Description and phylogenetic position of a new species of *Isopachys* from central Thailand and southern Burma* (Squamata: Scincidae).

by Mathias LANG & Wolfgang BÖHME

Abstract

A new species of the scincid genus *Isopachys* is described from central Thailand and neighboring Burma. With respect to the other members of this genus, the new species is widely distributed and not restricted to the coastal zone of the Gulf of Thailand. Phylogenetically it is the sister taxon of *I. gyldebestolpei*. Notes on osteology and life history are provided.

Key words: Squamata, Scincidae, *Isopachys borealis* sp. nov., Thailand, Burma.

Résumé

Une nouvelle espèce du genre *Isopachys* (Reptilia : Scincidae) est décrite, venant de la Thaïlande centrale et de la Birmanie. Cette espèce, en contraste avec les autres membres de ce genre, n’est pas restreinte long de la Baie de Thaïlande. Phylogénétiquement elle est proche de *I. gyldebestolpei*. Quelques notes sur l’ostéologie et les habitudes sont données.


Introduction

Over the past three years the Museum Alexander Koenig, Bonn has received 29 specimens of a limbless lygosomatine skink clearly belonging to the genus *Isopachys*. These specimens however, are not referable to any of the three known species, and come from collection sites well north of the localities for the other species. These specimens are strikingly different and can be diagnosed quite readily. We therefore propose the designation of a new species.

Systematic account

*Isopachys borealis* sp. nov.

*Holotype:*

Zoologisches Forschungsinstitut und Museum Alexander Koenig, Bonn (ZFMK) 45709 from Lan-Sak (80 m elev.), 20 km W of M. Uthai-Thani; Uthai-Thani Province, Thailand. Collected by W. THIELEN, July 1986.

*Paratypes:*

ZFMK 45704-45708, 45710, 45713-45714, IRSNB (Koninklijk Belgisch Instituut voor Natuurwetenschappen, Brussels) 2.543 (2) data as holotype. ZFMK 43938-43939 from Dong Noi, Uthai-Thani Province, Thailand. Collected by W. THIELEN, 15-19 July 1985. ZFMK 44150-44153 from Tap-Tan (80 m elev.), Uthai-Thani Province, Thailand. Collected by W. THIELEN, September 1985. ZFMK 45751 (skeleton) & 45752 from Mae-Sot (300 m elev.), 60 km west of Tak, Tak Province, Thailand. Collected by

*At present the official name is Myanmar. For convenience the old name will be used throughout the text.*

**Description and Diagnosis:**
*Isopachys borealis* is a scincid assignable to the subfamily Lygosomatinae, lacking external appendages (Fig. 1). The head is continuous with the body, lacking any external “neck” segment. The snout region is covered by a series of enlarged heavily keratinized shields to facilitate burrowing. The eyes are vestigial but contain scleral ossicles and are covered by a single scale (presumably fused palpebral scales). The lower jaw is countersunk. The tympanum is encapsuled and not visible externally, rather a distinct auditory crease is present anterior to the neck region (Fig. 5).

*Isopachys borealis* may be distinguished from all other *Isopachys* by its dark venter and its unique dorsal pattern (Fig. 1). In *guldenstolpei*, the terminal portion of the body and dorsal aspect of the tail has a checkered pattern as in *borealis*, but the markings are extremely regular and rectangular whereas in *borealis* the markings have an irregular outline and are round (Fig. 2a, 2b). Both *roliei* and *anguinaides* have longitudinal markings (Fig. 3).
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For three meristic values, (Table 1; Fig. 4) number of scales around neck, at midbody and from parietal to point dorsal of vent there is little or no overlap with the other recognized species.

Osteologically this species is unique within the genus by the exclusion of the maxilla from the infraorbital foramen due to the contact between the palatine and the ectopterygoid and the complete separation of the paired nasal bones medially by the frontal spine of the premaxillary bone.

**Description of holotype:**
ZFMK 45709. Snout-vent length 154 mm. Partially regenerated tail 37 mm, as wide as body, ending abruptly in a blunt undifferentiated tip (Fig. 1). Around neck are 24 longitudinal scale rows that reduce to 22 around midbody and 15 at base of tail. Between the parietal scale and the point dorsal to the vent are 142 scales.

