

## A NEW SPECIES OF *LUPEROSAURUS* (GEKKONIDAE) WITH COMMENTS ON THE GENUS

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**ABSTRACT:** The gekkonid genus *Luperosaurus* is poorly known and its relationships are not well understood. Here a new species of *Luperosaurus* is described and the close similarity of this genus with some members of the genus *Gekko* is indicated. One species of the genus *Gekko* is transferred to *Luperosaurus* so that overlapping generic definitions are avoided. A synopsis of *Luperosaurus* is also presented.

*Key words:* Reptilia; Sauria; Gekkonidae; *Luperosaurus*; Sp. nov.; West Malaysia

AMONG a collection of unidentified geckos forwarded to me for identification by R. F. Inger was a single specimen from Selangor, West Malaysia. This specimen could not be identified using keys for the area and it became apparent that it was from an undescribed taxon. The features of this specimen suggested that it had close affinities to the genus *Luperosaurus* and it is here formally named *Luperosaurus browni*. Comparison with other specimens and descriptions suggested two things. First, W. C. Brown's proposal that *Gekko brooksi* be transferred to *Luperosaurus* has foundation, and second, the genus *Luperosaurus* and other members of the *Gekko* group of gekkonine geckos (Russell, 1972) are poorly characterized. A diagnosis of the genus *Luperosaurus* is also given.

*Luperosaurus browni* sp. nov.

*Holotype.*—FMNH 185106, Ulu Gombak forest reserve 35.4 km north of Kuala Lum-

pur, Selangor, West Malaysia, collected 8 May 1970 by R. F. Inger.

*Diagnosis.*—A medium-sized *Luperosaurus* distinguished by the following combination of characteristics: moderate size (snout-vent 66.5 mm); habitus slender, elongate; dorsal tubercles small, rounded, not keeled, and about twice as large as surrounding dorsal scales; tubercles in about six longitudinal rows at the posterior end of the body, in adjacent rows separated by 8-18 granular dorsal scales in this region (rows indistinct anteriorly); 18 entire lamellae to the base of the fourth digit (left pes) (Fig. 1a), chevron-shaped beneath the hyperextensible portions of the digit; digits with basal webs extending between proximal portions but not connecting the hyperextensible portions (Fig. 1b); breadth of fourth digit (pes) at its widest point about 42.5% of its length; cutaneous folds bordering the posterior aspect of both front and hind limbs mildly developed, extending from elbow and knee to lateral border of

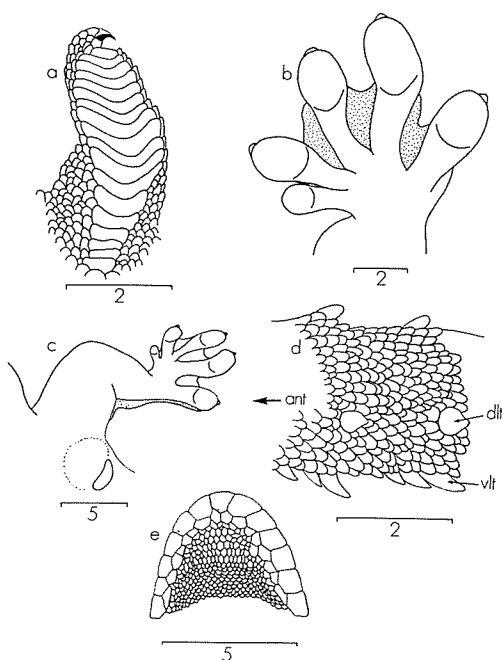


FIG. 1.—*Luperosaurus browni* sp. nov. a. Ventral aspect of digit four, left pes. b. Ventral aspect of left pes showing extent of interdigital webs (stippled). The arc on each digit indicates the posterior border of the proximalmost hyperextensible scansor. c. Ventral aspect of left hind limb illustrating the cutaneous fold (stippled) associated with the posterior border of the limb and fifth digit. d. Caudal tubercles in dorsolateral view. The dorsolateral tubercles (dlt) are rounded while the ventrolateral tubercles (vlt) are spinous. Anterior is indicated (ant). e. Ventral aspect of the gular region showing the absence of definitive chinshields. All scales are in millimeters.

fifth digit (Fig. 1c); no lateral body fold but tail with much enlarged ventrolateral tubercles (Fig. 1d); type (female) with a series of 32 preanofemoral pores (perforated scales), covering approximately the basal  $\frac{1}{2}$  of the thigh on either side but poorly developed laterally; rostral scale not entering nostril (rostral enters nostril in all other species of *Luperosaurus*).

