

Population Density and Habitat Preference of Indian Peafowl (*Pavo cristatus*) in Deva Vatala National Park, Azad Jammu & Kashmir, Pakistan

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Abstract.- The present study determined population density and habitat use of Indian peafowl (*Pavo cristatus*) in Deva Vatala National Park of Azad Jammu and Kashmir, Pakistan. Peafowl was found between 320 and 400m elevation above mean sea level (amsl) in the study area. Overall population density of peafowl in all habitats of the park was 10.13 birds per km² while it was 11, 19.79 and 5 birds per km² in open areas, natural forest and cultivated areas, respectively combined for both the ranges. Population density at Deva Range was 18, 10.42 and 6 birds per km² while in Vatala Range, it was 4, 18.75 and 4 birds per km² in open areas, forest habitat and cultivated areas, respectively. Indian peafowl preferred forest habitat where its population density was 19.79 birds per km², followed by open areas having 11 birds per km². Vegetation analysis of peafowl habitat showed that collectively herbs dominated flora of study area (35.47%), followed by grasses (27.38%), shrubs (20.34%) and trees (16.79%). Grasses were dominant in open areas (31.48%), in cultivated areas (40.24%) while shrubs were dominant in natural forest (29.24%). Major threats to Indian peafowl in the study area were habitat degradation, hunting, disturbance and livestock grazing pressure. Strict law enforcement to control illegal hunting, egg collection and stone crushing in the park area is required. Provision of better livelihood options to local people, energy sources, forage reserves for livestock would be helpful for conservation of Indian peafowl population and other wildlife of the park.

Key words: Indian Peafowl, population density, habitat use, threats, Deva Vatala National Park.

INTRODUCTION

Indian peafowl (*Pavo cristatus*), also known as blue or common peafowl, is the largest bird of family Phasianidae (Roberts, 1991). In Pakistan, major portion of its population is now found only in extreme south-eastern region of Sindh province around Tharparker, however, its small populations are also found in north-eastern border areas of the Punjab province (Roberts, 1991), including border belt in district Narowal, northern Punjab (Akbar *et al.*, 2005), where it moves between Pakistan (for feeding during the day) and Indian territory (for roosting at night). It was earlier reported to be thinly but widely distributed in areas of Vatala and Deva in Azad Jammu & Kashmir (Azam *et al.*, 2007).

Indian peafowl inhabits scrub forest occupying mostly edges of the forests (Johnsgard, 1986). They can be found in dry deciduous, moist deciduous, semi-arid regions, near agricultural fields

and water sources. Generally, they prefer habitat that contains mixed patches of scrub forest and open plains. They also need lekking sites and areas where they can take dust bath. They are observed to lie on dusty areas and rub their feathers with dust so as to remove broken feathers and parasites. That is why they are more abundant in semi-arid areas (Ramesh and McGowan, 2009).

Indian peafowl has been listed as Least Concern globally (IUCN, 2015). Roberts (1991) reported it as rare in wilderness areas of Pakistan. Indian peafowl has long train feathers which make it attractive and prominent for humans and predators (Gadagkar, 2003). The population of Indian peafowl is on the decline and has become locally extinct from some areas of its past distribution range (Ramesh and McGowan, 2009; Divya and Sarita, 2013). There are numerous threats to its existing populations including; habitat loss and degradation, human population pressure, illegal poaching, intensive agricultural practices and use of pesticides, retaliatory killing, collection of eggs for consumption and killing for medicinal purposes. In Pakistan, peafowl has been extirpated from many

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0030-9923/2015/0005-1381 \$ 8.00/0
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parts of its former range due to trapping and illegal poaching of this beautiful bird. This peacock is prized as a pet bird and its colorful feathers are also used in a variety of decorative items.

Due to very limited studies on Indian peafowl in Pakistan, exact estimates of surviving population of this species are not available. The present study aimed to estimate population density, habitat status and utilization and threats to Indian peafowl in Deva Vatala National Park, Azad Jammu and Kashmir. The results of this study would provide baseline information for developing management and conservation strategies for Indian Peafowl.

