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Species and Prevalence of Parasite Mites on Tree Geckos in Purwokerto, Central Jawa

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Abstract. Parasitic mite infections are very common on virtually all organisms including tree lizards. This research was aimed to determine the species and prevalence of parasitic mites infecting tree lizards in Purwokerto, Central Java. This research employed a survey method with a purposive random sampling technique. One hundred individuals of tree lizards were obtained from trees in 4 different sub-districts in Purwokerto. The results showed that 3 species of tree lizard namely, *Hemidactylus platyurus, H. frenatus* and *H. garnotii* were found infected by parasitic mites. The prevalence of parasitic mites in *H. garnotii* was 0%, while in *H. frenatus* and *H. platyurus* were 27% and 29%, respectively. The total prevalence of parasitic mites on tree geckos in Purwokerto, Central Java, was 28%. The results showed that there were 5 (five) species of parasitic mites belonged to the genus *Geckobia*, namely *G. keegani, G. gleadovania, G. turkestana, G. simplex* and *G. diversipilis*. The prevalence of *G. gleadovania* in *H. frenatus* geckos was 100%, while in *H. platyurus* geckos, the prevalence of infection by *G. diversipilis* was also 100%. The most infected body part was the trunk where the prevalence was 57%.

Keyword : species, prevalence, tree mites, geckos, Purwokerto

1. Introduction

Purwokerto is located between $109^0$17'20''- $109^0$18'40'' East longitude, $7^0$10' – $7^0$30' South latitude. Based on the geographical location, the city area has the rainfall of approximately 2.000-4.000 mm/year, humidity of about 52-100% with the monthly average temperature of 26.3^0 C [1]. Various tree types, such as mango (*Mangifera indica*), rambutan (*Nephelium lappaceum*), Ketapang (*Terminalia catappa*) and others, have grown well in many yards along the city areas. Not only appropriate for the growth of various tree types, this environmental condition is also good for the tree geckos.

Geckos are classified into Phylum *Chordata*, Class *Reptilia*, Order *Squamata*, Suborder *Lacertilia*, and Family *Gekkonidae* [2]. Tree geckos have two pairs of legs, tympanum, and sternum. The tree

geckos' special characteristics are shown by the presence of digiti with lamellae and claws which help them move on the trees [3]. Some species known well adapt to the residential environments are *Gekko gecko, Hemidactylus frenatus, H. garnotii, Cosymbotus platyurus* and *Gehyra multilata* [4].

The tree geckos' exploring range area is relatively extensive and also known entering the house geckos' home range areas or vice versa. The spread of tree geckos is relatively extensive and consequently increases the opportunity for various parasitic mites to meet and infect them. This increasing opportunity indicates the possibility of finding various species of parasitic mites and high prevalence of tree geckos infected by various species of parasitic mites [5].

Genus Geckbia mites infect almost all body surfaces of geckos, such as head, armpits, digiti, thighs, ears, and tail [6]. The mites reside themselves in the geckos' body by gripping the geckos' claws and sticking their mouth into the geckos' body parts. Types of gecko's habitats and behaviors can determine the species and prevalence of Geckobia mites [7].

Family Gekkonidae geckos are generally infected by the Geckobia ectoparasitic mites. Genus Geckobia including G. hemidactili known infecting *H. mabouia, G. carcinoides* geckos is an ectoparasite on *Gehyra oceanica* [8]. The other studies showed that *G. clelandi, G. cosymbotyi* and *G. glebosum* mites were able to infect *C. platyurus* [9]. These studies did not explain the infected group of geckos (house or tree geckos) by ectoparasitic mites or their prevalence.

According to [10], the prevalence of parasitic mites on *C. platyurus* and *H. frenatus* geckos in Indonesia is respectively 14.29% and 100%. These high prevalence values are due to the presence of geckos' lamellae, interspace between claws, and digiti tips which provide protection for the parasitic mites [11]. In addition to protection, these parts are more frequently in contact with the substrate so that the chance of contact with the parasitic mites increases. The reference searching results have not revealed many species of parasitic mites and their infection prevalence on tree geckos, especially in Purwokerto, Central Java. The purpose of this study was to determine the species of parasitic mites infecting the tree geckos and their prevalence in Purwokerto, Central Java. The results of this study are expected to provide a theoretical basis for controlling the tree geckos using the parasitic mites.

