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Original Research Article

Effect of Newer Insecticide Molecules on Seed Viability

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A B S T R A C T

Insecticides, viz. emamectin benzoate, spinosad, indoxacarb, rynaxypyr, chlorfenapyr, profenophos, novaluron and deltamethrinwere evaluated for their efficacy against pulse beetle, *Callosobruchus chinensis* on stored pigeon pea seed. The observation on germination and insect infestation were recorded at interval of onemonthup to six month of storageperiod. Among different insecticides, deltamethrin 2.8 EC @ 0.04 ml/kg and spinosad 45 SC @ 4.4 mg/kg of seed were found equally effective for control of pulse beetlein stored pigeon pea seed and maintained the pigeon pea seed germination above minimum seed certification standard (87.66%) upto 6 months of storage.

Introduction

Grain legumes popularly known as pulses, play an important role in Indian agriculture not only to increase soil fertility for obtaining reasonably high yields from succeeding crops but also in providing proteinaceous grain and nutritive fodder. India has the largest producer of pulses in world it has 27.99 million ha area and 18.45 metric ton production (Anonymous, 2013).

Among the pulses, Pigeon pea, *Cajanus cajan(L.)* is one of the important pulse crop. India is the largest producer of pigeon pea in world with area of 4.09 million hectares with a production of 2.74 million tons. In Maharashtra, pigeon pea is grown in an area of 10.97 lakh ha with a production of 9758 hundred tonnes (Anonymous, 2014).

In India 17 species of bruchids belonging to 11 genera have been recorded infesting different pulses (Arora, 1977). The genus *Calloso bruchus* attacks grains legumes during both pre and post harvest stages all over the world; but in India *C.maculates, C. analis* and *C. chinensis* are the predominant pest species of the genera (Dias and Yadav, 1988). In India Gujar and Yadav (1978) recorded 32.2 to 55.7 per cent loss in seed weight and 17.0 to 53.5 per cent loss in protein content. In case of severe infestation 100 per cent damage is caused by the pulse beetle (Pruthi and Singh, 1950).

Prevention of loss in stored product due to insect pest is one of the most important aspects in Indian agriculture. The use of insecticidal protectants is a common preventative measure to protect store grain from insect damage. Many of these insecticides are effective at relatively low

dosage and provide long term protection, which can range from six to twelve months (Athanassiou, 2004).

Taking into consideration the need for the management of this pest, present investigations were made to study the efficacy of newer insecticides against pigeon pea pulse beetle under storage condition.

Materials and Methods

A laboratory experiment was carried out at Seed Technology Research Unit, Dr. PDKV., Akola during 2014-15 to evaluate the efficacy of different insecticides against pigeon pea pulse beetle under ambient conditions with an objective toevaluate the effect of newer insecticide molecules on seed viability,

To obtain adequate culture of *Callosobruchus chinensis*, the adults were collected from the Pulses Research Unit, Dr. PDKV, Akola along with pulses on which eggs were laid by pulse beetle. These eggs laid seeds were kept in plastic container covered with muslin cloth and allowed the adult to emerge from the seeds.

Adults thus collected, were directly introduced into pigeon pea variety AKT-8811 in eight plastic containers and allowed them to lay eggs for seven days. Then adults were transferred into another set of containers and such procedure was repeated.

At the time of release of beetle in treatments, the cultures were sieved before four days to obtain 0-4 day's old beetles. These cultures were grown in laboratory conditions of temperature 27±2'C and relative humidity 70-80 %.

To treat the seeds with various insecticides at different doses required quantity of pesticide was diluted in 5 ml water and treat 1 kg of seed for proper coating. After drying in shade seed was packed in baglets of 2 kg capacity and kept in room under ambient condition.

100 grains of pigeon pea seed were taken out from treated seed in each month for calculating per cent seed germination to study the effect of new insecticides on viability of stored seed.