MATERIALS AND METHODS

Study area

The study was conducted in Deva Vatala National Park (32°51'-32°55' N and 74°16'-74°24' E) at elevation range of 306 m-411 m amsl having an area of 2993 ha, situated in district Bhimber of Azad Jammu and Kashmir, Pakistan (Figure 1). The area was upgraded as national park in 2007 and is surrounded by River Tavi and occupied Kashmir in the east on Line of Control (Subhani *et al.*, 2010). The park has mixed terrain of small mountains, ridges and plain areas having crop cultivated fields intermittent with natural vegetation, with dry sub-tropical climatic conditions. Maximum temperature of 38°C was recorded in June, 2011 while the minimum temperature of 5.72°C was recorded in December, 2011. In winters, nomads shift their livestock to this area for grazing and leave in April. The presence of rocks in the soil makes it hot spot for stone quarrying which poses a threat to biodiversity of this area. The park contains sub-tropical, semi-evergreen vegetation dominated by plant species like *Ziziphus nummularia*, *Ficus bengalensis*, *Dalbergia sissoo*, *Mangifera indica*, *Acacia modesta*, *Acacia nilotica*, *Lantana camara*, *Adhatoda zeylanica*, *Dodonaea viscosa*, *Carissa opaca*, *Dasmostachya bipinnata*, *Saccharum spontaneum* and *Cynodon dactylon* (Azam *et al.*, 2007).

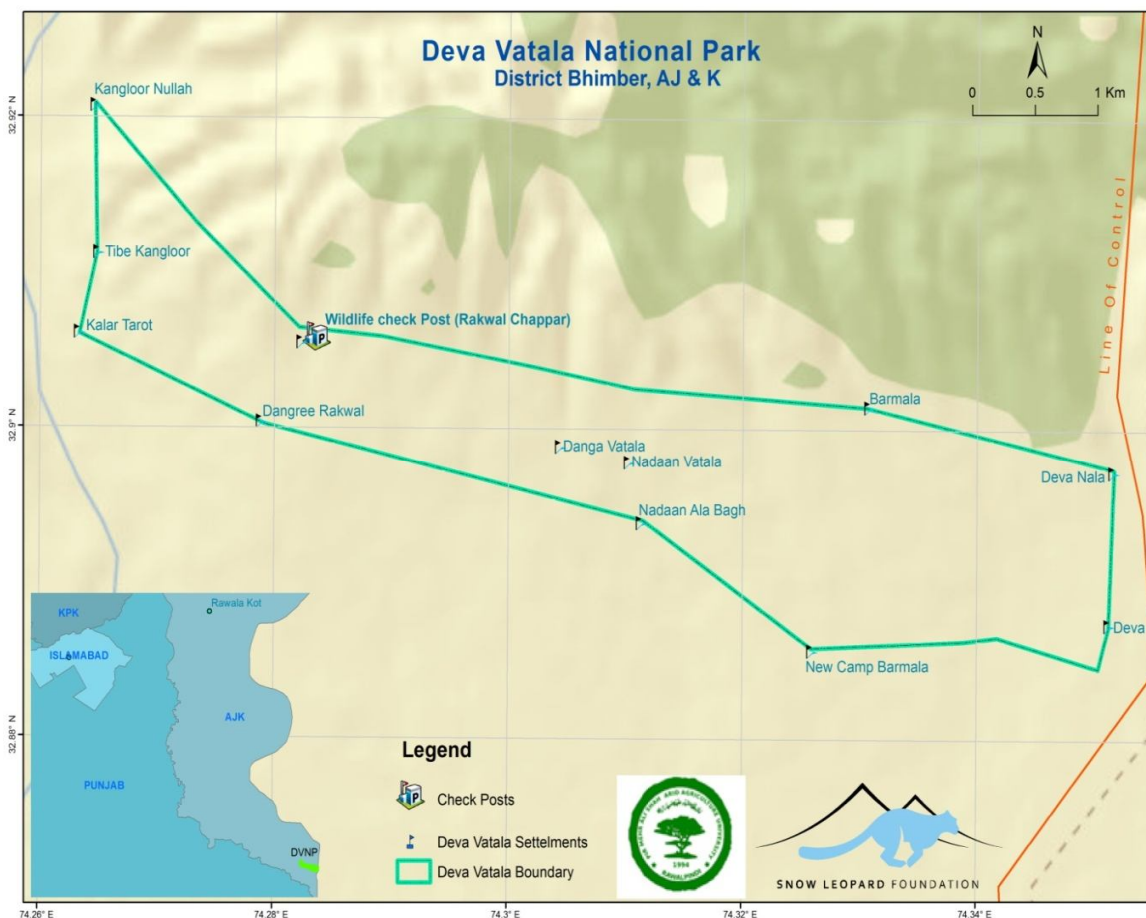
Both *Ficus bengalensis* and *Mangifera indica* are part of natural flora.

