



CURRENT STATUS OF *Cnemaspis littoralis* (JERDON, 1853) (SAURIA: GEKKONIDAE) WITH DESIGNATION OF A NEOTYPE

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Abstract

The gecko *Cnemaspis littoralis* was described by Jerdon in 1853 from a single specimen found in a warehouse on the sea coast of Malabar. A search of the reptile collection of the ZSI failed to uncover any trace of the type specimen of this species; similar searches of the reptile collections of BMNH also proved abortive. Manamendra-Arachchi *et al.* (2007) also highlighted the need of designating a neotype as the type had been lost. Therefore we ascertain that Jerdon's type of *Cnemaspis littoralis* is lost. Hence here we redescribe this species based on specimens collected from the coasts of Kozhikode district of Kerala and designate a neotype for the taxon. *Cnemaspis littoralis* is distinguished from all other species of Indian *Cnemaspis* by its overall slender form; few scattered, small, spine like tubercles on flanks; dorsal scales homogeneous; enlarged hexagonal subcaudals and large number of femoral pores (15-18) in males. We also provide observations on the natural history, reproduction and interactions of this species with invertebrates.

Keywords: holotype, redescription, taxonomy, distribution, Malabar, ecology, India.

Introduction

The genus *Cnemaspis* Strauch, 1887 is one among the most speciose gekkotan genera in the family Gekkonidae, represented by more than 100 species from South & South-east Asia and Africa (<http://www.reptile-database.org>). Within the last few years, the Southeast Asian and Sri Lankan species of *Cnemaspis*, have undergone extensive taxonomic revisions resulting in numerous new species (<http://www.reptile-database.org>). In India, the

genus was given sufficient attention during the colonial period (Beddome, 1870a,b; Gray, 1846; Jerdon, 1853; Theobald, 1876; Annandale, 1915). However, in recent years, there have been very few studies and the diversity within this genus in India is largely underestimated (Bauer, 2002; Das & Bauer, 2000; Mukherjee *et al.*, 2005). The most comprehensive review of this genus in India is by Manamendra-Arachchi *et al.* (2007). They

provided detailed descriptions of most of the peninsular Indian species based on the examination of museum specimens, but could not find any name bearing types for two species; *C. mysoriensis* (Jerdon, 1853), described from Bangalore and *C. littoralis* (Jerdon, 1853), described from the coasts of Malabar. Explorations in Bangalore have led to the redescription of *C. mysoriensis* and a neotype has been designated for the species (Giri *et al.*, 2009). Recent field work in Kerala has revealed the existence of *C. littoralis* from the Kozhikode district, which was earlier a part of the Malabar region. We herein designate a neotype and redescribe the species.

Cnemaspis littoralis was originally described as *Gymnodactylus littoralis* by Jerdon in 1853, based on a single specimen found in a warehouse on the sea coast of Malabar. Subsequent reviews of this lizard by Günther (1864) and Theobald (1876) provided merely a short description with the distribution as the sea coast of Malabar. Günther (1875), considered *G. planipes* described by Beddome in 1871 from Nellicootah, below the Nilgiris, to be a synonym of *G. littoralis*. Boulenger (1885) supported Günther's view based on examining the types of *G. planipes* collected by Beddome and gave the distribution of *G. littoralis* as Nellicottah and Nilambar. Smith (1935) mentioned the distribution of *Cnemaspis littoralis* as Nilambur and Nellakota, on the western side of the Nilgiris. He also suggested that Jerdon's type of *Gymnodactylus littoralis*, from the sea coast of Malabar, was probably an imported individual. Murthy's (1990) description of this species was meagre and mentioned its distribution as Nilambur, Kerala and Nellakota, Nilgiris, Tamil Nadu. The same was followed by Tikader & Sharma (1992) but they added Malabar in their distribution of this species. Inger *et al.* (1984a,b) reported this species from Ponnudi Hills of Trivandrum District, Kerala. They reported 3 individuals, two of which were found in evergreen forests at an altitude of 310-360 m a.s.l. and the other was from moist deciduous forest at 260 m a.s.l. The most recent report of *C. littoralis* is by Srinivasan *et al.* (1998) who reported this species from three sacred grooves viz. Iringole in Ernakulam district, Mookuthala in Malapuram district and Sangukulangara in Thrissur districts of Kerala state. Apart from these, there is no other record of this species

and the lack of a name-bearing type leaves the identity of this gecko in doubt.

