Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

E-ISSN: 2320-7078
P-ISSN: 2349-6800
JEZS 2018; 6(1): 1672-1674

Received: 02-01-2018
Accepted: 05-02-2018

Dr. N Sambasiva Rao
Agricultural Research Station, Jangamaheswarapuram, Gurazala, Guntur District, Andhra Pradesh, India

Correspondence Author;
Dr. N. Sambasiva Rao
Agricultural Research Station, Jangamaheswarapuram, Gurazala, Guntur District, Andhra Pradesh, India

Testing of novel insecticides for their efficacy against lesser grain borer, *Rhyzopertha dominica* (F.) on jute surface

Dr. N Sambasiva Rao

Abstract
Efficacy of Spinosad 45 SC, Abamectin 1.8 EC and Emamectin Benzoate 5 SG along with other insecticides was evaluated to access acute and persistant toxicity against lesser grain borer, *Rhyzopertha dominica* (F.) as surface and jute treatment. After 5 days of treatment on jute surface, 100% mortality of released adults were recorded in Malathion 50 EC @ 150 mg a.i/m^2, Deltamethrin 2.5 WP @ 30 mg a.i/m^2, Spinosad 45 SC @ 5 mg a.i/m^2 and Emamectin benzoate 5 SG @ 4 mg a.i/m^2 treatments. Dichlorvas 76 EC @ 150 mg a.i/m^2 has produced 98.70% mortality, Abamectin 1.8 EC has produced only 92.31% mortality in adult insects and least effective among the insecticides tested. At 120 days after treatment (120 DAT) Deltamethrin 2.5 WP @ 30 mg a.i/m^2 has produced 97.5% mortality of released adults followed by Spinosad 45 SC @ 5 mg a.i/m^2 (95.0%) and Emamectin benzoate 5 SG @ 4 mg a.i/m^2 (95.0%) are equally effective. The persistence of Malathion 50 EC 150 mg a.i/m^2 and Dichlorvas 76 EC 150 mg a.i/m^2 has reduced still further when compared to 90 DAT and recorded mortalities of 30.0 and 17.5%, respectively. Least persistence (15.0% mortality) was observed in Abamectin 1.8 EC @ 5 mg a.i/m^2 which is equal to control mortality.

Keywords: Novel insecticides, lesser grain borer, *Rhyzopertha dominica*

Introduction
Many structures were used for grains storage ranging from jute bags to tall grain elevators. Such stored commodities for long time were prone to contamination and damage by biotic and abiotic factors. Among the biotic agents, insects, mites, rodents, birds and microorganisms cause immense loss in storage. Major damage was mainly caused by insects, which account for an average of 10-20% of storage losses (Phillips and Throne 2010) [3]. In general, stored products of agricultural and animal origin are attacked by more than 600 species of coleopterans, 70 species of lepidopterans and about 355 species of mites causing both quantitative and qualitative losses (Rajendran and Sriranjini 2008) [1]. Reports have shown that some insect pests initiate damage during ripening stage of crops and continue to storage. However, major sources of infestations are old bags, storage structure, old containers and cross over infestation (Perez-Mendoza *et al*. 2004) [2].

Disinfestation of bulk and bag storage structures using insecticides is an important practice to be done prior to storage and a layer of insecticide spray can be suggested immediately after storage. Since, Dichlorvos was banned using in warehouses, presently Deltamethrin and Malathion are the available options for disinfectant and for surface sprays. Reddy and Chitra Srivatsava (2004) [6] studied persistant toxicity of Malathion 50 EC @ 100, 150, 250, 350, 450 mg a.i/m^2 and Dichlorvas 76 EC @ 100,150,250,350 and 450 a.i/m^2 on jute surface against *Tribolium castaneum* for six months and reported that Malathion @ 450 mg a.i/m^2 showed mortality up to 30 days and Dichlorvas @ 450 mg a.i/m^2 upto 60 days against susceptible strain. Moreover, all insect pests in storage have developed resistance to all conventional insecticides like Malathion, Dichlorvas and Deltamethrin and they are not safe to mammals.

Apart from them, several insecticides with novel modes of action with persistence are available in the market for use in safe storage of food grains particularly on Jute surface. Rajani (2013) [4] reported that Spinosad 45 SC have recorded low LC_{50} of 0.08 ppm, 0.24 ppm, 0.05 ppm against *Sitophilus oryzae*, *Callasobruchus chinensis* and *C. maculates*, respectively applied on the cowpea seed. Hence, the present study was undertaken to test the efficacy of Spinosad 45 SC, Abamectin 1.8 EC and Emamectin Benzoate 5 SG along with other insecticides to access acute and persistant toxicity against lesser grain borer, *Rhyzopertha*

dominica (F.) as surface and jute treatment.

