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Taxonomy of the shieldtail snake genus *Teretrurus* Beddome, 1886 (Serpentes: Uropeltidae) with a revised key and remarks on the geographic gaps in the Western Ghats, Peninsular India

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Abstract

The systematics of the shield tail snake genus *Teretrurus* is reassessed, involving a range-wide sampling, from Wayanad to Agasthyamalai in the Western Ghats. Based on published genetic differences, geographical-correlation, differences in scalation and subtle colour characters that are consistent in the freshly studied/collected specimens and in historical literature (by Boulenger), two subjective junior synonyms *Teretrurus hewstoni* and *T. travancoricus* are herein revived from *T. sanguineus* (which is re-appraised in a strict sense). Re-examination of the holotype of *Plectrurus scabricauda* confirms its synonymy with *T. sanguineus*. Drawing on published phylogenetic position and previous taxonomic treatment (by Smith), *Brachyophidium rhodogaster* is allocated to the genus *Teretrurus*. A revised key to the genus *Teretrurus* is presented.

Keywords: Agasthyamalai, Anamalai, Beddome, Palni Hills, Synonym, *Teretrurus*, Wall, Wayanad

Introduction

Shield tail snakes of the family Uropeltidae are a range-restricted group of small, unassuming burrowing snakes endemic to Indian peninsula and Sri Lanka (Beddome, 1886; Smith, 1943; Pyron *et al*., 2016). Recent taxonomic studies and new species descriptions in this group have revealed our incomplete understanding of the taxonomy, diversity and distribution of these snakes in both India (Jins *et al*., 2018; Cyriac *et al*., 2020; Ganesh & Achyuthan, 2020; Sampaio *et al*., 2020; Ganesh *et al*., 2021) and Sri Lanka (Gower, 2020; Wickramasinghe *et al*., 2020). In the Indian peninsula, much of the diversity of this group of snake's isalmost limitedtothe Western Ghats, especially in the southern ranges (Rajendran, 1985; Pyron *et al*., 2016; Cyriac & Kothandaramiah, 2017; Ganesh & Simha, 2020). Two genera, *Rhinophis* Hemprich, 1820 and *Uropeltis* Cuvier, 1829, are considered widespread and diverse, whereas other genera are narrow-endemics restricted to the Western Ghats and considered species-poor (Pyron *et al*., 2016). Two such genera that are currently considered as monotypic–*Teretrurus* Beddome, 1886 and *Brachyophidium* Wall, 1921, are the subject of this work.

Beddome (1886) erected the genus *Teretrurus* for *Plectrurus sanguineus* Beddome, 1867, in which he also included nominate taxa such as *Platyplectrurus hewstoni* Beddome, 1876 (as *Teretrurus sanguineus* var. *hewstoni*) and a new species-*Teretrurus travancoricus* Beddome, 1886. Boulenger (1890, 1893) synonymized *Teretrurus* under another genus *Platyplectrurus* Günther, 1868. Wall (1921) erected a new monotypic genus *Brachyophidium* whilst describing a species *B. rhodogaster* Wall, 1921 from Palni Hills. Smith (1943) reinstated the genus *Teretrurus*, and placed *Brachyophidium* under it as a synonym. *Teretrurus* was considered a monotypic genus with one species *T. Sanguineus* auctorum which is a species complex (Rajendran, 1985). The *T. sanguineus* complex has two morphologically diagnosable, allopatric, nominate taxa among its three synonyms: *Plectrurus scabricauda* Theobald, 1876 (Anamalai), *Platyplectrurus hewstoni* Beddome, 1876 (Wayanad), *Teretrurus travancoricus* Beddome, 1886 (Tinnevelly Hills) (synonymies in Boulenger, 1893; Pyron *et al*., 2016; Uetz *et al*., 2021).

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In a recent taxonomic treatment to this family, Pyron *et al.* (2016) recognized *Brachyophidium* as distinct from *Teretrurus*, seconding the view of Whitaker and Captain (2008). Within the framework of the taxonomic studies on shield tail snakes, the authors collected / studied many specimens of *Teretrurus* from across its geographic range. The *Teretrurus sanguineus* complex has subsequently been reported from many localities including Agasthyamalai, Anamalai and even in Waynad (Smith, 1943; Whitaker & Captain, 2008; Pyron *et al.*, 2016). Pyron *et al.* (2016) mistook that *T. sanguineus* complex occurs only in Southern Western Ghats. The present study revealed that Smith's view of *Brachyophidium* being synonymous with *Teretrurus* is correct and that within *T. sanguineus* complex, the currently-synonysmised nominate taxa from different hill ranges each represent valid species. In this work, it is again opted to follow Smith's view of transferring *B. rhodogaster* to *Teretrurus* and additionally resurrect two of the three subjective synonyms: *T. hewstoni* and *T. travancoricus* from the synonymy of *T. sanguineus*, which is re-appraised in a restricted sense.

