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***Research Article** (Open Access)*

# PESTICIDAL AGENT FOR BIO BALL TO CONTROL STORED GRAIN PESTS

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## ABSTRACT
Plant, *Sphaeranthus indicus* found throughout in India, evaluated for its biopesticidal activity against adult red flour beetle, *Tribolium castaneum* [Herbst]. Biopesticidal activity assessed by using dipping method and percent mortality observed within 48 h at various concentrations (mg/ml). Among four doses, the mortality was found to be positively correlated with the extract concentrations significantly ($P<0.01$) highest at 40 mg/ml.

***Keywords:** Biopesticidal activity, Sphaeranthus indicus, Tribolium castaneum and Alkaloid fraction.*

## INTRODUCTION
One of the major ways to eliminate world hunger and poverty is to make agriculture more environmentally sustainable. The pest problem is a major constraint for achieving higher production of agricultural crops (Isman, 2019). About 10–30% of crops including fruits and vegetables are lost due to pests and associated diseases each year (Rahman *et al*., 2021).
Management of agricultural pests over the past half century has largely depended on the use of synthetic chemical pesticides for field and postharvest protection of crops (Jose, 2019).
Plants may provide potential alternatives to currently used chemical insect-control agents because they constitute a rich source of bioactive chemicals (Kim *et al.,* 2003). Since these are biodegradable to non-toxic products, and are potentially suitable for use in integrated pest management. Much effort has therefore, been focused on plant-derived materials for potentially useful products as commercial insect-control agents. According to the literature, very little work has been carried out to investigate the insecticidal potential of the weed plant on the stored grain insect pests (Sultana *et al.*, 2016). One such weed, *Sphaeranthus indicus*, is very well known for its antimicrobial, wound healing, anti arthritics, immunostimulant, immunomodulatory, antioxidant anxiolytic, neuroleptic activities. Other applied applications are antifeedant, piscicidal, haemolytic, ovicidal and larvicidal (Mahajan *et al*., 2015). Thus, the present study designed to evaluate the biopesticidal potential of methanolic extract and alkaloidal fraction of flower of the weed *Sphaeranthus indicus*, at different concentrations and exposure intervals for control of stored grain insect pest, *Tribolium castaneum* (Herbst).

## MATERIALS AND METHODS
The plant material, collected from Village - Kol nhavi, Tahsil – Jalgaon, District – Jalgaon, shade dried flower of *Sphaeranthus indicus*. The flowers unsoiled, remove unwanted material. The material pulverized to form coarse powder. Then, flower powder exhaustively extracted in Soxhlet apparatus with methanol. The obtained solvent extract filtered to remove any suspended impurities under vacuum. The extract was separately concentrated under reduced pressure and controlled temperature ($55^0$C to $60^0$C). This methanolic extract (MeOHx) of flower preserved in dry, cool condition in a desiccator. Thus, it was screened for its Biopesticidal activity and based on promising results, it proceeds for fractionation (Mahajan *et al.,* 2022) to isolate the active ingredient especially alkaloid, and isolated fraction labelled as Semi Alkaloidal Fraction (SAF).

**Figure 1: Flowers of *Sphaeranthus indicus***

Toxicity of *S. indicus* tested by using dipping method described by De-Petro and De-Petro (1994). The 90 mm diameter discs were prepared by using Whatmann filter paper No. 1. The discs dipped in to the MeOHx and SAF at various concentrations. The discs dried at $40^0$C in oven for 30 min. For biopesticidal test, each disc placed at the bottom of glass petri plate; 10 adult red flour beetles, *T. castaneum* of 1-2 days old (either sex) released with a normal food and replicated thrice. Insect mortality observed at 48 h after treatment. Control run simultaneously in which paper was soaked with distilled water. The data for percent mortality is corrected by Abbott's (1925) formula:

$$\frac{\%\ \text{test mortality} - \%\ \text{control mortality}}{100 - \text{control mortality}}\ X\ 100$$

