

A new water skink of the genus *Tropidophorus* from the Phong Nha – Ke Bang National Park, central Vietnam (Squamata: Sauria: Scincidae)

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Abstract. A new species of depressed-bodied water skinks is described from the central Truong Son (Annamite mountain range) of Quang Binh province, Vietnam. The description is based on three adult specimens, collected during the dry season in the karst forest of Phong Nha – Ke Bang National Park. The new *Tropidophorus* differs from any other congener by the distinctly depressed body in combination with considerably enlarged dorsal scales resulting in a very low (22) midbody scale count. We provide first natural history notes for the new species.

Key words. Reptilia: Sauria: Scincidae: new species; morphology; taxonomy; natural history; Vietnam.

Introduction

The genus *Tropidophorus* comprises small to moderate-sized lygosomine skinks that are characterized, among else, by a large external ear opening, a superficially located tympanum, a rectangular to squarish rostral without a rounded, dorsal lobe, absent supranasals, eyelid's anterior and posterior corners falling within a single scale, which wraps around both the dorsal and ventral sides of the eyelid, and by most of the species being adapted to semiaquatic habitats along forest streams (e.g., SMITH 1923, TAYLOR 1963, MANTHEY & GROSSMANN 1997, GREER & BISWAS 2004). According to SMITH (1923), *Tropidophorus* species can be found in the vicinity of rocky streams, where they nocturnally live among the leaf litter of banks and hide under stones and boulders, sometimes completely immersed in the water.

Most recently, several new water skinks have been described, so that meanwhile up to 25 species are recognized, which are distributed in both continental and insular Southeast Asia (HIKIDA et al. 2002, 2003, GREER & BISWAS 2004). More than 60 percent of the species in the genus are restricted to only one

country, thus showing considerable local endemism (GREER & BISWAS 2004). At present, seven species of *Tropidophorus* are known to occur in Vietnam: *T. baviensis* BOURRET, 1939, *T. berdmorei* (BLYTH, 1853), *T. cocincinensis* DUMÉRIL & BIBRON, 1839, *T. hainanus* SMITH, 1923, *T. microlepis* GÜNTHER, 1861, *T. murphyi* HIKIDA, ORLOV, NABHITABHATA & OTA, 2002 and *T. sinicus* BOETTGER, 1886 (BOURRET unpubl., NGUYEN & HO 1996, NGO et al. 2000, HIKIDA et al. 2002). It is remarkable, that *T. murphyi* from northern Vietnam, together with two water skink species described further recently from northeastern Thailand (*T. latiscutatus*, *T. matsuii*), is distinguishable from all other known congeneric species by the distinctly depressed body which might reflect adaptations to life in rock crevices (HIKIDA et al. 2002).

During recent herpetofaunal investigations in the Phong Nha – Ke Bang National Park, central Truong Son (Annamite mountain range) of Quang Binh province, in central Vietnam (e.g., ZIEGLER & HERRMANN 2000, ZIEGLER et al. 2004) another water skink with an exceptionally depressed body and strongly keeled lateral scales was discovered in karst forest rock crevices. However, this



Fig. 1. Male holotype of *Tropidophorus nogei* sp. n. (ZFMK 83668) in life.

species showed distinctly enlarged dorsal scales and therefore a markedly lower mid-body scale count as compared with *T. latiscutatus*, *T. matsuii* and *T. murphyi*, so that we describe it as another new continental *Tropidophorus* below.

Results and Discussion

Tropidophorus nogei sp. n.

Holotype: Zoologisches Forschungsinstitut und Museum Alexander Koenig, ZFMK 83668: adult male (Figs. 1-6), from the karst forest of Cha Noi, Phong Nha – Ke Bang National Park, Quang Binh Province, Vietnam; collected by NGUYEN VAN HOAN, BUI NGOC THANH, DANG NGOC KIEN, VU NGOC THANH, MARTINA VOGT and THOMAS ZIEGLER at the end of the dry season (18 June) 2005.

Paratypes: ZFMK 83669: adult female, and VNUH 18.6.'05-1 (deposited in the Zoological Museum, Vietnam National University, Hanoi): adult female (Figs. 6-8, 12), same data as holotype.

