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Autecology and mating behaviour of the spotted forest skink, *Sphenomorphus maculatus* (Blyth, 1853) in the monsoon forest of Cat Tien National Park, southern Vietnam

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The autecology of the spotted forest skink *Sphenomorphus maculatus* (Blyth, 1853) is described for the first time. Individually marked animals within a chosen study site in a deciduous mixed forest in Cat Tien National Park, Dong Nai Province, southern Vietnam were observed in two adjacent years. *Sphenomorphus maculatus* is a diurnal, small terrestrial skink with a short lifespan of about one year, and an accordingly high growth rate. Shuttling is the main behavioural feature to maintain a body temperature of 31–32°C. These insectivorous skinks primarily demonstrate an actively foraging mode, feeding on active and immobile prey measuring 5–40 mm in size. The reproductive period starts in April, at the onset of the rainy season, and continues until May and June when females oviposit. Courtship and mating behaviour is strictly ritualized. Juveniles emerge at the end of the rainy season (August–September).

Key words: activity, foraging, growth rate, mating, reproduction, *Sphenomorphus maculatus*, thermal biology, Vietnam

INTRODUCTION

The description rate of amphibian and reptilian taxa has increased steadily for southeast Asia, with Indochina (Cambodia, Laos, Vietnam) forming an important centre of ongoing discoveries (Orlov et al., 2002; Nguyen, 2005; Bain et al., 2007; Nguyen et al., 2009; Ziegler & Nguyen, 2010; Bain & Hurley, 2011). However, very little is known about seasonality, life-history strategies, growth rates, foraging modes, diets and thermoregulation of the majority of tropical southeast Asian reptiles and amphibians (but see for example Harbig, 2000; Grossmann & Harbig, 2010; Purkayastha & Das, 2010). Only a few ecological studies exist which describe food and habitat preferences of reptiles from the lowland tropical forests (Ziegler, 2002; Huang, 2010), and also the reproductive biology is only described for a few abundant species (Ji et al., 2000; Huang, 2006a, b; Huang et al., 2006),

The genus *Sphenomorphus* Fitzinger 1843 is a diverse, paraphyletic group consisting of nearly 140 species widespread in India, southeast Asia (Honda et al., 2003; Bobrov & Semenov, 2008; Nguyen et al., 2009, 2011; Bain & Hurley, 2011), as well as in Australia (Reeder, 2003). Accordingly, this group demonstrates a high variety of body shapes and a high degree of ecological diversity. *Sphenomorphus maculatus* (Blyth, 1853) occupies forest habitats in eastern India, the Andaman Islands, Nepal, Bhutan, southern China, Myanmar, Thailand, Laos, Cambodia and Vietnam (Blyth, 1853; Nguyen et al., 2009; Das, 2010; Yamasaki et al., 2001). Herein we provide the first autecological study on this common and widespread species.

MATERIALS AND METHODS

The study was carried out in Cat Tien National Park, Dong Nai Province, southern Vietnam. The most common forest type present is secondary mixed deciduous forest with a dominance of several species of *Lagerstroemia* and *Afselia xylocarpa*. The study area had a size of about 1000 m^2 (11°27’11"N; 107°25’10"E; datum WGS 84). Trees form a closed canopy layer and light illuminated only small permanently moving spots from approximately 1000–1100 hours until 1730. The substrate consisted of clay soil and large volcanic stones (0.5–1 m in diameter) covered by leaf litter. During the rainy season (from late June until October), a stream caused occasional and partial flooding of the study site. Field work was conducted from 17 March–3 April 2008 and from 3 March–7 May 2009. Additional observations were obtained from 21 July–10 August 2008, from 26 March–21 June 2009 and from 26 July–30 December 2011.

