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Factors affecting habitat selection by Mrs Hume's Pheasant *Syrmaticus humiae* (Hume, 1881) in Mizoram, northeast India

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Abstract

Mrs Hume's Pheasant *Syrmaticus humiae* (Hume, 1881) is a globally near-threatened pheasant species. It is sparsely distributed in eastern part of Mizoram, northeast India. The factors that influenced the habitat selection of *S. humiae* in the tropical montane forest are studied during January 2013 to March 2015. Based on preliminary survey a possible site of occurrence of the species was identified in the community reserved forest (CRF) adjacent to Lengteng Wildlife Sanctuary (LWS), near Myanmar border. Line transects were laid on two separate sites to determine the habitat use by the species. Physical variables were recorded on each transect sampling site. Only eight sightings are recorded at the Pine dominated area having good ground cover of tall grasses. The data analysis by principal component analysis (PCA) and stepwise logistic regressions analysis showed that litter cover and temperature plays a significant role ($p<0.05$) in the habitat selection by *S. humiae*. The possible reasons for this relationship are discussed and compared with other records.

Key words: Mrs Hume's Pheasant, Mizoram, habitat selection, community reserve forest, litter cover, temperature.

Introduction

Mrs Hume's Pheasant *Syrmaticus humiae*, (local name *vavû*) is one of the least studied species which is globally threatened (Near Threatened category as per IUCN.[1] It is known to inhabit in highly fragmented areas in India, southern China, Myanmar and Thailand.[2-6] There are two subspecies of Hume's Pheasant, one is *S. h. humiae* which is found in north-east India, particularly in eastern parts of Nagaland, Manipur and Mizoram through western Myanmar south to the Irrawaddy river, while the other subspecies *S. h. burmanicus*, occurs in southern China, northern and eastern Myanmar and extreme northern Thailand. The species is also supposed to occur in the Chittagong hill tracts of Bangladesh,[6] but this is perhaps unlikely as the given

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site is relatively low altitude for this highland species and there is no definite record for the country. The species tends to inhabit in mature pine and oak associated forest with little ground vegetation not above one metre height.[7]

In China Mrs Hume's pheasant, categorised as class-I National Key protected animal[8] has been assumed to be distributed in the Yunnan and north-western Guangxi[9,10]. The Indian Wildlife (Protection) Act, 1972 includes *S. humiae* in Schedule-I category. It is the state bird of two states under Republic of India i.e., Mizoram and Manipur.

Available literature on habitat selection by *S. humiae* came from China and Thailand only. Lianxian (1997) reported the distribution and habitat selection of the *S. humiae* in Yunnan, China[4]. Liu *et al.* (2008) studied plant communities of foraging sites of *S. humiae* in China[11]. Bei *et al.* (2010) also reported summer habitat selection of the reintroduced *S. humiae* in China[12]. Zhou *et al.* (2010) presented modelling of foraging habitats of *S. humiae* in Dazhong Mountain, south-western China[13]. Yuan *et al.* (2014) have reported summer habitat selection of *S. humiae* in fragmented sites of Jinzhongshan, Guangxi[14]. Iamsiri (2008) reported variables affecting habitat use of Hume's Pheasant in two disturbed sites in northern Thailand[15]. Iamsiri and Gale (2008) worked on breeding season habitat use by *S. humiae* in the Doi Chiang Dao Wildlife Sanctuary, Northern Thailand[16]. No literature is found from Myanmar although this country harbours both the subspecies.

In Indian context, information on habitat selection of *S. humiae* is scanty. However, Selvan *et al.* (2013) reported the habitat use of three sympatric pheasants in the eastern Himalayan lowland tropical forest of Arunachal Pradesh[17]. No habitat selection data has been published to this particular species. In northeast India, Choudhury (2005) listed 53 sites of occurrence from some regions of northeast India namely Manipur, Nagaland and Mizoram including 21 sites from Mizoram[18]. Again, Choudhury (2006) added twelve additional sites from Mizoram[19]. But, recently survey report of Sailo *et al.* (2013) recorded the presence of the species from 10 sites[20], whereas, Lalthanzara *et al.* (2014) recorded the bird from 13 sites inside Mizoram[21]. But, these are merely the distribution survey reports. There is paucity of literature on habitat selection by *S. humiae* not only in northeast but also in to context whole of Indian. Therefore, the present study is taken up to address the factors affecting habitat selection by this charismatic ground dwelling bird.

