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Occurrence of Indian flying fox, *Pteropus giganteus* (Brünnich) (Chiroptera: Pteropodidae) in district Charsadda Khyber Pakhtunkhwa, Pakistan

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Abstract

Indian Flying fox, *Pteropus giganteus* (Brünnich) (Chiroptera: Pteropodidae) plays an important role in seeds dispersion and pollination of many edible and medicinal plants. The present research was conducted to determine occurrence of *P. giganteus* in district Charsadda, Khyber Pakhtunkhwa (KP), Pakistan during July-May 2011-13. Diurnal roosts of *P. giganteus* were studied in different localities including; Inzar Gul Khan Village (IGKV), Menawrai Baba Shrine Forest Plantation Village (MBSFPV) and Shakur Khan Village (SKV). *Pteropus giganteus* (n=15) were collected through the mist nets from MBSFP. The forearm length and wingspan of these bats were recorded as 174.10 ± 1.73 and 884 ± 18.17 mm, respectively. The highest abundance in MBSFPV (44%) and the lowest was recorded in IGKV (24%). They were mostly hanging upside-down over the trees. The Population of this bat species was greater in those areas where rich fruit orchards were present. A comprehensive survey will be needed to explore maximum roosts in the other adjacent areas for this species.

Keywords: Indian flying fox, distribution, habitat, Pakistan.

1. Introduction

Pakistan mammalian fauna is comprised of Ethiopian, Palearctic and Indomalayan forms that contributed 28% of the world mammalian forms. Pakistan bat fauna is comprised of about 50 bat species belong to 26 genera and 8 families. While maximum bat fauna are still waiting from exploration. Pakistan has four Pteropodidae bat species, including *R. aegyptus*, Fulvous fruit bat, *R. leschnaultii*, Indian Flying fox, *Pteropus giganteus* (Brünnich, 1782) [1]. Habitat loss, deforestation and human influence in the tropical regions of the world has reshaped the pattern of distribution of the mammals of the country [2, 3]. Salinity, water logging and alkalinity have been affected a sizeable area of the irrigated land of the country [4]. Irrigation through canal system has benefitted some bats, but irrigated forest plantation and road side plantation have altered the thorn forest landscapes [5]. A variety of crops and fruits are cultivated in Pakistan, fruit bats are considered as vermin for poaching those ripe fruits [1]. Bats play important ecological services [6] and considered as universally important bio-indicators [7]. For searching of food they travel long distances. In Bombay *P. giganteus* several kilometers across the sea to Alibag and other destinations along the sea coast for the search of food. In Madras huge colony broke into smaller feeding groups [8] and travel about 16 Km long distance to the feeding sites [2]. Indian Flying foxes are primarily feeding on fruits and flowers which are chewed and bitten off. The solids are discarded and the soft pulp and juices are swallowed. Plant sources used as food by the Indian Flying foxes from Sri Lanka to India includes flowers and flower buds of the silk cotton tree, tulip tree, *Spathodea campunulata*, red gum, *Eucllyptus rubusta*, *albi zzia*, *A. falcat*, dadap, *Erythrina lithosperma*, rubber, *Heavea brazilinsis*, coconut palms, fruits include those of the mango, *Magnifera indica*, the jak, *Artocarpus integra*, guavas, *Psidium guajava*, plantain, banana, papwa, Indian black berry [9] teak, custard apple, bread fruit, palm, date, *Phoenix sylvestris*, wood apple, together with many fruits and flowers of jungle trees [10, 11]. In non-fruiting season they chew the soft leaves and twigs of It avoids all citrus fruits, in the non-fruiting season, it is known to chew the soft leaves and twigs of semal and tamarind trees and the flower of mahua [11]. Prior going to feeding they often quench their thirst by lapping water from the surface of the river or lake, they only glide over the surface [11], of the water therefore there is no evidence that they feed on fish [12]. Although Indian Flying foxes act as pests for destruction of some fruit crops, it also plays an important role in pollination. Indian

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Flying Foxes bats disperse seed and pollinating a large variety of plants [13], more than 400 plants products useful to man are derived from 163 plants species depends upon fruit bats for pollination and seed dispersal [6]. Noting the significance of this group of mammals, the present study is designed to study the distribution of these bats throughout the district Charsadda, Khyber Pakhtunkhwa, Pakistan for the first time.

