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A New Salamander of the Genus *Paramesotriton* (Caudata: Salamandridae) from Laos

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ABSTRACT.—A new species of *Paramesotriton* is described from northern Laos. This represents the first record of Caudata from the country. The species is placed in the genus *Paramesotriton* based on osteological characters. It differs from all other members of the genus in dorsal color pattern and reduced tongue development.

The salamander family Salamandridae consists of 15 genera and some 58 described species in North America and Eurasia. Five genera occur in Asia. These are *Cynops* with seven species, *Echinotriton* with three species, *Pachytriton* with two species, *Paramesotriton* with six species, and *Tylototriton* with four species (Zhao et al., 1988; Zhao and Adler, 1993; D. R. Frost, pers. comm.). We report here on a distinctive new species of the genus *Paramesotriton* from northern Laos. This taxon represents the first record of Caudata from the country.

MATERIAL AND METHODS

Thirteen specimens were examined. The first seven of these were taken from Phoukhout District, Xiang Khouang Province (Fig. 1) by Bouavay Phouminh (NAWACOP Project, Xiang Khouang) in February 1998 and presented to Sivannavong Sawathvong (Department of Forestry, Vientiane); these were later given to one of us (BLS) in Laos. Two were still alive (FMNH 255451–52); these were shortly preserved in 10% buffered formalin after fixing small pieces of liver from each in 95% ethanol for later genetic analyses. The other five Xiang Khouang speci-

mens (FMNH 255450, 257850–53) had died and were already preserved in formalin upon receipt. Three of the Xiang Khouang specimens (FMNH 255450–52) were deposited in August 1998 at Field Museum, Chicago, and were transferred to 70% ethanol upon arrival there. The remaining four Xiang Khouang specimens (FMNH 257850–53) were transferred to 70% ethanol in June 1999 and deposited at Field Museum in April 2000. In August 1999 two specimens (FMNH 257854–55) were taken from Houay Pa Tin Stream, Saysamboun Special Zone (Fig. 1) by Phetsamay Vongkhammounty (Ministry of Agriculture and Forestry, Vientiane) and given alive to one of us (BLS) in Laos; these were shortly preserved in 10% buffered formalin after fixing small pieces of liver from each in 95% ethanol for later genetic analyses. In November 1999, Saysamboun Special Zone was visited by one of us (BLS) and the species was observed in the field; four of these were collected (FMNH 257856–59) and preserved in the same manner. The Saysamboun specimens were deposited at Field Museum in April 2000 and transferred to 70% ethanol upon arrival there.

We examined comparative material in the holdings of the Field Museum (FMNH) and the Museum of Vertebrate Zoology, University of California at Berkeley (MVZ); these are listed below.

Measurements were taken from preserved

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PLATE 1. (A) Dorsal view of live female paratype (FMNH 257855) of *Paramesotriton laoensis* species nov. Photograph by B. L. Stuart. (B) Ventral view of same specimen. Photograph by B. L. Stuart. (C) Phou Sang Kat Hill Range, Saysamboun Special Zone, Laos. Houay Sang Kat Stream, the type locality of *Paramesotriton laoensis* species nov., flows beneath the line of darker green scrub in the lower right of the photograph. Photograph by B. L. Stuart. (D) The pool in Houay Sang Kat Stream from which the holotype specimen of *Paramesotriton laoensis* species nov. was collected. A paratype of *P. laoensis* just prior to collection is in situ at the bottom of the pool in the center of the photograph (arrow). Photograph by B. L. Stuart.

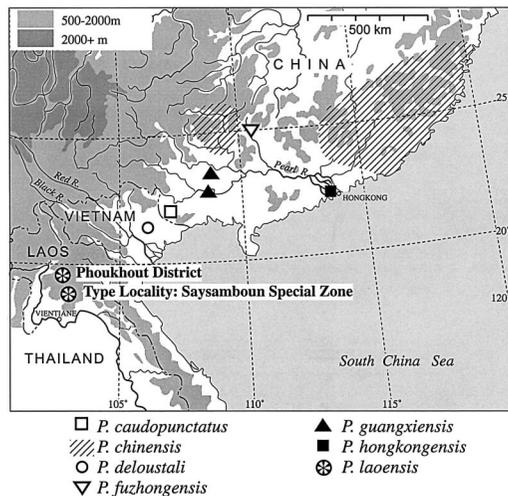


FIG. 1. Map of *Paramesotriton* distribution, illustrating the two localities from which *Paramesotriton laoensis* species nov. is known: Phoukhout District (Xi-ang Khouang Province) and Saysamboun Special Zone, Laos. Map constructed by Karen Klitz, Museum of Vertebrate Zoology.

specimens with dial calipers to the nearest 0.1 mm. We use the following abbreviations: SVL = snout-vent length measured from tip of snout to anterior edge of vent; TTL = total length; TAL = tail length measured from posterior edge of vent to tail tip; TAD = maximum tail depth; HL = head length measured from posterior edge of left parotoid to snout tip; HW = maximum head width; IO = interocular distance measured from anterior corner of eyes; EN = anterior corner of right eye to right nostril; IN = internostril distance; AX = distance between axillae on right side; AL = right anterior limb length measured from point of body insertion to tip of longest finger; PL = right posterior limb length measured from point of body insertion to tip of longest toe. Specimens were sexed by internal examination. Skeletal characters were assessed using x-ray photography at the Museum of Vertebrate Zoology.

Paramesotriton laoensis species nov.
Plate 1A-B

Material Examined.—Holotype: FMNH 257856, SVL 85.0, male; Laos (Lao PDR), Saysamboun Special Zone, in pool of Houay Sang Kat Stream (18°52'49"N 103°06'32"E; 1160 m elevation) at base of Phou Sang Kat mountain; collected 14 November 1999 by Bryan L. Stuart. Paratypes: From locality of holotype: FMNH 257857, SVL 69.0, female; FMNH 257858, SVL 77.0, female; FMNH 257859, SVL 72.5, female. From Saysamboun Special Zone, Houay Pa Tin Stream:

FMNH 257854, SVL 73.2, male; FMNH 257855, SVL 83.2, female. From Xi-ang Khouang Province, Phoukhout District, near Ban Nyot Phae: FMNH 255450, SVL 84.0, female; FMNH 255451, SVL 91.5, male; FMNH 255452, SVL 83.2, female; FMNH 257850, SVL 88.9, female; FMNH 257851, SVL 84.8, male; FMNH 257852, SVL 92.6, female; FMNH 257853, SVL 89.3, female.

