

A NEW SPECIES OF SCINCID LIZARD (GENUS *SPHENOMORPHUS*) FROM PALAWAN ISLAND, PHILIPPINES

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ABSTRACT: A new species of medium-sized *Sphenomorphus* is described from the biogeographically enigmatic island of Palawan in the western Philippines. This species represents only the third skink in the genus *Sphenomorphus* found on Palawan Island. The new species is compared with other *Sphenomorphus* found on Palawan and with phenotypically similar species in the genus from throughout its range. To aid in future identification of *Sphenomorphus* specimens from Palawan, we provide a key to the species from this island.

Key words: Borneo; New species; Palawan; Philippines; Scincidae; *Sphenomorphus*

THE GENUS *Sphenomorphus* Fitzinger 1843 is a large, polyphyletic group (Myers and Donnelly, 1991; Reeder, 2003; Skinner, 2007) composed of a variety of morphological types. There are at least 145 species (Uetz and Hallermann 2009) currently described, with all but three of these species occurring in Asia and the Pacific Islands. Many attempts have been made to divide this group into other genera or subgroups based on external and internal morphological characters (Boulenger, 1887; Brown and Alcalá, 1980; Ferner et al., 1997; Greer and Parker, 1967a, 1974; Smith, 1937; Taylor, 1922c). Some of these groupings have been subsequently rejected (e.g., the genera *Insulasaurus*, *Otosaurus*, and *Parotosaurus* synonymized with *Sphenomorphus*, fide Greer and Parker, 1967b,c) based on evidence that the characters used to define those groups were homoplastic. Although most of the subgroups of *Sphenomorphus* lack a phylogenetic validation, they are nonetheless useful in distinguishing new species from phenotypically similar species.

The most recent comprehensive examination of *Sphenomorphus* in the Philippines enumerated 23 species (Brown and Alcalá, 1980). Expanding on the previous work of Taylor (1922a,b,c, 1923, 1925), Brown and Alcalá synonymized several species recognized by Taylor and described four new species. In addition, they followed Greer and Parker (1967b,c, 1974) in synonymizing the

genera *Insulasaurus*, *Otosaurus*, *Parotosaurus*, and some members of *Lygosoma* with *Sphenomorphus*. Since Brown and Alcalá's review, three new species have been described (Brown, 1995; Brown et al., 1995, 1999), and one species has been moved into a new genus, *Parvosцинus palawanensis* (Ferner et al., 1997). Those studies brought the total number of recognized species of *Sphenomorphus* in the Philippines to 25.

Brown and Alcalá (1980) divided Philippine *Sphenomorphus* into six phenetic groups. These groupings were based on size at maturity, extent of limb and digit development, and numbers of midbody scale rows, subdigital lamellae, and paravertebral scale rows. Brown and Alcalá's species groups are based solely on overall phenotypic similarity within Philippine species and may not correspond to phylogenetically defined clades. However, currently, they are our only guide for Philippine *Sphenomorphus* systematics and, as such, are useful for species comparisons.

Palawan Island, in the western region of the Philippines, has two recognized species of *Sphenomorphus*: *S. victoria* and *S. wrighti*. These species are found in groups III and IV, respectively (Brown and Alcalá, 1980). Also on Palawan Island is the species *Parvosцинus palawanensis*, which is similar to *Sphenomorphus* and may be closely related to the genus, but is very different from the other species on the island due to its reduced size, lack of prefrontals, and scaled-over ear (Ferner et al., 1997).

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Past zoogeographic work has suggested a strong faunal relationship between Palawan and Borneo as a result of a possible land connection during the last Pleistocene glacial maximum (Heaney, 1986; Huxley, 1868; but see Brown and Diesmos, 2009; Brown and Guttman, 2002). Huxley (1868) modified the northwestern portion of Wallace's zoogeographic barrier, separating the Philippines into two zoogeographic zones and placing Palawan Island as part of the Sunda Shelf/Asian fauna. Brown and Guttman (2002) and McGuire and Kiew (2001) provided some of the first phylogenetic evidence suggesting that some of Palawan's endemic amphibians and reptiles may be more closely related to the oceanic portions of the Philippines, to the exclusion of the Sunda Shelf. With no clear distinction in the literature on the affinity of Palawan fauna, it is critical to compare it with the fauna of both Borneo and the oceanic Philippines.

In this paper, we describe a new species of lygosomine skink from Palawan Island, found during a collaborative survey between Conservation International Philippines and the University of Kansas Biodiversity Institute. We assign this new species to the genus *Sphenomorphus* based on the presence of enlarged medial precloacal scales that overlap lateral precloacal scales; supradigital scales double or triple and imbricate; hemipenes bifurcate; lack of undivided transparent scale in lower eyelid; four pentadactyl limbs; and fewer than 30 subdigital lamellae on Toe IV (Lim, 1998; Shea and Greer, 2002; Taylor, 1963). We further place this species in the *Sphenomorphus variegatus* Group (Greer and Parker, 1967a), which includes Philippine Group IV (Brown and Alcalá, 1980), based on the following external and internal characters: lack of postorbital bone; supratemporal fenestra very small; no anterior projection of the ectopterygoid process; well developed digits and limbs which overlap when adpressed; and enlarged nuchals lacking. The *Sphenomorphus variegatus* Group is spread throughout Asia and Southeast Asia, consisting of 37 species that are phenotypically similar. We compare the new species to species in the *S. variegatus* Group as well as to species in geographic proximity to Palawan Island, Borneo, and the Philippines. We show that the new species differs from its congeners in the

combination of size at maturity, scale morphology, and coloration.

MATERIALS AND METHODS

A research team supported by Conservation International Philippines and the University of Kansas Biodiversity Research Center made collections of animals in forested areas of Mt. Mantalingahan on Palawan Island during July 2007. These researchers used multiple techniques to collect the animals including capture by hand, pitfall traps, and snap traps. They fixed all specimens in 10% buffered formalin to preserve them, and after a few months the specimens were transferred to 70% ethanol. Senior author CWL determined sex by gonadal inspection and performed measurements using Mitutoyo digital calipers to the nearest 0.01 mm.

