

# Relative efficacy of seed treatment materials and storage method in reducing infestation of bruchids (*Callasobruchus chinensis* L.) in chickpea (*Cicer arietinum* L.)

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## ABSTRACT

Present study was conducted to know the effectiveness of botanicals, insecticides, wood ash and sand storage methods against infestation of chick pea seeds by the pulse beetle (*Callosobruchus chinensis*) during storage at University of Agricultural Sciences (UAS), Bangalore. Among tested treatments, the sand layer storage method found to be most effective in reducing the bruchids infestation. Neem oil and Pongamia oil from botanicals, found to be the effective in reducing the per cent damage, per cent weight loss, minimum number of adult emergence and minimum number of holes and causing the mortality of bruchids and which were on par with the insecticidal treatments (Malathion and Deltamethrin). Looking into the side effects of synthetic insecticides and cost basis, the study demonstrates that botanicals and sand layer storage method can play a major role in protection of chickpea seeds from bruchids infestation during storage.

**Key words :** Botanicals, Chickpea, Bruchids, Synthetic insecticides, Adult emergence.

Chickpea [*Cicer arietinum* (L.)] is a highly nutritious pulse cultivated throughout the world and is placed third in the list of important food legumes. India is the largest producer of chickpea contributing around 63% of the world's total production (ICRISAT, 2007). In India, chickpea is grown on 8.56 m.ha with the production of 7.35m tones and productivity of 859 Kg/ha. Chickpea is nutritionally rich pulse crop with a good source of protein (23%), carbohydrate (64%) and fat (5%) and also a good source of vitamins and phosphorus, which is the maximum provided by any pulse (Hulse, 1991) and does not contain any specific major anti - nutritional

factors. Chick pea seeds in developing countries suffer heavy qualitative and quantitative losses from the attack of pulse beetle. [*Callosobruchus chinensis*(L.)]

Bruchids infestation causes, reduction in weight, market value and germination of seeds (IITA, 1989). Residual effect resulting from mixing of synthetic organic insecticides with pulses beyond the permissible levels for control of beetle infestation has forced the researchers to look for some non-toxic pulse protectants. The integration of natural insecticidal products from local plant origin for use in storage by the farmers in developing countries appear

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to be quite safe and promising (Jillani *et al.*, 1988).

The present study was performed to evaluate the relative efficacy of four botanicals, two synthetic insecticides, ash and sand layer storage methods on infestation of bruchids in stored chickpea seeds.

## Material and Methods

Bruchids rearing was carried out under the optimal environmental conditions ( $30 \pm 2^\circ\text{C}$  temp. and  $70 \pm 5\%$  RH, Talekar, 1988). The culture was brought from National Bureau of Agriculturally Important Insects (NBAII), Bangalore. To obtain newly emerged pulse beetles of same generation, 20 pair insects were released in a plastic container having 250 g of chickpea seeds covered by a muslin cloth. After 7 days, the adults were removed and eggs laid seeds were maintained at required temperature and humidity. The insects emerged after four weeks were used in the investigation.

The experiment was conducted in factorial completely randomized design (FCRD) with nine treatments replicated three times with a storage period of four months in the laboratory in University of Agricultural Sciences, Bangalore during summer, 2011. The details of the treatments are furnished below.

T1 - Malathion 5% dust (5g/kg seeds), T2 - Deltamethrin (5 ml/kg seeds), T3 - Neem oil (5 ml/kg seeds), T4 - Pongamia oil (5 ml/kg seeds), T5 - Ash (3 parts: 4 parts seeds), T6 - Neem leaf powder (5% w/w), T7 - Eucalyptus leaf powder (5% w/w),

T8- Sand layer storage (2.5 cm thick layer), T9 – control (No treatment)

Two hundred grams healthy seeds of chickpea (variety JG-11) with zero infestation were treated and taken into transparent plastic jar of one kg capacity. Five pairs of 0-24 hour old bruchids were released into each of the plastic jars. The mouth of the jars was closed with muslin cloth and secured with rubber bands. Each month, 27 treated jars representing all nine treatments replicated thrice were taken out and total number of adult bruchids emerged in each jar, if any, were counted by drawing 100 seeds sample from each jar. Various observations such as number of holes per seed, per cent damaged seeds, per cent seed weight loss, sample test weight were recorded.

## Results

In sand layer storage and Malathion treated seeds, lesser number of bruchids emergence per hundred seeds (1.9 and 4.1) and average number of holes (1.2 and 1.3) was observed in all replications over 4 months storage period, which is significantly lower than the control which recorded 37.9 and 6.8 respectively. This indicates the effective control of bruchids in these treatments (Table 1).

