

Habitat Preference and Population Study of House Gecko (*Gekko gekko*) in Seribu Islands, Special Capital Region of Jakarta
{Preferensi Habitat dan Estimasi Populasi Tokek Rumah (*Gekko gekko*) di Kepulauan Seribu, DKI Jakarta}

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ABSTRACT

The house gecko (*Gekko gekko*) or tokek is a reptile species known widely used as an export commodity. Overexploitation can threaten wild populations of tokek in the wild. The research was conducted through a *Visual Encounter Survey* on the islands of Tidung, Pari, and Untung Jawa from 27 November to 02 December 2021. We also distributed questionnaires about the insight and presence of geckos in residents' homes or buildings. The number of respondents have been interviewed are 117 people, while for direct observation the results obtained are 273 individuals. The highest number of geckos was found on Pari Island and the least was on Untung Jawa Island. The house gecko is distributed throughout on these islands and is relatively more abundant in residential areas. The house gecko is most found on power poles and building walls and in breadfruit trees (*Artocarpus altilis*). Area of The Kepulauan Seribu is about 474562 hectares with a land area of 877 hectares. The population density of tokek based on direct observation was 13.60 individuals/ha. Therefore, the estimated population of tokek; in the Seribu Islands based on direct observations is around 11930.12 individuals.

Keywords: habitat preference, house gecko, density, Seribu Islands.

ABSTRAK

Tokek rumah (*Gekko gekko*) atau tokek merupakan salah satu spesies reptil yang banyak dimanfaatkan sebagai komoditas ekspor. Eksploitasi yang berlebihan berpotensi dapat mengancam populasi tokek di alam liar. Penelitian jenis ini dilakukan melalui *Visual Encounter Survey* di pulau-pulau Tidung, Pari, dan Untung Jawa pada 27 November hingga 02 Desember 2021. Kami juga menyebarkan kuesioner tentang wawasan dan keberadaan tokek di rumah-rumah pribadi atau bangunan penduduk. Jumlah keseluruhan responden yang diwawancarai sebanyak 117 orang, sedangkan untuk observasi langsung didapatkan hasil sebanyak 273 individu. Tokek paling banyak ditemukan di Pulau Pari dan paling sedikit di Pulau Untung Jawa. Tokek rumah tersebar di seluruh wilayah pulau-pulau dan relatif lebih melimpah di pemukiman warga. Tokek rumah paling banyak ditemukan pada tiang listrik dan dinding bangunan serta di pohon sukun (*Artocarpus altilis*). Luas wilayah Kepulauan Seribu sekitar 474562 hektar dengan luas wilayah daratan 877 hektar. Kepadatan populasi tokek berdasarkan observasi langsung adalah 13,60 individu/ha. Oleh karena itu, perkiraan populasi tokek di Kepulauan Seribu berdasarkan observasi langsung adalah sekitar 11930,12 individu.

Kata Kunci: preferensi habitat, tokek rumah, kepadatan, Kepulauan Seribu

INTRODUCTION

Reptiles are export commodities that can provide economic benefits to the people, from hunters to exporters levels. The house gecko (*Gekko gekko*) or tokek is one of several reptiles

widely used for export as meat commodities from non-livestock (Nijman *et al.* 2012), exploitation poses a threat to wild populations (Lwin *et al.* 2019), and available in the traditional markets as a remedy for skin diseases (Kurniati *et al.* 2019). This species is a medium-sized lizard with warty

skins with color variations of skin, from bluish to brownish-gray, decorated with red to orange spots all over the body.

Gekko gekko is a widely distributed species from Bangladesh, northeastern India, Nepal, Bhutan, Southern China, Taiwan throughout Southeast Asia, from Myanmar, Laos, Thailand, Cambodia, Vietnam, Peninsular Malaysia, Philippines, Singapore, Indonesia (excluding Papua) (Das 2015; Uetz & Hallermann 2022). This species can be found from lowland to sub-montane regions (0-1200 m asl) (McKay & Schult, 2006) within the primary and secondary forests and is well adapted in human-modified habitats. Recent reports on the population of this species in Indonesia were reported by Kumiaty *et al.* (2019), Manzili *et al.* (2020), and Maryanto *et al.* (2021). However, there is no report on the population of *Gekko gekko* in Kepulauan Seribu. Nevertheless, biological information and population study play an essential role in providing critical information for conservation management and utilization (Sinclair *et al.* 2006).

