

ON THE TAXONOMIC STATUS OF *UROPELTIS BICATENATA* (GÜNTHER) (REPTILIA: SERPENTES: UROPELTIDAE)

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(with six text-figures)

ABSTRACT.– The Indian uropeltid snake *Uropeltis bicatenata* (Günther, 1864) has been considered a junior synonym of *Uropeltis ceylanica* Cuvier, 1829, implicitly or explicitly, since Beddome (1886). Re-examination of the holotype and historical and newly collected material of *U. bicatenata* confirms Günther’s (1864) assessment that this form represents a distinct species of *Uropeltis*. We resurrect *U. bicatenata* from the synonymy of *Uropeltis ceylanica*, provide a new diagnosis of the species, redescribe the holotype, document variation among all known material, and discuss aspects of the state of the taxonomy of *Uropeltis*.

KEY WORDS.– India, shieldtail, snakes, systematics, taxonomy, Western Ghats.

INTRODUCTION

Uropeltidae (*sensu* McDiarmid et al., 1999) is a family of charismatic, burrowing alethinophidian snakes endemic to peninsular India and Sri Lanka (Gans, 1973, 1976, 1979; Cadle et al., 1990; Bossuyt et al., 2004). At first glance, the taxonomy of Uropeltidae appears stable, the vast majority of taxonomic actions having been executed in the 1800s. For example, only seven of the 47 currently recognised species were described after 1896 (McDiarmid et al., 1999), and only one of these in the last 50 years (Deraniyagala, 1975). However, this lack of recent taxonomic activity creates the false impression of a well-established systematic framework. In reality, most species are poorly characterised on the basis of few character systems for which variation has been studied across only small samples. In addition, much of the type and important historical material has poor locality data, and is housed in London and Paris, with limited accessibility to modern Indian and Sri Lankan workers. The robustness of the current taxonomy is uneven across the family, and it is our impression that the most unsatisfactory situation relates to the most speciose (c. 23 species) of the currently recognised genera, *Uropeltis* Cuvier, 1829. In

the 1800s, a flurry of taxonomic action saw several genera (*Siluboura* Gray, 1845; *Coloburus* Duméril in Duméril and Duméril, 1851; *Crealia* Gray, 1858) erected and subsequently relegated to the junior synonymy of *Uropeltis*, and many species synonymised within the genus, but little of this has been reassessed in any detail in the intervening period. This early work was often conducted in a more casual framework than would occur today, where type specimens were not designated and synonymies often listed without any discussion. This has resulted in an intricate and often confusing taxonomic history (see Gans, 1966; McDiarmid et al., 1999). This is exemplified by the type species of *Uropeltis*, *U. ceylanica* Cuvier, 1829, for which McDiarmid et al. (1999) list many unjustified emendations, junior synonyms and varieties, as well as documenting that the type locality “Ceylan” is both imprecise and presumably incorrect.

During examination of new *Uropeltis* material from the Western Ghats of Maharashtra, India, we recognised an apparently distinct form that keys out (using the most recent keys of Smith, 1943; Rajendran, 1985; Sharma, 2003) as *U. ceylanica* but which has a distinctive colour pattern and differs in other characters from the lecto-

type of *U. ceylanica* and many other specimens previously referred to that species. Furthermore, the new material closely resembles two historical specimens in separate collections—the type and previously only reported specimen of *U. bicatenata* (Günther, 1864) in the Natural History Museum, London, UK (BMNH), and a specimen wrongly identified by M. A. Smith (Ali, 1949) as *U. rubrolineatus* (Günther) in the collections of the Bombay Natural History Society, Mumbai, India (BNHS). *Uropeltis bicatenata* was described by Günther (1864) but has been subsequently considered a junior synonym of *U. ceylanica* (see below). Here we reassess *U. bicatenata*, resurrect it from the synonymy of *U. ceylanica*, rediagnose the species (based on historical and new material), and redescribe and figure the holotype. The Muséum National d'Histoire Naturelle, Paris, France is abbreviated as MNHN.

TAXONOMIC HISTORY

Günther (1863: 350) included “*Silybura bicatenata*. Dekkan. East India Company.” in a brief report listing new species to be described in a subsequent monograph. The latter work (Günther, 1864) presented a formal description of *S. bicatenata* (p. 191), a figure of the whole body (plate XVII H) and a line drawing of head scalation in dorsal view (plate XVII H’). These are reproduced here, below and in Fig. 1.

“*SILYBURA BICATENATA*. (Plate XVII. Figs. H, H’.)

Snout obtusely conical; rostral rounded, very short, shorter than the nasals; vertical square, its front part, which extends between the frontals being as large as its hind part; it is rectangular

anteriorly and posteriorly. Fourth upper labial as high as long. Caudal disk flat, well defined, not much shorter than tail, terminating in a broad, horny, bicuspid scale which is slightly turned upwards; each scale composing the caudal disc is provided with one or two or three keels. The body is surrounded by seventeen series of scales on the neck as well as in its middle; ventral shields 135; twelve pairs of subcaudals. The circumference of the thickest (anterior) part of the body is one-eleventh of the total length. Black above and below, each scale on the back with a yellowish margin. A yellow band runs along each side of the body; it corresponds to the joining edges of the fourth and fifth outer series of scales; anteriorly it is broken up into a series of large spots, posteriorly it flanks the lower part of the tail. Lower parts entirely black.

A single example of this beautiful species, 9½ inches long, was brought by Colonel Sykes from the Deccan. The specimen is a male, with the tail 8 lines long; it is figured on Plate XVII. Of its natural size; figure H’ represents the upper side of the head.”

Eleven years later, Günther (1875) still recognised *S. bicatenata* as a distinct species (with no indication that any more specimens had been found), and included it in a key to the species of *Silybura*. Theobald (1868, 1876) also listed *bicatenata* as a valid species. Beddome (1886) and Boulenger (1890, 1893) listed, without discussion, *Silybura bicatenata* under the synonymy of their preferred names for *S. ceylanica*, namely *S. nilgherriensis* Beddome, 1863 and *S. brevis*

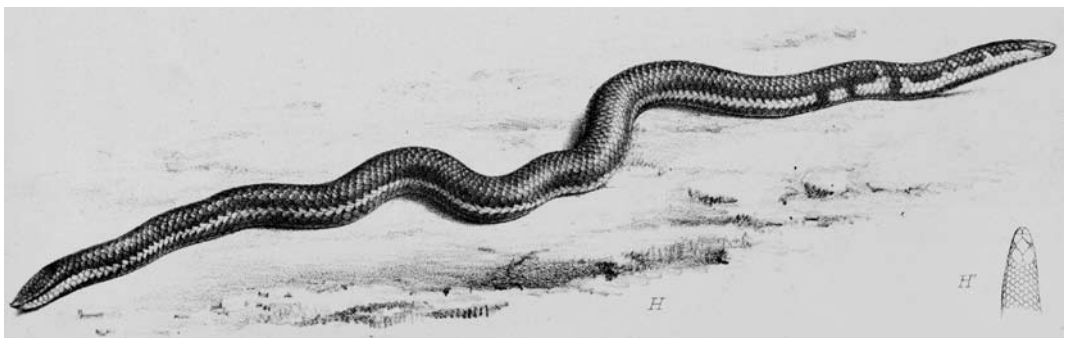


Figure 1. Reproduction of Günther's (1864: plate XVII. figs. H, H') original figures of *Uropeltis bicatenata* (Günther).



Figure 2. Holotype (BMNH 1946.1.16.8) of *Uropeltis bicatenata* (Günther). Scale in millimetres.

