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COMMUNICATION

ON TWO LITTLE-KNOWN TERRESTRIAL SOUTH ASIAN GECKOES *HEMIDACTYLUS RETICULATUS* AND *HEMIDACTYLUS SCABRICEPS* (REPTILIA: GEKKONIDAE)

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On two little-known terrestrial South Asian geckoes *Hemidactylus reticulatus* and *Hemidactylus scabriceps* (Reptilia: Gekkonidae)

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Abstract: We studied two poorly known terrestrial geckoes inhabiting peninsular India namely, *Hemidactylus reticulatus* Beddome, 1870 and *H. scabriceps* (Annandale, 1906). We present data on their morphometry, scalation, colouration and field observations based on both studies in the field and on voucher specimens. Hemipenal morphology for *H. scabriceps* is presented herein for the first time. Seen in light of some recent cases of misidentification between these two ecologically-similar parapatric species, the present work aids in precise identification and presents landscape clues that help understand their ecology.

Keywords: Coastal plains, ground-dwelling gecko, Indian peninsula, rocky outcrops, scalation.

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Author Contribution: SRG conceived the work. SRG collected data for both the species dealt with; while MR, NAJ and AMJ collected data for one species. MR, NAJ and AMJ did most of the fieldwork, while SRG participated in some field tours. SRG studied the voucher materials, at least some of which were also perused by MR, NAJ and AMJ. SRG led the writing in consultation with MR, NAJ and AMJ. All the authors equally participated in finalizing the write-up and read and approved the final version.

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INTRODUCTION

The gekkonid lizards of Indian peninsula are being studied in greater detail recently, with the description of several new forms (summarized by Venugopal 2010; Aengals et al. 2011). Of the over 15 species of gekkonid lizards of the genus *Hemidactylus* Oken, 1817 in southern India, up to 12 are largely scansorial forms, while very few are strictly terrestrial taxa (Aengals et al. 2011; Uetz & Hošek 2017). Further north in the Indian peninsula, some works have shed light on a few terrestrial *Hemidactylus* species such as *H. gracilis* (see Bauer et al. 2005), *H. imbricatus* (see Bauer et al. 2008), *H. sataraensis* (see Giri & Bauer 2008), and *H. albofasciatus* (see Gaikwad et al. 2009). Two such obligate ground-dwelling species from southern India—the Reticulated Gecko *H. reticulatus* Beddome, 1870, and the Scaly Gecko *H. scabriceps* (Annandale, 1906)—still remain poorly known (Uetz & Hošek 2017). Published information on both these geckos is very scarce. Recently, these species have been reported in a few places both within and outside their known distribution ranges and still their morphology and biology remain poorly documented (Ganesh & Chandramouli 2010; Kumar et al. 2015). General accounts on herpetofauna stemming from field survey from within their known distribution rarely report these species (Kalaiarasan & Kanakasabai 1999; but see Sondhi 2009; Agarwal et al. 2011).

Their superficially similar body form might be due to ecological-convergence in their respective distribution ranges. Some features such as partially divided digital lamellae, a large and robust tail relative to body size, rather poorly-developed limbs are traits which they share in common, possibly reflecting their strictly-terrestrial habits. Here again, some characters such as the degree of division in digital lamellae is taxonomically informative, as several studies have demonstrated unsettled and often conflicting taxonomy, including those that report partially-divided lamellae as synapomorphy characterizing genetically-tested sister taxa *H. reticulatus*, *H. imbricatus*, *H. albofasciatus*, *H. sataraensis*, and *H. gracilis* (Bansal & Karanth 2010). One such unique member possessing completely undivided digital lamellae *Dravidogecko anamallensis* (Günther, 1875) kept moving between this currently monotypic, endemic southern Indian genus *Dravidogecko* and *Hemidactylus* (see Bansal & Karanth 2013 and references therein). Given such gross similarities there were some unfortunate cases of published misidentifications with captioned photographs, which portray distinct characters that gave away their true identities. In this work, we elaborate on the morphology, distribution, natural history and habitat associations of these two species and also present an expanded characterization and, remark on characters that will help further distinguish these two taxa.

