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PJBS

ISSN 1028-8880

Pakistan Journal of Biological Sciences

ANSInet
Asian Network for Scientific Information
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

Pakistan Journal of Biological Sciences 7 (10): 1745-1749, 2004
ISSN 1028-8880

Relative Density of Porcupine (*Hystrix indica*) Population in Forest Plantation by Food Station Transect Method

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Abstract: Relative density of Porcupine (*Hystrix indica*) was recorded in forest plantation near Lalian, Tehsil Chiniot, District Jhang from March 1990 through March 1991. The objective of the study was to correlate the relative density of Porcupine with the density of active porcupine burrow systems. Three transect lines having 10 food stations spaced 100 m apart were operated for four consecutive days during the months of March (1990), May (1990), July (1990), November (1990), January (1991) and March (1991). The index values calculated (average of the four days of operation) varied greatly from month to month. In transect line 1 visitation index varied from 18 to 53%, in transect line 2 from 10 to 58% and in transect line 3 from 23 to 60%. The monthly indices of all the three transect lines varied from 18 to 53%. The average distance recorded between the food stations of transect line 1 and live burrows of Porcupines was 340.70±60.10m and the similar averages for transect line 2 and transect line 3 were recorded i.e. 324±29.09 and 655.20±27.61 m, respectively. So far as the active porcupine burrows present in the forest plantation are concerned, in the March (1990) survey, 7 simple and 11 complex burrows, in November (1990), 6 simple and 12 complex and in March (1991), 6 simple and 13 complex burrows were recorded.

Key words: Relative density, porcupine, population, forest plantation, food station

INTRODUCTION

Man has made remarkable advances in agriculture by adopting modern technology. But millions of people are still facing malnutrition and starvation. Of these the most important single fact or, however, is losses to food crops by the pests and diseases. Throughout much of the developing world, vertebrate pests including rodents constitute significant phonetic chains and thus cause a serious limitation on agricultural production by causing colossal losses to the crops from sowing time till harvest and even during the post harvest stages[1].

Porcupines are noxious wild animals, which belong to the order Rodentia of mammals. They are commonly met with throughout the world and have long been recognized as forest pests in many countries. There are two families of porcupines: I) Hystricidae (old world porcupines) and ii) Erethzontidae (new world porcupines). Erethzontidae consists of four genera (*Erethzon*, *Coendou*, *Echinoprocta* and *Chaetomys*) and about 23 species, whereas Hystricidae has four genera (*Thecurus*, *Hystrix*, *Atherurus* and *Trichys*) and approximately 20 species.

Hystrix indica is a very cautious and shy rodent, emerging from its burrow only well after dark. During the day time it stays in its burrow which can be very extensive, with numerous side entrances and descending to considerable depths underground[2]. Recent studies on the distribution and abundance of porcupine's burrows in Faisalabad region shows that the porcupine largely burrows in the embankment of drainage canals and forest plantations. From these sites, they visit the nearby farms in the course of their nightly foraging and cause damage to various crops such as maize, potato, sweet potato and sugarcane[3,4]. Walker *et al.*[5] have indicated that porcupines could travel upto 10 miles from their dens to the feeding area often along well marked paths.

It has been identified as a serious pest of traditional as well as non-traditional crops, fruit orchards, vegetables, flowering plants and grasses[6]. Damage estimates of 52% to *Melia azadirecta* 24.3% to *Morus alba* and 1% to *Dalbergia sissoo* has been described in different irrigated forest plantations of Punjab. Severe stocking damage of 60% to *Pinus roxburghaii* and 42% to *Robinia pseudoacacia* was recorded in different areas of Terbela watershed areas. Among the vegetables, okra,

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pumpkin, carrot, bitter gourd and onion are badly damaged. In rangelands different species of grasses such as *Pennisetum divisum, Cenchrus ciliaris, Cymbopogon jwarancusa and Sorghum helepenes* are uprooted which sevely effect sustainable grazing. Damage to plastic tubing is common where drip irrigation is practiced[7].

