

## 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 neighbouring 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. gyldenstolpei*. 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 contrast avec les autres membres de ce genre, n'est pas restreinte le long de la Baie de Thaïlande. Phylogénétiquement elle est proche de *I. gyldenstolpei*. Quelques notes sur l'ostéologie et les habitudes sont données.

**Mots-clés :** Squamata, Scincidae, *Isopachys borealis* sp. nov., Thaïlande, Birmanie.

### 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.

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

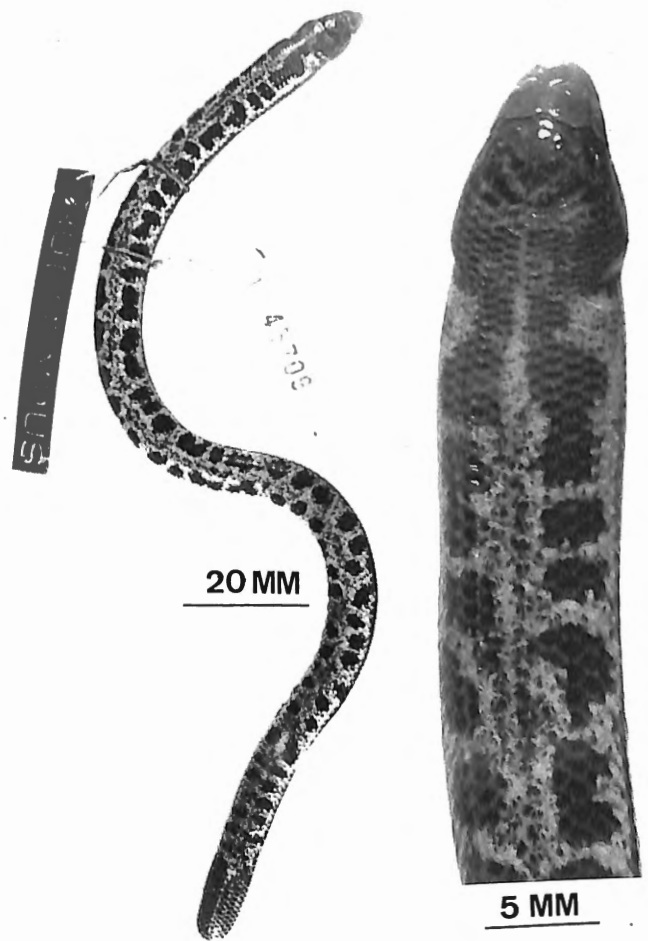


Figure 1. Dorsal and ventral view of holotype of *Isopachys borealis* (ZFMK 45709).

