



Burrow Density and Crop Damage Caused by Indian Crested Porcupine (*Hystrix indica*) in Talagang, Punjab

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Abstract

The Indian crested porcupine is widely distributed worldwide and largest rodent species in Pakistan. It belongs to old world porcupine group and is notorious for causing significant losses to agricultural crops and forestry sector throughout the world. The objective of the present study was to investigate the burrow density and damage caused by this species to crops in Talagang tehsil of district Chakwal. Its burrow density was recorded in two types of habitats from the study area. It includes cropland areas with agricultural activities and the non-cropland areas for study. From these two areas 28 and 27 burrows were found in respective habitats within 5 quadrates of 1km² in each. The ratio of active burrows was more in noncropland area that specifies its preferred place of living. For estimation of damage caused by the foraging activities of Indian crested porcupine in the study area the data was recorded at three stages i.e., early, premature and mature stage of two major crops, groundnut and wheat. Average 4% and 18.5% damage was observed on premature and mature stages of groundnut while 0.15% and 0.57% damage was found on premature and mature stages of wheat crop respectively. The results might prove to be helpful for the farmers of the region to protect their crop from rodent damage as they are made aware of the patterns of damage of these rodents.

Keywords: Cropland; Groundnut; Non-cropland; Wheat

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1. Introduction:

Across the whole world, a number of vertebrate pests are present in all agro forestry ecosystems that are economically highly significant. Among these many rodent species badly damaged the crops as wheat, rice, maize, sugarcane, gram, groundnut and oil palm through their feeding activities. Indian crested porcupine (*Hystrix indica*) is the largest rodent species that belongs to class Mammalia, order Rodentia (Khan, 2013; Raj, 2018). *Hystrix indica* belongs to Old World porcupine group. Its body length measures 70-90cm, tail adding a similarly 8-10cm and weighs 11-18kg (Khadim, 1997). It is mostly present in rocky hilly sides, moist deciduous forests and forest plantations but rarely found in intensely cultured regions (Sridhara & Tripathi, 2005). In rain fed cropland area of Chakwal, the cropping system is comprised of wheat as main winter crop while summer crops are groundnut and sorghum. The non-crop vegetation is found on boundaries of fields that provides diet and protection to rodents in non-crop period or at early stages of crops (Hussain *et al.*, 2016).

In the areas of natural range of *Hystrix indica*, its high population densities have led it to be considered as pest so eventually oppressed (Dhaheri *et al.*, 2018). It is found in Turkey, Israel, Pakistan, Nepal, India, China and Sri Lanka. In Pakistan, it is disbursed all over the country. Rangeland crops are broken severely by it in irrigated and rain fed poth war belt. The damaging crops include wheat, sugarcane and melon (Khan *et al.*, 2000). It's mostly taken diet item is groundnut that is followed by millet, rice, maize, and oats (Mushtaq, 2009). Higher damages by this rodent occur on small vegetable gardens, especially on underground storage organs (Laurenzi *et al.*, 2016).

Under the invasion of fluctuations of nature, animals mostly save them by adapting their food habits. Sometimes when there is a shortage of food, the tough and dead bark of a tree can be used as food (Gosh & Mondal, 2015). In irrigated forests of Pakistan, porcupines damage trees by removing their bark at ground level. Trees with thick and rough bark are typically shunned by them. They consume succulent flowers of various species and are particularly keen on garden trees. The species of trees which are attacked by *Hystrix indica* include *Acacia modesta*, mulberry and *Dalbergia sissoo*. (Greaves & Khan, 1978; Arshad *et al.*, 1990; Akbar *et al.*, 2005; Hafeez *et al.*, 2014). Porcupine meets meals and water necessities through digging and clipping. Throughout digging a few species of vegetation are fully ate up however in a while germinate in dogs. The plant species which can be in part consumed, they get renewed vegetative. These activities generate a network of direct and oblique influences on ecological systems (Khan *et al.*, 2016).

Indian crested porcupine lives in burrows built by it and complicatedly manipulated burrowing webbings (Mukherjee *et al.*, 2017). Their burrows are mostly observed in tidal flat plains and forest plantation distant from cropland. In daytime animals persist invisible in their dens but at night they come to nearby fields during their foraging and assault the crop areas (Bhargava *et al.*, 2001). They could cover up to 10 miles from their burrows to feeding sites and mark their path (Siddique, 2004).

