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Studies on the Effectiveness and Persistence of Various Botanicals and Insecticides on the Surface Treatment of Gunny Bags at Bimonthly and Monthly Intervals Against *Sitophilus oryzae* (Linn.) in Stored Wheat

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ABSTRACT

The study on storage was carried out in the division of Agricultural Entomology, Agricultural Research Station, Gulbarga during the year 2012-13 to know the efficacy and persistence of various botanicals and insecticides against *Sitophilus oryzae* Linn. over a period of 210 days in two different methods, i.e. the application of treatments at bimonthly and monthly intervals. In bimonthly interval at 30, 90, 150 and 210 DAS, deltamethrin at 0.005 per cent stood highly effective against *Sitophilus oryzae* and registered the maximum mortality of 96.40, 94.59, 93.69 and 89.55 percent, followed by sweet flag (5%) with mortality of 92.25, 89.53, 90.55 and 83.25 percent respectively, differing significantly over other treatments. Similarly, in another method, i.e., in a monthly interval in which the sweet flag (5%) remained predominant with the highest mortality of 97.30 and 96.65 percent at 30 and 90 DAS, however deltamethrin (0.005%) with 95.75 and 90.25 percent at 150 and 210 DAS respectively, differing significantly over other treatments. However, in both the methods, the residual toxicity, could not sustain with the lapse of time, as a result, there was no proper monitoring of inbuilt population of *S. oryzae* in stored wheat. From the above two methods of application of treatments against rice weevil management the bimonthly method was found effective.

INTRODUCTION

Agricultural commodities produced at the farm fields have been subjected to a series of operations from harvesting to threshing, winnowing, bagging, transportation, storage, processing and exchange till the produce reaches the final destination (consumers) appreciable losses do occur at all the stages. According to a study by World Bank (1999), post harvest losses of food grains in India amounts to 12-16 million metric tonnes each year and the loss, in terms of monetary is valued at rupees 50,000 crores per year (Singh 2010). Losses of food grains in India is estimated at 7-10 per cent of the total production of which 3-4 MT of wheat losses occur annually. In India large quantities of food grains are preserved in commercial warehouses for long duration. During storage, qualitative as well as quantitative losses occur due to insects, rodents and microorganisms. Large number of insect pests have been reported to be associated with stored grains. Most of the insect pests of storage, have remarkably high multiplication rate and in a single season may destroy 10-15% of the grain and contaminate the rest with undesirable odours and flavours. Insects play vital role in the transportation of storage fungi (Sinha & Sinha 1999). Regular prophylactic and curative measures. i.e., spraying and fumigation were undertaken to control stored grain pest. The usage of conventional pesticides was known to pose potential health hazards due to their toxic nature. Pollution of environment, development of resistance by insects from these toxic compounds. So a novel approach for the management of stored pests have been adopted by exploiting those plants, which are not only having medicinal and insecticidal value but also cheap, effective and easily available to most farmers. Organic insecticides which are being used as seed dressers or fumigants against the stored grain pests which are costly and involve the risk of residual toxicity and environmental hazards. Furthermore, cross infestation of insects can often be reduced by careful planning which includes the application of residual contact insecticides on the surface bags, alley ways, and walls of the godowns. So that the possibilities of pest organisms reaching the commodity will be kept to a minimum.

Jute bags, which form a very popular receptacle for the storage of foodstuffs in our country, that there is a likelihood of solving the problem of preventing insect damage to food stuff stored therein. Keeping these advantages in view, the study was undertaken with the following objectives.

To study the efficacy and persistence in consequent to the surface treatment of gunny bags using various botanicals and insecticides at bimonthly and monthly intervals against *Sitophilus oryzae* Linn. in stored wheat.

MATERIALS AND METHODS

Studies on the effect of surface treatment of gunny bags using various plant products and insecticides (Table 1) against *Sitophilus oryzae* Linn. for their bioefficacy, persistence, cross infestation, survival and multiplication in wheat grains, was carried out in the division of Agricultural Entomology, Agricultural Research Station, Gulbarga during the year 2012-13. Investigation included the comparative assessment of the best treatments, from among the above products against *Sitophilus oryzae*.

Stock culture of rice weevil was maintained by collecting adult beetles from the infested wheat grains of the college farm stores. The adults of rice weevil were reared in the laboratory on whole wheat flour containing 5 per cent dried brewer's yeast at 29ºC. Fresh grains were provided periodically for the development of beetles. A culture so maintained was used throughout the period of investigation.

Evaluation of bio efficacy was carried out in two different methods.

- Surface treatment of gunny bags using plant products and insecticides at bimonthly and monthly intervals against *Sitophilus oryzae* in stored wheat.
- The plant products and insecticides with different dosages were included in the experiment to assess the toxicity against *Sitophilus oryzae* (Table 1). The design followed was Completely Randomized Design with 12 treatments including untreated check and three replications.

Small jute bags with a capacity of holding 1000 g of wheat grains were prepared from the fresh new full sized bags. The concentrations of the four insecticides were prepared (Table 1).

