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The Geckos found in the Limestone Caves of the Ryu-Kyu Islands¹⁾

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Since the first biological expedition was made to the Ryu-Kyu Islands in the spring of 1935 with the aid of Marquis YAMASHINA, the cave faunas of these islands were drawn attention by many biologists. The collections made by those expeditions contained many interesting animals, among which a female specimen of gecko was noticeable. It was taken by the late Dr. Tadao KANO and Mr. Tomo-o YOHENA in a limestone cave on the coast of the Island of Kumé-jima, one of the Okinawa group of the Islands. This specimen was submitted to Prof. Yaichirô OKADA for determination, who seemed at first (1935, p. 392) to consider it as belonging to the genus *Eublepharis*, but later (1936a) described it under the name of *Gymnodactylus yamashinae*. This was the very first record of the geckos which were found in the limestone caves of the Japanese Islands. Unfortunately, a single known specimen, the holotype, of this reptile seems to have been destroyed during the World War II. It is impossible to the present authors to make any further examination of the type-specimen, though there appears to remain some doubt concerning the accurate position of the species.

In 1953, participating the Tokara Expedition of the Osaka Municipal Museum of Natural History as an entomologist, the junior author began the investigation of the cave faunas of the northern Ryu-Kyu. His second visit to the caves on these islands was made in the summer of 1958 by joining a biological survey on the Amami group. This Expedition was undertaken by the members of both the Zoological and the Botanical Institutes of Kyoto University, under the leadership of Prof. TAGAWA. The junior author and Mr. MORIMOTO took charge of investigations for both terrestrial and freshwater faunas, and explored a number of limestone caves, all of which were formed in the raised coral reef. Their efforts were fruitful, coming to the results of finding many remarkable animals, of which a new banded gecko might be most striking to be reported.

1) Contribution No. 20 from the Spelaeological Society of Japan; Biospeological Results of the Ryu-Kyu Expedition 1958 of Kyoto University, No. 1.

The authors wish herewith to express their hearty thanks to Prof. Motozi TAGAWA as well as to Messrs. Kunio IWATSUKI and Yoshinobu MORIMOTO for their kind aid rendered for the junior author during the Expedition. Special thanks are due to Mr. Ryôsuke ISHIKAWA, whose kind financial support made the junior author to carry out the Expedition possible. Deep gratitude is also due to Prof. Kazuo KOBAYASHI for his kind information, to Mr. Takaji MATSUI for the loan of valuable material, to Mr. Tomizo KIYAMA for his kind assistance at the field works, and to Mr. Yonekichi MAKINO for the preparation of vivid illustrations inserted to the present paper.

Gekko japonicus (DUMÉRIEUX et BIBRON).

Specimen examined: 1 ♂ (12-VIII-1958, collected by S. UÉNO and Y. MORIMOTO; preserved in the collection of the Zoological Institute, Kyoto University).

Locality: A limestone cave called "Gushika-yô"²⁾, at Iba, in Ritichô, on Yoron-jima, the southernmost island of the Amami group of the Ryu-Kyu Islands.

Notes: The specimen recorded above is different from ordinary individuals in having large dorsal tubercles, which are distinct from the granular scales, spread from the vertex to the base of tail and form ten or more irregular longitudinal rows. *G. japonicus*, however, shows a considerable extent of individual variation. Being unable to obtain any of the other specimens, it seems to be better to regard the example as *G. japonicus*, though it has not been recorded from the Island of Yoron-jima up to the present.

Gushika-yô Cave is situated in the thick growths of *Pandanus*-tree on the southern coast of the island not far from the coral beach. The cave has two different openings, of which the smaller one leads visitors into the first room, from where a narrow corridor slopes downward and enlarges into the second room. This second room itself is composed of two parts, the inner one of which is wet and inhabited by several species of cave animals (e. g., bembidiid, blattid, terrestrial isopod and arachnids). Another opening is vertical and continues directly to the first part of the second room. The gecko was found on the wall about a half way down the shaft from this vertical opening.

