

BRITISH JOURNAL OF HERPETOLOGY

Vol. 3, No. 2

June 1962

Published by

THE BRITISH HERPETOLOGICAL SOCIETY

Application for copies by non-members
should be made to the Secretary,

B.H.S., c/o Zoological Society of London, N.W.1.

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Contributions should be addressed to Dr. A. d'A. Bellairs, St. Mary's Hospital Medical School, London, W.2. Articles should be typed in double spacing on *one side* of the paper only. Figures should be drawn in *Indian ink* on plain white paper, or preferably Bristol Board.

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A MALIGNANT NEOPLASM WITH METASTASES IN THE LIZARD

Lacerta sicula cetti Cara

By

ROBIN LAWSON

Reported instances of neoplasia in reptiles are few. Schlumberger & Lucke (1948) in their monograph "Tumours of fishes, amphibians, and reptiles," have assembled abstracts of all the records in the literature dealing with tumours in these classes of animals. Of all the tumours of reptiles, those of lizards are as follows:

- | | |
|--------------------------------------|-------------------------|
| a. <i>Varanus dracoena</i> | Enchondroma |
| b. <i>Lacerta agilis</i> | Papilloma |
| c. <i>Lacerta muralis fumensis</i> * | Papilloma |
| d. <i>Lacerta viridis</i> | Papilloma |
| e. <i>Tupinambis teguixin</i> | Squamous cell carcinoma |
| f. <i>Tupinambis nigropunctatus</i> | Squamous cell carcinoma |

To this list must be added:

- | | |
|------------------------------|--|
| g. <i>Cyclura cornuta</i> | Chondro-osteo-fibroma † Rodhain (1949) |
| h. <i>Heloderma horridum</i> | Squamous cell carcinoma
Schlumberger (1958) |

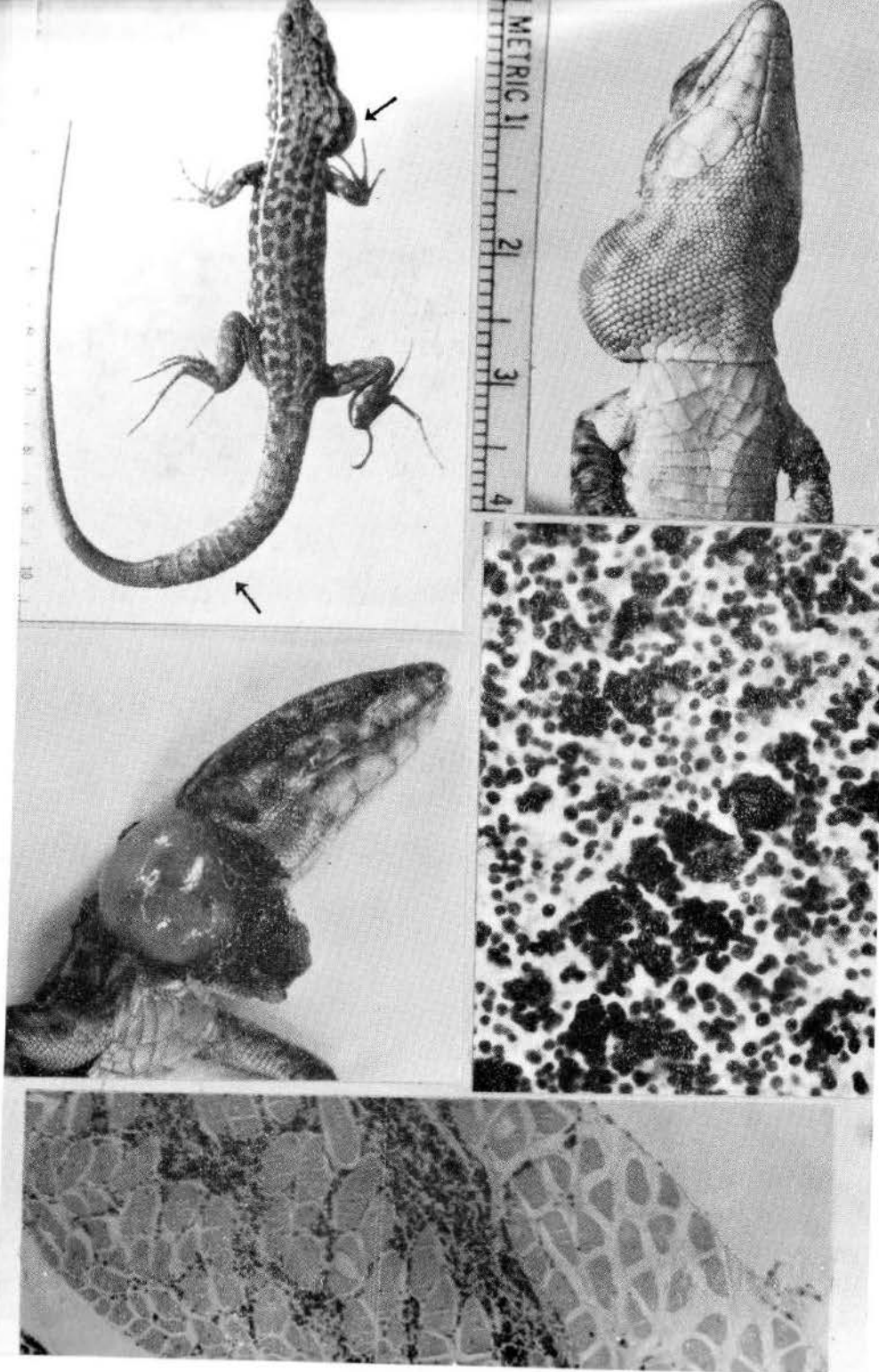
It can be seen from the above that, of these eight tumours, five are of a benign nature: a, b, c, d, and g (see footnote †). It is interesting to note that this is true of all the instances of neoplasia in the lizards of the genus *Lacerta*. Of the three malignant tumours, e, f, and h, all had infiltrated adjacent tissues to the primary sites, but in none were metastases found. Metastasizing tumours have been reported in crocodylians and *Serpentes* and possible cases in chelonians, by Schlumberger and Lucke.

