RESEARCH ARTICLE

ASSESSMENT OF LOSSES DUE TO PULSE BEETLE IN CHICKPEA UNDER LABORATORY CONDITION

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Abstract: A laboratory studies on assessment of losses due to pulse beetle, *Callosobruchus chinensis* (L.) (Coleoptera: Bruchidae) in stored chickpea under laboratory condition during 2016. The losses caused by pulse beetle were estimated by releasing 1, 2, 4, 8 and 16 pairs of adults in jars each containing 100g chickpea grains. The lowest mean grain damage, weight loss and germination loss were recorded in case of 1 pair of adult pulse beetle *i.e.,* 6.25, 1.25 and 4.00 per cent. While, highest losses were recorded in case of release of 16 pair *i.e.,* 60.25, 9.00 and 43.5 per cent after 30 days of storage, respectively. The losses followed the same trend after 90 days of storage and reached to highest *i.e.,* 40.75, 18.75 and 28.5 per cent in case of release of 1 pair of adult, While, 98, 45.75 and 99 per cent, respectively, in case of release of 16 pair of adult pulse beetle. The losses were increased with increase in storage period.

Keywords: Pulse beetle, Chickpea grains, Abiotic factors

INTRODUCTION

Pulses are important food crops due to their high protein and essential amino acid content. Apart from being an important source of dietary protein for human consumption, the pulse crops are also important for the management of soil fertility due to nitrogen fixing ability (Kantar *et al.,* 2007). Chickpea (*Cicer arietinum* L.) is a highly nutritious pulse cultivated throughout the world and is placed third in the importance list of the food legumes. India is the largest producer of this pulse contributing to around 63% of the world's total production (ICRISAT, 2007). Chickpea is used in arrange of different preparation in our cuisine and has a good source of energy i.e. 416 calories/100gm chickpea (Shrestha, 2001). It contains protein (18.22%) carbohydrates (52-70%) fat (4-10%), minerals (calcium, phosphorous and iron) and vitamins. It is already a traditional component of the Indian diet but is becoming increasingly scarce. Likewise, chickpea can be an important contributor to soil fertility and organic matter to soil (Kumar Rao *et al*. 1998). It is recorded that 55- 60 per cent loss in seed weight and 45.50 to 66.30 per cent loss in protein content of pulses is due to infestation caused by pulse beetle (Faruk *et al*. 2011). Plant-derived materials are more readily biodegradable, relatively specific in the mode of action and easy to use. They are environmentally safe, less hazardous, less expensive and readily available (Das, 1986). There is a steady increase in the use of medicinal plant products and edible oils as a cheaper and ecologically safer means of protecting stored products against infestation by insects. The above studies emphasize the need in controlling the pulse beetle *Callosobruchus chinensis* through plant derived oil extract and edible oils.

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MATERIAL AND METHOD

To estimate the losses at different population levels of the pulse beetle 1 pair, 2 pairs, 4 pairs, 8 pairs and 16 pairs of adults (both male and female) were released in separate jars containing 100g chickpea seeds. The experiment was replicated four times. The observations given below was recorded at 30, 60, 90 days after release of adults of beetles.

Mean grain damage (%)

A sample of 100g of chickpea grains were take from the jars of each replicate of every set after 30 days. The damaged grains were separated out from the total number of grains taken for observation in each replication. Care was taken to avoid recount of damage grain. The data taken was used for calculating the mean per cent damaged grains. The same procedure was adopted for recording observations at 30, 60 and 90 days after release of pulse beetle. The following formula was used for determination of mean damage percent as described.

$$\text{Grain damage (\%)} = \frac{\text{Total number of damaged grains}}{\text{Total number of grains}} \times 100$$

Mean germination loss (%)

To investigate the effect of plant leaf extracts oil and edible oils on seed viability, 100 seeds were taken from each treatment and were placed in petridish separately having water soaked blotting paper at its bottom. The petridishes was placed in B.O.D. at 18 ± 25^{0}C temperature and $75\pm$ 5% relative humidity. After incubation, the germinated seeds was counted and worked out the percent seed germination. The mean per cent germination loss was calculated by following formula:

Per cent germination

$$= \frac{\text{Number of germinated seeds}}{\text{Total number of selected seeds}} \times 100$$

Mean weight loss

After removing the beetles from each jar the weight of grains were taken separately on an electric balance from each replicate after 60 and 90 days of release. The mean per cent loss in weight was calculated by the following formula:

$$\textbf{Mean weight loss} = \frac{I-F}{I} \times 100$$

Where,

I=initial weight of grains

F=final weight of grains

RESULT AND DISCUSSION

Grain damage %

(Table 1)The minimum grain damage after 30 days of storage was recorded in case of release of 1 pair adult with 6.25 and was maximum in case of release of 16 pair of adult with 60.25 per cent. The grain damage was further increased up to 19.75 and 93.75 per cent after 60 days of storage and ultimately reached 40.75 and 98 per cent after 90 days of storage, respectively. Similar results were also reported by Doharey *et al.* (1987) who observed that the grain damage by *C. chinensis* increased from1.35 per cent to 99.91 per cent after 120 days of storage. Patil *et al.* (2003) tested the chickpea seeds cv. PG-12 were stored in jars, each containing 0, 1, 2, 4 or 8 pairs of newly emerged adults of *C. maculatus* and they reported that population count and seed infestation were directly proportional to the number of pairs of adult beetles released.