Günther, 1862, respectively. *Silybura* Peters, 1861 is an unjustified emendation of *Siluboura* Gray, 1845 which is a junior synonym of *Uropeltis* Cuvier, and treatment of *U. bicatenata* as a junior synonym of *U. ceylanica* has been followed, without further comment, by all four of the main subsequent comprehensive taxonomic treatments of Uropeltidae: Smith (1943: 80), Gans (1966: 18—the type locality of *Silybura bicatenata* is incorrectly given as “Wynad, Malabar, 3500 feet elevation”), Mahendra (1984: 85–86) and McDiarmid et al. (1999). This taxonomy has also been followed implicitly or explicitly by authors of post-Smith (1943) faunal lists (e.g., Das, 1997, 2003; Murthy, 1982, 1990; Sharma, 2003; Whitaker, 1978). Despite interpreting *U. bicatenata* as a junior synonym of *U. ceylanica*, several authors continued to list “*bicatenata*” as a colour variant of the senior synonym. This appears to have been initiated by Smith’s (1943: 80) diagnosis of *U. ceylanica*, which includes: “with a lateral yellow stripe (*bicatenata*)”. Rajendran (1985: 65) imprecisely quoted Smith by reporting a “bicarinate” variant of *U. ceylanica*. Murthy (1990: 15) upgraded Smith’s variant to *U. ceylanicus bicatenata* but confused things further by attributing various ventral colour patterns to the form that are not present in Günther’s material, and which were not ascribed by Smith to any particular one of his listed varieties.

Ali (1949) reported a uropeltid specimen from Bhimashankar, Maharashtra, India, that M. A. Smith had identified for him as *Uropeltis rubrolineatus* (Günther, 1875). We refer this specimen (BNHS S225) to *U. bicatenata*, which we consider a valid species. We follow the taxonomic nomenclature of McDiarmid et al. (1999).

TAXONOMY

Uropeltis bicatenata (Günther, 1864)

(Figs. 1–6, Table 1)

Silybura bicatenata Günther, 1863: *Nomen nudum*. Günther (1863: 350)

Silybura bicatenata Günther 1864: Günther (1864: 191, Pl. XVII H, H”; 1875: 229); Theobald (1868: 43; 1876: 134); Gans (1966: 18)

Silybura nilgherriensis Beddome, 1863: Beddome (1886: 15)

Silybura brevis Günther, 1862: Boulenger (1890: 269; 1893: 158)

Uropeltis ceylanicus Cuvier, 1829: Smith (1943: 80)

Uropeltis rubrolineatus (Günther, 1875): Ali (1949: 376)

Uropeltis (Siluboura) ceylanicus Cuvier, 1829: Mahendra (1984: 85–86)

U[ropeltis]. ceylanicus bicatenata (Günther, 1864): Murthy (1990: 15)

Uropeltis ceylanica Cuvier, 1829: McDiarmid et al. (1999: 144)

Holotype.— BMNH 1946.1.16.8 (formerly BMNH 60.3.19.1277), male, from “Dekkan” or “the Deccan” according to Günther (1863) and Günther (1864) respectively. The BMNH catalogue and the jar label gives “Deccan (?)”, which McDiarmid et al. (1999: 144) interpret as a questioning of the locality. Other than that the specimen was presented by Colonel Sykes, there are no further collection data, although the first part of the original BMNH specimen number indicates that the specimen was catalogued in 1860. The BMNH accessions register entry for 60.3.19.1277 states only “*Typhlops*”, presented by East India House.

Referred material.— BNHS S225 (female, collected by S. Ali, September 1948), Bhimashankar, Pune District, Maharashtra, India; BNHS 3251 and 3252 (male and female respectively, I. Agarwal and S. Kehimkar, 2004), close to Bhimashankar Wildlife Sanctuary, Pune District, Maharashtra, India; BNHS 3265 (male), 3266 (male) and 3267 (female) Fangul Gawhan, Pune District, Maharashtra, India (all three collected by S. Thakur, October 2003). See Table 1 for details and morphometric and meristic data, and Fig. 6 for distribution of localities.

Diagnosis.— A *Uropeltis* with 17 dorsal scale rows at midbody and a notably flat-to-mildly-concave tail shield (distinctly not convex). Ranges of variation of seven known specimens: total length 155–264 mm; ventral scales 130–141; subcaudal scales 8–9 (three females) or 10–12 (four males); tail shield with 34–43 keeled scales; typically 7 (uniquely 6, on one side only) maxillary and dentary teeth per row. *Uropeltis bicatenata* differs from type specimens of all other similarly scaled and shielded, nominate species of the genus, namely Smith’s (1943: 74) group IIA and IIB species (see Table

2) in the following ways: *Uropeltis arcticeps* (Günther, 1875) has fewer teeth (4–5 per row), a shorter ocular and proportionately smaller eye, and fewer ventrals (< 130). *Uropeltis ceylanica* has fewer teeth (4 maxillary, 5 dentary), a proportionately larger 3rd supralabial, a longer midline suture between prefrontals than nasals, a rostral that extends posterior to the nares, fewer subcaudals (6), a proportionately broader tail shield with fewer keeled scales (28), smaller ocular and eye, narrower frontal, shorter parietal, and narrower ventrals. *Uropeltis rubrolineata* (Günther, 1875) has more ventrals (>164), fewer subcaudals (6–7 female, 9 male), fewer maxillary teeth (typically 5 per row), fewer keeled shield scales (27–30), a proportionately shorter tail, and smaller eye relative to ocular scale. *Uropeltis rubromaculata* (Beddome, 1867) has fewer maxillary teeth (5 per row), a longer head relative to snout-vent length, and more keeled scales on the tail shield (45–52). *Uropeltis myhendrae* (Beddome, 1886) and *Uropeltis phipsonii* (Mason, 1888) have more dentary teeth (typically 9 per row), and proportionately longer rostrals—so that the portion visible from above is clearly longer than its distance from the frontal. *Uropeltis myhendrae* has more keeled scales on the tail shield (47). *Uropeltis phipsonii* has more ventrals (>143) and more supralabials (5; one type has 4 on one side), although four BNHS non-type specimens (BNHS S231–234) that we are confident can be referred to *Uropeltis phipsonii* all have 4 (AC, pers. obs.).

Remarks.— We consider many if not most species of *Uropeltis* to be poorly characterised, and have therefore restricted ourselves here to comparisons of all (*arcticeps*, *ceylanica*, *hipsonii*, *rubrolineata*, *rubromaculata*) or all BMNH-housed (*myhendrae*—one, possibly two MNHN types not examined, see McDiarmid et al., 1999) type material of Smith's Group IIA and IIB (Table 2). Although we are confident that *U. bicatenata* is a distinct, clearly diagnosable, valid species, we anticipate that the ranges of variation of individual characters will increase when larger samples are considered. That the material newly referred to *U. bicatenata* encompasses the size range of at least one of the types of each of the other species (compare Tables 1 and 2) lends some confidence to distinguishing the species based on small samples.

In addition to the combinations of characters listed above, *U. bicatenata* has a distinctive colour pattern that serves to separate it from all similarly scaled species. For example, *U. rubrolineata* and *U. rubromaculata* have vivid red (in life) and not yellowish markings, and the lateral stripes in the types of *U. rubrolineata* are broader, occupying dorsal scale rows 1–3 or 1–4 (versus rows 4–5 in *U. bicatenata*). Unlike the unblemished belly of all known *U. bicatenata*, the ventrals of the type specimens of *U. ceylanica*, *U. arcticeps*, *U. myhendrae*, *U. rubrolineata* and *U. rubromaculata* have pale specks, blotches and/or bands. The types of *U. ceylanica*, *U. phipsonii*, and *U. rubrolineata* also differ from all known material of *U. bicatenata* in having a broad transverse ventral band in the region of the anus, linking the left and right lateral stripes on the tail (although this character is known to vary in some other *Uropeltis*, e.g., *U. macrolepis macrolepis*, AC, pers. obs.). Finally, although varying in their clarity, the speckled yellow chevron markings on the dorsum of *U. bicatenata* are not seen in the other species. Günther's (1875) key separated *bicatenata* from other *Uropeltis* species having 17 scale rows, <160 ventrals, flat tail shield, and lacking a sharply pointed snout, on the basis of its regular, narrow, lateral yellow stripes, and this serves still to identify all the known material of this species except for one heavily blotched individual (see below).

