

## The dietary preferences of *Pteropus giganteus* and its impact on ecosystem

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### Abstract

Bat diversity is required to keep the ecosystem in balance. They are the only flying mammal and play a vital role as key stone species helping the earth's production system. The Megachiropterans are of great importance for the maintenance and re-establishments of tropical forest diversity. *Pteropus giganteus*, is one of the largest fruit bat in the world. Many fruits are dependent on bats for pollination, such as mangoes, bananas, and guavas, durian and other jungle and orchard fruits and even beans. They can transport seeds over greater distances than other mammals and birds. So, they help in the survival of plants, animals and, thus, of mankind. Protecting fruit bats and their habitats is crucial for sustaining the biodiversity and agricultural systems that depend on them. The present study is an attempt to study the food habit and their impact on ecosystem.

**Keywords:** Key stone species Megachiropterans, forest diversity, pollination, ecosystem

### Introduction

Bats are one of the beneficial members of the animal community. In the Old-World tropics, fruit bats are more than just fascinating creatures of the night; they are indispensable to the health and stability of ecosystems and agriculture. *Pteropus giganteus*, also known as flying fox belongs to pteropodidae family, play a crucial role in maintaining ecological balance. All the preferred roosting trees of *P. giganteus* are comparatively large and tall. Their activities are essential to various ecological processes, from pollination to seed dispersal, which helps sustain diverse habitats and agricultural systems. Pteropodid bats visit 141 species of plants for pollen or nectar including economically important species and they are of great importance for the maintenance and re-establishments of tropical forest diversity (Fujita and Tuttle, 1991) [1]. *Pteropus giganteus* mainly consume fruits, flowers, nectar and are necessary for reproduction and propagation of numerous plants. Megabats may or may not take away fruits from a tree and they usually cling on to flowers and fruits, while lapping up nectar or ingesting soft pulp and fruit juices (Fleming, 1982) [2]. They consume smaller fruits like figs in the same foraging tree. However, they carry larger fruits from the trees to special feeding night roosts for consumption (Prasad et al, 2014) [3]. The dietary habits of *Pteropus giganteus* also highlight some of the challenges they face in terms of conservation. They are highly susceptible to environmental disruption and have declined drastically in response to human activity. Conservation efforts are essential to protect these vital species and the ecosystem services they provide. The present study is an attempt to explore the importance of this fruit bat in the ecosystem and their role as pollinators and seed dispersers in ecosystem.

### Materials and Methods

Field study was carried out in the study area Tirunelveli for a period of one year. Roosting sites of *Pteropus giganteus* were identified. Usually it prefers to roost on the tall trees near the water sources. Fresh fecal samples, bolus and guano were collected under the natural roosting sites and foraging area of the study area by using a plastic sheet. The seeds, pollen, culled parts of fruits, flowers and chewed leaves were collected from bolus and guano and identified

taxonomically. The seeds were identified by visual observation and by using a simple hand lens. Pollens were identified under the compound microscope after mounting in a clean glass slide. Additional data's were gathered from visual observations and also from referred journals.

### Results

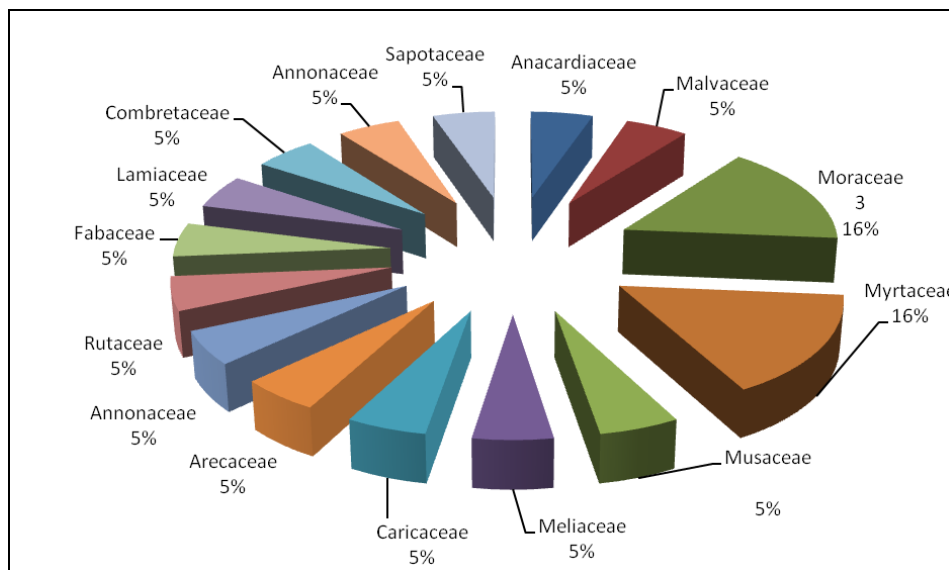
*Pteropus giganteus* is represented in foothills, plains of the study area only and not in the hills area. They roost on open foliage of tall trees like *Tamarindus indicus*, *Terminalia sp*, *Aeagle marmelos*, *Ficus benghalensis*, *Mangifera indica*. etc. The roosting sites of the flying fox *P. giganteus* were located in a variety of habitats that included sacred groves of temples (Sivasilam, Kallidaikurichi, Pattamudukku, Thirupudaimaruthur), private agricultural land (Athalanallur, Murappanadu) and public places like roadsides (Padnaneri, Nanguneri, Panakudi) and railway lines (Melapalayam) with locations adjacent to rivers, streams, wetland of the of the study area. Dietary preferences of *Pteropus giganteus* were given in table 1.

