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BEHAVIORAL PATTERNS OF URBAN *LEPTOCOMA ZEYLONICA* (PURPLE-RUMPED SUNBIRD) IN INDIA

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ABSTRACT

Purple-rumped Sunbird is another name for the Leptocomazeylonica, which is a prominent nectar-feeding bird that may be found in urban surroundings in India. In the course of this study, the behavioural activity patterns and floral resource utilisation of this species were investigated in a variety of urban environments. Examples were taken from home gardens, roadside vegetation, urban parks, and urban gardens. Continuous focused sampling was the method that was used in order to do the behaviour observation. In habitats that were abundant in nectar, the behaviours that were seen the most often were hopping (32 percent of the time) and probing for nectar (24 percent of the time), as shown by the data. The most typical areas to find this species were in urban gardens and home gardens that had a large number of plants that were in bloom. There were twelve different kinds of flowering plants that were discovered to be important sources of nectar. Statistical analysis demonstrated a positive and statistically significant correlation between floral abundance and visiting frequency ($r = 0.293$; $P = 0.014$). This was in contrast to the fact that the amount of glucose in nectar did not have a significant impact on the number of visits ($P = 0.148$). The length of the flower's corolla was shown to have a significant negative association with the frequency of visits ($r = -0.415$; $P < 0.001$), showing a preference for shorter corollas. This was a significant finding. According to these findings, purple-rumped sunbirds are dependent on urban flowering plants for both their food and their ability to adapt to their environment.

Keywords :Urban ecology,Leptocomazeylonica, Purple-rumped Sunbird, behavioral patterns, nectar-feeding birds, urban habitats, floral resources, avian foraging behavior.

INTRODUCTION

The transformation of natural habitats due to urbanization has greatly affected many species of birds through changes in their distribution, abundance and behavior. Urbanization causes the destruction of natural habitats, which causes fragmentation of habitat, changed vegetation structure and food source availability. Some species experience population declines due to urbanization, while other species are able to adapt to urban habitats by modifying feeding behavior, nesting behavior and activity patterns. The understanding of how birds respond to urban habitats will help researchers to assess the ecological effects of urbanization and develop strategies to conserve urban biodiversity.

Nectar-feeding Birds in Urban Ecosystems

Pollination of tropical ecosystems is accomplished by nectar-feeding birds as well as by plant-bird interactions. This type of bird can use flowering, ornamental, and garden vegetation as other food sources located in urban environments. The foraging behaviour of these birds may change based upon their access to nectar plants and competition with other birds and the environment. It is possible to gain a better understanding of the ecological significance of nectar-feeding birds in urban habitats in terms of how these habitats support avian biodiversity.

Biology of the Purple-rumped Sunbird

The *LeptocomaZeylonica* (Purple-Rumped Sunbird) is a tiny passerine bird from the family Nectariniidae and is found throughout South Asia, with populations in India, Bangladesh, Myanmar, and Sri Lanka. They primarily inhabit open woodlands, gardens, plantations, and urban green spaces, feeding mainly on flower nectar but also eating small insects and spiders (providing protein essential for growth and reproduction).Sexual dimorphism is highly evident; male adults have a crown and wings that are purple; back and sides that are maroon; and under wing coloring that is bright yellow; female adults are olive brown over most of their body; and underwing color is yellowish. Their long, curved bill and specialized tongue allow them to collect nectar from flowers efficiently.

Behavioral Adaptation in Urban Habitats

Urban areas can offer birds that feed on nectar a wide range of flowering plants year-round. The Purple-rumped Sunbird is often found feeding at flowering ornamental plants in urban gardens, parks and residential areas. Typical behaviours exhibited by the Purple-rumped Sunbird while foraging include hopping between branches, hovering in front of flowers, probing to extract nectar, and exhibiting aggressive behaviours toward other birds. The above behavioural adaptations help the Purple-rumped Sunbird take advantage of food resources in urban environments as well as adapt to living in areas modified by humans.

Importance of Studying Behavioral Patterns

Studying how the *LeptocomaZeylonica* behaves in cities helps us understand its place in nature and how it can adapt to shifts in its surroundings. What we can learn about the *Leptocoma*from these studies are useful pieces of information that tell us about how fishing habits of this species change due to environmental changes. Studies of this type also provide data that can be used by people to help make urban areas more hospitable to birds by making modifications to landscapes.

