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A new monitor lizard from Panay Island, Philippines

(Reptilia, Sauria, Varanidae)*

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Varanus mabitang, spec. nov. is described from Antique Province, Northwest Panay, Philippines. The new species is closely related to *V. olivaceus* from South-Luzon, Catanduanes, and Polillo Islands, Philippines, with which it shares the general morphological appearance, the blunt teeth, a large caecum, and several aspects of its highly specialized feeding habits. It differs from *V. olivaceus* by its almost uniform black colouration, the different head shape with a slightly domed snout and a strongly bulging nasal and temporal region, the finer scalation and consequently higher standard scale counts, the tail with a triangular cross section and a well developed double keeled scale row on its crest, the strongly keeled ventrals, and an exclusively vegetarian diet at least in the holotype.

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Introduction

At present, the number of monitor lizard species occurring on the Philippine Islands is somewhat unclear. Well known is the allopatric distribution of three different forms of the *Varanus salvator* group, *V. s. marmoratus*, *V. s. cumingi*, and *V. s. nuchalis*, throughout the Philippines, and the occurrence of *V. olivaceus*, an endemic species of the Luzon region. The type locality of *V. rudicollis* is given by Gray (1845) with "Philippines". The specimen was collected by H. Cuming, supposedly at Borongan on Samar Island. However, as is known in the meantime, several of Cuming's distribution records are erroneous. No conclusive evidence that this species occurs on the Philippines has been forthcoming since then, and it is widely assumed that the type locality given for *V. rudicollis* is erroneous (e.g. Taylor 1922, Bennett 1998). Other authors (Mertens 1959, Auffenberg 1976) list it as part of the Philippine varanid fauna. Auffenberg (1988) mentions that it may be part of the Philippine fauna in spite of statements to the contrary, referring to a preserved adult specimen (FSM) supposedly coming from the Philippines. Auffenberg (1976) also lists *V. dumerili* for the Philippines, but corrects this as an erroneous report later on (Auffenberg 1988). All monitor lizards known from the Philippines so far belong to the large sized group, with a total length of 150 cm or above.

The recent discovery of another large monitor lizard (a specimen with a total length of 175 cm still was considered as modestly large by hunters) on one of the biggest Philippine islands suggests that this country may still hold some more monitors to be discovered in the future. In view of the highly secretive life habits of *V. mabitang*, it is not too surprising that it escaped scientific discovery until

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recently. To our present knowledge, this arboreal lizard is confined to some of the remaining rainforest patches on Panay, where it obviously spends most of the time hiding in tree holes or on branches of high forest trees. Its completely dark colouration further helps to disguise the shape of this animal within its natural, shady and densely vegetated surrounding. The newly discovered species is most closely related to *V. olivaceus*, with which it shares the general morphological appearance. Like *V. olivaceus*, *V. mabitang* has slit-like nostrils, blunt teeth, very large feet, enlarged scales on the head, and a large caecum.

Material and methods

About four years ago (in 1996), during the process of setting up a base for the work of the Philippine Endemic Species Conservation Project (PESCP) on Panay, E. C. was informed by different hunters from the NW Panay area about the existence of a black, very large, arboreal monitor lizard. This lizard was said to be very rare compared to the West Visayan form of the water monitor *(V. salvator nuchalis)*, which is widespread and common all over Panay. All informations pertaining to this "mystery lizard" were collected. However, it took more than three years until the first specimen of this lizard could be examined by project members. Since the project did not hold a collecting permit for reptiles during that time, the animal was released after a non invasive examination and picture taking.

To obtain data on the habitat, in March 2001 M. G. made a field trip to the area where the animal had been caught. The trip was guided by the project member N. Paulino, a former hunter with a profound knowledge of the flora and fauna within his range, the person whom we owe most of the information regarding the biology of the new species.

Only when we were in the possession of a permit including reptiles (Gratuitous Permit No. 93), N. Paulino was asked to secure a second specimen. It was finally caught on May 19th, 2001, and brought to the PESCP research station at Sibaliw in the West of the NW Panay Peninsula. The animal was kept alive in a large outdoor enclosure, until M. G. and the cooperating DENR member of PESCP, Mr. Nilo Subong from Kalibo, Aklan Province, Panay, were able to go there. For observations, picture taking, and trials on its food choice, the animal was kept inside the enclosure for another week (May 29th to June 4th, 2001).

