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A Case Study of Florivory: Rewards for Pollinators of *Bombax ceiba* (Linn.), In and Around Gondia District (Maharashtra) India

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Abstract

Bombax ceiba is a deciduous tree also known as Red Silk Cotton or Semal or Katesawar. In India it belongs to Bombacaceae (Baobab family). Identification can be easily made when it is in full bloom with most enchantingly beautiful huge blood red flowers in the month of March and April. *B. ceiba* is an obligate outcrosser that offers pollen nectar rewards to avifauna and requires pollinators for pollen transfer between synchronously blooming conspecific individuals. Such florivory is detrimental to the reproductive success of *Bombax ceiba*. The study was done during the month of January upto April for consecutive three years 2021–2023 in Sadak Arjuni of Gondia District along with adjoining forest corridors of NNTR (Navegoan Nagzira Tiger Reserve Areas) where population of *Bombax ceiba* is quite common. Observation were done at various locations on daily basis by using Celestron® Binocular 10 x 50 mm and photographs were taken by Sony DSLR α57 55–300 mm zoom lens. Study indicates perfect florivory among 98 birds species belonging to 28 families for multiple ethological prospects such as feeding, roosting and nesting illustrate strong bond between existing avifaunal diversity and help ornithologist to study variety of birds existing in forest ecosystems.

Keywords

Florivory, Pollen–Nectar Relationship, Avifaunal Diversity

1. Introduction

Bombax ceiba is a deciduous tree also known as Red Silk Cotton or Semal or Katesawar in India it belongs to Bombacaceae (Baobab family). The Red Silk Cotton Tree *Bombax ceiba*, a large deciduous tree distributed in the Indian sub-continent. According to Mythology Semal is considered as tree of

the infernal region (Tree of Yama).

It is believed to have originated in Southern China and Indo Malaysia, Indonesia, China and Taiwan as well as part of Australia and Africa. In India, it can be found along the bank of rivers and streams with growth habitat at mixed deciduous forest and mixed evergreen forest.

Flowering occurs in the month of February and March during which bright scarlet, dark red flowers are bloomed to attract pollinators on the leafless trees. Flowers positioned singly and look bigger and bolder in size, hermaphrodite, open and copiously filled with sugary nectar acting as rewards for pollinators [13]. It has been observed that newly bloomed flower remains attached to peduncle for two days later on weathering of older flowers occurs. Apart from florivory, almost vegetative and reproductive parts have considerable medicinal values and ornamental value, seeds yield pale yellow edible oil, which can also be used for soap making and as a substitute for cottonseed oil in cooking. The inner wall of the fruit upon dehiscence produces silky white floss, which is used for filling pillows and sofas [23,24, 30, 31]. Despite its high economic value, the limited information available on its pollination biology and pollinators [1, 11,12, 28,29, 6] is not sufficient to explain its reproductive biology. Therefore, the focus of the present study was on providing a detailed account of the florivory by pollinators of *B. Ceiba*.

2. Study Area

Sadak Arjuni of Gondia district (Maharashtra) located at 21.10°N 80.15°E. It has an average elevation of 256 metres (843 feet). It is located near the Maharashtra Chhattisgarh border on Mumbai–Kolkata National Highway. Gondia district in Maharashtra state is situated in the Waingangā basin. Geometrically it is ideal habitat for the birds, wildlife and plant life with thick forest cover. The annual rainfall is about 1460mm to 1600mm. In comparison to Melghat [7] having Southern Tropical Dry Deciduous Forest, our region bears mixed deciduous forest ideal for *Bombax ceiba* growth.

3. Methodology

The study was undertaken during January to April for three consecutive years during blooming time of *B. ceiba* in open forest areas along with prominent location such as corridors of Navegoan Nagzira Tiger Reserve and adjoining forest areas of Gondia district. Overall more than 25 trees of *B. ceiba* were selected for regular monitoring and avifaunal florivory studies in the study area. Weekly visits were done on dense forest areas to observe avifauna of forest regions. Direct observations were made using Celestron® Binocular 10 x 50 mm and photographs of pollinators were taken by using Sony α 57 DSLR Camera using 55–300 mm lens attachments along with 18–55 mm. The foraging time, mode of approach, landing, probing behaviour, the type of forage collected, inter-tree foraging activity were carefully observed. Observations also confirmed whether birds visited flowers singly, in pairs, or in flocks.

