

Preliminary Study on Status and Ecology of *Pteropus giganteus* in Aligarh City, Uttar Pradesh

Megachiropteran species Pteropus giganteus, commonly known as Indian flying fox, belongs to the Pteropodidae family. It is known as ecologically important species, with economic benefits. This species is well known for its seed dispersal and pollinating activities. Considering the importance of P. giganteus, the present study was conducted for three months (February – April, 2016), at Nagar Nigam roosting site in Aligarh district of Uttar Pradesh. To explicate the population status, bats were recorded twice in a week in the evenings before the sunset and in the early morning hours, after sunrise, by using the 'Direct roost count' method. The mean population of P. giganteus was calculated 276 in February, while in April, it was 404. Showing an increase of 46.4%, the population of P. giganteus was also facing some threats, such as electrocution and deforestation. For the variation in roosting site selection, data were collected during winter and summer seasons. During the study, the population of P. giganteus showed remarkable changes in their roost site selection. The feeding ecology of this species was examined by direct observation. A total of eight fruit plant species were identified, eaten by P. giganteus. In identified fruits that dominantly eaten by P. giganteus were Fig.

Key words: *P. giganteus*, Roosting site selection, Feeding habits, Seed dispersal, Aligarh, Uttar Pradesh.

Introduction

Chiroptera, the second largest mammalian group, involves approximately 1,232 of the species of bats, distributed throughout the world (Kunz *et al.*, 2011). Microchiroptera and Megachiroptera are two sub-orders of Chiroptera. The Microchiroptera includes all the insectivore and carnivore bats, while Megachiroptera includes only frugivorous bats, and they are represented only by single family "Pteropodidae", found throughout the Old World tropics and subtropics, from Africa through Southern Asia to Australia and on the islands in the Indian and western Pacific Oceans. *P. giganteus*, one of the largest fruit bats, is a species of Pteropodidae family, and in the Indian subcontinent, stretching from Bangladesh, China, India, Maldives, Nepal, Pakistan to Sri Lanka (Khatun *et al.*, 2014). *P. giganteus* is well adapted to live in the vicinity of human habitats such as public parks, villages surrounding urban spaces, home gardens, temples, roadside plantations, agricultural fields and factory campuses. *Ficus* trees are the most favoured roosting trees, however, they are also known to roost on *Eucalyptus globulus*, *Mangifera indica* and *Tamarindus indica* (Vendan and Kaleeswaran, 2011). *P. giganteus* is a colonial species and lives in large diurnal roosts which may comprise hundreds to thousands of individuals (Fig. 1).

Pteropus giganteus leave their roosts 20 minutes after the sunset and fly one by one in long lines, all following one another in the same direction. *P. giganteus* feed mainly on ripe fruits such as figs, mangoes, bananas and flower nectar. *P. giganteus* are animals of considerable ecological and economic importance and play an essential role in the soil fertility, nutrient distribution, pollination and seed dispersal (Kar *et al.*, 2006). Flying foxes

*Roosting and
feeding ecology
of Pteropus
giganteus
examined by
direct
observation.*

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Fig. 1: *P. giganteus* and its roosting site at Nagar Nigam Aligarh.

are considered "keystone" seed dispersers on tropical Pacific islands, because they are the only extant animals capable of dispersing large seeds (>30 mm diameter) and long distances (Rainey, 1995; McConkey and Drake, 2002). This helps in maintaining the forest diversity as well as forest regeneration. Although the IUCN's "Red List of Threatened Species" has classified this species as "Least Concerned", the numbers of individuals are decreasing consistently (Dey *et al.*, 2015), primarily due to habitat loss, electrocution and hunting. Hence, the study on *P. giganteus* is important to make the local people aware about it, and also for the conservation of their falling population.

