



# An Investigation on the Vestiges of *Lyroderma lyra* and *Taphozous melanopogon* Guano in Tirunelveli District of Tamil Nadu, India

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## Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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## ABSTRACT

Chiropterans are the major contributors to mammalian biodiversity. They play a dynamic role in the ecosystem as pollinators, seed dispersers and pest controllers. Among the biocontrol agent of the agro ecosystem, the bats play a major role as a control agent. Their roosting places are mostly near the human habitation and agricultural fields. They forage among the dry deciduous forest and also in the agro ecosystem of the plains. The purpose of this study was to determine the dietary content in the fecal matter of *Lyroderma lyra* and *Taphozous melanopogon* in Tirunelveli district, Tamil

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Nadu. Agriculture is the main resource in this area. The undigested parts in the guano was microscopically observed and identified up to order level. As *L. lyra* and *T. melanopogon* are the microbats their Pellet contain large amount of partly digested insect parts. Among them, the order Coleoptera was the most dominant food of *L. lyra* followed by the other orders whereas for *T. melanopogon* the most dominantly identified order is lepidopteran followed by the remaining orders. The bats play an important role as pest controller in the ecosystem and hence they need to be protected.

**Keywords:** Pellet analysis; pest controller; *Lyroderma lyra*; *Taphozous melanopogon*.

## 1. INTRODUCTION

Bats are the second largest widely distributed only flying mammal. They belong to the order Chiroptera. The order is divided into two sub orders, as Megachiroptera and Microchiroptera. The Megachiroptera is the one and only family found in old world tropics and sub tropics and the Microchiroptera are found throughout the world comprise 17 diverse families with 169 Genera and 824 Species [1]. The microchiroptera use high frequency echolocation as their major locational sense. *Lyroderma lyra* is a carnivorous bat belongs to an ancient family Megadermatidae and *Taphozous melanopogon*, tomb bat belongs to Emballonuridae family. In India, these two species of bats are most common in many localities. They mainly live in the undisturbed dark chambers of abandoned buildings, temples, wells and caves. The size of the colony varies from ten to hundred [1-5]. It hangs on dark corners of the walls which provide best roosting sites for these bats [6]. There is less knowledge on the diet of these bats in southern Tamil Nadu. The present study made an attempt to investigate the foraging habit and pest controlling behavior of these two bat species by analyze the dietary contents in the fecal pellet and also to take initiative steps in the conservation of these species.

## 2. MATERIALS AND METHODS

### 2.1 Study Area

Tirunelveli is the southernmost district of Tamil Nadu, is described as a microcosm of the State, owing to its montage and diverse geographical and physical features which includes proud mountains, low savannas, rivers and cascades, seacoast and dense inland forest, sandy soils and abundant alluvium, a variety of flora, fauna, and secure wild life. The primary roost was identified in Arulmigu Jeganatha Perumal Temple, Shenbagaramanallur Village, Nanaguneri, Tirunelveli, and Tamilnadu and shown in Fig. 1.

### 2.2 Study Animal

The greater false vampire bat (*Lyroderma lyra*) of the family Megadermatidae is a carnivorous bat native to Asia. It is also known as the Indian false vampire bat [7] previously known as *Megaderma lyra* and due to changes in the genetic this species was recommended to a new genus *Lyroderma* and hence the name *Lyroderma lyra* [8]. The black-bearded tomb bat (*Taphozous melanopogon*) is a species of sac-winged bat found in the regions of South and South East Asia. Its species name is melanopogon meaning black beard [9]. Both species are given represented in Fig. 2 and they have unique morphology and listed under Least Concern (LC) in the IUCN Data.

### 2.3 Faecal Pellet Collection and Analysis

Bats were captured by mist netting during the pre-dawn hours while they return from foraging areas to the day roost. The trapped bats were placed in clean cotton bags separately by following the guidelines of the American Society of Mammologist (ASM) and they were placed for an hour or until defecation, after which they were released. The faces were transferred to the sterile Eppendorf tubes separately and labeled. Then the sample tubes were analyzed following the methodology described by Whitaker, [10] (i.e.) by soaking at 70% alcohol for 24 hours at the Zoology Department and Research Centre, Sarah Tucker College (Autonomous), Tirunelveli.

Each pellet was examined separately and the insect remains were identified to family, which is normally the lowest taxonomic level possible, or when it was not possible, to order following the manuals of Mani [11], Shiel et al., [12] and Whitaker [13]. The results are presented as overall percent volume [(sum of individual volumes/total volume for the sample) x 100], and percentage frequency [(number of pellets of occurrence/total number of pellets in sample) x 100] [13].