Study methods

For data collection purpose, study area was divided into two study sites *i.e.*, Deva Range and Vatala Range, further classified into three habitat types *i.e.*, open areas, forest areas and cultivated areas in each range. Based on reconnaissance survey, fixed transects of 1000 m long and 500 m wide (area 0.5 km²) were laid down in open and cultivated habitats whereas it was 1600 m long and 300 m wide (area 0.48 km²) in the forest, six transects in total in each range. Size of transects, length and width, was based on natural terrain of the area and visibility of Peafowls. Transects were taken at least 500 m apart from each other. Due to security reasons movement of researchers and use of GPS and camera was restricted in some core habitat zones of Indian peafowl which allowed only limited number of transects in peafowl habitat. Each transect was visited once in a month from September, 2010 to June, 2011. Data on population and vegetation was taken from these predetermined transects. Population density was calculated following Burnham *et al.* (1980). Habitat of Indian peafowl in the study area was analyzed by using quadrature method with the size of 10 x 10 m for trees, 4 x 4 m for shrubs and 1 x 1 m for herbs and grasses (Schemnitz, 1980). Fifteen quadrates were taken along the predetermined transects at the interval of 20 m in each habitat type of both study sites. Number of plants and cover of each species were recorded for each quadrate. Herbs and grasses were separated during sampling and later identified at Department of Botany, PMAS-Arid Agriculture University, Rawalpindi along with other samples of unidentified plants. Additional features such as slope, aspect, altitude, distance from water source, human disturbance etc. were also noted. To determine the magnitude of the Indian peafowl's vegetation preference, we calculated Ivlev's electivity indices;

$$IEI = \frac{a - b}{a + b}$$

where 'a' is the proportional use of a vegetation or habitat type and 'b' is the availability of that type. Thus, an IEI of 1.0 denotes maximum preference of a vegetation type, zero denotes use exactly according to availability and a value of -1.0 denotes



Fi. 1. Map of study area, Deva Vatala National Park, Azad Jammu and Kashmir

total avoidance (Fjellstad and Steinheim, 1996). Chi-square analysis in SPSS (version 17) at $p < 0.05$ confidence interval was used to compare population density of Peafowl among two ranges of the park and three habitat types in each range.

RESULTS AND DISCUSSION

Habitat preference

The result of IEI showed that in Deva Range the vegetation type most preferred by Indian peafowl was open area (IEI= 1), closely followed by forest area (IEI= 0.96) and then cultivated areas (IEI= 0.5). While in Vatala Range, Forest area was its most preferred habitat (IEI= 0.88) followed by open area (IEI= 0.33) and cultivated areas (IEI= 0.33). Hence, Indian peafowl collectively preferred forest habitat in the study area. Based on population

density estimates of peafowl, it seems that its preferred habitat in the park is natural forest where its population density was 14.37 birds/km², followed by open areas (11 birds/km²) and cultivated areas (5 birds/km²).