MATERIALS AND METHODS

Detailed morphological data were gathered from a series of formalin-preserved specimens of both the species, representing both the sexes. Field observations were made following diurnal time-constrained search method (DTCS, after Riberio-Junior et al. 2008) and nocturnal visual encounter method (VES, Crump & Scott 1994), apart from a few opportunistic sightings. Measurements in millimeter were taken from preserved specimens using standard vernier slide calipers (L.C. 0.5mm). Scalation characters were scored from preserved specimens using a magnifying hand lens (5 X zoom). Morphological terminologies and definitions follow Somaweera & Somaweera (2009). Hemipenal morphological terminologies follow Dowling & Savage (1960). Live individuals encountered in the field were examined to establish unambiguous species-identification but were not subjected to full morphological analysis like preserved specimens. Photographs were taken using high resolution digital cameras. Geo-coordinates (in decimal degrees up to two digits) and elevation (in meters above mean sea level) were taken using Google Earth software. Ecoregional classification follows Rodgers & Panwar (1988). Habitat type classification follows Champion & Seth (1968).

TAXONOMY

Hemidactylus reticulatus Beddome, 1870
(Image 1 a,c,e,g,h,k & m)

Material examined (n=5)

CSPT/L-18 (Chennai Snake Park Trust), two adult males, two adult females (incomplete tail) and a juvenile (unsexed, with incomplete tail); all coll. from Chengelpet Hills (12.72^{0}N & 79.97^{0}E, 115m) near Coromandel Coastal Plains (60km southwest of Madras or Chennai, in northeastern Tamil Nadu State) peninsular India.

Description

A small, stout gecko with moderately developed

limbs and digits, having a thickset cylindrical to slightly depressed trunk and a robust tail. Scales spiny and tuberculate, intermixed with larger conical tubercles; a distinct furrow of atuberculate vertebral strip, composed only of smaller scales extending from neck to mid-tail. Ventral scales smooth, imbricate and cycloid, much larger than dorsal scales, with distinct apical pits. Supralabials: 9–10; infralabials: 8; no femoral pores; preanal pores 6 disposed obliquely such that they converge anteriorly, separated by a poreless scale; caudal scales tuberculate intermixed with much larger distinctly keeled sharp spines, arranged as circular whorls on caudal myotomic segments; subcaudals: pointed; imbricate, not distinctly wider than rest; mental large, splitting more than half the length of anterior postmentals; postmentals: 4, anterior pair larger than posterior, anterior pair in contact with each other, while posterior pair fully separated from each other; midventrals across trunk: 35-39; 4th toe subdigital lamellae 8–9, 4–5 of which partially divided.

Measurements (in mm)

Snout to vent length: 35.10–43.20 (subadult 26.05), body width: 8.05–11.15 (5.10), tail length: 30.10–39.20+? (incomplete tail), axilla-groin distance: 20.30–24.45 (14.25), head length: 11.25–12.50 (8.15), head width: 7.20–8.10 (5.50), head depth: 4.00–8.50 (3.00), humeral length: 4.00–5.00 (2.50), radius-ulnar length: 4.00–5.20 (2.25), carpal length: 3.20–4.50 (2.00), femoral length: 7.20–8.25 (4.50), tibia length: 5.20–6.35 (3.55), metatarsal length: 4.25–6.30 (3.05), eye diameter: 2.00–3.00 (2.00), tympanum diameter: 0.5 (0.5), eye to nostril distance: 2.50–3.00 (2.00), eye to tympanum distance: 2.50–3.10 (2.00), eye to lip distance: 1.00 (0.5), internarial distance: 1.00–1.50 (0.5), interocular distance: 3.15–4.25 (2.25).

Colouration in formalin

Dorsum dull drab brown, with paler brown spots atop tuberculated scales; labia, lateral body and venter yellowish-white, with small brown speckles in gular and mental regions.

Colouration in life

Dorsum brown of varying shades, beset with orangish spots and blackish random reticulations; many larger conical tubercular spur centered within an orangish spot and surrounded by dark wavy reticulations; such dark reticulations prominent near lips, on rostral and subocular regions; a thin white vertebral stripe on neck and trunk often present; original tail often with wide light cross bands alternating with darker ground colour; spiny projections on tail, particularly the lateral ones white-tipped; lateral region of trunk, limbs and tail lighter than dorsal colour but never quite white; regenerated tail often of a lighter shade than the original tail, totally lacking spiny tubercles; labia, venter and underside of limbs and tail dirty white with fine brown speckles; larger dark spots in infralabial, gular and mental regions, radiating black striations in jaw-angle and below cheek; eye yellowish-brown with black, vertically elliptical pupil. Young ones similar to adults except that they are more orangish or light fawn, particularly the tail, with very few or no contrasting dark reticulations.

