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Research Article

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A study on the antifeedant activity of *Cassia fistula* leaves

Raji P., Abila M. G. and Antony V. Samrot

Department of Biotechnology, Jeppiaar Nagar, Rajiv Gandhi Salai, Sathyabama University, Chennai

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ABSTRACT

Plant derived metabolites as molecule to counter the damage caused by pests has been a usual way of practise in the traditional method of farming. It is the most sought method as it has reduced effect on the human and environment than the conventional pesticides. In this study the leaves of Cassia fistula were screened for active phytochemicals using various solvents namely petroleum ether, chloroform, ethanol and methanol. The bioactivity of the molecules of these extracts were analysed as feeding deterrent activity against Sitophilus granarius. The antifeedant indices for all the extracts were dose dependent. The greatest effect for feeding inhibition was observed for petroleum ether extract having the highest value followed by ethanol.

Key words: *Cassia fistula*, antifeedant, plant extracts

INTRODUCTION

Protection of agricultural produces has been of great concern to combat the shortage of food commodities arising as a result of improper storage and inadequate yield due to unfavourable climatic conditions. Multiplex problems emanating with the increase in population and fewer cultivable lands has added more stress on managing the food resource. Storage of the available food has yet another trauma to be faced by way of pests. Many developing countries face enormous loss caused by pests due to poor storage facility. The conventional ways to overcome the effect of pest by chemical agents has caused severe ill effects to human health and environment by way of biomagnification, creating resistance of pests and damaging the non target organisms. The use of plant derivatives as pest control agents have been employed by the ancient Greeks and also in many parts of the world as biopesticides[1,2].

Cassia fistula commonly called ‘golden shower’ is known for its ornamental beauty. It is Native to India, the Amazon and Sri Lanka, Mauritius, South Africa, Mexico, China, West Indies, East Africa, Brazil, Thailand [3].Indian literature has documented the use of this plant for skin infection, liver disorders, rheumatism, haematemesis, pruritus, leucoderm, diabetes, intestinal disorder etc. In some area juices of the root mixtures are given orally for treating snake bites[4,5]. Here is an attempt given to evaluate the antifeedant activity of the leaves of *Cassia fistula* belonging to the family *Caesalpiniaceae*. The objective of the present work is to use the plant extracts as an antifeedant which aims to reduce the feeding rate by behavioural modification and not in any way directly altering the physiological growth, reproduction or the biochemical aspects of the pest and hereby assume that our investigation does no harm to the biodiversity of the insect.

EXPERIMENTAL SECTION

Collection and preparation of the plant material

The fresh leaves of *Cassia fistula* were washed in fresh water and dried in room temperature to remove the moisture content. The dried leaves were ground using electronic blender and then the plant material was mixed with 100ml of solvents of varying polarity (petroleum ether, chloroform, ethanol methanol and aqueous)[6]. Interaction of the

sample with the solvent was planned for time duration of 48h. The coarse plant fibres were removed by filtration and concentrated for further analysis.

Antifeedant activity of the leaf extracts of *Cassia fistula*

The antifeedant bioassay tests were conducted on the house hold pests – *Sitophilus granarius*[7-11].The insects used for the tests were observed for their adaptability to the environment for a week. They were fed with a diet of green gram under the laboratory conditions of 28^0C. The feedants were starved for a considerable time period before being introduced to the feed. Processing of the feed was carried out by saturating them in their respective solvent extracts of concentrations 5.0 and 10.0 mg/ml. The dried feed is then noted for its initial weight before being introduced to the pests. The feeding habits of the insects were recorded for two working conditions one comprising the treated feed (tt) and the untreated feed (cc) which serves as the control. The uptake of feed was a measure of the change in the weight after the feeding period. All the samples were done in replicates of five and monitored for a period of seven days.

Disparity of change in weight of the feed resulting by the absorption of water from the study environment, provided for the normal growth and development of the insect during the bioassay was overcome by undertaking a correction procedure which is an estimate of the food consumed (FC) by using the formula.

$FC = I W_S - [(F W_S x I W_B) / FW_B)]$

Where, FC = Calculated food consumed, $I W_S$ = Initial weight of the control feed, $F W_S$ = Final weight of the control feed, IW_B = Initial weight of the test feed, FW_B = Final weight of the blank feed

The activity of the plant extracts to inhibit the feedants was evaluated by the antifeedant index (AFI). The AFI is the measure of the percentage of the weight of the treated feed consumed in comparison with the untreated feed [12].

AFI = % weight of the treated feed consumed X 100
% weight of the treated feed consumed + weight of the control feed consumed

Percentage mortality

Percentage mortality rate was identified by comparing the number of pest lived to the number of pest used in this study.