The jute bags filled with wheat grains were sprayed with the desired concentration of insecticides. About 300-500 starved individual tests insects of *S. oryzae* were released on the gunny bags at monthly interval. These test insects were released randomly in the experimental setup. Observations on per cent adult mortality were noted at monthly interval and population of live adults inside the gunny bags before the schedule of next spray.

RESULTS AND DISCUSSION

From Table 2, data clearly indicate that, deltamethrin at 0.005 percent claimed the highest mortality of 96.40, 94.59, 93.69 and 89.55 percent at 30, 90, 150 and 210 DAS with least live adult population of *S. oryzae* (0. 00, 10.00, 14.34 and 16.65 per cent) respectively, followed by sweet flag (5%) with a mortality of 92.25, 89.53, 90.55 and 83.25 per cent with minimum live adult population of (0.00%, 12.15%, 17.45% and 18.90%) respectively, differing significantly over all other treatments. However, upon comparison with untreated check i.e., at 30 DAS (1.84%), 90 DAS (2.14%), 150 DAS (1.89%) and at 210 DAS (1.95%), all other treatments have offered fairly good protection from infestation of *S. oryzae*. The present findings are in conformity with Yadav (1988) who reported that, deltamethrin at the rate of 10 and 20mg per m^2 on surface of jute bags provided good protection against the adults and larvae of *S. oryzae* for a period of 6 months. Similarly, Sone Lal et al. (1989) reported that, residual toxicity of deltamethrin flow, 25 at the rate of 30mg a.i/mt^2 provided good protection from *S. oryzae* upto 5 months.

Table 1: Various Botanicals and Insecticides used for the surface treatment of gunny bags.

Sl. No.	Treatments	Dosage (%)
1	Neem seed kernel extract	5
2	Neem leaf dust	5
3	Sweet Flag Rhizome dust	5
4	Nochi leaf dust	5
5	Clerodendron leaf dust	5
6	Bouganvillea leaf dust	5
7	Tulsi leaf dust	5
8	Carbaryl 50 WP	0.4
9	Malathion 50 EC	0.05
10	Fenitrothion 50 EC	0.05
11	Deltamethrin 2.8 EC	0.005

From Table 3, data clearly indicate that sweet flag at 5 per cent caused the highest mortality of 97.30% and 96.65% with least live adult population of *S. oryzae* of 0.00% and 11.00% at 30 and 90 DAS respectively, followed by deltamethrin (0.005%) with a mortality of 93.65 and 91.55 per cent with a live adult population of 0.00 and 13.20 per cent respectively, differing significantly over other treatments. However, compared to the untreated check (2.54% and 2.15%) all other treatments at 30 and 90 DAS exerted better action against the nuisance of *S. oryzae*. The present finding is in parallel with Jilani (1984) and Panesu et al. (1993) who reported that *Acorus calamus* L. as grain protectant having good toxic effect. However, in the present study the experiment was carried out on the imposition of treatment on the surface of gunny bags. There were no reviews as such to support the present findings.

Similarly, at 150 and 210 DAS, deltamethrin at 0.005 per cent registered the maximum mortality of 95.75 and 90.25 per cent with minimum live adult population (14.50% and 17.25%) of *S. oryzae* followed by sweet flag (5%) with a mortality of 89.45 and 86.25 per cent with minimum population of 16.65 and 19.25 percent respectively, differing significantly over other treatments. However, in comparison with check (3.52% and 2.00%), all other protectants have spared fair protection from *S. oryzae* infestation.

Table 2: Per cent mortality and live adult population of *Sitophilus oryzae* Linn. consequent to the surface treatment of gunny bags using various botanicals and insecticides at bimonthly interval in stored wheat.

Sl. No.	Treatments	Dose (%) v/v or w/v	Per cent Adult Mortality of *Sitophilus oryzae* on the surface of gunny bags				Per cent live adult population of *Sitophilus oryzae* inside the gunny bags (100 g of wheat seeds)			
			30 DAS	90 DAS	150 DAS	210 DAS	30 DAS	90 DAS	150 DAS	210 DAS
1	Neem Seed Kernel Extract	5	87.50^{c}	86.95^{c}	83.75^{d}	81.05^{c}	0.00	15.50^{c}	18.35^{c}	20.65^{c}
2	Neem leaf dust	5	86.45^{c}	85.18^{d}	83.10^{d}	79.53^{c}	0.00	15.00^{c}	18.10^{c}	21.70^{c}
3	Sweet flag Rhizome dust	5	92.25^{b}	89.53^{b}	90.55^{b}	83.25^{b}	0.00	12.15^{b}	17.45^{b}	18.90^{b}
4	Nochi leaf dust	5	84.35^{c}	85.00^{d}	80.19^{e}	75.65^{d}	0.00	16.45^{d}	19.25^{d}	22.72^{c}
5	Clerodendron leaf dust	5	84.00^{c}	82.01^{e}	80.56^{e}	75.15^{d}	0.00	15.95^{c}	19.55^{d}	20.70^{c}
6	Bouganvillea leaf dust	5	85.65^{c}	82.15^{e}	81.95^{e}	76.55^{d}	0.00	15.05^{c}	18.25^{c}	22.60^{c}
7	Tulsi leaf dust	5	73.00^{d}	70.65^{f}	65.00^{f}	45.00^{e}	0.00	15.00^{c}	25.00^{f}	35.45^{d}
8	Carbaryl 50 WP	0.4	91.65^{b}	85.60^{d}	86.69^{c}	80.45^{c}	0.00	14.55^{c}	20.25^{d}	18.00^{b}
9	Malathion 50 EC	0.05	89.72^{c}	85.15^{d}	87.05^{c}	80.25^{c}	0.00	16.72^{d}	17.55^{b}	19.00^{b}
10	Fenitrothion 50 EC	0.05	88.95^{c}	85.56^{d}	87.77^{c}	81.85^{c}	0.00	14.56^{c}	17.75^{b}	19.80^{b}
11	Deltamethrin 2.8 EC	0.005	96.40^{a}	94.59^{a}	93.69^{a}	89.55^{a}	0.00	10.00^{a}	14.34^{a}	16.65^{a}
12	Untreated Check	-	1.84^{e}	2.14^{g}	1.89^{g}	1.95^{f}	0.00	28.75^{e}	35.95^{g}	42.65^{e}

