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INSECT REPELLENT AND INSECTICIDAL ACTIVITY OF DIFFERENT DEVELOPMENTAL GROWTH STAGES OF POD AND STEM BARK EXTRACT OF *CASSIA FISTULA* L. AGAINST *TRIBOLIUM CASTANEUM*

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ABSTRACT

Insect repellent and insecticidal activity was evaluated from different developmental growth stages of *Cassia fistula* pod and stem bark extracts on adult red flour beetle *Tribolium castaneum.* Acetone extract of all the samples tested have shown insect repellent and insecticidal activity compare to control and standards tested. Samples aqueous old stembark, benzene old stembark and ethanolic young stembark extract have shown most promising insect repellent and insecticidal activity compare to other samples tested. Samples Benzene one month and ethanolic 4 month extract have shown good (More than 50%) repellent activity while samples aqueous one month, aqueous pulp, aqueous young stembark and Benzene 1 month showed good (more than 50%) insecticidal activity compare to other samples tested. From the results it confirmed that samples Aqueous old stembark, Benzene old stembark and ethanolic young stembark have shown significant ($p<0.01$) activity.

KEYWORDS: Cassia fistula, Extracts, insect repellent activity, insecticides, insecticidal activity.

INTRODUCTION

Stored insect pests diminish the quantity and quality of grain so it is world wide issue. Up to 5–10% in the temperate zone and 20–30% in the tropical zone grains are harmed by them **Nakakit**a, 1998). *Tribolium castaneum* is a main stored product insect in grain storage (**Semple**, 1986).

Botanical insecticides are best option for the hazardous chemical insecticides. According to (**Sreelatha and Geetha,** 2011) different types of abnormalities in insects are induced by phytochemicals so it is used for insect pest control. To avoid these losses it is essential to establish safe alternatives to conventional fumigants and insecticides as bioinsectiside for the protection of grain products against insect infestations.

Plant are with insecticidal properties so they are used traditionally for generations throughout the world. Botanical insecticides are less expensive, more safer, easily processed and used by farmers and small industries than synthetic ones (**Belmain** *et al*., 2001). Since these insecticides are active against a limited number of species. They are biodegradable to nontoxic products. They are potentially suitable for use in integrated pest management. They produces new classes of safer insect control agents (**Kim** *et al*., 2003). In medicinal plant extracts, insecticidal constituents and essential oils mono-terpenoids are present. Due to their high volatile nature plants have an important insecticidal activity which is used to control stored-product insects (**Konstantopoulou** *et al*., 1992 and **Regnault-Roger and Hamrouni**, 1995). Terpenoids and alkaloids are applied for insecticidal compounds which are effective alternative for insect pest management (**Joseph** *et al*., 2012). Due to insect pest up to 30% losses caused during storage (**Haubruge** *et al*., 1997). *Tribolium castaneum (***Danahaye** *et al*., 2007) is most harming and destructive pests of stored products throughout the world. Primary strategy of grain protection from insect is to use of chemical agents but it is the least complex and most cost-effective method (**Hidalgo** *et al*., 1998). Pesticides showed the rapid and highest effect, but destroy ecosystem.

C. fistula is medium sized deciduous tree. It is about 6-9 meters tall with straight trunk and spreading branches. It has lovely lots of brilliant yellow shaded bloom and long stick like cylindrical fruit. Fruits containing pungent odour with sweet pulp and containing several black seeds (**Allen and Allen,** 1981).This plant contain grayish bark. It is spread throughout larger areas of India in the outer deciduous and mixed mansoon forest rising to1300m in outer Himalays (**Nirmala** *et al*., 2008 and **Bahorun, 2005**).

Besides it's pharmacological uses its extract is used for pest and disease control (**Jaipal** *et al*., 1983, **Sharma and Basardrai** 1999**, Raja** *et al*., 2000).

MATERIAL AND METHOD

1. Collection and processing of the plant material

The different developmental growth stages of pods and stem bark of *Cassia fistula* were collected from Akluj and nearby locality in Solapur district. The pods samples were collected from June to January. The pods and barks samples were cut into small pieces and oven dried at 60^0C. Dried pods and bark samples were grind into powder and stored in air tight plastic container.

