

Chapter 6

Relation between nectar birds and flowering plants: a sustainable life model in nature

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Abstract

Birds are the largest pollinators and the main components of plant reproduction. Nectar is also an important diet for birds, especially in the dry season. Some birds use nectar as their main diet. In their diet, for survival except nectar, small insects and their larvae are included. They are attracted to flowers that are bright in colour. Urbanization is a widespread threat to whole biodiversity, and need to take strong steps to understand the role and importance of each species and their association. Their role in maintaining biodiversity is irreplaceable. As pollinators, their actions affect different aspects of plants like morphology, physiology, ecology, or life cycle. In this survey, 28 species of birds were recorded from different locations in Odisha and were observed eating nectar. Protecting and producing these pollinators and their habitat is a primary step towards maintenance of good population of flowering plants.

Keywords: Nectar, pollination, pollinators, nectar birds, bird-plant relation

1. Introduction

The nectar gland, or nectary, is an organ that secretes sugar sap or nectar and is one of the characteristics of flowers pollinated by insects, birds, or animals. The nectary may occur in many different parts of the flower (Beutler 1953). It usually presents inside the flowers, close to the reproductive organs, whereas nectar involved in indirect defense is generally offered in the vegetative part of the plant and is known as extra floral nectar. Floral nectar is a key innovation of angiosperms that evolved as a reward for visitors that transport pollen in return. It is a sugar-rich fluid dominated by hexose's glucose and fructose and the disaccharide sucrose. Therefore, nectar is the source of carbon and nitrogen compounds that feed the pollinating birds, and these birds totally depend on plants for their survival. Their diets include insects, fruits, flowers, seeds, nectar, etc. Nectar-feeding birds are highly specialized in drinking floral nectar. There are some unspecialized birds that also utilize floral nectars, especially under water stress conditions (Raju et al. 2003). The most known nectar-feeding birds are hummingbirds and sunbirds (Nair et al. 2012). These birds are the smallest and largest pollinators. They have long and narrow bills to collect nectar from flowers. The energetic costs of maintenance, temperature regulation, foraging, and reproduction increase in direct proportion to body mass raised to fractional exponents (Brown et al. 1978). Nectar-feeding birds can experience an extremely high rate of fluid intake; there are also situations in which they must deal with potential dehydration. These are small and maintain high metabolic rates; their rates of evaporative water loss are high even at modest ambient temperatures. At high environmental temperatures, the nectar's energy balance can be insufficient to maintain a positive water balance (Calder 1979; Roddy 2019). The sensitivity of the bird's eye is greatest in the middle and red parts of the spectrum. So, they mostly visit those plants whose flowers are red, orange, or brighter in colour (Cronk and Ojeda 2008). The bills and tongues of

nectar-feeding birds differ from continent to continent. A variety of hummingbirds have straight or even upturned bills, while bills for all sunbirds, honey eaters, and honey creepers are decurved to some extent. All tongues of these nectar-feeding birds collect nectar by capillarity, and licking responds to changes in sugar concentration and corolla length. The bill lengths of nectivorous birds are similar in all regions. Their bill lengths largely determine the range of flora lengths that can be legitimately probed (Gonzalez-Terrazas et al. 2012).

2. Importance of flowers for birds

Flowers and birds are interdependent on each other and benefited both partners. Birds depend on flowers for nectar and food, and taking nectar helps to pollinate. The leafless state of plant species during the flowering period appears to be a mechanism to enhance the attractiveness of flowers to their bird pollinators (Raju et al. 2003; Roguz et al. 2021). Dry-season bloomers play a vital role in sustaining bird species. They provide water and instant energy through sugars, proteins, and amino acids. The nectar helps birds overcome water stress and dehydration. These birds also provide small insects and larvae as a solid diet (Kumar 2000). It is a great opportunity for bird watchers to see a variety of birds busy drinking nectar to quench their thirst. They help to increase the ecological fitness of pollinator populations through enhanced larval and adult nutrition (Nepi et al. 2018; Trunschke et al. 2021). It also benefits the farm and the surrounding landscape. Conservation of this pollinator habitat can enhance overall biodiversity and the ecosystem services it provides, protect soil and water quality by mitigating runoff and protecting against soil erosion, and enhance rural aesthetics.

