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THE ANATOMY OF XENOPELTIS UNICOLOR

by

Prof. Dr. R. A. M. BERGMAN

Royal Tropical Institute, Amsterdam

General aspect.

Xenopeltis unicolor Reinwardt is a burrowing snake, living in South East Asia and in Indonesia. It is easily recognisable even at first sight, both by its peculiar colouring and by the shape of the head, which shows a dorso-ventrally flattened snout, with a curiously rounded frontal margin. Haas (1930) is right in stating that there is probably no other snake with such a remarkable 'physiognomy'. In its way of moving around it seems not to lift the head before going on, but rather to shove it sideways to right and left and then proceed on its way.

The scales are very flat and make a completely smooth covering for the animal, this being considered another adaptation to the burrowing life. The name *Xenopeltis*, however, does not refer to this particularity, but as pointed out by Mertens (1943) to the presence among the headshields of an interparietal surrounded by four parietals, an unusual feature.

The trivial name *unicolor* points to the uniformity of design from head to tail in fullgrown specimens. In the living animal, as far as my experience goes, the most vivid impression is not one of uniformity or monotony, but one of incessantly changing iridescence with an undertone of violet grey; an impression which it is hard to render into words. It is even difficult to convey by means of a photograph: in most of these the white lining of the scales becomes too much enforced and so they give more the idea of a geometric design, a succession of separate squares or lozenges instead of the impression of smoothness of movement and fluidity of colour which predominates in the living animal.

Smith (1943) describes the animal as black to chocolate-brown above, highly iridescent, ventrals and outermost row of scales white, uniform or edged with brown. De Rooij (1917) speaks of brown or blackish above. Brongersma (1930) describes two abnormally coloured specimens in the collection of the Amsterdam museum: the one nearly black, even ventrally, the other yellowish white. Mertens (1943) calls the animal the Rainbow snake. In my collection in Surabaia I have not found a single exception to the indeed very uniformly greyish-violet undertone to the iridescence. When the animal is dead and preserved in formalin or alcohol, the iridescence does not show itself any more and the main colour is dull grey.

Reinwardt (1827) gives as the native name and its meaning: "Ladguine Pagaer soll Auge des Tages bedeuten", an expression I have not been able to understand. Other native names, according to De Rooij (1917) are "ular ekor merak", which means the snake (looking like) the tail of a peacock; or in Batak language: "soratu", which I can not translate, and in Celebes: "ular tanah" which means earth snake. This was also the way it was called in Surabaia, and it evidently indicates the burrowing mode of life.

Frequency.

In South East Asia these snakes seem to be very common, according to Smith (1943), and in the Philippines they are rare according to Taylor (1922) who quotes Schlegel where he mentions the rarity of *Xenopeltis* in Java. In this country it is certainly not a very common species, as my friend Jhr. W. C. van Heurn told me, but neither are the specimens very rare as it appears from my own data, because between January 1936 and January 1942 I collected 52 specimens of this species in a total of about 5000 snakes.

Behaviour.

As already stated, the animal lives generally underground, coming only out at night, as Mertens (1943) witnessed in the specimen he had for many years in captivity. My snake hunter told me that these snakes could dig themselves in very quickly and that he had to use his "patjol" (hoe) very fast in the early morning to be able to dislodge them. He showed me a length of about 30 cm as the depth at which the *Xenopeltis* stayed underground. They are not poisonous, in fact completely harmless.

The food seems to be rather varied: other snakes (Wall (1921) mentions that he and Evans saw a *Natrix stolata* being eaten by a *Xenopeltis*), small rodents, frogs, and even birds (Smith, 1943). The snake Mertens (1943) received ate a frog the first day upon arrival; the author exactly describes how the snake seemed to notice it under the ground, when a frog was put into the terrarium. In a few seconds the frog was eaten by the snake, which usually came out right under its prey. On an average this snake took every week a frog or a lizard, even a dead mouse. The prey will be crushed by a loop of the body and sometimes immediately, sometimes as much as half an hour later, the frog will be swallowed, this act, however, going very fast. Brongersma (1934) found a small rodent in an adult specimen from Deli and a *Hemidactylus* in a rather young one from Lahat. Once I found in the intestine of a young female of 468 mm body length, some chitinous remnants, indicating that probably a lizard containing an insect had been eaten. Boulenger (1890) calls *Xenopeltis* "a snake of fierce habits", and Haas (1930) states that this snake will readily bite (... sehr bissig ist), but Mertens's specimen was not agressive and Smith (1943) writes: "I never knew one attempt to bite when handled", and my own experience is exactly the same; during the day the animals are slow in their movements, when offered sand they dig themselves in, but not very deep. I did not succeed in a few attempts to feed them; though very muscular and strong, they are not resistant, and some animals died after only a few days of captivity. Smith (1943) adds, that when "excited, it could vibrate its short tail with extraordinary speed, so rapidly that at times I have believed I could hear the movement".

Material and method.

For the present investigation I used the *Xenopeltis* collected in the fields near the town of Surabaia (North coast of East Java), between January 1936 and January 1942. As with the rest of the collection, the material itself has been lost owing to the Japanese occupation and in the case of this species perhaps a few,, but certainly not many of the measurements were lost. The remaining notes concern 52 specimens, exactly half of them males, and half of them females. The method used, is killing by occipital puncture, weighing, transfusion through the aorta with saline (Radsma) during some twenty seconds, followed by hardening in Bouin's liquid. After a few days the position of the organs was measured to the nearest mm and notes were taken on the aspect of the organs. For the statistical work, the directions given by Simpson and Roe (1939) have been used.

Anatomy.

The structure of the skull has been carefully analysed by others, showing the bones to be rigidly connected with each other, thus giving a reason to consider this species one of the very primitive. The animal is big in comparison with other burrowing or semi-burrowing snakes, and strong, heavy-muscled. The relation between the weight of the body itself, skin, skeleton, and muscles to that of the intestines seems certainly very different from what it is in swimming or arboreal snakes.

