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Case Report

Infestation of *Meristaspis* sp. Mite on Fruit Bats (*Cynopterus* spp.) Collected in an Animal Market of Yogyakarta

Farrah Eka Putri Aprilia[1], Yasmin Mutiara Sari[1], Raihan Arief Setiawan[1], Windi Ayutia Putri[1], Fahria Karima Benevalanti[1], Auzan Sukaton[2], Diah Ristya Oktaviani[3], Yudhi Ratna Nugraheni[3*]

[1]Undergraduate Student Faculty of Veterinary Medicine, Universitas Gadjah Mada, Yogyakarta
[2]Yayasan Konservasi Ekosistem Alam Nusantara (KIARA), Non-government Organisation (NGO), Bogor, Jawa Barat
[3]Department of Parasitology, Faculty of Veterinary Medicine, Universitas Gadjah Mada, Yogyakarta
*Corresponding author, Email: yudhi.ratna.n@mail.ugm.ac.id

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Abstract

One of the Asian fruit bats of the genus *Cynopterus* sp. plays a crucial role as pollinators and seed dispersers in various ecosystems. It is also important to note that this species can serve as potential reservoirs for zoonotic diseases. This study was conducted to investigate the presence of ectoparasites found on fruit bats *Cynopterus* sp. at the animal market Pasar Satwa dan Tanaman Hias Yogyakarta (PASTY) in Bantul, Yogyakarta, Indonesia. A total of 6 fruit bats (3 males and 3 females) were examined in the whole body for the presence of ectoparasite. The collected ectoparasites were then preserved in 70% alcohol for further examination. The whole mount method without staining was used to observe the ectoparasite under the microscope. Morphological identification was done using the identification key of the spinturnicidae family. The results showed that five of the six examined fruit bats were infested by *Meristaspis* spp. mites. This study reveals the infestation of *Meristaspis* sp. mites on fruit bats in the Yogyakarta Special Region. Further research with a larger sample size is necessary to be conducted to shed light on the ectoparasite-bat interaction. Understanding the potential zoonotic risks correlated with fruit bats and continuing advanced research and investigation efforts in this region is crucial.

Keywords : Bats; *Cynopterus*; Fruit bats; *Meristaspis*; Mite

Introduction

Wildlife diversity in Indonesia, particularly among wild mammals, is notably abundant, including a diverse range of fruit bat species. Research by Suyanto in 2021 documented an enormous 72 species of fruit bats in Indonesia. Fruit bats can also be infested by ectoparasites that carry zoonotic diseases that may affect humans and other wild animals. Ectoparasites are parasites that live on the surface of another animal, primarily on the skin and hair, and take a blood meal from the host (Hopla *et al.,* 1994). Fruit bats, for example, can become infected with a variety of ectoparasites, including *Meristaspis* sp., which may serve as disease vectors and could lead to disease transmission from animal to animal and from animal to human (Aroon *et al.,* 2016). The epidemiology of most ectoparasite-borne diseases among bats is poorly understood and probably greatly underestimated. There isn't specific information available about *Meristaspis* spp. transmitting diseases to animals or humans. It is important to note that the name *Meristaspis* typically refers to an extinct genus of trilobites (Bower & Woo, 1981. *Meristaspis* sp. mites, which belong to the Spinturnicidae family, are typically found on the wings, uropatagium, or around the anus of bats (Orlova *et al.,* 2020). A

previous study reports that *Meristaspis* sp. mites were identified through the Key to Philippine Genera of Spinturnicidae, which includes identifying characteristics such as non-enlarged claws I, developed caruncles I, four pairs of setae surrounding the anterior margin of the dorsal shield, and large, flattened distal setae on tarsus I (Delfinado & Baker, 1963).

Previous studies have documented the infestation of ectoparasites in bats in Southeast Asia and Pacific (Prasad, 1970). The study discussed bat mites (Spinturnicidae), including *Meristaspis* sp. Another study by (Negm & Fakeer, 2014) was also conducted on Egyptian fruit bats. They found that *Meristaspis kenyaensis* infested Pteropodidae bats. A survey on ectoparasite in bats was also reported that *Meristaspis lateralis* and *Meristaspis macroglossia* found in Malaysia (Ahamad *et al.,* 2013). However, investigation on the ectoparasite of fruit bats in Indonesia remains limited and scarce. Therefore, this study aims to investigate the presence of ectoparasites in fruit bats collected in a traditional animal market in Yogyakarta.

It is important to note that geographical variations can lead to differences in characteristics. Given the limited research on *Meristaspis* sp. mites in Indonesia, it is essential to study their diversity and distribution on fruit bats (*Cynopterus* spp.). The lack of attention to ectoparasite distribution and scarcity of reports on *Meristaspis* sp. infestations in fruit bats (*Cynopterus* sp.) in Indonesia make the purpose of this report significant as it highlights the presence of *Meristaspis* sp. infestations in fruit bats at the Pasar Satwa dan Tanaman Hias Yogyakarta (PASTY). The study of ectoparasitic mites related to bats, such as *Meristaspis* sp., can be precious in the medical field since these species serve as reservoirs and potential vectors for viruses and other pathogens with zoonotic potential for humans and wild animals.

