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Occurrence of the Indian Crested Porcupine (*Hystrix indica* Kerr.1792) and the Damage on Plantation Crops in the Nilambur Forest Divisions of Southern Western Ghats, Kerala, India

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ABSTRACT

The damage to coconut and rubber plantations by the Indian crested porcupine (*Hystrix indica*) in the Nilambur Forest Division, Malappuram District was reported for the first time. The objectives of this study were to document the mode of attack and estimate the extent of damage by Indian crested porcupine in the plantation crops of the forest fringes. The study was carried out from June 2013 to May 2016 as part of the documentation of human-wildlife conflict in Malappuram District. Stratified random sampling, along with quadrat (10 m x 10 m) method was used to assess the crop damage. Estimation of the economic loss to farmers was carried out by using the market price of the coconuts during the period, collected from the website of Farm Information Bureau, Govt. of Kerala. The mean economic loss of crops damaged by Indian crested porcupine was Rs.1322.35/- per ha/annum. The debarking behavior of Indian crested porcupine on coconut palms (n=31), rubber trees (n=27) and consumption of newly formed bamboo culms (n=42) were also reported. No one has implemented proper mitigation measures against the Indian crested porcupine in the District.

Key words: Bamboo culms, Debarking behavior, Economic loss, Fallen coconuts.

INTRODUCTION

Indian crested porcupine is one of largest rodents in Asia. They are nocturnal and burrowing and the hairs have been modified into spine-like structures called quills (Prater, 1980) which are used in defence against their enemies. The vision of porcupine is poor whereas the auditory and olfactory perception is well developed which helps them to forage at night time (Woods, 1973). All kinds of vegetables, fruits, grains and roots of trees are the main food source of the porcupines and they were also found to feed on the bark of several trees (Ahmad and Chaudhry, 1977; Khan *et al*., 2000). During the survey conducted as part of the documentation of human-wildlife conflict issues in the Malappuram District, we noticed that Indian crested porcupine was a serious pest of the plantation crops in the forest fringes. The objectives of this study were to document the mode of attack and estimate the extent of damage by Indian crested porcupine in the plantation crops of the forest fringes. The foraging ecology of the animal in the cultivated ecosystem of the Western Ghats region of the Karnataka was reported earlier by Chakravarthy and Girish (2002). The basic information about the feeding behaviour and damage to coconut crop was reported by Chakravarthy and Girish (2007) in Karnataka and by Govind and Jayson (2018) in central Kerala. No such study had been carried out in the Nilambur forest Divisions of the Malappuram District.

Study area

Malappuram District, in the Kerala State of India (10040' to 11030' N and 75035' to 76033' E) spanning an area of 3,550 km^2 is situated 50 km southeast of Kozhikode city, bounded by the Nilgiri Hills on the east, the Arabian Sea in the west, Thrissur and Palakkad Districts in the South. The main crop species are Arecanut (*Areca catechu*), coconut (*Cocos nucifera*), rubber (*Hevea brasiliensis*), plantain (*Musa paradisiaca*), paddy (*Oryza sativa*), cashew nut (*Anacardium occidentale*), pepper (*Piper nigrum*), ginger (*Zingiber officinale*), tapioca (*Manihot esculenta*) and pulses. It comprises of three Forest Ranges namely Edavanna, Nilambur and Vazhikadavu of Nilambur North Forest Division and two Forest Ranges namely Kalikavu and Karulai of Nilambur South Forest Division. The District with 1034.2 km^2 of forest lands of all the seven forest type of southern India, tropical moist deciduous, tropical semi evergreen, subtropical hills forest, sub-tropical savannahs, montane wet temperate grasslands apart from teak (*Tectona grandis*) plantations. Asian elephant (*Elephas maximus*), Wild pig (*Sus scrofa*), Leopard (*Panthera pardus*), Indian crested porcupine (*Hystrix indica*), Bonnet Macaque (*Macaca radiata*) are the wild animal species commonly found.

The dry season is from December to February and hot spell prevails from March to May and the South-West monsoon (SW) is from June to September and the Northeast monsoon (NE) from October to December. The normal rainfall of the District is 2,793.3 mm (Sreenath, 2013). Temperature is generally hot and humid and March and April months are the hottest and January, February being the

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coldest months. The maximum temperature ranges from 28.90 to 36.20°C and minimum temperature ranges from 17.00 to 23.40°C.