Measurements used are snout-vent length (SVL) measured from the tip of the snout to the cloacal opening; tail length (TL) measured from the cloacal opening to the tip of the tail; axilla-groin distance (AGD) measured from the posterior margin of the forelimb insertion to the anterior margin of the hind limb insertion; head length (HL) measured from the anterior margin of the ear opening to the tip of the snout; head width (HW) measured at the widest part of the temporal region; snout-forelimb length (SFL) measured from the anterior margin of the forelimb insertion to the tip of the snout; internarial distance (IND) measured between the dorsal margin of the two nares; rostrum length (RostL) measured from the anterior margin of the eye to the tip of the snout; interorbital distance (IOD) width of orbital region at mid orbital; eye diameter (ED) measured at widest point; ear diameter (EarD) measured at widest point; forelimb length (FLL) measured from base of palm to elbow; hind limb length (HLL) measured from knee to ankle.

Scales were counted by CWL on the right side of the body with a dissecting microscope. Scale counts include number of paravertebral scales (PVSR), dorsoventral scales between the parietals and the scales at the cloaca on the dorsal side; number of midbody scale rows (MBSR), scale rows around the middle of the body; number of subdigital lamellae on Toe IV (SDL); number of supralabials (SL); number of

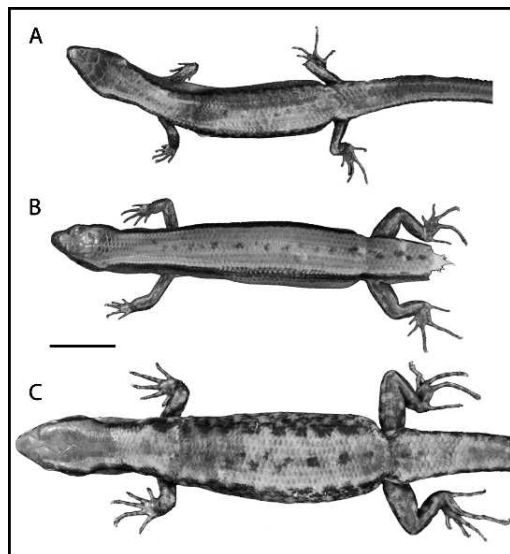


FIG. 1.—Dorsal aspect of (A) *Sphenomorphus traanorum* holotype (PNM 9562), (B) *S. victoria* (KU 309443), and (C) *S. wrighti* (KU 311439) at equal scale. *Sphenomorphus traanorum* has easily recognizable shorter axilla-groin distance and lack of dorsovertebral spots. Scale bar = 10 mm.

infralabials (IL); number of anterior loreals (L); and number of enlarged supraoculars (SO).

Institution abbreviations for specimens examined in this study follow Leviton et al. (1985), with the addition of the following field collector abbreviations: BSI-FS, Sulawesi Biotic Surveys and Inventories Field Series; ELR, E. L. Rico; and DSB, D. S. Balete.

For the recognition of the new species, we adopt the General Lineage Concept of de Quieroz (1998, 1999) as the natural extension of the evolutionary species concept (Wiley, 1978). Application of lineage based species concepts to island systems is straightforward because of the known history of isolation of island populations (Brown and Diesmos, 2002; Brown and Guttman, 2002). We consider as new species morphologically diagnosable forms for which the hypothesis of conspecificity can be rejected.

SPECIES ACCOUNT

Sphenomorphus traanorum *sp. nov.*
(Figs. 1–3)

Holotype.—PNM 9640 (formerly KU 311442: DSB 4816): Female: Philippines,

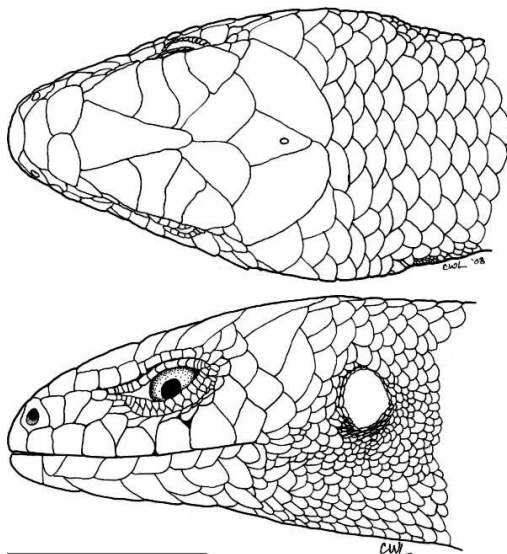


FIG. 2.—Lateral and dorsal view of head of holotype of *Sphenomorphus traanorum* showing scalation characteristics. Scale bar = 5 mm.

Palawan Island, Palawan Province, Municipality of Rizal, 2.5 km W and 0.7 km S Mt. Mantalingahan peak, 1550 m (8.8126° N, 117.6587° E). Collected 24 June 2007 by D. S. Balete.

Paratypes.—KU 311423 (ELR1553), PNM 9641 (KU 311424, ELR 1569): Philippines, Palawan Island, Palawan Province, Municipality of Rizal, Mt. Paray-Paray, 1593 m (8.8113889° N, 117.670000° E). Collected 3 July 2007, Male. KU 311440 (DSB 4769), KU 311443 (DSB 4848), KU 311441 (DSB 4772): Philippines, Palawan Island, Palawan Province, Municipality of Rizal, Mt. Mantalingahan “peak 2,” 2068 m (8.8125° N, 117.6608° E), KU 311424 and KU 311440: male; KU 311423, KU 311443, and KU 311441: female. Specimens collected by U. D. Carestia, H. J. D. Garcia, and D. S. Balete. KU 311423 has been cleared and double-stained.