Rationale of the Present Study

Purple-rumped Sunbird (*Leptocomazeylonica*) is popularly found in the urban environment of India but still lacks thorough documentation on its behaviour, in particular, the uses of flowers and activity patterns for feeding, within urban habitats. This study will investigate the activity and floral resource uses of this species in three different urban habitats. This is important because it will assist in

determining how well urban ecosystems provide resources to nectar-feeding birds and that subsequently aids in the conservation of birds in urban areas.

OBJECTIVES

1. To investigate *Leptocomazeylonica* behavioural activity patterns in various Indian urban environments, with a focus on dominating behaviours like hopping and nectar probing.

2. To examine the connection between the Purple-rumped Sunbird's visitor frequency and floral traits (flower quantity, nectar glucose concentration, and corolla length).

RESEARCH METHODOLOGY

Leptocomazeylonica (the purple-rumped sunbird) is a small, nectar-feeding, passerine bird found throughout South Asia. The bird's range includes India, Bangladesh, Myanmar and Sri Lanka. The purple-rumped sunbird is commonly found in gardens, urban green spaces, plantations, and open woodland habitats. The International Union for Conservation of Nature (IUCN) Red List places the purple-rumped sunbird as a species classified as "Least Concern" and the bird's population appears to be stable.There are two sexes of this species: males have a glossy purple crown and maroon back; females are olive brown above and yellowish under the belly. Purple-rumped sunbirds primarily feed on the nectar of flowers but also consume small insects, and they are often seen feeding in flowering plants in urban backyards.

Study Area

In urban areas of India, we studied flowering plants and their nectar resources for sunbirds. Home gardens (vegetable and flower), vegetation along roadsides, and urban parks were the types of habitat chosen to study. The study was performed in areas with a high density of a variety of flowering plants that provide nectar resources for Purple-rumped Sungbirds. We also performed observations in the areas with a lot of flowering vegetation with a high frequency of Purple-rumped Sungbirds being seen.

Behavioral Observation Method

Monitoring bird behaviour was performed using the continuous focal sampling method as described by Jeanne Altmann (1974). Purple-rumped Sunbirds were observed from a fixed vantage point in order to minimize disturbance. Observations were conducted primarily during the morning hours (07:00 - 10:00) when the activity levels of birds were highest.Binoculars (10 × 50) were used to view the birds from an appropriate distance. Each observation session lasted approximately one hour; therefore, multiple observation sessions performed during the study period. The total cumulative time that the focal bird could be viewed was recorded using a stopwatch.

Behavioral Categories

The activities of Purple-rumped Sunbirds were classified into the following behavioral categories based on established avian behavioral studies:

- Perching
- Hopping
- Hovering near flowers
- Nectar probing
- Piercing flowers
- Flitting between branches
- Preening
- Intraspecific interactions (interactions with other sunbirds)
- Interspecific interactions (interactions with other bird species)

Behavioral events were recorded through verbal descriptions using a digital audio recorder and later transcribed onto observation sheets for analysis.

Plant Resource Assessment

Standard botanical field guides were used to identify flowering plants visited by the Purple-rumped Sunbird. Samples of flowering plants (both flowers and leaves) were sampled for confirmation of species identity.The number of flowers per flowering plant was estimated using a photographic sampling technique. Digital photographs were taken of flowering plants. Each photograph was divided into grid sections, and in each grid section, the number of flowers was recorded using random sampling. The total estimated number of flowers per flowering plant was calculated from the sampled grid sections.

Nectar and Floral Measurements

Samples of nectar were obtained from randomly chosen types of flowers each day, and the average glucose content was measured using a portable glucose meter.Corolla length was measured with a Vernier caliper on 5 randomly selected samples per species to determine the average length of corollas.

Data Analysis

We summed up the total duration of focus people in view across all sample days. When we divided the whole time the focus individual was visible by the total duration of observation (all sample units combined), we could determine the frequency of Long-billed and Purple-rumped sunbirds at each location.

$$\text{Occurrence of sunbird} = \frac{Total\ time\ focal\ individuals\ in\ view}{Total\ time\ of\ observation} \times 100\%$$

The Friedman test was used to see whether there was a correlation between the species of plants and the frequency of sunbird visits. The link between sunbird visitation frequency and blossom colour was also determined using the Friedman test. The ranked Pearson correlation test was performed using Minitab software to determine the link between the number of visits by Long-billed and Purple-rumped sunbirds and variables such as flower count, nectar glucose content, and flower corolla length.