The lizard we are concerned with is an adult male of the Sardinian lacertid, *Lacerta sicula cetti* Cara. It was received on June 18th, 1961, along with a shipment of other lacertids as exchange material from a dealer in Holland. When received, the lizard was of normal appearance, with a complete tail.

It was placed in an indoor terrarium along with other lacertids where it at first fed well and appeared to be thriving. However, after approximately one month a slight bulging of the right lateral aspect of the neck was noted. During the next three weeks this bulge increased rapidly in size, and a second bulge was seen to be forming in the tail (See Plate). This was in the median portion where the diameter was increased 2mm. in excess of the greatest diameter of the proximal third. The swelling extended for about 10mm. along the length of the tail, and distal to this the tail had a thin and withered appearance.

* Presumably *Lacerta melisellensis fumana* Werner.

† Multiple tumours of the bone in two specimens of *Cyclura cornuta* had infiltrated surrounding muscles.



Top. *Lacerta sicula cetti*, in life, showing appearance of growths.

About this time it was decided to sacrifice the animal for pathological studies. Photographs were taken, and pending their development the lizard was replaced in the terrarium. About a week later and before the photographs had been developed, the lizard expired; this was on October 9th, 1961. During the whole of the time that the lizard was alive it was normally active, and no abnormalities in behaviour were noted. It had continued to feed well but had not been seen to eat on the last four days preceding death.‡

At autopsy the lizard was found to have a snout to vent measurement of 69mm. and a total length of 195mm. An "H" shaped incision was made over the bulge in the neck, and the skin was peeled back to reveal a tumorous mass which was photographed *in situ* (See Plate). It extended from 1mm. behind the external auditory opening almost to the shoulder. The tumour mass was then removed. It measured 10 × 9 × 4mm. and was ovoid in shape, creamish white in colour, and moderately soft in consistency. It was only very loosely adherent to the overlying skin and underlying tissues, and it did not appear to be encapsulated. Gross examination of the organs of the thoracic and abdominal cavities revealed no abnormalities to the naked eye. No other tumour masses were found.

Microscopic examination of sections prepared from the tumour revealed it to be composed of mainly lymphoid cells, and it was assessed to be a malignant lymphoma. At the periphery of the mass there was in places a thin covering of muscle; here the tumour had heavily infiltrated between the individual bundles (See Plate). It was evident from the histological examination of the tissues and organs that the tumour was extremely widespread. Much of the musculature of the tail had been replaced by tumour; there was much necrosis of the remaining intact muscle tissue; blood vessels were plugged with tumour, resulting in infarction; and all tissues of the distal two-thirds of the tail were completely necrotic.