**Table 1:** Dietary preferences of *Pteropus giganteus*

S. No	Plant Family	Diet of Fruit bat	Parts of the food consumed by fruit Bat
1	Anacardiaceae	<i>Mangifera indica</i> .	Fruits
2	Malvaceae	<i>Bombax ceiba</i>	Flowers, Fruits
3	Moraceae	<i>Ficus bengalensis</i>	Fruits
4	Moraceae	<i>Ficus religiosa</i>	Fruits
5	Moraceae)	<i>Morus spp</i>	Fruits
6	Myrtaceae	<i>Psidium guajava</i>	Fruits
7	Myrtaceae	<i>Syzygium cumini</i>	Fruits
8	Myrtaceae	<i>Eucalyptus spp</i>	Fruits
9	Musaceae	<i>Musa paradisiaca</i>	Fruits
10	Meliaceae	<i>Azadirachta indica</i>	Fruits, Leaves
11	Caricaceae	<i>Carica papaya</i>	Fruits
12	Arecaceae	<i>Borassus flabellifer</i>	Fruits
13	Annonaceae	<i>Polyalthia longifolia</i>	Fruits
14	Rutaceae	<i>Citrus spp</i>	Fruits
15	Fabaceae	<i>Tamarindus indicus</i>	Ripe pods, Leaves
16	Lamiaceae	<i>Tectona grandis</i>	Fruits
17	Combretaceae	<i>Terminalia catappa</i>	Fruits
18	Annonaceae	<i>Annona reticulata</i>	Fruits
19	Sapotaceae	<i>Manilkara zapota</i>	Fruits

Figure 1 explains the status of plant families and species consumed by *P. giganteus*. Pteropodidae consume 19 plant species belongs to 15 families. Among 15 families of plant,

Moraceae and Myrtaceae are more than other families. Moraceae and Myrtaceae are represented with 3 species of plants



**Fig 1:** Status of plant families and species consumed by *P. giganteus*

## Discussion

Megachiropteran bats play an essential role as an eminent pollinators and seed dispersers. Pteropodid bats visit plants for fruits, pollen or nectar including economically important species. Bats may be the main pollinators for up to 1,000 species of plants across the tropics, including many of socio-economic importance such as durian and mango (Fujita and Tuttle, 1991, Kunz, *et al.*, 2011; Lobova, *et al.*, 2009) [1, 4, 5]. In tropical and subtropical regions, fruit bats are critical for the pollination of certain types of mangoes, bananas, and durian trees (Fleming & Eby, 2003) [6]. A variety of economically important trees and their products, e.g. dyes, tannin, medicine, fiber, fuel, lumber, etc. which depend on fruit bats for their propagation (C.A.M.P. 2002) [7]. *Pteropus giganteus* forage among Moist mixed deciduous forest and Semi evergreen forest. Research highlights that fruit bats contribute to the growth of important tree species in tropical rainforests, which helps maintain biodiversity and forest health (Miller *et al.*, 2008) [8]. Among 17 plant species, they consume more (6) plant species belongs to 2 families Moraceae and Myrtaceae which includes *Ficus* spp, *Morus* spp, *Psidium guajava*, *Syzygium cumini* and *Eucalyptus* spp.

