

First Report of Growth Rate Juvenile Tokay Gecko (*Gekko gekko* Linnaeus, 1758) during Twenty-four Weeks in Captive Breeding Facility
[Laporan Pertama Laju Pertumbuhan Tokek Anakan (*Gekko gekko* Linnaeus, 1758) selama Dua Puluh Empat Minggu di Fasilitas Penangkaran]

Muhammad Alif Fauzi¹, & Amir Hamidy²

¹Herpetological Society of Indonesia (Penggalang Herpetologi Indonesia/PHI), Bogor, Indonesia

²Laboratory of Herpetology, Museum Zoologicum Bogoriense, National Research and Innovation Agency of Indonesia, Gd. Widyasatwaloka Cibinong Science Center Jalan Raya Jakarta-Bogor Km 46, Cibinong, Jawa Barat, Indonesia 16911

*Email: alifauzi313@gmail.com

Submitted: March 2022, **Accepted:** June 2022

ABSTRACT

As a conservation strategies to reduce the wild harvest of tokay geckos, captive breeding becomes one of the solution to fulfill demand market. To achieve this goal, scientific data on biological information on the growth of tokay gecko in captive breeding facility is needed to support management conservation of tokay gecko. A total of seven individual juveniles tokay gecko consisting of four males and three females were observed during 24 weeks old. We feed the juvenile of tokay gecko with 10-15 crickets every three days. We collected the growth rate data by weekly measuring Snout-vent Length (SVL), head length (HL), head width (HW) and body weight. Newly hatched tokay gecko have an SVL of 48.08 mm (44.70-53.24 mm) and weight 2.40 gram (1.90-2.70 gram). Juvenile at the age of one to three months have a special characteristic in having a black and white bands on the tail. This characteristic fades when entering the age of more than twelve weeks. Female individuals were recorded to have smaller hatching sizes than males, but have faster growth rate ($p=0.9536$). For 24 weeks, male and female individuals have SVL of 70.77 mm (64.35-76.74) and 73.02 mm (67.11-80.35), respectively. Sexual dimorphism in males and females show significant results in the HW/SVL ratio ($p=0.02697$). Further study on the observation of growth rate during life span are needed to describe whole process of growth stage tokay gecko which is very useful for captive breeding management of this species.

Keywords: Captive breeding, growth rate, juvenile tokay gecko

ABSTRAK

Sebagai upaya konservasi untuk pengurangan panen tokek rumah yang bersumber dari alam, kegiatan penangkaran memiliki merupakan salah satu solusi pemanfaatan untuk memenuhi kebutuhan pasar. Untuk mencapai tujuan tersebut dibutuhkan data ilmiah informasi biologis pertumbuhan tokek rumah pada fasilitas penangkaran untuk menentukan peraturan regulasi panen dan konservasinya. Sebanyak tujuh individu anakan tokek rumah yang terdiri dari empat jantan dan tiga betina diamati pertumbuhannya selama 24 minggu. Setiap anakan tokek rumah diberi makan jangkrik sebanyak tiga hari sekali sebanyak 10-15 individu. Kami melakukan pengamatan pertumbuhan anakan tokek rumah dilakukan dengan mengukur karakter *Snout-vent Length* (SVL), panjang kepala (HL), lebar kapala (HW) dan berat tubuh. Anakan tokek rumah yang baru menetas memiliki SVL 44,70-53,24 mm dan berat 2,36-2,42 gram. Anakan pada usia satu sampai tiga bulan memiliki ciri khas berupa corak hitam putih pada bagian ekor. Ciri tersebut akan memudar ketika memasuki usia lebih dari 12 minggu. Individu betina tercatat memiliki ukuran tetasan lebih kecil dibandingkan jantan, tetapi grafik pertumbuhannya lebih cepat ($p=0.9536$). Selama 24 minggu individu jantan dan betina masing masing memiliki SVL 70,77 mm dan 73,02 mm. Dimorfisme seksual pada jantan dan betina menunjukkan hasil yang signifikan pada rasio HW/SVL ($p=0.02697$). Penelitian lanjutan tentang kecepatan pertumbuhan sepanjang umurnya sangat penting untuk mendukung manajemen dan regulasi panen tokek rumah yang berasal dari penangkaran.

