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The Scincid Lizard *Lioscincus tillieri* (Reptilia: Scincidae) from New Caledonia in the Southwest Pacific: New Information on the Species' Biology, Distribution and Morphology

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ABSTRACT. *Lioscincus tillieri* was originally described in 1991 from a single juvenile specimen. Field observations on the species at several localities and the acquisition of a further fifteen specimens collected between 1995 and 1998 have provided new data on its biology, distribution, and morphology. Most notably *L. tillieri* is now known to have a live-bearing mode of reproduction, only the second occurrence of viviparity in the endemic New Caledonian skink fauna.

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The New Caledonian scincid lizard *Leiolopisma tillieri* was described by Ineich & Sadlier (1991) from a single specimen collected by entomologists in a malais trap set in Parc Rivière Bleue in the Plaine des Lacs region in the south of the island. The specimen was small (snout to vent length 29.5 mm) and presumed to be a juvenile.

At the time of description it was not possible to unambiguously assign the species to any existing monophyletic genus in the *Eugongylus* group of skinks (Greer, 1979). For this reason it was placed in "*Leiolopisma*" which comprised an essentially primitive assemblage of species from Australia, New Zealand, New Caledonia, and Mauritius (where the type species *Leiolopisma telfairi* occurs on Round Island). In the past 10 years there has been a progressive dismantling of the polyphyletic genus *Leiolopisma* (see Hutchinson *et al.*, 1990). The New Caledonian species placed in *Leiolopisma* by Sadlier (1986) have subsequently been reallocated to *Lioscincus* (Bauer & Sadlier, 1993), the next available generic name to accommodate these taxa. As it currently stands *Lioscincus* includes: *L. greeri, L. maruia, L. nigrofasciolatum, L. novaecaledoniae, L. steindachneri* (type species), and *L. tillieri*, but still remains an assemblage of generally primitive *Eugongylus* group species.

In overall morphology *L. tillieri* is most similar to the recently described New Caledonian species *Lioscincus*

maruia Sadlier *et al.* (1998) and the species of *Tropidoscincus* (also from New Caledonia), most significantly in also having an extremely long tail with 60 or more postsacral vertebrae. However both *L. tillieri* and *L. maruia* lack the unusual skeletal character in the region of the mesosternum that characterises *Tropidoscincus* (as defined by Sadlier, 1986), i.e. the species of *Tropidoscincus* have three mesosternal ribs whereas *L. tillieri* has two, the latter being the primitive character state for the *Eugongylus* group.

Known only from the single juvenile specimen collected in 1991, *Lioscincus tillieri* was listed as rare by Bauer & Sadlier (1993) in an assessment of the distribution and status of the endemic lizards of New Caledonia. The species was not collected again until 1995 when it was located in maquis shrubland on Mt Mou and Mt Vulcain during the course of two periods of field research that traversed that habitat type. Since then it has been located at a further three locations in the south of the island, always in maquis shrubland. The information presented here is a compilation of both opportunistic, and more recently, targeted field research carried out over a number of years. The acquisition of additional specimens has provided data on variation in scalation and osteology, colour pattern in adults, and reproductive mode, all previously unreported.

Materials and methods

Specimen abbreviations are prefixed as follows: Australian Museum (AMS); California Academy of Sciences (CAS); Museum National d'Histoire Naturelle Paris (MNHN).

Measurements. The following characters were scored for each specimen where possible: snout to vent length (SVL)—measured from tip of snout to caudal edge of anal scales; axilla to groin distance—measured from middle of base of the forelimb to middle of base of hindlimb; forelimb to snout length—measured from tip of snout to middle of base of forelimb; hindlimb length—measured from middle of base of hindlimb to tip of fourth toe including nail; tail length—measured from caudal edge of anal scales to tip of tail, on complete original tails only. Body measurements are for adults only, as determined by reproductive maturity (presence of enlarged, yolked ovarian follicles or embryos in females and enlarged testes in males) and/or obvious size classes, and are expressed as percentages of snout to vent length in the taxon accounts.

Scalation. Head scalation generally follows Taylor (1935) as described and figured by Sadlier (1986); midbody scale rows—number of longitudinal scale rows around body counted midway between fore and hindlimb; paravertebral scales—number of scales in a paravertebral row from first scale posterior to parietal scale to last scale at level of vent opening; fourth finger and toe scales—number of dorsal scales on fourth digit of hand and foot, distal scale contains claw and basal scale broadly contacts adjacent basal scale of third finger or toe; fourth finger and toe lamellae—number of ventral scales on fourth digit of hand and foot, distal scale contains claw and basal scale is last largely undivided scale to a point level with intersection of third and fourth digits. Bilateral characters were scored on both sides and the mean value used.