Muscles from many other parts of the body had been invaded, as had the kidneys and spleen. The liver was very heavily infiltrated, and there were large areas of necrosis. Of the tissues examined, only the brain and posterior half of the spinal cord appeared unaffected.

Richter describes malignant lymphomas as tumours that almost invariably arise either from lymphoid cells or from reticuloendothelial cells or their derivatives. In view of the difficulty of classifying the varieties of such tumours, the inclusive term "malignant lymphoma" may be used.

It is difficult to say in this case where the tumour originated. Lymph nodes as defined in the mammalian body are sparsely represented in reptiles. It is said that the pharyngeal tonsils, the thymus, and the spleen are organs of this nature (Bellairs). The thymus in lacertilians is represented by paired glands which are situated in the neck, one pair on each side, and which are placed one behind the other (Adams 1939).

Scott and Beattie have reported on a neoplasm with metastases in a salt water crocodile (*Crocodilus porosus*). From their microscopic findings the authors concluded that the tumour was a round cell sarcoma. However, Schlumberger and Lucke (*lit. cit.*), after perusal of the photomicrographs, have suggested that the tumour probably originated in the blood-forming tissues and is comparable to lymphosarcoma in man.

‡ The empty gut found at autopsy would tend to support this.

SUMMARY

An instance of a malignant tumour with metastases in a saurian has been reported. This is apparently the first of this type in the literature.

ACKNOWLEDGMENT

The author is indebted to Mr. John S. Applegarth, Curatorial Assistant, of the Stanford University Natural History Museum, who did the gross photography.

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REARING OF FROGS FOR PARASITOLOGICAL RESEARCH

By

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Frogs which have been purchased from dealers or captured in the field prove suitable material for most research purposes. The parasitologist, however, often requires animals which are free from helminth parasites and such material must be reared under carefully controlled conditions. The author has had considerable experience in rearing such helminth-free frogs and believes that his techniques may be of interest to herpetologists generally.

Although most schoolboys have succeeded in keeping a few tadpoles to the stage when, as young frogs, they leave the water, the common frog, *Rana temporaria*, is not an easy animal to rear under laboratory conditions. Young frogs require considerable quantities of living food but cannot be taught to come for it at set times or take it from special receptacles. They are highly nervous animals and are prone to damage themselves by leaping against the walls of their cages. Normal laboratory temperatures appear too high for their comfort and direct sunlight proves fatal to them. For these reasons, it was decided to raise our stock of frogs for parasitological research out of doors, rather than in the laboratory and although we had some initial doubts as to whether we could keep the frogs free from helminths in this situation, our doubts proved to be unjustified.

Frog spawn was collected in Spring, placed in nylon netting and thoroughly washed in tap-water. Masses of spawn, consisting of about a hundred eggs, were placed in circular earthenware dishes, each dish holding about a gallon of water and receiving one mass of spawn. No pond plants were added to the dishes, lest the former should be contaminated with infected larvae of frog parasites. In their place we introduced laboratory-raised filaments of the green alga, *Microspora*, and floated fronds of the water-fern, *Salvinia*, on the surface. These fronds were derived from a greenhouse tank. The dishes were covered with nylon net and placed in a shady spot out of doors. Under these conditions, the eggs hatched and the young tadpoles developed until the external gill stage. The dishes were then cleaned out and the plants renewed. If necessary, the number of tadpoles was reduced to about fifty per gallon of water. The tadpoles fed initially on the plant material available but later their diet was supplemented by fragments of well-washed, uncooked beef and beast liver, which were suspended in the water. These pieces of meat were renewed at frequent intervals and the water was changed whenever it threatened to become foul. Although there was a certain amount of cannibalism among the tadpoles, normally each gallon dish yielded a dozen or more young frogs. Before the tadpoles metamorphosed, small wooden rafts were floated on the surface of the water to serve as landing places for the young frogs.

