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Assessment of quantitative losses caused by pulse beetle (*Callosobruchus chinensis)* and their management by grain protectants in black gram

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ABSTRACT
A laboratory study was carried out in Department of Entomology, C.S.A.U.A&T., Kanpur, during 2014-15., to evaluate effect of grain protectants on qualitative losses caused by pulse beetle in black gram. Among different grain protectants such as neem oil, clove oil, camphor, aonla fruit powder, Lantana camera leaf powder and neem leaf extract, the lowest per cent weight loss of grains (1.33%) by treating grains with higher dose of neem oil and clove oil @ 5ml/kg seed and recorded maximum germination percentage of grains (96%) by treating with neem oil followed by clove oil (92%) @ 5ml/kg seed. However, neem oil proved to be the best in managing pulse beetle infestation and reduce the qualitative losses caused by beetle.
Keywords: *Chickpea; Callosobruchus chinensis; quantitative losses; neem oil.*

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INTRODUCTION

The importance of the storage life of seeds, for retaining them as viable seed and unspoiled food reserves, are known. Regardless of how the grains are stored, they are subjected to different storage insect pests, which affect their nutritive value of grains. The most vulnerable place is the farmer's store, both at farm and at home, where 60-70er cent of produce is retained. Losses are maximum here, since storage methods at the farm and at home are still traditional in several areas. Improper storage conditions affect the pulses, both in quantity and quality. Although attempts have been made to quantify the losses [4, 14, 15], very little research has been done on quantitative changes in stored pulses, especially on home level storage of pulses. Insects cause severe damages to stored grains, which are about 20-35per cent and 5-10per cent in tropical and temperate zones, respectively, Nakakita [12]. Many insect pests including red flour beetle, grainary weevil, lesser grain borer, damage black gram in storages, however, pulse beetle *Callosobruchus chinensis* L., belonging to the family chrysomelidae, is the most damaging crop pests by to the stored legume industry due to their generalized legume diets and wide distribution, Ahmed *et al.* (2003 and Yanagi *et al.* 2013). It is a cosmopolitan pest, attacking grain legumes during both pre and post harvest stages all over the world, Dias and Yadav [2]. It enters inside grains by making holes and start feeding until full damage. Normally infestation starts in the field because adult beetles can easily fly and lay eggs on the chickpea pods. Infestation is caused by grubs as well as adults, Michalaki *et al.* [9] and normally 6-8 overlapping generations are observed in a year. In India Gujar and Yadav [5] 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 cent per cent damage is caused by the pest, Pruthi and Singh [13]. The insects spends its entire immature stage in individual legume seeds, where they cause weight loss, decrease in germination potential increase in moisture, free fatty acid levels, decrease in protein contents, etc, resulting in total quality and quantity loss, thus, diminishing the market as well as nutritional value of the commodity, fetching low prices to farmers, Ipsita *et al.* [6]. Keeping in mind, the importance of black gram and

intensity of damages caused by *Callosobruchus chinensis* during storage to "Assessment of quantitative losses caused by pulse beetle (*Callosobruchus chinensis)* during storage of black gram.

MATERIALS AND METHODS

A laboratory study was carried out in Department of Entomology, C.S.A.U.A &T., Kanpur, during 2014-15., to evaluate quantitative losses caused by pulse beetle.The insect *Callosobruchus chinensis* (L.) belong to the Order-Coleoptera, family -Bruchidae known as pulse beetle.

Grain protectant used: Neem oil (3&5 ml /kg seed), clove oil (3&5 ml/kg seed), castor oil (3&5 ml /kg seed), camphor (1&2 gm/kg seed), aonla fruit powder (10&15 gm/kg seed), *Lantana camera* leaf powder (5&10 gm/kg seed) and neem leaf extract (5&10 ml/kg seed).