Materials and Methods

Field sampling was carried out in different parts of Kerala state; some specimens were collected, photographed in life, euthanized and fixed in 10% formalin. The following measurements were taken to the nearest 0.1 mm: SVL, snout to vent length (distance from tip of snout to anterior margin of vent); AG, distance from axilla to groin; TW, trunk width (maximum width of the body); ED, eye diameter (horizontal diameter of the orbit); EN, distance between anterior point of the orbit to the posterior part of the nostril; ES, snout length (distance from anterior margin of the orbit to the tip of the snout); ET, distance from posterior margin of the orbit to the anterior margin of the ear opening; IN, internarial distance (least distance between the inner margins of the nostrils); TD, tympanum diameter (horizontal distance from the anterior to posterior margin of the ear opening); HL, head length (distance from tip of snout to posterior edge of mandible); HW, head width (maximum width of the head); HD, head depth (maximum depth of the head); IO, interorbital distance (shortest distance between the superciliary scale rows); UAL, upper arm length (distance from axilla to elbow); LAL, lower arm length (distance from elbow to wrist); PAL, palm length (distance from wrist to the tip of the longest finger); FL, finger length (distance from the tip of the finger to the nearest fork); FEL, femur length (distance from groin to the knee); TBL, tibia length (distance from knee to heel); TOL, toe length (distance from tip of toe to the nearest fork); TL, tail length (distance between posterior margin of vent to the tip of the tail); TBW, tail base width.

The pholidosis recorded included number of supralabials and infralabials up to the angle of the jaw on the left and right side; number of mid-ventral scale rows; subdigital lamellae on the IV manus; subdigital lamellae on IV pes and number of femoral pores on the left and right femur. All the specimens were deposited at the museum of the Zoological Survey of India, Western Ghats Regional Center (ZSI WGRC). Opportunistic observations were also made on the natural history of these lizards in Narayankulam, Kozhizode district, Kerala.



Figure 1: *Cnemaspis littoralis*: neotype ZSI/WGRC/IR/V/2377, male (31.5 mm SVL) in life

***Cnemaspis littoralis* (Jerdon 1853)**

(Figure 2A-F in the plate, Table 1)

Neotype: ZSI/WGRC/IR/V/2377: adult male (31.5 mm SVL); Chaliyam coast, 13 km from Calicut City, Kozhikode District, Kerala, India (11.16095 N, 75.80838 E); Umesh P. K.; 6 February 2012.

Diagnosis: *Cnemaspis littoralis* differs from all other Indian *Cnemaspis* by the following characters. Maximum SVL, 31.6 mm; overall slender form; few scattered spine like tubercles on flanks; dorsal scales of body and tail homogenous; 15-18 femoral pores in males; subcaudals in median row, enlarged and hexagonal; supralabials to angle of jaw, 9-10; infralabials, 7-9; basal 4-6 lamellae on digits enlarged; a distinct black spot on the nape.

Description of Neotype: An adult male of 31.5mm SVL. Head relatively long (HL 28.9 % of SVL), moderately broad (HW 58.2% of HL), strongly depressed (HD 38.5% of HL), distinct from neck. Snout shorter than head length (ES 42.8% of HL); scales on the snout smooth, larger than those on the forehead and interorbital region. Eye relatively small (ED 43.6% of ES), pupils round. Interorbitals

moderately broad (IO 54.7% of HW). Scales on interorbitals and supercilium smooth. Ear opening deep, small (TD 5.5% of HL), longer than broad. Rostrals wider than long, partially divided by a median groove. Two supranasals separated from each other by an internasal. Nostrils circular; surrounded by two postnasals, supranasal and rostral. Mental subtriangular, broader than rostral; two pairs of postmentals, inner pair larger and separated by a small intermediate chin shield; inner postmentals bounded by mental, first infralabial, outer postmentals and two chin shields; outer postmentals bounded by inner postmental, first infralabial, second infralabial and three chin shields. Supralabials to angle of jaws 9; infralabials to angle of jaw 8. Scales on the ventral surface of head, smooth, granular.