2. Material and methods

2.1 Study Area

The roost sites of Indian flying fox, *Pteropus giganteus* (Brunnich, 1782) were studied in district Charsadda (34°15' North latitude and 71°73' East longitude), having about (95319 inhabitants) KP, Pakistan during July-May 2011-13. This study was carried out in 3 quadrates including: Inzar Gul Khan Village (IZKV), Menawrai Baba Shrine Forest Plantation (MBSFP) and Shakur Khan Village (SKV). It is considered as a hub for agriculture, orchards and a wide variety of biodiversity comprised of arid, semi-arid to desert plains. The dominant crops of these areas are, wheat, *Triticum aestivum* (Linnaeus, 1753); maize, *Zea mays* (Linnaeus, 1775); sugar cane, *Saccharum officinarum* (Linnaeus, 1753) and vegetation like shrubs, trees like poplar, *Eucalyptus globulus* (L'Heritier, 1789), *Acacia arabica* (Miller, 1754) and white cedar, *Melia azedarach* (Linnaeus, 1753) are the main flora of these areas. Fruit persimmon, *Diospyros kaki* (Thunberg, 1784); guava, *Psidium guava* (Linnaeus, 1753), ber, *Ziziphus jujuba* (Miller, 1768) is the major fruits of this area. Season fluctuates throughout the year as spring from March-May, autumn from September- November, summer from May-September and winter from November-March.

2.2 Methods

Maximum exploratory visits were made to collect all information about its distribution and roost sites in 3 quadrates; IGV, MBSFP and SKV. *Pteropus giganteus* (n=15) were randomly sampled

through the mist nets in MBSFP, while only counting and observations were taken in the IZKV and SKV. For each individual of *P. giganteus*, sex, locality and roost sites were noted. The destructive ways of collection were avoided and exceeded samples of *P. giganteus* were released. Netting was kept per month throughout the year. *Pteropus giganteus* were weighed, identified through available specimens; pictorials, literature and keys; and their cranium and morphometry using digital vernier caliper® (0-150 mm: Nimit Interprise, Maharashtra, India) was measured in the laboratory.

3. Results

The present research was conducted to explore *P. giganteus* at Charsadda district, KP, Pakistan during July-May 2011-13. The samples of *P. giganteus* (n=15) were collected from MBSFPV with 13 females and 2 male; they were observed in IGV and SKV for their behaviour and abundance. These 3 localities were present at the northern end of Charsadda. This area was comprised of a large number of fruit farms like, *D. kaki*, *D. sissoo*, *F. benjamina*, *L. chinensis*, *P. domestica*, *P. persica*, while other wild fruits include *M. alba*, *M. nigra* and *Z. mauritiana* were also abundant in this area. *Pteropus giganteus* were hanging upside-down over the trees, e.g., *Eucalyptus globules* and *F. benjamina* trees in gregarious colonies in all 3 roost sites. They were observed in a diurnal roost in IGV. They were occasionally flying during the day, while active through the night in search of food. They were at high risk of killing and scarring in the area by the local farmers due to poaching of ripe fruits by them. The main crops and orchards observed were *B. vulgaris*, *D. kaki* and crops are *S. officinarum* *T. aestivum*, *Z. mays*, *D. sissoo*, *E. tereticornis*, *M. alba* and *P. tremula* in the area. The vicinity of the area was comprised of *D. kaki* prominently, while other wild fruits like, *M. alba* and *Z. jujube* were also common. The third oldest roost was located in MBSFP. This was dense forest and a large number of tree species like *D. sissoo*, *M. alba* and *Z. jujuba* were present in it (Table 1).

