green fruits are cooked like vegetables, while the fruits are commonly used as desserts or processed into jam, puree, or wine **(Matsuura *et al*., 2004 and Ahmed *et al*., 2002**). The leaf extract or tea is known to be a tumor. While dried brown pawpaw leaves work best as a blood purifier and tonic, fresh green tea has antibacterial properties. Additionally, according to **Mantok (2005**), the tea helps with digestion and helps alleviate conditions including arteriosclerosis, high blood pressure, chronic indigestion, obesity, and heart disease, tumour-destroying substance.(**Walter, 2008).**

Cassia tora

Phylum –Tracheophyta
Class – Spermatopsida
Divison– Rosopsida
Order – Fabales
Family – Casesalpinaceae
Genus – *Cassia*
Species – *tora*

In the Ayurvedic medical system, *Cassia tora* leaves and seeds are used to treat a variety of conditions, including ringworm, leprosy, flatulence, colic, dyspepsia, constipation, cough, bronchitis, and heart diseases. Because *Cassia tora* leaves contain chrysophanic acid, or 9-anthrone, they are also utilized as an antifungal agent. Because seed extract contains anthraquinone aglycones and naphthopyrone glycosides 2, 3, it has also been shown to have a hypotensive effect in vitro. Because of its phenolic components, seed extract has also been shown to have antibacterial properties.

Abbott (1925) states that the cold percolation process is applied to new plant leave. Fresh leaves were first allowed to air dry before being ground into a powder using an electric blender. 300 ml of n-hexane and 500 g of powder were combined, let to sit for 72 hours, filtered, and then placed in a reagent bottle. After two hours of drying, the powder was mixed with methanol and chloroform and left for seventy-two hours. After passing through What Man's filter paper No. 1, the resulting crude extract was dried in a water bath or rotary vacuum evaporator at ambient temperature (40°C) at decreased pressure (25–30 mmHg). Before being employed for bioassay, these dry and semi-solid crude extracts were kept in a refrigerator.

Chemical analysis and identification of the compounds

Initially, n-hexane was used to separate the crude leaf extracts of both plants from the fat, and methanol and chloroform were then used to extract them. The concentrated solution was let to settle once a greenish yellow coating had formed. The purified samples were submitted to SAIF, CDRI Lucknow for spectral analysis in order to better identify and clarify the structure of the plant's leaf extracts: Tests were performed on the IR, UV, NMR, and mass spectra. Sesquiterpene lactones were ultimately identified by matching the spectrum data acquired from SAIF CDRI Lucknow with the legitimate markers that were accessibly.

Study of extract *Carica papaya* and *Cassia tora* on *callosobrushus chinensis* with different pulses –

1. Insects were collected from the infected grains.
2. Twenty beakers were collected. After being cleaned with distilled water, they were dried.
3. One hundred pulse seeds (such as Arhar, Mung, and Urad) were placed in each beaker.
4. Each beaker contains two drops of different amounts of methanol and chloroform fractions (e.g., 500 ppm, 100 ppm, 150 ppm, 200 ppm, and 250 ppm).
5. Three male and three female insect pairs were introduced. They poured one of control.
6. A piece of muslin cloth was placed over the mouth of each beaker and secured with a rubber band.
7. Seven days later, the muslin fabric was removed from the beakers, allowing the insects to be removed.
8. After counting the eggs that were placed on the grains, the beakers were once again covered with muslin cloths.
9. The beakers were once again closed after seven days, after which they were unsealed to count the number of larvae that had emerged from the eggs.
10. The beakers were opened once more after seven days in order to determine how many pupae had developed. The muslin fabric was then used to seal the beakers once more.
11. The adult insects emerged from the pupae when they were opened after seven days. They are beakers that are counted.
12. To check for germination, the seeds from each beaker were placed on a petri dish and moistened with water.
13. A count was made of the seeds that sprouted.

With the wrinkled seeds, the same experiment was conducted again

Percentages loss in weight of the plant materials

(Table see in last page)

Result and discussion

Khaire et al. (1993) reported Neem oil-treated seeds demonstrated a repelling effect on adult beetle egg-laying behavior, according to Khaire et al. (1993).

According to Pandey et al. (1986), neem leaf and twig plant extracts exhibited strong repellent properties against C. chinensis. According to Khaire et al. (1993), neem oil treatment of pigeon pea seeds shown a strong deterrent effect on adult C. chinensis beetle egg laying for up to 100 days following treatment.

Extracts of Cassia tora and Caricca papaya leaves at five concentrations demonstrated the highest deterrent activity against Callosobruchus chinensis at one hour, while extracts of the leaves at 250 ppm concentration demonstrated 90% deterrent activity in methanol and chloroform and the lowest in control.