Description of pholidosis (using a magnifying lense) and colouration, and biometric measurements were done immediately after death. For the first two days the animal was preserved in 7 % formalin, afterwards transferred to 70 % alcohol. On June 23th, 2001 the specimen was exported to Germany (CITES Export Permit No. 5571, issued by the Department of Environment and Natural Resources, Protected Areas and Wildlife Bureau, Quezon City, and CITES Import Permit No. E: 1884/01, issued by the "Bundesamt für Naturschutz", Bonn) for further examination and description. The body cavity was opened to determine the reproductive status, the development of the gastrointestinal tract, and its contents. For a closer examination of its dentition the head was x-rayed with a Faxitron 805 (Field Emission Corp. Ore., USA) in ZSM, and to obtain cross-sections without cutting, parts of the tail were moulded using "Palgat Plus" (ESPE Dental-Medizin GmbH & Co. KG, Seefeld), and the form later on filled with silica rubber, to obtain an easy to cut positive. Isotopic analyses were performed by the GeoBio-Center, Munich, with a Finnigan MAT Delta S. A Carlo Erba (EA 1108) elementar analyser was coupled to the MAT by a Finnigan Conflo-Interface. $^{15}N/^{14}N$ ratios are given by elevational delta notation ($\delta^{15}N$) *versus* air N_2 as relative standard.

For comparison, four *V. olivaceus* from ZFMK, Bonn, and two from PNM, Manila, were investigated. Not all scale counts and measurements could be taken from all individuals, as some had scars covering large parts of their bodies. For further comparison, data from Auffenberg (1988) were taken. He gives some scale counts and measurements for more than 100 specimens of *V. olivaceus*, and very comprehensive data on the feeding habits and biology of this monitor lizard.

Museum abbreviations: FSM: Florida State Museum, Gainesville; PNM: Philippine National Museum, Manila; ZFMK: Zoologisches Forschungsinstitut und Museum A. Koenig, Bonn; ZSM: Zoologische Staatssammlung München.

Results and Discussion

Varanus mabitang, spec. nov.

Type. Holotype: PNM 7272, female, caught in the South Pandan Forest, ca. 250 m a. s. l., Municipality of Pandan, Antique Province, NW Panay Island, Philippines, on 19 May 2001 by Narciso Paulino. – Due to the scarcity of this animal we collected no paratypes and we strongly advise to refrain from collecting further specimens at least as long as its population status must be considered as critically endangered. However, we possess some measurements, observations, and pictures from a second specimen, which actually was caught prior to the holotype, end of October 2000 (same person and same locality as holotype), and released unharmed after examination.

Diagnosis. *V. mabitang* can be distinguished from *Varanus olivaceus* Hallowell, 1856, as follows:

- Dorsal side black with scattering of tiny yellow dots on the posterior end of some scales of neck, back, and extremities (vs. greenish gray with darker transverse bands across neck, back, and tail, and extremities irregularly mottled yellowish-olive and gray);
- ventral surface of head, neck, tail, extremities, and belly dark gray to blackish (vs. grayish, grayish green, or yellow-gray with 3-4 longitudinal brownish black to black stripes on throat);
- nuchal scales adjoining head scales smaller than these (vs. same size);
- extremely small scales on neck, body, and tail, and consequently very high standard scale counts: scales from rictus to rictus 70 (vs. a maximum of 61, average 58,4), transverse rows of ventral scales from gular fold to a theoretical line connecting the insertion of hindlegs ventrally 124 (vs. a maximum of 121, average 109), transverse rows of dorsals from gular fold to a theoretical line connecting the insertion of hindlimbs dorsally 138 (vs. a maximum of 122, average 112), Tab. 1;
- tail triangular in cross section, upper scale crest with a well defined, double, longitudinal keel (vs. irregular oval in cross section, low double keel on tail hardly discernible), Fig. 1;
- head elongate, snout region slightly domed (vs. more massive with sloping snout region), Fig. 2;
- cranial table with well developed bulges above temporal regions (vs. flat);
- ventrals strongly keeled (vs. smooth or feebly keeled);
- scales of tail strongly keeled throughout entire length (vs. tail scales close to vent smooth), Fig. 3;
- exclusively vegetarian diet at least in the holotype (vs. a balanced molluscivorous-frugivorous diet).

Description of holotype (Figs. 4-7)

Habitus slender. Head forming a small, elongate triangle from above, with pointed and slightly domed snout. Nostril closer to tip of snout than to eye. Narial opening slit-like, angled upward posteriorly. Canthal ridge well developed between eye and nostril. Nasal region swollen, with a

Tab. 1. Scalation differences between *V. mabitang* and *Varanus olivaceus*. If no n is given, based on one individuum only. XVII. Scales from rictus to rictus in a straight line; XIX. Scales around midbody; XX. Transverse rows of ventral scales from gular fold to a theoretical line connecting the insertion of hindlegs ventrally; XXI. Transverse rows of dorsal scales from hind margin of head to gular fold; XXII. Transverse rows of dorsal scales from gular fold to a theoretical line connecting the insertion of hindlegs dorsally.

