Original Research Article

INSECTICIDAL ACTIVITY OF DIFFERENT DOSES OF *ACORUS CALAMUS*ESSENTIAL OIL AGAINST *SITOPHILUS ORYZAE*

Abstract

The toxicity of different doses (3, 4, 5, 6 and 7 percent) of Acorus calamusessential oil, against insect pest *Sitophilus oryzae* were evaluatedin the laboratory of Division of Entomology, FoA, Wadura, SKUAST-Kashmir during the year 2022.The various concentrations of *Acorus calamus* essential oil had significant effect on mortality of *Sitophilus Oryzae.*The highest mortality of 74.27 percent was recorded in 7 percent concentration of *Acorus calamus* essential oil on 12 Hours After Treatment (HAT) followed by 6 (71.01%), 5 (67.15%) and 4 (39.11%) percent concentration while untreated control recorded 5.13 percent mortality respectively. However, on 24 HAT the cumulative mortality increased to 76.35 in 7 percent, 74.11 in 6 and 5 percent, 43.01 in 4 percent concentration. On 72 HAT the concentrations of 7,6 and 5 recorded 94.11, 91.27 and 90.11 percent mortality respectively, while only 7.05 percent mortality was recorded in untreated control.

Keywords: Acorus calamus, Essential oil, Mortality, Rice weevil

1. Introduction

Stored grain insect pests can cause reductions in weight, quality, commercial value and seed viability. Seventy-five percent of these insects are coleopterans [1] and the most damaging species of storage insects are in the genera *Sitophilus* and *Tribolium* [2, 3]. *Sitophilus oryzae* L. (Coleoptera: Curculionidae), a ubiquitous pest of economic importance, is an internal feeding insect that bores into stored grain. Adult weevils feed mainly on the endosperm, reducing the carbohydrate content and the larvae feed preferentially on the germ of the grain, thus removing a large percentage of the protein and vitamins. Insects that selectively attack the germ will cause a greater loss in germination than others. The control of arthropod pests on stored products has been primarily through the use of fumigants and residual chemical insecticides to augment the more obvious approach of hygiene [4, 5]. The excessive use of conventional chemical insecticides has resulted in a number of serious problems, e.g. resistance to the chemical insecticides, elimination of economically beneficial insects, persistence in the environment, toxicity to humans and wildlife and higher cost of

crop production [6]. Numerous insects and mites have developed the ability to withstand nearly all pesticides used for their management due to cross-resistance and multiple resistance mechanisms [7]. Recognition of the deleterious effects of pesticides has spurred the exploration of alternative, less intrusive management approaches, such as employing the use of essential oils.

Many medicinal plants and spices have been used as pest control agents [8, 9]. Farmers and researchers often claim the successful use of plant materials in insect pest control, including ash [10, 11], vegetable oils [12], plant extracts [13] and botanical powders [14]. It has been reported that certain plant preparations and traditional methods are much safer than chemical insecticides [15]; therefore, these materials should be explored to protect stored products against pest infestation.*Acorus calamus* L. (Araceae), commonly known as "sweet flag", is a well-known ethnomedicinal and ethnobotanical plant worldwide. *Acorus* rhizome possesses a wide range of pharmacological activities, such as sedative, central nervous system depressant, behaviour modifying, anticonvulsant, memory enhancing, anti-inflammatory, antioxidant, antispasmodic, cardiovascular, hypolipidemic, and immunosuppressive. *Acorus calamus* L. essential oil have also been used as fumigant against stored food products [16]. Keeping in view the insecticidal properties of essential oil of *Acorus calamus*, the present study was carried out to evaluate its various concentrations against rice weevil.

