



Research Article

REPORT OF GROUND-DWELLING GECKOS (GEKKONIDAE: REPTILIA) FROM TENKASI DISTRICT, TAMIL NADU STATE, INDIA

^{*1}Selvaraj Selvamurugan,²Usha Balasubramanian and ²K.Vasanthi

¹Institute of Forest Genetics and Tree breeding, Coimbatore, Tamilnadu-642 002, India

²Sri Parasakthi College for Women, Courtallam, Tamilnadu-627 802, India

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ABSTRACT

We report for recently described species of geckos from South Tamilnadu, India. During a field study conducted on October 2019 at Tenkasi District of Tamilnadu State, India. We have recorded on reptile species namely are *Cnemaspis agarwali*, *Cnemaspis ornate*, *Hemiphyllodactylus nilgiriensis* based on the photographs. In this paper discuss in distribution and conservation status. Recently new descriptions of *Cnemaspis* and *Hemiphyllodactylus* species together with the present discovery show that the southern Western Ghats species of documents. Therefore we suggest further studies to evaluate the diversity of reptile in this region.

Keywords: Cryptic species, Gekkonidae, *Cnemaspis*, *Hemiphyllodactylus*, Tenkasi, Tamilnadu.

INTRODUCTION

The gekkonid genus *Hemiphyllodactylus* Bleeker has 35 species disjunctly distributed in South and Southeast Asia and the Southern Pacific (Agarwal *et al.*, 2018). Twenty-three of these species have been described since 2010 based on recent collections, a consequence of systematic review of the genus and an expanded morphological dataset, and the subsequent use of molecular data and multivariate analyses (Sayyed *et al.*, 2019; Tabari *et al.*, 2013). The genus is represented in peninsular India by the *Hemiphyllodactylus aurantiacus* Beddome species complex, disjunctly distributed in montane habitats in the northern Eastern Ghats and the hills of south India (Agarwal *et al.*, 2019). These nocturnal, largely scansorial, small geckos (snout to vent length <41 mm) were considered to belong to a single species, but (Agarwal *et al.*, 2019) demonstrated the existence of 12 species-level lineages. Three of these were described as new species, *H. arakuensis* Agarwal, Khandekar, Giri, Ramakrishnan and Karanth from the northern Eastern Ghats, and *H. jnana* Agarwal, Khandekar, Giri, Ramakrishnan & Karanth and *H. kolliensis* Agarwal, Khandekar, Giri, Ramakrishnan & Karanth from south India (Agarwal *et al.*, 2019). Most of the gekkonids are nocturnal thermoconformers, one genus

with a largely montane distribution separating deeply divergent lineages (paleoendemics; sensu (De Rham *et al.*, 2011; Murdoch *et al.*, 2016) is *Hemiphyllodactylus* (Agarwal *et al.*, 2018). The genus includes 28 described species patchily distributed across a vast area including peninsular India and Sri Lanka, extending through the Andaman and Nicobar Islands and mainland Southeast Asia east from Myanmar into Vietnam, Laos, Thailand and peninsular Malaysia up until the South Pacific (Chandramouli *et al.*, 2012; Grismer *et al.*, 2018; Sung *et al.*, 2018). Excluding six insular species in Hong Kong, Palau, the Philippines and Sumatra, the remaining 22 *Hemiphyllodactylus* species are from montane (~ 600–1700 m), forested habitats in mainland Southeast Asia and India-Sri Lanka (Grismer *et al.*, 2013; Nguyen *et al.*, 2014; Sukprasert *et al.*, 2018; Zug, 2010) including a number of paleoendemics (Tolley *et al.*, 2011).

