A SUCCESSFUL CROSS-BREEDING WITH *PSAMMOPHIS SIBILANS* AND *PSAMMOPHIS SUBTAENIATUS* IN THE TERRARIUM.

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Contents: Introduction - Popularity - The genus and the species - Length - Scalation - Habitat and behaviour - Polishing behaviour - Reproduction - Breeding - Conclusion - References.

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INTRODUCTION

In 1982 I bought my firs *Psammophis subtaeniatus sudanensis,* an African sandsnake. From that moment I became a lover of sandsnakes. In time my collection increased to four species: *Psammophis subtaeniatus sudanensis, Psammophis sibilans,* and *Psammophis schokari aegyptius,* all are African species, and *Psammophis condanarus,* the Indochinese sandsnake, which, as the name indicates, inhabits Southeast Asia. I also kept two unidentified sandsnakes from Togo, one of which was probably *Psammophis sibilans.*

Also in my collection was the related *Malpolon moilensis, Malpolon monspessulanus (insignitus* as well as *monspessulanus).* For a short period I also kept the related *Psammophylax rhombeatus.*

POPULARITY

The fact that I do not keep more species of sandsnakes is because these species are rarely available. The reasons for this include they are not easy to catch, and they have an unpleasant character (quick to bite). Also there are few terrarium keepers interested in these snakes, as they are quite cheap snakes, and the young cannot be sold for much money. The young often refuse to eat nest mice, so they have to be force-fed for a long time. As most snake keepers prefer to keep snakes which are easy to keep and breed, and the young can be sold for a lot of money, it is clear that sandsnakes never will be as popular as e.g. kingsnakes.

Reading this paragraph, one may think that it is not nice to keep these species of snakes, but the the contrary is true: because of their interesting behaviour and proud character they are extraordinary snakes to keep.

THE GENUS AND THE SPECIES

The genus *Psammophis* belongs to the family *Colubridae,* subfamily *Lycodontinae.* Within this subfamily occur non-venomous genera (like *Lamprophis*) as well as opistoglyph genera. The latter possess enlarged and grooved fangs in the upper jaw, situated below the eye. Additionally they have venom glands. The venom enters the victim with the aid of chewing with the fangs. In the genus *Psammophis* two enlarged fangs are placed in either side of the jaw: the longest just before the eye, the other (which is grooved) just behind the eye.

The fact that opistoglyph and aglyph genera occur within one subfamily seems curious but can be explained by the modern taxonomic view that no longer is based on differences in dentition alone, but also on genetic and immunological differences. Because of this the modern systematical placement shows a better relationship between the species, but is more difficult to use in practice.

Within the genus *Psammophis* several species groups are recognised, of which the sibilans-group is an important one. In the sibilans-group are *Psammophis sibilans, Psammophis subtaeniatus* and *Psammophis phillipsi.* The taxonomy of this genus is very difficult which will become obvious when reading the following paragraphs. Within these paragraphs I will mention the similarities and the differences between *Psammophis sibilans* and *Psammophis subtaeniatus,* especially, as these two species are very difficult to separate. Additionally, these are the two species I have bred, as you will learn below.

LENGTH

Branch (1988) gives the maximum length for *Psammophis sibilans* in southern Africa as 135 cm, with an average of 90-110 cm, juveniles measure 19-25 cm. Auerbach (1987) mentions a maximum length for *Psammophis sibilans brevirostris,* which lives in Botswana, as 150 cm, the young about 28 cm. Isemonger (1968) gives a maximum size for *Psammophis sibilans* of 185 cm, with an average of 120 cm; for *Psammophis subtaeniatus subtaeniatus* a length of 90 cm, with a maximum of 120 cm and for *Psammophis subtaeniatus sudanensis* a maximum of 135 cm, so that this subspecies reaches a slightly larger maximum length than the nominate form.

The problem with all these observations is that they are usually a bit unreliable. First there is the fact that as far as we know, in these snakes there is sexual dimorphism, which means that the males are larger and heavier than the females. So it is not correct to mention only one maximum and average measurement for both sexes. However, in the field it is also very difficult to determine the sex of a specimen especially in *Psammophis.* A second unreliable factor is that the measurements are usually taken from incidental observations. A third factor is, that the maximum length of snakes in the wild is not always a reliable indication of the maximum length that a snake can reach under optimum conditions, e.g., in a terrarium, with no predators.