Materials and Methods

This study is based on an examination of ten voucher specimens of *Teretrurus sanguineus* auctorum and *T. rhodogaster*. Some of these are newly collected specimens by the ZSI: Zoological Survey of India, survey teams in Chennai (SRC) and Calicut (WGRC) Centers, India. Other specimens studiedare already existing older ones stored in the following museums: CSPT: Chennai Snake Park Trust Museum, Chennai; MAD: Madras Govt. Museum, Chennai; SACON: Salim Ali Centre for Ornithology and Natural History, Coimbatore. Data was also obtained from the holotype of a synonym *Plectrurus scabricauda* housed at the ZSI Kolkata. Though it was not possible to access or study the type specimens lodged in European museums (Pyron *et al.*, 2016), much of the material studied here are topotypes that accurately represent the nominate taxa dealt with. This apart, the authors also conducted fieldwork and sighted these snakes in the wild and collected morphological and ecological data that are presented here. Sex of the specimens was determined by ventral incision and looking for genitalia, as well as the subcaudal count value. Scale rows were counted using dissection microscopes and illuminated hand lenses with 15X and 7X magnifications respectively. BHCKM conducted fieldwork and collected fresh specimens in Kalpetta-Meppadi Hills, Waynad, Kerala and Kalakkad-Mundanthurai Tiger Reserve, Tamil Nadu in 2015 and 2019, while SRG conducted fieldwork and photo-documented these snakes in Kodaikanal Wildlife Sanctuary, Tamil Nadu, during 2014-15. Morphological characters and their definitions follow Pyron *et al.* (2016). Specimen descriptions are based exclusively on examined material; while additional information from literature is amalgamated in Table 1, where necessary.

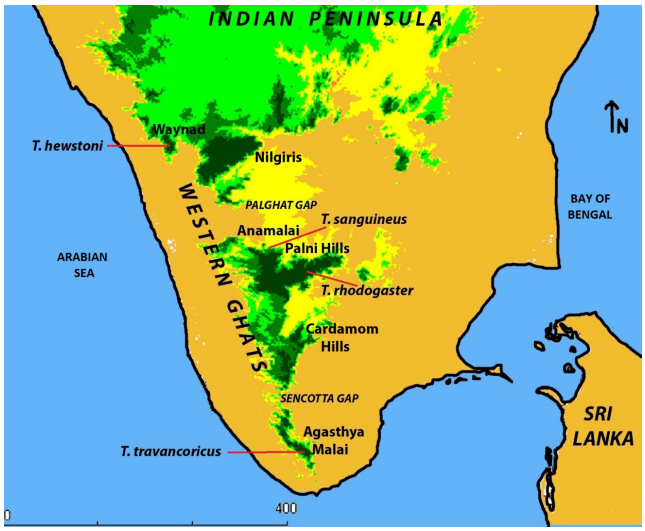

Figure 1. Map of southern India showing the distribution of *Teretrurus* species, in the Western Ghats.

Results

The specimens of *Teretrurus* examined in this work (n=10) as well as those (n=20) reported in previous literature (Boulenger, 1893; Pyron *et al.*, 2016) were for the most part similar in terms of coloration and scalation. One species, *T. rhodogaster,* was markedly smaller in length and was also readily separable from other *Teretrurus* species by the absence of distinct supraocular. The only scalation difference noted between the remaining *Teretrurus* populations currently conceived as *T. sanguineus* sensu auctorum, representing currently-synonymized nomina is ventral count. The ventral count differences and their corresponding nominate representation of the various *Teretrurus* populations across their total geographic

Table 1. Morphological data from this study and literature (Boulenger, 1893*; except *T. rhodogaster* from Pyron *et al*., 2016) of the *Teretrurus* species from throughout its range; m: mean value of ventrals.

Distribution Range	**Waynad**	**Anamalai**	**Palni Hills**	**Agasthyamalai**
Geographic barrier	N. of Palghat gap	S. of Palghat gap	S. of Palghat gap	S. of Sencotta gap
Supraocular	distinctly present	distinctly present	Fused to ocular	distinctly present
Ventrals (Boulenger*)	120-128 (m 124)	141-150 (m 145)	131-145 (m 138)^	130-136 (m 133)
Ventrals (this work)	122 (n=1)	145-149 (n=3)	142-146 (n=3)	133-138 (n=3)
Species (recognised as)	*T. hewstoni*	*T. sanguineus*	*T. rhodogaster*	*T. travancoricus*
Type locality	Manantoddy	Anamallay/Ponachi	Shembaganur	Paupanassum

Note: *Boulenger (1893) misrepresented some specimens of *T. sanguineus* with a wide range of ventral scales (120-150), as from Anamallays, which we had explained as being inaccurate.

range is summarized in Table 1. Though the ventral count differences are small and close to overlapping (e.g. lower limit of *T. travancoricus* vs. higher limit of *T. hewstoni*; higher limit of *T. travancoricus* and lower limit of *T. sanguineus*), their mean values differ by multiple of 10, a value that matches the ventral count range of each of these species-level entities discerned now.