Fig. 1. Study area Arulmigu Jeganatha Perumal Temple (A) Roost of *Lyroderma lyra* (B) and *Taphozous melanopogon* (C)



Fig. 2. Study animal *Lyroderma lyra* (A) and *Taphozous melanopogon* (B)

### 3. RESULTS AND DISCUSSION

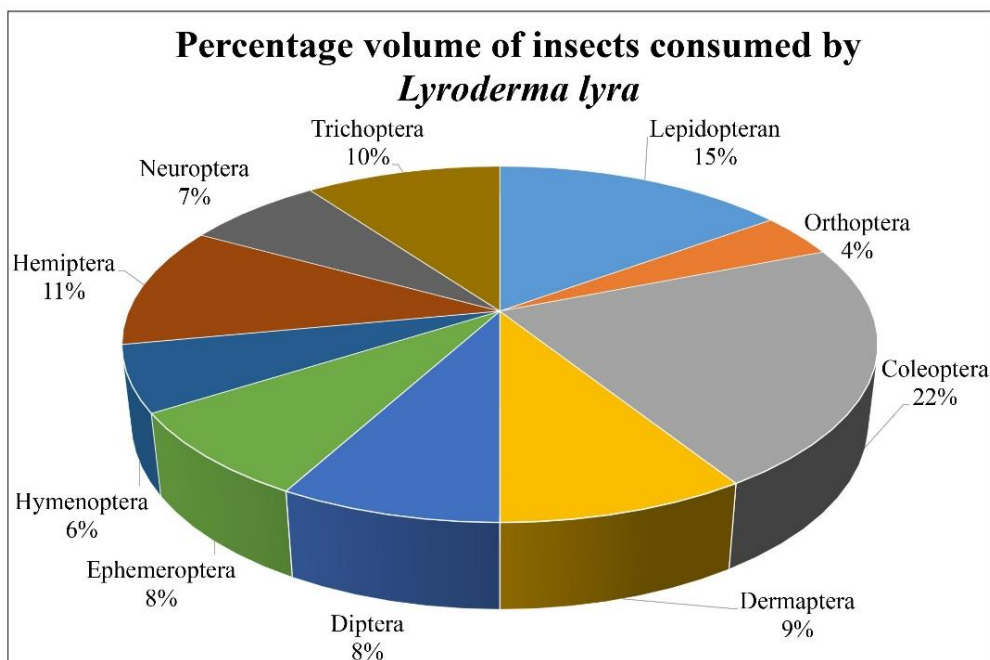
The main diet of many microchiropteran bats includes coleopterans, lepidopteran, dipteran, orthopteran and hemipteran group of insects [14,13]. Incidentally they are the insect groups which include our predominant crop pests [15]. In the present study two microchiropterans bats *Lyroderma lyra* and *Taphozous melanopogon* was chosen from the same site for a period of 5 months (June to October, 2019). The faecal pellets were examined under MAGNUS Binocular microscope and Nikon Eclipse 50i and identified up to order level. The consumption rate has been evaluated by calculating the percentage volume for each order of insects consumed by the bats. The percentage volume of preferred insect orders of *L.lyra* are Coleoptera 22%, Lepidoptera 15%, Hemiptera 11%, Trichoptera 10%, Hymenoptera 6%, Neuroptera 7%, Dermaptera 9%, Diptera 8%, Ephemeroptera 8% and Orthoptera 4%. The percentage volume of insect orders by *L.lyra* is

given in Fig.3. The coleopterans form the major food for *L. lyra* which was also reported by [16,17]. This is not surprising because coleopterans are the largest insect order in the world comprising of one third of all insect species and their hard chitinous exoskeleton passes undigested when compared to the soft bodied insects [14]. The most coleopterans pests of coconut and rice was identified in the diet [17]. Delphacidae and Pentatomidae were the most common among hemipterans which include rice pests [17-19].