4. Results and Discussion

During the above survey period a total of 49 bird species were documented (Table 1) belonging to 12 orders, 17 families and 49 genera. Columbidae family represents maximum (5) number of birds followed by Accipitridae (2) and Phasianidae (2) Strigidae (3). Rest of the families represent two or one bird. Among the orders Passeriformes represent maximum (43) number of birds followed by Ciconiiformes (8) and, Falconiformes and Columbiformes (7 bird species); Piciformes and Coraciiformes represent 5 birds each; Charadriiformes consist 4 birds; Cuculiformes and Strigiformes consist 3 birds each; Anseriformes, Apodiformes, Gruiformes, Psittaciformes, Pelicaniformes and Galliformes represent 2 birds each. The least (1) number of bird species represented by Podici-

pediformes (Table 1). Both the passerine and non-passerine birds visited the flowers throughout the day with more foraging activity during the forenoon and late afternoon hours. Among observed avifaunal florivory maximum member belongs to Corvidae family, which include birds Black Drongo, White -Bellied Drongo, Greater Racket -tailed Drongo, Ashy Drongo, Eurasian Golden Oriole, Common Iora, Rufous Treepie, House Crow, Indian Jungle Crow. Nesting and Roosting behavior was commonly seen among Coraciformes and Sylviidae. As a frequent visitor members belongs to Sturnidae and Megalaimidae. Nest of common pigeon, laughing dove, Spotted dove and members belongs to Psittaciformes were also observed which include Rose Ringed Parakeet, Plum -headed Parakeet, Alexandrine Parakeet. *B. ceiba* is an obligate outcrosser and requires pollinators for pollen transfer between synchronously blooming conspecific individuals. In line with this, the stigma remains receptive for two days and its surface is impregnated with a uniform layer of large, triangular, pointed, broadly spaced papillate cells which are efficient in pollen capture [17, 21]. The pollen grains also have the ability to germinate and produce long pollen tubes for three successive days during flower life [8, 9]. The percentage of pollen germination gradually decreases towards the third day and later the flowers drop off. The long period of stigma, receptivity and pollen germination facilitate cross-pollination in the presence of pollinators. Flower visitors help the flower in pollination by their rapid and frequent visit to the flowers for nectar collection [5, 15, 16]. *B. ceiba* is the deciduous, drought resistant, and growing wild on the roadsides, bare lands, farming boundaries and forest. It is widely distributed in India. However, very few researchers were carried out studies on the bird associated *B. ceiba* tree for feeding, roosting and nesting [5, 18, 20]. As per literature surveyed Indian subcontinent harbors about 1383 bird species and within the geological boundaries of India is 1306 [2-4, 14, 25] of which more than 577 species have been reported from Maharashtra State [19, 26, 27]. Birds associated with *Butea monosperma* has been studied in some part of India [10, 22].

5. Conclusion

B. ceiba is obligate out crosser for a wide variety of birds are reported to visit the elegant copious nectar filled flower everyday during early morning hours to dusk dawn. While probing flower for nectar their beak, head and whole body comes closer in contact with the reproductive whorls of flowers stamens, stigma thus actively facilitating pollination. Result aims to create social awareness among locals and tribal's and farmers to conserve the heritage of local flora and fauna with unethical anthropogenic activity like cutting of green vegetation, deforestation lead to disturbance in ecological balances instead it was recommend to protect such useful indigenous tree species to enhance biodiversity and the abundance of bird species.

Table 1. Checklist of Avifaunal diversity associated with pollination florivory of Red Silk Cotton

Bombax ceiba Linn.			
Order	Family	Common Name	Scientific Name
Falconiformes	Falconidae	Peregrine Falcon	Falco peregrinus
	Accipitridae	Brahminy Kite	Halia sturindus
		Black Kite	Milvus migrans
Columbiformes	Columbidae	Common Pigeon	Columba livia
		Laughing Dove	Stigmatopelia senegalensis
		Spotted Dove	Stigmatopelia chinensis
		Red Collared Dove	Streptopelia tranquebarica
		Eurasian Collared Dove	Streptopeli adercaocto
Psittaciformes	Psittacidae	Rose-ringed Parakeet	Psittacula krameri
		Plum-headed Parakeet	Psittacula cyanocephala
		Alexandrine Parakeet	Psittaculae upatria