Materials and Methods

Study area

Mizoram (21,087 sq. km, 21°58'N to 24° 35'N latitude and 92°15 to 93°29'E longitude) is located in northeast India. It is sandwiched by two international borders, Bangladesh from the west (318 kms) and Myanmar from the east and south (404 kms). It has a state boundary of Manipur, Assam and Tripura and it lies in the Indo-Myanmar Biodiversity Hotspot area. Mizoram is rich in wild flora and fauna, both in diversity and abundance. Six important bird areas are recognised from Mizoram by BNHS-ENVIS which fall under IBA criteria A1-A3. The dense natural forest covers 3158.57 sq. km. which is 14.98% of the total area and this is divided into tropical wet evergreen, tropical semi-evergreen and montane subtropical pine forests. The medium dense forest accounts for 2628.08 sq. km (12.46%), less dense forest 3738.57 sq. km (17.73%) and bamboo forest occupy 67-8.37 sq. km (31.81%)[22].

Kawlbem village (23°52'15"N and 93°18'25") at an average elevation of 1530m is located in the eastern part of Mizoram and is a fringe village of Lengteng Wildlife Sanctuary. The main occupation of the villagers is shifting cultivation. Collection of firewood is the daily routine of the people. A non-governmental organization (NGO) known as Young Mizo Association (Y.M.A) maintains the Community Reserve Forest (CRF) near the village. The CRF

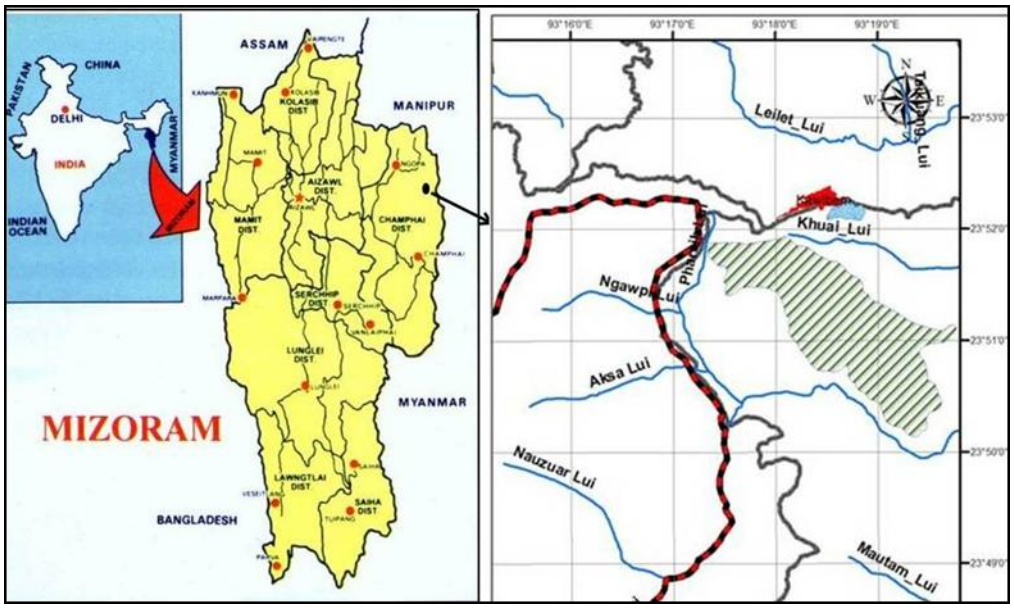

Figure 1. Study site- CRF, striped portion

(23˚51.720'N and 93˚16.534'E) encompass a cliff, one waterhole and a small stream which dry up in the dry season. The vegetation of the CRF is dominated by Pine (*Pinus* sp.), a tall grass at ground level interspersed with broadleaf evergreen forest near the waterholes and stream. The moist/damp area of the CRF is covered with wild banana and evergreen tall trees. The CRF is sometimes subjected to forest fire during the dry season which leaves the ground totally bare but, with the onset of monsoon in April/ May, the ground cover become green. The mean elevation of CRF is 1615m.