MATERIALS AND METHODS

Two locations in the forest fringe areas were selected randomly in each of the five Forest Ranges of the Nilambur Forest Divisions and the quadrats were laid in the farmlands (Fig 1). The quadrats of the size 10 m x 10 m were selected as follows. Five sample plots (Quadrats) in the coconut plantation, one control plot in the Reserve Forest near to the sample plot. Coconut damage by the Indian crested porcupine was recorded from the sample plots. The control plot within the forest was used to detect the presence of animals in the Forest fringes. Coconut palms in each plot were demarcated and marked by the colored ribbon. Crop damage incidences from the quadrats were recorded in each month (n=36 months). The details such as the number of fallen coconuts damaged in each plot, trees damaged in the plot and near to plot and age of the trees were recorded from the field. The occurrence of Indian crested porcupine in each permanent quadrat was identified by recording the indirect evidence such as droppings, diggings, feeding signs and nail marks. Estimation of the economic loss was calculated by using the market price of the coconuts during the study period, collected from the Farm Information Bureau, Kerala. In each month (n=36), the price of coconut in Northern Kerala for three days were selected, with a gap of 10 days. The Economic loss was calculated by multiplying the average market price of the coconut and the quantity of coconut damaged from the quadrats (Mean economic loss = Total economic loss of the District/ Total number of Forest Ranges). The length and breadth of the coconut husk removed by Indian crested porcupine in the field were measured by using vernier caliper and the length of the debarked portion of the coconut tree and rubber tree was measured by using Freemans measuring tape.

RESULTS AND DISCUSSION

The Indian crested porcupine was recorded from all the Forest Ranges except Nilambur Range in the Malappuram District (Table 1). A survey conducted around the Jigme Singye Wangchuk National Park, Bhutan reported that Porcupines were responsible for several complaints from the respondents as an agricultural pest, but they had little effect on agriculture income (Wang *et al*., 2006). In this study, severe damage was recorded to the coconut plantations both by the consumption of the fallen coconuts and by debarking the basal portion of coconut palms (n=31). Indian crested porcupine consumed 0.12±0.09 coconut/ tree/month (n=91). The fallen coconuts were consumed by removing the mesocarp and endocarp and then consuming

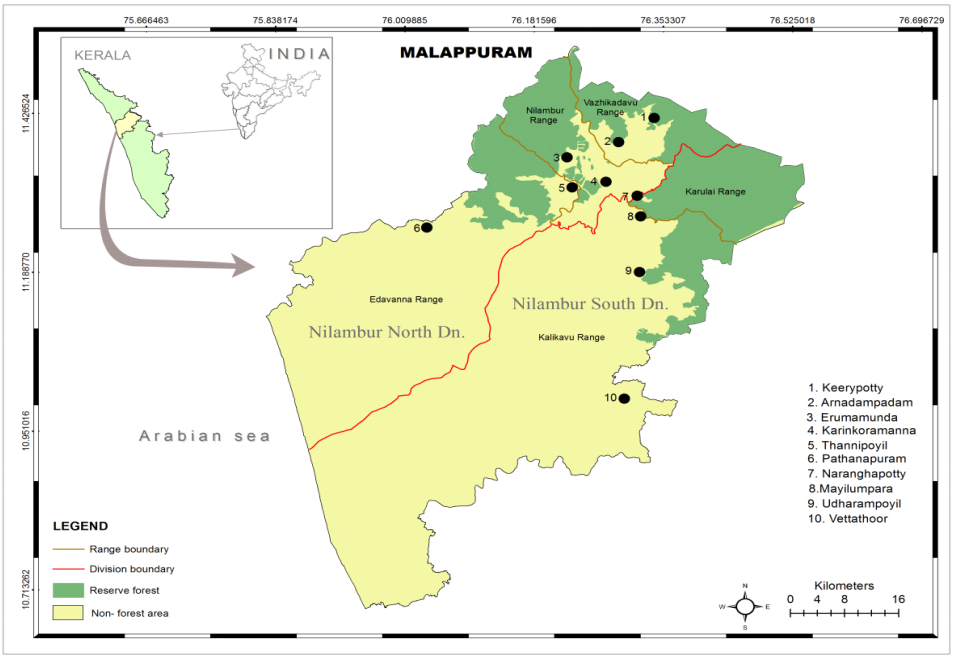


Fig 1: Map showing the Intensive study area.