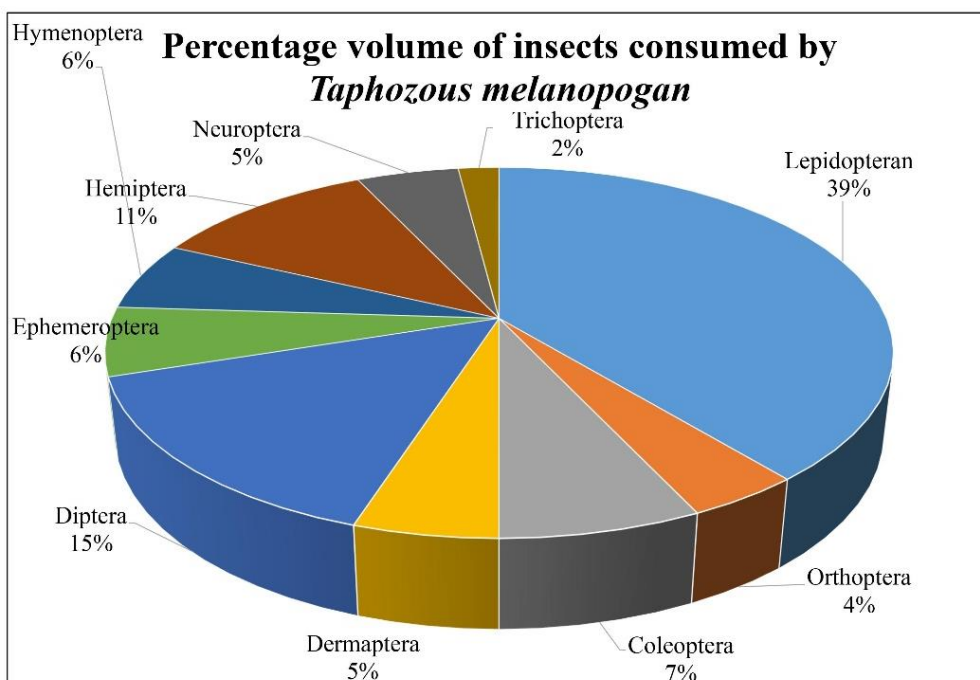
Then the percentage volume of preferred insect orders of *T. melanopogon* is given in Fig. 4. Lepidoptera made up 39% of the total, followed by Hemiptera 11%, Diptera 15%, Coleoptera 7%, Hymenoptera 6%, Ephemeroptera 6%, Neuroptera 5%, Dermaptera 5%, Orthoptera 4%, and Trichoptera 2%. The dietary preference study of *T. melanopogon* also highlights the preferential feeding on lepidopteran insects during their parturition and lactation period. Kunz

et al., [20] confirmed the selection of lepidopteran insects during the lactation period of bat is to meet their lipid demand. The data on the dietary preference of *T. melanopogon* confirms that crop pests comprise a major portion of their diet and so these bats definitely provide valuable natural

pest control. But the study in the forest ecosystem and in the semi-urban regions by Srinivasulu B and Srinivasulu C, [9] states the variation in the diet based on the habitat of the *T. melanopogon* and the roosting condition also plays a major variation in the diet.



