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BIOPESTICIDAL ACTIVITY OF *CASSIA TORA* L. AGAINST RED COTTON BUG, *DYSDERCUS CINGULATUS* FAB.

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ABSTRACT

Insecticidal effect of methanol and ethyl acetate leaves extract of *Cassia tora* were studied against *Dysdercus cingulatus*. The plant leaves were dried, powdered and extracted in soxhlet apparatus in methanol and ethyl acetate solvent for 24 hrs. The adult red cotton bug, *D. cingulatus* were exposed to various concentration and percent mortality were recorded after 96hrs.

The insecticidal activity of leaves extract of *Cassia tora* were LD_{10}= 4.871µg/gm. LD_{50}= 8.500µg/gm., LD_{90}=13.09µg/gm., LD_{99}= 13.71µg/gm. in methanol and LD_{10}= 2.597µg/gm., LD_{50}= 6.096µg/gm., LD_{90}= 13.05µg/gm., LD_{99} = 13.98µg/mg. in ethyl acetate. Results revealed that the mortality increase with increase in concentration of the plant extract. The ethyl acetate solvent extract showed more insecticidal property against *Dysdercus cingulatus*. Stastical variance, 95% confidance limits and regression equations are presented.

Keywords: *Dysdercus cingulatus, Cassia tora,* biopesticide.

INTRODUCTION

Cotton is one of the most important fibers and cash crop ofIndia subjected to destructive action of number of insect pest. Sucking pests have become quite serious from seedling stage; their heavy infestation at times reduces the crop yield toa great extent. The average crop losses worldwide due to pests and diseases are 60% of potential production. Among 1326 species of insect pest of cotton (Hargreeques) recorded worldwide, nearly 130 species occur in India. Out of these the red cotton bug, *Dysdercus cingulatus* Fab.is the severe pest of cotton crop. (Sharma *et. al.,* 2010). It is distributed all over the cotton producing regions of India (Sahayaraj and Illayaraja,2008). It is commonly known as red cotton bug causes serious damage by feeding on developing bolls and ripe cotton seeds (Natarajan and Rajendren, 2005). Their penetrations into the developing cotton bolls transmit fungi on the immature lint and seed, (Yasuda, 1992; Sontakke *et al*., 2013) which latter on stain the lint with typical yellow color, hence the name “cotton strainer”. Heavy infestations on the seeds affect the crop mass, oil content and the marketability of the crop (Sontakke *et.al*., 2013).

The huge amounts of synthetic pesticide are applied in the field of cotton to protect from insect attack. With a greater awareness of hazards associated with the use of synthetic organic pesticide there has been an increase need to explore suitable alternative methods of pest control. Farmers use different plant materials to protect cotton crop from pest infestation. Natural products in their crude form or plant extract provide unlimited opportunities as bio pesticide. Botanical insecticides are ecofriendly and environmentally safer alternative methods for crop protection (Mansour *et al.,* 2011; Kabiri *et al*., 2012; Abbad and Basheli, 2013). In recent years research efforts are reported on development of insecticides of plant origin. Most plant species that are used in phytomedicine contain ingredients, which inhibit the development of insects, hinder their feeding (antifeedants) or act as repellents and confusants (Laznik *et al.,* 2010). This paper reports the results of

research on the effects of *Cassia tora* plant extracts against red cotton bug, *Dysdercus cingulatus.*

Cassia tora L. is an annual herb or under shrub as a rainy season weed across the India (Choudhary *et al.*, 2011). It also possesses various biological and pharmacological activities including antihepatotoxic, antiallergic, antimutagenic, antifungal, radical scavenging, antimicrobial and insecticidal. The roots, flowers and seeds of *Cassia tora* contains 1, 3, 5 trihydroxy-6-7 dimethoxy-2- methyl anthroquinone and sitosterol (Jain and Patil, 2010). The seed oil has various percentages of mixed fatty acids. According to Mukherjee, 2002; Soumyanath, 2005 the leaves of wild Senna are the rich source of in emodin, tricontan-1-ol, d-tartaric acid, stigmasterol, sitosteral D-glucoside, palmitic, stearic, succinic and freindlen. Ranilalitha *etal*, (2015) evaluated the nymphicidal effect of two indigenous plant extacts of *Adathoda vasica* and *Vitex negundo* on cotton pest, *Dysdercus cingulatus* (Fab.). Several authors studied the insecticidal activity of *Cassia tora* (Ansari, 2017; Yankanchi and Gadache, 2010; Supare *et al*., 2015).

