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Effect of chemical seed protectants on quality parameters of red gram seed against. pulse beetle *Callosobruchus chinensis* L under ambient storage

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ABSTRACT: Among the insecticides tested as seed protectants against *Callosobruchus chinensis* under ambient condition for a period of nine months revealed that all seed protectants were significantly effective. Maximum germination was observed (86.67%) when seed treated with novaluron 10 EC @0.05ml/kg followed by emamectin benzoate 5 SG@40mg/kg (85.67 per cent). The vigour index was maximum in emamectin benzoate (1913.87) followed by novaluron.

KEYWORDS: seed, insecticides, pulse beetle, germination, vigour index

About 90% of the world production of pigeon pea is contributed by India occupying more than 10% of the total area under pulses. Total area under pigeon pea in India is about 3.6 million ha with annual production of 2.8 million tons and productivity of pigeon pea is about 753 kg/ ha respectively. (Anonymous, 2012-13). Among the various pulses, red gram or pigeon pea is an important crop both in respect of area as well as production. It is one of the important kharif crop. Pulses play an important role in Indian agriculture. Besides, they sustain the productivity of cropping system by fixing atmospheric nitrogen through biological process and improving soil fertility. In order to meet requirement of protein for increasing production, it is necessary to increase the production of pulses in India. In the post-harvest management of production, we have not been able to lower down its losses due to insect-pests infestation during storage (Jilani, 1984; Swaminathan, 1937). The insects causing damage to stored pulses are pulse beetle, *Callosobruchus chinensis*, khapra beetle, *Trogoderma gramarium* and lesser grain borer *Rhizopertha dominica*. Among these, the pulse beetle is most important infesting both in field as well as in storage, causing loss of nearly 10-90% (Rathore and Sharma, 2002; Mishra *et al*., 2007).

The bruchids (*Callosobruchus chinensis* L.) breed exclusively on pulses, having a very short life span with high degree of reproductive potential. The pest developed during storage and detached only when adult beetles comes out the year but its infestation is maximum from July is up to 50% losses. The

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maintenance of seed quality which is deteriorated by infestation of insect during ambient storage is managed by using various insecticide rapidly and effective method for destroying the life of bruchid in ambient stored of pigeon pea seed. The seeds can be protected from insect pests during storage by applying suitable insecticidal treatments (Patil *et al*., 2006; Booker, 1967). In view of above backgrounds, an attempt has been made to find out the most suitable and cheapest insecticide for seed treatment for maintaining seed quality during ambient storage condition.

In order to assess the effects of insecticides as seed protectants against quality parameters of seed, the test seed of the cultivar NDA-1 was obtained from the seed processing unit of Narendra Deva University of Agriculture and Technology, Kumarganj and Krishi Vigyan Kendra Masaudha, Faizabad. The total amount of obtained seed was first fumigated with aluminium phosphide (3g) and treated as @3 tab / t in airtight containers and disinfested before starting the experiment. There were total nine treatments with three replications for each. The amount of seed was 1 kg, taken under each replication. The treatments used were as follows:

Sl. No.	Seed protectants		Rate (Per kg of seed)
	Trade name	Common name	
1.	Proclaim (5 SG)	Emamectin benzoate	2 ppm (40.0 mg)
2.	Tracer (45 SC)	Spinosad	2 ppm (4.4 mg)
3.	Avaunt (14.5 SC)	Indoxacarb	2 ppm (13.8 mg)
4.	Coragen (20 SC)	Rynaxypyr	2 ppm (0.01 ml)
5.	Intrepid (10 EC)	Chlorfenapyr	2 ppm (0.02 ml)
6.	Curacron (50 EC)	Profenofos	2 ppm (0.004 ml)
7.	Rimon (10 EC)	Novaluron	5 ppm (0.05 ml)
8.	Decis (2.8 EC)	Deltamethrin	1 ppm (0.04 ml)
9.	Control	Untreated	

Required quantity of pesticides was diluted in 5 ml of water for proper coating on seed. The treated seeds were packed in 2 kg gunny bag (1 kg seed in each bag) and placed in racks of the laboratory under ambient condition for further investigations with three replications. The data of residual toxicity as mortality of pulse beetle in treatments was recorded at an interval of 3 months, up to a period of nine months of ambient storage. For observations according to the experiment the required number of seed was randomly obtained from each bags of every treatment in each replication.

