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A review on various important roles of *Pteropus* (bats)

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Abstract
Chiropterans (bats) play an important role in the ecosystem. The economic loss may feeding of bats on fruits but this is negligible as against to their beneficial roles. The economics benefits getting from bats include biological pest control, plant pollination, seed dispersal, guano, agriculture, education and research. Many disorders of humans such as menstrual and respiratory problem are cured by meat of bats and other body parts. Therefore, hunting and poaching should be strictly prohibits.

Keywords: chiropterans, ecosystem, beneficial, pollination, menstrual, agriculture, fruit bat, economic

Introduction
Family pteropodidae of plant visiting bats are found throughout the tropics and sub-tropics of the old time (Marshall, 1983, Mickleburgh, Huston & Racey, 1992) [22, 26]. Bates (Order- Chiroptera) constitutes one of the most important species rich and everywhere mammalian orders, containing over 1100 species (Simmons, 2005) [32]. In the Indian subcontinent the order is constituted by 121 species representing to 37 genera and eight families, of which 112 species in 33 genera and eight families occur within India (Sririviasalu & Sririvasal, 2001). Flying foxes play important role in forest regeneration because they have able to retain viable seed in their gut for many hours (Shilton *et al*., 1999) [1], their long distance foraging movements (Tidemann and Nelson, 2004; Epstein *et al*., 2009) [41, 10] and their flight line over forest clearing that are mainly presented by different forest animals (Fujita, 1991) [13].
The Indian flying fox is a fruit bats belong to family Pteropodae and thus related to the sub order Yinptero *chiroptera* (Teeling *et al.,* 2005; Szczesniak *et al.,* 2013; Lei and Dong, 2016) [39]. They are generally nocturnal and roost mainly in primary forest or area containing a mixture of local and preface plant species. Bats may go long distance to travel orchards and garden fruit tree for outside fruits when their natural food supplies are shorted (Aziz *et al.,* 2016) [3]. In worldwide benefits of the ecosystem services reported by fruits bats spread to over 300 plant species (Fujita and Tuttle, 1991; Shilton *et al.,* 1999; Stoner *et al.,* 2007) [13, 1, 38].

Results and Discussions
1. Role of Indian flying fox (*Pteropus giganteous*) as seed dispersal
Some fruits have many seeds while some have, one seeds dispersed by vertebrates are indeed more over variable and dependent on the behavior and specifies of dispersed (Schupp, 1993; Holl, 1998; Martinez-Garija and Gonaleg-Montagut, 2002) [30, 18, 23]. Seed itself are immotile, depend on dispersal medium for transit and fruit bats being only mammals able of true flight are considered as major seed dispersal carrier as they can lightly cross the barrier other frugivorous mammals cannot (Smallwood, 1982; Willson *et al.,* 1989) [19, 46].

2. Bats as pollinators
Pteropodid bats are important pollinators and seed dispersing agents in the old-world tropical forest regions (Start and Marshall, 1976; Thomas, 1982; Fujita and Tuttle, 1991; Banack, 1998) [22, 40, 14, 5]. Flowers prepare characteristics seeds and are well displayed for easy accessibility and visibility to attract bats (Baker, 1961; Faegri and Vander Pijl, 1966; Von Helversen *et al.,* 2000) [4, 11, 44]. Mauritius fruit bats are reported key stone species as they offered critical pollination and circulating services (Vincenot *et al.,* 2017) [44].

3. Bats as Agro forestry
Evaluation of economic importance and costs accrued from the function work of fruit bats in agro forestry system stays on the local view and knowledge about bat ecology appearance and bat seed dispersal and pollination idea (Fujita and Tuttle, 1991; Rist *et al.,* 2010) [13]. In contrast with the perception of fruit bat such as agricultural pests, ecological survey have supported positive effects of fruit bat seed spreading on seed germination success and survival of fruit crops (Fujita and Tuttle, 1991, Galindo- Gonzal *et al*., 2000, Lopez and Vaughan, 2004; Muscarella and Fleming, 2007; Djossa *et al.,* 2008; Marques and Fischer, 2009) [13, 15, 20, 9, 21].

4. Bats as guano fertilizers
Consumer driven nutrients reconversion such as fecal reconversion such as fecal decomposition by bats also effects community design in guano-based ecosystem. Bats guano forms the basis of food web consisting of bacteria, fungi, protozoans, nematodes and arthropods (Harris, 1970; Fenolio *et al.,* 2006) [17, 12]. Moreover, ecological importance and waste qualities of bat guano, it also had zoonotic importance and head noticed for both important residence and vectors of pathogens. With relation to fungi pathogens,

in sectivores bat are reported to be the main competitors as reservoirs of fungi for examples *Histoplasm capsulatum*, *Coccidioides immities*, *Cryptococcus laureentii* and *Blastomyces dermatitidis* (Yammato *et al.*, 1995; Garcia-Hermoso *et al.*, 1997; Mattsson *et al.*, 1999; Bunnell *et al.*, 2000) [16, 25, 8]. The difference in guano composition report that guano from bats in types of feeding niche may dynamical after the design of ecosystem (Justin and Roark, 2007)

5. Bats as foods

The economic loss may feeding of bats on fruits bat this is negligible as against to their beneficial roles (Varghese, 1998; Sirinivasalu and Srinivasalu, 2001a). Bats live ecological habitats, such as roosting in trees, inhabiting coastal region and feeding from fruit and because they are source of food for some human populations several *Pteropus* species come into indirect or direct contact comes with human and cattle (Mickleburgh *et al.*, 1992; 2009) [27].

6. Bats as agriculture

In Southeast Asia reviews into bats pollination have usually focused on the smaller nectarivorous (Stewart, Makow sky & Dudash, 2014). Pterepodids reporting how the updating of economically important fruit crop in the area rest upon the co evolutionary nature of bat-plant association (e.g. Acharya, Racey, Sotthibandhu & Bumrunngsri, 2015; Bumrunngsri, Sripaoraya, Chongsirisridith & Racey, 2009; Bumrungsri & Sripao-vaya, 2008). One specially reported example of this southeast Asia durian (Duriozibothinus) a beneficial fruit crop thoughout the areas both culturally and economically (Start and Marshall, 1976) [22]. While many modern agricultural cultivars are now famous semi-wild durian has long been grown for household using in Malaysia, Indonesia and Southern Thailand (Bumrungsri *et al.*, 2009).

7. Bats as medicine

The main causes for the fast decline of *Pteropus natunae* in Sarawak are considered wild meat and Chinese traditional medicine (Gumal *et al.*, 1998). In India many disorder of humans such as menstrual and respiratory problems are cured by meat of bats and other body parts. Fruit bats are often known to as messenger of the god lord Shiva and they also help to conserve rain forest (Vanitharani, 2005).

Conclusion

Bats are found everywhere in the world mainly in tropical and temperate regions. Public awareness on the benefits of bats in pollination, seed dispersal, medicine, food agro forestry and the importance of their as natural organic fertilizers may preserve their roosting habitats. Therefore, it needs an environmental awareness platform to focus on the importance of sanctified overview the local people for biodiversity conservation in sustainable manner.

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