Comparative Material Examined.—*Paramesotriton caudopunctatus* (MVZ 204295–96 from Guizhou Province, China); *Paramesotriton chinensis* (MVZ 230616–21 from Guangxi Autonomous Region, China); *Paramesotriton deloustali* (MVZ 222122, 223627–29, 225135, 226269 from Vinh Thu Province, Vietnam); *Paramesotriton fuzhongensis* (MVZ 230361–64, 230622–25 from Guangxi Autonomous Region, China); *Paramesotriton guangxiensis* (MVZ 220905–06 from Guangxi Autonomous Region, China); *Paramesotriton hongkongensis* (FMNH 56454–55, MVZ 230365–70 from Hong Kong SAR, China).

Diagnosis.—*Paramesotriton laoensis* is diagnosed by the following combination of characters: distinct tan (white-yellow in preservative) dorsal stripes; warts and glands covering much of the dorsal and ventral surfaces; reduced, poorly differentiated tongue pad lacking a free posterior margin; large, orange-red (white-yellow in preservative) spots on venter, chin, underside of axillae, and cloaca.

Description.—Habitus stout; head equal in width to body. Head strongly sloping in profile. Skull broad with maxillaries oriented angular to body axis. Snout short, truncate, rounded in profile, and exceeding beyond lower jaw. Nostrils close to snout tip. Upper lips thick, fleshy and overlapping lower lip under eye region. Vomeropalatine teeth in two rows beginning just posterior to the last maxillary tooth at the anterior limit of the choanae, converging into two parallel rows briefly, then diverging from one another. Tongue greatly reduced with poorly differentiated tongue pad lacking a free posterior margin. Twelve trunk vertebrae. Three tubercular dorsal ridges, one midline and two lateral, extending from top of head to base of tail. Glands and warts covering much of dorsal and ventral surfaces. Parotoids enlarged, projecting backwards. Gular fold present. Four fingers, five toes, all without webbing. Tail laterally compressed; dorsal tail fin and indistinct ventral tail fin; tail extremity round in profile.

Color in Life.—Body black. Tubercular dorsal ridges and dorsum of parotoid glands tan. Tan spot on dorsum of snout, dorsum of forelegs at junction with body, and extending somewhat obliquely from posterior corner of eye to near corner of mouth. Large, irregular, orange-red spots on venter, chin, underside of axillae, clo-

TABLE 1. Measurements of *Paramesotriton laoensis* sp. nov. Abbreviations defined in text.

Measurement	Males (FMNH 255451, 257851, 257854, 257856)		Females (FMNH 255450, 255452, 257850, 257852–53, 257855, 257857–59)	
	Range; Mean \pm SE (N = 4)		Range; Mean \pm SE (N = 9)	
SVL	73.2–91.5;	83.6 \pm 3.8	69.0–92.6;	82.2 \pm 2.6
TTL	157.7–188.1;	176.9 \pm 6.9	155.2–198.1;	180.3 \pm 4.5
TAL	78.5–94.4;	86.7 \pm 4.5	81.2–100.3;	91.6 \pm 2.3
TAD	11.0–16.0;	13.8 \pm 1.0	9.8–14.7;	12.5 \pm 0.6
HL	24.6–30.8;	28.2 \pm 1.3	22.7–29.8;	26.6 \pm 0.9
HW	19.4–23.7;	21.4 \pm 1.0	18.3–24.2;	20.9 \pm 0.7
IO	9.8–13.1;	11.8 \pm 0.7	10.3–12.8;	11.5 \pm 0.3
EN	5.9–7.5;	6.9 \pm 0.3	5.9–7.5;	6.6 \pm 0.2
IN	5.1–6.4;	5.7 \pm 0.3	5.4–6.5;	5.9 \pm 0.1
AX	37.1–47.0;	41.5 \pm 2.1	34.5–44.2;	40.2 \pm 1.1
AL	27.7–33.9;	31.5 \pm 1.4	25.5–34.3;	29.8 \pm 0.9
PL	26.1–31.8;	29.4 \pm 1.2	25.8–33.7;	29.4 \pm 0.8

aca; some smaller spots interspersed on venter. Orange-red on underside of tail base.

Color in Preservative.—Dorsal tan fades to yellow or white; ventral orange fades to yellow or white.

Variation.—Width of dorsal tan stripes variable, sometimes merging to form nearly solid tan dorsum; ventral spots vary in shape and arrangement.

Measurements.—Holotype (in millimeters): SVL 85.0, TTL 188.1, TAL 94.4, TAD 16.0, HL 28.2, HW 22.3, IO 12.2, EN 7.5, IN 6.4, AX 40.3, AL 30.8, PL 30.5. Other measurements summarized in Table 1.

Etymology.—Specific name *laoensis* meaning found in Laos (Lao PDR).

Habitat and Behavior.—Houay Sang Kat and Houay Pa Tin Streams flow in valleys on opposite sides of the Phou Sang Kat Hill Range just south of Saysamboun town, and are separated from each other by less than 2 km. Phou Sang Kat, and most neighboring hills, were without forest and covered by grasses and scrub (Plate 1C). Taller scrub, grasses, and banana trees lined both streams, and very little of either stream was shaded by canopy. Houay Sang Kat Stream was mostly flat with only a slight gradient, 1–2 m wide, with a substrate of silt, gravel, rocks, and submerged rock faces. Houay Pa Tin Stream was flat, 2–4 m wide, with similar substrate. Both streams had many pools with silt substrate, separated by sections of swift current with rocky substrate, and were quite cold. All specimens of *P. laoensis* from the Houay Sang Kat were found within a 2 \times 3 m pool at the base of a small cascade (Plate 1D). The pool was roughly 1 m in maximum depth, with a slow current, a substrate of silt covered by scattered rocks, and lined with a submerged rock face containing many crevices. The salamanders were seen actively moving on the sunlit pool

bottom, emerging from under rocks and crevices. The tan dorsal markings of *P. laoensis* blended with the dappled sunlight on the pool bottom, making them cryptic even by day. *Paramesotriton laoensis* is probably fully aquatic, as overlapping upper lips and greatly reduced tongue usually are specializations for feeding in highly aquatic salamander taxa (Özeti and Wake, 1969). The locality in Xiang Khouang Province has not been visited, and habitat details there remain unknown.