SCALATION

The following scalation data are mentioned in the literature: dorsal scale rows: 17; ventrals: 151-198; subcaudals: 78-121 (paired); anal: divided; supralabials: usually 8, of which the fourth and fifth are in contact with the eye; sublabials: 7-9; postoculars: 2 (sometimes 3). In Table 1 I give the scalation data for two specimens of *Psammophis sibilans* imported from Egypt which I obtained. TS 474 is a specimen, bought on 22 May 1991, which was completely apathetic and died within one week. TS 479 is a female that was imported in 1990, and is still in my possession.

From the characteristics given in the Table we learn that the described animals are within the range of the scalation data given in the literature. For individual specimens is is not possible to make any difference between *Psammophis sibilans* and *Psammophis subtaeniatus.*

In colour and markings *Psammophis sibilans* is an exceptionally variable snake, with additionally some regional variation, which is not surprising when the enormous distribution area is taken into account. There are almost uniformly coloured specimens (of which I saw one in the trade some years ago), but also striped forms, which look very much alike.

With *Psammophis subtaeniatus* it is known (Pitman, 1974) that in one clutch striped as well as uniformly coloured embryos were found. Isemonger (1968) gives the following characteristics:

varies from light to dark olive coloured, usually with a darker, broad middorsal stripe and black-edged scales. Sometimes there is a narrow, yellowish line on either side parallel to the dark middorsal stripe. The lips are yellowish white, mostly with irregular spots.

Identification	**TS 474**	**TS 489**	**TS 479** ♀
dorsal scale rows	17	17	17
ventrals	158	163	163
paired subcaudals	68	59+	104
supralabials of which in contact with the eye	8 4 and 5	8 4 and 5	8 4 and 5
sublabials	9		
postoculars	2	2	3
anal divided	yes	yes	yes
rostral as broad as high	yes	yes	?

Tabel 1: scalation *Psammophis sibilans.*

Auerbach (1987) describes for Botswana the following colouration: olive coloured and dorsally brown; he mentions the same broad dark mid-dorsal stripe as Isemonger does, but also that sometimes two narrow stripes divide this mid-dorsal stripe into three parts. Usually there is a row of little spots on the back that divide this stripe into two parts, sometimes these spots form an undivided line on the back.

In the eastern parts of Botswana there are also uniform olive-coloured 'intergrades,' however, usually these specimens have at least some markings on the neck and head. The belly is uniform white, sometimes with spots, little stripes or dots, that may form a longitudinal stripe along the edges of the ventrals.

According to this description there sometimes is and sometimes is not a mid-dorsal line and a stripe along the edges of the ventrals. Pitman (1974) mentions that colour and markings of *Psammophis sibilans* is highly variable, and cites that the whole *Psammophis*-complex is one of the most difficult problems of African snake taxonomy.

Within the same citation Pitman says that 5-10% of the Egyptian specimens of *Psammophis sibilans* have black latero-ventral narrow lines, just like *Psammophis subtaeniatus.* Broadley prefers to consider the Ugandese specimens of *Psammophis subtaeniatus* as typical *Psammophis sibilans.*

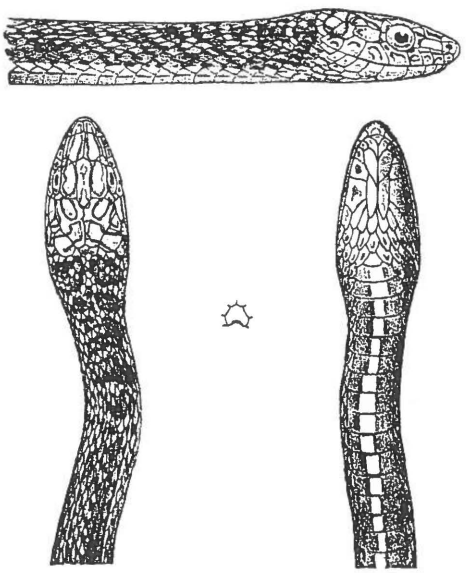
Anderson (1898) describes *Psammophis sibilans* on pp. 302-307. The characteristics he mentions, are the same as mentioned elsewhere. Remarkable is, however, the depiction of 'Type of *Coluber sibilans,* Linnaeus (Upsala Museum)' on page 306, where the ventral side is coloured dark and shows a light mid-ventral stripe (see picture).

