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(RESEARCH ARTICLE)

Comparative effect of *Callosobruchus maculatus* (Pest) on different pulses

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Abstract

Experiments were undertaken in room circumstances on variety of pulses to investigate the seed damage and weight loss caused by pulse beetle *Callosobruchus maculatus*. The pulses selected for the study of comparative effect of *Callosobruchus maculatus* were chick pea (desi chana) "*Cicer arietinum*", golden gram (moong daal) "*Vigna radiata*", field pea (matar) "*Pisum sativum*", Lentil (Masur) "*Lens culinaris*" and Kabuli chana (Chola) "*Cicer arietinum*". The selected five variety of pulses are infested with pulse beetles and kept the pulse boxes for forty-five days without disturbing the pulses.

Keywords: Pest; Pulses; Daal; Masur; Infested

1. Introduction

Legumes (pulses), all belonging to family Fabaceae are an important protein source of vegetarian diet. Legumes are a nutritious staple of diets around the world, they are inexpensive source of protein, vitamin, complex carbohydrate and fibre. In India top five pulses producing states are Madhya Pradesh, Maharashtra, Rajasthan, Uttar Pradesh and Karnataka. The productivity of pulses in India range around 764 kg/ha. Status of India with respect to global pulse production constitutes 25 per cent of global production and 27 per cent world consumption and importer 14 per cent of global imports. pulses play an important role in human nutrition in a predominantly vegetarian country like India.

Total pulses production during 2022-23 is estimated at 260.58 lakh tonnes which is higher by 14.02 lakh tonnes than the last year average pulses production of 246.56 lakh tonnes. In India 12.5 million tonnes of edible legumes are produced every year and nearly 18.6% of cowpea alone is damage by bruchids during storage (Agarwal et.al 1988). Caswell (1981) reported a loss of approximately 50% of cowpea in storage for three or four months due to infestation of *Callosobruchus maculatus*.

Callosobruchus maculatus (Fabricius) (Coleoptera: Bruchidae) the most dangerous insect pest in pulses ranges throughout the tropical and subtropical world, is known to be prolific and rapid in breeding and cause significant damage as well as diminish the nutritional value of stored pulses.

The infestation of the crops starts in the field (Prevett, 1961), while most damage occurs during storage. Important constraint in production and storage of pulses is stored-insect pests. It was reported around 55 - 60 per cent weight loss of stored pulses and 46 to 66 per cent loss in protein content by infestation with the insect pests. Feeding by the insect larva and adults account the major portion of the crop losses annually which causes the economic loss of millions of rupees. *Callosobruchus maculatus* adults are polymorphic with two morphs, i.e., a sedentary or flightless morph and a flight or dispersal morph. The life history of both morphs is different with regard to their morphology, physiology, and behaviour. The lifespan of the sedentary morph is shorter, and the fecundity is higher than the dispersal morph. The male and female are more easily distinguished in sedentary morph than dispersal morph. The adult pulse beetle does

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not eat the seeds but they mate and oviposit on them. A single female can lay up to hundred eggs or more than hundred eggs. An egg is laid singly, but the eggs may be present in one grain. The newly hatched larva bores into the seed and starts feeding on its content till the whole endosperm are eaten up. The pulse beetle feed on endosperm of seed leaving behind only seed coat causes reduction in germination of seeds, weight loss and lower market value (Tesfu and Emana,2013). One of the major pests of stored pulse is *Callosobruchus maculatus* infesting seeds by feeding on its inner protein thus causing nutrient loss for human consumption as well as seed loss its germination. Food and agricultural organization reported that 8.5 per cent of grain loss occurs during post-harvest handling and storage in India.

2. Material and methods

Clean seeds of different pulses were purchased from Daliganj market in Lucknow (Fig. 1 and Fig. 2). Seeds of different pulses put in different five boxes (Fig. 3) after that 5 pair of adults male and female were released for oviposition. The boxes were covered with muslin fabric and tightly fastened with rubber to prevent the escape of the beetle (Fig. 4). The observation regarding the weight loss of five different pulses were taken after forty-five days of releasing the adult insects into plastic boxes (Table 1).

Before the weight loss of five different pulses determined, the insects either alive or dead were taken out of the boxes. The percent loss in weight was worked out using the following formula (Girish et. al, 1975)

$$Percent\ Weight\ loss = \frac{Initial\ weight - Final\ weight}{Initial\ weight} \times 100$$

Figure 1 *Callosobruchus maculatus* on *Vigna radiata*

Figure 2 *Callosobruchus maculatus* on *Cicer arietinum* (desi chana)

Figure 3 Five boxes containing five different pulses

Figure 4 Five boxes covered with muslin fabric and tightly fastened with rubber to prevent the escape of the beetle

3. Results and Discussion

The result of the present study revealed the percent weight loss in five different stored pulses. It was 19.7 percent weight loss in *Cicer arietinum*, 14.25 percent weight loss in *Vigna radiata*, 17.7 percent weight loss in *Pisum sativum*, 4.75 percent weight loss in *Lens culinaris* and 18.8 percent weight loss in *Cicer arietinum* (Kabuli chana). The major weight loss seen in *Cicer arietinum* (19.7) it means *Cicer arietinum* is more prone to infestation and the least weight loss seen *in Lens culinaris* (4.75) it means *Lens culinaris* is less prone to infestation.