Diagnosis.—*Sphenomorphus traanorum* can be identified by the following combination of characters: (1) a medium body size (SVL at maturity 48–53 mm); (2) MBSR = 29–33; (3) PVSR = 62–69; (4) scales nonstriated and lacking apical pits; (5) four enlarged supraoculars; (6) anterior and posterior loreals undivided laterally, or anterior loreal laterally divided; (7) three preoculars; (8) prefrontals in

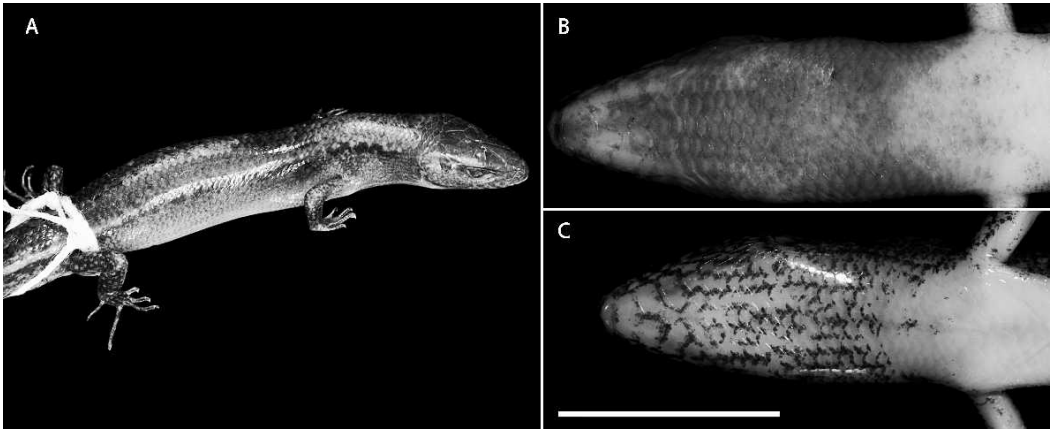


FIG. 3.—Photograph of holotype of *Sphenomorphus traanorum* showing size and color pattern (A), and gular region of KU 311440 male (B) and KU 311441 female (C) paratypes showing sexual dimorphism in gular color pattern. Scale bar (B, C) = 5 mm.

broad contact; (9) and 15–17 Toe IV SDL. On the basis of scale counts and osteology, we place *Sphenomorphus traanorum* into Group IV of Brown and Alcalá (1980) and the *S. variegatus* Group of Greer and Parker (1967a).

Sphenomorphus traanorum can be distinguished from species in the *S. variegatus* Group by the following: MBSR = 29–33 in *S. traanorum* distinguishes it from *S. amblyplacodes* (41), *S. annectens* (50), *S. anomalopus* (38), *S. concinnatus* (40), *S. dussumieri* (40), *S. florense* (44–50), *S. granulatus* (36), *S. haasi* (41, 42), *S. incognitus* (36–40), *S. jobiense* (38–46), *S. lineopunctulatus* (38), *S. maculatus* (38–42), *S. mimikanus* (40), *S. misolense* (42), *S. nigrolabris* (40–50), *S. sarasinorus* (44–46), *S. simus* (40), *S. striolatus* (40), *S. taylora* (53–61), *S. tropidonotus* (42–44), and *S. wolfi* (38–42); SDL on Toe IV = 15–17 in *Sphenomorphus traanorum* distinguishes it from *S. aignanus* (40–42), *S. amblyplacodes* (27), *S. annectens* (21), *S. concinnatus* (22–25), *S. dussumieri* (20–25), *S. florense* (27–29), *S. granulatus* (20), *S. incognitus* (18–20), *S. jobiense* (18–29), *S. lineopunctulatus* (22), *S. milnense* (35–37), *S. misolense* (22), *S. nigrolabris* (20–27), *S. sanctus* (25–30), *S. sarasinorus* (22–24), *S. simus* (25), *S. striolatus* (26), *S. taylora* (27–35), *S. tropidonotus* (27), and *S. wolfi* (22–25); supraoculars four in *S. traanorum* distinguishes it from *S. aignanus* (5), *S. amblyplacodes* (5), *S. annectens* (9), *S. florense* (6, 7), *S. granulatus* (7), *S. haasi* (6), *S.*

indicus (6), *S. jobiense* (5), *S. maculatus* (5), *S. milnense* (5), *S. mimikanus* (7), *S. misolense* (7), *S. nigrolabris* (6), *S. sanctus* (5), *S. sarasinorus* (7, 8), *S. simus* (6), *S. striolatus* (7), *S. taylora* (5–7), and *S. tropidonotus* (6); an SVL between 48–53.2 mm distinguishes *S. traanorum* from the larger species *S. aignanus* (80 mm), *S. amblyplacodes* (90 mm), *S. anomalopus* (70 mm), *S. concinnatus* (62 mm), *S. dussumieri* (59 mm), *S. florense* (71 mm), *S. incognitus* (77 mm), *S. indicus* (80 mm), *S. jobiense* (87 mm), *S. maculatus* (63 mm), *S. milnense* (61–68 mm), *S. mimikanus* (90 mm), *S. nigrolabris* (62–91 mm), *S. sarasinorus* (52–74 mm), *S. simus* (56 mm), *S. taylora* (147 mm), *S. tropidonotus* (61 mm), and from the smaller species *S. granulatus* (45 mm) and *S. misolense* (37–45 mm).

Sphenomorphus traanorum can be distinguished from Bornean *Sphenomorphus* by the following: PV = 62–69 in *S. traanorum* distinguishes it from *S. bukitensis* (73–74), *S. kinabaluensis* (80–89), *S. maculicollis* (79), *S. multisquamatus* (74–78), *S. murudensis* (71), and *S. sabanus* (84–95); MBSR = 29–33 distinguishes *Sphenomorphus traanorum* from *S. buttikoferi* (24), *S. cyanolaemus* (40), *S. multisquamatus* (40–49), and *S. tanahtinggi* (40–42); broad contact of the prefrontals (vs. no contact) distinguishes it from *S. aesculeticola*, *S. crassa*, and *S. maculicollis*; contact of the parietals with the supraoculars (vs. occlusion of contact by lateral parietal) distinguishes it from

S. hallieri; a SVL of 48–53.2 mm distinguishes *S. traanorum* from the much smaller species *S. aesculeticola* (35–43 mm), *S. bukitensis* (40.5–44 mm), *S. butleri* (34–44 mm), *S. buttikoferi* (35 mm), and *S. maculicollus* (47 mm); and from the larger species *S. crassa* (82 mm), *S. multi-squamatus* (60–69 mm), and *S. sabanus* (58 mm); SDL on Toe IV between 15 and 17 distinguishes *S. traanorum* from *S. aesculeticola* (6–10), *S. bukitensis* (12–13), *S. butleri* (12–13), *S. buttikoferi* (21–23), *S. crassa* (18–19), *S. cyanolaemus* (18), *S. hallieri* (10–15), *S. maculicollus* (18–23), *S. sabanus* (18–22), and *S. stellatus* (19).

