IS FORAGING BEHAVIOR A DAILY ACTIVITY IN *Hemidactylus platyurus*?

APAKAH PERILAKU FORAGING ADALAH AKTIVITAS HARIAN PADA *Hemidactylus platyurus*?

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ABSTRAK

Untuk memahami peran cicak ekor pipih dalam pengendalian hama di daerah perkotaan, kami mengamati perilaku mencari makan dan aktivitas harian *H. platyurus*, salah satu cicak rumah yang mudah ditemukan. Namun demikian, studi mengenai perilaku mereka masih kurang. Pengamatan dilakukan pada tanggal 14–27 Mei 2021, selama 18 jam mulai pukul 09.00 sampai dengan pukul 03.00 WIB dengan menggunakan metode *ad libitum sampling*. Hasil kami menunjukkan bahwa perilaku mencari makan ditemukan hampir setiap jam pengamatan yang sangat dipengaruhi oleh kelembaban relatif dan kelimpahan serangga. Cicak ini teramati sebagai predator yang menunggu mangsa secara pasif. Pengamatan kami juga menunjukkan bahwa spesies ini berpotensi mengendalikan salah satu hama rumah tangga, semut fase terbang (*alates*). Harapan kami, studi ini dapat menambah pemahaman tentang perilaku mencari makan cicak ekor pipih. Namun, penelitian lebih lanjut diperlukan untuk pemahaman yang lebih baik tentang perilaku mencari makan pada spesies ini.

Kata kunci: foraging, aktivitas harian, *Hemidactylus platyurus*.

ABSTRACT

To understand the role of the flat-tailed gecko on pest control in urbanized areas, we observed the foraging behavior and daily activity of *H. platyurus*. It is one of the house geckos easily found but more studies on their behavior are still lacking. The observation was conducted between 14–27 May 2021, for 18 hours starting from 09.00 to 03.00 WIB using the *ad libitum sampling* method. Our result suggests that the foraging behavior was found almost every hour of observation, which is strongly influenced by relative humidity and insect abundance. This gecko was observed as a sit-and-wait predator or passively searching for prey. Our observation also indicated that this species has potential to control one of the household pests, the adult ants (alates). Hopefully, this study contributed to the understanding of the foraging behavior of the flat-tailed gecko. However, more studies are needed for better understanding of foraging behavior in the flat-tailed gecko.

Keywords: foraging, daily activity, *Hemidactylus platyurus*.

INTRODUCTION

The flat-tailed gecko, *Hemidactylus platyurus*, is widespread in Southeast Asia and very common in urbanized areas. In Indonesia, this species is found in almost all the main islands. Based on the PCR-RAPD approach, human activities in inter-island trade and tourism boat crossings are the cause of the passive migration of this species (Sandriliana *et al*., 2018). On the other hand, their ability to survive and live abundantly in an urban environment may be due to successful foraging behavior. The success of foraging behavior will increase survival, reproduction and be a driver to successful geckos colonization in urban areas (Aowphol *et al*., 2006; Haley & Blackshaw, 2015). Moreover, as a foraging strategy, several species of geckos were found feeding on non-insect foods such as nectar, bread, boiled rice, cucumbers, and fried eggs (Taylor & Gardner, 2014; Weterings, 2017; Weterings & Weterings, 2018).

In the last decade, many studies on the foraging behavior and daily activities of geckos have been carried out (Tawa *et al*., 2014; Haley & Blackshaw, 2015; Bashaw *et al*., 2016; Baxter-Gilbert *et al*., 2021). A

study on *Gekko japonicus* shows that the distribution of daily locomotor activity of this species is affected by temperature (Tawa *et al*., 2014). In *Hemidactylus turcicus*, foraging success is increased in simple habitats, encouraging successful colonization of this species in urban areas (Haley & Blackshaw, 2015). Meanwhile, the diurnal gecko, *Phelsuma inexpectata*, changes its foraging behavior and other activities to a nocturnal period, one of which shows mating behavior (a daytime activity) (Baxter-Gilbert *et al*., 2021). While foraging behavior and daily activities are well documented in other species, studies on *H. platyurus* are still lacking.

However, several reports have recorded the agonistic, foraging and opportunistic behavior in *H. platyurus*. This gecko was found more aggressive towards conspecifics and exhibited more active individual exploratory (Lapwong, 2021); has a strong preference for Lepidoptera and a slight preference for Culicidae regarding diet (Tkaczenko *et al*., 2014); and feeding on rice from a bin as an opportunistic feeding strategy (Weterings, 2017). Besides, the role of the house gecko in pest control in urban areas is worth considering (Tkaczenko *et al*., 2014). Therefore, to better understand the behavior and the role of the flat-tailed gecko, this study is needed. Here, we observed the foraging behavior of *H. platyurus* and analyzed its correlation to insect abundance and environmental conditions. We also observed daily activity and recorded any visible behavior.