Study Area

The study was conducted in Aligarh, Uttar Pradesh (27.8800° N, 78.0800°E). It has an average elevation of 178m asl. The city is situated between the Ganges and the Yamuna rivers, around 130 Km. away from New Delhi, the capital of India. Aligarh has the monsoon-influenced humid subtropical climate, typical of north-central India. The average temperature range is 28-38°C. The monsoon season starts in late June, continuing till early October, bringing high humidity. Aligarh gets most of its annual rainfall of 800 millimeters during these months. Winter sets in December, and continues till February. Soils of Aligarh are alluvial in nature and the area occupies the inter-fluvial area of the rivers Ganga and Yamuna in the Central Ganga Plain. The drainage of the area is controlled by the rivers Ganga and Yamuna and their tributaries. A colony of *P. giganteus* is present in Nagar Nigam (Municipal Corporation) near the Ajmal Khan Tibbiya College of the Aligarh Muslim University, with approximately 400 individuals.

Methodology

The study was conducted during the period of February to April 2016. To explicate the population status of *P. giganteus* in the evening and in the morning, the data was collected twice a week, by using "Direct roost count"

method to observe that the bats coming in the morning are equal in number or not as going for foraging in the evening. To enumerate their population, the bats were recorded during 5:00 AM to 8:00 AM, in the morning, and during 5:00 PM to 7:00 PM, in the evening. The observations were done mostly with the naked eyes depending upon the need, with the help of Olympus Binocular (10X50/DPS-1). It also helped to spot out the hiding bats. To examine the variations in roosting site selection of *P. giganteus* data were collected for 80 days. 40 days data collected during winter and 40 days during summer. Individuals of *P. giganteus* counted on each roosting trees twice a week. Feeding habits of *P. giganteus* were recorded through direct observation by using binocular. We observed that during winter, after 5:40 PM, the bats leave their roosting site in all the directions, to search for the food. For the observation of these foraging sites, the bats were tracked from their roosting site by recording their flight path and also based on the local people's information, besides taking into account parts of the plant collected for the identification on which they feed upon. Simple statistical methods were used to analyze the data.

Results

Population status

The average population of *P. giganteus* was recorded to be at 276 in February 2016, while at the end of the study (in April 2016), the population increased to 404. The minimum population of *P. giganteus* was counted was 154 in the beginning of study. The population of *P. giganteus* was increasing (Fig. 2), but deforestation and electrocution were also found to be the main threats at their roosting site. As the colony is situated in the human habitat, tree felling was seen during renovation, and new construction works inside the Nagar Nigam were also underway. The habitat therefore is anomalously disturbed by the human agencies and in future it may become major threats to the roosting site. *P. giganteus* are less

