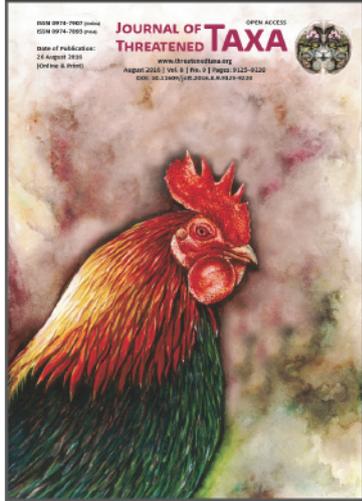


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### COMMUNICATION

#### HABITAT PREFERENCE AND ROOSTING BEHAVIOUR OF THE RED JUNGLEFOWL *GALLUS GALLUS* (AVES: GALLIFORMES: PHASIANIDAE) IN DEVA VATALA NATIONAL PARK, AZAD JAMMU & KASHMIR, PAKISTAN

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## HABITAT PREFERENCE AND ROOSTING BEHAVIOUR OF THE RED JUNGLEFOWL *GALLUS GALLUS* (AVES: GALLIFORMES: PHASIANIDAE) IN DEVA VATALA NATIONAL PARK, AZAD JAMMU & KASHMIR, PAKISTAN

### OPEN ACCESS



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**Abstract:** In Pakistan the Red Junglefowl is reported only from Deva Vatala National Park. The present study investigated the habitat preference and roosting behavior of the Red Junglefowl in three different habitat types which included a wild area, cultivated lands and a human settlement area. Habitat preference during the summer season comprised 87.50% wild area, 2.5% cultivated area and 10% human settlement area; during the winter season, the preference was 90% wild area and 10% human settlement area. More numbers of female birds (22) were seen during both the seasons as compared to males (17). The birds preferred old trees for roosting. A total of 16 roost sites were explored on five different tree species; including *Acacia nilotica* (25%), *Acacia modesta* (12.5%), *Olea ferruginea* (18.75%), *Magnifera indica* (25%) and *Dalbergia sissoo* (18.75%). The species roosted in groups of 4-8 birds and the duration of the average roosting time was about eight and half hours. We propose that similar studies on the ecology of Red Junglefowl should be conducted to get a better understanding of the species in the study area which is prerequisite for its conservation.

**Keywords:** Deva Vatala National Park, habitat preference, Red Junglefowl, roosting behaviour.

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**Author Contribution:** FA carried out field surveys, collected and compiled data and wrote first draft of MS. TM helped in reviewing initials drafts of MS. MSA supervised study. SQB, Durr-e-Shawar, MAA and Imad-ul-din-Zangi managed literature reviews and assisted during data analysis.

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## INTRODUCTION

The Red Junglefowl *Gallus gallus*, is the ancestor of the domestic chicken. It is known to utilize a variety of habitats, but is thought to prefer extensive, undisturbed mixed forested habitats for foraging as well as breeding (Ali & Ripley 1989). It occupies most tropical and subtropical habitats throughout its extensive range including mangroves, scrubland and plantations, although it seems to prefer flat or gently sloping terrain, forested edges and secondary forest (del Hoyo et al. 2001; Animal Diversity Web 2006). It is also found from sea level up to around 2,500m and from rain forest to dry lands in Southeast Asia (Delhoyo et al. 2001).

The Red Junglefowl (RJF) is distributed in the foothills of the Himalaya from Myanmar to north-western India broadening southward into peninsular India (Ali & Ripley 1987). It is additionally distributed in tropical and subtropical habitats in southern China and Southeast Asia. It has been introduced in different areas (Delacour 1951). The RJF is distributed from the Indus River down through India eastward across and down to Malaysia, Java and the Lesser Sunda Islands.

The RJF normally roosts in trees from 6–15 m above the ground (Bump & Bohl 1961). The bird species may form a close group along a limb or be scattered over different parts of the same tree at night. The same roosting site may be utilized for a long period of time unless the birds are disturbed. Johnsgard (1986) reported that the RJF roosted on large clumps of bamboo. Birds belonging to a harem flew to individual perches 5–6 m above the ground and selected a position well out on a bending cane and well screened above and below, and offering easy exit in case of imminent danger.

