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Taxonomic Status of *Mabuya multicaudata* (Gray, 1845)
(Scincidae: Squamata: Reptilia) from Taiwan,
with Comments on the Herpetofauna of Lanyu Island

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Abstract

A scincid lizard *Mabuya multicaudata* consists of two subspecies (*M. m. multicaudata* from the southern Philippines and *M. m. borealis* from the central and the northern Philippines) and two poorly studied populations isolated in Palau and Lanyu Island, Taiwan. In this paper, external characters of the Lanyu population are examined and compared with those of the two Philippine subspecies. The results indicate subspecific allocation of the former to *borealis* rather than to the nominotypical subspecies. Biogeographical implications of the present findings are discussed.

Introduction

Lanyu Island (Kotosho or Botel Tobago; 22° 00'-05'N, 121° 29'-36'E) is located ca. 70 km southeast of the main-island of Taiwan and ca. 390 km north of Luzon Island, the Philippines (Fig. 1). Faunal and floral characteristics of this islet have long been attracting biologists' attentions, and quite a few papers have been published regarding the biogeographical relationship of Lanyu Island with adjacent areas since Kuroda (1925) pointed out the close similarity of its avifauna with that of the Philippines [see Kano (1933, 1935) for review on early works].

Reptiles of Lanyu Island were first referred by Oshima (1912) who described an endemic gecko, *Gekko hikuchii*, on the basis of two specimens. The number of taxa recorded from the island have gradually increased with the advance of detailed surveys (Chen, 1984; Horikawa, 1927; Okada, 1932; Ota, 1987; Ota and Ross, 1990; Wang, 1962), and a total of 18 species and subspecies are currently recognized.

Of these, *Mabuya multicaudata*, a skink formerly exclusively known from the Philippines and Palau (Brown and Alcalá, 1980; Dryden and Taylor, 1969), was first listed by Chen (1984) as a member of the herpetofauna of Lanyu Island. Later, Cheng (1987) described three specimens from the island, and listed several characters to discriminate the species from the other sympatric congener, *M. longicaudata*. Lin and Cheng (1990) noted that specimens of *multicaudata* from Lanyu Island possessed 27 to 38 scales beneath the fourth toe, whereas Philippine specimen(s) had only 26 subdigits. However, neither of these authors referred to Brown and Alcalá's (1980) recent monograph on the Philippine scincids, in which they partitioned *multicaudata* into two subspecies, *M. m. multicaudata* from the southern Philippines and *M. m. borealis* from the central and the northern Philippines. Brown and Alcalá (1980) also reported the number of fourth toe subdigits in their specimens as ranging 22-29.