Vegetation analysis of peafowl habitat showed that collectively, herbs dominated the flora of the study area (35.47%), followed by grasses (27.38%), shrubs (20.34%) and trees (16.79%) (Figure 2). Importance Value Index of 54 plant species identified in Peafowl habitat is shown in Figure 3. Collectively, dominant plant species of Peafowl habitat in the park included *Saccharum bengalensis*, *Dalbergia sissoo*, *Adhatoda zeylanica*, *Lantana camara*, *Triticum aestivum*, *Parthenium hysterophorus*, *Cynodon dactylon*, *Ficus bengalensis*, *Dodonaea viscosa*, *Desmostachya bipinnata*, *Ageratum houstonianum*, *Heteropogon*

contortus, *Butea monosperma*, *Opuntia dillenii*, *Mangifera indica*, *Brachiaria reptans*, *Sorghum halepense*, *Gymnosporia royleana*, *Aerva persica*, *Acroptilon repens*, *Imperata cylindrica*, *Acacia nilotica*, *Acacia modesta* and *Ziziphus mauritiana* (Fig. 3).

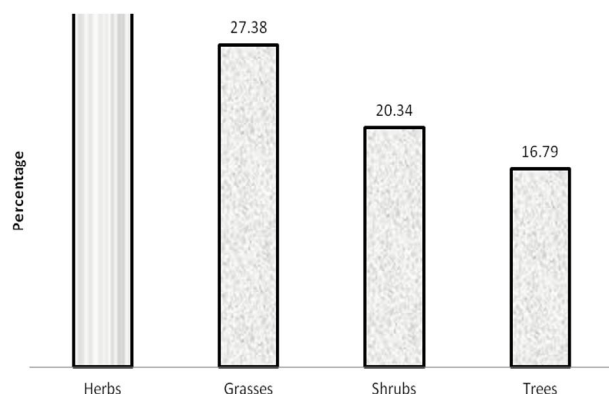


Fig. 2. Vegetation composition of Indian Peafowl habitat in Deva Vatala National Park.

Dominant plant species in natural forest habitat included *Dalbergia sissoo*, *Lantana camara*, *Adhatoda zeylanica*, *Saccharum bengalensis*, *Butea monosperma* and *Carissa opaca*. Open area habitat was dominated by *Saccharum bengalensis*, *Parthenium hysterophorus*, *Dalbergia sissoo*, *Ziziphus nummularia*, *Adhatoda zeylanica*, *Lantana camara* and *Ficus bengalensis*. Major plant species of cultivated areas included *Adhatoda zeylanica*, *Cynodon dactylon*, *Saccharum bengalensis*, *Dodonaea viscosa*, *Triticum aestivum*, *Parthenium hysterophorus* and *Heteropogon contortus*.

Most of the nesting and roosting sites of peafowl were recorded in forest habitat as it possesses tall trees. It is, therefore, an important habitat for their breeding activities. Dense shrubby layer, especially *Lantana camara* also provides good protective cover for the bird. Earlier studies conducted elsewhere also reported that Indian peafowl prefers scrub forests (Sivakumar *et al.* (2006), occupying edges of the forests (Johnsgard, 1986). The most used habitat by Green peafowl in Vietnam was also reported to be dry deciduous forest with access to permanent water and free from

human disturbance (Brickle, 2002). In Shuangbai Konglonghe Nature Reserve of China, Green peafowl were reported to inhabit mainly deciduous broad-leaved forest and evergreen broad-leaved mixed forest along the banks of rivers (Liu *et al.*, 2009).

