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Effect of Different Bio-insecticides and Deltamethrine on Storability of Green Gram (*Vigna radiata* (L.) Wilczek) Seeds

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ABSTRACT

The seeds of Vigna radiata var. PDM139 were treated with six bio-insecticides viz. eucalyptus oil (5 ml/kg seed), castor oil (5 ml /kg seed), neem leaf powder (5 and 10 g/kg seed), nemazol (2.5 and 5 ml/kg seed), turmeric powder (5 and 10 g/kg seed), lantana leaf powder (5 and 10 g/kg seed) and one chemical insecticide namely deltamethrine (0.04 and 0.08 ml/kg seed), were stored for eight months under ambient conditions at seed warehouse. For maintaining highest germination, vigour and field emergence the seed treatments with deltamethrine @ 0.04 ml/kg was best. The nemazol @ 5 ml/kg seed may replace the use of deltamethrine, as it is not only eco-friendly and non-hazardous but also significantly at par performance for field emergence (seedling length, seedling dry weight, test weight and seed volume) and stood on second place for germination (83.69%), seed vigour index–II (21.46) and seed density (1.06g/cc). Besides this, eucalyptus oil @ 5ml/kg seed may also be used for maintaining optimum germination (84.98%) and field emergence (77.39%).

Key words: *Green Gram; Bio-insecticides; Deltamethrine; Vigour.*

INTRODUCTION

India is a leading green gram cultivator, with up to 55% of the total world acreage and 45% of total production[1,2]. The yield of any crop directly depends on its seed quality like viability, vigour and its structural soundness and are directly affected with the seed storage practices3,[4]. Seed storage pests have been considered as major quality deteriorating factors in a number of previous studies, suggesting a number of management practices which includes the use of chemical and bio-chemical insecticides[5,6]. The use of chemicals are not only hazardous for the human consumption but also affect the physiology of seeds and thus ultimately leads to unrecoverable deterioration of seed quality and germination[7,8]. Henceforth, the present investigation was undertaken with the aim of understanding the effect of various bio and chemical insecticides on the storability of green gram seeds for a durable time period in addition of identification of a better bio-insecticide in order to reduce or replace the present chemical insecticide, in use.

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MATERIAL AND METHODS

The present investigation was carried on the seeds of green gram var. PDM-139 (Samrat) during August 2014 to April 2015 at CSAUA&T-Kanpur (U.P). The whole experiment was conducted in factorial completely randomized design (laboratory studies) and randomized block design (RBD) (field studies).

The freshly harvested seeds of green gram var. PDM-139 (moisture content 9.7%) were treated with deltamethrin (a.i. 2.8%) @ 0.04ml (T_1) and 0.08 (T_2) and bio-pesticides {nemazol (conc. 1.2%) @ 2.5ml (T_3) and 5ml (T_4); eucalyptus oil @ 5ml (T_5); castor oil @ 5ml (T_6); turmeric powder @ 5g (T_7) and 10g (T_8); lantana leaf powder@ 5g (T_9), and 10 g (T_{10}), neem leaf powder @ 5g (T_{11}) and 10g (T_{12}) /kg seed}along with untreated control (T_0). for the The observations for seed germination and vigour traits were recorded pretreatment and at monthly interval up to the April 2015 along with , the temperature (^oC) and relative humidity (R_H %). The seed testing during the experiment was done as per the guidelines of ISTA Rules (ISTA 2014).

Table 1: Average temperature (^0C) and R.H. (%) during storage period

Month	Aug '14	Sept '14	Oct '14	Nov '14	Dec '14	Jan '15	Feb '15	Mar '15	Apr '15
^OC	28.72	26.68	23.14	19.56	13.49	12.53	17.92	23.26	29.87
R_H %	80.46	75.18	62.13	66.78	72.17	76.61	72.17	61.43	44.29

RESULTS AND DISCUSSION

The pesticide treatments, storage period and their interaction showed significant on differences on the seed germination and vigour parameters of green gram seeds during storage period. In general, the seed germination and other vigour traits except the one electric conductivity (EC) continuously declined throughout the experiment with the increase in storing period in a differential rate, depending on the treatment and its interaction with month (T×M).