**Experimental protocol**

1. Size of glass petri-plate (Diameter): 9 cm.
2. Size of Whatmann filter paper (Diameter): ≈ 9 cm.
3. Volume required for soaking of paper: 1 ml.
4. Weight of Wheat flour: 25 g (Monolayer).
5. Concentrations of MeOHx: 20, 40, 60 and 80 mg /ml.
6. Concentrations of SAF: 10, 20, 30 and 40 mg /ml.
7. Number of adult red flour beetles released: 10 of either sex.
8. Number of sets: triplicates.
9. Percent mortality and time of exposure: 48 h after treatment.

**Statistical analysis**

The data expressed as mean ± SE using one way ANOVA followed by Bonferroni's Multiple Comparison Test by using GraphPad Prism software.

## RESULTS

Phytochemical analysis of MeOHx and SAF of flower of the *S. indicus* depicted in table 1.

Results obtained of biopesticidal activity of the MeOHx and SAF of flower of the *S. indicus* against *T. castaneum* presented in Table 2.

The SAF was found very effective against *T. castaneum* at a concentration 10 mg/ml was 30.83%; 20 mg/ml was 55.17% and 30 mg/ml was 72.83% mortality, which was significant ($p<0.001$) as compared with MeOHx. Among four doses, the mortality was found to be positively correlated with the extract concentrations significantly ($P<0.01$) highest at 40 mg/ml was 81.50%.

