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Damage impact of vertebrate pests on different crops and stored food items

Qamar Safi Ur Rehman *, Khan Waqar Ali, Wasti Syed Muhammad Ali, Majeed Waqar, Naveed Muhammad, Samad Abdul and Khan Aziz Ullah

Department of Zoology, Wildlife, and Fisheries, Faculty of Science, University of Agriculture Faisalabad, Faisalabad 38000, Punjab-Pakistan.

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Abstract

The sub-continent countries like Pakistan, India, and Bangladesh that fall in the category of developing countries suffer from high economic loss due to the damage to valuable crops. The crops are always under attack by vertebrate pests including rodent and bird pests during the time period of harvesting and storage. Our current study indicates that most of the crop damage and economic loss were caused by rodent pests. Vertebrate rodent pests include *Mus musculus* (house mouse) and *Bandicota bengalensis* (lesser bandicoot rat), *Rattus norvegicus* and *Rattus rattus* caused damage to crops like sugarcane, maize, household stored food items and grains. On contrary, the major bird pest is *Psittacula krameri* (Rose Ringed Parakeet) that caused damage to fruit gardens of Common Fig (Anjeer) and parrots, Guava and *Cascabela thevetia* (Pilli Kaneri). Rodents damage the seeds, standing crop and food items stored in households. While birds always prefer fresh fruits from the tree. The methodology of the study simply consists of the surveying of the different field of sugarcane, maize, fruit gardens of different villages in district Faisalabad and also includes different research gardens at main campus UAF. After collection, the samples were critically studied for pest identification in the laboratory at the department of zoology, wildlife and Fisheries University of Agriculture Faisalabad. The results demonstrated that both rodent pests and bird pest are equally depredatory towards valuable crops. In order to reduce this loss, we have to bring about the advances in the vertebrate pest management like the use of pesticides (Chemical) and some mechanical methods for trapping, killing and pushing of vertebrate pests.

Keywords: Vertebrate; Damage; Rodent; Birds; Pest; Crops; Stored food

1. Introduction

In developing, countries crops and stored food are highly aimed at damage by different vertebrate pests. Specified information on food and crop yield loss in developing counties is not documented as required. The people of developing countries loss their stored food and crops containing economical yield due to the attack of rats, mice and pest birds [1-2]. These problems are not described properly by researchers and agriculturists. Damage due to vertebrate pest's farmers bears the double loss, during harvesting season and post-harvest [3-4]. Most of the crops are vulnerable to vertebrate pests during its growth stages and stored food is vulnerable for as long as they are held in storage [5-7].

Commonly after harvesting the crop yield is stored in farmhouses in specialized structures that are designed especially for storage. These structures are present in the territory of one or more species of vertebrate pests including indigenous rodents and possibly depredatory birds [8]. Stored food is lost due to time to time consumption, contamination, wastage, and spoiled by vertebrate pests [9]. This is the first step towards next crop yield loss due to damaged seeds which are required by the farmer for plantation of the particular crop during its harvesting season [10].

* Corresponding author

E-mail address: ranasafi73@gmail.com

The negative impact of vertebrate pests on agriculture by eating and damaging crops lead to loss of agricultural yield as well as loss in economy. Damage impacted by rodents and depredatory birds can be harsh, may vary according to geography and season. Farmers apply many techniques to overcome economic loss due to rodents and birds by using rodenticides, avicides, trapping and aversion [11]. Although these strategies are effective at limiting crop loss, damage due to rodents and birds remains a problem in developing countries. Research on damage due to rodent and bird pests outlies the detail related to single or multiple species impacting only one crop's final product [12-14] or one species having an impact on different crop's final product [15]. There is a small portion of research which actually show detail on multiple pest species damages to multiple crops [16].

This study points out the major vertebrate pests of different crops and highlights the damage profile of these vertebrate pests on different crops including sugarcane, maize, and stored food items which include biscuits, chocolates, dates, stored seed of different crops and stored grains. During the study of vertebrate pest and their damage profile, we found out the major rodent pests are *Mus musculus* (house mouse) and *Bandicota bengalensis* (lesser bandicoot rat), while the major bird pest is *Psittacula Krameri* (rose-ringed parakeet).

2. Material and methods

2.1. The material of study

The study material includes crops of sugarcane, maize, root tuber, guava, common fig, and *Cascabela thevetia*. While stored food items include biscuits, dates, seeds of maize and chocolates.

