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Antifeedant activity of medicinal plants

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ABSTRACT

A laboratory bioassay was conducted to investigate the antifeedant effect of *Gomphrena serrata* extracts on *sitophilus oryzae* (rice weevil) belongs to the family *Curculionidae*. Antifeedants are natural or synthetic compounds that stops or inhibits feeding by a pest and especially an insect. *Gomphrena serrata- Amaranthacae* family comprises many species which are used in nutrition and traditional folk medicine. Study was done to find the new active substance in the plant which could show antifeedant activity and compared with standard *Strychnos nuxvomica*. The extracts of both sample and standard were obtained by cold maceration process. The residue formed is collected and both the extracts were subjected to study the antifeedant activity. The activity is performed by dilution method and found to be showing the antifeedant activity. The primary objective of our work is simple and cost effective method to find out the active substance from natural resources.

Indiscriminate use of synthetic insecticides has led to problems such as the resurgence of primary pests, secondary pest's outbreak, resistance development, insecticide residue, health hazards, environmental contamination and increased cost of insect control. So this study will be solution for these problems by utilizing plant's bioactive molecules. Plants are the most efficient producers of phytochemicals in the environment, including secondary metabolites that are used by the plant in defence against insects. The secondary metabolites produced from *Gomphrena serrata* could be utilized in the development of new biopesticides.

Keywords: Antifeedant Activity, Bioassay, Biopesticides, Secondary metabolites, Phytochemicals.

INTRODUCTION

A natural or synthetic substance that stops or inhibits feeding by a pest and especially an insect. Pesticides derived from plants such as neem tree, which act as antifeedant and replellants. Antifeedant are organic compounds produced by plants to inhibit attack by insects and grazing animals. These chemical compounds are typically classified as secondary metabolism in that they are not essential for the metabolism of the plant, but instead confer long. Antifeedant exhibit a wide range of activities and chemical structure as biopesticides.

A family of about 65 genera and 900 species, Amaranthaceae are mostly distributed in tropical but also in temperate regions. About 18 genera and over 50 species have been reported from India. Some of the larger genera with the number of their approximately reported species and common names are Alternanthera (200, alligator weed), Gomphrena (100, globe amaranth), Iresine (80, gizzard plant), Amaranthus (60, pigweed), and Celosia (60, Celosia). Ornamental plants of the family known for their multicoloured foliage and beautiful inflorescence are Amaranthus caudatus (Foxtail), A. tricolor, A. salixifolius, Celosia cristata (cocks comb; white, purple or yellowishred panicles), Deeringia amaranthoides, Gomphrena globosa (globe amaranth), Iresine herbtsii (purplish-red foliage) and I. lindenii (red foliage). Edible plants of the family, of which the leaves and young shoots are used as vegetable are Amaranthus blitum (Amaranth or Chaulai), A. caudatus, A. hybridus, A. spinosus (Katili Chaulai), A. tricolor (Bari Chaulai), A. viridis, Celosia argenta and Digera muricata (Lehsua). Inflorescence paste of Achyranthes aspera (Latjeera or Chirchita) is used as an antidote against snake and scorpion bites [1].

In recent years, attempts are being made to identify plants, including herbs and weeds, for their insecticidal property with a view to find out suitable alternatives to replace hazardous synthetic pesticides utilized in large scale in India. Great emphasis is given on the use of natural products, which are non-toxic, safe and biodegradable alternative to the conventional control of insects by synthetic pesticides [2].

Phytochemical constituents have been separated from the genus Gomphrena i.e., oleuropein3, stigmasterol, βsitosterol, isochavicinic acid, campesterol, betalain, friedelin, 3–epi–friedelinol, allantoin, and chrysoeriol–7–O–β–D–glucoside9. Ethnomedicinally, the genus Gomphrena has been documented various pharmacological activities including antimicrobial10, anticancer11, antimalarial12, and analgesic13.Therefore the current investigation had been carried out to study the morphological, microscopical, physicochemical and phytochemical characteristics of the root of G. serrata with the purpose of contributing to the establishment of monograph [3].

The chemical and medicinal plant commonly known as Globe Amaranth constituents present in the herbal medicine or plants are or Bachelor Button, belongs to the family Amaranthaceae. the major part of the physiological functions of living flora It comprises approximately 120 species found in the and hence they are believed to have better compatibility America, Antartica and Indo-Malaysia. 46 species found with the human body. in Brazil [4].

Rice weevil

Rice weevil, Sitophilus oryzae (L.), (Curculionidae: Coleoptera) is a major pest of cereals like rice, sorghum, wheat, barley and maize both in field before harvest and in storage. The white apodous grub and the reddish brown adults are internal feeders and cause serious quantitative and qualitative losses to cereal grains. Owing to the advantages of the botanical the synthetic ones in stored produce insect pest management these are extensively studied. Different types of plant preparations such as powders, solvent extracts, essential oils and whole plants are being investigated for their insecticidal activity including their action as fumigants, repellants, anti-feedants, antiovipositants insect growth regulators.

Considerable efforts have been made to control rice weevil using the plant derived insecticides. Srinivasan et al. (2003) reported that Calotrop is leaf extract recorded very low consumption rate besides exerting a significant effect on the survival of S. oryzae adults. Similarly Roy et al. (2005) showed leaf extract of Blumea lacera as botanical insecticides against lesser grain borer and rice weevil. Ethanol extract ofMelgota (Macaranga postulata) was used for repellency and insecticidal activity against the rice weevil (Rahman et al., 2007). The aim of this study was to determine the effect of medicinal plants in suppressing the rice weevil S. oryzae damage in stored rice [10].

