



EVALUATION OF DIFFERENT STORAGE CONTAINERS AGAINST PULSE BEETLE *Callosobruchus chinensis* (Linnaeus) IN BLACKGRAM

B. LAKSHMI ROJA*, N.C. VENKATESWARLU, A. RAJESH AND B. RAMANAMURTHY

Department of Entomology, S.V. Agricultural College, ANGRAU, Tirupati.

Date of Receipt: 13-10-2020

ABSTRACT

Date of Acceptance: 22-12-2020

A laboratory experiment was conducted to study the effect of different storage containers against pulse beetle *Callosobruchus chinensis* attack on blackgram seeds in storage during 2019-20. Different storage containers viz., earthen pot, metal bin, plastic bin, plastic bin with 3 cm sand layer above the grain, polypropylene bag, double layered poly ethylene bag, triple layered poly ethylene bag, polyethylene lined gunny bag and gunny bag as control were used for management of pulse beetle. The experiment was conducted with nine treatments and three replication in Completely Randomized Design. The results revealed that maximum oviposition was recorded on metal bin (27.33 eggs/female on 500 seeds) followed by earthen pot (27.00 eggs/female on 500 seeds) and plastic bin (24.33 eggs/female on 500 seeds) and lowest oviposition was recorded on triple layered polyethylene bag (6.33 eggs/female on 500 seeds) followed by Plastic bin with 3 cm sand layer above the grain (14.00 eggs/female on 500 seeds) for 500 seeds than gunny bag (30.33 eggs/female on 500 seeds) and significantly different with each other. Triple layered polyethylene bag and plastic bin with 3 cm sand layer above the grain were found superior and effective in reducing per cent weight loss (5.43% and 9.89%) of seeds, respectively at 90 days after infestation. Earthen pot (20.78%) and Metal bin (19.47%) were the least effective treatments in reducing the per cent weight loss of grains.

KEYWORDS: Blackgram, *Callosobruchus chinensis*, per cent weight loss, storage containers

INTRODUCTION

“Blackgram” (*Vigna mungo* L.) is commonly known as urd, uradbean, mashbean, minapapappu, mungbean, black mapte bean, which is one of the most assertive pulse crops cultivated worldwide in tropical and subtropical regions. It has wide range of adaptability and can be grown around the year in different agro-ecological regions of the country. Pulses are generally stored for a year or more than a year in different types of storage structures or containers until the next harvest where in measurable loss was seen due to infestation by number of stored grain insect pests. Pulses are being attacked by more than 25 species of stored product insects viz., *Callosobruchus chinensis* (Linnaeus), *Rhizopertha dominica* (Fabricius), *Tribolium castaneum* (Herbst), *Corcyra cephalonica* (Stainton), *Lasioderma serricornis* (Fabricius), *Stegobium paniceum* (Linnaeus) and few species of mites (Prabhakar, 1979). The seeds of all pulses are more vulnerable to bruchids infestation. Their damage can be observed both in the field as well as in storage. Primary infestation which happens in the field is practically unimportant, while secondary infestation that happens during the storage is causing substantial losses to the seeds of pulses.

The pulse beetle, *Callosobruchus chinensis* (Bruchidae : Coleoptera) is a cosmopolitan and polyphagous pest causing huge damage to blackgram seeds during storage conditions. The blackgram seed is found to be infested by two main species of *Callosobruchus* i.e., *Callosobruchus chinensis* (Linnaeus) and *Callosobruchus maculatus* (Fabricius) in large scale storage. Among the eight legumes, the highest damage caused by *C. chinensis* was reported in greengram (79.59%) followed by blackgram (59.30%), cowpea (51.04%), white gram (29.98%) and pea (1.70%) (Muhamad, 2007). *C. chinensis* has a very short life cycle, hence many number of generations in a year with high reproductive potential. The beetle shows a high degree of specificity for its development towards various legumes. Gujar and Yadav (1978) reported 55 to 60 per cent losses in seed weight and 45.50 to 66.30 per cent losses in protein content due to its damage and seeds are not fit for human consumption as well as for cultivation purpose. The storage containers play a pivotal role in decreasing the degree of damage done by the bruchid in storage condition and also a profound influence on the population build-up of bruchid.

