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A New Species of *Dibamus* (Squamata: Dibamidae) from West Malaysia

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Abstract. - A new lizard of the genus *Dibamus* is described from Pulau Tioman and Pulau Tulai, Pahang, West Malaysia. This species most closely resembles *D. novaeguineae, D. kondaoensis*, *D. leucurus and D. montanus*, but differs from all congeneric species in exhibiting the following combination of characters: postoculars 1, scales bordering first infralabial 4, SVL 123 mm, 25-26 midbody scale rows, frontonasal and rostral sutures complete, and the presence of slightly posteriorly notched cycloid body scales as an adult.

Key words. - *Dibamus, Dibamus tiomanensis*, new species, Dibamidae, Pulau Tioman, West Malaysia.

Introduction

The genus *Dibamus* presently contains 18 species (see Greer, 1985; Darevsky, 1992; Das, 1996; Honda et al., 1997; Ineich, 1999; Honda et al., 2001; Das and Lim, 2003; Das and Yaakob, 2003), a two-fold difference from the detailed review of the group by Greer (1985). Species of the genus *Dibamus* collectively range throughout southeast Asia, from southern China and the Philippines through Indonesia. *Dibamus alfredi* was described by Taylor (1962) from Thailand. *D. alfredi* were later found on the island of Nias, off the west coast of Sumatra (Greer, 1985) and from Danum Valley in Sabah State, Borneo (Tan, 1993; Das and Yaakob, 2003). A large gap was then left between Thailand and Borneo. Lim and Lim (1999) reported *D.* cf. *alfredi* from Pulau Tioman. Upon examination of their specimen, one from Pulau Tioman, and another from P. Tulai, we conclude that these specimens constitute a new species described herein. Pulau Tioman lies between longitudes 104° 7' to 104° 15' E and latitudes 2° 44' to 2° 54' N (Bullock and Medway, 1966). Finding another endemic population on this island provides another reason for its conservation as well as further studying its rich herpetofauna.

Material and Methods

Single females from both Pulau Tulai and Pulau Tioman were collected, fixed in 10% formalin, and preserved in 70% ethanol. Both specimens were deposited in the Zoological Reference Collection (ZRC) at the Raffles Museum of Biodiversity Research. Sliding calipers were used for all length measurements. Terminology used follows Greer (1985) and Honda et al. (1997). Individuals were sexed externally under a dissecting microscope; males were identified by having two small, flap-like limbs (one on each side of the vent) (Duméril and Bibron, 1839).

Taxonomy

Dibamus tiomanensis, new species
Figs. 1, 2

Holotype. - ZRC.2.3410, adult male collected at Kampung Paya, Pulau Tioman, Pahang, West Malaysia (Fig. 2) on 16 September 1995.

Paratypes. - Adult female (ZRC 2.5092) collected along the trail to Bukit Bakau, Pulau Tulai, West Malaysia (Fig. 2) collected 14 July 2001. Juvenile female (ZRC.2.5260) collected along the Tekek-Juara Cross Island Trail, Pulau Tioman, West Malaysia collected 11 July 2001.

Diagnosis. - *Dibamus tiomanensis* differs from all other species of *Dibamus* in having cycloid scales which are slightly notched posteriorly as an adult and flat cycloid light brown dorsal scales with cream borders as a juvenile. It also differs from other *Dibamus* in having the following combination of characters: rostral sutures incomplete; nasal and labial sutures complete; scales bordering posterior edge of first infralabial 4; postocular 1; transverse scale rows just posterior to head 29, at midbody 25, proximally anterior to vent 21; subcaudals 45; snout blunt in lateral profile (Fig. 1; Table 1); presacral vertebrae 124; postsacral vertebrae 23 (Table 3).

Figure 1. Photograph of *Dibamus tiomanensis*, new species, on forest leaf litter.

Description of holotype. - Snout-vent length 92.5 mm; tail length 13.1 mm; midbody diameter 2.5 mm. Snout bluntly rounded; nostril lateral; rostral pad with large number of evenly distributed sensory papillae; rostral sutures incomplete; nasal sutures complete from nostril to ocular; labial sutures complete from anterior part of nasal suture to mouth; frontonasal six times wider than long; frontal approximately 1.05 times wider than frontonasal; interparietal bordered posteriorly by four slightly smaller nuchal scales; postocular one; supralabial one; scales bordering posteromedial edge of first infralabaial four; ear opening absent; eyes dimly visible through ocular; body scales notched posteriorly; transverse scale rows just posterior to head 23, at midbody 25, at just anterior to vent 23; subcaudals 50; tip of tail blunt, not terminating in a spine; hind limb length 2.6 mm.