Before the world war II, I was interested in the comparative anatomy of the gall bladder pancreas complex in snakes (Bergman, 1938, 1941). By courtesy of Prof. G. C. Heringa, Miss van Heusden was able to prepare serial sections of 10 μ through these organs of various snakes, among them also *Xenopeltis*. The analysis of the latter was completed near the end of 1941, but when the Japanese occupied Java I was not allowed to safeguard the microscopic sections, the photographs and drawings, nor the plastic reconstruction, which all became lost. I regret not to be able to give full particulars and exact figures, but I found in this snake a rather interesting structure which may be described here in a few words. A number of inter-connected bile ducts coming from the gall bladder are running in a bundle through the pancreas to the intestine as is usually found in snakes. Before reaching the intestine these bile ducts enter at various places into a small vesicle which lies between the outer wall of the intestine and the closely adjacent pancreas. In this vesicle the pancreatic ducts from the various pancreatic lobules open, intermingling with the bile ducts. The epithelium of the vesicle, as I remember it, is different from that of the ducts, and the vesicle itself is connected with the intestine by a single, relatively short and broad canal. This means that the pancreatic juice and the bile are mixed in a common receptacle before running into the small intestine, which is certainly not a common feature. I should add that every detail of the whole structure seemed perfectly normal.

Gross pathology.

There is only one specimen, an adult male, of which I noted that the tail was broken. Its body length was 960 mm, and one would expect then a weight of some 550 gram, whereas I find listed 353 gram, which would suggest an underweight perhaps by hunger during a forced period of rest. Concerning another male, of 867 mm body length, there is a note that the end of the stomach was fixed to the kidney, which is certainly an abnormal situation, but as the material is lost it is unfortunately impossible to check this. I found no notes on helminth parasites, which is rather unexpected, so there were, if any at all, certainly very few of them.

Once in a male of 675 mm body length, the right testis was noted as "very thin". In three animals of a body length of 557, 867, and 1061 mm the testes have been described as consisting of clearly separated lobes.

In one female, body length 653 mm, the left ovary is said to look like a testis, divided in many lobules.

Blood.

The analysis of the blood salts of 5 females and 4 males has been made in the laboratory of Prof. Dr. G. M. Streef, but his notes were used as fuel by the Japanese. The more is this a pity, because *Xenopeltis* seems to have less blood than one would expect considering its size; which means that it is necessary to have two or three rather big specimens at the same moment in the laboratory, so as to make one able to pool the samples. When, as in the present case, one has to be careful to collect even the last drops of blood, the best method is to cut the aorta somewhat lower down, insert a canula carrying liquid paraffine instead of saline in the peripheral end, with the tap closed so as not to put on pressure.

The aorta is then severed completely, and the cranial end guided into a glass tube in which a diluted solution of heparin has been evaporated. The tap is then opened allowing the liquid paraffin to flow into the vessels, and the mixture of blood and liquid paraffine is pumped by the heart into the glass tube, where the blood soon forms a sediment.

Fertility.

There are only a few notes on the subject in literature. Kopstein (1938) does not mention it, Mertens (1943) quotes Pope, on an animal with 17 eggs, and takes it to be oviparous. In the Surabaia series out of 26 females only five ranging from 653 to 1020 mm body length show growing eggs from 8 to 20 mm length. The smallest, 653 mm, was caught in January and had eggs of 12 mm. The animal with the largest probably ripe eggs in the ovary was caught at the end of July. So from those data there is no conclusion possible as to oviparity or viviparity but it appears that a female of 653 mm body length was mature.

The number of eggs was in one case 6, all in the right ovary, in another also all of them in the right ovary, in a third 11, with 8 in the right and 3 in the left ovary.

The series is rather small, but considering that collecting went on the year round, except with the slowing down of the laboratory activities in November, there are some peculiarities in the sample.

The results are best shown in Table I, giving the body lengths of the snakes caught in the various months of the year. The asterisks mark female animals.

The irregularities in Table I are as follows:

1) the smaller animals are only found in the first months of the year and the neonati in January, the immature young from January till May;
2) there is a low catch in May-June and there are no catches in October-December.

The immature animals number a dozen against 32 mature animals caught in the same period, in the next period 8 adults were caught, so one would expect 3 young there.

	wet season	dry season	
young	12	0	12
adult	32	8	40
	44	8	52

Chi square is 2.89, and P a little smaller than 0.1, so the changes are 9 to 1 that there is an association between the appearance of the young and the first part of the year. The gaps in June and December might very well be related to a sexual cycle. Moreover we found big eggs, ripe or nearly

TABLE I

Body lengths of *Xenopeltis unicolor* caught each month

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	
	236												
	*238												
	*260												
	272												
					*315								
			336										
		*453											
		*468											
	*531		526	523									
	557												
	*653	*642	*608	*647				682					
	670		*687	654									
				675									
	*788	729	*765	*710									
	837	831	867	*844			*873	864	*865				
	*858	877	*867				*887						
		923	955	955			*895						
			960										
			971										
			*932										
			*953										
	*1037	*1016	1025	1013			1031	*1020					
			1061										
			1096										
N:	12	8	15	8	1	—	4	3	1	—	—	—	Total 52
Sex ratio:	5/7	4/4	9/6	5/3	-/1	—	1/3	2/1	-/1	—	—	—	Total 26/2

so, in a snake caught in July, and the 4 new-born *Xenopeltis* were found in January. This would suggest ovulation (or in the case of oviparity egg deposition) in August, hatching or birth in December.

Size.