Comparisons.—Distinct tan (white-yellow in preservative) dorsal stripes distinguish *P. laoensis* from all other *Paramesotriton*. Warts and glands covering much of the dorsal and ventral surfaces distinguish *P. laoensis* from all other *Paramesotriton* except *P. fuzhongensis*. A reduced, poorly differentiated tongue pad lacking a free posterior margin distinguishes *P. laoensis* from all other Asian salamandrids except *Pachytriton*. The species is allocated to the genus *Paramesotriton* because of its broad skull with maxillaries oriented angular to the body axis and 12 trunk vertebrae. Although *P. laoensis* shares features of the tongue with *Pachytriton*, the latter has a narrow skull with maxillaries oriented parallel to the body axis and smooth skin. Of the other Asian salamandrid genera, *Cynops* has 13 trunk vertebrae, *Echinotriton* has a lateral row of large warts supported by rib tips, and *Tylototriton* has a uniformly pigmented venter and 13–15 trunk vertebrae (Zhao, 1988).

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From *Sphenomorphus* to *Lipinia*: Generic Reassignment of Two Poorly Known New Guinea Skinks

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ABSTRACT.—*Lygosoma nototaenia* Boulenger, 1914, and *Lygosoma albodorsale* Vogt, 1932, previously placed in the genus *Sphenomorphus*, are redescribed from the three known specimens of each (including two new specimens of the latter species) and transferred to the genus *Lipinia*. The phenotypically similar genus *Scincella* is distinguished from *Lipinia* by an apomorphic feature of the secondary temporal scales. A novel phalangeal condition, shortening of the third phalanx of the fourth toe, is identified in *Lipinia cheesmanae* and *Lipinia longiceps*.

Among the 38 described species of skink recorded from the main island of New Guinea and currently assigned to the genus *Sphenomorphus* are two, *Sphenomorphus albodorsalis* (Vogt, 1932) and *Sphenomorphus nototaenia* (Boulenger, 1914), that remain little-known. Both were originally described in the genus *Lygosoma* and were transferred to *Sphenomorphus* by Loveridge (1948) and Mittleman (1952) with the division of the polyphyletic *Lygosoma* of previous authors. With the exception of Smith (1937) and Brongersma (1953), who placed *Lygosoma nototaenia* in *Leiopisma*, both species have been retained in *Sphenomorphus* by all subsequent authors (Bacon, 1967; Greer and Parker, 1967; Scott et al., 1977; Whitaker et al., 1982; Welch et al., 1990). Neither Loveridge nor any subsequent worker has reported examining the type material, and only de Rooij (1915; see also de Rooy, 1919), followed by Brongersma (1953), reported

examining additional material (of *S. nototaenia* only).

The purpose of this paper is to provide new data on the two species, to formally transfer them to the genus *Lipinia* and to comment on some previously unreported features of digit morphology in *Lipinia*. Museum abbreviations follow Leviton et al. (1985). Head scalation definitions follow Taylor (1935). Measurements were made with steel rulers and dial calipers, according to the definitions of Shea and Peterson (1985). Vertebral and phalangeal characters were determined from radiographs, made on Kodak Industrix film with settings of 30 kV and 5mA for 45 to 55 sec, depending on specimen size.

Lygosoma albodorsale Vogt, 1932 was described in a paper based largely on a collection made by Bürgers in 1912–1913 from the Sepik River region (as Kaiserin-Augustafusse) but with a few specimens from other sources. The material described in the paper is lodged in the Zoolo-

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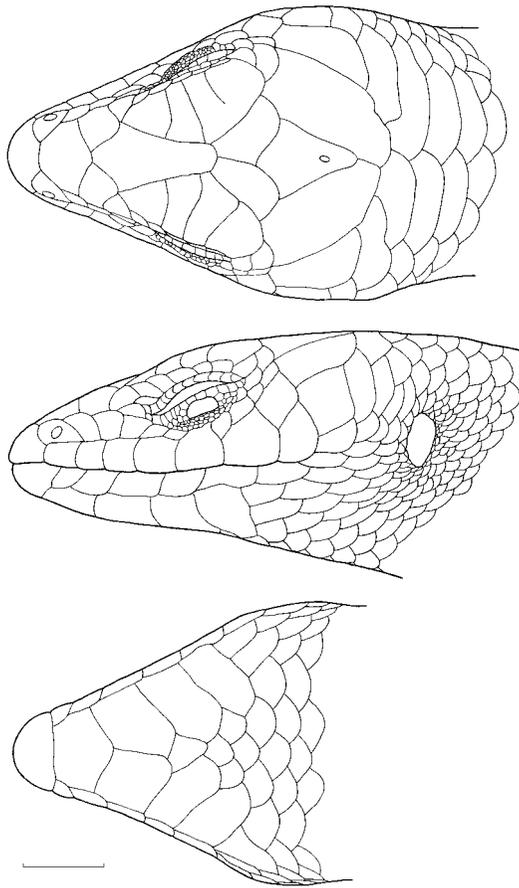


FIG. 1. Dorsal, lateral and ventral views of head scalation of holotype of *Lygosoma albidorsale* Vogt, 1932. Scale bar = 2 mm

gisches Museum, Berlin. Vogt (1932) did not indicate a locality or collector for *L. albidorsale* and gave no indication of the extent of the type series for the species, but only a single set of measurements was given, and no variation in other features was mentioned, suggesting a single type specimen. During a recent visit (1997) to the Zoologisches Museum by the senior author, no registered type specimen or register entry identified by this name was found, but a single specimen was located among a residue of unidentified material lacking identifiable registration numbers, the result of damage to the collection during the last World War. This specimen was associated with a pencilled label "*Lygosoma albidorsale* sp. nov.," but bore no other data. The specimen (Figs. 1–2), now registered as ZMB 57262, is presumed to be the holotype of the species, and agrees closely with two other specimens in the Australian Museum collection, R129260–61, from Weikor (3°48'S 142°50'E), East

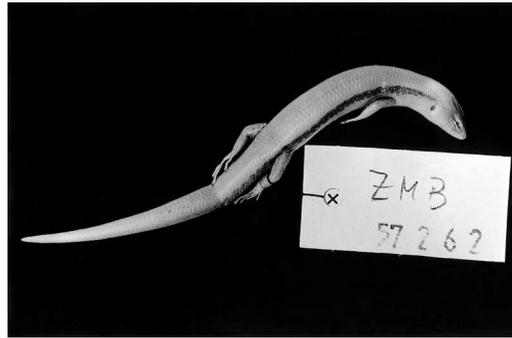


FIG. 2. Holotype of *Lygosoma albidorsale* Vogt, 1932.

