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Frontispiece: *Philochortus zolii*.

Photo: Herman A.J. in den Bosch

Observations on the Egyptian Grass-loving Lizard, *Philochortus zolii* (Lacertidae)

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Photos by the author unless indicated otherwise.

INTRODUCTION

The North African genus *Philochortus* Matschie, 1893 currently comprises seven species, each of which has only modestly been published about. I was therefore pleased to be invited on a field trip concentrating on various lacertids in Northern Egypt, and looked forward to collecting *Philochortus zolii* Scortecci, 1934. My main hope was to learn more about the lizard's reproduction, ethologically, especially its courtship behaviour, as well as its reproductive capacity (number of clutches, number of eggs per clutch and per individual). As we spent three days in the lizard's habitat and actually stayed the night in our sleeping bags, we did get a cursory impression of the general behaviour of the species in the field.

MATERIAL AND FIELD NOTES

My five specimens of *Philochortus zolii* were collected in Wadi Natrun (Egypt), 30°.425.33 N/ 30°.286.53 E, April 21-23, 2006 by hand and by using a sling.

The animals only tongue-flicked inquisitively at the sling but were quite wary when approached by hand.

We explored the location (fig. 2) for several days, starting as early as 7:00h when it was still fairly chilly that early in the year and sometimes cloudy, and finally found the species on the third day after 10 am. The three specimens that were initially found, were smaller subadults while all later finds were larger



Figure 1. Young specimen *Philochortus zolii*.

Photo: Philippe Geniez



Figure 2. The habitat with clumps of Halfa grass near Wadi Natrun.



Figure 3. A more general view of the surroundings.

animals. All five lizards that were collected, were first noticed at the base of tussocks of Halfa grass (*Desmostachya bipinnata*) or in the more open but prickly growth of *Fagonia* cf. *aegyptia*. *Desmostachya bipinnata* has a wide distribution and is native to north-east and west tropical, and northern Africa, countries in the Middle East, and temperate and tropical Asia. It varies in height from 30 to 150 cm. The stems are much branched, tufted and profusely rooted, and it branches from the rootstock, sending out rhizomes in all directions (POWO, 2020). Although not seen in or at the base of *Tamarix* bushes, the lizards might well be using those as well. *P. zolii* seems to avoid the more salty areas (recognisable to us by their white crusts).

One lizard with part of the tail missing was noticed in a neighbouring, considerably less vegetated, piece of land (fig. 3). All animals were found alone, dozens of metres apart. When disturbed, the lizards repeatedly ran very quickly for at least 5-10 m to hide again in the bushes or bask at the base thereof. While basking on the ground, the *Philochortus* made some sideways movements. We have not seen them higher up in the Halfa, but presumably they are quite able to clamber the stalks using their very long tail in the way one lizard showed on the collecting rod after being caught with the sling at its end (fig. 4).

This early in the year few invertebrates suitable as food for the lizards were noticed. Most common were ants, some flies, large spiders and various Odonata resting in the grass. Other herps that were seen in the area: during daytime only *Acanthodactylus* cf. *boskianus* was found when the *Philochortus* were also active; at night *Spalerosophis diadema*, *Tropicolotes tripolitanus*, *Sclerophis regularis*,

Bufotes boulengeri, and somewhat further afield *Cerastes vipera*, a common viper in Northern Africa.

A short, quasi-aggressive interaction with the *Acanthodactylus* was observed: they approached each other but at a distance of 30-40 cm dashed in opposite directions. Who fled from whom was unclear.

We visited other seemingly suitable areas in Wadi Natrun as well, but did not find any *Philochortus*. It might be that many of these localities were too salty (as exemplified by the white crusts on the earth), or too disturbed in every sense of the word.

WADI NATRUN

As the name implies Wadi el Natrun was and is a source of hydrated sodium carbonate, already exploited by the ancient Egyptians who used that in the mummification process. Not so long ago, fresh water aquifers — probably



Figure 4. How *Philochortus zolii* uses its tail around the stick with sling; in a more pronounced fashion as when moving through the grass clumps.

fed subterraneously by the Nile — were discovered which stimulated a multitude of small-scale, apparently frequently unsuccessful agricultural attempts. Although understandable with an annual population growth of near a million persons/year in Egypt, most parts of Wadi Natrun were and are consequently massively messed up (fig. 5). The soil is a mixture of clay and sand, mainly sandy in the habitat of *P. zolii*. One of the crops that was attempted in the area of the *Philochortus* habitat, sunflowers, hardly developed seeds and were not even harvested which left behind a ruined area.

HOUSING AND FOOD

The lizards were initially housed in two different vivaria: three specimens in a 45x45x115 cm glass vivarium, and two in a 30x30x40 cm vivarium. After two years all were housed together in the larger one. Both containers had peat dust and coarse sand as floor covering, with some stones, branches and stiff grass or reeds added to imitate the Halfa in Wadi Natrun. Light and heat was provided by 25-60 W incandescent bulbs, three in the larger terrarium that also received sun in the afternoon, and a lower wattage of 25-40 W in the smaller one. Of course, during summer the bigger container was partly shaded to prevent over-heating. In the cooler months the lower lamp-wattage was used. They were fed with locally collected Dutch invertebrates, crickets (*Acheta domestica*), mealworms (*Tenebrio molitor*) and Lesser mealworms (*Alphitobius diaperinus*), all dusted with a mineral preparation (Gistocal). Drinking water with added water-soluble 20.000 i.u. vitamin A and 40.000 i.u. vitamin D₃/l was available ad libitum. The larger animals seemed to prefer mealworms, the smaller ones crickets. In summertime various invertebrates (flies, grasshoppers, spiders, butterflies and their larvae) were actively hunted when released into their housing – where it became clear how fast they could move.

Substrate temperatures of maximally 50°C were reached under the 25-60W incandescent spotlights. Ambient temperatures varied between 18-30°C. Plastic boxes (13x17x6 cm) filled with moist potting soil provided a medium for oviposition.



Figure 5. Wadi Natrun is definitely not an undisturbed area.

FAECAL PELLETS

Analysis of the four faecal pellets collected from the animals while in transit provided no great surprises. Each pellet contained pieces of small Coleoptera, three included tiny ants (remarkably mostly heads), and two showed parts of little spiders. Only one pellet contained some grains of sand (< 5% volume), which seems an amazingly small quantity considering the habitat.

ECOLOGY

Philochortus zolii inhabits semi-deserts near oases with some clumps of grass and sparse bushes like *Tamarix* and sparse stands of *Alhagi graecorum*, commonly known as manna tree. It will also use the leftovers of nearby attempts to grain-growing. Various other smaller and less prominent plants can be found in the habitat. Several patches seem to be devoid of vegetation, at least at the time when the lizards were collected.

HABITS

We spent three days near Wadi Natrun, also taking stock of other possible *Philochortus* habitats there. On the last day, together with Sherif Baha el Din, we found several specimens. Six lizards (presumably four more or less adult specimens, and two subadults) were caught. One adult female went with Sherif who released her in the garden of his new home, which was reminiscent of the original habitat, hoping that she would be the foundress of a new population.

The five other animals were transferred to Leiden; Sherif thought a breeding program would be a good idea since their habitat disappears rapidly because of poor recent agricultural practice. Naturally, I was interested in learning more about their reproductive behaviour so a partnership was begun.

BEHAVIOUR

When caught with a sling, the animals quickly spiralled their tail around the string and/or catching stick (in this case a thin part of a fishing rod) in a way very much reminiscent of a picture in ARNOLD's (1989) paper on various African lacertids where fig. 12 showed a *Podarcis muralis* curling its tail in a less extreme manner. Remarkably enough, all the animals we spotted, were at the base of the tufts of grass (fig. 2), not in it as you would expect from this behavioural pattern and their general morphology. Further, on a flat surface (=quarantine vivarium), they performed a peculiar walk: it looks as if they put their heels first on the surface, then the foot sole and toes follow and with the legs held widely apart (cf. ARNOLD, 1998).

There does not seem to occur a seasonal colour change during the year, although older specimens seemed to show less contrast dorsally and the tail turns to a beige.

In the vivarium the spotlights were switched on from 9:30-15:00h in the summer months. The *Philochortus* emerged, and became active, about an hour later, after basking. They disappeared usually 1-2 hrs. later. Only in the



Figure 6. Head portrait of adult *Philochortus zolii*.

beginning of March the lizards remained active longer, up to 15:00h, but then disappeared even when the sun still shone in their vivarium as it did usually during less cloudy days, in the afternoon. Later in the summer season they were sometimes active up to 17 o'clock. This is in contrast to the majority of *Lacerta* s.l., *Podarcis*, *Psammodromus* and other Western Palearctic lacertids I have cared for over the years. While basking they intermittently opened their mouth for just a few seconds. A way of cooling down the head while the rest of the body still 'needs' some heat? Since there was no indication of any sickness, shortness of breath was ruled out. Towards the end of November most specimens hardly showed themselves anymore, they began to appear more regularly near the end of February, but only in March/April did activity increase somewhat. This may well be related to the more sunny conditions outside in The Netherlands. In February they appeared more regularly, but mainly between 10-11h, in March until 15:00h. In Nov-Dec only one specimen (female?) was clearly visible, although another lizard could sometimes be discerned under the dead grass where the vivarium was closest to the radiator in the living room. This practice remained somewhat the same over the years. When exactly they prefer to drink was unclear until one early morning an animal crept out from under a stone and immediately headed for the drinking nap. One may interpret this as logical since in the desert some water in the form of dew may only be available in the early morning.

It is common for lacertids in my vivaria to jump up to the gauze top covering and hang on belly-up. However, the *Philochortus* seemed to prefer to have their back up and their belly towards the floor (fig. 7). They can even run quickly without any awkward movements that way, potentially because their long legs easily spread out (see Discussion and photos). Additionally, they showed a peculiar kind of walk in 'normal' locomotion, with their heels touching the substrate first and with a rolling movement the rest of the foot is put down. The whole gait appeared rather spread out, which certainly seems fitting when moving in the grass.

At the end of July 2008 I observed for the first time three 2-3" long bites in the tail of another



Figure 7. How *Philochortus zolii* walks along the with mosquito gauze covered top of the vivarium, with its back upward.

specimen. To me this seemed like an introduction to courtship as I experienced such in many other lacertid species. However, no follow-up occurred and they parted without any other actions. On 5 and 12 July 2009 I saw two very 'emaciated' specimens with flattened bellies, presumably females and consequently searched the whole terrarium but did not find any eggs.

Early morning July 10, 2009 I noticed a small hole in the vivarium substrate very near a piece of bark, which next appeared to be closed by early afternoon and during the night. One of the smaller specimens was responsible for this first hole. The closing occurred from the inside by pushing substrate outside with the tip of the snout and the front legs. A larger specimen seemed to have taken up residence under a large stone. There the potential opening and closing was hard to observe because the vivarium is in the corner of the room near the window. In the field I did not see this opening and closing, but when chased did see them using these initially inconspicuous burrows as an escape route (fig. 8).

Although they walked around after basking for a while in the vivarium, it is difficult to say the *Philochortus* really often actively hunted for food. In contrast to many lacertids, they seemed to be fond of mealworm pupae, but then again they may cross these repeatedly without noticing that as a food item and only

when given by tweezers (often the same pupa!) and held in front of them, was it grabbed and eaten. I rarely saw them running after any of the insects or spiders presented. They surely must do so in the wild? The lizards dug enthusiastically, even so much that smaller stones became displaced. They often remained subterranean for longer periods, with a predilection for warmer spots in their housing. In December and January the *P. zolii* showed themselves even more rarely and I switched off the light sometimes for several days as in their natural habitat temperatures may then fall well below 10°C and some kind of hibernation could be likely. In that period most lizards remained hidden, although on close observation one or two were spotted among the dried grass tussocks.