From the time they left the water until they were used for research, the frogs were kept in brick-lined pits dug out of well-drained soil. Each pit was four feet long, three feet wide and two feet deep, and had vertical sides formed of bricks carefully cemented together. The floor of the pit

consisted of well-washed river sand, which could be renewed every few weeks when necessary. Below the three inches of sand was a six-inch layer of rubble, which communicated with a drainage pipe. Without careful attention being paid to the drainage, outdoor frog-pits can easily become miniature ponds in wet weather. In order to eliminate any possible toxic substances, the cement between the bricks was painted with a proprietary preparation, normally used for treating newly cemented fish ponds. A dish of water and plant-pots containing ferns were placed in the sand, their rims level with its surface. Care has to be taken not to introduce any infective helminth larvae in preparing these artificial habitats. Thus the soil in the plant-pots containing ferns was a heat-sterilized compost. The sand was similarly sterilized.

Young frogs were placed in the specially constructed pits immediately after their removal from the rafts in the tadpole dishes. Each pit was covered with stout entomological nylon net stretched over a wooden frame. On sunny days, additional shade was provided by placing a piece of sacking over half the area of the nylon net. Nylon net gives more adequate ventilation than does a glass covering and ensures that the pits are kept at a more even temperature. It is resistant to the weather but has the disadvantage of tearing rather easily. However, it is readily renewed.

Young frogs, up to a length of 25mm., were fed on *Drosophila* and aphids. The *Drosophila* were raised in the laboratory using the method described by Sang (1957). A mutant vestigial-winged strain was employed, as the young frogs were able to catch individuals of this strain more readily. A colony of aphids was maintained in a cool greenhouse on fuchsia and in this way an ample supply of these insects was available even during the winter months. The frogs were supplied with more food than they could eat at any one time. As the food was living it did not decay or contaminate the pits in any way; moreover, the sight of abundant food seems to be a necessary stimulus for regular feeding among young frogs in captivity. The water in the dish was renewed daily. Under such conditions, young frogs grow rapidly and by the time they are ready to hibernate in the November of their first winter, the largest individuals have attained a length of 25mm. In any one colony of frogs certain individuals begin their period of hibernation much later than others. In general, the first-year froglets remain active and continue to feed for a month after the older animals have gone into hibernation and in a mild winter some will still be feeding in late December. It is, of course, essential to continue the supply of food until all the frogs have ceased to feed.

When the young frogs attained a length of 30mm.—which they did in the first summer after their metamorphosis from tadpoles—they were given a change in diet. *Drosophila* was still used, but in addition blow-fly larvae and small mealworms were offered and these were readily accepted by the frogs. Both insects had been reared in the laboratory, under conditions which ensured they were not infected with helminth larvae. Growth during the second spring and summer was rapid and twelve months after leaving the water, the frogs were about 40mm. in length. Whereas a population density for newly metamorphosed froglets of twenty-five individuals per pit was considered satisfactory, 40mm. frogs were kept at a density of ten individuals per pit.

The mortality among our frog colony was very low and averaged less than 1% per month. There were no outbreaks of such contagious diseases as "red-leg" and as the animals rarely injured themselves by leaping against the walls of the pit, there were few wounds to become infected. The general health of the colony was partly attributed to its freedom from helminthic infestations. Frogs purchased from dealers or captured in the field frequently have twenty or thirty flukes, *Haplometra cylindracea*, in their lungs and a similar number of flukes, e.g. *Dolichosaccus rastellus* or *Pleurogenes claviger*, in their intestine. As these parasites derive their nutriment from the host animal, at the very least, they must have a certain debilitating influence on the host when present in considerable numbers. Elkan (1960) has shown that the tapeworm, *Nematotaenia dispar*, may bring about the death of toads by its tendency to cause intestinal obstruction. This same species has been recorded for the common frog and may, therefore, occasionally cause the death of frogs in captivity. Nematode parasites are even more abundant in frogs than the previously mentioned helminths and the presence of fifty *Rhabdias bufonis* in the lungs or thirty *Oswaldocruzia filiformis* in the intestine cannot be other than detrimental to the individual in which they occur. The health of frog colonies free from such parasites is not therefore unexpected.

The raising of large numbers of frogs by the method which has just been described makes heavy demands on space and technical assistance. The food has to be raised in the laboratory or greenhouse and even a single frog consumes an enormous number of insects in the course of a month. Frogs require to be at least eighteen months old before they can be used for parasitological research and for many purposes, animals older than this must be used. However, until some reliable method of eliminating all helminth parasites from frogs—by vermifuges or some similar technique—is devised, the rearing of helminth-free stock is an important process.

