

INTERNATIONAL JOURNAL OF AGRICULTURAL INNOVATION IN ECOLOGY AND AGROTECHNOLOGY



Publisher

EcoAgroTex Research Journals



editor.ecoagrotex@gmail.com



<https://ecoagrotex.com/index.php/jaiea>

ISSN: 3143-6730

Evaluation of pulse beetle losses in chickpeas stored in Southern Haryana

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Research Article

Date of Submission: 03-05-2026

Date of Acceptance: 11-07-2026

Date of Publication: 16-08-2026

Abstract:

The goal of the current research was to evaluate the losses brought on by the pulse beetle (*Callosobruchus* spp.) while chickpea grains were being stored in different storage structures. It was discovered that farmers continue to use conventional storage methods (earthen pots, earthen pots with sand, and jute bags). In August, September, and October of 2017 and 2018, 500g samples of chickpea grains were gathered from various storage structures (metal bins, plastic bags, gunny bags, earthen pots, and earthen pots + sand) in 15 villages in the districts of Rewari, Hisar, and Mahendergarh. Rewari has the greatest infestation, followed by the districts of Hisar and Mahendergarh, according to the findings of the sample analysis. In 2017 and 2018, the majority of farmers stored their chickpea grains in metal bins (51.45, 40.11%), followed by gunny bags (31.79, 31.64%), plastic bags (16.76, 15.82%), earthen pots (6.51, 7.91%), and earthen pots + sand (2.35, 4.52%). Gunny bag samples accounted for 70.91 and 53.63 percent of all bruchid-infested samples in both years, followed by plastic bags (48.28 & 20.29%), metal bins (11.24 & 15.94%), and clay pots (9.80 & 10.14%). The samples that were kept in clay pots with sand showed no signs of pulse beetle infection. In compared to August, September and October showed higher grain moisture percentages and pulse beetle infestations. Metal bins were shown to have lower qualitative and quantitative seed/grain losses among the frequently used storage structures.

Key words: Earthen pots, metal containers, chickpeas, bruchid, storage structures, and losses.

Introduction

According to Sujeetha et al. (2020), pulses, also known as legumes, are the second most important category of crops used by humans and animals worldwide. They include significant levels of thiamin, niacin, calcium, iron, and carbs (50–60%) and protein (20–40%) (Sharma et al. 2016). Due to inadequate intake of protein, vitamins, and minerals, 840 million people worldwide suffer from malnutrition (Anonymous 2016). In this way, pulses play a crucial part in guaranteeing future global food and nutritional security (Aslam 2004). In underdeveloped nations like India, where the per capita availability of pulses is 39.9 g/day (Chaturvedi & Ali 2000), they are the primary source of plant protein, in contrast to the FAO/WHO guideline of 80 g/capita/day. By fixing atmospheric nitrogen into the soil at no additional expense, pulses also maintain the soil's vitality and productivity (Sharma et al. 2013). India produced over 23.95 million tonnes of pulses in 2017–18 (Anonymous 2016). The most significant pulse crop in India is chickpeas, which are grown on 8.17 million hectares and produce 7.48 million tonnes, or 35.09% and 51.02% of the country's total acreage and output, respectively. Between 2009 and 2010,

Haryana produced 0.06 million tonnes of chickpeas on around 0.08 million hectares (Anonymous 2011). One of the most harmful storage pests is thought to be bruchids. There are more than 100 species of bruchids, which are separated into five subfamilies and 56 genera (Southgate, 1979). India has 117 species, divided into 11 genera (Arora 1977). Around the globe, stored pulses are attacked by a number of economically important species of the genus *Callosobruchus*. One of the main limitations on chickpea storage is the damage and loss of seed viability brought on by pulse beetle infestation. Since it is an inside feeder, only grubs cause harm (Anonymous 2019). In pulses, seed weight and protein content decrease by around 55–60% and 45–66%, respectively (Gujar 1978). In the field, where the infestation starts, eggs are laid on developing pods. All threshed seeds are susceptible to assault throughout the storage period. When the grubs hatch, they dig into the grains and eat the interior component, leaving the shell empty. After pupation, adults emerge from circular holes in the grains, resulting in both quantitative and qualitative losses, including nutritional loss, germination loss, making the grains unfit for human consumption and seed production, and decreasing their market value (Ali et al. 2004). According to Mookherjee et al. (1970), leguminous seeds were 32–64% more infected with pulse beetles than cucurbitaceous and solanaceous vegetable seeds and oil seeds (3%). Fifty pulse beetles were found in stored pulse grains after six months of conventional storage (Caswell, 1973). The infestation starts in the field and persists during storage. The greatest damage occurs between July and October (Chakraborty & Mondal 2015). A crucial component of food security is grain storage. The FAO study from 2004 states that when grains and other durable commodities like oilseeds and pulses are stored in poor nations, insect pests result in significant losses. According to Kumar et al. (2016), farmers in India often store seed in gunny bags and put it on wooden boards in the room for planting the next season, paying little attention to insect pest attacks during storage periods. In various godowns and warehouses around our nation, some 40 million tonnes of food grains are kept as a buffer reserve. Low seed moisture content and storage temperature slow down the process of ageing (Coolbear 1995). Roberts (1973) asserts that as seed storage temperature and moisture levels decrease, seed vitality increases. Poor storage conditions have been shown to reduce seed quality by 10% in tropical regions (Genchev 1997). Insects alone account for 10–50% of the damage caused by pests (Nonymous, 2012). Protecting the stored goods against deterioration—specifically, loss of quality and quantity during storage—is thus always necessary. The goal of the current study was to evaluate the losses brought on by pulse beetles while storing chickpea grains in different types of storage facilities.

