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Assessment of residual toxicity of seed protectants (insecticides) in stored pigeonpea seed

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ABSTRACT

Seed protectants have an important role in enhancing the storability of the legume seed by protecting the legume seeds for long time against pulse beetle, *Callosobruchus chinensis* during storage. But some seed protectants fail to protect seed due to short residual effect . Due to short persistency on seed , the bruchids can survive and breed easily and maintain their population on stored even treated legumes, later on seed damage badly. Considering this point in view the residual toxicity of eight seed protectants (insecticides) were assessed in stored seed of pigeonpea at different storage periods under ambient condition N.D. University of Agriculture and Technology, Kumarganj, Faizabad. Novaluron 10 EC@ 0.05ml/kg seed had longer persistency on stored pigeonpea seed with maximum toxicity against bruchids upto nine month of storage followed by emamectin benzoate (Proclaim 5SG) @2ppm (40.0 mg/kg seed), indoxacarb (Avaunt 14.5 SC) @2ppm (13.8 mg/kg seed), profenofos (Curacron 50 EC) @2ppm (0.004ml/kg seed) and spinosad (Tracer 45 SC) @2ppm (4.4 mg /kg seed).

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INTRODUCTION

The pulse beetle *Callosobruchus chinensis* is one of most important pest of stored legumes and causing considerable damage to seeds and grains during storage as well in field. The first recorded sighting and description of *C. chinensis* was in China in 1758 where the beetle gets its species name (Thembhare, 2007). The beetle's natural distribution is in the tropics and subtropics of Asia, and their population extensively dependents on the cultivation and distribution of legumes. The bruchids breed exclusively on pulses, having very short life span with high degree of reproductive potential. The pest developed during storage within the grains and detected only when adult beetles comes out. Its infestation is maximum from July to August which causes up to 50

per cent losses. The storage period of pigeonpea or red gram have much importance because good storability period (Sown up to two planting seasons or more) which provides much more time for pulse beetle infestation. To protect the seed from pulse beetle for longer period there is need to search such seed protectants, having longer persistence period on seed. Therefore, a study was undertaken to assess the residual toxicity of different seed protectants at different storage period in seed entomology laboratory of N.D.U.A. and T., Kumarganj, Faizabad.

MATERIAL AND METHODS

Eight seed protectants *viz*., emamectin benzoate (Proclaim 5SG) @2ppm (40.0 mg/kg seed), spinosad (Tracer 45 SC) @2ppm (4.4 mg /kg seed), indoxacarb (Avaunt 14.5 SC) @2ppm (13.8 mg/kg seed), rynaxypyr (Coragen 20 SC) @ 2ppm (0.01ml/kg seed), chlorfenapyr (Intrepid 10 EC) @ 2ppm (0.02 ml/kg seed), profenofos (Curacron 50 EC) @2ppm (0.004ml/kg seed), novaluron (Rimon 10 EC) @ 5ppm 0.05ml/kg seed) and deltamethrin 2.8 EC @ 1.0 ppm (0.04 ml/kg seed) along with control(untreated) were assessed for their residual effect based on corrected mortality per cent during 2014-15 under CRD with 3 replications. Disinfested seed of pigeonpea CV- NDA 1 was obtained from seed processing unit of N.D.U.A. and T., Kumarganj, Faizabad and packed in jute bag after proper coating with above mentioned seed protectants as per their respective doses and placed them in racks in laboratory under ambient condition up to nine months of storage.

Five hundred pairs of adults *Callosobruchus chinensis* were collected from godowns of seed processing unit of N.D.U.A. and T., Kumarganj, Faizabad and were released in containers (plastic jars) having one kg disinfested pigeonpea, CV-NDA 1 to obtain same age group of test insects. The mouth of containers were covered with muslin cloth and tied with the help of rubber band and were kept in B.O.D. incubator at 28 ± 1^0 C and 75 ± 5 per cent RH to conduct the experiment to assess the residual toxicity.

Ten gram of treated seed was taken from each replication of each treatment and put them in petri dishes to test the mortality per cent. Five pairs of same aged adults of pulse beetles (reared in laboratory) were released in each replications with each treatments to assess the residual toxicity after 3, 7 and 15 days of release after every interval of 3 months of storage for a total period of nine months.

On the basis of such observed data the Corrected per cent mortality (Abbott, 1925) and mortality per cent (Kumar, 2008) were calculated by following formulas:

$$\text{Corrected per cent mortality} = \frac{T - C}{100 - C} \times 100$$

where

T= mortality per cent in treatment

C= mortality per cent in control and,

$$\text{Mortality per cent} = \frac{\text{Number of dead beetles}}{\text{Number of total release beetles}} \times 100$$

RESULTS AND DISCUSSION

The results (Table 1 and 2) reveled that all the seed protectants were superior over control at different storage periods. However, the effectiveness of different seed protectants were decreased with increase of storage period.

At 3 month the corrected mortality percentage (Table 1) of pulse beetle ranged from 69.61 to 100 per cent at different Days After Release (DAR). The maximum corrected mortality percentage at 15 Days after release was recorded in novaluron 10 EC@ 0.05ml/kg seed with 100 per cent followed by emamectin benzoate 5 SG@ 40mg/kg seed and profenofos 50 EC@ 0.004ml/kg seed with 94.17 per cent; indoxacarb 14.5 SC@ 13.8 mg/kg seed, rynaxypyr 20 SC @ 0.01ml/kg seed, chlorfenapyr 10EC@ 0.02ml/kg seed and deltamethrin 2.8 EC@ 0.04ml/Kg seed with 82.36 per cent and statistically recorded at par from each other. The minimum mortality was recorded in spinosad 45 SC@ 4.4mg/kg seed with 76.54 per cent at 15 DAR. However, lowest was observed in indoxacarb 14.5 SC@ 13.8mg/kg seed with 69.61 per cent at 3 DAR.