Kepulauan Seribu is an archipelago located 45 km from the north coast of Jakarta. The administrative region consists of 78 small islands, a few bigger islands mainly dominated by human settlements, and small forests with dense shrubs. These habitats are likely suitable for *Gekko gekko* (Singh & Choudhury 2016), and it has been informed (by locals) that there are many house geckos on this island. It has also been reported that this species also shows habitat preference; they are found chiefly in abandoned buildings with zero level disturbances. It is also found in the number of houses within the human population. It is presumed that they have migrated from the forests close to the urban areas (Singh & Choudhury 2016).

This study was conducted to determine the population of *Gekko gekko* based on habitat preferences, abundance, and density in Kepulauan Seribu. The data is used as a basis for estimating the species population of the island.

MATERIALS AND METHODS

The study was carried out through a visual encounter survey (McDiarmid *et al.* 2012) on the islands of Tidung, Pari, and Untung Jawa, from 27 November to 02 December 2021, with direct

encounters during the day and night, although this species is nocturnal.

Data was collected by recording the time, counting the number of geckos, and measuring individuals by categories of eggs, neonates, juveniles, and adults. Meanwhile, the walls of buildings/houses, power poles, and any species of trees were recorded as characteristics of the microhabitat. The location of the gecko's discovery is mapped via GPS and recorded with Map Marker application by the cellphone. Records were also made of daily activities such as foraging, calling, being mating, and found both dead or alive. All data is documented with photos. Data collection was carried out without taking any live samples. We also conducted small surveys by means of a questionnaire about recent insights into and the presence of geckos in residents' private buildings. We distributed the questionnaire during the day. Therefore, we seek permission from the owner to visit the vulnerable locations at night. Any reports without sightings are separated from our records.

RESULTS

The research area of the three islands is about 20.9 ha, the number of houses visited is 169 houses, and the results of the interviews show that there are 63 individuals tokek in the housing. The number of people interviewed was 117 respondents, while the number of geckos from direct observation was 273 individuals. We found another reptile while doing a survey. The species are *Calotes versicolor*, *Dendrelaphis pictus*, *Ahaetulla mycterizans*, and *Varanus salvator*. We found several species that are also very abundant and close into the habitat of house geckos including *Gehyra mutilata*, *Hemidactylus frenatus* and *H. platyurus*. The survey results on the three islands are as follows:

Tidung Islands.

Tidung Besar Island. 5°47'48.1"S 106°29'45.8"E.

The island has the characteristics of a dense people with the condition of houses being close to each other, the distance from one building to another (1-8 meters), dominated by permanent buildings. The plants are dominated by trees: coastal mangrove (*Rhizophora* spp.), breadfruit (*Artocarpus* sp.), waru (*Hibiscus tiliaceus*), sea

hibiscus (*Thespesia populnea*), and coconuts (*Cocos nucifera*). The area of survey on Tidung Besar are showed in Figure 1, many house geckos encountered are found on the walls of residents' houses and coconut trees.

The interviews with 60 respondents from 60 houses visited showed the presence of house geckos in each of houses, while for direct observation, 36 individual house geckos were obtained, and 6 of them were individual house geckos observed in the house.

Tidung Kecil Island. 5°48'12.1"S 106°31'24.0"E.

The island has slightly more natural than Tidung Besar. This island is an uninhabited island with rare buildings found. Some of the residents' buildings that can be found are guard posts and tombs. While, characteristics of the vegetation are still dominated trees species which are coastal mangrove species, such as *Rhizophora* spp., breadfruit (*Artocarpus* sp.), waru (*Hibiscus tiliaceus*), sea hibiscus (*Thes-*

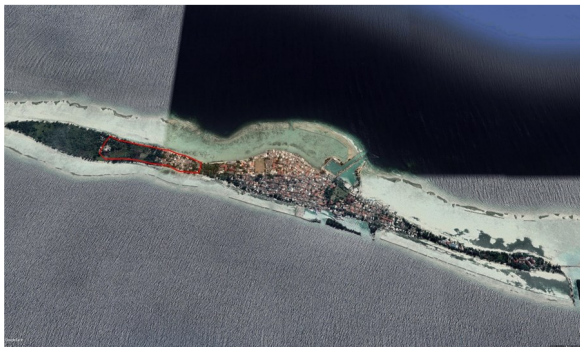


Figure 1. The observation area of house geckos (*Gekko gekko*). Tidung Island Administrative Area *G. gekko* observation location. Redlines – survey area. Blue dots – encounter point of *G. gekko*. (map: Google Earth).



