

Four new species of Reed Snake from Peninsular Malaysia (Serpentes: Colubridae: Calamariinae).

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ABSTRACT

Divergent populations of Reed Snakes within the snake subfamily Calamariinae are formally identified and named as new species. All are from Peninsular Malaysia in south-east Asia.

The new species are two from the genus *Macrocalamus* Günther, 1864, closely related to *M. chanardi* David and Pauwels, 2004, one from the genus *Oreocalamus* Boulenger, 1899 and one from the genus *Collorhabdium* Smedley, 1932.

Formally identifying each form as a new species is the critically important first step in their long-term conservation in the face of unprecedented threats caused by ongoing human population growth.

Keywords: Herpetology; snake; Malaysia; Calamariinae; Asia; *Macrocalamus*; *Oreocalamus*; *Collorhabdium*; new species; *wellsei*; *wellingtoni*; *daranini*; *turneri*.

INTRODUCTION

The diminutive Reed Snakes within the snake subfamily Calamariinae are easily overlooked components of ecosystems in south-east Asia.

Most species are known from relatively few specimens and almost all appear to be range restricted in the Sundaland region of south-east Asia.

A number of taxonomic studies have indicated forms of putative species that may in fact be of hitherto unnamed taxa.

These studies were revisited with reference to relevant specimens and studies of other similarly geographically constrained species in order to ascertain or confirm that there were potentially unnamed species.

Four potentially unnamed species, for which no synonym names were available were examined.

These were two from the genus *Macrocalamus* Günther, 1864, closely related to *M. chanardi* David and Pauwels, 2004, one from the genus *Oreocalamus* Boulenger, 1899 and one from the genus *Collorhabdium* Smedley, 1932. Both latter genera have until now been treated as monotypic.

This paper is written as a result of this review determining that there are in fact four different taxa worthy of species level recognition.

MATERIALS AND METHODS

All relevant and available specimens and literature was inspected. This includes with particular reference to the original type material and associated descriptions of the relevant putative species.

Specimens from all known areas that putative *Macrocalamus chanardi* David and Pauwels, 2004, Gray, 1842, *Oreocalamus hanitschi* Boulenger, 1899 and *Collorhabdium williamsoni* Smedley, 1932 were audited to attempt to find consistent

species-level differences between sampled populations.

Of particular relevance to this review, were phylogenetic and morphological studies of reptiles that helped identify biogeographical barriers for species similarly eco-constrained as these species as well as geological studies that helped identify potential barriers to dispersion of populations.

Included in the audit were photos of specimens with good locality data and distribution maps from State Museums, based on specimens in their collections.

Where available and applicable, fossil specimens and records were also reviewed.

Past descriptions and synonymies were reviewed with a view to using available names for species groups if they had been properly proposed in the past but in the case of the relevant taxa subject of this paper, no names were available.

Publications relevant to the taxonomic and nomenclatural conclusions in terms of the putative new species including all known synonyms, and specifically relevant to the taxonomic decisions in terms of the newly named forms include the following: Boo Liat (1963), Boulenger (1894, 1896, 1899, 1912), Chan-ard *et al.* (1999, 2015), Cox *et al.* (1998), Das (2012), Das and Lim (2001), David and Pauwels (2004), Duméril *et al.* (1854), Grandison (1972, 1978), Gumprecht (2000), Günther (1864), Hoser (2012), Malkmus *et al.* (2002), Manthey (1983), Manthey and Grossmann (1997), Quah *et al.* (2019), Ride *et al.* (1999), Smedley (1931, 1932), Smith (1930), Tweedie (1940, 1953), Vogel and David (1999), Vogel and Han-Yuen (2010), Yaakob and Lim (2002) and sources cited therein.

RESULTS

As already stated in the abstract, four hitherto unnamed forms had been identified as potentially unnamed taxa.

This was confirmed after inspection of specimens (via good

quality photos made available to me) and a review of the relevant literature.

Hence the four relevant species are formally named in accordance with the rules of the *International Code of Zoological Nomenclature* (Ride *et al.* 1999).

These are as follows: Two species are from the genus *Macrocalamus* Günther, 1864, being closely related to *M. chanardi* David and Pauwels, 2004.

The two species are from elevated areas of Peninsular Malaysia.