3. Methodology

3.1. Study area

Guchhait et al. (2023)

The survey was conducted in selected districts (Mayurbhanj, Sundargarh, Cuttack, Khordha) of Odisha to gather the primary data and some information is collected from literature too. Odisha is the Eastern state of India, which touches the Bay of Bengal. It lies between the latitudes 17.780 N and 22.73 N and between longitudes 81.37 E and 87.53 E. It shares a geographical border with each direction, like Chhattisgarh from west to north-west, West Bengal in the north-east, Jharkhand in the north, and Andhra Pradesh in the south (Ghadai 2021; Figure 1).

3.2. Methods

The survey was conducted from 2020 to 2023. Different wetlands, grasslands, water bodies, and lakes were taken as the study areas. Observations were carried out in the early morning, i.e., from 6:00 AM to 9:30 AM, and in the evening, i.e., from 4:00 PM to 6:00 PM, depending on the light condition. Regular surveys were done by walking on fixed routes throughout the study area. Birds were sighted by using binoculars, and identification was done by using a field guide.

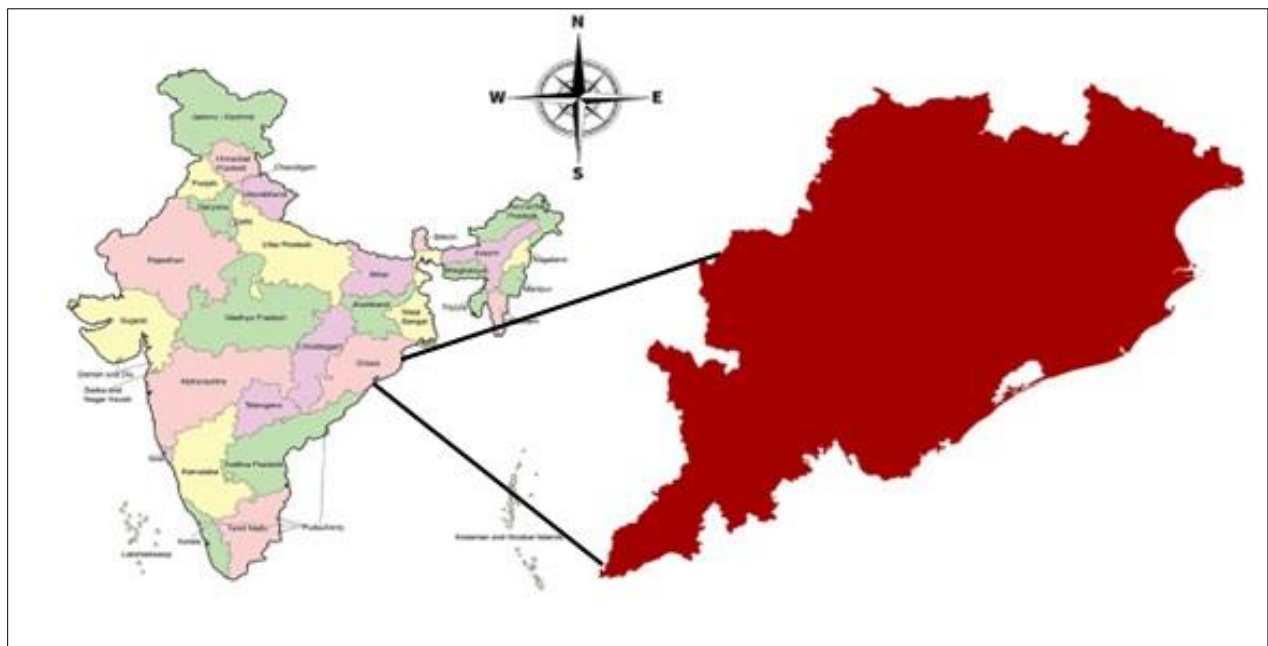


Figure 1: Geographical location of study areas

4. Results and discussion

In the dry season, flowering plants are an important source for nectar-feeding birds. Birds need enough nectar to quench their thirst. The current survey work recorded nearly 28 common nectar-feeding birds with their most visited nectar plants (Table 1).