Due to their vigilant nature, they live in an expanded burrow system usually having more than one opening with emerging on some lifted edge. The dens are distributed in the burrowing habitat and are engaged by one or more family groups (Mushtaq *et al.*, 2010). Indication of porcupine burrows is a mound of feces at entering site of cave or hollow tree. The porcupine presence is detected by way of watching for shattered quills and fecal masses under nourishing and sleeping plants or distinctive injury marks to trees in a region (Sarwer, 2018). The estimation of population of Indian crested porcupine is tough because of its shy nature and small size; therefore, indirect strategies are used to observe it like presence of footprints and fecal pellets (Diwakar & Janos, 2018). Indian crested porcupine eats hypogeal and epigeal tissues of plants. It mostly lives in inaccessible dens, so it has been little searched in Pakistan. The common method that is used to stop damage by porcupines is use of fumigants e.g., sodium cyanide, CO and aluminum phosphide in Pakistan (Khan *et al.*, 2011). Rodenticide baiting is the main technique of all practical porcupine control programs present today. Physical control practices include trapping, electric fencing, dog hunting, snaring and active policing but these are not effective. Biological control methods are still not available (Pervez *et al.*, 2015).

1.1. Objectives:

- To provide a complete picture of burrow density of *Hystrix indica* Kerr in talagang, tehsil of district Chakwal, Punjab.
- To quantify the crop damage and yield loss by Indian crested porcupine in selected area

2. Materials and Methods:

2.1. Study Area:

The present study was conducted in tehsil Talagang, located in the northern part of the Punjab. It is mainly rain fed area. There are no irrigation canals or rivers. A number of small dams have been constructed through which some irrigation takes place. The plains are cultivated, and a lot of area is covered by forests. Groundnut, wheat, oil seeds, grams, maize and jawar are major crops of this area. The average rainfall in this area is almost 445 millimeter while the average temperature is 14 centigrade in winter and 35 centigrade in summer.

2.2. Burrow Density of Indian Crested Porcupine:

Indian crested porcupine burrow density was calculated in two types of habitats of study area i.e., area with agricultural activities that is cropland area, and the other area was non-cropland (no agricultural activities or barren area). In each habitat, five quadrates of 1km² each; were thoroughly investigated for burrows of Indian crested porcupine. For this purpose, support was taken from local farmers and hunters. For identification of active status, each burrow was marked, and a field number was assigned to it. The burrows were extensively searched for signs of porcupine footprints or any other signs of porcupine activity like presence of fecal pellets and fresh quills. In addition, the burrow activity status was further confirmed by setting powdery patches of loose soil on the entrance of each burrow in the night and searching for footprints on the loose soil, for three mornings consecutively. Only the burrows having fresh porcupine footprints were considered active.

2.3. Damage to Crops:

For estimation of damage caused by the foraging activities of Indian porcupine in the study area, randomly four transect lines (200 m long each), were selected at different locations in two crops (groundnut and wheat) of the study area. At each transect line; the observer walked along the whole length of transect line, recording any damage caused by Indian crested porcupine, covering almost 10 m on both sides. The data was recorded at three stages i.e., early, premature and mature stage of two major crops groundnut and wheat in the study area. In case of damage to the crops, the number of plants damaged were recorded and the damage percentage was calculated (number of damaged plants multiply by 100 divided by total number of plants in the surveyed area). The evidence of the damage caused by Indian porcupine i.e., footprints, fresh fecal pellets, fresh quills and uprooting of the plants were recorded.

3. Results:

3.1. Burrow Density in Cropland Area:

Burrow density was estimated at 5 different localities in cropland area. Active status was confirmed by the presence of quills, fecal pellets, footmarks and vegetation present at the entrance of burrows. Moreover, footmarks were observed by placing loose soil at entrances of dens for three nights consecutively. Only 6 burrows were found active out of total 28 present in cropland area. It reveals that Indian crested porcupine avoids living in cropland area as there is a lot of human intervention (Table 1).