Another species, also from Peninsula Malaysia is from the genus *Oreocalamus* Boulenger, 1899, which until now has been treated as monotypic for the putative species *O. hanitschi* Boulenger, 1899 from Borneo.

The fourth newly named species is one that until now was treated as a population of the taxon

Collorhabdium williamsoni Smedley, 1932, but is sufficiently divergent to warrant being named as a separate species-level taxon. It is also from Peninsular Malaysia.

INFORMATION RELEVANT TO THE FORMAL DESCRIPTIONS THAT FOLLOW

There is no conflict of interest in terms of this paper or the conclusions arrived at herein.

Several people including anonymous peer reviewers who revised the manuscript prior to publication are also thanked as are relevant staff at museums who made specimens and records available in line with international obligations.

In terms of the following formal descriptions, spelling should not be altered in any way for any purpose unless expressly and exclusively called for by the rules governing Zoological Nomenclature as administered by the International Commission of Zoological Nomenclature (ICZN).

Material downloaded from the internet and cited anywhere in this paper was downloaded and checked most recently as of 30 June 2020 (including if also viewed prior), unless otherwise stated and was accurate in terms of the content cited herein as of that date.

Unless otherwise stated explicitly, colour and other descriptions apply to living adult specimens of generally good health and not under any form of stress by means such as excessive cool, heat, dehydration or abnormal skin or reaction to chemical or other input.

While numerous texts and references were consulted prior to publication of this paper, the criteria used to separate the relevant species has already been spelt out and/or is done so within the formal description and does not rely on material within publications not explicitly cited herein.

CONSERVATION

In terms of conservation of these newly described species, the relevant comments in Hoser (1989, 1991, 1993, 1995b, 1996, 2019a and 2019b) apply.

Wildlife laws as currently enforced in Malaysia are not in a materially significant way enhancing the long-term survival prospects of the relevant species.

Over breeding of humans and the environmental problems associated with this overpopulation are by far the greatest long term threat to the relevant species, noting that already liberated feral pest species continue to cause ongoing stress and decline of similar species as explicitly detailed in Hoser (1991).

MACROCALAMUS WELLSEI SP. NOV.

LSIDURN:LSID:ZOOBANK.ORG:ACT:52315894-EDA6-4587-9FF0-E23AFD97FD9B

Holotype: A preserved male specimen at the University Sains Malaysia Herpetological Collection, Penang, Malaysia, specimen number USMHC 1960 collected at Habu, Cameron Highlands, Pahang, Malaysia, Latitude 4.4401 N., Longitude 101.3913 E. This facility allows access to its holdings.

Paratype: A preserved female specimen at the Sierra University Herpetological Collection, La Sierra University, Riverside, CA, USA, specimen number LSUHC 11685 collected at Robinson Falls, Cameron Highlands, Pahang, Malaysia, Latitude 4.4608 N., Longitude 101.3881 E.

Diagnosis: Until now, both *Macrocalamus wellsei* sp. nov. and *M. wellingtoni* sp. nov. have been treated as southern populations of *M. chanardi* David and Pauwels, 2005, with a type locality of Bukit Larut, Perak, West Malaysia. That species taxon is found from there at least as far north as Gunung Jerai, Kedah, West Malaysia.

All three species are readily separated from all other previously named and identified species of *Macrocalamus* Günther, 1864 by the following unique suite of characters: Dorsum pale to dark brown, reddish brown or greyish brown, never black. Bright yellow dorsolateral stripes absent; two rows of light, dark-edged dorsolateral ocelli; a single, dark, ventrolateral stripe present (never two stripes); venter mid-way along body is orange, pink or coral (light pink) and immaculate; loreal is present.

Most similar to these species is *M. vogeli* David and Pauwels, 2005 but that species is readily separated from all of *M. wellsei* sp. nov., *M. wellingtoni* sp. nov. and *M. chanardi* by having a venter that is heavily speckled with brownish black (instead of being immaculate as seen in the other three species).

M. wellsei sp. nov., *M. wellingtoni* sp. nov. and *M. chanardi* are readily separated from one another as follows:

In *M. chanardi*, the venter is strongly yellow at the anterior end (including the chin and upper neck), grading through orange midway to red under the tail, separating this species from the other two. *M. wellsei* sp. nov. and *M. wellingtoni* sp. nov. are white under the chin and upper neck before quickly grading through orange on the lower neck to red under the belly and tail.