Pitman (1974) cites Broadley (1966), who noticed that in *Psammophis sibilans* a grey colour may occur on the ventrals, between the longitudinal latero-ventral stripes, but that this colour usually can only be observed after preservation of the specimen. If Broadley means the same

'colour field' as shown on the drawing by Anderson this is not definitely clear. Below I describe the characteristics of the two specimens in my possession.

TS 474: A broad olive-brown mid-dorsal stripe between the mid of the 5th scale row of each side; the scales have black edges, there is no narrow mid-dorsal light stripe; there is a light brown stripe between the mid of the 3rd and the mid of the 5th scale row on each side; an olive-coloured stripe runs between the mid of the 1st and the mid of the 3rd scale row on each side; lower half of the first scale row there is a white stripe, which is bordered on the belly by an uninterrupted black line on the sides of the ventrals; the ventral colour between the two black lines is yellowish-white. Other characteristics: there is an orange colour on the supralabials and on the sides of the neck. There are little brown-red spots on the ventral side of the head. Remarkable is that the only difference with *Psammophis subtaeniatus sudanensis* is the lacking of the mid-dorsal line.

TS 479:



This animal is almost identical in colour and markings as the above described specimen, with the only difference that there are no black stripes along the edges of the ventrals.
Both specimens show remarkable similarity in colour and markings to all specimens of *Psammophis subtaeniatus sudanensis* that I have kept and bred since 1982. The differences are restricted to three characteristics:

1: in both specimens the mid-dorsal line is lacking;
2: one of the specimens has no lines along the edges of the ventrals;
3: both animals show orange-red spots on the sides of head and throat.

Remarkable is that one specimen has no lines along the ventrals, while the other one does. The presence of these lines in the literature is usually mentioned as a characteristic of *Psammophis subtaeniatus*.

In Anderson (1898) a drawing (Plate XLIII) of *Psammophis sibilans* shows a male from Abbasiyeh, Cairo, that clearly has a mid-dorsal line, and so (from above) exactly looks like my specimens of *Psammophis subtaeniatus*. If this specimen also had ventral lines cannot be seen from the drawing.

A last remarkable point is that the female in my possession (TS 479), initially had an indistinct mid-dorsal line, but after half a year this line cannot be seen any more. Only under certain lighting can you see that the mid-dorsal scale row has a slightly lighter colour than those on both sides.

TS 489:
A male, imported in 1991 from Egypt, bought by me direct from the importer. Markings are identical to those of TS 479, with a clear mid-dorsal line and ventral lines.

HABITAT AND BEHAVIOUR

Isemonger (1968) mentions as distribution of *Psammophis sibilans* South Africa (Natal and Transvaal), Botswana, Namibia, Zimbabwe, Zambia, Malawi, Mozambique, Angola, East Africa, West Africa, and North Africa, with the restriction that this snake is not found in rainforest and deserts. Pitman (1974) also writes that this snake does not occur in swamps.

The snake is active during daytime and is often sunbathing on the same spot day after day in low bushes or on overhanging branches of a tree up to a height of three or four metres. It is an excellent climber. In the terrarium these animals like to sunbath on the branches and at night they retreat to a branch in the top of the terrarium. In my terrarium even copulation took place in the branches. As far as I have observed the behaviour under terrarium conditions does not differ from that of *Psammophis subtaeniatus.*

Pitman is right in arguing that the name Sandsnake is not correct for this species, because it does not occur on sandy substrate. Pitman also argues that at least some birds do not recognise the snake as an enemy: he personally observed large specimens of *Psammophis sibilans* frequently and peacefully sunbathing in the neighbourhood of the nests of Bulbuls *(Pycnonotus)* and Weaverbirds *(Ploceus).*

In the wild food consists of lizards (agamas, skinks and geckos), rodents and frogs. Also mice, little birds and chickens (they repeatedly return to the same source for food) are on the menu, as well as little snakes, including venomous snakes. In captivity they are greedy eaters, as I have seen myself. Also in this aspect they do not differ from *Psammophis subtaeniatus.* I feed them mice and nest rats.