Table 1: Burrow Density in Cropland and Non-Cropland Area at Talagang Tehsil, Chakwal District

Location	Cropland Area			Non-Cropland Area		
	Total No. of Burrows	Burrow Density		Total No. of Burrows	Burrow Density	
		Active	Inactive		Active	Inactive
1	4	2	2	6	4	2
2	7	2	5	5	2	3
3	4	1	3	5	3	2
4	5	0	5	6	3	3
5	8	1	7	5	4	1
Total	28	6	22	27	16	11

3.2. Burrow Density in Non- Cropland Area:

A total of 27 burrows of porcupine were recorded in non-cropland area; out of which 16 were active and 11 were inactive burrows. These results demonstrate about the preferred habitat of Indian crested porcupine. As this rodent avoids human intervention so its most preferred place of living is non-cropland area (Table 1).

3.3. Comparison of Burrow Density in Cropland and Non-Cropland Areas:

Table 1 and Figure 1 demonstrates comparison of burrow density in both cropland and non-cropland. It appeared that there are more number of burrows found in croplands area while number of active burrows is greater in non-cropland area. In cropland there are a total of 28 burrows, out of which only 6 are active while in non-cropland a total of 22 burrows were found, out of which 16 were active. An estimated p value equal to 0.05 demonstrates significance for burrow density in cropland and noncropland areas. More active burrows were found in noncropland, the area which has less human intervention as compared to cropland area.

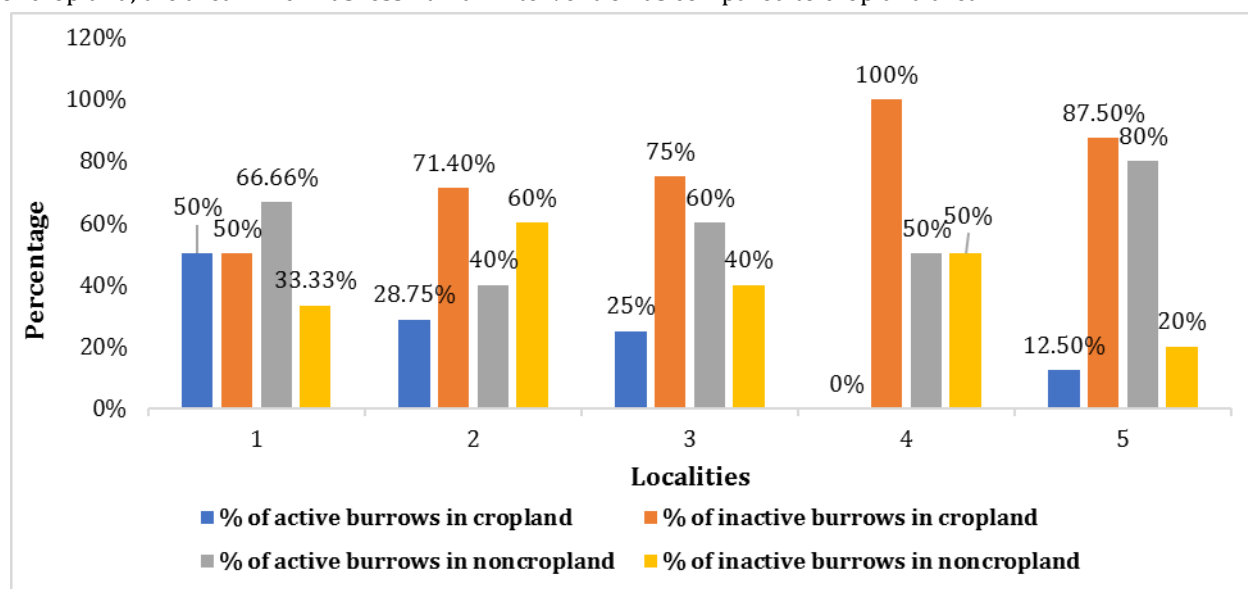


Figure 1. Comparison of % burrow density in cropland and non cropland area in tehsil Talagang

3.4. Crop Damage:

Damage to groundnut was recorded at early, premature and mature stage of crop in four different areas. The collected data revealed that porcupine damage was observed in 8 out of 12 fields of different localities at premature and mature stages of crop. No significant damage was seen at early stage of crop.