Diagnosis: The new species can be distinguished from any other *Tropidophorus* currently known by the following combination of characters: (1) Relatively large (up to 101 mm snout-vent length) with triangular head and distinctly dorso-ventrally depressed body; (2) dorsum brownish, with irregular and partly ill-defined pale brown transverse bands (three on neck, eight to nine between the limbs, and about 17 on the tail surface); venter beige to greyish with some indistinct dark marbling; (3) frontonasal and frontal undivided; (4) four supraoculars, bordered by five supraciliaries; posteriorly, the fourth supraocular is bordered by a small scale (postsupraocular); (5) two presuboculars, and four postsuboculars; (6) each parietal is followed by two to three enlarged nuchals; (7) six supralabials, fourth and sixth largest; (8) postmental undivided; (9) chinshields in three pairs; (10) tympanum superficial, ovoid; (11) 22 midbody scale rows (6 dorsal, 5/5 lateral, 6 ventral); (12) 44 to 49 middorsal (paravertebral) scales (from the posterior end of parietals to posterior margin of thigh); (13) dorsal body scales enlarged, smooth, except for outermost row, and distinctly larger than



Fig. 2. Portrait of the preserved holotype of *Tropidophorus nogei* sp. n. (ZFMK 83668).



Fig. 3. Dorsal view of the head of the preserved holotype of *Tropidophorus nogei* sp. n. (ZFMK 83668).



Fig. 4. Ventral view of the head of the preserved holotype of *Tropidophorus nogei* sp. n. (ZFMK 83668).

ventrals; (14) dorsolateral and lateral scales distinctly keeled on neck, body and anterior half of tail; (15) ventral scales smooth, arranged in 40 to 44 transverse rows from first gular row between third pair of chinshields to



Fig. 5. Cloacal region of the preserved holotype of *Tropidophorus nogei* sp. n. (ZFMK 83668).

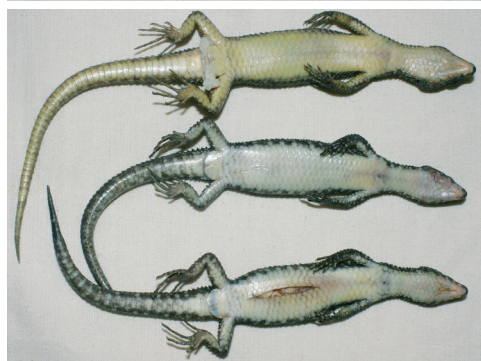
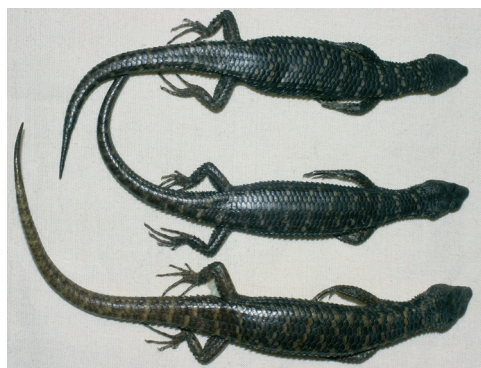


Fig. 6. Dorsal (top) and ventral (bottom) view of the preserved type series of *Tropidophorus nogei* sp. n.: male holotype (ZFMK 83668, largest specimen) and female paratypes (ZFMK 83669, outermost specimen; VNUH 18.6.'05-1, specimen in the middle).

preanals; (16) two enlarged preanals; (17) subcaudals enlarged, smooth; (18) nine to ten scale rows at position of tenth subcaudal on tail (including subcaudal); (19) fourth toe with 18 to 20 smooth subdigital lamellae.