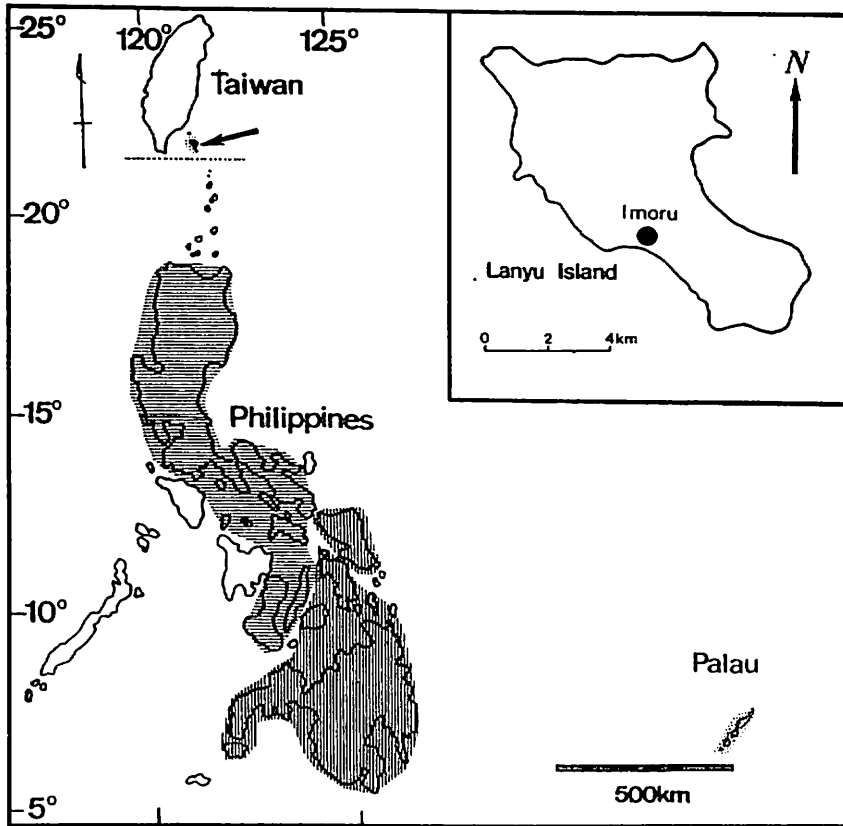


Fig. 1. Map of the West Pacific region showing the location of Lanyu Island (indicated with an arrow: also inset in the upper right corner). Ranges of *Mabuya multicarinata*, *M. m. borealis*, and populations of unknown subspecific status are exhibited by vertical and horizontal hatches, and stipples, respectively.

Thus, it must be stated that studies on the taxonomic allocation of Lanyu population are still quite incomplete like those on populations in Palau.

I collected several specimens of *M. multicarinata* during the recent surveys on Lanyu Island (Fig. 2 A). Based on these, as well as specimens of the two Philippine subspecies and their literature descriptions, I compare external characters of the Lanyu population with those of *M. m. multicarinata* and *M. m. borealis* for the purpose of elucidating their relationships. I also make a brief discussion on the herpetofaunal characteristics of Lanyu Island.

Materials and Methods

A total of 11 specimens (four adult males, six adult and one immature females) were collected from near Imoru, Lanyu Island, Taiwan, in July 1986 and May 1988. All specimens were measured after fixation in 10% neutralized formalin and preservation in 70% ethanol. They are compared with nine specimens of *M. m. multicarinata* and 11 specimens of *M. m. borealis* from the Philippines (see "Specimens examined" below