Figure 2. Observation area of house gecko (*Gekko gekko*) on Tidung Kecil Island. Redlines – survey area. Blue dots – encounters point of *G. gekko*. (map: Google Earth).

pesia populnea), and river tamarind (*Leucaena leucocephala*). The area of survey on Tidung Kecil are showed in Figure 2, the house geckos encountered are generally found on power poles and breadfruit and river tamarind trees.

Interviews were not carried out because of the small number of residents on Tidung Kecil. However, we extrapolated by counting the number of buildings with the presence of house geckos. Three individuals were found in 9 buildings visited on Tidung Kecil. Another 53 individuals were found on breadfruit trees and power poles.

Pari Island. 5°51'26.7"S 106°37'06.5"E.

This island has less of residents' houses. Still, the housings are close to one another (2-6 meters), with all types of permanent buildings, while the characteristics of trees are dominated by the following species, coastal mangrove (dominated by *Rhizophora* spp.), breadfruit (*Artocarpus* sp.), hibiscus (*Hibiscus tiliaceus*), sea hibiscus (*Thespesia populnea*), and acacia (*Acacia* sp.). This island has more vegetation than Tidung Island. The area of survey on Pari are showed in Figure 3, the house geckos encountered are generally found on the walls of residents' houses, power poles, and on breadfruit and acacia trees (Figure 4).

The interviews with 40 respondents from 40 houses visited resulted in house geckos in each of their houses, while for direct observations, 120 individual house geckos were obtained, and 36 of them were individual house geckos observed in the house.



Figure 3. Observation area of house gecko (*Gekko gekko*) in Pari Island area. Redlines – *G. gekko* survey area. Blue dots – encounter points of *G. gekko*. (map provided from Google Earth)

Untung Jawa Island. 5°58'38.8"S 106°42'25.9"E.

Untung Jawa Island has quite densely populated with residents' houses. The houses are close to each other (1-5 meters), with permanent and semi-permanent building types, while the characteristics of trees are dominated by the following species, coastal mangrove (dominated by *Rhizophora* spp.), breadfruit (*Artocarpus* sp.), hibiscus (*Hibiscus tiliaceus*), sea hibiscus (*Thespesia populnea*), acacia (*Acacia* sp.), Australian pine (*Casuarina equisetifolia*), and other trees that are considered to be garden plants. The area of survey on Untung Jawa are showed in Figure 5, the house gecko encounters are generally found on the walls of residents' houses, power poles, and acacia trees (Figure 6).

The results of interviews with 30 respondents from 30 houses visited stated that there were



Figure 4. House gecko (*Gekko gecko*) on Pari Island. Gecko eggs in bamboo (upper left) and others weree *Gekko's* habitats around houses.



Figure 5. The observation area of house gecko (*Gekko gecko*) in Untung Jawa Island. Redlines *G. gecko* survey area. Blue dots – encounter points of *G. gecko*. (map: Google Earth)

geckos, while direct observation obtained 65 individuals, with 18 gecko individuals in the house.

DISCUSSIONS

Habitat Preferences

The number of geckos found during the study on the three islands was 273 individuals (Table 1). Geckos are most commonly found on Pari Island, and least number on Untung Jawa Island. Geckos are distributed over three islands and are relatively abundant in residential areas. The average size of gecko found during the study was larger in adults compared to juveniles and neonates. Whereas the presence of eggs and droppings (feces) was noted as an additional record of their existence (Table 1).

