

# A NEW SPECIES OF *Cnemaspis* (REPTILIA: SQUAMATA: GEKKONIDAE) FROM THE WESTERN GHATS OF TAMIL NADU, INDIA

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**Abstract:** A new species of gecko (Reptilia: Gekkonidae) from the Western Ghats of South Western India is described, from the Anaikatty Hills, Coimbatore. *Cnemaspis pseudoinдика* sp. nov. is a medium-sized gecko (SVL to 41 mm) that may be distinguished from its congeners by its absence of spine-like tubercles on the flanks, three pairs of postmentals, the first pair separated by a median scale, dorsal scales granular, smooth, flanks with a few scattered, feebly enlarged, more-or-less keeled tubercles intermixed, ventral scales smooth, and lamellae under 4<sup>th</sup> digit of the pes 11–14.

**Keywords:** *Cnemaspis*, Gekkonidae, taxonomy, Western Ghats, India, tropical forests, biodiversity hotspot.

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## 1. INTRODUCTION

*Cnemaspis* Strauch is a speciose genus of gekkonid lizards that is distributed in three regions of the Old World tropics: Southeast Asia, South Asia, and Equatorial Africa (Bauer, 2002; Das & Grismer, 2003; Grismer & Das, 2006; Bauer et al., 2007). Recent molecular phylogenetic research has demonstrated that *Cnemaspis*, as presently construed, is not monophyletic, and that each of these geographic regions supports a genetically distinct clade of geckos (Bauer et al., 2007). South Asian members of the genus occur in India and Sri Lanka, as well as the Mentawi Archipelago (Indonesia) (Bauer et al., 2007). Thirty six species are currently recognized from India and Sri Lanka, including over 24 from India. of the 22 species in mainland India (two others occur on the Andaman Islands), one is of unknown provenance, one is restricted to Assam in Northeast India (Das & Sengupta, 2000), two to the Eastern Ghats of Tamil Nadu including that found in the Shevaroy Hills (Das & Bauer, 2002). The remaining species occur exclusively or partly in the Western Ghats, from southern Tamil Nadu North to Maharashtra (Mukherjee et al., 2005; Manamendra-Arachchi et al., 2007; Mukherjee, 2012). The Western Ghats is one of 34 currently recognized global biodiversity hotspots (Mittermeier et al., 2005), and is characterized by high herpetofaunal endemism (Hora, 1953; Inger & Dutta, 1986).

We here report on the discovery of a new species of *Cnemaspis* from the Anaikatty Hills (11°05' N, 76°47' E), Western Ghats of Tamil Nadu, southern peninsular India. The Anaikatty Hills are located on the eastern side of the Western Ghats and are largely covered by southern mixed dry deciduous forest. However, hill tops such as Perumalmudi (1500-1640 m asl), are covered by tropical semi-evergreen forest (Champion & Seth, 1968). Descriptions on the biotic and abiotic environs of the general area are available in Mukherjee (2012). *Cnemaspis anaikattiensis* Mukherjee et al., 2005 was

described from the foothills of the area, but this species has been synonymized with *C. sisparensis* (Theobald) by Manamendra-Arachchi *et al.*, 2007), an action that requires further review.

## 2. MATERIALS AND METHODS

Geckos were photographed in life and fixed in 6% formalin, then transferred to and stored in 70% ethanol. The following measurements were taken largely following Bauer (2002); SVL (snout-vent length): from tip of snout to anterior margin of vent; TL (tail length): from vent to tip of unregenerated tail; TW (tail width): measured at base of tail; TBL (tibia length): from the base of heel to knee; HL (head length): from posterior edge of last supralabial to tip of the snout; HW (head width): measured at angle of jaws; HD (head depth): maximum height of head (at occipital); FA (forearm length): from base of palm to elbow; EL (ear length): measured along long axis of opening; ED (eye diameter); greatest diameter of orbit; E-N (eye to nostril distance): from anterior margin of orbit to nostril; E-S (eye to snout distance): from anterior margin of orbit to tip of snout; E-E (eye to ear distance): from posterior margin of orbit to anterior margin of ear opening; IN (distance between nares); IO (interorbital distance); and A-G (distance from axilla to groin): from posterior margin of forelimb (manus) insertion to anterior margin of hind limb (pes) insertion. All linear measurements were taken using Mitutoyo® dial vernier calipers and are reported to the nearest 0.1 mm. Number of supralabials was counted from the angle of jaws. Ventral scale counts were made across mid-belly between the lowest rows of differentiated lateral granules on each side of the body. Lamellae under digit IV of the pes and distal to the enlarged plate at the first interphalangeal joint were counted.