Coloration of holotype. - The holotype has but two colors: an off-white to light brown and a dark brown. Entire venter dark brown which continues midway up flanks. Dorsal half of cylindrical body with a unique pattern of dark spots on an off-white background. Forty-four pairs of dark brown spots located symmetrically on either side of midline which consists of a narrow band of dark brown speckles running from neck region to tail. Dorsal spots measure from 2 to 5 mm and occasionally coalesce with each other. Head is dark brown with some small light brown patches. First pair of dorsal spots are continuous with head coloration to form an hour-glass shaped pattern (Fig. 1). Tip of snout (enlarged rostral, nasals, first supralabials, mental and first infralabials) is slightly more yellow than dorsal background coloration.

Head scalation of holotype. – Rostral large and well keratinized anteriorly blunt. Nasals extremely large and in median contact with each other. Nostril located in anterolateral aspect of nasal close to nasal-rostral suture (Fig. 5). Nasals also heavily keratinized located above enlarged keratinized first supralabials. Total of 5 supralabials line upper labial margin, second of which is narrowest. Third supralabial reaches eye region (Fig. 5).
Frontonasal about 4 times as wide as long. Frontal large contacting enlarged interparietal, which lacks interparietal foramen (Fig. 5). Frontoparietals separated.

Preocular single. Eye vestigial, covered by single scale (fused palpebrals) which does not fuse with upper eyelid (Fig. 5). Supraciliaries 3; postoculares 3. Temporals generally equal in size and indistinguishable from body scales (Fig. 5).

Mental enlarged and together with first infralabial heavily keratinized. Infralabials 4. Other throat scales undifferentiated.

Dorsal and ventral body scales typical scincid imbricating cycloid scales and not differentiated (Fig. 1).

Variation in paratypes:

Dorsal pattern varies little. In specimens with intact tail dorsal pattern continues to tip. Numerous specimens have regenerated tails, which tend to fracture quite readily in preservation. Regenerated tails are usually entirely brown.

In one specimen (ZFMK 44151) frontonasal and frontal scales are fused into a single large scale. In an additional two, (ZFMK 44152 & 49200) the frontonasal scale is asymmetrical. Remaining specimens are consistent and show a cephalic scale arrangement as described for holotype. Table 2 indicates variation of meristic values of holotype and paratypes.

Osteology:

Only a single specimen (ZFMK 45751) was skeletonized. The specimen was prepared by removing fleshy components by hand and successively treating skeletal elements with a solution of hydrochloric acid, ethylalcohol and water.

Premaxillae remain paired postembryonically (Fig. 6). Premaxillary spine extends posteriorly contacting anteromedial process of frontal, separating nasals (autapomorphy;
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Frontal rather broad with anterolateral processes contacting maxilla thus separating nasal and prefrontal (Fig. 6). Pre- and postfrontals in contact above orbit (autapomorphy for the genus within Scincidae). Postorbital somewhat short. Supratemporal process of parietal elongated. Mid-section of parietal constricted; parietal foramen small. Posterior braincase largely exposed (Fig. 6). Total of 9 premaxillary and 18 maxillary teeth, slightly recurved and blunt. Vomers constricted and overlain by medial contact of palatines posteriorly. Palatines with lateral processes that contact ectopterygoids thus excluding posterior aspect of maxilla from infraorbital foramen (autapomorphy for *borealis*; see below) (Fig. 6). Anteromedial processes of pterygoids in contact with one another forming the posterior aspect of the palate.

Insufficient skeletal material was available to compare lower jaw of *borealis* with other Scincidae. Noteworthy however is the fact that this species has an elongated retroarticular process which is flexed ventrally (Fig. 6). Hyoid apparatus of *I. borealis* consists of but four elements: hypophyal, body, paired first ceratobranchials and paired first epibranchials (Fig. 7). Ceratohyals, basihyals, second ceratobranchia and second epibranchials are absent. All pectoral and pelvic elements are lacking; 62 presacral vertebrae present.

**Internal anatomy:**

Little information concerning the internal anatomy of this newly described species is available. Noteworthy is the structure of the lining of the stomach which is heavily infolded into well-developed rugae. The lungs are elongated, paired and are heavily vascularized. The hemipenial morphology of this new species could not be determined because all specimens were already preserved upon receiving them. The ovaries are located approximately 21% of the snout-vent length anterior to the vent.

**Distribution:**

*Isopachys borealis* is found throughout central Thailand and neighboring Burma, centered along 16° N latitude (Fig. 8). Collection localities range from sea level (Plain of the Chao Phraya river; localities 4, 5 & 6; Fig. 8) up to 300m (Mae-Sot). The exact localities of the new species in addition to the literature localities of the remaining species of *Isopachys* are given in Fig. 8.