RESULTS AND DISCUSSION

Plant leaves crushed and applied over body as insect repellents is a common sight amongst the local tribe of the tropics. These natural extracts wades of pests and insects like mosquito, bees, wasps etc which otherwise could be a nuisance in their day to day life. Some even mix the dried leaves of certain plants along with the food grains that they intent to preserve. Little did those ethnic practitioners understand that the plant themselves try hard to keep the pest at bay by way of secreting some phyto molecules in them. Inspired by this we tried to use the leaves of *Cassia fistula* for the antifeedant analysis. The crude extracts of the plant were obtained by solvent extraction and the choice of our solvents were solely based on screening the type of the active molecules involved in the antifeedant activity. Henceforth petroleum ether and chloroform as nonpolar solvents and ethanol and methanol as polar solvents were taken for the laboratory investigation. The antifeedant tests for the two concentrations (5 mg/ml and 10 mg/ml) of the ethanolic, methanolic, petroleum ether, chloroform extracts of *Cassia fistula* leaves are represented in Fig.1. It indicates the anti feedant indices were increasing at increasing concentrations. The non polar solvent systems witnessed their extracts had an increase in the feeding inhibition activity when the concentration of the extracts were nearly doubled from 5mg to 10mg. This analysis gives us an insight that the active molecule hindering the feeding could be of non polar nature. Our previous report on the plant to possess various phytoconstituents like tannin, saponin, terpenoids, flavonoids, phytosterols etc., might have showed activity [13].

The concentrations of the leaf extracts taken for the study include 5 mg and 10 mg of the crude sample (Fig. 2). It was observed that 10 mg ethanol and methanol extract and 5 mg petroleum ether extract required a period of seven days to reach 100% mortality, whereas 5 mg ethanol and methanol and 10mg petroleum ether extract required six days to inhibit the feedants. However all the extracts reached 100% mortality by the end of the total testing period of seven days. The essential oils of *A. absinthium*L. were also be reported to be toxic to adults of *Sitophilus granarius* (L.) (Coleoptera). The oils showed about 80-90% mortality of these insects after 48 h of exposure [14].

Dancewicz and Gabryś [15] had investigated the deterrent activity of *Allium sativum* L., *Artemisia absinthium* L and tansy (*Tanaceum vulgare L.*) against peach potato aphid (*Myzuspersicae* [Sulz.]). Munoz et al [16] also claimed that the ethyl acetate extracts from *Calceola riatalcana* exhibited strong bioinsecticidal effects against *Drosophila*

melanogaster and *Spodoptera frugiperda* and found the most active compound was identified as verbascoside[16].