Comparative materials were examined in the collections of the Zoological Survey of India (ZSI), Kolkata and the Bombay Natural History Society (BNHS), Mumbai. In addition, comparisons were made with the original type descriptions of the *Cnemaspis* of peninsular India and with revisionary and regional works (Smith, 1935; Inger *et al.*, 1984; Tikader & Sharma, 1992; Sharma, 2002; Manamendra-Arachchi *et al.*, 2007).

### Systematics

(Reptilia: Squamata: Gekkonidae: Gekkoninae)

*Cnemaspis pseudoindica* sp. nov.

False Indian day gecko

Figures , Table 1



Figure 1. *Cnemaspis pseudoindica* sp. nov.

**Holotype.** BNHS 1823, mature male (SVL 41 mm, TL 46 mm); Perumalmudi peak, Anaikatty Hills, Western Ghats, Coimbatore district, Tamil Nadu, India (11°03' N, 76°48' E); Collected by Debanik Mukherjee, 20 December 2005.

**Paratypes.** BNHS 1824, mature male (SVL 37 mm), BNHS 1825, mature female (SVL 39 mm, TL 43 mm). Data as above.

**Additional Materials.** SACON 0025, mature male (SVL 40 mm, TL 46 mm); SACON 0026, female (SVL 38 mm, TL 41 mm); SACON 0027, male (SVL 34 mm, tail regenerated); SACON 0028, female (SVL 33 mm, TL 44 mm); SACON 0029, mature female (SVL 40 mm, tail regenerated); SACON 0030, mature female (SVL 41 mm, tail regenerated) were collected from the same place and released after examination. Data as above.

**Etymology.** The specific name *C. pseudoindica* denotes its superficial phenotypic resemblance of the species to *Cnemaspis indica*.



**Figure 2.** Showing the dorsal feebly enlarged, few tubercles of False Indian day gecko



**Figure 3.** Showing the ventral colouration in life

**Diagnosis.** *Cnemaspis pseudoindica* sp.nov. is diagnosable from its congeners by the following combination of characters: a medium sized *Cnemaspis* (SVL up to 41 mm); flanks without spine-like projecting tubercles; nostril not in contact with first supralabial; three pairs of post mentals, first pair separated by a single median scale; dorsal scales smooth, granular, intermixed with a few feebly enlarged, irregularly arranged tubercles on flanks; ventral scales smooth, 19–22 rows of midventral scales; precloacal pores absent, 3–6 femoral pores on each thigh; distal lamellae under digit IV of the pes 11–14.

**Description of Holotype.** Mature male, 41 mm SVL, 46 mm TL; head distinct from the neck; snout obtusely pointed; rostral broader than long and partially divided by a cleft or rostral groove, rostral in contact with first supralabial; two pairs of supranasals on either side, anterior pair larger, divided by an internasal; postnasal single, nostrils not in contact with first supralabial; supralabials (to the angle of jaws, left-right) 7–8 and infralabials 6–7; no tubercles along mandibles or side of head; ear opening vertically elongated; two rows of scales separating orbital rim from supralabials; eye with circular pupil; extrabrillar fringes present, anterior scales enlarged; supraciliaries not elongated; scales on the snout weakly keeled, larger than those on occiput; scales on lores smooth, those on dorsal surface of head weakly keeled; mental nearly triangular, broader than rostral; three pairs of postmentals, first pair separated by a median scale, postmentals in contact with first and second infralabials.

Dorsal scales granular, gradually increasing in size from neck to posterior dorsum, scales on the flanks larger than those on the mid-dorsum, intermixed with a few, scattered, feebly enlarged, keeled tubercles; scales on dorsal surface of thigh, shank, upper arm, and forearm weakly keeled; scales on the inner side of the hind and fore limbs, palm and sole smooth; ventral scales larger than those of dorsum at same level; ventral scales smooth, imbricate, decreasing in size from chin to gular region, increasing in size from pectoral region to abdomen; mid-ventral scales in 22 rows. No precloacal pores or groove; 6 femoral pores on each thigh.

Digits elongated and clawed; subdigital scansors on the base digit I of manus and pes 1 or 2, 2 or 3 enlarged interphalangeal scansors; distal lamellae under the digit IV of pes 12; relative length of digits of manus  $I < II < III < IV \approx V$ , of pes  $I < II < III \approx V < IV$ .

Scales on tail dorsum smooth, with few relatively larger, weakly keeled tubercles; the median row of subcaudal plates larger than adjacent scales and one cloacal spur on either side

Colouration. The holotype (under preservation) is dark brown with white lateral tubercles; ventral with light brown spots; limbs and digits with dark and light bands.