In India, the genus *Cnemaspis*, currently represented by 33 species, has a disjunct distribution, with a single species reported from Assam in north-east India, two insular species from Andaman Islands, and the rest distributed in peninsular India excluding the northern Eastern Ghats (Das *et al.*, 2007; Shankaraiah *et al.*, 2015). The maximum diversity of *Cnemaspis* is concentrated in

*Corresponding Author: Mr. Selvaraj Selvamurugan, Institute of Forest Genetics and Tree breeding, Coimbatore, Tamilnadu-642 002, India, Email: selva199420@yahoo.in

the Western Ghats biodiversity hotspot with 25 known species (Cyriac & Gandhi, 2018; Sayyed *et al.*, 2018). Fifteen of these species are endemic to the central and southern Western Ghats, *C. anamudiensis* Cyriac, Johny, Umesh, & Palot, *C. australis* Manamendra-Arachchi, Batuwita and Pethiyagoda, *C. beddomei* (Theobald), *C. gracilis* (Beddome), *C. indica* (Gray), *C. jerdonii* (Theobald), *C. kottiyorensis* Cyriac and Umesh, *C. littoralis* (Jerdon), *C. maculicollis* Cyriac, Johny, Umesh, & Palot, *C. monticola* Manamendra-Arachchi, Batuwita and Pethiyagoda, *C. nairi* Inger, Marx & Koshy, *C. nilagirica* Khandekar, Manamendra-Arachchi, Batuwita and Pethiyagoda, *C. ornata* (Beddome), *C. sisparensis* (Theobald), and *C. wynadensis* (Beddome) (Manamendra *et al.*, 2007). The remaining ten species *C. ajijae* Sayyed, Pyron and Dileepkumar, *C. amboliensis* Sayyed, Pyron and Dileepkumar, *C. flaviventralis* Sayyed, Pyron & Dahanukar, *C. girii* Mirza, Pal, Bhosale & Sanap, *C. goaensis* Sharma, *C. heteropholis* Bauer, *C. indraneildasii* Bauer, *C. kolhapurensis* Giri, Bauer & Gaikwad, *C. limayei* Sayyed, Pyron & Dileepkumar, and *C. mahabali* Sayyed, Pyron & Dileepkumar are known from the northern Western Ghats (Das *et al.*, 2007; Grismer *et al.*, 2018; Sayyed *et al.*, 2019). Apart from the Western Ghats, seven species are reported from other parts of India - two species *C. andersonii* (Annandale) and *C. wicksii* (Stoliczka), from the Andaman Islands; *Cnemaspis assamensis* Das & Sengupta from Assam, northeast India (Das *et al.*, 2007) and four species *C. adii* Srinivasulu, Kumar & Srinivasulu, *C. mysoriensis* (Jerdon), *C. otai* Das & Bauer, and *C. yercaudensis* Das & Bauer, from peninsular India outside the Western Ghats. Amongst the peninsular Indian forms,

the former two are from the Deccan and Mysore Plateau, Karnataka respectively and the latter two are from Vellore Fort and Yercaud Hills, Tamil Nadu respectively (Chandramouli *et al.*, 2012; Das *et al.*, 2007). Recently recorded on reptile species namely are *Cnemaspis agarwali*, *Cnemaspis ornate*, *Hemiphyllodactylus nilgiriensis* species is currently known based on the photographs in near hills five falls in coutrallam, Tenkasi district, Tamilnadu State, India. In this paper discuss in distribution and conservation status.

MATERIALS AND METHODS

Study area

The Reptile species were recorded from photographs taken in Coutrallam Falls (8°55'55"N 77°16'09"E / 8.93194°N), Tenkasi district, Tamilnadu..It is located in Western Ghats to the South of Coutrallam town and to the north of Coutrallam Lower, the first lake in the descent of Chittar. It is located 5 km from the nearest town Tenkasi and 59 km from the nearest city Tirunelveli. Figure 2. Showed in Coutrallam Falls (also called Kuttralam/Kuttalam Falls) is located in Tenkasi district in the South Indian state of Tamil Nadu bordering to Kollam district, Kerala. The falls is located on the Western Ghats on the river Chittar. It is located 5 km from the nearest city Tenkasi. The falls receives its waters during the South-west monsoon from May to September, but the maximum amount of rainfall is received during the North-east monsoon during October to December.