Even after having kept them for several years,



Figure 8. Holes in the desert soil dug by *Philochortus zolii*.

none of the specimens had an even slightly swollen tail-base, often seen in male lizards, and none of the femoral pores exuded the waxy rods so characteristic of reproductive males. Only in one or two, the largest lizards, the diameter of the femoral pores grew a bit larger.

Suddenly a first death happened 24 May 2010, probably a female. Later that year, and into 2011 all the animals died. After consultation and autopsy and discussion by veterinarians at the University of Utrecht, it became clear that the cause was a spoiled vitamin D₃ preparation. Unbeknownst to me this had been stored in the deep freeze by the apothecary who prepared the vitamin supplement. This was extremely disappointing. Possibly the effect of the absence of the vitamin took hold relatively fast in *Philochortus* as one can presume desert lizards normally receive a large dose of UV which helps in forming vitamin D₃ under natural circumstances.

THREATS

Apart from the obvious disastrous human influence (fig. 5), it is to be feared that the many botched attempts at agriculture in Wadi Natrun will seriously hamper the survival of the only known Egyptian population of *P. zolii*. This lizard no doubt is prey to some birds, and to the night-active snake *Spalerosophis diadema* found in the area, that is especially fond of lizards. I am, however, unsure if the snake captures them in their burrows (fig. 8), or out in the open during dawn and dusk. From my own experience *S. diadema* is rarely if ever active in daytime during the warmer months.

DISCUSSION

The genus *Philochortus* has not recently been reviewed. Especially the curious ostensible absence of any members of the genus between the occurrences of *P. zolii* in Egypt and Libya is remarkable, as is the over 1000 km in distance. Other members of the genus are found in Algeria, Djibouti, Eritrea, Ethiopia, Kenya, Mali, Niger, Saudi Arabia, Somalia and Yemen. As BAHÄ EL DIN (2006) and KAMAL et al. (1966) provisionally treated the Egyptian specimens as *P. zolii*, for now it seems best to follow suit. And indeed, as the

nearest species, *P. intermedius* (a name previously used for the Egyptian species) lives much to the south (Djibouti, Eritrea, Ethiopia) and as such being an unlikely candidate for the Egyptian form. The curious gap of around 1000 km between the Egyptian locality Wadi Natrun and the Libyan one near "Ajdabja" (= Ajdabiyah?), with no *Philochortus* records in-between, was already mentioned by MARX (1986). By the way, SCORTECCI (1934) reported a find in the oasis Elbarkat (Libya) in March. No up-to-date work on the genus exists, although BAHÄ EL DIN (2006) fairly recently discussed *P. zolii* Scortecci, 1934 and *Philochortus intermedius* Boulenger, 1917. It may well be that more thorough investigations will noticeably change the summary of species or fill in the distance between the two North African localities.

One specimen concerns *Philochortus zolii* Scortecci, 1934 (MCZ 46850) which according to MARX (1968: 19) says "35 miles west of Ajedabja, 10 miles south of Libyan coast". This is ridiculed by SCHLEICH et al. (1996) "as the Mediterranean lies 15 km W of Ajedabia". In my opinion this was a simple typo, as Marx was prone to these (Van Wallach, pers. comm. 21 Nov 2007), with ten miles being approximately 15 km, thus no need to be so scornful. As the city Agedabia is variously spelled as Adzedabia, Agedabia or Egdabya, and it lies 12 km from the coast, this most likely indeed is the locality of the collected specimen. Moreover, Van Wallach checked the handwritten labels in the collection for me and mentioned that "in Loveridge's script this reads as follows": (46850) "35 miles west of Agedabia, which is 10 miles south of coast of Libya/Cyrenaica" (Van Wallach, pers. comm. 21 Nov 2007).

The daily rhythm in the vivarium, certainly in the first year, was understandably comparable to what we noticed in the wild, although that was just a few days in early Spring. Still, this certainly was not my first acquaintance with lizards in a desert-like area, having been to various areas in the Middle East and Morocco, and having spent some time in a field lab in the Sinai at various times later in the year. It is obvious that great summer heat is avoided, as well as the early mornings when day-active lizards cannot quickly reach their activity temperature. Similarly they are less active in the cooler winter months of say



Figure 9. *Philochortus zolii* subadult.

November-February. The grass-loving aspect was never clearly demonstrated in captivity. The main attraction seemed the need for a cooler or warmer spot, be that grass, bark or a piece of stone.

Predation pressure seemed to be relatively low since, of the specimens observed, only two showed a partly damaged tail. It took almost four months before the tail of the single lizard, which lost a part of its tail while being caught, started to regenerate. Remarkably, the regenerated part was just as brightly vermilion-orange as the original tail; in several Eurasian forms that is not always the case, with the newer part ordinarily being brownish or grey. At the end of July 2006, just 12 mm had regrown, in November regeneration reached 55 mm, then remained at a standstill.

Unsurprisingly, as several animals were judged subadults when caught, the lizards grew in weight and size (tables 1-3): from an average of 4.07 g (2.34-6.81 g) in May 2006, to 6.24 g (5.12-7.98 g in January 2010), and 55 mm head-body to 61 mm. Because of slight measuring inaccuracies (the animals do not always keep still) mistakes of a few mm may

occur. Tail-lengths also increased, but as partial tail loss was seen (due to interactions? but not witnessed) will not show an ideal growth curve. A maximum of 190 mm was noted. Also, as sexes were very hard to discern in my sample, a male-female distinction could not be confirmed. BAHÄ EL DIN (2006) gave a snout-vent length of 73 mm, slightly larger than the maximum of 69 mm which I measured in a fully relaxed animal. The dorsal body striping fades somewhat over the years to a less contrasted pattern in which beige dominates, but does not disappear (see figs. 1, 6 and 9). Especially the younger animals show an amazing colour pattern of longitudinal stripes of almost white and black, with a vermilion tail. The bright vermilion to orange tail colour also becomes less bright, but this may also be the result of a lack of ultraviolet in the vivarium. SCORTECCI's (1934) specimen measured head-body 47 mm; a subadult compared to the data presented here (assuming Libyan and Egyptian *Philochortus* are the same species). MARX (1969) gave as snout-vent length 52-73 mm and the tail length of six specimens with complete tails 149-215 mm; maxima not reached by my sample. The

Table 1. Data on length, weight, and colour of the five wild-caught *Philochortus zolii* May 2006. (HB+tail = head-body length + tail length; * tail partly regenerated; ** lost when captured. Ventral colour = snout tip-cloaca, dorsal colour = snout tip-above cloaca dorsally as well as laterally, tail colour both ventrally as dorsally = Pores: - underdeveloped without waxy rods protruding; ± developed but without waxy rods protruding; + developed, waxy rods protruding.)

Specimen	HB+tail (mm)	Weight (g)	Femoral pores	Ventral colour	Dorsal colour	Tail colour	Remarks
1	50+150	3.00	-	white	1)	orange	4)
2	54+166	3.87	-	white	1) but slightly brighter	orange, base slightly less intense	4)
3	48+51+ ...**	2.34	-	white	1)	orange	4)
4	68+155*	6.81	-	white	2)	light beige with slight orangey hue	4)
5	57+166	4.36	-	white	3)	pale orange	4)

- 1) Dorsal band dark brown, flanked by thin dark-beige lines that fuse on the dorsal part of the base. Lateral bands very dark-brown, almost black, ventrally bordered by slightly broader stripes (than the dark-beige ones as described above) of light crème. The lateral band starts to show a blocked pattern (light brown alternated with very dark brown. This band is edged by an almost as wide very light coloured one. Thereunder a very thin, somewhat irregular light-brown band. The belly is snow white.
- 2) Bands as in 1), but lighter pale beige. Lateral band still clearly showing a blocked pattern.
- 3) Bands as in 1), darker than in 2) but clearly paler.
- 4) Hands, feet, fingers and toes, and legs anteriorly, show a reddish tinge which colour is more pronounced on the posterior limbs.

Table 2. Data on length, weight, and colour of the five wild-caught *Philochortus zolii* in March 2007. (Legends as in table 1.)

Specimen	HB+tail (mm)	Weight (g)	Femoral pores	Ventral colour	Dorsal colour	Tail colour	Remarks
1	53+165	3.34	-	white	2)	orange	4)
2	60+176	5.17	-	white	2)	distally very faint orange, rest almost beige	4)
3	52+54+ 55*	3.01	-	white	1)	very faint orange, almost beige	4) but pale
4	69+160*	7.10	-	white	2) though hardly chequered, and quite pale	greyish-brown	4) but pale
5	57+178	5.38	- but larger diameter	white	2)	grey-beige	4) pale

Table 3. Data on length, weight, and colour of the five wild-caught *Philochoortus zolii*, measured January 2010. (Legends as in table 1.)

Specimen	HB+tail (mm)	Weight (g)	Femoral pores	Ventral colour	Dorsal colour	Tail colour	Remarks
1	67+157	5.62	-	white	1)	light orange	4) sunken flanks
2	60+180	7.13	-	white	3)	greyish-pinkish orange	4)
3	58+100+48*	5.35	-	white	2)	very faint orange dorsally, pinkish-orange ventrally	grey-beige
4	64+190	7.98	slightly enlarged	white	2) though hardly chequered, and quite pale	beige-greyish dorsally, greyish ventrally	4) only thighs pale yellowish
5	58+172*	5.12	-	white	2) though hardly chequered, and quite pale	beige-greyish dorsally, greyish ventrally	4) very pale beige

* partly regenerated

dark dorsal striping changed from almost black to brownish/dark-beige, the initially light beige stripes to a duller version, in a certain light sometimes looking greyish. The tail colour remains more or less the same orange.

One wonders if the quite brightly coloured vermilion tail helps to distract possible predators from attacking the body like ARNOLD (1984, 1988) proposed for the bright blue as in hatching and juvenile lacertids while running around more in the open when searching for prey. An alternative, but probably too far-fetched, explanation could be that the colour lures prey insects as in the grass the orange rather disrupts camouflage to avoid predation (see cover photo). Then again, the clearly visible tail may distract potential enemies and leads an attack to a more expendable, and regenerable!, body part while hunting in the more open areas. An explanation as sometimes proposed for, e.g., snakes that may twitch their differently coloured tail tip to lure prey, was never seen. Apart from some slight up-and-down movements of the front legs, with a clear sideways shuffling component of

the body, the lizards hardly react to each other in the terrarium, and the first aspect mainly occurred when I was the disturbing factor, while, e.g., providing fresh water and food. Even when walking over another specimen they do so as if it were twigs. The single vague indications to courtship behaviour with short tail-biting was in July 2008. The timing of this could be related to a recent oviposition as this correlation in European lacertids is well-known to me. As mentioned, on July 5, 2009 and July 12, 2009 two animals appeared to have laid eggs; flanks sunken and they quickly accepted food, but no eggs were found. On the latter date the largest specimen (male?) had emptied most of the moist earth from the container meant for oviposition. Was a possible clutch been consumed by him/her? Sadly, no further overtures were ever witnessed. Especially unfortunate, as one of my priorities was to describe the reproduction in this species, in the hope of a further understanding, and possibly contributing the native population size by controlled captive breeding.



