

**Short Communication**

## Various threats to survival of bats in district Lakhimpur-Kheri, Uttar Pradesh, India

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### ABSTRACT

Bats are unique among mammals as they are the only group that has evolved true powered flight, like aves. India has a rich diversity of bat fauna comprising approximately 119 species of bats, out of which 14 species are megachiropteran bats belonging to 8 genera and one family (Pteropodidae) and the remaining are microchiropteran bats. In Uttar Pradesh, a total of 14 species of bats are recorded. Out of which, three species belong to the family Pteropodidae and remaining 11 species belong to five insectivorous families such as Vespertilionidae, Hipposideridae, Emballonuridae, Megadermatidae and Rhinopomatidae. Previous literatures revealed that population of bats are declining day by day due various anthropogenic factors such as habitat destruction, human influences, hunting and electrocution etc. The present study also revealed major threats to survival of bat species in district Lakhimpur-Kheri, Uttar Pradesh, India. The electrocution was observed one of the major threats to *P. giganteus* in study area. The present study also made some recommendations to protect and conserve bat population.

**Key words:** Habitat destruction, Human influences, Hunting, Electrocution, Megachiropteran, Microchiropteran

### INTRODUCTION

Bats are unique among mammals as they are the only group that has evolved true powered flight, like aves. One of the 26 mammalian orders, the Chiroptera includes about 1232 species of bats which represent a quarter of the total 5487 mammalian species of the world (Schipper *et al.*, 2008; Simmons, 2010; Kunz *et al.*, 2011). A total of 128 species of bats are reported from South Asia, with the microchiropterans being better represented than the megachiropterans (115 vs. 13 species). Among the countries representing South Asia, India has more than 90% of the total bat diversity of this region. India harbors 119 species of bats, out of which 14 species are fruit-eating or megachiropteran bats belonging to 8 genera and one family (Pteropodidae) and the remaining are insect-eating or microchiropteran bats (Bates and Harrison, 1997). In Uttar Pradesh, a total of 14 species of bats are recorded. Out of which, three species belong to the family Pteropodidae and remaining 11 species belong to five insectivorous families such as Vespertilionidae, Hipposideridae, Emballonuridae, Megadermatidae and Rhinopomatidae (Elangovan *et al.*, 2015). The order Chiroptera is subcategorized as Megachiroptera and Microchiroptera, on the basis of their specialization in feeding habits and morphological adaptations. Microchiroptera, which form the majority of bat species globally, feed on insects while Megachiroptera are predominantly fruit eaters. They exhibit a great dietary diversity e.g. insect, fish, blood, fruit, nectar, and pollen (Kunz, 1982). They are contributing extensively to global biological diversity. Their diversity is reflected not only in the number

of species but also through different aspects of morphology, roosting and feeding behaviour (Fenton, 1997). In India, fruit bats are listed in scheduled-V of the Wildlife (Protection) Act, 1972 because of its wide distribution but locally this species considered as threatened because of its habitat destruction like cutting roosting trees for road expansion and other purposes (Molur, S. *et al.*, 2008). Agricultural and industrial developments and other pressures from increased human populations are common threats for fruit bats throughout the world (Hutson, A. M. 2002). Electrocution is also one of serious threats for this species. Electrocution in giant fruit bat was reported in Madikeri, Coorg district by (Molur, S. *et al.*, 2007). Population of *Pteropus giganteus* is declining both at global and national scale. This is predominately due to habitat loss and degradation, loss of large trees, reduction in food availability, introduction of power lines, hunting, etc. (Jnawali *et al.* 2011, Acharya 2015, Manandhar *et al.* 2017, Sharma *et al.* 2018). The present study was conducted to reveal major threats to survival of bats in this area and also alarms for decline of fruit bat population (*Pteropus giganteus*) by electrocution. The present study also suggested some recommendations to protect and conserve bat population.