*Corresponding author, E-mail: blakshmiroja@gmail.com

Table 1. Details of containers used

S. No.	Treatments	Name of container
1	T ₁	Earthen pot
2	T ₂	Metal bin
3	T ₃	Plastic bin
4	T ₄	Plastic bin with 3 cm sand layer above the grain
5	T ₅	Polypropylene bag
6	T ₆	Double layered poly ethylene bag
7	T ₇	Triple layered poly ethylene bag
8	T ₈	Polyethylene lined gunny bag
9	T ₉	Gunny bag (control)

Table 2. Evaluation of different storage containers against *C. chinensis* on blackgram seeds in storage conditions during 2019-2020

S. No.	Treatments	No of eggs laid on 500 seeds	**Per cent weight loss (%)
T ₁	Earthen pot	27.00 ^b	20.78 ^b (27.11)
T ₂	Metal bin	27.33 ^{ab}	19.47 ^b (26.17)
T ₃	Plastic bin	24.33 ^{bc}	15.46 ^c (23.13)
T ₄	Plastic bin with 3 cm sand layer above the grain	14.00 ^d	9.89 ^f (18.32)
T ₅	Polypropylene bag	23.33 ^c	12.17 ^e (20.40)
T ₆	Double layered poly ethylene bag	15.67 ^d	11.59 ^e (19.89)
T ₇	Triple layered poly ethylene bag	6.33 ^e	5.43 ^g (13.46)
T ₈	Polyethylene lined gunny bag	16.67 ^d	13.77 ^d (21.76)
T ₉	Gunny bag (control)	30.33 ^a	23.11 ^a (28.72)
	SEm±	1.094	0.356
	CD @5%	3.277	1.065
	CV%	9.221	2.785

** Values in the parentheses are angular transformed values.

* Values with the same alphabet are not significantly different as per DMRT.

MATERIAL AND METHODS

Mass culture of the pulse beetle

The mother culture of *C. chinensis* was obtained from the local market and it was multiplied on locally available greengram seeds under laboratory conditions. About 20 pairs of adult beetles were released into plastic boxes containing 500 g of disinfested greengram seeds at 55°C for 4 hours. Fifteen of such containers were maintained for mass culturing of the test insect. The boxes were kept undisturbed under laboratory condition till the emergence of F₁ adults. The test insect was mass cultured in the laboratory for 2-3 generations and freshly emerged adults were used in the experimental study.

Evaluation of different storage containers against pulse beetle

Nine different containers were used to conduct the experiment as follows;

One kg of TBG-104 blackgram variety was taken in each storage container and 10 pairs of freshly emerged adults of *C. chinensis* were released in each container treatment wise. The containers were assessed to *C. chinensis* infestation based on the following parameters.

No. of eggs laid

After 15 days of infestation, 500 seeds of blackgram were sampled randomly from each container and observation on number of eggs laid on seeds were recorded and later added to the same container. The containers were kept in the laboratory without disturbing up to 90 days.

Per cent weight loss

The final weight of the seeds were recorded at 90 days after release of adults and the weight loss due to insect infestation was calculated by deducting the final weight of the infested seeds from the initial weight of the healthy seeds and expressed in terms of per cent weight loss.

Per cent weight loss =

$$\frac{\text{Initial weight of grains} - \text{Final weight of grains}}{\text{Initial weight of grains}} \times 100$$

Statistical Analysis

The collected data was subjected to statistical analysis in Completely Randomized Design (CRD) using SPSS software.

RESULTS AND DISCUSSION

Fecundity of *C. chinensis* on blackgram

The results of present investigation revealed that, the mean number of eggs laid by the pulse beetle among the tested containers varied from 6.33 to 27.33 eggs on 500 seeds as against 30.33 eggs in gunny bag (control) (Table 2).