De Rooij (1917) gives as maximum size 900 mm and 100 mm for body and tail length; Smith (1943) for males 1050 mm + 95 mm, for females 850 mm + 70 mm. In our series the figures are for males 1096 mm +

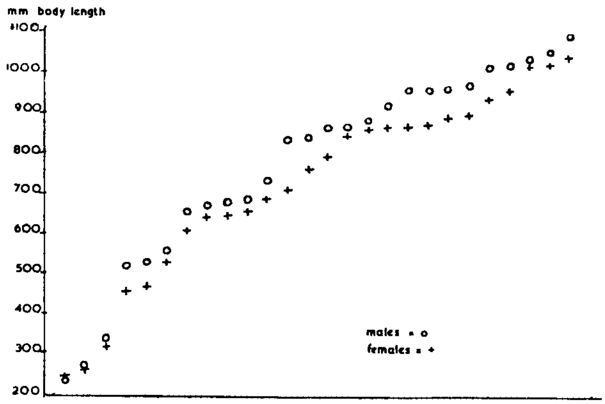

Fig. 1. *Xenopeltis unicolor* Reinwardt, Galton curve of body length.

98 mm, for females 1037 mm + 94 mm. The succession of body lengths is for both sexes in the Surabaia series practically the same, as the Galton curve shows. Moreover, the first bend in this curve is around 600 mm, we have seen that the shortest female in our series bearing big eggs measured 653 mm, so this is the place where we assume the onset of maturity. In other words, we consider animals longer than 600 mm adults, and shorter ones juveniles.

The average body length in adult animals is for the Surabaia series in males 891 and in females 827 mm, with $D/\sigma_D = 1.5$, too low to make the difference reliable. Perhaps, however, this is because of the smallness of the series. For the length of the tail there seems to be no sexual difference: in males 83 mm, in females 80 mm, with $D/\sigma_D = 1$. As in many other snakes, the males are sometimes recognisable at a swelling on the base of the tail by the presence of both hemipenes.

The weight is for all specimens, young and adult together, in males 329.5 and in females 273 with $D/\sigma_D = 4.1$ which is a very clear difference. This makes us reluctant to accept the verdict that there should be no sexual difference in body length because it could not be demonstrated statistically.

TABLE II

Topography *Xenopeltis unicolor* ♀ adults

	M	N	R	M ± σ_M	$\sigma \pm \sigma_\sigma$	V ± σ_V	σ_M^2
Length of							
Body	827	20	608-1037	827.0 ± 29.5	132.0 ± 20.9	15.9 ± 2.5	870.–
Tail	80	20	63-94	79.9 ± 2.1	9.5 ± 1.6	11.9 ± 1.9	4.5
Top of							
Heart	203	19	147-250	203.6 ± 7.2	31.5 ± 5.0	15.4 ± 2.5	52.2
Liver	270	19	201-339	270.0 ± 9.5	41.3 ± 6.7	15.3 ± 2.5	90.–
Gallbl.	546	19	395-687	545.0 ± 20.5	89.4 ± 14.5	16.4 ± 2.6	420.5
Pancreas	561	19	404-709	561.0 ± 20.0	92.5 ± 15.0	16.5 ± 2.7	450.7
Spleen	531	17	377-665	529.2 ± 18.0	79.8 ± 12.8	14.8 ± 2.4	326.–
Ovary R.	563	19	423-711	567.6 ± 19.7	85.9 ± 13.9	15.1 ± 2.4	389.–
Ovary L.	664	19	494-840	664.0 ± 25.6	113.1 ± 18.2	17.0 ± 2.8	650.–
Kidney R.	676	19	501-852	674.2 ± 26.4	115.0 ± 18.7	17.0 ± 2.7	695.–
Kidney L.	709	19	525-887	711.1 ± 26.8	116.5 ± 18.9	16.5 ± 2.7	715.–
End of							
Heart	231	19	170-283	231.0 ± 8.4	36.6 ± 6.0	15.8 ± 2.6	70.3
Liver	447	19	343-555	450.0 ± 15.8	69.1 ± 11.2	15.5 ± 2.5	251.–
Gallbl.	561	19	405-708	558.9 ± 21.1	92.0 ± 14.8	16.1 ± 2.6	445.–
Pancreas	577	19	422-726	577.0 ± 21.2	92.5 ± 15.0	16.1 ± 2.6	450.–
Spleen	539	17	384-674	542.8 ± 20.8	85.5 ± 13.9	16.1 ± 2.6	430.–
Ovary R.	652	19	471-830	655.0 ± 24.4	106.5 ± 17.3	17.4 ± 2.6	600.–
Ovary L.	701	19	520-875	701.0 ± 26.8	117.0 ± 19.0	16.7 ± 2.7	720.–
Kidney R.	722	19	537-905	719.3 ± 24.4	106.3 ± 17.3	15.8 ± 2.5	598.–
Kidney L.	753	19	558-942	753.0 ± 28.0	122.1 ± 19.8	16.2 ± 2.6	784.7
Stomach	555	17	409-700	553.6 ± 20.5	89.4 ± 15.4	16.1 ± 2.8	420.–