Table 1: Some common plants of nectar feeding birds

Scientific Name	Common Name	Family	Plants	IUCN Status
<i>Arachnothera longirostra</i>	Spider hunter	Nectariniidae	<i>Erythrina variegata</i> , <i>Dendrophthoe falcata</i> , <i>Melastoma malabathricum</i> , <i>Spathodea campanulata</i>	LC
<i>Chloropsis jerdoni</i>	Jerdon's Leaf bird	Chloropseidae	<i>Neolamarckia cadamba</i> , <i>Erythrina variegata</i> , <i>Bombax ceiba</i>	LC
<i>Cinnyris asiaticus</i>	Purple Sunbird	Nectariniidae	<i>Butea monosperma</i> , <i>Dendrophthoe falcata</i> , <i>Morinda tinctoria</i> , <i>Woodfordia fruticosa</i> , <i>Ipomoea carnea</i>	LC
<i>Copsychus saularis</i>	Oriental Magpie Robin	Muscicapidae	<i>Butea monosperma</i> , <i>Bombax ceiba</i> , <i>Erythrina variegata</i>	LC

<i>Dicrurus macrocercus</i>	Black Drongo	Dicruridae	<i>Bombax ceiba</i> , <i>Butea monosperma</i> , <i>Erythrina variegata</i>	LC
<i>Dumetia hyperythra</i>	Tawny bellied Babbler	Timaliidae	<i>Erythrina variegata</i> , <i>Bombax ceiba</i>	LC
<i>Gracupica contra</i>	Asian Pied Starling / Indian Pied Mynas	Sturnidae	<i>Bombax ceiba</i> , <i>Butea monosperma</i> , <i>Erythrina variegata</i> , <i>Ficus benghalensis</i> , <i>Lantana camara</i> , <i>Ziziphus marutiana</i>	LC
<i>Leptocoma zeylonica</i>	Purple rumped Sunbird	Nectariniidae	<i>Combretum indicum</i> , <i>Dendrophthoe falcata</i>	LC
<i>Oriolus kundoo</i>	Indian Golden Oriole	Oriolidae	<i>Azadirachta indica</i> , <i>Bombax ceiba</i> , <i>Butea monosperma</i>	LC
<i>Oriolus xanthornus</i>	Black hooded Oriole	Oriolidae	<i>Bombax ceiba</i> , <i>Erythrina variegata</i> , <i>Ficus benghalensis</i> , <i>Ficus religiosa</i> , <i>Salmalia malabaricus</i>	LC
<i>Passer domesticus</i>	House Sparrow	Passeridae	<i>Aloe arborescens</i>	LC

<i>Gymnoris xanthocollis</i>	Chestnut shouldered Petronia / Yellow – throated sparrow	Passeridae	<i>Small berries, Madhuca indica, Capparis spinosa, Salmalia malabaricus, Erythrina variegata, Bassia latifolia</i>	LC
<i>Pycnonotus cafer</i>	Red vented Bulbul	Pycnonotidae	<i>Capparis spinosa, Erythrina variegata, Spathodea campanulata, Woodfordia fruticosa, Careya arborea, Cocos nucifera, Erythrina variegata, Bauhinia variegata, Clitoria ternata, Clerodendron infortunatum, Tabernaemontana divaricata, Bombax ceiba</i>	LC
<i>Pycnonotus jocosus</i>	Red Whiskered Bulbul	Pycnonotidae	<i>Lantana camara, Helicteris isora, Careya arborea, Psidium guajava,</i>	LC

			<i>Erythrina variegata</i> , <i>Spathodea campanulata</i>	
<i>Sturnia malabarica</i>	Chestnut tailed Starling	Sturnidae	<i>Butea monosperma</i> , <i>Bombax ceiba</i> , <i>Erythrina variegata</i> , <i>Grevillea robusta</i>	LC
<i>Zosterops palpebrosus</i>	Indian White eye / Oriental White eye	Zosteropidae	<i>Scurrula parasitica</i> , <i>Syzygium laetum</i> <i>Callistemon citrinus</i> , <i>Prunus cerasoides</i> , <i>Erythrina variegata</i> , <i>Madhuca longifolia</i> <i>Bombax ceiba</i> , <i>Ficus benghalensis</i> , <i>Ficus religiosa</i>	LC
<i>Chloropsis aurifrons</i>	Golden – fronted Leafbird	Chloropseidae	<i>Bombax ceiba</i> , <i>Erythrina variegata</i> , <i>Butea monosperma</i> , <i>Woodfordia fruticose</i> , <i>Firmiana colorata</i>	LC
<i>Acridotheres fuscus</i>	Jungle Myna	Sturnidae	<i>Bombax ceiba</i> , <i>Erythrina variegata</i> , <i>Butea variegata</i> ,	LC