The distribution range of this species is rather wide, spreading from southern China and Formosa to the northern provinces of Honshu. So far as known to the authors, however, it has never been obtained in the caves in the main parts of the Japanese Islands up to the present. It is a single known species of gecko in both Honshu and Kyushu, and is frequently found around human habitation. In Shikoku, the second species, *G. tawaensis*, was recently discovered (OKADA, 1956), but the habitat of this species is quite different from those of *G. japonicus*. On the contrary, many species of geckos are found in the Ryu-Kyu Islands, and at least three species

2) Sometimes called "Gushika-abu". "Abu" means a cave in the dialects of the Islands of Yoron-jima and Okinawa, while "yô" is the normal way of calling a cave on the Island of Okinoêrabu. It is strange that the introduced word is more widely used than the native one.

of them inhabit the Island of Yoron-jima³⁾. *G. japonicus* seems not to be a dominant species in the native houses on these islands (at least on the Islands of Okinoérabu and Yoron-jima), and is usually found on the trunks of trees in the forests or among the branches of *Pandanus*-tree. The habitats around human habitation appear chiefly to be occupied by another species, *Hemidactylus frenatus*. The present individual should not be regarded as a mere troglodyte, for it may have some value from the ecological point of view.

***Eublepharis splendens* NAKAMURA et S. UÉNO, sp. nov.**

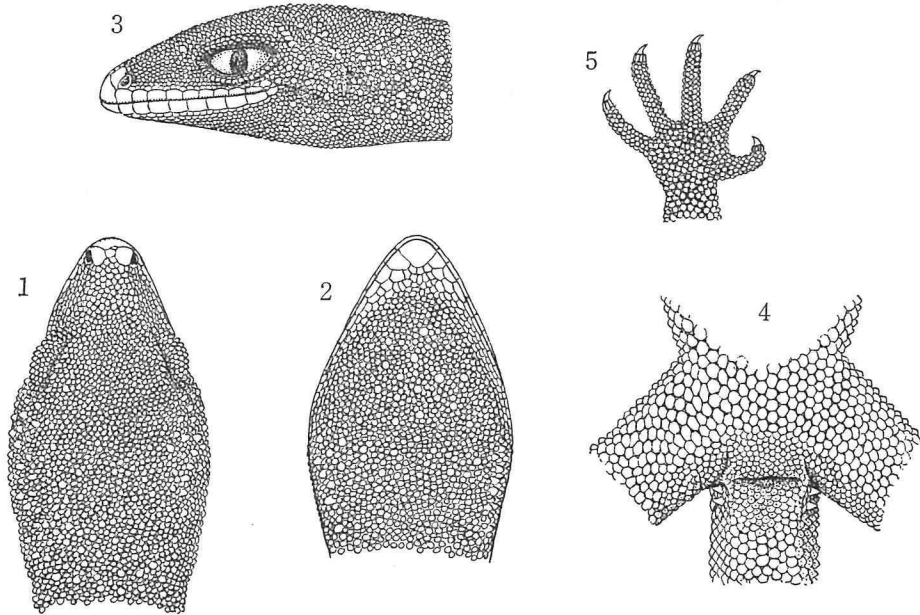
Diagnosis: Body covered with minute, well convex scales, which are intermixed with numerous conical or trihedral tubercles on the dorsal side and are loosely imbricate only on the small area before vent; dorsal tubercles usually smaller than the interspaces between them; nostril bounded dorso-posteriorly by 8 minute scales; present 10 supralabials and as many sublabials; mental bounded posteriorly by 3 or 4 small scales, chin-shields not enlarged and not distinguishable from minute granular scales covering throat. Limbs fairly long and more or less slender. Tail cylindro-conical, swollen at basal one-third in the adult. Colour blackish brown above and cream white below, with 4 characteristic pink bands⁴⁾ on the dorsal side, i.e., the foremost one on occiput, the second one a little behind the roots of fore-limbs, the third one some way before hind-limbs and the hindmost one just behind hind-limbs; the hindmost band continuing laterally to a round spot on the basal parts of metafemora; the apical part of each femur provided with a round pink spot; the apical part of tail greyish black above and below, with scattered marble white spots.

Description of Morphological Features (Adult Female): Body elongate, with fairly long limbs and a short tail; scales on both the dorsal and ventral surfaces small and granular.

