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Cover: Common Keeled Skink *Eutropis carinata* in oil pastels, colour pencils, & micron pen adapted from photograph by H. Byju © Pooja Ramdas Patil.

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SHORT COMMUNICATION

Gastrointestinal parasites of the Indian Flying Fox *Pteropus medius* in Nagpur City: a seasonal study through faecal sample analysis

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Abstract: The Indian Flying Fox *Pteropus medius*, among the largest Indian fruit eating bats, is commonly observed with unhurried wing beats at dusk and tends to roost during the day in sizable, noisy colonies situated on trees within bustling towns and villages. Notably, these colonies are prevalent in busy areas of Nagpur city, particularly on expansive Banyan Trees *Ficus bengalensis* and Pangom Oil Trees *Millettia pinnata*, owing to the consistent availability of fruits and flowers throughout the year. This study focuses on evaluating gastrointestinal helminth infection in fruit-eating bats during the summer, monsoon, and winter seasons in Nagpur city, Maharashtra. A total of 58 samples were collected, processed, and examined using the double sedimentation technique. Of these, 46 samples (80.01%) tested positive for *Ascaris* spp. eggs, with a higher percentage during the monsoon season. Additionally, during the peak summer season, a juvenile flying fox from one of the colonies was rescued in a dehydrated state, displaying crusty scab-like lesions on the wing's anterior and posterior regions. Subsequent examination revealed the presence of the ectoparasite *Macronyssus* spp. on body of the juvenile Indian Flying Fox.

Keywords: *Ascaris* spp., Banyan Tree, dehydration, ectoparasite, helminths, *Macronyssus* spp., mites, nematode, Pangom Oil Tree, sedimentation technique.

Bats, belonging to the order Chiroptera, represent the only volant mammals globally, encompassing 1,116 species. They are further classified into Megachiroptera (fruit bats) and Microchiroptera (insectivorous bats), based on their feeding habits and morphological adaptations. Constituting 20% of the world's mammals, bats play crucial roles as pollinator, seed disperser, and influencing germination of local plant communities (Digana et al. 2000; Louis et al. 2008). Their significance extends in structuring and regenerating forest, especially in cleared areas (Gorghov et al. 1993; Rainey et al. 1995). Beyond ecological contributions, bats provide economic benefits such as biological pest control, guano mining, and support for tourism, education, and research.

Despite these positive aspects, some bat species can have negative effects, causing damage to humans, livestock, crops, buildings, and infrastructure. They may also pose risks such as airplane strikes, disease transmission, and contamination (Louis et al. 2008). Furthermore, bat population is appeard to be declining due to various human-induced environmental stresses and misbeliefs, including habitat destruction, disturbance to caves, food resource depletion, overhunting, pesticide use, and the spread of parasitic and infectious diseases. In view of their overlooked importance, bat conservation becomes imperative (Dittmar et al. 2009).

This study aims to assess major gastrointestinal helminth infections in fruit-eating bats during the summer, winter, and monsoon season, contributing to our understanding of bat health and ecosystem dynamics.

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Material and Methods

Samples were collected from the different roosting sites. Amongst them two sites located at 21.158°N, 79.068°E, are close to the Maharashtra State Veterinary Council office (MSVC), and one additional site (21.158°N, 79.064°E) near Nagpur's High Court area (Image 1). The fresh samples were collected twice a week early in the morning (7:00 AM- 8:00 AM) using forceps and placed in labeled sterile plastic bottles, and routinely processed for helminthic ova using the double sedimentation technique. This method concentrates eggs for observation under a microscope (10x). To execute the technique, placed 5 g of fecal sample in a beaker, mixed thoroughly with 10–15 ml of water, repeated the process until level reached to 50 ml, and then poured through a wire mesh sieve into a sedimentation flask. Filled to the brim and left to settle for 20 minutes. Immediately decanted the supernatant, the 15 ml of water added to the sedimentation flask and shaken, Supernatant poured into a beaker, and allowed to settle for 20 more minutes, and decanted again. Finally, last single drop of sediment was taken and placed on a glass slide, covered with a glass slip, and examined under the microscope (10x) for ova (Image 2). Ectoparasites were collected from rescue juvenile flying fox during clinical examination. The collected ectoparasites kept in glycerol, and directly mounted on a microscope slide, covered, and examined (Soulsby 1982).

Results and Discussion

A total of 58 samples were collected over one calendar year from three roosting sites of Indian Flying Foxes (refer to Table 1). Among them, 46 samples tested positive for the presence of helminthic ova, specifically *Ascaris* spp., in alignment with the findings of Louis et al. (2008). The seasonal prevalence of endoparasitic infection was notably higher during the monsoon season, consistent with the results reported by Fowler (1986).

Ectoparasites, identified as *Macronyssus* spp. mites (Image 3), were collected from rescued juvenile flying foxes, a pattern observed similarly by Radovsky & Krantz (1998). The mites were noted infesting bats, appearing as tiny moving specks or red 'jewels' (Radovsky 1967). *Macronyssus* spp. mites were significantly present on wing membrane areas posterior to the radius ulna and within the fur. Protonymph stages were predominantly found on wing membranes, while adult mites concentrated more on the head, as reported by Spears et al. (1999).