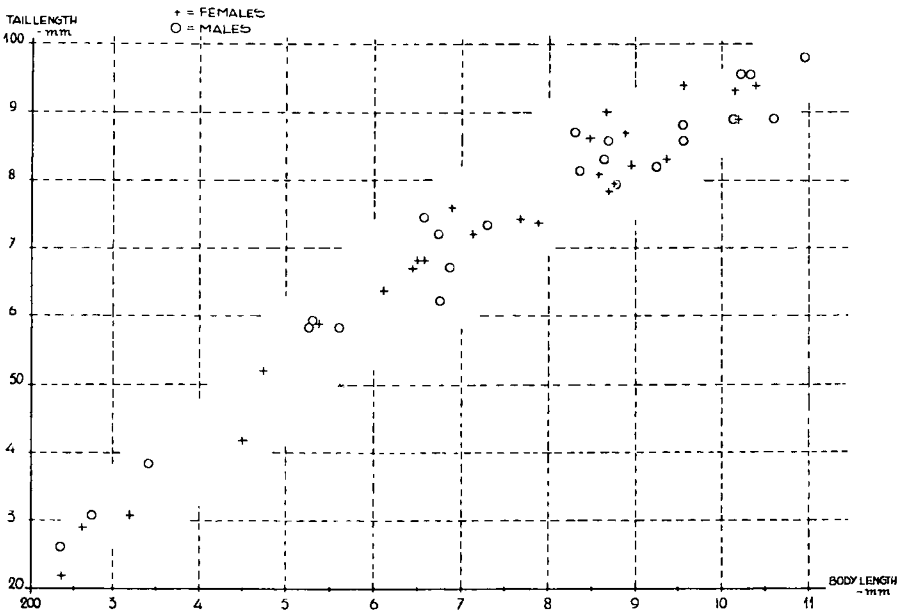

Fig. 2. *Xenopeltis unicolor* Reinwardt, variation of body length and tail length in the two sexes.

TABLE III

Topography *Xenopeltis unicolor* ♂ adults

	M	N	R	M ± σM	σ ± σ_σ	V ± σV	σM^2
Length of							
Body	884	20	654-1096	890.7 ± 30.8	137.5 ± 21.7	15.4 ± 2.2	950.–
Tail	83	20	62-98	83.3 ± 2.3	10.0 ± 1.6	12.0 ± 2.0	5.3
Top of							
Heart	215	20	154-275	215.8 ± 7.5	33.3 ± 5.3	15.4 ± 2.4	55.5
Liver	295	20	215-354	294.9 ± 10.3	46.4 ± 7.3	15.6 ± 2.5	106.–
Gallbl.	592	20	431-702	593.6 ± 18.5	82.8 ± 13.2	14.0 ± 2.2	344.–
Pancreas	609	20	441-722	611.1 ± 19.2	85.9 ± 13.6	14.0 ± 2.2	370.–
Spleen	594	14	403-670	595.0 ± 22.4	80.8 ± 15.2	13.5 ± 2.6	503.–
Testis R.	622	20	453-746	625.3 ± 21.5	96.0 ± 15.2	15.3 ± 2.4	462.–
Testis L.	705	20	518-858	704.4 ± 24.0	107.2 ± 17.0	15.2 ± 2.4	577.–
Kidney R.	719	20	530-863	718.0 ± 25.0	111.5 ± 17.5	15.5 ± 2.4	625.–
Kidney L.	751	20	556-908	749.0 ± 25.9	115.8 ± 18.3	15.4 ± 2.4	670.–
End of							
Heart	246	20	174-314	247.5 ± 9.1	40.5 ± 6.4	14.6 ± 2.6	82.–
Liver	486	20	338-597	485.2 ± 17.6	78.6 ± 12.4	16.3 ± 2.6	310.–
Gallbl.	609	20	448-726	609.0 ± 19.2	85.9 ± 13.6	14.1 ± 2.2	370.–
Pancreas	626	20	453-747	626.6 ± 19.0	84.4 ± 13.4	13.5 ± 2.1	360.–
Spleen	604	14	412-681	604.5 ± 22.4	80.5 ± 15.8	13.4 ± 2.6	500.–
Testis R.	683	20	492-832	684.4 ± 23.1	103.4 ± 16.4	15.1 ± 2.4	535.–
Testis L.	735	20	544-903	736.9 ± 24.6	110.0 ± 17.4	15.0 ± 2.4	610.–
Kidney R.	771	20	568-937	771.0 ± 26.6	118.9 ± 18.9	15.4 ± 2.4	710.–
Kidney L.	805	20	594-984	804.8 ± 28.6	127.7 ± 20.2	15.9 ± 2.6	820.–
Stomach	606	19	447-714	604.0 ± 20.0	87.0 ± 14.0	15.1 ± 2.4	400.–

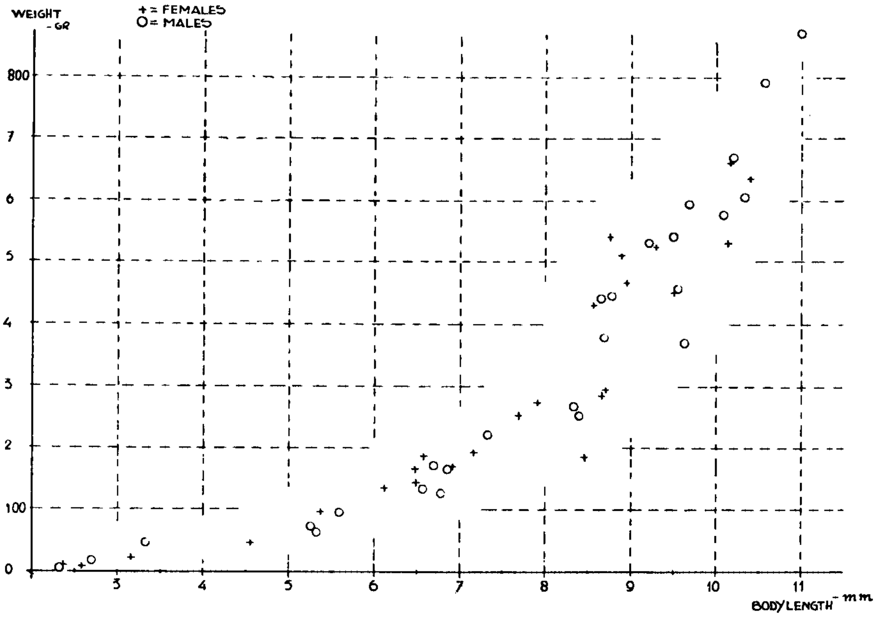

Fig. 3. *Xenopeltis unicolor* Reinwardt, variation of body length and weight in the two sexes.