Head large, somewhat rhomboidal in outline and covered with minute convex scales, which are unequal, irregularly roundish or indistinctly polygonal, and intermixed behind the level of eyes with tubercular scales, which suddenly enlarge in size behind occiput and become conical; present a row of conical scales at the base of each dorsal eye-lid; temples provided with scattered large conical or spinose scales; snout relatively narrow and subtriangular; the distance between nostril and eye nearly equal to that between eye and ear-opening, but shorter than that between anterior canthi; eyes large, about two-thirds as long as the distance between snout and eye, with pupil vertically elliptical; eye-lids well developed and movable, each with a fringe of conical scales; ear-openings fairly large, vertical and about twice as high as wide. Rostral subpentagonal, nearly three-fifths as high as wide, with a distinct dorsal emargination, bounded above by two large internasals and two small

3) *Gekko japonicus* (DUMÉRIL et BIBRON), *Peropus mutilatus* (WIEGMANN) and *Hemidactylus frenatus* DUMÉRIL et BIBRON.

4) The pink colour fades rapidly when the animal is killed and put in preservative.



Figs. 1-5. *Eublepharis splendens* sp. nov., ♀, of Jindé-gumui Cave.—1. Head, dorsal view.—2. Do, ventral view.—3. Do, left lateral view.—4. Anal region, ventral view.—5. Left hand, dorsal view.

asymmetrical scales placed between internasals; each nostril surrounded by large first supralabial, large internasal and 8 minute scales; present 10 supralabials and as many sublabials, of which the tenth usually very small and invisible on right lower labium, sublabial shields evidently larger than supralabials; mental semi-circular and large, much larger than first sublabial, bounded posteriorly by 3 minute scales. Throat with scattered small tubercles, which are intermixed with granular scales.

Trunk covered with minute scales, which are semiglobose or subconical, each scale more or less granulose; on the dorsal surface, these scales are intermixed with numerous conical tubercles, which are usually smaller than the interspaces between them but partly (especially on the posterior portion) as wide as the interspaces; ventral scales juxtaposed, not imbricate and similar to dorsal ones on the greater part of belly, loosely imbricate only on the small area before vent.

Limbs fairly long and relatively slender, covered with minute granular scales similar to those on the trunk; these scales are intermixed with many conical tubercles on their dorsal sides; digits not very long, rather stout, moderately compressed and gradually narrowing towards apices; infradigital lamellae small, 7-8 in number on both first finger and first toe, 14 on fourth finger and 17 on fourth toe; claws short, sharp, strongly compressed and triangular, each surrounded at the base by 6 or 7 enlarged longitudinal scales and distal infradigital lamella.

Tail robust, cylindro-conical, swollen at basal one-third and then tapering towards apex; the basal one-fourth of tail covered with coarse granular scales, ventral ones of which are much larger and more or less flatter than the dorsals and loosely imbricate; irregular transverse rows of conical or trihedral tubercles present on the dorsal side at basal one-fourth, the tubercles are evidently larger in the posterior rows than in the anterior ones; two large conical tubercles present on each side at the ventro-lateral position just behind vent; the apical three-fourths of tail evenly covered with minute granular scales, with a well defined boundary between this and basal parts.

Colour in Life (Adult Female): Body blackish brown on the dorsal side from the level of ear-openings to the basal one-fourth of tail, cream white on the ventral side excepting the apical three-fourths of tail; the dorsal side of head and of metafemora dark brown, those of limbs excluding metafemora greyish brown, evidently paler than the other parts on the dorsal side of body; each lateral side of head with a longitudinal pale brown streak from behind nostril through the under side of eye to ear-opening; rostral as well as supra- and sublabials greyish, each with a pale spot; mental yellowish white; digits greyish, with the ventral sides paler; claws yellowish white and translucent; the dark brown colour of the dorsal side extends ventrally on the basal one-fourth of tail.

Pink or pinkish markings present on the dorsal side (excluding the apical part of tail) as follows: 4 clearly defined pink bands, of which the foremost one is narrowest on the median line, situated on occiput and dilated on each lateral side at the dorso-posterior portion of ear-opening; the second band placed a little behind the roots of fore-limbs, dilated on the lateral sides and extending onto the basal parts of profemora; the third one placed some distance before hind-limbs and terminating on each side by an enlarged part; the fourth placed just behind hind-limbs and extending on each lateral side onto the basal part of metafemur, where it enlarges into a round spot; a well defined, round pink spot present at the apical part of each femur; narrow pinkish streak present on the median line from behind the first band to the back of the roots of hind-limbs; vertex and tibiae with irregular indefinite markings, which are pinkish or rather whitish; some of the conical tubercles on trunk, femora and tibiae are clear pink, forming peculiar patterns especially on the lateral sides between the second and third bands, as well as on femora and matatibiae.