Oils like neem and pongamia were also effective as oils have ovicidal effects. In case of Malathion treated seeds, lesser number of bruchids emergence was observed may be due to contact toxicity and

**Table 1.** Effect of seed treatments on bruchids population and No. of holes/seed during Storage

Treatments	No. of bruchids					No. of holes per seed				
	1 MAS	2 MAS	3 MAS	4 MAS	Mean	1 MAS	2 MAS	3 MAS	4 MAS	Mean
T1	2.4	3.3	4.3	6.3	4.1	1.00	0.80	1.00	2.50	1.33
T2	2.3	4.3	5.3	7.3	4.8	1.30	1.70	1.50	3.00	1.88
T3	2.3	4.3	4.3	8.3	4.8	2.00	3.00	2.00	3.50	2.63
T4	4.3	5.3	8.3	10.3	7.1	1.00	1.00	2.67	2.33	1.75
T5	4.3	8.3	7.3	12.3	8.1	2.00	1.80	2.67	4.50	2.74
T6	7.3	15.3	26.3	37.3	21.6	2.00	5.00	5.33	7.00	4.83
T7	8.3	33.3	28.3	38.3	27.1	3.67	6.33	6.67	7.67	6.08
T8	1.3	1.4	1.5	3.3	1.9	1.17	1.17	1.00	1.32	1.16
T9	27.3	35.3	38.3	50.7	37.9	4.00	7.00	8.00	8.00	6.75
Mean	6.7	12.3	13.8	19.4	13.0	2.01	3.09	3.43	4.42	3.21
MAS	S.Em.		CD @ 5%			S.Em.		CD @ 5%		
Treatments	0.46		1.37			0.42		1.41		
MAS X Treatments	0.61		1.89			0.57		1.84		
	0.93		2.82			1.02		3.09		

MAS- Month after Storage

also odor (Lakshminarasimhaiah, 1993; Parashivamurthy *et al.*, 1994) reported the effectiveness of Malathion, neem oil and pongamia oil in controlling bruchids in pigeon pea and field bean.

The seeds stored in sand layer storage and Malathion treatment were recorded highest 100 seed weight (25.3 and 25.1g) compare to all other treatments and which is significantly higher than the control (Table 2).

**Table 2.** Effect of seed treatments on 100 seed weight (g) of Chickpea cultivar JG-11 during storage

Treatments	100 seed weight				
	1 MAS	2 MAS	3 MAS	4 MAS	Mean
T1	28.33	27.00	23.33	21.67	25.08
T2	28.00	24.67	19.67	18.33	22.67
T3	25.67	23.67	18.67	17.00	21.25
T4	27.00	24.00	21.33	19.67	23.00
T5	25.00	21.67	17.00	12.00	18.92
T6	17.33	13.00	11.67	9.33	12.83
T7	16.00	13.00	11.00	8.00	12.00
T8	28.33	27.00	24.00	22.00	25.33
T9	14.00	11.00	11.00	8.00	11.00
Mean	23.30	20.56	17.52	15.11	19.12
S.E.m.				CD @ 5%	
MAS	0.27			1.02	
Treatments	0.20			0.76	
MAS × Treatments	0.61			1.72	

MAS-Month after Storage

The less percent of damaged seeds and weight loss was recorded in sand layer storage (4.5 and 2.3 %) and deltamethrin treated seed (4.5 and 4.2%), which was very significantly lower than the control (72.5 and 42.1%) and on par with neem oil, pongamia oil and Malathion treatment were on par with each other (Table 3). Similar results were also reported by Yadava and Bhatnagar (1987) in cowpea and Uma Reddy and Shoba Reddy (1987) in green gram. These results clearly indicate that sand layers effectively prevent bruchids infestation and were However, the sand layers are not effective in controlling the infestation already present (inoculated / hidden / field infestation) in the seeds medium covered under a layer of sand. (Suresh 1997; Subramanya *et al.*, 1999; Choudhary and Pathak 1989).