Table 1: The occurrence of Indian crested porcupine in the study area in different years.

Forest Ranges	2013 (n=7)	2014 (n=12)	2015 (n=12)	2016 (n=5)
Kalikavu	4	2	1	0
Karulai	5	6	10	5
Vazhikadavu	2	4	10	2
Nilambur	0	0	0	0
Edavanna	7	11	12	4

Note: The numbers indicate the presence of porcupine detected from the field (as indirect signs).

the endosperm. As the Indian crested porcupine belongs to the order Rodentia, they remove the mesocarp with sharp edges with uniform size, which was considered as the indirect sign of porcupine in the field (Plate 01). Indirect evidence showed that Indian crested porcupine frequently carries the coconut into the forest for consumption. The mode of feeding by the Indian crested porcupine on the coconut that reported in this study was also reported in Thrissur District, Kerala by Govind and Jayson, 2018.

The mean economic loss by Indian crested porcupine in the District was Rs.1,322.35/- per ha/annum and the highest occurrence and crop damage was recorded from Edavanna Forest Range followed by Karulai, Vazhikadavu and Kalikavu (Table 2 and Fig 2). The estimated value is high compared to the amount of Rs. 615.47 estimated in Thrissur District near to Malappuram District (Jayson, 2013). Indian crested porcupine is considered as a generalist herbivore in the diet as its food includes both vegetative matter and animal matter. There is a significant difference in the content of bark in the diet according to the season (Akram *et al*., 2017). The crop species like maize, potato and groundnut are recognized as vulnerable to Indian crested porcupine damage (Brooks *et al*., 1998; Khan *et al*., 2000; Mian *et al*., 2007). The fallen coconuts were the most damaged crop which caused economic loss to the farmers in Malappuram District. The absence of crop mentioned above and the availability of coconut plantation in the forest fringe may be the reason for the damage.

The different hypothesis proposed on tree debarking behaviour of the ungulates says that it is due to the presence of trace elements and minerals in the bark, quality variation in the nutritional level of twigs and barks and the less availability of high-quality forage (McIntyre, 1972). These hypotheses can be attributed to Indian crested porcupine also as it is a mammal and there is no other established hypothesis to explain its debarking behaviour. In the coconut tree, the average length of the basal portion without bark from the ground level was 18.3 (±3.03) cm and it was started from the exposed root system itself (Plate 2). The debarking behavior of porcupine on the rubber trees (n=27) and consumption of newly sprouted bamboo culms (n=42) was also recorded from the Edavanna Forest Range (Plate 03). The debarking as girdling was not observed in coconut trees. In rubber trees, the girdling has occurred and the average length of the basal portion without bark from the ground level is 9.65 (±1.83) cm. A significant difference

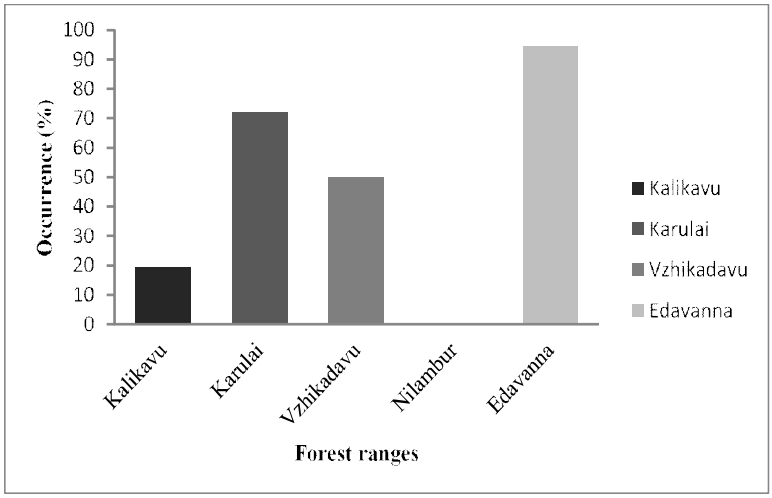


Fig 2: Incidence of crop damage by Indian crested porcupine in various Forest Ranges.