Sphenomorphus traanorum can be distinguished from the two species in Philippine Group I (*S. beyeri* and *S. diwata*) by the presence of PVSr = 62–69 (vs. PVSr > 90), by the presence of large shield-like temporal scales (vs. small, undifferentiated temporal scales), and by having fewer MBSr (29–33 vs. > 40). The new species can be distinguished from Philippine Group II (*S. atrigularis*, *S. biparietalis*, *S. lawtoni*, *S. luzonensis*, *S. steerei*, and *S. tagapayo*) by larger SVL at maturity (vs. SVL < 50 mm), Toe IV SDL = 15–17 (vs. Toe IV SDL < 13, except *S. lawtoni*, which has SDL up to 15), and by having a greater relative hind limb length (HLL / AGD > 0.19 vs. HLL / AGD < 0.18). *Sphenomorphus traanorum* can be distinguished from species in Philippine Group III and IV by the following: MBSr = 29–33 distinguishes *S. traanorum* from *S. arborens* (36–39), *S. cumingi* (48–54), *S. laterimaculatus* (39), and *S. variegatus* (38–44); PVSr = 62–69 distinguishes it from *S. acutus* (51–61), *S. cumingi* (75–87), and *S. laterimaculatus* (78). The presence of broad prefrontal contact, fewer Toe IV SDL and 1 or 2 anterior loreals distinguishes *S. traanorum* from *S. mindanensis*. *Sphenomorphus traanorum* can be distinguished from *S. leucospilos* and *S. decipiens* by the presence of a divided frontoparietal scale (vs. a fused frontoparietal scale); further from *S. leucospilos* by having a wider head (HW / HL > 0.66 vs. HW / HL < 0.60) and a broader snout, obtusely rounded vs. acutely pointed; coloration of *S. leucospilos* is very different from *S. traanorum*, with large white spots on the dorsal and lateral surface of the body and a dark brown ground color, gular

region bluish, *S. traanorum* lacks white spots and only has gular coloration (possible blue in life) in males. In addition to the difference in frontoparietal scales, *S. traanorum* can be further distinguished from *S. decipiens* by its greater adult SVL (vs. 31–45 mm) and lack of vertebral spots (vs. line of small spots down vertebral column).

The new species differs from other *Sphenomorphus* on Palawan Island by the following: from *S. wrighti* by the presence of 15–17 Toe IV lamellae (vs. 22–25), by the presence of a uniform dorsal coloration (vs. dark spots along the vertebral column), the presence of a uniform coloration on the flanks (vs. black and white mottling on the flanks), a shorter length (SVL = 48–53.2 mm vs. SVL = 54–64 mm), and by the presence of chin mottling in females (vs. ivory colored chin in males and females). *Sphenomorphus traanorum* can be distinguished from *S. victoria* by the presence of 15–17 Toe IV lamellae (vs. 18–21), the presence of a uniform dorsal coloration (vs. dark spots along the vertebral column), and by having a broken or missing dorsolateral band (vs. a solid, broad, dorsolateral band extending from the nuchal region to tail; Fig. 1). The new species differs from *Parvosцинus palawanensis* (formerly *Sphenomorphus palawanensis*) by the presence of an external tympanum (vs. scaled over tympanum), larger body size (SVL = 48–53.2 mm vs. SVL = 29.7 mm), greater number of Toe IV SDL, MBSr and PVSr. See Table 1 for a complete list of character differences between *Sphenomorphus traanorum* and its phenotypic congeners. (See Appendix I for specimens examined.)

Description of holotype.—A medium-sized *Sphenomorphus*, SVL 50.1 mm, with clawed, pentadactyl limbs. Snout rounded in lateral profile; rostral wide forming an oval dorsal margin with the nasals and frontonasal scale; frontonasal wider than long, in contact with nasals, rostral, anterior loreal, and prefrontal scales; prefrontals in broad medial contact with the left scale overlapping the right, in contact with anterior and posterior loreals, frontal, frontonasal, first supraciliary, and first supraocular; frontal longer than wide, in contact with three supraoculars on right, two on left, posterior apex rounded; four enlarged supraoculars, first largest, second widest;

TABLE 1.—Distribution of diagnostic characters (+ present; 0 absent; — missing) in phenotypically similar and geographically proximate *Sphenomorphus* species. Characters are listed under the following numbers: (1) adult SVL, (2) MBSR, (3) PVSR, (4) number of toe IV SDL, (5) number of large supraoculars, (6) parietal scales contact supraocular, (7) prefrontal scales in broad contact, (8) number of anterior loreals, (9) number of supralabials, (10) number of infralabials, (11) texture of subdigital lamellae, and (12) presence of enlarged prelocaal scales. Data taken from the literature, are cited as follows: (A) Bacon (1967); (B) Boulenger (1887); (C) Boulenger (1898); (D) Boulenger (1903); (E) Brovn and Alcala (1980); (F) Burt, 1930; (G) de Rooij (1915); (H) Greer and Parker (1967a); (J) Grismer (2008); (K) Inger (1958); (L) Inger and Hosmer (1965); (M) Inger et al. (2001); (N) Thompson (1912); (P) Vogt (1928); and (Q) Vogt (1932). Palawan species are grouped together with *S. traanorum* in bold, all other species are in alphabetical order.