Sepik Province, Papua New Guinea, collected by W. H. Ewers on 25 September 1964 (Fig. 3).

The holotype differs in several ways from Vogt's description, although the size and coloration are in general agreement. A redescription of the species, based on the holotype and two additional specimens, follows, with the values for the holotype given in parentheses for variable characters.

Nasals moderately separated, nostril centrally placed in nasal; supra- and postnasals absent; prefrontals narrowly to moderately separated (moderately); supraoculars four, first two or three (three) in contact with frontal; supraciliaries 8–9 ($\bar{x} = 8.8$, $N = 6$; 8L/9R); a single pair of broadly contacting frontoparietals; unpigmented parietal eye spot distinct, in posterior third of interparietal; parietals in contact behind interparietal; nuchals 2–3 (3); two loreals of equal height, anterior slightly narrower than tall, posterior squarish; presuboculars three, not wedged between supralabials; postsuboculars 3–4 ($\bar{x} = 3.7$, $N = 6$; 4); lower eyelid with a translucent to semiopaque window, about one-third size of eyelid; primary temporal single; upper secondary temporal overlaps lower secondary temporal; ear broadly vertically ellipti-

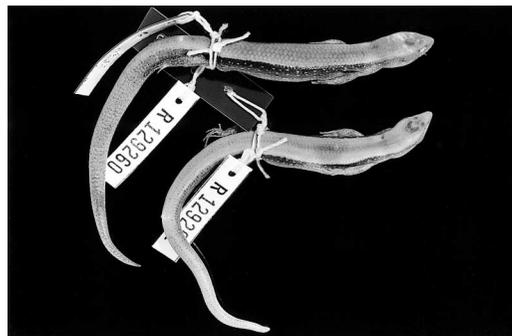


FIG. 3. The two known nontype specimens of *Lipinia albidorsalis* (AMS R129260–61)

cal, height subequal to height of eye, anterior margin smooth, lacking lobules; tympanum deeply sunk; supralabials seven, fifth below centre of eye, and contacting granular scales of lower eyelid; postsupralabials two; infralabials six, first two contacting postmental; three pairs of transversely enlarged chin shields, all laterally contacting infralabials; first pair of chin shields in medial contact, second pair separated by a single scale, third pair separated by three scales.

Body scales smooth, in 22–25 longitudinal rows at midbody ($\bar{x} = 23.7$, $N = 3$; 22); scales in paravertebral series, slightly broader than adjacent dorsal scales, 50–53 from parietal to level of anterior margin of hind limb ($\bar{x} = 51.0$, $N = 3$; 50); medial pair of preanal scales overlap more lateral preanals; adpressed limbs separated by several scale rows; scales above fourth toe in two rows over most of length; subdigital lamellae of fourth toe 19–23 ($\bar{x} = 21.2$, $N = 6$; 22L/23R).

Presacral vertebrae 26; sternal ribs three; mesosternal ribs two; phalangeal formula of manus and pes 2.3.4.5.3 and 2.3.4.5.4, respectively; premaxillary teeth nine (osteology based on the two AMS specimens).

Snout–vent length (SVL) 44.5–54 mm ($N = 3$; 45 mm); axilla–groin length 51.1–52.8% of SVL ($\bar{x} \pm SD = 51.9 \pm 0.8$, $N = 3$; 23 mm); forelimb length 20.4–24.4% of SVL (22.8 ± 2.1 , $N = 3$; 11 mm); hind-limb length 30.6–36.7% of SVL (34.4 ± 3.3 , $N = 3$; 16.5 mm); head length 18.7–21.0% of SVL (20.0 ± 1.2 , $N = 3$; 9.45 mm); head width 73.5–75.7% of head length (74.6 ± 1.2 , $N = 3$; 7.15 mm); head depth 45.6–54.0% of head length (49.7 ± 4.2 , $N = 3$; 5.10 mm).

Dorsally and ventrally pale yellow; a dark upper lateral stripe beginning diffusely on lores, forming a brown spot behind lateral canthus of eye, continuing very obscurely above ear, becoming a continuous narrow (up to three scales wide) rough-edged brown stripe from caudo-dorsal to ear, diffusing again on tail base, and containing numerous scattered pale spots less than a scale in size. Limbs weakly brown mottled above. Soles of feet variegated brown.

Points of difference between the holotype and Vogt's description are the presence of a distinct window in the lower eyelid (not completely scaled), two loreals (not one), three of four supraoculars contacting frontal (not four of five), 8/9 supraciliaries (not eight), 22 midbody scales (not 24, although irregular pairing of scale rows laterally could allow a count of 24), 22/23 subdigital lamellae (not 25). Further, Vogt's description of a broad white dorsal stripe from tip of snout, broader on back, and ending on tail tip, edged with brown, apparently equates to the uniformly pale dorsum of the species and its dark upper lateral stripe.

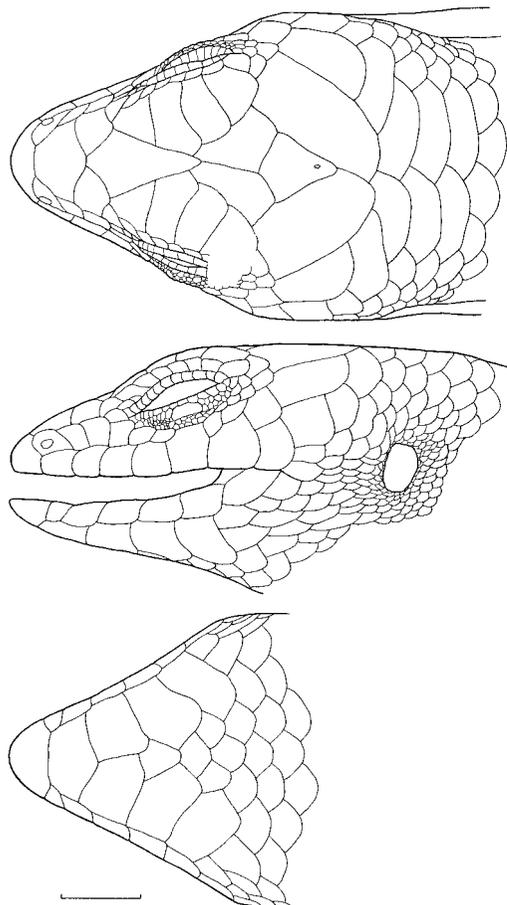


FIG. 4. Dorsal, lateral and ventral views of head scalation of holotype of *Lygosoma nototaenia* Boulenger, 1914. Scale bar = 2 mm

The largest specimen (R129260) has a single enlarged yolking follicle in each ovary.