M. wellsei sp. nov. are separated from the other two species by having two well defined rows of light brown spots forming lines running longitudinally down the upper dorsum to the base of the tail, versus absent or ill defined in the other two species or if well defined, this being so only at the anterior end of the body.

Both *M. wellsei* sp. nov. and *M. wellingtoni* sp. nov. have a wide and well-defined light streak running from the back of the eye to the neck, versus ill defined and not touching the eye in *M. chanardi*.

Dorsally, *M. wellsei* sp. nov. is blackish brown in colour, versus dark brown in the other two species.

The genus *Macrocalamus* Günther, 1864 is separated from other snakes by the following unique suite of characters: A colubrid snake genus characterized by: A cylindrical body, a head triangular, depressed, barely distinct from a thick neck with tapered preocular region and snout, 15 smooth dorsal scale rows, without apical pits throughout the body, internasals fused with prefrontals and a very elongate loreal. Rostral higher than broad, triangular, well visible from above, totally separating the nasals from each other and contacting the prefrontals that are significantly notched by the rostral

on their anterior margin; internasals fused with prefrontals; nasals entire, rather small, roughly pentagonal; nostril piercing shield between the lower margin of the nasal and the upper margin of the first supralabial; one pair of large prefrontals, followed by a hexagonal, elongated frontal, pointing caudally, that is located between one undivided supraocular on each side; a very large parietal separated from the seventh supralabial by the anterior temporal; one elongated loreal between the nasal and the preocular; 7 or 8 supralabials, first very small, second and third always in contact with the loreal, fourth and fifth always entering the orbit; one (rarely 2) preocular, one postocular; no subocular; 1 squarish anterior temporal and 2 superposed posterior temporals, the superior one much longer than inferior; 7 lower labials.

Distribution: *M. wellsei* sp. nov. appears to be restricted to the Cameron Highlands, Pahang, Malaysia. North of this region one

finds *M. chanardi* and south of here one finds *M. wellingtoni sp. nov.* (from Fraser's Hill and Genting Highlands).

Etymology: The new species *M. wellsei sp. nov.* is named in honour of Richard Wells of Lismore, New South Wales, Australia in recognition of his many major contributions to the taxonomy and nomenclature of Australian reptiles, including the historical publication Wells and Wellington (1985). The formation of this scientific name is deliberate, as Richard Wells is often referred to as "Wellse", "Wellsei", or "Wellsey" and therefore it should not be changed.

MACROCALAMUS WELLINGTONI SP. NOV.

LSIDURN:LSID:ZOOBANK.ORG:ACT:E3274F48-829F-4933-9D7A-EABD37479B33

Holotype: A preserved adult female specimen at the University Sains Malaysia Herpetological Collection, Penang, Malaysia, specimen number USMHC 1540 from Fraser's Hill, Pahang, Malaysia, Latitude 3.7119 N., Longitude 101.7366 E.

Paratype: A preserved juvenile specimen at the University Sains Malaysia Herpetological Collection, Penang, Malaysia, specimen number USMHC 1523 from Fraser's Hill, Pahang, Malaysia, Latitude 3.7119 N., Longitude 101.7366 E.

Diagnosis: Until now, both *Macrocalamus wellingtoni sp. nov.* and *M. wellsei sp. nov.* have been treated as southern populations of *M. chanardi* David and Pauwels, 2005, with a type locality of Bukit Larut, Perak, West Malaysia. That species taxon is found from there at least as far north as Gunung Jerai, Kedah, West Malaysia.

All three species are readily separated from all other previously named and identified species of *Macrocalamus* Günther, 1864 by the following unique suite of characters: Dorsum pale to dark brown, reddish brown or greyish brown, never black. Bright yellow dorsolateral stripes absent; two rows of light, dark-edged dorsolateral ocelli; a single, dark, ventrolateral stripe present (never two stripes); venter mid-way along body is orange, pink or coral (light pink) and immaculate; loreal is present.