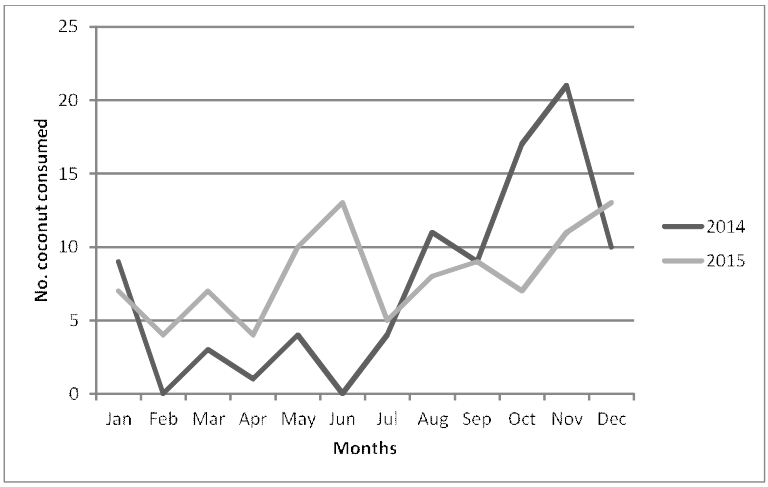


Fig 3: Yearly difference in the coconut consumption by Indian crested porcupine.



Plate 1: Coconut husk removed by Indian crested porcupine.



Plate 2: Debarked basal portion of coconut tree.



Plate 3: Debarked basal portion of rubber tree.

in the length of the basal portions without bark was observed in these two plant species (t= 11.800 p < 0.001). The debarking mark on the coconut palm was observed more frequently from October to February, which is similar to the finding from Karnataka (Chakravarthy and Girish 2007). The damage on fallen coconuts, rubber trees and coconut palms by Indian crested porcupine were recorded within a distance of 300 m from the Reserve Forest. Chakravarthy and Girish (2007) also reported that crop damage by Indian crested porcupine was severe nearby of Reserve Forest.

Many studies reported the attack of Indian Crested Porcupine on forest plantations and other trees (Ahmad and Chaudhry, 1977; Sharma and Prasad, 1992; Khan *et al*., 2010; Khan *et al*., 2014). The rubber trees over 15 years of age were debarked in the basal portion by the Indian Crested porcupine reported in this study was not reported in previous studies. Even though the mortality of the trees due to the girdling by Indian Crested Porcupine was reported earlier in many studies (Ahmad and Chaudhry, 1977; Greaves and Khan, 1978; Sharma and Prasad, 1992) no such observation was there in our study area. The forest edge sharing the boundary of the rubber plantation near to selected plot of Edavanna Forest Range was filled with bamboo. The bamboo clump sprouting occurred during the October to December, during this period no new attack was observed

Table 2: Economic loss due to Indian crested porcupine.

Forest Range	Economic loss (Rs.)
Kalikavu	364.32
Karulai	1,416.80
Vazhikadavu	580.21
Edavanna	2,928.05

Table 3: Population estimation of Indian crested porcupine (indirect signs).

Year	Forest Division	Animal density (No. /Km^2)
1997	Nilambur north	575.01
	Nilambur south	930.10
2002	Nilambur north	46.11
	Nilambur south	38.96
2011	Nilambur north	1844.21
	Nilambur south	1481.88

Easa and Jayaraman, 1997; Easa *et al*., 2002; Sivaram *et al*., 2011.

on the rubber tree whereas the consumption on newly formed bamboo clumps was recorded. However, no such change was observed on the consumption of fallen coconuts (Fig 3). The population status of Indian crested porcupine in the District showed a drastic decrease in 2002, compared to 1997, in both the Forest Divisions of Nilambur and then it again resurged into a high figure in 2011 (Table 3).

CONCLUSION

In the current study the negligence of the farmers towards the fallen coconut in the field and the over hype on the crop raiding incidences of large mammals like elephant and wild pig, along with the lack of quantified data on the crop loss to Indian crested porcupine was the reason for the increased occurrence of Indian crested porcupine in the plantation crops near the forest. The girdling on the basal part of the rubber trees will affect its health so that it creates the huge psychological problem for the farmer and also causing economic loss as the affected tree has to be treated with some chemicals for curing. No one has given attention to implementing proper mitigation measures against the

attack of Indian crested porcupine in the District. This study will help to change the farmer's attitude as they can aware of the potential loss and thereby proper management strategies can be implemented to reduce the problem.

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