While discussing the remarkable way *P. zolii* walks over the gauze top of the vivarium with Nick Arnold (BMNH), May 13 2006, with its dorsal side up (figs. 7, 10), while many other lacertids do so belly-up, he pointed out that although *Philochortus* does not look it at first sight, it is a partial analogue of the East Asian *Takydromus* and the West African *Poromera*, forms that climb easily in and over flimsy vegetation. These taxa, and *Gastropholis* too, can do the kinds of things I saw in *Philochortus*. The behaviour is associated with anatomical features that enhance function including blade-like expansion of the neural spines on the vertebrae that increase the areas for muscle insertion and origin, permitting the lizard to stiffen its body when crossing gaps in the vegetation, and spiral its tail etc. (ARNOLD, 1997, 2004).

We also covered the rather funny walk *Philochortus* has, and the digging behaviour. Most lacertids dig a burrow by first clawing earth with each fore foot and then shoving it back with the hind foot on that side, especially once they have got a little distance into the soil. But about 15 years previously, Nick noticed that captive *Heliobolus lugubris* from Namibia did something quite different (cf. ARNOLD, 1998). They dig entirely with the forelimbs and then go into the burrow, turn round and use the same limbs to push the soil out of the hole. Nick later heard Sherif Baha el Din describe the same behaviour in *Philochortus* in addition to the more common backwards movement of front and hind legs, and later again also in *Pseuderemias*. This compares nicely with the way I described the opening and closing of apparent overnight burrows. It is probably a

Figure 10. How *Philochortus zolii* walks along the with mosquito gauze covered top of the vivarium, with its back upward. Also seen in the first phase in the smaller photo with less contrast.

synapomorphy for these three genera and is not found in other rather similar lacertids like *Latastia* and *Nucras*, or anywhere else in the Lacertidae that we know about.

SUMMARY

Field notes and vivarium observations on *Philochortus zolii* are given as contribution to the biology of this little-known genus of lacertids. These concern the activity rhythm, food preferences, weights and sizes and colouration of the five captive specimens. The largest specimen had a maximum snout-vent length of 61 mm, a tail length of 190 mm and weighted 6.24 g. Unhappily no reproduction was recorded, which very well may have been caused by a lack of adult males. Possible oviposition occurred in the vivarium in July 2009. The annual activity was lowest in November to February; in the warmer months the daily activity peaked with the start focused around

10-12 o'clock, in later years this shifted to 14-17 o'clock because of the position of the vivarium when the lizards could profit from the sunshine coming from the south-west. The curious way the *Philochortus* walk with the dorsal side up on the gauze cover of their cage, is described and discussed, as is their locomotion in the vivarium.

SAMENVATTING

Waarnemingen vroeg in het voorjaar in het veld in 2006, zowel als later in het terrarium over gedrag van vijf *Philochortus zolii* gedurende vier jaar, betreffen het activiteitsritme, voedselvoorkeuren, kleuren en afmetingen. De maximaal bereikte kopromplengte was 61 mm, staart 190 mm, en het hoogste gewicht bedroeg 6,24 g. Helaas plantten de dieren zich niet voort in het terrarium, wellicht te wijten aan het ontbreken van volwassen mannetjes. Mogelijke eileg wordt gepostuleerd voor juli 2009. De

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activiteit over het jaar in het terrarium is het laagst van november tot februari. In de warmere maanden ligt de meeste dagactiviteit tussen 10 en 12 uur, hetgeen in later jaren verschoof naar tussen 14 en 17 uur, eenvoudigweg omdat de zon dan in de bak scheen. De opmerkelijke manier waarop deze hagedissen over het gazen deksel lopen, met de rug omhoog, wordt beschreven, evenals hoe ze zich verder voortbewegen, met name over de bodem en in het gras.

ACKNOWLEDGEMENTS

I thank Pierre-André Crochet and Philippe Geniez for their help and companionship on our field trip, Philippe additionally for conscientiously reading the manuscript, Sherif Baha el Din (Cairo) and his wife Mindy for their hospitality plus Sherif's essential aid in the field, and Nick Arnold (BMNH) for discussing early parts of the manuscript years ago. Van Wallach checked the label of the Libyan specimen.

Redescription of the Thailand blindsnake “*Ramphotyphlops ozakiae* Wallach in Niyomwan, 1999,” nomen nudum, as *Ramphotyphlops mollyozakiae* n. sp. (Serpentes: Typhlopidae)

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INTRODUCTION

In the late 1990's the author assisted Piyawan Niyomwan, who was working on her thesis on the blind snakes of Thailand, by sending her a MS draft of a key to the typhlopids of Thailand, which included an as-of-yet undescribed species from that country. There was never any mention of the proposed species, *Ramphotyphlops ozakiae*, as having been published

(and no publication of such was discussed or sent). Niyomwan then borrowed one of the designated specimens from the proposed type series in the Field Museum and, mistakenly believing the species to have been published by the present author, included it in her published thesis (NIYOMWAN, 1999). Niyomwan presented scale counts and proportional measurements of the proposed holotype (FMNH 180007; see Table 1), illustrated it with line drawings of the head and a colour photo, and mapped the type locality. However, inclusion of the species in the thesis was

Table 1. Data presented on *Ramphotyphlops ozakiae* in NIYOMWAN (1999).

Page	Description
v	listing of <i>Ramphotyphlops ozakiae</i> as part of Thai fauna
13–14	listing of material examined (<i>R. ozakiae</i> , FMNH 180003–180007)
24	listing of FMNH specimens, including <i>R. ozakiae</i> paratype
25	listing of <i>R. ozakiae</i>
27	distribution map with plot of type locality
32	list of species with description of <i>R. ozakiae</i> Wallach, 1998
35	Fig. 4-3D: color photo of <i>R. ozakiae</i> , FMNH 180007
37	Fig. 4-5D: line drawings of three head views of <i>R. ozakiae</i> (FMNH 180007)
40	Fig. 4-8H: line drawing of venter of tail of <i>R. ozakiae</i> (FMNH 180007)
41	Tab. 4-1: measurements and scale counts of <i>R. ozakiae</i> (FMNH 180007)
42	Tab. 4-2: proportions of one specimen of <i>R. ozakiae</i> (FMNH 180007)
45	listing of <i>R. ozakiae</i> in discussion of BW/SVL, HW/SVL, and RW/HW
46	listing of <i>R. ozakiae</i> in discussion of RW/SVL, TL/SVL, and TW/SVL
47	Tab. 4-3: proportions of one specimen of <i>R. ozakiae</i> (FMNH 180007)
57	identification key couplet with <i>R. albiceps</i> and <i>R. ozakiae</i> ; Fig. 6 showing snout dorsum and tail venter color pattern and Fig. 7 showing dorsal head shields [reproduced in English in NIYOMWAN et al., 2001: 51, couplet 6 and figs. 9–10]
68	bibliographic citation of the Wallach Ph.D. thesis (WALLACH, 1998)
79	App. 1: material examined with only one <i>R. ozakiae</i> (FMNH 180007) listed
96	App. 2: total length of material examined with <i>R. ozakiae</i> (FMNH 180007) at 227 mm
107	App. 3: scale counts of material examined with <i>R. ozakiae</i> (FMNH 180007) with 317 + 6 + 3 = 326 total middorsals
118	App. 4: head shields of <i>R. ozakiae</i> (FMNH 180007)
130	App. 5: further description of head shields of <i>R. ozakiae</i> (FMNH 180007)
140	App. 6: twelve measurements of FMNH 180007 (FMNH 180007)

never suggested to be a new description; it was believed that *Ramphotyphlops ozakiae* had already been published and authorship was attributed to Wallach throughout the text. Communication with Ms. Niyomwan confirmed that the use of the name *R. ozakiae* was accidental and unintentional, and was due to her belief that the species had already been published. This belief may have been further solidified when borrowing FMNH 180007, which had been proposed as the holotype of the type series by Wallach and probably was tagged as such in the collection and on the loan invoice.

Considerable confusion existed following the publication of Niyomwan's thesis and consultation with various systematic herpetologists (Hobart M. Smith, Patrick David, Olivier Pauwels, Richard Etheridge, Jay M. Savage) indicated that the taxon should be known as *Ramphotyphlops ozakiae* Wallach in NIYOMWAN, 1999, and such a designation was subsequently followed (WALLACH et al., 2014; CHAN-ARD, 2012). However, the species was considered "validly but unintentionally published" (CHAN-ARD, 2012).

According to Art. 8(a)(2) of the Code (ICZN, 1985), one criterion of publication is that the work "must be obtainable, when first issued, free of charge or by purchase," and only a few copies of the thesis by NIYOMWAN (1999) were distributed within Chulalongkorn University to her Committee members and colleagues (P. Niyomwan, pers. comm.). The name *Ramphotyphlops ozakiae* is technically a nomen ineditum (unpublished name) but according to the Rules it is officially recognized as a nomen nudum (naked name) as it does not conform to Articles 8 (valid publication) and 11 & 13 (availability) of the Code.

Several authors (CHAN-ARD, 2012; COX et al., 2013; HEDGES et al., 2014), not aware of Niyomwan's thesis in 1999, cited authorship as *Ramphotyphlops ozakiae* (NIYOMWAN et al., 2001). However, according to the Article 16.1 of the most recent edition of the Code (ICZN, 1999), any name proposed after 1999 "must be explicitly indicated as intentionally new," with the inclusion of terms such as "sp. nov.," "n. sp.," or "new species" to indicate a new nominal taxon. The publication of *Ramphotyphlops ozakiae* by NIYOMWAN et al. (2001) also constitutes a nomen nudum. All previous references to the species (as *Typhlops*

ozakiae, *Ramphotyphlops ozakiae* and *Indotyphlops ozakiae*) are invalidly published and unavailable (nomina nuda) according to the Rules of Nomenclature (ICZN, 1985 & 1999). Those names are cited below in the synonymy. According to Art. 16.1 of the Code (ICZN, 1999), the intention of authors to establish a new nominal name after 1999 must explicitly state that it is new (i.e., sp. nov. or new species). Names proposed between 1931 and 1999 must satisfy the conditions of Art. 13.1.1 and be accompanied by a description or definition that states in words characters that are purported to differentiate the taxon.

HEDGES et al. (2014) transferred the species from the genus *Ramphotyphlops* to *Indotyphlops* based upon geography and similarity to other *Indotyphlops* as molecular data are not yet available.

COX et al. (2013) erroneously recorded the holotype as MCZ R 177983. *Ramphotyphlops ozakiae* is a data deficient species (IUCN, 2014) and the Data Deficient taxon ID is 191975 (BUTLER, 2019).

MATERIALS AND METHODS

All measurements were made to the nearest 0.5 mm and abbreviations include SVL = snout-vent length, T or TL = tail length, TW = mid-tail width, LOA = total length, ABD, MBD and PBD = anterior, midbody and posterior diameter in horizontal plane, MTW = mid-tail width in horizontal plane, HW = head width at interocular level, RW = rostral width at mid-scale, SL = supralabial, INS = inferior nasal suture, SNS = superior nasal suture, DSR = dorsal scale row formula, TMD = total middorsals between rostral and apical spine, SC = subcaudals, DC = dorsocaudals counted on vertebral line, SIP = supralabial imbrication pattern, left and right side counts indicated by a diagonal (left/right). Discussion of visceral characters and their definitions can be found in WALLACH (1985, 1993, 1998, 2001, 2005), CUNDALL et al. (1994), WALLACH & INEICH (1996), WALLACH & GÜNTHER (1998), and BROADLEY & WALLACH (2002, 2007a–b). Data on characters of the soft anatomy are presented in three formats: meristic numbers, values listed as % (i.e., 12.0–13.5%) represent the character as % SVL, and values given as decimals (i.e., 0.42–0.50) represent ratios between two visceral characters. An organ listed without reference to a point



Figure 1. Preserved holotype of *Ramphotyphlops mollyozakiae* (FMNH 180007).