Osteology. Specimens were *X*-rayed to assess phalangeal formula, and the number of presacral and postsacral vertebrae.

Species account

Lioscincus tillieri (Ineich & Sadlier)

Figs. 1–4

Leiolopisma tillieri Ineich & Sadlier, 1991: 343.

Material examined. AMS R148032–33 Mt Vulcain, Mine Galliéni 21°54'S 166°20'E (500 m); AMS R148035–38 Mt Vulcain, vicinity Refuge du Vulcain 21°54'S 166°23'E (970 m); AMS R146479 Mt Mou, 22°04'01"S 166°20'34"E (1,000–1,050 m); AMS R146486 Mt Mou 22°03'53"S 166°20'36"E (1,095 m); MNHN 1989.26 (holotype *Leiolopisma tillieri*), Rivière Bleue, 22°06'05"S 166°40'06"E (310 m); AMS R147909, R152616, R152628, CAS 205462 Rivière Bleue, 22°05'47"S 166°40'13"E; AMS R151335 Yaté (vicinity), 22°10'02"S 166°53'50"E (330 m).

Diagnosis. *Lioscincus tillieri* is distinguished from other species of *Lioscincus* by the following combination of characters: (*a*) scales of dorsal surface of body and tail with two strong keels; (*b*) midbody scale rows 34–38; (*c*) paravertebral scales 65–71; (*d*) lamellae under the fourth finger 18–23; (*e*) lamellae under the fourth toe 27–33; (*f*) parietals each bordered by a nuchal scale and 2 upper secondary temporal scales; (*g*) dorsal surface of head with a relatively unmarked uniform brown colour pattern.

Description. The description is based on 16 specimens comprising nine adults (three males and six females) 52–64 mm SVL, two subadults 41–45 mm SVL, and five juveniles 29.5–38 mm SVL (including the holotype). Measurements are for adults only (n = 9 unless otherwise stated); scalation was assessed on all specimens unless otherwise stated.

Measurements. Distance from axilla to groin 55.9–60.0% SVL;($\bar{x}$ = 57.6); distance from forelimb to snout 36.1–40.0% SVL ($\bar{x}$ = 38.0); hindlimb length 43.8–50.9% SVL ($\bar{x}$ = 47.4); tail 279.2–296.4% SVL ($\bar{x}$ = 288.6, n = 3).

Scalation. Frontonasal broader than long (W/L = 120–140%, $\bar{x}$ = 128.3, n = 6); prefrontals moderately large, narrowly separated (56.25%), in point to narrow contact (25.0%), rarely more widely separated (12.5%) or contacting (6.25%); frontal longer than wide (W/L = 70.5–86.6%, $\bar{x}$ = 78.5, n = 6), the holotype has the frontal fused to the frontoparietals; frontoparietals fused; interparietal distinct; parietals each bordered by a nuchal scale and two, rarely one, (6.2%) upper secondary temporal scales; primary temporal single; lower secondary temporal single; tertiary temporals usually two, occasionally three (9.4%); postlabials two; nasals moderately to widely separated; supraciliaries 4–7, usually 5 (34.4%) or 6 (56.2%), rarely 4 or 7, third usually elongate and bordering posterior half of first supraocular and nearly all of second supraocular; upper labials 7, rarely 6 (4.1%); lower labials 6, rarely 5 (4.1%); postmental contacting first and second lower labial; chinshields three, first pair in broad medial contact.