2.2. Area of study

We started our study by visiting the fields and storehouses of fruits, grains, vegetables in our selected study areas. We selected 204 R.B village, 208 R.B village, 209 R.B village, University of Agriculture Faisalabad's research gardens and warehouses of Faisalabad District in the grain market (Figure 1). Out of these areas, 204 R.B village, 208 R.B village and 209 R.B village is famous to produce quality maize and sugarcane. In the University of Agriculture Faisalabad (UAF) Research Gardens different plants of Common Fig (Anjeer), Guava and *Cascabela thevetia* (Pilli Kaneri) are produced for research purpose. While in grain market we found plenty of grains, seeds of different crops and ground nuts in storehouses. Therefore we selected these areas for the study of vertebrate pests including rodents and birds. This study includes the information collected through samples. Different techniques, pesticides, and mechanical methods are used by farmers to overcome the damage of vertebrate pests on the crops of sugarcane and maize. While in grain market the shopkeepers use mechanical methods to overcome the damage due to rodents.

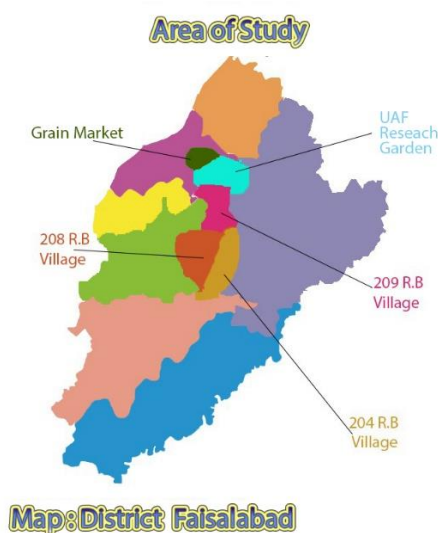


Figure 1 Map of study area

2.3. Collection of samples

An idiosyncratic sampling technique is used to collect samples from different fields of sugarcane, maize, research gardens of guava and olive by scrutinizing the fruits of these crops conscientiously. We collected most of the samples

from 208 R.B village, 209 R.B village, UAF research garden and grain market. After collection, samples were brought in the laboratory of Department of Zoology, wildlife and fisheries, the University of Agriculture Faisalabad for the identification of pests that damage the particular crop, seed, and food item by expert pest manager.

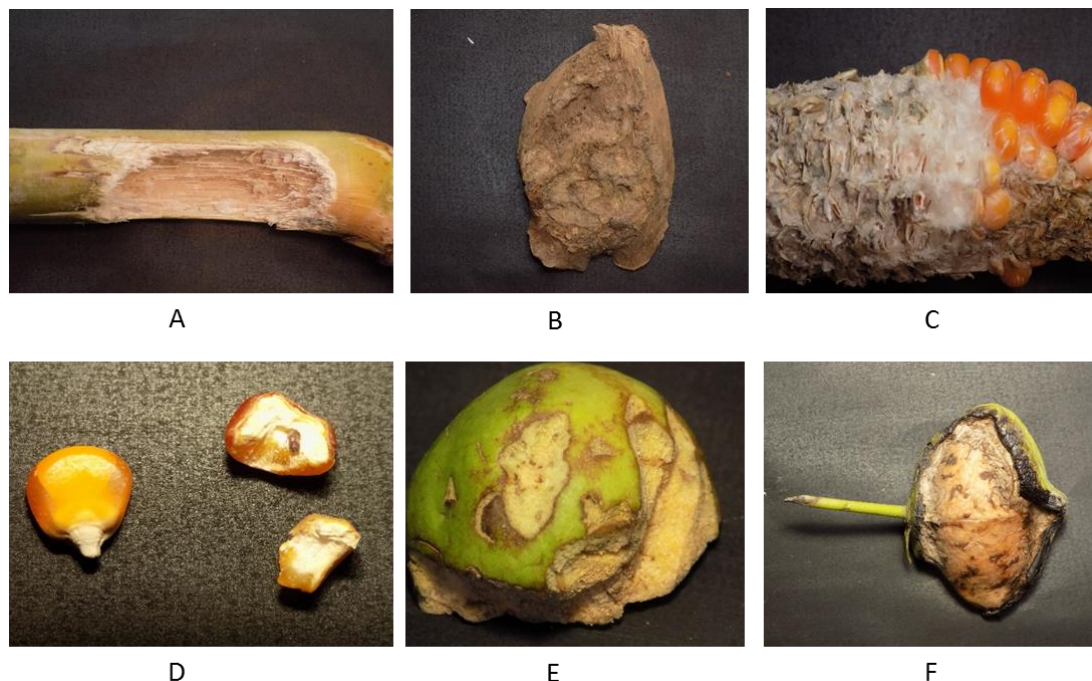


Figure 2 Samples used for the study. A- Sugarcane damaged by *B. bengalensis*, B- Root tuber damaged by *B. bengalensis*, C- Maize kernal damaged by *B. bengalensis*, D- Maize seeds damaged by *M. musculus*, E-Guava damaged by *P. Krameri* and F- *C. thevetia* damaged by *Psittacula Krameri*