Materials and Methods

The current study was conducted at the CCS Haryana Agricultural University's Department of Entomology in Hisar, Haryana. In August, September, and October of 2017 and 2018, 500g samples of chickpea grains were gathered from various storage structures (metal bins, plastic bags, gunny bags, earthen pots, and earthen pots + sand) in 15 villages in the districts of Rewari, Hisar, and Mahendergarh. In order to identify infestation, these samples were analysed in a lab to determine the moisture content of the grains. The weight and quantity of damaged and healthy grains were noted for each sample. The data was examined in terms of the percentage of bruchid infestation, the percentage of seed wetness, and the percentage of storage structure use.

Results and Discussion

In 2017, 63 (36.42%) of the 173 samples that were gathered in all three regions were determined to be pulse beetle infested. The same year, pulse beetle infestation was found to be more prevalent in chickpea samples from Rewari district, followed by Hisar and Mahendergarh. In Mahendergarh, September had the highest infection rate (45%), followed by October (35.00%) and August (5.88%), with moisture contents of 10.90, 10.15, and 10.12%, respectively. According to data from Hisar samples, September had the highest infection rate of 65% with a moisture level of 11.32%. With moisture contents of 10.30 and 11.12 percent, respectively, the pulse beetle infestation was much lower in August (10.53%) and October (40.00%). With moisture contents of 11.28, 11.46, and 10.45 percent, respectively, the infestation in Rewari was 55 percent in October, 50 percent in September, and 11.76 percent in August (Fig 1). Of the 177 samples taken throughout the three districts in 2018, 68 (38.42%) had indications of pulse beetle infestation. The greatest pulse beetle infestation was found in chickpea samples from the Rewari district, followed by Hisar and Mahendergarh. With moisture contents of 11.13, 10.88, and 8.55 percent, respectively, the greatest infestation in Mahendergarh was 52.63 percent, followed by 35.00 percent in October and 10.00 percent in August. Data from Hisar samples showed that September had the highest infection rate of 55% with a moisture content of 11.08%. With moisture contents of 8.98 and 11.14 percent, respectively, pulse beetle infestation was lower in August (15.00%) and October (44.44%). With moisture content values of 11.06, 11.24, and 9.26 percent, respectively, the infestation in Rewari was 60 percent in September, 55 percent in October, and 11.76 percent in August (Fig 2).

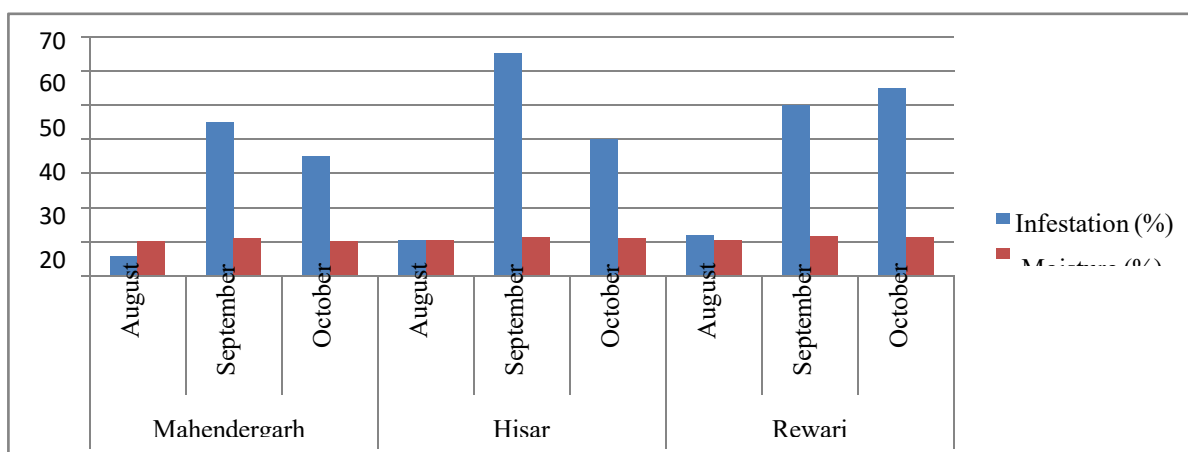


Fig 1. Pulse beetle infestation in chickpea grains in different district of Haryana during 2017