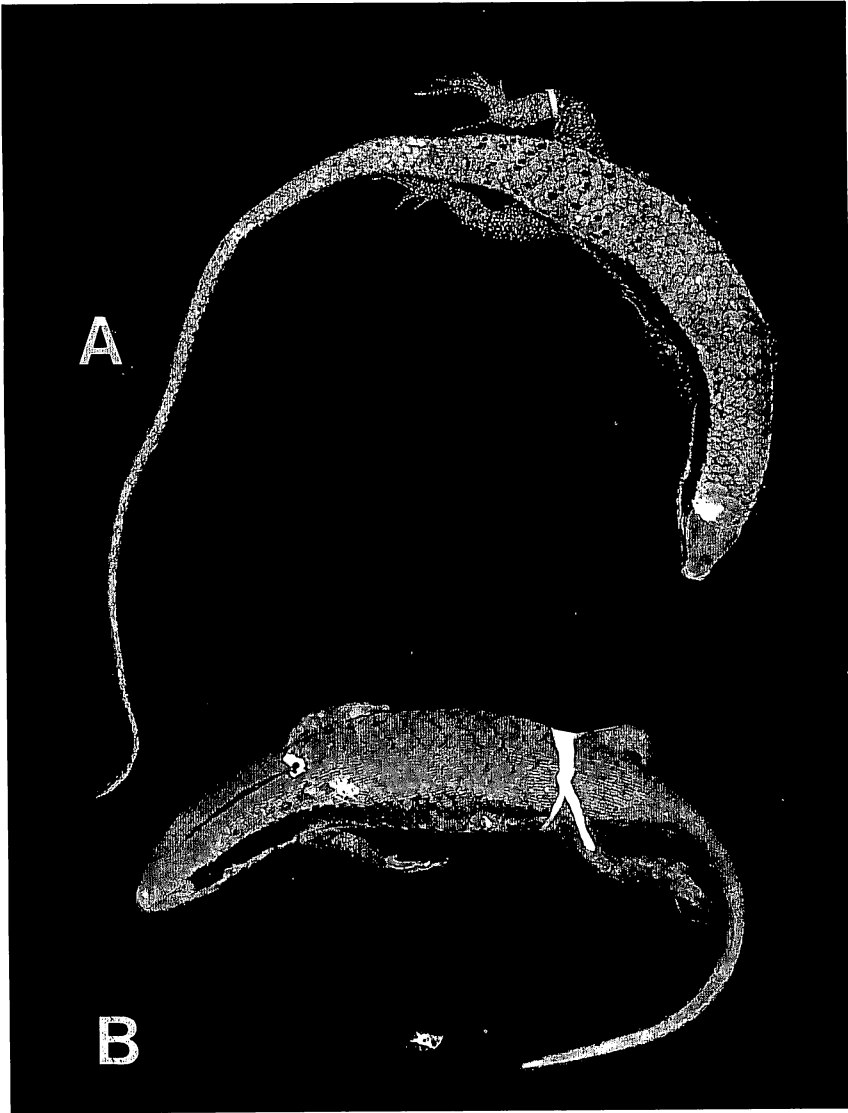


Fig. 2. Specimens of (A) *Mabuya multicarinata* from Lanyu Island (KUZ 9615), and (B) *M. m. multicarinata* from Mindanao Island, the Philippines (USNM 34739). Note the presence of a dark vertebral stripe in the nuchal region of the latter.

for detailed locality data of these specimens), as well as descriptions of the two subspecies by Brown and Alcalá (1980).

Definitions and terminology of characters used for comparisons below follow those of Brown and Alcalá (1980) unless otherwise noted. In the following sections, catalogue numbers of specimens deposited in the herpetological collection of the Department of Zoology, Kyoto University, are preceded by KUZ. The other institutional acronyms are those suggested by Leviton *et al.* (1985).

Results

External characters of specimens from Lanyu Island. — Snout-vent length 55.1–82.7 (\bar{X} =80.0; SD=2.76) mm for four adult males, 64.2–83.6 (\bar{X} =77.6; SD=6.32) mm for six adult females. Snout tapering, rounded at tip; rostral broader than high, broadly convex along dorsal margin; supranasals long and narrow, moderately to narrowly separated from each other; prefrontals narrowly to moderately separated from each other; frontal in contact with first and second, or with only second supraocular; four enlarged supraoculars; interparietal absent in two specimens, present but small in the others; left and right parietals in contact with each other; seven or eight upper labials, fifth broadest and just beneath center of eye in 10 specimens, sixth in one specimen; six, seven, or eight lower labials; mental about as broad as postmental; ear lobules almost lacking; dorsal and lateral scales with five to eight keels; 28–31 midbody scale rows (\bar{X} =29.8, SD=0.87); 34–41 vertebral scales between parietals and base of tail (\bar{X} =38.8, SD=1.99), preanals not or only slightly enlarged; fourth toe longest, first toe shortest; 24–28 subdigits beneath fourth toe (\bar{X} =26.5, SD=1.21).

Dorsal ground color somewhat greenish olive to tannish brown; some dark brown or black spots, about as large as a dorsal scale, in central and posterior parts of dorsum in six specimens, such spots lacking in the others; vertebral stripe wholly lacking; most specimens with a faint, light dorsolateral stripe or series of light spots along upper margin of broad, dark brown or black band on lateral surface; anterior upper labials dusky or brownish except for ventral margins; largest upper labial beneath orbit marked by narrow dark line along dorsal margin; lower labials having more or less distinct dark bars; light lateral line or band evident from upper labial or ear region to forelimb, further extending behind forelimb but as scattered light spots; ventral surface grayish tan or slightly bluish slate, with chin and preanal regions markedly lighter; dark spots lacking in ventral surface of head.