One entry of Boulenger's (1893) series of eight specimens (a to h), purportedly stated as from "Anamallays" has a ventral range of 120to 150 that totally subsumes the ventral range (123-150) of his 12 more specimens (i to t) originating from Waynad south till Travancore Hills (see Boulenger, 1893). In addition, the status of the remaining specimens apart from the name-bearing type in his series (a to h) are also unclear (see below; and also Wallach *et al*., 2014; Pyron *et al*., 2016). Moreover, fresh material of *Teretrurus* (n=10 specimens; half of Boulenger's dataset) from across its entire range, do not reveal any from Anamalai that has a range outside what is indicated in the Table 1 presented below.

Even the better-sampled *T. rhodogaster* has a comparatively narrower ventral range (143-149) based on over 30 specimens (Wall, 1921, 1922, 1923). Rajendran (1985) compared his (142-153) and Smith's (135-145) ventral counts and remarked that it involves specimens from "another geographic population". It is here construed that Rajendran's express association of varying ventral ranges and mention of geographic population as consistent with the conclusion, here arrived at. Pending better resolution, we here follow the pooled, overall ventral range of 131-145 given by Pyron *et al*. (2016) for *T. rhodogaster*.

Therefore, based on (i) the potential evidence of mismatch with regard to the status and origin of specimens in Boulenger's (1893) series (a to h), (ii) the geographically-consistent ventral count values of Boulenger's own remaining specimen series (i to t), (iii) the ventral counts of our examined topotypic materials and (iv) Rajendran's (1985) statement of the same issue for a related species (*T. rhodogaster*), it is here postulated that Boulenger's statement of the series a-h originating from Anamallays is most likely incorrect. Hence, in addition to the varying ventral counts, based on published genetic divergences (Cyriac & Kothandaramiah, 2017), subtle differences in ventral colour and allopatric distribution range (Figure 1 & 2), the authors infer these populations to be distinct species, classified as follows:

Taxonomy

Teretrurus Beddome, 1886

1886. *Teretrurus* Beddome, *Acct. Earth Snakes Pen. of India & Ceylon.* p. 28.

1921. *Brachyophidium* Wall. *J. Bombay Nat. Hist. Soc.*, **28**: p. 41.

Type Species: *Plectrurus sanguineus* Beddome, 1867 (by subsequent designation; Beddome, 1886; Pyron *et al*., 2016)

For the synonym, *Brachyophidium rhodogaster* Wall, 1921 (by original description; Wall, 1921)

Content: Four species viz. *Teretrurus sanguineus* (Beddome, 1867), *T. hewstoni* (Beddome, 1876), *T. travancoricus* (Beddome, 1886) and *T. rhodogaster* Wall, 1921.

Differential Diagnosis: A genus of uropeltid snakes characterized by: absence of mental groove (vs. present in *Melanophidium*); presence of a distinct temporal scale (vs. absent in *Plectrurus, Pseudoplectrurus*); eye within an ocular scale (vs. eye distinct from surrounding scales in *Platyplectrurus*); has midline contact between nasal scales (vs. absent in most *Rhinophis* and some *Uropeltis* spp.); 15 midbody scale rows (vs. 17-19 in most *Rhinophis* and *Uropeltis* spp.); tail compressed, simple, without a caudal disc (vs. tail rounded, ending in a truncate or convex caudal disc in *Uropeltis* and *Rhinophis* spp.); tail tipending in a pointed structure, without lateral ridges (vs. tail tip ending in two bicuspid ridges in *Plectrurus*, *Pseudoplectrurus*; tail tip with lateral ridges in *Platyplectrurus*).

Distribution range: Western Ghats ranges viz. Waynad, Nilgiris, Anaimalai, Palni, Travancore / Agasthyamalai (Kerala, Tamil Nadu states), southwest India (Wallach *et al*., 2014; this work).

Teretrurus sanguineus (Beddome, 1867)
(Figure 1, 2, 3)

1867. *Plectrurus sanguineus* Beddome, *Madras Quart. J. Med. Sci.*,**11**: 14.

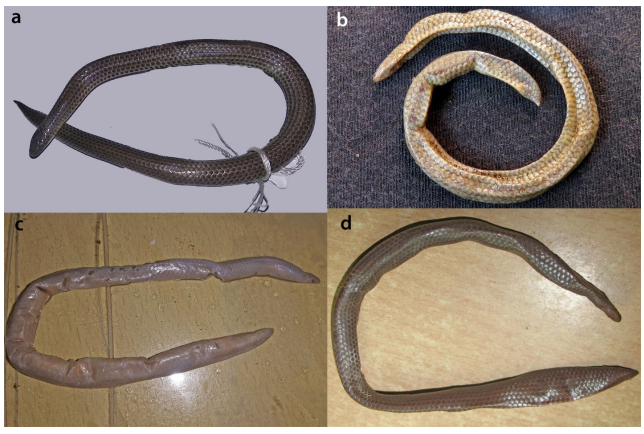

Figure 2. Preserved specimens of *Teretrurus* species: **(a)** *T. travancoricus* ZSI/WGRC/2135-6, **(b)** *T. hewstoni* ZSI/WGRC/3124, **(c)** *T. sanguineus* CSPT/S-10, **(d)** *T. rhodogaster* CSPT/S-14. Photos: S. R. Ganesh.