MATERIALS AND METHODS

This research was conducted in an outdoor area (4 x 2.5 m), Pacitan, East Java, where the substrates are cement walls and wooden ceilings. The outdoor area was chosen since this species spent more time in open cells (Lapwong, 2021). However, this area has several shelters for the flat-tailed gecko to hide (through small cracks and crevices around wooden structures and cement walls). The observation was conducted between 14−27 May 2021, for 18 hours starting from 09.00 to 03.00 WIB. The behavioral sampling method used was *ad libitum sampling*, which is recording every individual behavior that was seen (Altmann, 1974). The observed foraging and daily activities included grooming, hiding, agonistic, and mating (Table 1). Air temperature, relative humidity (RH), the number of individuals and abundance of insects were

Table 1. An ethogram of the daily activity used within observation.

Behavior	Description	Authors
Grooming	The tongue touches the labial or rostral scales, which increase after eating.	Cooper *et al.,* 1996
Hiding	Hide either part of the body or the whole body.	This study
Agonistic (retreating)	The animal turns in the opposite direction of the other individual and come forward.	Briggs, 2012
Agonistic (fighting)	Both individuals attempt to bite or tail waves against each other, usually laterally, with their heads positioned in opposite ways.	Coelho *et al*., 2018
Mating	Mating movement, the animal either sticking together or copulation.	Langkilde *et al*., 2003
Foraging	Movements included watching, stalking, lunging, and biting on the prey	Bashaw *et al*., 2016

recorded every hour. For foraging behavior, the main focus was around the light bulb (LED lamp), where the light would attract insects. Based on the previous survey, ants alates were the most common insects found around the light bulb. One possible reason for this is because LED lights are less attractive to some nocturnal insects (Poiani *et al*., 2015; Wakefield *et al*., 2016). So that the abundance of insects was visually calculated in the 50 cm x 50 cm bright area around the bulb and divided into 3 categories as follows: 1 = low, 1−15 individuals/2500 cm^2; 2 = medium, 16−30 individuals/2500 cm^2; 3 = high, more than 30 individuals/2500 cm^2.

We used simple linear regression analysis to determine the effect of temperature, humidity, and insect abundance on foraging behavior. The Pearson correlation coefficient to determine the correlation between those variables. The data were analyzed using R version 4.0.5. Also, individuals observed in each behavior (foraging, hiding, and grooming) will be totaled and calculated as a percentage. Percentage data is used to compare and display the number of individuals in each observed behavior.

RESULTS AND DISCUSSION

All individuals were found just sitting and waiting for prey during the observation, but none hunting actively. Hunting is characterized by the behavior of *H. platyurus* which is actively searching for prey. However, this study revealed that *H. platyurus* is a kind of sit-and-wait predator, and grabs the preys in a short distance movement as they approach. Predators sitting and waiting are stereotypic behaviors in reptiles with low activity levels and very limited metabolic capacity (Porges *et al*., 2003). It is found in many lizard species (Daniells *et al*., 2008; Shepard, 2007), because they spend most of the time immobile, likely sunbathing or searching for prey passively. (Watters, 2009).

Hemidactylus platyurus foraging behavior was found almost every observation hour, which is increased at 17.00−20.00 WIB, and reached its peak at 18.00−19.00 WIB (Figure 1). The increase of foraging behavior is thought to be due to the high abundance of flying ants at that time, even though their diversity was low. Nevertheless, our observations showed that the lower the insect abundance, the lower foraging activity would be. On the other hand, if the

