

**NOTES ON THE FIRE-LIPPED KEELBACK *Rhabdophis murudensis*
(SMITH, 1925) (OPHIDIA : COLUBRIDAE: NATRICINAE)
FROM NORTHERN BORNEO**

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ABSTRACT - Four members of the genus *Rhabdophis* (Natricinae) occur in Borneo. *Rhabdophis murudensis* is a montane species first described from Mt. Murud in Sarawak, Malaysian Borneo, and is one of the least known of the Southeast Asian natricines. After its description early in the 20th century, no specimens were collected for almost 60 years. Beginning in the 1980s, several were observed from Mt. Kinabalu, Sabah. A more detailed description of the species, as well as a short discussion of aspects of its ecology and behaviour are presented, with specific reference to behaviour relating to the snake's venomous dorso-nuchal glands.

KEY WORDS. - *Rhabdophis, murudensis*, Natricinae, Mt. Kinabalu, Sabah, nuchal glands.

INTRODUCTION

Four species from the genus *Rhabdophis* Fitzinger, 1843 (Natricinae) occur in Borneo, including *R. chrysargos* (Schlegel, 1837), *R. conspicillatus* (Schmidt, 1925), *R. murudensis* (Smith, 1925) and *R. subminiatus* (Schlegel, 1837). The Kalimantan record of *R. subminiatus* mentioned in Stuebing's (1991) checklist is based on a single specimen record from "S.E Borneo" (De Rooij, 1917). This species has also been recorded from Sumatra (David & Vogel, 1996). One of the natricines, *R. chrysargos*, is widely distributed from continental Asia through Sundaland (Tweedie, 1983; Karsen et al., 1998). *R. conspicillatus* has been found in Borneo and Peninsular Malaysia. *R. murudensis* is so far known only from northeastern Sarawak and Sabah, in Malaysian Borneo (Stuebing, 1994; Stuebing & Inger, 1999a).

Rhabdophis murudensis, formerly *Natrix murudensis* (revised by Malnate, 1960), was originally described by Smith (1925) who stated that it closely resembled *R. chrysargos* Schlegel. It differs from the latter in possessing fewer maxillary teeth and in having a single anterior temporal shield. The first two specimens were collected at approximately 1700-2100m from Mt. Murud in northern Sarawak, by Dr. Eric Mjöberg (Smith, 1925). In 1929, F. N. Chasen

and H. M. Pendlebury obtained two more specimens of *R. murudensis* at elevations of approximately 2200 and 2500m at "Kamborangoh", near the current radio relay station above Kinabalu Park Headquarters. They obtained a third specimen from Kiau at 915m on the lower east slope of Mt. Kinabalu. At about the same time, a sixth specimen was collected on Mt. Trus Madi, Sabah, by R. Audy. Another *R. murudensis* was collected in the late 1970s at 1800m on Mt. Mulu during the Royal Geographic Society's Gunung Mulu Expedition, though no further information on the specimen was ever published (Anderson et al., 1982). In Borneo the four species have overlapping but still distinctive altitudinal distributions: *R. conspicillatus* occurs from about 100 to 1,000m.; *R. chrysargos* from 100 to 1500m; *R. murudensis* from 915 to 2500m, and *R. subminiatus* from sea level -1100m (David & Vogel, 1996).

In the mid 1980s, an employee of the Kinabalu Park captured a live *Rhabdophis murudensis*, in the Kinabalu Park Headquarters compound, 1600m. At that time, it was misidentified as *Rhabdophis chrysargos*, and reared in a terrarium, from which it escaped several years later. Fortunately it was photographed in 1989. In 1992, a dead specimen of the same identity was collected along the road near Kinabalu Park Headquarters (approx. 1600m) and on

this occasion misidentified as *Rhabdophis subminiatus*.

While working on Bornean snakes at The Field Museum, Chicago, in 1998, we received a specimen shipped for identification by Sabah Musuem, Kota Kinabalu. It was examined and compared with the slide of the live "*R. chrysargos*." We were interested to discovered that both snakes were in fact *Rhabdophis murudensis*, a species collected for only the second time in almost 50 years (Stuebing & Inger, 1999b). In this paper, we give data on scale characters and more information on several inconspicuous characters, the nuchal groove and associated glands.