At 6 months of storage, the corrected mortality percentage ranged from 12.00- 40.92 per cent at different DAR. The maximum corrected mortality percentage at 15 DAR was observed in novaluron 10 EC@ 0.05ml/kg seed with 40.92 per cent followed by emamectin benzoate 5 SG@ 40mg/kg seed 37.24 per cent and profenofos 50 EC@ 0.004ml/kg seed with 31.78 per cent. The minimum corrected mortality per cent at 15 DAR was recorded in indoxacarb 14.5 SC@ 13.8mg/kg seed with18.14 per cent followed by rynaxypyr 20 SC @0.01ml, chlorfenapyr 10EC@ 0.02ml/kg seed, and

Table 1 : Residual toxicity of seed protectants (insecticides) based on corrected mortality per cent in stored seed of pigeonpea at different storage periods

Treatments	Seed protectants (Insecticides)	Dose (Per kg seed)	Corrected mortality per cent of Pulse beetle at different storage period (Months)								
			3			6			9		
			Days after release (DAR*)			Days after release			Days after release		
			3	7	15	3	7	15	3	7	15
T_1	Emamectin benzoate 5 SG	40 mg	83.95	84.20	94.17	31.21	27.28	37.24	23.06	20.87	21.77
T_2	Spinosad 45 SC	4.4 mg	73.91	84.20	76.54	27.97	18.14	27.28	19.26	16.62	13.03
T_3	Indoxacarb14.5 SC	13.8 mg	69.61	73.61	82.36	12.00	13.64	18.14	19.26	20.87	21.77
T_4	Rynaxypyr 20 SC	0.01ml	73.91	68.40	82.36	24.00	18.14	22.64	11.53	8.37	8.73
T_5	Chlorfenapyr10 EC	0.02ml	73.91	78.98	82.36	27.97	13.64	22.64	15.45	8.37	4.43
T_6	Profenofos 50 EC	0.004m	78.34	78.98	94.17	36.01	27.28	31.78	19.26	16.62	17.47
T_7	Novaluron10 EC	0.05ml	73.91	89.41	100	39.97	36.28	40.92	23.06	25.00	26.07
T_8	Delltamethrin 2.5 EC	0.04 ml	73.91	73.61	82.36	31.93	22.64	22.64	15.45	12.50	13.03
T_9	Control	Untreated	--	--	--	--	--	--	--	--	--

Table 2: Mortality per cent of pulse beetle, *Callosobruchus chinensis* during storage period

Treatments	Seed protectants (Insecticides)	Dose (Per kg seed)	Mortality per cent of pulse beetle at different storage period (Months)								
			3			6			9		
			Days after release (DAR*)			Days after release			Days after release		
			3	7	15	3	7	15	3	7	15
T_1	Emamectin benzoate 5 SG	40 mg	86.70	90.00	96.70	43.30	46.70	53.30	33.40	36.70	40. 00
T_2	Spinosad 45 SC	4.4 mg	80.00	90.00	86.70	40.00	40.00	46.70	30.00	33.30	33.30
T_3	Indoxacarb14.5 SC	13.8 mg	76.70	83.30	90.00	26.70	36.70	40.00	30.00	36.70	40.00
T_4	Rynaxypyr 20 SC	0.01ml	80.00	80.00	90.00	36.70	40.00	43.30	23.40	26.70	30.00
T_5	Chlorfenapyr10 EC	0.02ml	80.00	86.70	90.00	40.00	36.70	43.30	26.70	26.70	26.70
T_6	Profenofos50 EC	0.004m	83.40	86.70	96.70	46.70	46.70	50.00	30.00	33.30	36.70
T_7	Novaluron10 EC	0.05ml	80.00	93.30	100.0	50.00	53.30	56.70	33.30	40.00	43.30
T_8	Delltamethrin 2.8 EC	0.04 ml	80.00	83.30	90.00	43.40	43.30	43.30	26.70	30.00	33.30
T_9	Control (Untreated)		23.30	36.70	43.30	16.70	26.70	26.70	13.40	20.00	23.30

deltamethrin 2.8 EC@ 0.04ml/kg seed with 22.64 per cent and statistically at par. However, on other hand lowest was observed in indoxacarb 14.5 SC@ 13.8mg/kg seed with 12 per cent at 3 DAR.

At 9 months of storage, the corrected mortality per cent ranged from 4.43 to 26.07 per cent at different DAR. The higher corrected mortality percentage was recorded in novaluron 10 EC@ 0.05ml/kg seed with 26.07 per cent followed by emamectin benzoate 5 SG@ 40mg/kg seed and indoxacarb 14.5 SC@ 13.8mg/kg seed with 21.77 per cent at 15 DAR. The minimum corrected mortality per cent was recorded in chlorfenapyr (Intrepid 10 EC) @ 2ppm (0.02 ml/kg seed), followed by rynaxypyr (Coragen 20 SC) @ 0.01ml/kg see at 15 DAR.

Thus, seed of pigeonpea treated with novaluron 10 EC @ 0.05ml/kg seed had Corrected mortality per cent (maximum residual effect) followed by emamectin benzoate 5 SG@ 40mg/kg seed and indoxacarb 14.5 SC@ 13.8 mg/kg seed among tested seed protectants which can be utilized to protect the seed against pulse beetle for long storage (upto 9 months). These findings are inconformity with the findings of Dikshit (2002), Raheem and Sridevi (2011) and Mandeep and Thakur (2012).

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