Lygosoma nototaenia was described from a single specimen (BMNH 1946.8.17.56; Figs. 4–5) collected by the Wollaston Expedition from Launch Camp, Setekwa River, in what is now southern Irian Jaya. Two additional specimens (ZMA 18349–50; Fig. 6) were reported by de Rooij (1919) from Kloof Camp and an unidentified locality, both on the Lorentz River, in the same general region as the holotype, and served as the source of the description of the species by de Rooij (1915). These two specimens were also examined by Brongersma (1953), who noted the existence of a windowed eyelid. However, no author has compared the holotype to the other two specimens. Although Boulenger (1914) illustrated the species, he only provided a low resolution dorsal view of the head scalation.

A redescription of the species, based on the holotype and these two additional specimens,

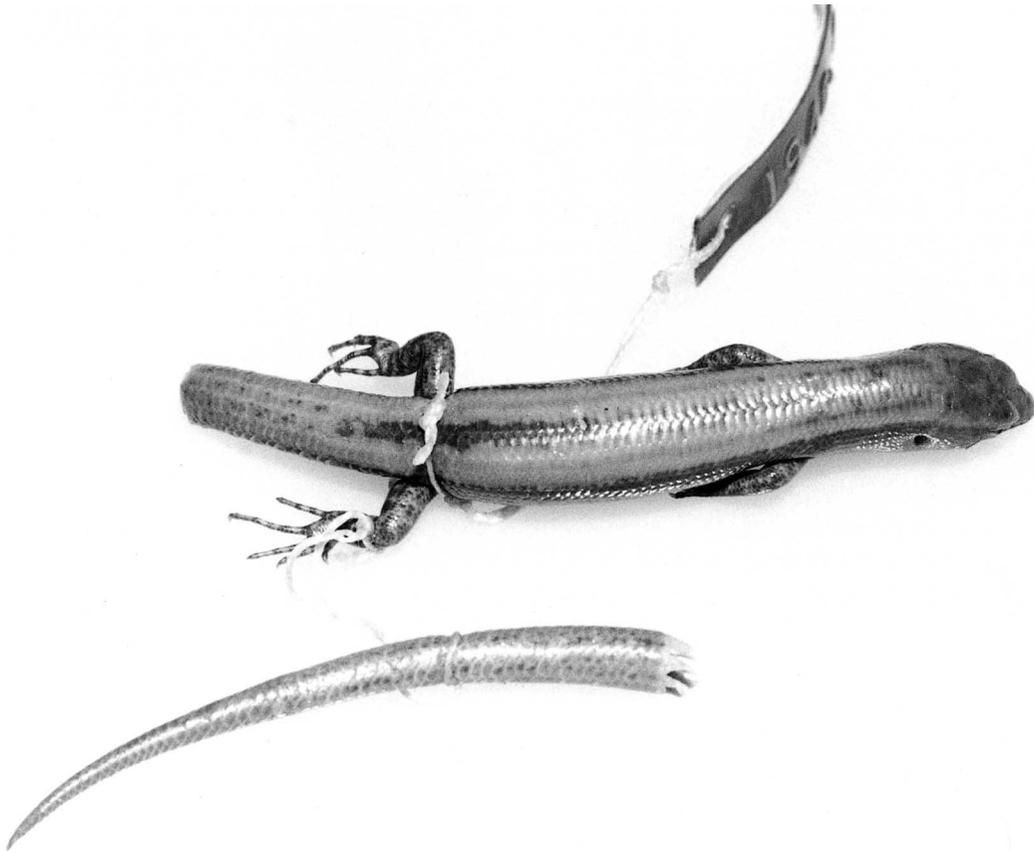


FIG. 5. Holotype of *Lygosoma nototaenia* Boulenger, 1914.

follows, with the values for the holotype given in parentheses in variable characters.

Nasals broadly separated, nostril centrally placed in nasal; supra- and postnasals absent; prefrontals narrowly to moderately separated (narrowly); supraoculars four, first two in contact with frontal; supraciliaries nine; a single pair of broadly contacting frontoparietals; unpigmented parietal eye spot distinct, in posterior third of interparietal; parietals in contact behind interparietal; nuchals 2–3 ($\bar{x} = 2.7$, $N = 6$; 3); two loreals of similar height, anterior slightly narrower than tall, posterior squarish; presuboculars three, not wedged between supralabials; postsuboculars four; lower eyelid with a translucent to semiopaque window, about one-third the size of eyelid; primary temporal single; upper secondary temporal overlaps lower secondary temporal; ear broadly vertically elliptical, height subequal to height of eye, anterior margin smooth, lacking lobules; tympanum deeply sunk; supralabials seven, fifth below centre of eye, and contacting granular scales of lower eyelid; postsupralabials two; infralabials 6–7 ($\bar{x} = 6.8$, $N = 6$; 7), first two contacting post-

mental; three pairs of transversely enlarged chin shields, all laterally contacting infralabials; first pair of chin shields in medial contact, second pair separated by a single scale, third pair separated by 2–3 ($\bar{x} = 2.7$, $N = 3$; 3) scales.

Body scales smooth, in 24–25 longitudinal rows at midbody ($\bar{x} = 24.3$, $N = 3$; 24); scales in paravertebral series, slightly broader than or equal in width to adjacent dorsal scales, 52–55 from parietal to level of anterior margin of hindlimb ($\bar{x} = 53.3$, $N = 3$; 53); medial pair of preanal scales overlap more lateral preanals; adpressed limbs separated by several scale rows; scales above fourth toe in two rows over most of length; subdigital lamellae of fourth toe 18–20 ($\bar{x} = 18.7$, $N = 6$; 20L/19R).

Presacral vertebrae 26 (holotype)-27 (ZMA specimens); phalangeal formula of manus and pes 2.3.4.5.3 and 2.3.4.5.4, respectively; premaxillary teeth nine (both ZMA specimens).