TABLE IV

Topography *Xenopeltis unicolor* in $^0/_{00}$ of body length

	Adults		Juveniles	
	♂	♀	♂	♀
Body length in mm	891	827	410	380
Relative values	1000	1000	1000	1000
Heart top	243	245	258	258
end	277	279	290	292
Liver top	330	325	346	350
end	545	542	598	590
Gallbladder top	667	657	673	700
end	680	672	692	718
Pancreas top	688	677	692	710
end	700	696	716	730
Spleen top	669	638	689	712
end	680	653	696	723
Sex gland R. top	700	684	720	752
end	769	790	768	794
Sex gland L. top	790	800	798	830
end	826	848	828	858
Kidney R. top	805	810	810	808
end	867	870	865	866
Kidney L. top	841	860	843	841
end	900	911	900	894
Stomach end	680	670	696	718
Tail length	93	96	110	103

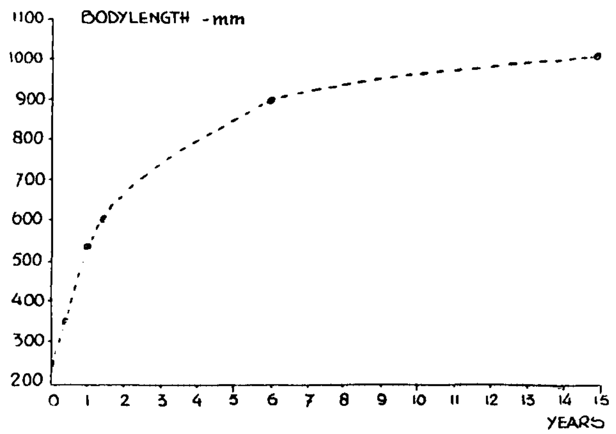

Fig. 4. *Xenopeltis unicolor* Reinwardt, growth curve based on data by Mertens.

TABLE V

Xenopeltis unicolor ♀ adults

Length of	M	N	R	M ± σM	σ ± σ_σ	V ± σV	σM^2
Body	827	20	608-1037	827.0 ± 29.5	132.0 ± 20.9	15.9 ± 2.5	870.–
Tail	80	20	63-94	79.9 ± 2.1	9.5 ± 1.6	11.9 ± 1.9	4.5
Heart	28	19	20-39	28.3 ± 1.2	5.3 ± 0.9	18.8 ± 3.1	1.5
Liver	176	19	142-224	176.0 ± 5.8	25.2 ± 4.1	14.4 ± 2.3	33.4
Gallbl.	15	19	10-22	15.6 ± 0.8	3.6 ± 0.6	22.5 ± 3.6	0.7
Pancreas	16	19	12-20	15.9 ± 0.5	2.2 ± 0.4	13.9 ± 2.3	0.3
Spleen	8	17	4-12	7.9 ± 0.6	2.3 ± 0.4	29.2 ± 5.0	0.3
Ovary R.	90	19	48-151	90.6 ± 6.5	28.4 ± 4.6	31.3 ± 5.1	42.8
Ovary L.	37	19	21-57	37.3 ± 2.5	10.9 ± 1.8	29.6 ± 4.8	6.3
Ovaries	127	19	74-208	127.0 ± 9.1	39.6 ± 6.4	30.9 ± 5.0	83.–
Kidney R.	46	19	32-60	46.2 ± 1.9	8.1 ± 1.3	17.5 ± 2.8	3.5
Kidney L.	44	19	32-56	43.8 ± 1.7	7.4 ± 1.2	17.0 ± 2.7	2.9
Kidneys	90	19	64-116	89.6 ± 3.5	15.3 ± 2.5	17.0 ± 2.7	12.3

Xenopeltis unicolor ♂ adults

Length of	M	N	R	M ± σM	σ ± σ_σ	V ± σV	σM^2
Body	884	20	654-1096	890.7 ± 30.8	137.5 ± 21.7	15.4 ± 2.2	950.–
Tail	83	19	62-98	83.3 ± 2.3	10.0 ± 1.1	12.0 ± 2.0	5.3
Heart	31	20	20-39	31.0 ± 1.4	6.4 ± 1.0	20.8 3.3	2.1
Liver	191	20	123-243	192.4 ± 7.4	33.0 ± 5.2	17.2 ± 2.7	54.5
Gallbl.	16	20	11-24	16.6 ± 0.8	3.6 ± 0.6	21.8 ± 3.4	0.6
Pancreas	17	20	10-25	16.7 ± 0.9	4.1 ± 0.7	24.6 ± 3.9	0.8
Spleen	10	14	6-13	8.8 ± 0.7	2.5 ± 0.5	25.2 ± 5.0	0.5
Testis R.	60	20	32-86	60.0 ± 3.1	14.0 ± 2.2	23.3 ± 3.7	9.8
Testis L.	31	20	17-45	30.7 ± 1.5	6.6 ± 1.0	21.5 ± 3.4	2.2
Testes	91	20	51-131	90.9 ± 4.5	19.1 ± 3.0	20.7 ± 3.3	18.2
Kidney R.	52	20	35-74	53.0 ± 2.5	11.0 ± 1.7	20.7 ± 3.3	6.1
Kidney L.	53	20	38-76	53.5 ± 2.4	11.0 ± 1.7	20.3 ± 3.2	6.0
Kidneys	106	20	73-150	106.5 ± 9.0	22.7 ± 3.6	21.2 ± 3.4	81.4

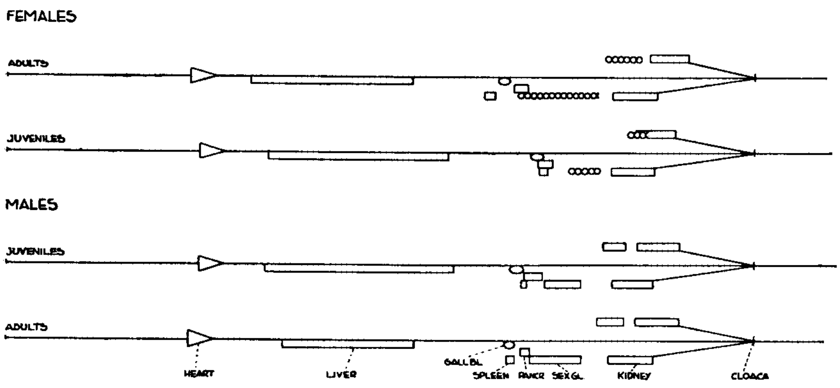

Fig. 5. *Xenopeltis unicolor* Reinwardt, topography of the organs in o/oo of body length.