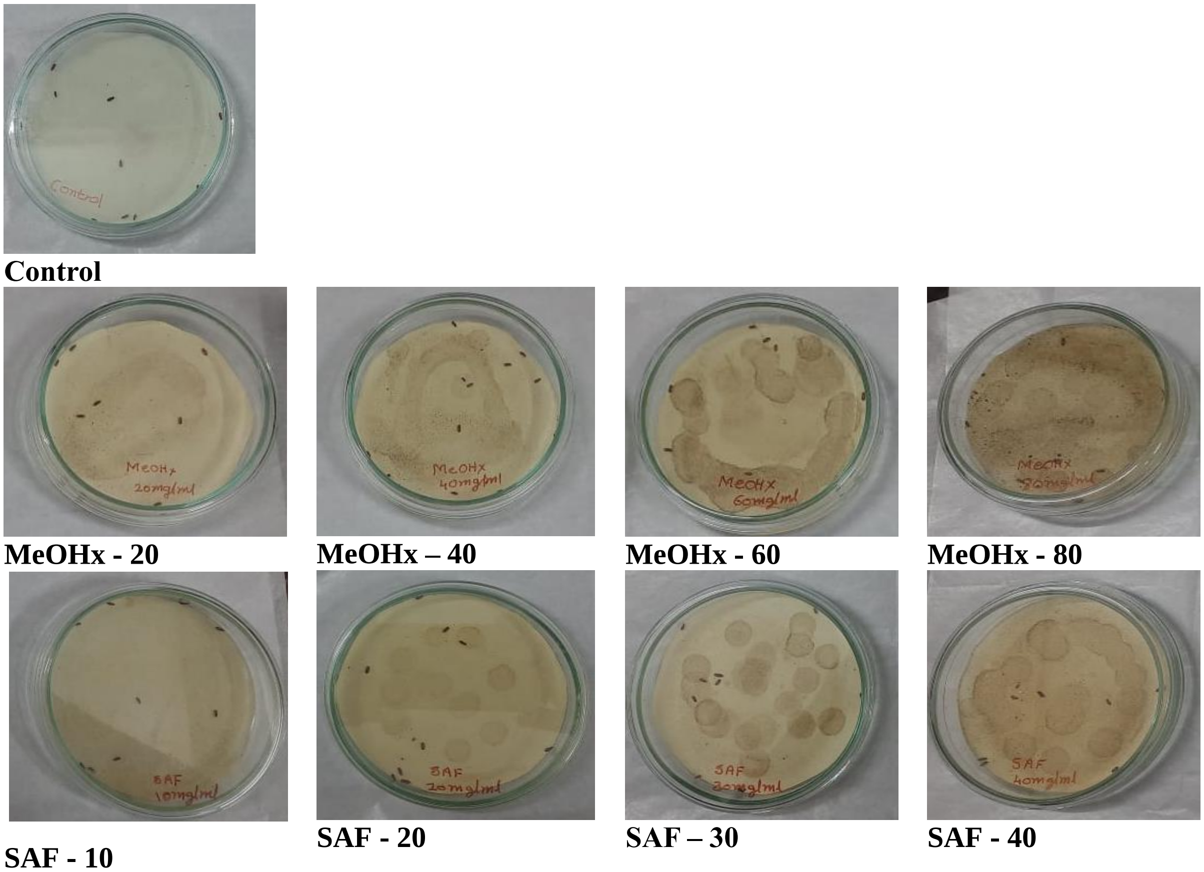


**Figure 2: Pestcidal test of MeOHx and SAF of flower of the *S. indicus* against *T. castaneum*.**

**Table 1: Phytochemical analysis of the MeOHx and SAF of flower of the *S. indicus***

| Phytochemical ingredients | MeOHx | SAF |
|---|---|---|
| Alkaloids | +++ | +++ |
| Flavonoids | ++ | - |
| Glycosides | +++ | ++ |
| Phenolic compounds | ++ | - |
| Saponins | + | - |
| Tannins | + | - |
| Terpenoids | - | - |

*+ Less, ++ Moderate, +++ High, - Absence*

**Table 2: Biopesticidal studies of the MeOHx and SAF against *T. castaneum***

| Per cent mortality within 48 h at various concentrations (mg/ml) | | | |
|---|---|---|---|
| **Conc.** | **MeOHx** | **Conc.** | **SAF** |
| 20 | 20.00 ± 00.57 | 10 | 30.83 ± 01.30*** |
| 40 | 43.00 ± 01.65 | 20 | 55.17 ± 01.66*** |
| 60 | 60.00 ± 01.50 | 30 | 72.83 ± 01.37*** |
| 80 | 73.17 ± 01.10 | 40 | 81.50 ± 01.28** |

***P<0.01 and ***P<0.001*

## DISCUSSION

The majority of synthetic insecticides used for the protection of crops during pre- as well as post-harvest storage affect environment and humanity adversely and this can no longer overlooked. Thus, alternative strategies are urgently required to combat attack of insect pests at various stages of crop production and protection during storage (Mendki *et al.,* 2001). Farhana *et al*., (2006) demonstrated strongly effective biopesticidal activity of three spicey plants namely seeds of *Coriandrum sativum, Trachyspermum ammi and Trigonella foenum-graecum* against *T. castaneum*. Moharramipour *et al*., (2009) reported potential toxicity of the essential oil of *Prangos acaulis* against *T. castaneum* at a dose 370.4 µl/l and the half-life mortality were 7.5 days. However, no report on toxicity effect of *S. indicus* against *T. castaneum* has appeared in literature. In this present study, the MeOHx and SAF have proved effectively to arrest the *T. castaneum* damage in stored grains. The above findings corroborated with reports of earlier worker (Patole 2007), though he tested activity against *Callosobruchus chinensis* Linn. Hence, the utility of this plant as excellent stored grain protectants is accounted.

## CONCLUSION

The present investigation indicated that *S. indicus* possess potential botanical agents as an alternative to synthetic pesticides against *T. castaneum*. It can be concluded that, SAF of flower of the *S. indicus*, is reasonably sensitive to *T. castaneum* followed by MeOHx, even at low concentrations. However, further studies are required on the purification and identification of active components responsible for *T. castaneum* mortality and their evaluations against other insect pests.

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