Most similar to these species is *M. vogeli* David and Pauwels, 2005 but that species is readily separated from all of *M. wellsei sp. nov.*, *M. wellingtoni sp. nov.* and *M. chanardi* by having a venter that is heavily speckled with brownish black (instead of being immaculate as seen in the other three species).

M. wellsei sp. nov., *M. wellingtoni sp. nov.* and *M. chanardi* are readily separated from one another as follows:

In *M. chanardi*, the venter is strongly yellow at the anterior end (including the chin and upper neck), grading through orange midway to red under the tail, separating this species from the other two. *M. wellsei sp. nov.* and *M. wellingtoni sp. nov.* are white under the chin and upper neck before quickly grading through orange on the lower neck to red under the belly and tail.

M. wellsei sp. nov. are separated from the other two species by having two well defined rows of light brown spots forming lines running longitudinally down the upper dorsum to the base of the tail, versus absent or ill defined in the other two species or if well defined, this being so only at the anterior end of the body.

Both *M. wellsei sp. nov.* and *M. wellingtoni sp. nov.* have a wide and well-defined light streak running from the back of the eye to the neck, versus ill defined and not touching the eye in *M. chanardi*.

Dorsally, *M. wellsei sp. nov.* is blackish brown in colour, versus dark brown in the other two species.

The genus *Macrocalamus* Günther, 1864 is separated from other snakes by the following unique suite of characters: A colubrid snake genus characterized by: a cylindrical body, a head triangular, depressed, barely distinct from a thick neck with tapered preocular region and snout, 15 smooth dorsal scale rows, without apical pits throughout the body, internasals fused with prefrontals and a very elongate loreal. Rostral higher than broad, triangular, well visible from above, totally separating the nasals from each other and contacting the prefrontals that are significantly notched by the rostral

on their anterior margin; internasals fused with prefrontals; nasals entire, rather small, roughly pentagonal; nostril piercing shield between the lower margin of the nasal and the upper margin of the first supralabial; one pair of large prefrontals, followed by a hexagonal, elongated frontal, pointing caudally, that is located between one undivided supraocular on each side; a very large parietal separated from the seventh supralabial by the anterior temporal; one elongated loreal between the nasal and the preocular; 7 or 8 supralabials, first very small, second and third always in contact with the loreal, fourth and fifth always entering the orbit; one (rarely 2) preocular, one postocular; no subocular; 1 squarish anterior temporal and 2 superposed posterior temporals, the superior one much longer than inferior; 7 lower labials.

Distribution: *M. wellingtoni sp. nov.* occurs in the region from Fraser's Hill and Genting Highlands in Pahang, Malaysia. *M. wellsei sp. nov.* appears to be restricted to the Cameron Highlands, Pahang, Malaysia. North of this region one finds *M. chanardi*.

Etymology: Named in honour of Cliff Ross Wellington of Ramornie, New South Wales, Australia in recognition of his many major contributions to the taxonomy and nomenclature of Australian reptiles, including the historical publication Wells and Wellington (1985), as well as his services for wild life in Thailand and other parts of south east Asia, including many excursions in Thai bush.

COLLORHABDIUM DARANINI SP. NOV.

LSIDURN:LSID:ZOOBANK.ORG:ACT:34C8E055-53D9-4474-AD53-47CE87381297

Holotype: A preserved specimen at the La Sierra University Herpetological Collection, La Sierra University, Riverside, CA, USA, specimen number LSUHC 12753 collected from Genting Highlands, Pahang, Malaysia, Latitude 3.4240 N., Longitude 101.7932 E.

Diagnosis: *Collorhabdium daranini sp. nov.* has until now been treated as a southern population of *C. williamsoni* Smedley, 1932, being previously monotypic for the genus.

Collorhabdium williamsoni from the Cameron Highlands, Pahang, Malaysia, is readily separated from *C. daranini sp. nov.* from Genting Highlands, Pahang, Malaysia by having seven clearly visible longitudinal black lines running down the body, versus none or indistinct in *C. daranini sp. nov.* as well as a large yellow spot on either side of the neck at the back of the head, versus absent in *C. daranini sp. nov.*