Upon capture, snout-vent length (SVL) and tail length (TL) of all lizards were measured with a caliper

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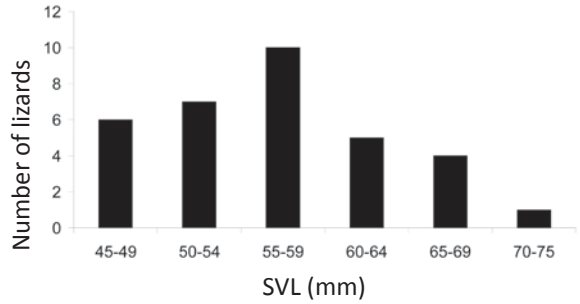

Fig. 1. SVL frequency distribution observed in a population (*n*=33) of *Sphenomorphus maculatus* in Cat Tien National Park in March 2008 and 2009.

(accuracy 0.5 mm); status of tail (regenerated or not) was also noted. Cloacal temperature of active animals and ambient temperature above ground were measured simultaneously using a Thermopair AZ8803. We noted lizard behaviour before capture. All lizards caught within the study area were marked by amputation of a distal finger phalanx (as a permanent mark) and one or two color beads (as a temporary mark) attached to the skin fold on the back with nylon thread. These methods have been shown to have no influence on the behaviour and vital capacity of lizards (Fisher & Muth, 1989; Husak & Fox, 2003; Tsellarius & Tsellarius, 2001). Skinks were subsequently released at the place of capture.

For exact taxonomic determination, voucher specimens of *S. maculatus* were collected outside the study area. The specimens are deposited in the herpetological collection of the Zoological Museum of the Lomonosov Moscow State University (ZMMU NAP-00160; ZMMU NAP-00216; ZMMU NAP-00281; ZMMU NAP-02076; ZMMU NAP-02079), Russia and the Zoologisches Forschungsmuseum Alexander Koenig (ZFMK 88951; ZFMK 88952; ZFMK 88953; ZFMK 88954) in Bonn, Germany. Eight other species of lizards were found within the study area (*Lygosoma quadrupes* Linnaeus, 1766; *Eutropis multifasciata* Kuhl, 1820; *Eutropis macularia* Blyth, 1853; *Lipinia vittigera* Boulenger, 1894; *Scincella rufocaudata* Darevsky & Nguyen, 1983; *Acanthosaura coronata* Günther, 1861; *Draco indochinensis* Smith, 1928; and *Cyrtodactylus cattienensis* Geissler, Nazarov, Orlov, Böhme, Phung, Nguyen, Ziegler, 2009.

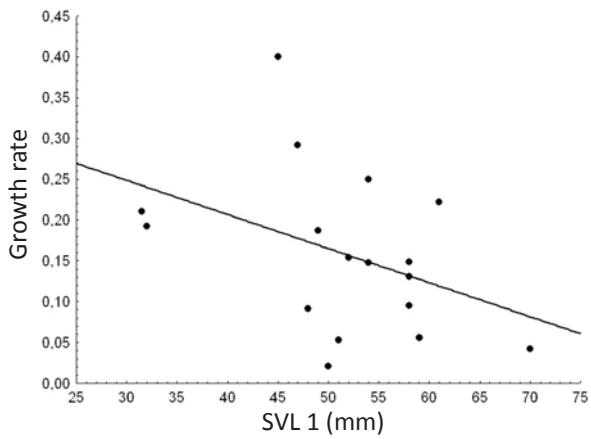

Fig. 2. Growth rate and body length in a population of *Sphenomorphus maculatus* in Cat Tien National Park (*n*=17).

Observations (using field binoculars, BPC 8 x 30) started when lizards emerged in the morning and ended after lizards submerged in the evening. Ambient temperatures above surface and in lizards' shelters were recorded at 1200 hours. The number of lizards observed during the day was noted. We also recorded food preference when skinks were feeding, as well as courtship and mating behaviours. Total observation time was 41 days (215 hours). Video recordings and photos were taken using a digital camera (Nikon D90) at 2–10 m distance from the focal animals.

We used Microsoft Excel and Statistica v.7.0. for statistical analyses. A *t*-test was applied for comparison of male and female body lengths. Growth rates (GR) were calculated as $(SVL_2\text{-}SVL_1)/D$, where SVL_1 represents the SVL at the first capture, SVL_2 represents the SVL at the second capture and D represents the number of days between first and second capture. We used χ^2-tests to compare frequencies of observed lizards during sunny and cloudy days. All mean numbers are given with standard errors (SE). Spearman's rank correlation coefficient (r_s) was used to measure the statistical dependence between two empiric samples.