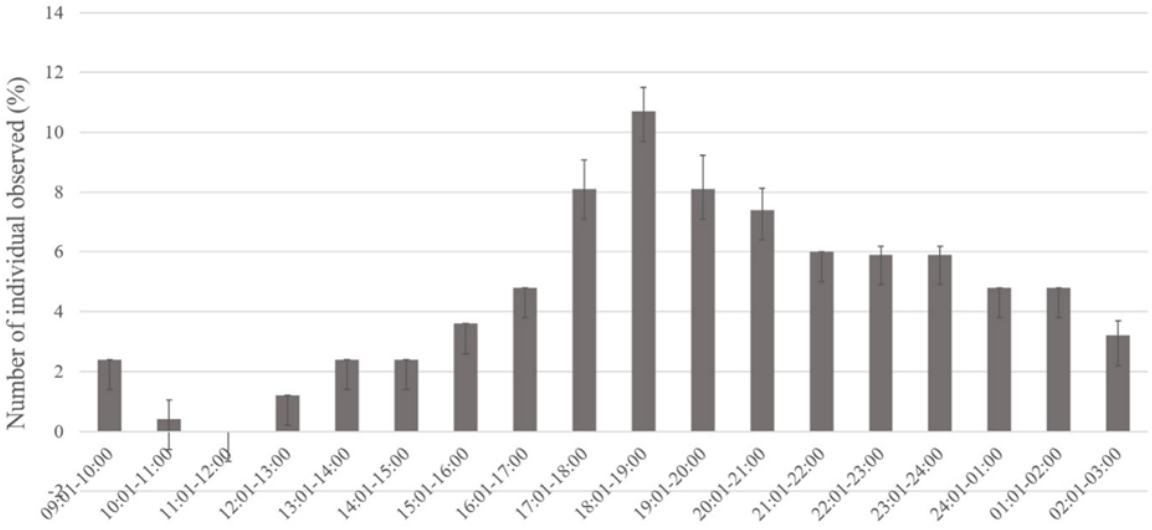

Figure 1. Number of individuals of *H. platyurus* observed in foraging for each hour of observation.

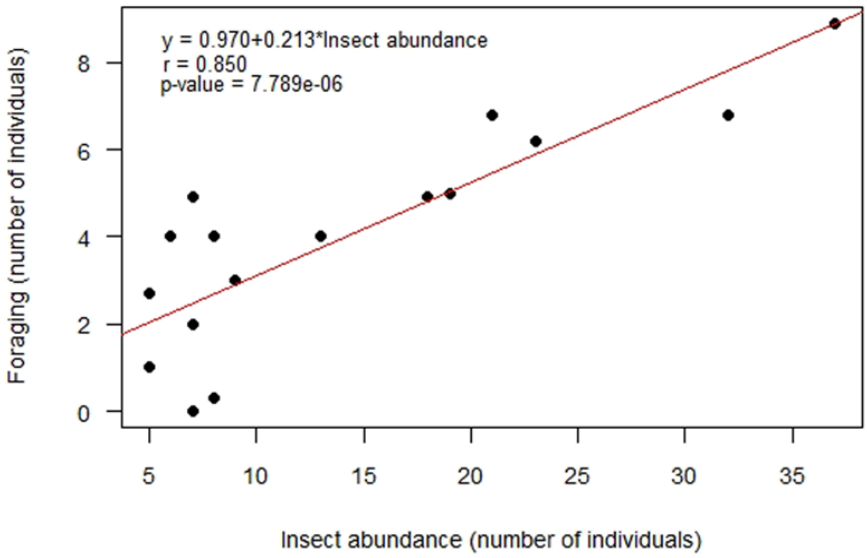

Figure 2. Correlation between foraging and insect abundance based on simple regression analysis and the Pearson correlation coefficient.

abundance of insects increases, foraging activities will also increase (Figure 2). Lack or abundance of prey in the environment will result in low time spent foraging by all lizards (Watters, 2009). In addition, artificial lighting in attracting arthropods cause a difference in the activity level of tropical gecko in disturbed areas (Cummings *et al*., 2021). Moreover, our observation indicate that this species has the potential to control one of the household pests, the ants alates. Some species of ants, both alates and foraging workers, are considered as pests that can enter homes or other human made structures for foraging or nesting (Klotz *et al.,* 1995; MacGown *et al.,* 2007).

Simple linear regression analysis showed that foraging behavior was affected by humidity (y = −7.19 +0.12) but not by temperature (y = 20.7433 -0.5945). Then, Pearson correlation coefficient analysis shows that there is a significant correlation between humidity and temperature with foraging behavior (df = 16, p-value = 0.010, r = 0.589 and df = 16, p-value = 0.007, r = −0.608, respectively) (Figure 3). These results indicate that the foraging behavior will increase with increasing humidity, but decrease with increasing temperature. A possible reason for this may be to minimize water loss, as reported by Aowphol *et al*. (2006) that the foraging period will decrease in *Gekko gecko* when humidity is low. However, these different results were displayed by invasive species such as *H. frenatus* and *H. turcicus*. In temperate climates, they are more active when the temperature is warmer (Lei & Booth, 2014; Wessels *et al*., 2018). This is because the environmental temperature in the area fluctuates greatly, so living and adaptable reptiles are predicted to change their active period depending on the ambient temperature (Tawa *et al*., 2014). Furthermore, in the sub-tropics, *H. frenatus* was found to be able to adapt to colder regions allowing expansion (Lapwong *et al*., 2020). Invasive species usually have a wider functional temperature range and higher thermal tolerance, thus having the advantage of survival during the transport and dispersal phases of the invasion pathway (Kelley, 2014).