100 grains were kept on moist paper towel , replicated thrice and kept in seed germination at 25° C temperature and 70 % RH. The observation were recorded on seventh day and per cent seed germination was calculated as below

$$\text{Per cent seed Germination} = \frac{\text{No. of normal seedling}}{\text{Total no. of seed kept}} \times 100$$

Results and Discussion

The result presented in Table 1indicated that per cent seed infestation after 30 days of storage was absolutely prevented in the seeds treated with deltramethrin 2.8 EC @ 0.04 ml/kg seed, spinosad 45 SC @ 4.4 mg/kg seed and emamectin benzoate 5 SG @ 40 mg/kg seed.

The per cent seed infestation was further increased up to0.34 and 12.99 per cent after 90 days of storage and ultimately reached 1.12 and 17.99 per cent after 180 days of storage, respectively.

Data regarding germination of seeds from table 2 revealed that there was no significant difference in germination of seeds at first month of storage period.

Table.1 Effect of insecticides on per cent infestation of pigeon pea seed by *Callosobruchus chinensis*

Sr. No.	Treatments	Dose/kg seed	Per cent seed infestation					
			30 days after treat.	60 days after treat.	90 days after treat.	120 days after treat.	150 days after treat.	180 days after treat
1	Emamectin benzoate 5 SG	40 mg	0.00 (0.71)	0.27 (0.88)	0.47 (0.99)	1.39 (1.18)	1.08 (1.04)	1.45 (1.20)
2	Spinosad 45 SC	4.4 mg	0.00 (0.71)	0.34 (0.92)	0.50 (1.00)	0.93 (0.97)	1.21 (1.10)	1.60 (1.27)
3	Indoxacarb 14.5 SC	13.8 mg	0.10 (0.77)	1.02 (1.23)	1.55 (1.43)	2.29 (1.51)	2.58 (1.61)	3.32 (1.82)
4	Rynaxypyr 20 EC	0.01 ml	0.88 (1.17)	2.32 (1.68)	2.59 (1.76)	2.91 (1.71)	2.99 (1.73)	4.24 (2.06)
5	Chlorfenapyr 10 EC	0.02 ml	0.59 (1.05)	1.91 (1.55)	2.22 (1.65)	2.84 (1.68)	3.94 (1.99)	4.07 (2.02)
6	Profenophos 50 EC	0.004 ml	0.33 (0.90)	1.19 (1.30)	1.47 (1.40)	2.43 (1.56)	3.07 (1.75)	3.37 (1.84)
7	Novaluron 10 EC	0.05 ml	0.16 (0.81)	0.95 (1.20)	1.37 (1.37)	1.73 (1.32)	2.16 (1.47)	2.64 (1.63)
8	Deltramethrin 2.8 EC	0.04 ml	0.00 (0.71)	0.00 (0.71)	0.34 (0.92)	0.68 (0.83)	0.99 (1.00)	1.12 (1.06)
9	Untreated control	----	8.73 (3.04)	6.81 (2.70)	12.99 (3.67)	16.42 (4.05)	16.71 (4.09)	17.99 (4.21)
	F' test		Sig.	Sig.	Sig.	Sig.	Sig.	Sig.
	SE(m) ±		0.04	0.02	0.03	0.03	0.04	0.04
	CD at 5 %		0.13	0.08	0.10	0.10	0.13	0.13
	CV		6.92	3.67	3.99	3.65	4.64	4.12

Figures in parenthesis are corresponding Square root $\sqrt{X + 0.5}$ transformation values.