Ecological notes. — On Lanyu Island, *Mabuya multicarinata* was found both in the mountains and lowlands, and was especially frequently observed in marginal portions of secondary forests neighboring to gaps such as paths. Not an animal was, however, observed in the vicinity of human houses. This lizard seems to be diurnal, and many animals were observed active or basking during the daytime.

It is interesting to note that, unlike many other Taiwanese scincids, often climbed up trees quickly when I attempted to catch them. Four of the eleven animals, all collected during the night, were found resting in crevices of tree trunks, ca. 50–180 cm above the ground, like the other congeneric species on the island, *M. longicaudata* [see Ota (1986)]. These observations seem to indicate the partial arboreality of this lizard on Lanyu Island.

Three females were gravid when they were captured, and their clutch sizes varied two to three. Detailed reproductive data of the present sample will be published elsewhere (Okada *et al.*, in prep.).

Discussion

Brown and Alcalá (1980), in partitioning the Philippine populations of *M. multicarinata* into two subspecies, diagnosed each of them as follows: interparietal relatively

short and parietals usually in contact with each other behind the interparietal in *borealis*, relatively elongated, wholly separating parietals in nominotypical subspecies; blackish spots or blotches lacking on chin and gular regions in the former, frequently present in the latter; dark vertebral stripe not evident in the former, evident at least on anterior part of body in the latter (Fig. 2 B). They also provided detailed description for each subspecies on the basis of a large series of specimens (121 for nominotypical subspecies and 88 for *borealis*). Specimens from Lanyu Island examined in the present study have parietals contacting each other, no dark spots or blotches on the ventral surface of head, and no dark stripe on the dorsum of body. Previous authors referring to the Lanyu population of *M. multicarinata* did not provide states of these characters in their samples except for a line drawing by Cheng (1987) showing the possession of a small interparietal and parietals contacting each other in, at least, one of his specimens.

Results of comparisons in the three diagnostic characters of the subspecies between the present sample and descriptions by Brown and Alcalá (1980) indicate the closer relationship of the Lanyu population with *M. m. borealis* rather than with *M. m. multicarinata*. The remaining characters in the sample from Lanyu Island are identical with, or vary but within ranges of variations of, corresponding characters in the two Philippine subspecies except for three points as follows: two specimens from Lanyu Island (KUZ 9613 & 9615) have no interparietal at all; one specimen (KUZ 7181) has eight upper labials, of which the sixth is largest, just beneath the center of eye; and one specimen (KUZ 9613) has eight lower labials (Table 1). These may indicate some differentiations between the Lanyu and the Philippine populations. However, since the majority of the specimens examined show states of these characters well agree with those in the Philippine specimens, I believe the above differences do not warrant the separation of Lanyu population from those of the Philippines in any taxonomic category. Besides these, Lin and Cheng (1990) noted that the number of the fourth toe subdigits in their specimens vary from 27 up to 38. The latter much exceeds the maximum value in this character in the Philippine specimens (Table 1). None of the present specimens, however, show such a large subdigital count, and therefore, it is highly probable that the value provided by Lin and Cheng (op. cit) derived from an aberrant individual. Thus, it seems most appropriate at present to assign the Lanyu population to *M. m. borealis*.

Several authors pointed out the close faunal similarity of Lanyu Island with the Philippines rather than with the main-island of Taiwan [see Kano (1936) for review]. As to reptiles, however, most species and subspecies are shared only with the latter and not with the former (Table 2). These have been interpreted as indicative of their past entries from the main-island into Lanyu Island (Kano, 1933; Okada, 1931; Ota, 1991; Wang, 1962). On the other hand, the two species endemic to Lanyu Island, *Gekko hikuchii* and *Lepidodactylus yami*, have their closest relatives in the Philippines and not in the other part of Taiwan (Ota, 1987, 1989a,b; Ota and Crombie, 1989; Ota et al., 1990), suggesting that they have derived from ancestors dispersed into the island from the Philippines (Ota, 1991). Occurrence of *Mabuya multicarinata borealis* on Lanyu Island seems to offer another example of such migrations.