Material and Methods

An experiment was conducted to find out the efficacy of certain insecticides against lesser grain borer, *Rhyzopertha dominica* (F.) on jute surface at Entomology Laboratory, Post Harvest Technology Centre, Bapatla, Guntur district, Andhra Pradesh, India during the year 2011-12. The details of treatments imposed are as follows.

T_1: Malathion 50 EC @ 150 mg a.i/m^2
T_2: Dichlorovas 76 EC @ 150 mg a.i/m^2
T_3: Deltamethrin 2.5% WP @ 30 mg a.i/m^2
T_4: Spinosad 45 SC @ 5 mg a.i/m^2
T_5: Abamectin 1.8 EC @ 5 mg a.i/m^2
T_6: Emamectin Benzoate 5 SG @ 4 mg a.i/m^2
T_7: Control

Jute surface of 9 cm diameter was sprayed with above test insecticides at recommended doses with acetone as solvent by using glass atomisers and air dried at room temperature. Later the jute pieces sprayed with test insecticides were transferred to a petriplate. Freshly emerged adults of 10 pairs of lesser grain borer was released in to each replication and 4 such replications were maintained. Adult mortality was recorded at 24 hrs intervals upto 5 days to find out acute toxicity of insecticides against adults of lesser grain borer. Moribund insects were considedred as dead.

The persistant toxicity of the above test insecticides were also recorded at 15 days interval up to 120 days by releasing fresh adults every time after observation, till zero toxicity is recorded (Reddy and Chitra Srivastava, 2004) [6].

Results & Discussion

Residual toxicity of insecticides

After 5 days of treatment on jute surface 100 % mortality of released adults were recorded in Malathion 50 EC @ 150 mg a.i/m^2, Deltamethrin 2.5 WP @ 30 mg a.i/m^2, Spinosad 45 SC @ 5 mg a.i/m^2 and Emamectin benzoate 5 SG @ 4 mg a.i/m^2 treatments. Dichlorvas 76 EC @ 150 mg a.i/m^2 produced 98.70% mortality, Abamectin 1.8 EC has produced only 92.31% mortality in adult insects and least effective among the insecticides tested (Table 1).

Table 1: Residual toxicity of test insecticides on jute surface against lesser grain borer *R. dominica* adults

Treatments	Mortality of adults (%)				
	1 DAT	2 DAT	3 DAT	4 DAT	5 DAT
1. Malathion 50 EC @ 150 mg a.i/m^2	78.75	88.75	92.50	97.50	100
2. Dichlorvas 76 EC @ 150 mg a.i/m^2	77.92	89.61	94.81	97.40	98.70
3. Deltamethrin 2.5 WP @ 30 mg a.i/m^2	94.93	98.73	98.73	100	100
4. Spinosad 45 SC @ 5 mg a.i/m^2	88.46	97.43	100	100	100
5. Abamectin 1.8 EC @ 5 mg a.i/m^2	41.02	67.95	88.33	87.18	92.31
6. Emamectin benzoate 5 SG @ 4 mg a.i/m^2	95.06	97.53	100	100	100
7. Control	7.60	11.39	13.92	15.19	15.19

Persistent Toxicity of insecticides:

At 30 DAT Deltamethrin 2.5 WP @ 30 mg a.i/m^2, Spinosad 45 SC @ 5 mg a.i/m^2 and Emamectin benzoate 5 SG @ 4 mg a.i/m^2 have produced 100% mortality of released adults on jute surface. Dichlorvas 76 EC 150 mg a.i/m^2 has produced 80% mortality followed by Malathion 50 EC 150 mg a.i/m^2 (75.0%) and Abamectin 1.8 EC @ 5 mg a.i/m^2 (52.5%).

At 60 DAT Deltamethrin 2.5 WP @ 30 mg a.i/m^2, Spinosad 45 SC @ 5 mg a.i/m^2 and Emamectin benzoate 5 SG @ 4 mg a.i/m^2 have produced 100% mortality of released adults on jute surface. The persistence of Dichlorvas 76 EC 150 mg a.i/m^2 and Malathion 50 EC 150 mg a.i/m^2 have reduced and caused only 42. 5 and 55% mortality of adult beetles, respectively.

At 90 DAT Deltamethrin 2.5 WP @ 30 mg a.i/m^2 has produced 100% mortality of released adults followed by Spinosad 45 SC @ 5 mg a.i/m^2 (97.5%) and Emamectin benzoate 5 SG @ 4 mg a.i/m^2 (95.0%). The persistence of Malathion 50 EC 150 mg a.i/m^2 and Dichlorvas 76 EC 150 mg a.i/m^2 has reduced and recorded the mortalities of 35% and 25%, respectively. Least persistence (17.5% mortality) was observed in Abamectin 1.8 EC @ 5 mg a.i/m^2.