Localities

During August 2013 and February 2014, this species was observed in (Fig. 1) Chengelpet (12.72^{0}N & 79.97^{0}E, 115m) and Thirukkalukundram (12.61^{0}N & 80.03^{0}E, 200m) hillocks.

Field observations

A total of 12 sightings consisting of three juveniles, four adult males and five adult females were obtained, from a fieldwork of 22 man-hours in four days. Hypothetically, this suggests an encounter rate of 1.8 hours or 108 minutes survey to obtain a sighting. Dormant individuals were sighted during daytime (09:00–15:00 hr) under stones and small rocks, often lying on a rocky substratum, and rarely on soil. Active individuals were sighted at night (20:00–22:30 hr) moving about slowly on the ground always on flat horizontal scapes, never ascending vertical rocky 'walls' unlike other geckoes in the region.

All individuals were found only in rocky areas, never quite far from rock formations. Habitat types include xeric scrub to thorn forest types and were always quite open and thinly wooded. Prefer slightly higher elevation belts (>200m) and in coastal plains country occur solely wherever rock boulders are abundant.

Hemidactylus scabriceps (Annandale, 1906) (Image 1 b,d,f,i,j,l & n)

Teratolepis scabriceps Annandale, 1906
Lophopholis scabriceps - Smith & Deraniyagala, 1934
H. reticulatus (non Beddome, 1870) - Ganesh & Chandramouli, 2007; Sondhi, 2009

Material examined (n=5)

CSPT/L-40 (Chennai Snake Park Trust), three adult males and two adult females, all coll. from Tuticorin (8.76^{0}N & 78.13^{0}E, 5m), Coromandel Coastal Plains

Image 1. Profiles of *Hemidactylus reticulatus* showing entire dorsal (a), lateral (c), ventral (e), anal (g), mental (h), trunk close-up (k) and live uncollected individual (m) and that of *H. scabriceps* showing entire dorsal (b), lateral (d), ventral (f), anal (i), mental (j), trunk close-up (l) and live uncollected individual (n). © S.R. Ganesh.