2. Research Methods

2.1. Time and Place of Research

The samples of tree geckos were obtained from four districts consisting of South Purwokerto, North Purwokerto, East Purwokerto, and West Purwokerto. There are no different types of trees used as the sampling locations. The trees growing in various yards of houses in the four districts are mango, rambutan, ketapang and duku. Identification of geckos and examination of mites were conducted in the Entomology-Parasitology laboratory, Faculty of Biology, Universitas Jenderal Soedirman. The research was conducted in five months, from May to September 2020. This research used a survey with a random sampling technique. 25 samples of tree geckos were taken from each district. Therefore, 100 individuals of tree geckos were collected from those four districts. The variables observed in this study were species of parasitic mites and their prevalence on the tree geckos. The parameters measured were the number of individuals of each parasitic mite species and the number of tree geckos infected by the parasitic mite species.

2.2.Tree Gecko Sample Collection

Sampling collection was performed at night when it was not raining. Tree geckos were caught using hands when they are still within reach and using a soap water containing-sprayer when they were out of reach. The caught tree geckos were then put into plastic bags. The temperature and humidity were measured using a thermohygrometer. Tree geckos were anesthetized using ether in a killing bottle and then fixed using alcohol 70%. The identification of tree geckos was conducted using morphological characters as well as morphometric and meristic criteria.

2.3. Identification of parasitic mites tree geckos

Parasitic mites in the geckos' body were isolated using a needle or toothpick. Furthermore, the obtained parasitic mites were macerated using KOH solution 10% for 14 days in an Ependorf tube. The mites were then transferred to the glass objects and dropped with Hoyer's solution to preserve the samples. Identification of parasitic mites was conducted using the chaetotaxy principles based on the setae number and location using the determination keys proposed by Bertrand et al. (2013). In addition to determining the species of parasitic mites, the data obtained were calculated for their prevalence values. The prevalence was calculated by dividing the number of tree geckos infested by the parasitic mites by the total number of individual tree geckos.

3. Results

The identification results show that those tree geckos obtained from four districts belong to genus *Hemidactylus*. The characteristics of this genus included the dorsal body which has the color of white gray to blackish brown as well as long and wide fingers with split or not-split lamellae. The identification results also show that there were three species of tree geckos: *H. platyurus, H. frenatus* and *H. garnotti*. Those three tree gecko species have obvious morphological differences.

The tree geckos caught in each district were different. Of 100 tree geckos, 72 individuals were *H. platyurus*, 26 individuals were *H. frenatus* caught in all three districts. Meanwhile, 2 individuals of *H. garnotii* were caught and only found in West Purwokerto district (Table 3.1). The temperature when the samples were taken ranged from 26.3 ^{0}C to 26.9 ^{0}C.

Tabel 3.1. Number and species of the captured tree geckos (*Hemidactylus)*

Sampling Location	Number and Species of tree geckos (*Hemidactylus)*			Total
	H. frenatus	*H. platyurus*	*H. garnotii*	
North Purwokerto	13	12	0	25
East Purwokerto	3	22	0	25
West Purwokerto	8	15	2	25
South Purwokerto	2	23	0	25
Total	26	72	2	100

156 individuals of parasitic mites were obtained from the tree geckos' body and those all mites were identified in family *Pterygosomatidae*, genus *Geckobia*. Meanwhile, the chaetotaxy principles identified five species of parasitic mites: *G. keegani, G. gleadovania, G. turkestana, G. simplex* and *G. diversipilis*.

28 individual tree geckos were infested by the parasitic mites with the prevalence can be seen in table 3.2.

Tabel 3.2. Prevalence of parasitic mites in tree gecko species

Gecko Species	infested	Not infested	Total Gecko	Prevalence (%)	Total Prevalence (%)
H. frenatus	7	19	26	27	
H. platyurus	21	51	72	29	
H. garnotii	0	2	2	0	
Total	28	72	100		28

The obtained parasitic mites were able to infest all body parts of tree geckos covering eyes, ears, femur, digiti, axillary, trunk, and tail. The prevalence of parasitic mites in the body parts of tree geckos is presented in table 3.3.

Tabel 3.3. Prevalence of parasitic mites in the body parts of tree gecko species

Body Part	Number of the infested individual tree gecko species and their prevalence (%)			
	H. frenatus (n=7)	Prevalence	*H. platyurus* (n-21)	Prevalence
Mata	1	14	7	33

Body Part	Number of the infested individual tree gecko species and their prevalence (%)			
	H. frenatus (n=7)	Prevalence	*H. platyurus* (n-21)	Prevalence
Eyes	0	0	1	4
Ears	3	42	5	23
Femur	5	71	4	19
Digiti	2	28	2	9
Axillar	1	14	12	57
Trunk	1	14	5	23

Based on the species of parasitic mites, the prevalence of *Geckobia diversipilis* reached 100% and was able to better infest H. platyurus than H. frenatus. Meanwhile, *G. gleadovania* had the highest prevalence in *H. frenatus* when compared to that of the other types of parasitic mites (table 3.4).