characteristics	*Varanus mabitang*, holotype	*Varanus olivaceus*, counts of specimens in ZFMK & PNM		Auffenberg (1976)	Auffenberg (1988)	
XVII	70 (n=2)	56.5 (n=4)	51-61	48	58.4 (n=106)	50-61
XIX	212	179.4 (n=5)	165-200	186	186.1 (n=106)	169-214
XX	124	104 (n=5)	95-107	111	109 (n=106)	101-121
XXI	53	42.4 (n=5)	40-45			
XXII	138	112.2 (n=5)	105-122			
Ventrals	strongly keeled	smooth (n=6)		not mentioned	feebly keeled (n=106)	
Double crest on tail	high, well developed	low, hardly discernible		not mentioned	low	

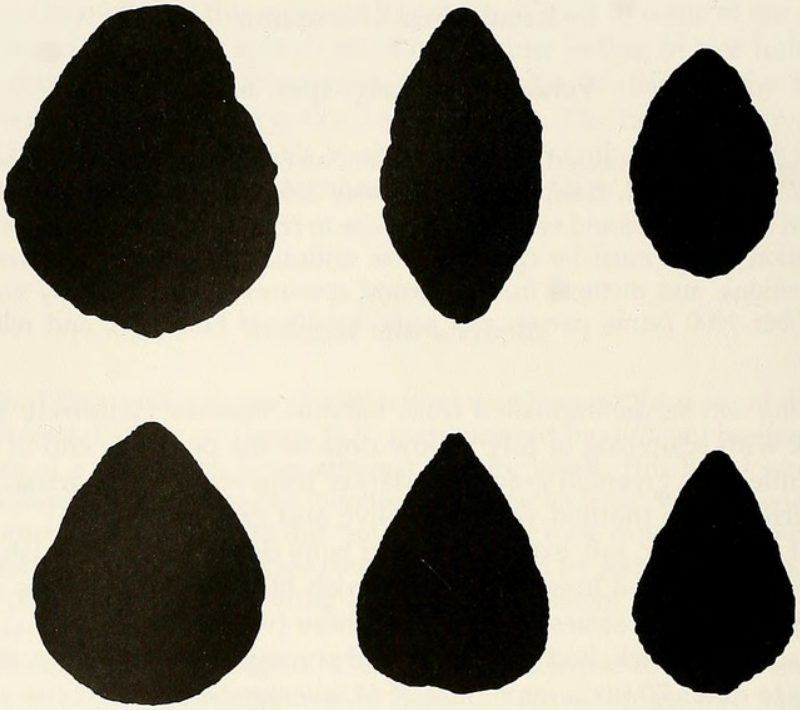

Fig. 1. Cross sections of the tail of *V. mabitang* and *V. olivaceus* (both females of almost same size), showing shape differences at one, two, and three head length behind vent (from left to right). The tail of *V. mabitang* (below) has a triangular shape in cross section, while the tail of *V. olivaceus* (above) is irregular oval.

median, longitudinal concave groove. Parietal region with prominent bulges above temporal regions. Two enlarged supraoculars left and right, distinctly longer than broad. Scale covering the pineal organ slightly enlarged, roundish, black with a yellowish-whitish centre. Scales on dorsal surface of head flat, relatively large, polygonal, largest in the intraorbital and parietal area. Each scale with six to eight pustules (plaques *sensu* Auffenberg 1994). Scales on sides of head in temporal region very small, oval. Scales on sides of head between eye and snout and below eyes enlarged, roundish to polygonal, with several pustules on each.

There are 10 maxillary teeth in one half of the jaw, they are roundish in transverse section, blunt posteriorly and conical anteriorly. The last two are very short, the following four are the longest, and the first four again small. There are five roundish, conical premaxillary teeth. The thirteen dentary teeth are round and blunt, gradually increasing in size posteriorly. Both in the alive and freshly dead lizard, the dentary teeth do not extend beyond the gum, being visible only as almost translucent, flat and round ovals within the gum.

Neck long and slender. Dorsal neck scales anteriorly roundish to ovally broadened, smaller than adjoining head scales. Posterior nuchal scales elongate, very small, and high domed; surrounded by wide interspaces with minute intercalary granules; each nuchal scale bearing a pore at its posterior edge. Dorsal scales longish oval, surrounded by minute intercalary granules; smallest between front limbs but not smaller than posterior nuchal scales, gradually increasing in size towards tail; keeled, with keels becoming much more pronounced posteriorly. Scales on sides of dorsum smaller than along the middle. Scales on neck and dorsum arranged in relatively regular transverse rows.

Scales below head enlarged at snout region, otherwise small; gular scales longish oval, arranged in more or less regular transverse rows.

Ventral scales larger than dorsals, longish rectangular, strongly keeled, with a well defined pit (external opening of a scale pore) on posterior part on each. On the border between ventrals and dorsals, each ventral scale row divides into two dorsal scale rows.

Dorsal scales of limbs longish, partly rectangular, high domed on front limbs and keeled on hind limbs, keels more pronounced on lower limb. Scales on undersurface of front- and hindlimbs roundish and flat. Very large, long fore- and hindfeet, with long and slender toes and very long, strong, curved claws (Fig. 4).