Methodology: The powder were collected locally and dried for one week and processed into fine powder in a grinder. The three oils used in the study were procured from the local market. The extract of neem leaf was prepared in the laboratory after collection of new leaf from neem tree. These leaves were then dried in shade and further they were grinded in mixer. The extract of neem leaves prepared by soxhlet extraction method using acetone as solvent. 30 gm leaves powder and 300 ml of solvent was taken for the extraction keeping the ratio of 1:10. After 8 hours of extraction the extract were filtered using what's man filter paper no. 1 and kept in refrigerator as stock solution. Further dilution was done with the solvent to get the desired dose for experiments. Oils and powders thoroughly mixed with required quantity of seed in a two kg capacity jar by manual operation, sub sampled in three replications of 50 g of seed each and infected with 5 pairs of 24 hours old adults from the pure culture raised in laboratory. All jars were kept under the room temperature of 27±1° C and 75±5 per cent relative humidity. The mouth of jars were covered with muslin cloth and tied round with rubber band.

Weight loss: For testing the per cent loss in weight, the number of infested grains was weighed separately. The loss in weight has been out by using the following formula:

$$\text{Loss (per cent)} = \frac{N - N_1}{N^2} \times 100$$

Where,

N_1 = the weight of damaged grains in 500 grains.

N^2 = the weight of 100 healthy grains.

N = the weight of equal number of healthy grains in 100 grains.

Germination test: Treated grains with different protectants were kept for 90 days and thereafter, this test was conducted. For germination (Filter) papers taken and wetted with simple tap water. Twenty five (25) seeds were chosen randomly and placed on filter paper at proper distance, covered by second one and folded properly and tied with rubber band, kept in iron dish with three replications. These iron dishes kept at temperature (20-30^{0}C) and relative humidity (70-75%) in controlled room. The germination was counted 5 days later. The data on the percentage germination were subjected to the statistical analysis.

Apparatus used: Following apparatus were used: glass jars, muslin cloth, specimen tube, rubber band, weighing balance, weighing box and magnifying lens.

RESULTS

In the present investigation two doses of each protectants (low and high) i.e. neem oil (3&5 ml), castor oil (3&5 ml), clove oil, (3&5 ml) camphor (1&2 gm), aonla fruit powder (10&15gm), *L. camara* leaf powder (5&10gm) and neem leaf extract (5&10 ml) per kg seed were tested against pulse beetle. Two doses of each protectants were tested and the different observations were taken at various intervals for recording the effect of various treatments on some important stages of black gram.

Effect on weight loss:

The per cent grain weight loss was observed in black gram, treated by different grain protectants i.e. oils, powder and non-toxic materials. In lower dose per cent loss were recorded of different seed protectants i.e. neem oil, clove oil, camphor and neem leaf extract which provided less weight loss 3.00, 3.66, 6.33 and 4.00 per cent, respectively, while similar weight loss was recorded on the seed treated with aonla fruit powder and lantana camera leaf powder (4.66). Minimum percentage in weight loss was observed on the seeds, treated with higher dose of neem oil (1.33), clove oil (1.33), neem leaf extract (2.00), castor oil (2.00), Camphor (2.33), while maximum grain weight loss was recorded on the seed treated with Aonla fruit powder (3.00) and lantana camera leaf powder (3.33).

Table-1: Effect of different seeds protectants on weight loss by *Callosobruchus Chinensis*

Sl. No.	Treatments	(Lower) Dose/kg Seed	% weight loss	(Higher) Dose/kg Seed	% weight loss
1	Neem oil	3ml.	3.00 (9.97)	5ml.	1.33 (6.62)
2	Castor oil	3ml.	3.66 (11.02)	5ml.	2.00 (8.13)
3	Clove oil	3ml.	3.00 (9.97)	5ml.	1.33 (6.62)
4	Camphor	1g.	4.00 (11.53)	2g.	2.33 (8.78)
5	Aonla fruit powder	10g	4.66 (12.46)	15g	3.00 (9.97)
6	*L. camera* leaf powder	5g	4.66 (12.46)	10g	3.33 (10.51)
7	Neem leaf Extract	5ml	6.33 (14.57)	10ml	2.00 (8.13)
8	Control	-	8.33 (16.77)	-	8.66 (17.11)
	S.E.(d)+		1.02		1.24
	C. D.		2.16		2.62