Population density

Peafowl observations were mostly recorded between 320–400 m elevation in different habitats in the study area. Its overall population density in the park was 10.13 birds / km² (Table I). Deva Vatala National Park is smaller in size as compared to other reserves, having high disturbance due to livestock grazing and other human activities, leaving very few undisturbed areas for peafowl habitat. In Pakistan, due to lack of detailed study on Indian peafowl, no exact estimates of their population density is available. Studies conducted in India reported population density of 88.24 peafowl / km² in Rajaji National Park (Das and Sivakumar, 2009) and 53.1 peafowl / km² in Sariska Tiger Reserve (Kidwai *et al.*, 2011). These are much higher as compared to present results of Deva Vatala National Park which is probably due to larger areas of those parks, having better protection and good habitat quality.

In Deva Range, highest population density (18 birds/ km²) was observed in open area habitat followed by natural forest (10.42 birds/km²) and cultivated area (6 birds / km²) from six transects in each habitat type (Table 1). This range consisted of open areas with sandy soil where male peafowl would gather for playing, displaying and bathing during early morning and late evening hours. Disturbance by livestock during the day drives them towards adjacent forest areas with thick vegetation. In Vatala Range, highest population density of 18.75 birds / km² was recorded in forest habitat. Open and cultivated area habitats had a low density of 4 birds/ km² each (Table 1). Here, most of open area habitat has been damaged due to stone quarrying activities which disturb peafowl population. Forest habitat was comparatively less disturbed in this range, hence, most individuals were observed in that habitat. Low population of peafowl was recorded in cultivated areas in both study sites which is probably due to frequent disturbance by

Table I.- Population density of Indian Peafowl at Deva Vatala National Park

Study site	Transect #	Area of transect (km ²)	Average number of Peafowl (n)	Peafowl/km ²	Average density	Stat analysis
Deva	1	0.5	9	18	11.47	p = 0.01, χ ² = 6.42, d.f = 2 at α = 0.05
	2	0.48	5	10.42		
	3	0.5	3	6		
Vatala	1	0.5	2	4	8.91	p = 0.01, χ ² = 16.26, d.f. = 2 at α = 0.05
	2	0.48	9	18.75		
	3	0.5	2	4		
Total		2.96	30	10.14	10.19	

Key: Transect 1= Open area Transect 2= Forest area Transect 3= Cultivated area.