House geckos are found in various habitats; the most preferred habitat is human settlements. It is recorded that there were nine types of habitats occupied by house geckos, with individuals found as many as 148. Most geckos are commonly found on power poles (inside the pipe hole) and buildings (walls). The residential areas, especially power poles and building walls, are preferred over other habitats (Aowphol *et al.* 2006; Manthey & Grossman 1997). Ulman & Singh (2020) also showed that geckos prefer habitats close to human settlements, and the selection of certain woods as building materials affects the presence of geckos in the house, even

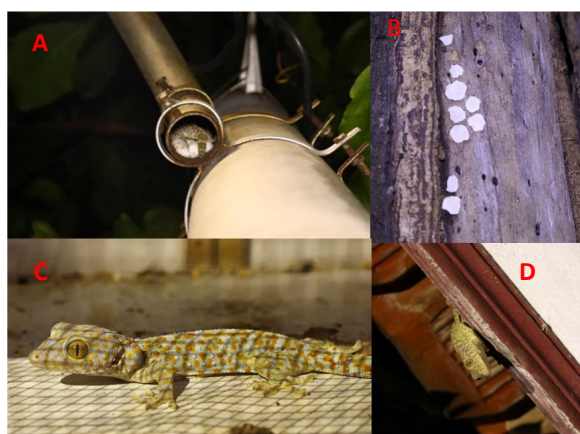


Figure 6. House geckos (*Gekko gecko*) on Untung Jawa Island. A) house gecko and house gecko eggs in power pole holes, B) House geckos hatched eggs inside tree trunks C) house gecko inside resident's building (kept) D) House gecko on ceilings.

in the population of geckos in the Kepulauan Seribu. The effect of choosing certain wood on the presence of this species in a building is because permanent houses dominate buildings in the Kepulauan Seribu. Several geckos were found in wooden buildings with wooden gates, doors, and fences (Figure 7).

Two main factors influence the presence of house geckos adjacent to human settlements. First, house geckos are adaptive to environmental disturbances (Janiawati *et al.* 2016; Singh 2021), thus, house geckos will not be disturbed by the activities of the surroundings in human-modified habitats. Second, house geckos in residential areas are also associated with higher food availability and opportunity. Many insects can

be the primary prey of house geckos (flying alates and other nocturnal insects that are primarily phototrophic positive) in residential areas and the hideouts of house geckos from potential predators (Cooper & Whiting 2000; Reaney & Whiting 2003).

In addition to residential areas, the house gecko is also found in various types of trees on each island; there were 22 species of trees where the house gecko was found, with 125 individuals found in trees. The house gecko was primarily found in *Artocarpus altilis*, followed by *Cocos nucifera* and *Acacia* sp. (Figure 7). Geckos initially lived in trees in undisturbed rainforests (Manthey & Grossman, 1997) and are now adapted to secondary forests and areas

Table 1. The number of house geckos, size ratio and evidence of the presence of house geckos found on three different islands in the Seribu Islands.

Islands	Number of individuals	Size Ratio			Feces	Eggs	Calls
		Mature	Neonate	Juvenile			
Tidung Besar	32	31	0	1	0	4	0
Tidung Kecil	56	55	1	0	20	19	0
Pari	120	105	5	10	14	67	1
Untung Jawa	65	53	2	10	0	131	0
	273	244	8	21	34	221	1