Alkon and Saltz[8] stated that the porcupine (*Hystrix indica*) in the desert of the high lands of southern Israel fed intensively on cultivated potatoes. Yitzchak and Herr[9] reported that the porcupines fed preferably on the older underground plant bulbs. In Baluchistan porcupine regularly excavated the bulbs of *Eremumrus aurantiacus*. In the South West Punjab (Pakistan) they prefer the bark of the Persian Lilac (*Melia azadirecta*) and would systematically attack this tree in the forest plantation. The other preferred foods of porcupine were Mulberry (*Morus alba*) and Mango (*Mangifera indica*). Its active burrows have been recorded from sugarcane and wheat fields (Personal communication, Beg and Khan, 1991).

Chaudhary and Ahmad[10] concluded that porcupine ignored potato and cucumber bait, though they readily took guava and apple baits and especially to the latter. They recommended the use of potassium cyanide to apples at the rate of one gram per apple of normal size to control porcupines and reported that bait prepared with zinc phosphide, sevin and recumin were not eaten at all. Chaudhary and Ahmad[11] tried potassium cyanide, zinc phosphide, recumin and sevin at the rate of 1-15 g to apples. Only potassium cyanide bait was eaten by the animals, which resulted in 100% mortality. Zinc phosphide bait was eaten carefully, whereas recumin and sevin were not eaten at all.

In order to inhibit the porcupine depredations we need to have an ecologically acceptable method for controlling its population and monitoring its population trends following a reduction programme. The present study was designed to assess the efficacy of a methodology for monitoring trends in the porcupine population of a forest plantation. The objective of this study was to correlate the relative density with the density of active porcupine burrow systems in the surroundings of the transect line.

MATERIALS AND METHODS

Data on porcupine visit to the food stations were collected for one year (March 1990 through March 1991) by using transect lines methods. These transect lines were laid at Chak Bahadar Forest Plantation near Lalian, Tehsil Chiniot, District Jhang. All the three transect lines were operated simultaneously on bimonthly bases through out the year. Each transect line was comprised of 10 food stations at 0.10 km intervals. Whereas, transect lines were at least 3 km apart from each other. Each transect line remained operative for four successive nights.

To ensure easy access to the food stations, each of the transects was laid parallel to the motorable road and each food station for given transect was given a number from 1 to 10. Around each food station all vegetation and debris were cleared and rocks were leveled in 1 m^2 area covered it with about 1 cm layer of fine dust about the consistency of flour.

The food used was consisted of wheat balls (made by mixing wheat grain, flour, water and vegetable oil), having 3 cm diameter. Three of these wheat balls were placed in the center of each of the food station in the evening and removed (if left unconsumed) the next morning. The food material (bait) was kept at each station for four consecutive nights. Each evening before replacing the food all tracks were erased with the help of a broom.

After placement of the food in the center of the food station, an impression of "dummy track" was made with three fingers. This "dummy track" helped in knowing the working of food station. If any visible porcupine track was recorded then the station was designated as operable for the previous night. The total number of porcupine station visited was converted to indices of relative abundance. The number of inoperable nights were substracted from the total number of station nights to yield the total number of operable station nights. Using the total number of operable station nights and the total number of porcupine visits for operative period, the index of relative abundance were calculated by using the following equations[12].

$$\text{Index of relative abundance} = \frac{\text{Total porcupine visits}}{\text{Total operative station nights}} \times 100$$

Location of all the porcupine dens in vicinity of the Transect lines were mapped and counted. The distance to the nearest four dens from each of the food station of a given Transect was also noted.

RESULTS AND DISCUSSION

Table 1 shows combined visitation values for each of the four days of the six operation periods of the three Transect lines separately as well as jointly. The combined average visitation index for the three transect lines was 35% on the first day, 36% on the second day, 41% on the third day and 49% on the fourth day. There was a gradual increase in the visitation index values from day one through day four.