	1	2	3	4	5	6	7	8	9	10	11	12	n
<i>traanorum</i>	48–53.2	29–33	62–69	15–17	4	+	+	2	7	5, 6	keeled/smooth	+	6
<i>victoria</i>	45	30, 31	64–72	18–21	4	+	0, +	1	6	7	smooth	+	1
<i>wrighti</i>	54–64	37–41	71–78	22–25	4, 5	+	+	2	7, 8	6, 7	keeled	+	10
<i>acutus</i>	51–76	26–30	51–61	28–36	6	+	+	2	8, 9	8, 9	smooth	+	1E
<i>aesculeticola</i>	35–43	26–32	—	6–10	4	+	0	2	6	5	—	0	M
<i>aigananus</i>	80	32–38	—	40–42	5	+	+	—	—	—	—	0	C
<i>amblyplacodes</i>	90	41	—	27	5	+	+	2	8, 9	—	keeled	+	Q
<i>annectens</i>	48	50	—	21	9	+	0	2, 3	—	—	—	+	G
<i>anomalopus</i>	70	38	—	16	4	+	+	2	—	—	keeled	+	G
<i>arborens</i>	45–66.3	36–39	64–75	18–22	5	+	+	1	5, 6	6	smooth	+	6
<i>bukitensis</i>	40.5–44	31–33	73, 74	12, 13	4	+	+	2	6	5	keeled	0	J
<i>butleri</i>	34–44	31–33	66, 67	12, 13	4	+	+	1, 2	6	5, 6	smooth	+	J
<i>buttikoferi</i>	35	24	—	21–23	4	+	+	—	—	—	smooth	+	J
<i>concinnavus</i>	62	40	—	22–25	4	+	+	1	—	—	—	+	M
<i>crassa</i>	82	32	—	18, 19	4	+	0	2	7	6	—	+	B
<i>cumingi</i>	115–143	48–54	75–87	22–27	7, 8	+	0	1	7, 8	6, 7	keeled	+	9
<i>cyanoaenus</i>	60	40	67–75	18	6	+	+	3	7	6	keeled	+	J
<i>deceptans</i>	31–45	32–38	57–66	14–18	4	+	+	1, 2	6–8	6, 7	smooth	+	10
<i>dussumieri</i>	59	40	—	20–25	4, 5	+	+	—	—	—	—	+	B
<i>florense</i>	71	44–50	—	27–29	6, 7	+	+	1	—	—	smooth	—	G
<i>granulatus</i>	45	36	—	20	7	+	+	2	—	—	keeled	+	D
<i>haasi</i>	46–57	41, 42	—	16–18	6	+	+, 0	2	7	6	smooth	+	L
<i>hadleri</i>	48–55	33–41	—	10–15	4	0	+	2	—	—	smooth	+	0
<i>incognitus</i>	77	36–40	—	18–20	4	+	+, 0	—	—	—	—	—	A, M
<i>indicus</i>	80	30–38	—	16–22	6	+	+, 0	—	—	—	—	—	N
<i>jobiense</i>	87	38–46	—	18–29	5	+	+	2	—	—	keeled	+	B
<i>kinabaluensis</i>	45–58	32–38	80–89	15–20	5, 6	+	+, 0	1	7	7	smooth	+	M
<i>laterimaculatus</i>	52	39	78	19	4	+	+	2	7	7	keeled	+	F
<i>leucospilos</i>	42–55	32, 33	62–68	16–18	4	+	+	1	6, 7	7	smooth	+	5
<i>lineopunctulatus</i>	—	38	—	22	4	+	0	—	—	—	—	—	H
<i>maculatus</i>	63	38–42	—	16–22	5	+	0	1	—	—	keeled	+	B
<i>maculicollis</i>	47	35, 36	79	18–23	7, 8	+	0	1, 2	6	6	smooth	+	A
<i>milhense</i>	61–68	30–32	—	35–37	5	+	+	1	—	—	—	+	D
<i>minikanus</i>	90	40	—	15–16	7	+	+	—	—	—	keeled	+	C

TABLE 1.—Continued.

	1	2	3	4	5	6	7	8	9	10	11	12	n
<i>mindanensis</i>	42-56	30-32	56-65	17-20	4	+	0	1	7, 8	7	smooth	+	F
<i>miscolense</i>	37-46	42		22	7	+	+	—	7	—	—	—	P
<i>multisquamatus</i>	60-69	40-49	74-78	16-23	6, 7	+	+	2, 3	6-8	5-7	smooth	+	J, K
<i>murudensis</i>	50.4	30-34	71	16, 17	6	+	+	2	6	7	smooth	+	E, J
<i>nigrolabris</i>	62-91	40-50	81-100	20-27	6	+	+	2	7	7	keeled	+	3
<i>palawanensis</i>	29.7	21	52	12	4, 5	+	—	1	6	5	smooth	+	1
<i>sabanus</i>	58	38-42	84-95	18-22	6, 7	+	+	1	6, 7	5-7	keeled	+	J, K
<i>sanctus</i>	48	32-34	—	25-30	5	+	+	2	—	—	keeled	+	G
<i>sarasimortis</i>	52-74	44-46	81-96	22-24	7, 8	+	+	2	7	7	keeled	+	4
<i>simus</i>	56	40	—	25	6	+	+	2	—	—	keeled	+	B
<i>stellatus</i>	55-75	22-24	—	19	4	+	+	2	5, 6	—	keeled	+	A, M
<i>striolatus</i>	50	40	—	26	7	+	+	—	—	—	keeled	+	C
<i>tandahinggi</i>	48-64	40-42	—	16, 17	5	+	+	3	8, 9	7	—	+	M
<i>taylori</i>	147	53-61	114-118	27-35	5-7	+	—	2	—	—	—	+	N
<i>tropidonotus</i>	61	42-44	—	27	6	+	0	2	—	—	keeled	+	G
<i>variegatus</i>	49-63	38-44	66-76	19-25	6	+	0, +	2	7, 8	6, 7	keeled	+	11
<i>wolfi</i>	—	38-42	—	22-25	4	+	+	—	—	—	—	—	H

frontoparietals divided, left overlapping right for half the length, in contact with three supraoculars on the left and two on the right; interparietal arrowhead-shaped with parietal eye in posterior third; parietals in broad overlap, left overlapping right, in contact with fourth supraocular, postsupraocular, and secondary temporal; nuchals same size as dorsals, not obliquely enlarged.