Ramphotyphlops mollyozakiae n. sp.
Molly Ozaki's Blindsnake
Figs. 1–3

Synonymy

Typhlops ozakiae nomen nudum

NIYOMWAN, 1999: 13–14, 79, 96, 107, 118, 130, 140; NABHITABHATA & CHAN-ARD, 2005: 133, 173, 222; DAS, 2010: 350, 376; CHAN-ARD, 2012: <http://dx.doi.org/10.2305/IUCN.UK.2012-1.RLTS.T191975A2023185.en>; IUCN, 2014: 10; PATAWANG et al., 2016: 1.

Ramphotyphlops ozakiae nomen nudum

NIYOMWAN, 1999: v, 24–25, 27, 32, 35, 37, 40–42, 44–47, 57, figs. 4.1, 4.3D (holotype), 4.5D (holotype), 4.8H (holotype), 4.9H (holotype), 6 (right), 7 (right); NIYOMWAN et al., 2001: 47, 51–52, figs. 9b, 10b; CHAN-ARD et al., 2015: 147; WALLACH, 2003: 229; 2006: 15; 2009: 42; WALLACH & PAUWELS, 2004: 15; WALLACH et al., 2007: 696; 2014: 617, 1186; AF-ROOSHEH, 2009: 17; CINAR, 2009: 269; DAS, 2012: 153; 2018: 169; COX et al., 2013: 15–17; PARR et al., 2014; WALLACH et al., 2014: 629, 757.

Indotyphlops ozakiae nomen nudum

HEDGES et al., 2014: 6, 11, 16, 23, 37; PYRON & WALLACH, 2014: 16, 34, 56, 80; FELDMAN et al., 2015: 48; HIKIDA, 2015: 44; MATTISON, 2015: 152; PAUWELS & GRISMER, 2015: 457; FOTOLULU, 2018: 521; ITIS, 2019; UETZ & HOSEK, 2019: <http://reptile-database.reptarium.cz/species?genus=Indotyphlops&species=ozakiae>.

(midpoint, anterior tip, posterior tip) or gap/interval refers to the organ length, gap (G) = length between two organs, interval (I) = length from anterior tip of more cranial organ to posterior tip of more caudal organ, and midpoint-midpoint distance (MPD) = length between the midpoints of two organs.

Data on the holotype as reported by NIYOMWAN (1999) are provided in parentheses under the description of the type specimen.

DESCRIPTION

A synonymy of previously published names referring to this taxon is listed below. As a consequence of the epithet *ozakiae* having been accidentally published but not formally described, all of these names are nomina nuda. The appropriate name for this species should therefore be:

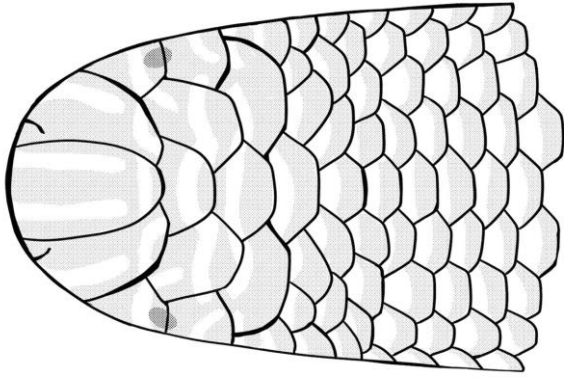


Figure 2. Dorsal view of head of holotype of *Ramphotyphlops mollyozakiae* (FMNH 180007).

Drawing: Emma Hsiao.

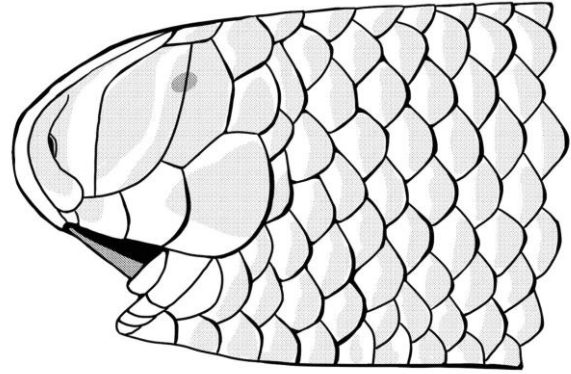


Figure 3. Lateral view of head of holotype of *Ramphotyphlops mollyozakiae* (FMNH 180007).

Drawing: Emma Hsiao.

Holotype

FMNH 180007 (previously field number WRH 3679), a 158 mm male collected by W.R. Heyer on 17 September 1969.

Type locality

Sakaerat Experimental Station, Amphoe Pak Thong Chai, Nakhon Ratchasima Province, southeastern Thailand, 14°43'N, 102°01'E, elevation 200 meters.

Paratypes

FMNH 180003 (WRH 676) collected 25 March 1969 at type locality; FMNH 180004 (WRH 2560) collected 6 June 1969 at type locality; FMNH 180005 (RFI 3389) collected 27 August 1969 at type locality; FMNH 180006 (WRH 3390) collected 27 August 1969 at type locality; ZMUC R52174 collected by O. Hagerup on 5 October 1916 at Lomban Djulo (Loemban Djoeloe), north of Lake Toba, Sumatra, western Indonesia, 2°40'38"N, 99°50'40"E, elevation 1100 meters.

Etymology

This species is named in honour of Molly Ozaki (1927–2010), long-time Secretary and Administrative Assistant in the Division of Amphibians and Reptiles (and briefly in the Division of Fishes), Field Museum of Natural History, Chicago, IL. Her tenure extended from 1978 to 1992 (Fig. 4). Mere words cannot describe her or capture the essence of her

personality. Although she and her husband, Yoji, were held prisoner in a Japanese camp during WW II, they exhibited no resentment over their former tribulations. In my experience, Molly was the most gracious, accommodating, and effective secretary ever to administrate a herpetology department. Molly greatly facilitated herpetological research in the Field Museum during her 15 years of service. She is certainly missed by all who were fortunate enough to have known or worked with her.



Figure 4. Molly Matsunaga Ozaki in the FMNH Reptiles & Amphibians departmental office.

Diagnosis

Since molecular data are lacking for most members of both *Ramphotyphlops* and *Indotyphlops*, morphological data must be relied upon for clues to relationships. *Ramphotyphlops mollyozakiae* is most similar to *R. albiceps* (currently placed in *Indotyphlops* by HEDGES et al., 2014), with which it is sympatric, and can be distinguished from *R. albiceps* by head colour (brown vs. yellow head and nape), number of postoculars (1 vs. 2–4), and the number of helical coils in the hemipenis (0.5 vs. 3.5), in addition to the visceral characters listed in Table 2. Although not diagnostic, due to overlap in ranges, it also has a smaller average number of middorsals ($x = 307$ vs. 343) and a thicker body proportion (L/W ratio: $x = 40$ vs. 68). *Ramphotyphlops mollyozakiae* differs from *R. lineatus* in fewer scale rows (20 vs. 22–24), relatively longer tail (T/LOA $\geq 1.8\%$ vs. $\leq 1.8\%$), INS contact (SL 2 vs. SL 1), and number of postoculars (1 vs. 2–4) and from all other *Ramphotyphlops* with 20 scale rows, *R. mollyozakiae* can be distinguished by its SNS being visible on the dorsum of the snout. *Ramphotyphlops mollyozakiae* can be distinguished from *Virgotyphlops braminus* by the INS contact (SL 2 vs. pre-ocular) and bisexual mode of reproduction (vs. unisexual) (WALLACH, 2020).

From all Asian species of *Indotyphlops* with 20 scale rows, *R. mollyozakiae* can be separated from *I. jerdoni* by a single postocular (vs. 2); from *I. lankaensis* by total middorsals (> 290 vs. < 265), larger body size (LOA > 150 mm vs. < 130 mm), thinner body proportions (L/W > 38 vs. < 35), and the INS contact (SL 2 vs. pre-ocular); from *I. malcolmi* by larger body size (> 150 mm vs. < 135 mm), thinner body (L/W > 38 vs. < 32), and nasal shield (divided vs. undivided); from *I. pammeces* by total middorsals (< 327 vs. > 328), thicker body (L/W < 53 vs. > 54), and nasal shield (divided vs. undivided); from *I. porrectus* by SIP (T-III vs. T-V), posterior scale rows (20 vs. 18), and total middorsals (< 330 vs. > 400); from *I. schmutzi* by SIP (T-III vs. T-V), total middorsals (< 330 vs. > 385), and larger body size (> 150 mm vs. < 145 mm); from *I. tenebrarum* by larger size (≥ 154 mm vs. ≤ 144 mm), broader rostral (RW/HW > 0.35 vs. < 0.30), and nasal shield (divided vs. undivided); from *I. veddae* by larger body size (> 150 mm vs. < 95 mm), subcaudals (≤ 12 vs. ≥ 13), thicker body (L/W

Table 2. Comparison of visceral data of *Ramphotyphlops mollyozakiae* and *R. albiceps* (mean values as % SVL).

Character	<i>mollyozakiae</i> (n = 6)	<i>albiceps</i> (n = 4)
Shy	12.0	7.7
HMP	29.8	32.3
SHI	31.9	34.2
HLI	31.9	34.2
HGBG	30.4	35.8
RLMP	46.1	51.6
LLMP	44.0	48.7
TLS	20.7	15.0
LKG	27.4	22.1
GBMP	62.9	70.7
GBKG	23.3	15.2
GBKI	32.6	22.9
RGMP	77.7	83.2
LGMP	80.2	84.2
GKG	4.8	1.1
RAMP	83.1	85.9
LAMP	84.7	86.7
T	30.8	33.1
TLg	18.3	20.4
RLgMP	40.3	42.7
RLgPT	48.8	51.1
RBPT	42.1	46.4
TB	41.0	45.2
TBMP	21.6	23.8
HLMPD	16.3	19.3
TLMPD	29.6	33.9
LKMPD	44.8	38.2
TBGBMPD	41.4	47.0
HRGMPD	47.7	50.9
HKMPD	61.1	57.5
TBKMPD	69.2	66.0

< 55 vs. > 60), and nasal shield (divided vs. undivided); and from *I. violaceus* by larger body size (≥ 154 mm vs. ≤ 135 mm), and the INS contact (SL 2 vs. pre-ocular) (Table 3).