Natural enemies include snake-eagles, buzzards, and other birds of prey. In the wild a great number of snakes have lost their tail because of an unpleasant meeting with a bird of prey. Other species of snakes are a threat to *Psammophis,* like *Mehelya, Dispholidus* and cobras. The venom of *Psammophis sibilans* is as with *Psammophis subtaeniatus* apparently harmless to men.

POLISHING BEHAVIOUR

Sandsnakes like Montpellier snakes *(Malpolon sp.)* show an interesting behaviour known as polishing behaviour. This behaviour has been described for *Malpolon monspessulanus* and *Psammophis sibilans* (C. de Haan, 1982) and *Psammophis subtaeniatus sudanensis* (Steehouder, 1984a and 1984b).

The above mentioned descriptions are several years old now and I assume that only a few people have access to the literature. Since that time many new snake enthusiasts have joined the Society so I quote from the article by C. de Haan (1982):

'In short wording the perfectly performed 'polishing behaviour' of Malpolon monspessulanus consists of two series of about 100 almost identical 'up and down movements' of the head along almost the entire lower surface of the body, during which a colourless, quick drying gland secretion is discharged via the little opening situated at the outside of the nostril valve. This secretion is applied to the ventral and subcaudal scales in a zigzag track that becomes invisible almost immediately. When the first series of polishing movements has been carried out with the left nostril, a the second series follows with the right nostril. The interval between the series seldom lasts longer than 10 seconds. During each series of movements the nostril is in a continuous contact with the scales and this lasts some 90 seconds for 100 head movements across a little more than 200 scales, at a body temperature of 33-36°C. An acceptable explanation for this behaviour has never been given, despite the fact that the secretion from the nasal gland has been analysed and that is known now that each Malpolon monspessulanus shows this behaviour, irrespective of the age or sex of the animal. Polishing behaviour

can be seen several times per day as soon as he or she has been warmed up to a certain temperature, at lower temperatures always directly after a sloughing, and often after a meal.

The polishing behaviour of Psammophis sibilans will occur under the same conditions as mentioned above, but consists of one single, at the most 50 seconds lasting series of very complex movements. The most remarkable is that the head (together with a part of the body) moves up to 17 times across the back to the left and right side respectively. The left or right nostril respectively touches with that a part of the left or right lateral scales respectively and polishes, with a strong wipe to the direction of the tail, a new piece of the ventral surface, that raises for this reason in a vertical wave' (De Haan, 1982).

In figure 1 (from De Haan, 1982) we see *Malpolon monspessulanus* during the polishing behaviour. De Haan studied this behaviour very accurately with the help of self recorded film registration. In figure 2 you see moments from the polishing behaviour of *Psammophis sibilans,* also after De Haan (1982).