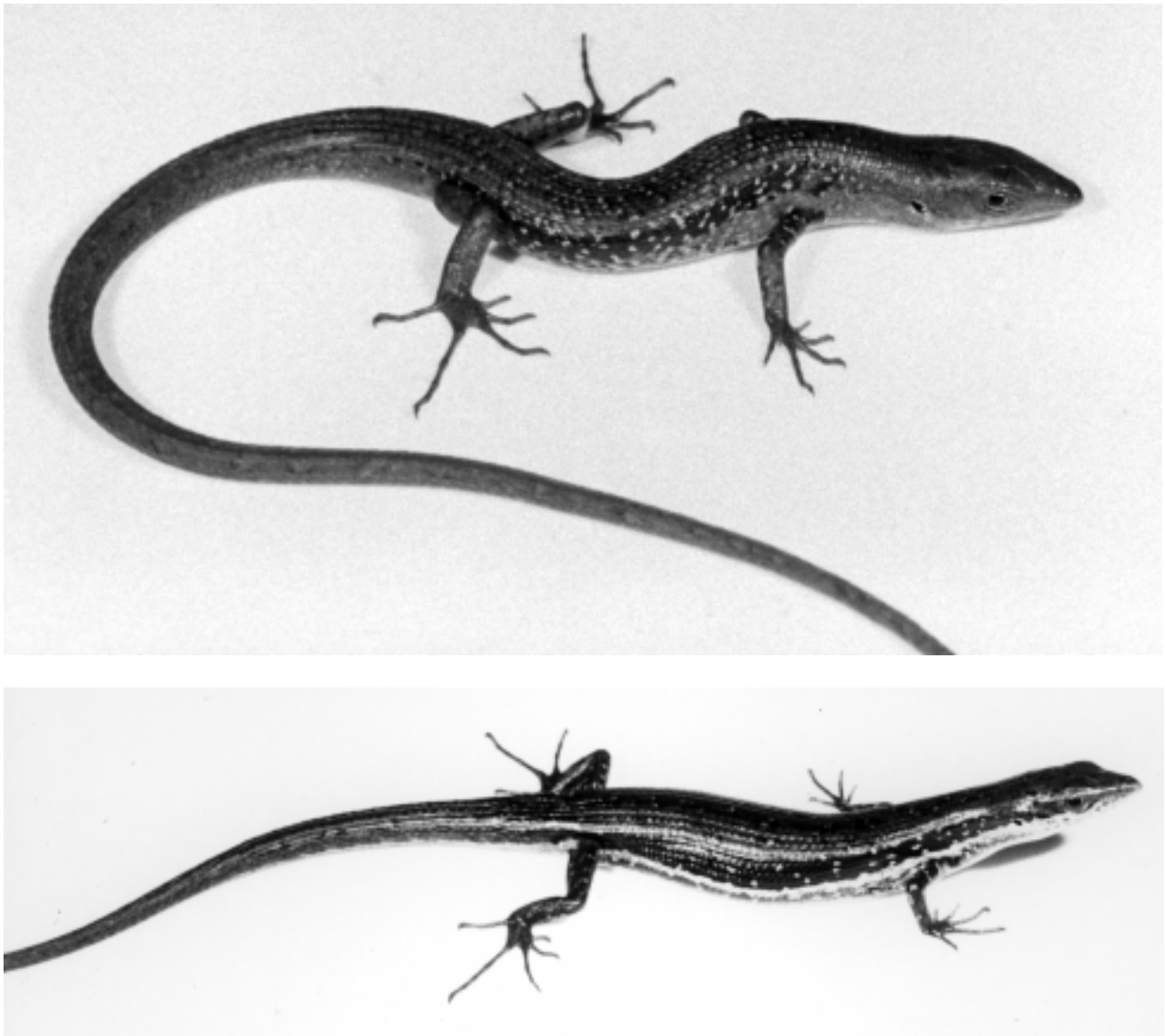

Figure 1. Male (upper) and female (lower) of *Lioscincus tillieri*.

Lower eyelid with an obvious semi-transparent disc, length approximately 33–38.5% ($\bar{x}$ = 36.4, n = 6) of total eye length.

Ear opening moderately large and with enlarged lobules anteriorly.

Scales of body and tail with two strong keels; midbody scale rows 34–38 ($\bar{x}$ = 35.1, SD = 1.23, n = 16); paravertebral scales 65–71 ($\bar{x}$ = 68.3, SD = 1.85, n = 16); scales on top of fourth finger 15–18 ($\bar{x}$ = 17.1, SD = 0.51, n = 16); lamellae beneath fourth finger 18–23 ($\bar{x}$ = 20.3, SD = 1.00, n = 16); scales on top of fourth toe 21–25 ($\bar{x}$ = 22.6, SD = 1.07, n = 16); lamellae beneath fourth toe 27–33 ($\bar{x}$ = 30.5, SD = 1.76, n = 16), smooth.

Osteology. Premaxillary teeth (adults only) 9 (n = 4), or 11 (n = 1); presacral vertebrae 28–29 ($\bar{x}$ = 28.9, SD = 0.34, n = 16); postsacral vertebrae 58–73 ($\bar{x}$ = 64.9, SD = 5.52, n = 7); phalangeal formula for manus and pes 2.3.4.5.3 and 2.3.4.5.4 respectively; two pairs of ribs contacting mesosternum.