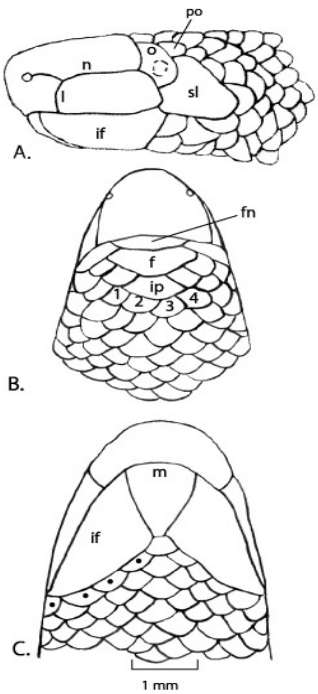

Figure 2. Lateral (A), dorsal (B), and ventral (C) view of head of *Dibamus tiomanensis*, new species. (f: frontal, fn: frontonasal, ip: interparietal, if: first infralabial, l: labial suture, m: mental, n: nasal suture, o: ocular, po: postocular, sl: supralabial)

Description of paratypes. - The paratypes (both females) are similar to the holotype in all aspects except the following: transverse scale rows posterior to head 29, transverse scale rows anterior to vent 21 and 22, and subcaudals 45 and 48.

Variation. - Paratype ZRC.2.5260 is the only juvenile. It shows a possible ontogenetic change in scale morphology. Juveniles have cycloid, flat, and light brown-cream bordered scales. Adults have posteriorly notched brown scales.

Color in life. - Adults have a brown ground color both dorsally and ventrally, except on the snout and jaws which are a lighter shade of brown. Juveniles have a cream-colored snout and jaws which contrast well with the darker spotted sensory papillae and body scales which are light-brown bordered with cream. Manthey and Grossman (1997:205) present a color photograph of the holotype.

Table 1. Comparison of several scale characters and measurements within *Dibamus*. The size of the frontal is measured relative to the frontonasal and the interparietal relative to the surrounding anterior body scales. Sample sizes for postoculars and scales on posterior edge of infralabials are given in parentheses. Entries for midbody scale rows and subcaudal scales are as follows from top to bottom: range, mean, and sample size (modified from Greer, 1985). (*= 1 & 3 refer to 1 scale present on the left infralabial and 3 on right; **=tail regenerated; *** = text in Das and Yaakob (2003) mentions 3 scales bordering the infralabials in diagnosis, whereas 4 scales are mentioned in description of holotype).

Dibamus	Post-oculars	Scales on posterior edge of infralabial	Mid-body scale rows	Subcaudal Scales		Relative size of:		Max. SVL	Tail Length (% of SVL)
				Males	Females	Frontal	Interparietal		
alfredi	2(4)	3(3) 4(1)	20-21 20.3 3	46-47 46.5 2	41-46 43.5 2	1.4-2.0	1.7-2.2	135	17-18
bogadeki	1(1)	2(1)	23 23 1	51 51 1	-	-	-	177**	22.5
booliati	1(2)	3(2)***	20 20 1	-	24-39 31.5 2	-	-	102.7	9.4-13.0
bourreti	1(1)	2(1)	24 24 1	-	52+ 52+ 1	2.3	4.5	151	23+
celebensis	2(10) 3(3)	3(6) 4(7)	26-30 27.4 13	38-40 39.3 3	35-40 38.0 4	1.2-2.3	1.0-2.9	188	10-13
deharvengi	1(1)	2(1)	16 16 1	57 57 1	-	1.3	1.4	92	22.4
greeri	1(3)	1&3(2)*	20 20 1	53 53 1	54 54 1	-	-	86	23-28
ingeri	2(1)	3(1)	20 20 1	36 36 1	-	1.5	1.0	96	14.8
kondaoensis	2(1)	3(1)	23 23 1	59 59 1	-	1.03	1.0	112.4	19.4
leucurus	1(23)	3(21) 4(2)	20-23 21.0 23	48-52 49.5 4	41-47 43.5 4	1.2-4.2	1.0-3.1	136	16-20
montanus	1(2)	2(2)	22 22 2	49 49 1	43 43 1	2.0	2.2	130	15-18
nicobaricum	1(6)	4(6)	23-25 24.6 6	34-38 35.6 3	31-36 34.3 3	-	-	134.7	8.7-18.3
novaeguineae	2(92) 3(2)	3(53) 4(41) 5(1)	22-26 24.5 107	42-45 43.0 6	37-42 39.6 9	1.0-3.0	0.7-2.4	158	9-19
seramensis	4(1)	4(1)	33 33 1	-	40 40 1	0.7	1.2	203	11
smithi	1(1) 2(4)	2(5)	18-19 18.8 5	59 59 1	59-61 60.0 3	1.5-2.3	1.3-2.0	108	21-24

Table 1. Continued.

