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A review of Indochinese skinks of the genus *Lygosoma* Hardwicke & Gray, 1827 (Squamata: Scincidae), with natural history notes and an identification key

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Abstract: We review the supple skinks (*Lygosoma* Hardwicke & Gray, 1827) known to occur in Indochina (Cambodia, Laos and Vietnam). Here, the existence of seven species is documented: *L. angeli*, *L. boehmei*, *L. bowringii*, *L. corpulentum*, *L. haroldyoungi*, *L. isodactylum* (type of *Squamicilia* Mittleman, 1952), and *L. quadrupes* (type of *Lygosoma*). Based on morphological characters, *L. carinatum* Darevsky & Orlova, 1996 is shown to be a synonym of *L. corpulentum*. Although *L. bowringii* is expected to turn out as a complex of cryptic species when molecular methods are applied to a broad sampling, Indochinese representatives form a homogenous group based on morphology. Two further *Lygosoma* listed by Bourret (2009), viz. *L. albopunctatum* and *L. punctatum* (generotype of *Riopa* Gray, 1839) are distributed further west and probably fail to reach the Indochinese realm. We also provide natural history notes and an identification key for the seven species currently recognized from Cambodia, Laos and Vietnam.

Key words: Scincidae; *Lygosoma*; Indochina; Cambodia; Laos; Vietnam; taxonomy; natural history

Introduction

The genus *Lygosoma* Hardwicke & Gray, 1827 has a long and complicated nomenclatural history. In the classical work by Boulenger (1887), it was considered a truly cosmopolitan group present in "Australasia, East Indies, China, North and Central America, Tropical and South Africa" (Boulenger 1887, p. 210). More than 60 genus names were listed as generic synonyms of which eleven were regarded to represent distinct subgenera. In his important subfamilial revision, Mittleman (1952) elevated most subgenera to genus level, including some former sections of *Lygosoma*, e.g., *Riopa* Gray, 1839. Greer (1977) thought that *Lygosoma* included clades not only from SE Asia but even from Africa. The original taxonomic and nomenclatural concepts of Greer (1977) have been recently reviewed by Wagner et al. (2009). For the supple skinks of SE Asia, there is still a debate whether *Riopa* should be differentiated from or included in *Lygosoma*. Diagnoses in the literature (e.g., Boulenger 1887; de Rooij 1915; Mittleman 1952) include alternative conditions in diagnostic morphological characters, which could be related to ecological adaptations, so the character states may represent convergent conditions with limited phylogenetic and/or taxonomic value. One characteristic used in these diagnoses is the presence or absence of an ear opening. However, Mertens (1971) and Nguyen et al. (2011) showed that especially in skinks the states of this trait can vary according to species of one genus or even among populations of the same species. Regarding the lower eyelid (with or without transparent window), it was shown that the presence of a transparent window, for instance in lacertids, has evolved several times independently in different phylogenetic clades (Arnold et al. 2007). That is why we, despite some reservations and pending future molecular studies, preliminarily follow Greer's lumping concept and regard the Indochinese species formerly assigned to *Riopa* (see, e.g., Teynié et al. 2004; Moravec & Böhme 2008; Pauwels et al. 2008) as congeneric with *Lygosoma*, a view which has also been taken in the two major recent faunistic works on the area, viz. Nguyen et al. (2009) and Das (2010).

Material and methods

Field surveys were conducted by W. Van Devender et al. in Cat Tien National Park, Dong Nai Province, Vietnam

in May and June 2001, 2002, 2004, 2005 and 2006; by P. Geissler in Cat Tien National Park, Dong Nai Province, Vietnam from July to August 2008 and from March until June 2009; by T. Ziegler in Phong Nha – Ke Bang National Park, Quang Binh Province, Vietnam in October 2009; by T. M. Phung in Nui Dinh, Ba Ria – Vung Tau Province, Vietnam in October 2009; by T. Hartmann in Phnom Kulen National Park, Siem Reap Province, Cambodia in 2009. In addition, we examined specimens deposited in the collections of the Institute of Ecology and Biological Resources (IEBR), Hanoi, Vietnam; Zoological Museum of Moscow State University (ZMMU), Russia; Zoological Institute St. Petersburg (ZISP), Russia; Hungarian Natural History Museum (HNHM), Budapest, Hungary; and Zoologisches Forschungsmuseum Alexander Koenig (ZFMK), Bonn, Germany. A total of 37 species was examined for taxonomic identification. Other museum abbreviations mentioned in this paper are: The Natural History Museum, formerly British Museum of Natural History (BMNH), London, UK; The Field Museum, formerly Field Museum of Natural History (FMNH), Chicago, USA; Museum für Naturkunde, formerly Zoologisches Museum Berlin (ZMB), Germany; and Uppsala University Museum of Evolution, Zoology section (UUZM), Uppsala, Sweden. Synonymy and chresonymy lists are given for the taxa inhabiting the Indochinese region.

Morphological characters: Measurements were taken with digital calipers to the nearest 0.1 mm. SEM photographs were prepared with a Hitachi S-2460N at ZFMK. The following abbreviations are used: SVL: snout-vent length; TaL: tail length; TrunkL: trunk length (from posterior axilla to anterior groin); HL: head length (from snout tip to posterior point of upper jaw); HH: maximum head height; HW: maximum head width; SFlL: distance from tip of snout to anterior axilla of forelimb; SL: snout length (from tip of snout to anterior corner of eye); FlL: forelimb length (from axilla to palm); HlL: hindlimb length (from groin to palm). Scalation: paravertebral scales (from posterior margin of parietals to a point above the vent), ventrals (from chin shields to vent). Other abbreviations: a.s.l.: above sea level, SD: standard deviation. Bilateral scale counts are given as right/left.

Results and discussion

Taxonomic account

Lygosoma angeli (Smith, 1937)

Riopa angeli, M.A. Smith, 1937. Bull. Mus. Nat. Hist. Nat., Sér. 2, 9 (6): 366.
Riopa angeli, R. Bourret, 2009 [reprint]. Léz. de l'Indoch., Frankfurt: 287.
Lygosoma angeli, V.V. Bobrov, 1995. Smithsonian Herpetol. Infor. Serv. 105: 3.
Riopa angeli, V.S. Nguyen & T.C. Ho, 1996. Checkl. Rept. Amphib. Vietnam, Hanoi: 37.
Riopa angeli, V.S. Nguyen, T.C. Ho & Q.T. Nguyen, 2005. Checkl. Rept. Amphib. Vietnam, Hanoi: 61.
Riopa angeli, V.V. Bobrov & D.V. Semenov, 2008. Lizards of Vietnam, Moscow: 72 + 192.
Lygosoma angeli, V.S. Nguyen, T.C. Ho & Q.T. Nguyen, 2009. Herpetof. Vietnam, Frankfurt: 253.
Lygosoma angeli, I. Das, 2010. Field Guide Rept. S.E. Asia, London: 238.
Lygosoma angeli, A. Teynié & P. David, 2010. Voy. Natural. Laos, Chamalieres: 105.

Holotype. MNHN 1937.21. Type locality: Trang Bom, Bien Hoa (now Dong Nai Province), southern Vietnam.
Specimens examined. MNHN 1937.21 (holotype), unknown gender, collected by M. Colani in Trang Bom, near Bien Hoa (now in Dong Nai Province, southern Vietnam); HNHM 2011.171.1, adult female, collected by O. Merkl and G. Csorba on 28 March 1998 at Nam Phak River, Dong Hua Xao NBCA (near 15°58′ N, 105°55′ E); MNHN 2003.3304, adult male, collected by A. Teynié et al. in Xepian NBCA, Champasak Province, southern Laos; IEBR A.2010.21, adult male, collected by W. Van Devender et al. on 9 June 2004 near Suoi Rang Ranger Station, Cat Tien National Park, Dong Nai Province, southern Vietnam; ZFMK 91686, adult female, collected by P. Moler on 3 June 2004 near the headquarters of the Cat Tien National Park (11°25′19.3″ N, 107°25′42.0″ E, 104 m a.s.l.); two juveniles: ZFMK 91687 collected by W. Van Devender et al. on 26 May 2004 near Bau Sau Ranger Station (11°27′32.9″ N, 107°20′43.7″ E, 167 m a.s.l.) and IEBR A.2010.22 collected by P. Moler on 3 June 2004 near the headquarters of the Cat Tien National Park (11°25′19.3″ N, 107°25′42.0″ E, 104 m a.s.l.), Dong Nai Province, southern Vietnam; IEBR A.0913–A.0914, adult and subadult males, collected by T.M. Phung in October 2009 in Nui Dinh, Ba Ria – Vung Tau Province, southern Vietnam.