Coloration. There is sexual dimorphism in colour and pattern between the three adult males and six adult females. Adult females are more obviously two-toned having contrasting light dorsal and dark lateral coloration, and have a pale hip-stripe along the dorsolateral margin which is absent in males.

Adult males (Fig. 1, upper): dorsal surface brown with scattered light and dark markings, lighter in colour overall than females and with the differences in tone between the dorsal and lateral colours not as pronounced as in females. Dorsal markings aligned as in females to resemble obscure dark-edged ocelli. No pale hip stripe along posterior dorsolateral edge. Head a uniform brown above and at the sides. Lateral surface distinct from dorsal surface, two-toned between fore and hindlimbs being black uppermost and

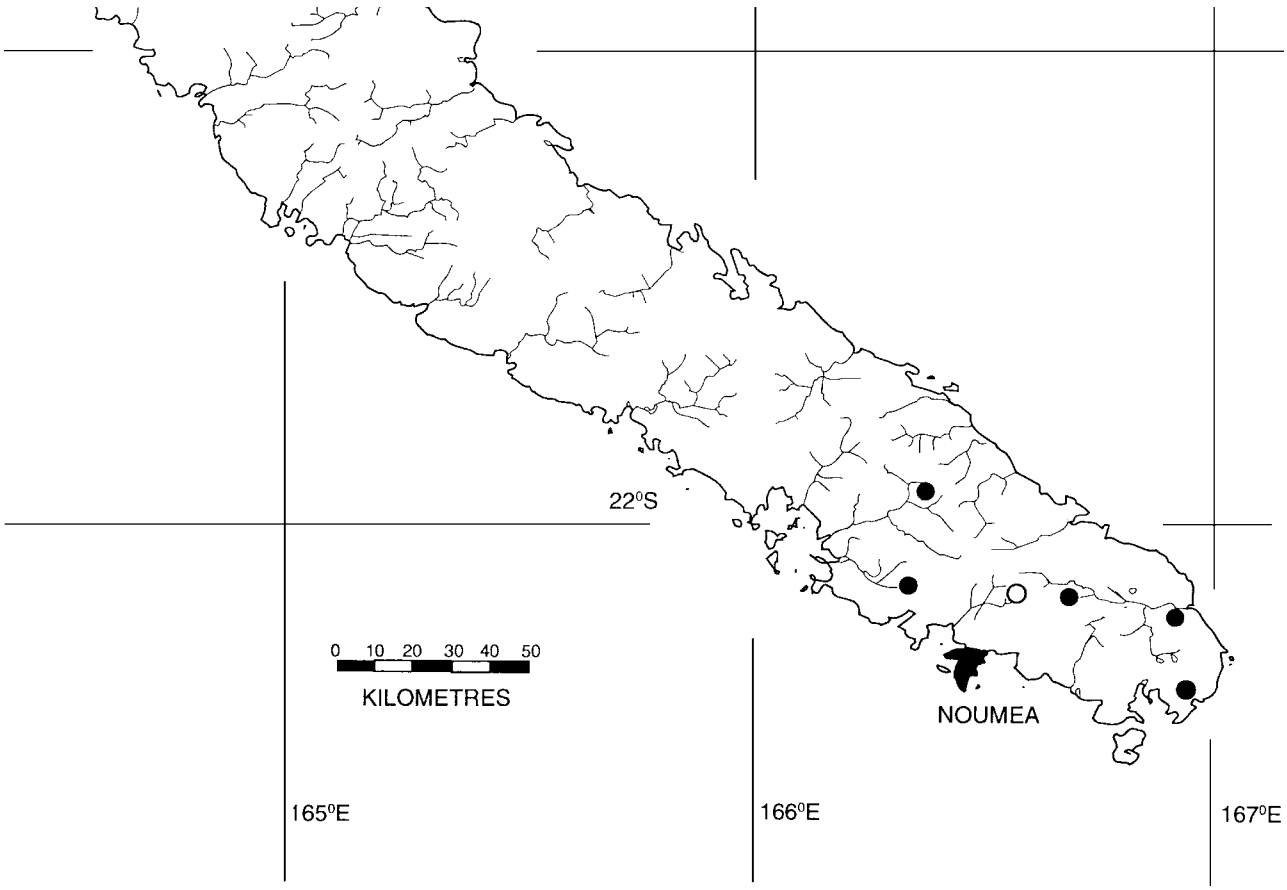

Figure 2. Distribution of *Lioscincus tillieri* in New Caledonia, specimen records (●) and observation records (O).

midbrown below with variable pale spotting overall, pale midlateral stripe obscure, most obvious just behind forelimb. Ventral surface in life, bold lemon yellow.