### STUDY AREA

Lakhimpur-Kheri is the largest district of the state Uttar Pradesh in India as shown in figure 1. It is a part of Lucknow division, with a total area of 7,680 square kilometres (2,970 sq miles). The district is located within the Terai lowlands at the base of the Himalayas and

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on the border of Nepal, with several rivers and lush green vegetation. It is situated between 27.6°N - 28.6°N latitudes and 80.34°E - 81.30°E longitudes. Its topography comprises mainly four types of soils namely, sandy soil, alluvial soil, smooth soil and domat soil. Soil of Tarai areas is Clay and Domat which is dark in color and very suitable for growing of rice, wheat and sugar cane. The highest recorded elevation is 147 m. above sea level at Lakhimpur-Kheri. The climate is hot throughout the year except the rainy seasons. During summer (March to June), the temperature can reach above 40 °C (104 °F) and in winters (October to February) it can drop to around 4 °C (39 °F). The nights are very cold and fog is very common during winter. The average annual rainfall is 1500.3 millimeters, mostly in the monsoon months (July to September). Important rivers are Ghaghara, Saryu, Sharda, Kodyala, Ull, Gomti, Kathina and Mohan. Semrai and Nagaria are important wetlands and rich in biodiversity. Fulhar Jheel near Madho Tanda is a famous lake. Lakhimpur-Kheri is a forest dominated district having 165212 hectares land as forest area which is 21.38% of total land. (en.wikipedia.org and <http://www.kheri.nic.in>).



**Figure 1.** Map of study area (Lakhimpur- Kheri)

## MATERIALS AND METHODS

The regular faunistic surveys were conducted yearly to record various threats to survival of bat species in district Lakhimpur- Kheri of Uttar Pradesh over a period of five years during January 2010 to December 2015. For threats analysis, questionnaire forms were filled up among local people in the vicinity of the roosting colonies. The overall threats were ranked by the respondents. We used MS Excel and R Console version 2.15.2 for analysis. Photographs were taken by Nikon D-3500 camera.

## RESULTS AND DISCUSSION

In our previous study, a total 4 species of bats were recorded in study area. Out of which, one species belong to the family Pteropodidae, namely *Pteropus giganteus* (Indian flying fox) and three species belong to insectivorous families such as Vespertilionidae and Megadermatidae, namely *Megaderma lyra* (Greater false vampire bat), *Pipistrellus coromandra* (Little Indian bat) and

*Pipistrellus ceylonicus* (Kelaart's Pipistrellus bat). The survival of these bats in district Lakhimpur-Kheri is severely threatened due to habitat loss, loss of man-made structures, human interference, electrocution and hunting. The population of Indian flying fox, *P. giganteus* and microchiropteran bat species were gradually declining day by day. The current study alarms various threats to bat species in this region.

### Habitat destruction

One of the major threats to bats in study area is destruction of habitats and roost trees. Loss of habitats (old mango orchards and larger *ficus* tree species) by continued and uncontrolled tree felling is the major threat to the population of *P. giganteus*. These large trees are important roosting habitats for the Indian flying fox. As such tree felling is likely a main driver for the declining number of roosting bats observed in some colonies, reflecting reports made by Sharma *et al.* 2018. Bats faced loss of roosting habitat, feeding habitat, clean water in the study area. This is due to cut down of old private orchards, various fruity plants and reduction of water bodies specially ponds. A large number of old private orchards have been cut down during last two decades as shown in figure 4. Loss of these habitats led to the population decline of fruit bats. The survey as well as secondary data showed that there was extensive urbanization during last 15-20 years. During study period, 5 out of its 14 day roosts were abandoned by *P. giganteus* due to cut down of mango orchards, hunting and human interference. A total of 5673 individuals of *P. giganteus* were found in their 12 day roosts during 2010-11 and two new roosts with 1115 individuals were added in 2015 to increase their population up to 6791. However, due to destruction of their day roost at Khar-gapur, Mitauli, Bankeganj, Oyal and Bhira, only 5090 individuals were remained at present. Therefore, the population *P. giganteus* is gradually decline day by day in this region. The extensive urbanization results into loss of habitats and shifting of existing roosts. Urban development also contaminates existing water resources adversely affecting bat foraging patterns. It has been observed that the population of microchiropteran bats is decreasing in rural areas and increasing in urban and industrial areas because these are mosquito-prone areas, providing better food supplies. Bats often suffer from loss of feeding habitats due to use of pesticides which poison the bats and reduce the population of insects and from agriculture pattern which provide insufficient diversity of prey. All of these reasons cause bats to increase their daily travel which exposed them to more predators, stress, exhaustion, collisions with structures and fatality from electric wires (electrocution). The loss of human-made structures such as mud houses and thatched huts were observed to be adversely affecting the bat populations. The destruction of their roosts through the modification as well as replacement of old mud houses, thatched huts, old buildings and wells is also one of the major threats to survival of bats. Old and abandoned buildings, mud houses and thatched huts are particularly important roosts for microchiropteran bats. The loss of roosts due to development also may be an issue affecting bat conservation.