DAS-Days after storage: In the vertical columns means followed by the same letters are not different statistically (P = 0.01) by DMRT

Table 3: Per cent mortality and live adult population of *Sitophilus oryzae* Linn. consequent to the surface treatment of gunny bags using various botanicals and insecticides at monthly interval in stored wheat.

Sl. No.	Treatments	Dose (%) v/v or w/v	Per cent adult mortality of *Sitophilus oryzae* on the surface of gunny bags				Per cent live adult population of *Sitophilus oryzae* inside the gunny bags (100 g of wheat seeds)			
			30 DAS	90 DAS	150 DAS	210 DAS	30 DAS	90 DAS	150 DAS	210 DAS
1	Neem Seed Kernel Extract	5	90.50^{c}	88.95^{c}	86.25^{c}	84.50^{c}	0.00	14.15^{c}	19.40^{c}	22.15^{b}
2	Neem leaf dust	5	89.45^{c}	86.25^{d}	84.20^{c}	80.65^{d}	0.00	14.25^{c}	18.35^{c}	22.00^{b}
3	Sweet flag Rhizome dust	5	97.30^{a}	96.65^{a}	89.45^{b}	86.25^{b}	0.00	11.00^{a}	16.65^{b}	19.25^{b}
4	Nochi leaf dust	5	85.65^{d}	82.00^{f}	80.15^{e}	76.23^{e}	0.00	15.00^{d}	20.25^{c}	23.70^{b}
5	Clerodendron leaf dust	5	84.45^{d}	82.00^{f}	75.65^{f}	70.63^{f}	0.00	16.25^{d}	20.45^{c}	21.65^{b}
6	Bouganvillea leaf dust	5	84.75^{d}	84.23^{e}	80.50^{e}	70.45^{f}	0.00	16.75^{d}	18.55^{c}	23.75^{b}
7	Tulsi leaf dust	5	71.65^{e}	70.45^{g}	65.95^{g}	55.60^{g}	0.00	17.75^{d}	26.65^{e}	40.50^{c}
8	Carbaryl 50 WP	0.4	93.59^{b}	84.69^{e}	82.89^{d}	81.49^{d}	0.00	15.65^{d}	22.45^{d}	19.95^{b}
9	Malathion 50 EC	0.05	92.66^{b}	86.60^{d}	86.60^{c}	84.50^{c}	0.00	17.65^{d}	18.65^{c}	20.65^{b}
10	Fenitrothion 50 EC	0.05	93.75^{b}	86.65^{d}	85.65^{c}	82.65^{d}	0.00	15.60^{d}	18.70^{c}	21.45^{b}
11	Deltamethrin 2.8 EC	0.005	93.65^{b}	91.55^{b}	95.75^{a}	90.25^{a}	0.00	13.20^{b}	14.50^{a}	17.25^{a}
12	Untreated Check	-	2.54^{f}	2.15^{h}	2.62^{h}	2.00^{h}	0.00	26.75^{e}	33.23^{f}	36.65^{d}

DAS-Days after storage: In the vertical columns means followed by same letters are not different statistically (P = 0.01) by DMRT.

CONCLUSION

It is well understood from the facts and figures presented in Tables 2 and 3, among the two different methods of application of botanicals and insecticides on the surface of gunny bags, the bimonthly method of application was found effective against *S. oryzae.* Among the treatments, delta-melthrin, by virtue of its superb insecticidal property, was found promising throughout the storage period followed by sweet flag which too offered the best protection from the cross infestation by rice weevil. However, in the monthly method of application of treatments, sweet flag though remained effective, but only upto 90 days, unable to sustain its toxicity throughout the storage period followed by deltamelthrin, which has better sustenance of residual toxicity over the entire storage period. Despite of initiating the measures in two different methods, there was no control over the inbuilt population of *S. oryzae.* The probable reason might be the variation in the temperature of the godown, insect resistance etc.

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