The highest number of eggs were recorded on blackgram seeds confined in metal bin (27.33 eggs/female on 500 seeds) followed by earthen pot (27.00 eggs/female on 500 seeds) and plastic bin (24.33 eggs/female on 500 seeds) which were significantly on par with each other. The lowest number of eggs were found in triple layered polyethylene bag (6.33 eggs/female on 500 seeds) followed by Plastic bin with 3 cm sand layer above the grain (14.00 eggs/female on 500 seeds) which were significantly different from each other. The other treatments; Polyethylene lined gunny bag and Double layered poly ethylene bag were also recorded least number of eggs with 16.67 and 15.67 eggs respectively on blackgram seeds and were significantly on par with each other and also on par with (T₄) plastic bin with 3 cm sand layer above the grain. However the next more number of eggs laid by pulse beetle was recorded in Polypropylene bag which is significantly different with highest and lowest number of eggs laid by pulse beetle (Table 2).

Per cent weight loss

The results of the present studies revealed that the per cent weight loss caused by the pulse beetle after 90 days varied from 5.43 to 20.78 per cent. Whereas in control (gunny bags) 23.11 per cent of weight loss was recorded (Table 3.1).

The highest percentage of weight loss was observed in earthen pot (20.78%) followed by metal bin (19.47%) which were statistically on par with each other. While the lowest per cent weight loss was observed in triple layered polyethylene bag (5.43%) followed by Plastic bin with 3 cm sand layer above the grain (9.89%), double layered polyethylene bag (11.59%), polypropylene bag (12.17%) which were significantly different from other

treatments. While the treatments polyethylene lined gunny bag and plastic bin were recorded with 13.77 and 15.46 per cent weight loss of blackgram seeds and are significantly different with each other.

The present results are similar with the findings of Dwivedi *et al.* (1991) who reported that the maximum damage was caused by pulse beetles in urd (8.7%) and moong (8.3%) stored in bags for a period of 6 months. Tin containers proved to be the best structures for storage of urd and moong at farm level. Moong was relatively preferred than urd during storage by pulse beetles. Tammanagouda (2002) observed seed infestation of 34.10 per cent in polythene bag as compared to those in cloth bag at the end of 10 months of storage period. Meena and Bhargava (2003) revealed that significantly higher dry mass loss (5.29%) and damage kernels (29.24%) were noticed in mud pot kernels. The number of adults varied from 2.33 in gunny bag to 4.00 in cloth bag against *C. cephalonica* in stored kernels of groundnut. Sharma (2013) found maximum weight loss in mud pot (1.40%), followed by gunny bag (1.33%), urea bag (1.25%), cloth bag (1.16%), polythene bag (1.00%) and metal bin (0.90%) against *Trogoderma granarium*.

The present results are in accordance with Sudini *et al.* (2015) who evaluated different containers and reported that after four months of storage under ambient conditions, triple-layer bags supported retention of seed weight, germinability and oil content significantly better than cloth bags. Baributsa *et al.* (2017) After 6-7 months of storage period, weight loss of 8.2% for unshelled groundnuts and 28.7 per cent for shelled groundnut was recorded when stored in woven bags. In Purdue Improved Crop Storage (PICS) bags for both shelled and unshelled groundnut, the density of insect pests did not increase and there was no weight loss and germination was also not affected. Manjunath *et al.* (2019) investigated the effect of different bins and bags against *Caryedon serratus* on oviposition preference, adult emergence and per cent pod damage. The results revealed that least infestation was observed in magic cover followed by plastic bin and triple layered polythene bag. The per cent pod damage was least in plastic bin followed by magic cover and triple layered polythene bag. Whereas, per cent weight loss recorded was least in magic cover followed by triple layered polythene bag and plastic bin. Swamy *et al.* (2019) who revealed that among the storage containers tested against *Sitophilus zeamais*; maize seeds stored in

polythene bags were recorded with the less per cent (16.58%) seed damage, lowest per cent weight loss (5.41%), less moisture content (10.98%) and the less pest population (40.00 adults) of *S. zeamais* while the highest per cent seed damage (50.25%), weight loss (15.88%), more moisture content (12.34%) and the highest pest population (80.33 adults) was recorded in earthen pots followed by gunny bags (48.00%, 15.13%, 12.25% and 78.67 adults) recorded by *S. zeamais* at 120 days of storage period.

