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Studies on the efficacy of various botanicals and insecticides against *Sitophilus oryzae* (Linn.) in stored wheat

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ABSTRACT

The storage experiment was conducted at the Agriculture Research Station, Gulbarga during the year 2012-13 over a period of seven months to know the effectiveness of various botanicals and insecticides against *Sitophilus oryzae* (Linn.) in two different methods *viz.* in, Impregnation method and once application method on the surface treatment of gunny bags in botanicals and insecticides once in the beginning. In Impregnation method deltamethrin at 0.005 per cent stood significantly superior over other treatments in protecting the wheat grains from the infestation of *S. oryzae* at 30 DAS (100 %), 90 DAS (80.10 %), 150 DAS (50.20 %) and 210 DAS (11 %) respectively with a minimum live adult at 30 DAS (0.00 %), at 90 DAS (7.00 %), at 150 DAS (12.12 %) and at 210 DAS (25.20 %) respectively. Residual toxicity of deltamethrin lasted effectively upto 150 DAS. In once application method, sweet flag (5.00 %) at 30 DAS and 90 DAS, caused the highest mortality of 99.10 and 97.12 per cent respectively with minimum live adult weevil population of 0.00 and 14.00 per cent respectively, however residual toxicity of sweet flag lasted effectively upto 90 DAS. Similarly at 150 and 210 DAS deltamethrin at 0.005 per cent remained superior causing a mortality of 79.12 and 66.30 with a minimum live adults population of *S. oryzae* (11.65 And 29.55 %) respectively. Among the two different methods impregnation method was found effective where in the toxicity levels of deltamethrin lasted effectively upto 210 days unlike in the once application method though sweet flag remained superior in the beginning upto 90 days but over prolonged storage period deltamethrin remained effective in managing the insect population of *S. oryzae* to a maximum extent.

Key words : *Sitophilus oryzae (Linn.), Botanicals, Insecticides, Wheat, Gunny bags.*

Introduction

Wheat (*Triticum astivum* L.) is one of the most important cereal crop in the world and it is staple food of nearly about 35 per cent of world population. In India large quantities of food grains are stored in commercial ware houses for varying period and regular prophylactic and curative measures i.e. spraying and fumigation are done to control stored grain insect pest.

The use of conventional pesticides have potential health hazards due to toxic nature, pollution of the environment, development of resistance by insects and hazards from toxic compounds. Thus there is a need to develop pest control strategies by exploiting the plants of medicinal and insecticidal value, which are not only cheap and effective, but are also easily available to most farmers. Certain organic insecti-

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cides are being used as seed dressers or fumigants against the stored grain pests which are costly and involve the risk of residual and environmental hazards. Under such circumstances, plant materials are inevitable favourites by virtue of lesser impact on the environment. Food grains stored in gunny bags are quite unsafe from several biotic and abiotic factors. The insects residing on and inside the bags can be effectively and safely managed through adequate fumigation. Furthermore cross infestation of insects can be checked to some extent by applying residual contact insecticides on the bags, alleyways, walls of the god own.

Jute bags form a very popular receptacle for the storage of food stuffs. Insects can easily enter the bags finds an ideal shelter inside. It is only by rendering popular receptacle the jute bag insect proof thereby preventing the insect damage to food stuffs.So different methods like chemical pesticides, biological control, mechanical cooling forms for temperature manipulation, use of microbial pathogens, insect growth regulators, plant extracts and inert dusts are receiving increasing attention and research for use in storage environment.

Keeping these advantages in view the present study was under taken with the following objectives

1. To evaluate the efficacy and persistence of protectants in Impregnation and surface treatments of gunny bags in preventing cross infestation by *Sitophilus oryzae* (Linn.).

Material and Methods

Studies on the effect of Impregnation and surface treatment (spray/dust) of gunny bags using plant products like sweet flag, neem, neem seed kernel, nochi, tulsi, boganvillea (Table 1) and insecticides like Deltamethrin 2.8 EC, Malathion 50 EC, Fenitrothion 50 EC and Carbaryl 50 WP against rice weevil *Sitophilus oryzae* (Linn.) for their bioefficacy, persistence, cross infestation, survival and multiplication in wheat grains was carried out in the division of Agricultural Entomology, Agriculture Research Station, Gulbarga during the year 2012-13. Investigation comprises the comparative assessment of the best treatments in two different methods among the above products against *S.oryzae*.