Growth.

As far as I know only one observation has actually been made by Mertens (1943). He received a specimen 35 cm long, still bearing the youthful colour pattern on the head. It came in in July and lived in captivity for 13 years 9 months and 25 days, and died on 11 or 12 May 1943. It seems probable that a snake about 350 mm long in July belongs to the same hatch which produced animals of 238 mm in January, and we may suppose that birth took place in December before. This makes a total life span of 14 years and a quarter for Mertens's snake.

The author gives only two references on growth: one stating that the snake nearly reached 100 cm already after 6 years, and the other that, after 13 years it has grown nearly to one meter. This seems to indicate that after 6 years of age, growth stops or at least is no longer very fast. In our series the January catches count 4 neonati of 236-272 mm, and the next body length recorded for that month is 531 mm. It is safe to assume that these animals are at least one year old, and we may even include the next month of which the shortest animals are 453 mm and 468 mm long. This would give a growth rate of 500 mm — 250 mm = 250 mm for the first year; considering that we found big eggs in a snake of 650 mm body length in August, this would mean maturity, e.g., in June at 600 mm body length, which is for the third semester a gain of 100 mm; from there on, using the data of Mertens we find a gain of 300 mm in four and a half year and perhaps another 100 mm in the next six years. Length plotted against time is shown in fig. 4.

Metrical analysis.

The topography of the heart is in both sexes the same, there is a noteworthy distance between heart and liver and also between liver and gall bladder. Gall bladder and pancreas are not so close together as in most snakes, and the spleen also is detached from the pancreas. In this respect it is worth while to remember that, as shown by the skull features, *Xenopeltis* is one of the oldest snake types.

The ovaries reach, as they always do, farther cranially and caudally than do the testicles. The kidneys are very much at the same place in both sexes.

The length of the organs offers no appreciable difference except, as is to be expected, the gonads. First there is in each sex a difference between right and left: the testes R and L are on an average 60 and 30 mm long, with $D/\sigma_D = 8.3$. The ovaries R and L are 90 and 37 mm, with $D/\sigma_D = 7.6$. In this respect it is curious that we found two animals with eggs in the right ovary only, and one with big eggs on both sides but in the relation 8 : 3. The total length of both testes is 91 mm, and for both ovaries 127 mm, with $D/\sigma_D = 3.6$.

The kidneys in males are of the same length on both sides, in females the right seems to be a little longer, the difference is, however, not significant. The right kidney in males and females shows 53 mm and 46 mm, with $D/\sigma_D = 2.2$, the left kidney in both sexes 53 mm and 43 mm, with

TABLE VI

Xenopeltis unicolor ♀ adults

Intervals from/to	M	N	R	$M \pm \sigma_M$	$\sigma \pm \sigma_\sigma$	$V \pm \sigma_V$	σ_M^2
Snout-heart	202	19	147—250	203.5 ± 7.3	31.7 ± 5.1	15.5 ± 2.5	52.7
Heart-liver	39	19	15—63	39.4 ± 2.6	11.2 ± 1.8	28.7 ± 4.6	6.6
Liver-gallbl.	99	19	52—147	98.7 ± 6.3	27.3 ± 4.4	27.9 ± 4.5	39.3
A	342	19	230—433	339.2 ± 12.0	52.5 ± 8.5	15.4 ± 2.5	145.5
Pancr-ovar/R	—14	19	—59+9	—14.2 ± 3.7	16.2 ± 2.6	115.0 ± 18.6	13.9
Ovar/L-kidn/R	23	19	10—43	23.6 ± 2.0	8.7 ± 1.4	36.6 ± 6.0	4.0
Kidn/R-cloaca	104	19	71—132	104.4 ± 4.2	18.3 ± 3.0	17.5 ± 2.8	17.6
B	114	19	56—167	114.6 ± 6.5	28.8 ± 4.7	25.1 ± 4.1	47.4
Pancr-ovar/L	87	19	50—149	87.7 ± 5.6	24.6 ± 4.0	28.0 ± 4.6	31.9
Ovar/L-kidn/L	8	19	—12+23	8.1 ± 1.7	7.6 ± 1.2	93.0 ± 15.1	3.–
Kidn/L-cloaca	74	19	50—95	73.6 ± 3.1	13.5 ± 2.2	18.4 ± 3.0	9.6
C	169	19	118—255	169.6 ± 7.9	34.7 ± 5.7	20.5 ± 3.3	63.5
A + B	456	19	332—579	458.7 ± 17.1	74.0 ± 12.0	16.2 ± 2.6	292.–
A + C	511	19	357—667	506.3 ± 19.9	86.7 ± 14.0	17.1 ± 2.8	391.–
Pancr-kidn/R	99	19	61—166	99.0 ± 5.9	25.8 ± 4.1	26.0 ± 4.2	35.–
Pancr-kidn/L	132	19	84—207	130.3 ± 7.5	32.8 ± 5.3	25.4 ± 4.1	56.7