In my publication of 1984 (Steehouder, 1984) I added that my *Psammophis subtaeniatus sudanensis* uses the same polishing system as *Psammophis sibilans* in the description of De Haan, on the understanding that the ventral surface gets a kind of 'there and back wipe,' more extended than described by De Haan. A schematic depiction of this you will find in figure 3. Between the lines d (from dorsal) and v (from ventral) is the body of the snake. The thick uninterrupted lines indicate the movement of the snout in contact with the body. The interrupted lines give the movement of the snout not in contact with the body. The arrows give the direction of the movement that is followed. Ln = left nostril, Rn = right nostril. Branch (1988) mentions that 'some *Psammophis*-species *(Psammophis sibilans* and *Psammophis schokari)* polish themselves to prevent loss of moisture.' Concerning the first statement, this is not true: in the mean time has become clear (by observations by Mr. De Haan and myself) that all the observed species of the genus *Psammophis* polish themselves in an identical way, including the extended wipe on the ventral surface. Personally I have observed this in *Psammophis condanarus, Psammophis sibilans, Psammophis subtaeniatus* and *Psammophis schokari,* and also in both unidentified *Psammophis*-specimens from Togo. No observations of other species are known to me and one of my wishes is to observe one day the polishing behaviour of other *Psammophis*-species. Concerning the benefit of this polishing behaviour, this will undoubtedly become more clear when the volume on snakes of Böhme's 'Handbook on European Reptiles and Amphibians' finally will be published. In this volume Kees de Haan dealing with the species *Malpolon monspessulanus* will discuss the polishing behaviour. For the moment the polishing behaviour is to do with the discharge of a gland secretion that has an unclear function in relation to members of the same species. The statement of Branch has become very unlikely now. Montpellier snakes also seem to apply this secretion on objects in their surroundings. A clean snake keeper will regularly observe with great dissatisfaction that the windows of the terrarium again need to be cleaned: long wipes of excretion make them only half transparent. Yet, the excretion normally is not applied directly on stones or trunks (De Haan, personal communication): as soon as it has dried on the ventral scales it will be scraped off (usually automatically, sometimes on purpose) on all kinds of substrate and also (in *Malpolon monspessulanus*) on the dorsal scales of members of the same species. With Sandsnakes secretion is never wiped onto the terrarium windows, at least I have never noticed this in my terraria. But it does happen that the animals accidentally polish each other: a snake that is polishing itself comes in contact with the body of another snake, and continues polishing its companion.

My snakes do not polish themselves very frequently. In a recent publication (Steehouder, 1991) I mentioned the possible reason for this: the high relative humidity of the air in my snake room. In humid air smells are less volatile than in dry air. Kees de Haan mentions in his publications

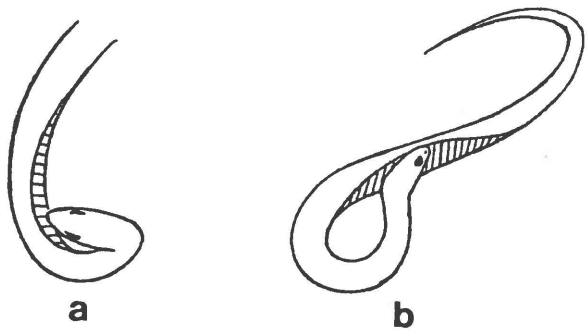


Figure 1: polishing behaviour of *Malpolon monspessulanus* (after De Haan, 1982).

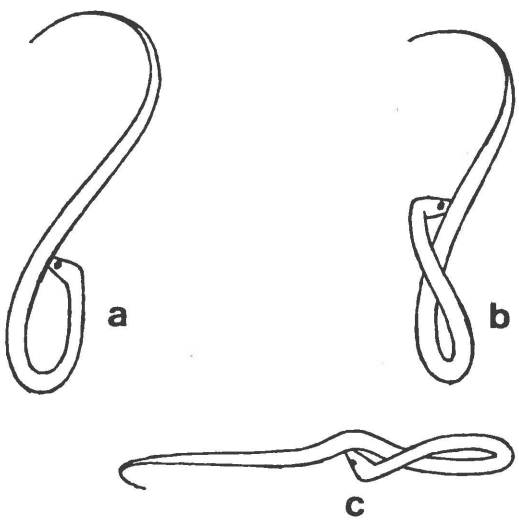
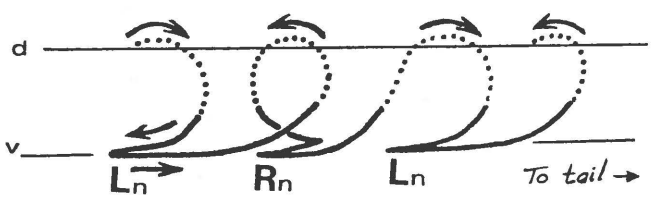


Figure 2: Polishing behaviour of *Psammophis sibilans* (after De Haan, 1982).



Polishing behaviour of *Psammophis subtaeniatus* (after Steehouder, 1984a).

that Montpellier snakes are polishing especially during warm and dry weather. The relative humidity of the air in my snake room is usually quite high (minimum 60%, usually higher).