Comparisons: The new species is easily distinguishable from all seven water skink species known to occur in Vietnam (BOURRET unpubl., SMITH 1923, NGUYEN & HO 1996, NGO et al. 2000, HIKIDA et al. 2002) by its very low (22) midbody scale count: in contrast, *Tropidophorus baviensis* has 28–30, *T. berdmorei* 32–40, *T. cocincinensis* 30–32, *T. hainanus* 30–40, *T. microlepis* 28–32, *T. murphyi* 30–32, and *T. sinicus* 28–30 scale rows around the middle of the body. In addition, in adult *T. berdmorei* dorsals as well as laterals are smooth or obtusely keeled, and the species further bears eight supraciliaries, 64 scales from parietals to above vent, and 53 scales from chinshields to vent; among other characters, in *T. cocincinensis*, the fifth supralabial is largest and below the middle of the eye, and there exists a series of small scales between the loreals and supralabials; in *T. hainanus* the dorsals and laterals are sharply keeled, and some of the scales in the vertebral row are bicarinate or, when uncarinate, smaller than the surrounding scales; *T. microlepis* has the fifth supralabial being largest and below the eye, a series of small scales between the loreals and the supralabials, the dorsals and laterals strongly keeled, as well as three enlarged preanal shields (SMITH 1923); *T. sinicus* differs from the new species in having the dorsals sharply keeled, and divided postmentals and frontonasals (BOURRET unpubl., SMITH 1923, 1935, TAYLOR 1963, WEN 1992). The Vietnamese species *T. baviensis*, which also bears a somewhat dorso-ventrally depressed body, has seven supraciliaries and the dorsal caudal scales strongly keeled and slightly smaller than the ventrals, arranged in eight longitudinal rows, with the lateral two rows on each side strongly keeled; furthermore, the flank scales are arranged in six or seven longitudinal rows in *T. baviensis*, and the ventral scales are arranged

in eight longitudinal rows (NGO et al. 2000). *Tropidophorus murphyi* has a strongly dorso-ventrally depressed body, however, it differs from the new species in having six to eight supraciliaries, 55–67 paravertebral scales, and 13 scale rows at position of the tenth subcaudal on the tail (HIKIDA et al. 2002). Also *T. latiscutatus* and *T. matsuii* from Thailand have strongly dorso-ventrally depressed bodies, however, they differ from *T. noggei* sp. n. in having more supraciliaries (six to seven, and eight), higher midbody scale counts (28–30, and 34), a higher paravertebral scale count (58–63, and 65), as well as more scale rows at position of the tenth subcaudal on the tail (13, and 15); in addition, *T. matsuii* has the frontonasal divided (HIKIDA et al. 2002). *T. guangxiensis* WEN, 1992, from southern China, differs from the new species, e.g., by having the frontonasal divided, eight supralabials, with the fifth supralabial being the longest, the dorsal scales being keeled and slightly larger than the lateral scales as well as smaller than the ventrals, moreover by having 29 scale rows around the middle of the body (WEN 1992). From the remaining continental species, *T. robinsoni* SMITH, 1919 differs from *T. noggei* sp. n. in having 30–40 midbody scale rows where the dorsals and laterals are sharply keeled; *T. assamensis* ANNANDALE, 1912 differs from the new species by having 30 midbody scale rows, the dorsals and laterals are strongly keeled and mucronate, as well as the ventrals are obtusely keeled; *T. laotus* SMITH, 1923 has 30–34 midbody scale counts, the frontonasal and usually also the anterior loreal divided, and dorsal and lateral scales quite smooth in adults; *T. thai* SMITH, 1919 differs from the new species in having 38 scales around the midbody, the frontal and frontonasal divided, and the dorsals and laterals more strongly keeled (BOURRET unpubl., SMITH 1923, 1935). From the *Tropidophorus* species occurring in insular Southeast Asia, the new species is also easily distinguishable by its low midbody scale count: in contrast, *T. baconi* HIKIDA, RIYANTO & OTA, 2003 from Sulawesi has 24–27 mid-