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ON THE POSSIBLE EXISTENCE OF A GIANT FROG IN
NEW GUINEA

By

MICHAEL J. TYLER

INTRODUCTION

During a recent period of residence at Nondugl in the Central Highlands of New Guinea, natives informed me that a frog of gigantic size that they named "Agak", occurred at a locality a few miles away. Having at that time spent several months collecting reptiles and amphibia in the district surrounding Nondugl, I was almost convinced that the report was either extremely exaggerated or false, in view of the fact that the reported size exceeded that of any species known in the world. I considered, however, that a search in the locality was justified.

Since the information obtained during this search strongly supported the natives' claim, details of the locality and the route taken are published here in the hope that a future expedition may visit the area and obtain specimens.

Nondugl (Lat. 5° 49' S., Long. 144° 44' E.) is a small settlement at 5,600 ft. on the northern side of the fertile Wahgi Valley, which runs for over one hundred miles between the highland centres of Mt. Hagen and Goroka. The valley courses between two magnificent ranges of mountains: the Wahgi-Sepik Divide on the North-East, of which the unclimbed Mt. Odan at 12,300 ft. is the highest peak, and the Kubor range to the South-East.

OUTWARD ROUTE

To reach the area in which the giant frog Agak was reported to occur, entailed crossing the Wahgi-Sepik Divide, and descending to the lowlands south of the source of the River Jimi.

I left Nondugl on May 13th, 1960, and travelled North-West by Land Rover for approximately twenty road miles to Kweanna, which is four miles due North of Banz (Lat. 5° 48', Long. 144° 36'). Kweanna is situated at an elevation of 6,000 ft. in a small gorge beside the Mombul River. The only Europeans there, Mr. and Mrs. Alan Booth, invited me to spend the night at their home. In the presence of Mr. Booth, I asked the local natives whether any of them had seen a specimen of Agak. One boy, aged about thirteen, stated that he had seen one in dense forest near the Tim River, at a locality probably ten miles distant. When asked to describe the colour, he compared the dorsal surface to that of a blade of green grass, and what he had glimpsed of the ventral surface to the pale brown of a dead leaf of a *Pandanus* tree nearby. Using a pointed stick, he made a rough diagram of the body on the ground. The body length measured over twelve inches, and the boy insisted that this was not an exaggeration.

The following day, accompanied by one cook, two interpreters, one messenger and six bearers, I left Kweanna at 8.0 a.m., and followed a track which ran parallel to the Mombul River to its source approximately three miles due North. The gradient of the ascent was a gradual one, and

the pass at 9,500 ft. (Lat. $5^{\circ} 44'$, Long. $144^{\circ} 38'$) was reached within two hours of leaving Kweanna. Progress from this point onwards was far more difficult, for the track descended precipitously through virgin moss-forest, and the occasional strips of level ground were morasses. I would estimate that only eight miles were covered in the next six hours, before we reached a small village named Tarar (believed to be approximately Lat. $5^{\circ} 42'$, Long. $144^{\circ} 38'$), which was situated on a ridge overlooking the eastern bank of the Tim River.

I discussed the purpose of the visit with the village chief, who was named Lulu-ai Tangil, and learned from him that the giant frog was to be found at the confluence of the Tim and Tagan Rivers, approximately three miles due North of Tarar. I was informed that the frog was known to the people of Tarar by the name of "Carn-pnay" and not Agak.

On May 15th, accompanied by hunting parties totalling seventy men and boys, we left Tarar and descended 5,000 ft. in three hours to the confluence of the two rivers. The track passed through sub-tropical moss-forest into the tropical rain forest with an appreciable change in the temperature and humidity.

HABITAT OF THE GIANT FROG

In the absence of a Milinch map of the area, and the inadequate detail shown on the existing Fourmil, an exact map reference cannot be supplied. The preceding report of the route, should however prove sufficient to enable a future party to visit the area. The writer is of the opinion that the site of the Tim-Tagan confluence is approximately Lat. $5^{\circ} 40'$, Long. $144^{\circ} 38'$.

With the exception of the terminal one-hundred-and-twenty-feet of the acutely-angled land between the rivers before the confluence, where the camp site was established, the tropical forests rise steeply from the river banks, and the natives stated that it was in this environment that the frog was occasionally discovered.