Dibamus	Post-oculars	Scales on posterior edge of infralabial	Mid-body scale rows	Subcaudal Scales		Relative size of:		Max. SVL	Tail Length (% of SVL)
				Males	Females	Frontal	Interparietal		
somsaki	1(4)	2(4)	18-19 18.5 4	44**-58 51 2	27**-57 42 2	1.1-1.27	1.0-2.16	106	18-24
taylori	3(13) 4(6)	2(2) 3(14) 4(4)	22-28 23.4 22	41-55 48.4 5	41-52 48 7	0.2-1.3	1.0-1.2	169	14-19
tiomanensis	1(3)	4(3)	25-26 25.3 3	50 50 1	45-48 46.5 2	1.2	1.8	123	15-16
vorisi	2(2)	3(2)	20 20 2	33 33 1	11 11 1	1.2	1.0	89.2-90.1	6.1-16.8

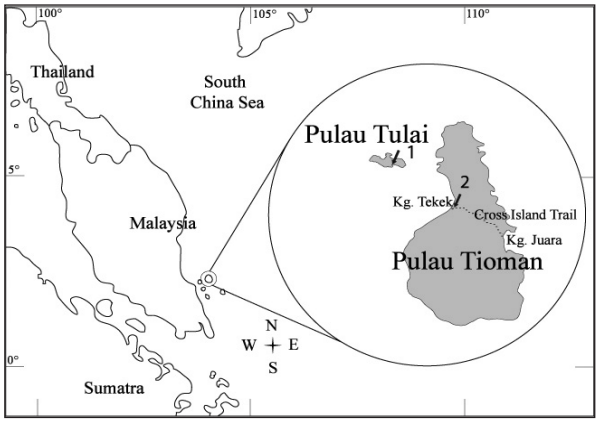

Figure 3. Map of Southeast Asia showing the distribution of known *Dibamus tiomanensis* specimens. (1) Trail to Bukit, Pulau Tulai, (2) Tekek-Juara Cross island trail on Pulau Tioman (from Kg. Tekek to Kg. Juara)

Etymology. - This species is named after the type locality for the holotype (Pulau Tioman = Tioman Island)

Distribution. - Endemic to Pulau Tioman and adjacent Pulau Tulai (Fig. 2).

Comparisons. - *Dibamus tiomanensis* was listed as *D.* cf. *alfredi* owing to its geographic proximity to *D. alfredi*, which occurs in Peninsular Malaysia and Thailand (Manthey and Grossman, 1997; Taylor 1963). The presence of four scales bordering the first infralabial posteriorly differentiates the new species, *Dibamus tiomanensis*, from *D. bogadeki*, *D. booliati*, *D. bourreti*, *D. deharvengi*, *D. greeri*, *D. ingeri*, *D. kondaoensis*, *D. montanus*, *D. smithi*, *D. somsaki*, and *D. vorisi*. In having one post ocular present, *D. tiomanensis* differs from *D. alfredi*, *D. celebensis*, *D. novaeguineae*, *D. seramensis*, and *D. taylori*. From the remaining two congeners, *D.*

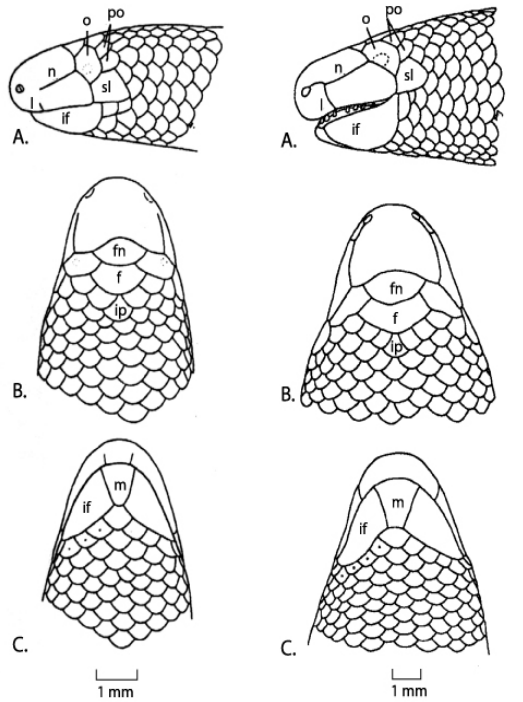

Figure 4. Lateral (A), dorsal (B), and ventral (C) view of heads of *Dibamus alfredi* (left) and *Dibamus novaeguineae* (right). Figures from Greer (1985). [f: frontal, fn: frontonasal, ip: interparietal, if: first infralabial, l: labial suture, m: mental, n: nasal suture, o: ocular, po: postocular, sl: supralabial]

tiomanensis differs from *D. montanus* Smith, 1921 (Langbian Plateau, Vietnam) in having more pre-sacral vertebrae (124 vs. 112-114) and *D. leucurus* (Bleeker, 1860) (Sumatra, Borneo) in the presence of slightly posteriorly notched cycloid scales as an adult.