Uropeltis bicatenata is distinct also (DJG, pers. obs.) in colour pattern and meristic and morphometric characters from all types of all other species (*brevis* Günther, 1862; *shorttii* Beddome, 1863; *nilgherriensis* Beddome, 1863; *annulata* Beddome, 1886) recognised as junior synonyms of *U. ceylanica* in the most recent comprehensive treatments (Smith, 1943; Gans, 1966; McDiarmid et al., 1999). Detailed data for these types are not presented here because a much-needed, full re-evaluation of the taxonomy of *U. ceylanica* is beyond the scope of the present study. Some of our new observations lie outside Smith's (1943: 61) diagnosis of Uropeltidae—the five (versus a constant four) supralabials in at least some *U. phipsonii*, and the several instances of tooth counts beyond the reported range of 6–8 per maxilla and 8–10 per mandible (Tables 1, 2).

Redescription of holotype.— Some morphometric and meristic data are given in Table 1. New photographs and drawings of the holotype are presented in Fig. 2 and 3, respectively. The specimen is an adult male in fair condition, preserved in a single loose, flat coil. Some parts of the body are soft, especially in the anterior half of the specimen. In particular, the head is soft, and here the outermost layer of keratin of the scales has been lost so that determining exact squamation patterns is difficult in some places. The colour is somewhat faded, with the black and yellow described by Günther (1864) now dark brown and pale, golden yellow. There are no incisions into the specimen, its sex has been inferred here from the relatively long tail and high number of subcaudal scales via comparison with the dissected, referred, sexually dimorphic BNHS material. It is unclear how Günther (1864) sexed the holotype as a male.

Snout tip a little squashed, but capped by short, rounded (dorsal and lateral views) rostral shorter (dorsal view) than gap between it and anterior tip of frontal scale (= “vertical” of Günther, 1864). Rostral extends back dorsally no further than level of nares. Ventral surface of rostral gently notched at margin of mouth. Unpaired hexagonal frontal distinctively shaped, being marginally longer than broad, with short lateral (ocular) margins that are not parallel (divergent anteriorly), and slightly concave posterolateral margins. Anterolateral margins also slightly concave posteriorly, and subequal in length to posterolateral margins. Paired nasals (there are no separate internasals) not greatly outsized by prefrontals (= “frontals” of Günther, 1864), with subequal midline contacts between two pairs both being asymmetric. Small (c. 0.3 mm diameter) subcircular external naris slightly countersunk within small depression, lying in anteroventral corner of undivided nasal. Four supralabials: first smallest, making shortest contribution to margin of mouth. Second a little longer, much larger. Third (low posteriorly) and especially fourth much the largest. Nasal contacts supralabials 1 and 2; ocular contacts supralabials 3 and 4. Ocular large, conspicuous (but slightly less than half ocular length), circular eye in anteroventral corner. Eye bulges in dorsal view, shrivelled pupil appears subcircular. Pre-, supra- and postoculars absent. Paired

parietals not notably longer than frontal, with broadly rounded posterior margins. Two small scales in temporal region between and in contact with fourth supralabial and posterior of parietal. Three elongate infralabials: second and third subequal in length, notably longer than first. First infralabials make minimal midline contact immediately behind small, slightly protuberant mental. Beyond first infralabials, single pair of scales (left substantially overlapping right, anteriorly) lies between mental and first single mid-ventral scale (latter = first ventral *sensu* Gower and Ablett, 2006). First ventral longer than wide, these proportions reversed by third ventral.

Inside of mouth pale, without notable pigmentation. Tongue deeply forked, dorsal surfaces of pointed tips with some midline pigmentation. Seven teeth in each maxillary row and seven (left) and eight (right) in dentary rows. No signs of palatal teeth. All teeth simple, pointed, backward pointing, rather straight. Spacing of teeth even in all rows. No great variation in tooth size, but largest maxillary teeth towards middle of row, anterior teeth largest in dentary row. Dentary teeth hidden deeper in gingivae and less prominent than maxillary rows. Antermost maxillary teeth approximately aligned with suture between first and second supralabials, posteriormost tooth just behind posterior margin of third supralabial. Dentary row of similar length and alignment.

Body subcylindrical to slightly dorsoventrally compressed. All head and body scales lack keels, macroscopically smooth, with iridescent outer keratin layer. Dorsal body scales evenly sized around and along body. Midline ventral scales between mental and anal 134 (*versus* Günther’s count of 135), generally evenly sized except for gradually narrowing anterior- and posteriormost members. At midbody, ventrals approximately 1.5 times as broad as exposed part of adjacent, first row of dorsals. At level of fifth ventral, 19 dorsal scale rows, reducing to 17 rows soon thereafter, maintained until at least up to tenth ventral anterior to anals. At one ventral anterior to anals, 15 dorsal scale rows. Immediately anterior to tail shield, 12 dorsal scale rows. Paired anal scales (right overlying left) considerably larger than posteriormost ventrals and all subcaudals. Distal margin of each anal overlaps two other scales in addition to anterior-

Table 1. Meristic and morphometric (mm) data for the holotype (*) and referred specimens of *Uroplectis bicatenata* (Günther). Tail shield is here defined by region covered by those keeled scales that are matt over at least half their surface. Measurements to 0.1 mm taken with dial callipers, those to 1 mm with ruler; circumferences measured with string and ruler. Abbreviations: C = circumference; D = distance; f = female; l = left; L = length; m = male; r = right; SVL = snout-vent length; W = width.

1	Specimen	BMNH 1946.1.16.8*	BNHS S225	BNHS 3251	BNHS 3252	BNHS 3265	BNHS 3266	BNHS 3267
2	Locality	"Deccan"	Bhimashankar	Bhimashankar	Bhimashankar	Fangul Gawhan	Fangul Gawhan	Fangul Gawhan
3	Sex	m	f	m	f	m	m	f
4	Total L (TL)	248	264	155	165	204	192	239
5	Tail L (tl)	16.5	12	8.4	7.4	12.9	13.6	10.7
6	TL/tl	15	22	18.5	22.3	15.8	14.1	22.3
7	tl as % of TL	6.7	4.5	5.4	4.5	6.3	7.1	4.5
8	Midbody W	7.3	8.7	5	4.8	7.1	7	7.8
9	TL/W	34	30	31	34	29	27	31
10	Midbody C	26	27	16	18	22	21	25
11	W at anus	6	7.4	4.2	4.3	6	5.4	6.1
12	C at anus	22	25	14	16	20	18	20
13	Shield W	4.9	6.9	3.9	3.5	5.3	4.6	6.3
14	Shield L	10.7	10	7.1	7	10.5	10.1	11
15	Min. no. scales across shield W	6	6	7	6	6	6.5	6
16	Max. no. scales across shield L	9	7	8.5	7.5	9	9	9
17	No. keeled scales on shield	41	34	41	38	43	41	42
18	Maximum L of parietal scale	3	3.2	2.2	2.3	2.6	2.3	2.8
19	D between rostral and posterior of midline suture between parietals	6.1	6.1	3.9	4.9	5.4	5.3	5.9
20	D between snout tip and posterior of midline suture between parietals	6.7	6.9	5.2	5.3	5.7	5.7	6
21	Midline D between rostral and frontal scales	1.7	1.6	1.2	1.1	1.3	1.1	1.2
22	D between snout tip and posterior of last supralabial scale (= HL)	7.5	7.9	6	5.9	7.2	6.8	7.3
23	SVL/HL	31	32	24	27	27	26	31
24	L frontal scale	3.1	3.4	2.5	2.9	2.9	3.1	3.2