Scales on tail rectangular, strongly keeled, arranged in irregular whorls; scales larger on ventral than on dorsal side, the anterior ventral scale rows divide into two dorsal scale rows in irregular

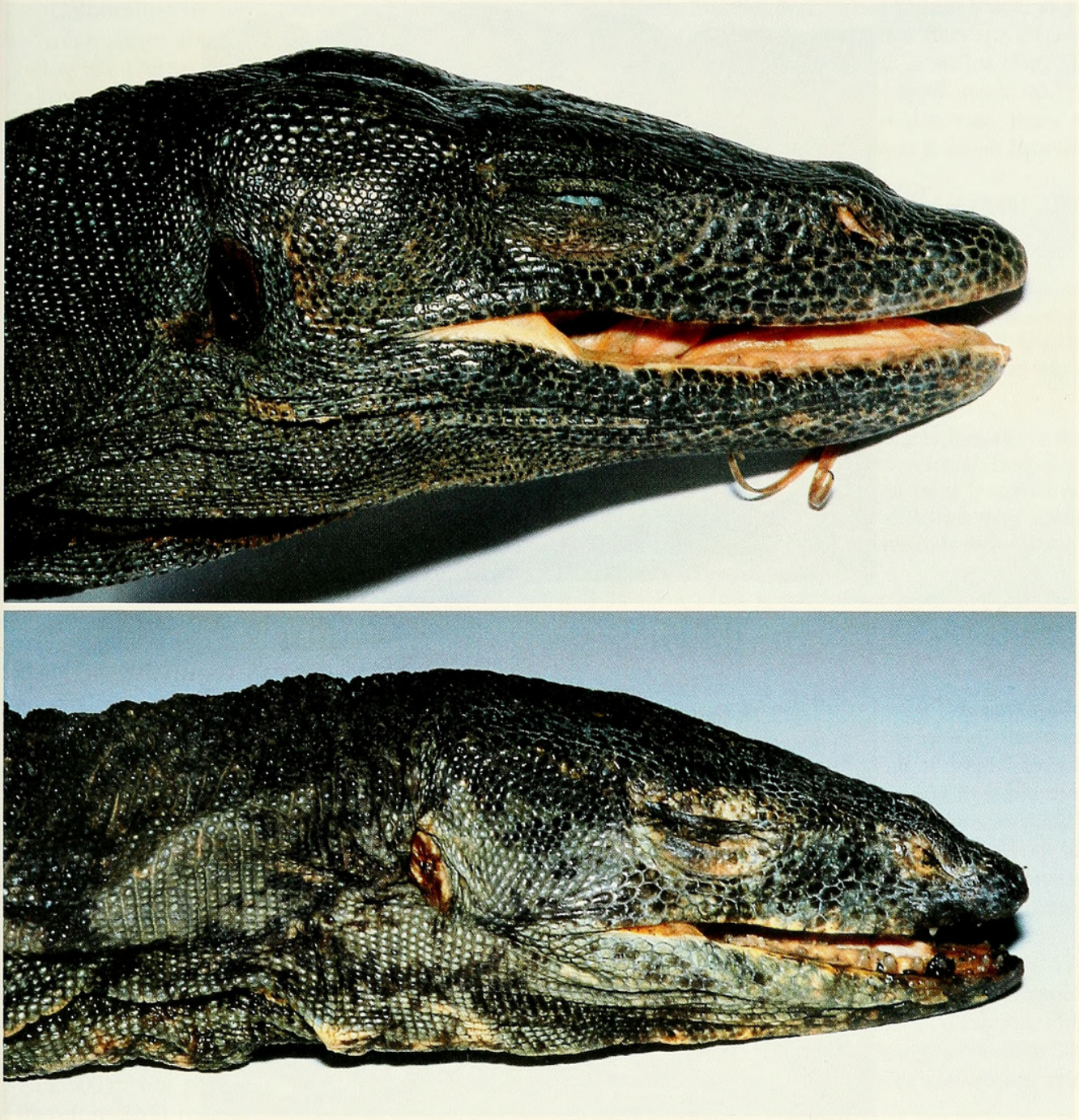

Fig. 2. Profiles of *V. mabitang* (PNM 7272) and *V. olivaceus* (ZFMK 57589), showing the more pointed and slightly upward turned snout of *V. mabitang* (above) and the sloping snout region of *V. olivaceus* (below). Both animals are females of almost same size.

distances at the tail base, after 12 scale rows every second ventral row divides, and after about one third of the tail, each ventral row divides into two dorsal rows. Upper crest of tail with prominent, longitudinal double keeled scale row. Tail slender, triangular in cross section, with a sharp upper edge defined by the double keel (Figs. 1 and 3).