The RJF is relatively little affected by habitat loss since it can occupy a variety of plantations and planted fields on forest edges (Delhoyo et al. 2001; Corder 2004). However, it has recently been reported that that genetic contamination through interbreeding with domestic and feral chickens poses the real threat, pushing pure wild jungle fowl to the verge of extinction (Corder 2004; Animal Diversity Web 2006). The RJF is a resident bird of moist-deciduous forests and bamboo and scrub jungle interspersed with patches of cultivation (Ali & Ripley 1987).

The dominant tree species in Deva Vatala National Park include *Launea coromendaliana*, *Zanthoxylum armatum*, *Acacia nilotica*, *Butea monosperma*, *Mangifera indica*, *Cassia occidentalis*, *Dalbergia sissoo* and *Calotropis procera*. Shrubs include *Lantana camara* and *Ziziphus mauritiana*. The dominant herbs are *Silvia*

spp., *Saccharum spontaneum* (Sroot) and *Trichodesma indica* (Subhani et al. 2010).

At the moment, no pertinent data are available on the habitat preference and roosting ecology of the bird species in the country. It is pertinent to have baseline information about its habitat preference and roosting behavior for its future conservation perspectives.

## MATERIALS AND METHODS

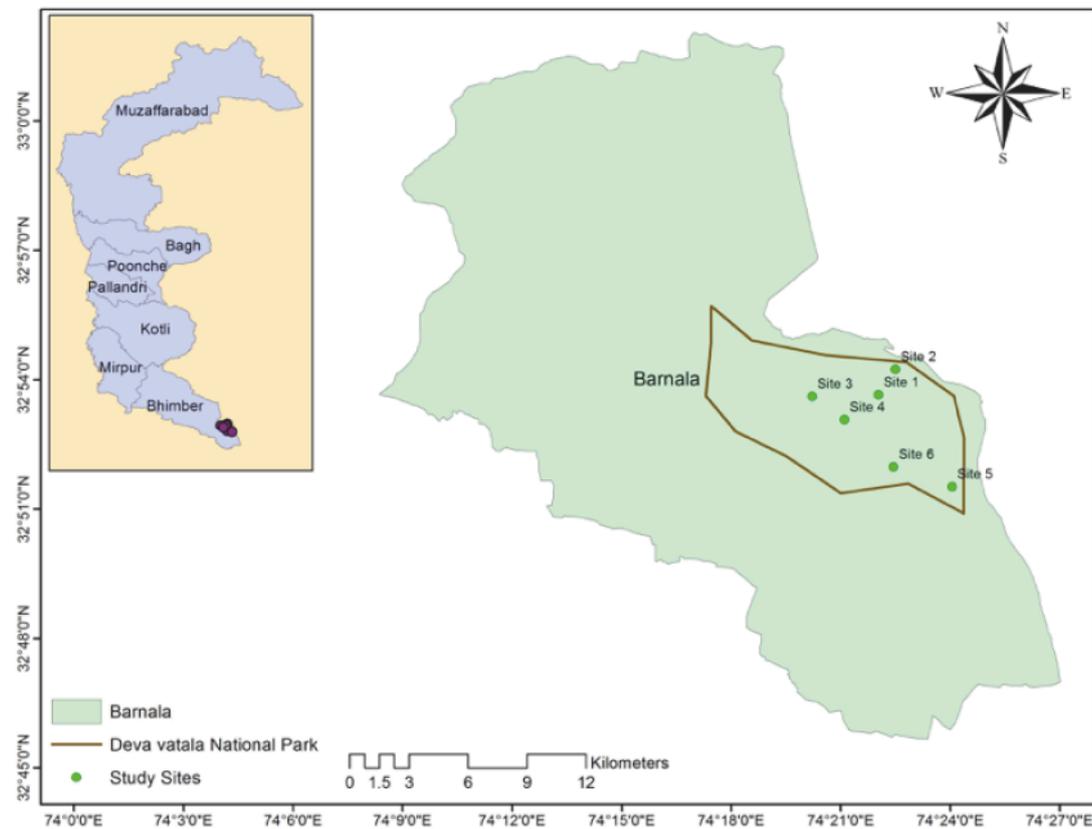
### Study area

Deva Vatala National Park (DVNP) is situated on the Pakistan-India border (32°51'–32°55'N & 74°16'–74°24'E) in district Bhimber of Azad Jammu & Kashmir, Pakistan (Fig. 1). In the east, DVNP is surrounded by River Tuvi and the Indian Jammu & Kashmir, in the west by Bhimber City, in the north by Bandala Valley and in the south by district Gujrat of Pakistan. The study area was declared as a Game Reserve in 1982, having 500ha area and was up-graded as a National Park in 2007, covering an area of 2,993ha. Its elevation ranges from 306 to 411m and it has a number of seasonal streams and small ponds. It contains undulating as well as plain areas, covered by mixed natural vegetation (GoAJK 2010).