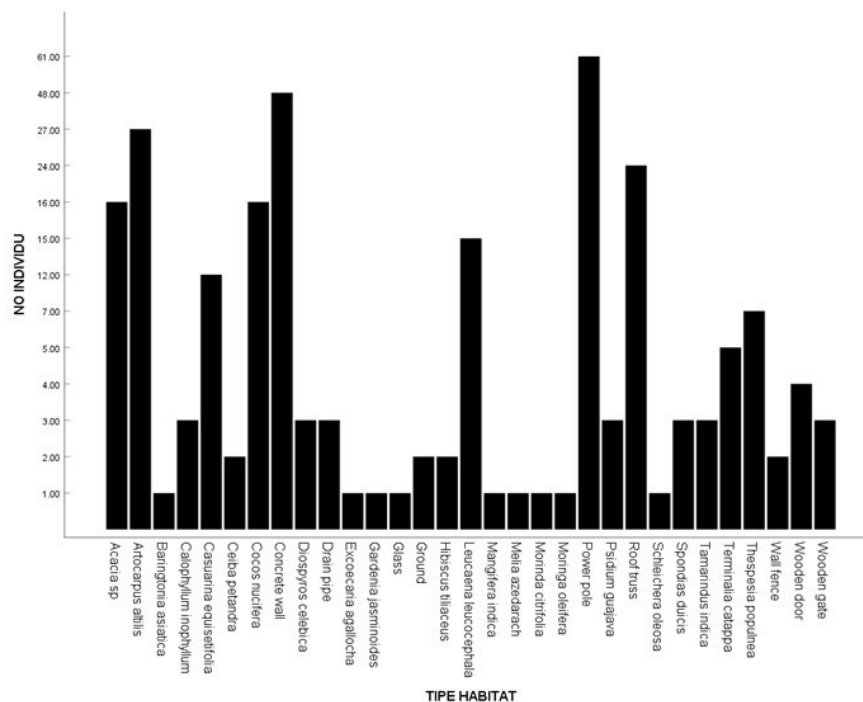


Figure 7. Habitat preferences of house geckos in a various habitats of Kepulauan Seribu. The geckos can be found in residential areas and trees.

with many buildings but connected to secondary forests or gardens. Findings regarding habitat selection have confirmed the same opinion by Singh & Choudhury (2016), Rai & Chettri (2019), and Ulman & Singh (2020), that geckos can be found in trees of secondary forest areas and adjacent to settlements.

Based on the study results, *Artocarpus altilis*, *Cocos nucifera*, and *Acacia* sp. is a type of tree species with high canopy cover and natural holes in the trees. House geckos favor these characteristics in choosing tree preferences as their habitat (Figure 6b). Cooper & Whitting (2000) recorded House geckos' tree habitat (also recorded that more prominent and shady trees will provide better protection against threats from predators and provide more prey because of the larger tree surface area. Trees with a higher trunk diameter and height are also a habitat preference for house geckos in trees (Singh & Choudhury 2016; Rai & Chettri 2019), so *Artocarpus altilis*, *Cocos nucifera*, and *Acacia* sp. trees match with the mentioned characteristics and suitable as the primary habitat for house gecko in the Kepulauan Seribu.

Density

The total number of individual house geckos resulting from direct observation is 273 individuals, while the total number of interview results is 117. We obtained this number from all three islands surveyed. The total number of houses visited from the three islands was 169 houses. The interview results showed 63 individual house geckos in the house. The recapitulation of the survey results and the estimated population density of the house gecko on the three surveyed islands are in Table 2.

Geckos in residential areas are easier to see than in tree habitats with house geckos. House geckos that occupy tree habitats are more challenging to observe because they are in a dark location. Meanwhile, the interviews conducted were less effective because some of the islanders were active outside their homes and were very rarely inside their homes, so the results of direct observations and the results of interviews are very much different. Hence, the data from direct observations are more accurate as the main result is the density of the house gecko population density in Kepulauan Seribu,

Table 2. Recapitulation of survey results and density of house geckos in the Kepulauan

Islands	Number of House Geckos from the interviews	Number of House Geckos from Direct Observation	Survey Area (ha)	Density from the interviews	Density from the Direct Observations
Tidung	63	88	7,15	8,81	12,31
Pari	36	120	5,95	6,05	20,17
Untung Jawa	18	65	7,8	2,31	8,33
	117	273	20,9	5,72	13,60

Table 3. Extrapolated data for house geckos in the Kepulauan Seribu. Noted: estimation of the potential habitat of the house gecko based on findings during the study, excluding coastal areas and water areas

Total area (a)	474.562	Ha
Total not-potential habitat area for house geckos (b)		
Total water area	469.085	Ha
Total area of coastal area	4.600	Ha
Total potential habitat area (B = a-b)	877	Ha
Average population density from direct observation (A)	13,60	Individuals/Ha
Average population density from interview results (A')	5,72	Individuals/Ha
Population Estimation (A' x B)	5.016,44	Individuals
Population Estimation (A x B)	11.930,12	Individuals

while the density data from the interviews are for comparison only (Table 2).

Data Extrapolation

The administrative area of the Kepulauan Seribu Regency is about 474,562 hectares. The most prominent characteristics of the Kepulauan Seribu region are 469,085 hectares of sea, 4600 hectares of coastal areas, and 877 hectares of land area. This area consists of several islands (BPS 2021). Based on the condition of the Kepulauan Seribu, we assume that the 877 hectares land area may be the primary habitat of the house geckos because the waters and coastal areas are not suitable for house geckos. Based on the estimated population of the house gecko in the Kepulauan Seribu Regency through direct observations, it is estimated around 11,930.12 individuals. The population data is shown in Table 3.