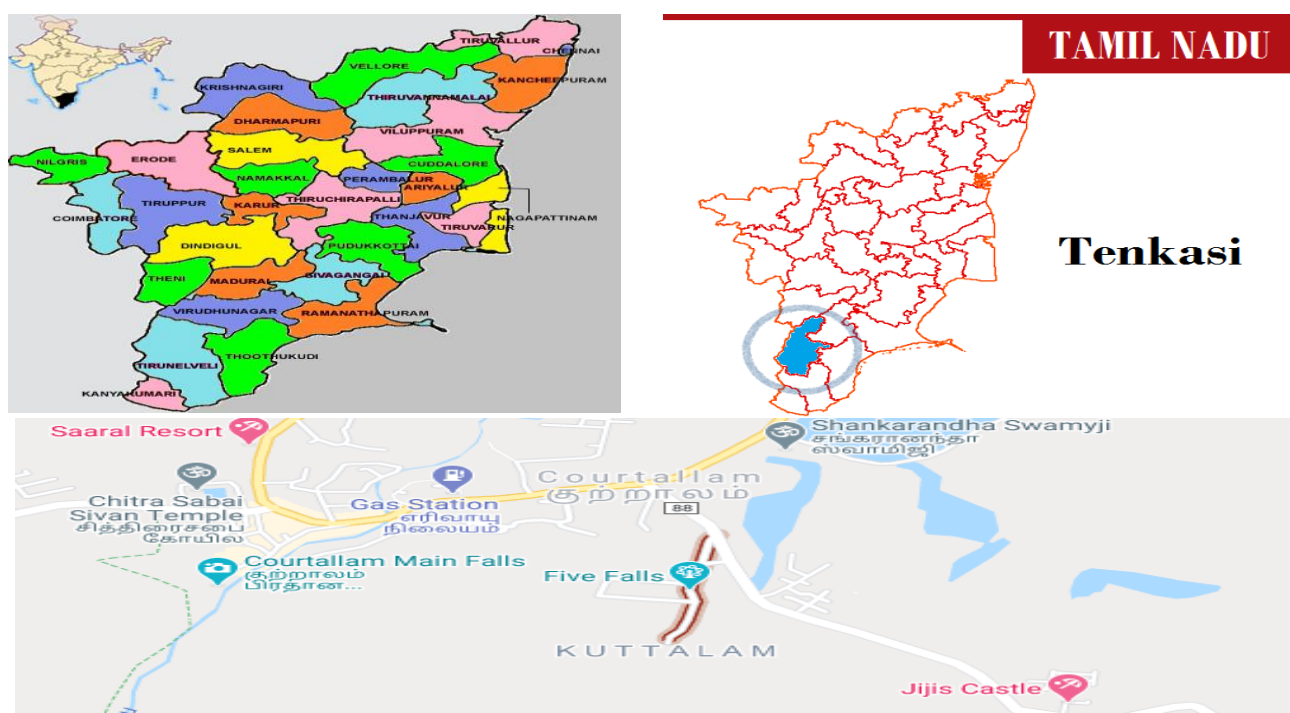


Figure 1. A map showing record of reptile species at Tenkasi District, Tamilnadu State, India.



Figure 2. A view of locality, five falls in Coutrallam, Tenkasi District, Tamilnadu.



Figure 3. *Cnemaspis ornate* species.



Figure 4. *Cnemaspis agarwali* species



Figure 5. *Hemiphyllodactylus nilgiriensis* male species.

RESULTS AND DISCUSSION

Ornate Dwarf Gecko *Cnemaspis ornata* (Beddome) figure 3. recorded locality, five falls in Coutrallam, Tenkasi district, Tamilnadu. Based on the photographs. Diagnosis: Head covered with small, granular, conical scales; back with much larger, conical or strongly keeled tubercles; ventrals smooth. Digits longer; tail cylindrical; male with 6-9 preanal pores. Brown above and pale brownish on the undersides. Dorsal pattern consists of a row of white blackedged ocelli down the centre of the back and a light black edged band on the shoulders. (Aengals, 2012). Sayyed *et al.* (2019) have focused study on *Cnemaspis ornata*. We have examined the lectotype and series of paralectotypes at the Natural History Museum, London (NHMUK), conducted field surveys and documented our observations at Tirunelveli, Tamil Nadu which is the type locality of *C. ornata*. Additional field collections of *C. ornata*-like geckos from Thenmala, Kerala State revealed that presence of an undescribed species of *Cnemaspis*. Thus, here we describe this new species of *Cnemaspis* from the lower elevation of the southern Western Ghats of

Kerala. The new species described herein was previously misidentified as *C. ornata*. We have observed and examined fresh specimens including the type series of the new species during our field surveys at the type locality and in other parts of Tirunelveli, Tamil Nadu. In addition, the cluster analysis implies that *C. aaronbaueri* is morphometrically distinct. However, additional analyses using both morphometric data from more specimens and molecular data will bolster these results.