Tabel 3.4. Prevalence of parasitic mite species on tree gecko species

Mite species	Number of individual gecko species and their prevalence (%)			
	H. frenatus (n = 7)	Prevalence	*H. platyurus* (n-21)	Prevalence
Geckobia keegani	5	71	16	76
G. gleadovania	7	100	16	76
G. turkestana	0	0	8	38
G. simplex	3	42	8	38
G. diversipilis	5	71	21	100

4. Discussion

H. platyurus tree geckos have long and broad fingers with webs between the 2nd, 3rd, and 4th fingers as well as a long flattened tail with lateral tufts and ventrolateral folds along the body [6]. Meanwhile, *H. frenatus* has long and broad fingers without membranes, yet sometimes there is a membrane proximal on the 3rd, and 4th fingers as well as an elongated round tail with six tubercle sides and no ventrolateral folds along the body [12]. In addition, *H. garnotii* has a reddish-gray dorsal body, a rounded head with a round snout longer than the distance from the eyes to ear canals and a flattened long tail with serrated edges [13].

. Based on table 3.1, it is assumed that tree species influence the obtained number of tree geckos caught. One factor related to the tree species is the canopy which is related to the number of insects which are considered as the tree geckos' food [14].

The temperature in this study is included in an optimal temperature range for geckos to perform their activities as stated by [15] mentioning that the temperature needed for activities in home-range is 19-34^{0}C.

G. keegani parasitic mites have a laterally rounded body shape, with little *setae* on legs. On tibia part, mites 1 to 4 have 5 *setae*. These mites have no setae on their trochanter of leg 4 [11]. In contrast to *G. keegani*, *G. gleadovania* has an almost round body shape. This mite has 5 setae on the tibia of leg 1 to 4. These mites have one *setae* on their trochanter of leg 4. Genu of leg 1 and 4 respectively has no *setae* [4]. With a wider body shape than the mite types found in this research, *G. turkestana* has 5 *setae* on their tibia of leg 1 to 4. These mites have one or two setae on their femur of leg 2 and 3. The idiosome of dorsal part is covered with the relatively dense setae, while that of lateral part is covered with many setae [16]. *G. simplex* has an almost round body shape with setae on the tibia of leg 1 to 4, one setae on the femur of leg 2, and 3 setae on femur of leg 3 [6]. *G. diversipilis* has an almost round body shape like *G. simplex*, but its setae on the dorsal genu is only on leg 1 and 4 or only found on the genu of leg 1. These mites have 3 setae on the femur of leg 1. Setae are not found on the femur of leg 3 and there are two setae on the femur of leg 4. In the genu of leg 1, there are no setae [9].

Based on table 3.2, the prevalence of parasitic mites on both tree geckos is relatively the same with the total prevalence due to the presence of physical contact between geckos including mating, fighting,

and living in one adjacent habitat, as stated by [8]. This equation causes the chance to meet and infest increases.

Table 3.3 explains that the prevalence of parasitic mites in the body of *H. frenatus* was mostly found in the digiti part, while that in *H. platyurus* was mostly found in the trunk. The greater the prevalence of parasitic mites in the digiti is assumed related to the presence of lamellae and interspace between claws and digiti tips which are parts directly in contact with the substrate when the geckos walk or crawl [16]. Table 3.3 also informs that parasitic mites can infest all geckos' body parts as stated by [16]. [16] further explained that the geckos' ventral part has a thin skin structure which possibly eases mites to access the blood vessels as the mites' food sources. In addition, there is a ventrolateral fold on the ventral side of *H. platyurus* which allows the mites to protect themselves from various frictions.

Table 3.4 informs that *G. gleadovania* mites have the highest ability to infest all *H. frenatus* geckos as stated by [10] finding the fact that the prevalence of these parasitic mites reached 100%. Allegedly, the more elongated size of *chelicerae G. diversipilis* can cause the ability of parasitic mites to attach stronger as stated by [10].

5. Conclusion

There were 5 species of parasitic mites consisting of *Geckobia keegani, G. gleadovania, G. turkestana, G. simplex* and *G. diversipilis*.

The prevalence of *G. gleadovania* in *H. frenatus geckos* was 100% and that of *G. diversipilis* in *H. platyurus* geckos was also 100%. The most infected body part of tree geckos was on the trunk with the prevalence of 57%.

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