The Tim and the Tagan are shallow rivers, each about sixty feet wide. Whereas the Tim descends to the confluence very gradually, the Tagan consists of series of rapids followed by small waterfalls, and is therefore far more difficult to ascend.

ACTIVITIES AT THE TIM-TAGAN CONFLUENCE

Most of the search parties were active only at night, when the creature was said to forage for food. The area which could be examined was restricted to a two-mile radius of the camp site, because of the limited life of the bamboo torches carried by the natives.

Before any of the parties set out, Lulu-ai Tangil warned me that I had selected the wrong period of the year for my visit. He stated that the frog was very rare, and usually only seen when it visited the rivers to spawn. Spawning was said to coincide with the ripening of a fruit called "Marita" which was estimated by the interpreters to be probably during December.

All descriptions made by the natives of the colour of Carn-pnay tallied with that made by the boy interviewed at Kweanna, and the body-length was always estimated at being at least twelve inches. Natives who

claimed to have seen Carn-pnay were asked to also describe the size and colour of various species of frogs seen in the area by the writer, i.e. *Hyla darlingtoni*, *Nyctimystes humeralis*, *Rana sp.* etc. The accuracy of the descriptions bore testimony to the high quality of their powers of observation.

Carn-pnay was said to be located by its call. After being beaten to death with sticks, the meat was apparently then shared out amongst several men. Although the search parties returned without any specimens, my interviews with nearly two hundred natives convinced me that the frog does exist, and is probably an undescribed species of extreme size.

RETURN ROUTE

After several days of fruitless searching, torrential rains and lack of food forced the party to withdraw to Tarar, and after one night there we returned to Kweanna via the village of Kowil. This route had no apparent advantage over the outward one, and was more difficult in places.

SUMMARY OF INFORMATION OBTAINED

In the absence of specimens, the reader may feel inclined to dismiss the contents of this paper on the grounds that the evidence is purely hypothetical. The writer wishes to emphasise that he was only convinced upon visiting the locality, and personally meeting those who claimed to have seen it.

The information which supports the existence may be tabulated as follows:

1. The area in which the locality occurs is very improperly known, and has not previously been visited by a collector of zoological specimens.
2. The frog is known to the natives living near to the locality by a particular name: "Carn-pnay".
3. The frog is described as having a body-length of twelve inches by natives who rely upon their knowledge of the terrain, and its fauna and flora, for their survival, and who can describe other species of frogs with accuracy.

ACKNOWLEDGEMENTS

I wish to express my gratitude to Mr. and Mrs. Frank Pemble-Smith of Nondugl for their help and encouragement during the preparations for the trip, and to Mr. and Mrs. Alan Booth for the hospitality extended to me at Kweanna.

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NOTES ON THE GARTER SNAKE (*THAMNOPHIS SIRTALIS*),
WITH PARTICULAR REFERENCE TO GROWTH AND BREEDING.

By

ROBERT J. RICHES

In August, 1957, a gravid female Garter snake was purchased from a dealer, and two weeks later (on the 18th of August) it gave birth to eighteen young ones, three of these being born dead. The litter was produced early in the afternoon of a very hot sunny day. Several of them were deposited still in transparent membranes from which they emerged almost immediately. The average length of the fifteen living baby snakes was 162mm., and all were extremely lively.

The babies commenced feeding two days later when they accepted earthworms very readily. As a supply of small fish or frogs was not available the baby snakes were fed solely on earthworms, and after a period of two months or so several of the young snakes were beginning to show signs of a rickety condition, and a number of them died as the condition became more serious. It was at this point that it became possible to obtain a constant supply of small minnows and the remaining snakes soon began to grow with this more satisfactory form of diet.

GROWTH

Two of the small snakes were, shortly after birth, given to a friend, and these specimens (which subsequently proved to be a true pair) were fed almost solely on minnows from the outset. The female of this pair increased in length and bulk very rapidly, and the following is a note of measurements taken over a period of two years.

28th September, 1957	...	...	260mm.
28th February, 1958	...	...	364mm.
27th March, 1958	...	...	405mm.
24th April, 1958	...	...	450mm.
19th July, 1958	...	...	600mm.
27th September, 1958	...	...	610mm.
20th March, 1959	...	...	630mm.
9th April, 1959	...	...	650mm.
2nd August, 1959	...	...	710mm.
3rd October, 1959	...	...	740mm.