SVL 38.5–47.5 mm ($N = 3$; 7.5 mm); axilla-groin length 49.4–51.2% of SVL (50.3 ± 0.9 , $N = 3$; 24 mm); forelimb length 24.2–26.0% of SVL (24.9 ± 1.0 , $N = 3$; 11.5 mm); hind-limb length 35.8–39.0% of SVL (36.9 ± 1.8 , $N = 3$; 17 mm);



FIG. 6. The two known nontype specimens of *Lipinia nototaenia* (ZMA 18349–50)

head length 19.5–21.6% of SVL (20.6 ± 1.0 , $N = 3$; 9.9 mm); head width 66.7–73.7% of head length (69.3 ± 3.9 , $N = 3$; 7.3 mm); head depth 50.0–56.6% of head length (53.2 ± 3.3 , $N = 3$; 5.6 mm); tail of holotype regenerated and detached.

Dorsally and ventrally pale yellow; a dark vertebral stripe from nape to tail base, continuing a variable distance along tail as a median series of dark blotches. Dark vertebral stripe in ZMA 18349 anteriorly discontinuous, represented by a series of single and paired blotches. A variably expressed weak narrow dark laterodorsal stripe along common margin of dorsal scale rows 2 and 3 on nape and body. Face mid-brown, supralabials with a small pale central spot. A continuous dark brown upper lateral stripe from lateral canthus of eye, above ear and forelimb, thence along body (where two scales wide) above but contacting hind limb, then breaking into a series of progressively smaller brown spots on tail. Margins of stripe may be irregular, and stripe may contain a few small pale spots. Limbs coarsely brown variegated above. Soles of feet weakly variegated brown.

The placement of these two species in *Sphenomorphus* was based on erroneous data and presumption. Both were transferred to *Sphenomor-*

phus by Loveridge (1948) and Mittleman (1952) on the basis of the type descriptions, which did not mention the existence of a distinct central "window" in the lower eyelid, whereas species with a windowed lower eyelid were transferred to other genera. Although *Sphenomorphus* has become more restricted in content since that time, *S. albodorsalis* and *S. nototaenia* have remained in the genus by default.

The existence in both species of a windowed lower eyelid is unique among the New Guinea *Sphenomorphus* (apart from some *S. minutus*, a species which properly belongs in a distinct, distantly related lineage; Greer and Parker, 1968; Greer, 1979). Further, both species lack three apomorphic features present in the majority of New Guinea *Sphenomorphus*: divided or deeply grooved subdigital lamellae, producing a larger preaxial series and smaller postaxial series (first noted by Smith, 1937), fragmentation of the scales in the temporal region, and a posteromedial extension of the supraciliary scale series behind the supraocular scales, as well as a character of uncertain polarity, a complete subocular row. However, both species are clearly members of the major lineage of lygosomine skinks to which *Sphenomorphus* belongs, the *Sphenomorphus* group (Greer, 1979, 1990), with

the medial pair of preanal scales laterally overlapping the adjacent preanals, the upper secondary temporal and nuchal scales separated by an interposed scale, and modally nine or fewer premaxillary teeth. Within this major lineage, seven genera share with the two species the derived state of a windowed lower eyelid in all or some species: *Lerista*, *Lipinia*, *Lobulia*, *Papuascincus*, *Paralipinia*, *Prasinohaema*, and *Scincella* (Greer, 1974; Allison and Greer, 1985; Darevsky and Orlov, 1997). *Sphenomorphus albodorsalis* and *Sphenomorphus nototaenia* lack the apomorphic diagnostic features of *Lerista*, *Lobulia*, *Papuascincus*, *Paralipinia*, and *Prasinohaema* that are determinable on preserved, nonovigerous specimens (Greer, 1974, 1986; Allison and Greer, 1985; Darevsky and Orlov, 1997). The remaining two genera with windowed eyelids, *Lipinia* and *Scincella*, are poorly diagnosed in the literature (Greer, 1974), differing from one another primarily in the loss of a postorbital bone, presence of slightly to strongly expanded subdigital lamellae, and usual presence of a strongly striped dorsal pattern in *Lipinia*, although the first character state is also found in some *Scincella*. Most *Lipinia* species additionally have a reduced clutch size of two (Greer, 1974). Although *Scincella* has not previously been diagnosed by synapomorphies other than the windowed lower eyelid, most species have the lower secondary temporal overlapping the upper secondary temporal [checked for 36 species, mostly from type specimens: Appendix 1; we note also that the unique specimen of *Paralipinia rara* has this condition (A. Resetar, pers. comm.), *contra* the illustration by Darevsky and Orlov, 1997], with only the Asian *Scincella schmidtii* (holotype) and the Mexican *Scincella silvicola* (bilaterally in holotype, unilaterally in paratype) having the primitive state for skinks of the lower secondary temporal overlapped by the upper. Both *Sphenomorphus albodorsalis* and *Sphenomorphus nototaenia* have the primitive configuration of temporal shields, excluding them from *Scincella*. Additionally, they are geographically distant from *Scincella*, which does not otherwise reach the Indonesian Archipelago, the Philippines, or New Guinea (Ouboter, 1986).

We have dissected the right temporal arch of a single specimen of each species. No postorbital is present in *S. nototaenia* (ZMA 18349), whereas *S. albodorsalis* (AM R129260) has a well-developed long postorbital bone lateral to the postfrontal and medial to the squamosal and jugal. In size and all features of scalation, the two species are similar to New Guinea species of *Lipinia*, although this similarity reflects the absence of apomorphic scalation features characterising the genus. The subdigital lamellae of both species are broad, although not as expanded as in the arboreal species of *Lipinia*. Fecun-

dity, at least in *S. albodorsalis*, is two, although it is not known whether this is variable. In coloration, *S. nototaenia* agrees with the definition of *Lipinia*, although the vertebral stripe is dark rather than pale as in other species (possibly homologous with the dark margins to the pale vertebral stripe of *L. noctua*). The uniformly pale dorsum of *S. albodorsalis*, although not fitting the diagnosis of the genus, could be easily derived from that of *L. noctua* by loss of dark pigment. Hence, although the evidence for an association with *Lipinia* is not unequivocal, both *S. albodorsalis* and *S. nototaenia* are best considered generally primitive members of that genus and are here transferred to *Lipinia*.