CONCLUSION

It is to conclude that triple layered polyethylene bag and plastic bin with 3 cm sand layer above the grain were found superior and effective in minimizing the oviposition and per cent weight loss against pulse beetle attack in the storage of the blackgram seed.

The superiority of triple layered polyethylene bag and plastic bin with 3 cm sand above the grain may be due to unfavourable structural compositions that with the growth and development of pulse beetle. In triple layered polyethylene bags there will be less amount of oxygen available for the insects for their development. The plastic bin with sand layer was providing anaerobic conditions filling the spaces which makes the microclimate unsuitable for the development of the pulse beetle. Earthen pot, metal bin and gunny bag were very comfortable for the egg laying and development as they maintain good moisture and optimum temperature conditions to the pulse beetle. Hence, triple layered polyethylene bag and plastic bin with 3 cm sand layer above the grain may be used for storing the blackgram seeds without compromising with the quality of seeds.

LITERATURE CITED

- Baributsa, D., Baoua, I.B., Bakoye, O.N., Amadou, L and Murdock, L.L. 2017. PICS bags safely store unshelled and shelled groundnuts in Niger. *Journal of Stored Products Research*. 72: 54–58.
- Dwivedi, P.K., Bansode, P.C and Agrawal, R.K. 1991. Assessment of losses in blackgram, *Vigna mungo* and greengram, *Vigna radiata* stored at farm level in different types of structures in Madhya Pradesh (India). *Journal of Entomological Research*. 15: 203-207.

Evaluation of storage containers against pulse beetle in blackgram

- Gujar, G.T and Yadav, T.D. 1978. Feeding of *Callosobruchus maculatus* (Fab.) and *Callosobruchus chinensis* L. in greengram. *Indian Journal of Entomology*. 40: 108-112.
- Manjunath, J., Manjula, K., Prasad, K.V.H., Krishna, T.M., Prasad, T.N.V.K.V and Reddy, B.R. 2019. Evaluation of different bins and bags as storage structures against *Caryedon serratus* (Olivier) in groundnut. *Andhra Pradesh Journal of Agricultural Sciences*. 5(1): 66-71.
- Meena, B.L and Bhargava, M.C. 2003. Effect of different storage containers on the incidence of *Corcyra cephalonica* in stored kernels of groundnut. *Indian Journal of Applied Entomology*. 17: 41-43.
- Muhamad, A.Q. 2007. Development and monthly percent damage by *Callosobruchus chinensis* L. *Pakistan Journal of Agricultural Research*. 20: 183-188.
- Prabhakar, G.S. 1979. Studies on the bruchid fauna, infesting pulse crops of Karnataka with special emphasis on bioecology of *Callosobruchus chinensis* (L.). *M.Sc. (Ag.) Thesis*. University of Agricultural Sciences, Bangalore.
- Sharma, R. 2013. Management of Khapra beetle, *Trogoderma granarium* everts on wheat. *Ph.D. Thesis*. The Swami Keshwanand Rajasthan Agricultural University, Bikaner.
- Sudini, H., Rao, G.V.R., Gowda, C.L.L., Chandrika, R., Margam, V., Rathore, A and Murdock, L.L. 2015. Purdue Improved Crop Storage (PICS) bags for safe storage of Groundnuts. *Journal of Stored Products Research*. 64(B): 133-138.
- Swamy, S.V.S.G., Ramana, M.V and Krishna, R.Y. 2010. Screening of urdbean cultivars against *Callosobruchus chinensis*. *Indian Journal of Plant Protection*. 38 (1): 5356.
- Tammanagouda, P. 2002. Influence of organics on seed yield, quality and storability studies in greengram cv. Chinamung. *M.Sc. (Ag.) Thesis*. University of Agricultural Sciences. Dharwad, Karnataka.