Diagnosis. The species differs from its congeners by the combination of the following characters: SVL 76–112 mm, equal to TaL; TrunkL 3.4–4.2 times longer than SFlL; lower eyelid scaly; supranasals in contact; frontal as long as frontoparietal; frontoparietal single; nuchals absent; external ear opening with a small lobule; supralabials 7; dorsal scales smooth (see Fig. 9A); scale rows around midbody 30; paravertebral scales 107–115; ventral scales 112–123; limbs very short (SVL/FlL: about 20; SVL/HlL: about 13); subdigital lamellae under fourth toe 6–7 (Smith 1937b; pers. observ.).

Redescription. Size (min–max, mean ± SD)**:** SVL: 77.5–112.3 mm, 97.3 ± 12.6 mm, $n = 6$; TaL 55.4–86.3 mm, 67.9 ± 14.0 mm, $n = 4$; TrunkL 55.8–85.4 mm, 71.7 ± 10.7 mm, $n = 6$; HL 9.4–12.1 mm, 10.5 ± 1.0 mm, $n = 6$; HW 4.8–6.2 mm, 5.6 ± 0.5 mm, $n = 6$; HH 4.0–4.8 mm, 4.4 ± 0.4 mm, $n = 6$; SFlL 15.9–21.4 mm, 18.5 ± 2.2 mm, $n = 6$; FlL 4.3–5.5 mm, 4.9 ± 0.4 mm, $n = 6$; HlL 6.4–8.4 mm, 7.4 ± 0.7 mm, $n = 6$; for other measurements see Table 1.

Head indistinct from neck; snout short and obtuse; rostral wider than high, visible from above; supranasals present, in contact medially; frontonasal wider than long, in contact with supranasals, anterior loreal, prefrontals, and frontal; prefrontals small, widely separated by frontal and touching both loreals; frontal almost as wide as long, narrowing posteriorly, in contact with frontonasal, prefrontals, first and second supraoculars, and frontoparietal; frontoparietal single, wider than long, bordered posteriorly by parietals and interparietal; interparietal small, narrowing posteriorly and bordered by two parietals and frontoparietal, with

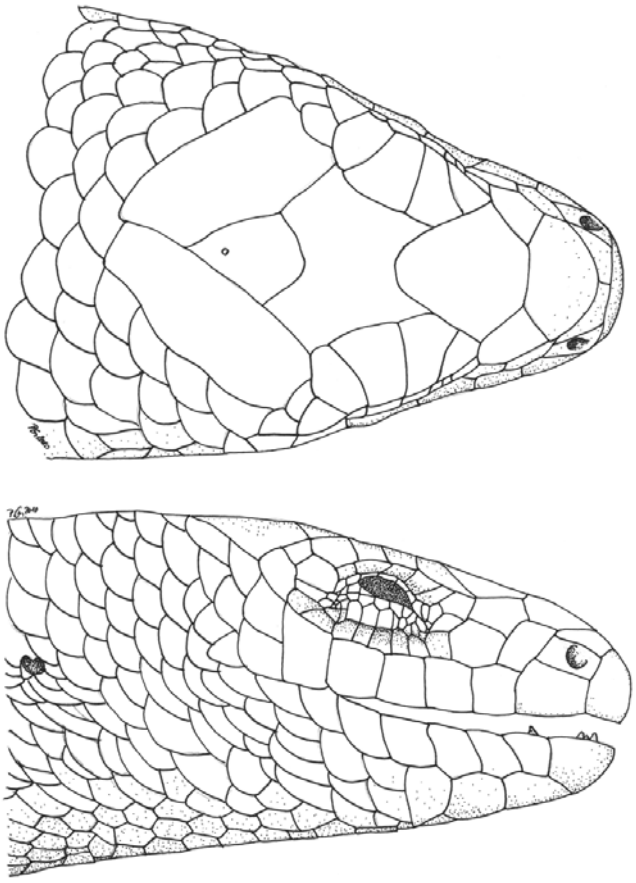

Fig. 1. Dorsal and lateral views of the head of *Lygosoma angeli* (MNHN 1937.21, holotype), from Trang Bom, Dong Nai Province, southern Vietnam. Drawings: P. Geissler.

a small transparent spot in the posterior angle; parietals in contact behind the interparietal, lateroposterior margin of parietal bordered by 4–5/4–5 scales; enlarged nuchal scales absent; nasal in contact with rostral, first supralabials, anterior loreal and supranasal; loreals 2, anterior one higher; presuboculars 3; supralabials 7, fourth and fifth below the eye; supraciliaries 5–6; supraoculars 4, second and third widest; lower eyelid with 4 enlarged transparent scales, separated from the supralabials by a row of small scales; postsuboculars 3; primary temporals 2; secondary temporals 3; ear opening oval with a small projecting lobule, tympanum deeply sunk (for dorsal and lateral head scalation see also Fig. 1); mental wider than long, rounded anteriorly, in contact with postmental and first infralabial on each side; infralabials 6–7; postmental single, in contact with first infralabial and anterior portion of second infralabial on each side (not in case of IEBR A0913); chin shields 2 pairs, first pair in contact medially or separated by a small scale (IEBR A0913–A0914), second pair separated by one scale, both pairs in contact with infralabials.

Dorsal scales smooth, slightly constricted between the anterior and posterior portion (Fig. 9C), midbody scale rows 30; paravertebral scales 107–115; ventral scales in 112–123 rows, smooth, equal in size to dorsal scales; precloacal scales 6, slightly enlarged; limbs very short, pentadactyl, widely separated when adpressed, finger not reaching the eye; subdigital lamellae under fourth finger 5; subdigital lamellae under fourth toe 6–7 (Table 2).

Colouration in preservative. Dorsum light brown, each scale bearing a basal black blotch; ventral side much lighter and each scale with a smaller blotch. For colouration in life see Fig. 2. The photographs of live specimens show the change in colour pattern from juveniles to subadults and adults. Both juveniles have dark brown and beige stripes on the back. Each scale bears an enlarged basal brown blotch which is divided by an unpigmented median band. This band is narrower and more diffuse in two subadult specimens, and absent in adult specimens. Dorsal scales of adult specimens are dark brown, edged in cream, forming a reticulated pattern.

Distribution. According to Nguyen et al. (2009) the status of this species in Vietnam is unclear and it is known from Dong Nai Province only. Ours is the first record for Ba Ria – Vung Tau Province. Teynié et al. (2004) reported a specimen from Xepian National Biodiversity Conservation Area, Champasak Province, southern Laos. We herein document the second individual of this species from Champasak Province, Laos (see Figs 2C, 8A). It is likely that the apparent distribution gap in central Vietnam and eastern Cambodia is only due to the secretive habits of this species and maybe also due to its rarity. We assume that this lizard also occurs in the intervening regions.

Natural history. All known specimens of *Lygosoma angeli* were found in lowland forests (Smith 1937; Bobrov 1992; Teynié et al. 2004; Teynié & David 2010). Both Laotian specimens (MNHN 2003.3304 and HNHM 2011.171.1) were found under the bark of a stump in a forest on the edge of a riparian area (Teynié et al. 2004; pers. observ.). An adult female (ZFMK 91686) contained three eggs (12.1–13.2 mm in length and 4.7–5.1 mm in diameter), and another adult female (HNHM 2011.171.1) had four eggs (8.4–10.5 mm in length and 4.1–5.4 mm in diameter).

Remarks. Smith (1937) mentioned that the holotype had punctiform external ear openings. However, a re-examination revealed that the external ear openings are oval with a small projecting lobule (see Fig. 1).

Lygosoma boehmei, Ziegler, Schmitz, Heidrich, Vu & Nguyen, 2007

Lygosoma boehmei, T. Ziegler, A. Schmitz, A. Heidrich, N.T. Vu & Q.T. Nguyen, 2007. Rev. Suisse Zool.: 397–415.
Riopa boehmei, V.V. Bobrov & D.V. Semenov, 2008. Lizards of Vietnam, Moscow: 73 + 193.
Lygosoma boehmei, V.S. Nguyen, T.C. Ho & Q.T. Nguyen, 2009. Herpetof. Vietnam, Frankfurt: 254 + 341.

Fig. 2. *Lygosoma angeli*: A – juvenile (IEBR A.2010.21) and B – adult (ZFMK 91687) from Cat Tien National Park, Dong Nai Province, southern Vietnam; C – adult female (HNHM 2011.171.1) from Dong Hua Xao NBCA, Champasak Province, Laos. Photographs: W. Van Devender (A, B) and G. Csorba (C).

Lygosoma boehmei. I. Das, 2010. Field Guide Rept. S.E. Asia, London: 238.

Holotype. ZFMK 86359. Type locality: Cha Noi, Phong Nha – Ke Bang National Park, Quang Binh Province, Central Vietnam.