Measurements. I. Total length: 1268 mm; II. Snout vent length: 527 mm; III. Tail length from cloaca to tip of tail: 741 mm, with some centimetres of tip missing; IV. Length of hindlimb from inner insertion of hindlimb to end of longest toe without claw: 227 mm; V. Length of forelimb from inner insertion of forelimb to end of longest toe without claw: 188 mm; VI. Length of head from tip of snout to anterior margin of tympanum: 89.9 mm; VII. Head width (maximum width between eyes and tympanum): 43.85 mm; VIIIa/VIIIb. Head height (above eye/maximum height between eyes and tympanum): 32.90 mm/35.00 mm; IX. Distance from anterior margin of eye to middle of nostril: 27.20 mm; X. Distance from middle of nostril to tip of snout: 21.85 mm; XI. Distance from anterior

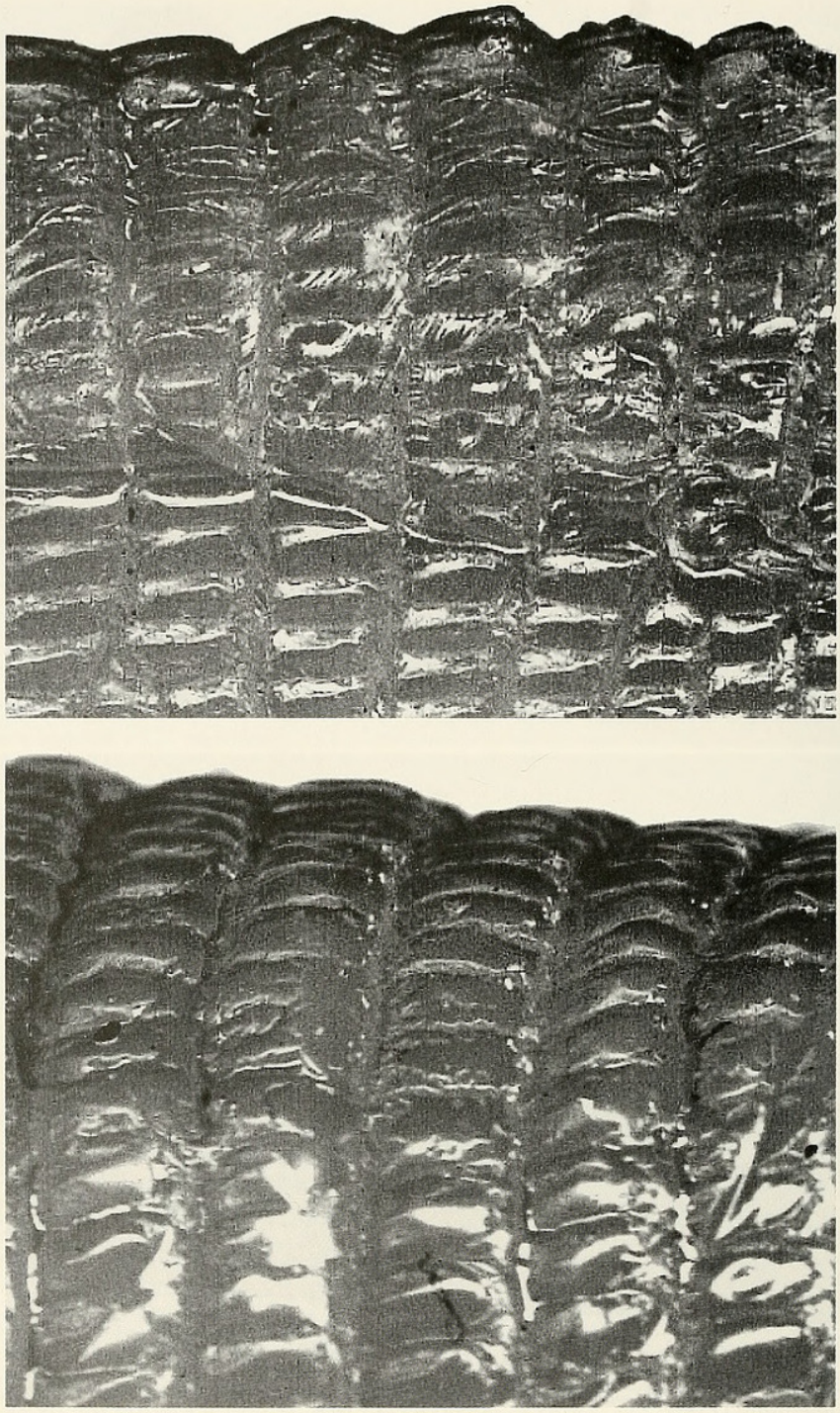

Fig. 3. Tail scalation of *V. mabitang* (above) and *V. olivaceus* (below) at one head length behind vent. Same animals as Figs 1 and 2.

margin of tympanum to anterior margin of eye: 42.30 mm.