Methods

i. Evaluation of insect repellent activity

Insect repellent activity was evaluated on adult red flour beetle *Tribolium castaneum*. The repellency test was carried out as per reported method with some modifications (**Zettler,** 1991). Adults of the insects were collected from the local grain market and authenticated from entomology Dept. Agricultural College Kolhapur. Insects were released in glass jar (10 x 15 cm) containing wheat flour mixed with 5% yeast powder. The flour was kept at 60 ± 1^0C in oven for two hours before culturing, to remove contamination of other organisms. The culture jars were put in the incubator maintained at 30 ± 1^0C and 70 ± 1% relative humidity. The adults were removed after seven days of oviposition period and the eggs were allowed to develop to the pupae stage. With a 40 mesh sieve, the pupae were shifted from the flour and placed into tiny glass jar (5x10 cm) containing wheat flour and yeast. From these jars, the adults of F_1 generation (2-3 weeks) were obtained for experiment. The filter paper disc (Whatman No.40, diameter 8cm) were prepared and cut into two equal halves. On one of the half 1ml of 5, 10, 15 and 20% solution of each extracts were added and on another half 1ml solvent was added as a control. These halves were air-dried for 10-30min. and each treated half disc was then attached to control half disc lengthwise, edge to edge with adhesive tape and put in a Petri dish (8 cm dia.). The inner edge of the petridish was smeared with glue stick in order to prevent escaping of insects. The seam orientation was changed in replicates to prevent the effect of any external directional stimulus influencing the distribution of the test insects. Thirty adult insects were released in the center of each filter paper circle and a plastic cover with few holes was put on the petridish. The distribution of insect in the two halves was observed after 1h and then hourly intervals for 5h. Three replicates were maintained for each treatment. The average of the count was converted to percentage repellency (PR) using Talukder and Howse formula.

ii.Procedure of Insecticidal activity

Different strengths of individual extracts (5, 10 and 15%) were prepared in 5ml of acetone by sonication. The film of different working concentrations (5ml) of acetone solution was prepared in petri dishes (10cm diameter) and dried for 1h. Some wheat flour was placed on dish to provide food for insects. Thirty adult insects of red flour beetle were put in to each Petri dish covered by perforated plastic disc and maintained at 27^0C. Mortality count was recorded after 24h. Each set was run in triplicates. The experiment was repeated with promising extracts.

RESULT AND DISSCUTION

Insect repellent and insecticidal activity of aqueous, ethanolic and benzene extracts of one month old pod, 4 month old pod, pod pulp and young and old stembark of *C. Fistula* against *Tribolium castaneum* is shown in **Table No. 1 and 2.**

Table 1: Insect repellent activity of different developmental growth stages of pods and stem bark of *Cassia fistula.*

Treatment	Conc. In mg (%)	Average repellence* after					% Repellency over 5h
		1h	2h	3h	4h	5h	
Plain acetone	5 ml	00	00	00	01	01	03.33
Citronella oil	10% v/v	**22**	**26**	**27**	**28**	**28**	93.33
Aq.1M.P.	20	05	06	08	08	08	30.00
Aq.4 M.P.	20	02	03	03	04	04	13.33
Aq. Pulp	20	06	08	08	09	10	30.00
Aq. Y.B.	20	07	08	09	10	11	36.66
Aq. O.B.	20	**15**	**17**	**20**	**23**	**24**	80.00**
Benzene 1 M.P.	20	11	13	15	17	19	63.33
Benzene 4 M.P.	20	07	08	09	10	10	30.00
Benzene Pulp	20	04	05	05	06	07	23.33
Benzene Y.B.	20	08	09	11	11	12	40.00
Benzene O.B.	20	**18**	**18**	**20**	**24**	**24**	80.00**
Ethanol 1M.P.	20	10	11	11	12	13	43.33
Ethanol 4M.P.	20	12	13	14	15	16	53.33
Ethanol pulp	20	06	07	08	09	09	30.00
Ethanol Y.B.	20	**23**	**25**	**26**	**26**	**27**	90.00**
Ethanol O.B.	20	04	05	06	07	07	23.33

*** Average of three replicates and values for no. of insects repelled out of thirty.**

Table 2: Insecticidal activity of different developmental growth stages of pods and stem bark of *Cassia fistula*.