Weight loss %

The minimum weight loss (Table 2) after 30 days of storage was recorded with 1.25 per cent in case of release of 1 pair of adult and maximum in case of release of 16 pair of adult with13.25 per cent. It was further increased up to 6.75 and 32.50 per cent after 60 days of storage and ultimately reached 18.75 and 45.75 per cent after 90 days of storage, respectively. Anandhi *et al.* (2008) revealed that the release of five pairs of *C. chinensis* about in 250g of pulse increased to a mean population of 648.3 after 180 days of storage. The loss in weight increased up to 17.3 during the period. Venkatesham *et al.* (2015) evaluated the losses caused by pulse beetle, *Callsobruchus chinensis* L. were determined by releasing five pair of adults in a glass jar each containing 500g chickpea grains. The mean seed damage, Weight loss was 7.87 per cent, 4.19 percent, respectively after 30 days of release which increased with the storage duration resulting in 99.33 and 48.73 per cent, respectively after 120 days.

Germination loss %

The minimum germination loss (Table 3) after 30 days of storage was recorded with 4 per cent in case of release of 1 pair of adult and maximum in case of release of 16 pair of adult with 43.5 per cent. It was further increased up to 12 and 81 per cent after 60 days of storage and ultimately reached 28.5 and 99 per cent after 90 days of storage, respectively. Patil *et al. (*2003) reported that 100 g seeds of chickpea cv. PG-12 were stored in plastic jar, each containing 0, 1, 2, 4 or 8 pairs of newly emerged adults of *C. maculates* A significant reduction in germination was recorded when more than 2 pairs of adult beetles were released in a jar. A germination level of 61.0% was recorded for seeds stored with 8 pairs of adult beetles. Similar results were also reported by Jat *et al*. (2013) conducted an experiment by releasing 1, 2, 4, 8 and 16 pairs of adults in jars each containing 100g chickpea grains and recorded the losses caused by pulse beetle. The lowest mean grain damage, weight loss and germination loss were recorded in case of 1 pair of adult pulse beetle *i.e.*, 7.79, 1.81 and 4.55 per cent. While, highest losses were recorded in case of release of 16 pair *i.e.*, 60.93, 13.99 and 44.57 per cent after 30 days of storage, respectively.

Table 1. Effect of pulse beetle on percent grain damage at different population density level

No of pairs released	Grain damage (%)		
	30DAR	60DAR	90DAR
1	6.25 (14.42)	19.75 (26.36)	40.75 (39.65)
2	16.25 (23.74)	35.75 (36.70)	53.5 (46.99)
4	25.5 (30.30)	48.75 (44.26)	74 (59.32)
8	42.75 (40.81)	67.5 (55.22)	93.75 (75.59)
16	60.25 (50.89)	93.75 (75.65)	98 (81.97)
CD at 5% level	**1.813**	**2.417**	**2.370**
SE(m) ±	**0.596**	**0.795**	**0.779**

Table 2. Effect of pulse beetle on percent weight loss at different population density level

No of pairs released	Weight loss (%)		
	30DAR	60DAR	90DAR
1	1.25 (6.33)	6.75 (14.96)	18.75 (25.80)
2	3.75 (11.09)	12 (20.22)	24.5 (29.65)
4	5.75 (13.83)	15.5 (23.31)	33 (35.03)
8	9 (17.43)	21.75 (27.76)	41.5 (40.08)
16	13.25 (21.32)	32.5 (34.73)	45.75 (42.54)
CD at 5% level	**1.68**	**2.62**	**2.36**
SE(m) ±	**0.553**	**0.862**	**0.778**

Table 3. Effect of pulse beetle on percent germination loss at different population density level

No of pairs released	Germination loss (%)		
	30DAR	60DAR	90DAR
1	4 (11.48)	12 (20.22)	28.5 (32.24)
2	11 (19.31)	26.75 (31.12)	55.75 (48.28)
4	20 (26.36)	46 (42.68)	80.75 (63.99)
8	31.75 (34.27)	61.75 (51.78)	94 (75.81)
16	43.5 (41.24)	81 (63.95)	99 (83.62)
CD at 5% level	**1.851**	**1.912**	**1.968**
SE(m) ±	**0.609**	**0.629**	**0.647**

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