Proportion indices. XII. Relative tail length (III:II): 1.41 (several cm of tail are missing!); XIII. Position of nostril between tip of snout and eye ((IX:X): 1.25; XIV. Position of nostril to snout tip ([VI-XI]:IX): 1,75; XV. Relative head length in relation to head width (VI:VII): 2.05; XVI. Relative head length in relation to maximum head height (VI:VIIIb): 2.57.

Scale counts. XVII. Scales from rictus to rictus in a straight line: 70; XVIII. Scales around tail base: 113; XIX. Scales around midbody: 212; XX. Transverse rows of ventral scales from gular fold to a theoretical line connecting the insertion of hindlegs ventrally: 124; XXI. Transverse rows of dorsal scales from hind margin of head to gular fold: 53; XXII. Transverse rows of dorsal scales from gular fold to a theoretical line connecting the insertion of hindlegs dorsally: 138; XIII. Scales around neck before gular fold: 160; XXIV. Ventrals from tip of snout to gular fold: 117; XXV. Supralabials: 35.

Weight. 1850 g.

Colouration (in life). Dorsal and lateral sides of head black. Nuchal and dorsal region black, skin between scales and some of the intercalary granules, especially on neck und anterior dorsum, partly yellowish. Dorsal side of extremities black, with a tiny yellow dot at posterior end of scales (Fig. 5), yellow dots most prominent on hindlimbs. Dorsal side of tail black. Ventral side of head, neck, body, extremities, and tail anthrazite. The yellow colouration is only visible at a short distance, from a distance of 2 m or more, the animal looks uniform black (Fig. 6). Claws dark grey; eyes reddish brown; tongue pink.

Special anatomical features. *V. mabitang* possesses a large caecum, such as *V. olivaceus*. PNM 7272 contains ovarian follicles of a size between 5 and 7 mm, showing that it is mature.

Additional material. End of October 2000 a much larger specimen of *V. mabitang* was caught by Narciso Paulino in the same area as PNM 7272 in the South Pandan Forest. This specimen was brought to our field station at Sibaliw, NW-Panay Peninsula, for examination and picture taking, and released afterwards. Total length: 1750 mm; snout vent length: 640 mm; tail length: 1110 mm; weight: 5750 g; XII. 1.73; XVII. 70 (scale count taken from pictures); no enlarged supraoculars.

The overall appearance is very similar to PNM 7272, but the habitus is more massive, and the bulges above the temporal region much more pronounced (Fig. 7), with only a small longitudinal groove between both bulges on the parietal region. The colour is black, with only very faint, tiny yellow dots on scales of front feet, and no yellowish colouration on neck and back. Scales on head largest in parietal region. The body scales are very small, with the anterior nuchal scales smaller than the posterior head scales, and the posterior nuchals same size as smallest dorsals.

Etymology. The name mabitang is used for this species since generations within its range by the local people. The meaning is somewhat like big monitor lizard (in Kinarayan dialect). The name is used as invariable noun in apposition to the generic name.

Distribution. So far, *V. mabitang* is only known from forested areas of the NW-Panay Peninsula and the Western Panay Mountain Range. The area belongs to the West Visayan region, one of the well distinguished Philippine faunal regions (Heaney & Regalado 1998, de Jong & Treadaway 1993, Leviton 1963, and others), which are characterized by a high level of endemism. It just now starts to show that Panay is an endemism centre on its own within this region. Recent faunal investigations revealed several species new to science, which to present knowledge are endemic to Panay (e.g. Brown et al. 1997, Brown et al. 1999, Brown et al. in press, Ferner et al. 1997, Gaulke in press, Gonzales & Kennedy 1996). The closest relative of *V. mabitang*, *V. olivaceus*, is distributed over southeastern Luzon, Catanduanes and Polillo islands. The area belongs to another faunal region, the Luzon region.

The vertical distribution of *V. mabitang* within the Panay mountain range is still unknown. We know from sightings that it occurs at least up to a height of 450 m on the NW Panay peninsula. Generally we assume that its vertical distribution is restricted by similar factors as in *V. olivaceus*. This lizard occurs in heights up to about 400 m. Important temperature and moisture changes between 300 and 500 m are probably limiting many of the food plants of *V. olivaceus* to lower elevations, and therefore limit its upper distribution (Auffenberg 1988).

Habitat and life habits. To our present knowledge, *V. mabitang* is a highly arboreal, secretive lizard of the lowland rainforest.

Both specimens defecated seeds of the fruit of screw palms after capture. In captivity, different kinds of forest tree fruit and land snails were offered to PNM 7272. While it fed on the fruit of two species of screw palms (*Pandanus* spp.) and on the fruit of a fig tree *(Ficus minahassae)*, it showed no interest in the snails. Even when crawling directly in front of its snout, the sole reaction was short tongue flicking. According to N. Paulino, *V. mabitang* does not eat any carnivorous food, only fruit and leaves. He witnessed them eating fruit of different screw palms (*Pandanus* spp.), of a palm tree (*Pinanga* sp.), of a fig tree *(Ficus minahassae)*, and leaves from screw palms and a kind of shrub (local name is "topsi"). When opening the stomachs of some individuals previously, he found seeds and leaf remains.