Table 1. External characteristics of *Mabuya multicarinata* from Lanyu Island and *M. m. borealis* from the Philippines. Data for the two Philippine subspecies are taken from comparative specimens examined as well as descriptions by Brown and Alcalá (1980). * Data given in Cheng (1987) are included.

Locality (subspecific status)	Snout-vent length in adults (in mm)		Frequency (in %) of separated parietals	Upper labials	Lower labials	Midbody scale rows	Vertebral scale rows	Fourth toe subdigits	Vertebral stripe
	Males	Females							
Lanyu Island	76.1-82.7	64.2-83.6	0.0	7-8	6-8	28-31*	34-41	24-28*	lacking
Southern Philippines (<i>multicarinata</i>)	65-86.6	59-80	87.9	6-7	6-7	28-32	36-42	22-28	usually present
Northern and central Philippines (<i>borealis</i>)	61-96.9	61.8-79	15.1	6-7	6-7	28-32	36-42	22-29	lacking

Table 2. Reptilian species and subspecies known from Lanyu Island. Their presence (+) and absence (-) in the adjacent regions are also given. See Ota (1991) for original sources of locality records and taxonomic status of each taxon.

Species and subspecies	Lanyu I.	Main-island of Taiwan	Philippines
<i>Gekko kikuchii</i>	+	-	-
<i>G. hokouensis</i>	+	+	-
<i>Hemidactylus frenatus</i>	+	+	+
<i>Lepidodactylus yami</i>	+	-	-
<i>Hemiphyllodactylus t. typus</i>	+	+	+
<i>Japalura swinhonis</i>	+	+	-
<i>Takydromus sauteri</i>	+	+	-
<i>Sphenomorphus boulengeri</i>	+	+	-
<i>Emoia atrocostata</i>	+	+	+
<i>Mabuya longicaudata</i>	+	+	-
<i>M. m. borealis</i>	+	-	+
<i>Ramphotyphlops braminus</i>	+	+	+
<i>Amphiesma stolata</i>	+	+	-
<i>Calamaria pavementata</i>	+	+	-
<i>Elaphe c. carinata</i>	+	+	-
<i>Oligodon formosanus</i>	+	+	-
<i>Psammodynastes pulverulentus</i>	+	+	+
<i>Trimeresurus stejnegeri</i>	+	+	-

Kano (1936), after analysing distributional patterns of various organisms in the Philippines, Lanyu Island and the main-island of Taiwan, postulated the presence of a land-bridge that connected Lanyu Island and the Philippines during the late Pliocene or early Pleistocene. However, the close similarity between samples of *M. multicarinata* from Lanyu Island and the northern Philippines as revealed above suggests the more recent entry of this lizard into Lanyu Island, although the recent land-bridge formation between the two regions seems unlikely (Dickerson, 1924). Leviton (1963) surmised the dispersal of some reptiles from Luzon Island northward by rafting, and pointed out the presence of a favorable current. This explanation may be applied to the occurrence of *M. m. borealis* on Lanyu Island.

Very little information is yet available regarding the herpetofauna of the Philippine islets north of Luzon Island (i.e., Babuyan and Batan Groups: Ota and Crombie, 1989), and future intensive surveys over these regions are strongly desired to elucidate the biogeographical relationship between Lanyu Island and the northern Philippines.

Specimens examined. — *Mabuya multicarinata borealis*, Lanyu Island, Taiwan: KUZ 7160, 7181–7182, 9595, 9597, 9613–9615, 9723, 9960, 13356; Luzon Island, the Philippines: CAS 61492–61498 (paratypes); Negros Island, the Philippines: 134316–134318. *M. m. multicarinata*, Mindanao Island, the Philippines: CAS 147109–147116, USNM 34739.

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