Specimens examined. ZFMK 86359 (holotype), female, collected by A. Heidrich & T. Ziegler on 21 June 2006, in Cha Noi, 350–400 m a.s.l., Phong Nha – Ke Bang National Park, Quang Binh Province, central Vietnam.

Diagnosis. SVL 91 mm, shorter than TaL; TrunkL 1.6 times longer than SFlL; lower eyelid scaly; supranasals in contact; frontoparietals 2; frontoparietals half as long as frontal; enlarged nuchals absent; external ear openings without lobules; supralabials 7; dorsal scales bearing pseudokeels (sensu Ziegler et al. 2007); midbody scales in 32 rows; paravertebral scales 66; ventral scales in 81 transverse rows; limbs short (SVL/FlL: about 6; SVL/HlL: 4–5); subdigital lamellae under fourth toe 14 (Ziegler et al. 2007; Tables 1, 2).

Figs 3A, B. Holotype of *Lygosoma boehmei* (ZFMK 86359) from Phong Nha – Ke Bang National Park, Quang Binh Province, central Vietnam. Photographs: T. Ziegler.

Colouration in preservative. Dorsal and dorsolateral surfaces of head and body brownish grey; limbs and tail brownish black; dorsal scales distinctly edged by brownish black; lateral parts of head, body, and tail base lighter and shifting to yellowish beige on venter; lower surface of tail darker; flanks and neck with irregular dark flecks; sutures of anterior labials edged by greyish black. For the colouration in life see Fig. 3.

Distribution. This species is currently known only from the type locality (Ziegler et al. 2007). See Fig. 8B.

Natural history. The holotype was found active at night at the end of the dry season in a steep karst forest area (Ziegler et al. 2007).

Lygosoma bowringii (Günther, 1864)

Eumeces bowringii, A.C.L.G. Günther, 1864. Rept. Brit. India, London: 91.

Euprepes (*Riopa*) *punctatostriatus*, W. Peters, 1871. Monatsber. Akad. Wiss., Berlin: 31.

Lygosoma comotti, G.A. Boulenger, 1887. Ann. Mus. Civ. Genova (2) IV: 622.

Lygosoma bowringii, G.A. Boulenger, 1887. Cat. Liz. Brit. Mus. III, London: 308.

Lygosoma whiteheadi, F. Mocquard, 1890. Le Naturaliste, 12: 144.

Lygosoma comotti, G.A. Boulenger, 1890. Fauna Brit. India, London: 207.

Lygosoma bowringi, O. Boettger, 1901. Ber. Senck. Ges. 25: 50.

Lygosoma bowringii, N. de Rooij, 1915. Rept. Indo-Austral. Archipel.: 264.

Riopa bowringi, M.A. Smith, 1935. Fauna Brit. India, Rept. Amphib., II, London: 315.

Riopa bowringi, R. Bourret, 2009 [reprint]. Léz. de l'Indoch., Frankfurt: 284.

Mochlus bowringi, M.B. Mittleman, 1952. Smiths. Misc. Coll. 117: 22.

Riopa bowringi, E.H. Taylor, 1963. Univ. Kansas Sci. Bul., 44 (14): 977–979.

Riopa bowringii, V.S. Nguyen & T.C. Ho, 1996. Checkl. Rept. Amphib. Vietnam, Hanoi: 37.
Riopa bowringii, V.S. Nguyen & T.C. Ho, Q.T. Nguyen, 2005. Checkl. Rept. Amphib. Vietnam, Hanoi: 61.
Riopa bowringii, V.V. Bobrov & D.V. Semenov, 2008. Lizards of Vietnam, Moscow: 73 + 194.
Lygosoma bowringii, V.S. Nguyen & T.C. Ho, Q.T. Nguyen, 2009. Herpetof. Vietnam, Frankfurt: 254.
Lygosoma bowringii, A. Teynié & P. David, 2010. Voy. Natural. Laos, Chamalieres: 107.
Lygosoma bowringii, I. Das, 2010. Field Guide Rept. S.E. Asia, London: 238.

Holotype. BMNH 56.11.17.41. Type locality: Hong Kong, China.
Specimens examined. ZFMK 70463, juvenile, collected by S. Weitkus in August 1998 at Cua Lo, Nghe An Province, central Vietnam; IEBR A.2010.41, unknown gender, collected by S.V. Nguyen in May 2003 in Loc Lam Forest, Lam Dong Province, southern Vietnam; IEBR A.0828, male, collected in April 2007 from Yen Tu Mountain, Luc Nam, Bac Giang Province, northern Vietnam; ZFMK 90335, 90337, juveniles, ZFMK 90334, 90336, and 90338, unknown gender, collected by T. Hartmann in June 2009 in Phnom Kulen National Park, Siem Riep Province, northern-central Cambodia.

Diagnosis. SVL 42–53 mm, ± equal to TaL; TrunkL 1.6–1.8 times longer than SFlL; lower eyelid scaly; supranasals in contact; frontoparietals 2; frontoparietals half as long as frontal; nuchals in 1–2 pairs; ear opening with 1–2 projecting lobules; supralabials 7; body scales smooth (Fig. 9B); midbody scale rows 26–32; paravertebral scales 52–59; ventral scales 53–60; limbs short (SVL/FlL: 5–6; SVL/HlL: about 43) subdigital lamellae beneath fourth toe 10–15 (Günther 1864; Smith 1935; Taylor 1963; Bourret 2009; pers. observ.). For additional morphological characters see Tables 1, 2.

Colouration in preservative. Dorsum brown, each scale with a blackish spot forming longitudinal lines; dorsolateral stripe thick, dark brown, light-edged above; flanks and lateral parts of head and tail base spotted with black and white; ventral surface cream. In juveniles, lateral colouration darker; dorsal and dorsolateral stripes darker and more distinct. For colouration in life see Fig. 4.

Distribution. In Cambodia, this species is known from the Cardamom region, southwestern Cambodia (Grismer et al. 2007, 2008). Our specimens represent the first record from northern-central Cambodia (near 13°42'12" N, 104°00'03" E, 254 m a.s.l). In Laos, *Lygosoma bowringii* has been known from Sépian, Boloven Highlands and Si Phan Don, both in Champasak Province; Vientiane city, Vientiane Province (Teynié et al. 2004; Teynié & David 2010). In Vietnam, this species is reported from the following provinces: Hai Duong (Chi Linh), Nghe An (Cua Lo); Thua Thien – Hue (Bach Ma), Quang Nam (Cu Lao Cham); Dak Lac, Lam Dong (Da Lat), Dong Nai (Cat Tien); Tay Ninh (Lo Go-Sa Mat), Ho Chi Minh City, Kien Giang (Phu Quoc) (Bobrov & Semenov 2008; Nguyen et al. 2009). Our record is new for Bac Giang Province. See Fig. 8C. Outside of Indochina, the species is reported to occur in Myanmar, Thailand, Peninsular Malaysia, Singapore, Indonesia (Sumatra, Pulau Berhala, Pulau Weh, Borneo, Java, Java, Sulawesi and Bali), Bangladesh, eastern China, India (Andaman and Nicobar Islands), the Philippines (Sulu Archipelago and Mindanao [introduced]), and introduced to Australia (Christmas Island) (Das 2010).

Natural history. *Lygosoma bowringii* inhabits mainly lowland habitats, but can also be found in evergreen mountain forests up to 5,000 feet (1,524 m a.s.l.) elevation (Smith 1935). It prefers open habitats like disturbed forests, pine plantations, pond areas, clearings in towns and cities. This is a diurnal and semifossorial species and specimens are often found in leaf litter, where they feed on small arthropods. In northern Vietnam and on Phu Quoc Island (southern Vietnam), specimens were found even in coastal dune habitats (Ziegler & Weitkus 1999; Paul Moler, pers. comm.). *Lygosoma bowringii* is oviparous and produces 2–4 eggs per clutch (7.3 × 12.4 mm in size) (Taylor 1963; Teynié et al. 2004; Grismer et al. 2007; Das 2010; Teynié & David 2010).

Remarks. Ziegler et al. (2007) assumed that the widespread species *Lygosoma bowringii* actually represents a species complex. Based on our morphological data, specimens from Indochina form a homogenous group. Molecular analyses with sampling over the complete range of *L. bowringii* are needed to resolve this issue.