Within *Lipinia*, *L. albodorsalis* is similar in general morphology to *L. noctua*, and would key to this species in the key presented by Zweifel (1979), at couplet 2. It may be distinguished from *L. noctua* primarily on coloration, lacking both a narrow pale vertebral stripe bordered laterally by dark markings (either a continuous dark border or a series of dark blotches) on the adjacent dorsal scales, and a pale occipital spot. The only precise locality known for *L. albodorsalis*, Weikor, East Sepik Province (Fig. 7), is within 50–100 km of several East and West Sepik Province localities from which *L. noctua* is known (Aitape, But, Kamberamba, Passam and Suain; Zweifel, 1979 and AMS R12931–32, R30852). *Lipinia nototaenia* similarly keys to *L. noctua*, although at the final couplet, and may be distinguished by the presence of a narrow dark vertebral stripe. It is allopatric to *L. noctua*, occurring to the south of the main cordillera (Fig. 7), although it is sympatric with *Lipinia longiceps* on the Setekwa River (Boulenger, 1914).

When analyzing radiographs of various species of *Lipinia*, we noticed that two New Guinea species with relatively large basal toe pads share a phalangeal morphology that is virtually unique in skinks. In both *L. cheesmanae* ($N = 2$, including one juvenile) and *L. longiceps* ($N = 4$) the antepenultimate phalange (third) in the fourth toe of the pes is less than half the length of the phalange proximal to it, instead of being about the same length (Fig. 8). This small phalange arises at the level of the distal end of the expanded basal pad. The functional significance of this shortened phalange is unclear. Certain other phalanges in both the manus and pes of these two species also appear to be subtly lengthened and shortened to various degrees. Indeed, the entire manus and pes can probably be profitably viewed as a subtly modified adaptive complex related to climbing habits. In the other species of *Lipinia* examined, the antepenultimate phalange of the fourth toe of the pes is slightly longer than, equal to, or slightly shorter than the more proximal phalange: *L. albodorsalis*

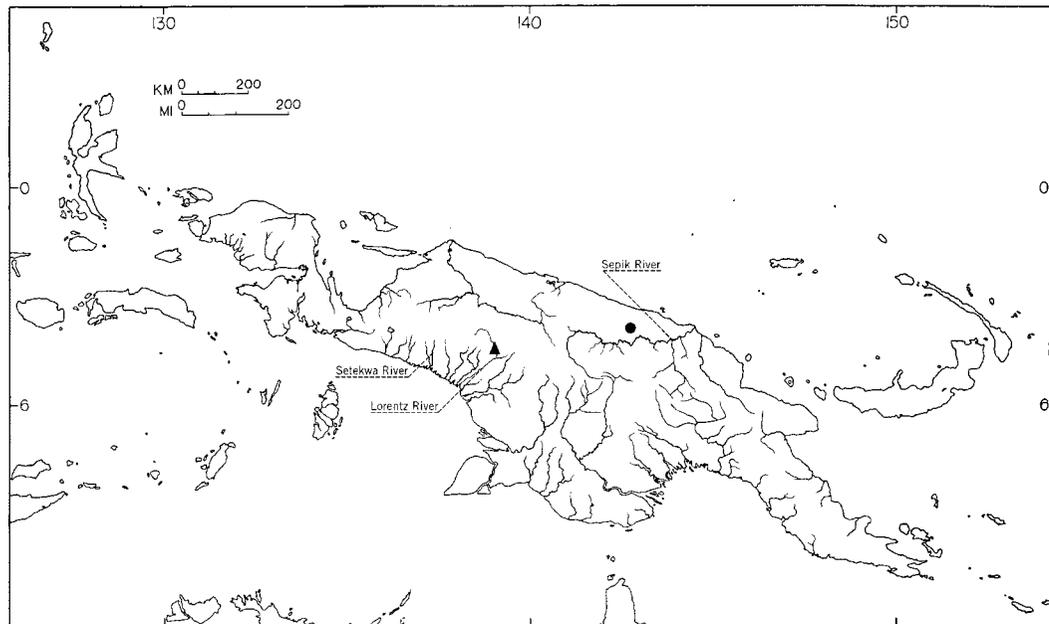


FIG. 7. Distribution of *Lipinia albodorsalis* (Sepik River and dot) and *Lipinia nototaenia* (Setekwa and Lorentz Rivers and triangle) in New Guinea.

($N = 1$), *L. auriculata* ($N = 2$), *L. leptosoma* ($N = 5$), *L. noctua* ($N = 19$), *L. nototaenia* ($N = 3$), *L. pulchra* ($N = 1$), *L. quadrivittata* ($N = 3$), *L. rabori* ($N = 3$), *L. subvittata* ($N = 5$). In the large series of *L. noctua*, all three relative sizes of the antepenultimate phalange were observed.

The only other species of *Lipinia* examined radiographically with noticeably expanded toe pads is *L. leptosoma*. In this species the pad on the fourth toe of the pes extends to the distal end of the (unreduced) antepenultimate phalange instead of only to the basal end of the (reduced) phalanges in *L. cheesmanae* and *L. longiceps*. Although phalange length is probably

easily modified in evolution, the absence of any evidence for a reduced phalange in *L. leptosoma* could be taken to suggest that its toe pad evolution and function may have been different from the other two species.

The only other non-*Lipinia* skink with large basal toe pads is *Prasinochaema virens*. In adults of this species ($N = 5$), the antepenultimate phalange of the fourth toe of the pes is just less than half the length of the more proximal phalange and arises at the level of the distal end of the toe pad. Hence, the morphology is similar to *L. cheesmanae* and *L. longiceps* except that the antepenultimate phalange is not as shortened relative to the more proximal phalange. In juvenile *Prasinochaema virens* ($N = 2$), the antepenultimate phalange is about as long as the immediately proximal phalange, suggesting that the relative length of the antepenultimate phalange shortens ontogenetically.

An appreciably shortened antepenultimate phalange in the fourth toe of the pes also occurs in the gekkonid genus *Hemidactylus*. Such a phalange even occurs in the third and fourth digits of the manus and the third and fifth digits of the pes in this genus. *Hemidactylus* has a basal pad, and its distal end is coincident with the basal end of the shortened phalange (Russell, 1976, 1977). Hence there is a significant degree of convergence between the two skink groups, *Lipinia cheesmanae* + *Lipinia longiceps* and *Prasinochaema virens* and the gecko *Hemidactylus*.