Materials and Methods

Sample collection

This research was conducted at the traditional animal market (Pasar Satwa dan Tanaman Hias Yogyakarta) in the Bantul Regency of the Yogyakarta Special Region. The sample for this case report consisted of 6 fruit bats (*Cynopterus* sp.) that could potentially transmit zoonotic diseases to visitors at the Pasar Satwa dan Tanaman Hias Yogyakarta. The sample selection for this study involved live bats meeting specific criteria, including the absence of physical defects, normal movement patterns, and responsiveness. During the handling process, precautions were taken to ensure the safety of researchers and the well-being of the bats. This included the use of gloves to prevent bites and scratches, avoidance of direct contact with bat saliva, urine, or bodily fluids due to potential zoonotic risks, and a careful approach to minimize stress on the bats. Additionally, measures were implemented to minimize loud noises and avoid crowded environments during the handling of bat samples. These stringent criteria and handling methods were applied to create a safe and controlled environment for both the researchers and the bats involved in the study. Fruit bats were examined for the presence of ectoparasite. Ectoparasites were collected manually by forceps and subsequently put in the 1.5 mL tube with 70% alcohol.

Morphological identification

Fruit bats were documented by the camera and identified based on the Indonesian bats identification key by Suyanto (2021). Ectoparasites were subjected to morphological identification following the identification key by (Delfinado & Baker, 1963). Collected ectoparasites were observed under a microscope with a 100-400x objective magnification. All samples were examined and identified in the Parasitology Laboratory of the Faculty of Veterinary Medicine, Universitas Gadjah Mada.

Ectoparasite preservation

Ectoparasite samples were preserved in 70% alcohol and then rinsed with distilled water. Subsequently, they were soaked in a 10% KOH or NaOH solution for 24 hours and transferred to Eppendorf tubes. The ectoparasites were dehydrated using alcohol to remove water molecules from the tissues. The ectoparasites were then immersed in xylene for 10 minutes, followed by immersion in clove oil for five

minutes. The ectoparasites were transferred onto glass slides, and a few drops of Entellan were added, following previous reports by Walter and Krantz (2009).

Data analysis

The data in this study were presented in figures and analyzed descriptively.

Results and Discussion

Fruit bats identification

Bat sample collection at the Pasar Satwa dan Tanaman Hias Yogyakarta (PASTY) in Yogyakarta, the collected bats were identified as *Cynopterus* sp. from the Pteropodidae family. These bats exhibit distinctive morphology, characterized by their relatively large body size, head, and snout resembling a dog, relatively large eyes, small and pointed ears, a simple nose, a strong snout, and a diet primarily consisting of fruits. The morphometric lengths were evaluated manually. The length of the body ranged from 4 to 5 cm, with an average of 4.5 cm. Similarly, the length of the wing exhibited a range of 6 to 7 cm, with an average of 6.5 cm. The humerus length fell within the range of 3 to 4 cm, with an average of 3.5 cm. The length of the leg indicated steadiness with a range of 4 to 5 cm and an average of 4.5 cm. The length of the tail diverse between 1 to 2 cm, with an average measurement of 1.5 cm. These results provide detailed insights into the morphological characteristics of the sampled bats, emphasizing the precision and uniformity of the measurements taken across different body parts as presented in Table 1.

Table 1. Body part measurement bat samples in this study

Part of Body	Range (cm)	Average
Body	4-5 cm	4,5 cm
Wing	6-7 cm	6,5 cm
Humerus	3-4 cm	3,5 cm
Leg	4-5 cm	4,5 cm
Tail	1-2 cm	1,5 cm

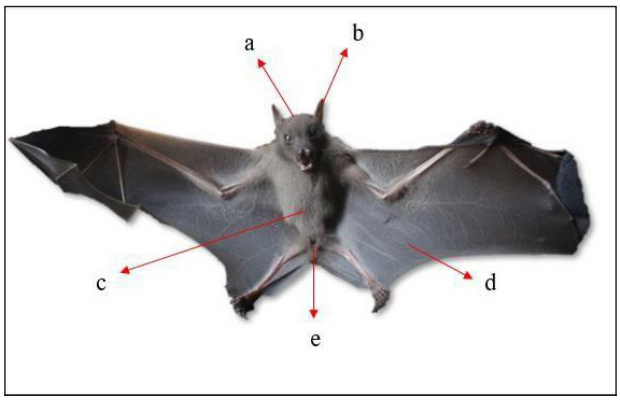

Figure 1. Fruit bat (*Cynopterus* sp.) in this study. a) Head, b) Ears, c) Body, d) Wings, e) Reproductive Organ (Female).