Nasal pierced in center by large naris, surrounded anteriorly by rostral, dorsally by frontonasal, posteriorly by anterior loreal, and ventrally by first supralabial; anterior loreal 1, posterior loreal larger than anterior; preoculars 3, ventral 2 equal and much larger than dorsal scale; seven supralabials, fifth under center of eye; supraciliaries 11, anterior three larger than rest of series; 16 ciliaries; lower eyelid scaly and transparent, lacking non-scaled "window"; suboculars 10, largest anteriorly and medially; primary temporals 3, secondary temporals 2, lower overlapping upper; ear large (EarD [1.7] / EyeD [2.48] = 0.68) and moderately sunk.

Infralabials 8, decreasing in size posteriorly in series; mental large, forming a straight suture with a single large postmental and first infralabials; chin scales increasing in number posteriorly (1, 2, 3) and then blending into size and shape of gular scales; gular scales slightly smaller than ventrals.

Body slightly elongate (AGD [26.41] / SVL [50.12] = 0.53), cylindrical, with 33 equal-sized midbody scales, limbs overlapping when adpressed; paravertebral scales 63, imbricate, smooth, without striations, keels or pits. Tail elongate, slightly longer than body (TL [65.37] / SVL [50.12] = 1.3) triangular at base, thicker dorsally than ventrally, becoming slightly dorsoventrally compressed after 10 mm; subcaudal scales nondifferentiated for basal half of tail, enlarged and scute like for distal half of original tail.

Forelimbs smaller than hind limbs (FLL [4.32] / HLL [5.11] = 0.84), pentadactyl; forelimb scales equal in size to body scales, imbricate and smooth, reducing slightly closer to manus; dorsal scales on distal part of digits multiple; lamellae becoming slightly keeled distally on each digit. Relative digit length with lamellae (L/R) in parentheses III(10/9) > IV(10/8) > II(8/7) > V(7/6) > I(6/5). Palmar

scales irregular, raised, forming ventral protrusions from palmar surface; large set of four scales leading on distolateral edge of Digit V to the wrist, largest scale at wrist.

Hind limbs small (HLL [5.11] / SVL [50.12] = 0.10), pentadactyl; hind limb scales equal in size and shape to body scales; dorsal scales on digits multiple. Lamellae keeled proximally and distally, flat for a few scales in between on Digit IV. Relative digit length with lamellae (L/R) in parentheses: IV(16/16) > III(12/12) > V(9/9) > II(9/8) > I(5/5). Plantar scales irregular, slightly raised; three large, ventrally pointed scales along ankle/plantar margin; ventrally raised scales along distolateral edge of Digit V to ankle, increasing in size toward ankle.

Precloacal region with series of enlarged scales between pelvic region and cloaca, more elongate than ventral scales; medial precloacal scales larger, overlapping lateral scales.

Coloration of holotype in preservative.—Dorsal ground color chestnut to dark brown with small, black, irregular specks. The dorsolateral region has a dark brown stripe that extends from the nuchal region to the base of the tail. Flanks cream colored with small, black speckles. Ventrums white, thoracic region without spotting, gular region with dark pattern of small spots. Lateral surface of the head dark brown over chestnut-brown. Limbs dark brown with circular chestnut spots, irregularly arranged. Coloration in life not recorded.

Reproductive condition of holotype.—Gravid female with single large egg (13.6 mm) in left oviduct. Right oviduct with small follicles, but no eggs. Left oviduct fully expanded to size of body wall to accommodate large egg. Egg contains 2.5-mm embryo (preserved separately).

Variation.—All six specimens closely approximate the holotype in scale characteristics and shape (Table 1). Variation in the anterior loreal scale from the holotype state is present in two paratypes: KU 311440 has a divided anterior loreal; KU 311443 has an anterior loreal not in contact with the supralabials, obstructed by an elongate nasal. Paratype KU 311441 is missing the hind limb digits and left manus. Paratype KU 311423 lacks broad contact of the prefrontals. Coloration of females (KU 311443, PNM 9562, and KU 311441) differs from males (KU 311440 and KU 311424): females with small, black, irreg-

ular specks on chestnut-brown dorsal coloration, males without specks. The dorsolateral region in females has a dark brown stripe that extends from the nuchal region to the base of the tail; males lack the darker stripe and have a more uniform coloration of dark brown throughout their dorsal and lateral portions of the trunk. Flank of females cream colored with many small, black, speckles. Flank in males dark brown, gradually fading to white on the ventral portions of trunk. Venter white, thoracic region without spotting, gular region grayish in males, without spotting; females have small, dark, spots in the gular region (Fig. 2B, C). Lateral surface of head in females with dark brown patterning over a chestnut-brown base color; males without much patterning, with a gray color below grading into a dark brown dorsal color. Limbs in both sexes dark brown with circular chestnut spots, irregularly arranged. Other meristic and continuous differences are shown in Table 2.

Distribution and natural history.—Found only on Mt. Mantalingahan and Mt. Paray-Paray on Palawan Island in the Philippines (Fig. 3). The species was collected between 1550 and 2068 m above sea level and may be a montane endemic. Little is known about the natural history of *S. traanorum* because few specimens have been collected, presumably owing to the secretive nature of this forest species, and logistical and bureaucratic obstacles to survey work on Palawan.

Tissues.—Liver was removed from all six type specimens. Samples are stored at KU under field collector number and museum catalog number.

Etymology.—*Sphenomorphus traanorum*: The specific epithet is derived from the term *Traan*, meaning “people in scattered places,” which is used by Palawanon tribes in reference to their ancestral tradition of living in small houses in the uplands of Palawan Island, separated by forest and shifting agricultural plots. This tradition is the predominant practice of tribal groups living at the type locality of the new species (Fig. 4).

DISCUSSION

The genus *Sphenomorphus* is in need of major systematic revision due largely to its

TABLE 2.—Meristic (+ present, 0 absent) and continuous variation among six specimens of the new species *Sphenomorphus traanorum*. PNM and KU refer to museum catalog numbers. Abbreviations of measurements are defined in the Methods. For tail measurements, an “A” is for autotomized and an “R” is for regenerated. Missing data represented by —.