Effect of months: On perusal of table 2 we observed that with the advance in seed storage period there was gradual diminution in all seed quality parameters, supporting to a fact that natural ageing is inevitable in all the species as well as seeds[9,10]. With the advancement in storing period (i.e., 0^{th} to 8^{th} month) the seed germination and vigour parameters except the electric conductivity (EC) which unexceptionally shows a negative correlation with studied parameters, wilted with an exponential rate. The sudden decline in seed germination and seed vigour were recorded (except EC) after first month of storage (August) as compare to this the minimum reduction in the seed quality was recorded in the 4^{th} (November) and 5^{th} (December) month of storage. On correlating the experimental results it is observed that the higher temperature (28.72^{o}C) and relative

humidity (80.46%) in compare to 4th (19.56/66.78%) and 5th (13.49ºC/72.17%) months could be the most appropriate reason for the sudden decline in the seed germination and vigour parameters in the very first month. Influence of month of storage was significant on all parameters (hard seeds, seedling length, dry weight of seedlings, seed vigour index-I, seed vigour index-II, EC value, test weight, seed volume and seed density). The diminishing in germination was highly correlated with the aging period. Further, table 2 reveals the mean effect of months on all the studied parameters. Interestingly, the EC values (table 2) increased significantly with the deteriorating seed vigour, advocating a significantly negative correlation between EC and rest of the tested parameters.

Effect of treatments: Table 2 describes significant influence of seed treatment with chemical (deltamethrine) and bio insecticides on all tested seed quality parameters. Significantly higher germination, seedling length, dry weight of seedling, seed vigour index-I, seed vigour index-II, test weight, seed volume, seed density, field emergence and lowest hard seeds were recorded when seeds were treated with deltamethrine @ 0.08 ml/kg (T_2). Lowest EC value (0.07 dSm^{-1}) was recorded when seeds were treated with deltamethrine @0.04 ml/kg (T_1) after 8 months of storage. These results are supported with the earlier studies [11, 12, 13, and 14]. Whereas, for germination and seedling length minimum percentage reduction after 8 months of storage was reported when seeds were treated with eucalyptus oil @5 ml/kg (T_5) and nemazol @ 5 ml/kg (T_4), respectively.

Among the bio-insecticides, seed treated with eucalyptus oil @ 5 ml/kg (T_5) was significantly at par performance to deltamethrine @ 0.08ml/kg (T_2) for germination whereas, seed treated with nemazol @ 5 ml/kg (T_4) showed significantly at par performance to deltamethrine @ 0.08 ml/kg (T_2) for other seed quality parameters such as seedling length, seedling dry weight, test weight, seed volume. Significantly at par performance to deltamethrine @ 0.08 ml/kg (T_2) for field emergence was also reported when seeds were treated with another dose of deltamethrine @ 0.04 ml/kg, nemazol @ 2.5 ml/kg, nemazol @ 5 ml/kg and eucalyptus oil @ 5 ml/kg. Some of the bio-insecticides such as turmeric powder @ 5 g/kg (T_7) and 10 g/kg (T_8), neem leaf powder @ 5 g/kg (T_{11}) also showed good performance regarding germination percentage but not performed well in other seed quality parameters such as seedling length, seed vigour index-I, seed vigour index-II and percent field emergence. Similarly, castor oil @ 5 ml/kg (T_6), lantana leaf powder @ 5 g/kg (T_9) and 10 g/kg (T_{10}) were not found effective to maintain germination during storage of 8 months because they showed significantly inferior performance than control (T_0). Likewise, seed vigour index – II significantly reduced than control (T_0) when seeds were treated with lantana leaf powder @ 5 and 10 g/kg seed.The results of the study thus amply suggested that castor oil @ 5 ml/kg (T_6), lantana leaf powder @ 5 and 10 g/kg should not be used for maintaining longevity & vigour in green gram seeds var. PDM-139 during storage of 8 months because these treatments showed deleterious impact on germination perecentage and seed vigour index–II.

Effect of treatments* × *months: Effect of interaction was found significant for all seed quality parameters except test weight (Table 2). Seed treated with deltamethrine @ 0.08 ml/kg (T_2) performed well for dry weight of seedling, hard seeds, seed vigour index-I, EC value, test weight, seed volume and seed density in 1st and 8th month of storage. In compare to this deltamethrine @ 0.04 ml/kg (T_1) also exhibited at par performance to another dose of deltamethrine i.e. 0.08 ml/kg for most of the vigour parameters in similar months.

After one month of storage, bio insecticide nemazol @ 5 ml/kg (T_4), showed similar performance to deltamethrine @ 0.04 (T_1) and 0.08 ml/kg (T_2) for seedling dry weight, EC value, seed volume and seed density and after 8 months of storage seed vigour index-II, seed volume and seed density. Another bio insecticide, eucalyptus oil @ 5 ml/kg showed similar performance to deltamethrine @ 0.04 (T_1) and 0.08 ml/kg (T_2) for maintaining germination after 8 months of storage.