Conclusion

Primary goal of study was the seasonal fecal sample analysis for intestinal parasite of the Indian Flying Fox *Pteropus medius*, for contributing valuable current insights into the prevalent gastrointestinal parasites affecting free-roaming bat populations. The findings revealed that 80.01% of faecal samples were infected with the gastrointestinal parasite *Ascaridia* spp., aligning with Fowler's (1986) observations. The endoparasitic infection originates from environmental contamination, possibly through polluted water or food sources. In

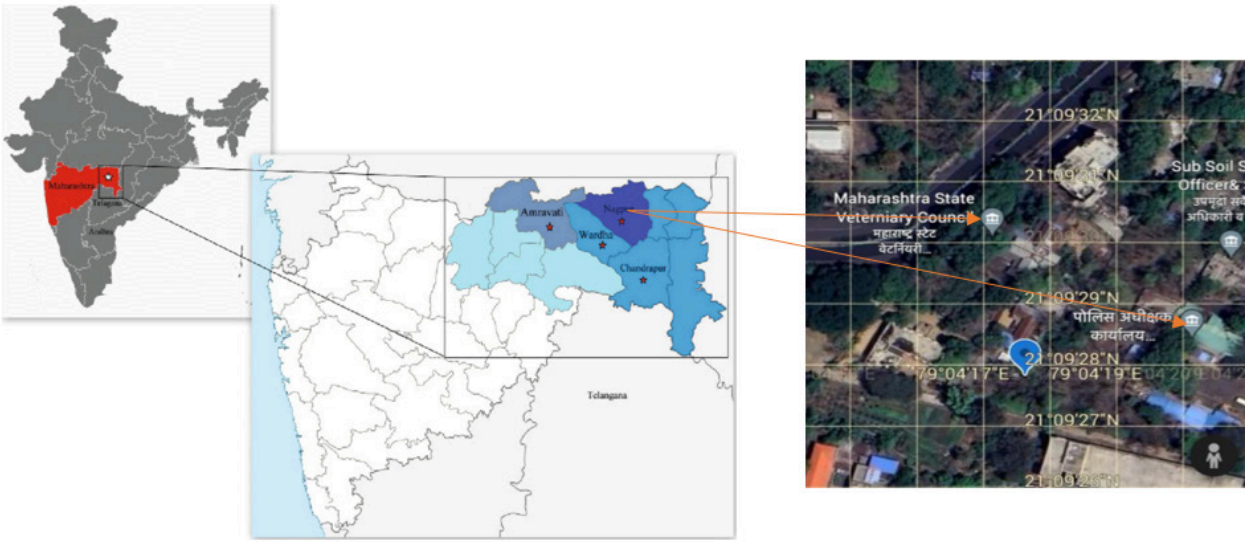

Image 1. Map showing the study area - Marked with pointing arrows roosting sites of the Indian Flying Fox, Nagpur, Maharashtra, India. © Google maps.

Table 1. The number of faecal samples collected and samples positive for *Ascaris* spp.

Season	No. of samples	No. of samples positive for *Ascaris* spp.	Percentage of positive samples
Summer	19	15	78.94 %
Monsoon	18	17	94.44 %
Winter	21	14	66.66 %
		Average percent	**80.01%**

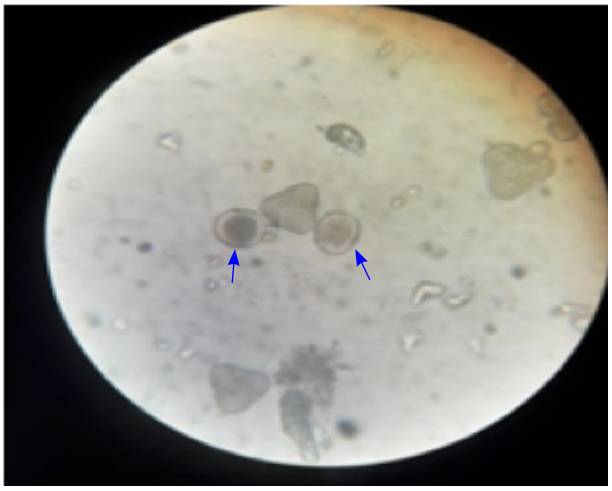

Image 2. Ova of *Ascaris* sp. © Priya Gawande.

this study, the nematode infection was commonly found probably due to its direct life cycle involving no intermediate host and easy transmitted by oro-fecal route through contaminated feed, water, and soil and has the potential to accumulate in a free-ranging flying fox population (Fowler 1986). Moreover, further studies are required to rule out the role in zoonotic transmission. Additionally, the study documented *Macronyssus* spp. mites. These parasites feed on their host's blood and lymph and can complete their life cycle partially outside the host (Dittmar et al. 2009; Radovsky 2010). This finding is notable due to *Macronyssus* spp.'s known distribution in Europe and its original host being the bat *Nyctalus leisleri*, according to Fain et al. (2003).

Image 3. Mite *Macronyssus* sp. © Priya Gawande.

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