Therefore, the present study was undertaken to evaluate the effect of methanol and ethyl acetate extracts of *Cassia tora* leaves against the red cotton bug, *Dysdercus cingulatus* Fab.

MATERIALS AND METHODS

Plant Collection and Extraction

Leaves of *Cassia tora* were collected from Aurangabad and nearby areas and were properly identified from the taxonomist. The plants were washed three times in tap water and rinsed in distilled water. The excess water was soaked and the leaves were separated and dried in shade. The dried leaves materials were powdered in a domestic grinder and stored in air tight containers in refrigerator till further use. From this stock 250gm. of powder was extracted separately with 750 ml. of solvent using Soxhlet apparatus. Extractions were done in methanol and ethyl acetate solvents separately, for 24 hr.

Insect Culture

Nymphs and adults of *Dysdercus cingulatus* Fab. were collected from the cotton fields around the Aurangabad city. The collected insects were maintained in the laboratory conditions, at a temperature of 28±2ºC and at 70-80 % relative humidity in acrylic plastic jars feed with fresh leaves, cotton bolls and water soaked cotton seeds. The laboratory emerged adults were used for the experiments.

Insecticidal Bioassay

Fresh cotton bolls and their weighted pieces were taken in eachacrylic plastic jar and were exposed to several doses of methanol and ethyl acetate extracts of *Cassia tora*. The dose was prepared by mixing the extract with respective solvent and was applied and sprayed to fresh cottonball and their pieces. One jar of control containing only fresh cotton boll and their pieces sprayed with only respective solvent was maintained. The treated cotton boll and their pieces were allowed to evaporate the solvent for 24 hours. 10 newly emerged adults were released in each experimental and control acrylic plastic jar containing the cotton boll and their pieces. The mortality in response to plant extract of different solvents was recorded after 24 h up to 96h of treatment. The percent mortality was calculated after 96h and the observed data was subjected to probit analysis (Finney 1947).

RESULTS AND DISCUSSION

The toxic effect of *Cassia tora* leaves extract were evaluated against red cotton bug, *Dysdercus cingulatus*. The numbers of dead *Dysdercus cingulatus* were counted after 24, 48, 72 and 96h at different doses of methanol and ethylacetate crude extract. The total percent mortality was observed after 96h. Then the corrected mortality was calculated by using Abbott's formula and the results are presented. The results showed that the mortality increases with increase inconcentration at all doses (Table and Figure).

The results of the probit analysis for the estimation of LD_{10}, LD_{50}, LD_{90}, LD_{99}, variance, 95% confidence limits and regression equation at 96h for the mortality of red cotton bug, *Dysdercus cingulatus* are presented in table-2. In bioassay of methanol and ethyl acetate leaves extract of *Cassia tora* were LD_{10}= 4.871µg/gm. LD_{50}=8.500µg/gm., LD_{90}=13.09µg/gm., LD_{99}=13.71µg/gm. in methanol and LD_{10}= 2.597µg/gm., LD_{50}= 6.096µg/gm., LD_{90}= 13.05µg/gm., LD_{99} = 13.98µg/mg. in ethyl acetate respectively. Among the various estimate of regression based probit analysis, the $\chi 2$ values for the regression coefficients showed homogeneity to the data.

Table -1

Effect of plant extract on regression equation LD_{10}, LD_{50}, LD_{90}, LD_{99} values with variance, standard error, x^2 and 95% confidence limits for adult of *Dysdercus cingulatus*after 96h.

Solvent	Regression Equation	LD_{10}	LD_{50}	LD_{90}	LD_{99}	Variance	Standard Error	x^2	95% Confidence limit	
									Lower	Upper
Methanol	5.3008x+0.0732	4.871	8.500	13.09	13.71	0.001319	0.03631	1.3545	0.8583	1.0005
Ethanol	3.4581x+2.2848	2.597	6.096	13.05	13.98	0.0030	0.6584	0.7142	0.0547	0.7304

