GEOGRAFI
UNIVERSITI PENDIDIKAN SULTAN IDRIS
SULTAN IDRIS EDUCATION UNIVERSITY
ISSN 2289-4470 • EISSN 2462-2400

Observations of Albinism in Endemic Toque Monkeys *Macaca sinica* from Different Bioregions of Sri Lanka

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ARTICLE HISTORY
Received: 29th March 2025
Revised: 20th April2026
Accepted: 30th April 2026
Published: 04th May 2026

KEYWORDS
Albinism
Endemic
habitat fragmentation
Inbreeding
Monkey

ABSTRACT - Albinism is an exceptionally rare congenital condition in wild non-human primates, typically arising from autosomal recessive mutations that impair melanin biosynthesis. In this study, we report the first photographic documentation of albinism in the endemic Toque Monkey (*Macaca sinica*) from different bioregions in Sri Lanka. Field observations conducted between January 2024 and July 2025 identified four albino individuals across distinct geographical units corresponding to the natural ranges of the three recognized subspecies: *M. s. sinica*, *M. s. aurifrons*, and *M. s. opisthomelas*. Diagnostic features included a complete absence of pigmentation in the fur, visibly pink skin, and red or pink eyes, hallmarks of oculocutaneous albinism. Observations from both captive and wild contexts revealed that albino individuals were socially integrated within their troops and exhibited no immediate signs of behavioral exclusion. These findings suggest that albinism, although phenotypically conspicuous and potentially maladaptive in terms of predation and sun sensitivity, may not drastically disrupt social cohesion in *M. sinica*. The spatial distribution of these sightings raises questions regarding potential genetic drift, inbreeding, or habitat-induced population fragmentation that may be increasing the expression of rare recessive traits. This study highlights the need for targeted genetic assessments and long-term ecological monitoring to better understand the evolutionary and conservation implications of albinism in island-endemic primate populations.

INTRODUCTION

Sri Lanka is home to a rich diversity of primates, including several endemic species that play a critical role in maintaining the ecological balance of the island's forests (Pathiraja et al., 2014). Among the primates, the Purple-faced Langur (*Semnopithecus vetulus*), the Grey Langur (*Semnopithecus priam*), and the Toque Monkey (*Macaca sinica*) are of particular conservation interest due to their restricted ranges and increasing threats from habitat destruction, urbanization, and human-wildlife conflict (Dittus, 2014). The Toque Monkey is the only species of macaque found in Sri Lanka and is endemic to the island, making it a key focus for primate conservation efforts (Dittus, 2014; Crusz, 1973). Albinism is a rare congenital disorder characterized by the partial or complete absence of melanin pigment in the skin, hair, and eyes, resulting from genetic mutations that affect melanin production pathways (Leroux

https://doi.org/10.37134/geografi.vol14.1.3.2026

et al., 2022). In animals, albinism can make individuals more vulnerable to environmental stressors such as sun exposure and predation, and in some species, it may also affect vision and social behavior (Leroux et al., 2022; Montilla et al., 2022). In wild primates, albinism is extremely uncommon and is often underreported due to the elusive nature of affected individuals and the rarity of the condition itself. Genetic factors, such as inbreeding or mutations in genes like TYR, OCA2, and others involved in pigmentation, may contribute to the manifestation of albinism in isolated or small populations (Kamaraj et al., 2014).

The Toque Monkey is a widely distributed non-human primate species in Sri Lanka and has increasingly developed human-monkey conflict due to extensive habitat loss (Dittus et al., 2019). There are three recognized subspecies of *Macaca sinica,* each adapted to distinct ecological zones of Sri Lanka. *M. s. sinica* inhabits the dry zone of the north and east, which is characterized by low annual rainfall, prolonged dry periods, high temperatures, and vegetation dominated by dry evergreen forests, scrublands, and open grasslands. *M. s. aurifrons* occurs in the wet zone of the southwest, an area receiving high annual rainfall with relatively stable temperatures and dense, evergreen rainforests with closed canopies and high biodiversity. *M. s. opisthomelas* is found in the intermediate and montane regions of the central highlands, where climatic conditions are more moderate, with intermediate rainfall levels, cooler temperatures, and a mosaic of habitats including submontane forests, montane cloud forests, and grassland–forest ecotones (Weerasekara et al., 2018). While the species is well-studied in terms of behavior and ecology, reports of congenital abnormalities such as albinism are exceedingly rare (Madhushanka et al., 2024; Montilla et al., 2022). In this communication, we present photographic evidence of five albino Toque Monkeys observed in three distinct regions of Sri Lanka, corresponding to the ranges of the three subspecies. These observations offer valuable insight into the genetic health and diversity of *M. sinica* populations and highlight the need for continued monitoring and genetic assessment of isolated primate populations in Sri Lanka.