25	W frontal scale	2.8	3	2.1	2.2	2.5	2.5	2.5	2.8
26	Max. L prefrontal	2.2	1.7	1.4	1.5	1.9	1.8	1.8	1.8
27	Max L. ocular scale (LO)	2.3	2.5	1.9	1.8	2.2	2.2	2.2	2.5
28	Eye diameter (ED)	1.1	1.1	0.9	0.9	1.1	1.1	1.1	1.2
29	LO/ED	2.09	2.27	2.11	2	2	2	2	2.08
30	D between nares	1.8	1.9	1.5	1.6	1.9	1.6	1.6	1.7
31	D between eyes	3.5	3.7	2.6	2.7	3.2	3.1	3.1	3.2
32	D between eye and naris	2.3	2.3	1.7	1.7	1.9	1.9	1.9	2.1
33	D between snout tip and eye	3.4	3.4	2.7	2.7	3.3	3.1	3.1	3.3
34	Head W at corner of mouth	4.8	4.9	3.7	3.8	4.2	4	4	4.5
35	Max. W of ventral scales at midbody (WV)	3.5	4	2.2	2.5	3.4	2.8	2.8	3.6
36	Max. W of 1st dorsal scale row at mid-body (WD)	2.3	2.6	1.4	1.6	2.3	2	2	2.2
37	WV/WD	1.52	1.54	1.57	1.56	1.48	1.4	1.4	1.64
38	Maxillary teeth (left, right)	7,7	7,7	7,7	7,6	7,7	7,7	7,7	7,7
39	Dentary teeth (left, right)	7,8	7,7	7,6	7,7	7,7	7,7	7,7	7,7
40	Supralabials (left, right)	4,4	4,4	4,4	4,4	4,4	4,4	4,4	4,4
41	Infralabials (left, right)	3,3	3,3	3,3	3,3	3,3	3,4	3,4	3,4
42	No. dorsal scale rows at level of 5th ventral	19	19	19	19	19	19	19	19
43	No. dorsal scale rows at level of 10th ventral	17	18	19	17	18	18	17	17
44	No. dorsal scale rows at midbody	17	17	17	17	17	17	17	17
45	No. dorsal scale rows at level of ten ventral scales anterior to anal scale	17	17	17	15	16	17	17	17
46	No. dorsal scale rows at level of one ventral scale anterior to anal scale	15	15	15	15	15	15	15	15
47	Ventral scales	134	135	135	141	130	131	137	137
48	Anal scales and nature of overlap	2 r/l	2 r/l	2 r/l	2 r/l	2 r/l	2 r/l	2 r/l	2 r/l
49	Subcaudals (left, right)	12, 12	8, 8	11, 11	9, 8	12, 10	12, 12	12, 12	8, 8

Table 2. Meristic and morphometric (mm) data for all types (except *U. myhendrae*, for which MNHN type material was not examined) of species of *Uropehtis* in Smith's (1942) Group IIA and IIB. † specimen badly shrivelled, so measurements and some counts not taken. ‡ two untagged specimens in same jar. Methods and abbreviations as for Table 1.

	<i>U. ceylanica</i>	<i>U. myhendrae</i>	<i>U. arciceps</i>	<i>U. arciceps</i>	<i>U. rubrolineata</i>	<i>U. rubrolineata</i>	<i>U. rubrolineata</i>
1 Specimen	MNHN 39	BMNH 1946.1.16.9	BMNH 1946.1.16.12	BMNH 1946.1.16.11	BMNH 1946.1.15.63	BMNH 1946.1.16.26†	BMNH 1946.1.15.53
4 Total L (TL)	161	334	194	148	177		398
5 Tail L (tl)	6.8	13.7	11.1	8.6	6.4		12.9
6 TL/tl	23.7	24.4	17.5	17.2	27.7		30.9
7 tl as % of TL	4.2	4.1	5.7	5.8	3.6		3.2
8 Midbody W	5.7	11.7	6.4	5.3	5.4		10.7
9 TL/W	28	29	30	28	33		37
11 W at anus	5.1	9.8	5.3	4.6	4.6		8.7
13 Shield W	4.8	9.4	5.2	4.4	4.2		7.2
14 Shield L	7.3	14	9.5	7.4	6.8		12.7
15 Min. no. scales across shield W	7	8	6	6	6	6	5
16 Max. no. scales across shield L	6.5	7.5	8	8	7.5	7.5	7.5
17 No. keeled scales on shield	28	47	32	34	29	30	27
18 Maximum L of parietal scale	1.9	4.7	2.7	1.9	2.6		5.3
19 D between rostral and posterior of midline suture between parietals	4.2	7.4	4.9	3.8	4.5		8.6
20 D between snout tip and posterior of midline suture between parietals	4.9	9.5	5.4	4.4	5.5		10.9
21 Midline D between rostral and frontal scales	1.3	1.8	1.4	1.2	1		2.2
22 D between snout tip and posterior of last suprabial scale (= HL)	5.3	11	6	4.7	6.3		13.2
23 SVL/HL	29	29	30	30	27		29
24 L frontal scale	2.4	3.7	2.9	2.4	2.5		4.2
25 W frontal scale	1.7	3.3	1.9	1.5	2		3.6
26 Max. L prefrontal	1.6	2.3	1.8	1.3	1.5		2.7
27 Max L ocular scale (LO)	1.5	2.3	1.7	1.4	1.6		3.6
28 Eye diameter (ED)	0.7	1	0.6	0.6	0.6		1.3
29 LO/ED	2.14	2.3	2.67	2.33	2.67		2.77

30	D between narres	1.1	2.7	1.3	1.1	1.6	2.9
31	D between eyes	2.3	4.5	2.6	2.1	2.7	4.8
32	D between eye and naris	1.8	3.1	2.2	1.6	1.8	3.4
33	D between snout tip and eye	2.5	5.4	3.1	2.4	3	5.7
34	Head W at corner of mouth	3.4	7	3.9	3.2	4.1	8.7
35	Max. W of ventral scales at midbody (WV)	2.1	5.5	2.7	2.1	2.3	5.7
36	Max. W of 1st dorsal scale row at midbody (WD)	1.6	3.3	1.9	1.4	1.5	3.4
37	WV/WD	1.31	1.67	1.42	1.5	1.53	1.68
38	Maxillary teeth (left, right)	4, 4	7, 8	4, 4	5, 4	5, 5	5, 5
39	Dentary teeth (left, right)	5, 5	9, 8	4, 5	5, 5	7, 8	8, 8
40	Supralabials (left, right)	4, 4	4, 4	4, 4	4, 4	4, 4	4, 4
41	Infralabials (left, right)	3, 3	3, 3	3, 3	3, 3	3, 3	3, 3
44	Dorsal scale rows at midbody	17	17	17	17	17	17
47	Ventral scales	130	140	127	128	167	165
48	Anal scales and nature of overlap	2tr/l	2r/l	2r/l	2r/l	2r/l	2
49	Subcaudal scales (left, right)	6, 6	7, 8	8, 8	9, 9	7, 6	9, 9

ormost subcaudals. Twelve pairs of macroscopically smooth subcaudal scales between anus and single terminal tail scute.