#### *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

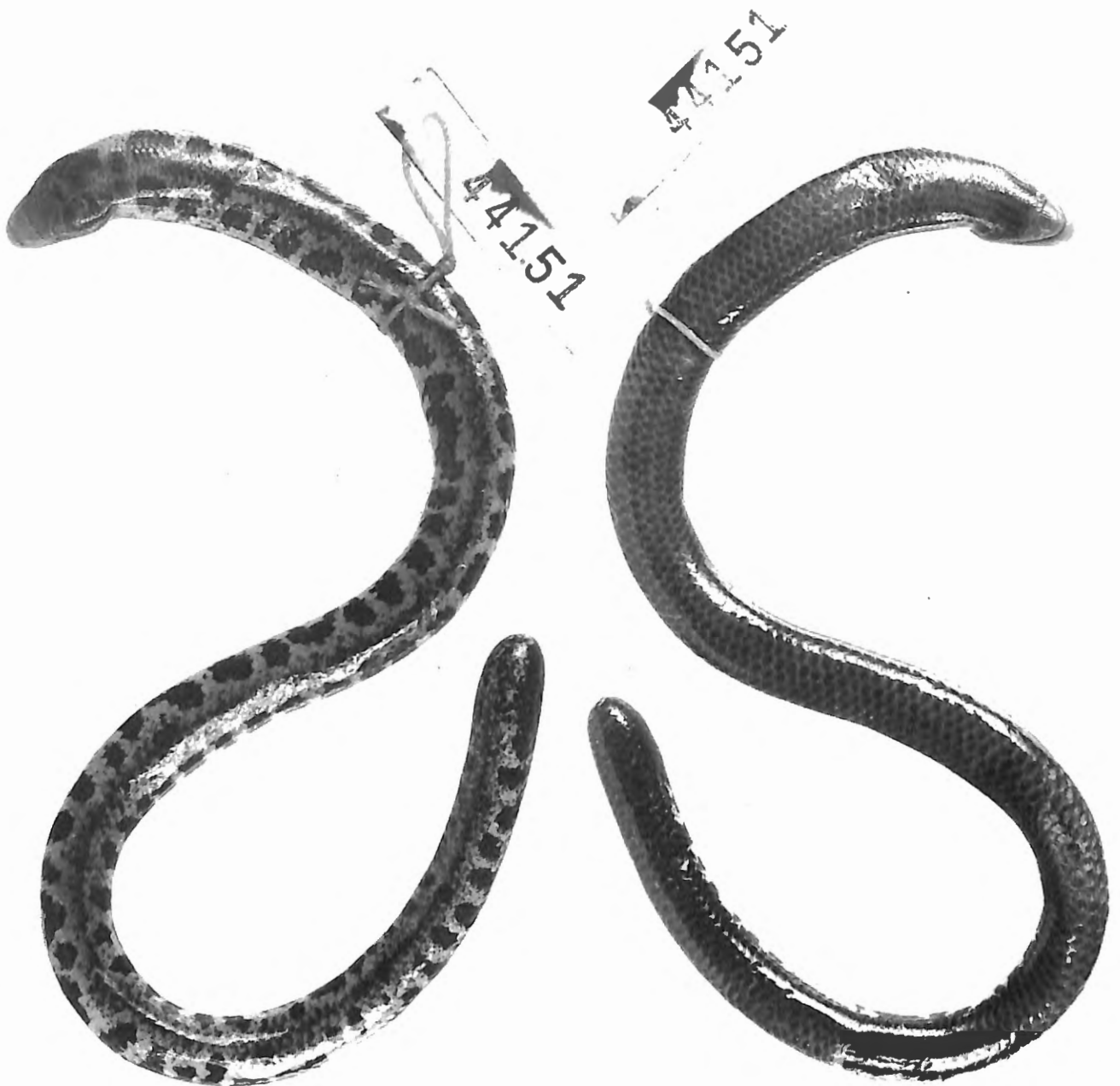


Figure 2a. Dorsal and ventral patterns of *Isopachys borealis*.

W. THIELEN, July 1986. ZFMK 47725-47726 from Taling Sung (140 m elev.), 95 km NW of M. Nakhon Sawan, Kamphaeng Phet Province, Thailand. Collected by W. THIELEN, 17 August, 1987. ZFMK 49182-49184 from Nong Rua (250 m elev.), 45 km W of Khon-Kaen, Khon-Kaen Province, Thailand. Collected by W. THIELEN, August, 1988. ZFMK 49199-49200 from Nam Len (270 m elev.), 30 km northeast of Phetchabun, Phetchabun Province, Thailand. Collected by W. THIELEN, July 1988. ZFMK 45570-45572 from Phadow, 150 km S of Moulmein, Burma. Collected by W. THIELEN, July 1986.

*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 encapsulated 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 *gyldenstolpei*, 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 *roulei* and *anguinoides* have longitudinal markings (Fig. 3).