**Fig. 3.** The percentage volume of insect orders consumed by *Lyroderma lyra*

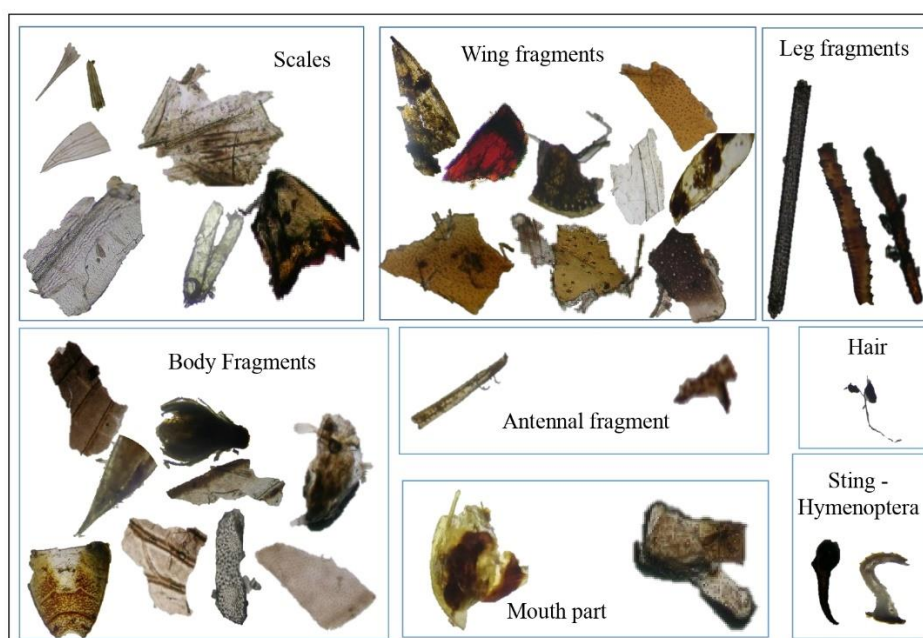


**Fig. 4.** The percentage volume of insect orders consumed by *Taphozous melanopogon*

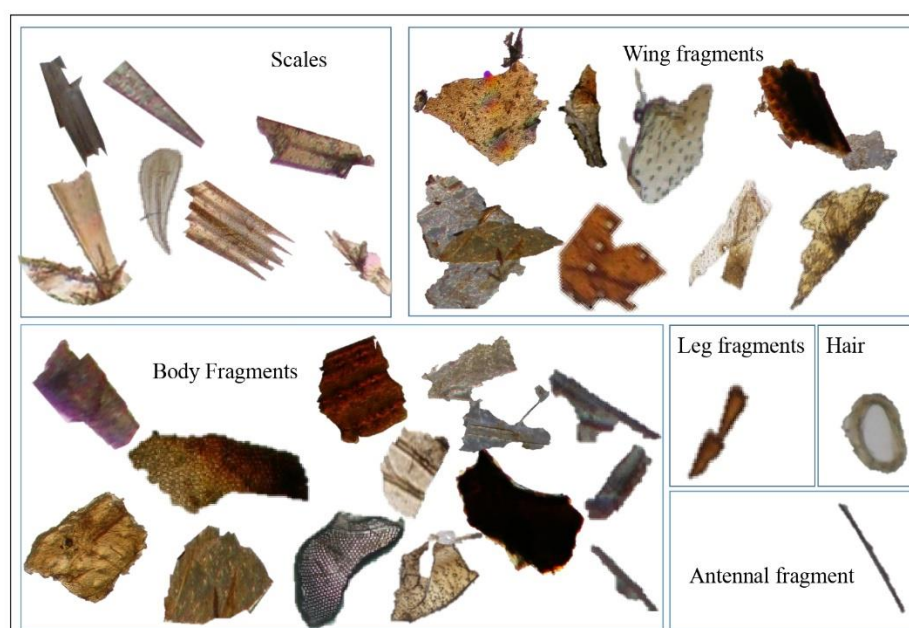


They feed on insects, fish, frogs, or blood and roost in the places such as Temple, Caves, Mines, Buildings and Trees [1]. Most bats eat insects as half of the bat weight in one night. A little bat can eat 600 insects in an hour. A colony can eat 6,000 tons of insects in one year. The teeth of insectivorous bats are

also more important since they have several morphological adaptations that enable them to catch and manage insects in flight [21]. The parts of insects identified in the guano of *L. lyra* and *T. melanopogon* is given in Fig. 5. & Fig. 6. respectively.



**Fig. 5. Insect and insect parts (Hair, Antenna, Wings, Scales, Spine, leg fragments) found in the guano of *Lyroderma lyra***



**Fig. 6. Insect parts found in the guano of *Taphozous melanopogon***

Of all the major dietary items, Coleopteran insects were consumed more by *L. Iyra* and Lepidopteran insects were consumed more by *T. melanopogon*. The pestiferous insects are the major ones causing great damages to forest and agricultural field and reduce the bioresource. In India 15% of total agricultural production is lost by pests every year [15]. Agriculture is the main occupation in all the firkas of Tirunelveli district especially in Nanguneri alone 80% of the population depend on agriculture.

Wing morphology aids the bats to do various flight performances and to capture prey in their aerial feeding habits [22]. The size of the bat, wing loading, maneuverability and flight expense affords a big role on bats to be on their wings [23] which in turn is reflected in their hunting ability during foraging.

But the population of these bats is in danger due to habitat and roost destruction through interferences by human. Conservation and management of bats in the ecosystem should be considered as an essential element for ecosystem sustainable development. Their ecological and economic impact is valued as the health managers of both forest and agro ecosystem. Renovation of abandoned buildings and temple towers cause mass slaying of these bats. Instead of mass slaying the bat entries to the building can be blocked. The conservation of their day roosts and feeding habits (protection of feeding roosts) are vital to conserve these beneficiaries in the ecosystem [24,25].

#### 4. CONCLUSION

The dietary analysis of *Lyroderma Iyra* and *Taphozous melanopogon* confirm their role as a pest monitor in both agro and urban ecosystem and keep a check on major nocturnal pests and pestiferous insects. Among mammals, chiropterans are undoubtedly the most gregarious and successful beneficial animals to the ecosystem and have lured the attention of ethologists. They play a vital role in assessment of the ecosystem. Their diversity is shown by their appearance, their dietary habits, social organization and their choice of place to roost. As they feed on the insects they are natural pest controllers and they can also be called as farmers' friends. They minimize the use of Pesticides and threats like roost disturbances, firing, deforestation greatly affect their population. We can provide artificial roosts to

replace there lost habitat. At last stop Hunting of Bats.

#### DATA AVAILABILITY

The data underlying this study and supplementary details are available from the corresponding authors.

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#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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