A new water skink from central Vietnam

	ZFMK 83668 (holotype)	ZFMK 83669 (paratype)	VNUH 18.6.05-1 (paratype)
SVL	101.0	95.7	94.9
TaL	121.0	82.5	78.5 +
TL	222.0	178.2	173.4 +
HL	17.3	16.1	16.0
HW	16.4	13.8	14.6
HH	9.4	8.6	8.2
SL	7.6	6.9	7.2
ET	9.1	7.9	7.9
TW	2.9	2.4	2.6
TH	3.8	3.6	3.7
SFl	38.5	34.7	33.3
AG	52.4	48.6	50.0
NW	11.1	11.0	10.2
MW	20.1	20.1	21.0
MH	11.3	10.9	12.7
FIL	30.0	26.5	28.0
HIL	39.7	36.9	36.5
4TL	12.7	11.6	11.4

Tab. 1. Measurements (taken by a caliper, in mm) of the male holotype and the female paratypes of *Tropidophorus noggei* sp. n. SVL: snout-vent length (from snout tip to cloaca); TaL: tail length (from cloaca to tail tip); TL: total length; HL: head length (distance from snout tip to posterior margin of interparietal); HW: maximum head width; HH: maximum head height; SL: maximum snout length (from tip to anterior margin of the eye); ET: maximum eye to tympanum length (from hind margin of the eye to anterior border of tympanum); TW: maximum tympanum width; TH: maximum tympanum height; SFl: maximum snout to forelimb length; AG: maximum axilla to groin length; NW: minimum neck width; MW: maximum midbody width; MH: maximum midbody height; FIL: maximum forelimb length (from body insertion to beginning of claw of fourth finger); HIL: maximum hindlimb length (from body insertion to claw of fourth toe); 4TL: maximum length of fourth toe (without claw).

body scale rows as well as keeled dorsal scales (HIKIDA et al. 2003); the Philippine species *T. grayi* GÜNTHER, 1861 bears 24-28 midbody scale rows and has its dorsal scales keeled as well (HIKIDA et al. 2003), *T. davaoensis* BACON, 1980 has 36-38 midbody scale rows and the frontonasal divided, *T. misaminius* STEJNEGER, 1908 bears 28-34 midbody scale rows and the sixth upper labial beneath the centre of the eye, and *T. partelloi* STEJNEGER, 1910 has 28-32 midbody scale rows together with the fifth upper labial beneath the centre of the eye (BROWN & ALCALA 1980); moreover the Bornean species do not have such a low midbody scale count as the new species: *T. beccarii* (PETERS, 1871): 30-34, *T. brookei* (GRAY, 1845): 32, *T. iniquus* LIDTH DE JEUDE, 1905: 34, *T. micropus* LIDTH DE JEUDE, 1905: 34, *T. perplexus* BARBOUR, 1928: 30

scale rows around midbody (MANTHEY & GROSSMANN 1997, MALKMUS et al. 2002); *T. mocquardi* BOULENGER, 1894, which is listed as valid species by GREER & BISWAS (2004) is not considered as valid in MANTHEY & GROSSMANN (1997) and treated as synonymous to *T. beccarii* by MALKMUS et al. (2002).

Description of holotype: Adult male, for measurements see Table 1. Body distinctly dorso-ventrally depressed, approximately twice as wide as high. Forelimb and hindlimb relatively slender, short, pentadactyl. Fingers and toes touching (overlapping) when adpressed. Head triangular, swollen at the temples and distinctly set-off from neck. Head width at the widest portion of the head is nearly equal to head length. Snout rounded, rostral partly visible from above; fronto-



Fig. 7. Female paratype of *Tropidophorus noggei* sp. n. (VNUH 18.6.'05-1) in life.



Fig. 8. Portrait of the female paratype of *Tropidophorus noggei* sp. n. (VNUH 18.6.'05-1) in life.