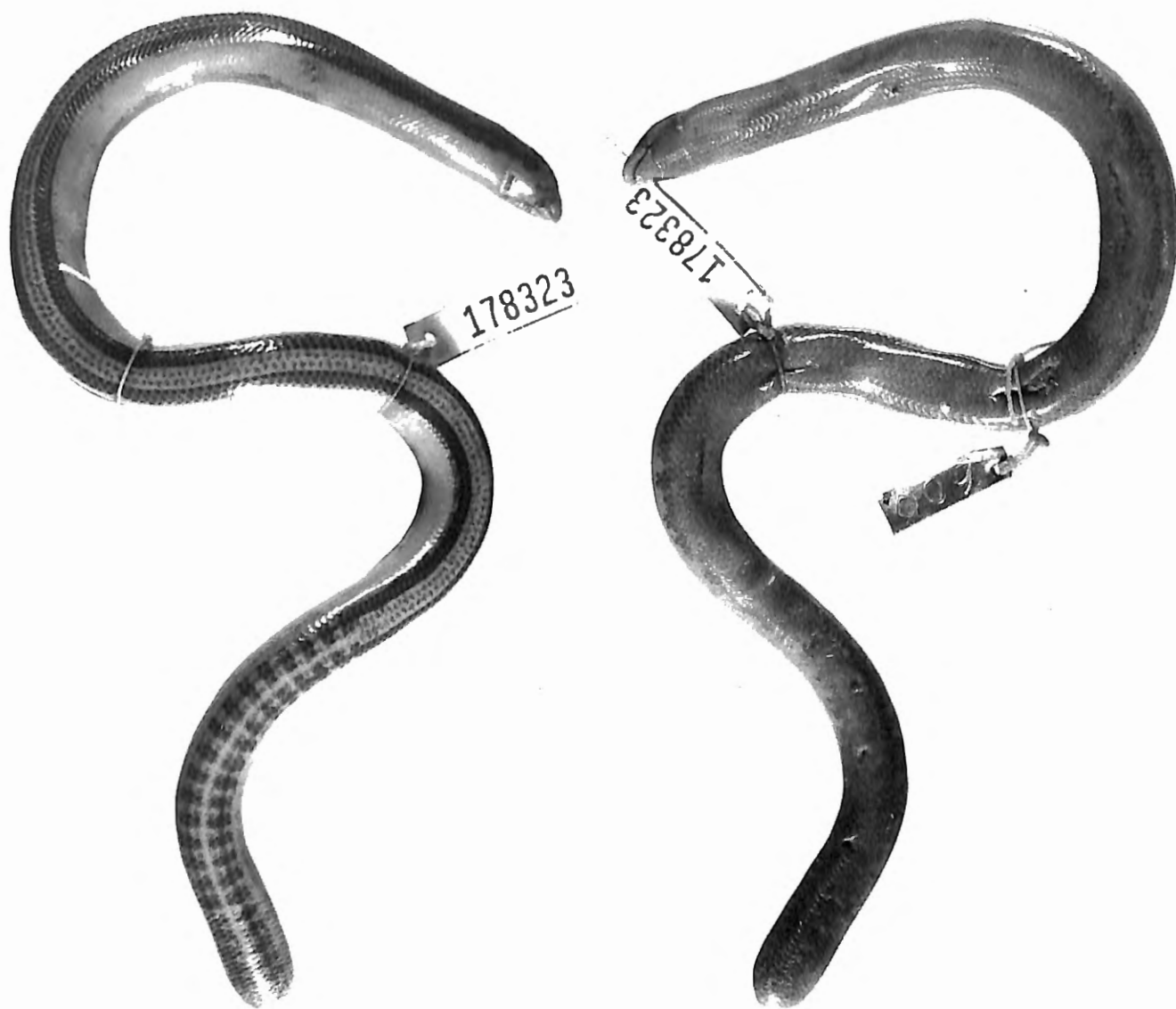


Figure 2b. Dorsal and ventral patterns of *I. gyldenstolpei*.

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.

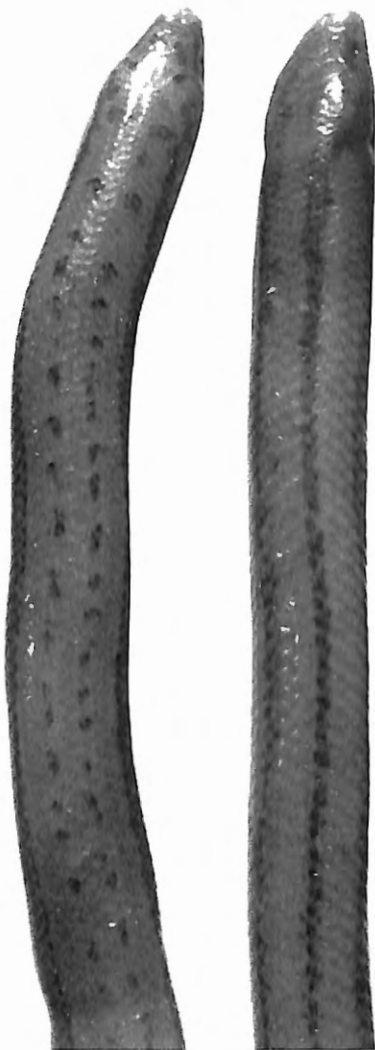
*Description of holotype :*

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, nasal, 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).



10 MM

Figure 3. Dorsal patterns of *Isopachys roulei* and *I. anguinoides*.

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; postoculars 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.