2. Material and methods

2.1 Raising of plant material

The seedlings of *A. calamus* which wereraised in polybags were procured from Regional cum Facilitation Centre North Zone II located at Faculty of Agriculture, Wadura Sopore and transplanted in the field with plant to plant and row to row distance of 15cm and 30cm, respectively.The rhizomes of mature plants were harvested, shade dried and ground to a fine powder and sieved through 30mm mesh. The powdered material was put to hydrodistillation for extraction of essential oil using Clevenger's apparatus.The essential oil of *A. calamus* thus obtained was collected in the vials and stored in refrigerator for further use.

2.2 Preparation of different concentrations of essential oil of *A. calamus*

Acetone was used as solvent for preparation of different concentrations.The doses 30, 40, 50, 60 and 70 µl corresponding to 3, 4, 5, 6 and 7 per cent were used for determining toxicity of *A. calamus* essential oil against *Sitophilus oryzae*.

2.3 Rearing of *Sitophilus oryzae*

The rearing of *S. oryzae* was carried in the laboratory of Division of Entomology, FoA, Wadura, SKUAST-Kashmir.The rice grains infested with *S. oryzae*,was brought from different godowns/shops of Kashmir. Rice grainswere taken in 5 litre capacity rearing jars and placed in hot air oven at 60°C for 24 hours for sterilization. The adult insects (both male and female) were collected randomly from the infested grains with the help of aspirator and transferred to the respective sterilized food placed in jars (5 litre capacity).The jars were covered with muslin cloth in order to supply adequate humidity to the grains and kept in B.O.D incubator at 28.5 ± 2°C and 65± 5% relative humidity to ensure proper egg laying and maintaining culture of rice weevil for further investigation.Mortality per cent was recorded after 12, 24, 36, 48, 60 and 72 hours after treatment.Test insects were considereddead if appendages do not move when prodded with a fine brush.

$$\textbf{Mortality (\%)} = \frac{\textbf{No. of insects dead}}{\textbf{Total No. of insects fumigated}} \times 100$$

2.4 Data analysis

The data recorded in different treatments were subjected to analysis of variance (ANOVA) using R software.

3. Results and Discussion

The insecticidal activity of Sweet flag against rice weevil is shown in Table 1. The highest mortality of 74.27 percent was recorded in 7 percent concentration of Sweet Flag on 12 Hours After Treatment (HAT) followed by 6 (71.01%), 5 (67.15%) and 4 (39.11%) percent concentration while untreated control recorded 5.13 percent mortality respectively (Table 1). However, on 24 HAT the cumulative adult mortality increased to 76.35 in 7 percent, 74.11 in 6and 5 percent, 43.01 in 4 percent concentration (Table 1). On 72 HAT the concentrations of 7,6 and 5 recorded 94.11, 91.27 and 90.11 percent mortality respectively, while only 7.05 percent mortality was recorded in untreated control.

Table 1: Effect of different concentrations of *Acorus calamus* essential oil against rice weevil

Concentration (%)	**Mortality (%) (HAT)**						
	12	**24**	**36**	**48**	**60**	**72**	**Mean**
3	28.01^{k} (5.34)	33.03^{jk} (5.79)	39.11^{ijk} (6.29)	41.01^{ijk} (6.44)	42.13^{hij} (6.53)	43.05^{hij} (6.60)	**37.72±2.42** (6.18)
4	39.11^{ijk} (6.29)	43.01^{ijk} (6.60)	45.03^{hij} (6.75)	46.13^{hi} (6.83)	47.11^{ghi} (6.90)	49.15^{fgh} (7.05)	**44.92±1.43** (6.74)
5	67.15^{efg} (8.22)	74.11^{cdef} (8.64)	81.13^{abcde} (9.03)	88.03^{abc} (9.41)	89.01^{abc} (9.46)	90.11^{ab} (9.52)	**81.59±3.80** (9.06)
6	71.01^{def} (8.46)	74.11^{cdef} (8.64)	80.03^{abcde} (8.97)	88.17^{abc} (9.42)	88.35^{abc} (9.43)	91.27^{ab} (9.58)	**82.16±3.42** (9.09)
7	74.27^{cdef} (8.65)	76.35^{bcde} (8.77)	81.17^{abcde} (9.04)	86.03^{abcd} (9.30)	89.01^{abc} (9.46)	94.11^{a} (9.73)	**83.49±3.11** (9.16)
Control	5.13^{i} (2.37)	5.05^{i} (2.36)	4.05^{i} (2.13)	6.01^{i} (2.55)	4.03^{i} (2.13)	7.05^{i} (2.75)	**5.22±0.47** (2.39)
Mean	**47.45±11.1** (6.92)	**50.94±11.85** (7.17)	**55.09±12.84** (7.46)	**59.23±13.81** (7.73)	**59.94±14.26** (7.77)	**62.46±14.4** (7.93)	