METHODOLOGY

The required plant sample was collected from waste lands, roadsides and dry sandy soil. It is collected and cleaned using water. The unwanted materials in the collected plant is removed. It is kept for drying under a

shade for a couple of weeks. The whole plant is taken including the flowers, stem, leaf and root. The Nuxvomica seeds (standard) were collected and dried. The dried plant materials are then powdered into fine particles sieved to separate the larger particles and then weighed. The weighed plant powder was then kept for cold maceration for 24hrs at the ratio 1:5 that is 100g of sample and standard .Then to add 500ml water. We have used water because of the cost effective and economical. Mostly polar solvents are used because they can easily elute the compounds .After the maceration process it is filtered using a museline cloth .The filtrate is then heated and evaporated at 600c temperature .After the complete evaporation of the moisture content the residue is collected and weighed and stored in the cool place covered with aluminium foil. The rice weevil was collected for the antifeedant activity from the stored grains. Now the collected residue is mixed in water for the solubility test. We are using the dilution method for the antifeedant activity. As we are increasing the concentration of the sample. The dilution method is as follows to prepare the stock solution of sample. Take a volume of the residue and mix the same amount of water for example: We have 15.51 g of sample residue from this 5gm of sample and the remaing 5g for the stock solution and 5ml of water is added to it is taken for the solubility test and remaining 10g is used for the stock solution and 5.91g of standard residue was obtained. Then to take 0.97g for the solubility test and the remaing 5g for the stock solution and 5ml of water is added to it. To the 10gm of sample 10ml of water is added and 5g of standard 5ml of water is added. Now the stock solution is used for dividing the desired concentration as follows 1:1, 1:2, 1:3, 1:4, 1:5 that is 1ml of water in each petridish with 1,2,3,4,5ml of sample and standard .This is mixed with the vector or stored grain powder for example rice powder. After adding the desired concentration equal number of pest is added to each Petridis. To mix the concentration with rice powder use your hands with gloves. Make as a pressed ball and kept in hot air oven for 15min at 60 ^{0} c. Takeout the mixture and powder it and place the equal number of pest. The pest inside the desired concentration are kept under observation in a time interval 1 hr, 2hrs, 3hrs, 4hrs, 5hrs, 6hrs, and 12hrs the number of pest alive and death is recorded in each time interval. The results are noted and tabulated.

RESULT AND DISCUSSION

The conventional extraction of sample (*Gomphrena serrate*) gave yield of 15.5g. Activity is performed by dilution method, the sample extract is divided into desired concentration(1:1, 1:2, 1:3, 1:4, 1:5) then Pest is collected and equal amount (10) of pest were introduced into desire concentration and different duration were tried. At 1:1 and 1:2 sample concentration pest counts were more when compared to the other concentrations in first two time interval. At 1:1 and 1:2 concentrations of pest count was reduced as time increased. At 1:5 concentration pest counts reduced in first time interval more than in other concentrations. After the 6th hour duration in 1:5 concentration pest counts reduced double the count of 1:1 concentration.

The conventional extraction of sample (*Gomphrena serrata*) used to prove the antifeedant activity against the pests (rice weevil) by the dilution method .Maximum antifeedant activity of sample was found in 1:5 concentrations in 6 hours which is equal to that of standard.

In conclusion we have developed in simple, safe, fast, clean, eco-friendly, cost effective and efficient isolation procedure for the proved the antifeedant activity of *Gomphrena serrata*.

Table 1: Standard Concentration

S.No	No.of Pest (Rice Weevil)	Time Intervals(Hrs)	No.Of Pest Dead(Standard) Concentration				
			1:1	1:2	1:3	1:4	1:5
01	10	1	7	8	10	10	10
02	10	2	8	8	10	10	10
03	10	3	8	9	10	10	10
04	10	4	10	10	10	10	10
05	10	5	10	10	10	10	10
06	10	6	10	10	10	10	10

Table 2: Sample Concentration

S.No	No.of.Pest(Rice Weevil)	Time Intervels(Hrs)	No of pest dead(sample) Concentration				
			1:1	1:2	1:3	1:4	1:5
01	10	1	0	1	2	3	5
02	10	2	1	2	3	4	6
03	10	3	2	3	3	4	9
04	10	4	2	4	4	5	9
05	10	5	3	5	5	6	10
06	10	6	4	6	6	7	10

CONCLUSION

Plant-based pesticides have been used as pesticides from ancient time. To control insects, the use of conventional pesticides introduces many risks to the environment. Plant origin products with insecticidal properties have been tried for controlling of variety of insects. The present investigation was carried out to find out the bio-active potentials of this test plant for its possible use in agriculture. For this purpose, the three stored product pests were used as the test organisms. Compared to HPLC method this is done in low cost and simple method used to isolate active ingredients from the natural resources.

In conclusion, we have developed a simple, safe, fast, clean, eco-friendly, cost effective and efficient extraction procedure for the detection of antifeedant activity. The maximum antifeedant activity is shown by *Gomphrena serrata* at the concentration 1:5 in 6 hours. The procedure can be used as a standard protocol for the above experiment.

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