Lygosoma corpulentum Smith, 1921

Lygosoma corpulentum, M.A. Smith, 1921. Proc. Zool. Soc. London, I (29): 431.
Riopa corpulenta, M.A. Smith, 1935. Fauna Brit. India, Rept. Amphib., II, London: 315.
Riopa corpulenta, R. Bourret, 2009 [reprint]. Léz. de l'Indoch., Frankfurt: 283.
Mochlus corpulentus, M.B. Mittleman, 1952. Smiths. Misc. Coll. 117: 23
Riopa corpulenta, V.S. Nguyen & T.C. Ho, 1996. Checkl. Rept. Amphib. Vietnam, Hanoi: 37.
Lygosoma carinatum I.S. Darevsky & V.F. Orlova, 1996. Zool. Zh. 75 (5): 791.
Riopa corpulenta, V.S. Nguyen, T.C. Ho & Q.T. Nguyen, 2005. Checkl. Rept. Amphib. Vietnam, Hanoi: 62.
Lygosoma carinatum, V.S. Nguyen, T.C. Ho & Q.T. Nguyen, 2005. Checkl. Rept. Amphib. Vietnam, Hanoi: 59.
Riopa corpulenta, N.L. Orlov, 2006. Russ. J. Herp. 13 (3): 1–2.
Riopa corpulenta, V.V. Bobrov & D.V. Semenov, 2008. Lizards of Vietnam, Moscow: 74 + 196.
Riopa carinata, V.V. Bobrov & D.V. Semenov, 2008. Lizards of Vietnam, Moscow: 73 + 195.
Lygosoma corpulentum, V.S. Nguyen, T.C. Ho & Q.T. Nguyen, 2009. Herpetof. Vietnam, Frankfurt: 256.
Lygosoma carinatum, V.S. Nguyen, T.C. Ho & Q.T. Nguyen, 2009. Herpetof. Vietnam, Frankfurt: 255.

Fig. 4. *Lygosoma bowringii*: A – adult (ZFMK 90336); B – juvenile (ZFMK 90337). Photographs: T. Hartmann.

Lygosoma corpulentum, A. Teynié & P. David, 2010. Voy. Natural., Laos, Chamalieres: 110.
Lygosoma corpulentum, I. Das, 2010. Field Guide Rept. S.E. Asia, London: 239.
Lygosoma carinatum, I. Das, 2010. Field Guide Rept. S.E. Asia, London: 239.

Holotype: BMNH 1946.8.3.66. Type locality: Dalat, South Annam (now Lam Dong Province, southern Vietnam).
Specimens examined: MNHN 1897.416, unknown gender, collected in 1897 in Ban Ta Cheng, Pays Du Khas, Annam (now Ban Tasseng, Attapeu Province, Laos) (Smith 1935); ZISP 20482, juvenile female (holotype of *L. carinatum*), collected by I.S. Darevsky in June 1983 in Kanak, Kon Tum (now Ke Bang District, Gia Lai Province), southern Vietnam, 600 m a.s.l.; ZMMU R-8778, subadult male (paratype of *L. carinatum*), collected by G. Kuznetsov in Buon Loi, Kon Tum (now Ke Bang District, Gia Lai Province), southern Vietnam, 700 m a.s.l.; IEBR A.2010.39, adult male, collected by V.S. Nguyen in January 2000 from Ta Dung Mountain, Lam Dong Province, southern Vietnam; MNHN 2003.3322, unknown gender, collected in 2003 in Ban Sépian (near 15°07′60″ E, 106°16′60″ N, 1297 m a.s.l.), Boloven Highlands, Champasak Province, Laos; ZFMK 91685, adult female, collected by P. Moler on 3 June 2004 (near 11°26′41.74″ N, 107°25′1.82″ E) and IEBR A2010.23, juvenile, collected by W. Van Devender et al. in 2004 (near 11°26′26.97″ N, 107°25′1.82″ E), both localities are close to the headquarters of the Cat Tien National Park, Dong Nai Province, southern Vietnam; MNHN 2008.0427–2008.0429, three subadults, collected in 2008 near Paksong village (near 15°10′60″ N, 106°13′60″ E, 1288 m a.s.l.), Boloven Highlands, southern Laos; ZMMU R-13262, subadult, collected by Eduard Galoyan in 2008 in the Cat Tien National Park, Dong Nai Province, southern Vietnam.

Diagnosis. The species is characterized by the following characters: SVL 97.8–168.9 mm, ± equal to TaL; TrunkL 1.6–2.2 times longer than SFlL; lower eyelids scaly; supranasals in contact; frontoparietals 2; frontoparietals half as long as frontal; nuchals absent or in 1 pair; ear openings without lobules; supralabials 7; scale rows around midbody 36–40; paravertebral scales

78–86; limbs short (SVL/FlL: about 7; SVL/HlL: about 5); subdigital lamellae under fourth toe 11–15 (Smith 1921, 1935; Darevsky & Orlova 1996; pers. observ.).

Redescription. Size (min–max, mean ± SD)**:** SVL: 97.8–168.9 mm, 129.7 ± 29.9 mm, $n = 7$; TaL 97.6–159.8 mm, 117.1 ± 23.1 mm, $n = 6$; TrunkL 55.9–102.8 mm, 77.1 ± 19.5 mm, $n = 6$; HL 16.9–30.3 mm, 23.3 ± 5.2 mm, $n = 7$; HW 12.0–21.8 mm, 16.3 ± 4.0 mm, $n = 7$; HH 8.1–15.5 mm, 11.6 ± 3.0 mm, $n = 7$; SFlL 30.4–46.5 mm, 39.4 ± 6.7, $n = 7$; FlL 16.4–24.7 mm, 18.6 ± 3.8 mm, $n = 7$; HlL 21.3–34.6 mm, 24.8 ± 5.5 mm, $n = 7$; see also Table 1.

Head indistinct from neck; snout rounded; rostral wider than long, visible from above; supranasals in contact medially; frontonasal wider than long, in contact with supranasals, anterior loreals, prefrontals, and frontal; prefrontals small and widely separated; frontal broader than supraocular, in contact with frontonasal, prefrontals, first and second supraoculars, and frontoparietals; supraoculars 4, second widest; frontoparietals 2, in contact with each other and with second, third, and fourth supraoculars, frontal, interparietal and parietals; parietals in contact posteriorly (except in MNHN 2003.3322, in which this region is covered by small regenerated scales), lateroposterior margin of parietal bordered by 3–5/3–5 scales; interparietal small, narrowing posteriorly, with a transparent spot in posterior angle; enlarged nuchals absent or in 1 pair; nasal in contact with rostral, supranasal, anterior loreal and first supralabial on each side; rostral, mental, nasal, supranasal, and first pair of infra- and supralabials somewhat thickened and greyish; loreals 2, posterior one longer; preocular single, presuboculars 2; postsupraoculars 2; postsuboculars 3; supraciliaries 5–7; primary temporal single; secondary temporals 3, upper and lower one overlapping the middle one; supralabials 7 (Smith 1935; Teynié et al. 2004), fifth and sixth below the eye; lower eyelid scaly, with 5 enlarged transparent scales, separated from the supralabials by a row of small scales; external ear opening subcircular, without lobules; mental wider than long, rounded posteriorly; postmental single; chin shields in 2 pairs, in contact with infralabials, first pair in contact medially, second pair separated by 3 gular scales (except MNHN 2003.3322: first pair separated by 2 scales and second pair by 4 scales).

Midbody scale rows 36–40; paravertebral scales 78–86; ventral scales 85–99, as large as dorsal scales; dorsal scales smooth in adults but bear pseudokeels (sensu Ziegler et al. 2007) in juveniles and subadults, scales in adult specimens constricted between the visible and mucronate parts (Fig. 9C); precloacals 4, slightly enlarged; limbs short, pentadactyl, separated when adpressed, finger not reaching the eye; three median fingers equal in length, first and fifth somewhat shorter, subdigital lamellae under fourth finger 8–11; first toe shortest, fourth longest; subdigital lamellae under fourth toe 11–15 (Table 2).

Colouration in preservative. Dorsum and dorsal surface of tail of adult specimens greyish brown, with irregular dark brown blotches; head and upper surface of limbs somewhat darker, without blotches; ventral side of body and tail cream, palms and feet greyish brown; labials cream, edged by dark brown. Colouration of subadult specimens is similar to adults but darker, especially the posterior half of body and the dark brown tail. Body of juveniles darker than of subadults, brownish; shoulder region lighter; dark brown blotches absent. For colouration in life see Fig. 5.

Distribution. In Laos, this species is only known from Ban Ta Cheng, Pays Du Khas, Annam (now Ban Tasseng, Attapeu Province), as well as Ban Sépian and Paksong, both in Paksong District, Champasak Province (Teynié et al. 2004). All three localities are situated in the Southwest of the Boloven Highlands. In Vietnam, the species, for more than 60 years, was only known from the type locality "Dalat, South Annam" at about 1500 m a.s.l. (now Lam Dong Province, southern Vietnam). Since 1996 the species was reported from: Ke Bang District (Gia Lai Province) (Darevsky & Orlova 1996 [type locality of *Lygosoma carinatum*]); Kon Plong (Kon Tum Province) (Orlov 2006; Nguyen et al. 2009); Khanh Hoa; and Dong Nai (Bobrov & Semenov 2008). Ours is the first voucher from Cat Tien National Park, Dong Nai Province. For distribution in Indochina see Fig. 8D. Outside of Indochina, this species has been reported from Chantaburi (Kao Soi Dao) and Chachoengsao (Khao Ang Ru Nai), southeastern Thailand (Nabhitabhata et al. 2000; Das 2010). We assume that the species also occurs in Cambodia.