These observations are surprising, because no exclusively vegetarian monitor lizard is known so far, and no monitor lizard feeding on leaves. To verify the observations, the stable isotope compositions of nitrogen of PNM 7272 was analysed for scaling its diet and trophic level (see Schoeninger et al. 1997 for methodology). We analysed fruit and leaves of screw palms, fruit of fig trees, and also claw material, different soft tissues, and contents of the gastrointestinal tract . The plants range at –0.1 to 1 ‰ $\delta^{15}N$, and the biomass of PNM 7272 is shifted by around 1.5-3.1 ‰ $\delta^{15}N$. This coincides with only

Fig. 4. *V. mabitang*, see the long fingers and claws.

Fig. 5. *V. mabitang* (PNM 7272), showing the yellow dots on posterior scale edges on neck and forelimbs.

Fig. 6. *V. mabitang* looks uniformly black when seen from some distance.

one single step in a food chain (Fry 1988). The food ingested by this lizard has to be expected at near 0-1 ‰ $\delta^{15}N$. Significant amounts of carnivorous diets can be excluded, because this should shift the nitrogen isotope composition towards values near or above 6 ‰ $\delta^{15}N$. A publication of the nitrogen isotopic composition of *V. mabitang* (near 3 ‰ $\delta^{15}N$) and *V. olivaceus* (near 9 ‰ $\delta^{15}N$) is in preparation at the GeoBio-Center Munich.

The exclusively vegetarian diet is one of the most unusual features of PNM 7272. So far, *V. olivaceus* was the only known varanid with frugivorous feeding habits. Auffenberg (1988) proposed for *V. olivaceus* an evolutionary dietary shift from insectivory or faunivory to frugivory, which neccesitated special adaptations in its gastrointestinal tract like the large caecum. So far *V. olivaceus* did not complete this evolutionary shift, it is a molluscivorous-frugivorous animal, with both food components being of equal importance for its nutrition. As main reason for its still partially faunivorous diet, Auffenberg (1988) mentioned that fruit is an adequate source of carbohydrate, but is generally inadequate in