### Disturbance of bat roosts

Disturbance of bat roosts in urban and rural settings may negatively affect bat populations. Bats roosting in

urban buildings, rural houses and orchards also cause their negative images to the general public. My survey work and secondary data showed that most of the local people are not aware regarding the economic importance of bats and disturb their roosts. Most of orchard owners get rid of fruit bats by using crackers during the time of crop. Orchard owner and children of the village also create disturbances in different ways during crop season and at the time of crop harvesting. Due to these, the huge bat roosts were being disturbed and displaced which resulted in the fragmentation of the original large roosts into small roosts. Earlier a huge colony of *P. giganteus* was found in a day roost at Khargapur village, but it was restricted to only 260 in 2013 and displaced in 2014. Tree-roosting species typically rotate amongst a pool of many roosts (Lewis, 1995). Similarly, the colony of *P. giganteus* at Paraili village were observed using two different day roosts, of which one is located near the village and other one is located about 800m away from first one. On disturbances, they migrate from one roost to other roost and protect themselves. The little Indian bat, *Pipistrellus coromandra* also use a pool of many roosts on disturbances. Roosts are often considered the most important habitat component and roost switching appears to be essential for most species (Taylor, 2006). Replacement of mud-houses and thatched huts with permanent houses in rural areas drastically reduced the number of their roosts as well as population.

### Hunting

Secondary data of survey work showed hunting of *P. giganteus* on large scale in the study area during last decade for various purposes such as meat, oil, leather, medicine and museum specimens. Hunting was reported in day roosts located at Khargapur, Jugrajpur and Bhira. It was found on inquiries with local people that *P. giganteus* was still hunted for food and medicine. Its meat and oil (extract from its burned body) were used by some villagers to cure paralysis, asthma/breathing disorders and body pains. Most of bat roosts are unprotected in this region. Day roosts of *P. giganteus* at Paraili, Biharipur and Belabojhi were protected by local people and owner of orchards.

### Electrocution

Not only the habitat destruction and disturbances were the major threats but electrocution was also the serious threat for Indian flying fox, *P. giganteus*. The electric lines were observed to be a deadly obstacle for Indian flying fox, *P. giganteus* on their route between their day roosts and main feeding sites. The present work alarms for this species being adversely affected by electrocution. No published information is available on the electrocution accidents in this district of Uttar Pradesh. During regular surveys conducted from January 2010 to December 2015, twenty four individuals of *P. giganteus* were found electrocuted in power lines at various places in study area as shown in Table 1 and Figure 2. The number of electrocuted bats observed was 4 in 2010, 2 in 2011, 3 in 2012, 5 in 2013, 6 in 2014 and 4 in 2015 as shown in figure 3. Most of the electrocuted bats were observed near fruit trees or just after tree canopy between roosting and feeding sites where electric power lines passes through as shown in figure 5A, 5B, 5C. It was found that most of the electrocuted bats showed characteristics of accidental death such as protruding tongue outside the mouth, open eyes, burned wings. Electrocution incidents were not reported for microchiropteran bats in the study area. The Indian flying fox have a large wingspan that can be easily electrocuted on power lines. According to Kjetil Bevinger, (1997) electrocution is a simpler problem than collision; it may take place when a bird touches two phase conductors or one conductor and an earthed device simultaneously, especially when the feathers are wet. Hence, body size and behaviour, such as perching and roosting on poles or wires, are the keys to understand why and how birds become electrocuted. The microchiropteran bats having small wingspan were not affected. Most of the observations revealed that the occurrence of electrocution was higher wherever electric power lines passes near the fruit bearing trees or adjacent to their roosts.