Recently described (Khandekar, 2019) Agarwal's dwarf gecko (*Cnemaspis agarwali*) species near Kidayur road, Sankari village. East of Salem city, District Salem, Tamil Nadu, India. *Cnemaspis agarwali* sp. nov. is so far known only from the type locality, at an elevation of ca. 350 m asl. The species was encountered during a single day of fieldwork on an isolated rocky hillock in mid-November near Kidayur road, Sankari, Tamilnadu. These scansorial, diurnal geckos were observed only on large rocky boulders. On a subsequent visit to the same locality in mid-April, they were abundant and active in the evening, only on the rocky boulders. Soon after dark, they became inactive and

were observed predominantly the ground, in dry leaf litter around the rocky boulders. In this study figure 4. Agarwal's dwarf gecko (*Cnemaspis agarwali*) species recently documented in five falls in Coutrallam, Tenkasi District, Tamilnadu State in India. The Species identified based on the photographs located on the Western Ghats to the South of Coutrallam town. Discovery of *Cnemaspis agarwali* species from the lower elevations of eastern Tamil Nadu highlights that this genus could be more widespread than currently understood and that regions of peninsular India outside the Western Ghats potentially harbour many more distinct undescribed lineages. Therefore, systematic studies with fine scale sampling across peninsular India are needed to uncover the true diversity and distribution of peninsular Indian *Cnemaspis* (Khandekar, 2019).

Hemiphyllodactylus nilgiriensis (Figure 5) recorded locality in five falls, Coutrallam, Tenkasi District, Tamilnadu State, India. The species we have recently record and identification of based on the photographs in near Coutrallam five falls, Tenkasi District, Tamilnadu State in India. Recently described (Agarwal *et al.*, 2020) *H. nilgiriensis* species is currently known in and around its type locality in the eastern slopes of the Nilgiris, Nilgiris District, Tamil Nadu. The holotype and paratype (CESL 467) were collected from a mud cliff along a road on the eastern side of the Nilgiris. The habitat at the type locality comprises mixed deciduous forests and open scrub patches. The specimens in Mulli were found in the early evening hours (ca. 18:00 hrs) partially hiding in a crevice ca. 1.5 m above the ground. Recently recorded in based on the photographs *H. nilgiriensis* species is currently known near five falls of Coutrallam Hills in Tenkasi District, Tamilnadu State, India. The two new species described herein are the first *Hemiphyllodactylus* from the Western Ghats, *H. nilgiriensis* species. From the Nilgiri massif and *H. peninsularis* species. From the Agasthyamalai Hills. There is up to 3.2 % sequence divergence within *H. nilgiriensis* sp. Nov. Within a straight-line distance of ~32 km, while pairwise distance with *H. peninsularis* species, which is ~312 km away is just 5.1 %. In contrast, *H. aurantiacus* and *H. kolliensis*, the type localities of which are just ~50 km straight-line distance apart but separated by inhospitable lowland habitat, are non-sister and 12.9 % divergent from one another. This is indicative of elevation and or forest habitat being a strong determinant of distribution within this group (Agarwal *et al.*, 2020). There is a strong latitudinal gradient in annual rainfall and seasonality in the Western Ghats and the two localities fall in different biogeographic regions, the Central and Southern Western Ghats.