CONCLUSION

The house gecko from a conservation perspective is considered less critical in long period. In fact, this species is commercially has a high market demand in several countries. However, recently there has been increasing attention to trade, and the pace of hunting is fast and uncontrolled, especially since *Gekko gekko* was designated as a species included in the CITES appendix II list in 2019. The implementation of conservation of species populations must immediately receive special attention, so that they are in accordance with the principle of sustainable use in their habitat.

Our research provides information that residential areas (power poles and building walls) and trees with natural heights and holes also provide suitable habitats for house geckos. The estimated high individual population with a land area not too large in the archipelago certainly has a high density of houses in the Kepulauan Seribu region. Thus, conservation efforts for residents can take a role as an encouragement to protect this species. Residents must be educated and made aware of the importance of this type of house gecko.

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REFERENCES

- Aowphol, A., K. Thirakhupt, J. Nabhitabhata, & HK. Voris, HK. 2006. Foraging ecology of the Tokay gecko, *Gekko gekko* in a residential area in Thailand. *Amphibia Reptilia* 27(4): 491–503. <https://doi.org/10.1163/156853806778877121>
- BPS. 2021. Kabupaten Kepulauan Seribu Dalam Angka 2021. *BPS Kabupaten Kepulauan Seribu*, 265.
- Cooper, WE., & MJ. Whiting. 2000. Islands in a sea of sand: Use of Acacia trees by tree skinks in the Kalahari Desert. *Journal of Arid Environments* 44(4): 373–381.
- Das, I. 2015. *Field guide to the reptiles of South-East Asia*. Bloomsbury Publishing.
- Janiawati, IAA., MD. Kusriani, & A. Mardiasuti. 2016. Structure and Composition of Reptile Communities in Human Modified Landscape in Gianyar Regency, Bali. *HAYATI Journal of Biosciences* 23(2): 85–91.
- 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.
- Lwin, K., Neang, T., Phimmachak, S., Stuart, B., Thaksinham, W., Wogan, G., Danaisawat, P., Iskandar, D., Yang, J. & Cai, B. 1996. *Gekko gekko*. The IUCN Red List of Threatened Species 2019:e.T195309A237 8260.
- Manzili, S., Ibrohim, & A. Hamidy. 2020. Study of morphological variations of *Gekko gekko* (Linnaeus 1758) population in

- Indonesia. *AIP Conference Proceedings*. 2231.
- Maryanto, I., S. Hisheh, Maharadatunkamsi, RA. How, & LH. Schmitt. 2021. The impact of Pleistocene glaciations on population structure and systematics in five snake species in the Banda Arc islands of southern Wallacea: the views from genes, morphology and species assemblages. *Journal of the Royal Society of Western Australia* 104: 65–84.
- Manthey, U., & Grossmann, W. 1997. *Amphibien & Reptilien Südasiens*. Naturund Tier Verlag.
- McDiarmid, RW., MS. Foster, C. Guyer, N. Chernoff, & JW. Gibbons, (Ed). 2012. *Reptile biodiversity: standard methods for inventory and monitoring*. Univ of California Press.
- McKay, JL., & J. Schult. 2006. An incidence of cannibalism in the Asian House Gecko (*Hemidactylus frenatus*). *Herpetofauna-Sydney*. 36(2): 83.
- Rai, A., & B. Chettri. 2019. Tokay gecko: note on *Gekko gecko* (Linnaeus, 1758) with its recent sighting in Meghalaya, *Reptile Rap* 34(3): 11–14.
- Reaney, LT., & MJ. Whiting. 2003. Picking a tree: Habitat use by the tree agama, *Acanthocercus atricollis atricollis*, in South Africa. *African Zoology* 38(2): 273–278.
- Singh, B., & P. Choudhury. 2016. Habitat Preference Of Tokay Gecko (*Gekko gecko*) In Barak Valley Of Assam, India. *Journal of Bioresources* 3(1): 53–59.
- Singh, M. 2021. Density, habitat associations and conservation status of *Gekko gecko*