**Habitat and life history:**

Most of the specimens of *I. borealis* were taken in moist topsoils of cultivated lands (sweet potato and pineapple plantations) in clearings with moderate sunlight. By contrast, the other three species of *Isopachys* are found in dry sandy soils in which they can easily burrow (SMITH, 1935; TAYLOR, 1963). Specimens of *I. anguinoides*, *gyl- denstolpei* and *roulei* were collected beneath rotting timber and rotting grass or under debris of various types (SMITH, 1935; TAYLOR, 1963). *Isopachys anguinoides* has been found sympatrically with *I. gylデン stolpei* (Fig. 8).

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**Figure 5.** Top and side view of head of holotype of *Isopachys* borealis. Abbreviations for scales are: F = frontal; FN = frontonasal; FP = frontoparietal; IP = interparietal; L = loreal; M = mental; N = nasal; P = parietal; PT = posttemporal; R = rostral; SC = supraciliary; SO = supraocular; ST = supratemporal; 1-5 = supralabials.
The few references on the life history aspects of *Isopachys* indicate that at least *anguinoides* and *gylænstolpei* are oviparous (Taylor, 1963). Information on reproductive behavior of the remaining species is not available. Stomach content analysis of several specimens of the new species indicate the presence of termites and earth worms in the digestive tract.

**Phylogenetic position:**

Heyer (1972) provided a hypothesis of relationships within *Isopachys*. The character state polarities he used were deduced using the remaining Scincidae as the outgroup. Heyer (1972) listed three derived character states to define *Isopachys*. Two of these (frontal bones fused and palatine bones in contact) are synapomorphies at more inclusive levels within Scincidae. The presence of broad and shallow lateral processes of the parietal remains as a synapomorphy defining the four species of *Isopachys*. An additional autapomorphy for the genus is the broad contact of the pre- and postfrontal bones at the intraorbital region (Fig. 6). This latter character seems to be unique within Scincidae, but common among burrowers.

The phylogenetic position of *borealis* within *Isopachys* is deduced by reevaluating Heyer’s (1972) relevant characters (those that vary within the ingroup) using the outgroup comparison method. *Larutia*, the presumed sister taxa of *Isopachys* (see Greer, 1977: 537; Böhme, 1982) is the first functional outgroup, *Sphenomorphus* the second and the remaining Scincidae the third functional outgroup. The character complexes listed below are taken for the most part from Heyer (1972). His original numbers are given in parentheses and are preceded by an H. For the sake of brevity the reader is referred to Heyer (1972) for the evaluation of character state polarities. Only a single polarity incongruence is noted (Character 8).
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Q I. gyllenstoelpei

I. anguisoides

I. roulei

Figure 8. Distribution of known localities of *Isopachys*. The type localities are boxed in. Localities are: 1) Phadow, 150 km S of Moulmein, Burma. 2) Mae-Sot (300 m elev.), 60 km west of Tak, Tak Province, Thailand. 3) Talung Sung (140 m elev.), 95 km NW of M. Nakhoon Sawan, Kamphaeng Phet Province, Thailand. 4) Dong Noi, Uthai-Thani Province, Thailand. 5) Lan-Sak (80 m elev.), 20 km W of M. Uthai-Thani, Uthai-Thani Province, Thailand. 6) Tap-Tan (80 m elev.), Uthai-Thani Province, Thailand. 7) Nam Len (270 m elev.), 30 km northeast of Phetchabun, Phetchabun Province, Thailand. 8) Nong Rua (250 m elev.), 45 km W of Khon-Kaen, Khon-Kaen Province, Thailand. 9) Kanchanaburi, Kanchanaburi Province, Thailand. 10) Hua Hin, Prachuap Khiri Khan province, Thailand. 11) Nong Kae, Prachuap Khiri Khan Province, Thailand. 12) Ang Hin, Chon Buri Province, Thailand. 13) Bang Lamung, Chon Buri Province, Thailand. 14) "Bangstaphan" (= Bang Saphan Yai), Prachuap Khiri Khan Province, Thailand. 15) Ko Tao Island, Gulf of Thailand. The type localities of *I. gyllenstoelpei*, Koh Lak (Prachuap Khiri Khan Province) could not be located. The type locality of *I. roulei* is "Siam".