RESULTS

Sphenomorphus maculatus individuals possessed a mean (±SE) SVL of 58.2±1.22 mm m (*n*=22, range: 49–70) in males and 56.9±1.76 mm (*n*=24; range: 45–66) in females; the difference between males and females was not significant (*t*-test, *p*=0.269). Mean (±SE) ratio of SVL to non-regenerated TL was 0.5±0.01 (*n*=12). The majority

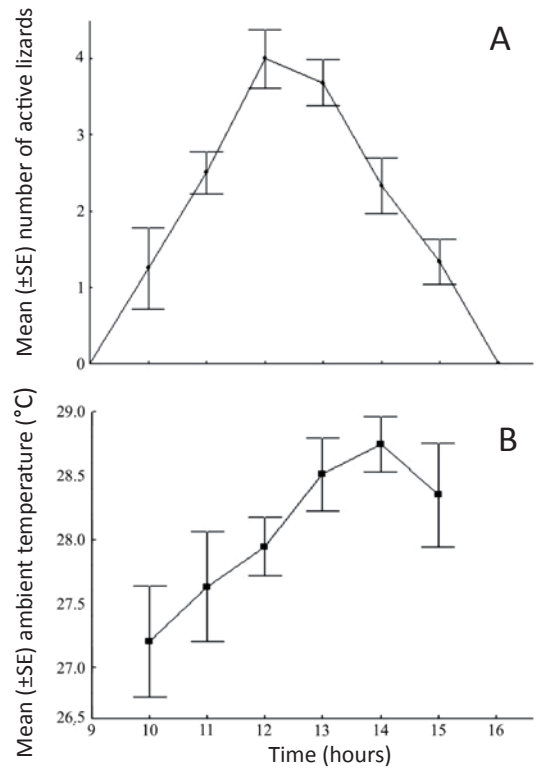

Fig. 3. Daily lizard (*Sphenomorphus maculatus*) activity during 19 sunny days in 2008 and 2009 (A) and ambient temperature above the surface in the same period (B).

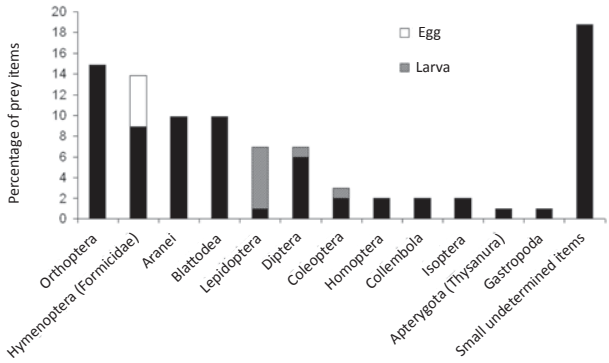

Fig. 4. Distribution of prey caught by *Sphenomorphus maculatus* in Cat Tien National Park. Data based on visual observations (*n*=53) and stomach content study (*n*=40).

of lizards (78.4 % of 38 individuals) in the local population had a regenerated tail. The total number of animals captured and marked within study area in the two year study period was 38. None of the lizards marked in 2008 were recaptured in 2009. No significant differences in body length frequency distribution were revealed between March 2008 and 2009 (χ^2=2.81, p>0.05, Fig. 1). Juveniles (SVL<40 mm) were only observed in July and December 2011. Juvenile lizards demonstrated a growth of 0.2–0.3 mm per day (5–12 mm per month). Growth of animals above 60 mm SVL was less than 0.1 mm per day, resulting in a non-significant negative correlation between body length and growth (r_s=-0.412; p=0.11; n=17, Fig. 2).