On the other hand: according to De Haan (personal communication) the smell of the wipes of secretion is probably nil and the smell of the scraped off particles probably nil or minimal. According to him these particles are probably lifted from the substrate by the wet tips of the tongue of the snakes, brought into the mouth and wiped off on the special protrusions at the entrance of the shaft of the tongue, after which these protrusions reach to the entrance of Jacobson's organ (Young, 1990). It is more likely that in this organ a taste is determined rather than a smell.

The fact that my snakes are not polishing very frequently may be caused by the fact that they are not housed in very large terraria. When the stones, the windows, the trunks, etc. have been treated with secretion thoroughly, and the smell or taste is in the terrarium for a long time, there is not much reason to start polishing again.

De Haan also told me that he keeps *Psammophis schokari* in terraria with many branches against the windows: 'Sometimes I notice that polishing secretion is present on the windows in little tufts or little wipes, not more than that, probably because one nostril was there on its way to the other side of the body. In Malpolon the long zigzag wipes one often finds on the windows are a mistake for the polishing surface I think. I never saw them polishing against a larger surface than their own ventral surface. Polishing behaviour at a window or the ventral surface of a companion clearly are coincidental mistakes.'

The scraping off of the polishing secretion from the ventral surface is (according to De Haan) the only real marking-trick. This method has the advantage that this can be done automatically during exploration, hunting, escaping, etc., if the secretion has been applied on the ventral surface during a favourable moment at a safe spot.

Another advantage is that the fast moving snake can take in its own particles of secretion into its mouth via continuous tongue movements, and give it a thought then. De Haan observed how rushing Montpellier snakes like in an animated cartoon, first when they had already passed an evidently present intriguing trace of particles, they noticed that they had passed it, returned to give it an extensive research, and then followed the trace or 'escaped' from it (De Haan, personal communication).

De Haan found that his Montpellier snakes principally polished themselves when they go out for a hunt. Even specimens that should 'know' that they live in a relatively small cage do this. When, in a small cage, there was no food for some time they would polish themselves and start making efforts to escape. In other words: polishing behaviour means that they have planned a forage. The knowledge that they are always able to find a way back to a secure hiding place, gives the Montpellier snake freedom to go far away and concentrate on hunting and on the presence of enemies (De Haan, personal communication).

The behaviour of *Psammophis sibilans* is, as far as I have observed to date, is identical to the specimens of *Psammophis subtaeniatus,* described by me in earlier publications. The animals eagerly eat mice the year round. These are hunted in a turbulent way. A non moving prey is not recognised easily, but as soon as the mouse is moving, the snake goes after it. The hunting behaviour of one snake stimulates the others. Often they are all together hunting after one prey, while the other mice are left in peace for that moment (e.g., while they are not active enough, or because the prey that is being hunted by the snakes gives more visual agitation already).

It is characteristic that the snake raises the front part of its body off the ground, and stands quite still with the head a bit downwards above the prey to strike at the right moment and to seize the prey in the neck or the front part of the back. The mouse seized in this way is held in the air while the snake keeps the mouth secure or makes chewing movements to infuse the venom. The venom is quite strong and works rapidly: even bigger mice are usually dead or paralysed within a minute.

I could not find any differences between the behaviour of the specimens of *Psammophis sibilans* I have seen until now, and the *Psammophis subtaeniatus sudanensis.* The difference between the behaviour of these two snakes and that of *Psammophis schokari* and *Psammophis condanarus* is remarkable, both latter species are quiet and more approachable. Second generation captive bred animals of *Psammophis subtaeniatus sudanensis* are still as nervy and turbulent as their wild-caught parents.