Direct poisoning **Bhaduri et al. (1985**) claimed that Bankalami leaf extract had insecticidal effects against pulse beetles. According to some researches, pulse beetle can be controlled with a range of plant preparations. According to Ogunwolu and Idowu (1994), C. maculatus is poisoned by 2.5% powdered A. indica seeds. Dust and ether extracts from brown pepper seeds are useful in raising the mortality rate of C. maculatus adults infesting cowpea seeds, according to Mbata et al. (1995). According to Kim et al. (2003), within a day of treatment, extracts of horseradish (Coccoleria auroracia) oil, mustard (Brassica juncea) oil, and cinnamon (Cinnamomum cassia) bark and oil demonstrated strong insecticidal action against C. chinensis.

Larval mortality in the current investigation was highest in 250 ppm concentrations of chloroform and methanol extract of Caica papaya and Cassia tora. Chenopodium ambrosioides' dried ground leaf, according to Tapondjou et al. (2002), prevented the formation of F• offspring and the adult appearance of C. chinensis and C. maculatus. Our conclusions are generally supported by these results. leaf, whereas in the control it was at its lowest.

The experimental plant's leaf extracts prevented the appearance of adults in the current investigation. Adults appeared at the lowest concentration in 250 ppm of methanol and chloroform and at the highest concentration in the control.

(Tables see in last page)

Conclusion: In-depth research is necessary to identify environmentally friendly bruchids and other pests. Through thorough investigation, we can pinpoint practical methods that lessen the influence on the environment and guarantee the security of farming operations. This finding is critical to creating long-term pest control strategies that promote crop health and ecosystem health.

References :-

1. Abbott, W.S. (1925). A method for calculating insecticide effectiveness. J.Eco. Entomol., 18: 265-267.
2. Anonymous (2007-2008) Highlights of research on pulses. University of Agricultural Sciences, Dharwad, Karnataka, India
3. Aravind, G., Bhownik D, Duraivel S, Harish G. Traditional and Medicinal Uses of Carica papaya. Journal of Medicinal Plants Studies 2013, Volume 1, Issue 1, 7-15
4. Bhaduri N., Ram S., Patil B. D. Evaluation of some plant extracts as protection against the pulse beetle, Callosobruchus maculatus F., which damages cowpea seeds. Journal of Entomological Research. 1985;9(2):183-187. [Google Scholar]
5. Choudhary B.S. and Pathak S.C. (1989) Relative preference of Callosobruchus chinensis (LINN.) for different varieties of Bengalgram. B 8.

6. Dotta L, de Andrade JIA.,. Goncalves E.L.T, Brum A, Mattos J.J., Maraschin M, Martins ML Leukocyte phagocytosis and lysozyme activity in Nile tilapia fed supplemented diet with natural extracts of propolis and Aloe barbadensis. Journal of Fish& Shellfish Immunology 39 (2014) 280-284
7. Hasimun, P., Suwendar, and Ernasari GI. Analgetic activity of papaya (Carica papaya L.) leaves extract. International Seminar on Natural Produst Medicines. ISNPM 2012. Journal of Procedia Chemistry 2014, 13; 147 – 149
8. Jat N R, Rana B S and Jat S K (2013) Estimation of losses due to pulse beetle in chickpea: Bioscan 8(3), 861-863.
9. Kanjilal U.N. (1979). Forest flora of Chakrata, Dehradun and Saharanpur forest divisions, United Provinces. Bishan Singh and Mahendra Pal Singh, Dehradun, India.ulletin of Grain Technology, 27(3): 181-187.
10. Khaire, V.M., Kachare, B.V. and Mote, U.N. (1993). Effect of different vegetable oils on ovipositional preference and egg hatching of Callosobruchus chinensis Linn, en pigeonpea seeds. Department of Entomology, Mahatma Phule Agricultural University, Seod Research Journal 21:128-130
11. Kirtikar, K.R., Basu, B.D. (1999). Indian Medicinal Plants, Vol. I. Dehradun; India: International Book Distributors. pp.56-58.
12. Kim S.I., Roh J.Y., Kim D.H., Lee H.S., Ahn Y.J. Insecticidal activities of aromatic plant extracts and essential oils against Sitophilus oryzae and Callosobruchus chinensis. Journal of Stored Products Research. 2003;39(3):293-303. [Google Scholar]
13. Mantok ,C. 2005. Multiple usage of green papaya in healing at Tao Garden Health Spa and Resort, Thailand. Retrieved from : www. tao.garden .com
14. Matsuura, F.C. A.U, Folegatti, M.I.D.S, Cardo- so, R.L. and Ferreira, D.C 2004. Sensory acceptance of mixed nectar of *papaya*, pas- sion fruit and Acerola. *Science Agric*ulture (Piracicaba, Braz). 61: 604-608.
15. Mbata G. • N., Oji O. A., Nwana I. E. Insecticidal activity of preparations from brown pepper, Piper guineense, shroom seeds to Callosobruchus maculatus (Fabricius). Discovery and Innovation. 1995;7(2):139-142. [Google Scholar]
16. Mukherjee, A., Joshi, K., Joshi, P., Shubha, Roy, M.L., Jethi, R., and Chandra, N. (2018). Status of major pulse crops in northwestern Himalaya and its importance in nutritional security. Climate Risk Management: Sustainable Pulses Production,
17. Ogunwolu O., Idowu O. Efficacy of powdered Zanthoxylum zanthoxyloides (Rutaceae) root bark and Azadirachta indica (Meliaceae) seeds for the control of the cowpea seed bruchid, Callosobruchus maculatus (Bruchidae) in Nigeria. Journal of African Zoology. 1994;108(8):521-
18. Pandey, N.D., Mathur, K.K., Pandey, S. and Tripathi, R.A. (1986). Effect of some plant extracts against pulse beetle, Callosobruchua chinensis Linnaeus. Indian Journal of Entomology 48:85-90.
19. Pandey, N.K. and Singh, S.C.(1995). Effect of neem leaf powder on survival and mortality of pulse beetle, Callasobruchut chinensis (L.) infestation gram. Uttar Pradesh Journal of Zoology 3:162-164,
20. Prajapati N.D., Purohit S.S., Sharma A.K., Kumar T. (2003). A handbook of medicinal plants: a complete source book. Agrobios (India).
21. Ranjan, K.P., and Singh, R.K.P. (1998). Cropping patterns in backward agriculture – a case of north Bihar. Status of Agriculture in India, 55(2):69-72.
22. Reddy AA. Technology of pulses production: status and way forward. Economic and Political Weekly. 2009;
23. Sarika Sharma., Man Singh Dangi., Shailendra Wadhwa., Vivek Daniel., Akhilesh Tiwari. (2010). Antibacterial activity of Cassia tora leaves. International Journal of Pharmaceutical and Biological Archives., 1(1): 84-86.
24. Singh, A.K., Singh, S.S., Prakash, V., Kumar, S. and Dwivedi, S.K., (2015). Pulses production in India: current status, constraints and way forward. Journal of Agricultural Research, 2(2), 75-83.
25. Sharma S.S. (1984) A review of the literature on damage caused by Callosobruchus species (Bruchidae: Coleoptera) during storage of pulses. Bull. Grain Tech. 22(1), 62-6*
26. Tapondjou L. A., Adler C., Bouda H., Fontem D. A. Efficacy of powder and essential oil obtained from leaves of Chenopodium ambrosioides as post-harvest grain protectants against six-toed stored product beetles. Journal of Stored Products Research. 2002;38(4):395-402. [Google Scholar]
27. Walter, L. 2008. Cancer remedies Retrieved form: www.health-science-spirit.com/cancer6-remedies