The apical three-fourths of tail greyish black, somewhat paler on the ventral side, with scattered marble white spots. These spots are irregular and divided into three groups as follows: 4 spots forming a ring which is placed just behind the boundary between basal and apical parts; 3 or 4 longitudinal spots on the lateral sides and an elongate one on the apical half of median line; and several indefinite ones spread over the ventral side.

Description of Young: Body slenderer than the adult, with slenderer limbs and longer tail; scales on both the dorsal and ventral surfaces of head, trunk and limbs as well as on the dorsal surface of the basal half of tail minute and granular,

scales on the small area before vent larger than those on the anterior part of belly and loosely imbricate, scales on the dorsal surface of the apical half of tail as well as on the whole ventral surface of it much larger than those on the other parts of body; dorsal tubercles (excepting those on the basal part of tail) similarly scattered to those in the adult, but usually smaller and less prominent especially on the lateral sides of head. Mental large, with truncated posterior margin, bounded posteriorly by 4 minute scales.

Tail markedly different from that of the adult, including the inverse state of scales; the basal part cylindrical, exceedingly longer than that in the adult, occupying basal three-fifths of the whole length and provided on the dorsal side with more than 12 rows of conical tubercles, which become irregular near the base of tail; present a fold behind each row of tubercles; the apical part conical, somewhat swollen at the base and attenuated towards the tip.

Living colour unknown, but the characteristic markings quite similar to those of the adult (excepting those on tail), i. e., 4 bands on the dorsal side, a spot on the basal part of each metafemur and a round spot on the apical part of each femur; tail with a band at basal two-sevenths and large asymmetrical irregular spots on the apical half.

Measurements: Holotype: Total length: 121 mm; length from snout to vent: 76 mm; length from vent to the tip of tail: 45 mm; length from snout to ear-opening: 16 mm; width of head: 15 mm; length of fore-limb: 29 mm; length of hind-limb: 35 mm.

Paratype (young): Total length: 84 mm; length from snout to vent: 50 mm; length from vent to the tip of tail: 34 mm; length from snout to ear-opening: 12 mm; width of head: 10 mm; length of fore-limb: 20 mm; length of hind-limb: 25 mm.

Type-specimens: Described on the basis of two specimens (1♀ and 1 young), as given below:

Holotype: ♀ (preserved in 70% alcohol) (Jindé-gumui Cave, 23-VIII-1958, collected by S. UÉNO). Paratype: 1 young (preserved in 10% formalin) (Mikyô, VI-1957, by T. MATSUI).

The holotype is deposited in the collection of the Zoological Institute, Kyoto University; the paratype is in MATSUI's collection.

Type-localities: A limestone cave called "Jindé-gumui", at Kametsu, on the eastern coast of the Island of Tokunoshima; and Mikyô, Amagi-son, on the central massif of the Island.

Range: Endemic to the Island of Tokunoshima, one of the Amami group of the Ryu-Kyu Islands.

Notes: So far as known to the present authors, four species of banded geckos have hitherto been known to belong to the genus *Eublepharis*, i. e. *E. hardwickii* J. E. GRAY of central and southern India, *E. macularius* (BLYTH) of northwestern India and Transcaspia, *E. lichtenfelderi* MOCQUARD of the Norway Islands and Hainan, and *E. orientalis* M. MAKI of the Okinawa group of the Ryu-Kyu Islands

(the Islands of Tonaki-jima and Okinawa). The present new species is distinguished at first sight from all these species by the conspicuous pink bands on the dorsum and by the minute granular scales which cover the body surface. Its closest relative seems to be *E. orientalis*⁵⁾, from which it may be discriminated by the absence of enlarged chin-shields and by the difference in the number of labial shields, other than the features mentioned above.