METHODS AND MATERIALS

Field observations were conducted opportunistically during wildlife surveys and site visits across various regions of Sri Lanka between January 2024 and July 2025. Albino toque monkeys were identified visually based on key phenotypic traits, including a complete absence of fur pigmentation, visibly pink skin, and reddish or pink eyes, characteristics consistent with oculocutaneous albinism. Each observed individual was photographed using a digital camera equipped with a zoom lens to capture high-resolution images. These photographs were subsequently reviewed to confirm the presence of diagnostic features of albinism. Subspecies-level (Figure 1) identification of the observed monkeys was carried out using Nekaris and Wijeyeratne (2009) with particular reference to morphological characteristics and the geographical location of each sighting.

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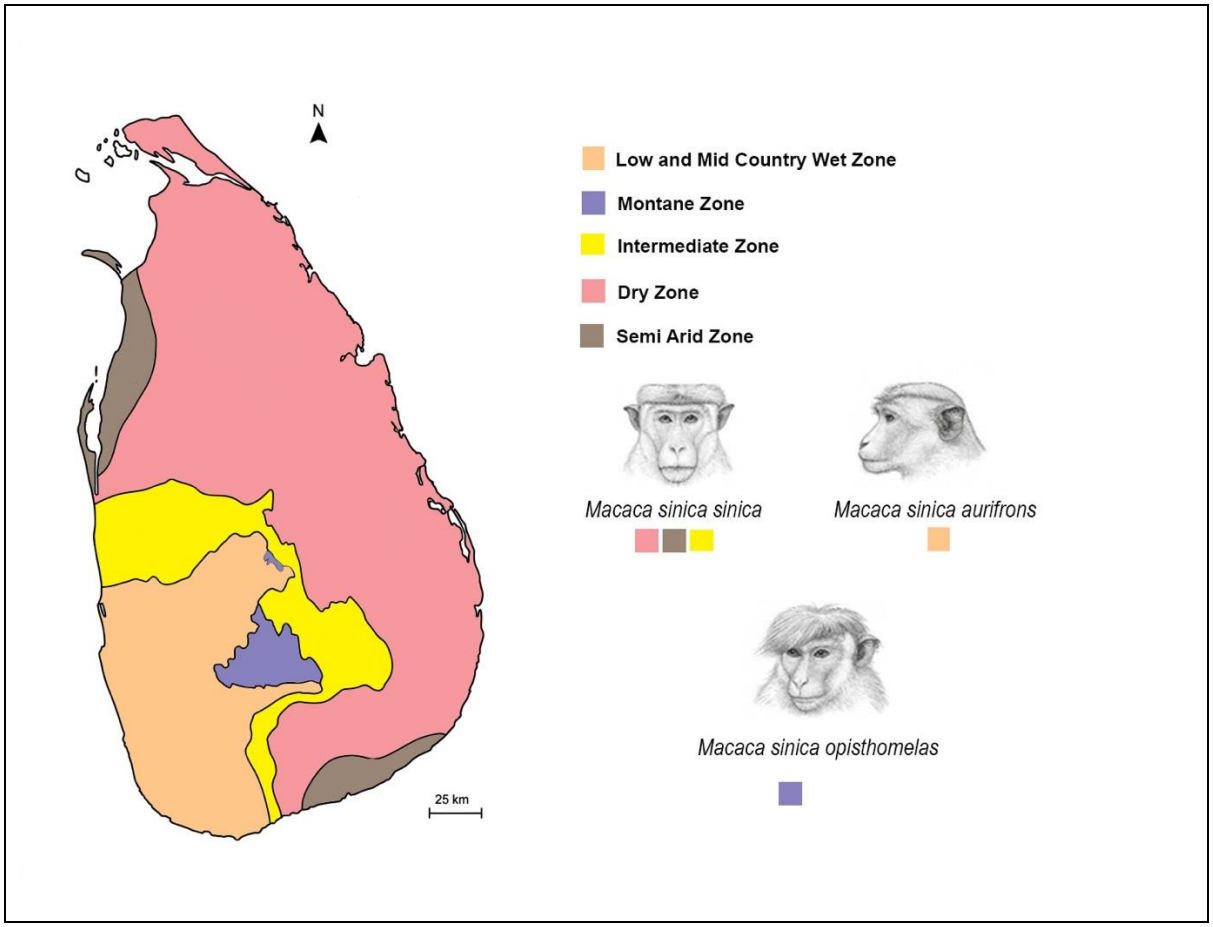