Table 2: Mean Effects of Treatments and Months on the Seeds Storage

Treatment		Germination%		Hard Seed %		Seedling Length (cm)		Seedling Dry Weight (mg/10 seedlings)		SVI-I		SVI-II		EC (dS/m)		Test Weight (gm)		Seed Volume (cc/100 seeds)		Seed Density (g/cc)		Field Emergence (%)	
	Doses	M	R%	M	R%	M	R%	M	R%	M	R%	M	R%	M	R%	M	R%	M	R%	M	R%	E	R%
Control	-	80.77	15.69	1.58	87.59	18.20	15.20	0.185	23.47	1815.21	12.38	20.59	21.51	0.13	250.00	37.18	3.95	4.12	4.25	1.04	13.91	71.82	15.16
Initial values		89.75		2.66		20.32		0.213		1965.47		23.52		0.06		37.63		4.23		1.15		84.66	
Deltamethrine	0.04ml	85.55	8.54	1.06	87.59	19.20	11.76	0.190	17.37	1874.00	9.31	21.33	15.00	0.07	216.66	37.30	1.78	4.15	3.30	1.09	10.43	80.24	5.22
	0.08ml	85.66	8.44	0.96	100.00	19.51	9.79	0.192	16.90	1880.96	8.49	21.62	14.49	0.08	116.66	37.35	1.59	4.17	2.83	1.10	8.69	81.63	3.5
	2.5ml	83.25	10.33	1.73	75.18	19.48	7.13	0.189	19.71	1858.80	9.75	21.41	14.83	0.12	233.33	37.33	1.64	4.15	3.78	1.06	12.17	78.34	7.46
Nemazol	5ml	83.69	9.59	1.44	87.59	19.50	7.03	0.191	19.24	1863.99	9.51	21.46	14.54	0.13	283.33	37.31	1.67	4.17	3.07	1.06	11.30	78.71	7.02
Eucalyptus oil	5ml	84.98	7.75	1.62	62.40	19.24	8.90	0.186	20.65	1847.24	10.73	21.21	15.98	0.14	333.33	37.26	1.86	4.15	3.54	1.04	13.91	77.39	8.58
Castor Oil	5ml	79.34	15.66	2.18	50.00	19.28	8.36	0.187	21.59	1842.14	11.05	20.98	16.75	0.15	316.66	37.21	2.12	4.13	4.01	1.03	12.17	72.45	14.42
Turmeric Powder	5g	81.49	12.67	1.44	75.18	19.29	8.16	0.188	19.24	1856.34	10.00	21.23	15.68	0.12	250.00	37.25	1.88	4.14	4.25	1.05	13.04	75.12	11.26
	10g	82.28	11.86	1.17	87.59	19.36	7.57	0.190	18.30	1861.50	9.64	21.05	18.87	0.10	233.33	37.26	1.83	4.13	4.49	1.06	12.17	75.81	10.45
Lantana Leaf Powder	5g	78.93	15.76	1.62	87.59	19.19	9.49	0.184	21.12	1840.11	10.81	19.79	22.57	0.18	400.00	37.23	2.15	4.10	5.43	1.05	14.78	73.49	13.19
	10g	79.27	15.25	1.77	62.40	19.26	7.62	0.187	19.24	1842.46	11.84	19.94	21.08	0.17	366.66	37.24	1.86	4.13	4.49	1.05	12.17	73.86	12.75
Neem Leaf Powder	5g	83.09	11.79	1.36	75.18	19.28	7.52	0.188	18.30	1861.01	10.02	21.23	15.94	0.11	233.33	37.30	1.70	4.13	4.49	1.06	11.30	76.54	9.59
	10g	83.40	10.61	1.81	62.40	19.34	7.33	0.191	17.84	1863.39	9.64	21.34	15.09	0.10	216.66	37.29	1.75	4.15	3.54	1.07	9.56	76.38	9.78
SE(d) +/-	tr	0.16		0.02		0.05		0.003		1.14		0.07		0.004		0.06		0.014		0.006		1.65	
	m	0.13		0.01		0.04		0.002		0.90		0.06		0.003		0.05		0.006		0.004		-	
	tr x m	0.47		0.05		0.15		0.008		3.32		0.21		0.012		0.17		0.023		0.016		-	
CD (5%)	tr	0.32		0.04		0.10		0.006		2.30		0.15		0.008		0.12		0.028		0.011		3.34	
	m	0.25		0.03		0.08		0.004		1.80		0.11		0.006		0.09		0.009		0.009		-	
	tr x m	0.93		0.11		0.30		0.016		6.52		0.42		0.023		N.S.		0.045		0.032		-	