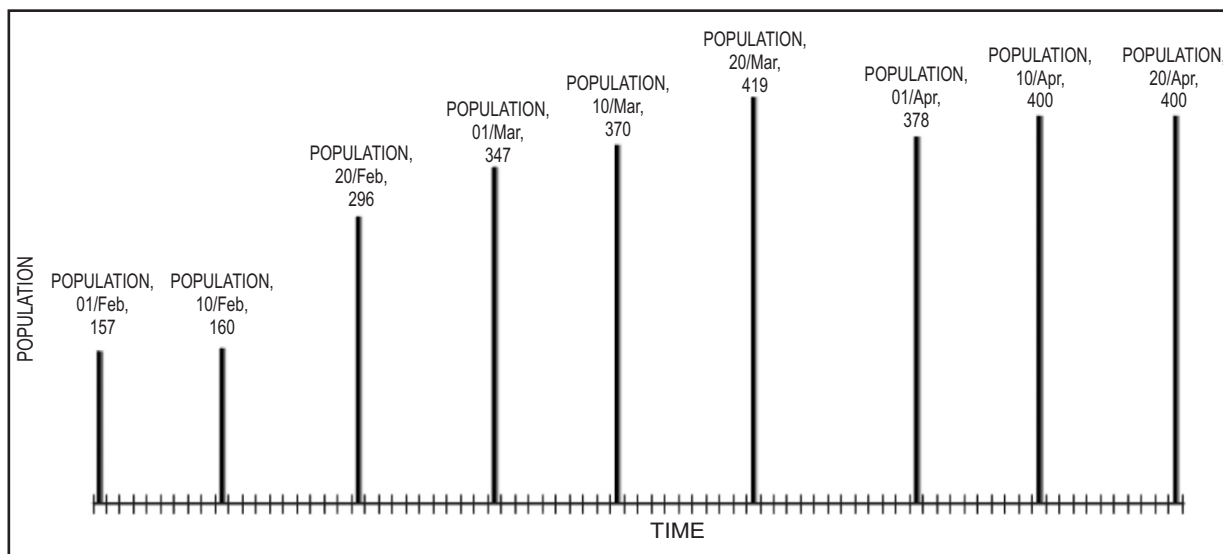


Fig. 2: Population trend of *P. giganteus* at Nagar Nigam roosting site.

successful in avoiding unexpected obstacles during the dark nights. There was a great chance of electrocution, therefore. The Electric wires were common sights everywhere. It therefore seems to be a danger to the flying species. As many as 3-4 bats died per week because of electric wire (Fig. 3).

Roosting tree selection

Total identified trees at the roosting site of *P. giganteus* were six (6), belonging to 6 different families and 6 genera. The roosting trees include the cotton trees (*Bombax ceiba*), mango (*Mangifera indica*), Peepal (*Ficus religiosa*), ashoka (*Saraca asoca*), jamun (*Syzygium*

cumini) and *Eucalyptus*. All the roost trees were woody. During the study period, maximum numbers of the roosting *P. giganteus* were recorded on *F. religiosa*, whereas the minimum numbers were recorded on *Eucalyptus*.

Seasonal variation in roosting

In winter, the bats were observed roosting with closed wings, at the edge of naked branches of the roosting trees, notably on *Ficus religiosa* and on *Bombax ceiba*. In summer, the bats were observed roosting underneath the thick foliage covers in the middle of the tree canopy, flapping their wings and mostly populated



Fig. 3: In picture under red circle died *P. giganteus* hanging to the wire and two dead individuals.