Figure 1. ***LeptocomaZeylonica***

RESULT

Throughout this study, observations of the Purple-Rumped Sunbird (*Leptocomazeylonica*) occurred over various lengths of time at different urban habitat types throughout India. The greatest frequency of occurrence was found within home and urban garden habitats, where flowering plants were abundant. There were moderate amounts of time that individuals of this species were observed in urban park habitat, and they were least frequently encountered on i.e. roadside vegetation, likely due to lower amounts of nectar-producing plants in this habitat, and higher levels of disturbance.The frequency of occurrence for different behaviors exhibited by Purple-Rumped Sunbirds varied depending on the type of urban habitat. The most frequent behavior was observed to be hopping back and forth between branches and flowers, followed by nectar probing, demonstrating active foraging behavior on behalf of the species. In urban garden habitats, hopping was the most frequent behavior exhibited, followed by nectar probing and hovering near flowers.

Conversely, individuals of this species in roadside vegetation exhibited nectar probing more often than hopping, indicating that birds in this habitat likely spent more time extracting nectar from numerous available flowers.In home garden habitat types, the prevalence of both hopping and nectar probing was again observed to be the most frequently occurring behaviors exhibited by Purple-Rumped Sunbirds, while preening and flitting between branches were both observed to occur infrequently. The frequency of encounters between aggressive individuals was extremely low, indicating that there was likely at a relatively low level of competition for nectar sources among Purple-Rumped Sunbirds observed in this habitat.Based on statistical analysis, feeding related behaviours varied significantly between habitats (T-tests, $p<0.05$), therefore indicating a relationship between habitat characteristics; specifically: plant diversity and floral abundance influence Purple Rumped Sunbird's activity patterns.The study identified 12 different flowering plant species (Table 1)

that provided nectar for *Leptocomazeylonica* in the urban habitats. These flowering plants consisted of both decorative and native flowering plants typically found in garden and urban landscapes.

Table 1: Flowering Plant Species Visited by the *Leptocomazeylonica* in Urban Habitats of India

(+ = Present / Visited, − = Not Observed)

Plant Species	Common Name	Family	Flower Colour	Urban Garden (UG)	Roadside Vegetation (RV)	Urban Park (UP)	Home Garden (HG)
Hamelia patens	Fire bush	Rubiaceae	Orange	+	+	−	+
Thunbergia erecta	Bush clock-vine	Acanthaceae	Purple	+	−	+	+
Ixora coccinea	Jungle flame	Rubiaceae	Orange	+	−	+	+
Pyrostegia venusta	Flame vine	Bignoniaceae	Orange	+	+	−	+
Caesalpinia pulcherrima	Peacock flower	Caesalpiniaceae	Yellow	+	−	+	+
Hibiscus rosa-sinensis	Shoe flower	Malvaceae	Red	+	+	+	+
Graptophyllumpictum	Caricature plant	Acanthaceae	Purple	+	−	−	+
Jacaranda mimosifolia	Fern tree	Bignoniaceae	Purple	−	+	+	−
Bauhinia variegata	Orchid tree	Caesalpiniaceae	Purple	−	+	+	−
Tecoma stans	Yellow trumpet flower	Bignoniaceae	Yellow	+	+	+	−

Odontonematubiforme	Scarlet firespike	Acanthaceae	Red	+	–	+	+

Table 2: Frequency of Behavioral Activities of *Leptocomazeylonica* in Different Urban Habitats (activities per minute)

Behavior	Urban Garden	Roadside Vegetation	Urban Park	Home Garden
Hopping	12.4	9.1	10.2	12.0
Perching	5.8	4.6	6.1	5.4
Nectar Probing	8.6	9.8	7.4	6.1
Hovering	3.2	2.8	3.5	2.9
Flower Piercing	1.4	1.1	1.6	1.2
Flitting	4.3	3.7	4.8	4.1
Preening	1.9	1.4	2.2	1.7
Intraspecific Interaction	0.8	0.5	0.7	0.6
Interspecific Interaction	0.4	0.2	0.3	0.2

Table 3: Percentage Activity Budget of *Leptocomazeylonica*

Activity	Percentage of Total Behavior (%)
Hopping	32%
Nectar Probing	24%
Perching	15%
Flitting	11%
Hovering	8%
Preening	5%
Flower Piercing	3%
Social Interactions	2%