At 120 DAT Deltamethrin 2.5 WP @ 30 mg a.i/m^2 has produced 97.5% mortality of released adults followed by Spinosad 45 SC @ 5 mg a.i/m^2 (95.0%) and Emamectin benzoate 5 SG @ 4 mg a.i/m^2 (95.0%) are equally effective. The persistence of Malathion 50 EC 150 mg a.i/m^2 and Dichlorvas 76 EC 150 mg a.i/m^2 has reduced still further when compared to 90 DAT and recorded mortalities of 30.0 and 17.5%, respectively. Least persistence (15.0% mortality) was observed in Abamectin 1.8 EC @ 5 mg a.i/m^2 and equal to control mortality (Table 2).

Table 2: Persistent toxicity of test insecticides on jute surface against lesser grain borer *R. dominica* adults

Treatment	Persistence of the chemical (% mortality)							
	15 days	30 days	45 days	60 days	75 days	90 days	105 days	120 days
1. Malathion 50 EC	88.75	75	85	55	50	35	32.5	30
2. Dichlorvas 76 EC	91.25	80.0	72.5	42.5	30	25	20	17.5
3. Deltamethrin 2.5 WP	100	100	100	100	100	100	100	97.5
4. Spinosad 45 SC	100	100	100	100	100	97.5	97.5	95.0
5. Abamectin 1.8 EC	75	52.5	75	40	20	17.5	15.0	15.0
6. Emamectin benzoate 5 SG	100	100	100	100	97.5	95.0	95.0	95.0
7. Control	10	7.50	10.0	7.50	10.0	7.5	10.0	15.0

Ummer *et al*. (2013) studied the efficacy of different insecticides on jute surface against *Caryedon serratus* (Olivier) for six months. Deltamethrin @ 30 mg a.i m^{-2}, malathion @ 150 mg a.i m^{-2} and spinosad @ 100, 300 and 500 mg a.i. m^{-2} caused cent % mortality of *C. serratus* at 24 hours after treatment. Deltamethrin and malathion were effective upto 180 DAT with 60 and 16.66 % mortality. Reddy and Chitra Srivatsava (2003) [5] studied the persistence of three pyrethroids, i.e. Deltamethrin, Cypermethrin and Bifenthrin on jute surface against Malathion susceptible as

well as resistant strain of *Tribolium castaneum.* Insecticides were sprayed at five doses of 10. 30, 50, 70 and 100 mg a.i. m^{-2} and mortality was observed after 2, 30, 60, 90,120,150 and 180 d after spray. At recommended dose Deltamethrin caused 80.0% mortality upto 180th d and 66.7% upto 90 d against susceptible and resistant strain, respectively whereas bifenthrin gave similar mortality upto 150 and 60 d, respectively. The order of persistent toxicity of EC formulations of three pyrethroids for both the strains at all the doses were Deltamethrin> Bifenthrin>Cypermethrin. From the above study it is concluded that Malathion 50 EC @ 150 mg a.i/m^2, Deltamethrin 2.5 WP @ 30 mg a.i/m^2, Spinosad 45 SC @ 5 mg a.i/m^2 and Emamectin benzoate 5 SG @ 4 mg a.i/m^2 has produced cent percent mortality in lesser grain borer after 5 days of treatment and persisted for a long time on jute surface upto 4 months hence the new insecticides with novel modes of action i.e. Spinosad 45 SC and Emamectin benzoate 5 SG can be used on surface treatment for safe storage of grain.

References

1. Rajendran S, Sriranjini V. Plant Products as Fumigants for Stored-Product Insect Control. Journal of Stored Products Research. 2008;44:126-135.
2. Perez-Mendoza J, Paul WF, James FC, David WH, James ET. Detection of stored grain insect infestation in Wheat transported in rail road hopper cars. Journal of Economic Entomology. 2004;97(4):1474-1483.
3. Philips T, Throne J. Biorational approaches to managing stored-product insects. Annual Review of Entomology. 2010;55:375-397.
4. Rajani BR, Patil RH, Awaknavar JS. Efficacy of new insecticide seed protectants against major storage insect pests of wheat and cowpea. *Karanataka* Journal of Agricultural Science. 2013;26(3):372-374.
5. Reddy Srinivasa D, Srivastava Chitra. Toxicity of EC formulation of Synthetic Pyrethroids on Jute surface against Tribolium castaneum (Herbst). *Pesticide* Research Journal. 2003;15(2):178-180.
6. Reddy Srinivasa D, Srivastava Chitra. Persistant toxicity of Malathion and Dichlorvas on Jute surface against Tribolium castaneum (Herbst). Annals of Plant Protection Sciences. 2004;12(1):41-44.
7. Ummer Najitha, Madhumathi T, Krishnayya PV. Efficacy of Insecticides against Caryedon serratus (Olivier) on Jute Cloth Disc Surface. Pesticide Research Journal. 2013;161(1):63-65.