Tail shield (= "caudal disk" of Günther, 1864) conspicuous, well defined. Flat to gently concave, oval, longer than head. Shield scales matt, minutely pitted. Some dorsal body scales anterior and anterolateral to shield (as defined here) bear low carinae but distinct from shield scales by being mostly or entirely shiny. There are 41 matt, keeled scales lying entirely or mostly within the shield. Transversely, shield is maximally six keeled scales wide; longitudinally minimally nine keeled scales long (excluding terminal scute). Antermost shield scale bears four subparallel, low carinae or keels, all other shield scales bear one, two (mostly) or three, generally more prominent carinae. Shield carinae straight, longitudinal, hardened keels, with perpendicular to mildly concave posterior margin, so that hardened posterodorsal tips are square to posterodorsally-pointed in lateral view. Terminal scute mildly transversely convex, dorsally and ventrally. Terminally it bears pair of paramedian, posteriorly directed short spines. Upper surface of terminal scute bears few irregularly scattered, small, hardened pointed tubercles.

Background colour an even chocolate-brown across dorsal and ventral surfaces of body, head and tail. Body scales slightly paler distally, with yellowish halo immediately inside transparent outer rim. Some notable pale golden-yellow markings stand out against background. Lateral stripe begins narrowly on margin of mouth, on second supra- and infralabials. Stripe remains narrow on upper jaw until broadening behind eye, passes over most of large fourth supralabial; broadens at posterior of third infralabial. Behind corner of mouth, lateral stripe two to three scales wide. Stripe becomes broken on right (level with ninth ventral) and left (20th ventral) to form three blotches on right and two on left. Four dorsal crossbars (widely incomplete middorsally) arise from blotched region, anteriormost lies anterior to first lateral blotch. Backwards from level of 32nd ventral lateral stripe again complete along most of body as regular, narrow, zigzag line (with rounded edges). Zigzag formed by yellowish markings on posterodorsal edge of each scale in fourth dorsal row and posteroventral edge of each fifth

Table 2. contd.

	<i>U. phipsonii</i>	<i>U. phipsonii</i>	<i>U. rubromaculata</i>	<i>U. rubromaculata</i>	<i>U. rubromaculata</i>	<i>U. rubromaculata</i>	<i>U. rubromaculata</i>	<i>U. rubromaculata</i>
1 Specimen	BMNH 1946.1.16.33-34‡	BMNH 1946.1.16.33-34‡	BMNH 1946.1.15.82	BMNH 1946.1.15.83	BMNH 1946.1.15.84	BMNH 1946.1.15.51	BMNH 1946.1.15.52	
4 Total L (TL)	277	218	343	349	256	365	368	
5 Tail L (tl)	14.9	12.3	14.6	18.7	15	15.2	16.5	
6 TL/tl	18.6	17.7	23.5	18.7	17.1	24	22.3	
7 tl as % of TL	5.4	5.6	4.3	5.4	5.9	4.2	4.5	
8 Midbody W	8.5	8.3	9.9	10.8	8.6	11.4	10.2	
9 TL/W	33	26	35	32	30	32	36	
11 W at anus	7.1	6.8	9	9.3	7.7	10.8	9.9	
13 Shield W	6.3	4.8	8.6	8.1	7.2	9.8	9.2	
14 Shield L	12.3	10.7	15.1	17.5	14.2	16.9	17.1	
15 Min. no. scales across shield W	5.5	5	6	6	6.5	7	6.5	
16 Max. no. scales across shield L	8	8.5	9	9.5	10	8.5	9	
17 No. keeled scales on shield	34	30	45	50	52	52	49	
18 Maximum L of parietal scale	2.8	2.4	5	5.3	4.1	5.8	5.4	
19 D between rostral and posterior of midline suture between parietals	5.3	4.6	8.1	8.2	6.5	8.4	8.2	
20 D between snout tip and posterior of midline suture between parietals	6	5	9.7	9.9	7.7	10.5	10.1	
21 Midline D between rostral and frontal scales	1.3	0.9	2	2.2	1.8	2.3	2.2	
22 D between snout tip and posterior of last supralabial scale (= HL)	8.5	6.8	12	12.2	9.4	13	13	
23 SVL/HL	31	30	27	27	26	27	27	
24 L frontal scale	3.5	2.9	4.7	4.2	3.5	4.7	4.9	
25 W frontal scale	2.7	2.2	3.6	3.8	3	3.8	4.2	
26 Max. L prefrontal	1.7	1.2	2.9	3.1	2.3	3	3.3	
27 Max L ocular scale (LO)	2.2	1.9	3.3	3.3	2.8	3.3	3.4	
28 Eye diameter (ED)	1	0.8	1.5	1.5	1.3	1.5	1.5	
29 LO/ED	2.2	2.38	2.2	2.2	2.2	2.2	2.3	
30 D between nares	1.7	1.5	2.7	2.7	2.3	3.1	2.9	
31 D between eyes	3.3	2.9	4.6	4.9	3.8	5.1	5.2	

32	D between eye and naris	2.3	2.1	3	3.1	2.4	3.3	3.3
33	D between snout tip and eye	3.6	3	5	5.1	4	5.7	5.5
34	Head W at corner of mouth	5.2	5	7.3	7.6	6	9.4	8.2
35	Max. W of ventral scales at midbody (WV)	4.1	3.6	5	5.2	3.9	5.7	5.6
36	Max. W of 1st dorsal scale row at midbody (WD)	2.7	2.5	3.4	3.1	2.7	3.4	3.6
37	WV/WD	1.52	1.44	1.47	1.68	1.44	1.68	1.56
38	Maxillary teeth (left, right)	8, 8	7, 7	5, 5	5, 5	5, 5	5, 5	5, 5
39	Dentary teeth (left, right)	9, 9	9, 9	7, 7	7, 7	6, 7	6, 6	7, 7
40	Supralabials (left, right)	5, 5	5, 4	4, 4	4, 4	4, 4	4, 4	4, 4
41	Infralabials (left, right)	4, 4	3, 3	3, 3	3, 3	3, 3	3, 3	3, 3
44	Dorsal scale rows at midbody	17	17	17	17	17	17	17
47	Ventral scales	147	144	133	131	127	135	133
48	Anal scales and nature of overlap	2 r/l	2 r/l	2 r/l	2 r/l	2 r/l	2 r/l	2 r/l
49	Subcaudal scales (left, right)	11, 11	11, 12	9, 8	10, 9	10, 10	9, 8	8, 8

row scale. Lateral stripes again broken briefly about ten ventral scales in front of anus. Stripes remain narrow zigzags until three ventrals in front of anus, here extending onto tail as broad continuous stripes (about two scales wide). Left and right stripes converge a little toward end of slightly tapered tail, barely crossing lateral-most margins of penultimate subcaudal scales where stripes terminate one scale prior to terminal scute. Anal scales with off-white posterior margin, just inside transparent outer edge. No transverse bands extending onto ventral surface of tail from lateral stripes.

Posterior to irregular and incomplete anterior cross-bars, majority of dorsal surface of body marked with delicate, largely regular pattern of forward-pointing V-shapes (chevrons) spaced one dorsal scale row apart. Each V formed by yellowish blotches on distal tips of midline (ninth) dorsal scale row and posteromedial margin of next two (seventh and eight) scale rows, although even here, scales have transparent distalmost edge. Dorsal V pattern continues up to level of anus with varying completeness. Between anus and tail shield dorsal surface unpatterned, uniform brown. Dorsal pattern Vs often incompletely formed, in particular the pale spot on distal tip of scale row nine not always contacting the generally more continuous patches on rows seven and eight, particularly further posteriorly, so that pattern (\ /) can also be described as herringbone- or tyre-tread-like. Tail-shield scales uniform pale brown except for translucent tips of carinae. Terminal scute with midline whitish stripe on posterior half, two pointed tips also pale.