Order	Family	Common Name	Scientific Name
Strigiformes	Strigidae	Barn Fish Owl	<i>Ketupa zeylonensis</i>
		Brown Wood Owl	<i>Strix leptogrammica</i>
		Spotted Owlet	<i>Athene brama</i>
Apodiformes	Apodidae	Asian Palm Swift	<i>Cypsiurus balasiensis</i>
		Little Swift	<i>Apus affinis</i>
Upupiformes	Upupidae	Common Hoopoe	<i>Upupaep ops</i>
Coraciformes	Coracidae	Indian Roller	<i>Coracias benghalensis</i>
	Alcedinidae	Common Kingfisher	<i>Alcedo atthis</i>
Passeriformes	Aegithinidae	Common Iora	<i>Aegithinathia</i>
	Pycnotidae	Red Vented Bulbul	<i>Pycnonotu scafer</i>
		Red whiskered bulbul	<i>Pycnonotus jocosus</i>
	Sylviidae	Large Grey Babbler	<i>Turdoides malcolm</i>
		Jungle Babbler	<i>Turdoides striatus</i>
		Yellow- Eyed Babbler	<i>Chryso mmasinense</i>
		Common Babbler	<i>Turdoidescaudatu</i>
		Lesser Whitethroat	<i>Sylvia curruca</i>
		Booted Warbler	<i>Hippo laiscaligata</i>
		Orphean Warbler	<i>Sylvia hortensis</i>
		Common Tailor Bird	<i>Ortho bomussutorius</i>
		Black Drongo	<i>Dicrurus macrocercus</i>
		White-Bellied Drongo	<i>Dicrurus caerulescens</i>
	Greater Racket-tailed Drongo	<i>Dicrurus paradiseus</i>	
	Corvidae	Ashy Drongo	<i>Dicrurus leucophaeus</i>
		Eurasian Golden Oriole	<i>Oriolusoriolus</i>
		Common Iora	<i>Aegithinathia</i>
		Rufous (Indian) Treepie	<i>Dendrocittavagabunda</i>
		House Crow	<i>Corvussplendens</i>
		Indian Jungle Crow	<i>Corvusculminatus</i>
Common Myna		<i>Acridotherestrictis</i>	
Brahmani Starling		<i>Sturnuspagodarum</i>	
Asian Pied Myna		<i>Sturnus contra</i>	
Rosy Starling		<i>Sturnusroseus</i>	
Megalaimidae	Chestnut-Tailed Starling	<i>Sturnusmalabarica</i>	
	Coppersmith Barbet	<i>Megalaimahaemacephala</i>	
	Brown-Headed Barbet	<i>Megalaimazeylanica</i>	
Muscicapidae	Yellow-Crowned Woodpecker	<i>Dendrocoposmahrattensi</i>	
	Black Bird	<i>Turdus merulani</i>	

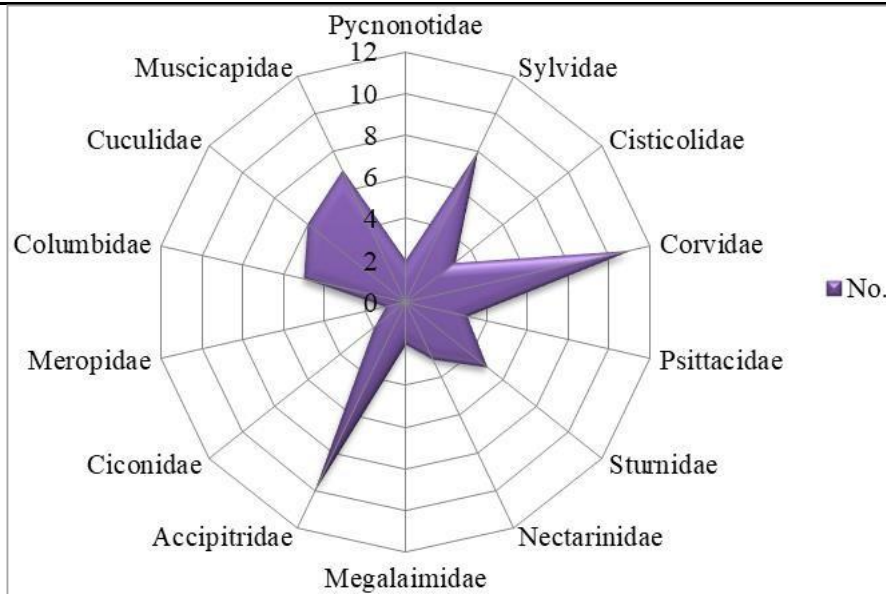


Figure 1. Graph showing abundance of avifaunal family associated with florivory of *Bombax ceiba* Linn.

Abbreviations

NNTR: Navegoan Nagzira Tiger Reserve

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Conflicts of Interest

The authors declare no conflicts of interest.

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