Jindé-gumui Cave, the locality of the holotype, is situated on a hill at the western margin of the town of Kametsu. It is but 700 m distant from the seashore and has three different openings, developing horizontally just below the cultivated lands, though the openings are shaded by a cluster of grass. There are neither pools nor streams in this small grotto and, though some excreta of bats are found in the dark zone, the floor is relatively dry. Cave animals are therefore extremely scarce, no troglobiont having been obtained exclusive of a pselaphid beetle. Two arachnids, a chilopod (*Thereuopoda clunifera*), a tanypleurine pselaphid (new genus and new species), the present new banded gecko and a venomous snake (*Trimeresurus flavoviridis*) are all the animals the junior author could find there.

The holotype of the present new species was found in the dark zone of the cave. It rested on the wall of limestone and seemed not to be so active. When frightened by an approach of glittering light of acetylene lamp, however, it made a jump of fully 50 cm from the wall to the floor and dashed to escape into the spaces of a collapse. At that time, it ran on the four limbs without touching the abdomen to the ground, keeping both the head and tail raised and pointing the tip of the latter upward. It did not utter any squeaking sound when it was caught.

Several individuals of a pterygosomid mite were found around the eyes of the holotype of this banded gecko. According to Mr. Kenjirô KAWASHIMA, to whom the authors' thanks are due, the mite may belong to a new genus and new species. At our present knowledge, no parasitic mite has hitherto been reported from the Japanese species of geckos, and the discovery may be of a similar scientific value to that of its host.

It is most surprising that such a remarkable animal as the present new species has been remained undiscovered up to the recent times. It is impossible to know the natural habitats and habits of the Mikyô specimen, as it had died when it was secured by MATSUI. The great rarity and the peculiar habitats of the species, however, seem to have hidden it from the presence for long. It is not only attractive for a taxonomic interest, but is significant from the zoogeographical point of view. Some animals have recently been known on the Island of Tokunoshima to have close relationships to those of Okinawa rather than to those of Amami-Oshima. *Calliophis boettgeri* may be a good example among them (*Hemibungarus boettgeri*: Koba, 1956, p. 149; MATSUI, 1957, pp. 56, 58; HIRAIWA *et al.*, 1958, pp. 538, 541). The analysis of the distribution of geckos is a difficult and intricate task, because many of these reptiles may spread overseas by drift or by human agencies. However, the discovery of a representative of the genus *Eublepharis* on the Island of Tokunoshima

5) The holotype of this species is said to be deposited in the Zoological Institute of Kyoto University, but the authors have failed in finding it in MAKI's collection preserved in our Institute.

may be quite comparable to that of *C. boettgeri*, on the basis that this gecko is considered as a native inhabitant of the island.

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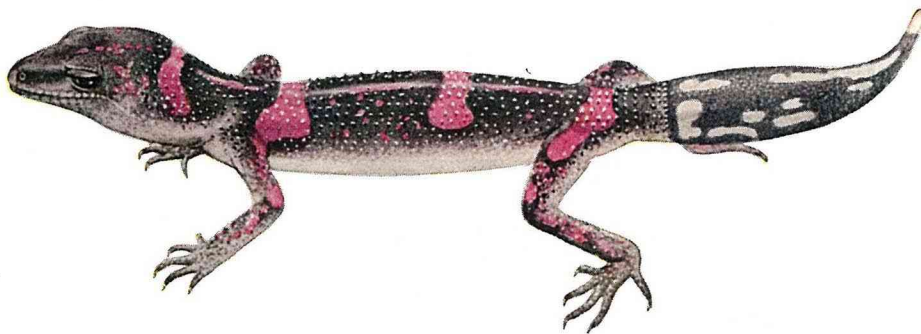


Fig. 1. *Eublepharis splendens* sp. nov., adult ♀ (holotype), of Jindé-gumui Cave, at Kametsu on the Island of Tokunoshima; colour in life; natural size.

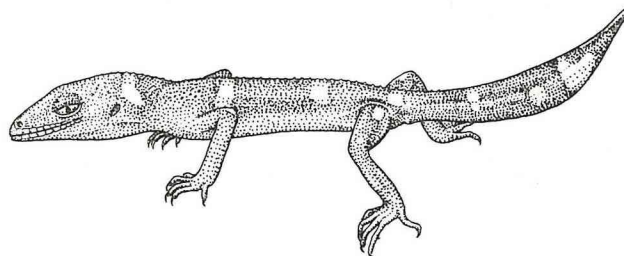


Fig. 2. Same species, young (paratype), of Mikyō on the Island of Tokunoshima; natural size.

del. Y. MAKINO