Description (holotype)

FMNH 180007 (Fig. 1), an adult male with SVL 153 (146.9) mm, TL 4.5 (4.3) mm, LOA 157.5 (151.2) mm, TL/LOA 2.9% (2.9), ABD 3.0 mm, MBD 3.0 (3.5) mm, PBD 3.5 mm, LOA/MBD ratio 52.5 (42.7), MTW 2.5 (2.9) mm, TL/MTW 1.8 (1.5), HW 2.6 (1.8) mm, RW 1.0 (1.0) mm, RW/HW 0.38 (0.54), DSR 20-20-20 (20-20-20), TMD 318 (317), SC 12, DC 13, scales smooth, cycloid and imbricate without pits. Snout rounded in dorsal aspect,

Taxon	ASR	MSR	PSR	SIP	TMD	SC	LOA	L/W	RTL (%)	RTW	INS	SNS	PO
<i>Ramphotyphlops</i>													
<i>albiceps</i>	20–22	20	20	T–III	301–424	8–25	117–302	39–104	1.3–6.7	0.9–3.0	2	Yes	2 (3–4)
<i>angusticeps</i>	20	20	18–20	T–III	617–709	20–29	243–455	64–95	2.3–4.0	2.4–3.9	1	No	2–3
<i>becki</i>	20	20	20	T–III	206–241	8–15	62–149	17–31	2.3–6.3	1.0–2.1	2	No	2 (3)
<i>conradi</i>	20	20	20	T–III	398	8–11	165–175	58–66	1.2–1.5	1.0	2	No	1–2
<i>exocoeti</i>	20	20	20	T–III	466–508	17–20	230–398	52–73	2.2–2.9	1.8–2.7	2	No	2
<i>lineatus</i>	22–24	22–24	20–22	T–III	315–438	8–11	152–480	36–60	1.7–1.8	0.8–1.1	1	No	2–3 (4)
<i>multilineatus</i>	20	20	20	T–III	513–586	20–22	220–427	46–73	2.6–4.3	1.7–2.9	1	No	2
<i>mollyozakiae</i>	20	20	20	T–III	291–327	7–12	154–176	38–53	1.8–2.9	1.1–1.8	2	Yes	1
<i>similis</i>	20	20	18	T–III	234–235	9–12	154–235	18–27	3.2–3.9	1.0–1.2	2	No	1
<i>Indotyphlops</i>													
<i>jerdoni</i>	20	20–22	20	T–III	260–313	9–15	130–280	35–47	2.1–3.3	1.3–1.5	2	Yes	1–2
<i>lankaensis</i>	20	20	20	T–III	229–261	11–15	67–130	27–35	2.5–4.4	1.5	Pre	Yes	1
<i>malcomi</i>	20	20	20	T–III	261–308	9–12	81–135	30–32	2.5–4.2	1.1–1.2	2	Yes	1
<i>pammeces</i>	20	20	20	T–III	328–391	11–13	119–195	54–75	1.9–3.1	1.3–1.6	2	Yes	1–2
<i>porrectus</i>	19–20	18–20	18	T–V	388–468	7–14	65–285	40–91	1.4–2.3	0.9–2.0	2	No	1–2
<i>schmutzi</i>	18–20	18–20	18–20	T–V	403–413	9–12	58–140	63–93	1.8–2.0	1.8–2.0	2	No	1
<i>tenebrarum</i>	20	20	20	T–III	298–339	9–14	65–144	34–72	2.1–3.0	1.4–2.0	2	Yes	1
<i>veddae</i>	20	20	20	T–III	295–309	13–14	93	60–91	3.0	1.4	2	Yes	1
<i>violaceus</i>	20	20	20	T–III	245–308	10–13	65–135	30–43	2.2–3.1	2.0	Pre	Yes	1
<i>Virgotyphlops</i>													
<i>braminus</i>	20	20	20	T–III	261–368	8–15	35–203	30–60	1.5–3.5	0.7–2.0	Pre	Yes	1

Table 3. Scutellation data for relevant *Ramphotyphlops*, *Indotyphlops* and *Virgotyphlops* species. ASR, MSR and PSR = anterior, midbody and posterior scale rows, SIP = supralabial imbrication pattern, TMD = total middorsal scales, SC = subcaudal scales, LOA = total length, L/W = total length/midbody diameter ratio, RTL = relative tail length (as % LOA), RTW = relative tail width (TL/TW), INS = inferior nasal suture contact (Pre = pre-ocular, 1 = SL 1, 2 = SL 2), SNS = superior nasal suture contacting rostral, PO = number of postoculars.

rostral oval in shape, tapering slightly anteriorly and posteriorly, extending nearly to the interocular line, supranasals subequal in width to rostral, bordered posteriorly by a frontal that is twice as broad as deep; frontal bordered posteriorly by a similar sized postfrontal and laterally by a pair of transversely oriented, blocky supra-oculars, 1.5 times as broad as deep and as wide as three costal scales; a single pair of transversely oriented parietals present, separated on midline by postparietal, also twice as broad as deep, which is largest vertebral scale; enlarged occipitals absent. Snout rounded in lateral view, nasal semi-divided with a complete suture between SL 2 and nostril and an incomplete suture extending dorsally onto dorsum of snout, curving towards the rostral but not making contact, nostril elongate and bean-shaped, obliquely oriented and directed laterally; infranasal small and narrow, supranasal broad and extending onto dorsum of snout just beyond the rostral, posterior border concave; pre-ocular broader than supranasal and ocular, and taller than ocular; both pre-ocular and ocular obliquely inclined to horizontal; eye reduced to a small faint spot beneath the pre-ocular-ocular suture in dorsal view but under the ocular in lateral view; postocular single, elongate and apparently fused from two costal scales; supralabials 4, SIP T-III, SL 4 largest, broader than tall and 2.5 times the size of SL 3, SL 3

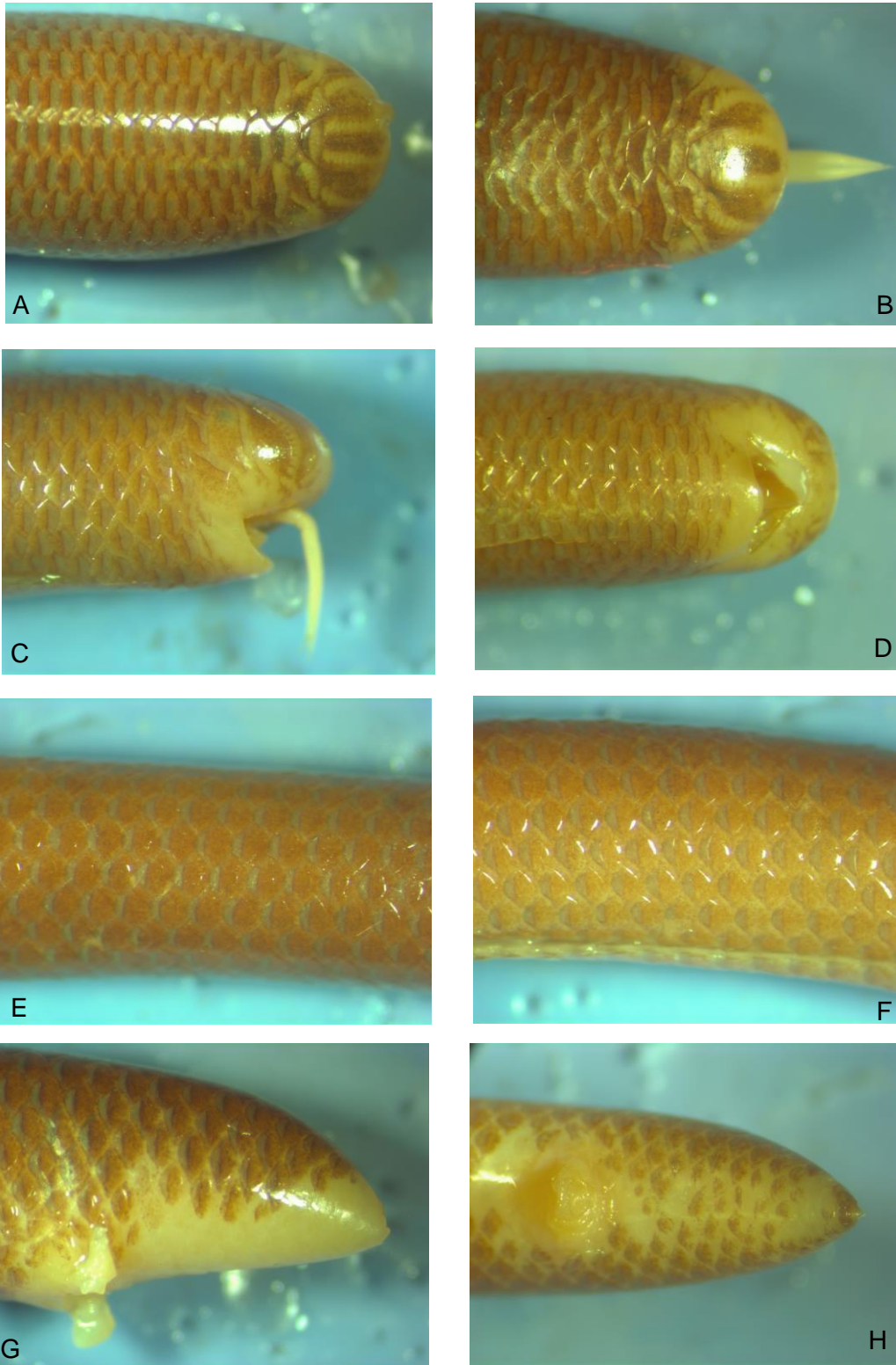
subequal in size to SL 2, taller than broad, SL 2 as broad as tall and 4 times the size of SL 1; mental weakly projecting from curvature of lower jaw, fitting into a notch in the median rostral when mouth is closed; infralabials 4, the first 3 of which are visible externally.

In coloration (after preservation) the middorsal 10 rows are dark reddish-brown, the midlateral rows lighter, and the ventral scale rows lighter still with peppering or brown vermiculations over a yellow base; gland rows on head yellow as well as supralabials and infralabials, cloacal region, most of subcaudals, and tip of tail; tongue yellow. Individual costal scales appear greyish along the basal 1/4 to 1/3 of each scale with the remainder brown.

The tongue has a pair of caudally projecting lateral papillae just posterior to the tongue's cleft.

Variation (paratypes)

There is variation in the extent of the yellow coloration of the labials and subcaudals, ranging from completely yellow upper and lower lips (FMNH 180004, 180007) to only some yellow markings on SL3 and/or 4 (FMNH 180003). Additionally, the nasal, pre-ocular and ocular are yellow only on the right side of FMNH 180005. Ventral tail coloration ranges from entirely yellow (FMNH 180005), to a yellow cloacal region and tail tip (FMNH 180006),



A. Dorsal view of head of paratype of *Ramphotyphlops mollyozakiae* (FMNH 180004).
 B. Dorsal view of head of holotype of *Ramphotyphlops mollyozakiae* (FMNH 180007).
 C. Lateral view of head of holotype of *Ramphotyphlops mollyozakiae* (FMNH 180007).
 D. Ventral view of head of holotype of *Ramphotyphlops mollyozakiae* (FMNH 180007).
 E. Dorsal view of midbody of paratype of *Ramphotyphlops mollyozakiae* (FMNH 180003).
 F. Lateral view of midbody of paratype of *Ramphotyphlops mollyozakiae* (FMNH 180003).
 G. Lateral view of tail of paratype of *Ramphotyphlops mollyozakiae* (FMNH 180005).
 H. Ventral view of tail of paratype of *Ramphotyphlops mollyozakiae* (FMNH 180003).

to only isolated and scattered yellow scales (FMNH 180003).

Statistics on the five paratypes (4 females, 1 male) include total middorsals (291–319, $x = 305.2$), subcaudals (7–10, $x = 8.8$), total length (154–172 mm, $x = 161.6$ mm), relative tail length (1.8–2.8%, $x = 2.3\%$), L/W (38.4–53.3, $x = 43.2$), and TL/TW (1.1–1.8, $x = 1.5$). FMNH 18003 had one small developing egg (0.75 x 1.75 mm) in each ovary and 7/5 follicles; FMNH 18004 had one moderate egg (1.3 x 2.5 mm) in right oviduct and 6/4 follicles; FMNH 180006 had only 7/4 follicles; ZMUC 52174 had one large egg (1.5 x 6.5 mm) in right oviduct and 5/4 follicles in ovaries.