Figure 1. Geographic distribution of Toque Macaque *(Macaca sinica)* subspecies in Sri Lanka

RESULTS

The first and second observation of an albino Toque Monkey was recorded at the Dehiwala National Zoological Gardens, where the individual was kept in captivity. The monkey exhibited classical signs of albinism, including completely white fur, pink facial skin, and red eyes. This observation, although in a managed setting, confirms the survival of albino individuals under captive conditions (Figure 2, A-1 (*Macaca s. sinica)* and A-2 (*M. s. aurifrons)*). The third albino Toque Monkey was sighted in Minneriya, in the Dry zone (Figure 1) within a natural habitat consistent with the ecological zone of *M. s. aurifrons*. The individual was observed foraging with a troop of normally pigmented Toque Monkey comprising 22 adults and 12 infants and subadults. Observations were conducted between 09:00 h and 10:30 h, during which the albino individual remained socially integrated within the troop, with no visible signs of aggression, avoidance, or exclusion.

https://doi.org/10.37134/geografi.vol14.1.3.2026

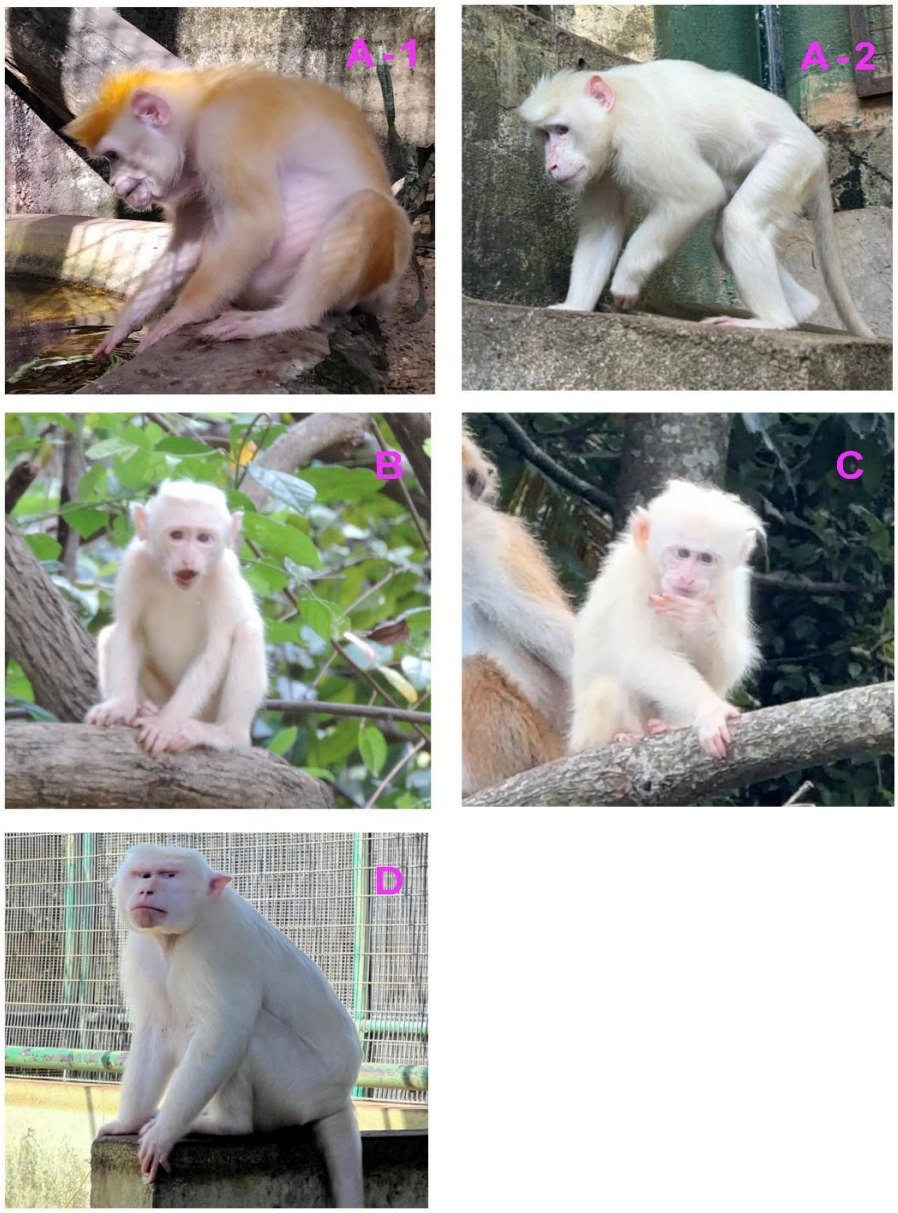

Figure 2. Photographs of albino Toque Monkeys observed in Sri Lanka. (A-1(*M. s. sinica)*, A-2 (*M. s. aurifrons*) Albino individuals in captivity at the Dehiwala National Zoological Gardens. (B) Albino monkey sighted in Minneriya, within the natural habitat of *M. s. aurifrons*, observed foraging alongside normally pigmented troop members (Madhushanka et al., 2024). (C) Albino individual recorded in the Badulla area, within the range of *M. s. opisthomelas* (Photo credit: Gagasiripura Dhammaloka Thero). (D) Albino Toque Monkey initially observed in Anuradhapura, located within the ecological range of *M. s. sinica*.

The forth albino individual was observed in the Badulla area in Uplands (Figure 1), within the central highlands, which corresponds to the known range of *M. s. opisthomelas*. Similar to the previous sightings, this individual also displayed pale fur, pink skin, and red eyes and was seen moving alongside a group of normal-colored troop members without any signs of aggression or avoidance from the group (Figure 2, C). The fifth albino Toque Monkey was initially observed in Anuradhapura (Saaliya wewa), which falls within the ecological range of *Macaca s. sinica*. The individual has since been transferred to the Ridiyagama Safari Park, Hambantota. It exhibits classical albinistic features, including completely white fur, pinkish skin, and reddish eyes. The relocation to a managed facility offers an opportunity for