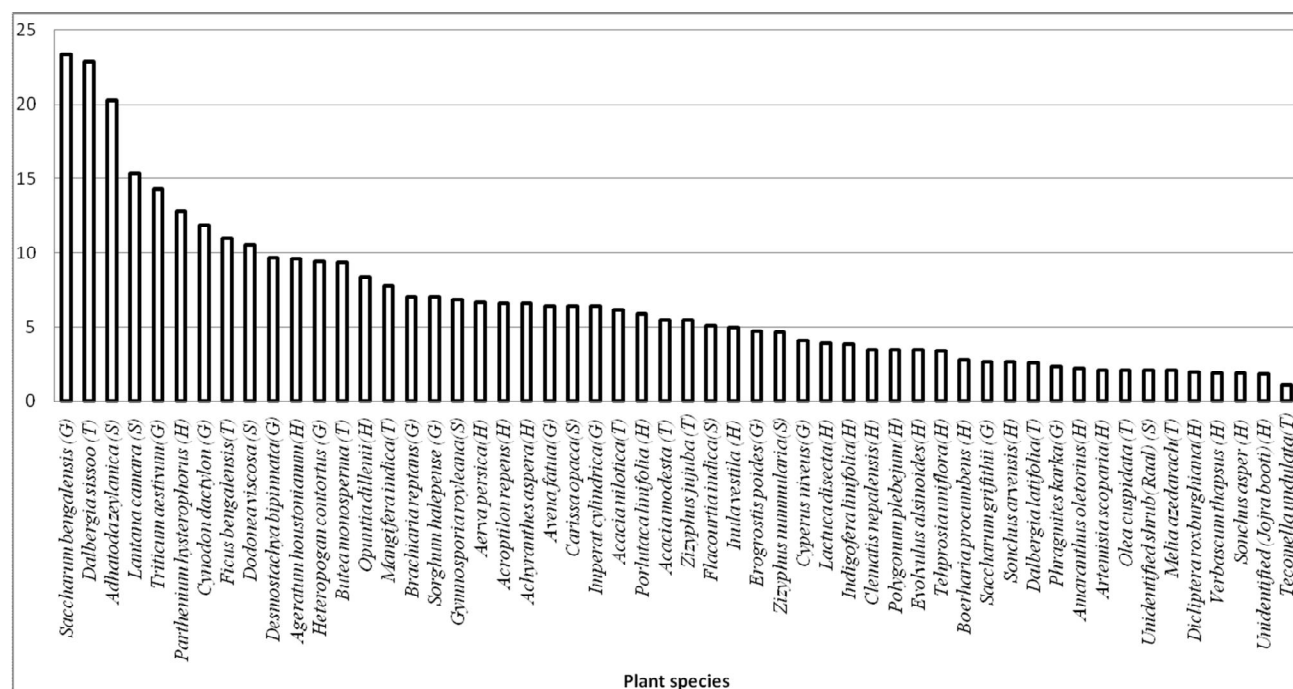


Fig. 3. Importance Value of Plant species recorded in Indian Peafowl habitat in Deva Vatala National Park.

human activities and livestock grazing. However, wheat crop in cultivated areas provided foraging to peafowl at seedling stages.

Population density of peafowl in three different habitat types was significantly different in Deva Range (p = 0.01, χ² = 6.42, d.f = 2 at α = 0.05) and in Vatala Range habitats (p = 0.01, χ² = 16.26, d.f. = 2 at α = 0.05). However, population density of peafowl between Deva and Vatala Range was not significantly different from each other (t = 0.423, p = 2.77, d.f. = 4 at α = 0.05).

Present study noted that most of male peafowl come to open areas in early morning and

late evening hours for dust bathing, display and feeding. Occasionally females were also sighted along with males, but in very low number as compared to the males, whereas females were mostly found in forest habitat. Ramesh and McGowan (2009) also reported that Indian peafowl prefers habitats with mixed patches of forest and open lands and roost at tall trees. During the present study, their presence was recorded near agricultural fields. Locals told that peafowl gather near the edges of agricultural fields when crop is at seedling stage and they nibble the juicy seedling. Some previous studies conducted in Pakistan also

suggested that peafowl prefers cultivated areas (Azam and Shafiq, 2005; Akbar *et al.*, 2005). Present study recorded that peafowl mostly roost on tall trees of *Ficus bengalensis*, *Mangifera indica* and *Butea monosperma*. *Ficus bengalensis* and *Mangifera indica* are natural trees. *Butea monosperma* although not very tall but used by peafowls for roosting. However, Roberts (1991) reported that Indian peafowl were observed roosting on Chir pine (*Pinus roxburghii*) trees in Lehtrar Valley (Pakistan) in the sub-tropical pine forest.

The most serious threats to the peafowl and other wildlife species in the study area were recorded to be habitat degradation as a result of livestock grazing, fuel wood cutting and grass collection by the local population. Burning of dry grass to clear the area for agriculture farming is also causing loss of habitat. In addition, hunting and disturbance through human activities such as stone crushing and mining also threaten peafowl population. Collection of peafowl eggs for hatching and sale to keep as pet is a common practice in this area which severely affects its population. Strict enforcement of wildlife laws is required to control illegal hunting, egg collection and other activities restricted in a national park such as stone crushing and mining. Public awareness, provision of alternate energy sources and forage reserves for livestock may be helpful to reduce pressure from peafowl habitat.

ACKNOWLEDGEMENTS

Authors are thankful to Higher Education Commission of Pakistan for financial support and Azad Jammu & Kashmir Wildlife Department for field support during the study.

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(Received 3 July 2013, revised 10 June 2015)