The coloration (in life), sides of the head yellow; dorsum brown with light 'V'-shaped patterns and faded yellow markings; both dorsum and venter with yellow tinge; enlarged tubercles yellow or white; ventral dirty white with brown spots, which are relatively prominent in gular region; limbs and digits with dark and light bands.

Variation. Most specimens were similar to the holotype for meristic characters. Variable features (data for holotype, followed by the range of eight additional specimens examined in parentheses): supralabials 7–8 (6–8); infralabials 6–7 (6–8); mid-ventrals 22 (19–22); lamellae under digit IV of pes 12 (11–12). Males differ from females in having hemipeneal swellings at the tail base and 3–6 femoral pores on each thigh (no pores in females).

**Comparisons.** Smith (1935) separated members of *Cnemaspis* into two groups; one having spine-like tubercles projecting from the flanks and the other without such tubercles. Manamendra-Arachchiet *al.* (2007) also used this character in the first couplet of their dichotomous key to peninsular Indian *Cnemaspis*. The new taxon belongs to the latter group, sometimes considered as the *Cnemaspis indica* group. It may be differentiated from other members of this group by its lack of precloacal pores (present in *C. australis* Manamendra-Arachchiet *al.*, *C. beddomei* (Theobald), *C. nairi* Inger *et al.*, 1984 *C. ornata* (Beddome), *C. otai* Das & Bauer 2002, *C. yercaudensis* Das & Bauer 2002, and a new species from Maharashtra (Giriet *al.*, submitted). From other species lacking flank spines and precloacal pores, *C. pseudoindica* may be separated from *C. boiei* (Gray) by the presence of femoral pores in males, and from *C. indica* (Gray) in having smooth, juxtaposed, dorsal scales intermixed with a few larger feebly keeled tubercles on the flanks (versus strongly keeled, imbricating dorsal scales without flank tubercles), however, the new species shows a superficial external similarity with *C. indica*.

It seems new species is most similar to *C. wynadensis* (Beddome), *C. sisparensis* (Theobald), *C. heteropholis* (Bauer) and *C. anaikattiensis* (Mukherjee *et al.*, 2005).

The new species differs from *C. wynadensis* in dorsal having smooth, juxtaposed, dorsal scales intermixed with a few larger feebly keeled tubercles on the flanks (versus larger, rounded, pointed or keeled, uniform or mixed with smaller tubercles in *C. wynadensis*).

The new species differs from *C. sisparensis* in dorsal having smooth, juxtaposed, dorsal scales intermixed with a few larger feebly keeled tubercles on the flanks (versus dorsal tubercles are strongly enlarged and regular, 7-8 femoral pores in *C. sisparensis*).

The new species differs from *C. anaikattiensis* nostril not in contact with first supralabial (versus in contact in *C. anaikattiensis*), first pair of post mental divided by a single median scale (versus three scales in *C. anaikattiensis*), dorsal scales smooth with few feebly enlarged tubercles (versus prominent conical tubercles numerous in *C. anaikattiensis*)

The new species differs from *C. heteropholis* in supranasals divided by an internasal (versus in contact in *C. heteropholis*), nostril not in contact with first supralabial (versus in contact in *C. heteropholis*), dorsal scales smooth and homogeneous in new species (versus heterogeneous),

**Natural History.** *Cnemaspis pseudoindica* sp. nov. currently known only from the Hill top (1600 masl) of the Perumalmudi in Anaikatty Hills. However, it is not likely to be found on other hill tops covered with tropical semi-evergreen shola forests, where temperature is comparatively low and atmosphere is moist, especially on the eastern side of the southern Western Ghats. Tree species such as *Syzigium* sp., *Nothopegia* sp., *Mallotus philippensis* etc. were dominant in the region. *Cnemaspis mysoriensis* is common in low hills (600-800 m asl.). Like other members of the genus, *C. pseudoindica* is diurnal. Most of the females had well developed eggs and enlarged endolymphatic sacs during March to April, and September, consistent with a bimodal or continuous breeding season. Communal egg deposition among many smaller bodied *Cnemaspis* species including *C. pseudoindica*, perhaps indicates an evolutionary strategy to avoid the rate of extinction from habitat loss and climate change.

### 3. DISCUSSION

*Cnemaspis*, *Cyrtodactylus* and *Cyrtopodion* are perhaps comparatively newly evolved genera as compared to other Gekkonids and convergent character evolution might have played key roles to adapt and evolve to utilize almost similar ecological microhabitats, such as rocky outcrops or exposed highland rocks; as compared to Northeast of India, where generic diversity is higher perhaps because of Allopatric and Peripatric speciation, Western Ghats have more species diversity may be because of Sympatric or Parapatric speciation.