*Description*.—A moderate-sized gecko of snout-vent length 66.5 mm for the holotype (the only known individual a female with a single oviducal egg); habitus elongate, slender, moderately depressed; head about same width as body; head breadth about 59% of head length and 13.5%

of snout-vent length; snout tapered, rounded, its length 42.5% of head length; internasal distance (between but not including nasal scales) 17% of snout length; eye moderately large, its diameter 55% of snout length; ear opening obliquely oval, sloping posterodorsally; distance between eye and ear opening 63% of snout length; greatest diameter of ear opening 1.0 mm; rostral quadrangular, without a groove at the dorsal midpoint; height of rostral about 50% of its width; nostril surrounded by the first upper labial and four nasal scales, the rostral excluded from contact; supranasals separated by one enlarged scale; mental triangular, smaller than the adjacent lower labials; 12–13 upper labials, 12 lower labials on each side; definitive chinshields absent (Fig. 1e), anteriormost gular scales only slightly larger than the other gulars; scales on snout somewhat larger than those on the body; scales on dorsal and lateral surfaces small, granular, juxtaposing, interspersed with small, low, rounded, unkeeled tubercles in indistinct rows anteriorly but in about 6 rows posteriorly; tubercle rows on dorsum separated by 8–18 rows of granules posteriorly; about 41 interorbital scale rows; about 96 midbody scale rows from flank to flank; ventral scales flat, triangular to cycloid, imbricate, in about 28 longitudinal rows; limbs well developed, length of extended hind limb in preserved state (from midventral line) 61% of axilla-groin distance; limbs bordered with mildly developed cutaneous lobes posteriorly; digits webbed basally between nonhyperextensible portions, quite strongly dilated; breadth of fourth toe about 42% of its length; 18 entire lamellae beneath the fourth toe to its base, chevron-shaped beneath the hyperextensible portions; 11 lamellae beneath the first toe; all but first digit, manus and pes, clawed; compressed penultimate phalanx not free of the dilated part of the digit and not extending beyond it any more than fractionally to carry the claw-bearing phalanx beyond the expansion; 32 preanofemoral pores in a continuous series covering proximal  $\frac{1}{3}$  of thigh; pores preceded by two significantly enlarged rows of scales on body and at the very base of the thighs; followed in preanal area by about 8 rows of enlarged scales; pores on thighs bordered by small, relatively uniform scales posteriorly; tail convex dorsally, flat beneath; depth of tail just posterior to basal swelling 65% of its width at the corresponding point; dorsal surface of tail covered with small scales, similar to those on body, and enlarged conical tubercles in annuli about 7 scale rows apart; four tubercles per annulus, two dorsolateral and two ventrolateral where the curvature of the dorsal tail surface meets the flat base; ventrolateral tubercles larger than dorsolateral ones; relatively small, imbricate scales on ventral tail surface, larger along the midline than laterally; distal one-third of the tail of the holotype regenerated, lacks tubercles.

*Measurements (in mm)*.—A mature female: snout-vent length 66.5; axilla-groin distance 33.4;