During sunny days, the emergence of *S. maculatus* was between 1000–1100 hours, at an air temperature in nocturnal shelters of 24–25°C. We observed the maximum number of lizards between 1200 and 1300 hours at 28–29°C) before the number of active animals decreased until 1600 hours when all lizards retreated (Fig. 3). The mean (±SE) body temperature of active animals was 32.1±0.14°C (*n*=23), approximately 4°C higher than the ambient air temperature (28.1±0.21°C). When ambient air temperature above the ground exceeded 28–29 °C, the lizards hid in their shelters or remained in the shade. On cloudy days lizard activity was limited. *Sphenomorphus maculatus* is mostly ground dwelling, although individuals occasionally climb stones, logs and trees at heights below two metres above the forest floor. Skinks regularly crossed the forest brook, indicating that these lizards are good swimmers. Each animal used between one and two night shelters usually at least 15 cm deep under stones or logs.

In total, 53 successful feeding acts were observed. Stomach contents of one juvenile, one subadult and three adult voucher specimens as well as twelve fecal samples of adult skinks were obtained and analyzed. The total number of prey items obtained from stomachs, feeding observations and feces was 93. Prey size in adult *S. maculatus* varied between 5 mm and 40 mm (Fig. 4). The most frequently ingested food items were crickets (Orthoptera), ants (Formicidae) and spiders (Aranei), followed by cockroaches (Blattoidea), caterpillars (Lepidoptera) and flies (Diptera). Some skinks also consumed large spiders (Sparassidae and Pisauridae); ant eggs were found in fecal samples.

Skinks demonstrated an active foraging strategy and a sit and wait strategy in 32.7% and 25% of observed cases, respectively (mostly while basking, sensu Bogdanov (1965) and McArthur & Pianka (1966); 42.3% of individuals used a cruising foraging tactic (sensu Regal, 1983), catching prey while moving from one basking site to another. On average, individuals caught prey items more often while moving (75%) than while being immobile. If the prey item was large, it took up to ten minutes or more before ingestion. Large spiders were killed by several rapid bites. Skinks were observed to stay in their shelters for one or two days after feeding on large prey.

The first copulation was observed on 19 March 2009, and the mating season continued until the onset of the rainy season. Each observed female mated several times with 1–3 males over 2–3 days. All males chased the females before mating. When a male reached a female, he took the female's tail in his jaws and then moved his head closer to her body. The male then straddled the female and rubbed her belly with his jaws for several seconds, before biting into the skin fold beneath her forelimb from the right side. Then male then moved his cloaca under the female, with his left hind limb across the female's body. Copulations lasted for 1–2 minutes, with tails of mating pairs being crossed (Fig. 5). After copulation, the female rapidly moved away from the mating site. Virgin females (recognizable by the absence of male bite marks on their body) but not mated females, bit males during courtship and mating.

Fig. 5. Mating behaviour of *Sphenomorphus maculatus*, observed on 22 April 2009 in Cat Tien National Park. (A) Male bites female's tail. (B) Male bites female's pelvis, female bites male. (C) Male bites the female's flank and massages it. (D) Male bites the fold of skin under the female's forelimb. (E) Male positions his cloaca under female's cloaca and places his left hind limb across the female's tail.

The pregnancy period in *S. maculatus* lasted approximately one month. By the end of April all seized females contained eggs. Between the end of April and the middle of May females began to oviposit. Two females were observed digging and ovipositing in the substrate. Each clutch comprised four eggs, measuring 11–12 x 5–5.5 mm. Mean (±SD) weight of each egg was 0.33±0.031 g (*n*=8). Embryos in recently laid eggs were discovered to be poorly developed. While eyes were already evident, leg development had not yet begun. Observations in 2011 suggest that juvenile skinks appear in June–July during the rainy season, as well as at the onset of dry season (three hatchlings with SVL between 28.5 and 32 mm were caught on 30 December 2011).

Two cases of predation were observed. On 16 June 2009, at 2000 hours an approximately 1.5 m long Malayan crait (*Bungarus candidus*) was observed predating on one adult specimen of *S. maculatus*, and a ferret badger (*Melogale personata*) was observed digging out a specimen of *S. maculatus* from beneath a large lava rock.