Natural history. Teynié et al. (2004) and Teynié & David (2010) suggested that *Lygosoma corpulentum* is restricted to wet mountainous areas. However, our record from the Cat Tien National Park (Dong Nai Province) proves that this species also occurs in semi-evergreen lowland rainforests. All specimens were found under or in rotten trunks and logs. One specimen from Laos was found at the edge of a coffee plantation (Teynié et al. 2004). Teynié & David (2010) stated that this species is semi-fossorial. One adult specimen in the Cat Tien National Park was also observed to be active at night (M. Kenyon, pers. comm.) Grossmann & Harbig (2010) provided additional data about feeding and reproductive ecology of this species in captivity: food items included arthropods, annelids, and snails. This skink produces two clutches per year with 4–5 eggs per clutch; hatching takes 44–62 days; the hatchlings have SVL between 45–48 mm, TaL between 34.5–38.0 mm. The latter authors also showed that the growth rate of the tail is higher in the first months, until the SVL/TaL proportion of the adults is reached. Based on these data we approximate the age of specimen ZISP 20482 to be at least 4 months. IEBR A.2010.23 seems to be a freshly hatched specimen.

Fig. 5. *Lygosoma corpulentum*: A – juvenile (IEBR A2010.23), photograph: W. Van Devender; B – subadult ZMMU R-13262, photograph: E. Galoyan; C – adult female (ZFMK 91685), photograph: W. Van Devender.

Taxonomic remarks. Our investigation of the type series and recently collected specimens of *L. carinatum* and *L. corpulentum* revealed no distinct differences between these two species. All diagnostic characters obtained from the original descriptions and examined specimens resemble each other or rather overlap (see Tables 1, 2).

Darevsky & Orlova (1996) mentioned that the keeled dorsal scales are a diagnostic character of *L. carinatum*, shared with *Lygosoma herberti* (Smith, 1916) from Thailand but the first species differs from the latter by having a lower count of midbody scale rows (36–40 versus 26–28). However, Ziegler et al. (2007) stated that the keels on the scales of *L. carinatum* mentioned by Darevsky & Orlova (1996) are in fact pseudokeels. This optical illusion may arise from the sculpturing of the lower, normally covered part of the scales. The sculpturing seems to be stronger in juvenile specimens, such as the holotype of *L. carinatum* (see Fig. 11 in Ziegler et al. 2007) indistinct in subadults (ZMMU R-8778, paratypes of *L. carinatum*) and completely absent in adult specimens (Figs 9C–E). Another character, which changes with age, is the laterally constricted shape of the marginal scale, which is present only in adult specimens (see Fig. 11 in Ziegler et al. 2007 and Figs 5C, E).

Darevsky & Orlova (1996) also distinguished *L. carinatum* from *L. corpulentum* by the number of

Fig. 6. *Lygosoma haroldyoungi* from Ban Wang Mone, Vientiane Province, Laos. Photograph: N. Orlov.

supralabials (7 vs. 6). Smith (1921) originally described *L. corpulentum* with 7 supralabials but he subsequently mentioned only 6 supralabials in his 1935 monograph. The lower number (6) of supralabials in *L. corpulentum* specimens was followed by Darevsky & Orlova (1996), Teynié et al. (2004) and Teynié & David (2010). However, all specimens of *L. carinatum* and *L. corpulentum* we examined, including the type series of the former and the Laotian specimen of the latter-mentioned by Smith 1935, showed that they both had 7 supralabials.

Because there are no morphological differences separating these two nominal species we consider *Lygosoma carinatum* Darevsky & Orlova, 1996 to be a junior synonym of *Lygosoma corpulentum* (Smith, 1921).

Lygosoma haroldyoungi (Taylor, 1962)

Riopa haroldyoungi, E.H. Taylor, 1962. Univ. Kansas, Sci. Bull. 43 (7): 242.
Riopa haroldyoungi, J. Moravec & W. Böhme, 2008. Herp. Not. 1: 9
Lygosoma haroldyoungi, N.L. Orlov, A.B. Streltzov & R. Peney, 2010. Russ. J. Herp. 17 (2): 128.
Lygosoma haroldyoungi, A. Teynié & P. David, 2010. Voy. Natural., Laos, Chamalieres: 112.
Lygosoma haroldyoungi, I. Das, 2010. Field Guide Rept. S.E. Asia, London: 239.

Holotype. FMNH 178213 (formerly EHT-HMS No. 53). Type locality: "Base of Doi Suthep near Chiang Mai", Chiang Mai Province, Thailand.

Diagnosis. SVL 115–148 mm; TrunkL 3.3 times longer than SFlL; lower eyelids scaly; supranasals in contact; frontal a little shorter than frontoparietal; frontoparietal single; nuchals absent; ear openings anteriorly covered by an overhanging scale; supralabials 9; scale rows around midbody 38–42; paravertebral scales 141–145; limbs very short (SVL/FlL: 12; SVL/HlL: about 9); subdigital lamellae under fourth toe 6–7 (Taylor 1962, 1963; Moravec & Böhme 2008; Orlov et al. 2010). Measurements and additional morphological data are given in Tables 1, 2.

Colouration in preservative. Dorsum light brown with 22–32 dark brownish bands, these bands being narrower and less developed on the flanks; snout tip greyish; ventral surface cream with black bands on the lateral margin. For colouration in life see Fig. 6.

Distribution. In Indochina, this species is known only from Vientiane Province, central Laos: near Nan Kheuat in the vicinity of Nam Ngum reservoir (approximately 18°30′ N, 102°30′ E), near Ban Nangom (Moravec & Böhme 2008); Ban Wang Mone (near 18°22′ N, 102°39′ E, 380 m a.s.l.), Ban Phong Hong District (Orlov et al. 2010); Ecovillage of Nam Lik, near Ban That Wang Monh, Phonhông district (Teynié & David 2010); and Phonmee village, Vientiane city (Anonymous 2011). For the distribution in Indochina see Fig. 8E. Outside Indochina, this species is currently known only from Thailand (Taylor 1962, 1963; Soderberg 1967; Way 1975; Welch et al. 1990; Nabhitabhata et al. 2000; Inthara et al. 2004; Pauwels et al. 2008). Pauwels et al. (2008) also assumed the occurrence of this species in the countries neighbouring Thailand, i.e., Myanmar and Cambodia.

Natural history. Pauwels et al. (2008) reported that *Lygosoma haraldyoungi* is a diurnal and semifossorial species. This species can be found under the leaf litter of different forest types and also in agricultural areas. Teynié & David (2010) found their specimens on rock-covered forest floor in moist, hilly forests and semideciduous forests. One specimen was observed at the entrance of a cave.

Ethnozoological remark. During the Buddhist Lent in July 2011 one 30 cm long specimen was caught by

a farmer near a rice mill in Ponmee village near Vientiane, Laos. Resembling a snake ("Naga") with legs, the animal was believed to bring good luck to its neighbourhood and was brought to Kaisone Temple, where it was kept by the local monks (Anonymous 2011).

Lygosoma isodactylum (Günther, 1864)

Eumeces isodactylus, A.C.L.G. Günther, 1864. Rept. Brit. India, London: 93.
Lygosoma isodactylum, G.A. Boulenger, 1887. Cat. Liz. Brit. Mus. III, London: 339.
Lygosoma isodactylum, F.I. Mocquard, 1907. Rept. Indoch., Rev. Coloniale: 38.
Riopa isodactyla, M.A. Smith, 1935. Fauna Brit. India, Rept. Amphib., II, London: 317.
Riopa isodactyla, R. Bourret, 2009 [reprint]. Léz. de l'Indoch., Frankfurt: 286.
Squamicilia [isodactyla], M.B. Mittleman, 1952. Smiths. Misc. Coll. 117: 9.
Riopa isodactyla, E.H Taylor, 1963. Univ. Kansas Sci. Bul. 44 (14): 968.
Lygosoma isodactylum, I. Das, 2010. Field Guide Rept. S.E. Asia, London: 239.

Holotype: BMNH 59.7.1.18. Type locality: "Gamboja" (now Cambodia).