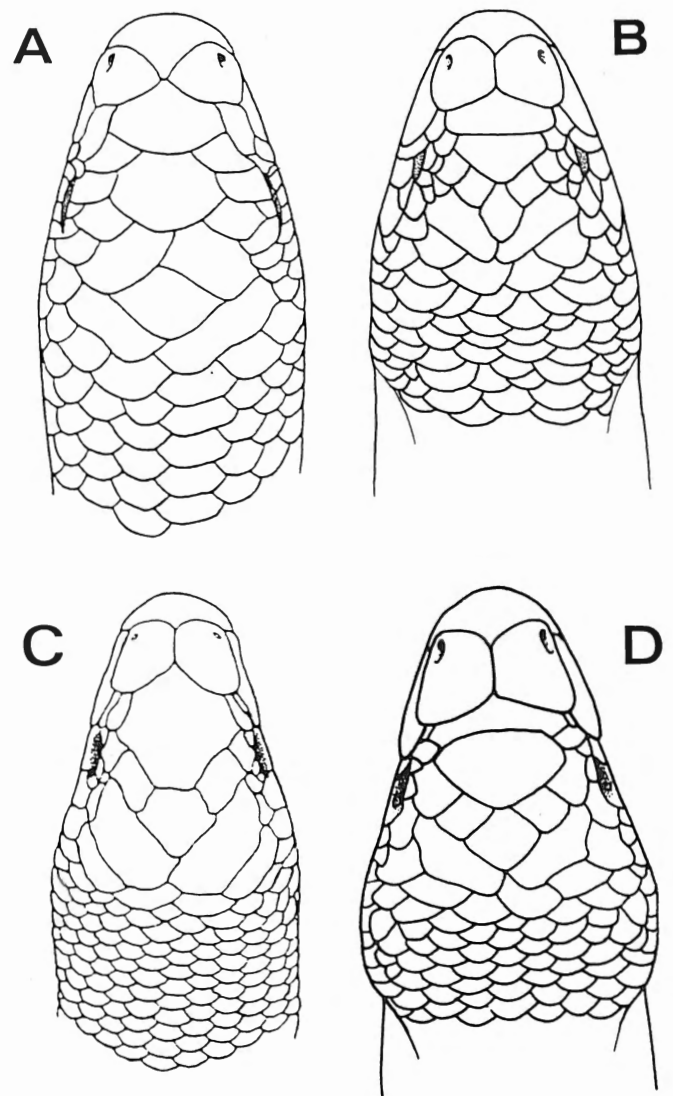


Figure 4. Patterns of dorsal head shields of the four species of *Isopachys*. A) *anguinoides* (redrawn from СМІТН, 1935); B) *roulei*; C) *gyldenstolpei* (redrawn after СМІТН, 1935); D) holotype of *borealis*.

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;

see below). 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 ceratobranchials 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 300 m (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*, *gyldestolpei* 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. gyldestolpei* (Fig. 8).

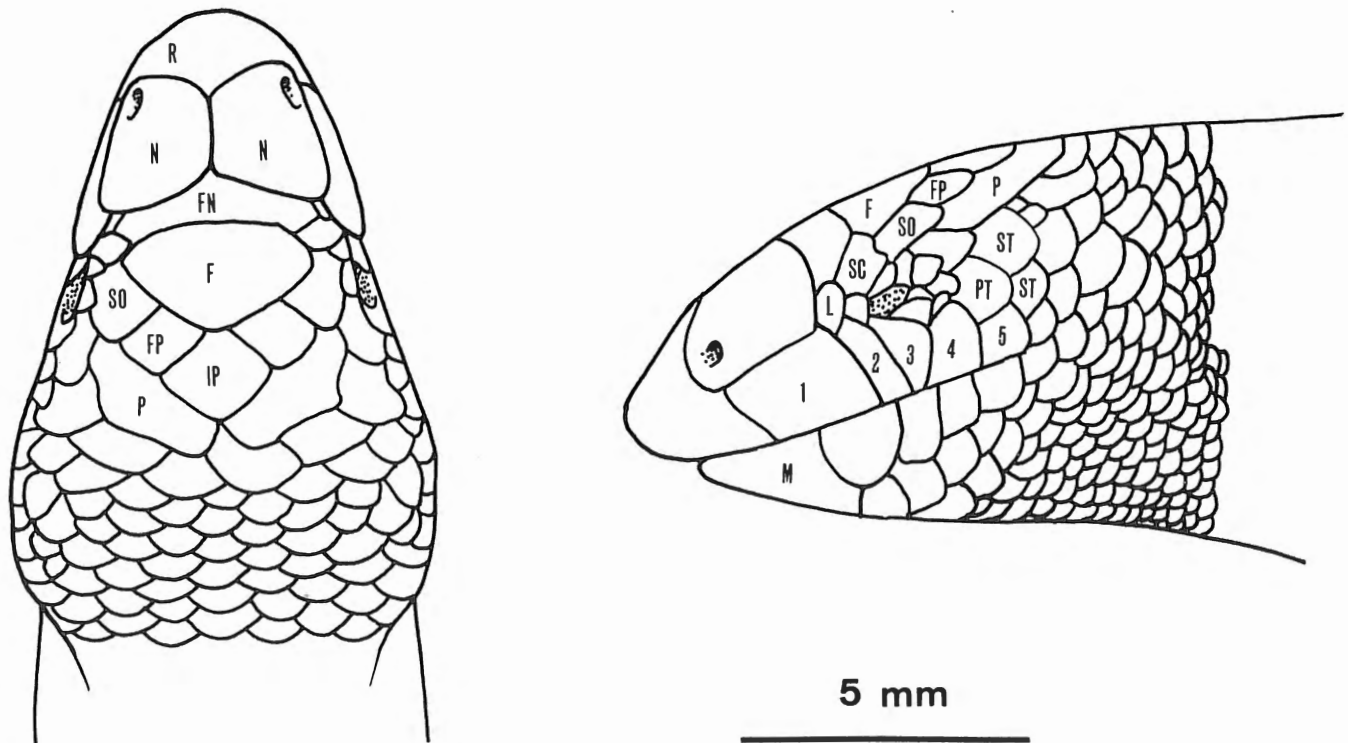


Figure 5. Top and side view of head of holotype of *Isopachys borealis*. Abbreviations for scales are: F = frontal; FN = frontonasal; FP = frontoparietal; IP = interparietal; L = loreal; M = mental; N = nasal; P = parietal; PT = posttemporal; R = rostral; SC = supraciliary; SO = supraocular; ST = supratemporal; 1-5 = supralabials.

