JBiopest 7(1):18-21(2014)

Efficacy of different insecticides against *Sitophilus oryzae* Linn. in stored wheat seed

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ABSTRACT

Seven insecticides, *viz.*, neem seed kernel powder (NSKP), neem cake, dry neem leaf powder (all at 10 g/kg), neem oil (10 mL/kg), nimbecidine (5 and 10 mL/kg) and deltamethrin (Decis 2.5 WP; 40 mg/kg) were evaluated as seed protectant against *Sitophilus oryzae* L. in stored wheat seed (HUW 234). In a sample size of two kg in gunny bags, adult were released at the rate of 10 pairs/bag and bags were stored at room temperature. Observation on number of live adults was recorded after 3, 6 and 9 months of storage. The deltamethrin (Decis 2.5 WP; 40 mg/kg) was found most effective treatment followed by neem India, at higher and lower doses, nimbecidine at higher and lower dose, neem oil, neem cake, dry neem leaf powder and NSKP treatments.

MS History: 10.1.2014 (Received)-11.3.2014 (Revised)-12.6.2014 (Accepted)

Key words: Insecticides, neem seed kernel powder, neem cake, dry neem leaf powder, *Sitophilus oryzae* L.

INTRODUCTION

There are near one billion hungry peoples in today's world and more than five hundred millions of grains annually destroyed due to pests and plants disease. Stored products protection based on scientific and technical principles are important and economic. Therefore, pest identification and use of suitable methods for their control is also noteworthy. Rice weevil is one of the major and dangerous pests of wheat and some other grains (Hatami *et al*., 2011).

Wheat (*Triticumae stivum* L.) belonging to family Graminae is the world's most important cereal crop. As wheat has only few insect-pests under field conditions, but it is prone to insect attack after harvest and cause both quantitative and qualitative losses in post harvest storage. Rice weevil, *Sitophilus oryzae* Linn., is a serious pest of stored wheat and feeds on, rice, corn, oat, barley, sorghum, buck wheat ear and their products. It belongs to family Curculionidae and order Coleoptera and was first seen breeding on rice hence named as rice weevil way back in 1763. It is a cosmopolite insect supposedly originated in India and spread all around the world through infested and ship-transported grains. They are considered as the main stored wheat pests due to the fact that they present a high biotic potential and cross-infestation, are a deep pest, have a high number of hosts and also due to the fact that both larvae and adults cause damage additionally cites other damages caused by weevils in stored grains, such as: formation of heat cavities in the grain mass, pollution of the grain mass, dissemination of molds in the grain mass and depreciation of the product. Due to the poor storage status of grains, the losses caused by insects range from 0.2 to 30 % (Alleoni and Ferreira, 2006). Keeping in view the above facts in mind the present study was conducted to reduce the huge storage losses in wheat by the use of different insecticides against *Sitophilus oryzae* Linn.

MATERIALS AND METHODS

Experimental site

The present investigations were carried out at Seed Storage Laboratory, Department of Entomology, Narendra Deva University of Agriculture and Technology, Narender Nager, Faizabad, Uttar Pradesh, India using N.S.K. Powder (M/S Maurya oil mill Jagadishpur) (10 g/kg seed); Neem Cake (M/S Maurya oil mill Jagadishpur) (10 g/kg seed); Dry Neem Leaf Powder (10 g/kg seed); Neem Oil (M/S Maurya oil mill Jagadishpur); Nimbecidine (0.03% EC Azadarichtin) (M/S T. stanes company Ltd coimbatore) (5 mL/kg seed); Nimbecidine (0.03% EC Azadarichtin) (M/S T. stanes company Ltd coimbatore) (10 mL/kg seed); Neem India (1500 ppm Azadarichtin) (M/S ITC Ltd Kolkata) (5 mL/kg seed); Neem India (1500 ppm Azadarichtin) (M/S ITC Ltd Kolkata) (10 mL/kg seed);

Deltamethrin (2.5 WP) (M/S Gharda chemicals Ltd. Thane Maharashtra) (40 mg/kg seed) and Untreated check.

Maintenance of culture of *S. oryzae*

Large number of adults of *S. oryzae* were collected from godown of seed processing plant of the University and were released @ 100 pairs/jar in two cylindrical glass jars of 10 x 15 cm size each containing 1 kg pre-sterilized wheat of variety HUW 234. The jars were kept in Biological Oxygen Demand (BOD) incubator at 30^0C and RH 75% after covering their mouths with muslin cloth tied with rubber band.

Preparation of N.S.K. and dry neem leaf powder

Leaves plucked from neem tree were sun dried and neem seed kernal purchased from M/S Maurya Oil mill Jagdishpur, Sultanpur were grind with the help of mixer and grinder to make them fine powder.

Sexing of *S. oryzae*

The adults of *S. oryzae* taken from already maintained culture, and their sex determination was done on the basis of size and intensity of curve of rostrum. The adults having shorter and less curved rostrum were identified as males and those of having longer and more curved rostrum were identified as females. After determining their sexes the beetles were released @ 10 pair (One male and one female) in each bag.