Body slender (TW 19.4% of SVL), elongate (AG 45.4% of SVL). Dorsal scales homogenous, granular; few very small spine like tubercles on the dorsolateral side of the body; flanks with few small, scattered, subconical, spine like tubercles. Ventral scales larger than dorsal scales, smooth, subimbricate. Mid-body scale rows across belly 26. Femoral pores 17; four rows of enlarged, juxtaposed

scales above the femoral pores; no precloacal pores; precloacal scales enlarged, juxtaposed.

Forelimbs moderately long; upper arm shorter than lower arm (UAL 16.5% of SVL, LAL 19.4% of SVL). Hind limbs long, tibia longer than femur (FEL 18.1% of SVL, TBL 19.0% of SVL). Dorsal and ventral scales on both forelimbs and hind limbs smooth. Scales on manus and pes smooth. Digits elongated with slightly recurved claws. Subdigital lamellae entire, a few fragmented; lamellae on the basal phalanges, enlarged, subquadrangular. Interdigital webbing absent. Subdigital lamellae on finger I: 8 (1 enlarged basal scansor); finger II: 12 (5 enlarged basal scansors); finger III: 14 (5 enlarged basal scansors); finger IV: 13 (4 enlarged basal scansors); finger V: 12 (4 enlarged basal scansors); toe I: 8 (1 enlarged basal scansors); toe II: 12 (4 enlarged basal scansors); toe III: 15 (5 enlarged basal scansors); toe IV: 15 (6 enlarged basal scansors); toe V: 14 (4 enlarged basal scansors). Relative length of digits, fingers: 4>3>5>2>1; toes: 4>3>5>2>1.

Tail (original) subcylindrical, flattened below; its length greater than SVL (TL 106.7% of SVL). Tail base swollen. Dorsal scales of tail homogenous, granular, few small spine like tubercles on the sides, towards the base of the tail. Ventral scales imbricate; median subcaudals enlarged, hexagonal. A post cloacal spur present on either sides of the base of the tail.

Colouration in preservative: Head grayish brown; dorsum, grayish brown with a vertebral series of dark edged, paired pale brown spots; a distinct black, subrectangular spot on the nape; ventrals, white; tail pale brown above, with a series of indistinct dark and light markings; white below.

Colouration in life: Dorsum, pale brown with dark brown and dull white mottlings; a vertebral series of paired paler spots edged on the sides by darker brown spots; spine like tubercles on flanks, white; ventral side of body, white. Dorsum of head, mottled with buff yellow and dark brown; ventral side of head, in breeding males, bright yellow bordered by a dark line up to the throat; nape with a subrectangular black spot; ventral side of neck and abdomen white. Limbs pale brown, mottled

with dark brown markings; fingers and toes cross barred with light and dark brown; tail pale brown, with a series of lighter, dark edged, spots; ventral side, white.

Variations: Most specimens had 9 supralabials except ZSI/WGRC/IR/V/2378A and 2380 which showed 10 supralabials. Infralabials ranged from 8-9 except in ZSI/WGRC/IR/V/2381A,B which both showed 8 infralabials on the right and 7 infralabials on the left. Femoral pores were present only in males and ranged from 15-18 on each femur. ZSI/WGRC/IR/V/2380 showed 16 femoral pores on the right and 15 femoral pores on the left.