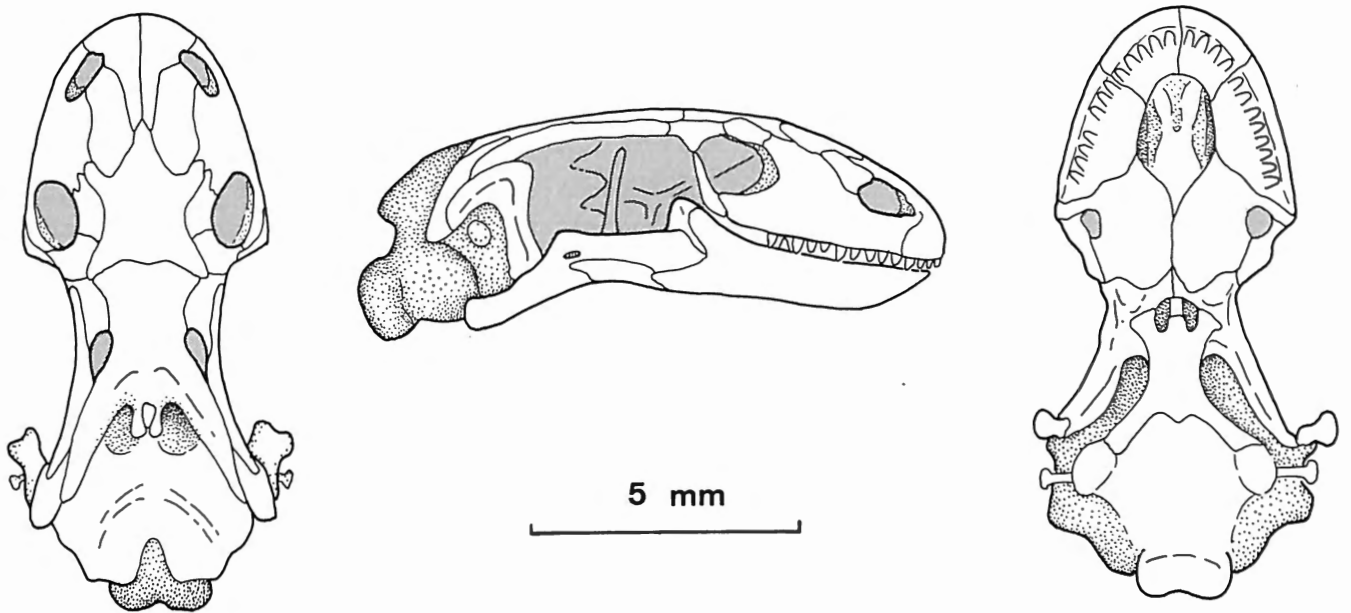


Figure 6. Dorsal, lateral, and ventral views of the skull of *Isopachys borealis*.

The few references on the life history aspects of *Isopachys* indicate that at least *anguinoides* and *gyldenstolpei* 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).

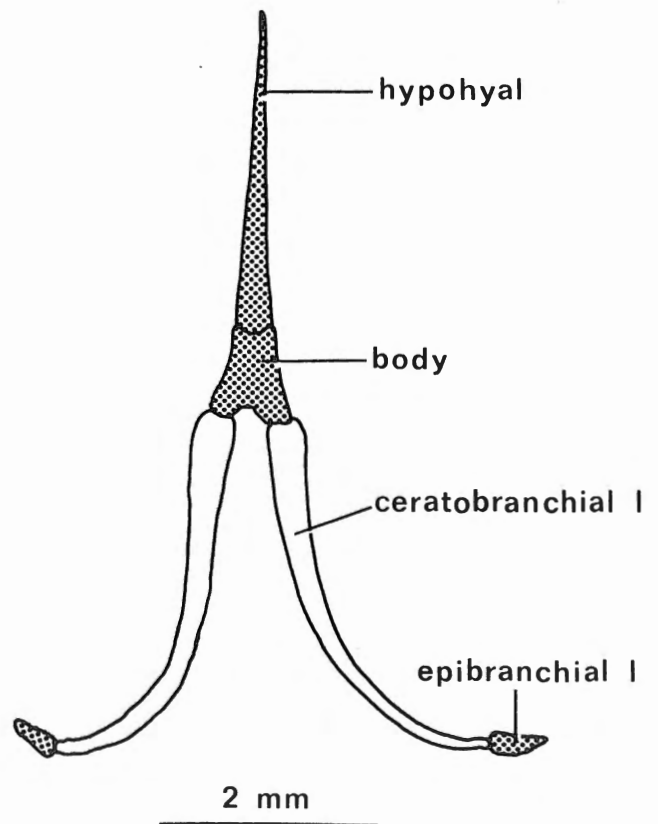


Figure 7. Ventral view of hyobranchial skeleton of *Isopachys borealis*.