https://doi.org/10.37134/geografi.vol14.1.3.2026

long-term monitoring of its health, behavior, and potential reproductive capacity under controlled conditions (Figure 2, D). Typically, the normal phenotype of Toque Monkeys includes a brown coat, a whitish belly, and sometimes a reddish or pinkish face, especially around the muzzle and eyes. In contrast, all five albino individuals lacked melanin pigmentation, which made their distinguishing features immediately apparent (Figure 3).

Figure 3. Typical pigmented phenotype of Toque Monkey (*M. s. aurifrons)*

DISCUSSION

Albinism is a rare, non-adaptive genetic condition characterized by the absence of melanin pigment in the skin, hair, and eyes, typically resulting from mutations affecting the melanin biosynthesis pathway, such as those in the TYR, OCA2, or SLC45A2 genes (Kamaraj et al., 2014). In non-human primates, albinism has been documented only occasionally in both captive and wild populations, often as isolated cases with no long-term population-level studies due to the rarity of such occurrences (Madhushanka et al., 2024; Sarah Williams-Blangero, 1991).

This study documents the first confirmed photographic evidence of albinism in all three sub-species of endemic Toque Monkey (*Macaca sinica*) across three distinct localities in Sri Lanka, each representing the natural range of the recognized subspecies: *M. s. sinica* (Dry zone), *M. s. aurifrons* (Wet zone), and *M. s. opisthomelas* (Intermediate zone) (Weerasekara et al., 2018). The findings highlight the possible widespread but low-frequency occurrence of albinism in this species, with sightings in both captive and wild contexts. The presence of these albino individuals within socially integrated troops, with no observed exclusion or aggression, suggests that social cohesion is not significantly disrupted by phenotypic abnormality, at least behaviorally. This is consistent with findings from other macaque species, where physical anomalies do not always result in social rejection (Leroux et al., 2022).