Most interesting is the hemipenis, which is everted in FMNH 180005, an adult male with LOA 159 mm. It is not the typical short typhlopoid hemipenis that everts itself inside out when in use and retracts in the opposite manner but the *Acutotyphlops-Anilius-Ramphotyphlops* type, found in conjunction with retrocloacal sacs, that is typically longer than the tail, everts directly, and is retracted in a coiled position in order to fit inside the tail. Hemipenis coiling varies from 0–15 coils (WALLACH, 1998). The hemipenis of *Ramphotyphlops mollyozakiae* lacks complete coils and appears as a single awn with a basal kink or half coil. The organ is 3.5 mm in length, tapering slightly from a basal bulge 1.0 mm long to a thin awn 2.5 mm in length. Short retrocloacal sacs are present (2.5 mm or 1.6% SVL).

Internal anatomy

Characters of the soft anatomy include the sternohyoideus (Shy) posterior tips (10.3–15.0%, $x = 12.0\%$), sternohyoideus-heart gap (0.44–0.64, $x = 0.57$), heart (3.5–4.9%, $x = 4.2\%$), heart MP (28.8–30.7%, $x = 29.8\%$), snout-heart interval (30.6–33.1%, $x = 31.9\%$), liver overlaps the heart (0.6–2.3%, $x = 1.7\%$), right liver lobe (26.9%, MP = 46.1%), right liver segments (7–13, $x = 9.7$), left liver lobe (27.6%, MP = 44.0%), left liver segments (8–17, $x = 11.0$), heart-liver interval (21.3–39.7%, $x = 31.9\%$), gall bladder MP (51.6–72.4%, $x = 62.9\%$), liver-gall bladder gap (0.7–5.5%, $x = 2.8\%$) and interval (21.6–40.1%, $x = 31.0\%$), gall bladder-gonad gap (8.4–16.3%, $x = 12.3\%$), right gonad MP (70.5–83.1%, $x = 77.7\%$), left gonad MP (73.1–86.5%, $x = 80.2\%$), total adrenal MP (80.5–86.2%, $x = 83.9\%$), liver-kidney interval (60.8–65.0%, $x =$

62.2%), right and left kidney identical (3.8–6.5%, $x = 5.0\%$), right kidney MP (87.7–90.2%, $x = 89.4\%$), left kidney MP (89.7–94.2%, $x = 92.3\%$), kidney-vent gap (3.0–7.1%, $x = 5.2\%$), and interval (11.9–15.5%, $x = 13.1\%$), rectal caecum (3.2–5.2%, $x = 3.8\%$), caecum-vent interval (8.7–11.9%, $x = 10.1\%$), trachea (29.0–32.0%, $x = 30.8\%$), trachea MP (15.8–17.3%, $x = 16.5\%$), total tracheal rings/cartilages (210–294, $x = 244$), tracheal rings/10% SVL (68.9–93.6%, $x = 79.2\%$), tracheal lung AT (8.5–10.5%, $x = 9.4\%$), tracheal lung (17.1–20.3%, $x = 18.3\%$) and vascular foramina (16–22, $x = 18.8$), tracheal lung MP (17.8–19.3%, $x = 18.5\%$), terminal tracheal entry, right lung (11.3–20.6%, $x = 17.0\%$), right lung MP (36.3–43.5%, $x = 40.3\%$) and PT (41.9–53.8%, $x = 48.8\%$), intrapulmonary (right) bronchus (6.5–14.0%, $x = 10.3\%$), bronchus/right lung (0.56–0.68, $x = 0.60$), trachea/bronchus (35.5–45.6%, $x = 41.0\%$), trachea/bronchus MP (19.4–24.3%, $x = 21.6\%$), heart-kidney MPD (59.4–62.9%, $x = 61.1\%$), heart-liver MPD (10.8–20.0%, $x = 16.3\%$), heart-right lung (7.4–12.8%, $x = 10.6\%$), liver-kidney MPD (40.5–49.0%, $x = 44.8\%$), right lung-adrenal MPD (41.7–45.2%, $x = 43.6\%$), trachea-adrenal MPD (64.4–69.0%, $x = 67.4\%$), trachea-liver MPD (23.6–32.8%, $x = 29.6\%$), and trachea/bronchus-kidney MPD (65.8–70.9%, $x = 69.2\%$).

Distribution

Southeastern Thailand and western Indonesia (Sumatra), known from 200–1100 meters elevation.

DISCUSSION

Typical snake hemipenes, in conjunction with absence of retrocloacal sacs, are universally found in the following worldwide snake genera: *Afrottyphlops*, *Amerotyphlops*, *Antilotyphlops*, *Argyrophis*, *Cubatyphlops*, *Gerhophilus*, *Grypotyphlops*, *Indotyphlops*, *Letheobia*, *Madatyphlops*, *Malayotyphlops*, *Megatyphlops*, *Rhinotyphlops*, *Typhlops*, *Xenotyphlops*, and *Xerotyphlops*. The *Acutotyphlops-Anilius-Ramphotyphlops*-like hemipenis is restricted to the Australasian region (ROBB, 1966). Male reproductive structures are unknown in *Cathetorhinus*, *Cyclotyphlops*, *Virgotyphlops*, and a few species (*bipartitus*, *conradi*, *lorenzi*, *mansuetus*, *marxi*,

similis, and *supranasalis*) currently assigned to *Ramphotyphlops* based on geography (PYRON & WALLACH, 2014). These taxa are either known only from females or have not been examined for hemipenes and/or retrocloacal sacs. Both *mollyozakiae* and *albiceps* are once again referred to *Ramphotyphlops* rather than *Indotyphlops* (as suggested by HEDGES et al., 2014 and followed by PYRON & WALLACH, 2014) based upon the male reproductive structures.

Ramphotyphlops now consists of 23 valid species with the addition of *R. albiceps* and *R. mollyozakiae* (UETZ & HOSEK, 2019), which are the most northerly members of a genus mainly found in the East Indies, both species occurring in Thailand with *R. albiceps* also extending farther north in Hong Kong (KARSEN et al., 1998).

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SUMMARY

The typhlopoid species from Thailand referred to in the literature since 1999 as *Typhlops*, *Ramphotyphlops* or *Indotyphlops ozakiae* was never formally described or validly published and therefore all previous names are nomina nuda. It is now described as *Ramphotyphlops mollyozakiae* and finally published after 20 years, becoming the latest recognized member of the genus.

SAMENVATTING

De blindslang uit Thailand die sinds 1999 in de literatuur circuleert onder de namen *Typhlops*, *Ramphotyphlops* of *Indotyphlops ozakiae* was nooit officieel beschreven, waardoor alle eerdere aanduidingen nomina nuda betreffen. De soort wordt nu, na twintig jaar, taxonomisch beschreven als *Ramphotyphlops mollyozakiae*, waarmee de vorm de jongste aanwinst in het genus betreft.

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Severe head injury in *Boiga melanota* (BOULENGER, 1896) observed in the southeastern corner of Thailand

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INTRODUCTION

On our two week journey to South Thailand in February-March 2020, my wife Aoi and I visited the southeastern corner of the country. This area was new to me whereas my wife had made some business trips to this remote region decades before. The three southeastern provinces Pattani, Yala and Narathiwat are probably the least visited in Thailand. Tourists are discouraged from going there due to occasional terror attacks. In terms of culture and religion this area is quite different from the rest of Thailand as Muslims are the majority of the population. Usually tourists are concentrated in small parts of Thailand, but you may still encounter some throughout much of the country - although the COVID19 pandemic has dramatically stopped tourism in Thailand, same as elsewhere in the world. The pandemic began a couple of weeks after our journey, but we did not see one single westerner in these three provinces and had a pleasant stay! The fourth



Figure 1. Planning the night trip. The farmer who lives and works in the area (left) we are going to visit, explains where we should go.

province in Thailand dominated by Muslims is Satun in the very southwest where terror attacks generally do not occur.

This report deals with my observations made on a night trip in the southern part of Narathiwat Province, 2-3 km from the border of Malaysia and 55 km from the Gulf of Thailand, on 25 February 2020. The locality was north of Hala Bala, Chanae district, coordinates 5.82477° N, 101.84714° E, 50 m elevation. It was in cultivated land – a rubber plantation and some open field – but with an important riparian habitat of trees, shrubs and open areas dominated by grass vegetation. Most observations were made in the latter habitat. The primary stream was the Ba La River, a tributary to the larger Ko Lok River comprising the border to Malaysia. There were also smaller streams and ponds and there was no forest in the vicinity.

Usually my wife and I prioritise habitats of rain-forest and other primary forest when we travel in Thailand, but it proved impossible to stay overnight in the Hala Bala Wildlife Sanctuary, which is approx. 5 km to the south, as we had not made reservations in advance. Instead I got the opportunity to make a night outing in farm land and adjacent natural habitats. It was arranged by the local naturalist and guide, Sul-fadlee Hagisanawee, in conjunction with the inhabitants living and working there (fig. 1). He and his friend accompanied me on the trip.

In this article an unusual encounter at night with a large *Boiga melanota*, which had been exposed to a severe injury to the head, is described and discussed. On the same night and in the same habitats the following two amphibians (normally found in primary forest) and four reptiles were recorded as well:

Leptobrachium hendricksoni Taylor, 1962 – Spotted Litter Frog
Microhyla berdmorei (Blyth, 1856) – Pegu Narrow-mouthed Frog
Siebenrockiella crassicollis (Gray, 1831) – Black March Turtle
Eutropis multifasciata (Kuhl, 1820) – Many-lined Sun Skink
Dendrelaphis pictus (Gmelin, 1789) – Southern Painted Bronzeback
Homalopsis buccata (Linnaeus, 1758) – Malayan Masked Water Snake or Puff-faced Water Snake

BOIGA MELANOTA (BOULENGER, 1896) – WESTERN MANGROVE CAT SNAKE

Until recently the Mangrove Cat Snakes, or just Mangrove Snakes, of Thailand were considered to belong to the species *Boiga dendrophila* (Boie, 1827), subspecies *melanota*. But in a phylogenetic study based on sequencing of mitochondrial and nuclear DNA, *melanota* was elevated to species level (WEINELL et al., 2020). The taxon *Boiga tanahjampeana* proved to be the sister taxon of *melanota*, which caused *dendrophila* s.l. to be paraphyletic. Since the authors preferred to maintain the species level status of the morphologically distinct *tanahjampeana*, elevating *B. dendrophila melanota* to the taxonomic status of a species was required.

Members of the *B. dendrophila* complex are not likely to be confused with any other species in their habitat: the body colour is deep black with yellow vertical bars, although cases of melanism or the yellow pattern replaced by a whitish coloration occur (VOGEL, 2000). The head is black above with bright-yellow, black-edged labials. The chin and the anterior part of the throat are yellow. They are large colubrids attaining a total length up to 250 cm, allegedly even 280 cm, and the body is vertically compressed. They are rear-fanged and venomous with enlarged grooved maxillary teeth and the palatine teeth are also enlarged (SMITH, 1943). Though several colubrids like the genera *Dispholidus*, *Philodryas*, *Rhabdophis*, *Tachymenis* and *Thelotornis* contain species responsible for serious (including fatal) human envenomations, *B. dendrophila* s.l. and other members of the genus *Boiga* are generally not considered dangerous to humans and other large

mammals (MINTON, 1990; DAVID & INEICH, 1999; SAVIOLA et al., 2014; WEINSTEIN, 2017). Earlier studies of Duvernoy's secretions of *B. melanota* determined by injection in mice demonstrated low lethal potency (WEINSTEIN & SMITH, 1993; MACKESSY, 2002). Their toxins are, nevertheless, tremendously powerful to other vertebrates.