Percentages loss in weight of the plant materials

S.	Name 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.	*Carica papaya*	2000	185	1815	96.2%
2.	*Cassia tora*	2000	190	1800	98%

Statistical data of Purified fraction of *Carica papaya* (CMF_1) Methanol extract against Pulse beetle *(Collosobruchus chinensis)* on fresh Pegeon Pea Arhar.

Concentration	24 hr. larval mortality	Regression equation (y = a$\pm$bx)	Chi - Square x^2(n-1)	LC_{50}(ppm)	Variance (V)	S.E.	Fiducial limits (ppm)
50	59	-3.750$\pm$1.748x	4.512	139.874	0.0246	0.157	L = 126.940 U =130.564
100	86						
150	120						
200	145						
250	169						
Control	11						

Statistical data of Purified fraction of *Carica papaya* (CCF_2) Chloroform extract against Pulse beetle *(Collosobruchus chinensis)* on fresh Pegeon Pea Arhar.

Concentration	24 hr. larval mortality	Regression equation (y = a$\pm$bx)	Chi - Square x^2(n-1)	LC_{50}(ppm)	Variance (V)	S.E.	Fiducial limits (ppm)
50	45	-4.146$\pm$1.845x	6.868	176.479	0.0265	0.163	L = 140.570 U = 246.648
100	68						
150	99						
200	129						
250	157						
Control	11						

Statistical data of Purified fraction of *Cassia tora* (CCF_3) Chloroform extract against Pulse beetle *(Collosobruchus chinensis)* on Wrinkled Pegeon Pea Arhar seeds.

Concentration	24 hr. larval mortality	Regression equation (y = a$\pm$bx)	Chi - Square x^2(n-1)	LC_{50}(ppm)	Variance (V)	S.E.	Fiducial limits (ppm)
50	72	-3.780$\pm$1.84x	10.034	112.337	0.0243	0.156	L = 77.211 U = 148.935
100	99						
150	130						
200	164						
250	189						
Control	10						

Statistical data of Purified fraction of *Cassia tora* (CMF_4) Methanol extract against Pulse beetle *(Collosobruchus chinensis)* on Wrinkled Pegeon Pea Arhar seeds.

Concentration	24 hr. larval mortality	Regression equation (y = a$\pm$bx)	Chi - Square x^2(n-1)	LC_{50}(ppm)	Variance (V)	S.E.	Fiducial limits (ppm)
50	76	-4.047$\pm$2.056x	4.683	92.981	0.0252	0.159	L = 83.763 U = 101.766
100	119						
150	152						
200	180						
250	203						
Control	10						

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