Adult females (Fig. 1, lower): dorsal surface brown (some individuals darker or lighter in tone) and either relatively uniform (smaller adult females) or with variable light and dark markings in which the dark flecks are aligned along the anterior and posterior edge of the pale spots to give the overall appearance of obscure, pale, dark-edged ocelli in the most boldly marked of the females. Posterior dorsolateral edge in region of hindlimbs with a narrow (1 scale width) pale hip stripe, covering the basal portion of the tail and area in front of hindlimbs, poorly expressed in two smaller adult females. Lateral surface dark brown-black, distinct from dorsal, with variable pale spotting uppermost and prominent pale midlateral strip (1 scale width). Ventral surface in life, bold lemon yellow.

Distribution. *Lioscincus tillieri* appears to be endemic to maquis habitat in the ultramafic block that covers much of the southern third of the island. Maquis is a heathy formation on ultrabasic rocks, it includes 30% of the native species, 36% of the genera, and 47% of the families occurring in New Caledonia. Ninety-three percent of the species are endemic to New Caledonia (Morat *et al*., 1986). Within this region (Fig. 2) *L. tillieri* has been recorded from Mt Vulcain in the north to Kwa Néie in the south. Specimen based records are from Mt Vulcain, Mt Mou, Rivière Bleue, and Yaté, and observations from Montagne des Sources and Kwa Néie. It occurs over a broad altitudinal range from low (200 m asl) to high (1,000 m asl) elevation.

Biology. During the course of several visits to New Caledonia observations were made on *Lioscincus tillieri* at Mt Mou (January and September 1995), Mt Vulcain (September 1995), and the type locality of Parc Rivière Bleue (September 1995 and May 1998). The habitat at all three locations is maquis heathland, with notable differences between each site. High elevation maquis at Mt Mou is low and dense with an impenetrable understorey of ferns (Fig. 3). By contrast, the mid to high altitude maquis at Mt Vulcain (700–900 m asl) is low and open (Fig. 4). Low altitude maquis (250 m asl) at Rivière Bleue is well developed and lies adjacent to a forest of *Casuarina* with a dense and tall (1 m) grassy understorey—several *Lioscincus tillieri* were observed at the ecotone between the two habitats.

Both adults and juvenile *Lioscincus tillieri* were observed on the ground amongst shrubs and grasses, and occasionally perched on the groundcover. Clearly arboreal habits were observed on several occasions: an adult male was seen on the trunk of a sapling oriented head down and clearly trying to keep itself pressed flat against the trunk (AMB); one

individual was sighted in a low bush and dropped to the ground when disturbed; and two others not initially seen perching dropped to the ground from a low bush when disturbed. On all occasions *L. tillieri* was wary and difficult to approach. In particular juveniles and subadults observed in elevated positions were only seen briefly before dropping to the ground and seeking shelter. The type specimen of the species was a juvenile collected by entomologists in a malais trap approximately 1 m above the ground.

There are few sheltering sites in maquis habitat. The only specimen of *Lioscincus tillieri* located by searching beneath ground cover was a single individual from Col d'Yaté collected under a stone during overcast and showery weather (A. Whitaker, pers. obs.).

The records of viviparity for the species are from two adult females collected on Mt Mou in January (SVL 60.5 mm and 64 mm) which contain embryos with all scalation features obvious. Three adult females collected in September (SVL 52–55 mm) contained 2–3 large oviductal eggs. This is only the second case of viviparity recorded in the New Caledonian skinks, the other live-bearing species being *Marmorosphax tricolor* (Sadlier, 1986).

Conservation status. *Lioscincus tillieri* is known from six locations and under optimal conditions was observed to be moderately common at two of these (Mt Vulcain and Rivière Bleue). For these reasons it is regarded as only moderately restricted in distribution and is not considered to be rare, and would not be regarded as threatened under the current IUCN classification system (1996).