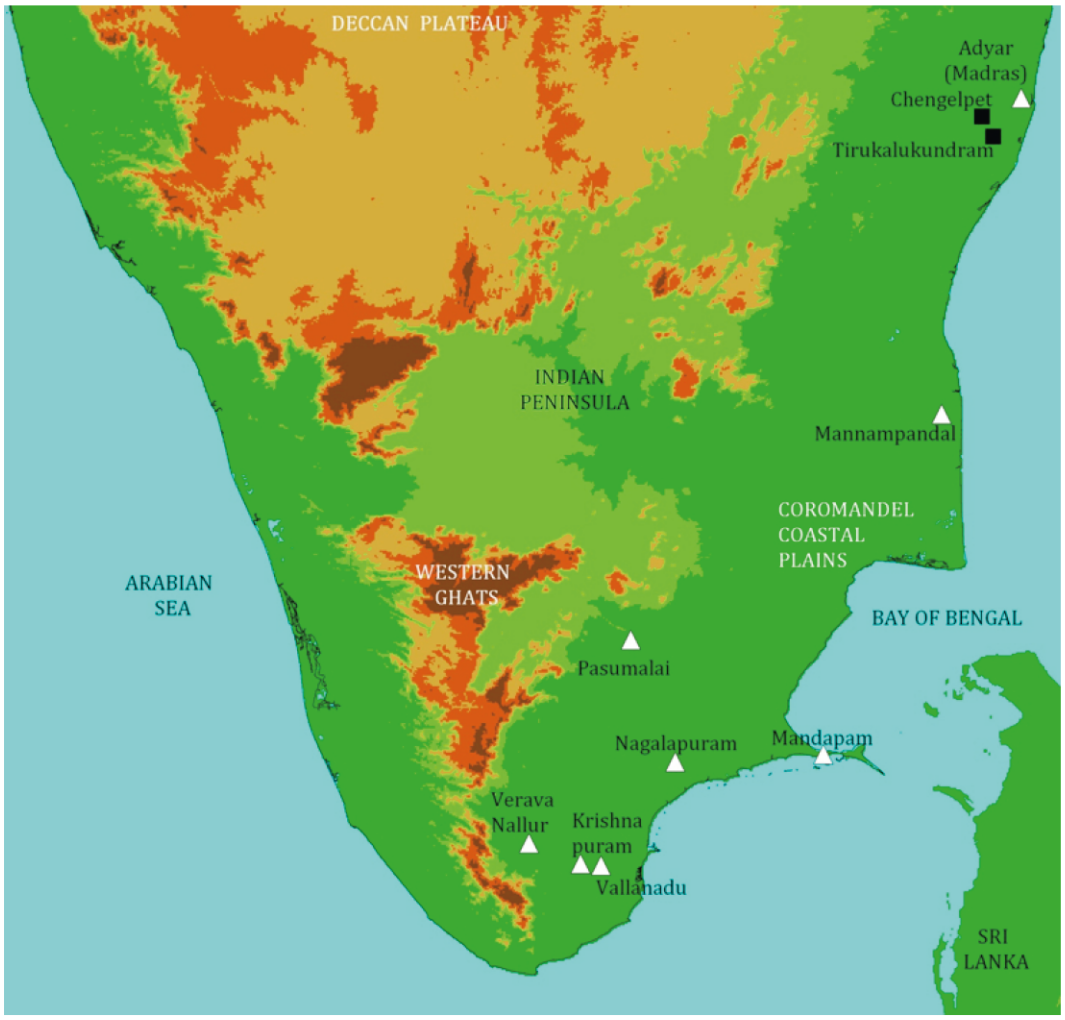

Figure 1. Physical map of Indian peninsula showcasing their geographical contact zones, depicting the localities of *Hemidactylus reticulatus* (black squares) and *H. scabriceps* (white triangles) based on examined specimens / sightings, including two previously published Indian localities namely Adyar and Mannampandal.

(southeastern Tamil Nadu), peninsular India.

Description

A small-sized gecko with moderately developed limbs and digits, having a fairly long, subcylindrical trunk and thick tail. Scales distinctly imbricate, smooth, homogenous, generally those on head smaller, progressively larger on trunk and largest on tail. Dorsal scales mildly larger than those on lateral trunk and venter. Supralabials: 7–9; infralabials: 6–8; no femoral pores; preanal pores 6, disposed obliquely such that they converge anteriorly, separated by a poreless scale; subcaudals not distinctly wider than rest; mental very large, splitting more than half the length of anterior postmentals, postmentals: 4, anterior pair twice as large as posterior, anterior pair in broad contact with each other, while posterior pair fully separated from each other, midventrals across trunk: 21–24, 4th toe subdigital lamellae 5–7, 3–4 of which partially divided. Original tail basally bulged, tapering sharply towards the tip, with regenerated tails more or less carrot-shaped.

Measurements (in mm)

Snout to vent length: 40.20-47.10, body width: 8.20–11.50, tail length: 37.00–40.00, axilla-groin distance: 19.50–26.50, head length: 12.50–14.00, head width: 8.20–9.40, head depth: 4.50–6.50, humeral length: 3.25–4.15, radius-ulnar length: 4.15–5.50, carpal length: 4.10–5.20, femoral length: 7.20–8.35, tibia length: 5.05–6.10, foot length: 5.20–6.45, tail width: 4.70–6.05, eye diameter: 2.00–3.00, tympanum diameter: 0.85–1.20, eye to nostril distance: 3.0–3.50, eye to tympanum distance: 2.45–3.10, eye to lip distance: 1.00–1.50, internarial distance: 3.10–3.35, interocular distance:

3.45–4.60.

Hemipenis

Organ fleshy and smooth, rosy white (in preservative); pedicel slightly narrower than hemipenal lobe; organ bilobed, sulcus spermaticus short and narrow, not coiled, but situated straight, suture-like, reaching the lobe-head from the region of bifurcation; sulcul lips smooth, bearing no macroscopically-visible flounces or spines; hemipenal length: 3.1; pedicel length: 2.5; lobe length: 0.8; region of bifurcation length: 0.7; lobe width: 1.5.