The causes behind the emergence of albinism in these populations remain unclear. While albinism can arise spontaneously due to de novo mutations, it is also associated with inbreeding in small or fragmented populations where genetic diversity is reduced (Prado-Martinez et al., 2013). Given the increasing habitat fragmentation and urban encroachment across Sri Lanka, it is plausible that restricted gene flow within isolated Toque Monkey populations could contribute to the expression of rare recessive traits such as albinism. Conservation genetics studies would be valuable in assessing the extent of genetic bottlenecks in these populations. Additionally, albino individuals in the wild may face greater ecological challenges. Their lack of camouflage could increase predation risk, while increased sensitivity to sunlight may cause ocular and dermal complications (Melin et al., 2007).

https://doi.org/10.37134/geografi.vol14.1.3.2026

Despite this, the observed albino Toque Monkeys appeared healthy and socially active, which may suggest either recent occurrence or some level of tolerance in the local ecological context. These observations underscore the importance of detailed field monitoring and reporting of phenotypic anomalies in wild primate populations, particularly in island ecosystems where endemism and vulnerability intersect. Genetic sampling and long-term behavioral studies would further elucidate the frequency, inheritance, and fitness consequences of albinism in *Macaca sinica*.

CONCLUSIONS

The documented sightings of albino Toque Monkeys across multiple ecological zones in Sri Lanka provide rare and valuable evidence of albinism within this endemic primate species. The occurrence of albino individuals in both captive and wild settings, integrated within normal pigmented troops, suggests that while albinism is an uncommon genetic anomaly, it does not necessarily impede social acceptance or survival in the short term. However, given the potential genetic and ecological challenges associated with albinism, further research is needed to assess its prevalence, genetic basis, and long-term impacts on population viability. These findings highlight the importance of continued monitoring and conservation efforts for Toque Monkeys, particularly in the face of ongoing habitat fragmentation and environmental pressures in Sri Lanka.

ACKNOWLEDGEMENT

We gratefully acknowledge the generous support and encouragement of Venerable Gagasiripura Dhammaloka Thero, whose guidance was instrumental throughout the course of this study. We also extend our sincere appreciation to W. P. Supun Maduranga Kumara and Sesala Sewwandi of the Ridiyagama Safari Park, and Menaka N. K. Pathirage, Prabath C. Wijerathne of the Dehiwala Zoological Gardens—both institutions under the Department of National Zoological Gardens, Sri Lanka—for their invaluable assistance and cooperation during fieldwork and data collection. Their unwavering commitment to animal welfare and dedicated support were vital to the successful completion of this research.

CONFLICT OF INTEREST

The authors declare no conflicts of interest.

AUTHORS CONTRIBUTION

Danushka S. Weerasekera contributed to conceptualization, methodology, investigation, data curation, and writing the original draft. Shashi Madushanka contributed to investigation, data curation, and writing—review and editing. Shamal Samaranayake contributed to investigation, resources, and data curation. Dinushika P. Manawadu contributed to investigation and data curation. W. G. K. Hemantha Samarasekara contributed to resources and investigation. Kithsiri B. Ranawana contributed to supervision, conceptualization, writing—review and editing, and project administration. All authors have read and approved the final version of the manuscript and agree to be accountable for all aspects of the work.

AVAILABILITY OF DATA AND MATERIALS

The data supporting the findings of this study are available within the article and its supplementary materials.

DECLARATION OF GENERATIVE AI

The authors declare that no generative AI was used in the writing of the manuscript.

https://doi.org/10.37134/geografi.vol14.1.3.2026

ETHIC STATEMENTS

This study involved observational data collection of wild and captive individuals without any direct handling, manipulation, or experimental intervention. Therefore, formal ethical approval was not required. All observations were conducted in accordance with relevant institutional and national guidelines for wildlife research in Sri Lanka. Permissions were obtained from the Department of National Zoological Gardens for observations conducted in captive settings.

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