Tamil Nadu, the southernmost state in India, contains a number of high mountain ranges in the Western Ghats, besides the Bilgiriangan-Male Mahadeshwara ranges, Sirumalai, Shevaroy and associated hills and many smaller hill ranges and massifs to the east; though most of the state is lowland coastal plains (Figure 1). Tamil Nadu has a tremendous diversity in precipitation; all regions receive

the summer monsoon, except the east coast that largely gets its rainfall in winter, with southern montane regions receiving rainfall during both monsoons. The resultant high diversity in habitats is reflected in the number of endemic geckos known from the state, which include *Cnemaspis agarwali* Khandekar, *C. australis* Manamendra-Arachchi, Batuwita & Pethiyagoda, *C. otai* Das & Bauer, *C. shevaroyensis* Khandekar, Gaitonde & Agarwal, *C. thackerayi* Khandekar, Gaitonde & Agarwal, *C. yercaudensis* Das & Bauer, *Cyrtodactylus speciosus* (Beddome), *Dravidogecko anamallensis* Chaitanya, Giri, Deepak, Datta- Roy, Murthy & Karanth, *Dravidogecko douglasadamsi* Chaitanya, Giri, Deepak, Datta-Roy, Murthy & Karanth, *Dravidogecko meghamalaiensis* Chaitanya, Giri, Deepak, Datta-Roy, Murthy & Karanth, *Dravidogecko tholpalli* Chaitanya, Giri, Deepak, Datta-Roy, Murthy & Karanth, *Hemidactylus acanthopholis* Mirza & Sanap, *H. kolliensis* Agarwal, Bauer, Giri & Khandekar, *H. sankariensis* Agarwal, Bauer, Giri & Khandekar, *H. vanam* Chaitanya, Lajmi & Giri, *Hemiphyllodactylus aurantiacus* (Beddome), *H. kolliensis* Agarwal, Khandekar, Giri, Ramakrishnan & Karanth. With the description of these two new species of *Hemiphyllodactylus*, 19 geckos are known to be endemic to Tamil Nadu, which includes 11 species described since 2018 (Agarwal *et al.*, 2020; Khandekar, 2019; Shankaraiah *et al.*, 2015).

CONCLUSION

Given the spate of recent discoveries, diversity is likely to be massively underestimated and a huge number of new species are waiting to be discovered across the mountainous landscape of Tamil Nadu and more broadly, peninsular India. The exploration and conservation of montane forest habitats has to be a priority if this biodiversity is to be evaluated and saved. Additional undescribed taxa within the genus undoubtedly still remain. It is likely that extensive surveys in mainland India will yield further new discoveries and rediscoveries in the genus.

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REFERENCES

- Aengals, R. (2012). Studies on the Family Gekkonidae (Reptilia) from Karnataka and Tamil Nadu. *Records of the Zoological Survey of India*, 112(1), 103-112.