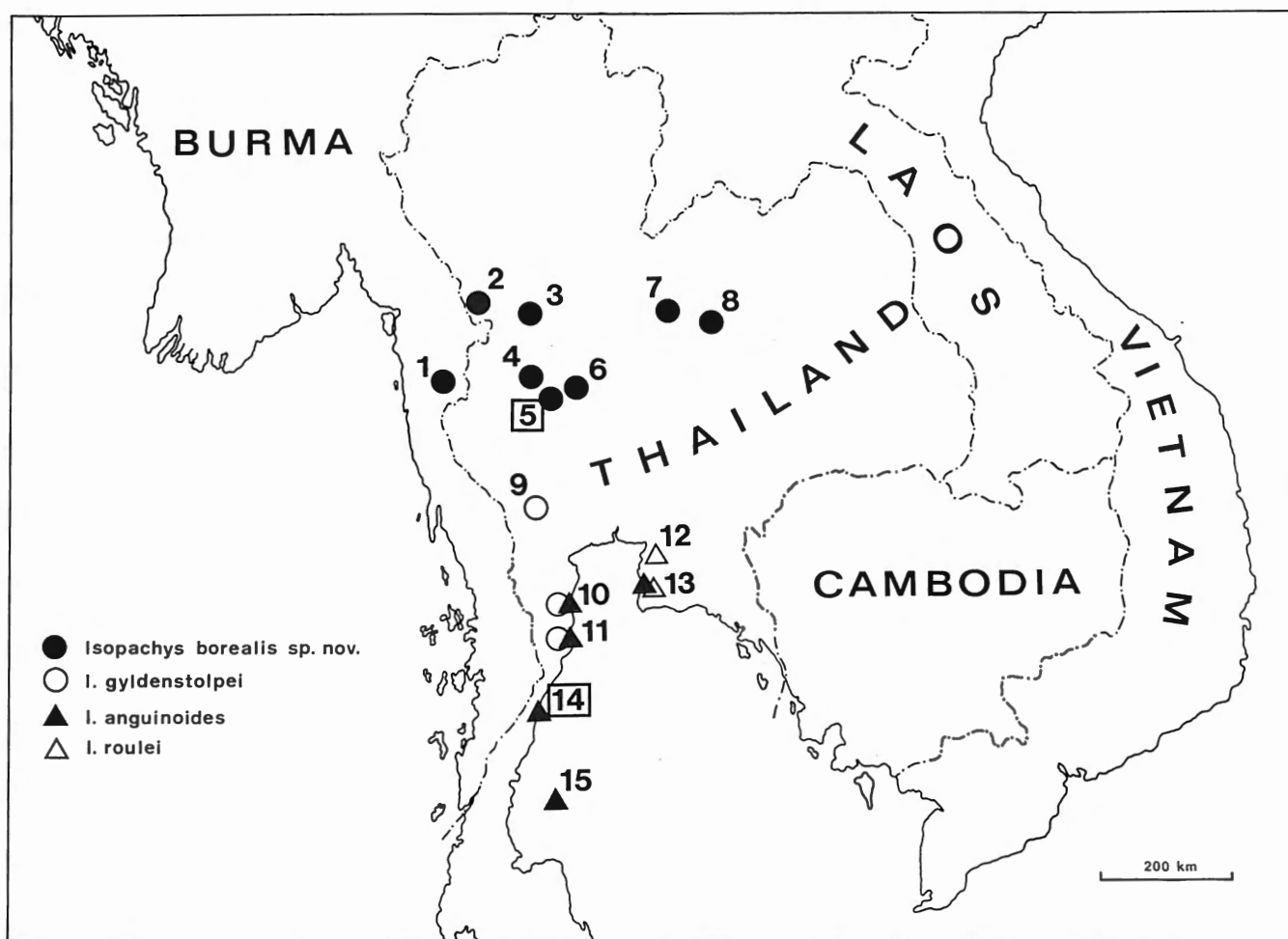


Figure 8. Distribution of known localities of *Isopachys*. The type localities are boxed in. Localities are : 1) Phadow, 150 km S of Moulmein, Burma. 2) Mae-Sot (300 m elev.), 60 km west of Tak, Tak Province, Thailand. 3) Taling Sung (140 m elev.), 95 km NW of M. Nakhon Sawan, Kamphaeng Phet Province, 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) "Bangtaphan" (= Bang Saphan Yai), Prachuap Khiri Khan Province, Thailand. 15) Ko Tao Island, Gulf of Thailand. The type localities of *I. gyldenstolpei*, 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.  | 11) External ear (H32, modified) : 0) external ear opening with exposed tympanum; 1) auricular crease present externally, tympanum scaled-over. |
| 2) Prefrontal scales (H8) : 0) paired; 1) fused with frontals.  | 12) Retroarticular process (H35) : 0) moderately developed; 1) well-developed; 2) well-developed projecting ventrally.                          |
| 3) Frontonasal scales (H9) : 0) present; 1) fused.  | 13) Interclavicle (H36) : 0) present; 1) reduced; 2) absent.  |