Effect on germination:

The results revealed that there was no significant difference in germination among treatments. All the grain protectants i.e. neem oil, castor oil, clove oil, camphor, aonla fruit powder , *L. camera* and neem oil extract have been found safer and do not have any adverse effect on germination. All the treatment is capable to maintain the germination above to Minimum Seed Certification Standard. The germination per cent is recorded in the lower dose seed treated with neem oil (94.0%), Clove oil (92.0%), castor oil (88.0%), camphor (85.0%), Neem leaf extract (83.0%), *L. camera* leaf powder (80.0%), aonla fruit powder (78.0%). The maximum germination per cent recorded in higher dose seed treated with neem oil (96.0%), clove oil (93.0%), castor oil (90.0%), camphor oil and neem leaf extract (89.0%), *L. camera* leaf powder (86.0%), and aonla fruit powder (83.0%). Thus all the treatments (lower and higher doses) capable to maintain germination above the Minimum Seed Certification Standards.

Table-2: Effect on Different seed protectant on germination of the seeds

Sl. No.	Treatments	(Lower) Dose/kg Seed	% weight loss	(Higher) Dose/kg Seed	% weight loss
1	Neem oil	3ml.	94.00 (75.82)	5ml.	96.00 (78.46)
2	Castor oil	3ml.	88.00 (69.73)	5ml.	90.00 (71.56)
3	Clove oil	3ml.	92.00 (73.57)	5ml.	93.00 (74.65)
4	Camphor	1g.	85.00 (67.21)	2g.	89.00 (70.63)
5	Aonla fruit powder	10g	78.00 (62.02)	15g	83.00 (65.64)
6	*L. camera* leaf powder	5g	80.00 (63.43)	10g	86.00 (68.02)
7	Neem leaf Extract	5ml	83.00 (65.64)	10ml	89.00 (70.63)
8	Control	-	70.00 (56.78)	-	72.00 (58.05)
	S.E.(d)+		1.62		2.08
	C. D.		3.43		4.40

DISCUSSION

Results showed that at higher doses, lowest percentage weight loss was recorded of different seed protectants *i.e.* neem oil (1.33%) and clove oil (1.33%) followed by castor oil and neem leaf extract (2.0%) whereas other treatments such as aonla fruit powder (3.0%) and *L. camera* leaf powder (3.33%) were observed. In case of lower doses highest grain weight loss was recorded in neem leaf extract (6.33%) *L. camera* leaf powder and aonla fruit powder (4.66%), camphor (4.0%), castor (3.66%) and lower in neem oil and clove oil (3.0%). Similar findings was obtained from Mittal [10] also observed that loss in grain weight was minimum, when seeds were treated with oils. Kumar *et al.* [7] evaluated that oils were effective for reduction in the percentage of loss in grains weight.

Maximum germination percentage was recorded in higher dose seed treated with neem oil (96.0%), clove oil (93.0%), castor oil (90.0%), camphor oil and neem leaf extract (89.0%), *L. camera* leaf powder (86.0%), and aonla fruit powder (83.0%). Results are agreement with Mummigatti and Rahunathan [11] observed that the germination of black gram was not affected by all vegetable oils tested. Doharey *et al*. [3] reported that seeds treated with edible oils have no significant adverse effect on germination. Mahdi and Hamoudi [8] observed that oils completely protected the cow pea seed from the attack of *C. chinensis* and no adverse effect on seed germination was noted.

CONCLUSION

It can be concluded that the seed treatment with higher doses reduces the weight loss and increase germination percentage directly by reducing the infestation of pulse beetle. So seed treatment with neem oil @ 2&5 ml/kg seeds proves effective in management of pulse beetle in storages.