The speciation of *Cnemaspis* complex may be reanalyzed with respect to endemism, as many newly described endemic taxa may not have a bright taxonomic future to re-discover or re-describe because of higher extinction rates and slower adaptation to spatio-temporal environmental changes as endemic species are specialized, which may lead to extinction.

However, lack of intensive field surveys, fresh material coupled with the difficulty of the intercontinental comparison of old, often poorly preserved type material without its precise type locality data has made progress in *Cnemaspis* taxonomy quite difficult. Manamendra-Arachchi et al. (2007) have made an attempt to revise and review South Asian *Cnemaspis* species complex. However, their treatment of Indian taxa was not as thorough as that of Sri Lankan forms and involved no new material. Further, while they applied a uniform approach to their descriptions and species accounts, they did not include full taxonomic descriptions of all Indian species in their monograph; species described after the work of Sharma (1976) including over twelve species from the Western Ghats (Inger et al., 1984; Bauer 2002; Pal et al., 2021; Sayyed et al., 2019; Agarwal et al., 2020) were included only in their species list and keys.

Further investigations in various discontinuous forest patches in the Western Ghats, especially the higher altitude forests may yield more new species of reptiles including day geckoes.

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**Table 1. Mensural features (in mm) of nine specimens of *Cnemaspis pseudoindica* sp. nov.; Holotype: Male, 1823 BNHS, Paratypes: Male, 1824 BNHS, 1825 Female, BNHS and additional specimens observed. For expansion of abbreviations, see Materials and Methods**

Measurement	Holotype	Paratypes		Additional specimens						Mean
	Male	Male	Female	Male	Female	Male	Female	Female	Female	
	1823 BNHS	1824 BNHS	1825 BNHS	0025 SACON	0026 SACON	0027 SACON	0028 SACON	0029 SACON	0030 SACON	
SVL	41	37	39	40	38	34	33	40	41	38.1
TL	46	Broken	43	46	41	broken	44	broken	broken	44
TBL	7.5	7.5	7.48	7.5	7.5	7.5	7.5	7.5	7.5	7.4
TW	4.4	4	4.3	4.5	3.5	4	4	4	4.5	4.1
HL	6.4	7	7	6.5	6.5	7	7	6.5	7	6.7
HW	6.18	6	6	6	6	6	6.2	6.5	6.5	6.1
HD	5	5	5	5.5	5.5	5	5	5	5.5	5.1
EL	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
FA	6	6	6	6	6	5.5	5.6	6	6	5.9
ED	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
E-N	3	3.5	3.5	3	3.5	3	3.4	3.5	3.5	3.3
E-S	4.5	4.5	4.8	5	5	4.5	4.7	5	5	4.7
E-E	3.4	3.5	3.4	3.5	3.5	3.5	3.3	3.5	3.5	3.4
IN	2	2	2	2	2	2	2	2	2	2
IO	3.6	3	4	3	3	3	3.7	4	4	3.4
A-G	22	20	21	22	22	18	18	23	22	20.8

#### Comparative Materials Examined.

*Cnemaspis indica* (Gray): ZSI 12486: Collected by W. Theobald from Nilgiris Year 1873 Zoological Survey of India, Kolkata.

*Cnemaspis indica* (Gray): ZSI 5843 & 4910: Collected by Col. Beddome from Nilgiris Year 1873, Zoological Survey of India, Kolkata.

*Cnemaspis indica* (Gray): BNHS 1252 : Collected by J.C. Daniel & party from Parsons valley, Nilgiris, Tamil Nadu State, Year 1977. Bombay Natural History Society, Mumbai.

*Cnemaspis wynadensis* (Beddome): Reg No. ZSI 17841 & 17848. Collected by F.H.Gravelly from Kavalai, Cochin State, 1300-3000 ft Zoological Survey of India, Kolkata.

*Cnemaspis sisparensis* (Theobald) [= *Gonatodes bireticulatus*] Annd: ZSI 17970: Collected by F.H.Gravelly from Kavalai, Cochin State, 1300-3000 ft. Zoological Survey of India, Kolkata.

*Cnemaspis anaikattiensis* (Mukherjee, Bhupathy & Nixon): ZSI 25601 & 25602: A.M.A. Nixin and Debanik Mukherjee, 17 September 2003; Anaikatty Hills, Coimbatore, Western Ghats, Tamil Nadu, India.