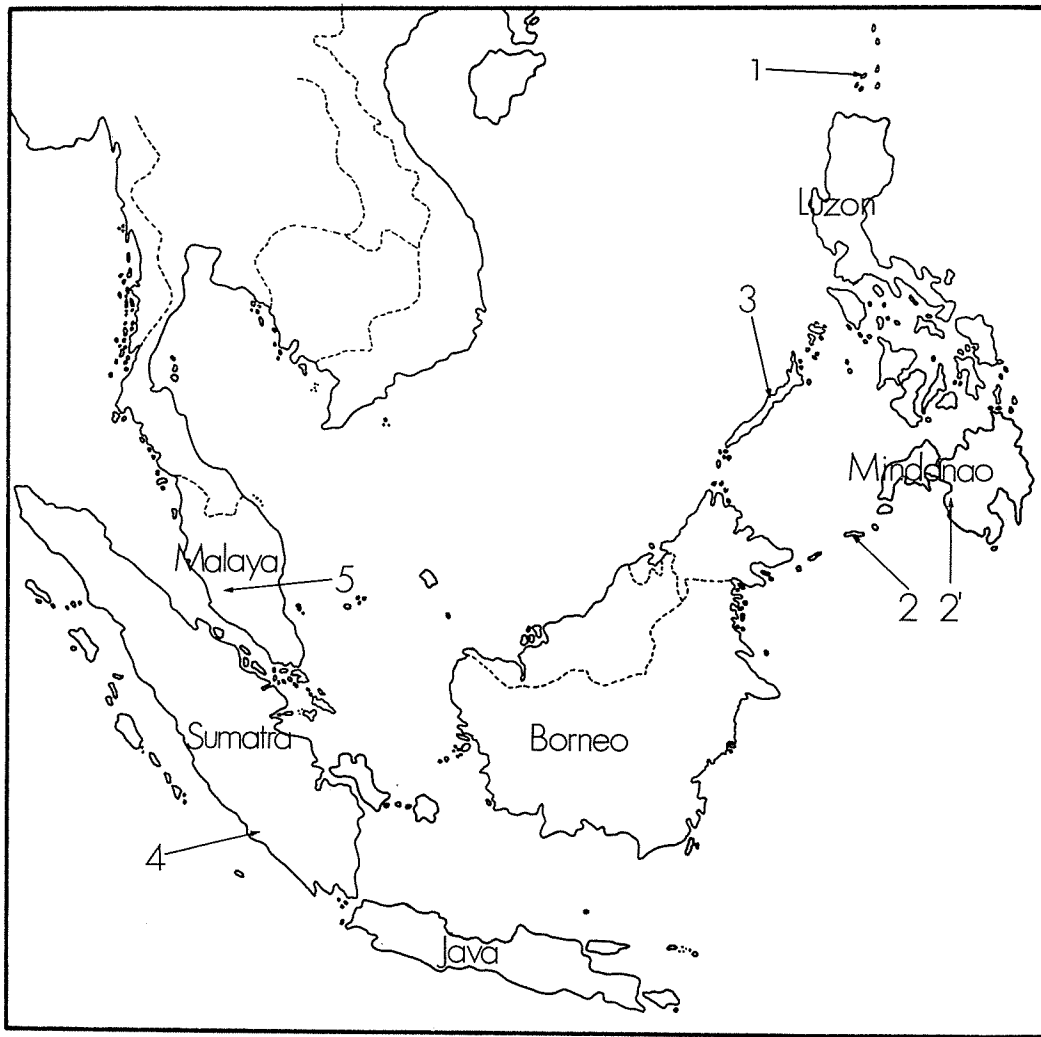


FIG. 2.—Distribution of the genus *Luperosaurus*. The type species of the genus, *Luperosaurus cumingi*, is recorded as being from "the Philippines" (Boulenger, 1885) and its exact distribution cannot therefore be indicated. The distributions of other known species are indicated by numbers: 1. *L. macgregori*, Calayan, Babuyan (Stejneger, 1907); 2. *L. joloensis*, Siet Lake, Jolo (Taylor, 1918); 2'. *L. joloensis*, Cotabato (Museum of Comparative Zoology, Harvard, specimen number 26118); 3. *L. palawanensis*, Palawan Island (Brown and Alcala, 1978); 4. *L. brooksi* (comb. nov.), Benkoelen (= Bangkahulu) (Boulenger, 1920); 5. *L. browni* sp. nov., Ulu Gombak Forest Reserve.

hind limb length 20.35; head length 15.3; head breadth 9.0; snout length 6.5; eye diameter 3.55; tail depth 2.15; tail breadth 3.3; internasal distance 1.1; length of fourth digit (pes) 4.7; maximum breadth of fourth digit (pes) 2.0.

*Color (in preservative).*—Dorsal ground color uniform reddish-brown with lighter, rust-colored tubercles; venter uniform immaculate white; ventral surface of tail white, mottled with rusty brown.

*Eggs.*—No data available other than the holotype has one oviducal egg.

*Etymology.*—Named in honor of Walter C. Brown who has contributed significantly to our knowledge of *Luperosaurus* and its close relatives.

*Ecological note.*—Collected in hilly rain

TABLE 1.—Comparison of *Gekko* and *Luperosaurus*.

Character	<i>Gekko</i> *	<i>Luperosaurus cumingi</i>	<i>Luperosaurus brooksi</i>	<i>Luperosaurus browni</i>
Digits strongly dilated	+	+	+	+
Digits half webbed	±**	+	+	+
Lamellae undivided	+	±	+	+
First digit unclawed	+	+	+	+
Cutaneous folds on limbs	-	+	+	+
Dorsal scalation	granules & tubercles	granules	granules & tubercles	granules & tubercles
Ventral scalation	imbricate	granules	imbricate	subimbricate
Chinshields	+***	-	-	-
Tail	round***	depressed	depressed	depressed
Tail spines	absent***	lateral spines	lateral spines	lateral spines
Ventral tail scales	enlarged***	small	small	small
Lateral body scales	not spinose	slightly spinose	not spinose	not spinose

\* A composite overview of the genus.

\*\* Checked with *Gekko subpalmatus* for extent.