### CONCLUSION

Various threats to bat population have been observed and recorded in study area. Habitat destruction, disturbances to bat roosts by human activities, hunting for

**Table 1.** Details of electrocution Incidents of *P. giganteus* observed in Lakhmpur-Kheri

S. No.	Place of electrocution	GPS coordinate	Date of Observation	No. of bats	Sex	
					M	F
1	Roshan Nagar	N 28°05'019" E 80°21'582"	10th June 2010	2	2	0
2	Khargapur	N 28°04'063" E 80°56'674"	10th June 2010 5th July 2014	4	1	3
3	Rehariya	N 28°00'367" E 80°19'185"	6 <sup>th</sup> December 2011	2	0	2
4	Aliganj	N 28°06'343" E 80°35'210"	15 December 2012 4th July 2013 23rd January 2015	5	2	3
5	Deuwapur	N 28°00'506" E 80°25'466"	15 December 2012 4th July 2013 23rd January 2015	6	2	4
6	Sikandrabad	N 27°57'274" E 80°29'495"	8th June 2014	2	1	1
7	Phardhan	N 27°59'260" E 80°38'337"	25th October 2014 23rd June 2015	3	1	2

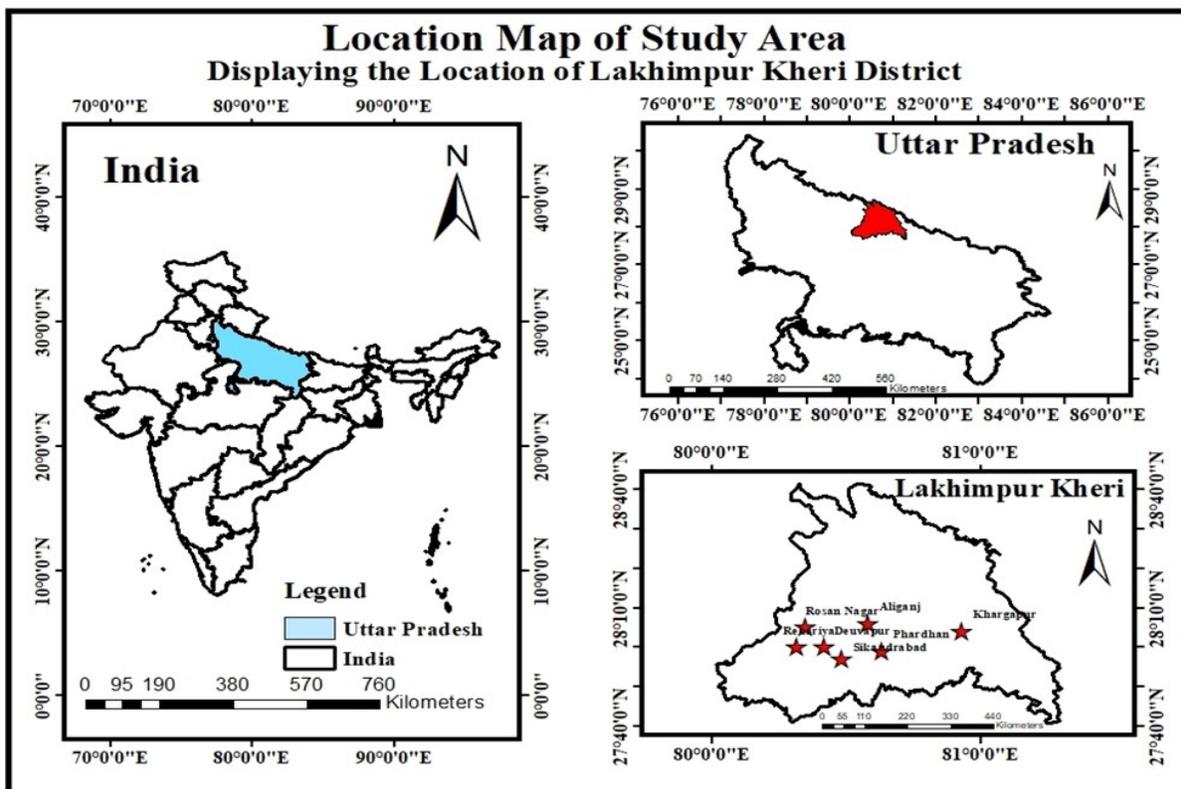


Figure 2. Map of Lakhimpur-Kheri showing locations of electrocution of *P. giganteus*