1876. *Plectrurus scabricauda* Theobald, *Descr. Catl. Reptiles Brit. Ind.*, p. 136.

Material examined (n=3): CSPT/S-10 female from Anamalai, date unknown; MAD no number male from Kavalai, Cochindate unknown; SACON/VR-46 female coll. S. Bhupathy from Anamalai, date unknown.

Taxonomic History: This species was first described as *Plectrurus sanguineus* by Beddome (1867) based on holotype from Anamalai forests above Ponachi [=Pollachi; Wallach *et al*., 2014] (10.446˚N 76.984˚E; 900 m asl). Beddome (1886) whilst describing the genus *Teretrurus*, rightly allocated his *P. sanguineus*, as the type species, giving it the current name combination (Smith, 1943). A subjective junior synonym *Plectrurus scabricauda* Theobald, 1876 described based on the holotype ZSI 6996 (stated to be lost fide Das *et al*., 1998, but present in the collection – N.S. Achyuthan pers. comm. in May 2021) from Anamallays exists (Beddome, 1886; Boulenger, 1893; Smith, 1943; Pyron *et al*., 2016).

Remarks: Boulenger (1893) listed six specimens (1 male, 3 females, 2 juveniles) all with the locality data stated as "Anamallays" (sic) with a ventral range of 128-147. We agree with subsequent workers that as Beddome (1867) in his original description elaborated on only one specimen with 144 ventrals and 7 subcaudals, that specimen is the name-bearing type, the holotype (Pyron *et al*., 2016). Wallach *et al*. (2014) had opined that specimen to be the lectotypebut the original description (Beddome, 1867) makes no indication of any other specimen but for the described one and hence it was corrected by Pyron *et al*. (2016). In either case, the rest of the five specimensin that lot, with differing ventral counts, have no name-bearing status. Pyron *et al*. (2016) also commented that Boulenger's ventral values of those 6 specimens did not match with that of Beddome's count (144), but herein the authorsopine that one specimen's count (147) is the closest to Beddome's count. As explained above, owing to the large ventral count range (120-150) (Boulenger, 1893), Boulenger's statement that these specimens originate only from the Anamallays is most likelyincorrect. But the type specimen (with 144 or 147 ventrals) is consistent with what is generally the ventral value for the Anamalai population of *Teretrurus*. Beddome (1867) stated in his original description, the dorsal scale rows count to be 17. Usually, it is understood as midbody count. But the value 17 was later reported as a miscount, the correct value of

midbody count being 15 (Boulenger, 1893; Constable, 1949).

Differential Diagnosis: A species of *Teretrurus* endemic to the Anamalai Hills, possessing a distinct supraocular scale (vs. lacking in *T. rhodogaster*), with much higher ventral counts 142-150 (vs. 120-128 in *T. hewstoni*; 130-136 in *T. travancoricus*).

Description and variation: *Measurements in mm*: snout-vent length: 150-190; tail length: 2.5-6; head length: 4.5-5.5; head width: 4-5; body width 4.5-6; eye diameter: 0.8; eye-snout distance: 1.8; inter-orbital distance: 2-2.5; inter-narial distance: 0.5-0.7. Habitus: Small-bodied, trunk cylindrical to slightly compressed, especially near tail; body fairly slender; head not distinct from neck, as wide as midbody; snout obtusely rounded in profile; tail small, suddenly tapering to a sharp, finepoint. *Scalation*: scales smooth, cycloid, without apical pits; head scales lacking pre-, post-oculars; supraocular and temporal present; eye covered under ocular scale, partially fused; mental groove absent; dorsal scales in 16:15:15 rows, with 16 -->15 at 36-38th ventral scale; supralabials 4/4; infralabials 4/4; ventrals 144-149; subcaudals 7-9 pairs; terminal caudal scales rather smooth, with a single sharp projection in the end. Coloration: dorsum dark to coffee brown, rather uniform and unpatterned; venter rich red (turning creamy yellow in preservative) with a few black patches; eye black.

Plectrurus scabricauda Holotype ZSI 6996 Annamallay: Measurements in mm: Snout to vent length 159; tail length 13; head length 5; head width 3.5; *Habitus*: a rather soft and brittle specimen; body slightly damaged at mid portion due to preservation artifact; trunk subcylindrical to mildly dorso-ventrally depressed at places, owing to long-time preservation; head small, snout pointed to slightly ovoid in profile; *Scalation*: dorsal scale rows 13:15:13 scales smooth, cycloid, without apical pits; scales on head wrinkled, due to long-time preservation; eyes covered under ocular scales; supraocular and temporal present; preocular, postocular, loreal and mental groove absent; supralabials 4/4; infralabials 4/4; ventrals 141, subcaudals 11 pairs; terminal caudal scales equally wrinkled as head scales, due to preservation artifact. *Coloration*: dorsum drab greyish brown, venter creamy orange, except towards body extremities (mental and subcaudals) which present with patches of darker shades; eye grey.