Distribution: Recent field work throughout Kerala state has revealed the occurrence of *Cnemaspis littoralis* from the dry and coastal regions of Kozhikode district, previously a part of the Malabar region (type locality); Kannur district; Nellikuth and Nilambur, Malapuram district; Mannuthy, Thrissur district; Chittoor Government college, Palakad district (Palghat Gap); Kodanad and Cochin of Ernakulam district. Inger *et al.* (1984) reported the occurrence of *C. littoralis* from Ponmudi, Trivandrum district of Kerala. The occurrence of *C. littoralis* from Nilambur and Nellikuth (~80km from the coast) and from Chittur College, Palakad (~130km from the Coast) suggests that this species is not restricted to the littoral of Kerala but also the dry and humid regions throughout Kerala.

Natural history: All the specimens observed were from trees close to human settlements or from teak, rubber, acacia and coconut plantations (Fig. 3). Individuals were also found as commensals to humans, living on trees around houses in the heart of Kannur, Calicut, Thrissur and Cochin, which are well developed cities. The neotype, ZSI/WGRC/IR/V/2377 was collected from a jackfruit tree in Chaliyam coast, Kozhikode district; other specimens (ZSI/WGRC/IR/V/2378A,B) were collected from a coconut tree in Narayankulam, Kozhikode district; the male and female specimens collected from Kaprikad (ZSI/WGRC/IR/V/2379A,B) were found on acacia trees in an acacia plantation; the two males collected from Nellikuth (ZSI/WGRC/IR/V/2381A,B) were found on a teak tree.



Figure 3: Habitat of *C. littoralis* neotype

Adult *Cnemaspis littoralis* exhibit a distinct sexual dimorphism, with males having a bright yellow throat which is absent in females. In Chaliyam, the second author observed the courtship behavior in two individuals (not collected), wherein the male approaches a female with slight jerks and slightly lifts its chin, exposing the bright yellow throat. Eggs were observed in Narayankulum on coconut trees at a height of 10-12m. Most eggs were laid in pairs under the perianth of the nuts, in the furrows created by the feeding of the Eriophid mite, *Aceria guerreronis* (Keifer) which is a major pest of coconuts in Kerala. The eggs are completely sheltered by the perianth of the nuts (Fig. 4). This strategy of selecting coconuts affected by the eriophid mites might have developed as an anti-predatory mechanism. However *A. guerreronis* is believed to have arrived to India and existed since the early 1960's (Haq, 2011) suggesting that *C. littoralis* have only recently learned to utilize affected coconuts as an oviposition site. *Aceria guerreronis* is also associated with two larger predatory mites *Neoseiulus paspalivorus* and *N. baraki* of the family Phytoseiidae (Domingos *et al.* 2010; Lawson-Balagbo *et al.* 2007; Moraes *et al.*, 2004). These predatory mite colonies may also provide a stock of available food source for newly hatched *C. littoralis*. On one occasion, a cluster of 7 eggs was observed under the perianth of a coconut, showing that *C. littoralis* may sometimes exhibit communal oviposition. Eggs were found during all the seasons, suggesting that this species may not have a particular breeding season or that they may have an extended breeding season. Two eggs, collected from under the perianth of a coconut measured 6.6 x 5.1 mm and 6.4 x 4.9 mm. One of the eggs hatched after 12 days and the neonate measured 11.2 mm from snout to vent and had a tail

length of 8.4 mm. Dermatophagy was observed in the newly hatched *C. littoralis* (Fig. 5). The neonatal lizards also fed on the white footed ant (*Technomyrmex sp.*). Adult lizards were observed feeding on the eggs of the Long-legged ant *Anoplolepis gracilipes* (Fr. Smith) which is a major invasive species throughout the world causing alterations in the native ecosystem (Drescher *et al.*, 2007). Adult lizards first inspected nest budding ant colonies moving on the ground from the base of trees at a height of around 30cm from the ground. They then sally down and snatch a single egg from one of the ants and return back to the same tree. One individual *C. littoralis* was observed feeding on 5 ant eggs consecutively using the same technique.



Figure 4: Eggs of *C. littoralis* under the perianth of the coconut.



Figure 5: A newly hatched *C. littoralis*.