Kata Kunci : Penangkaran, pertumbuhan, anakan tokek rumah

INTRODUCTION

Indonesia as a megabiodiversity country with a large number of species richness and endemism faces a major threat to its biodiversity conser-

vation due to several factors such as deforestation and habitat loss (von Rintelen *et al.* 2017). Apart from these factors, wildlife trade is a factor that affects the loss of biodiversity in Indonesia (Harrison *et al.* 2016; Maulany *et al.*

2021). It is illustrated by the large number of wild animals in Indonesia that are used for trade. Indonesia is one of the largest exporters of wildlife in Southeast Asia (Nijman *et al.* 2010). The practice of wildlife trade is carried out by the community as a source of income and as a source of food (Fauzi *et al.* 2020; Mardiasuti *et al.* 2020; Arida *et al.* 2021). Within wild animals exported from Indonesia, reptile is one of taxa which exported in large numbers (Nijman *et al.* 2012). One species that in the last 10 years has a high trading volume is tokay gecko (*Gekko gekko*) (Kurniati 2019).

The tokay gecko (*G. gekko*) is internationally traded for various needs such as medicine, food, and pets (Sy & Shepherd 2020). The tokay gecko currently poses a major threat of decline due to its high utilization level (Ardiantoro *et al.* 2020). During the 2013-2018 period, the origin of the exported geckos declared from captive breeding facilities. However, the origin of specimens produced from captive breeding facilities is doubtful and possible source from wild harvest (Kurniati 2019). At CoP 18 CITES in 2019, *G. gekko* uplisted to appendix II. Referring to article IV CITES, the wild harvest for commercial purposes of species listed in appendix II needs to produce the Non-detriment Findings (NDF), document as strengthening scientific evidence that harvesting does not affect natural populations. After the uplisting of the tokay gecko into appendix II, the gathering biological information of the tokay gecko has begun, such as a survey of the gecko population in Pandeglang Regency, Banten Province (Kurniati 2019), and the micro and macro structure of the reproductive anatomy of the tokay gecko (Kurniati & Phadmacanty 2021).

Research activities on tokay gecko are still needed to reveal the biological information that are useful to evaluate its conservation management. The growth rate information of geckos from juvenile to harvestable size is crucial as the basis for supporting regulations for captive breeding supervision. This information is important considering the case of laundry the origin specimens of the tokay gecko produced from captive breeding. According to Nijman & Shepherd (2015), tokay gecko can reach adult size for as long as 18 months.

However, information on the growth of the gecko from juvenile to harvest size is unclear. Through this study, the growth of juvenile tokay gecko for 24 weeks is presented as an initial reference for biological information.

METHODS

We measured the growth rate of hatched tokay geckos in UD. Andira Alternatif (Captive Breeding Permit SK.59/K.2/BID.TEK.1/KSA/4/2019). The study was conducted from June to November 2021 (six months). Each baby gecko is placed in a glass aquarium container (size 130 mm x 130 mm x 240 mm) with a room temperatures ranging from 25C to 27C. Every three days each baby gecko is fed using 10-15 crickets (age of crickets are two or three weeks after hatching). The measurement including Snout-vent length (SVL), head length (HL), head width (HW) using a Mitutoyo digital caliper (0.1 mm accuracy) and body weight using a digital balance (0.1 g accuracy). We measured seven hatched baby gecko until 24th weeks age. However, all the individuals were died after measured because of unknown condition. So here, we only can gather sequence of comprehensive growth rate data from 7 individual tokay geckos until age of 24 weeks.