Distribution and Natural History: In a relativelyrestricted sense (as re-appraised hereinincl. *P. scabricauda*), *T. sanguineus* is definitely known only from Anamalai-Munnar ranges (Beddome, 1867). It is perhaps the only congener that partly co-occurs with another congener *T. rhodogaster* that inhabits a much easterly and higher elevation range (Palni Hills). Rajendran (1985) mentioned of having collected this species from Nyamakkad of Kannan Devan Hills (10.151˚N, 77.080˚E; 1870 m asl) near Munnar. This apparently rare species has not been recently sighted anywhere in the Anamalai (museum holding records in Boulenger, 1893; Constable, 1949), despite surveys that covered at least some parts of this massif (Roux, 1928; Kumar *et al*., 2001).

Teretrurus hewstoni (Beddome, 1876)
(Figure 1, 2, 4)

1876. Platyplectrurus hewstoni Beddome, *Proc. Zool. Soc. London 1876:* pp. 701

Taxonomic History: This species was first described as *Platyplectrurus hewstoni* by Beddome (1876) based on holotype collected from Manantoddy [=Mananthavadi] (11.779˚N 76.002˚E; 900 m asl) in the Wayanad. Subsequently, Beddome (1886) transferred it to the genus *Teretrurus* and also relegated its status as a subspecies of

Figure 3. Holotype of *Plecturus scabricauda* ZSI 6996 coll. from Anamallays: **(a)** entire view, **(b)** jar label, **(c)** head right view, **(d)** head left view, **(e)** head ventral view, **(f)** tail ventral view. Photos: N.S. Achyuthan.

T. sanguineus. Boulenger (1890) synonymized it under *Platyplectrurus sanguineus*. Boulenger (1893) and Smith (1943) maintained this synonymy, and its status remains the same till date.

Material examined (n=1): ZSI/WGRC/V-3124, femalecoll. B.H.C.K. Murthy and party from Manikunnu Mala, in Meppadi, Wayanad district, Kerala, India.

Differential Diagnosis: A species of *Teretrurus* endemic to Wayanad Hills, possessing a distinct supraocular shield (vs. lacking in *T. rhodogaster*), with much lower ventral counts 120-128 (vs. 130-136 in *T. travancoricus*; 142-150 in *T. sanguineus*).

Description and variation: *Measurements in mm*: snout-vent length: 159; tail length: 4.5; head length: 5.7; head width: 3; body width: 3.3; eye diameter: 0.7; eye-snout distance: 1.8; inter-orbital distance: 2.5; inter-narial distance: 0.8. *Habitus*: Small-bodied, trunk cylindrical to slightly compressed, especially near tail; body fairly slender; head not distinct from neck, as wide as midbody; snout fairly rounded, ovoid in profile, not pointed; tail small, abruptly ending in a short pointed spur. *Scalation*: scales smooth, cycloid, without apical pits; head scales lacking pre-, post-oculars; supraocular and temporal present; eye covered under ocular scale, partially fused; prefrontal distinctly shorter than frontal or parietal; mental groove absent; dorsal scales in 15:15:15 rows; supralabials 4/4; infralabials 4/4; ventrals 122; subcaudals 7 pairs; terminal caudal scales weakly keeled, with a sharp projection in the end. *Coloration*: dorsum drab brownish grey having mild orange stripes along the interstitial regions of the scales; parietal-occipital regions with a weak reddish orange collar mark and similar coloredspeckles on sides; venter orange (turning creamy yellow in preservative) densely mottled with blackish brown reticulations; eye black.

Distribution and Natural History: This species is distributed only north of the Palghat Gap, in the Central Western Ghats, in Wayanad region. The authors found this species in Manikunnu Mala, near M.S. Swaminathan Research Foundation there in Puthoorvayal (11.604˚N, 76.106˚E; 950 m asl) near Meppadi-Kalpetta region in Waynad district, Kerala during August 2015. The snake was encountered during daytime, resting under fallen logs near secondary gallery forests adjoining plantations.