Discussion

The present designation of a neotype for *Cnemaspis littoralis* is according to Article 75.3 of the International Code of Zoological Nomenclature, ICZN (1999) and is based on specimens collected from the coastal areas of Kozhikode, Malapuram and Thrissur districts of Kerala (all previously a part of the Malabar region which stretched mainly from Kannur to Thrissur district of Kerala state), and match the

original description of Jerdon (1853) in general morphology and colour. *C. littoralis* differs from all of its Indian congeners by the following characters. *C. beddomei*, *C. nairi*, *C. ornata*, *C. otai*, *C. sisparensis*, *C. wynadensis*, *C. indica*, and *C. yercaudensis*: absence of spine like tubercles on the flanks (vs. small, scattered spine like tubercles present on flanks in *C. littoralis*); *C. indraneildasii*, *C. heteropholis* and *C. goaensis*: dorsal scales heterogenous (vs. homogenous in *C. littoralis*); *C. jerdonii*: 8 femoral pores in males (vs. 15-18 femoral pores in *C. littoralis*); *C. gracilis*: Median series of subcaudals not enlarged (vs. enlarged, hexagonal, in *C. littoralis*); *C. mysoriensis*: 2-3 femoral pores in males (vs. 15-18 femoral pores in *C. littoralis*); *C. australis*: ventrals keeled (vs. ventrals smooth in *C. littoralis*); *C. monticola*, *C. nilagirica*, *C. goaensis*, *C. wicksii* and *C. andersonii*: ventral scales of neck carinate (vs. ventral scales of neck smooth in *C. littoralis*).

Beddome in 1871 described *Gymnodactylus planipes* from specimens collected from Nellicootah below the Nilgiris. Later, Günther (1875) considered *G. planipes* (erroneously spelt as *G. planiceps* in his account) to be a synonym of *G. littoralis*, but did not provide the reasons to do so. Boulenger (1885) however, supported Günther's view and synonymized *G. planipes* with *G. littoralis* based on examining Beddome's type collected from Nellicootah and Nilambar deposited at the British Museum of Natural History (BMNH). Manamendra-Arachchi *et al.*, (2007) presumed the type locality of *C. planipes* to be Nellakota situated at an altitude of 1500m and ~80 km from the west coast of Kerala and considered it unlikely that *C. planipes* is a synonym of *C. littoralis* as the type locality of *C. planipes*-Nellakota is not of the littoral side of Malabar. The fact that virtually no other *Cnemaspis* have a range from sea level to well over 1500m needs to be addressed (*pers. com.* Aaron Bauer, May 2013). Our examinations of specimens from Nellikuth (12 km from Nilambur) of Malapuram district, which we assume to be the type locality of *C. planipes*, match our present description of *C. littoralis*. Beddome's description of *Gymnodactylus planipes*, "Of slender form, snout elongate, body and tail uniformly granular without tubercles, pupils round, subcaudals enlarged, 8 upper labials, the 2 last being very minute, 6 lower labials,

median shield very large, angular behind and separating the chin shields of which there are 2 small scale-like pairs, femoral pores 16-17 on each thigh, none in the preanal region, the plates on the lower portion of the fingers and toes large and flat, the terminal one much dilated and 3 times as large as the others; maximum length 2 ¾ inches, of a greyish color, with a prominent black blotch on the nape of the neck and generally a row of white black edged spots down the back" is strongly consistent with the present description of *C. littoralis* collected from the same toptype. Moreover, we have observed individuals of *C. littoralis* from Chittur Government College, Palakad which is ~130km from the Coast and not of the littoral side of Kerala. Hence, based on our collections from Nellikuth, Nilambur and the coastal belt of Kozhikode and Thrissur, we consider *C. planipes* to be a synonym of *C. littoralis* according to Article 23.3 of the ICZN.