DISCUSSION

The body temperature of *S. maculatus* is comparable with other small insectivorous lizards of the same size from different latitudes (Cherlin, 1983). Although ambient temperatures in tropical rainforests are higher than those in forests of higher latitudes, basking and shuttling (sensu Spellerberg, 1972) is still important for reaching optimal body temperature. This behaviour is common among ectotherms (Brattstrom, 1965), and was also recorded in other species of *Sphenomorphus* (Spellerberg, 1972; Huang et al., 2006). In boreal conditions, lizards can be nocturnal and diurnal (Cherlin, 1983). During the observation period, night temperatures were not much below day temperatures, and *S. maculatus* was indeed also observed being active at night. Shifting to a cathemeral activity pattern may enable these small lizards to increase the potential prey spectrum and may facilitate predation avoidance.

The diet of *S. maculatus* is very diverse. Active foraging, the main foraging strategy of scleroglossan lizards (Pianka & Vitt, 2006), allows lizards to find both active and motionless prey items, while a sit and wait strategy only allows the seizing of active invertebrates (Huey & Pianka, 1981). The high percentage of non-active prey such as ant eggs and insect larvae among the observed prey items (12.9 %) provides evidence for a predominately active foraging strategy in *S. maculatus*. Thus, active foraging is the main foraging strategy in these skinks. Spotted forest skinks also seized spiders with a size comparable to their own.

The breeding period of *S. maculatus* coincides with the majority of small oviparous tropical lizards, including other oviparous *Sphenomorphus* (James & Shine, 1985; Huang, 2010). However, our observations showed that juvenile *S. maculatus* also appear at the beginning of the dry season. Thus, *S. maculatus* might reproduce twice a year, at the onset and at the end of the rainy season. Juvenile *S. maculatus* grow faster than similarly sized forest lizards from higher latitudes. For example, lacertid lizards with adult SVL of 60–70 mm begin to reproduce during their second or even third winter (Arakelyan & Danielyan, 2000; Tsellarius & Tsellarius, 2009; Kolarov et al., 2010). This indicates that growth rates are 0.08–0.001 mm/day, which is comparable to *S. maculatus* (GR=0.3–0.4 mm/day). Female maturation is environmentally triggered, and negatively correlated with the length of the seasonal activity period even among different populations within one species (Adolph & Porter, 1966). We suggest that the absence of a hibernation period allows females of *S. maculatus* to mature several months after hatching, while small lizards from higher latitudes become mature after two or three hibernation periods (Sergeev, 1937; Arakelyan & Danielyan, 2000). It also has been shown that annual adult survival and age at maturation are positively correlated in lizards (Shine & Charnov, 1992). We lack precise data about the lifespan of *S. maculatus,* but the high growth rate and absence of marked animals within the study area after one year indicates that these skinks live approximately one year. The absence of marked individuals during the second study year may also be explained by migration, although for example long-lived skinks usually demonstrate high site fidelity (Bull & Freake, 1999; Kerr & Bull, 2006). The majority of skinks studied in March had an SVL between 50 and 65 mm, and probably hatched in the beginning of the previous dry season. The estimated growth rates match with our field observations if juveniles hatched in December reach an SVL of 50–55 mm by mid-March; individuals larger than 70 mm most likely hatched in the beginning of the previous rainy season. Several African skinks and Brazilian lizards are also characterized by a short lifespan, high growth rates, and large changes in population size and demography (Barbault, 1976; 1986; Wiederhecker et al., 2003) suggesting that this strategy is widespread in tropical regions.

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REFERENCES

Adolph, S.C. & Porter, W.P. (1966). Growth, seasonality, and lizard life histories: age and size at maturity. *Oikos* 77, 1257–1269.

Arakelyan, M.S. & Danielyan, F.D. (2000). Growth and age composition of some Parthenogenetic and bisexual species of Armenian rock lizards. *Entomological Review* 80, 161–166.

Bain, R.H. & Hurley, M.M. (2011). A Biogeographic synthesis of the amphibians and reptiles of Indochina. *Bulletin of the American Museum of Natural History* 360, 1–138.

Bain, R.H., Nguyen, Q.T. & Doan, V.K. (2007). New herpetofaunal records from Vietnam. *Herpetological Review* 38, 107–117.