Our field research clearly indicates that *Lioscincus tillieri* is restricted to maquis habitat, and that it inhabits structurally different types of maquis. However, it is not known whether any particular successional stage of maquis is preferred. Consequently the impact of fire and disturbance by mining on maquis habitat are unknown but could be significant and impact on populations of *L. tillieri* at a local level. Field research in the maquis shrublands of the southern ultramafic block is required to clearly establish the species' habitat requirements in order to fully assess the species conservation status.

Figure 3. Maquis habitat at Mt Mou (800+ m asl).

Discussion

Relationships. *Lioscincus* is an assemblage of generally primitive *Eugongylus* group species from New Caledonia that can not be assigned to any existing monophyletic genus. The species included in the genus possess the following basic suite of derived characters: supranasal scale absent; frontoparietals fused to form a single scale; lower eyelid with a semi-transparent disc; presacral vertebrae 29. *Lioscincus tillieri* clearly possesses a larger suite of apomorphic character states, most notably the presence of two strong keels to the scales of the dorsal surface of the body and tail, and a viviparous mode of reproduction. Its inclusion in *Lioscincus* is considered temporary pending further research on the relationships of these species.

Aside from *Lioscincus tillieri* five other species of New Caledonian skinks have the derived character state of an extremely long tail. Three species of *Tropidoscincus*, the monotypic *Lacertoides pardalis*, and the recently described *Lioscincus maruia*, all have tails as much as 2.5 times longer than the body and an exceptionally high number of postsacral vertebrae, usually 60 or more. It is possible that this common feature is indicative of close relationship between these species. It is also interesting to note that they all inhabit open forest or shrubland habitats, although *Tropidoscincus variabile* and *T. rohssii* also occur in open areas within closed forest habitat.

Lioscincus tillieri is most similar to *L. maruia* in body proportions (long-limbed and long-tailed), habits and habitats (surface active species inhabiting maquis shrubland), and certain aspects of scalation (keeled body scales), osteology ($\bar{x}$ = 58 postsacral vertebrae), and coloration (yellow flush to the ventral surface). However *L. maruia* differs from *L. tillieri* in a number of aspects, most notably in having: weakly tricarinate *vs* strongly bicarinate body and tail scales; modally 11 *vs* 9 premaxillary teeth; a single upper secondary temporal scale *vs* two; and an oviparous *vs* viviparous mode of reproduction. For these characters the condition described for *L. tillieri* is most likely the apomorphic state. In any case they serve to further diagnose the species and emphasis its uniqueness.

Figure 4. Maquis habitat at Mt Vulcain (950 m asl).

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References

Bauer, A.M., & R.A. Sadlier, 1993. Systematics, biogeography and conservation of the lizards of New Caledonia. *Biodiversity Letters* 1: 107–122.

Greer, A.E., 1979. A phylogenetic subdivision of Australian skinks. *Records of the Australian Museum* 32(8): 339–371.

Hutchinson, M.N., S.C. Donnellan, P.R. Baverstock, M. Krieg, S. Simms & S. Burgin, 1990. Immunological relationships and generic revision of the Australian lizards assigned to the genus *Leiolopisma* (Scincidae: Lygosominae). *Australian Journal of Zoology* 38: 535–554.

Ineich, I., & R.A. Sadlier, 1991. A new species of scincid lizard from New Caledonia (Reptilia Lacertilia Scincidae). In *Zoologia Neocaledonica*, vol. 2., eds. J. Chazeau & S. Tillier. *Mémoires du Muséum national d'Histoire naturelle* (A), 149: 343–347.

IUCN, 1996. *IUCN Red List of Threatened Animals*. Gland, Switzerland: IUCN.

Morat, P., T. Jaffré, J.M. Veillon & H.S. MacKee, 1986. Affinités floristiques et considérations sur l'origine des maquis miniers de la Nouvelle-Calédonie. *Bulletin du Muséum national d'Histoire naturelle* 8(4)(section B), *Adansonia* (2): 133–182.

Sadlier, R.A., 1986. A review of the scincid lizards of New Caledonia. *Records of the Australian Museum* 39(1): 1–66.

Sadlier, R.A., A.H. Whitaker & A.M. Bauer, 1998. *Lioscincus maruia*, a new species of lizard (Reptilia: Scincidae) from New Caledonia, southwest Pacific. *Pacific Science* 52(4): 334–341.

Taylor, E.H., 1935. A taxonomic study of the cosmopolitan scincoid lizards of the genus *Eumeces* with an account of the distribution and relationships of its species. *Science Bulletin of the University of Kansas* 36(14): 642.

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