Diagnosis. According to Günther (1864), Boulenger (1887), Taylor (1963) and Bourret (2009) the species shows the following diagnostic features: SVL 83–117 mm, longer than TaL; lower eyelids scaly; supranasals separated by rostral and fused with nasal anteriorly; frontal little longer than frontoparietal; frontoparietal single; nuchals absent; ear openings almost covered by two large scales; supralabials 7; scale rows around midbody 30–34; paravertebral scales 88–98; limbs very short (SVL/FlL: about 9; SVL/HlL: about 7); subdigital lamellae under fourth toe 7–10 (see Tables 1, 2).

Colouration in preservative. Dorsal head blackish with light spots in front of and behind interparietal and on anterior border of frontal; labials with a black spot; narrow light band on occiput, widening much on sides; blackish transverse band between the ears, narrowing laterally; dorsum and flanks dark brown, scales edged black; fine punctations on the flanks and lateral tail; ventral side cream with irregular black spots; black spot on postmental and fine blotches on chinshields; underside of digits blackish (Günther 1864; Taylor 1963; Smith 1914). Juvenile specimens show a darker dorsum without lateral and ventral spots (Bourret 2009).

Distribution. In Indochina, this species is known only from Cambodia. Elsewhere, it has been reported from several localities in central and southeastern Thailand (Taylor 1963; Nabhitabhata et al. 2000).

Natural history. According to Smith (1914), the species inhabits anthropogenically influenced areas: one specimen was found in a rock quarry and one beneath stacks of firewood in a yard. Bourret (2009) reported that *Lygosoma isodactylum* lives in rotten trunks and in the ground. He also documented that the movements of this species are snake-like, with only the forelimbs being used.

Remark. The status of this species in Indochina is unclear. Since the description of Günther (1864), for almost 150 years, no further records of this species from Indochina were reported.

Lygosoma quadrupes (L., 1766)

Anguis quadrupes, C. Linnaeus, 1766. Syst. Nat. I, ed. 12, Stockholm, I: 390.
Lacerta serpens, M.E. Bloch, 1776. Beschäft. Ges. Nat. Fr. Berlin 2: 28.
Scincus brachypus, J.G. Schneider, 1799. Hist. Amphib. II, Jena: 192.
Seps pentadactylus, F.M. Daudin, 1802. Hist. Nat., Rept. IV, Paris: 325.
Mabuya serpens, L.I. Fitzinger, 1826. N. Class. Rept., Wien: 53.
Lygosoma serpens, J.E. Gray, 1827. Zool. J. III: 228.
Lygosoma aurata, J.E. Gray, 1831. Syn. Rept. (I) Cat. Tort. Corc. Enal., London: 72.
Lygosoma abdominalis, J.E. Gray, 1839. Ann. Mag. Nat. Hist., II: 332.
Lygosoma brachypoda, A.M.C. Duméril & G. Bibron, 1839. Erp. Gen., Paris: 721.
Podophis chalcides, J.E. Gray, 1845. Cat. Liz. Brit. Mus., London: 88.
Lygosoma chalcides, G.A. Boulenger, 1887. Cat. Liz. Brit. Mus. III, London: 340.
Lygosoma chalcides, N. de Rooij, 1915. Rept. Indo-Austral. Archipel., Leiden: 225
Lygosoma quadrupes, M.A. Smith, 1935. Faun. Brit. India, Rept. Amphib., Vol 2, London: 290.
Lygosoma quadrupes, R. Bourret, 2009 [reprint]. Léz. de l'Indoch., Frankfurt: 265.
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Lygosoma quadrupes, E.H, Taylor, 1963. Univ. Kansas Sci. Bul. 44 (14): 1049.
Lygosoma quadrupes, V.S. Nguyen & T.C. Ho, 1996. Checkl. Rept. Amphib. Vietnam, Hanoi: 32.
Lygosoma quadrupes, V.S. Nguyen, T.C. Ho & Q.T. Nguyen, 2005. Checkl. Rept. Amphib. Vietnam, Hanoi: 59.
Lygosoma quadrupes, V.V. Bobrov & D.V. Semenov, 2008. Lizards of Vietnam, Moscow: 65 + 181
Lygosoma quadrupes, V.S. Nguyen, T.C. Ho & Q.T. Nguyen, 2009. Herpetof. Vietnam. Frankfurt: 257.
Lygosoma quadrupes, A. Teynié & P. David, 2010. Voy. Natural. Laos, Chamalieres: 114.
Lygosoma quadrupes, I. Das, 2010. Field Guide Rept. S.E. Asia, London: 240.

Holotype: UUZM 140. Type locality: Java, Indonesia. Syntype of *Lacerta serpens* Bloch, 1776 (see taxonomic remark): ZMB 1276. Type locality unknown.

Specimens examined: IEBR 894, adult male, collected by C. Potrim in Doi Can, Ba Dinh, Hanoi, northern Vietnam; IEBR 504, adult male, collected by H.T. Ta in Thanh Xuan, Hanoi, northern Vietnam; IEBR A.2010.40, unknown gender, collected by V.S. Nguyen in March 2001 in Phong Nha – Ke Bang National Park, Quang Binh Province; ZFMK

Fig. 7. *Lygosoma quadrupes* from Cat Tien National Park, Dong Nai Province, Southern Vietnam. Photograph: W. Van Devender.

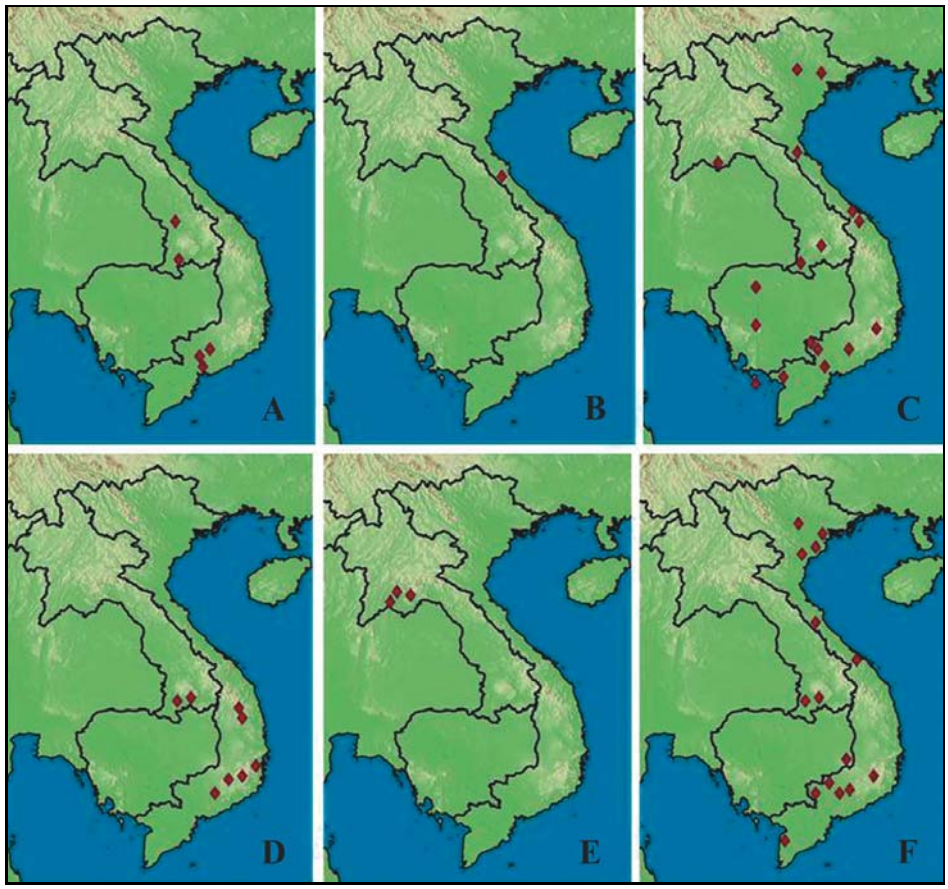

Fig. 8. Distribution of *Lygosoma* species in Indochina: A – *Lygosoma angeli*; B – *Lygosoma boehmei*; C – *Lygosoma bowringii*; D – *Lygosoma corpulentum*; E –*Lygosoma haroldyoungi*; F – *Lygosoma quadrupes*. Exact localities are given in the taxonomic accounts.

91826, unknown gender, collected by T.A. Pham in August 2001 in Lo Go – Xa Mat, Tay Ninh Province; ZFMK 91825, unknown gender, collected by T.C. Ho in May 2003 in Loc Bac forest, Lam Dong Province; IEBR A.2010.24, adult male, collected by P. Moler on 4 June 2004 close to the headquarters of Cat Tien National Park, Dong Nai Province, southern Vietnam; ZFMK 88964, adult male, collected by P. Geissler in June 2009 near the headquarter of the Cat Tien National Park, Dong Nai Province, southern Vietnam; ZFMK 83908, adult male, collected by M.H. Thach in Giao Thuy, Nam Dinh Province, northern Vietnam.