Barbault, R. (1976). Population dynamics and reproductive patterns of three African skinks. *Copeia* 1976, 483–490.

Barbault, R. (1986). Rapid-aging in males, a way to increase fitness in a short-lived tropical lizard? *Oikos* 46, 258–260.

Blyth, E. (1853). Notices and descriptions of various reptiles, new or little-known. Part I. *Journal of the Asiatic Society of Bengal* 22, 639–655.

Bobrov, V.V. & Semenov, D.V. (2008). *Lizards of Vietnam*. Moscow: KMK [in Russian].

Bogdanov, O.P. (1965). *Ecology of Middle-Asian reptiles*. Moscow: Nauka [in Russian].

Brattstrom, B.H. (1965). Body temperatures of reptiles. *American Midland Naturalist* 73, 376–422.

Bull C.M. & Freake M.J. (1999). Home-range fidelity in the Australian sleepy lizard, *Tiliqua rugosa. Australian Journal of Zoology* 47, 125–132.

Cherlin, V.A. (1983). Adaptations of reptiles to the thermal conditions of environment. *Journal of general Biology* 44, 253–264 [in Russian].

Das, I. (2010). *A Field Guide to the Reptiles of South-East Asia*. London: New Holland Publishers Ltd.

Fisher, J.W & Muth, A. (1989). A Technique for Permanently Marking Lizards. *Herpetological Review* 20, 45–46.

Grossmann W. & Harbig, P. (2010). Pflege und Vermehrung des Korpulenten Schlangenskinks *Lygosoma corpulentum* Smith, 1921 im Terrarium – Erste Ergebnisse *Sauria* 32, 35–46.

Harbig, P. (2000). Erste Erfahrungen bei Terrarienhaltung und Zucht des Laos-Kielskinks, *Tropidophorus laotus* Smith, 1923. *Sauria* 22, 3–9.

Honda, M., Ota H., Kobayashi, M., Nabhitabhata, J., Yong, H. & Hikida, T. (2003). Phylogenetic relationships, character evolution, and biogeography of the subfamily Lygosominae (Reptilia: Scincidae) inferred from mitochondrial DNA sequences. *Molecular Phylogenetics and Evolution* 15, 452–461.

Huang, S.P., Hsu, Y. & Tu, M.C. (2006). Thermal tolerance and altitudinal distribution of two *Sphenomorphus* lizards in Taiwan. *Journal of Thermal Biology* 31, 378–385.

Huang, W.S. (2006a). Ecological characteristics of the skink, *Mabuya longicaudata*, on a tropical East Asian island. *Copeia* 2006, 293–300.

Huang, W.S. (2006b). Ecology and reproductive patterns of the grass lizard, *Takydromus sauteri*, in a tropical rain forest of an East Asian island. *Journal of Herpetology* 40, 267–273.

Huang, W.S. (2010). Ecology and reproductive characteristics of the skink, *Sphenomorphus incognitus*, on an East Asian Island, with comments on variations in clutch size with reproductive modes in *Sphenomorphus*. *Zoological Studies* 49, 779–788.

Huey, R.B. & Pianka, E.R. (1981). Ecological consequences of foraging mode. *Ecology* 62, 991–999.

Husak, J.F. & Fox, S.F. (2003). Adult male collared lizards, *Crotaphytus collaris*, increase aggression towards displaced neighbours. *Animal Behaviour* 65, 391–396

James, C.D. & Shine, R. (1985). The seasonal timing of reproduction: a tropical-temperate comparison in Australian lizards. *Oecologia* 67, 464–474.

Ji, X., Lin L.H., Lin C.X., Qiu Q.B. & Du, Y. (2000). Sexual dimorphism in body size and head size and female reproduction in a viviparous skink, *Sphenomorphus indicus*. *Zoological Research* 21, 349–354.

Kerr, G.D., & Bull, C.M. (2006). Exclusive core areas in overlapping ranges of the sleepy lizard, *Tiliqua rugosa*. *Behavioural Ecology* 17, 380–391.