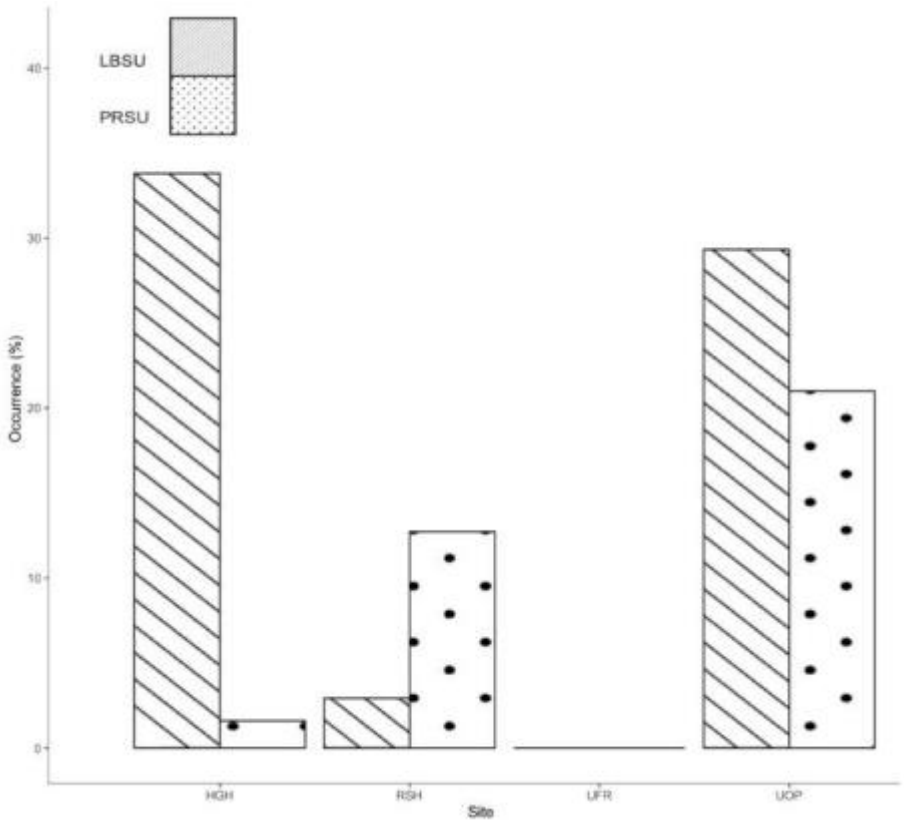

Figure 2: Occurrence of sunbirds at different sites (LBSU= Long-billed sunbird, PRSU= Purple-rumped sunbird, UFR=Udawattakele Forest Reserve, UOP=Garden habitats at University of Peradeniya, RSH=Roadside habitat, Doluwa, HGH=Home garden habitat, Gampola).