Table 1: Behaviour of Indian flying fox, *Pteropus giganteus* (Brünnich) roosted on different host plants

S. No	Area	n*	Female	Male	Host plants	Behaviour
1.	IGV ¹	—	—	—	<i>Eucalyptus globules</i> , <i>Acacia arabica</i>	Upside-down roosting, flying, noising, licking, crawling over the trees, feeding
2.	MBSFPV ²	15	13	2	<i>Dalbergia sissoo</i> , <i>Morus alba</i> , <i>Zizipus jujuba</i>	Upside-down roosting, flying, noising
3.	SKV ³	—	—	—	<i>Ficus benjamina</i> , <i>Eucalyptus globules</i>	Upside-down roosting, noising, crawling over the trees, feeding

¹IGV: Inzar Gul Khan Village; MBSFPV: Menawri Baba Shrine Forest Plantation; SKV: Shakoor Khan Village; n: no of bats observed

²Poplar, *Eucalyptus globules*; keeker, *Acacia arabica*; sheesham, *Dalbergia sissoo*; white mulberry, *Morus alba*; ber, *Zizipus jujuba*; white cedar, *Melia azedarck*; anjeer, *Ficus benjamina*

³SKV and IGV: bats were not collected, however, observations have been taken

The ratio of body mass (gm) and head and body length (mm) was (BM/HBL: 4:1), however, the ear-length (EL) was 39.5±1.3 (M±SD), the ratio of forearm with hind foot length was (FA/HF: 3.5:1). Moreover, the difference between 2nd and 3rd metacarpal

length was 35.2 mm, between 3rd and 4th metacarpal length was 1.3 mm and between 4th and 5th metacarpal length was 1.79 mm, further wingspan (WS) was 845.07±40.3 (Table 2).

Table 2: Morphometric measurements of Indian flying fox, *Pteropus giganteus* (Brunnich) collected from Menawrai Baba Shrine Forest Plantation, Charsadda, Khyber Pakhtunkhwa, Pakistan during May-July 2011-2013

Body parameters	n ¹	M±SD ² (mm)
Body mass	15	1121.9±38.9
Head and body length	15	270.9±6.1
Ear	15	39.5±1.3
Forearm length	15	174.1±1.7
2 nd metacarpal	15	93.2±0.7
3 rd metacarpal	15	128.4±0.9
4 th metacarpal	15	127.1±1.2
5 th metacarpal	15	128.9±1.0
Wingspan	15	845.1±40.3
Hind foot	15	49.8±1.3

¹n: number of specimens measured collected from Menawri Baba Shrine Forest Plantation

²Data were analyzed statistically by using statistica[®]; values in columns are mean±standard deviation (M±SD)

While the abundance (%) of *P. giganteus* was observed, its order was: Shakur Khan Village Inzar Gul Village (44%) > Meanawrai Babab Shrine Forest Plantation (33%) > Inzar Khan Village (23%) (Figure 1).

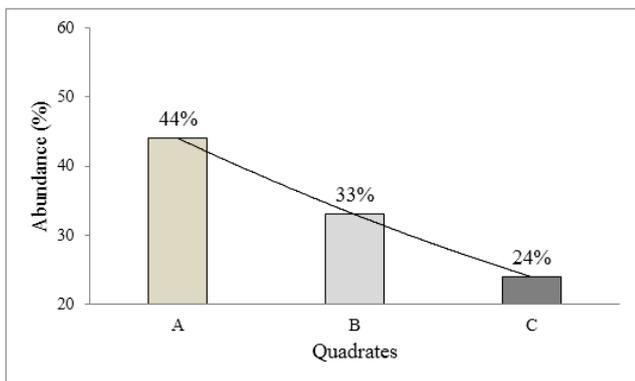


Fig 1: Abundance of *P. giganteus* at 3 quadrates in District Charsadda, Khyber Pakhtunkhwa, Pakistan, n: Number, A: Menawrai Baba Forest Plantation, B: Shakur Khan Village, C: Inzar Gul Village; data were analyzed statistically by using statistica[®] (%); trend-line: polynomial

4. Discussion

The occurrence of the *P. giganteus* of Charsadda, KP (Pakistan) was studied for the first time during the present research. Bates and Harrison [14] recorded that bats are the true flying mammals. Therefore, wingspan and forearm length were measured, which were 884±18.17 and 174.10±1.73 mm, respectively, because both parameters considered as tools for flight and movement of these bats at the present quadrates.