Evaluation of insecticides

Twenty kg freshly harvested insect free grains of wheat variety HUW 234 obtained from seed processing plant of University, divided into 10 equal parts, weighing two kg each, and was used for testing the efficacy of different neem products against *S. oryzae*. Required amount of N.S.K. Powder, Neem Cake, Dry Neem Leaf Powder was weighed with the help of electronic balance and Neem Oil, Nimbecidine and Neem India was measured and mixed with the help measuring cylinder in 2 kg grain separately. However as per treatment Deltamethrin 2.5 WP was weighed and diluted into 10 mL of water and mixed in 2 kg wheat sample kept for this purpose. Then this treated wheat grain was again divided into four equal parts, each weighing 500 g and was kept in gunny bags of two kg capacity. *S. oryzae* taken out from already maintained culture were sexed and released @ 10 pairs / bag and the bags were kept in steel racks at room temperature for further observations. The details of treatment used have been given in Table 1. Observations on number of adult of *S. oryzae* was recorded after 3, 6 and 9 months of storage and data so obtained is subjected to analysis of variance as suggested by Gomez and Gomez (1983) for Complete Randomized Design.

RESULTS AND DISCUSSION

Analysis of variance revealed significant differences among all the treatments under study. Data taken after 3 months showed that all treatments were effective in checking population build up of *S. oryzae* as these had significantly less population than untreated check. Minimum and significantly less population 37.00 was recorded with the application of Deltamethrin and was proved most effective. It was followed by neem India (10 mL), Nimbecidine (10 mL), Neem India (5 mL), Nimbecidine (5 mL), Neem Oil, Dry Neem Leaf Powder, Neem Cake and N.S.K. Powder adult population of 56.00, 61.25, 62.00, 63.50, 70.75, 76.75, 80.25 and 83.25 /500g, respectively. Sia *et al.* (1989) has also reported that deltamethrin @ 1% was safe and effective against insect damage for 4 months. After 6 months, all the treatments were found effective and significantly better than untreated check. Minimum and significantly less population (152.00 adults/500 g sample) was recorded in Deltamethrin application followed by Neem India (181.50 adults) @10 mL, Nimbecidine (191.75) @ 10 mL, neem India (192.75) @ 5mL, Nimbecidine (201.00) @ 5 mL, neem oil (206.20), N.S.K. Powder (214.50), neem cake (215.50) and neem dry leaf powder (228.00) each @ 10 g/kg seed, respectively. After 9 months of treatment, Deltamethrin (204.00 adults/500 g seed) provided best protection against *S. oryzae* followed by Neem India (244.50) @ 10 mL, Neem India (253.25) @ 5 mL, Nimbecidine (288.50), Nimbecidine (307.25) @ 5mL, Neem Oil (315.30) @ 10 mL, Neem Cake (322.00), Dry Neem Leaf Powder (327.00) and N.S.K. Powder (349.00) @ 10 g/kg seed, respectively.

Earlier workers like Singh *et al.* (1998) have also reported that Deltamethrin was most effective in protecting the wheat seeds up to nine months against *S. oryzae* and *T. granarium.* Whereas, neem products were found effective than control in the present investigations.

Table 1. Effect of insecticides on the population of *S. oryzae* after 3, 6, and 9 months of storage

Treatments	Population of *S. oryzae* months after		
	3	6	9
N.S.K. Powder 10 g/kg seed	83.25	214.50	349.25
Neem cake 10 g/kg seed	80.25	215.50	322.00
Dry Neem leaf powder 10 g/kg seed	76.75	228.00	327.00
Neem oil 10 mL/kg seed	70.75	206.20	315.50
Nimbecidine (0.03% EC Azadirachtin) 5 mL/kg seed	63.50	201.00	307.25
Nimbecidine (0.03% EC Azadirachtin) 10 mL/kg seed	61.25	191.75	288.50
Neem India (1500 ppm Azadirachtin) 5 mL/kg seed	62.00	192.75	253.25
Neem India (1500 ppm Azadirachtin) 10 mL/kg seed	56.00	181.50	244.50
Deltamethrin 2.5 WP 40 mg/kg	37.00	152.00	204.00
Untreated check	157.25	344.50	523.00
C.D. at 5%	4.27	11.47	7.087

Similarly, effectiveness of Neem products against *S. oryzae* over longer periods of time has also been reported by Sharma (1999) in maize. This may be attributed to the reason that bioactive constituents of the plant materials may be more available in the extract at higher concentrations, which may be responsible for the higher mortality of adult insect within a short exposure of time (Ashamo, 2007). In the present studies Neem products provided less protection as compared to deltamethin, because seed damage is not always reduced by neem materials at par with synthetic insecticides (Sehgal and Ujagar, 1999).

In the present investigations, all insecticides were found effective as compared to control. Deltamethrin 2.5 WP @ 40 mg/kg seed was found most effective in controlling the insect population, while least effective treatment was N.S.K Powder @ 10 g/kg seed. The efficacy of various treatments in descending order was Deltamethrin 25 WP @ 40 mg/kg seed, Neem India @ 10 mL/Kg seed, Neem India 5 mL/kg, Nimbecidine 10 mL/kg seed, Nimbecidine @ 5 mL/kg seed, Neem Oil @ 10 mL/kg seed, Neem cake @ 10 g/kg seed, Dry Neem Leaf Powder @ 10 g/kg seed, N.S.K. Powder @ 10 g/kg seed and control. Therefore, present studies conclude that Deltamethrin 2.5 WP @ 40 mg/kg seed was found most effective in controlling the insect population of *S. oryzae* in stored wheat seeds, hence it should be recommended for commercial application to reduce the huge storage losses in wheat.

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