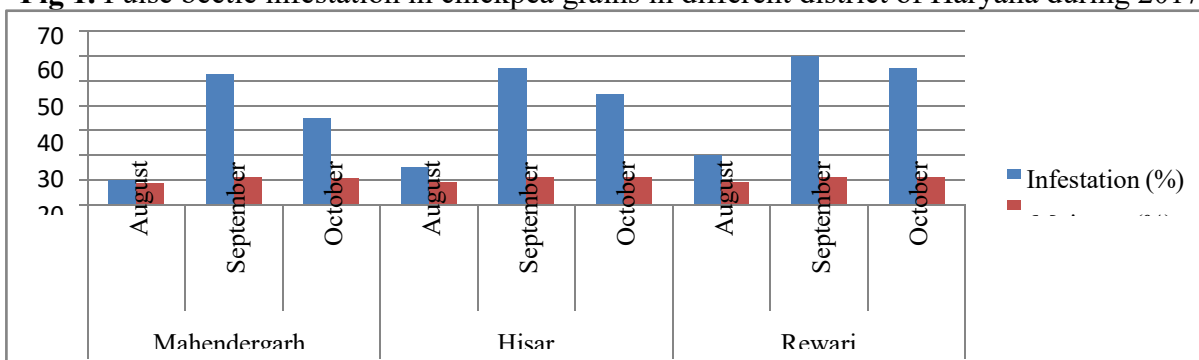
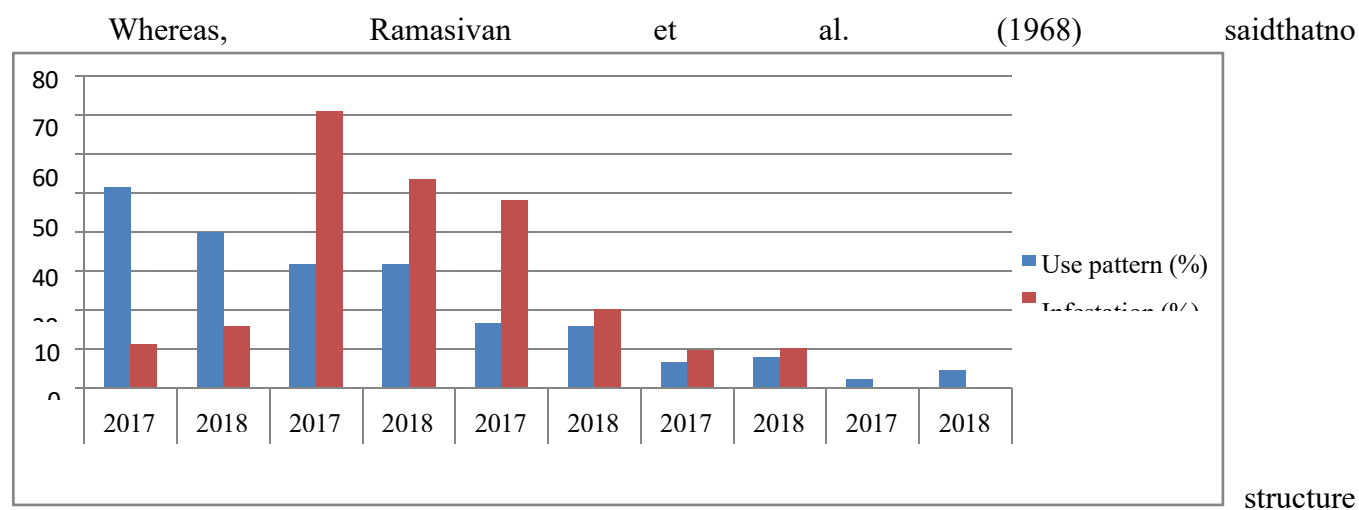


Fig 2. Pulse beetle infestation in chickpea grains in different district of Haryana during 2018

