Nocturnal pollination of *Parkia biglandulosa* by nectar feeding bat, *Cynopterus sphinx*

Bat-flower interactions appear to be an important factor in the reproductive phenology and population structure of plants. In the Old World tropics, pteropodid bats visit at least 141 species of plants for nectar or pollen, including many economically important species. Nectar-feeding bats pollinate flowers in exchange for nectar and pollen rewards. These bats promote out-breeding and contribute towards maintaining genetic diversity of plant population. Pollination mutualisms also provide the following benefits to plants: reduced pollen waste (compared to alternative methods such as wind pollination), longer transport distance, higher pollination success at low plant densities and higher rate of outcrossing and gene flow.

*Parkia biglandulosa* (Mimosoideae: Leguminosae) is a tall, handsome tree species distributed in tropical regions of Asia, Africa and South America. In *Parkia* species, the densely flowered spherical inflorescence, capitula, is mostly covered with fertile flowers. Sterile flowers, present in the proximal region of capitula, secrete nectar that is stored in a nectar ring. The capitula are visited for nectar by bats; other visitors include birds, insects and non-flying mammals. The objective of the present study was to observe pollination of *Parkia biglandulosa* by the nectar-feeding bat *Cynopterus sphinx*.

Visual observations were made on the nectar-feeding behaviour of megachiropteran bat, *Cynopterus sphinx* (Chiroptera: Pteropodidae) and pollination of *Parkia biglandulosa* in Tenkasi, Tirunelveli district, Tamil Nadu, South India (8°55’W lat., 77°16’E long.). Fourteen species of megachiropteran bats are known from India and *Cynopterus sphinx* is sympatric in the study area, a medium sized fruit bat (average forearm length 70.2 mm; body mass 45 g). Observations were made twice a week throughout the entire flowering season. Four trees were found in the study area and the total number of capitula available was determined by cluster sampling method. Observations were initiated at 18.00 h and ended at 6.00 h on each observation night, taking advantage of the available diffuse light. During each observation, the number of foraging flights and feeding strategies of bats was noted every hour throughout the night. Mist-net studies were carried out during five nights, other than observation days to examine pollen in the fur of the bats visiting capitula.

Observations reveal that during the flowering season from October to December, nectar production occurs in the nectar ring of capitula of *Parkia biglandulosa*. The main pollinator, *Cynopterus sphinx* lands on the capitula to feed on the nectar (Figure 1). It also settles on the lower and middle branches of the tree, at the height of ca. 10 m, to reach the flowers. In the present study, an average of 52 individuals of *Cynopterus sphinx* visited a mean of 300 capitula per night. The foraging periodicity is characterized by unimodal pattern of activity that occurred from 20.00 to 23.00 h (Figure 2). Similar pattern of activity peak is dominant among frugivorous and nectarivorous species, although bimodal patterns have also been reported in several species.

We also found that the seasonality and availability of capitula influenced the frequency of bat visits. For instance, during the peak season (flowers ca. 540), a maximum number of bat-visits per night (ca. 75 visits) was recorded (Figure 3). Thus the magnitude of foraging activity of bats was correlated with the number of available flowers (*r* = 0.865). Using mist-net, 10 adult males and 14 adult females were captured in five nights between 20.00 and 01.00 h in the vicinity of capitula.
of Parkia trees. Observations show that about 45.8% bats were found loaded with pollen on their fur. This species inadvertently collect pollen on the ventral side of the body as it landed on the capitula to feed the nectar. Pollen carried by the nectar feeding bats is also reported; pollen of Ceiba pentandra was observed on the abdomen, wings and head of Cynopterus sphinx and on the bodies of Rosettus leschenaulti and Pteropus giganteus. The presence of pollen on the body and wings of these bats strongly suggests that they are important pollinators.

In India, two species of pteropodid bats, Cynopterus sphinx and Pteropus giganteus visiting capitula and feeding on nectar from Parkia biglandulosa under natural conditions has also been reported. It may be concluded that the availability of capitula and the nectar reward may have a significant influence on the foraging behaviour of bats and possibly on the reproductive potential of Parkia species.


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