Both species, being the entirety of the genus *Collorhabdium* Smedley, 1932 are readily separated from all other Calamariinae by the following unique suite of characters: Head not distinct from the neck, eye small; pupil round; nostril between a very small anterior and very large posterior nasal; prefrontal not entering the eye; preocular and temporals absent. 9 maxillary teeth, anterior ones slightly larger. Posterior mandibular teeth are shorter. Body is rounded and covered with smooth scales without apical pits. 15 mid-body rows, rounded ventrals. Short tail, pointed and all divided subcaudals. Snout obtusely pointed, projecting, rostral is visible from above and large; suture between internasals is either equal to, or slightly longer than broad, being longer than the distance from the tip of the snout, shorter than parietals, more than twice as broad as the supraocular. Preocular is large; a single postocular; no temporals; five upper labials; third and fourth entering the eye; first lower labial in contact with next behind the mental. Anterior sublinguals much longer than the posterior, in contact with 3 or 4 lower labials. 14 mid body rows, 144-152 ventrals in males (161 in a female) anal entire, 30-32 subcaudals in males and 22 recorded in a female.

Brownish, greyish or blackish above. The head has indistinct yellow markings and there may or may not be a distinctive large yellow spot on either side of the neck at the back of the head. There may or may not be seven longitudinal lines running the length of the body. Venter is white, with the dorsal colouration

extending on to the outer edges of the ventrals, and further in under the anal plate. Chin and throat speckled with darker pigment. Up to about 30 cm in adult length.

Distribution: *Collorhabdium daranini* sp. nov. is known only definitively from the Genting Highlands, Pahang, Malaysia, but presumably also occurs as far north as Fraser's Hill, Pahang, Malaysia. *C. williamsoni* Smedley, 1932 occurs in the Cameron Highlands, Pahang, Malaysia.

Etymology: *Collorhabdium daranini* sp. nov. is named in honour of Dara Nin of Ringwood, Victoria, Australia, who for many years has worked with Snakebusters: Australia's best reptiles shows educating people about wildlife and conservation with Australia's only hands on reptile shows that let people handle the animals.

OREOCALAMUS TURNERI SP. NOV.

LSIDurn:lsid:zoobank.org:act:D2FB6679-B8AB-45A1-8158-8480CCB269AD

Holotype: A preserved specimen at the The Field Museum of Natural History, Chicago, Illinois, 60605, USA, specimen number: FMNH Amphibians and Reptiles 130994, collected from Mt. Batu Berinchang (AKA Mount Batu Brinchang), in the Cameron Highlands, Pahang, Malaysia, Latitude 4.5175 N., Longitude 101.3825 E. This facility allows access to its holdings.

Diagnosis: *Oreocalamus turneri* sp. nov. from Peninsula Malaysia has until now been treated as an outlier population of *Oreocalamus hanitschi* Boulenger, 1899 from northern Borneo. However it is readily separated from that species by the frontal not being quite as deep as wide (versus as deep as wide in *O. hanitschi*) and the absence of the reddish tinge seen in the dorsal colouration of live *O. hanitschi*. *O. turneri* sp. nov. also has a yellowish venter versus orangeish in *O. hanitschi*.

Both species are similar in most respects to species within *Macrocalamus* Günther, 1864, which they would otherwise key out as, but can be separated from *Macrocalamus* as described in this paper (see latter part of description of *M. wellsei* sp. nov. or *M. wellingtoni* sp. nov.), by the presence of a pair of internasal shields (versus not so in *Macrocalamus*) and the presence of 17 dorsal mid body scale rows.

Oreocalamus has no tracheal lung and the first upper labial may either be distinct or united to the nasal. *Oreocalamus hanitschi* is defined in detail in Boulenger (1899).

Distribution: *Oreocalamus turneri* sp. nov. is known only from the type locality in Peninsula Malaysia.

Etymology: *O. turneri* sp. nov. is named in honour of Grant Turner, originally of Bundoora, (Melbourne) Victoria, Australia, but more recently of Queensland, Australia, in recognition of his many contributions to herpetology in Australia, in particular with reference to his many years of intensive fieldwork on the reptiles and frogs of the Basalt Plains on Melbourne's northern outskirts. As of 2020 this important habitat has been almost wholly destroyed by ongoing residential housing developments in line with Australian government policy of increasing the human population by several orders of magnitude.

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CONFLICTS OF INTEREST

None.

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 Amount: \$ _____
 Card No.: _____
 Name: _____
 Date: _____
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