MATERIALS AND METHODS

Material examined – All from Sabah, Malaysia (Table 1). Zoological Reference Collection, Raffles Museum of Biodiversity Research, National University of Singapore: Male ZRC 2.4162, Kamborangoh, Mt. Kinabalu; Female ZRC 2.4163, Kiau, Mt. Kinabalu; Female ZRC 2.4164, Mt. Trus Madi; Sabah Parks Zoological Collection, Kinabalu Park, Sabah, Malaysia: SP 04091, Headquarters Area, Kinabalu Park; Sabah Museum, Kota Kinabalu, Sabah, Malaysia: SSM REP 0326, Mt. Kinabalu.

Abbreviations of collections – MAS, Malcolm A. Smith; SP, Sabah Parks, Kinabalu Park, Sabah; SSM, Sabah State Museum, Kota Kinabalu, Sabah; ZRC, Zoological Reference Collection of the Raffles Museum of Biodiversity Research, National University of Singapore, Singapore.

TAXONOMY

Rhabdophis murudensis (Smith, 1925)

(Fig. 1)

Description – Smith (1925) wrote the following account of the type specimen: "Maxillary teeth 23, the last 2 abruptly enlarged. Eye moderate. Rostral broader than high, just visible above; internasals longer than the prefrontals, broadly truncate anteriorly; frontal nearly as broad as long, as long as its distance from the rostral, much shorter than the parietals; nostril in a partly divided nasal; loreal longer than high; 1 pre- and 3 postoculars; temporals 1+2; 9 supralabials, fourth to sixth touching the eye; 11 lower labials, 6 in contact with the anterior chin shields, which are a little longer than the posterior. Scales in 19 rows, reducing to 15 before the vent, all strongly keeled except those of the outer row which are only feebly keeled. Ventrals 179, anal divided, subcaudals 63 pairs (tail incomplete)."

Three ZRC specimens are consistent with the type in shape of head scales, except that the internasals are not longer than the prefrontals. The photograph of the 1989 specimen shows similar scale conformation. Scale counts and size of the specimens we examined are given in Table 1. SP 04091 has 23 maxillary teeth with the last two enlarged. All the specimens we have examined have many, almost uniformly spaced, small, conical organelles on dorsal head scales and temporals. A prominent groove extends down the suture between the parietals and runs between four to seven pairs of nuchal scales in the snakes we have examined. Nuchodorsal glands (sensu Smith, 1943) are evident in SSM

Table 1. Morphological data for *Rhabdophis murudensis* (Smith, 1925) from Borneo.

Specimen No.	Locality	Collector	Date	Alt. (m)	Sex	TL	SV	T	SR	V	C	SL	IL
MAS7210 (Type) ¹	Mt. Murud	E. Mjöberg	1925	1700	F	--	--	--	X-19-15	179	63	9	11
MAS72091	Mt. Murud	"	"	1700	F	-	--	--	X-19-15	176	83	9	11
ZRC2.4162	Mt. Kinabalu	F.M. Chasen & H. Pendlebury	1929	2500	M	910	700	210	19-19-17	180	97	9	10
ZRC2.4163	Mt. Kinabalu	"	"	>1000	F	681	425	25	19-19-17	185	80	9	11
ZRC2.4164	Mt. Trus Madi	R. Audy	-	>1000	F	713	582	131	X-19-X	180	72	9	11
SSM REP0326	Mt. Kinabalu	T. Low	1978	1800	M	1044	873	171	19-19-17	183	54*	9	11
SP04091	Kinabalu Park	Martin M.	1992	1,600	M	928	726	200	19-19-15	180	92	9	10

¹ Data from Smith (1925)

REP 0326, though not well preserved. SP 04091 also displayed the nucho-dorsal groove though the gland was not obvious because of the slight damage to the neck. This specimen also displays an area of depression between the parietals, each of which has two parallel longitudinal grooves running posteriorly and is overhung by a free-edged, shingle-like flange of the shield. On the right parietal, the flange extends anteriorly but is well separated from the frontal and supracocular. The left parietal has a similar flange-like section that runs back from the supracocular almost to but not reaching the depression. SP 04091 has a deep groove beginning at the rear of the frontal and continuing between the parietals. The groove widens near the rear of the parietals and continues between first pair of nuchals behind the parietals. In the three ZRC specimens the groove extends back between three to seven pairs of vertebral scales.