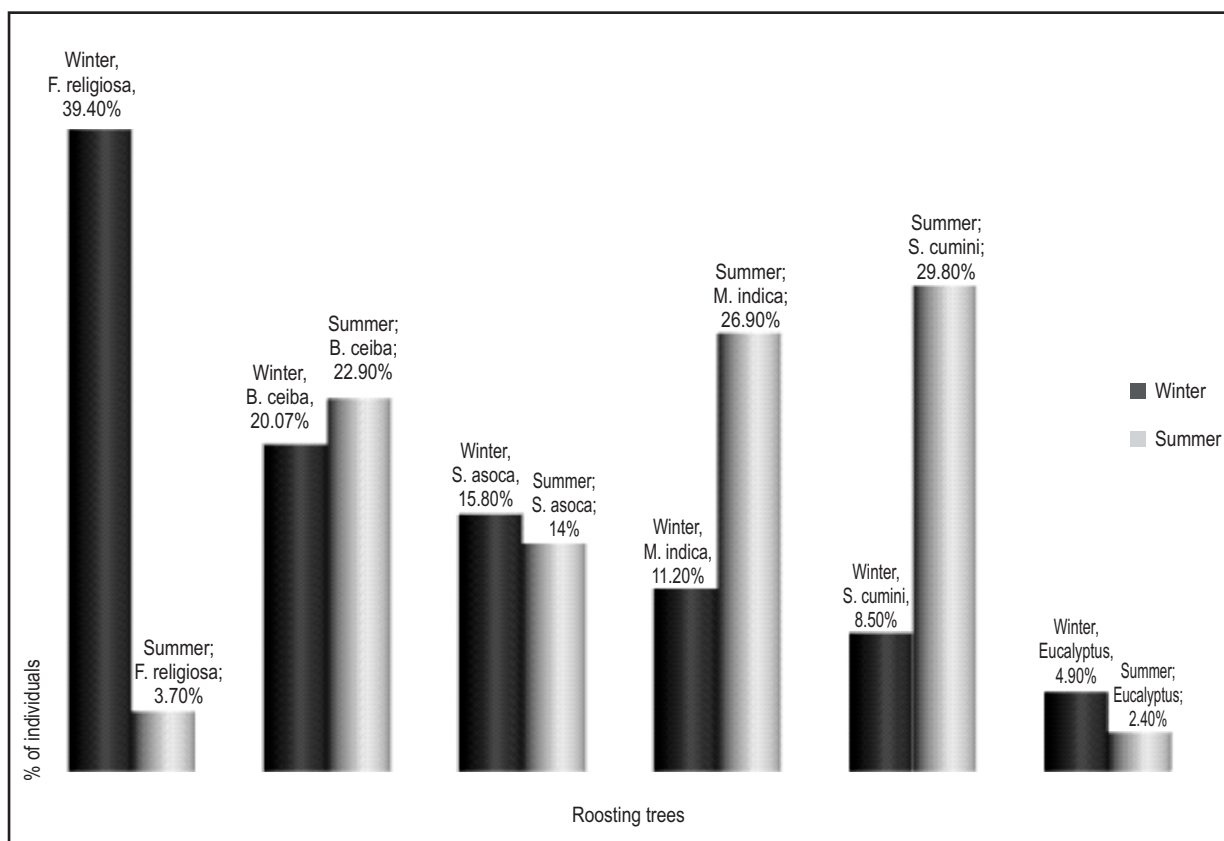


Fig. 4: Roosting variation of *P. giganteus* in winter and summer.

at *Syzygium cumini* and *Mangifera indica*. *P. giganteus* exhibit remarkable seasonal changes in roost composition, roost size and roost-shifting, this behaviour pattern of *P. giganteus* might be a response of changes in seasons and availability of food. The variations observed in the roost sizes and roost occupancy during the monthly surveys in winter and summer is shown below (Fig. 4).

Feeding habits of *P. giganteus*

A total 8 fruiting plants species eaten by *P. giganteus* were identified. Dominant fruits eaten by *P. giganteus* were *Ficus religiosa*, *F. benjamina*, *F. benghalensis*. Fruits of trees species, namely, *Ficus religiosa*, *F. benjamina*, *F. benghalensis*, *Putranjiva roxburghii*, *Saraca asoca*, *Polyalthia longifolia*, *Mangifera indica* and *Bombax ceiba* were identified throughout the study period. The highest number of *P. giganteus* were recorded to be feeding upon *P. roxburghii*, at the Tar Bangla on the Aligarh Muslim University campus, while the minimum number of these bats were recorded to feeding upon *M. indica* and *S. asoca* (Fig. 5). These bats showed highly inter-specific variations in terms of timing, amount of food production, and seasonal availability of fruits. During the month of February and March, the bats were observed to feeding on *F. religiosa*, *P. roxburghii*, *B. ceiba* and *S. asoca*. Sometimes, these bats were observed to feed upon their roosting trees *B. ceiba*, *S. asoca*, *M. indica* and *F. religiosa* at the time of foraging flight.

Discussion

Before initiating the study, on the first investigation of the roosting site, approximately 500 individuals of *P. giganteus* were observed, but their colonies were disturbed by a human intervention (an exhibition was organized by Nagar Nigam) in this period. During the beginning of study their number was considerably affected and came down to merely almost 150 at that considerable site. As the study started, the bats were observed to coming back to their old roosting site. During the exploration (18-21 February 2016), we counted the population of *P. giganteus* to be 419, which was the highest; while the lowest recorded population 154 on 1 February 2016. Throughout the study highest population of *P. giganteus* were recorded on *F. religiosa*. The major fluctuation seen in the population was their increasing number from 154 to 419 individuals. As the weekly fluctuations seen in the populations it can be said that in future the colony of *P. giganteus* at the Nagar Nigam Roosting site may be more or less stable. The population fluctuation pattern however does suggest that there could necessarily be some local movements. The database information that came out from the study could possibly be useful for future researchers to compare these sets of data with their own studies. Nonetheless, here, we do need a long term study, covering all the climatic seasons, for proper understanding of the population-regime of this site. This in turn, will give us a holistic overview on the population status of the *P. giganteus*, in the Aligarh city.