Table 2: Damage to groundnut crop at different stages of development at Talagang

Transect	Premature Stage			Mature Stage		
	Total No. of Plants	Damaged Plants		Total No. of Plants	Damaged Plants	
		Rodents	% Damage		Rodents	% Damage
Chingee Mogla	16450	590	3.5%	13500	2750	20%
Dhok Marian	13800	760	5%	12375	1114	9%
Dholar	14250	520	3.6%	15750	3600	22.8%
Tamman	21550	845	3.9%	20250	4500	22%
Total	66050	2715	4%	61875	11964	18.5%

Table 2 and Figure 2 demonstrates comparison of damage to groundnut crop at premature and mature stage by Indian crested porcupine in tehsil Talagang during 2018. This comparison reveals that there is a significant difference between damage at both stages. Only 4% of average damage was calculated at premature stage while at

mature stage estimated average damage is 18.5%. P value was calculated 0.01 for groundnut damage at premature and mature stage. It demonstrates significance because it is lesser than 0.05 level of significance.

Table 3: Comparison of damage % to wheat by Indian crested porcupine at premature and mature stage of crop in Talagang

Locality	Premature stage	Mature stage
Chingi	0.34%	0.8%
Taman	0	0.4%
Dholar	0.28%	0.7%
Dhok Marian	0	0.4%
Total	0.15%	0.57%

3.5. Wheat:

Wheat is the 2nd major crop of the study area. Data was recorded at three stages of crop. At the tilling stage no loss was observed. Damage was seen at premature and mature i.e., harvesting stage by Indian crested porcupine. Recorded damage was not heavy. Estimated % cannot disturb the economy of even local farmer. Table 3 and figure 3 demonstrates that there is more damage to wheat by Indian crested porcupine at mature stage as compared to premature stage. Estimated p value is 0.04 less than 0.05 demonstrates significance.

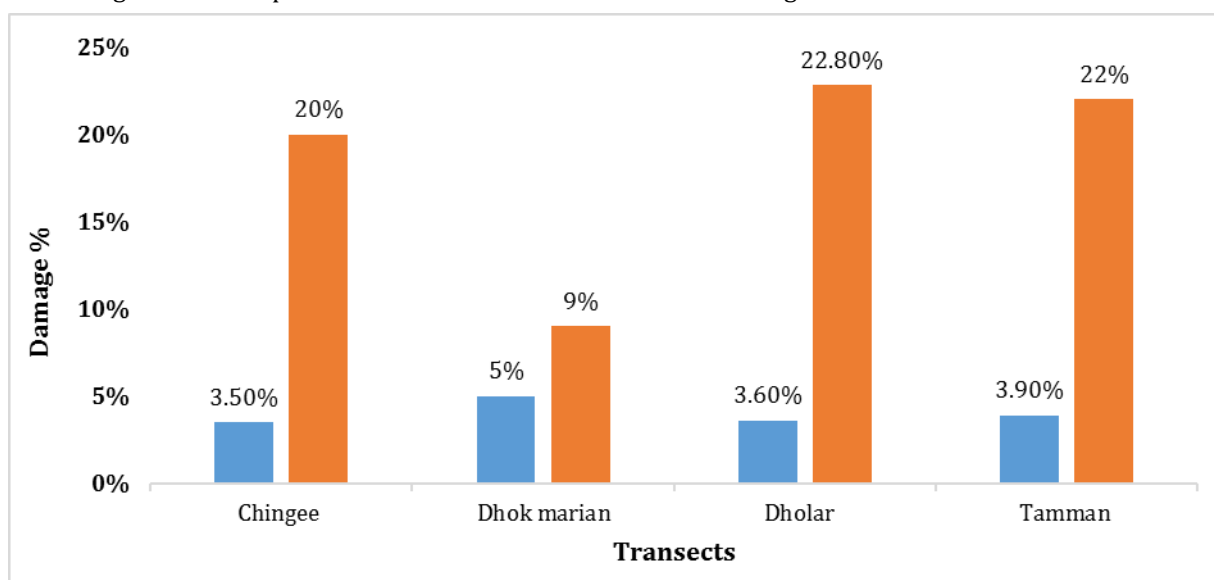


Figure 2: Comparison of damage % at premature and mature stage of groundnut crop in Talagang