Stock culture of rice weevil was maintained by collecting adult beetles from infested wheat grains from the farm store were reared in the laboratory on whole wheat flour containing 5 percent dried brewer's yeast at $29^0 \pm$ C.

Evaluation of bio efficacy was carried out in two different methods

Impregnation and surface treatment of gunny bags in the above treatments (Table 1) only once in the beginning.

Table 1. Different botanicals and insecticides used for Impregnation and surface treatment of gunny bags

Sl. No.	Treatments	Dosage (%)
1	Neem seed kernel extract	5
2	Neem leaf extract/dust	5
3	Sweet Flag Rhizome extract/dust	5
4	Nochi leaf extract/dust	5
5	Clerodendron leaf extract/dust	5
6	Bouganvillea leaf extract/dust	5
7	Tulsi leaf extract/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

Surface treatment of gunny bags at different intervals to evaluate the duration of effectiveness. Various plant products and Insecticides at different dosages were included for the experiment to assess the toxicity against *S. oryzae*. Completely randomized design was followed with 12 treatments including untreated check and three replications.

Small jute bags that could hold 1000 grams of wheat grains were prepared from fresh new full sized bags. Fresh wheat seeds which were fumigated were used for the experiments. Small jute bags filled with wheat grains were sprayed with desired concentrations of insecticides. About 300 to 500 starved individual test insect such as *Sitophilus oryzae* (Linn.) was released randomly on the gunny bags at monthly interval.

Observations on per cent adult mortality of *S. oryzae* on the surface of gunny bags and the live adult population inside the gunny bags were noted at monthly interval before the schedule of next spray.

Results and Discussion

The findings of the present study as well as the relevant discussion have been summarized under the

following heads:

From table 2 it is confirmed that at 30 DAS, deltamethrin at 0.005 per cent recorded the highest *S.oryzae* mortality of cent per cent followed by sweet flag at 5 per cent with mortality of 96.10 per cent differing significantly over other treatments. Consequently the minimum live adult population of was found nil in all treatments. However compared untreated check (2.01 %) all other treatments have rendered good protection against *S.oryzae* in stored wheat.

Similarly at 90 DAS, deltamethrin at 0.005 per cent registered the highest mortality of 80.10 per cent with the minimum live adult population of (7.00 %) inside the gunny bags followed by sweet flag at 5 per cent with 64.00 per cent mortality with the adult population of 9.23 per cent differing significantly over other treatments. However compared to untreated check (3.20 %), all other protectants have offered fair protection from *S.oryzae* infestation in stored wheat.

Also at 150 DAS, deltamethrin at 0.005 per cent caused the highest adult mortality of 50.20 per cent with the minimum live adult population of 12.12 per cent followed by sweet flag (5 %) with a mortality of 16.01 per cent with least population (19.00 %) of live adults of *S.oryzae*. However upon comparison with untreated check (3.23 %) except sweet flag and malathion at 5 and 0.5 per cent, all other protectants have lost their potency to check the menace of *S.oryzae*. The present data supports the findings of Ramzan *et al.* (1987) who observed that deltamethrin at 0.005 per cent gave satisfactory protection against *S.oryzae* upto 6 months. Similar findings were reported by Sunil K (2005) that sweet flag at 1 per cent had minimum adult population of 5.50 per cent of *S.oryzae* in stored sorghum after 180 days. Variation in adult population of *S.oryzae* is mainly due to the use of gunny bags in the experiment.

Finally at 210 DAS, again deltamethrin at 0.005 per cent caused the highest mortality of 11 per cent with least number of adult population of *S.oryzae* (25.20 %) was recorded. However compared to untreated check (1.5 %) all other protectants have lost their efficaciousness in managing the *S.oryzae* population in stored wheat.