Sex	PNM 9641	KU 311440	KU 311423	KU 311443	PNM 9640	KU 311441	Avg.	SD
	Male	Male	Female	Female	Female	Female		
Paravertebrals	62	63	69	67	63	64	65	3
Midbodyscals	33	31	31	33	33	29	32	2
Supralabials	7	7	7	7	7	7	7	0
Infralabial	6	5	5	6	6	6	6	1
Toe IV Subdigital lamellae	17	17	17	15	16	—	16	1
Prefrontal contact	+	+	0	+	+	+		
Supraoculars	4	4	4	4	4	4	4	0
Divided frontonasal	0	0	0	0	0	0		
Divided frontoparietal	+	+	+	+	+	+		
Parietal contact	+	+	+	+	+	+		
Oblique nuchals	0	0	0	0	0	0		
SVL	52.47	51.14	37.44	53.22	50.12	47.99	48.73	5.83
TL	13.93A	40.44R	21.34A	55.77	65.37	71.76	64.3	8.05
AGD	26.91	25.22	18.83	28.38	26.41	24.85	25.1	3.32
SFL	19.08	19.17	—	17.76	17.63	17.02	18.13	0.85
TW	6.3	4.91	3.91	4.8	4.19	4.14	4.71	0.87
TD	5.26	5.23	3.89	4.6	4.53	4.54	4.68	0.51
HL	12.68	10.41	8.35	9.58	9.85	9.28	10.03	1.47
HW	8.34	7.41	5.57	6.62	6.87	6.16	6.83	0.97
SL	3.94	3.96	2.73	3.24	3.34	3.73	3.49	0.48
IND	2.14	2.08	1.65	1.71	1.87	1.91	1.89	0.19
IOD	4.94	4.45	3.78	4.11	4.35	4.24	4.31	0.39
FL	3.88	3.24	2.42	2.93	3.28	3.22	3.16	0.48
ED	4.05	3.34	2.55	2.41	2.48	3	2.97	0.64
EARD	2.44	1.95	1.35	1.51	1.7	1.53	1.75	0.4
FLL	5.42	5.05	—	4.35	4.32	4.60	4.75	0.43
HLL	6.71	5.92	—	5.61	5.11	5.36	5.74	0.55

history as a notorious taxonomic receptacle. It is suspected that it is widely paraphyletic with respect to other Asian skink genera (Reeder, 2003; Skinner, 2007); as a consequence, it is difficult to speculate on the identity of the closest relatives of *S. traanorum*. Osteology and external morphology place *S. traanorum* in the *S. variegatus* Group and Philippine Group IV (Brown and Alcala, 1980; Greer and Parker, 1967a), which constitutes a large grouping of phenotypically similar species. This grouping is constructive for diagnosing this new species because it compares *S. traanorum* to a widespread group of phenotypically similar congeners. Whether the *S. variegatus* Group or Philippine Group IV reflects the true evolutionary history of these species (i.e., is, or is not, a monophyletic assemblage) remains to be explored. Nevertheless, the new species is clearly morphologically distinct from its phenotypically most similar congeners and cannot possibly be

confused with other Southeast Asian scincids. We are therefore confident in our identification of *S. traanorum* as a distinct evolutionary lineage.

Sphenomorphus traanorum increases the number of known *Sphenomorphus* on Palawan Island from two to three (exclusive of *Parvosцинus palawanensis*). Each of these species occurs in sympatry on Mt. Mantalingahan. *Sphenomorphus wrighti* and *Sphenomorphus victoria* have wider distributions, the former without specific localities and the latter also found on Thumb Peak (“Sapacoy”) and Irawan, near Puerto Princesa City. It is possible that *S. traanorum* occurs in other regions of Palawan Island, although current sampling precludes a complete understanding of the species’ distribution.

The skink fauna on Palawan Island is surprisingly depauperate compared with other islands in the Philippines. There are 11 skink species found on Palawan Island, compared

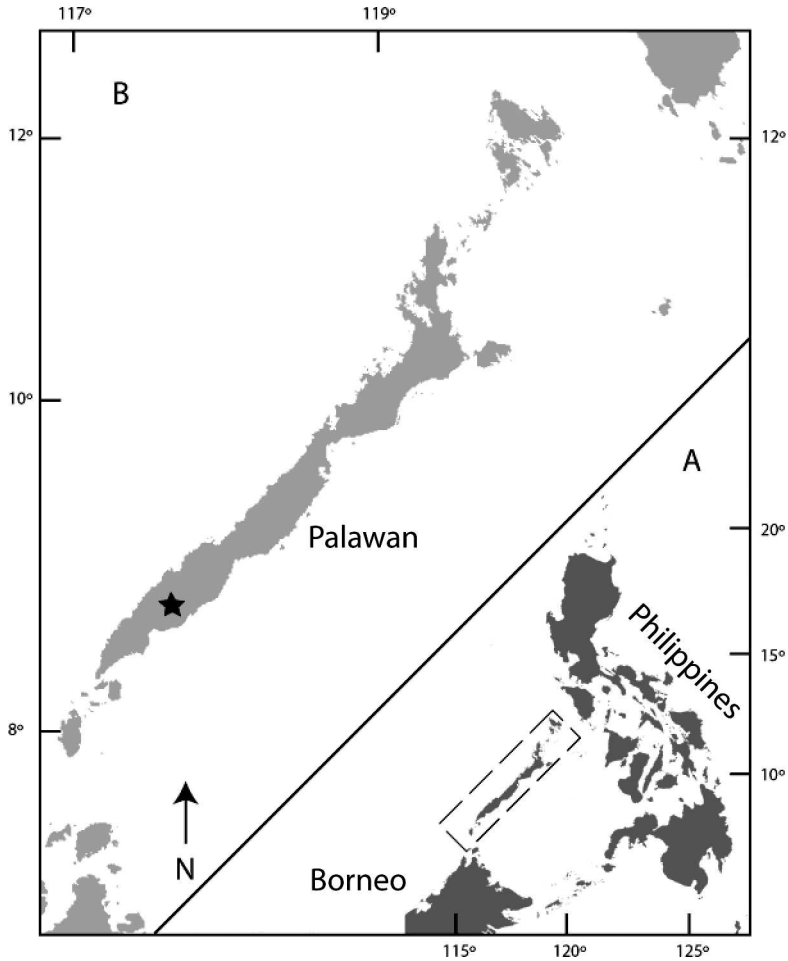


FIG. 4.—Map of the Philippines (A) and Palawan Island (B) showing the type locality of *Sphenomorphus traanorum* (star).

