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INSECTICIDAL ACTIVITY OF *CHRYSANTHEMUM INDICUM* AGAINST RED COTTON BUG, *DYSDERCUS CINGULATUS* FAB

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ABSTRACT

Insecticidal activity of methanol and ethyl acetate leaves extract of *Chrysanthemum indicum* 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 *Chrysanthemum indicum were* (LD_{10}=4.638,LD_{50}=9.230,LD_{90}=13.80, LD_{99}=14.91) in methanol and $LD_{10=}$ 2.494µg/gm.,LD_{50}= 6.486µg/gm., LD_{90}= 13.04 µg/gm.LD_{99} =13.96 µg/mg. in ethyl acetate respectively. 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.

INTRODUCTION

Cotton is one of the most important fibers and cash crop of India 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 to a 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 biopesticide. 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 *Chrysanthemum indicum* plant extracts against red cotton bug, *Dysdercus cingulatus.*

Chrysanthemum indicum is the source of Anti-inflammatory and immunomodulatory (Wemming *et. al*., 2005; Yeon *et. al*.,2009). Antibacterial (Ben, 2008; Shafaghet *et. al*., 2010) and antimicrobial (Shunying *et. al*, 2005; Rajalakshmi, 2013). Ajajkumar *et. al,* (2005) reported the secondary metabolites of *Chrysanthemum indicum* plants like pyrethrin and its derivatives are being extensively used for insecticidal activity. Ranilalitha *et.al,* (2015) evaluated the nymphicidal effect of two indigenous plant extacts of *Adathoda vasica* and *Vitex negundo* on cotton pest, *Dysdercus cingulatus* (Fab.). Several

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authors studied the insecticidal activity of *Chrysanthemum indicum* (Kardidan *et.al.,* 1996; Kamraj *et. al*., 2009; Sharma *et. al.,* 2008).

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

MATERIAL AND METHODS

Plant Collection and Extraction

Leaves of *Chrysanthemum indicum* 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 each acrylic plastic jar and were exposed to several doses of methanol and ethyl acetate extracts of *Chrysanthemum indicum*. The dose was prepared by mixing the extract with respective solvent and was applied and sprayed to fresh cotton ball 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 recordedafter 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

The toxic effect of *Chrysanthemum indicum* 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 ethyl acetate 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 in concentration 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 *C. indicum* were LD_{10}= 4.638 µg/gm LD_{50}=9.230 µg/gm, LD_{90}= 13.80 µg/gm and LD_{99}=14.91µg/gm. And in ethyl acetate were LD_{10}=2.494µg/gm., LD_{50}=6.486µg/gm. LD_{90}=13.04µg/gm. And LD_{99}=13.96µg/gm. respectively. Among the various estimate of regression based probit analysis, the χ^2 values for the regression coefficients showed homogeneity to the data.

Table 1 Percent mortality of *Dysdercus cingulatus* treated with leaf extract *Chrysanthemum indicum*.

Solvent	Dose in µg.	No. of insect used	Mortality after 96 h.	Percent mortality	Corrected mortality
Control	-	10	-	-	-
Methanol	4	10	1	10	10
	6	10	2	20	20
	8	10	3	30	30
	10	10	5	50	50
	12	10	8	80	80
	14	10	10	100	100
Ethyl acetate	2	10	1	10	10
	4	10	2	20	20
	6	10	4	40	40
	8	10	6	60	60
	10	10	8	80	80
	12	10	10	100	100

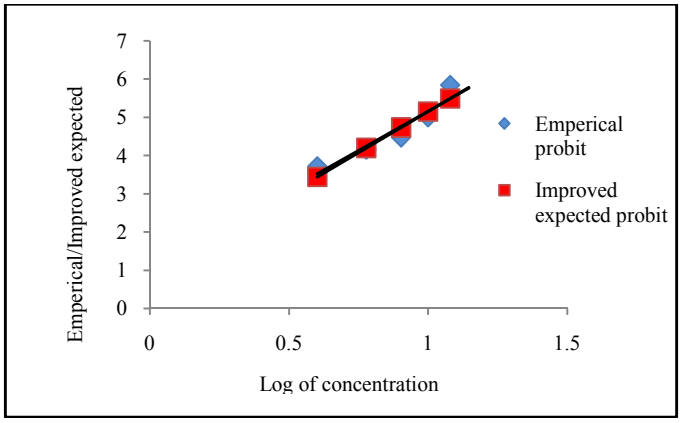

Fig 1 Regression and provisional lines for *Dysdercus cingulatus* exposed to methanol leaf extract of *Chrysanthemum indicum* after 96 h.