Sampling

Based on preliminary data, four habitats of *S. humiae* were identified; all were inside Kawlbem village area. Surprisingly, the sites identified were all outside the protected areas (LWS). Trails and forested path in the possible habitat area are walked thrice a month for 3 months (January - March 2013) in the early morning hours (0500hrs – 0900hrs) and afternoon (1400hrs – 1600hrs). From this preliminary survey, CRF was selected for intensive study area and the other sites are discarded as no encounter was made during the preliminary study. The study area have two line transects (Burnham et al, 1981)[23] roughly 500 m apart. The transects are studied during January 2013 to March 2015. Three member team walked along the transect for four times a month and two times in a day i.e. in the morning (0500 hrs – 0930hrs) and afternoon (1300hrs - 1530hrs). Details of the bird encountered and physical parameters like altitude, coordinate, slope, landscape, temperature, rainfall, relative humidity, cloud cover, tree, shrub, herb, grass, litter cover, distance from water source, canopy cover and wind velocity are recorded from each sampling area.

Habitat Data Analysis

The collected data were then analysed using principal component analysis (PCA) and logistic regression (step-wise method) using SYSTAT 13 software. Out of nineteen physical parameters considered, fourteen factors such as altitude, coordinate, wind, temperature, slope, landscape, relative humidity, distance from water source, tree, shrub, herb, grass, litter cover and canopy

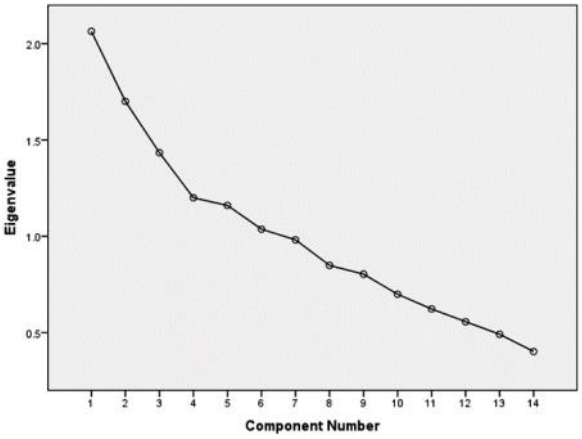

Figure 2. Scree Plot Curve.

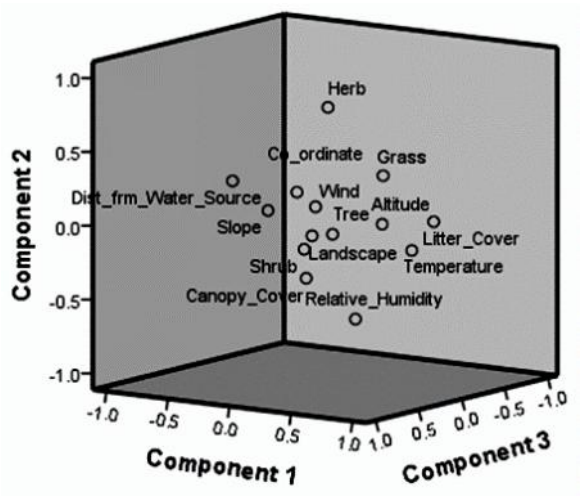

Figure 3. Component plot in rotated matrix

cover were identified for statistic analysis. The Kaiser-Meyer-Olkin of Sampling Adequacy (MSA) and Barlett's test of sphericity confirmed that the data set is appropriate for factor analysis ($p<0.001$). The latent root, percentage of variance and scree test criteria extracts six factors with eigen values higher than one that are statistically significant factors(Fig.2), and the cumulative percentage of variance for these six factors are also more than 61%. All variables are found to have significant loading on one factor after varimax rotation. After factor scores are computed, logistic regression identifies the effect of the newly extracted factors on species found to ascertain to habitat use. The most significant factors which have significantly influenced presence of species are determined by multiple logistic regression analysis of component by stepwise method (forward Wald).

Result and Discussion

During the course of study, transect at the broadleaf evergreen area did not yield even a single detection of *S. humiae,* so we assume that the bird is not using the evergreen habitat for foraging, and therefore abandoned the transect afterwards. Further sampling was continued only at Pine dominated transects. All the 8 sightings during the study were of a single male, sighted only in the Pine dominated areas. This is in line with Iamsiri and Gale (2008) who reported that Pine dominated forest was the primary habitat of the pheasant at least during the early breeding period[16]. The present study records the bird above the cliff areas where Pine tree and tall grasses fully dominated the habitat in CRF. Humphrey and Bain (1990) from their studies in Thailand observed that oak, oak-chestnut, and pine forests with interspersed patches of bracken *Pteridium* and *Imperata* grasslands were a favourable place for *S. humiae*[24]. Earlier studies made by Iamsiri *et al.* (2005) reported that the bird prefers an evergreen harwood forest mixed with dense pines and large oaks with a relatively open shrubs layer of above 1m high[7]. Fuller and Garson (2000) generalised the habitat of *S. humiae* as open and dry subtropical evergreen forests with mainly oaks of the Fagaceae or conifers of the Pinaceae[5]. Moreover, pine dominated area is known to provide important foraging materials for insectivorous birds[25].