### Field methods

Three different habitat types were selected in the study area for data collection including a wild area, cultivated land and human settlement. Data were collected from May 2010 to April 2011 by conducting regular field visits. Field observations of the species were made twice a day, once at 08:00hr and then at 16:00hr. A total of six line transects (two transects in each habitat type) were established in the study area (Fig.1). Each transect was of 1km length and 250m (on each side) wide and was visited twice a month. The area of each transect was 0.5km<sup>2</sup>. A total of 12 field visits were made during the study period. The two sampling transects in the wild area included sites 1 and 2, those in cultivated land were sites 3 and 4 and sites 5 and 6 in the human settlement area (Fig. 1).

The observations were recorded by walking on transects, supplemented by vehicle surveys. The data were collected for two seasons; summer and the winter. Habitat use pattern of the RJF was studied by direct field observations of the bird species and also by observing its indirect signs like fecal pellet, feathers, scratching on dung in each of the habitat type. During the field data collection, the sex and age of individuals were also



**Figure 1.** The study area, showing locations of the six different sampling sites in three different types of habitats, viz., wild area, cultivated land and human dwellings.

recorded to establish the male to female ratio.

Habitat type 1 (wild area) included natural vegetation and the dominant plant species were *Acacia modesta*, *Acacia nilotica*, *Mangifera indica*, *Dalbergia sissoo*, *Olea ferruginea*, *Lantana camara*, *Ziziphus jujuba* and *Dodonea viscosa*. The habitat type 2 (cultivated land) included cropping systems of wheat, maize, millet, peas, melon and water melon. While the third type of habitat in the study area (human settlement area) included tree plantations and livestock. The tree species were *Broussonetia papyrifera*, *Morus alba* and *Melia azedarach* and the livestock included domestic goat, buffalo, ox, sheep and cattle. The roosting of the RJF was explored by observing the birds directly during roosting time, the roost sites were located with the help of search lights at night and their coordinates were recorded.

#### Statistical analysis

Data regarding the habitat preference of RJF were analyzed by one-way analysis of variance (ANOVA). The three habitats were compared for both summer and winter season usage and Post Hoc LSD test was performed to check which habitat types differed

significantly. Habitat utilization of the RJF during the summer and winter season was compared using the paired t-test. One sample t-test was used to compare roosting height of the RJF. All calculations were made using SPSS (version 16.0) at 0.01 and 0.05 level of significance.

## RESULTS

### Habitat preference

During the study more numbers of RJF were observed during the summer season (n=40) and less during the winter season (n=10). A statistical analysis of summer and winter data showed that habitat utilization between summer and winter season differed significantly ( $t=10.35$ ,  $df=5$ ,  $p<0.05$ ). The RJF observed during the summer season included 13 males, 16 females and 11 chicks. Maximum numbers of RJF were recorded in the wild area (n=35) and least (n=5) in cultivated lands. Similarly, more indirect signs of RJF (13 feathers, 29 fecal pellets and 7 scratching on dung) were recorded in the wild area and least (2 scratching on dung) in cultivated

**Table 1. Summer and winter habitat preference of the Red Junglefowl *Gallus gallus* in Deva Vatala National Park, AJ&K, Pakistan.**

Season	Habitat	Direct sightings				Indirect sightings			
		Males	Females	Chicks	Total	Feathers	Faecal pellets	Scratching on dung	Total
Summer	Wild area	09	15	11	35	13	29	07	49
	Cultivated lands	01	0	0	01	0	0	02	2
	Human settlement	03	01	0	4	0	02	03	5
	<b>Total</b>	<b>13</b>	<b>16</b>	<b>11</b>	<b>40</b>	<b>13</b>	<b>31</b>	<b>12</b>	<b>56</b>
Winter	Wild area	03	06	0	09	06	16	02	24
	Cultivated lands	0	0	0	0	0	0	0	0
	Human settlement	01	0	0	01	0	0	1	1
	<b>Total</b>	<b>04</b>	<b>06</b>	<b>0</b>	<b>10</b>	<b>06</b>	<b>17</b>	<b>03</b>	<b>25</b>

lands.