Additional information from referred specimens.—

Some meristic and morphometric data are presented in Table 1. Line drawings of head scalation and photographs of some of the referred material are shown in Fig. 4 and 5, respectively. The referred material comprises six additional specimens (three males, three females) ranging from 155 to 264 mm total length (TL), thus encompassing the holotype (male, 248 mm). Sexual dimorphism in tail length (4.5% of TL in females, 5.4–7.1% in males) and number of subcaudal scales (females 8–9, males 10–12) is pronounced and non-overlapping. No other notable dimorphism was observed.

Head scalation patterns in referred material generally match holotype. Portion of rostral visible dorsally always shorter than its distance from frontal, only in BNHS 3251 does it extend as far back as level with posterior margin of nares (Fig. 4B). Frontal generally with concave antero- and posterolateral margins, but extent varies—anterolateral margins strongly concave in BNHS 3265 and 3267, posterolateral margins straight to mildly convex in smallest specimen (BNHS 3251). Midline nasal and prefrontal sutures straight only in BNHS 3251 and 3267. Supra- and infralabials constant in number and relative sizes. Under front of lower jaw, first pair of infralabials make broad midline contact behind mental only in BNHS 3267. Only in BNHS 3251 do first pair of chin scales behind first infralabials not make broad, overlapping (some left over right, some *vice versa*) contact, so that first ventral contacts mental (Fig. 4C). Ocular and eye consistently large and maintain fairly constant relative proportions. Parietals generally short, rounded, longest in BNHS 3267. BNHS 3251 has asymmetric pair of small scales immediately between back of irregularly sutured parietals. Left side of BNHS S225 has three (not two) small scales between and contacting fourth supralabial and parietal (Fig. 4A). Teeth almost constant in number. Pupil in preserved specimens generally an irregular blob, most circular in BNHS 3267. Anal scales always paired, right overlying left. Subcaudals always macroscopically smooth. Tail shield similarly proportioned in all specimens, with 34 to 43 keeled, matt scales, most of which are bicarinate, a few uncarinate, fewer tricarinate, and none tetracarinate. A single tetracarinate, glossy scale lies just anterior to shield of BNHS 3251. Largest keels resemble closely those of holotype in being sharply pointed with perpendicular to concave posterior margins, so that shield as a whole is rough. Terminal scute of BNHS S225 broken; that of 3251 lacks right posterior spine. Length of spines varies (long in e.g., BNHS 3265, 3266). Most specimens have small additional, less acutely pointed lateral and/or posteromedial spines. Terminal scute spines of BNHS 3265 have small additional lateral cusps, BNHS 3265 has a small posteromedial cusp.

Background body colour not chocolate brown in any referred specimen. Grey-brown in BNHS

S225, but black (as originally described for holotype by Günther, 1864) to dark blue-black in all more recently preserved specimens. Paler markings always shades of yellow (never red), more lemon-yellow anteriorly and more orange-yellow posteriorly in larger Fangul Gawhan individuals. Body scales resemble those of holotype in consistently having transparent distal margins lying beyond thin, translucent, yellowish halo. Apart from translucent distal margins, ventrals uniformly darkly coloured in all specimens. Scales under lower jaw uniform in all specimens except BNHS 3265 and 3266, which have small, pale-yellowish spots on each of paramedian scales contacting first and second ventrals. BNHS 3265 has an additional small spot nearby on second ventral.

Lateral body stripes and dorsal chevron markings constant and distinctive in all referred specimens except for notable variant BNHS 3267 (Fig. 5e, f), which has extensive lateral blotches and faint dorsal speckles only occasionally coming close to forming Vs. BNHS 3267 is interpreted as a rare exception—it is the only unusually marked individual seen among tens of uncollected live animals at Bhimishankar (AC, SST, pers. obs.) and c. 10 animals seen at Fangul Gawhan (SST, pers. obs.). Indeed, it was collected especially because of its unusual colour pattern.

Dorsal chevrons vary in completeness, best defined in holotype, in referred specimens spots on distal ends of midline (ninth) dorsal scale row small or absent, so that pattern is more herringbone ($\setminus /$) or tyre-tread than chevron-like, and arms of Vs or /s are sometimes incomplete. Midline dorsal scales often with yellow marks on posterolateral margins instead of posterior tip, so that V or $\setminus /$ pattern is more U-U like. Dorsal markings extend onto tail but fade before shield, this varying from two (BNHS 3265) to seven (BNHS 3266) scales anterior to first shield scale. Lateral stripe extends forwards generally onto second supralabial and posterior of third infralabial, but may continue further forwards as a thin line on lips, most notably in BNHS 3252 where it extends onto first supra- and infralabials. First break in stripes behind head ranges from level with ninth (BNHS 3267) to fifteenth (BNHS 3266) ventral, though in BNHS 3251 it remains complete. Anteriorly, stripe nar-

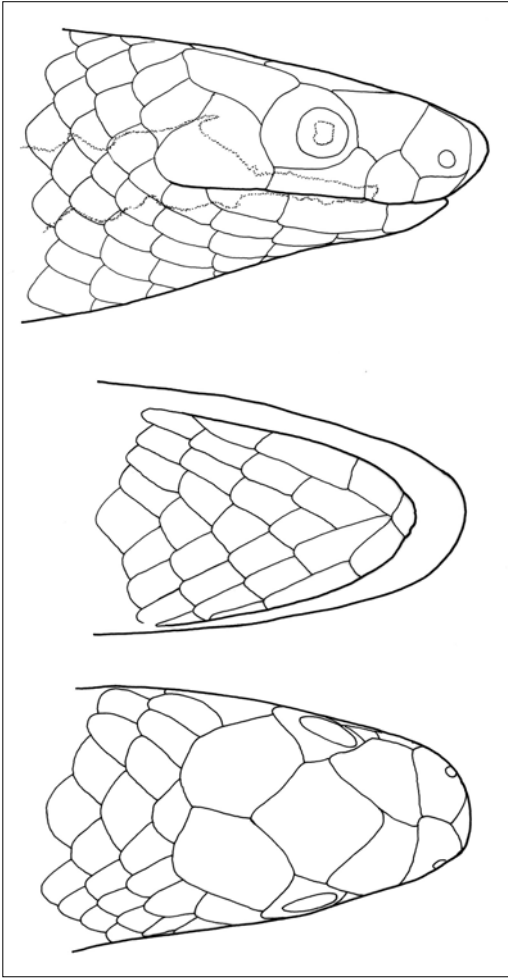


Figure 3. Outline scale drawings of head of holotype (BMNH 1946.1.16.8) of *Uropeltis bicatenata* (Günther) in lateral, ventral and dorsal views. For scale see Fig. 2.

rows after final main break between points level with ventrals 29 to 39. Anterior to anus, stripe broadens at a point between one and four ventral scales further forwards than in holotype (i.e., three to six scales anterior to anal). Stripe on tail generally two scales wide, three in BNHS 3265 and BNHS 3267, never encroaching onto subcaudals. In all referred specimens except BNHS 3267, lateral stripes generally thin, complete, regular, and zigzagged. Except in BNHS 3267, posteriorly the stripes are never broken for the entire length of one scale, in BNHS 3252 they are unbroken.