Diagnosis. SVL 55–82 mm, ± equal to TaL; TrunkL 3.4–4.3 times longer than SFlL; lower eyelids scaly; supranasals separated; frontal as long as frontoparietal; frontoparietal single; nuchals 0–2 pairs; ear openings punctiform, without lobules; supralabials 6–7; dorsal scales smooth (Fig. 10F); scale rows around midbody 24–28; paravertebral scales 109–116; limbs very short, (SVL/FlL: about 17; SVL/HlL: about 12); lamellae under fourth toe 4–7 (Smith 1935; Taylor 1963; Bourret 2009; pers. observ.). Measurements and additional morphological characters are given in Tables 1, 2.

Colouration in preservative. Dorsum light brown; dorsum, flanks, and tail with indistinct dark longitudinal lines along the edges of the scales; ventral sur-

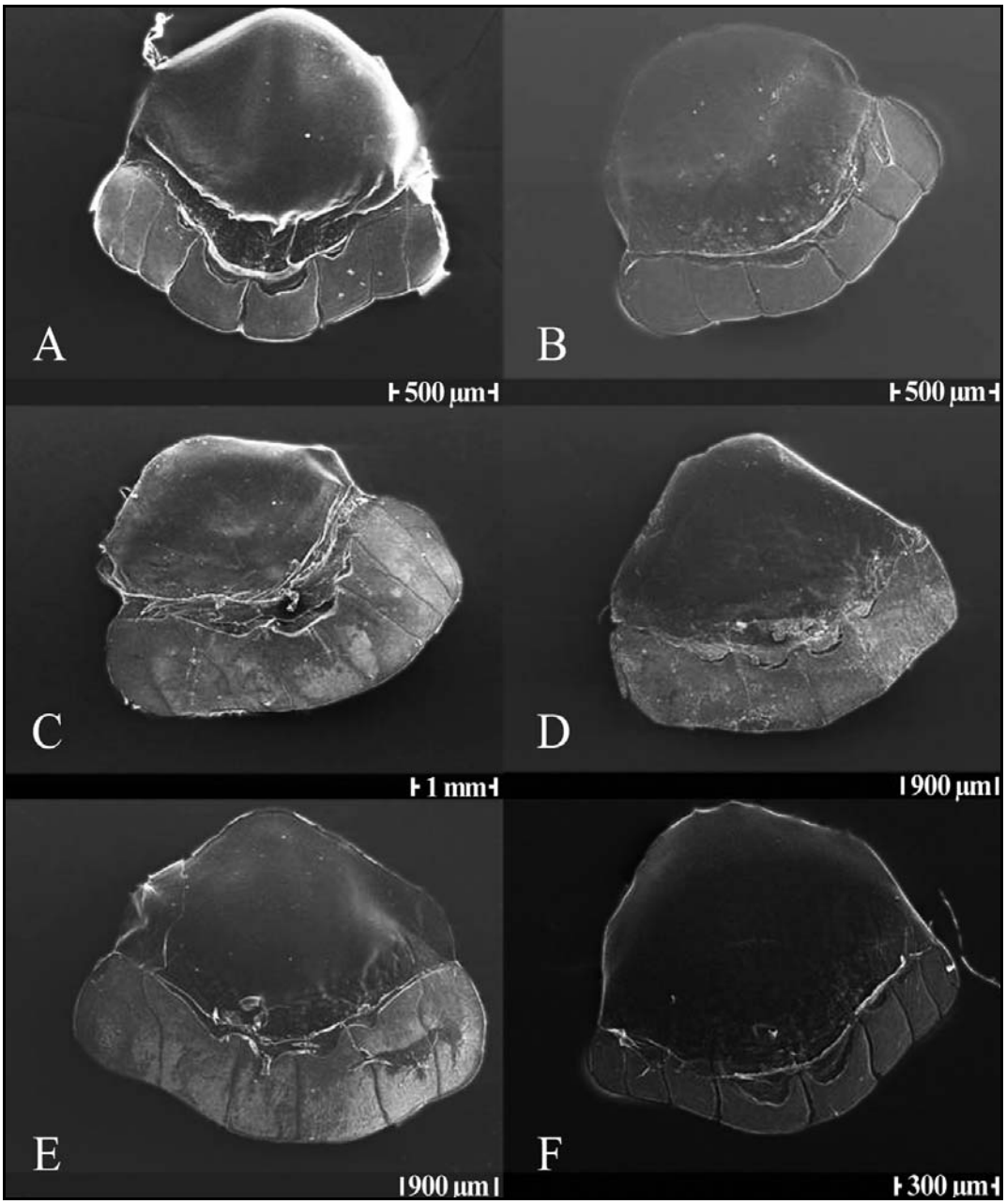

Fig. 9. Dorsal scales of: A – *Lygosoma angeli* (IEBR A2010.21); B – *Lygosoma bowringii* (IEBR A0828); C – *Lygosoma corpulentum* (IEBR A.2010.39); D – *Lygosoma corpulentum* (ZMMU R-8778); E – *Lygosoma corpulentum* (ZFMK 91685); F – *Lygosoma quadrupes* (ZFMK 88967). SEM photographs: P. Geissler.

face cream; supralabials rather dark, sutures lighter. Smith (1935) reported that the juveniles bear a blackish colouration with fine longitudinal golden lines. For colouration in life see Fig. 7.

Distribution. Smith (1935) and Bourret (2009) mentioned that *Lygosoma quadrupes* is quite common in central and southern Siam and the southern parts of French Indochina. In Cambodia, this species is reported from Pichrada, eastern Cambodia (near 12°29′49″ N, 107°29′33″ E, 700 m a. s. l.) (Stuart et al. 2006). In Laos it has been recorded from Xepian National Park near Ban Kiatnong Village, Pathomphon District and Ban Sépian Village, Paksong District, Champasak Province (Welch et al. 1990; Teynié et al. 2004; Teynié & David 2010). In Vietnam it is known to occur in the following provinces: Hanoi (Nghia Do; Doi Can; Quang Ba), Nam Dinh (Giao Thuy), Thai Binh (Dong Tien), Thanh Hoa (Ha Trung), Quang Binh (Phong Nha – Ke Bang), Thua Thien – Hue (Bach Ma), Binh Phuoc (Nghia Trung), Dong Nai (Cat Tien, Ma Da), Kien Giang (U Minh) (Bobrov 1992, 1995; Ziegler et al. 2006; Bobrov & Semenov 2008; Nguyen et al. 2009). Our records are new for Lam Dong and Tay Ninh provinces. For distribution in Indochina see Fig. 8F. Outside of Indochina, this species is known from Thailand, China, Western Malaysia, Indonesia, and the Philippines (Boulenger 1887; Smith 1935; Taylor 1963; Manthey & Grossmann 1997; Bourret 2009; Das 2010).

Natural history. *Lygosoma quadrupes* inhabits both forest and agricultural land from the lowlands to montane areas at an altitude of up to 1200 m a.s.l (Teynié & David 2010). This diurnal, fossorial species can be found under leaf litter, stones, roots and all sorts of rotten plant material. The small limbs are used for crawling around in the leaf litter. To move rapidly these lizards adpress their limbs and move snake-like. They feed on small invertebrates (Smith 1935; Teynié & David 2010). Smith (1935) also reported that a female laid three eggs (9 × 5 mm in size) in May. The young hatched at the end of June at a total length of 48 mm and SVL 26 mm.

Taxonomic remarks. *Lygosoma quadrupes* was first described as *Anguis quadrupes* by Linnaeus (1766). It was considered a snake and assigned to the class Amphibia (Linnaeus 1766). Because the absence of legs and external ear openings are partly diagnostic for *Anguis*, (Linnaeus 1766) also described *Anguis quadrupes* as a species without external ear openings ("Aures non habet"). This was corrected by Bloch (1776) in his description of *Lacerta serpens.* Bloch knew that the species had already been described by Linnaeus, but because of the mentioned errors he felt that a new description was required (Bauer & Günther 2006). Although Bloch (1776) already mentioned his *Lacerta serpens* as identical with *Anguis quadrupes,* Hardwicke & Gray (1827) designated *Lacerta serpens* Bloch, 1776, as the type species of their new genus *Lygosoma* Hardwicke & Gray, 1827. Overlooking the argumentation of Bloch (1776), the latter authors stated that the animals of this genus do have a visible tympanum, "which separates them from the *Anguis quadrupes* of Linnaeus". Smith (1935) conclusively put *Lacerta serpens* Bloch, 1776 into the synonomy of *Lygosoma quadrupes* (Linnaeus, 1766).