From table 3 at 30 DAS, it is clear that sweet flag at 5 per cent caused the highest mortality of *S.oryzae* (99.10 %) followed by deltamethrin (96.10 %) at 0.005 per cent differing significantly. Consequently the number of live adults of were found nil in all the treatments. However compared to untreated check (2.40 %) all other protectants have rendered their effectiveness in checking the nuisance of *S.oryzae* infestation.

Similarly at 90 DAS, sweet flag at 5 per cent claimed the maximum mortality of 97.12 per cent with a least number of live adult population of

Table 2. Per cent mortality and live adult population of *Sitophilus oryzae* (Linn.) consequent to the impregnation of gunny bags in botanicals and insecticides once in beginning.

Sl. No.	Treatments	Dose (%) v/v or w/v	Per cent Adult Mortality of *Rhyzopertha dominica* on the surface of gunny bags				Per cent live adult population of *Rhyzopertha dominica* inside the gunny bags (100 gms 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	90.12^{c}	57.20^{c}	12.00^{c}	0.00^{c}	0.00	10.00^{d}	15.50^{d}	42.20^{g}
2	Neem leaf Extract	5	86.30^{d}	31.10^{f}	0.00^{g}	0.00^{c}	0.00	11.55^{f}	19.20^{g}	49.00^{j}
3	Sweet flag Rhizome Extract	5	96.10^{b}	64.00^{b}	16.01^{b}	0.00^{c}	0.00	9.23^{c}	19.00^{f}	32.00^{d}
4	Nochi leaf Extract	5	75.30^{e}	32.10^{f}	0.00^{g}	0.00^{c}	0.00	10.23^{e}	18.00^{e}	42.10^{f}
5	Clerodendron leaf Extract	5	72.10^{ef}	30.10^{f}	0.00^{g}	0.00^{c}	0.00	14.00^{h}	20.21^{i}	46.00^{i}
6	Bouganvillea leaf Extract	5	75.10^{e}	45.00^{e}	0.00^{g}	0.00^{c}	0.00	12.00^{g}	20.00^{h}	39.00^{e}
7	Tulsi leaf Extract	5	58.10^{g}	19.12^{g}	0.00^{g}	0.00^{c}	0.00	20.00^{i}	34.00^{j}	44.00^{h}
8	Carbaryl 50 WP	0.4	70.10^{f}	20.00^{g}	1.90^{f}	0.00^{c}	0.00	10.00^{d}	14.20^{b}	30.10^{c}
9	Mela thion 50 EC	0.05	98.10^{b}	42.10^{e}	4.34^{d}	0.00^{c}	0.00	9.16^{b}	14.21^{c}	29.00^{b}
10	Fenitrothion 50 EC	0.05	90.10^{c}	53.00^{d}	0.00^{g}	0.00^{c}	0.00	28.10^{j}	44.18^{k}	79.00^{k}
11	Deltamethrin 2.8 EC	0.005	100^{a}	80.10^{a}	50.20^{a}	11.00^{a}	0.00	7.00^{a}	12.12^{a}	25.20^{a}
12	Untreated Check	-	2.01^{h}	3.20^{h}	3.23^{e}	1.5^{b}	0.00	33.10^{k}	65.20^{l}	90.20^{l}

DAS – Days after storage

In the verticals columns means followed by same letters are not different statiscally (P = 0.01) by DMRT.

Table 3. Per cent mortality and live adult population of *Sitophilus Oryzae* (Linn.) consequent to the application of botanicals and insecticides on the surface of gunny bags once in the beginning.