nasal undivided, in contact with rostral, nasals, anterior loreals and prefrontals; prefrontals not separated, in broad contact, bordering frontal, frontonasal, two loreals, first supraoculars, and first supraciliaries; frontal large, narrowing posteriorly, in contact with prefrontals, first and second supraoculars, and frontoparietals; supraoculars four, laterally bordered each by five supraciliaries; supraciliary rows complete along the entire length of the lateral edge of the supraoculars; last supraocular followed each by one post-supraocular (small scale posterior to the supraocular series), that is higher than broad; interparietal longer than wide, smaller than frontal, narrowing posteriorly, bordering parietals; small transparent spot on interparietal, showing location of parietal foramen; parietals separated by interparietal; each pa-

rietal is followed by three enlarged nuchals; nostril piercing nasal; nasal in contact with rostral, first and second supralabials, frontonasal and anterior loreal; anterior loreal borders nasal, second supralabial, posterior loreal, prefrontal and frontonasal; six supralabials, fourth and sixth largest; three anterior supralabials, one just beneath, and two posterior to orbit; shallow groove running on loreal-labial border, posteriorly crossing fourth supralabial in obliquely downward direction; two presuboculars, anterior one larger than posterior one, in contact with posterior loreal and second and third supralabials; lower eyelid with at least eight scales, separated from labials by two or three rows of granular scales; eyelid's anterior and



Fig. 9. Map showing the type locality of *Tropidophorus noggei* sp. n. in the Phong Nha - Ke Bang National Park, Quang Binh Province, Vietnam (indicated by dot).

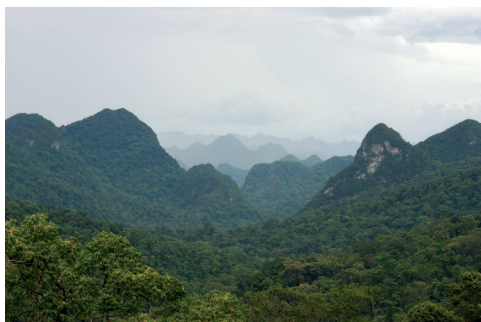


Fig. 10. The steep karst forests of Cha Noi: habitat of *Tropidophorus noggei* sp. n. in the Phong Nha – Ke Bang National Park.

posterior corners contained within a single, wrap around scale; postocular single, bordering fourth supraocular, postsupraocular, upper postsubocular; postsupraocular bordering fourth supraocular, postocular, upper postsubocular, parietal, and temporals; four postsuboculars, first one in contact with fourth and fifth supralabial; temporals bordering parietal largest, followed by temporal scale bordering sixth supralabial; ear opening large, tympanum superficial, ovoid; mental in contact with first infralabials and postmental; postmental undivided, in contact with mental, first infralabial, and first pair of chinshields; chinshields in three pairs, first pair in broad contact, second pair separated by single scale, and third pair separated by three scales; four (left) to five (right) infralabials; 22 midbody scale rows (6 dorsal scales, smooth, except for outermost row, 5/5 keeled lateral scales, and 6 smooth ventral scales); nine scale rows at position of tenth subcaudal on tail (including subcaudal); 44 middorsal scales from posterior end of parietals to posterior margin of thigh (paravertebral scales), only somewhat broader than neighbouring scales, smooth; dorsal body scales distinctly larger than ventrals; dorso-lateral and lateral scales distinctly keeled on neck, body and anterior half of tail; ventral scales arranged in 40 transverse rows from first gular row between third pair of chinshields to preanals; two enlarged preanals,

right overlapped by left; subcaudals enlarged, smooth; scales on forelimbs keeled, those on hindlimbs keeled dorsally, but smooth ventrally; subdigital lamellae smooth, numbering 18–20 on the fourth toe.

Color in preservative dark brown on dorsal and lateral surfaces of head, body and tail. The light ventral side is yellowish beige to greyish with some indistinct dark marbling. The dark brownish dorsal scales are edged by lighter brown. Three pale brown transverse bands are discernible on the neck, eight to nine ill-defined pale brown transverse bands on the dorsum between the limbs and about 17 light bands on the dorsal tail. These bands comprise from about half a scale to one scale's width and are rather irregular in shape. Light flecks or bands are also discern-



Fig. 11. In this karst rock crevice the female paratype of *Tropidophorus noggei* sp. n. (ZFMK 83669) was discovered.



Fig. 12. The female paratype of *Tropidophorus noggei* sp. n. (ZFMK 83669), hidden in the narrow rock crevice depicted in Fig. 11: only the tail is visible.

ible on the dorsum of the limbs as well as on the lateral sides of neck, body and tail. Dark supra- and infralabials with light spots. For coloration in life see Fig. 1.