			<i>Careya arborea,</i> <i>Spathodea companulata</i>	
<i>Argya striata</i>	Jungle Babbler	Leiothrichidae	<i>Butea monosperma,</i> <i>Erythrina variegata,</i> <i>Helicteres isora</i>	LC
<i>Chrysomma sinense</i>	Yellow eyed Babbler	Paradoxornithidae	<i>Erythrina variegata</i>	LC
<i>Orthotomus sutorius</i>	Common Tailor Birds	Cisticolidae	<i>Butea monosperma,</i> <i>Erythrina variegata,</i> <i>Bombax ceiba</i>	LC
<i>Pycnonotus luteolus</i>	White browed Bulbul	Pycnonotidae	<i>Lantana camara,</i> <i>Erythrina variegata,</i> <i>Bombax ceiba,</i> <i>Helicteres isora</i>	LC
<i>Dicrurus caerulescens</i>	White bellied Drongo	Dicruridae	<i>Bombax ceiba,</i> <i>Erythrina variegata</i>	LC
<i>Dicrurus bracteatus</i>	Spangled Drongo	Dicruridae	<i>Erythrina variegata,</i> <i>Grevillea robusta</i>	LC
<i>Dicrurus paradiseus</i>	Greater racket tailed Drongo	Dicruridae	<i>Bombax ceiba,</i> <i>Erythrina variegata</i>	LC
<i>Psittacula cyanocephala</i>	Plum headed Parakeet	Psittaculidae	<i>Adhatoda vasica</i> <i>Punica granatum</i> <i>Butea monosperma,</i>	LC

			<i>Bassia latifolia</i>	
<i>Psittacula eupatria</i>	Alexandrine parakeet	Psittaculidae	<i>Salmalia malabaricus</i> , <i>Butea monosperma</i> , <i>Erythrina variegata</i>	NT
<i>Psittacula krameria</i>	Rose ringed Parakeet	Psittaculidae	<i>Erythrina variegata</i> , <i>Butea monosperma</i>	LC

(LC: Least Concern; NT: Near Threatened)