M = Mean values over eight months R% =Reduction over eight months in initial values E = Filed emergence in April 2015
tr = treatments m = months tr x m = interaction between treatment and months

CONCLUSION

The seed quality in terms of germination percentage and seed vigour traits significantly drops with the increase in seed storage period except the EC value, since this value negatively correlates with the seed vigour parameters. For maintaining highest germination, vigour and field emergence of green gram seeds var.PDM-139, it is advisable to give seed treatment with chemical insecticide deltamethrine @ 0.04 ml/kg. However, on the basis of our experimental findings e use of bio-insecticide nemazol @ 5 ml/kg seed is good alternative to deltamethrine as both showed significantly at par performance for all the studied parameters, when stored for eight months in packaging of cloth bag Beside above insecticides, eucalyptus oil @ 5ml/kg seed can also be used for maintaining germination and field emergence. Furthermore, we strongly supports, advises and encourage the use of bio-insecticides over chemo-pesticides for the sake of abetment of the hazardous effects of chemo-pesticides on both human as well as environment.

REFERENCES

1. Singh, N., Singh, H. and Nagarajan, P. Development of SSR markers in mung bean, *Vigna radiata* (L.) Wilczek using *in silico* methods. *J. crop weed* **9**: 69–74 (2013).
2. Rishi, N. Significant plant virus diseases in India and a glimpse of modern disease management technology. *J. Gen. Plant Pathol.* **75:** 1–18 (2009).
3. Wencomo, H.B., Ortiz, R and Caceres, J. Quality of seeds from Leucaena species stored under ambient conditions. *Afr. J. Agric. Res.* **12(4):** 279-285 (2017).
4. Finch-Savage, W.E and Bassel, G.W. Seed vigour and crop establishment: extending performance beyond adaptation. *J. Exp. Bot.* **67(3):** 567-591 (2016).
5. Adesina, J.M and Titilayo, E.M.A. Tolerance Activities of *Callasobruchus maculatus* (F.) (Coleoptera: Chrysomelidae) Against *Secamone afzelii* (schult) K. Schum Leaf extracts. *Jordan Journal of Agricultural Sciences* **12:** 4 (2017).
6. Moshi, A.P and Ivy, M. The status of research on and application of biopesticides in Tanzania- Review. *Crop Prot.* **92:** 16-28 (2017).
7. Poma, G., Cuykx, M., Amato, E., Calaprice, C., Focant, J.F and Covaci, A. Evaluation of hazardous chemicals in edible insects and insect-based food intended for human consumption. *Food Chem. Toxicol.* 100, 70-79 (2017).
8. Singh, C.M., Angiras, N.N and Kumar, S. Weed management. MD Publications Pvt. Ltd., New Delhi (1996).
9. Colville, L., Bradley, E.L., Lloyd, A.S., Pritchard, H.W., Castle, L and Kranner, I. Volatile fingerprints of seeds of four species indicate the involvement of alcoholic fermentation, lipid peroxidation, and Maillard reactions in seed deterioration during ageing and desiccation stress. *J. Exp. Bot.* **63:** 6519–6530 (2012).
10. Mira, S., Hill, L.M., González-Benito, M.E., Ibáñez, M.A and Walters, C. Volatile emission in dry seeds as a way to probe chemical reactions during initial asymptomatic deterioration. *J. Exp. Bot.* **67(6):** 1783-1793 (2016).

11. Kumar, S.B.V., Vyakaranahal, B.S., Deshpande, V.K., Raikar, S.D., Nadaf, H.L and Kumar, B.N.A. Effect of seed polymer coating on growth and yield of pigeonpea. *Karnataka Journal of Agricultural Sciences* **27(4):** 469-471 (2014).
12. Kadam, U.K., Palande, P.R., Shelar, V.R and Bansode, G.M. Effect of newer insecticidal seed treatment on viability of chickpea seed during storage. *Int. J. Plant Sci.* **8(1):** 134-136 (2013).
13. Singh, P., Singh, C.B., Kumar, M., Vyas, R.P and Kanaujia, V.P. Relative efficacy of neem based bio-insecticides on germination, seedling length and seed vigour index in pigeon pea (*Cajanus Cajan* L.). *Seed Res.* **39(1):** 54-57 (2011).
14. Singh, P., Tiwari, N., Vaish, C.P and Maurya, C.L. Effect of treatment, container and storage period on longevity of lentil (*Lens Culinaris* Medic) seed. *Seed Res.* **35(1):** 53-57 (2007).