Treatment	Concentration (mg/ml)	Average mortality count	% Mortality *
Plain acetone	5ml	00	00.00
Neem oil	0.15	22	73.33
Celphos	5%	29	96.66
Aq.1 M.P.	05	13	43.33
	10	15	50.00
	15	17	56.66
Aq.4 M.P.	05	08	26.66
	10	10	33.33
	15	12	40.00
Aq. Pulp	05	10	33.33
	10	12	40.00
	15	15	50.00
Aq. Y.B.	05	18	60.00
	10	19	63.33
	15	19	63.33
Aq. O.B.	05	**20**	66.66
	10	**20**	66.66
	15	**21**	70.00**
Benzene 1 M.P.	05	16	53.33
	10	18	60.00
	15	20	66.66
Benzene 4 M.P.	05	07	23.33
	10	08	26.66
	15	08	26.66

**** p<0.01 compare to standard citronella oil at (10%), EA-Ethyl Acetate**

Treatment	Concentration (mg/ml)	Average mortality count	% Mortality *
Benzene pulp	05	06	20.00
	10	06	20.00
	15	07	23.33
Benzene Y.B.	05	09	30.00
	10	10	33.33
	15	11	36.66
Benzene O.B.	05	**19**	63.33
	10	**20**	66.66
	15	**21**	70.00**
Ethanol 1M.P.	05	09	30.00
	10	10	33.33
	15	12	40.00
Ethanol 4M.P.	05	06	20.00
	10	07	23.33
	15	08	26.66
Ethanol pulp	05	11	36.66
	10	12	40.00
	15	12	40.00
Ethanol Y.B.	05	**21**	70.00**
	10	**22**	73.33**
	15	**23**	76.66**
Ethanol O.B.	05	10	33.33
	10	12	40.00
	15	13	43.33

*** Average of three replicates and values for no. of insects killed out of thirty ** p<0.01 compare to standard**

Aqueous old stem bark extract (80.00%), Benzene one month extract (63.33%), Benzene old stembark extract (80.00%), ethanolic young stembark extract (90.00%) showed insect repellent activity compared with citronella oil (10%). Aqueous old stem bark and aqueous young stem bark extracts showed highest insecticidal activity (mortality rate of 70.00% and 66.66% respectively). Benzene one month pod and old stembark extracts showed mortality rate 66.66% and 70% respectively as well as ethanolic young stembark extract showed highest mortality rate 76.66% against *Tribolium castaneum* at 15mg/ml concentration compared with standard Neem oil mortality rate (73.33%) and Cephlos mortality rate (96.66%).

In the present study, Acetone extract of all the samples tested have shown insect repellent and insecticidal activity compare to control and standards tested. Samples aqueous old stembark, benzene old stembark and ethanolic young stembark extract have shown most promising insect repellent and insecticidal activity compare to other samples tested. Samples Benzene one month and ethanolic 4 month extract have shown good (More than 50%) repellent activity while samples aqueous one month, aqueous pulp, aqueous young stembark and Benzene 1 month showed good (more than 50%) insecticidal activity compare to other samples tested.

Synthetic insecticides and fumigants are commonly used to control these insect pests throughout the world. Fumigants are known to be convenient and economical control measure (**Varma and Dubey**, 2001 and **Ogendo** *et al.*, 2008). Methyl bromide is completely phased out which is main reason of ozone depletion (Shaaya and Kostyukovsky, 2006 and Tayoub *et al*., 2012). Phosphine controls of stored product insect pests (**Varma and Dubey**, 2001). But showed bad effects on human health safety concerns, non target organisms and environment and pest resistance and resurgence (**Ogendo** *et al.*, 2008). All major pests of stored products are developed resistance against phosphine (**Pimentel** *et al*., 2007; **Lorini** *et al*., 2007 and **Nayak** *et al*., 2012). Plant extracts are using in pest control by farmers. Botanical insecticides are best option for the hazardous chemical insecticides.

CONCLUSION

From the results it concluded that samples Aqueous old stembark, Benzene old stembark and ethanolic young stembark have shown significant ($p<0.01$) insect repellent and insecticidal activity compare to control and standards used.

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