Table 2. Matrix of diagnostic characters and their states for species of *Dibamus* (modified from Greer, 1985).

Dibamus	Rostral suture complete and separate (+), complete and meeting (-), incomplete (0) or absent (1)	Nasal suture complete (+), reduced (-), or absent	Labial suture complete (+), incomplete dorsally to varying degrees (-), or absent (0)	First infralabial surrounded by 1(+), 2 (-), 3(0), 4(1), or 5(2) scales	No. of post ocular scales 1(+), 2(-), 3(0), or 4(1)	Body scales cycloid (+) or cycloid and slightly knotched posteriorly (-) in adults
alfredi	0	-	-	0,1	-	+
bogadeki	0	+	+	-	+	+
booliati	1	-	+	-	+	+
bourreti	+	+	0	-	+	+
celebensis	0	+	+	0,1	-,0	+
deharvengi	-	+	+	-	+	+
greeri	0	-	+	0*	+	+
ingeri	0	+	+	0	-	+
kondaoensis	0	+	+	0	-	+
leucurus	0	-	+	0,1	+	+
montanus	-	+	+	0	+	+
nicobaricum	+	+	+	1	+	+
novaeguineae	0	+	+	0,1,2	-,0	+
seramensis	0	+	+	1	1	+
smithi	0	-	0	-	+,-	+
somsaki	-	+	+	-	+	+
taylori	0	+	+	-,0,1	0,1	+
tiomanensis	0	+	+	1	+	-
vorisi	0	+	0	0	-	+

* = See Table 1 for information on this character state.

D. nicobaricum is included in this study following Das' (1996) redescription and reevaluation of the species (in which it is inaccurately referred to as *D. nicobaricus* through parts of the paper) despite Honda et al. (2001) avoidance of it's recognition as a nominate species.

Great difficulty arises in finding specimens of Dibamus for study due to their fossorial lifestyle. As a result, many descriptions are based on 2-5 individuals. An unusually large collection of *D. novaeguineae* from Mt. Canlaon, Negros Island, Philippines (Greer, 1985:150) has given a unique insight to how variable morphological characters can be within a single population (See Table 1). Further studies are needed in studying variation within this family as slight character state variances have warranted the recognition of new species [See Das and Lim (2003), Das and Yaakob (2003), and this paper] which may prove to be a variant of an already described taxon.

Table 3. Sacral vertebrae count of described species of *Dibamus*.

Dibamus	Sacral vertebrae	
	pre-sacral	post-sacral
alfredi	116-126	22-26
bogadeki	134	25
booliati	113-120	11-25
bourreti	115-129	12-40+
celebensis	117-132	17-22
deharvengi	120	36
greeri	96-111	28-31
ingeri	97	21
kondaoensis	140	33
leucurus	106-135	21-28
montanus	112-114	24-27
nicobaricum	124	23
novaeguineae	109-125	18-24
seramensis	130	18
smithi	130-137	30-34
somsaki	119	31
taylori	112-135	21-29
tiomanensis	124	23
vorisi	97	20

Natural History

The holotype was found under a large stone in Kampung Paya, Pulau Tioman. ZRC 2.5092 was found beneath leaf litter in loose dirt adjacent to a large rock and bamboo stands in secondary forest along the trail to Bukit Bakau on Pulau Tulai at 20 m elevation. ZRC.2.5260 was found beneath a decaying log one meter from the cross-island trail in primary forest on Pulau Tioman.

Adult *Dibamus tiomanensis* displayed a behavior most likely intended to ward off a predator. When picked up or startled, the body scales flare up at an angle almost perpendicular to the body. When viewed, the smooth surface appears rugose, resembling the bristle-covered epidermis of an earthworm. It is possible that a non-palatable species of worm exists in the same area and has served as a model for *D. tiomanensis* to mimic. Darevsky (1992) mentions that *D. greeri* has bright blue rings on its body, perhaps mimicking a megascolicid worm inhabiting the same leaf litter. Such mimicking behavior was also recently reported in *D. booliati* (Das and Yaakob, 2003).

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