## Discussions and Conclusions

The results of the study showed that bruchids infes-

**Table 3.** Effect of Seed Treatments on Per cent Seed Damage and percent seed weight loss During Storage

Treatments	Percent seed damage					Percent seed weight loss				
	1 MAS	2 MAS	3 MAS	4 MAS	Mean	1 MAS	2 MAS	3 MAS	4 MAS	Mean
T1	1.0 (5.7)	5.6 (13.7)	8.0 (16.4)	10.0 (18.4)	6.1 (14.3)	1.3 (6.5)	3.4 (10.6)	4.8 (12.6)	9.2 (17.6)	4.6 (12.5)
T2	2.0 (8.1)	3.0 (10.0)	5.0 (12.9)	8.0 (16.4)	4.5 (12.2)	1.3 (6.5)	2.9 (9.8)	4.2 (11.8)	8.7 (17.1)	4.2 (11.9)
T3	0.7 (4.8)	7.0 (15.3)	12.3 (20.5)	16.0 (23.6)	9.0 (17.4)	1.6 (7.4)	3.7 (11.1)	4.5 (12.2)	12.4 (20.6)	5.5 (13.6)
T4	2.0 (8.1)	5.0 (12.9)	16.0 (23.6)	12.0 (20.2)	8.7 (17.2)	1.4 (6.8)	2.4 (9.0)	3.3 (10.5)	6.4 (14.6)	3.3 (10.6)
T5	10.0 (18.4)	16.0 (23.6)	22.0 (27.9)	26.0 (30.6)	18.5 (25.5)	5.5 (13.5)	8.5 (16.9)	9.7 (18.1)	17.4 (24.6)	10.2 (18.7)
T6	18.0 (25.1)	38.0 (38.0)	50.0 (44.9)	70.0 (56.7)	44.0 (41.5)	8.3 (16.7)	23.5 (28.9)	28.7 (32.38)	49.3 (44.5)	27.4 (31.6)
T7	22.0 (27.9)	4.8 (12.6)	68.0 (55.5)	84.0 (66.4)	44.7 (41.9)	11.1 (19.4)	29.1 (32.6)	40.1 (39.3)	63.0 (52.5)	35.8 (36.7)
T8	0.4 (3.6)	4.7 (12.5)	5.0 (12.9)	8.0 (16.4)	4.5 (12.2)	0.6 (4.7)	1.8 (7.7)	3.2 (10.3)	3.8 (11.2)	2.3 (8.9)
T9	35.0 (36.2)	72.0 (58.0)	83.0 (65.6)	100.0 (89.9)	72.5 (58.3)	13.9 (21.9)	37.4 (37.7)	49.2 (44.5)	68.0 (55.6)	42.1 (40.5)
Mean	10.12 (18.5)	17.3 (24.6)	29.9 (33.1)	37.11 (37.6)	5.0 (12.9)	12.5 (20.7)	16.4 (23.9)	26.4 (30.9)		
S.E.m.									CD @ 5%	
MAS	0.05					0.19			0.61	
Treatments		0.04				0.14			0.59	
MAS × Treatments		0.11				0.32			0.97	
Treatments										

MAS- Month after Storage

tation of grains starts from top surface of the grain and progress gradually down wards after the completion of each successive generation, commencing with the adults released on the top layer of the grains. After the emergence of F1 generation, the adults congregated on the open surface of the grain and displayed different activities viz., moving, resting, mate following copulation and mated females started egg laying on the grains. The adult beetles lived for a span of 8-12 days. They died subsequent to egg laying and copulated females in subsequent generation appeared to gradually move down the grain columns with owing to the resource depletion in the top layers (Suresh, 1997).

There was no significant increase in the number of adults emergence from one bruchid generation to next in case of ash treatment (4.3, 8.3, 7.3 and 12.3 bruchids per 100 seeds) at first to fourth months after storage respectively. Though there was an infestation in first insect generation, the adults emerged subsequently had a hindrance for movement due to ash mixed with seeds. This may probably due to the deposition of fine ash particles in the joints of insect body. There was a steady increase in seed damage (10.0, 16.0, 22.0 and 26.0 per cent at first to four months after storage) and seed weight loss also increased from 8.3 per cent (1<sup>st</sup> month after storage) to 17.4 per cent (4<sup>th</sup> month after storage). The steady increase in per cent infestation and seed weight loss due to cumulative effect of each insect generation. The effectiveness of ash in reducing the infestation due to bruchids was also reported by Chiranjeevi (1991) in green gram, Jane *et al.* (1991) in cowpea. Ash apparently acts as physical barrier hence the adults could not able to make and lay eggs as they were physically normal but functionally dead as per Jane *et al.* (1991).

The study demonstrates that botanicals and sand layer storage method can play a major role in protection of chickpea seeds from bruchids infestation during storage. Thus it is concluded that sand layer storage method is best method to control bruchids infestation in storage. Likewise, botanicals also play a major role in evading the infestation during storage in chickpea. Though insecticide treatments were effective against bruchids but, they are not cost effective and unsafe for human health and consumption.

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