Xenopeltis unicolor ♂ adults

Intervals from/to	M	N	R	$M \pm \sigma_M$	$\sigma \pm \sigma_\sigma$	$V \pm \sigma_V$	σ_M^2
Snout-heart	215	20	154—275	214.1 ± 7.6	34.2 ± 5.4	15.9 ± 2.5	58.5
Heart-liver	49	20	29—74	49.0 ± 2.7	12.2 ± 1.9	24.9 ± 3.9	7.4
Liver-gallbl.	106	20	66—136	106.8 ± 5.0	22.3 ± 3.5	20.7 ± 3.3	24.9
A	370	20	260—445	369.9 ± 12.2	54.8 ± 8.7	14.8 ± 2.3	150.–
Pancr.-test/R	—3	20	—23+19	—3.0 ± 2.2	9.7 ± 1.5	327.0 ± 51.3	4.7
Test/R-kidn/R	36	20	17—55	36.0 ± 2.6	11.4 ± 1.8	31.7 ± 5.0	6.5
Kidn/R-cloaca	112	20	76—159	113.7 ± 4.8	21.5 ± 3.4	19.0 ± 3.0	23.0
B	146	20	94—201	144.7 ± 6.9	30.9 ± 4.9	21.3 ± 3.4	47.7
Pancr-test/L	79	20	28—111	79.5 ± 4.5	20.1 ± 3.2	25.2 ± 4.0	20.3
Test/L-kidn/L	16	20	4—37	15.5 ± 1.8	8.2 ± 1.3	51.3 ± 8.1	3.4
Kidn/L-cloaca	79	20	57—112	79.1 ± 3.2	14.2 ± 2.2	17.8 ± 2.8	10.1
C	175	20	104—228	172.8 ± 7.9	35.4 ± 5.7	20.5 ± 3.2	63.0
A + B	516	20	372—639	516.7 ± 17.7	79.2 ± 12.5	15.3 ± 2.6	313.4
A + C	545	20	390—665	542.6 ± 20.3	90.9 ± 14.4	17.0 ± 2.7	412.9
Pancr-kidn/R	93	20	66—116	92.5 ± 5.1	23.0 ± 3.6	24.8 ± 4.0	26.5
Pancr-kidn/L	126	20	51—161	126.2 ± 6.1	27.3 ± 4.3	21.7 ± 3.4	37.3

D/σ_D = 3,2, a significant difference. If we take the length of both kidneys together, the figures are for males 106 mm, females 90 mm, D/σ_D only 1.8.

In *Xenopeltis* the end of the right lung sac may easily be seen, this point, however, has only been recorded for 13 males and 12 females. The ranges of body lengths are in males 523 to 1096 mm, in females 453 to 1037 mm, the averages 821 and 786 mm, the lung ends in males between 314 and

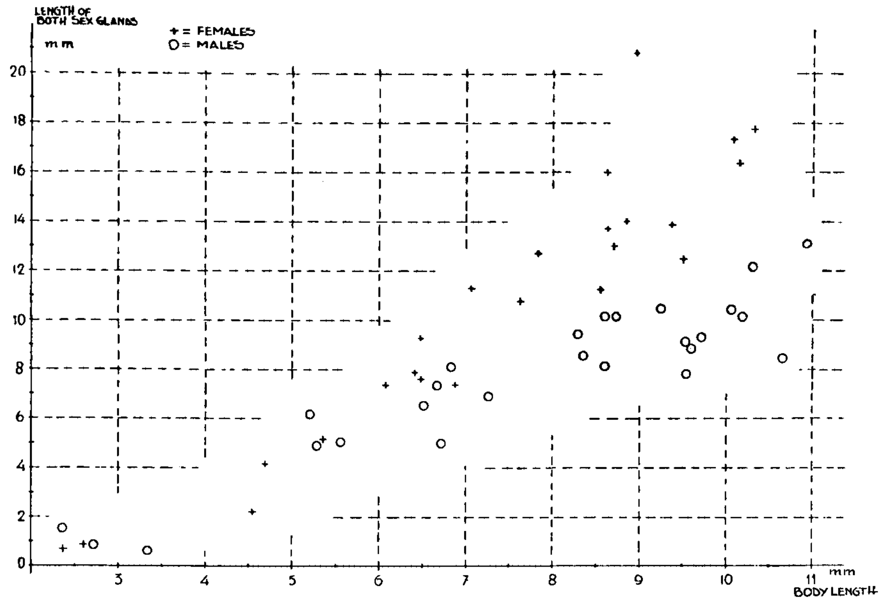

Fig. 6. *Xenopeltis unicolor* Reinwardt, variation of body length and length of the gonads in the two sexes.

610 mm, and in females between 291 and 678 mm, at an average of 474 and 438 mm. In $^0/_{00}$ of the body length this spot is in males at 577 mm from the snout, in females 557 mm, a difference which is of no importance.

Intervals.

The differences between the sexes are generally not significant. The distance between heart and liver, however, seems smaller in females, $D\sigma_D$ = 2.6 nearly significant. The distance between the sex gland and the kidney is significantly less, in females on the right side D/σ_D = 3.7, and nearly so on the left D/σ_D = 2.9. Due to this feature the sum of intervals on the right side caudally is smaller than in males D/σ_D = 3.1, and the difference between the sum of all intervals on the right side in both sexes, although not significantly different, seems not quite negligible. The vari-