The results of the one-way analysis of variance (ANOVA) showed that utilization of three habitat types by the RJF during the summer season differed significantly ( $df=17$ ,  $F=15.76$ ,  $p<0.05$ ). The Post Hoc LSD showed significant difference between utilization of wild area and cultivated lands. It also differed significantly for wild area and human settlement ( $p<0.05$ ). However, no significant difference was found in utilization between human settlement and cultivated lands ( $p >0.05$ ) (Table 1).

During the winter season, 10 RJF were directly observed including four males and six females. The maximum direct sightings were made in the wild area ( $n=09$ ) and a minimum in human settlements ( $n=01$ ), with no RJF were observed in cultivated land during the winter season. More indirect signs (06 feathers, 16 fecal and 2 scratching on dung) were recorded in wild area (Habitat type 1) and only one scratching on dung was observed in human settlement area.

One-way analysis of variance (ANOVA) showed that habitat utilization of three habitat types during the winter season differed significantly ( $df=17$ ,  $F=5.32$ ,  $p=0.018$ ). The Post Hoc LSD test showed that utilization of the wild area and cultivated lands differed significantly ( $p<0.01$ ). The habitat utilization of the wild area and human settlement differed significantly ( $p<0.01$ ) (Table 1). The habitat preferred by the RJF on the basis of direct sightings during the summer season comprised 87.50% of the wild area, 2.5% of the cultivated area, and 10% of the human settlement area. While during the winter season, the RJF preferred 90% of the wild area and 10% of the human settlement area. More numbers of female birds (22) were seen during both the seasons as compared to males (17), and the male to female ratio was 1:1.29 (Table 1).

**Table 2. Tree species preference, roost height and roosting time of the Red Junglefowl in Deva Vatala National Park, AJ&K, Pakistan.**

Plant species	Roost height (m)	Tree species age	Roosting time
<i>Acacia nilotica</i>	4.57	Mature	8 hr 40 min
<i>Acacia nilotica</i>	4.87	Old	-
<i>Acacia nilotica</i>	7.01	Old	-
<i>Acacia nilotica</i>	4.26	Mature	-
<i>Mangifera indica</i>	6.70	Old	-
<i>Mangifera Indica</i>	5.79	Old	-
<i>Mangifera indica</i>	7.01	Old	-
<i>Mangifera indica</i>	6.09	Old	-
<i>Dalbergia sisso</i>	5.48	Old	8 hr 28 min
<i>Dalbergia sisso</i>	4.87	Mature	-
<i>Dalbergia sisso</i>	4.87	Mature	8 hr 25 min
<i>Olea ferrugenia</i>	3.65	Mature	-
<i>Olea ferrugenia</i>	7.62	Old	8 hr 30 min
<i>Olea ferruginea</i>	5.79	Old	8 hr 38 min
<i>Acacia modesta</i>	2.74	Young	8 hr 33min
<i>Acacia modesta</i>	4.26	Mature	-
Mean±SE	<b>5.34±0.33</b>		<b>8 hr 33.33 min</b>

### Roosting ecology

A total of 16 roosting events of RJF were observed during the current study on five different tree species which included *Acacia nilotica* (25%), *Acacia modesta* (12.5%), *Olea ferruginea* (18.75%), *Magnifera indica* (25%) and *Dalbergia sissoo* (18.75%). The bird species roosted in groups of 4–8 birds and it preferred horizontal branches for roosting at night. The average roosting height was  $5.34\pm0.33$  m (Table 2). However, females with chicks roosted on lower branches or on the ground. The RJF departed from roosts 11–20 minutes before sunrise and arrived at roosts 10–25 minutes before

sunset. The average time spent roosting on a tree was about 8h 32min. The females roosted earlier than the male while males departed roosts before females.

## DISCUSSION

Galliformes, diverse group of birds (Keane et al. 2005), is considered one of the more threatened avian orders and globally 300 species are red listed (McGowan 2002; Brickle et al. 2008). These birds are considered as biological indicators of the habitat quality (Bhattacharya et al. 2007). The RJF is such a bird occurring in Deva Vatala National Park. We investigated habitat preference and roosting behavior of the bird species. Our results showed that among three different types of habitat, the RJF preferred the wild area over cultivated land and human dwellings. It is due to the fact that in the wild area the birds have better food resources, nesting and roosting sites. Furthermore, the wild areas provide adequate cover for Junglefowl and their chicks, and is also less disturbed.