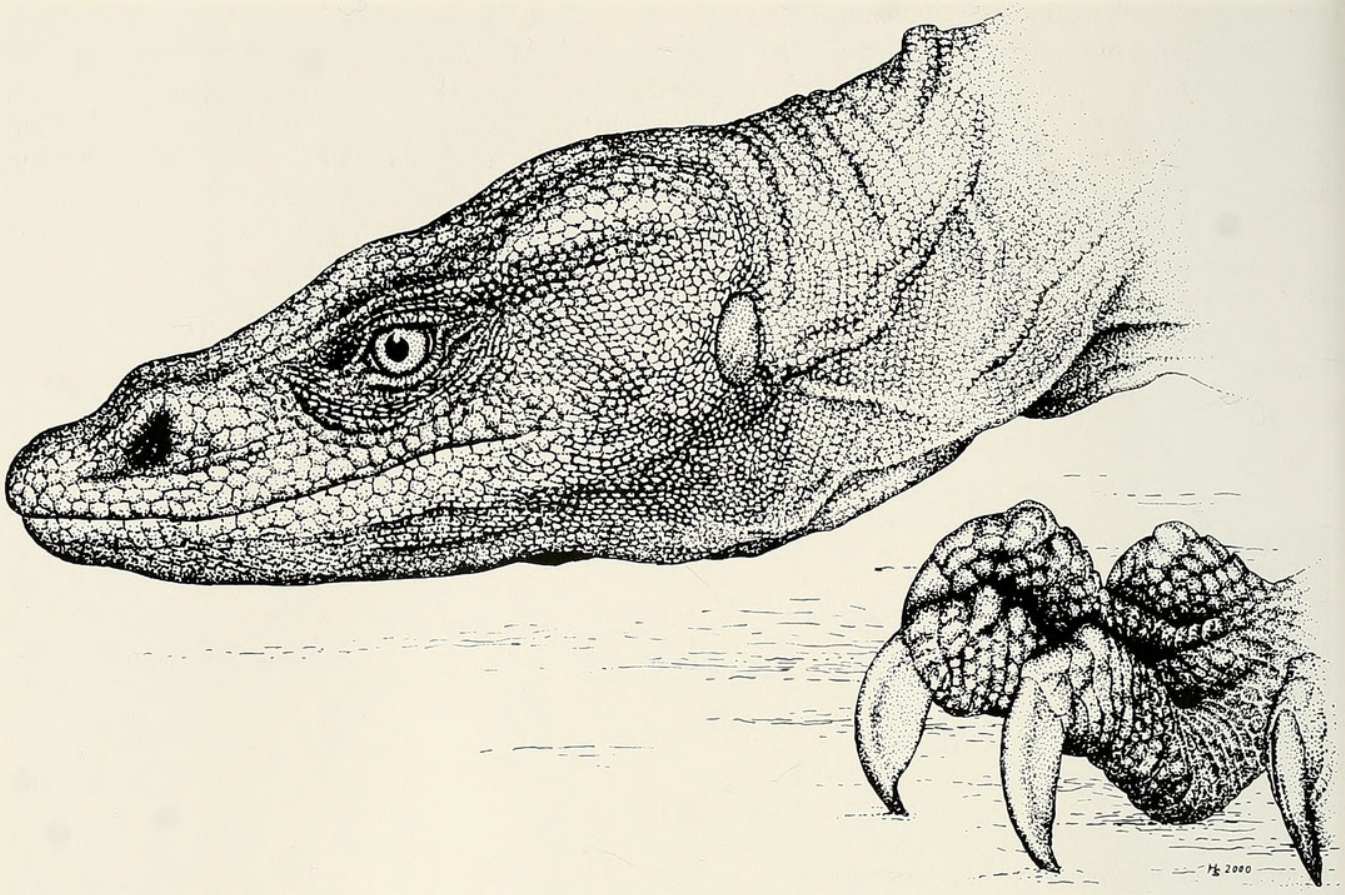

Fig. 7. Profile and hand of the first caught, large *V. mabitang* (175 cm), drawing by Helga Schulze.

protein. By feeding on land snails, in much less important percentages also on other animals like insects, arachnids, and vertebrates, *V. olivaceus* compensates this lack in protein, and at the same time adds calcium to its diet. Auffenberg (1988) refuted that *V. olivaceus* ever feeds on leaves as stated by some of the local inhabitants. While dissecting more than 100 specimens he never found evidence of leaves, nor did they take leaves in captivity or were observed feeding on leaves in the wild by any of the project members.

From the isotopic measures we conclude that PNM 7272 is unique among all other varanids. The nitrogen isotope measures inevitably fit with the herbivorous diets discussed. The general appearance of PNM 7272, the well developed ovarian follicles, and the well developed fat bodies give no indication that this specimen was suffering from malnourishment. Nitrogen isotope analyses of claw material and muscle tissue of the folivorous-frugivorous sailfin lizard *(Hydrosaurus pustulatus)* from the same habitat range at 1.5 to 1.9‰ $\delta^{15}N$, and this is nearly identical to the $\delta^{15}N$ level observed in *V. mabitang*. For the mabitang one may presume a continuous evolutionary line, shifting from a mixed faunivorous-frugivorous diet to a frugivorous-folivorous diet.

So far, we have data for one animal only. Future investigations will show whether the trend towards an exclusively vegetarian diet has been reached in *V. mabitang* in general.

Both animals behaved very timid after capture. They never tried to defend themselves or showed any sign of threatening behaviour typical for monitor lizards, like tail coiling and uncoiling, gular extension, or hissing. Being held, they let extremities, tail, and head hang down. Most remarkable were the extended periods of time, which both animals spend in complete tanatosis (no movement could be observed for two consecutive days in PNM 7272). Letisimulation was never observed in *V. olivaceus* by Auffenberg (1988), but is described for *V. exanthematicus*, an African monitor lizard, by Barbour (1926). According to N. Paulino, feigning death is a common behaviour of the mabitang after capture.

Systematic relationships. *V. mabitang* is closely related to *V. olivaceus*, whose phylogenetic relations to other varanids still is subject to discussion, in spite of all studies done on the latter (e.g. Auffenberg 1976, 1978, 1979a, 1979b, 1988). In 1962 the monotypic subgenus *Philippinosaurus* was erected for *V. grayi* (now *V. olivaceus*) by Mertens, based on different skull features and the dentition. Auffenberg

(1976) accepted the subgenus *Philippinosaurus* in his redescription of *V. grayi*, but later on (Auffenberg 1988) classified this species among the "slit-nosed" monitors, and as being closest to *V. bengalensis*, a member of the subgenus *Empagusia*. In a pers. comm. (cited in Böhme 1991) he later on stated that a relation to *V. salvator* is also feasible. Based on the investigation of its hemipenial morphology, Böhme (1991) supported the idea of a rather isolated position (see also Ziegler & Böhme 1997). Based on the investigation of DNA sequences, Fuller et al. (1998) place *V. olivaceus* in close relationship to *V. prasinus*, a much smaller, arboreal monitor lizard from New Guinea, which was classified within the Australian subgenus *Odatria* by Mertens (1942), but according to its hemipenial morphology belongs in the Asian subgenus *Euprepiosaurus* (Böhme 1988). From this short overview, it is obvious that we still are far from a satisfying resolution of the phylogenetic relationship of *V. olivaceus*, and therefore also of its close relative *V. mabitang*. The results depend highly on the method used.

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