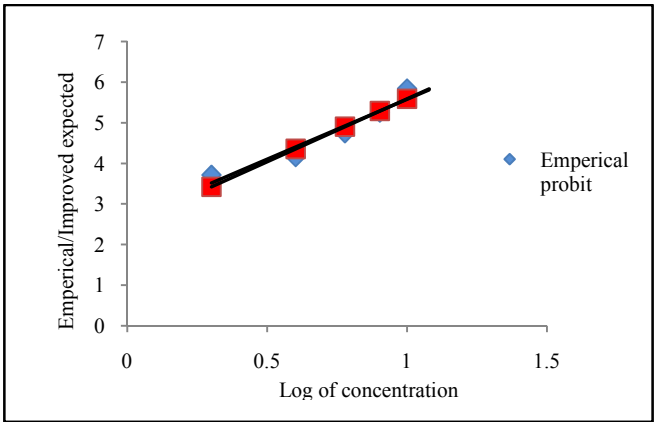

Fig 2 Regression and provisional lines for *Dysdercus cingulatus* exposed to ethyl acetate leaf extract of *Chrysanthemum indicum* after 96 h.

Table 2 LD_{10},LD_{50},LD_{90},LD_{99}values with variance, 95% confidence limits and probit analysis parameters for adult of *Dysdercus cingulatus* after 96 h of treatment.

Solvent	LD_{10}	LD_{50}	LD_{90}	LD_{99}	Variance	95% CL		Regression equation	x^2
						Lower	Upper		
Methanol	4.638	9.230	13.80	14.91	0.00220	00.8733	1.0571	Y=4.2895x+0.8597	1.3372 (2)
Ethyl acetate	2.494	6.486	13.04	13.96	0.00411	0.6863	0.9377	Y=3.1008x+2.4876	0.9055 (2)

DISCUSSION

Chrysanthemum indicum is the medicinal plant for the treatment of several diseases has insecticidal property against several pests. Kamraj *et. al*., (2009) studied the effect of methanol and ethyl acetate extract of leaf of *Chrysanthemum indicum* against mosquito larvae and showed highest toxic effect. The LC_{50} and LC_{90} of methanol and ethyl acetate extract against mosquito larvae was 42.29mg/L and 39.98mg/l respectively. The methanol flower and leaf extract of *Chrysanthemum* sp. showed insecticidal activity against flour beetle, *Tribolium confusum* (Haouas *et. al.,* 2008).

Rajalakshmi, (2013) proved antimicrobial and antibacterial activity of leaf extracts of *Chrysanthemum indicum* against the plant pathogens. Kardidan *et. al.,(*1996) investigated the insecticidal activity of *Chrysanthemum* flower affected the mortality and oviposition of insects.

In the present investigation, the toxicity of Ethyl acetate and Methanol leaf extract of *Chrysanthemum indicum* 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 to 2.0 %) egg mortality and the survival rate gradually decreased. Such a 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_{50}=2.46, LC_{90}=2.53) and (LC_{50}=2.44, LC_{90}=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, *Ulva lactuca* caused dose dependant mortality after 96 h. of treatment (LC_{50}=313.59, LC_{90}=1329.46) against *Dysdercus cingulatus.* (Asha *et. al.*, 2012). Sahayaraj and Kalidas (2011) observed the benzene and chloroform extract of seaweed *Padina pavonica* against nymph instars of *D. cingulatus*.

The nymph mortality in benzene extract was (LC_{50}=0.004, LC_{90}=0.0084) and in chloroform was (LC50=0.039, LC_{90}= 0.045) at 96h. respectively. The brown macro algal extract of *Sargassum wighti* 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_{50} = 0.009%).

The finding of the present investigation revealed that, the leaf extract of *Chrysanthemum indicum* possesses remarkable insecticidal activity against *Dysdercus cingulatus*. The $LD_{10=}$ 2.494µg/gm., LD_{50}= 6.486µg/gm., LD_{90}= 13.04µg/gm., LD_{99} =13.96µg/mg. in ethyl acetate and $LD_{10=}$ 4.638µg/gm..,LD_{50}= 9.230µg/gm., LD_{90}= 13.80 µg/gm., LD_{99} =14.91 µg/gm. in methanol 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

CONCLUSION

The results of the study have confirmed that the *Chrysanthemum indicum* have explored the potential of bio pesticide and crop protecting activity against cotton pest.

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