Kolarov, T.N., Vljevic, L.K., Polovic, L.D.G. & Kalezic, M.L. (2010). The Body Size, Age Structure and Growth Pattern of the Endemic Balkan Mosor Rock Lizard (*Dinolacerta mosorensis* Kolombatovich, 1886). *Acta Zoologica Academiae Scientiarum Hungaricae* 56, 55–71.

McArthur, R.H. & Pianka, E.R. (1966). On the optimal use of a patchy environment. *American Naturalist* 100, 603–9.

Nguyen, Q.T. (2005). *Herpetological collaboration in Vietnam.* In *Herpetologia Bonnensis II*, 233–240. Vences, M., Köhler, J., Ziegler, T. & Böhme, W. (eds.). Proceedings of the 13th Congress of the Societas Europaea Herpetologica.

Nguyen, V.S., Ho, T.C. & Nguyen, Q.T. (2009). *Herpetofauna of Vietnam*. Frankfurt am Main: Chimaira.

Orlov, N.L., Murphy, R.W., Ananjeva, N.B., Ryabov, S.A. & Ho, T.C. (2002). Herpetofauna of Vietnam. A checklist. Part 1. Amphibia. *Russian Journal of Herpetology* 9, 81–104.

Pianka, E.R. & Vitt, L.J. (2006). *Lizards: Windows to the Evolution of Diversity*. Berkeley: University of California Press.

Purkayastha, J. & Das, M. (2010). *Sphenomorphus maculatus* (Sauria: Scincidae): a case of death-feigning. *Herpetology Notes* 3, 285–287.

Reeder, T.W. (2003). A phylogeny of the Australian *Sphenomorphus* group (Scincidae: Squamata) and the phylogenetic placement of the crocodile skinks (*Tribolonotus*): Bayesian approaches to assessing congruence and obtaining confidence in maximum likelihood inferred relationships. *Molecular Phylogenetics and Evolution* 27, 384–397.

Regal, P.J. (1983). The adaptive zone and behaviour of lizards. In: *Lizard Ecology*, 105–118. Huey, R.B., Pianka, E.R. & Schoener, T.W. (eds.). London: Harvard University Press.

Sergeev, A.M. (1937). Materials to the understanding of the postembryonic growth of reptiles. *Russian Journal of Zoology* 16, 723–734 [in Russian].

Shine, R. & Charnov, E.L. (1992). Patterns of survival, growth and maturation in snakes and lizards. *American Naturalist* 139, 1257–1269.

Spellerberg, I.F. (1972). Thermal ecology of allopatric lizards (*Sphenomorphus*) in southeast Australia. *Oecologia* 11, 1–16.

Tsellarius, A.Y. & Tsellarius, E.Y. (2001). Dynamics of population spatial structure in *Lacerta saxicola* in deciduous forests of Navagir mountain ridge. *Russian Journal of Zoology* 80, 1–8

[in Russian].

Tsellarius, A.Y. & Tsellarius, E.Y. (2009). Length of life and mortality factors in rock lizard *Darevskia brauneri* (SAURIA) according to the long-termed observations on the Navagir mountain ridge. *Russian Journal of Zoology* 88, 1276–1280 [in Russian].

Wiederhecker, H.C., Pinto, A.C. S., Marcela, S.P. & Guarino, R.C. (2003). The demography of the lizard *Tropidurus torquatus* (Squamata*,* Tropiduridae) in a highly seasonal neotropical savanna*. Phyllomedusa* 2, 9–19.

Yamasaki, T., Hikida T., Nabhitabhata J., Panha S. & Ota, H. (2001). Geographic variations in the Common Skink *Sphenomorphus maculatus* (Blyth, 1853) in Thailand, with re-validation of *Lygosoma mitanense* Annandale, 1905 as its Subspecies. *The Natural History Journal of Chulalongkorn University* 1, 23–31.

Ziegler, T. (2002). *Die Amphibien und Reptilien eines Tieflandfeuchtwald-Schutzgebietes in Vietnam*. Münster: Natur und Tier-Verlag.

Ziegler, T. & Nguyen T.Q. (2010). New discoveries of amphibians and reptiles from Vietnam. *Bonn Zoological Bulletin* 57, 137–147.

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