HAT = Hours After treatment

*** Values in parenthesis are square root transformed values**

Our results are in accordance with the findings of [17, 18 and 19], who observed that concentration of *Acorus calamus* essential oil had significant effect on mortality of *Sitophilus Oryzae.*

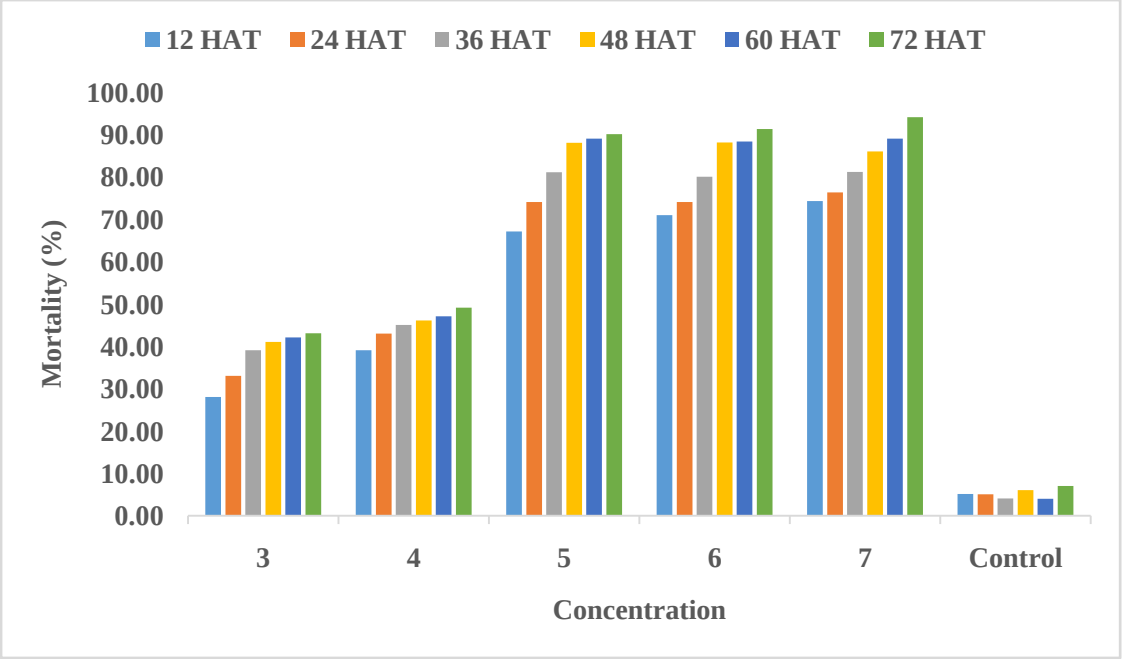

Fig 1: Insecticidal activity of *Acorus calamus* essential oil against rice weevil

4. Conclusion

The study concludes that various concentrations of *Acorus calamus* essential oil had significant effect on mortality of *Sitophilus Oryzae* and the essential oil of *Acorus calamus* can be useful in controlling the stored product insect by surface treatment in godowns as an alternative to synthetic insecticides, further the efficacy of the botanical can be tested on other stored product insects also.

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