By pollinating fruit crops and dispersing seeds, fruit bats indirectly support agricultural economies. In Australia, the contribution of fruit bats to the pollination of crops such as mangoes and macadamias, which are important to the local economy (Eby, 1998) [9]. The primary food source for *Pteropus giganteus* is fruit, which they consume in large quantities. They are known to feed on the juicy fruits of trees such as mangoes (*Mangifera indica*), guavas (*Psidium guajava*) (Prasad *et al.*, 2014) [10] for their high nutritional content (Morrison, 1980) [11], and figs (*Ficus* spp.) (Kunz & Lumsden, 2003) [12]. Figs are an important food source due to their high energy content and availability (Fleming *et al.*, 1996) [13]. They regularly consume figs in the wild (Zhan-Hui Tang, 2007) [14]. The spread of fig trees through bat-mediated seed dispersal contributes to the stability of

rainforest ecosystems by supporting a diverse array of plant and animal species.

These fruit bats have a preference for ripe and juicy fruits, which provide the necessary energy for their high metabolic rate and nocturnal activities. Similarly, adult bat *Pteropus rodricensis* meet protein needs from fruits only and do not require insects (Dempsey, 2004) [15]. The ripe tamarind pods and mangoes were favored foods for *Pteropus rodricensis* (Cheke and Dahl, 1981) [16]. They feed on a variety of pulpy fruits and to a lesser extent upon the nectars and flowers. Wang *et al* (2004) [17] reported that Photo cells in the eyes of the fruit bats can detect the red color which is helpful in finding ripe fruits.

They exhibit nocturnal foraging behaviors, with peak activity during the late evening and early morning when fruits are ripe and flowers are in bloom. They are particularly attracted to the nectar of certain flowering plants, which they consume as an additional source of energy (Simmons & Kress, 2001) [18]. Their large size and strong wings allow them to carry and transport fruit, while their long, specialized tongues are adapted for extracting nectar from flowers (Fleming *et al.*, 1996) [13]. During fruiting seasons, these bats are highly mobile, traveling long distances to find suitable fruiting trees. During peak fruiting seasons, they may congregate in areas with abundant fruit resources, while in off-seasons, they might travel further or switch to alternative food sources, When fruit is scarce, they may rely more on nectar and rarely on leaves. Leaves are an important dietary source of carbohydrates and protein, and an especially rich source of calcium for bats (Nelson *et al.*, 2005) [19]

An individual bat may visit more than 30 flowers per night. They are highly mobile and transport seeds over greater distances than other mammals and birds. Chewed leaves and remnants of papaya, neem, *Ficus* sp., *Tamarind* sp., could be seen from below its night roosting trees. In a study of fruit bats in Samoa (*Pteropus tonganus*), leaves consumed added up to 46% more calcium to bats' diets. (Nelson *et al.*, 2005) [19]. Female bats experience significant calcium

demands during pregnancies and lactation due to large size of their young at birth. (Nelson *et al.*, 2005)<sup>[19]</sup>.

In some instances, bats travel long distances to a specific plant population; one fruit bat species can fly two and a half hours nightly to visit a particular chiropterophilous plant species. Venden and Kaleeswaran (2011)<sup>[20]</sup> observed that a variety of seeds of different plant species were dispersed by bats in the vicinity of the roosting trees apart from the foraging trees. Bastawde and Mahabal (1976)<sup>[21]</sup> reported that they travel 2 to 20 kilometers in search of suitable feeding sites and transfer more than a ton seeds from the fruiting trees and do faraway dispersal (Fujita and Tuttle, 1991)<sup>[11]</sup>. One bat can consume up to 60,000 seeds of fruits like fig per night so they help in the survival of plants, animals and, thus, of mankind (Cox *et al.*, 1992)<sup>[22]</sup> and they are essential for the regeneration of forests.

Despite their ecological importance, fruit bats face significant conservation challenges. Habitat destruction, climate change, and hunting pressures threaten their populations. In many regions, fruit bat populations have declined due to these factors, which can have cascading effects on ecosystem health and agricultural systems (Bates *et al.*, 2019)<sup>[11]</sup>. Habitat destruction, particularly the loss of fruiting and flowering trees, can impact their food sources and overall survival. Additionally, hunting and the destruction of roosting sites pose significant threats to their populations (Eby & Law, 2008)<sup>[23]</sup>. Efforts to conserve *Pteropus giganteus* must include protecting their natural habitats and ensuring the availability of their primary food sources. Their role in maintaining healthy, diverse ecosystems also helps diminish the impact of pests and diseases that could otherwise threaten agricultural productivity.

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