Figure-1

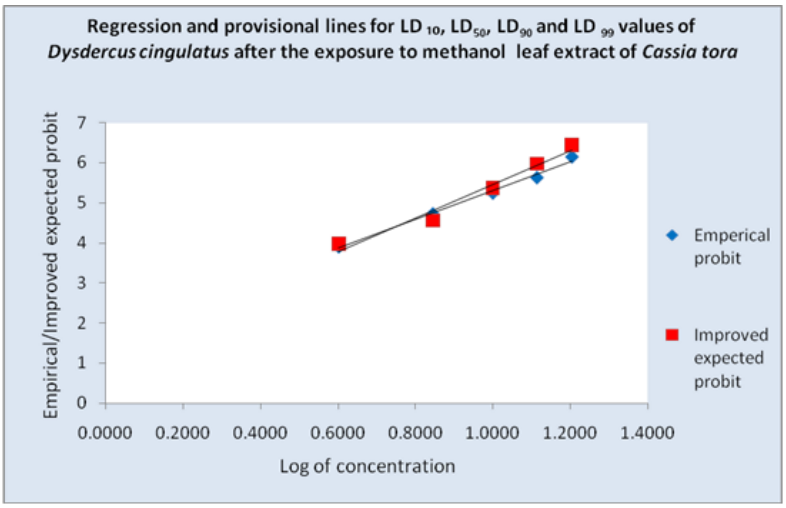
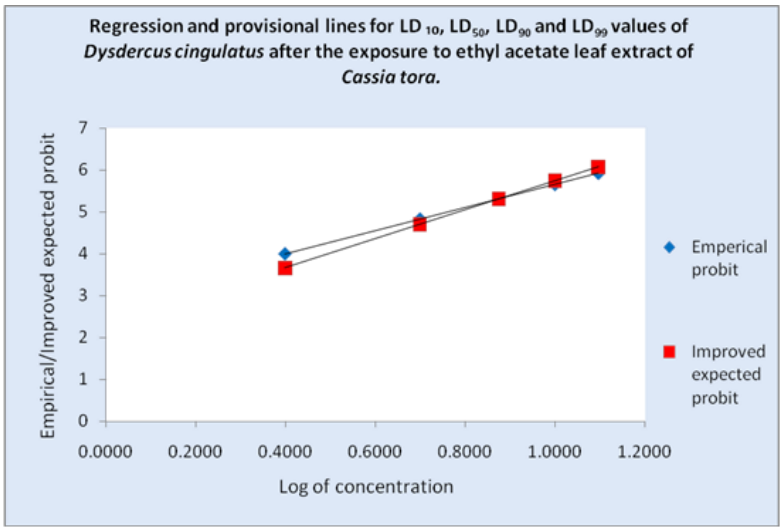


Figure-2



Ansari and Bhot (2017) studied the toxicity of aqueous leaves, stems, flowers, pods and root extracts of *Cassia tora* on *Artemia salina*. All the extracts showed effective mortality on *Artemia salina*. But the aqueous leaf extracts at a concentration of 100 µg/ ml showed the highest mortality rate followed by aqueous flower extract.

The crude extract of *Cassia tora* at a concentration of 10 and 10.2 ppm showed 50% larval mortality after 24, 48, 72 and 96 h of exposure against African malaria vector, *Anopheles gambiae* (Valentine *et al*., 2017).

Yankanchi and Gadache, (2010) screened five indigenous weeds, *Clerodendrum inerme* L. (Verbenaceae), *Withania somnifera* L. (Solanaceae), *Gliricidia sepia* L. (Fabaceae), *Cassia tora* L. (Caesalpiniaceae) and *Eupatorium odoratum* L. (Asteraceae) for their effect on mortality against rice weevil, *Sitophilus oryzae* L. (Coleoptera: Curculionidae). Results demonstrated that after the exposure of 2.5 and 5% ethanol extracts of *Cassia tora* and C. *inerme* showed mortality from 20.00% to 43.33% after 1 to 21 days respectively.

Sahu *et al*., (2017) investigated the cell mediated and humoral immune response after supplementing methanolic extract of *Cassia tora* in broiler bird.

Supare and Patil, (2015) evaluated the larvicidal activity of *Cassia tora* (leguminaceae) seeds powder extract against the larvae of *Anopheles stephensi.* The mortality was tested at various concentrations (0.1%, 0.2%, 0.3%, and 0.4%). The 0.4% *Cassia tora* extract gave 80% mortality against *Anopheles stephensi.*

Crude extract of the leaves of *Cassia tora* showed toxic effect on Swiss mice. Oral dose of 100mg/Kg, 200mg/Kg was found to be lethal. Administration of diet containing 0.5% or more seed of *C. tora* for 13 weeks resulted toxic to rats producing myeloid hyperplasia with peripheral leukocytosis, thrombocytosis and mild anaemia (Deore *et al.,* 2009).