The DVNP is basically located at the border between India and Pakistan and the areas near line of control (LOC) have thick vegetation and so offer more vegetation cover for the RJF. The calls of the bird species were mostly heard in such areas with more cover available, where mainly *Lantana camara* is the most abundant shrub of the study area. Furthermore, the RJF signs and sightings were also found higher in numbers near LOC, may be because of less disturbance and more food and water resources (Tuvi River) since there is scarcity of water during the non-raining season. In such a habitat, there is very low or almost no movement by shepherds and so is less disturbed by livestock as well. On the other hand, the other two types of habitats available to the RJF (cultivated land and human dwellings) seem to be more disturbed and so these two habitat types harbor less population of the RJF, resultantly, the population of the bird species is pushed towards the less disturbed wild areas of the national park.

A study conducted by Javed & Rahmani (2000) showed that the RJF preferred mixed forest over teak and sal forest in Dudhwa National Park in India. Selvan et al. (2013) in Arunachal Pradesh India reported that the RJF was encountered mostly in moderate canopy cover (40-50%), High shrub and low tree density area. Presence of human and livestock has a negative impact on galliforms (Bhattacharya et al. 2007). Though RJF utilizes a variety of habitats (Subani et al. 2010) it prefers undisturbed habitats for foraging and breeding (Ali &

Ripley 1989). Some earlier published studies show that the RJF prefers areas with suitable habitat, providing nesting site, nesting material, food and protection from predators (Cody 1980). Similarly, Crowell (1962) showed that within geographical areas, species are not evenly distributed across all available habitats, but tend to use some habitats more than others.

The RJF preferred the wild habitat over cultivated land and human dwellings. Some earlier published studies also reflect similar results showing that the RJF prefers a specific habitat type. The RJF used mixed forest more in proportion to availability as compared to the sal forest, which was used less in proportion to its availability (Javed & Rahmani 2000). Kalsi (1993) observed that mixed forests and plantations were used more in proportion to their availability. In summer the forest-grassland edge habitat was used in significantly greater proportion to its availability. In winter again habitat use was similar to the summer and overall habitat use patterns.

The RJF is found with the greatest frequency and abundance in the habitats to which it is best adapted. The bird species was less observed near human habitations and seemed to be affected by disturbance. Our results are quite similar to that of Crowell (1962), according to him habitat preference might change across geographical areas and over seasons. Alteration and destruction of habitats by humans can have a drastic effect on the RJF. Therefore, data on the habitat requirements of the RJF could be useful for predicting the effects of habitat destruction on natural communities.

During the present study females of the RJF were observed in greater numbers than males. In a study in India, Collias & Collias (1967) had also observed more females than males. Similarly, Javed & Rahmani (2000) in their study showed that the number of hens was higher than the number of cocks; both during the summer (510 females to 369 males) and winter (93 females to 84 males) across different habitats. In the current study, the male to female ratio showed that more females are present as compared to males in Deva Vatala National Park. Similar findings were reported by Javed & Rahmani (2000) in Dudhwa National Park in India, where he found a male to female ratio of 0.75:1.0.

In the current study, the RJF preferred horizontal branches of trees for roosting at night. The average roost height was  $5.34 \pm 0.33$  m above the ground. The species was observed roosting in groups of 4 to 8 birds. In an earlier study by Johnsgard (1986), it was reported that the RJF roosted on large clumps of bamboo tree. Birds belonging to a harem flew to individual perches 5–6 m

above the ground and selected a position well out on a bending cane and well screened above and below, and offering easy exit in case of imminent danger. Another study conducted by Nicholas & Pairath (1963) also reported that the RJF roosted on the bamboo tree. All the roosts were near water holes. According to Bump & Bohl (1961), the RJF normally roosts in trees from 6–15 m above the ground. They may form a close group along a limb or be scattered over different parts of the same tree at night. The same roosting site may be utilized for a long period of time unless the birds are disturbed.

## CONCLUSION

The present study concludes that the RJF prefers wild areas over cultivated land and human habitations and roosts in groups of 4–8 birds on horizontal branches of trees at about 5m above the ground level. More studies on the ecology of the RJF should be undertaken to generate baseline data which is a prerequisite for the conservation of the RJF in Deva Vatala National Park.

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#### Communications

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