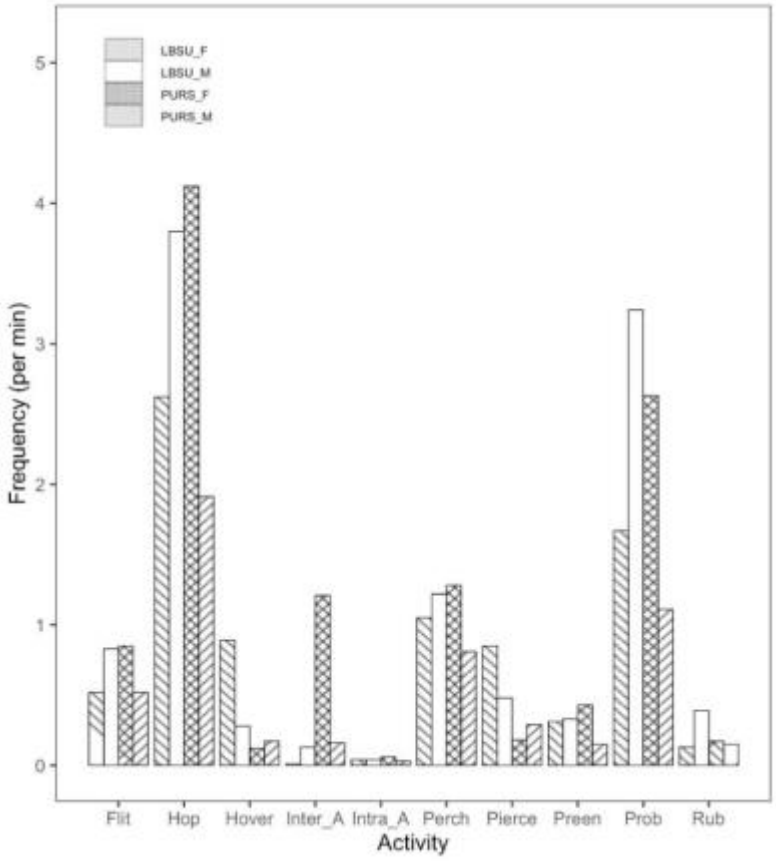

Figure 3: Frequencies of different activities at Garden habitats (LBSU_F= Long-billed sunbird Female, LBSU_M= Long-billed sunbird Male, PURS_F= Purple-rumped sunbird Female, PRSU_M= Purple-rumped sunbird Male, Hop= Hopping, Perch= Perching, Prob= Probing, Hover= hovering, Pierce=Piercing Inter A= Interspecific aggression, Intra A= Intraspecific aggression, Preen= Preening, Flit=Flitting, Rub=Rubbing the beak).

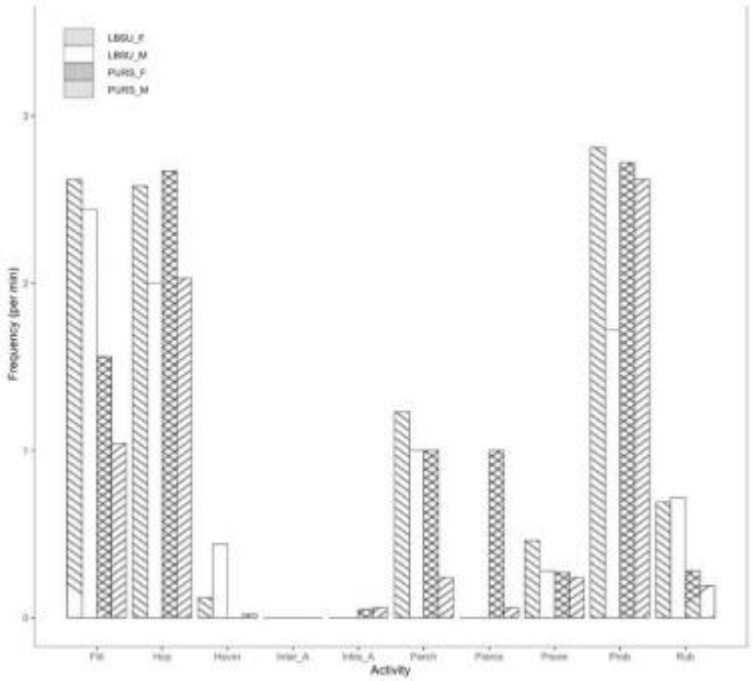

Figure 4: Frequencies of different activities at Road side habitat (LBSU_F= Long-billed sunbird Female, LBSU_M= Longbilled sunbird Male, PURS_F= Purple-rumped sunbird Female, PRSU_M= Purple-rumped sunbird Male, Hop= Hopping, Perch= Perching, Prob= Probing, Hover= hovering, Pierce=Piercing, Inter A= Interspecific aggression, Intra A= Intraspecific aggression, Preen= Preening, Flit= Flitting, Rub=Rubbing the beak).