Figures 1 and 2 make it clear that the infection grows as the moisture content of the chickpea seeds rises, with September being the peak infestation. According to the current study, Sharma et al. (2013) found that *C. chinensis* was the main bug infesting chickpeas, peaking in September–October at 38.05%, followed by June–July at 15.75%, and January–February at 11.23%. Additionally, they reported that samples from the districts of Bhiwani and Hisar had the greatest pulse beetle infestation (56.2%). In September and October, samples from Rewari and Mahendergarh showed 50.7% pulse beetle infection. Shaheen et al. (2006) observed that pulse beetles had damaged 28.36–54.46% of several chickpea types with moisture contents ranging from 9.04–11.33%. According to Chakraborty & Mondal (2016), cow peas had the greatest average damage (34.95%), followed by kidney beans (0.55%), green grams (32.73%), black grams (30.76%), and tiny peas (1.45%). Singh (2020) reports that the percentage of damage was assessed and found that the smaller variety of pigeonpea had a grain content loss of 61.34%, while the bigger variety had a loss of 61.59%. Deshpande et al. (2011) investigated cowpea varietal sensitivity and resistance to the bruchid *Callasobruchus maculatus*. They discovered that the infection had a mean of 80.33 percent and varied from 42.71 to 97.29 percent. Additionally, there was a favourable correlation between bruchid damage and moisture content. Additionally, Bajiyya (2009) discovered that 67.34 percent of the samples with moisture content up to 10.00 percent were infested with various insect pests. 81.81 percent of samples with moisture contents between 10.10 and 13.50 percent were infected, while 80.00 percent of those with moisture contents more than 13.50 percent were infested. Additionally, the current survey discovered that the greatest percentage of farmers (51.45%) stored chickpea grains in metal bins in 2017, followed by gunny bags (31.79%), plastic bags (16.76%), earthen pots (6.51%), and earthen pots with sand (2.35%). Pulse beetles were identified in 70.91% of the gunny bag samples, followed by plastic bags (48.28%), metal bins (11.24%), and earthen pots (9.80%). Remarkably, samples kept in earthen pots with sand showed no signs of infection (Fig 3). In 2018, the majority of farmers (40.11%) kept their chickpea grains in metal bins, which were followed by gunny bags (31.64%), plastic bags (15.82%), earthen pots (7.91%), and earthen pots with sand (4.52%). Of the gunny bag samples, pulse beetles were found in 53.62 percent, followed by plastic bags (20.29%), metal bins (15.94%), and clay pots (10.15%). The samples stored in sand-filled clay pots showed no signs of infestation (Fig. 3).



was free from pulse beetle damage.

Fig 3. Storage structure use pattern and infestation of pulse beetle in chickpea

In Gujarat, earthen jars were the most common kind of storage, followed by heaps, pits, tin jars, jute bags, and wooden bins (Patel 1970). When Kharab (1981) looked at the storage methods used by Bengal gram farmers in Haryana, he discovered that 36% of them utilised bags and 64% used bulk storage. Awaknavar et al. (1989) examined five storage structures (metal bin, coal tar barrel, gunny bag, plywood bin, and earthen pot storage) that might be used on farms to shield pulses from the bruchid, *C. chinensis*, in agreement with the present study. The weight loss percentages for the metal bin, coal tar drum, gunny bag, plywood bin, and earthen pot storage were, respectively, 3.2, 4.2, 4.8, 6.3, and 5.0. In a similar vein, Gupta (1990) assessed how pulses were stored in Rajasthan and found that 24% of farmers used bags and 76% utilised bulk storage. Bhargava & Choudhary (2007) surveyed every district in Rajasthan during the 2005–06 school year. They discovered that *Callosobruchus* species damaged grain the least in metal containers and the most in loose storage. Bajiya (2009) found that mud pot and bhukhari had the highest infection (100%), followed by loose (85.00%), bag (74.46%), kothi (66.66%), stone bin (50.00%), and metal container (38.88%). Bag (37.60%), metal container (14.40%), loose (16.00%), kothi (7.80%), stone bin (8.00%), bhukhari (8.00%), earthen pot (6.40%), and pusa bin (2.40%) were the most often seen storage methods and store receptacles/structures in Jaipur districts.

Conclusion

According to statistics from both years, Rewari district had the highest pulse beetle infestation of chickpea samples, followed by Hisar and Mahendergarh. September saw the highest pulse beetle infestation, followed by October. The majority of farmers were found to store the chickpea grains in metal bins, which were followed by gunny bugs, plastic bags, earthen pots, and earthen pots with sand. Gunny bag samples showed the highest level of infection across various storage structures, followed by plastic bags, metal bins, and clay pots. The samples that were kept in clay pots with sand showed no signs of pulse beetle infection.

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