To know the germination of pigeonpea seed the germination paper (towel paper) method was adopted. One hundred randomly selected seed of each replication from each treatment placed on already water-soaked towel paper, which were rolled after covering them with another water-soaked towel paper. The rolled towel papers were covered with butter paper and kept in seed germinator at 25^0C and 75% RH at 7^{th} day the germination per cent were recorded on the basis of normal seed ling. The germination was recorded at 0, 3, 6 & 9 months. Seedling vigour index was computed by adopting the following formula as suggested by Abdul-Baki and Anderson (1973) and was expressed in whole number for seed vigour index, germination percentage of was multiplied by total seedling length.

Vigour index = germination (%) X Seedling length (cm)

Effect of seed Protectants on Percent seed damage by *C. chinensis* from each sample of each replication hundred seed will be randomly selected carefully to short out healthy and unhealthy seed with the help of magnifying lens (10x). The observation will be recorded at 90,180 and 270 days after treatment. The data thus obtained will be used for computing per cent damage seed by using above formula.

Per cent seed damage =

$$\frac{\text{Number of Seed in Sample}}{\text{Total number of seed in Sample}} \times 100$$

Effect of seed protectants (treatments) on per cent seed damage:

The results showed variations in percent seed damage in pigeon pea at different storage periods.

All the Seed protectants at 6 and 9 months were found significant over control however damage by seeds was non-significant at 3 months of storage. At 3 month of storage, the damage of pulse beetle ranged 0 - 1 per cent within the seed protectants and the maximum damage was recorded in profenofos with 1per cent followed by spinosad, rynaxypyr, profenofos and deltamethrin with 0.67 per cent seed damage and were statistically at par. The minimum damage was recorded in novaluron followed by emamectin benzoate, indoxacarb and chlorfenpyer with 0.33 per cent damage and were statistically at par. At 6 month of storage, the per cent seed damage ranged 0.67- 2.67 where the maximum damage was observed in rynaxypyr (2.67 per cent) followed by deltamethrin (2.33), chlorfenpyer and indoxacarb (2.00). The minimum damage was observed in (0.67 per cent) damage followed by emamectin benzoate (1.33) and profenofos (1.67 per cent). At 9 month of storage, the percent seed damage ranged 1.33 - 3.00 per cent. The maximum damage was observed in rynaxypyr followed by deltamethrin (2.67) and Indoxacarb (2.33). The minimum damage was observed in novaluron (1.33) followed by emamectin benzoate, spinosad, chlorfenpyer and indoxacarb. All treatments were significantly superior than the untreated control (5.33%). Seed damage increased significantly as storage period increased (Table 1).

Effect of seed protectants on germination:

At 3 month of storage, the germination among different treatments ranged between 88.33 -89.33 per cent. The maximum germination was recorded in novaluron followed by emamectin, spinosad and chlorfenpyer with 89.00 per cent germination which was statistically at par for each other. The minimum germination was observed in indoxacarb with 87.67 per cent followed by rynaxypyr (88.00) and

Table 1. Effect of seed protectant (insecticide) on pulse beetle damage (%), seed germination (%) and seed vigour index [germination (%) x seedling length (cm)] in pigeon pea at different storage periods (months)

Treatment/ Dose (per kg Seed)	Damage (%) at - months			Germination (%) at - months			Seed vigour index at – months		
	3	6	9	3	6	9	3	6	9
T_1 Emamectin benzoate @ 40 mg	0.33	1.33	1.67	89.00	86.00	85.67	2177.79	2089.87	1913.87
T_2 Spinosad @ 4.4 mg	0.67	1.67	2.00	89.00	81.67	79.67	1897.54	1765.34	1783.24
T_3 Indoxacarb @ 13.8 mg	0.33	2.00	2.33	87.67	79.67	77.67	1909.67	1697.07	1449.14
T_4 Rynaxypyr @ 0.01ml	0.67	2.67	3.00	88.00	84.00	78.67	1693	1809.54	1825.3
T_5 Chlorfenapyr @0.02ml	0.33	2.00	2.00	89.00	85.00	84.67	1934.07	1800.34	1758.12
T_6 Profenofos @ 0.004ml	1.00	1.67	2.00	88.33	86.00	83.33	1699	2094.87	1779.74
T_7 Novaluron @ 0.05ml	0.00	0.67	1.33	89.33	87.67	86.67	1893.2	2083.24	1893.46
T_8 Delltamethrin @ 0.04 ml	0.67	2.33	2.67	88.33	84.67	83.33	1942.4	1746.80	1772.14
T_9 Control	1.33	3.33	5.33	81.33	77.33	70.67	1902.07	1661.7	1518.4
CD	NS	0.93	0.57	0.87	0.66	0.93	57.61	51.01	48.78
SEm±	0.38	0.44	0.27	0.41	0.31	0.44	27.42	24.27	23.22