The present study records no sightings of *S. humiae* at broadleaf evergreen areas in CRF. This may be due to unavailability of food items and the thin ground cover, which left the bird more susceptible to predator in the broadleaf evergreen forest site. However, there is a record that *S. humiae* prefer to select broadleaf ever-

green forest as habitat category throughout the year at Yunnan, China (Li *et al.* 2010), and they concluded that the key factors of habitat selection differed with seasons[26]. Again, Liu *et al.* (2008) observed that the habitat selection of Hume's pheasant was affected by plant diversity and food richness[11].

Nineteen habitat variables considered were grouped in to fourteen components. Out of these fourteen components, six most important components having eigen value >1 are extracted (fig. 2). The total cumulative percentage of these six components was more than 61%. It was finally observed that the component 1, comprising two variables, *viz.* litter cover and temperature, is found to be significant in habitat selection by *S. humiae* in CRF ($p<0.05$) (table 1). In support to the present result, Iamsiri (2008) reported that cover of ground leaf litter as one of the habitat variables significant for habitat use[15]. Bei *et al.* (2008) found grass-cover as significant factor (among others) for habitat selection by *S. humiae* from their studies at Xuangxi, China[27]. Bei *et al.* (2010) also reported a large cover of shrubs and grasses was used by the bird[12]. Iamsiri (2008) added that areas with a medium cover of ground leaf litter (69.8 %) were related to their diets and/or foraging behaviours[15]. Further, according to Liu and Zhang (2008), food was also one of the main factors that limited dispersion of *Syrmaticus*[28]. Meanwhile, from their studies at Guangxi, China, Yuan *et al.* (2014) found that the food factor was a major factor affecting summer habitat selection and other four principal components *viz.* safety, disturbance, geographical and water factors are significant ($p<0.05$) for *S. humiae* habitat selection[14]. This difference in significant factor for habitat selection by the bird may be attributed to differences in habitat type, location, parameters studied and experimental design. Li *et al.* (2009) also reported a different habitat factors as principal component such as the average height of trees, density of trees, diameters at the breast height of trees, density of shrubs, cover of shrubs and density of grasses from their studies on habitat selection of breeding Brown Eared-Pheasants in Hebei province, China[29]. Meanwhile, other report indicated that the slope and herb cover were important factors for summer habitat selection by re-introduced Mrs Hume's Pheasant in Cenwanglaoshan Nature Reserve, China[30].

Thus, we can say that, in the study area, *S. humiae* prefers habitat area with thick litter cover, temperature below 20°C; and annual average temperature is 12.4°C. This is in line with the findings of Iamsiri and Gale (2008) in the Doi Chiang Dao Sanctuary, Thailand[16]. The thick litter cover in the study area is believed to provide food source and protection against predator of Mrs. Humes' Pheasant. So, maintaining tall grass or ground cover to a required level (33.4 cm) and control of fires in order to promote thick leaf litter, reduce anthropogenic activities and habitat destruction. It is undoubtedly clear that food resource availability in different habitat patches was the vital factor affecting the habitat preference of *S. humiae*. Therefore protecting pine dominated open forest would greatly benefit the pheasant species in the CRF of Mizoram, northeast India.

Because of its relatively secretive and not particularly vocal, there are only a few sightings of *S. humiae*, occurring mostly along ridges or other relatively open pine dominated areas but with good ground cover by tall grasses, there is a pos-

Table 1. Logistic regression analysis of component by stepwise method

Variable		B	S.E.	Sig.	Exp(B)	95% C.I.for EXP(B)	
						Lower	Upper
Step 1[a]	Litter_Cover and Temperature	.019	.008	.014	1.019	1.004	1.035
	Constant	-5.030	1.224	.000	.007		

Variable(s) entered on step 1: Litter_Cover * Temperature

sibility that the analysis might be biased due to the difficulty of observing the bird in densely vegetated areas as reported by Gu and Swihart (2004), or even a steep grassy/rocky slopes[31]. Therefore, our limited transect data analysis may be enhanced by further radiotracking data and more telemetry study will be required to adequately assess fine-scale habitat use.

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