1) Tail tip shape (H2): 0) tapering; 1) rounded, blunt.
2) Prefrontal scales (H8): 0) paired; 1) fused with frontals.
3) Frontonasal scales (H9): 0) present; 1) fused.
4) Third temporal scale (H17): 0) present; 1) fused.
5) Postmental scale (H23): 0) present; 1) fused.
6) Nasal bones (H24): 0) in contact; 1) separated.
7) Jugal (H28): 0) moderately developed; 1) reduced.
8) Palatines (H29): 0) in contact; 1) separate. Although we agree with GREE R (1970) that widely separated palatine bones is the plesiomorphic conditions among skinks, at the level of the ingroup widely separated palatines is the apomorphic condition.
9) Pterygoids (H30): 0) separated; 1) in contact at midline.
10) Basipterygoid process (H31): 0) well-developed; 1) process reduced.

11) External ear (H32, modified): 0) external ear opening with exposed tymanum; 1) auricular crease present externally, tymanum scaled-over.
12) Retroarticular process (H35): 0) moderately developed; 1) well-developed; 2) well-developed projecting ventrally.
13) Interclavicle (H36): 0) present; 1) reduced; 2) absent.
14) Sternum (H37): 0) present; 1) much reduced; 2) absent.
15) Humeral vestige (H38): 0) present; 1) absent.
16) Rib articulation with sternum (H39): 0) present; 1) absent.
17) Osteoderms (H42): 0) free from skull; 1) co-ossified with skull.
18) Palatine & ectopterygoid posterior relationship: 0) separated posterior to infraorbital foramen; 1) in contact.
Figure 9. Proposed phylogenetic relationship among the four species of Isopachys. See text for description of characters.

Table 1
Comparative table of quantitative and qualitative characters differentiating the 4 recognized species of Isopachys.

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<thead>
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<th>Character</th>
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<th>roulei</th>
<th>gyldenstolpei</th>
<th>borealis</th>
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Table 2
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Lowest value: 77 29 23 20 14 140
Highest value: 177 73 28 22 17 152
Mean: 24.9 20.4 15.4 142.7

Categories examined: I: snout-vent length (mm); II: tail length (mm); III: # scales around neck; IV: # scales at midbody; V: # scales around base of tail; VI: # scales from parietal to above vent.

Table 3
Character data matrix of Isopachys. Characters described in the text.

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19) Palatine and ectopterygoid anterior relationship: 0) separated; 1) meet, to exclude maxilla from infraorbital foramen.

The character data matrix (Table 3) was subjected to the Hennig 86 program of FARRIS (1988), which is an interactive program for phylogenetic analysis. Both the implicit enumeration and branch breaker options were used to evaluate the most parsimonious cladogram (FARRIS, 1988). The single resulting most parsimonious cladogram is relatively robust (consistency index = 0.91, length = 24) with each node being well-supported (Fig. 9). Two homoplasies have to be accounted for (the convergence of character 6 and the reversals of character 10). Autapomorphies are provided for all terminal taxa except Isopachys roulei. The latter species is easily distinguished from the other three species by the extremely low number of scales around neck, midbody and tail as well as having a frontonasal scale which is distinctly larger than the frontal scale (Table 1).

The cladistic analysis suggests that Isopachys borealis is more closely related to glydenstolpei than to the other two species (Fig. 9). Isopachys roulei is the sister-taxon to this clade and anguinoides is the earliest diverging taxon within Isopachys.

**Etymology:**
The specific epithet borealis is an adjective derived from the Greek noun boreas and refers to the northernmost distribution of this species within the genus.

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**Specimens examined**

*Isopachys roulei* - FMNH (Field Museum of Natural History, Chicago) 177265, 177268: Thailand; Chon Buri Province: Bang Sian (not located on map).

*Isopachys anguinoides* - FMNH 177487, 177521: Thailand; Prachap Khiri Khan Province: Hua Hin.

*Isopachys glydenstolpei* - FMNH 178323: Thailand; Prachap Khiri Khan Province: Hua Hin.

*Isopachys borealis* - see text (holotypes and paratypes).

**Literature cited**


Mathias LANG,  V.R. Herpetologie, Koninklijk Belgisch Instituut voor Natuurwetenschappen, Vautierstraat 29, 1040 Brussel

Wolfgang BÖHME, Zoologisches Forschungsinstitut und Museum Alexander Koenig, Adenauerallee 150-164, D-5300 Bonn 1 W. Germany