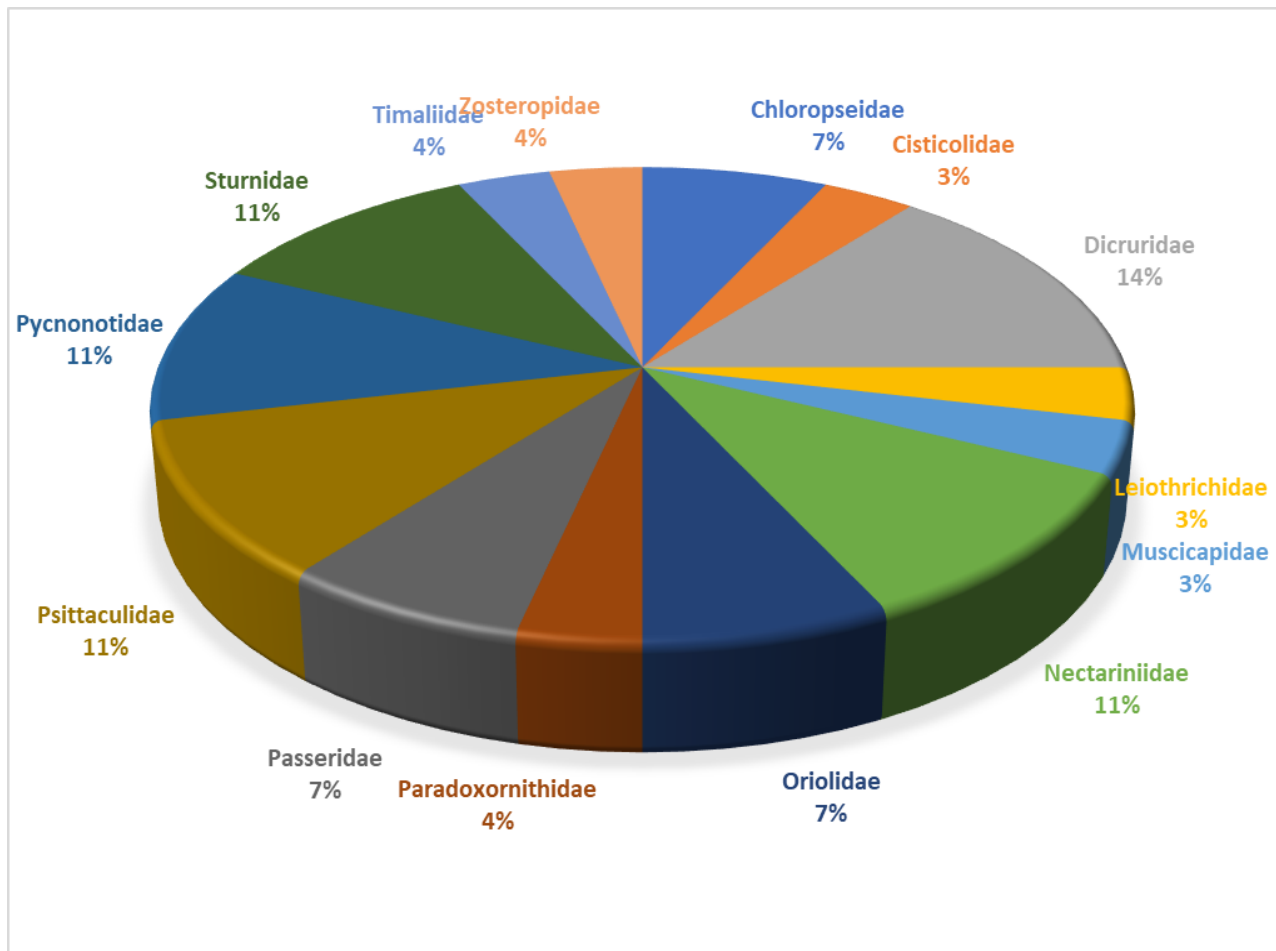


Figure 2: Distribution of families of nectar feeding birds



Plate 1: Purple Sunbird in Ipomoea carnea

From the above **Table 1**, most of the nectar-feeding birds belong to the least concern category as per the International Union for Conservation of Nature (IUCN). There are some of the most common plant species where a variety of nectar-feeding birds are observed (**Plate 1**). The flowers of these plants are vibrant in colour, which attracts these nectar-feeding birds. These plants have food and medicinal values too (**Kumar 2015; Kumar et al. 2018; Kanhar et al. 2020; Kumar et al. 2021; Das et al. 2022; Das 2023**) but due to many anthropogenic activities, the population of these common plant species is now declining in many patches of the study area. Plantation of these plant species or conserving the existing species could be helpful in conserving not only nectar-feeding birds but also many other pollinators. Most of the nectar-feeding birds belong to the Dicruridae

family. Most birds in this family do not depend on nectar. The family of Nectariniidae are the true nectar-feeding birds; they fully depend on the flower for their regular diet (Figure 2).

5. Conclusion

For the reproduction of many plant species, pollination is essential, but due to various reasons, the populations of wild pollinator species are declining in several regions, which negatively affects the flowering plants that depend on them (Klein et al. 2007; Kluser and Peduzzi 2007). The loss of these pollinators is likely to have serious consequences for both general biodiversity and crop productivity (Kevan and Phillips 2001). They are also important for the reproduction of more than 65% of the world's wild plants. It also means trouble for humans, as we all depend on the services of pollinators in many ways, from the food we eat to the air we breathe. This decline in pollinator populations is due in part to human practices that have contributed to the loss of wild and flower-rich habitat. By changing some of our practices, such as how we manage flowering plants in our gardens and farms, plantations, and other activities, we can help to conserve these vital pollinator species.

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