Table.3 Effect of insecticides on per cent germination of pigeon pea seeds

Sr. No.	Treatments	Doses /kg seed	Per cent seed germination					
			30 days after treat.	60 days after treat.	90 days after treat.	120 days after treat.	150 days after treat.	180 days after treat.
1	Emamectin benzoate 5 SG	40 mg	90.00 (9.49)	91.00 (9.54)	89.00 (9.43)	87.66 (9.36)	88.00 (9.38)	86.00 (9.27)
2	Spinosad 45 SC	4.4 mg	89.66 (9.47)	88.66 (9.42)	87.66 (9.36)	88.00 (9.38)	87.66 (9.36)	87.00 (9.33)
3	Indoxacarb 14.5 SC	13.8 mg	90.33 (9.50)	88.00 (9.38)	86.00 (9.27)	85.33 (9.24)	85.00 (9.22)	85.00 (9.22)
4	Rynaxypyr 20 EC	0.01 ml	90.00 (9.49)	89.33 (9.45)	87.33 (9.34)	85.00 (9.22)	84.66 (9.20)	84.66 (9.20)
5	Chlorfenapyr 10 EC	0.02 ml	89.66 (9.47)	89.66 (9.47)	88.00 (9.38)	85.66 (9.26)	85.00 (9.22)	85.00 (9.22)
6	Profenophos 50 EC	0.004 ml	89.00 (9.43)	88.66 (9.42)	87.00 (9.33)	86.33 (9.29)	86.33 (9.29)	86.33 (9.29)
7	Novaluron 10 EC	0.05 ml	89.66 (9.47)	90.00 (9.49)	87.66 (9.36)	87.66 (9.36)	87.00 (9.33)	86.00 (9.27)
8	Deltramethrin 2.8 EC	0.04 ml	90.33 (9.50)	90.33 (9.50)	89.00 (9.43)	89.00 (9.43)	87.00 (9.33)	87.66 (9.36)
9	Untreated control	----	91 (9.54)	90.66 (9.52)	86.66 (9.31)	85.33 (9.23)	83.66 (9.15)	84.00 (9.16)
	F’ test		NS	NS	NS	NS	NS	NS
	SE(m) ±		0.08	0.09	0.08	0.09	0.08	0.08

Generally germination is the combined effect of insecticidal treatment as well as *Callosobruchis chinensis* infestation. But there are no references on effect of insecticide on germination of seeds. Non significant result was found in respect of effect of insecticides on per cent seed germination of pigeon pea seeds after the six month of storage. In all the treatments except untreated control after six months showed that all the insecticides specially deltramethrin 2.8 EC @ 0.04 ml/kg seed, spinosad 45 SC @ 4.4 mg/kg seed and emamectin benzoate 5 SG @ 40 mg/kg seed had no adverse effect on germination. However, the germination of seeds ranged from 84-87.66 per cent. Maximum per cent seed germination was recorded in treatment deltramethrin 2.8 EC @ 0.04 ml/kg seed (87.66%).

In present study all seed insecticides were found safefor seed dressing without deleterious effect on germination of pigeon pea seed. Hence, these new molecules can be safely used against storage pulse beetle of pigeon pea.

The findings of present investigation are in close conformity with the findings of Athanassiou *et al.*,(2004) who found that deltamethrin was effective against stored-product pests and can provide a long-term protection that lasts four months or more. Kadam *et al.*,(2013) studied that deltamethrin 2.8 EC @ 0.04 ml/kg or lufenuron 5 EC @ 0.1 ml/kg or emamectin benzoate 5 SG @ 40 mg/kg of seed were found equally effective for control of stored grain pest of chickpea up to 9 months of storage. Kumari *et al.*,(2014) reported that the infestation due to pulse beetle in pigeon pea seed was minimum (3.66%) in emamectin benzoate after two months of storage in gunny bag and statistically at par with deltamethrin and spinosad.

Dikshit (2002) who stated that deltamethrin insecticides did not affect the germination of treated pulse seed. Similar results were obtained by Patilet al.,(2006) where deltamethrin shown significantly higher germination than untreated control. Kadam et al.(2013) studied that deltamethrin 2.8 EC @ 0.04 ml/kg or lufenuron 5 EC @ 0.1 ml/kg or emamectin benzoate 5 SG @ 40 mg/kg of seed were found equally effective for control of stored grain pest of chickpea and maintained the chickpea seed germination above minimum seed certification standard (85%) up to 9 months of storage.

Similar results were obtained by Pal and Katiyar (2013) evaluated deltamethrin @ 40 mg /kg seed were observed most effective against pulse beetle infesting moong bean up to twelve months of storage without deteriorating the viability of seed. Mandali and Reddy (2014) who studied that deltamethrin maintained the seed germination above seed certification standards in red gram

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