Table 1: Porcupine visits to active food stations on the four days of the transect operation

	Day one	Day two	Day three	Day four
Transect 1				
Number of active stations	60	60	60	60
Number of porcupine visits	18	17	19	19
Visitation index	31	28	32	38
Transect 2				
Number of active stations	59	60	60	50
Number of porcupine visits	23	25	27	28
Visitation index	39	42	45	56
Transect 3				
Number of active stations	50	50	50	50
Number of porcupine visits	18	20	23	21
Visitation index	36	40	46	53
Combined				
Number of active stations	169	170	170	140
Number of porcupine visits	59	62	69	68
Visitation index	35	36	41	49

Monthly variations in visitation index: Average visitation index for all the 10 food stations and four days of each of operation periods (Table 2) showed that in transect line 1, there were 39 operable station nights in March (1990), 40 in May (1990), 30 in July (1990), 40 in November (1990), 40 in January (1991) and 39 in March (1991). In March (1990) visitation index was 26%, which decreased to 25% in May (1990), to 18% in July (1990), then raised to 28% in November (1990), 43% in January (1991), which again declined to 26% in March (1991). The average visitation index values for all the six months was 29%. The monthly variation in values of the visitation index were statistically non significant ($x=4.812$; d.f.=5; $p>0.05$). In the transect line 2, operable station nights were 40 in the months of March, May and November (1990), January and March (1991). In July (1990) it was 30. In March (1990) visitation index was 10%, it increases to 28% in May (1990), to 43% in July (1990), to 58% in January (1991) and to 48% in March (1991). The average index value for all the six months was 40%. Monthly variation in the value of visitation index was statistically significant ($x =24.796$; d.f. =5; $p<0.05$).

In transect line 3, the number of operable nights were 40 in the months of May (1990), November (1990), January (1991) and March (1991). However, in July (1990) it was 30. It may be pointed out here again that this transect was not operated in March (1990). In May (1990), visitation index was 23%, which increased to 30% in July (1990), to 40% in November (1990), to 60% in January (1990) and March (1991). The average index value for all the five months was 43%. The monthly variations in the values of visitation index was statistically significant ($x=18.488$; d.f.=4; $p<0.05$). The overall average index value for transect 1 was 29% as compared to 40% of transect 2 and 43% of transect 3.

In all the three transect lines, the operable station nights were 79 in March (1990), 120 in May (1990), November (1990) and January (1991), 90 in July (1990) and 119 in March (1991). In March (1990), the combined visitation index value was 18%, in May (1990) 25%, in July (1990) 32%, in November (1990) 40%, in January (1991) 53% and in March (1991) 45%. Average index value for all the six months was 37%. The monthly variation in the index values was statistically significant ($x =38.084$; d.f =5; $p<0.05$).

Thus the visitation value was low in March (1990), which consistently increased through January (1991) and then slightly declined in March (1991). The index values for March (1990), May (1990) and July (1990) were much smaller as compared to those of November (1990), January (1991) and March (1991). Another note able point is that the index value in March (1990) and March (1991) were considerably different.

Results given in Table 3 showed the average distance of the nearest four porcupine burrows to each of the 10 food stations of transect line 1. The average distance between the burrow and food stations ranged from 222 to 412 m and average distance for all the 10 food stations was 340.70±60.10 m.

In transect 2 the average distance between the burrows and food stations ranged from 275 to 375 m and the average distance for all the 10 food stations was 340.90±29.09 m. In transect 3 the average distance between the burrows and food stations ranged from 400 to 1200 m and the average distance for the 10 food stations was 655.20±27.61 m.

All active porcupine burrows present in the forest plantation were located and counted thrice, in March (1990), November (1990) and in March (1991) (Table 4). Two types of burrow systems, namely, simple and complex were recorded. A simple burrow comprised of only one opening while a complex burrow have more than one openings. During the survey of March 1990, 7 simple and 11 complex burrows were recorded in the entire plantation area. In November (1990), 6 simple and 12 complex burrows were noted. While in March (1991), the number of simple and complex burrows was 6 and 13, respectively. Very less change was recorded in the number of burrows indicating a stable population of porcupines in the forest plantation.