Hemipenes somewhat elongate, unpigmented. The apical lobes of the outer genital organs are discernible in the left organ, but not everted. Sperm groove bordered with lips, apically forked and each running along the apical lobes. Truncus laterally each with an ear-shaped, thin-skinned tissue bulge. Asulcally, the transitory area between the truncus and apex is, in the turgid state, marked by two inflated, thin-skinned rises. Along each of the outer margins of the two rises, few plicae-like structures (petala sensu SAVAGE 1997; terminology used herein after ZIEGLER & BÖHME 1997, 2004) are discernible. Above these two inflated rises an actual plica ornamentation, which is differentiated from the truncus by a distinct tissue seam, is barely visible due to the inverted state of the lobes. The pedicel appears smooth without any further ornamentation.

Variation of paratypes: The paratypes correspond largely to the description of the holotype, for measurements see Table 1. In contrast to the holotype description, the paratypes bear 49 paravertebral scales rows, as well as 43 (ZFMK 83669) to 44 (VNUH 18.6.'05-1) transverse rows of ventrals from first gular row between the third pair of chinshields to preanals. In addition, in both paratypes the anterior loreal borders the first and second supralabials. Furthermore, in the specimen ZFMK 83669 there are ten scale rows at position of the tenth subcaudal on tail (including subcaudal) and four infralabials; in VNUH 18.6.'05-1 the nasal is only in contact with the first supralabial, and the parietals are followed each by only two enlarged nuchals.

Obviously, due to sexual dimorphism, the female paratypes are somewhat smaller and their heads are not thus triangular and swollen at the temples as it is the case in the male holotype. In addition, the undersides of their tails are much stronger and darker mar-

bled than in the male holotype. In contrast to the holotype they also bear distinct light blotches on the lower sides of the flanks. The tail tip of VNUH 18.6.'05-1 was broken and the last 19 mm of the tail of ZFMK 83669 are obviously regenerated.

Etymology: We name this new species in honour of Professor Dr. GUNTHER NOGGE, Director of the Cologne Zoological Garden, in recognition of his long-term support for the Cologne Zoo's nature conservation project in the Phong Nha – Ke Bang National Park.

Distribution: Currently, the new species is only known from its type locality, the karst forest of Cha Noi within Phong Nha – Ke Bang National Park in Quang Binh province, central Vietnam (Fig. 9).

Natural history: The water skinks were discovered at night in a steep primary karst forest area (Fig. 10). We did not find any water courses in the immediate vicinity, however, the discovery took place within the end of the dry season. The skinks were found at the base of karst rock outcrops in front of horizontal and narrow rock crevices about 30 to 50 cm above the forest floor (Fig. 11). After being disturbed by the light of our head torches they escaped head-first into the narrow rock crevices. Once hidden, it was only possible to grasp with a long pair of tweezers at the tails of the water skinks which were well-concealed (and anchored) about 15 to 30 cm inside the karst rock crevices (Fig. 12).

According to our local guide, the species also occurs in immediate vicinity of karst forest streams and is furthermore able to dive. However, in nearby karst forest streams of the Phong Nha – Ke Bang National Park we only found adults (including pregnant females) and freshly born juveniles of the barely known water skink species *Tropidophorus cocincinensis* within the end of the dry season (middle of June). Whereas *T. cocincinensis* was only found between the leaf litter of karst forest stream banks, *Tropidophorus noggei* sp. n. seems to be adapted to karst

rock crevices, also at a distance from forest streams.

The left testis of the fixed holotype was yellowish and measured 9.0 mm in length and 6.2 mm in width; the paratype ZFMK 83669 contained each two yellowish eggs up to 13.3 mm long and 8.6 mm wide, in the paratype VNUH 18.6.'05-1 three large eggs could be detected, one of them measuring about 13 x 10 mm. Stomach contents of the holotype revealed remains of an about 4 mm broad centipede; the stomach of the paratype ZFMK 83669 was not dissected but the stomach content of VNUH 18.6.'05-1 contained remains of a nearly 2 cm long, dark insect.

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