Colouration in formalin

Dorsum slaty grayish-brown, with black and off-white random spots; pattern continuing on to original tail, regenerated tail immaculate brown; labia, lateral body and venter yellowish-white with some grey-brown dots near chin and gular regions.

Colouration in life

Dorsum usually light brown, but varies from light creamy yellowish to reddish ochre to blackish coffee brown in tinge, scattered with numerous white and black randomly disposed spots and blotches, vaguely resembling consecutive rhomboid or lozenge-shaped pattern; each white or dark spot covering a few to several of body scales in area; labia, venter, lateral region of trunk and underside of limbs and tail sandy white powdered with small brownish dots; larger such dots in infralabials, mental and gular regions; snout, surpaorbital region and digits much lighter than rest of the body but never quite white; original tails often with alternate whitish and dark brownish whorled bands; eye yellowish-brown with black, vertically elliptical pupil.

Localities

Between 2013 and 2015, this species was sighted in (Fig. 1) Vallanadu (8.67^{0}N & 77.91^{0}E, 30m), Krishnapuram (8.68^{0}N & 77.80^{0}E, 45m), Veeravanallur (8.69^{0}N & 77.52^{0}E, 60m), Nagalapuram (9.23^{0}N & 78.12^{0}E, 40m), Mandapam (9.27^{0}N & 79.11^{0}E, 3m) and further north towards Pasumalai (9.89^{0}N & 78.07^{0}E, 150m). The sighting localities cover the far south of the Indian peninsula from near Cape Comerin till about Vaigai River, including places on the coastline (e.g., Mandapam), westwards further inland up to those just abutting the foothills of the Western Ghats at 150m elevation (e.g., Pasumalai).

Field observations

A total of 14 sightings consisting of one subadult, seven adult males and six adult females were obtained, from 55 man-hours of fieldwork. Hypothetically, this equates to an encounter rate of 3.93 hours or 235 minutes of survey to obtain a sighting. Sightings were obtained mostly during the northeast monsoon season and post monsoon season during November–March and in July. Dormant individuals were sighted during daytime (07:00–11:30 hr) under debris, thick leaf litter and sometimes under stones. Active individuals were sighted at night (19:00–03:00 hr) briskly moving about on ground both on bare open ground and in vegetated patches. Gravid females with two developing eggs noticeable through the venter were observed in pre-monsoon season, i.e., July (in Nagalapuram, in the year 2013) and post-monsoon seasons, i.e., December (in Vallanadu, in the year 2014) and February (in Nagalapuram, in the year 2015).

All individuals were found mainly in areas with sandy or alluvial soil types, even quite close to the seashore. Habitat types include rather open country, with tropical dry-evergreen habitat, thinly wooded flatlands and even paddy fields and other cultivated croplands. Prefer mainly lower elevation belts (<200m) while sporadic inland records requiring confirmation exist. It is our impression in the field that the predominant dorsal colour of these geckoes roughly matched that of the surrounding soil in the various places they were observed. Particularly obvious was the different shades of reddish-brown, ochre to sandy yellowish colours.

DISCUSSION

Some previous sightings of *H. scabriceps* (Ganesh & Chandramouli 2007; Sondhi 2009) were confused with *H. reticulatus* owing to their superficial morphological resemblance, although they differ a lot in scalation and colour pattern (Smith 1935). Their places of sighting such as Mannampandal (11.10^{0}N & 79.69^{0}E, 20m) by Ganesh & Chandramouli (2007) and Tuticorin (8.76^{0}N & 78.13^{0}E, 5m) by Sondhi (2009) are regions devoid of natural rocky outcrops - a feature essential for the occurrence of *H. reticulatus*. Their radically different dorsal scalation, i.e., uniform and imbricate in *H. scabriceps*, tuberculate with intermixed spines in *H. reticulatus* will instantly identify them as distinct species. Additionally, in most parts of their geographic ranges (Ganesh & Chandramouli 2010; Kumar et al. 2015), these two species are largely allopatric in distribution. Some earlier reported localities

such as Adyar near Madras (=Chennai) and Chengelpet (also near Madras) might be as close as just 50km but still they each correspond to a coastal plains site and a rocky outcrop site respectively. Therefore, even here these two species are parapatric in distribution (i.e., soft allopatry of Pyron & Burbrink (2010)). The present work detailing their morphology, complementary habitat preferences and distribution range serves to better distinguish these poorly known geckos.

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