B. melanota is a common arboreal species in South Thailand where it occurs in a variety of evergreen and mixed dipterocarp forests, including secondary forests (CHAN-ARD et al., 2015). It is usually found in well-watered areas such as edges of streams, rivers and mangrove swamps (GRISMER, 2011). It is also a good swimmer. In spite of their nocturnal habits members of the *B. dendrophila* complex are commonly encountered during the day coiled in branches though it may also retreat into tree holes (DAVID & VOGEL, 1996; GRISMER, 2011). Being large and conspicuously coloured they may be easily detected and potentially killed by humans.

The diet of *B. dendrophila* s.l. is well documented and consists of a wide variety of birds and lizards, but regularly mammals, snakes and frogs are eaten, and to a small extent even crabs, slugs and possibly fish (GREENE, 1989, VOGEL, 2000, BRINGSØE, in press).

OBSERVATIONS

At 20:25 h on 25 February 2020 (one hour after sunset), north of Hala Bala, Chanae district, Narathiwat province, Thailand (5.82477° N, 101.84714° E; WGS 84; 50 m elev.), the author observed an adult *B. melanota* (184 cm total length, see fig.2) swimming in shallow water near the bank of the Ba La River, a tributary to the larger Ko Lok River which forms the border to Malaysia. The habitat was uncultivated land with scattered trees and shrub vegetation along the stream, and bordered rubber plantations (fig. 3). This individual showed a severe injury on the left and posterior part of the head's dorsal side (figs. 4-5). The wound was deep and had especially affected the left labial region, and a considerable portion of the underlying bone had been destroyed and was missing. Hence the mouth could not close properly on the left side. The wound also reached the dorsal side of the head just behind the left eye. Here it was bifurcated: the larger cut went from behind the eye obliquely toward the median



Figure 2. The author with the adult *Boiga melanota*, total length 184 cm, found in shallow water of the major stream.

Photo: Sulfadlee Hagisanawee

line of the head, whereas a minor cut started from behind the eye obliquely towards the neck. A superficial scar appeared in the left side of the anterior part of dorsum (figs. 5-6).

There was no indication of infection and though the wounds were not fully healed, they seemed to be in the process of healing. The underside of the head and of the anterior part of the body proved undamaged and without any sign of injury or wound. Possibly the left venom gland had been destroyed. The snake appeared well-nourished, strong, aggressive and healthy, so the critical phase might have been passed successfully.

DISCUSSION

Considering the lack of injury on the ventrum of the head i.e. on the chin and lower labials, and other parts of the body, I find it unlikely that the severe attack that destroyed bones had been caused by any non-human animal. A bite inflicted by e.g. a civet or domestic cat with strong bite-force and sharp teeth might destroy part of the snake's skull, but would probably have caused additional damage elsewhere on the head, e.g. on the underside, because it will need to get a firm gripping bite with the upper and lower jaw. On the contrary an attack by a human such as an agricultural worker using an agricultural tool would fit with the appearance

Figure 3. The habitat where *Boiga melanota* was found at night. It was observed in the water near the bank in front of the person. Photo taken on 6 July 2020 by Sulfadlee Hagisanawee



of the wounds. Hoes and sickles are commonly used in Southeast Thailand and such a tool might well have been used for the attack. Malignant and wanton killing of snakes, including harmless species, by humans is known over much of the world (DODD, 1987). Nevertheless, this *B. melanota* might well have survived the injury considering the condition of the snake appearing strong and well-nourished and the healing state of the wounds.

It is likely that the trauma more than bisected the left-most of the snake's two Duvernoy's venom glands and probably even destroyed it (figs. 4-5). A minor part of the anterior lobular section may still be there. Furthermore, there is apparently a remnant of the quadratomaxillary ligament and possibly one of the associated mandibular muscles slightly visible

toxin being 77 amino acid residues long and with five disulfide bonds, has also been isolated from the venom of *B. dendrophila* s.l. (HEGDE et al., 2010; SAVIOLA et al., 2014). It produces potent and irreversible neuromuscular blockade of chick biventer cervicis muscle preparations. It shows a 100-fold weaker and reversible inhibition of electrically induced twitches in mouse hemidiaphragm nerve-muscle preparations and is considered a bird-specific toxin. Moreover, irditoxin, a dimeric neurotoxin composed of two three-finger toxins, has been recorded in *B. d. dendrophila* and several other *Boiga* species; it is crucial as it is highly toxic to diapsid (birds and reptiles) prey, but has nearly no effect on synapsids (mammals), i.e. roughly 1000 × less potent to them (DASHEVSKY et al., 2018). It is rather unusual



Figure 4. Adult *Boiga melanota* with a severe and deep injury on the left side of the head.



Figure 5. The head injury of *Boiga melanota* was apparently without infection and in the process of healing. Notice there was also a mild injury on the left side of the front of the body.

(Weinstein, pers. comm.). These could also be damaged. See the schematics and explanations in RIEPPEL (1980) and MCDOWELL (1986). It seems likely that the left-most of the snake's two venom glands had been destroyed by the injury. The important role of the venom in prey-handling of *B. dendrophila* s.l. has been treated in a number of studies. The Duvernoy's secretion of *B. melanota* exhibits significant haemolytic activities (BROADERS & RYAN, 1997). Boigatoxin-A, a three-finger toxin (3FTX) and non-enzymatic protein has been isolated from the venom of *B. d. dendrophila* (LUMSDEN et al., 2005; HEGDE et al., 2010). It causes weak postsynaptic neurotoxicity in skeletal muscle and furthermore it exhibits prejunctional neurotoxic activity in smooth muscle of the rat vas deferens. Denmotoxin, another three-finger

that three-finger toxins are taxon-specific, which illustrates the link between venom toxin evolution and prey preference (PAWLAK et al., 2006, 2009).

Other components of *Boiga dendrophila* s.l. venom and their characteristics have been reviewed by SAVIOLA et al. (2014).

Which impact could it have for the large *B. melanota* when one of the two venom glands has probably been destroyed? Would the snake still be able to hunt and kill birds although its venom yield might have been halved? In another bird-eating member of the genus possessing three-finger toxins targeting natural avian prey, *B. irregularis*, the venom yields of large individuals commonly exceeds 20 mg



Figure 6. The adult *Boiga melanota*, total length 184 cm, found in shallow water of the major stream.

which can kill 9 kg-equivalents of bird (domestic chicken) corresponding to approx. three adult chickens (PAWLAK et al., 2009; MACKESSY, 2010). In *B. irregularis*, iridotoxin is also essential for its predation on birds. On that basis the available venom yield of the injured adult *B. melanota* would easily be able to kill avian prey whose body weight is assumed not to exceed 300 g. Namely the more common birds seen in *Boiga* habitats are the size of thrushes, pittas and similarly small species.

In an analysis of the hydrodynamics of venom in interaction with the groove geometry it has been suggested that the enlarged rear maxillary teeth as seen in e.g., *Boiga* spp. can deliver venom effectively and fairly rapidly into wounds (YOUNG et al., 2011).

Little has been published about snakes surviving severe injury. GREENE (1988) provided a superficial review of injury in wild reptiles, but some cases were subsequently treated in captivity.

HEYBORNE et al. (2020) observed an adult *Pituophis catenifer deserticola* with an open perforation in the neck. The length of the wound was approx. 40 mm. The authors considered attempted predation as a plausible

explanation. However, I believe the injury might also have occurred during swallowing of a large prey which could potentially still have been alive and struggling fiercely thus creating the large wound.

KOŁODZIEJ & CENKER (2019) described an adult *Zamenis longissimus* found in the wild in Austria lacking both eyes. It was strong and well-nourished. There was no sign of injury around the orbits. Potentially this was a case of anophthalmia (congenital).

A number of studies of injury in snake populations have been made, however, severe injuries are generally not reported. An intriguing exception is island populations of *Notechis scutatus* in which gulls and other birds peck at the heads of the snakes (AUBRET & THOMAS, 2009). In one population 7.5% were blind and 6.6% half blinded and large scars were observed. In a Hungarian population of *Dolichophis caspius* 22% of the captured individuals had scars, but none on the head (FRANK & DUDÁS, 2019). It was suggested that body scarring did not decrease foraging success and associated growth. NAGY (2001) made a survey on *Natrix natrix* with injuries in a habitat dominated by fish ponds in Hungary. 54% of 186 individuals had various types of injury,

predominantly on the tail, to a lesser extent on the body and fewest injuries were on the head. There were even four cases in which fish bones had penetrated the body or throat from the inside. In a study in Poland 104 live *Natrix natrix* were recorded, 18 of which had scars and injuries (BORCZYK, 2004). 5 of the 18 injuries were on the head. Furthermore 18 dead individuals were collected, 14 of which were road-killed. In KABISCH' (2020) detailed review of predation on *N. natrix* additional examples of surviving individuals with scars after injuries are also provided. Most cases were believed to have been caused by mammalian attacks. GREGORY & ISAAC (2005) recorded injuries in an English population of *N. helvetica* suffering from broken bones, assorted scars and wounds and tail loss. In an Austrian population of *N. tessellata* 15% had fresh or healed injuries, mostly missing tail tips (SMOLE-WIENER, 2011).

A particularly serious type of human-caused injury in snakes is road-kills: confrontation with vehicles have very high mortality rates (SANTOS et al., 2011, WINTON et al., 2018).

SUMMARY

A record of a large *Boiga melanota* with a severe head injury is provided. It was found in a stream on a night trip in a cultivated area in Southeast Thailand in the southern part of the Narathiwat Province. The injury was in the left part of the head, just behind the left eye. A considerable portion of bone had been destroyed, the mouth could not close properly in the left side, and the left venom glands might well have been destroyed. The quadratomaxillary ligament and a mandibular muscle were probably also traumatized. There was no sign of infection, and the snake was fresh, aggressive and well-nourished. It is likely that the injury was the result of a human attack using an agricultural tool such as a hoe or sickle. It is judged that it might well have recovered fully and survived. The venom of *B. dendrophila* s.l. contains three-finger toxins such as irditoxin, which are highly toxic to birds and reptiles but have little effect on mammals. It is concluded that even with only one venom gland the injured *B. melanota* has probably been able to easily kill birds and reptiles with its venom.

Severe injury in wild snakes having survived is seldom reported. A review of other published cases of injured wild snakes which have

survived is made. Cases of wild snakes surviving severe injury are rarely reported. The published cases that exist are reviewed here. The injuries discussed appear to be considerably milder than the one described for *Boiga melanota*.

SAMENVATTING

De vondst van een grote *Boiga melanota* met een ernstige verwonding aan de kop wordt beschreven. Het dier werd aangetroffen in een rivierarm tijdens een nachtelijke tocht in bouwland in het zuidoosten van Thailand, in de provincie Narathiwat. De verwonding was links op de kop, achter het linkeroog. Een flink stuk bot was beschadigd, de bek kon links niet goed meer sluiten en de linker gifklieren waren mogelijk aangetast. Het quadratomaxillaire ligament en een kaakspier waren wellicht ook verwond. Er toonden zich geen tekenen van infectie en de slang oogde levendig, agressief en goed doorvoed. Waarschijnlijk was de verwonding het resultaat van een aanval door de mens met een schoffel of kapmes. Aangenomen mag worden dat de slang de aanval verder overleefde.