3. Results and discussion

Samples of damaged crops and stored food items were collected from the study area during the harvesting and post-harvest season. We identified two major rodent pests and one bird pest, causing significant damage to valuable crops during harvesting season and post-harvest in warehouses. These pests are *Mus musculus* (house mouse), *Bandicota bengalensis* (lesser bandicoot rat) and *Psittacula Krameri* (rose-ringed parakeet). These vertebrate pests affect crop in various ways. These pests damage major parts of crops during harvesting season and post-harvest, which results in a heavy economic loss.

This study provides significant knowledge about the damaging impact of the vertebrate pest on sugarcane, maize, root tubers crops and on stored food items. Sugarcane, maize and root tuber are attacked by vertebrate pests during their mature stage because at the mature stage the nutritional content is quite high which helps them to fulfill their requirements. Stored food items came under attack when it is stored in that warehouses which are near to the habitat of rodent pest. According to the report of Madhusudan (2003), about 11% economic loss is due to the damage of crops during the post-harvest time [17]. Crop damaged by rodents and bird pests is a common thing in the district Faisalabad. The loss during the post-harvesting season can be overcome by storing items at clean and pest proof premises. Most of the Pesticides inhibit the population of rodent and bird pests; however, crop production is variable across time and space [11]. Integrated pest management proved to be a more effective technique in reducing pest damage and increasing yield of the particular crop [18].

During the study, we noticed that the pest activities are enormously higher during crop's mature state and its rate doubles after post harvesting situation. Damage at the earlier stage or mature stage results in low crop production as well as greater economic loss. The geographical conditions of study areas favor the survival of vertebrate pest. Due to geographical and climatic conditions of crop cultivated areas i.e. 204 village, 208 village and 209 village, it is favorable for the growth and reproduction of non-identical rodent pest especially *Bandicota bengalensis* (lesser bandicoot rat) and *Mus musculus* (house mouse). While UAF research gardens and grain market favor the vertebrate bird pest *Psittacula krameri* (rose-ringed parakeet) and rodent pest *Mus musculus* (house mouse) respectively. The damaging

impact of vertebrate pests can be controlled by proper monitoring principally during the maturation spell of crops and during post-harvest. Farmers use pesticides and mechanical methods to reduce the economic loss caused by vertebrate pests. The recorded observations are mentioned in Table 1.

Table 1 Observed vertebrate pest and their damage to the crop and stored food items

Crop/Food item	Pest observed	Damage
Sugarcane		Lesser bandicoot rat eats the stem of sugarcane from nodes and internodes. Specially internode which contains higher contents of glucose (Figure 2 A).
Maize	<i>Bandicota bengalensis</i> (lesser bandicoot rat)	Lesser bandicoot rat eats mostly the kernel of maize (Figure 2C).
Root tuber		Lesser bandicoot rat eats the upper part of root tuber and left the rest with its damage signs (Figure 2B).
Stored biscuits		House mouse damage the biscuits in a unique pattern by eating it smoothly and form curve like pattern.
Stored seeds of maize	<i>Mus musculus</i> (house mouse)	Most of the seeds are damaged partially by the house mouse (Figure 2D).
Stored chocolate		Small packs of chocolate are damaged in a unique manner that the teeth marks of house mouse are left on the item.
Guava		Rose-ringed parakeet damages the guava fruit by eating it from different sides and leave its damage pattern on fruit (Figure 2E).
Common fig	<i>Psittacula kramera</i> (rose-ringed parakeet)	Rose-ringed parakeet damages the final product of common fig by eating from the upper portion of the fruit.
	<i>Cascabela thevetia</i>	Rose-ringed parakeet damages the whole fruit of <i>Cascabela thevetia</i> and left only the seed (Figure 2F).

4. Conclusion

It is evident that most of the damage was due to rodents which occurred during the postharvest season. While bird pests always preferred fresh food by directly attacking plants. This loss can be compensated by using different management techniques. Rodent control strategies must consider economics as well as ecology. The differences in species composition of rodents depending on locality, habitat type, and preferred food. The high population density of rodents occurred in spring was increased activity. However, the lowest density was during the winter season. Baits of different colors may be used to control rodent's pests. Availability of food, Locality and neighboring are the key to control the pest. Mechanical, biological and chemical control methods can be used effectively in an Integrated Pest Management Approach (IPMA) for the regulation of the rodent's population density.

Compliance with ethical standards

Acknowledgments

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Disclosure of conflict of interest

There is no conflict of interest among all authors.

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