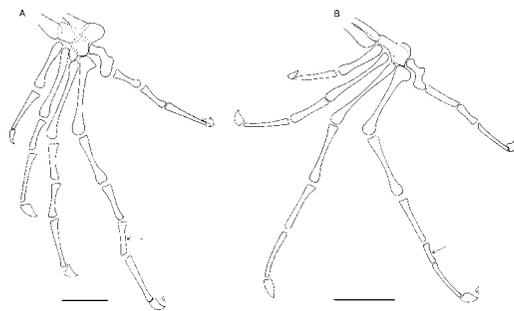


FIG. 8. The left pes in *Lipinia nototaenia* (A; ZMA 18350) and *Lipinia longiceps* (B; AM R59407) to show the reduced antepenultimate phalange (arrow) in the fourth digit of the latter. Scale bar = 1 mm. Drawing from radiographs.

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APPENDIX 1

Scincella Species Examined for Overlap Pattern of Temporal Shields

- Southeast Asia: *S. barbouri* (Stejneger, 1925): USNM 68723–24, paratypes; *S. beddomei* (Boulenger, 1887): BMNH 1946.8.17.68–70, syntypes; *S. bilineata* (Gray, 1846): BMNH 1946.8.17.71–74, syntypes; *S. boettgeri* (van Denburgh, 1912): CAS 21678, holotype, USNM 64208, paratype; *S. capitanea* Ouboter, 1986: illustration of holotype in type description; *S. doriae* (Boulenger, 1887): MSNG 6638, paralectotypes, USNM 94536, holotype of *Leiolopisma smithi* Cochran, 1941, CIB unnumbered ($N = 1$); *S. eunicis* (Cochran, 1927): USNM 72180, holotype; *S. formosensis* (van Denburgh, 1912): CAS 25027, holotype; *S. himalayana* (Günther, 1864): BMNH 1946.8.16.24, 1946.8.17.62, 1946.8.19.71, syntypes, NMW 16633.1–5, syntypes of *Euprepes blythi* Steindachner, 1869; *S. huanrenensis* Zhao and Huang, 1982: CIB R810012–18, R810040–41, paratypes; *S. kolkataensis* (Cochran, 1927): USNM 72282–84, holotype and paratypes; *S. ladacensis* (Günther, 1864): BMNH 1946.8.16.28, holotype, NMW 16444.1–10, syntypes of *Euprepes stoliczkai* Steindachner, 1869, NMW 16643.1–4, syntypes of *Euprepes kargilensis* Steindachner, 1869, CIB 775002–03, 755096–97; *S. laterimaculata* (Boulenger, 1887): BMNH 1946.8.17.53–55, syntypes; *S. melanosticta* (Boulenger, 1887): MSNG 27853, syntype; *S. modesta* (Günther, 1864): BMNH 1946.8.16.75–76, syntypes, CIB 74I5066, 74I5069, 74I5092; *S. monticola* (Schmidt, 1927): AMNH 20998, holotype, FMNH 7342–43, paratypes; *S. ochracea* (Bourret, 1937): MNHN 48.57, syntypes; *S. potanini* (Günther, 1896): ZIL 7683–84, 8176–77, nontype specimens ascribed to this species by Bedriaga (1912), CIB 65I5068, 65I5076, 65I5125; *S. przewalskii* (Bedriaga, 1912): ZIL 7073, holotype; *S. punctolineata* (Boulenger, 1893): MSNG 28501, holotype, BMNH 1946.8.16.85, holotype of *Leiolopisma tavesae* Smith, 1935; *S. reevesi* (Gray, 1838): BMNH 1946.8.16.37, syntype, 1983.138, CIB 601357, 625292–93, 735010, 64III5297, 64III6057; *S. rupicola* (Smith, 1916): BMNH 1946.8.16.77, holotype; *S. schmidti* (Barbour, 1927): MCZ 7966, holotype; *S. septentrionalis* (Schmidt, 1927): illustration of holotype in description; *S. siamensis* (Taylor and Elbel, 1958): FMNH 135985, holotype; *S. sikkimensis* (Blyth, 1854): BMNH 1946.8.16.79, holotype of *Tiliqua schlegeli* Günther, 1860; *S. tragbulensis* (Alcock, 1898): MCZ 718; *S. travancorica* (Beddome, 1870): BMNH 1946.8.16.33–36, syntypes; *S. tsinlingensis* (Hu and Djao, 1966): illustration of holotype in description, CIB 627021, 627040, 627069, paratypes; *S. vandenburghi* (Schmidt, 1927): CAS 26134, holotype; *S. victoriana* (Shreve, 1940): MCZ 44738–39, holotype and paratype.
- America: *S. caudaequinae* (Smith, 1951): USNM 137217; *S. forbesorum* (Taylor, 1937): FMNH 100031, holotype; USNM 134307, paratype; *S. gemmingeri* (Cope, 1864): USNM 6331, syntypes; *S. lateralis* (Say, 1823): AMS R3721–22, R71819–21, R73669; *S. silvicola* (Taylor, 1937): FMNH 100008, holotype, 104678, paratype.

Although the most recent full revision of the genus in Asia, by Ouboter (1986), recognized many fewer species, we remain unconvinced of many of the synonymies he proposed, particularly under *S. modesta* and *S. reevesi* for which he had little material (see also Wang and Zhao, 1986; Zhao and Adler, 1993; Chen et al., 2001). We have been unable to ascertain the whereabouts of the holotype of *Scincella potanini* (Günther, 1896) or the holotype and only reported specimen of *Scincella pootipongi* (Taylor, 1962). The former is not able to be located in the Zoological Institute, Russian Academy of Sciences (N. Ananjeva, pers. comm.), the successor to the Zoological Museum of the Imperial Academy of St Petersburg, in which the type was stated to be lodged. The latter is not in the Field Museum, which received the other type specimens described in Taylor's (1962) paper—Taylor's collection catalog skips over the number (34858), which was stated to be assigned to the holotype (A. Resetar, pers. comm.). The types and only known specimens of two additional species placed in *Scincella* by Greer (1974), *Scincella exigua* (Anderson, 1878) and *Scincella formosa* (Blyth, 1853), have the medial preanal scales overlapped by the lateral preanals (I. Das, pers. comm.) and are now regarded as only dubiously placed in *Scincella* (see also Smith, 1935, for the latter species). Das et al. (1998) reinstated *Scincella tragbulensis* as distinct, but placed it, together with *Scincella himalayanus*, *Scincella ladacensis*, and *Scincella sikkimensis*, in the genus *Asymblepharus*, originally proposed by Eremschenko and Szczerbak (1980) for the single species *Ablepharus alai-cus*. In the absence of any explicit justification for this transfer, we maintain the former four species in *Scincella* (see also Das, 1994).