Ahad *et al.,* (2016) showed the grain protectant activity of *Cassia tora* against pulse beetle, *Callosobruchus chinensis.* The number of dead *Callosobruchus chinensis* were counted after 24, 48, and 72h at different doses (5.3 to 7.8, 4.7 to 6.5 and 4.1 to 6.0g/100 ml) of n-hexane extract. The total percent mortality was observed with increase in concentration at all doses.

Jang *et al*., (2002) assessed the seed extracts of *Cassia tora* for the mortality of 4th-stage larvae of *Aedes aegypti* and *Culex pipiens pallens*. Methanol extracts *of C. tora* at 40 ppm showed 86.7 and 100% and at 20 ppm gave 59.2 and 78.3% mortality against *Aedes aegypti* and *Culex pipiens*.

In the present investigation, the toxicity of ethylacetate and methanol leaf extract of *Cassia tora* was tested against red cotton bug, *Dysdercus cingulatus.* In our study the mortality increases with increase in concentration at all the doses at 96 h of exposure.

Similar to the present investigation several studies documented the insecticidal activity of plant extracts against Red cotton bug, *D. cingulatus*. Sharma *et al.* (2010) showed the percent mortality of *Azadiracta indica* against *D. cingulatus*. The highest mortality (75.00%) found at 1.0% concentration of neem seed kernel extract and when eggs treated with the neem extract increased percent mortality (12.25%) was noticed at a concentration of 0.005%.

Evengelin *et al.* (2014) reported the third instar nymphs of *Dysdercus cingulatus* were treated with *Adhatoda vasica* extract, in increasing concentration from (0.5-2.0%) egg mortality and the survival rate gradually decreased. Sucha dose dependant mortality was also observed by Sahayaraj and Shobha (2012), and found that the aqueous seed extract of *Tephrosia purpurea* and *Acalypha indica* at 96 h showed insecticidal activity (LC_{10} =2.46, LC_{50} =2.53) and (LC_{10} =2.44, LC_{50} =2.50) respectively against *Dysdercus cingulatus*. The crude extract of *Ailanthus excelsa* at different concentration affected the egg mortality (1-56.66%, 2-75.33%, 3-81.33%) and adult emergence of *Dysdercus cingulatus.* Sontakke *et. al.,* (2013), Ranilalitha *et al.,* (2015) concluded that crude methanol extract of *Adathoda vasica* and *Vitex negundo* showed percent mortality against nymph instar of *Dysdercus cingulatus*. Similarly the methanol extract of marine green algae, *Ulvalactuca* caused dose dependant mortality after 96 h of treatment (LC_{10} =313.59, LC_{50} =1329.46) against *Dysdercus cingulatus* (Asha *et al.,*2012). Sahayaraj and Kalidas (2011)observed the benzene and chloroform extract of seaweed, *Padina pavonica* against nymphal instars of *D. cingulatus.*The nymph mortality in benzene extract was (LC_{10} =0.004,LC_{50} =0.0084) and in chloroform was (LC_{10} =0.039, LC_{50} =0.045) at 96 h. respectively. The brown macro algal ex- 90tract of *Sargassum wightii* showed higher mortality than *Padina pavonica* against *Dysdercus cingulatus,* Asaraja and Sahayaraja (2013). Sahayaraj and Jeeva (2012), investigated the insecticidal activity of brown seaweed algae, *Sargassum tenerrimum* against *D. cingulatus* (LC =0.009%).

Gadewad and Pardeshi observed the ethyl acetate solvent extract of *Chrysanthemum indicum* and *Sida acuta* (LD_{50} =6.486 µg/gm,LD_{50}=6.165 µg/gm respectively) shows more insecticidalproperty than methanol solvent extract (LD_{50}=9.230 µg/gm, LD_{50}=9.69 µg/gm respectively) against red cotton bug, *Dysdercus cingulatus* Fab.

The finding of the present investigation revealed that, the leaf extract of *Cassia tora* possesses remarkable insecticidal activity against *Dysdercus cingulatus* due to presence of active insecticidal phytocompunds. The LD_{10}= 4.871µg/gm., LD_{50}= 8.500µg/gm., LD_{90}=13.09µg/gm., LD_{99}=13.71µg/gm. in methanol and LD_{10}= 2.597µg/gm., LD_{50}= 6.096µg/gm., LD_{90}= 13.05µg/gm., LD_{99} = 13.98µg/mg. in ethylacetate were observed. The study needs further investigation to find out active ingredients responsible for insecticidal properties against cotton pest and to reach any final recommendations.

The results of the study have confirmed that the *Cassia tora* have explored the potential of bio pesticideand crop protecting activity against cotton pest.

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