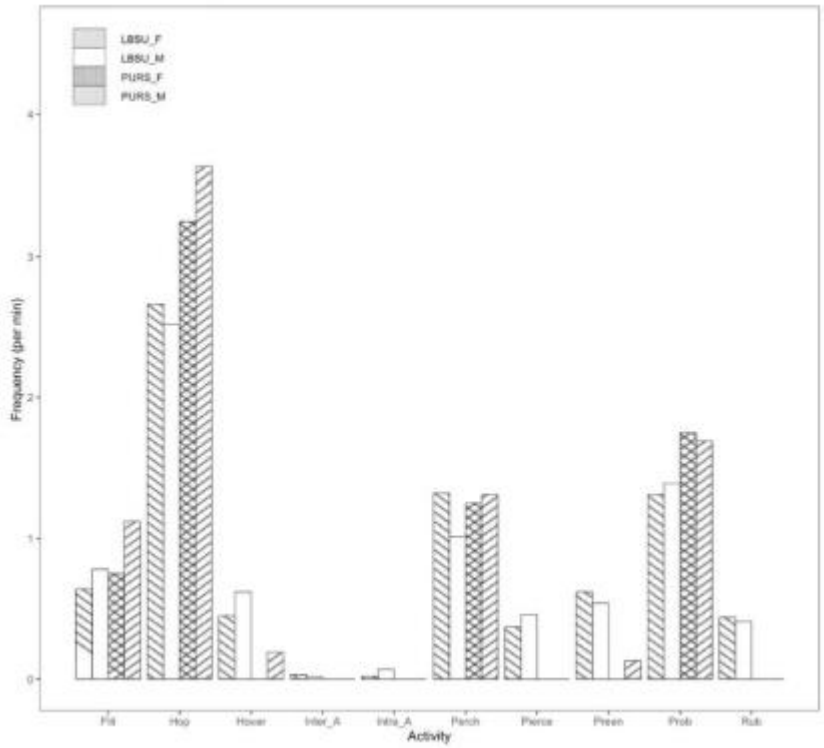

Figure 5: Frequencies of different activities at Home garden (LBSU_F= Long-billed sunbird Female, LBSU_M= Longbilled sunbird Male, PURS_F= Purple-rumped sunbird Female, PRSU_M= Purple-rumped sunbird Male, Hop= Hopping, Perch= Perching, Prob= Probing, Hover= hovering, Pierce=Piercing, Inter A= Interspecific aggression, Intra A= Intraspecific aggression, Preen= Preening, Flit= Flitting, Rub= Rubbing the beak).

Table 4: Friedman Test Showing Effect of Plant Species and Flower Colour on Visitation Frequency of *Leptocomazeylonica*

Variable Tested	Friedman Coefficient	P-value	Significance
Plant species visited	0.014	0.705	Not Significant
Flower colour	0.200	0.655	Not Significant

Table 5: Pearson Correlation Between Flower Count and Number of Visits by *Leptocomazeylonica*

Variable	Pearson Correlation Coefficient (r)	P-value	Significance
Flower count vs. visitation frequency	0.293	0.014	Significant

Table 6: Pearson Correlation Between Nectar Glucose Concentration and Visitation Frequency

Variable	Pearson Correlation Coefficient (r)	P-value	Significance
Nectar glucose concentration vs. visitation frequency	0.175	0.148	Not Significant

Table 7: Pearson Correlation Between Corolla Length and Visitation Frequency

Variable	Pearson Correlation Coefficient (r)	P-value	Significance
Corolla length vs. visitation frequency	-0.415	<0.001	Significant

According to the results of the Friedman test, there is no significant difference in the number of times a Purple-rumped Sunbird (*Leptocomazeylonica*) will visit different flowering plants (Friedman statistic = 0.014; P value = 0.705). In addition, from this same test it can be concluded that the number of visits was also not dependent upon the colour of the flowers (Friedman statistic = 0.200; P value = 0.655).The Pearson correlation coefficient indicated that there was a statistical relationship between the number of flowers on a given plant and the frequency of visits by a Purple-rumped Sunbird (Pearson correlation = 0.293; P value = 0.014). This suggests that plants with more flowers received more frequent visits from the birds.

The results of the Pearson correlation analysis indicated that there is no significant correlation between nectar sugar content and the number of visits made by the Purple-rumped Sunbird (Pearson correlation = 0.175; P value = 0.148). Nectar sweetness therefore is not likely to be the main factor affecting visitation frequency.However, a statistically significant negative Pearson correlation was found between the length of the corolla of a flower and the number of visits made by the Purple-rumped Sunbird (Pearson correlation = -0.415; $P < 0.001$). This indicates that the Purple-rumped Sunbird prefers visiting plants with shorter corolla lengths because they facilitate easier access to nectar.

CONCLUSION

This research shows the behaviour of the *Lepocomazeylonica (*i.e., the blue-tailed bee-eater) differs greatly within urban environments in India. More than half of the behaviours recorded (32% and 24%) resulted from hopping and nectar probing respectively. The majority of these birds were found in urban

gardens and home gardens characterised by a high diversity of flowering plants.The characteristics of the flowers also dictated visitation patterns. There was a positive correlation from one to the other with respect to flower abundance and visitation rates with short corolla lengths being preferred. However, visitation rates for flowers with higher nectar glucose contents were not significantly affected.Ultimately, this research describes how diverse, flowering plants in urban green areas should be an important food source for nectar-feeding birds present in those areas. Maintaining and increasing the floral diversity within urban landscapes would greatly support the ecological sustainability of urban birds.

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