Mayer *et al.* [15] recorded that bats are tremendous detector of a number of climatic and environmental factors such as global climate change, forest disturbances, habitat loss and fragmentation, overhunting, urbanization and agriculture intensification. Bates and Harrison [14] stated all over the Indian subcontinent different species of Chiroptera are distributed including 119 bat species belonging to 8 families and 37 genera from Afghanistan, Nepal, India, Pakistan, Sri Lanka, Northern Myanmar, Maldives and Tibet. Bates and Harrison [14] recorded the *P. giganteus* from Pakistan, Nepal, India,

Myanmar and with a single record from China. Simmons [16] stated that among all the bat species *P. giganteus* is the world largest bat in body weight. While during the present study, *P. giganteus* were explored for the first time in 3 roosts sites (quadrates), i.e., IGV, MBSFPV and SKV in Charsadda district, KP, Pakistan. These roosts were comprised of only this single species of the family Pteropodidae. These roosts were the temporary sites for these bats and were then migrated to an unknown area on the inset of the winter.

During the present study, the maximum body weight was recorded 1121±38 g, while their head and body length was 270±6.0 mm in *P. giganteus*. The pelage of this species was long, varied in color at the shoulder and ventral surface, independent of age, sex and climate variations. Their body was entirely covered with hairs, snout was long, ears were black and narrow at the upper tips and wings were heavy and large. Their feet were provided with claws twisted at the ends with greater thumb with claws. Therefore, they were identified easily in their roosts sites.

Bates and Harrison [14] recorded that *P. giganteus* lives in large colonies, comprised of hundreds of thousands of individuals that were commonly roosted in well-established tree site and forest. Similarly, in the present research, the second roost, SKV was comprised of thick plantation of the eucalyptus trees. While the 3rd roost sites, IGV was densely foliated and some of the *P. giganteus* were hanging over the other trees present scattered near the roost.

Bates and Harrison [14] noted thousands of individuals congregate in Paradeniya Gardens in Sri Lanka Bastawade noted that colony size varies seasonally. A large number of individuals of a colony of maximum (1078) and a minimum of (274) were observed in Poona. During the present research, *P. giganteus* was observed in gregarious condition (n=258 in IGV; n=485 in SKV; n=364 in MB SFPV), respectively.

They were found almost in colonial form at their roost sites near the fruit orchards and water bodies. Sinha, [11] noted at Kerala, 56 Km from Puna, which remains cool relatively even in Summer, individuals of bats were observed, but their number diminishes in summer, increases in rainy season and remained the same in the spring season. Colonies are usually located in close association with man and tend to be found in cities upon sheesham, *Delberjia sisso* and mango, *Mangifera indica* trees.

Individuals of the bat species were also grooming several times

include licking, scratching, cleaning of the ear and teeth grooming among adults. They hang upside down using thumb on the claw. They are migrating in the autumn in Nepal to Kathmandu valley^[17]. During the present study, two years of self-observations and interview of the locals were done in IGV, MBSFPV and SKV. They were hanging upside-down, flying, crawling over the trees, noising, eating and scratching their wings. *Pteropus giganteus* were migrating on the onset of the winter during October to next march as this is the winter season in the area, while they are coming back to the old roost on the onset of the summer during March to October, which is the summer season of the area. A variety of plant species were used as roost by the *P. giganteus* at the 3 roost sites. These include the wild fig, *Ficus palmate*; white cedar, *Melia azedarach*; paper mulberry, *Broussonetia papyrifera*; black mulberry, *Morus nigra*; white willow, *Salix alba*; black poplar, *Populus nigra*; Indian jujube, *ziziphus mauritiana*; blue gum, *Eucalyptus globules*; babul, *acacia Arabica* and common guava, *Psidium guajava*. The black poplar, *populus nigra* was the most abundant, while wild fig, *Ficus palmate* and Indian jujube, *ziziphus mauritiana* were the least abundant of all species.

Noting their ecological importance, the present study was conducted in various habitats and localities to identify their number and base line information in Pakistan. As *P. giganteus* were considered as vermin for poaching ripe fruits of the area. Therefore, farmers were using a variety of scaring techniques to run away the bats. A detailed study about their biology and ecology will be needed at their distribution sites.

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