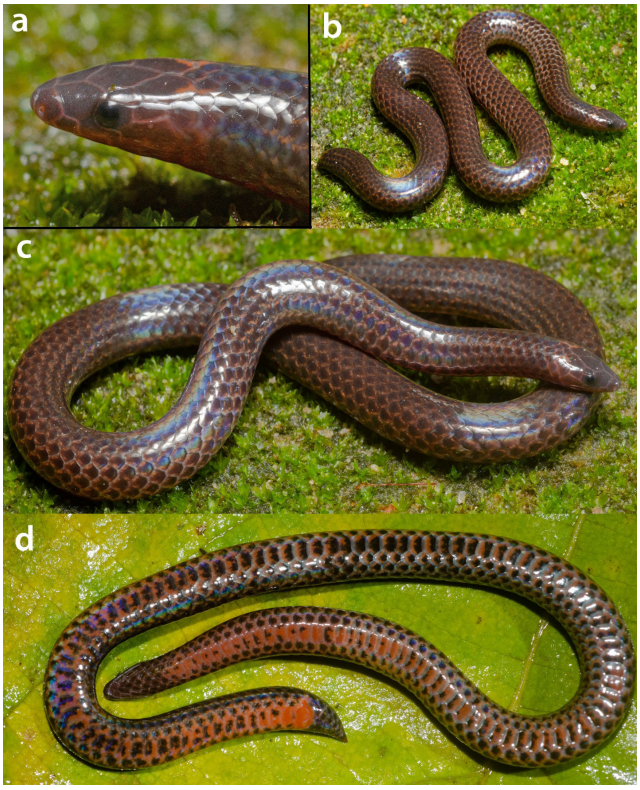

Figure 4. *Teretrurus hewstoni*: live colouration; **(a)** head lateral view; **(b)** entire dorsal view; **(c)** entire lateral view, **(d)** entire ventral view. Photos: Avrajjal Ghosh.

Tereturus travancoricus Beddome, 1886
(Figure 1, 2, 5)

1890. *Platyplectrurus sanguineus*, Boulenger, *Fauna Brit. Ind. Rept. & Batr.* London, 274 part

Taxonomic History: This species was first described as *Teretrurus travancoricus* by Beddome (1886) based on syntypes consisting of both the sexes, collected from mountains between Travancore and Tinnevelly, above Paupanassum [=Papanasam] (8.728˚N 77.264˚E; 1100 m asl), where it was commonly found under large stones and decaying logs in forests. Boulenger (1890) synonymized this taxon under *Platyplectrurus sanuineus*, with this arrangement being accepted by subsequent authors (Boulenger, 1893; Smith, 1943), to this day.

Material examined (n=3): ZSI/WGRC/V-3125, 3126a male and female, coll. B.H.C.K. Murthy and party on 21.viii.2019 from Marapala, Ambasamudram Range, Kalakkad-Mundanthurai Tiger Reserve KMTR; ZSI/

SRC/VRS-286. coll. S. Prabhakaranand party on 25.iii.2008 from Kuttiyar Dam, Upper Kodhayar, KMTR-Kanyakumari Wildlife Sanctuaryborder, Tamil Nadu.

Differential Diagnosis: A species of *Teretrurus* endemic to the Agasthyamalai/Travancore hills possessing a distinct supraocular scale (vs. lacking supraocular in *T. rhodogaster*), with ventral counts 130-135 (vs. 120-128 in *T. hewstoni*; 142-150 in *T. sanguineus*).

Description and variation: *Measurements in mm*: snout-vent length: 130-150; tail length: 7-7.5; head length: 5-5.5; head width: 4-4.5; body width 4.5-6; eye diameter: 0.8; eye-snout distance: 1.8; inter-orbital distance: 2-2.5; inter-narial distance: 0.5-0.7. *Habitus*: Small-bodied, trunk cylindrical to slightly compressed, especially near tail; body fairly slender; head not distinct from neck, as wide as midbody; snout fairly rounded, ovoid in profile, not pointed; tail small, abruptly ending in a short pointed spur. *Scalation*: scales smooth, cycloid, without apical pits; head scales lacking pre-, post-oculars; supraocular and temporal present; eye covered under ocular scale, partially fused; nostril piercing the undivided nasal scales; nasals in broad midline contact, not separated by rostrum; mental groove absent; dorsal scales in 14:15:15 rows, with 14-->15 at 36th-38th ventral scale; supralabials 4/4; infralabials 4/5; ventrals 133-138; subcaudals 7-9 pairs; terminal caudal scales keeled, with two sharp projections in the end. *Coloration*: dorsum drab brownish grey, with orange-red mild stripes between interstitial portions; a conspicuous canthal-supraocular-temporal orange stripe on each side of head; reddish orange speckles on sides; venter rich red (turning creamy yellow in preservative) with a few black patches; dorsal part of tail, with an orange-red mid-vertebral stripe eye black.

Distribution and Natural History: This species is definitely known only from the Southern Western Ghats, south of Sencottah Gap–in the Agasthyamalai Hills. Rajendran (1985) mentioned of having collected this species from Nalumukku, Oothu and Kakachi atop Manimuthar and Podhigai hills. During our surveys, we sighted this species in Ambasamudram Rangeand Kodhayar river tract of the Kalakkd-Mundanthurai Tiger Reserve (KMTR).