Table 1 Percent weight loss caused by *Callosobruchus maculatus* in different five stored pulses

	Name of pulses	Storage duration (days)	Initial weight in gm	Final weight in gm	Percent weight loss %
1.	*Cicer arietinum* (desi chana)	45	100 gm	80.30	19.7
2.	*Vigna radiata* Golden gram (mung daal)	45	100 gm	85.75	14.25
3.	*Pisum sativum* garden pea (matar)	45	100 gm	82.30	17.7
4.	*Lens culinaris* Lentil (Masur)	45	100 gm	95.25	4.75
5.	*Cicer arietinum* Kabuli chana (Chola)	45	100 gm	81.20	18.8

The table shows the comparative percent weight loss in different stored pulses which are very common in Indian kitchen.

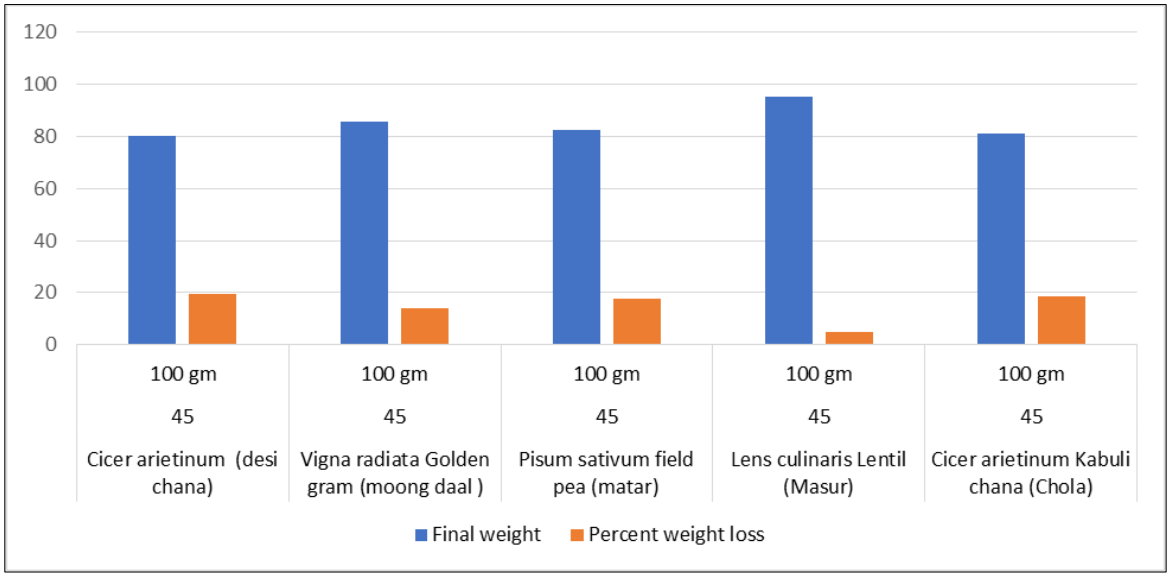

Figure 6 Percent weight loss caused by *Callosobruchus* in different five stored pulses

4. Conclusion

From the present study it can be concluded that among the five studied pulses *Lens culinaris* (4.75%) is less susceptible to the pulse beetle as the minimum percent weight loss found in it and *Cicer arietinum* (desi chana) (19.7%) is more susceptible to the pulse beetle as the maximum percent weight loss found in it. The increasing order of susceptibility of pulses to the *Callosobruchus maculatus* is *Lens culinaris* (4.75%) <*Vigna radiata* (14.25%) <*Pisum sativum* (17.7%) <*Cicer arietinum* (Kabuli chana) (18.8%) <*Cicer arietinum* (desi chana) (19.7%).

Callosobruchus maculatus (Cowpea weevil) infestations can lead to reduced germination rates of seeds. Infested seeds can develop holes from which the adult beetles emerge, further reducing the quality of the product. Besides reducing the market value of stored pulses, infestations can also lead to mold growth in damaged seeds. In India economically

Callosobruchus maculatus is very serious thread to different pulses which is stored in large quantity in cold storage but not all have equipped with modern facilities.

Compliance with ethical standards

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Disclosure of conflict of interest

The authors have no any conflict of interest for publishing this article.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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