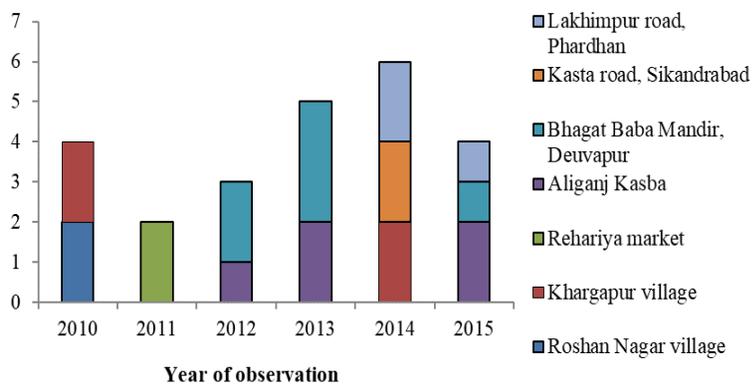


Figure 3. Details of electrocution of *P. giganteus* in Lakhimpur-Kheri



Figure 4. Loss of day roost of *P. giganteus* at Bhira



Figure 5. Electrocution of *P. giganteus*. A. At Phardhan , B. At Khargapur, C. Baba Bhagat Mandir, Deuvapur.

meat and medicine and electrocution incidents are the major threats to survival to bat population. A total of 14 day roosts of *Pteropus giganteus* were recorded in different areas, out of which 5 day roosts were displaced during last 5 years of study due to various reasons. Fruit bat (*Pteropus giganteus*) generally roosted in old mango orchards since 40 to 60 years. These mango orchards were cleared by villagers for expansion of agricultural land, for earn some money, for valuable wood and furniture. These were also cut down as they were not productive and due to partition in families of orchard owners. Water bodies nearby day roosts are the lifeline to fruit bats but due course of time, these were filled up with garbage for land extension. Clearance of fruit trees on large scale put a pressure on bats to search their food. All of these reasons cause bats to increase their daily travel which exposed them to more predators, stress, exhaustion, collisions with structures and fatality from electric wires (electrocution). Not only the habitat destruction and disturbances were the major threats but electrocution was also the serious threat for Indian flying fox, *P. giganteus*. A large number of fruit bats were electrocuted every year in power lines at various places in study area.

Population of microchiropteran bats has been observed to decline in rural areas and flourish in urban as well as industrial areas because these are mosquito-prone areas, providing better food supplies. Microchiropteran bats often suffered from loss of feeding habitats due to extensive use of agricultural pesticides which poison the bats and reduce the population of insects. A major change in crop patterns (e.g. Rice and wheat crop to sugarcane) observed in study area which provides insufficient diversity of prey for microchiropteran bats. The loss of human-made structures such as mud houses and thatched huts were observed to be adversely affecting microchiropteran bat population. The destruction of their roosts through the modification as well as replacement of old mud houses, thatched huts, old buildings and wells is also one of the major threats to survival of insect eating bats. Old and abandoned buildings, mud houses and thatched huts are particularly important roosts for microchiropteran bats. The loss of roosts due to development also may be an issue affecting bat conservation.

## RECOMMENDATIONS

Literature revealed that chiropterans are one of the least studied mammals in India especially in the state Uttar Pradesh. The current study recorded various threats to survival of bat population in study area. Following recommendations can be made regarding their protection and conservation.

- i) An extensive survey should be made for all species of bats in Uttar Pradesh.
- ii) The present study recommended introduction of well insulated electric power lines, consideration of alternative routes away from fruity trees, earth cabling etc. These are the possible measures which may reduce the mortality among the fruit bat (*Pteropus giganteus*) and other fauna.
- iii) Ecological and behavioural studies should be strongly recommended for better understanding of the status and economic value of bats in study area.
- iv) There should be need for periodic monitoring, habitat management and public awareness.

- v) Habitat management includes not only conserving roosting areas such as caves, trees, old buildings and mud houses, temples but also in conserving its sources of food (Fruits or insects).
- vi) Study and documentation of pollination and seed dispersal by bats in different ecosystems, would help improve the image of bats among people of study area.
- vii) Removal of Megachiroptera or fruit bats from Schedule V of the Indian Wildlife (Protection) Act, 1972 with legislation to extend to other species of chiroptera also.
- viii) Forest policies and guidelines should include control measures for disturbance and hunting of bats, protection of key roosting sites especially *Pteropus giganteus* roosts and important habitats of bats by declaring them as 'Bat Hub' or 'Bat Zone'.
- ix) Measures for preventing felling of fruity tress and private orchards which are the major source of their food..
- x) Migration of bat population and newly formed roosts of *Pteropus giganteus* should be identified.
- xi) To make an effort against the negative attitudes towards bats through a variety of awareness programmer aimed at local people of different ages and in different strata of society.

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