The specimens from Kodhayar were collected in March 2008, just before the monsoon season, from under fallen logs, while specimens in Ambasamudram Range were collected in July 2019 from under rocks within dense leaf litter on the forest floor. Sympatric shield tail species

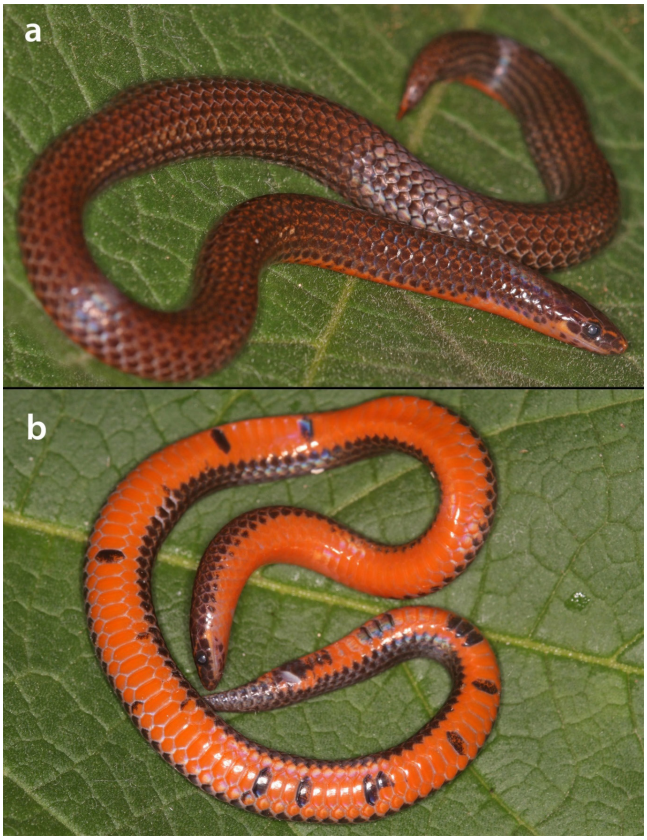

Figure 6. *Teretrurus travancoricus*: live colouration; **(a)** entire dorsal view; **(b)** entire ventral view. Photos: B.H.C.K. Murthy & K.A. Subramanian.

reported / sighted were *Melanophidium punctatum, Uropeltis* cf. *liura, Uropeltis myhendrae* and *Rhinophis travancoricus* (Rajendran, 1985; Ishwar *et al*., 2001).

Teretrurus rhodogaster (Wall, 1921)
(Figure 1, 2, 6)

1921. *Brachyophidium rhodogaster* Wall, *J. Bombay Nat. Hist. Soc*., **28**: p. 41

Material examined (n=3): CSPT/S-14a-cone male and two females, from Shenbaganur, Kodaikanal (Palni Hills), Tamil Nadu.

Taxonomic History: Wall (1921) described this species as *Brachyophidium rhodogaster* based on the holotype from Palni hills, designated as Shenbaganur (10.228˚N 77.499˚E; 1850 m asl) in Kodaikanal by Wall (1922) (Pyron *et al*., 2016). Smith (1943) synonymized the monotypic genus *Brachyophidium* Wall, 1921 with *Teretrurus* Beddome, 1886, giving it the combination *Teretrurus rhodogaster*. Later authors (Whitaker & Captain, 2008;

Pyron *et al*., 2016) challenged this interpretation based on disparate head scalations compared to *Teretrurus*. But recent phylogenetic study (Cyriac & Kothandaramaiah, 2017) supports the stance of Smith (1943) in considering *Brachyophidium* as a synonym of *Teretrurus*.

Differential Diagnosis: A species of *Teretrurus* endemic to the Palni-Anamalai hill complex, lacking a distinct supraocular scale (vs. possessing in *T. sanguineus, T. travancoricus, T. hewstoni*).

Description and variation: *Measurements in mm*: snout-vent length: 159-163; tail length: 13.5-19; head length: 6.7-8.2; head width: 5-5.5; body width 5.5-7; eye diameter: 1; eye-snout distance: 2-2.2; inter-orbital distance: 3.3-4; inter-narial distance: 0.8-1. *Habitus*: Small-bodied, trunk cylindrical to slightly compressed, especially near tail; body fairly slender; head not distinct from neck, as wide as midbody; snout fairly pointed to slightly rounded in profile; tail small, abruptly ending in a short pointed spur. *Scalation*: scales smooth, cycloid, without apical pits; nasal scales entire, pierced by nostrils; nasals in broad midline contact, not separated by rostrum; prefrontal abnormally elongate and much produced, as large as frontal, but a bit smaller than parietal; head scales lacking pre-, post-oculars; supraocular not discernable, at least partially fused with ocular scale; temporal present; mental groove absent; dorsal scales in 13:15:15 rows, with 13-->15 at 38-40th ventral scales; supralabials 4/4; infralabials 4/5; ventrals 142-146; subcaudals 7-10 pairs; terminal caudal scales keeled, with a single sharp projection in the end. *Colouration*: dorsum purplish or dark cherry red to maroon coloured, with orange crescent-shaped collar mark and bright washes along the sides; venter uniform and unpatterned bright orange to pink (turning pale off-white in preservative); subcaudals orange medially, border on both sides by purplish black; eye black.