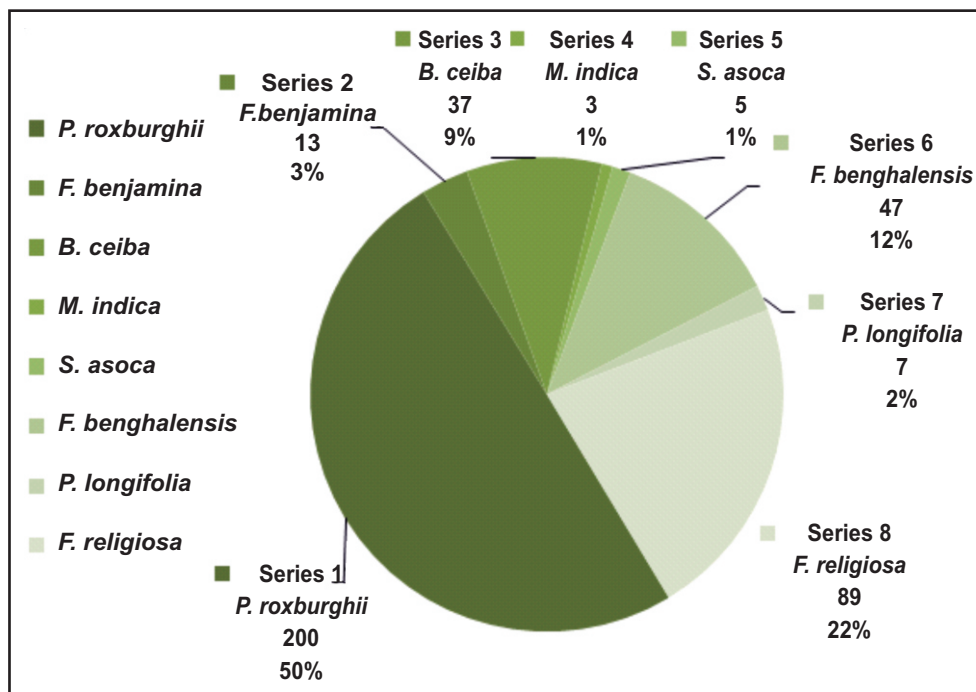


Fig. 5: Feeding % of *P. giganteus* at each identified fruit plant species.

So far as taking up the conservation measures is concerned, the site needs urgent protection from further habitat destructions and electrocution. Electrocution can be controlled by deploying underground electricity supply system. The decline of these bats raises serious ecological and economic concerns, especially when one considers their role as primary seed dispersers and pollinators (Marshall, 1985).

In the winter's mornings the bats were observed to roost on a single tree at *F. religiosa*, while in daytime and evenings, they were found at different roosting trees, such as *F. religiosa*, *S. cumini* and *M. indica*. This variation of bats is because of the higher temperature in the daytime (availability of sunshine) that make the bats comfortable to avoid the coldness in the less temperature of February. During the summer seasons very little individuals of bats were observed to roost on *F. religiosa*, in comparison with the winter seasons. In the summer bats were observed them to be roosting on different dense trees when they would return from their foraging sites. In our observation, *P. giganteus* roost selection seems to have been strongly influenced by temperature, and food availability. It was observed that taller, larger, canopy trees were preferred as roosting sites by *P. giganteus* this may be because they provide more space for these large colonies. Preference to roost in thick foliage trees may be the protection from sun or rain. As observed in summer, their excessive roost preference for the Ashoka trees, while in winter, bats prefer roosting at *Ficus* trees. *P. giganteus* prefer to roost near the human settlement and the identified roost sites were more likely to be located near the human populations. Throughout this study, maximum number (43.10%) of bats were recorded to roost on *F. religiosa*, while very little individuals (7.30%) recorded on *Eucalyptus*. This possibly may be the reason of foliage

cover of *Eucalyptus* that is not dense as like as *F. religiosa* and the fruit of *Eucalyptus* is also not a source of their diet.