Het gif van *B. dendrophila* s.l. bevat drievingerige toxines zoals irditoxine, die in hoge mate giftig zijn voor vogels en reptielen, maar weinig effect hebben op zoogdieren. Zelfs met maar één gifklier kan de gewonde *B. melanota* in staat geacht worden om met gemak vogels en reptielen te doden met zijn gif. Zelden is beschreven dat ernstig gewonde slangen in het wild zijn hersteld. De enkele publicaties waarin dat gerapporteerd wordt, haal ik hier aan. Waarbij gemeld zij dat die verwondingen aanzienlijk geringer waren dan in het onderhavige geval.

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Arboreal behaviour in a coastal population of Bocage's Wall Lizard (*Podarcis bocagei*)

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INTRODUCTION

Bocage's Wall Lizard (*Podarcis bocagei*, López Seoane, 1884) is an endemic species from the Northwest of the Iberian Peninsula (GALÁN, 2015). *P. bocagei* is a ground dwelling species that usually colonizes open areas where the vegetation has been cleared, while in areas with dense vegetation it occupies edges, slopes, rocky outcrops and constructions (GALÁN, 1994).

OBSERVATION

During a survey for reptiles in a coastal area, I observed several Bocage's Wall Lizards (*Podarcis bocagei*) basking on ornamental olive trees (*Olea europaea*). This planting of trees in curious areas like roundabouts seems to be a fairly recent fashion in Spain. The lizards were observed in a gardened area on 1st October 2020, in Baiona, Pontevedra, Spain (UTM 29TNG06, ETRS89, 13 masl). One male was detected basking 2 m above the ground.

Arboreal behaviour has been reported for several lizard's species, including *Darevskia dryada* (DAREVSKY & TUNIYEV, 1997), *Podarcis hispanica* complex in North Africa

(KALIONTZOPOULOU et al., 2009), *P. hispanica* complex (type I/II) in Portugal (MALKMUS, 2004) and *P. hispanica* complex (type II) in Southern Spain (GONZÁLEZ DE LA VEGA, 1988). But this behaviour is reported as rare in other species from the genus *Podarcis*, e.g. in *Podarcis muralis* and *Podarcis sicula* (ARNOLD & OVENDEN, 2007) or from the genus *Iberolacerta* (ARRIBAS, 2012).

GALÁN (2011) claimed that in areas overgrown by dense vegetation *P. bocagei* used trees as basking spots. In this case the area was clear of dense vegetation and there were plenty of places to bask. The management of this resting area, with olive trees being aggressively pruned and losing the crown, promotes the creation of a belt of regrowths at the base and cup of the trees that could prevent the access of lizard predators like feral cats or gulls. Thus, it seems that olive trees were selected as a refuge rather than as basking areas.

It seems more than an anecdotal description of a behaviour but rather an adaptation to an artificial area, as *P. bocagei* individuals were observed several times on ornamental olive trees in different gardened areas in the study zone.

SUMMARY

Arboreal behaviour in *Podarcis bocagei* inhabiting a coastal habitat in Northwestern Spain is reported in this note. Ornamental olive trees were selected as a refuge rather than as basking areas.



Podarcis bocagei habitat as reported here.
Photo: Google Streetview®



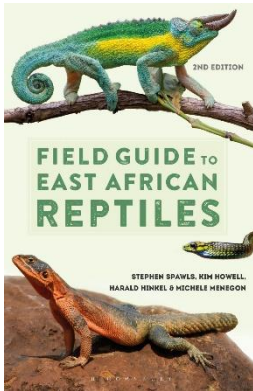
Male *Podarcis bocagei* basking on an ornamental olive tree.

Photos: César Ayres

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Book review

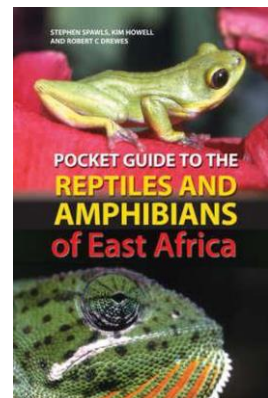
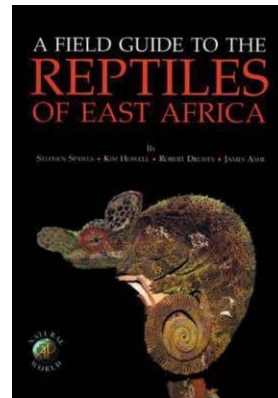


SPAWLS, S., K. HOWELL, H. HINKEL & M. MENEGON, 2018.
Field guide to East African reptiles, 2nd edition.
Bloomsbury Publishing Plc, London, UK, New York, USA.
624 pages, 600+ colour photos, colour distribution maps, paperback
ISBN/EAN: 978-1-4729-3561-8
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The vast majority of people travelling to East Africa is likely to be primarily interested in the large mammals (and a few might be interested in the birds) for which the region is famous. Those people usually travel by car, bus or truck. Such vehicles are excellent for viewing bigger animals and, for safety reasons, are generally the only travel option. Observing smaller animals, like most of the reptiles, is virtually impossible from safari trucks or something similar. Crocodiles, monitors and large snakes may be the only exceptions. Only a limited number of national parks or game reserves, like [Arusha National Park](#) in Tanzania, are accessible on foot. Those interested in reptiles need therefore to rely on those parks or on the often spacious terrain around the lodges or camping sites. As a consequence, the need for travel guides to East African reptiles is limited and the number of reptile guides is much lower than those focussed on mammals.

Over the years, field guides to East African reptiles were limited to simple listings, checklists or comparable publications issued by local organisations and covered only restricted areas. The above mentioned Arusha National Park, for example, published a field guide focussed on the herpetofauna of that park (RAZZETTI & MSUYA, 2002). In the early years of the current millennium a comprehensive field guide was produced covering the reptiles of Kenya, Uganda, Rwanda, Burundi and Tanzania (SPAWLS et al., 2002). This book will be referred to as the first or 2002 edition. Over almost two decades this book could be considered as the standard work covering the complete field of East African reptiles. The group of authors of this first edition published

a pocket guide in 2006 (SPAWLS et al., 2006) representing an excerpt from the standard guide, and added amphibians. As in other parts of the world, many new species have been found and described in East Africa. Existing species have been split and range extensions have been recorded. As a result of new techniques in the field of genetics and molecular biology, many species were reclassified, regrouped and their scientific names changed. The need for an updated version of the field guide was therefore obvious and recognised by the authors. The second edition was published in 2018 and is reviewed in this article.



Older field guides to East African herpetofauna by SPAWLS et al., 2002, 2006.

The introduction states: “Our original guide described 432 species of reptile from East Africa; the new list contains 492 species. Well over 100 species have had their generic names changed.”. Trying to deal with all these species in some detail makes the book a reference work in addition to a field guide.



East African reptiles; top left: *Agama lionotus*, Tsavo West, Kenya; top right: *Broadleysaurus major*, Bamburi, Kenya; bottom left: *Latastia longicaudata*, Tsavo West, Kenya; bottom right: *Trachylepis striata*, Mto Wa Mbu, Tanzania.

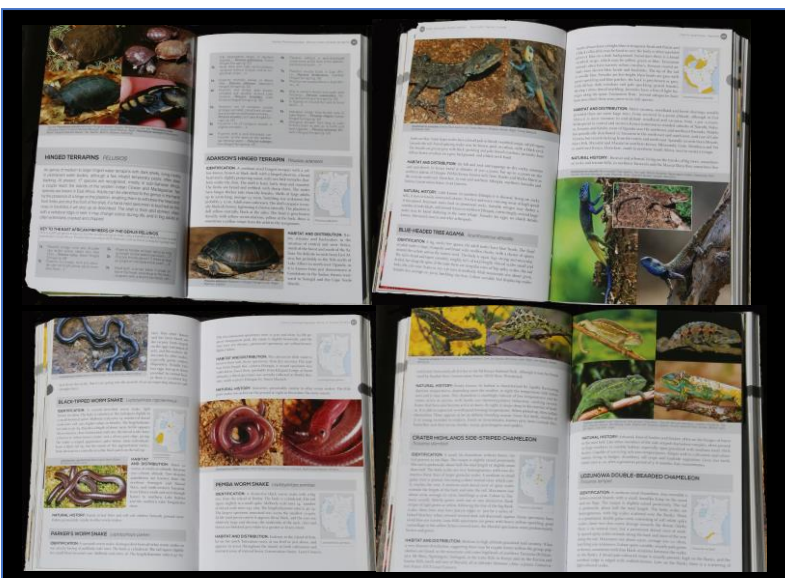
Photos: John Boonman.

On first impression the book is overflowing with information. The chosen font is rather small and the pictures are clustered together with minimal space between them. The resulting layout has almost no margins as the photos and text fill each page in every direction. The quality of the photos is generally good. It seems the authors were trying to fit as many species as possible in as small a book as possible. This worked in the first edition as it was solely a field guide. As a reference work as well, this edition would be much improved if they had chosen a more reader-friendly layout.

This second edition is available as an e-book, not a very common practice for books other than novels. It should be realised that most of the older e-readers have black and white screens. In order to be able to make full use of the possibilities of the field guide, it should be used on modern e-readers with a colour screen, tablets or laptops fitted with software

to deal with documents in ePub-format, or as a PDF. For use in the field, small sized, modern e-readers with sufficient battery capacity (usually not a real problem) can be recommended, even more since e-books with E-ink screens are readable in full daylight (and in fact need an external light source), in contrast to tablets and laptops which are best read in dim light.

The guide is very well-structured. Twenty-five pages of "introductory essays", less than in the first edition, are followed by the species accounts, grouped as chelonians, lizards, worm lizards, crocodiles, and snakes with more than 550 pages in total. The book ends with a glossary, line drawings, defining scales, shields, horns and alike and an index. A list of literature or references is sorely missing. Only in the introduction is there one page devoted to recommendations for further reading, and resources.



A selection of pages from the reviewed book.

Each grouping of animals contains general information followed by keys to families and genera. At the end of those identification trees each and every species is described in the same fashion: identification, habitat and distribution, and natural history. All the sections contain at least one photo of the species, often more, and a small distribution map. Because a map of the same size is used for every species, even the scarce ones, the yellow shadings indicating the distribution are often very small.

As a practical test some reptiles observed in the area were identified according to the recommendations described in the book. After an animal was spotted, I leaved through the book, matched the animal with the pictures shown, checked the distribution map and finally looked at the text. In all cases — not the most difficult ones must be admitted — identification turned out to be straightforward.

LITERATURE

- ALEXANDER, G. & J. MARAIS, 2007. A guide to the reptiles of Southern Africa. Struik Publishers, Cape Town, South Africa.
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Results are shown in the photos on the previous page. It can be concluded that the claim of being a field guide is fulfilled, at least for the easy species. Less well-known or scarce species will probably provide more difficulties when attempting to identify them.

The status of this book as a potential reference work is also achieved as even the most seldomly encountered species are described. Any possibly new form will, however, escape attention in such a manner. For that reason some more background would have been appreciated. For instance, while describing *Philochortus rudolfensis* the authors mention “some authorities” believe it to be a subspecies of another form. It would have been useful to refer to those authorities, in whatever form, to allow the reader to follow up if they are interested.

To conclude, the book is a useful field guide. As far as it can be judged, it is as up-to-date as a work of this type can be with lots of detail. Its use in the field is slightly hampered by the lay-out. It would have been more user-friendly if a form was chosen similar to the one of “A guide to the reptiles of Southern Africa” (ALEXANDER & MARAIS, 2007), describing a representative example of a group in a more transparent lay-out, with pictures of that example and related species, and finally listing all the species in the group by name. At present, readers must check the Internet for the differences between the species. In many cases that will assist in completing the identification process. As a reference work the book is useful as well. A more explicit linking to background resources would have improved its value.

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