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REFERENCES

1. Ahmed KS, Itino T, Lchikawa T. (2003). Duration of developmental stages of *Callosobruchusn chinensis* (Bruchidae: Coleoptera) on Azuki bean and the effect of neem and sesame oils at different stages of their development. *Pak. J Biol. Sci.,* 6(10):332-335.
2. Dias, C. A. R. and Yadav, T. D. (1988). Incidence of pulse beetle in different legume seeds. *Indian Journal of Entomology.* 50 (4): 457- 461.
3. Doharey, R. B., Katiyar, R. N. and Singh, K. M. (1983). Eco- toxicological studies on pulse beetle infesting green gram. 4 Effect of edible oil treatment on the germination of green gram (*Vigna radiata*) Wilczek seeds. *Indian Journal of Entomology*. 45 (4): 414-419.
4. Girish, G. K., Kumar, A. and Jain, S. K. (1975). Part II assessment of the quality loss in wheat damaged by *Trogoderma granarium* Everts during storage. *Bulletin of Grain Technology*. 13: 26-32.
5. Gujar, G.T. and Yadav, T.D. (1978). Feeding on *Callosobruchus chinensis* L. in Green gram. *Indian Journal Entomology.40* (2):108-112.
6. Ipsita, D., Girish, K. and Narendra, G. S. (2013). Microwave Heating as an Alternative Quarantine Method for Disinfestations of Stored Food Grains. *International Journal of Food Science.* 13.
7. Kumar, K., Singh, M. M., Mehta, D. N. and Hammed, S. F. (1990). Effect of some vegetable oils as protectant against pulse Beetle*, (Callosobruchus chinensis*). *Bull Grain Technology.* 28 (1): 58-60.
8. Mahdi, M. T. and Hamoudi, R. F. (1984). Effect of some plant oil on the control of cowpea weevil (*Callosobruchus maculatus* F.). *J. food Sci. Tech*., 26 (5): 184-185.
9. Michalaki, M. P., Athanassiou, C. G., Kavallieratos N. G., Kavallieratos, Y. A. and Balotis, G. N. (2006). Effectiveness of *Metarhiziumanisopliae* applied alone or in combination with diatomaceous earth against *Triboliumconfusum* Du Val larvae: Influence of temperature, relative humidity and type of commodity. *Crop Prot.,* 25:418-425.
10. Mital, H. (1971). Protection of cowpea from crop infestation with the aid of fixed oil*. J. W. Afr. Sci. Assoc*., 16: 45-48.
11. Mummigatti, S. G. and Ragunthan. A. N. (1977). Inhibition of multiplication of *C. chinensis* by vegetable oil. *J. food Sci. Tech*., 14 (4): 184-185.
12. Nakakita H. Stored rice and stored production of insects. In: Nakakita H. (Ed.) (1998). Rice Inspection Technology. Tokyo: A. C. E. Corporation. 49-65.
13. Pruthi, H. S. and Singh, M. (1950). Pests of stored grain and their control. Manager of publications, Delhi: pp. 68.
14. Sudhakar, T. R. and Pandey, N. D. (1981). Chemical factors in resistance of wheat, raw and paraboiled rice varieties to *Sitophilus oryzae* (L) I. Aminoacid. *Indian Journal of Entomology. 43:*54-62.
15. Vimala, V. and Pushpamma, P. (198.3). Storage quality of pulses stored in three agroclimatic regions of Andhra Pradesh I. Quantitative changes. *Bulletin of Grain Technology.* 21: 54-62.
16. Yanagi, S., Saeki, Y., Tuda, M. *(2013).* Adaptive Egg Size Plasticity for Larval Competition and its Limits in the Seed Beetle *Callosobruchus chinensis". Bulletin of Grain Technology.* 6(10):332-335.

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