The study on feeding habits of *P. giganteus* will also help to understand their importance/significance in ecosystem. *P. giganteus* consumed fruits of a variety of different colors. Maximum feeding of *P. giganteus* recorded on *P. roxburghii* because of the excessive availability of *P. roxburghii* fruits and comparatively less distance from the roosting site. Minimum numbers of bats were recorded to feed upon *M. indica* and *S. asoca*, this less feeding on *M. indica* may be the reason of mangoes were not ripen in April. Fruits observed in this study were mostly yellow and green. However, most of the fruits consumed by bats had a pleasant odour when sniffed. Moreover, guano of dark colors reflecting the colour of the fruit consumed and different coloured ejecta pellets were also found each day under the bats' roost. The majority of the 8 species of fruits eaten by flying foxes, 3 were also eaten by local people, and of these, only one were sold in local markets *M. indica*. Two species *P. roxburghii*, *B. ceiba* were also used in traditional medicine. In many countries the extent to which flying foxes eat fruit which is harvested and sold leads to conflict between bats and those picking and marketing the fruit. This often results in persecution of the bats (Aziz *et al.*, 2016) but throughout the study period, there has been no indication that such a conflict exists and local people reported no conflict in previous times either. Nearly 300 plant species of various genera mainly rely on large populations of fruit bats for their propagation and these plants produce approximately 500 economically valuable products (Fujita and Tuttle, 1991). Yet, the role of these bats in the propagation of numerous plant species still remains uninvestigated (Fujita and Tuttle, 1991).

अलीगढ़ शहर, उत्तर प्रदेश में *टेरोपस जाइगेन्टीयस* के स्तर एवं
पारिस्थितिकी पर प्रारम्भिक अध्ययन
मुशाहिद रज़ा एवं उरुस इल्यास
सारांश

मेगाचिरोप्टरान प्रजाति *टेरोपस जाइगेन्टीयस*, जिसे सामान्यतः इंडियन फ्लाईंग फॉक्स के रूप में जाना जाता है, *टेरोपोडिडा* कुल से संबंधित है। इसे आर्थिक लाभों के साथ पारिस्थितिकीय रूप से महत्वपूर्ण प्रजाति के रूप में जाना जाता है। यह प्रजाति अपने बीज छितराव एवं परागण कार्यकलापों के लिए अच्छी तरह जानी जाती है। *टेरोपस जाइगेन्टीयस* के महत्व पर विचार करते हुए वर्तमान अध्ययन उत्तर प्रदेश के अलीगढ़ जिले में नगर निगम नीड़ायन स्थल में तीन माह (फरवरी-अप्रैल, 2016) तक किया गया। आबादी स्तर को स्पष्ट करने के लिए “प्रत्यक्ष बसेरा गणना” विधि का उपयोग करके सूर्यास्त से पहले सांय काल में और सूर्योदय के बाद सवेरे के समय सप्ताह में दो बार चमगादड़ों को अभिलिखित किया गया। *टेरोपस जाइगेन्टीस* की औसत आबादी फरवरी में 276 परिकलित की गई जबकि अप्रैल में यह 404 थी। 46.4 प्रतिशत की वृद्धि को दर्शाते हुए *टेरोपस जाइगेन्टीस* की आबादी थी कुछ संकटों, यथा-विधुतमारण और निर्वनीकरण, का सामना कर रही है। नीड़ायन स्थल चयन में विभिन्नता के लिए सरदी एवं गरमी के दौरान आँकड़े एकत्र किए गए। अध्ययन के दौरान *टेरोपस जाइगेन्टीस* की आबादी ने अपने बसेरा स्थल चयन में उल्लेखनीय परिवर्तनों को दर्शाया। प्रत्यक्ष प्रेक्षण द्वारा इस प्रजाति की संभरण पारिस्थितिकी की जांच की गई। *टेरोपस जाइगेन्टीस* द्वारा खाए जाने वाले कुल आठ फल पादप प्रजातियों की पहचान की गई। *टेरोपस जाइगेन्टीस* द्वारा प्रधान रूप से खाए जाने वाले पहचान किए गए फलों को चित्रित किया गया है।

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