| 4) Third temporal scale (H17) : 0) present; 1) fused.   | 14) Sternum (H37) : 0) present; 1) much reduced; 2) absent.   |
| 5) Postmental scale (H23) : 0) present; 1) fused.   | 15) Humeral vestige (H38) : 0) present; 1) absent.  |
| 6) Nasal bones (H24) : 0) in contact; 1) separated.   | 16) Rib articulation with sternum (H39) : 0) present; 1) absent.  |
| 7) Jugal (H28) : 0) moderately developed; 1) reduced.   | 17) Osteoderms (H42) : 0) free from skull; 1) co-ossified with skull.   |
| 8) Palatines (H29) : 0) in contact; 1) separate. Although we agree with GREER (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. | 18) Palatine & ectopterygoid posterior relationship : 0) separated posterior to infraorbital foramen; 1) in contact.                            |
| 9) Pterygoids (H30) : 0) separated; 1) in contact at midline.   |   |
| 10) Basipterygoid process (H31) : 0) well-developed; 1) process reduced.  |   |

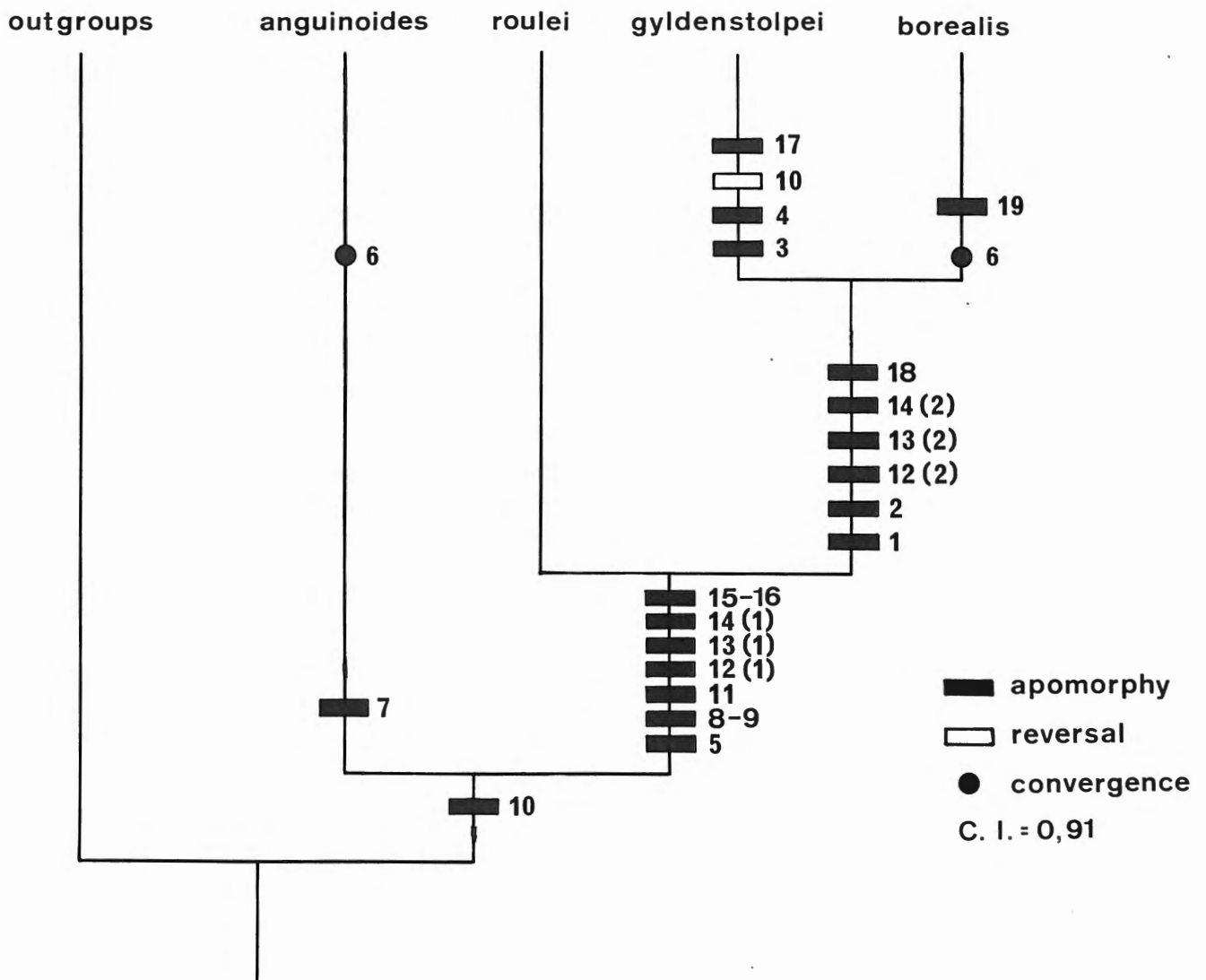


Figure 9. Proposed phylogenetic relationship among the four species of *Isopachys*. See text for description of characters.