Distribution and Natural History: This species is known only from the Palni hills (Wall, 1921, 1922, 1923) and its vicinity including Vandaravu-Kodaikanal-Perumal Malai-Pandri Malai massifs. Rajendran (1985) also collected this species from the type locality–Shenbaganur in Kodaikanal. This species inhabits high elevations above 1700 m asl, in dense montane rainforest and grassland habitats. During June 2014 and Jan 2015, we located four adults of this species in carrot, beetroot and potato plantations in Kodaikanal and also within natural forests under fallen logs strewn at the base of a thicket of Tree

Figure 6. *Teretrurus rhodogaster*: live colouration; **(a)** entire dorsolateral view; insets – underside of head and tail; **(b)** ventral view of hind body and tail. Photos: S. R. Ganesh.

Ferns in Tiger Shola. On one occasion a pair (adult male and female) in accompaniment was sighted syntopic with *Platyplectrurus madurensis* and *Uropeltis pulneyensis* (Wall, 1923; Rajendran, 1985).

Revised key to the genus *Teretrurus* (modified from Smith, 1943)

I. Supraocular fused with ocular shield; prefrontals long;
Ventrals 131-146; venter uniform, unpatterned orange red ……. *T. rhodogaster*

II. Supraocular separated from ocular shield; prefrontals short;
Ventrals 120-128; venter orange with broad purplish brown blotches ……... *T. hewstoni*
Ventrals 130-136; venter red with prominent black patches ……..…... *T. travancoricus*
Ventrals 141-150; venter often uniform red, with a few black spots ……..… *T. sanguineus*

Discussion

It is only expected that the nominate taxa synonymized under a catch-all, glorified concept of *T. sanguineus* auctorum represented multiple, geographically-

concordant, allopatric species. This finding is in line with some of the earlier works on uropeltid taxa considered either a synonym or subspecies of other over-circumscribed taxa. As recent examples, Gower *et al*. (2008) revived *Uropeltis bicatenata* (Günther, 1864), Ganesh *et al*. (2014a) revived *U. shorttii* (Beddome, 1863) from the synonymy of *U. ceylanica* Cuvier, 1829 and elevated *U. madurensis* (Beddome, 1878) as a full species from *U. arcticeps* (Günther, 1875), within which these taxa had been resting unrecognized thus far (Smith, 1943; Rajendran, 1985).

It is also amazing to note the presence of geographic barriers bordering the distributions of the various *Teretrurus* species recognized in the present work. Two ancient and prominent geographic barriers–the Palghat Gap (at 10.550˚-10.830˚N) and the Sencottah Gap (at 8.970˚N) occur (Robin *et al*., 2010; Vijayakumar *et al*., 2016) across the geographic range of the *T. sanguineus* complex (Rajendran, 1985). *Tereturus hewstoni* occurs only in the Wayanad, north of the Palghat Gap. *Teretrurus sanguineus* occurs south of Palghat gap, in the Anamalai, essentially in the western parts of the massif (between Parambikulam-Valparai-Munnar regions). *Teretrurus rhodogaster* occurs in eastern parts of the massif, in the higher reaches of the Palni Hills (between Vandaravu-Kodaikanal-Perumal Malai-Pandri Malai regions). *Teretrurus travancoricus* occurs only south of the Sencottah Gap, in the Agatshyamalai, Mahendragiri and Ashambu hills.

But for Ferguson's (1895) record of *T. sanguineus* from Peermed, *Teretrurus* species has not been reported from massifs between Nedumkandam and Courtallam (Rajendran, 1985). Despite surveys by R.H. Beddome, Frank Wall, Angus Hutton and M.V. Rajendran, *Teretrurus* species has not been reported from ranges such as the High Wavys or Meghamalai, Srivilliputhur Hills and Sivagiri-Devarmalai Hills (Beddome, 1893; Pyron *et al*., 2016). Studies such as those by Malhotra & Davis (1991), Hutton & David (2009), Chandramouli & Ganesh (2010), Bhupathy & Sathishkumar (2013), Ganesh *et al*. (2014b) and Chaitanya *et al*. (2019) do not list any *Teretrurus* species despite surveys and good records of uropeltid snakes. As of now, it remains to be tested if the paucity of records of *Teretrurus* from these ranges is a survey artifact or reflect actually depauperate distribution.

Authors have recorded potentially unreported populations (Murthy, 1995) or species (Cyriac & Kodandaramaiah, 2017) of *Teretrurus* which prompts us to state that more species in this genus might still await formal descriptions. Similar to Gower *et al*. (2008) and Ganesh *et al*. (2014a), these *Teretrurus* species occurring in different massifs, having different ventral counts and other subtle morphological differences represent morphologically-diagnosable allopatric populations, which could only be construed as different species, under any given species concept. Our work on *Teretrurus* throws light on using morphology in conjunction with geography to understand the true species diversity in it. Given the resources at disposal, this the taxonomic proposal that best reflects the current evidences scattered around the multiple sources cited. Further works involving genetics (Cyriac & Kothandaramiah, 2017) as well as distribution modeling studies will help us better understand the diversity of the genus *Tereturus*.

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