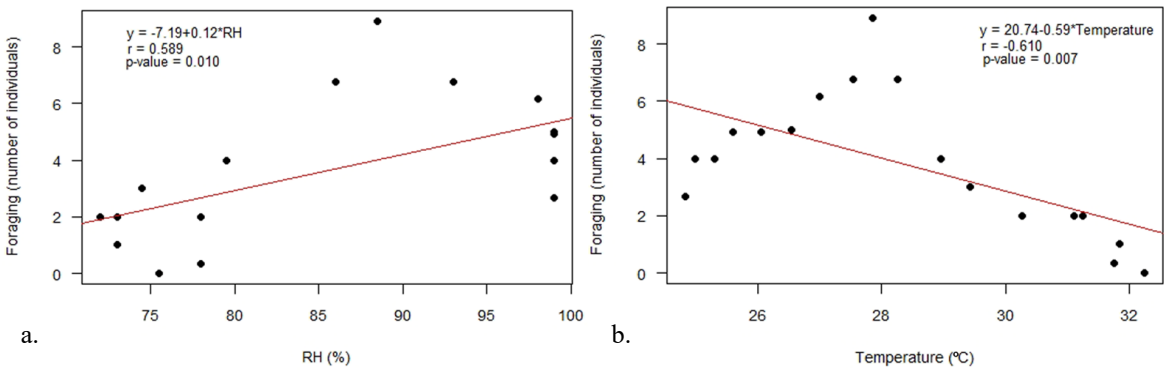

Figure 3. Effect and correlation between humidity (a) and temperature (b) on the number of foraging individuals.

The daily activities found were only foraging, grooming, and hiding, while others were not found during the observation (Figure 4). Grooming was found to increase the most when foraging reached its peak at 18.00−19.00 WIB. This labial licking behavior was only observed from the foragers after eating their prey and not observed at all when the gecko is not eating. Correspondingly, Cooper *et al*. (1996) observed the labial-licked was after eating while remaining, rarely while moving after eating or at rest without eating, and not at all while moving without eating. Also in his report, it may help maintain alertness to prey visual stimuli associated with certain chemical cues. Furthermore, hiding was observed in only a few individuals for a few hours of observation. However, hiding was observed to be quite high when insects were abundant at 19.00−20.00 WIB. We suspect this is due to increased human activity at that hour at the observation site. According to Lapwong (2021), the flat-tailed gecko was found to spend less time in the shelter and exploring more. Also in his report, the impossibility of hiding is one of the reasons for the unsuccessful of this gecko invasion because this behavior limits them from being human-mediated introduced. In addition, hiding is an antipredator behavior to cope with changing predation risk without incurring excessive costs in terms of missed foraging opportunities or physiological disturbances (Martín, 2001).

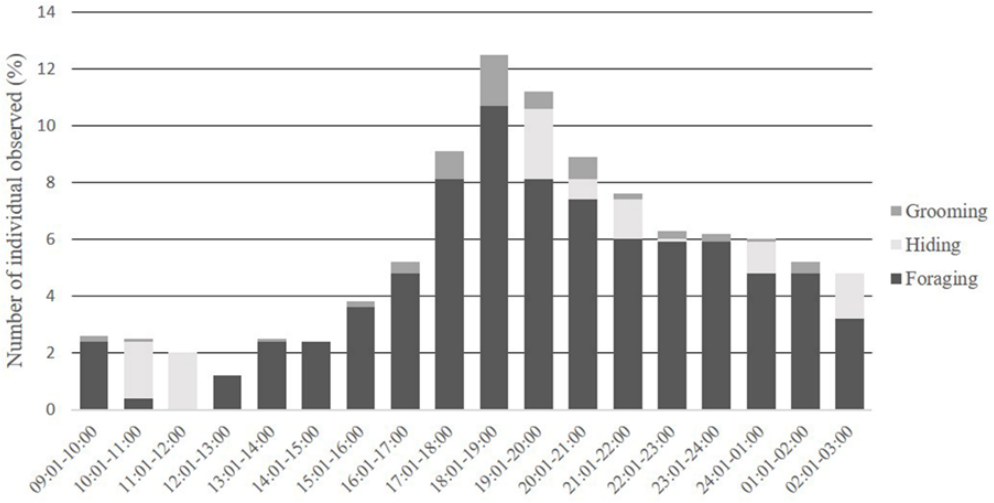

Figure 4. Daily behavior observed at every hour of observation.

CONCLUSION

The observed foraging behavior was the daily activity of the flat-tailed gecko, where this behavior was almost found for 18 hours of observation. It is influenced by insect abundance and favorable environmental conditions, especially when humidity is high. Also, our observations showed that *H. platyurus* is one of the sit-and-wait predators and has the potential to control one of the household pests, the adult ants (alates). However, further studies are needed to better understand of foraging behavior in the flat-tailed gecko.

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