Sl. No.	Treatments	Dose (%) v/v or w/v	Per cent Adult Mortality of *Rhyzopertha dominica* on the surface of gunny bags				Per cent live adult population of *Rhyzopertha dominica* 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	88.10^{e}	52.10^{g}	7.20^{e}	0.00^{f}	0.00	21.00^{f}	20.05^{c}	40.00^{d}
2	Neem leaf dust	5	92.10^{d}	45.20^{h}	2.00^{g}	0.00^{f}	0.00	23.13^{g}	22.15^{e}	39.00^{c}
3	Sweet flag Rhizome dust	5	99.10^{a}	97.12^{a}	39.00^{b}	19.89^{b}	0.00	14.00^{a}	20.00^{b}	31.15^{b}
4	Nochi leaf dust	5	95.34^{bc}	76.20^{de}	29.30^{d}	6.23^{d}	0.00	18.50^{d}	25.00^{f}	43.00^{h}
5	Clerodendron leaf dust	5	78.20^{f}	74.00^{e}	25.20^{e}	6.10^{d}	0.00	25.00^{h}	27.00^{h}	42.00^{g}
6	Bouganvillea leaf dust	5	94.21^{c}	79.00^{d}	31.50^{c}	14.20^{c}	0.00	26.25^{i}	26.00^{g}	45.00^{i}
7	Tulsi leaf dust	5	44.00^{h}	9.10^{i}	0.00^{k}	0.00^{f}	0.00	50.10^{k}	67.00^{j}	86.00^{j}
8	Carbaryl 50 WP	0.4	46.20^{h}	7.23^{i}	0.00^{h}	0.00^{f}	0.00	20.45^{e}	22.15^{e}	41.13^{f}
9	Melathion 50 EC	0.05	64.01^{g}	60.00^{f}	8.10^{g}	0.00^{f}	0.00	18.00^{c}	20.15^{d}	40.15^{e}
10	Fenitrothion 50 EC	0.05	95.30^{bc}	85.12^{c}	17.12^{f}	5.23^{d}	0.00	30.00^{j}	48.00^{i}	88.00^{k}
11	Deltamethrin 2.8 EC	0.005	96.10^{b}	90.20^{b}	79.12^{a}	66.30^{a}	0.00	17.10^{b}	11.65^{a}	29.55^{a}
12	Untreated Check	-	2.40^{i}	1.10^{j}	1.12^{j}	1.10^{e}	0.00	50.23^{l}	69.00^{k}	98.00^{l}

DAS – Days after storage

In the verticals columns means followed by same letters are not different statiscally (P = 0.01) by DMRT.

(14.00 %) followed by deltamethrin (90.20 %) mortality at 0.005 per cent differing significantly from other treatments compared to untreated check (1.10 %) all treatment have showed good effect against *S.oryzae*. The present findings are in accordance with Jilani (1984), Khan (1986), Panesu *et al.* (1993) and Tiwari (1993) who reported that *Acorus calamus* as good grain protectant with long residual activity.

At 150 DAS, deltamethrin at 0.005 per cent caused maximum mortality of 79.12 per cent with a minimum live adult population (11.65 %) followed by sweet flag at 5 per cent with a mortality of 39.00 per cent differing significantly over other treatments. However upon comparison with untreated check (1.12 %) all other treatments except few, have lost their potentiality in checking *S. oryzae* manifestation. The present findings are ingreement with Yadav (1988) and Sone lal *et al.*, (1988-89) who reported the effectiveness of deltamethrin @ 10 and 20 mg per m^2 on surface of jute bags provided satisfactory protection against the adults and larvae of *S.oryzae*. Similar findings were also reported by Aggarwal *et al.* (1992) that the efficacy of deltamethrin 2.5 WP against *T. castaneum* at 30 mg a i. / m^2 on bags upto 75 days.

Finally at 210 DAS too, deltamethrin at 0.005 per cent recorded the highest mortality of 66.30 per cent with least population of live adults of *S.oryzae* (29.55 %) inside the bags followed by sweet flag (19.89 %) mortality at 5 per cent. However compared to check (1.10 %) most of the protectants have lost their effectiveness in managing the menace of *S.oryzae*.

Conclusion

From the findings, it can be concluded that among the two different methods, Impregnation method (dipping of gunny bags from Table 2) was found effective as the deltamethrin remained effective over a prolonged storage period upto 210 days, unlike in the once application, method though sweet flag stood superior upto 90 days but over a period of storage deltamethrin was found effective up to 210 days. The mortality was mainly due to the toxicity level and persistence of deltamethrin over prolonged storage period.

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