BEHAVIOURAL PATTERNS OF MALE BENGAL FLORICAN (HOUBAROPSIS BENGALENSIS) IN RELATION TO LEK ARCHITECTURE

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For critically endangered Bengal florican (Houbaropsis bengalensis), there is a gap in the knowledge of behavior in relation to their habitat use inside the lek. For a critically endangered lekking bird, understanding habitat use pattern and behavior is vital for management and conservation. By obtaining information on the use of habitat by a species, we can designate the size of management units as well as methods. Our study revealed that lek was situated on a seasonal drainage canal which was covered with tall grassland. Males selected display site around it in short grass patches. All the displays were performed in short grassland facing towards tall grassland near seasonal drainage canal.

The Bengal florican is the rarest bustard of tall grasslands1 with two subspecies2: (i) H. b. bengalensis in Terai and Duar in Indian subcontinent and (ii) H. b. blandini in South-East Asian floodplain of the Tonle Sap lake. In the Indian subcontinent Bengal florican is a flagship species of Terai grasslands. It is hard to find in landscape, only territorial males during display can be seen. Males are highly territorial during the breeding season3. In all Bustards strong reuse of same territory is very common4-7. Territories of male Bengal florican are often clustered together to form an exploded lek8. There are various hypothesis to determine lekking behaviour. Packman1 in his radiotellymetry study in Cambodia, found that females too remained within the exploded lek throughout the breeding season and suggested hotspot model of lekking behaviour. Grasslands are considered main habitat character for Bengal florican and strong inter-annual reuse of breeding sites by both sexes, even following habitat conversion has been observed1. It indicate that there are some other characters of habitat too rather than Grassland. To understand this aspect we intensively studied a lek of Bengal florican. Our goal in this study was to know the possible factors responsible for strong reuse of same territory within the lek by Bengal florican. In particular, we were interested to understand the relationship, if any, between display site preference and topography of the landscape.

MATERIAL AND METHODS

Present study was carried out in adjoining grasslands of the

Sonaripur forest rest house of Dudhwa national park (80.6922° to 80.7502° N, 28.4403° to 28.5044° E) from 2011 to 2013. The studied lek contains 5 display sites during study. To study the lek, we used Landsat 5 surface reflectance and DEM. Landsat 5 data was acquired from USGS Earth Explorer and DEM was acquired from Cartosat Liss IV sensor of ISRO through BHUVAN. Drainage network9-11 was also calculated. These datasets were used in study to understand landscape level patterns within the lek. The lek of Bengal Florican in Sonaripur range of Dudhwa national park was studied in detail.

To understand the composition of grassland, survey was carried out with stratified sampling method in 2011. Furthermore we made polygon of the different grassland patches inside the territory of male Bengal Florican with the help of GPS supported with GLOSNOSS to increase the accuracy. Time Distance, direction and preferred patch of the display were also recorded from watch tower situated outside the territory, while, observations inside the territory were carried out in the afternoon between 12:00 and 15:00 hours. We draw landmarks and grass patterns map of the display site on notebook. With the help of these landmarks and grass patterns we collected GPS coordinates of the patches which were associated with display flight take off and landing position and other behaviour. The direction of display was calculated by GPS coordinates.

A fusion of GRASS GIS, Google earth and R12 was used in study. Landscape level analysis was carried out in GRASS

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RESULTS AND DISCUSSION

Structure of grassland: Display sites were the patches of Imperata cylindrica which were found in Imperata cylindrica and Saccharum spontaneum type grasslands (Fig.-1). Some associated shrubs were Ziziphus mauritiana, Grewia sclerophylla, Callicarpa macrophylla, Artemisia indica and Triumfetta rhomboidea. In tall grassland dominant grasses were Saccharum bengalense with S. spontaneum sometime Imperata cylindrica is also found. The common shrubs were Artemisia indica, Ziziphus mauritiana and Callicarpa macrophylla. Along the wet area in tall grassland Phragmites karka, Typha elephantina and Narenga porphyrocoma, along with Saccharum spontaneum and Saccharum arundinaceum were found. Some other associated species were, Persicaria spp., and fern Dryopteris spp.

Arrival of male in habitat and display site selection: During the study period all the individuals of male Bengal Florican were first seen in their breeding habitat between 5 and 10 March. During the onset of the breeding season males of Bengal florican started exploring the area by roaming all around the grassland probably to find a suitable display site. Just after the arrival males preferred the burnt grasslands with harrowing. Display site was always made up of small patches of short grassland covering an area of 19030.47 ± 8459.726 sq. m, (n= 5). Imperata cylindrica followed by Saccharum spontaneum were the most dominant grasses inside the display site. Males were always sighted feeding in their territory, generally in short grass patches.

General Behaviour of male Bengal florican: Male expend most of the time inside the display site. However, at the time of threat male generally lower their head and move behind S. spontaneum patches and stay calm with observing towards threat, if the threat was approaching towards him male move in tall grassland either by walking with lowered head or by flying. During the time of evening large grassland animals such as Spotted deer (Axis axis), Swamp deer (Cervus ducuacelli ducuacelli), Barking deer (Muntiacus muntjak), Wild boar (Sus
scrofa) arrive on a regular basis and sometime wild Asian elephants (*Elephas maximus*) also arrive in the display site. They often graze on *Imperata cylindrica* inside the display site. During this time male moved inside the tall grasslands. No displays were seen during this time. Males were found moving towards the tall grassland around 12:00 and coming out around 15:00 hours often walking, also, four times male returned flying from the direction of Bankey Tal which was mostly surrounded by tall wet grassland. It is interesting to note that most of the dropping of the Bengal Florican found only in the patch in which flight display ended.