with the slightly smaller Mindoro Island with 12 species. More than half the species on Palawan have widespread distributions, with only five skink species (*Dasia griffini*, *Parvosцинus palawanensis*, *Sphenomorphus wrighti*, *S. victoria*, and *S. traanorum*) endemic to the island. Most of the widespread species (*Emoia atrocostata*, *Eutropis indeprensa*, *E. mutifasciata*, and *Lipina quadrivittata*) are distributed across the oceanic Philippine Islands, Palawan, and Borneo. Two widespread species, *Lygosoma quadrupes* and *Lamprolepis smaragdina*, occur on Palawan, but at the edge of their distribution. *Lygosoma quadrupes* is widespread in Indochina and Borneo, occurring

on Palawan, but on the oceanic Philippine Islands. *Lamprolepis smaragdina* is widespread in the oceanic Philippines, Palawan, and extends east to the Solomon Islands, but it does not occur on Borneo. The discrepancy in the affinities of widespread Palawan skink taxa, oceanic or Bornean, continues to show that the relationships between Palawan, Borneo, and the oceanic Philippines fauna are not as clear as previous investigators have assumed (see other examples in Brown and Guttman, 2002; McGuire and Kiew, 2001). A multitaxon assessment of the true biogeographic relationships of Palawan Island provides fertile ground for future research.

KEY TO PALAWAN ISLAND *SPHENOMORPHUS*

1. a. Small body size; prefrontals absent; scute-like subcaudals; ear scaled over.....
..... *Paroscincus palawanensis*
- b. SVL > 30 mm; prefrontals present; subcaudals equal to other scales; tympanum exposed..... 2
2. a. Frontonasal divided or single; PVSr 71–78; MBSr 37–41; coloration light brown with small dark bars on vertebral scales, dark dorsolateral strip broken on dorsal and ventral edge..... *Sphenomorphus wrighti*
- b. Frontonasal single; PVSr 64–72; MBSr 30–31; toe IV SDL 18–21; coloration brownish, with small black bars on vertebral scales, dark dorsolateral strip solid.....
..... *Sphenomorphus victoria*
- c. Frontonasal single; PVSr 62–69; MBSr 29–33; toe IV SDL 15–17; dorsal spotting random and only in females.....
..... *Sphenomorphus traanorum*

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APPENDIX I

Specimens Examined

Sphenomorphus acutus: PHILIPPINES: SAMAR: Eastern Samar Province: Municipality of Taft: Barangay San Rafael: KU 310818. *Sphenomorphus arborens*: PHILIPPINES: PANAY: Antique Province: Municipality of San Remigio: Barangay Aningalan: KU 306805–9, 306830. *Sphenomorphus cumingi*: PHILIPPINES: POLILLO: Quezon Province: Municipality of Polillo: Barangay Pinaglubayan: KU 302923; MINDORO: Occidental Mindoro Province: Municipality of Sablayan: Barangay Batong Buhay: KU 304067–8, 304070–2, 305728; LUZON: Camarines Sur Province: Municipality of Naga City: Barangay Panicason: Mt. Isarog: TNHC 62748; Zambales Province: Municipality of Olongapo: SBMA Naval Base: TNHC 62749. *Sphenomorphus decipiens*: PHILIPPINES: LUZON: Nueva Vizcaya Province: Municipality of Quezon: Barangay Maddiangat: KU 308925; Camarines Sur Province: Municipality of Naga City: Barangay Panicason: Mt. Isarog: TNHC 62883, 62885–8, 62891; Albay Province: Municipality of Malinao: Barangay Tagoytoy: Mt. Malinao: TNHC 62896–8. *Sphenomorphus laterimaculatus*: PHILIPPINES: LUZON: Sorsogon Prov-

ince: Municipality of Bulusan: San Roque: CAS-SUR24204 (Holotype). *Sphenomorphus leucospilos*: PHILIPPINES: LUZON: CAS 64232 (Cotype); Quezon Province: Municipality of Tayabas: Barangay Lalo: TNHC 62680–3. *Sphenomorphus mindanensis*: PHILIPPINES: SAMAR: Eastern Samar Province: Municipality of Taft: Barangay San Rafael: KU 310809. *Sphenomorphus nigrolabris*: INDONESIA: SULAWESI: “North Sulawesi:” BMNH 1946.8.19.69 (Lectotype); Sulawesi Tengah Province: Kabupaten Douggala: Kecamatan Kulawi: Desa Mataue: Lore Lindu National Park: BSI-FS 1413, 1477. *Parvoscincus palawanensis*: PHILIPPINES: PALAWAN: Palawan Province: Municipality of Puerto Princesa City: Malabo: CAS-SUR 23122 (Holotype). *Sphenomorphus sarasinorum*: INDONESIA: SULAWESI: Sulawesi Tengah Province: Kabupaten Douggala: Kecamatan Kulawi: Desa Mataue: Lore Lindu National Park: BSI-FS 1856, 1857; “Central Sulawesi:” BMNH 1946.8.15.9 (Type), NHMB 4744 (Lectotype). *Sphenomorphus variegatus*: PHILIPPINES: Camiguin Sur: Camiguin Province: Municipality of Mambajao: Barangay Pandan: KU 309899–907; SAMAR: Eastern Samar Province: Municipality of Taft: Barangay San Rafael: KU 310819; LEYTE: Leyte Province: Municipality of BayBay: Barangay San Vicente: KU 311271. *Sphenomorphus victoria*: PHILIPPINES: PALAWAN: Palawan Province: Municipality of Brooke’s Point: Barangay Samarinana: Mt. Mantalingahan Range: KU 309443. *Sphenomorphus wrighti*: PHILIPPINES: PALAWAN: Palawan Province: Municipality of Rizal: Mt. Paray-Paray: KU 311417–22; Mt. Mantalingahan peak 2: KU 311436–39.