REPRODUCTION

Auerbach (1987) gives information on egg laying for *Psammophis sibilans brevirostris:* number of eggs per clutch: 10-30, average size of the eggs: about 3.5 x 1.5 cm, time of egg laying: mid summer. Branch (1988) published different data for *Psammophis sibilans:* 4-15 eggs of 2.8 x 1.5 cm. For *Psammophis subtaeniatus subtaeniatus* Auerbach gives a number of 4-10 eggs per clutch, and a size of 3.2 x 1.2 cm. Branch published the same data, so I assume that they based their data on the same source. My personal opinion is that these data are not based on an average of a large number of observations, but probably on a single or few observations. The large number (30) of eggs of *Psammophis sibilans* he mentions, is at least doubtful. A probable explanation is that this clutch consisted of the eggs of several females, deposited in the same nest.

Pitman (1974) mentions 10-15 as the normal number of eggs, with a possible number of 30 (apparently he also had his doubts). For the maximum size of the eggs he gives 4.0 x 2.8 cm. According to him the eggs are deposited in humid piles of organic material, like dead leaves or grass, and usually placed under some light shadow. The incubation of the eggs lasts some three months. In Uganda the eggs are deposited from November to January. The young have a length of up to 30 cm, slough for the first time within about one week and feed on newborn mice and little frogs.

BREEDING

I obtained my female at the end of 1990 and housed her in the same cage as two young males (second generation captive bred, born 1988 and 1989) of *Psammophis subtaeniatus sudanensis.* Early spring of 1991 the snakes started copulating: the female copulated with both males. The same as in *Psammophis subtaeniatus* copulations took place almost unnoticeable, while the animals were resting or were lying in the branches. I never saw any copulation ritual, they were just copulating. This took place during day time, in the evening and at night.

The eggs were laid on 13 April 1991. The average weight was 12 g. One egg measured 5 x 2 cm, another 5.5 x 2 cm, and a third one 4.5 x 2 cm. The other two eggs were not measured nor weighed. The size of the eggs is larger than the measurements found in the literature. This is even more surprising when we take into account that it was a very young female: total length about 60 cm.

In 1983 I had successful results with the incubation of eggs of *Psammophis subtaeniatus,* so I used the same method again: a little plastic container was filled with a layer of wet coarse river sand. The eggs were half buried. In each side of the container a little hole was made for some ventilation. The container was closed, but the lid was removed every few days to refresh the air more extensively.

Like in *Psammophis subtaeniatus* the size of the eggs increased enormous because of absorption of water. On 14, 15 and 16 June 1991 three young hatched. In appearance they are identical to the young of *Psammophis subtaeniatus sudanensis,* hatched in earlier years: complete with a mid dorsal line and lines on the edges of the ventrals. The only difference is that they

are more heavy build. A really remarkable difference in behaviour is that these young are much more easy to raise than the young of *Psammophis subtaeniatus sudanensis.* Two of the young started to feed on live nest mice immediately after the first slough. For this reason they are growing very fast. The third young eats less eagerly. Any way, this seems to confirm the publications of Pitman (1974) that young *Psammophis sibilans* eat nest mice.

CONCLUSION

From the above it may well be clear that it is not easy to find clear differences between *Psammophis sibilans* and *Psammophis subtaeniatus.* The external differences mentioned in the literature are not really stable. In my opinion it is impossible to separate the two species on external characteristics. Because of the overlap of distribution areas in many cases this is not possible even when you know the location where the specimen was captured. This is demonstrated by the specimens imported from Togo (see the beginning of this article), of which one was impossible to separate from *Psammophis subtaeniatus,* while that species does not occur in West Africa. The only difference between that snake and my specimens of *Psammophis subtaeniatus* was the red-brown lateral stripe in stead of an olive-coloured one.

The 'characteristic' narrow ventral lines that gave *Psammophis subtaeniatus* its name ('with a line on the lower surface') also can not count as a characteristic for differentiation. This is also confirmed by the publication of Böhme (1986) in this magazine: only one of the lower surfaces depicted in Figure 2 is from *Psammophis subtaeniatus.*

Psammophis sibilans and *Psammophis subtaeniatus* proved to have a mutual fertility, as was already demonstrated by the existence of intergrades: specimens from overlapping distributional areas which have characteristics of both species. The three young now born in my snake collection not only are interbreds, but until now only show external characteristics of *Psammophis subtaeniatus.* We will have to wait and see how they develop as they grow older, also if they are capable to reproduce themselves or not is still in the future.

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