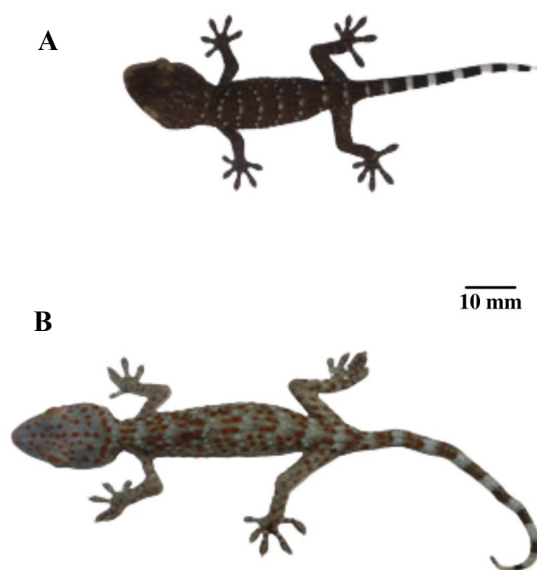


Figure 1. Compared size of newly hatched tokay gecko and 24th week old. A). Newly hatched tokay gecko; B). 24th weeks age tokay gecko

Sex determination is carried out by dissecting the dead individuals. We analyze the data using the R studio (4.1.2) (R Core Team, 2021). The nonparametric analysis is used to determine the sexual dimorphism of juvenile tokay gecko by standardizing the character/SVL using Wilcoxon test. We use a linear regression test to determine the relationship between the SVL and weight. The test is considered to have a significant difference in the p-value <0.05.

RESULTS

The newly hatched male geckos (*G. gekko*) have a SVL of 49.09 ± 2.81 mm and weight 2.42 ± 0.35 gram (n=4), while the female have a SVL of 46.29 ± 2.28 mm and a weight of 2.36 ± 0.05 gram (n=3). Baby of tokay gecko is characterized by having black vertical pupils, the body covered with fine tubercles, there are dot patterns of reddish-orange color on the dorsum, 7-8 white streaks from the nape to the anterior thigh, pale white ventral, 8-10 white stripes on the tail. The most distinct morphological character to distinguish between adult and baby tokay geckos is the presence of black and white stripes on the tail. This strip is distinct in the baby, and black part of the strips change to a grayish in the age of 12th week. A special feature newly hatched tokay gecko is the birthmark on the ventrum. This birthmark will also grow in length as they mature.

The growth of SVL showed in the graph is increasing steadily (Figure 2). SVL average in males for 24 weeks old is 70.77 mm and females of 73.02 mm. The increase in SVL size

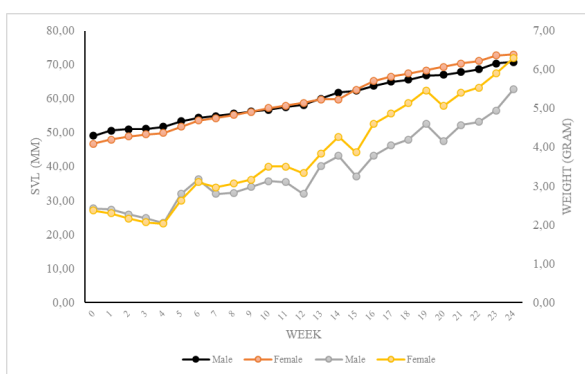


Figure 2. Growth rate of juvenile tokay gecko during 24 weeks .

for 24 weeks old each sex is 21.67 mm ($x = 0.90$ mm/week) for males and 26.29 mm ($x = 1.09$ mm/week) for females. Contrary to SVL, weight character shows results that fluctuate every week. Character body weight for 24 week age in males average 5.50 gram, while females is 6.30 gram.