\*\*\* Checked with general collection BM(NH).

forest at night on a tree trunk two meters above the ground; tree 80 cm in diameter (R. Inger, in lit.).

#### DISCUSSION

The genus *Luperosaurus* is one of the least known of all gecko genera and specimens turn up infrequently. Until now only four species have been described and these are represented by only eleven specimens (Brown and Alcalá, 1978). Even if one adds the newly described species plus *Luperosaurus brooksi* (see below) there are still only six species and these are represented by thirteen specimens. The ecology of *Luperosaurus* remains enigmatic. Brown and Alcalá (1978) state that it exhibits a relict distribution and that all included species occur in forested areas and may occupy habitats primarily in the canopy stratum. The specimens are also widely distributed and a review of the genus is therefore difficult. It is possible, however, to make some comments about the genus since the type species of the genus (*Luperosaurus cumingi*) is available for comparison.

*Luperosaurus* was first described by Gray (1845) for *L. cumingi* and then, in order of

publication came *L. macgregori* Stejneger 1907, *L. joloensis* Taylor 1918, and *L. palawanensis* Brown and Alcalá 1978. All of these species are from the Philippine Islands, so the inclusion of the new species plus *L. brooksi* increases the range of the genus considerably (Fig. 2).

The genus *Luperosaurus* resembles the genus *Gekko* quite closely and was placed within the *Gekko* group of gekkonine geckos by Russell (1972). The differences between these two genera are that *Luperosaurus* is said to lack tubercles, to have granular rather than imbricating ventral scales, and to possess cutaneous lobes on the limbs. When *L. browni* and *L. brooksi* are considered, however, only the last distinction holds up (Table 1). Further work is required before the affinities of these two genera can be clarified.

Features of specimens in the genus *Luperosaurus* are so variable that it is difficult to find common characters which bind the genus together. For example, chinshields are lacking in some species (thus distinguishing them from *Gekko*) but others have them. The lack of uniformity among the species is shown in Table 2. The new combination *Luperosaurus brooksi* is used

TABLE 2.—Comparison of features of species in the genus *Luperosaurus*. Characters of *L. macgregori*, *L. joloensis*, and *L. palawanensis* are taken from descriptions.

Character	<i>L. brooksi</i> (Boulenger, 1920)	<i>L. browni</i>	<i>L. cumingi</i> (Gray, 1845)	<i>L. macgregori</i> (Stejneger, 1907)	<i>L. joloensis</i> (Taylor, 1918)	<i>L. palawanensis</i> (Brown & Alcalá, 1978)
Body shape	elongate	elongate	moderate	*	*	*
Head length: breadth ratio	1.75:1	1.7:1	1.2:1	*	1.8:1	1.17:1
Ear opening	small, round	small, obliquely oval	very small, subcircular	small, obliquely elliptic	narrow, oblique	*
Dermal folds on limbs	+	+	+	slight folds	+	+
Digital dilation	strong	strong	strong	strong	strong	strong
Digital webbing	½	½	½	½	½	½
Scansors	undivided	undivided	distally divided II-V	undivided	undivided	undivided
Rostral scale size	2× broad as deep	2× broad as deep	large, square	broad, rectangular	upright, longer than deep	quadrangular
Median rostral cleft	none	none	none	none	none	*
Rostral enters nostril	+	-	+	+	+	+
Nasal scales	3	4	3-4	3	3	3
Labial scales (upper/lower)	11/10-11	12-13/12	16/15	15/14	11/11	11-13/10-11
First upper labial enters nostril	+	+	+	+	+	+
Symphysial smaller than adjacent labials	+	+	+	+	?	-
Chinshields	-	-	-	-	+	*
Dorsal scalation	granules with tuber- cles post.	granules with tuber- cles post.	granules with some tubercles	granules	granules with spine- like laterals	granules with a few "spearhead- like scales"
Ventrals	subimbricate to imbricate	subimbricate	granular	granular	granular	moderately en- larged, flat
Preanofemoral pores	40	32	4-13	16	32	28-32
Tail shape	depressed	depressed	depressed	slightly depressed	depressed	slightly de- pressed
Dorsal tail scalation	granules	granules	granules	granules	granules	*
Ventral tail scalation	small imbri- cate scales	small imbri- cate scales	small imbricate scales	small imbricate scales	small imbri- cate scales	"no enlarged subcaudal plates"
Annulations defined by projecting scales	+	+	+	+	+	*

\* Signifies no description given for this category by the original author(s).

in preference to *Gekko brooksi* as the features of this species seem to be more adequately accommodated in this way. While examining the holotype of *L. brooksi* comb. nov. in the British Museum (Natural History) I found a note in the bottle stating, "probably *Luperosaurus* as currently understood, W. C. Brown '74." W. C. Brown (pers. comm.) also indicated this conviction to me, and the same sentiments are expressed by Brown and Alcalá (1978). The current paper thus would seem to be the place to record this change formally.