Cnemaspis littoralis is the most widely distributed species of *Cnemaspis* among the Indian congeners. The ability of this species to learn new behaviors such as ovipositing in coconuts affected by eriophid mite, which has only recently colonized India, may have also contributed to the dispersal of this species. Despite its wide distribution, the lack of taxonomic clarity for *C. littoralis*, indicates that the genus *Cnemaspis* has for too long been ignored. Hence further studies are needed to resolve several taxonomic confusions within this genus.

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CURRENT STATUS OF *Cnemaspis littoralis* WITH REDESCRIPTION OF A NEOTYPE

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Table 1: Measurements and Pholidosis of neotype and addition specimens of *Cnemaspis littoralis*, collected from different localities in Kerala (All measurements in mm).

Parameters	Neotype ZSI/WGRC/IR/V/2377	Other materials (including neotype) (ZSI/WGRC/IR/V/2377-2382)		
		Range	Mean	SD
SVL	31.5	27.9-31.6	30.02	1.6069
AG	14.3	10.4-14.3	13.02	1.6774
TW	6.1	4.4-6.2	5.42	0.6431
ED	1.7	1.5-1.8	1.61	0.1246
EN	3.1	2.5-3.1	2.9	0.2138
ES	3.9	2.6-4.1	3.67	0.4995
ET	2.7	2.1-2.9	2.48	0.3182
IN	1	0.5-1.0	0.77	0.1488
TD	0.5	0.3-0.5	0.42	0.0707
HL	9.1	7.2-9.3	8.32	0.7166
HW	5.3	4.1-5.3	4.56	0.4173
HD	3.5	2.7-3.6	3.22	0.3059
IO	2.9	2.5-3.4	3.03	0.2774
UAL	5.2	3.6-5.2	4.18	0.4883
LAL	6.1	4.3-6.1	5.05	0.5372
PAL	3.1	2.8-3.5	3.16	0.2264
FL1	1.7	1.2-1.7	1.43	0.1506
FL2	2.4	2.1-2.5	2.3	0.1512
FL3	2.6	2.5-2.9	2.68	0.1246
FL4	3.2	3.1-3.6	3.21	0.1727
FL5	2.1	2.0-2.3	2.22	0.1165
FEL	5.7	4.9-5.7	5.23	0.2615
TBL	6	4.4-6.0	5.41	0.4941
TOL1	1.5	1.3-1.8	1.48	0.1458
TOL2	2.7	2.3-2.9	2.62	0.1909
TOL3	3.2	2.7-3.4	3.13	0.2446
TOL4	3.8	3.3-3.9	3.61	0.2295
TOL5	2.8	2.5-3.0	2.7	0.1852
TL	33.6	28.7-35.2	32.06	2.5185
TBW	3.5	2.8-3.7	3.27	0.3314
Supralabials (R/L)	(9/9)	9-10		
Infralabials (R/L)	(8/8)	7-9		
Femoral pores	17/17	15-18		
Lam IV manus	13	13-14		
Lam IV pes	15	15-16		

Comparative materials:

Cnemaspis littoralis: ZSI/WGRC/IR/V/2378, two adult males, Narayankulam, Kozhikode District, Kerala (11.50749 N, 75.80667 E), Umesh P. K., 14 December 2011; ZSI/WGRC/IR/V/2379, adult male & adult female, Kaprikad, Ernakulam District, Kerala (10.18308 N, 76.51633 E), Vivek Philip Cyriac, 26 October 2011; ZSI/WGRC/IR/V/2380, adult male, Chaliyam, Kozhikode District (11.16095 N, 75.80838 E), Umesh P. K., 6 February 2012; ZSI/WGRC/IR/V/2381, two adult males, Nellikuth, Malapuram District (11.35676 N, 76.3083 E), Umesh P. K., 19 February 2012.