Discussion

Bourret listed *Riopa albopunctata, R. angeli, R. bowringii, R. corpulenta, R. isodactyla, R. punctata* and *Lygosoma quadrupes* from Indochina in his unpublished manuscript (which was recently published in 2009). He indicated that *R. albopunctata* may be present in "Cochinchine" (southern Vietnam). Bourret's record was subsequently cited by Bobrov (1993), Nguyen et al. (2009), and Das (2010). Nevertheless, Bobrov & Semenov (2008) removed *L. albopunctatum* from the checklist of Vietnamese lizards. Therefore, the occurrence of *L. albopunctatum* in the Indochina region remains doubtful. The status of *L. punctatum* (Gmelin, 1789) in Indochina, the type species of *Riopa* (Gray, 1839), is also unclear. The type locality of this species was designated as "Zeylanica" (now Sri Lanka) by Bauer (2003) and it is known to occur in Pakistan, India, Sri Lanka, and Bangladesh (Nguyen et al. 2009; Das 2010). The single record of *L. punctatum* from Vietnam (Bourret 2009) may be erroneous. Smith (1935) noted that a specimen in the British Museum (now The Natural History Museum, London), was "said to have been collected" by Fruhstorfer in the Man-Son Mountains, Tongking (now Lang Son Province). Hans Fruhstorfer (1866–1922) from Berlin, a commercial collector of natural history specimens, worked in Vietnam from 1899–1901 and sold his material to different museum collections in Europe (Adler 2009). Moreover, he also collected specimens in other Southeast Asian countries (Martin 1922). Hence, only seven species of *Lygosoma* are currently documented in Indochina by specimens with reliable data. A key to these species is provided below. Finally, future work, particular molecular based studies, should be made to clarify the generic validity of *Riopa* as well as the taxonomic assignment of more widely distributed species (e.g., *L. bowringii*).

Key to the species of *Lygosoma* in Indochina

1a) Frontoparietal single **2**
1b) Frontoparietals paired **5**
2a) Supranasals separated from each other **3**
2b) Supranasals in contact medially **4**
3a) Midbody scales in 24–28 rows; paravertebral scales 109–116 ..... ***L. quadrupes***
3b) Midbody scales in 30–34 rows; paravertebral scales 88–89 ..... ***L. isodactylum***
4a) Supralabials 9; midbody scales in 38–42 rows; paravertebral scales 141–145 ..... ***L. haroldyoungi***
4b) Supralabials 7; midbody scales in 30 rows; paravertebral scales 107–115 ..... ***L. angeli***
5a) Midbody scales in 36–40 rows; paravertebral scales 76–86 ..... ***L. corpulentum***
5b) Midbody scales in 28–32 rows; paravertebral scales 52–66 6
6a) Midbody scales in 28 rows; paravertebral scales 52–58 ..... ***L. bowringii***
6b) Midbody scales in 32 rows; paravertebral scales 66 ..... ***L. boehmei***

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Appendix

Table 1. Measurements (in mm) of Indochinese species of *Lygosoma* (* data obtained from literature).

	L. angeli	*L. boehmei*	*L. bourringii*	*"L. carinatum"*	*L. corpulentum*	*L. haroldgoungi*	*L. isodactylum*	*L. quadrupes*
Sample size	$n = 6$	$n = 1$	$n = 5$	$n = 2$	$n = 7$	*	*	$n = 8$
SVL	77.5–112.3 (97.3 ± 12.6)	86.0	41.6–53.3 (48.4 ± 4.4)	70–96	97.8–168 (129.7 ± 29.9)	114.8–148.0	82.5–117.0	55.0–82.1 (66.1 ± 7.7)
TaL (* generated)	55.4–86.3 (67.9 ± 14.0, ($n = 4$)	91.0	43.8 ($n = 1$)	–	97.6–159.8 (117.1 ± 23.1, ($n = 6$)	–	66.0–93	44.9–82.1 (70.6 ± 17.3, ($n = 4$)
TrunkL	55.8–85.4 (71.7 ± 10.7)	47.0	23.1–30.1 (26.7 ± 2.9)	41.7–53.9	55.9–102.8 (77.1 ± 19.5)	84.2–112.0	58.0	45.7–67.9 (51.6 ± 9.2)
HL	9.4–12.1 (10.5 ± 1.0)	12.3	7.7–10.8 (9.7 ± 1.2)	10.9–19.4	16.9–30.3 (23.3 ± 5.2)	15.2–18.1	11.7–14.0	6.6–8.1 (7.3 ± 0.6)
HW	4.8–6.2 (5.6 ± 0.5)	10.5	4.4–6.1 (5.5 ± 0.7)	9.0–14.9	12.0–21.8 (16.3 ± 4.0)	9.5–12.0	7.7–9.0	3.4–4.0 (3.7 ± 0.2)
SFlL	15.9–21.4 (18.5 ± 2.2)	29.4	13.2–16.3 (15.3 ± 1.2)	21.7–33.7	30.4–46.5 (39.4–6.7)	–	20.0	11.8–14.8 (13.2 ± 1.1)
SL	3.2–3.7 (3.5 ± 0.2	6.1	5.3–7.6 (6.6 ± 0.8)	5.2–7.1	6.8–11.0 (8.5 ± 1.6)	–	–	2.0–2.5 (2.2 ± 0.2)
STL	8.3–10.2 (9.4 ± 0.8)	14.5	6.5–9.2 (8.2 ± 1.0)	11.3–17.4	15.6–24.4 (19.8 ± 3.4)	–	10.3	5.9–7.1 (6.4 ± 0.4)
FlL	4.3–5.5 (4.9 ± 0.4)	14.7	8.2–9.3 (8.8 ± 0.4)	11.6–13.2	16.4–19.2 (18.6 ± 3.8)	10.3–11.5	11.5	2.4–4.9 (3.9 ± 0.7)
HlL	6.4–8.4 (7.4 ± 0.7)	19.0	11.4–13.2 (12.2 ± 1.0)	15.6–17.8	21.3–22.2 (24.8 ± 5.5)	12.0–17.0	12.4–15.5	4.7–6.3 (5.4 ± 0.6)
SVL/FlL (mean)	19.9	5.9	5.5	6.7	6.9	12.1	8.6	16.9
SVL/HlL (mean)	13.1	4.5	4.0	4.9	5.2	9.1	7.1	12.2
Trunkl/SFlL	3.4–4.2 (3.8 ± 0.3)	1.6	1.6–1.8 (1.7 ± 0.1)	1.6–1.9 (1.8 ± 0.2)	1.7–2.2 (1.9 ± 0.2)	3.3		3.4–4.3 (3.9 ± 0.5)

Table 2. Selected morphological characters of Indochinese species of *Lygosoma* (* data obtained from literature).

	L. angeli	*L. boehmei*	*L. bowringii*	*"L. carinatum"*	*L. corpulentum*	*L. haroldyoungi*	*L. isodactylum*	*L. quadrupes*
Sample size	$n = 9$	$n = 1$	$n = 8$	$n = 2$	$n = 9$	*	*	$n = 8$
Prefrontals in contact	no	no	no	no	no	no	no	no
Supraoculars	4	4	4	4	4	4	4	4
Frontoparietal(s)	1	2	2	2	2	1	1	1
Parietals in contact posteriorly	yes	yes	yes	yes	yes	no	yes	yes
Scales bordering parietals posteriorly	9–10	10	5–7	7	8–10			7–9
Nuchals	0	0	1–2	0–1	0–1	0	0	0–2
Supranasals in contact	yes	yes	yes	yes	yes	yes	no	no
Supranasal fused with nasals	no	no	no	no	no	no	anterior	yes
Loreals	2	2	2	2	2	2	1	2
Preocular	2	2	2	1	1		2	2
Supraciliaries	5–6	6	6–7	6	5–7	6	7	6
Supralabials	7	7	7	7	7	9	7	6–7
Lower eyelid	scaly	scaly	scaly	scaly	scaly	scaly	scaly	scaly
Infralabials	6–7	7	6	6–7	6–7	9–10		6–7
Number of chin shields (pair)	2	1	2	2	2	2	3	3
Midbody scale rows	30	32	28	38–39	36–40	38–42	30–34	24–28
Paravertebral scales	107–115	66	55–59	81–85	78–86	141–145	88–98	109–116
Ventrals in transerve rows	112–123	81	53–60	85–91	87–99			110–116
Precloacals (enlarged)	6	6	6–8	3–4	4	7–9	6	6
Subdigital lamellae on fourth finger	5	8–10	10–11	11	6–11	-	-	4–6
Subdigital lamellae on fourth toe	6–7	14	12–13	15–16	11–15	6–7	7–10	4–7