The results described above showed that the visitation index value generally improved over the four days of operations. In the lumped data of three transect lines, for example the visitation index was 35% on the first day, 36% on the second day, 41% on the third day and 49% on the fourth day. It may be possible that if the transect line had been operated for longer period of time the visitation index might have further improved. Here it is interesting to point out that Muhammad[13], who

Table 2: Bimonthly visitation data for the transect lines of the forest plantation

	Mar. 1990	May 1990	Jul. 1990	Nov. 1990	Jan. 1991	Mar. 1991	Combined
Transect 1							
Number of operable station nights	39	40	30	40	40	39	228
Number of porcupine visits	10	10	7	11	17	10	65
Visitation index	26	25	18	28	43	46	29
Transect 2							
Number of operable station nights	40	40	30	40	40	40	230
Number of porcupine visits	4	11	13	21	23	19	91
Visitation index	10	28	43	53	58	48	40
Transect 3							
Number of operable station nights	-	40	30	40	40	40	190
Number of porcupine visits	-	9	9	16	24	24	82
Visitation index	-	23	30	40	60	60	43
Combined							
Number of operable station nights	79	120	90	120	120	119	648
Number of porcupine visits	14	30	29	48	64	53	238
Visitation index	18	25	32	40	53	45	37

Table 3: Relationship between average food station-burrow distance and the visitation index

	Average distance from nearest 4 burrows (m)		
Station number	Average	Range	Visitation index
Line 1			
1	387	250-600	8
2	312	200-450	33
3	222	50-450	54
4	275	75-650	33
5	312	250-450	17
6	362	350-400	29
7	412	400-450	46
8	400	300-450	29
9	375	200-500	42
10	350	150-650	13
Mean	340.7	50-650	
S.D	60.1		
Line 2			
1	350	150-600	21
2	350	225-500	63
3	325	225-450	33
4	350	250-450	42
5	375	250-550	54
6	312	100-650	63
7	312	100-750	46
8	300	100-750	42
9	275	100-850	38
10	300	150-900	29
Mean	340.9	100-900	
S.D	29.09		
Line 3			
1	712	400-1200	20
2	685	400-1150	50
3	675	425-1100	45
4	665	450-1050	65
5	625	500-950	65
6	625	550-900	45
7	640	575-850	50
8	625	500-700	30
9	650	600-650	20
10	650	600-650	20
Mean	655.2	400-1200	
S.D	27.61		
Overall Mean	440	50-1200	
S.D.	155		

Table 4: Active porcupine burrows present in the forest plantation

	Number of active burrows			Number of openings of complex burrows	
Month of survey	Complex	Simple	Total	Total	Average
Mar. 1990	11	7	18	69	6.27
Nov. 1990	12	6	18	76	6.33
Mar. 1991	13	6	19	81	6.23

operated Transect line on the embankment of a drainage canal, reported that maximum index values were generally obtained on the second day of the four operation days.

The discrepancy between the present study and that of the Muhammad[13] study with respect to maximum visitation index might have been related to the distance of the transect line from the porcupine burrows. In the case of former study, the average distance between transects and porcupine burrows was 96.68±72.52 m (ranging 50-650). In the present study this distance was 440±155 m (ranging 50-1200). Clearly in the forest plantation of the present study, the porcupine burrows were located at greater distances from the transect lines. Naturally it should have been relatively more difficult for the forest plantation porcupines to locate food station transect lines as compared to the porcupines of the drainage canal.

In the present study the overall visitation index was 37% for all the three transect lines. As compared to this, the overall visitation index for the three transect lines operated by the Muhammad[13] was 73%. This difference in the visitation index values seems to be related to the difference in the average distances between the porcupine burrows and transect lines. Another considerable factor is the density of porcupine burrows. In the forest plantation of the present study only 18 burrows of porcupines could be located, whereas in the vicinities of the Muhammad[13] study three transects were heavily infested with the porcupine burrows. Transect was related to shorter distance between the burrows and transects and heavier infestation of the area around these transects with porcupine burrows.

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