Table 1

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

	<i>anguinoides</i>	<i>roulei</i>	<i>gyldenstolpei</i>	<i>borealis</i>
nasal scales	separated	contact	contact	contact
frontal/frontonasal	equal	FN larger	fused	FN smaller
frontoparietals	contact	separated	separated	separated
# supralabials	5	4	4	5
# scales @ neck	26-27	20-23	29-31	23-28
# scales @ midbody	21-24	18	24-28	20-22
# scales @ tail	15-18	14-15	19	14-17
# scales parietal-vent	108	125-135	203	140-152
snout-vent (mm)	60-71	82-106	167-220	77-177



Table 2  
Meristic values in *Isopachys borealis*.

	I	II	III	IV	V	VI
ZFMK 43938 paratype	94	38	26	20	17	141
ZFMK 43939 paratype	114	41	25	20	16	140
ZFMK 44150 paratype	128	52	24	21	15	141
ZFMK 44151 paratype	132	36	24	20	16	141
ZFMK 44152 paratype	133	51	28	20	15	144
ZFMK 44153 paratype	131	50	25	21	17	143
ZFMK 45704 paratype	149	73	25	20	15	141
ZFMK 45705 paratype	118	51	23	20	16	142
ZFMK 45706 paratype	138	—	25	20	16	140
ZFMK 45707 paratype	82	30	25	21	16	140
ZFMK 45708 paratype	128	53	24	20	15	145
ZFMK 45709 paratype	154	37	24	22	15	142
ZFMK 45710 paratype	79	34	25	21	17	140
ZFMK 45713 paratype	155	39	24	20	15	146
ZFMK 45714 paratype	156	—	26	20	15	140
ZFMK 45751 paratype	133	—	26	21	16	147
ZFMK 45752 paratype	87	32	24	21	15	148
ZFMK 47725 paratype	93	—	25	20	16	144
ZFMK 47726 paratype	77	29	24	20	14	149
ZFMK 49182 paratype	177	—	25	20	16	152
ZFMK 49183 paratype	91	—	24	20	15	142
ZFMK 49184 paratype	88	37	25	20	15	140
ZFMK 49199 paratype	132	—	26	21	15	143
ZFMK 49200 paratype	93	39	24	20	14	143
ZFMK 45570 paratype	95	36	26	20	15	140
IRSNB 2543 paratype	167	41	26	21	15	140
IRSNB 2543 paratype	105	38	24	20	15	142
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.

Characters	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
<i>anguinoides</i>	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0
<i>gyldestolpei</i>	1	1	1	1	1	0	0	1	1	0	1	2	2	2	1	1	1	1	0
<i>roulei</i>	0	0	0	0	1	0	0	1	1	1	1	1	1	1	1	1	0	0	0
<i>borealis</i>	1	1	0	0	1	1	0	1	1	1	1	2	2	2	1	1	0	1	1

- 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 the northernmost distribution of this species within the genus.

#### Acknowledgements

Many thanks to Robert INGER and Hymen MARX (Field Museum of Natural History) for providing comparative material of *Isopachys*. Thanks to Ursula BOTT for preparing the cladogram and distribution map and to Jens SCHICKE for photographic material.

#### Specimens examined

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

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

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

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

#### Literature cited

BÖHME, W., 1982. A new lygosomine skink from Thailand (Reptilia : Scincidae). *Bollettino del Museo Civico di Storia Naturale Verona*, 8 : 375-382.

FARRIS, J.S., 1988. Hennig 86 Reference. Manual.

GREER, A.E., 1970. A subfamilial classification of scincid lizards. *Bulletin of the Museum of Comparative Zoology, Harvard University*, 139 (3) : 151-183.

GREER, A.E., 1977. The systematics and evolutionary relationships of the scincid lizard genus *Lygosoma*. *Journal of natural History*, 11 : 515-540.

HEYER, W.R., 1972. A new limbless skink (Reptilia : Scincidae) from Thailand with comments on the generic status of the limbless skinks of southeast Asia. *Fieldiana, Zoology*, 58 (10) : 109-129.

SMITH, M.A., 1935. The fauna of British India, including Ceylon and Burma. Reptilia and Amphibia. Vol. II. Sauria. TAYLOR and FRANCIS, London. xii + 440 pp.

TAYLOR, E.H., 1963. The lizards of Thailand. *University of Kansas Science Bulletin*, 44 (14) : 687-1077.

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

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