Smith's description of the color and pattern of the type specimen reads, "Dark olive brown above with a chain of small yellow spots down either side of the back in the posterior two-thirds of the body; neck with reddish and black markings: upper lip chin and throat yellow; belly grayish yellow, with longitudinal chains of small black spots; tail below dark grey. In a second female (No. 7209) captured at 1700 m, the ventral spots are confined to a chain on either side of the belly."

In the 1989 Mt. Kinabalu photograph, the snake's head and nape are dark olive brown, but the skin of the upper lip is bright reddish-orange, almost vermillion. The eye is brown with a light green segment in dorsal portion. The skin of the neck posterior to the nape is reddish-orange with regularly arranged black spots. The body is gray with short, indistinct black crossbars. A row of light spots associated with the ends of these dark markings appearing at midbody and running down the dorsum, converging to a single row anterior to the vent and extending to the end of the tail. In alcohol, the brilliant reddish-orange of the lips and neck turns to a light yellow, and this is the colour described for the type specimen. Ventrals are light cream-colored, dusky on their outer edges, and marked with rows of irregular, intermittent gray spots along their lateral portions. The ventrals are increasingly darker posteriorly, and the tail grayish dorsally. The chin is creamy white.

The three ZRC specimens all are dark olive colour on dorsal surfaces of the head, leaving the entire lip light cream; the entire lip may have been red in life. The nape has the dark colour of the head covering a band of about 12 scales behind the head; the band has a notched rear border. SP 04091 has a pattern similar to these specimens.

Ecology and Behavior - All specimens were collected in Sabah or Sarawak at an altitude of approximately 1000-2600 m., in primary oak forests on mountains (Murud, Kinabalu, Trus Madi), at elevations where temperatures average approximately 15 C. From 1981-1991, while working with the Ecology Section of Kinabalu Park, one of us (TFL) observed individuals of *Rhabdophis* on numerous occasions, along the Kinabalu Park nature trails at about 1300-1500 m, and along the summit trail at 2,500m. On one occasion, along the Kinabalu summit trail near Kamborongoh (2300m), an adult individual of *R. murudensis* was seen camouflaged on a bed of thick moss, in direct sunlight of late morning at the side of the trail.

In the mid 1980s, a snake referred to earlier was caught near the Mountain Garden (1800m) at Kinabalu Park Headquarters. It was fed a diet of frogs (*Limnonectes kuhlii*) and occasionally white mice. It was kept initially for photographic, and subsequently for educational purposes. It was relatively inactive during the day, but at night seemed restless. When the snake was disturbed, it expanded its neck dorsoventrally to expose bright reddish-orange skin



Fig. 1. Head of *Rhabdophis murudensis* (Smith, 1925).

between the scales and raised its head a few cm above ground with the snout slightly pointed downward. A different individual when threatened, "inflated the neck region, exposing the red interscale region and (the) dorso-nuchal glands (sensu Smith, 1943) became more distinct externally as a pair of pale, swollen structures" (I. Das, pers.comm..)

DISCUSSION

Nuchal glands occur in ten species of Asian snakes (Smith, 1938), and are prominent in several Southeast Asian species, including *Rhabdophis nuchalis*, *R. angeli*, *R. himalayanus* and *R. subminiatus* (Smith, 1943). In Borneo the glands occur exclusively in *Rhabdophis murudensis*. Mori et al. (1996), who worked on a related species (*Rhabdophis tigrinus*), stated that its paired nuchal glands are embedded under the dorsal skin of the neck region, and are ductless but easily ruptured under pressure, releasing a secretion. This secretion has been shown to contain cardiac steroids including gamma-bufotalin (Mori et al., 1996).

Smith (1943) noted that the nuchal groove of *R. subminiatus* passed through nuchal scales that were arranged in pairs, which is also the case in *R. murudensis*. *Rhabdophis tigrinus* from Japan possesses a distinctive neck arching display which evidently exposes the noxious secretions of the nuchal glands to potential predators. Interestingly, this response is elicited more frequently at a temperature of 15° C compared to 25°C (Mori et al., 1996), suggesting that this behavior might also be expected of *R. murudensis* at the relatively cool temperatures on Mt. Kinabalu. Although this neck arching behaviour has not yet been observed in *R. murudensis*, there is a strong likelihood that it will be if live specimens become available.

The endemic Fire-Lipped Keelback's restricted ecological distribution to the montane habitats of northwestern Borneo, and its unusual predator defense system, make it one of Borneo's most distinctive snakes, deserving of further investigation and of course, conservation.

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