Whitish line toward distal margins of anal scales of holotype is yellow in referred specimens, varying from faint and diffuse (BNHS

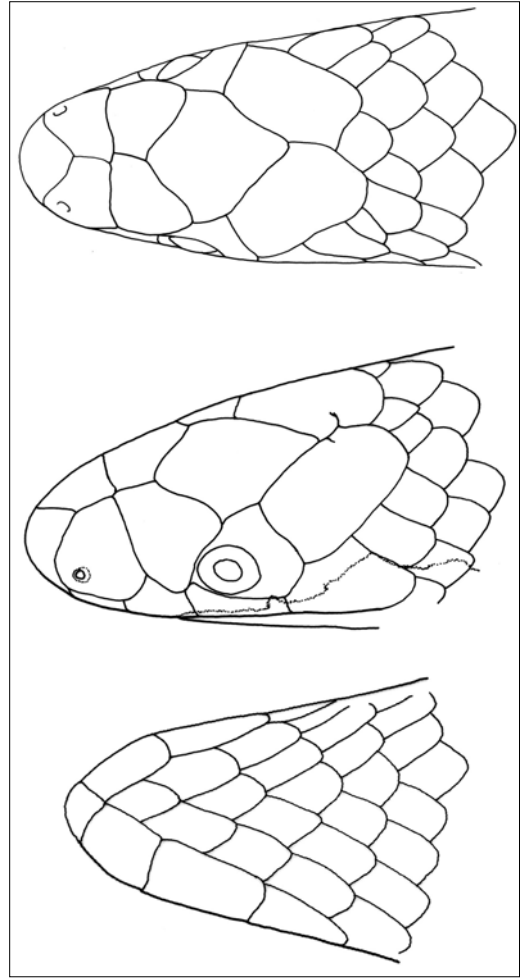


Figure 4. Outline scale drawings of heads of referred specimens of *Uropeltis bicatenata* (Günther). Upper figure: dorsal view of BNHS S255 (female, TL = 264); Middle, lower figures: anterodorsolateral view of head and ventral view of lower jaw of BNHS 3251 (male, TL = 155 mm).

3251, BNHS 3252) in the smallest specimens to a thin faint arc (BNHS 3267) or clearer but still narrow (BNHS 3265) band in larger animals. As in the holotype, hardened spines on distal edge of terminal scute, and short midline stripe are yellow (larger animals) to off-white in all referred specimens. In life, the recently collected referred specimens were blackish with vibrant golden/orange yellow markings. From photographs taken in life, the pupil is circular.

Distribution, ecology and conservation.— *Uropeltis bicatenata* is known with certainty from only two localities, Bhimashankar and Fangul Gawhan (locally known as Fangli) both in Pune

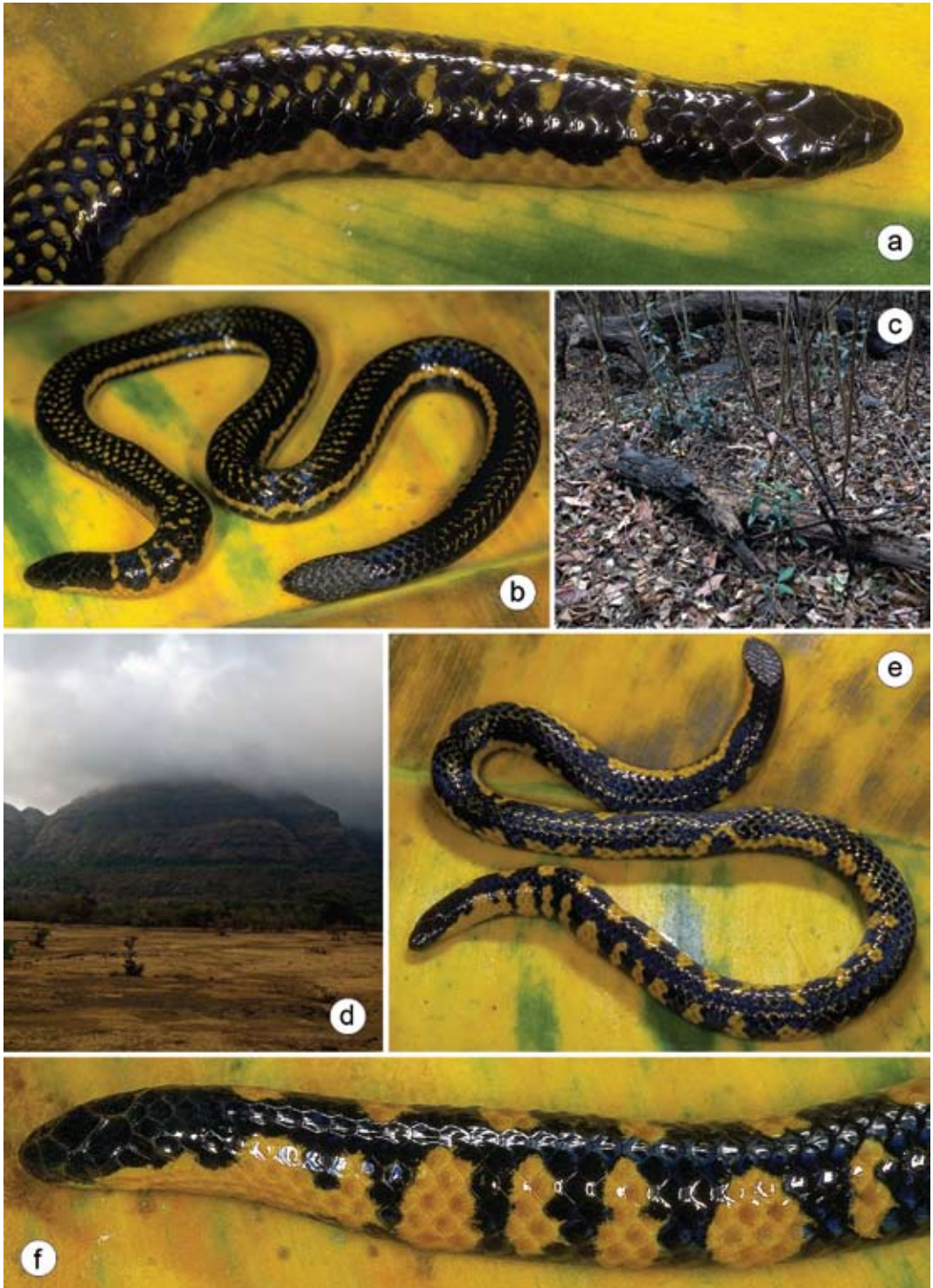


Figure 5. Habitat at Fangul Gawhan, and variation in colour pattern in referred specimens of *Uropeltis bicatenata* (Günther) from this locality: a), b) typical colour pattern for species, as seen in BNHS 3265; c) forest floor in summer (May, dry season); d) hill seen in May; forest in which *U. bicatenata* have been found is seen as a thin green horizon towards lower part of hill; e), f) exceptional colour variant BNHS 3267.