Ectoparasite identification

Morphological identification has revealed the presence of Spincturnicidae family of mites. It was collected from the wings of fruit bats (*Cynopterus* sp.). The mites exhibit morphological characteristics, including four pairs of legs with short spines or fine hairs covering the leg surface, a rounded ovoid dorsal body shape, and claws on the legs used for attachment to the host's wing membrane. The characteristics such as leg I greatly enlarged with spinelike lateral (Fig. 2a), leg 2, leg 3, leg 4 (Fig. 2b-2d), a pair of setae below the stigmata, a short dorsal peritreme, pairs of setae surrounding the anterior boundary of the dorsal shield, developed caruncula I, large and flattened distal setae on tarsus I (Fig. 2f), large claws I (Fig. 2e), gnathosoma (Fig. 2g) and an absence of setae on the postanal region. Based on this identification, the mites belonged to the order Mesostigmata, the family Spinturnicidae, and the genus *Meristaspis*. A total of six individuals of *Meristaspis* sp. (three females and three males) were successfully collected from five fruit bats (three females and two males). These mites were classified as adult-stage parasites due to possessing eight legs (four pairs).

Parasitic infestations are common among wildlife, including *Cynopterus* spp. Ectoparasitic infestations typically involve blood-sucking or lymph-feeding parasites that target the hairy skin areas to meet their nutritional needs. According to (Chen *et al.,* 2014), some bat ectoparasites serve as disease vectors and can transmit diseases from animals to animals and from animals to humans (zoonoses), including coronaviruses like MERS and SARS. Ectoparasitic occurrences are relatively common in bats, particularly those in the wild (not in captivity).

The diagnostic criteria for Spinturnicidae infestations are based on (Zania *et al.,* 2022),

which involve the presence of mites in the wing area. Some cases suggest that Spinturnicidae mites act as vectors for pathogens, including bacteria, protozoa, and viruses (Burazerović *et al.,* 2018). Infestations of *Meristaspis* sp. have been documented to infect several bat species, as reported in a previous study. For instance, *Meristapis calcaratus*, was reported to infest Flying fox species and *Meristaspis mindanaoensis*, reported from New Guinea and the Philippines collected from *Cynopterus brachyotis*, *Macroglossus* sp., *Nyctimene* sp., and *Rousettus* sp. as hosts (Delfinado & Baker, 1963). In this study, the morphological characteristics of each ectoparasite species were recorded as references for identification. Mites collected from fruit bats *Cynopterus* sp. in this study were identified as *Meristaspis* sp, according to the previous study by Delfinado and Baker (1963). The finding of this study also corroborates the previous finding by Negm et al. (2014). The researcher found *Meristaspis* sp. infested Egyptian fruit bats from the family of Pteropodidae. Our study also found *Meristaspis* sp. collected from *Cynopterus* sp. bats, which belonged to the Pteropodidae family.

One of the limitations of this study is that the sample size is relatively small due to the difficulty in capturing *Cynopterus* spp., which restricts their availability in the animal market. This is influenced by the limited demand for *Cynopterus* spp. in the community, resulting in minimal interest in breeding this type of bat. The scarcity of references and data on ectoparasite diversity and distribution in bats also limited this study.

This research addressed the limited knowledge regarding ectoparasites in *Cynopterus* sp., offering new insights into the infrequently found parasites within this bat species. These mites on *Cynopterus* sp. make it an intriguing aspect to consider when studying ectoparasites on these bats. Furthermore, understanding the significance of ectoparasite existence for both ecology and public health is crucial. Such awareness is hoped to lead to greater caution in human-bat interactions, reducing the risk of pathogen transmission between species (Allocati *et al.,* 2016).

It is highly recommended that a long-term study of *Cynopterus* sp. ectoparasites is needed to obtain data on the severity of *Meristaspis* sp. infestations and their distribution in Indonesia. It is also advisable to conduct research in various regions where *Meristaspis* sp. cases have yet to be documented. A large sample size and a more diverse range of locations are necessary to understand better the extent and prevalence of *Meristaspis* sp. in Indonesia.

This research contributes to the limited knowledge regarding ectoparasites in *Cynopterus* sp. and emphasizes the significance of considering ectoparasites as an aspect of broader ecological and public health concerns. This awareness is hoped to lead to more cautious interactions between humans and fruit bats, reducing the risk of pathogen transmission between species. Future studies should involve long-term, in-depth research to assess *Meristaspis* sp. infestations and distribution throughout Indonesia. Exploring regions where *Meristaspis* sp. infestations have yet to be previously documented will provide a more comprehensive understanding of the country's prevalence and extent of these ectoparasites.

Conclusion

In conclusion, the study unveils the presence of ectoparasites on fruit bats of the genus *Cynopterus* sp. at the Pasar Satwa dan Tanaman Hias Yogyakarta (PASTY) in the Yogyakarta Special Region, Indonesia. The study revealed the infestation of *Meristaspis* sp. mites on five out of the six examined fruit bats. These mites are part of the Spinturnicidae family and were found primarily on the wings of bats. *Cynopterus* sp., as fruit bats, play crucial environmental roles as pollinators and seed dispersers in various ecosystems. As a result, it is essential to emphasize that they can also be undertaken as reservoirs for several zoonotic diseases, which are related risks to human and animal health. The presence of *Meristaspis* sp. mites ectoparasites on fruit bats is concerning due to their possible involvement as pathogen vectors. Further studies are needed with larger samples in order to acquire a better understanding of the interaction, diversity, and distribution of mites in bats in Indonesia.

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