PLATE 5

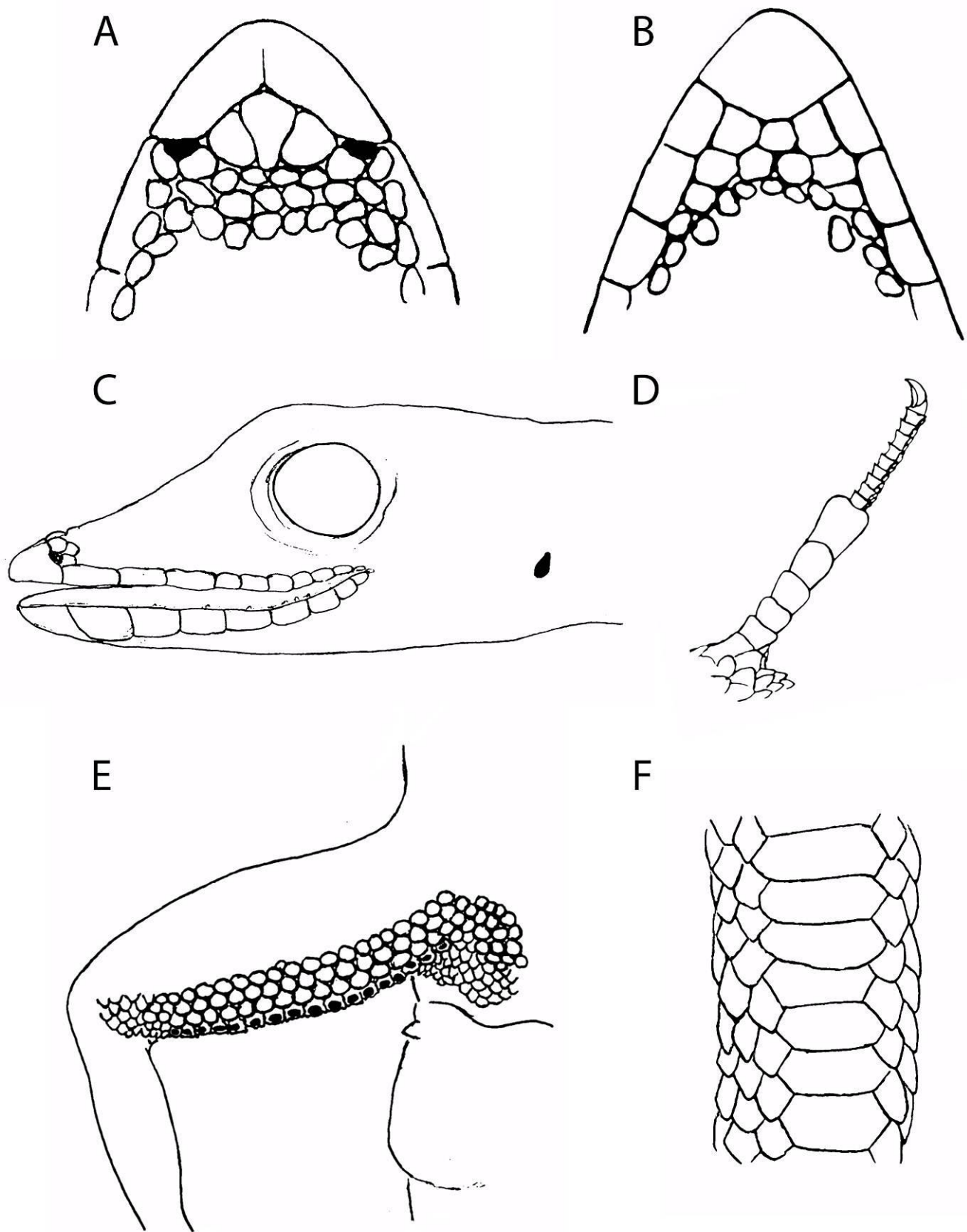


Figure 2: *Cnemaspis littoralis*, Neotype, ZSI/WGRC/IR/V/2377, **A**, dorsal scales on snout; **B**, ventral scales of chin; **C**, lateral view of head showing labials; **D**, fourth toe of right pes showing subdigital lamellae; **E**, Left hind limb and preanal region showing femoral pores and enlarged juxtaposed scales on thighs and preanal region; **F**, A portion of hexagonal subcaudal scales.