**Display Behaviour:** Displays were always performed in short grass patches mostly at the time of dawn and dusk. There was uncertainty in patches from which display started but it ended at a definite point for each display site. During the study if same display site was selected by the male for consecutive years the preferred patches and display directions remained same as preceding year. All the territories were arranged around the tall grassland. At landscape level display direction of males was towards tall grassland (Fig.-2).

**Mating and Post Mating Events:** The displays by male towards tall grassland indicate the presence of female in tall grasslands. Female floricans are very shy and remain unnoticed. We observed the female in the lek of male during the study period always moving near the tall grassland. The female often remain hidden in tall grasslands and found occasionally with the males. When female is seen, the male lowered his head and moved towards the female, both disappeared in tall grassland indicating that mating take place in tall grassland. We observed two female with chicks near tall grassland at Bankey tal in may 2011-12.

For the present study we selected the same lek which was previously studied by Rahmani *et al.*

![Fig. 2. - Frequency of display by male Bengal Florican in the study site.](http://www.novapdf.com/)
habitat use pattern. On the other hand studies in Cambodia\textsuperscript{1,14} using radio collar provided valuable information of habitat use pattern but they gave little attention to behavior.

In this study we found that the preferred display sites in lek were not changed considerably. It indicates that the size of lek did not much change during past 25 years. However there was decline in total number of displaying males in the lek. It was still the lek which contained highest number of displaying male in Dudhwa. As seen in Cambodia both sexes show strong inter-annual faithfulness to breeding sites, even following habitat conversion\textsuperscript{1}. It seems that for selection of territory by florican vegetation is not the only character of the habitat, there are other habitat characters too. We think that this character was the the presence of drainage canal due to following reason. Grassland community organization in terai region is mostly governed by soil-moisture gradient produced by flood\textsuperscript{15}, fire and soil\textsuperscript{16}. Furthermore, tall grasslands are found in the most hydric areas\textsuperscript{17}. These \textit{Imperata cylindrica} and \textit{Sachharum} grasses associations are found in relatively wet area\textsuperscript{16}. It seems that these grassland associations are governed by drainage canal. Our study revealed that not only the selected grassland but also the preferred patches were remained same during the study. The Bankey tal is the only sink along the lek, all these are situated between railway line and road both have high elevation than surroundings. Although their year of construction is unknown but these are present\textsuperscript{18} and remain unchanged till the study period. So the topography of the lek is one of the important factor which has not changed considerably during this time period, it is also a major factor governing the community organization of grassland by defining the course of drainage and distribution of soil moisture.

Furthermore all the occupied display sites were found near the drainage canal, whereas all unoccupied past display sites were found away from drainage canal. It indicates that the intensity of flow or course of drainage canal was changed which in turn changed vegetation structure and composition. Hence the site become unsuitable for display by male in long time duration between from 1988 to 2013 at the time of present study\textsuperscript{19}. After arrival male prefer same burnt \textit{Imperata cylindrica} and \textit{Saccharum spontaneum} type grassland patches in lek which is also confirmed by former workers\textsuperscript{13,19-21}. We think display sites are not associated with burning because male always arrive in same grasslands every year. If burnt grasslands were preferred, why they not selected other grasslands, which were also burnt same time. It indicates there was not any relationship between burnt patches and display site selection. We think that just after arrival male prefer these burnt grassland due to high availability of insects after burning\textsuperscript{22}.

As mentioned earlier the display sites were always small patches with short grass height, mostly dominated by \textit{Imperata cylindrica}. Visibility of bare soil in display site indicates low densities of grasses. Lehmkuhl\textsuperscript{16} defined these grasslands as grazing lawns. We had also seen heavy activity of herbivores in display sites it seems these grazing lawns were the preferred patches for display.

Results indicate think male leave display site at noon in search of water as well as shade to avoid excessive heat in summer. Alonso \textit{et. al.},\textsuperscript{5} also indicated that bustards have low tolerance to heat. In peak summer (May-June) temperature reaches up to 42\textdegree C in Dudhwa national park. Most of the displays take place at evening hours\textsuperscript{13}, but we had found a less frequency of display during our study. Although we had used same method for behavioural study. The reason behind the less frequency of display may be less frequency of visit by female. In non-passerine birds, reproductive displays are the most common method of mate attraction. Direction of display flight are generally directed towards female and associated with male quality, in birds\textsuperscript{23-24}. Males displayed towards a definite tall wet grasslands patch which indicate the presence of female in tall wet grassland. In the study in Cambodia (Gray \textit{et al.})\textsuperscript{25} described the presence of female in unburned grassland. However, scenario of Dudhwa and Cambodia are different. In Dudhwa, in the condition of early burning only tall wet grassland remain unburned. In Indian subcontinent most of the females were found in tall grass, especially \textit{Saccharum spontaneum}\textsuperscript{7}. It is hard to find female in tall grasslands however in Cambodia it was seen that core area overlap occurred between sexes\textsuperscript{1}. Presence of female with chicks near tall grassland indicate female prefer for tall grasslands for foraging too. Most of the activities by female near the tall grassland also indicate that tall grasses are the preferred habitat by female. It seems male guard these tall grasslands for breeding opportunities. There is a need of further study to understand the habitat preference and behavior of female Bengal Florican.
REFERENCES