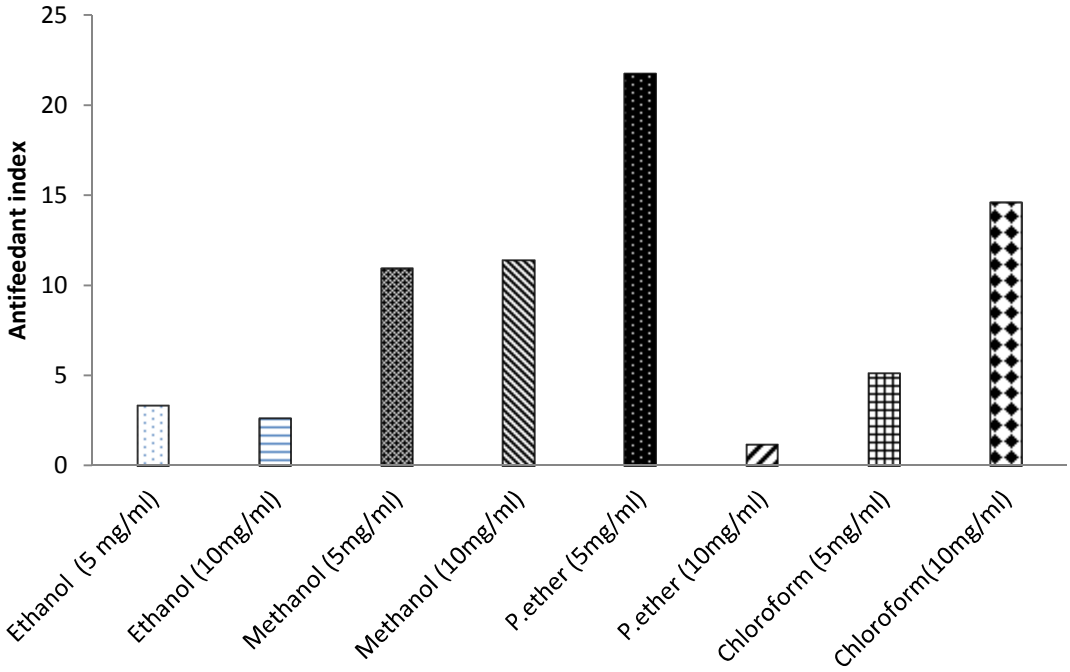

Fig.1Antifeedant activity of the leaf extracts of *Cassia fistula*

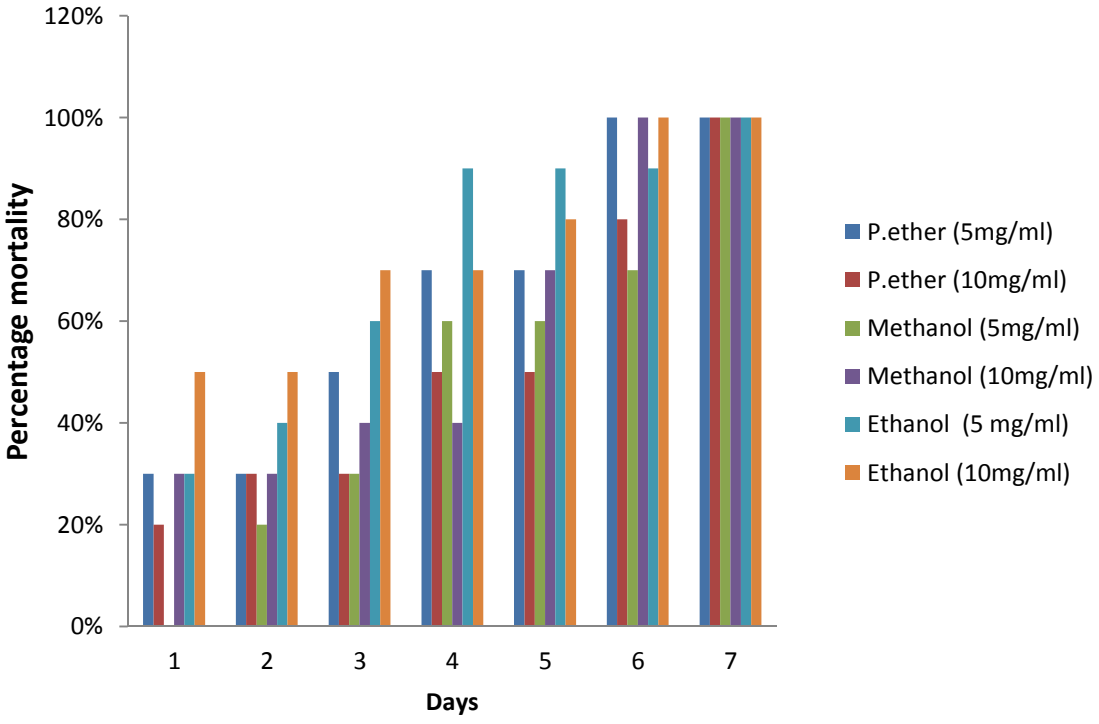

Fig. 2 Percentage mortality of *Cassia fistula* leaf extracts feedants

Similar results were obtained for Ononitol monohydrate from ethyl acetate extract of *Cassia tora* showed more than 65% antifeedant activity against *H. armigera*[17]. Another plant alkaloid benzophenanthridines isolated from *Zanthoxylumschinifolium* stem bark was a potent antifeedant against the storage pest *Tribolium castaneum* adults [18] cheng fang wang). Antifeedant activity of plant extracts on the various developmental stages of *S. frugiperda* was reported by Scapinello[19] using *Melia azedarach* extracts. Adults showed adverse effect for the extract with morphological deformities whereas the pupa and larvae of the species had adverse effects with changes in length and weight. However the feeding inhibition effect of the plant extracts on pest may be due to multiplex reasons like inhibition of midgut esterase, postdigestive toxicity or involving other cellular targets like midgut phenol oxidase, proteinase, ETH, tyrosinase or other PPOs involving cuticle synthesis inhibition[20-22].

CONCLUSION

We hereby summarise that although our plant extract has pronounced effect on the mortality of the feedants and thereby controlling their proliferative damage on storage foods, the mode of action of the phytoconstituents involved in the desired activity of *Cassia fistula* should be studied and the molecules characterised by analytical methods so as to give an potent molecule either as individual molecules or as related structures offering a synergistic approach in giving us a better and improved integrated pest control management making the organic revolution more meaningful.

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