deltamethrin (88.33). All the treatments showed higher germination than control 81.33 per cent germination. At 6 month of storage, the germination within seed protectants were ranged 79.67 - 87.67 per cent in which maximum germination was observed in novaluron. Emamectin benzoate and profenofos showed 86.00 per cent and statistically at par. The minimum germination was in indoxacarb followed by spinosad, Rynaxypyr and significantly higher compared to control (77.33 per cent). At 9 month of storage, the highest germination within seed protectants was ranged 86.67 - 77.67. The highest germination was recorded in novaluron followed by emamectin benzoate and chlorfenpyer. The minimum germination was recorded in indoxacarb followed by rynaxypyr and spinosad. All the treatments are superior to control (Table 1).

Effect of seed protectants on seed vigour index:

At 3 month of storage, the vigour ranged 2177.79 - 1693. The highest vigour was recorded in emamectin benzoate followed by deltamethrin and chlorfenapyr. The minimum vigour was recorded in rynaxypyr followed by profenofos and novaluron. At 6 month of storage, the vigour ranged 2094 - 1697.07 and the higher vigour was recorded in emamectin benzoate followed by novaluron and profenofos. Minimum vigour was recorded in indoxacarb followed by deltamethrin and spinosad. The vigour index in control was 1661.7 and was very low compared to all other treatments. At 9 months of storage emamectin benzoate showed highest seed vigour index followed by novaluron and rynaxypyr. The minimum vigour was recorded in chlorfenpyer, followed by profenofos and deltamethrin. The vigour index was higher at nine months of storage (Table 1). The results clearly indicated that all the seed protectants showed better performance at significant level over control. The insect infestation was found non-significant at 3 months of storage but in case of 6 and 9 month of storage the damage was increased up to significant level. In present study, it was clear that the considerable grain damage increased progressively with increased in storage period. Longnathan *et al*. (2011) and Adhikary and Barik (2012) reports support the results.

The germination level decreased simultaneously as storage period increased in all treatments but maintained above IMSCS except control up to 9 months of storage. These results are also supported by Raghvani and Kapadia (2003), Lal and Raj (2012) and Singh *et al.* (2014) in Pigeonpea, Babu *et al*. (2008) in Soyabean and Raheem *et al*. (2011) and Khashaveh *et al*. (2009) in red gram. The vigour index was found significant over control up to 9 months of storage in all the seed protectants. Mandeep and Thakur (2011) and Raheem *et al*. (2011) reported similar findings. There was significant difference among all the treatments over control in case of all the experimental parameters. Among all tested insecticides as seed protectants, the novaluron 10 EC@0.05ml/kg emamectin benzoate 5 SG@40mg/kg and profenofos 50 EC@0.004ml/kg seed were found more effective due to minimum insect infestation. In case of seed germination, all tested seed protectants were able to maintain the seed germination above IMSCS level up to 9months of storage. The maximum seed germination was maintained by novaluron 10 EC@0.05ml/kg followed by emamectin benzoate 5 SG@40mg/kg and Chlorfenapyr at 3, 6 & 9 months of ambient storage. The maximum vigour was obtained in emamectin benzoate 5 SG@40mg/kg treated seed followed by novaluron 10 EC@90.05ml/kg up to 9 months of ambient storage. On the basis of above we can say that novaluron 10 EC@0.05ml/kg seed was best among all the tested seed protectants to protect the seed effectively and can be used to protect the pigeonpea seed above IMSCS Level up to 9 months of ambient storage.

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