4. Discussion:

Indian porcupine is widely distributed in different parts of the world and is the largest rodent species in Pakistan. It belongs to the old-world porcupine group and is famous for causing significant losses to the world's agricultural crops and forest sector. The objective of this study was to investigate the density of the burrow and damage caused by these species to the crops (groundnut and wheat) in Talagang tehsil in the Chakwal region. There were more active burrows in non-cropland habitat as compared to cropland. Area with dense vegetation was favored by porcupine for burrowing because non-cropland area is less disturbed and protected from flooding. It shows Indian crested porcupine preferred to live in habitat without human intervention as described in studies related to this. Amjad et al., 1990 described that forest area provides shelter and food to porcupine. In addition to this, non-cropland areas give proximity to cropland which is much richer in food resources.

Groundnut is a major crop in Pakistan that provides a great source of energy to porcupine because of its extensive digging practices. 4.82% damage was reported to groundnut crop by porcupine in Quaidabad (Hafeez et

al., 2012). Khan et al. (2012) described the estimation of groundnut damage in Chakwal district. They found 3.4% loss of groundnut by vertebrate pests. Mian et al. (2007) estimated 20.2% damage to groundnut by *Hystrix indica* in Chakwal. Brooks et al. (1988) reported damage to groundnut crop by Indian crested porcupine, with 30-40 plants damaged per night. In this study an average 4% loss was found at premature stage of groundnut while 18.5% damage at mature stage. This appeared to be a heavy damage, but this could be expected from a large rodent like Indian crested porcupine. The plants at early stages do not attract this rodent while plants at mature stages are more exposed to damage because of having fruits. In the case of wheat, a little damage was found on premature and mature stage of crop. At a premature stage 0.15% damage was recorded. Results at mature stage revealed average 0.57% damage by Indian crested porcupine. This damage % is not as much as to disturb the economy. Previously Hafeez et al. (2012) estimated 1.14% damage to wheat by Indian crested porcupine in Faisalabad and 6.82% damage in Quaidabad. Mian et al. (2007) reported 8.50% damage to wheat crop by this rodent in pothwar belt.

In this study the damage was identified by uprooting of the crop and presence of fresh quills, fecal pellets and foot marks at various places. According to local farmers, it travels 3 to 4 km to reach the cropland area. It damages crops in the region near forest as it likes to live in an area without human intervention. It was also found that the damage was mostly done to the mature crop before harvesting. No damage was seen at germination stage because at this stage there is nothing to feed them. The damage at harvesting stage directly affects the overall economy of the country and the income of the farmers (Jose, 2017). The results were in agreement with the previously conducted studies showing major damage to groundnut crops and preferred habitat in non-crop land area. Upon studying the field, it was observed that the farmers did not much care about applying precautionary measures to control the entry and movement of rodents in the fields. Physical traps include glue traps, simple early traps, or more complex capture devices. Baiting techniques require more time and work than other chemical methods to control rodents. This method is less cost-effective and less frequently used. Different rodenticides can be used to kill the animals including metal phosphides (zinc – once baits containing zinc phosphide are ingested), norbormide, alpha-chloralose, brodifacoum, flocoumafen, difenacoum (Aktar et al., 2009). The study can help farmers in identifying the damage done by crops and the prevention methods that can be utilized to save the crops from these rodents. Farmers can keep a log of the type of crop being damaged and the patterns of damage.

5. Conclusion:

The present study concludes that the damage made by Indian crested porcupine to these crops was found out by observing the fields at regular time intervals. Uprooting of plants was a major characteristic feature of damage and observed at multiple parts of the field. Likewise, the density of the burrows was also found in the region. The active and inactive status of burrows was found by observing footprints and quills of porcupine outside the burrows. More active burrows were found in non-cropland areas showing their preferred habitat. The results might prove to be helpful for the farmers of the region to protect their crop from rodent damage as they are made aware of the patterns of damage of these rodents. Multiple strategies have been adopted by farmers all around the world to prevent damage such as netting, caging, baiting and use of various rodenticides. The farmers in Talagang region can also develop strategies to overcome the rodent damage and ultimately increase the crop yield.

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