TABLE VII

Xenopeltis unicolor, correlations in the total group

	M	N	R	$M \pm \sigma_M$	$\sigma \pm \sigma_\sigma$	$V \pm \sigma_V$	σ_M^2
Males							
Body length	765	25	236-1096	771.4 ± 51.0	254.0 ± 36.0	33.0 ± 4.7	2600.–
Tail length	73	25	26-98	72.3 ± 3.8	19.2 ± 2.7	26.4 ± 3.8	14.8
	r = 0.965			Z = 2.0 ± 0.21			
Body length	772	26	236-1096	778.5 ± 49.5	253.0 ± 35.1	32.5 ± 4.5	2460.–
Weight	337	26	7-869	329.5 ± 48.8	249.0 ± 34.5	75.5 ± 10.4	2390.–
	r = 0.895			Z = 1.45 ± 0.21			
Body length	772	26	236-1096	778.5 ± 49.5	253.0 ± 35.1	32.5 ± 4.5	2460.–
Both testes	77	26	7-131	77.0 ± 6.6	33.6 ± 4.7	43.5 ± 6.0	43.5
	r = 0.920			Z = 1.59 ± 0.21			
Body length	772	26	236-1096	778.5 ± 49.5	253.0 ± 35.1	32.5 ± 4.5	2460.–
Both kidneys	92	26	25-150	93.0 ± 6.1	31.8 ± 4.4	34.1 ± 4.8	39.–
	r = 0.955			Z = 1.90 ± 0.21			
Females							
Body length	728	26	238-1037	734.4 ± 45.8	233.0 ± 32.4	31.6 ± 4.4	2100.–
Tail length	71	26	22-94	71.4 ± 3.9	20.1 ± 2.8	18.2 ± 2.5	15.5
	r = 0.972			Z = 2.10 ± 0.21			
Body length	733	25	238-1037	744.4 ± 45.2	231.0 ± 32.8	31.8 ± 4.4	2140.–
Weight	284	25	8-673	273.0 ± 38.4	192.0 ± 27.2	70.5 ± 10.0	1480.–
	r = 0.900			Z = 1.47 ± 0.21			
Body length	735	24	238-1037	748.5 ± 46.0	225.0 ± 32.4	30.0 ± 4.3	2110.–
Both ovaries	106	24	7-208	104.6 ± 11.3	55.5 ± 8.8	53.2 ± 8.5	127.–
	r = 0.920			Z = 1.59 ± 0.22			
Body length	717	25	238-1037	731.5 ± 47.1	236.0 ± 33.5	32.3 ± 4.6	2230.–
Both kidneys	78	25	27-116	78.7 ± 5.0	25.0 ± 3.5	31.5 ± 4.4	25.–
	r = 0.946			Z = 1.80 ± 0.21			

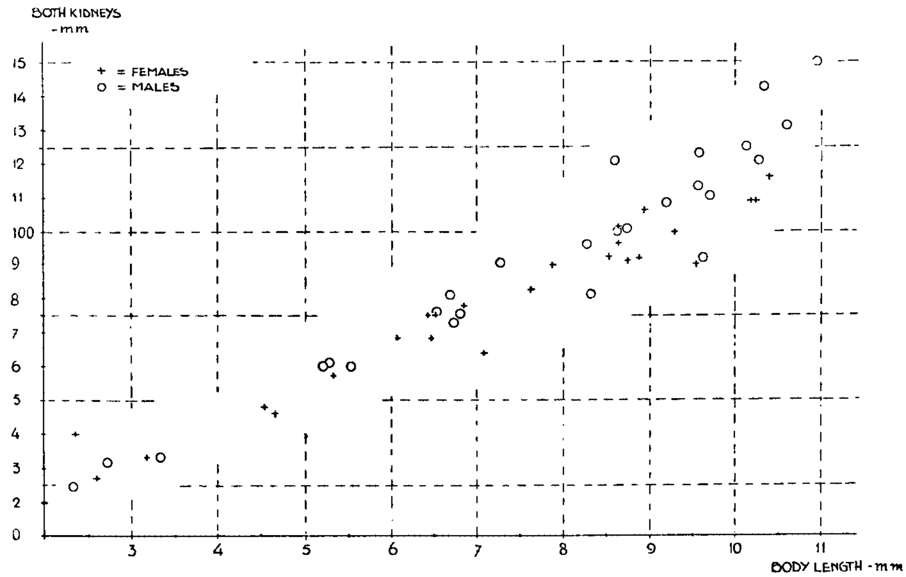

Fig. 7. *Xenopeltis unicolor* Reinwardt, variation of body length and length of the kidneys in the two sexes.

ability of the topographic data is in males and females of the same order: V around 15, which seems rather high. For the length of the organs, the coefficient of variation is in males smallest for the liver (17) and largest for the pancreas and spleen (around 25). The rest of the organs range from 20 to 22. In females the values seem somewhat lower: liver and pancreas 14, kidney, heart 17-19, spleen and gonads 30. Between the variation of the length of the liver and the sex glands $D/\sigma_D = 3.$—.

In males there are no statistically significant differences between the coefficients of variation for liver and pancreas and any of the other organs.

As far as intervals are concerned the variation is very wide, the figures for the distances between pancreas and right sex gland (B1) seem disproportionately high; the next one is the distance between sex gland and kidney on the right (B2) and left side (C2). For the rest of the intervals the coefficient of variation is only little higher than of the length of the organs.

Correlations.

As is shown in figs. 2 and 3 there is a certain correlation between the length of the body and the length of the tail, viz., the weight of the animal.

In figs. 5 and 6 the relation between body length and length of the gonads and the kidneys is illustrated for both sexes.

The correlations have been figured for all the animals, juveniles and adults together and are rather high: r ranges from 0.895 to 0.965 in males and 0.900 to 0.972 in females. According to Simpson it is useful to transcribe r in terms of Z, because this makes the evaluation of differences easier. In our case the correlations are for similar objects in both sexes of the same order, for body length and length of tail in males $Z = 2.0 \pm 0.2$ and in females 2.1 ± 0.2, for body length and weight $Z = 1.45 \pm 0.2$ and 1.47 ± 0.2, for body length and length of the gonads $Z = 1.59 \pm 0.2$ and 1.59 ± 0.2, for body length and length of the kidneys $Z = 1.90 \pm 0.2$ and 1.80 ± 0.2.

In males and females the lowest correlation is between body length and weight, the highest between body length and length of the tail: the differences are in males 0.55 and in females 0.63, with $\sigma D = 0.3$, the quotient is then 1.8 or 2.1. So even in each sex the differences between the highest and lowest coefficient of correlation are not significant.

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