During 24 weeks growth, *G. gekko* showed significant sexual dimorphism in the HW/SVL ratio character ($W = 427, p = 0.02697$) (Table 1). SVL and weight variables have a very strong correlation value of 0.97. The regression linear model between SVL and weight is $y = -5.3 + 0.153x$. These results indicate that weight gain is influenced by SVL (Figure 3). *G. gekko* growth for 24 weeks in male and female individuals have different growth pattern in SVL characters and body weight (Figure 3). Comparison of the age of the two characters, the females have smaller SVL size and body weight compare to the males when it just hatched. However, at 17 weeks old, females experience an accelerated growth compare to males in SVL characters ($W = 316, p = 0.9536$), while the females body weight grow faster than males at 7 weeks old ($W = 366, p = 0.2992$).

DISCUSSION

In general, the growth of juvenile tokay gecko up to 24 weeks old showed interesting results. At this age, the differences between male and female have been observed in the

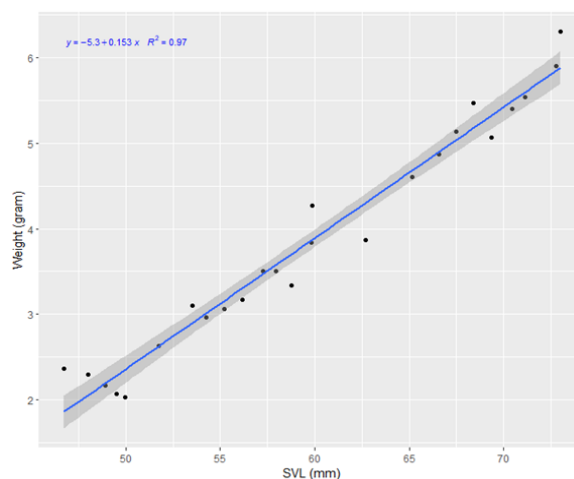


Figure 3. A linear regression between SVL and Weight.

HW/SVL ratio. In the group Eublepharidae, males have a larger head size as well as in the fully mature tokay gecko. The large head character in males have an implication of the theory of natural selection due to the ability of aggressiveness (Kratochvil & Frynta 2002). However, in terms of growth, males have slower growth than females. It is unknown the relationship between the amount of feed consumed and the growth of gecko. So further comprehensive research needs to be done to explain the growth of geckos in detail.

The size information of the newly hatched tokay gecko from this study is slightly different from Das (2011) who recorded that the newly hatched have a size of 39.8-42.3 mm. However, in this study we recorded 44.70-53.24 mm. Changes in the morphology of the gecko, especially in the tail when it enters 12 weeks old, can be categorized as a sign that the gecko has reached subadult. However, this diagnosis does not occur in all individuals of 12 weeks old, at least two individuals that reached the age of 24 weeks still have black and white tail patterns. These results may be due to the level of feed consumption by the individuals observed. According to Nugrahani (2012) that juvenile tokay gecko that consume crickets since week 0 will experience faster color changes. Individuals which eat infrequently will find it difficult to increase in length and change their motives.

The study on the tokay gecko growth are important to improve captive breeding management since the high mortality in tokay gecko aged 1-2 months. At this age, the juvenile tokay gecko are very sensitive to temperature changes and to stress because of the hand touch during measurement. The addition of the size of the growth of baby gecko per week with a value of 0.9 mm with the intensity of feed that is not routine. Routine feeding treatment needs to be carried out to see the effectiveness of the amount of feed on the growth rate of geckos to harvest size. Availability of cricket size (cricket age 2 or 3 week after hatch) must also be considered. In addition, abiotic factors such as temperature and humidity must also be considered in the scale of experimental cages and broodstock cages.

ACKNOWLEDGMENTS

Author (MAF) thanks to UD. Andira Alternative which has supported and facilitated the research. Thank you in advance to Yusratul Aini for suggestion on data analysis. We thank BBKSDA Jawa Timur (Agency for Conservation of Natural Resources of East Java) to support the activities in gathering biological data of tokay gecko.

AUTHORS CONTRIBUTIONS

The author has the same contribution in writing this article.