The most distinct of all the species assigned to *Luperosaurus* is *L. amissus* which shows a reduced number of preanofemoral pores (femoral pores being absent), absence of extensive digital webs, and presence of enlarged chinshields. The only known specimen was collected in 1923 but it was misplaced and unnoticed until 1958 (Taylor, 1962). After careful examination (Brown and Alcalá, 1978) this specimen was removed from the genus *Luperosaurus* and placed in synonymy with *Gekko japonicus*.

*Luperosaurus browni* differs from *L. brooksi* in the presence of more pronounced tail fringe scales, the presence of more strongly marked tubercles extending further forward (as far as the axilla on each side, although they only approach the middorsal line towards the back legs), the presence of smaller ventrals which are not so markedly imbricate, and the smaller number of preanofemoral pores.

*Luperosaurus browni* differs from *L. cumingi* in having a more slender body, a relatively longer and narrower head, fewer labial scales, presence of tubercles but lack of lateral spinose scales, a greater number of preanofemoral pores, and the presence of larger projecting scales on the tail.

Brown (1964) pointed out that the genera *Gekko* and *Luperosaurus* were not clearly distinct and suggested that, in general, species belonging to the genus *Gekko* are larger and species belonging to *Luperosaurus* exhibit more extensive digital webbing. The other two genera, *Lepidodactylus* and

*Pseudogekko*, that he included in this discussion were distinguished because they show a tendency towards divided subdigital lamellae, but this feature also occurs in *Luperosaurus* (see below).

Brown and Tanner (1949) suggested that *Pseudogekko* and *Luperosaurus* were closely related. Brown (1964) noted that the paratype of *Luperosaurus macgregori* had divided subterminal lamellae and that therefore this specimen should be referred to the genus *Lepidodactylus*. The assignment of *macgregori* to the genus *Luperosaurus* thus became doubtful and Brown (1964) suggested that the type be reexamined, and Brown and Alcalá (1978) did this. In the latter report, however, there is no mention of divided scansors in either the holotype or paratype and thus the significance of Brown's (1964) statements are unclear. My examination of the holotype of *L. cumingi* has revealed divided scansors but I do not consider this to be grounds for removing this species from *Luperosaurus*. Indeed, I have examined ten species of the genus *Lepidodactylus* and in this genus there is a range of digital form encompassing species without divided scansors and species with fully divided distal scansors. Brown and Alcalá (1978) also report this situation.

Brown (1964) has thus pointed out that the Oriental Pacific gekkonid lizards of the genera *Gekko*, *Lepidodactylus*, *Luperosaurus*, and *Pseudogekko* represent categories which are not sharply and clearly delimited from each other. This reflects the lack of knowledge of interrelationships among gekkonid genera in general (Russell, 1976). In particular, the genus *Luperosaurus* is poorly known and its distinction from the genus *Gekko* is unclear. To help resolve this problem I present a synopsis of the generic characters of the genus *Luperosaurus*. The genus is determined by the following combination of characters (based in part on Underwood, 1954; Kluge, 1967; Russell, 1972; and Brown, in lit.): (1) skeletal—nasals paired, vomers fused; (2) scales—

scales on dorsal surface homogeneous or heterogeneous but tubercles or spearhead-like scales small if present, tubercle rows indistinct anteriorly if present but more distinct posteriorly, enlarged scales of pore series limited to the preanal region or continuous with series on thighs, those scales bear pores in one or both sexes, chinshields present or absent, scales on ventral surface of tail moderate to small and imbricate but not scute-like, cutaneous flaps bordering posterior aspects of antibrachium; (3) digital—digits elongate and moderately to broadly dilated, covered beneath with scansors which are undivided proximally and divided or undivided distally on digits II–V, compressed and arcuate penultimate phalanx on digits II–V closely bound to the dilated part except for a very short portion which extends beyond its tip, first digit lacking a claw, distalmost phalanx elongate and depressed, first digit strongly developed, fleshy portion of dorsal interossei muscles traverse the phalanges only to the level of the distal extremity of the antepenultimate one. A short synopsis of the genus is also given by Brown and Alcalá (1978).

My synopsis is somewhat vague. Because of the small number of known specimens (all except three of which are types), the osteological features of this genus are not well known. The variability of certain features indicates that our conceptualization of generic boundaries is not well-formed.

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