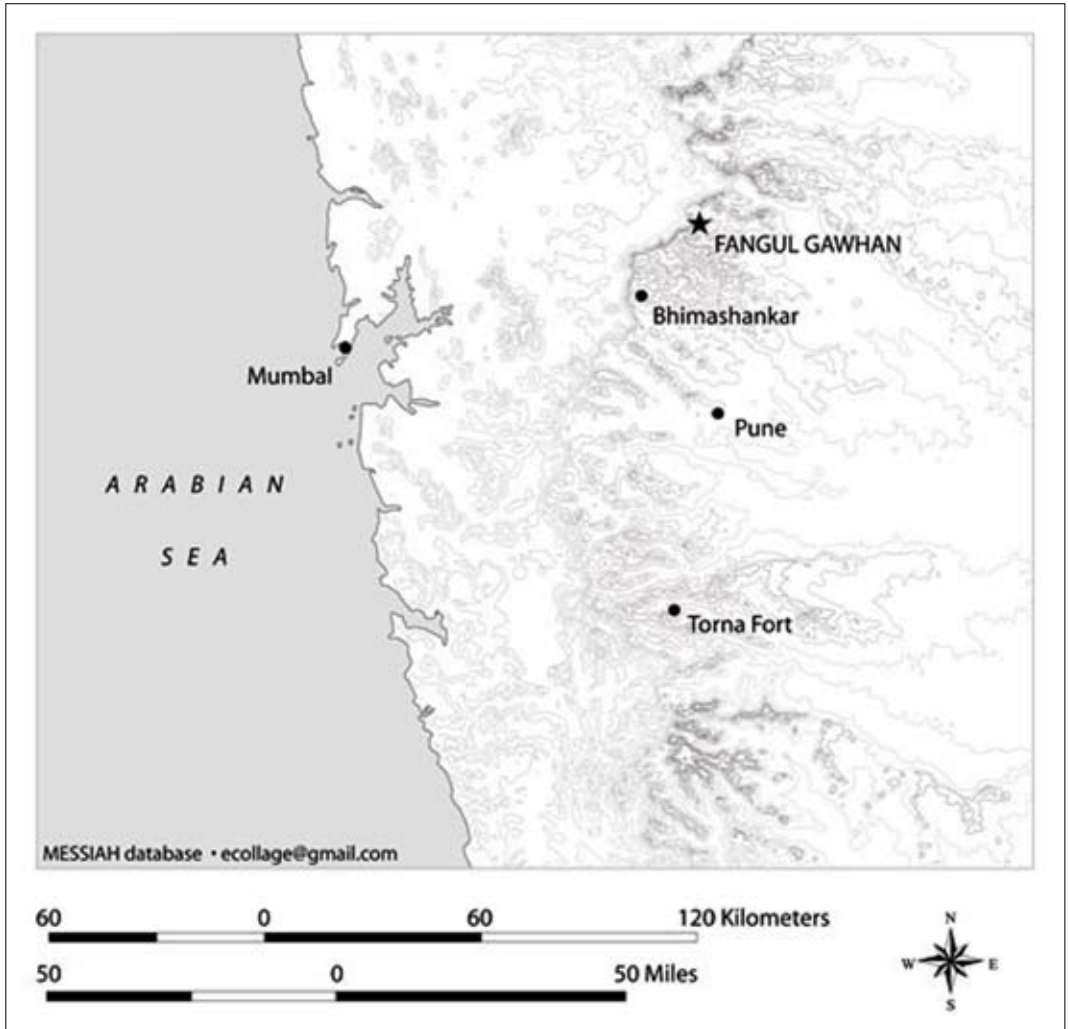


Figure 6. Map showing known (Bhimashankar, Fangul Gawhan) and possible (Torna Fort) localities for *Uropeltis bicatenata* (Günther).

District, Maharashtra (Fig. 6), separated by c. 30 km. Further fieldwork is required to ascertain whether the species occurs at intervening and surrounding localities, and at other altitudes and habitats. The type locality of “Deccan” is imprecise but can be considered to include the two known localities, which lie in the higher altitudes of the Ghats at this part of their range, at the western edge of the Deccan plateau. In addition to the two known localities, a superficially similar (in colour and pholidosis), potentially conspecific form has been seen (but not collected) at the more southerly locality of Torna (c. 40 km south-west of Pune), Pune District, Maharashtra (Fig. 6).

The specimens from Fangul Gawhan (Fig. 5c, d) were found under a log in secondary semi-evergreen forest: 10–15 m tall with 70% canopy (19°15'11"N, 73°42'27"E, 803 m asl), a short distance from the village (19°15'55"N, 73°43'02"E, 740 m asl). Vegetation in the immediate vicinity of the collection site included *Mallotus philippensis*, *Albizia amara*, *Ficus racemosa*, *Atalantia racemosa*, *Carvia callosa*, *Olea dioica*, *Mangifera indica*, *Pittosporum dasycaulon*; *Piper* sp. and *Memycylon umbellatum*.

In addition to the recently collected material, several other sightings of *Uropeltis bicatenata* have been made inside the protected area (130 km²) of Bhimashankar Wildlife Sanctuary (cen-

trally 19°14'N, 73°35'E; 650–1,140 m asl) (AC, SST, pers. obs.; I. Agarwal, S. Kehimkar, pers. comm.). The species can be seen occasionally on roads (including roadkills), and in and near waste heaps, but little is known about tolerance to habitat disturbance. The site at Fangul Gawhan is not officially protected, but the Forest Department has attempted to get local people to prevent further degradation of the forest. Although there is no indication that the species is currently threatened, we suggest that it is recognised as data deficient based on IUCN criteria pending further, especially distributional data.

Uropeltis bicatenata is closer in appearance and ground colour to *U. m. macrolepis*, which has 15 midbody scale rows, than it is to *U. phipsonii*, which like *U. bicatenata*, has 17 scale rows. All three species as (as presently understood) are found in the Bombay Ghats/ Hills. More work is required to determine if any of these species are sympatric.

Suggested common name.— We prefer “Bicatenate *Uropeltis*” or “Two-chained *Uropeltis*”. We assume *bicatenata* to stem from the Latin *catena*, meaning chain—this perhaps in reference to the superficially chain-link-like lateral stripes that are formed by rounded-zigzag lines, or alternatively to the arms of the Vs on the dorsal surface of the body, although this seems less likely given that these markings are more complete Vs and less herringbone (\ /) like in the only specimen available to Günther. *Uropeltis* translates as shield-tail, from the Greek and Latin *pelte* for small shield, and the Greek *oura* for tail. However, “shieldtail” is widely used to refer to uropeltids as a whole, rather than *Uropeltis* (e.g., Whitaker and Captain, 2004; Das and de Silva, 2005), and we suggest it is best avoided as a common name for members of the genus.

DISCUSSION

Uropeltis bicatenata is a valid species. That it remained hidden in the synonymy of *U. ceylanica* for more than 100 years, with the second known specimen being referred to a third species (*U. rubrolineata*) by one of the foremost workers in the field (M. A. Smith) illustrates the inadequate state of the taxonomy of uropeltids, especially *Uropeltis*. It is our belief that *Uropeltis* is taxonomically extremely poorly understood, and in

need of substantial revision. This should ideally be based on investigation of a wider range of characters for type, historical, and newly collected material. The latter is needed in many cases to establish distributions because locality data of type and referred material is often imprecise. Newly collected material would also enable taxonomic hypotheses to be more readily tested with DNA sequence data.

Previously, the taxonomy of uropeltids has been founded on a small set of characters, mostly colour, size, number of ventral and subcaudal scales, the relative size of the eye and ventrals, the form of the tail tip, size of the rostral scale, and snout shape. Some of these have been dealt with in a confusing manner. For example, terms previously used to describe snout shape (some of which are used in diagnoses and keys) include obtusely pointed, acutely pointed, pointed and rounded. Sometimes different terms have been applied to the same species—the snout of *U. macrolepis* has been described as both “rounded” (Smith, 1943) and obtusely conical” (Günther, 1864). Characters describing the size of the eye relative to the ocular, and the ventral scale width relative to adjacent dorsal rows have been imprecise, with little or no raw data or exact proportions presented. Our study has highlighted the potential utility of several previously un- or underexploited character systems for *Uropeltis* systematics. Although further work is required to further test this potential, these characters include tooth counts, the number of keeled shield scales, and morphometrics (Tables 1, 2). Investigating new characters as part of future work will be an important component of the much needed revision of uropeltid taxonomy.

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