- Agarwal, A., Kakade, S. M., Lee, J. D., & Mahajan, G. (2019). Optimality and approximation with policy gradient methods in markov decision processes. *arXiv preprint arXiv:1908.00261*, 4.
- Agarwal, I., Bauer, A. M., & Khandekar, A. (2020). A new species of South Asian *Cnemaspis* (Squamata: Gekkonidae) from the Eastern Ghats, India. *Zootaxa*, 4802(3), Zootaxa. 4802.4803. 4803.
- Agarwal, I., Khandekar, A., & Bauer, A. M. (2018). A new bent-toed gecko (Squamata: Gekkonidae: Cyrtodactylus) from the Western Himalayas, Himachal Pradesh, India. *Zootaxa*, 4446(4), 442-454.
- Chandramouli, R., Chen, X., Subbalakshmi, K. P., Hao, P., Cheng, N., & Perera, R. (2012). Automated detection of deception in short and multilingual electronic messages: Google Patents.
- Cyriac, G., & Gandhi, L. (2018). *Emerging biomarkers for immune checkpoint inhibition in lung cancer*. Paper presented at the Seminars in cancer biology.
- Das, A., Ahmed, M. F., Lahkar, B. P., & Sharma, P. (2007). A preliminary report of reptilian mortality on road due to vehicular movement near Kaziranga National Park, Assam, India. *Zoos' Print Journal*, 22(7), 2742-2744.
- De Rham, C., Gabadadze, G., & Tolley, A. J. (2011). Resummation of massive gravity. *Physical Review Letters*, 106(23), 231101.
- Grismer, L. L., Wood Jr, P. L., Anuar, S., Muin, M. A., Quah, E. S., McGuire, J. A., Hong Thai, P. (2013). Integrative taxonomy uncovers high levels of cryptic species diversity in *Hemiphyllodactylus* Bleeker, 1860 (Squamata: Gekkonidae) and the description of a new species from Peninsular Malaysia. *Zoological Journal of the Linnean Society*, 169(4), 849-880.
- Grismer, L. L., Wood Jr, P. L., Thura, M. K., Zin, T., Quah, E. S., Murdoch, M. L., Lwin, N. (2018). Twelve new species of *Cyrtodactylus* Gray (Squamata: Gekkonidae) from isolated limestone habitats in east-central and southern Myanmar demonstrate high localized diversity and unprecedented microendemism. *Zoological Journal of the Linnean Society*, 182(4), 862-959.
- Khandekar, A. (2019). A new species of rock-dwelling *Cnemaspis* Strauch, 1887 (Squamata: Gekkonidae) from Tamil Nadu, southern India. *Zootaxa*, 4571(3), 383-397.
- Manamendra-Arachchi, K., Batuwita, S., & Pethiyagoda, R. (2007). A taxonomic revision of the Sri Lankan day-geckos (Reptilia: Gekkonidae: *Cnemaspis*), with description of new species from Sri Lanka and southern India. *Zeylanica*, 7(1), 9-122.
- Murdoch, M. L., Aguilar, C., & Grismer, M. S. (2016). Taxonomy, phylogeny, and distribution of *Bronchocela rayaensis* (Squamata: Agamidae) on the Thai-Malay Peninsula. *Zootaxa*, 4092(3), 414-420.
- Nguyen, T. D. H., Maschietti, M., Åmand, L.E., Vamling, L., Olausson, L., Andersson, S.I., & Theliander, H. (2014). The effect of temperature on the catalytic conversion of Kraft lignin using near-critical water. *Bioresource Technology*, 170, 196-203.
- Sayyed, A., Grismer, L. L., D Campbell, P., & Dileepkumar, R. (2019). Description of a cryptic new species of *Cnemaspis* Strauch, 1887 (Squamata: Gekkonidae) from the Western Ghats of Kerala State of India. *Zootaxa*, 4656(3), 501-514.
- Sayyed, M., Tekin, H., Kılıcoglu, O., Agar, O., & Zaid, M. (2018). Shielding features of concrete types containing sepiolite mineral: comprehensive study on experimental, XCOM and MCNPX results. *Results in Physics*, 11, 40-45.
- Shankaraiah, N., Siraj, K., Nekkanti, S., Srinivasulu, V., Sharma, P., Senwar, K. R., Jadala, C. (2015). DNA-binding affinity and anticancer activity of β -carboline chalcone conjugates as potential DNA intercalators: Molecular modelling and synthesis. *Bioorganic Chemistry*, 59, 130-139.
- Sukprasert, A., Sutthiwise, S., Lauhachinda, V., & Taksintum, W. (2018). Two new species of *Hemiphyllodactylus* Bleeker (Squamata: Gekkonidae) from Thailand. *Zootaxa*, 4369(3), 363-376.
- Sung, C., Lim, S., Kim, H., Kim, T., Moon, K., Song, J., Hwang, H. (2018). Effect of conductance linearity and multi-level cell characteristics of TaOx-based synapse device on pattern recognition accuracy of neuromorphic system. *Nanotechnology*, 29(11), 115203.
- Tabari, H., Grismer, M. E., & Trajkovic, S. (2013). Comparative analysis of 31 reference evapotranspiration methods under humid conditions. *Irrigation Science*, 31(2), 107-117.
- Tolley, K. A., Tilbury, C. R., Measey, G. J., Menegon, M., Branch, W. R., & Matthee, C. A. (2011). Ancient forest fragmentation or recent radiation? Testing refugial speciation models in chameleons within an African biodiversity hotspot. *Journal of Biogeography*, 38(9), 1748-1760.
- Zug, G. R. (2010). Speciation and dispersal in a low diversity taxon: the slender geckos *Hemiphyllodactylus* (Reptilia, Gekkonidae). *Smithsonian Contributions to Zoology*, 104-107.