Comparative study of different medicinal plants extracts as repellency and toxicity against *Tribolium castaneum*

Common Medicinal Plants as Repellents and toxicity against Stored Grain Insects- *Tribolium castaneum*

Efficacy of different medicinal plant extracts on the repellents and toxicity against stored grain insect- *Tribolium castaneum*

**Abstract:**

Many species of plants have potential to be utilized as medicinal and therapeutic agents, not only for the treatment of various diseases of man and animals but can also be used as insect control agents for various stored grains. Present work has been focused to assess the repellency and toxicity of some medicinal plant’s immune to insect attack. Response varied with plant materials, insect species and exposure time. The potential of leaves of several plants were selected as repellents and toxicity against *Tribolium castoreum.* Mortality was recorded after 12, 24, 48 and 72 hours after exposure. The repellent action of these plant extracts was also studied. selected test leaves which showed 78% to 76% of repellency against *Tribolium castaneum* insect as compared to the control without test leaves.

**Key word**: plant extracts, *Tribolium castaneum,* repellent activity, toxicity effect.

**Introduction:**

The storage of grains and other food products in respect to insect infestation is a serious problem throughout the world. In 1989, 9% post-harvest losses, due to insect and mite infestation, were reported worldwide suggesting a need to make an all-out effort to combat these post-harvest losses. In Pakistan, it has been estimated that 5–7% loss of food grain occurs due to poor storage conditions (Jilani & Ahmad, 1982). Wheat among all the cereals grains, constituting 80% of the staple food of Pakistan, is highly sensitive to the attack by insects. Besides insects, rodents and molds are also the main biological factors involved in stored food grain losses. The most important and premier requirement of the country, therefore, is to check insect and microbial growth so as to control and reduce grain losses during storage in the season (Tadashi, 1989; Pree et al., 1989).

Modern methods of food grain treatment using insecticides and fumigants to check post-harvest losses during storage are highly expensive (White & Leesch, 1995). These treatments, due to their residual effects are toxic and continuous applications of such chemicals leads to environmental pollution and health hazards, besides developing resistance in organism (Champ 1981; Subramayam & Hagstrum, 1995). Presently worldwide attention is focused on screening and development of less hazardous and cheap material as Methyl bromide and phosphine and mostly the natural products such as powdered vegetable/fruit peels are recommended as grain protectants (Singh et al., 1978) Plant extracts are more effective in the way as they do not cause pollution, they produce less toxicity and are bio-degradable. Some plants naturally have the repellent effect against many stored grain pests (Behal, 1998). Botanical components are very suitable in comparison to synthetic insecticides for the reason that of an understood repute for being environmentally harmless and with a reduction of dangerous to humans and other non-target organisms (McCloskey et al., 1993). The need for a greater diversity of effective compounds against insects can be met by the introduction of several pesticides with new mode of action, which is less affected by existing resistance mechanism. Therefore, effectiveness of four selected botanicals against aphid was carried out in field location. Botanicals were used as crude concoction in water as solvent.

Traditionally, different parts of neem tree and other plant leaves have also been used as food grains protectants at farm level (Jilani & Ahmad 1982). The search for deriving effective insecticides from natural material became highly imperative. Hence present study was undertaken to screen the leaves of medicinal plants, growing under regional environmental conditions and also investigate their potential in controlling insect infestation.

**Materials and methods:**

**Sample collection**

The samples were collected from the local areas of Thanjavur.

**Preparation of Plant Extracts**

The aqueous extract of different medicinal plants was selected for the current research. They were collected from the local areas of Thanjavur. The leaves were ground separately in a dish and weight to level the quantity with distilled water at 1:1 ratio in a 500ml beaker. The beaker was then partially sealed with aluminium foil and kept at room temperature for 24 hours. On the next day, muslin clothes were used to filter it and the leaf extract was collected in a beaker.

**Tribolium castaneum**

*Tribolium castaneum* is commonly known as red flour beetle. It is a worldwide stored product pest. Red flour beetles have chewing mouthparts, but do not bite or sting. Red flour beetles attack stored grain products causing serious damage. The beetle life cycle lasts about three years or more. The female flour beetle lies about 300-400 eggs during its life cycle. The beetles give off an unpleasant smell, and their presence encourages mould growth in flour.

**Medicinal plants used for the study**

Different medicinal plant leaves have collected and prepared the extracts and also aqueous and hexane extracts were made from these extracts using distilled water and hexane as solvents.

**Culture of insects**

Adults from the stock culture were collected and deposited in separate culture bottles and kept for 2-3 days, so that the insect may lay eggs. After three days the adults were removed and the culture bottles were kept in the laboratory. The adults that emerged from the eggs in the culture from this bottle were considered as newly emerged. These newly emerged adults were used to study the repellent activity and toxicity of plant extracts.

**Filter paper bioassay**

The experiment was conducted in such a way that different concentrations of the leaf extract were tried at the same time or same concentration of the different plants was tried at the same time. The repellent effect of the different medicinal plants extract against *T. castaneum* adults was evaluated using the bioassay method. Test areas consisted of Whatman No.1 filter paper cut in half (F12.5 cm). An aliquot of the plants extract dissolved in hexane (analytical purity) was evenly applied on half-filter paper discs using a micropipette corresponding to the doses of 100% respectively. The other half of the remaining filter paper was treated with aqueous and hexane used as a control. The filter papers were air-dried for about 5 min to evaporate the solvent completely and full discs were subsequently remade by attaching treated halves to untreated halves with clear adhesive tape. Each remade filter paper disc was tightly fixed on the bottom of Petri dish on. Then 10 adults *T. castaneum* adults were released at the center of the filter paper disc and the Petri dishes were subsequently covered and kept in room temperature. Each treatment was replicated and the changes in the set up was analyzed at particular intervals i.e. 1, 2, 3, 4, and 24 hours. Calculation of percentage repellency: Percentage repellency was calculated by the method described by Laudani et al. (1955): Repellency = [𝐶 −𝑇] ÷[𝐶]×100 The extreme PR values express twoextremeconditions:0 showing no repellency, and100 showing the strongest repellency. Where T = mean number of insects on treated; C = mean number of insects on control. Percentage repellency of the insects against different plant extracts at different concentrations has been observed.

**Toxicity**

An aliquot of plant extract dissolved in water (analytical purity) was evenly applied to a Whatman No.1 filter paper(F6cm) corresponding to the doses of 100 % , respectively. Applying water and hexane alone to a Whatman No.1 filter paper (F6 cm) was taken as a control. Then, the filter paper was dried in air for 5min prior to being closely fixed on the bottom of a clean Petri dish (F6 cm) by solid adhesive. Then 10 adults *T. castaneum* adults were released at the center of the filter paper disc and the Petri dishes were subsequently covered and kept in room temperature. Each treatment was replicated and the changes in the set up was analyzed at particular intervals i.e. 12, 24, 48, and 72 hours. Insects showing any movement were considered to be alive when prodded with a camel’s hair brush.

Result and Discussion:

Conclusion:

**Future Aspects:**

Application of repellents is very important because it needs a lot of research work. The efficacy of repellents is still questionable because they can penetrate packaging surface and damage food stuffs and only few chemicals are approved by EPA or FDA.

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