REFERENCES

- Ardiantoro, A., A. Hamidy & N. Kurniawan. 2021. Evaluation on the legal trade of tokay gecko (Lacertidae;Gekkonidae; *Gekko gecko* Linnaeus, 1758) in Indonesia. *Journal of Tropical Life Science* 11(1): 93-100
- Arida, E., E. Boscha, MA. Fauzi, A. Ardiantoro & NL. Maireda. 2021. Beliefs in the dietary benefits of water monitor, *Varanus salvator* meat in Western Java, Indonesia. *Journal of Tropical Ethnobiology* 4(1): 21-32.
- Das, I. 2010. *A field guide to the Reptiles of Southeast Asia*. New Holland Publishers. UK.
- Fauzi, MA., Hamidy, A. & N. Kurniawan. 2020. The threat of appendix CITES-listed turtles harvesting in Central Borneo and South Sumatra. *Journal of Tropical Life of Science* 10(3): 215-222.
- Harrison, RD., R. Sreekar, JF. Brodie, S. Brook, M. Luskin, H. O'Kelly, M. Rao, B. Scheffers & N. Velho. 2016. Impacts of hunting on tropical forests in Southeast Asia. *Conservation Biology* 30(5): 972-981.
- Kratochvil, L. & D. Frynta. 2002. Body size, male combat and the evolution of sexual dimorphism in eublepharid geckos (Squatamata: Eublepharidae). *Biological Journal of the Linnean Society* 76: 303-314

- Kurniati, H. 2019. Estimasi populasi tokek rumah *Gekko gekko* (Linnaeus, 1758) di Kaki Gunung Karang, Kabupaten Pandeglang, Provinsi Banten, Jawa Bagian Barat. *Jurnal Biologi Indonesia* 15(2): 141-151.
- Kurniati, H. & NLPR. Phadmacanty. 2021. Macro dan Micro-anatomy of tokay gecko's reproductive organs and growth of external body in support on reproduction activities (Squamata: Gekkonidae: *Gekko gekko*). *Jurnal Veteriner* 22 (3): 429-441.
- Maulany, R.I., A. Mutmainah, N. Nasri, A. Achmad & PO. Ngakan. 2021. Tracing current wildlife trade: A initial investigation in Makasar City, Indonesia. *Forest and Society* 5(2): 277-287.
- Mardiastuti. A., B. Masy'ud, LN. Ginoga, H. Sastranegara & Sutopo. 2020. *Pemanfaatan herpetofauna oleh masyarakat lokal di Indonesia*. IPB Press. Bogor.
- Nijman, V. 2010. An overview of the international wildlife trade from Southeast Asia. *Biodiversity Conservation* 19: 1101-1114.
- Nijman, V., CR. Shepherd, Mumpuni & KL. Sanders. 2012. Over-exploitation and illegal trade of reptiles in Indonesia. *Herpetologica Journal* 22: 83-89.
- Nijman, V. & CR. Shepherd. 2015. Adding up the numbers: An investigation into commercial breeding of Tokat Geckos in Indonesia. TRAFFIC. Petaling Jaya. Malaysia
- Nugrahani, A. 2013. Penetasan telur, pertumbuhan dan pendugaan umur anakan tokek (*Gekko gekko*, Linnaeus, 1758) di penangkaran. [Tesis]. Bogor. Institut Pertanian Bogor.
- R Core Team. 2021. R: A language and environment for statistical computing. R Foundation for Statistical Computing. Vienna. Austria. [https:// www. R-project.org/](https://www.R-project.org/).
- Sy, EY. & CR. Shepherd. 2020. An analysis of tokay gecko (*Gekk gekko*) in the Philippines. *Journal of Nature Studies* 19 (1): 144-150
- von Rintelen, K., E. Arida & C. Hauser. 2017. A review of biodiversity-related issues and challenges in megadiverse Indonesia and other Southeast Asian countries. *Research Ideas and Outcomes* 3: e20860.