The rate of growth of the male snake was not so great, but as adult male Garter snakes are normally considerably smaller than adult females this was only to be expected. The measurements of the male were as follows:—

15th September, 1957	...	...	193mm.
2nd March, 1958	...	...	250mm.
30th April, 1958	...	...	350mm.
15th June, 1958	...	...	440mm.
27th September, 1958	...	...	470mm.
20th March, 1959	...	...	470mm.
15th April, 1959	...	...	480mm.

This specimen died at the end of April, 1959, the cause being unknown.

By comparing the tables of measurements it can be seen that the female snake had attained the length of two feet in only eleven months; the male at this time being approximately eighteen inches long and of a much slimmer build.

It must be stated that these snakes were not allowed to hibernate either in the winter of 1957/58 or 1958/59.

BREEDING

In their second winter (1958/9) both snakes were kept in a heated vivarium with the only two other remaining survivors of the litter; a female approximately eighteen inches long and a very dark coloured male between fifteen and sixteen inches in length. On numerous occasions the small dark coloured male made attempts to mate with the large female, who was then over two feet long and quite a bulky snake. No successful mating was observed, or in any case expected, as both snakes were considered to be too young. It should also be mentioned at this point that the dark male Garter snake also made attempts at times to mate with several young Grass snakes (*Natrix natrix*).

In April, 1959, the large female was separated from the other snakes and put into an outdoor vivarium of the garden frame type. Within a few months it became apparent that the snake was gravid and on August 16th, sixteen young ones were produced.

The next winter, 1959/60, this snake (together with the dark coloured male and the other small female) was allowed to hibernate in the outdoor vivarium. In the spring the dark male was observed to be mating with the largest female very soon after emergence from hibernation. A litter of forty-five young ones was born on August 16th (the same date as the previous year). Two further young ones were produced, still-born, a week later.

SUMMARY

It appears that under favourable conditions in captivity a female Garter snake can attain a length of two feet in under one year. The rate of growth of the particular female specimen for which a table of measurements has been given is perhaps exceptional, as it must be admitted that it has not been subsequently possible, even with the same vivarium conditions and using the same diet, to rear a specimen to over eighteen inches in length in the first twelve months of its life.

Pope (1956) states that a female Garter snake is capable of producing its first litter in its second Summer. In the case of the litter born on August 16th, 1959, it would appear that prevention of hibernation for the two previous Winters had no effect at all on the fertility of the male and female snakes concerned.

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FURTHER INSTANCES OF ACARINE PARASITES ON SAND
LIZARDS (*LACERTA AGILIS*)

By

ROBERT J. RICHES

Referring to Mr. Robert V. Skinner's report in a previous issue of the Journal (Vol. 2, No. 5, p. 93), it is considered that further occurrences of acarine parasites on Sand Lizards should be placed on record. A small number of lizards were caught in September, 1956, more or less in the same locality as the one caught by Mr. Skinner, i.e., in the heathland between Studland and Shell Bay, Dorset. Most of the specimens caught were juveniles, but of the adults two females were found to have ticks in the region of the forelimbs and throat. These parasites were dispatched to the British Museum (Natural History) and identified as the nymphs and adults of the tick, *Ixodes reduvius*.

An adult female lizard caught on the same stretch of heathland in May, 1961, also had a large tick adhering to its throat.

22 Cottrell Road, Eastville, Bristol, 5.

AN INFESTATION OF GRASS SNAKES NEAR SWANSEA

By

COLIN MATHESON

The Grass snake or Ringed snake, *Natrix natrix helvetica*, is widely distributed in Wales and is recorded for every county, sometimes reaching a great size. One of the largest Grass snakes recorded for the British Isles, measuring 5 feet 9 inches in length, was taken in Glamorgan.

It seems worth while reporting the following case of infestation of a house in South Wales by Grass snakes. About the middle of September, 1961, a young specimen was sent for identification to the Zoology Department, National Museum of Wales, by Mr. Ieuan Lewis, Chief Public Health Inspector at Pontardawe, about 8 miles N.E. of Swansea. This was one of a number of small snakes which were reported to him during that month as infesting a house and "lean-to" building in the Pontardawe area. The infestation seemed to originate in the lean-to building, which is described by Mr. Lewis as a stone-built structure of random rubble with a slated lean-to underdrawn roof; abutting on and communicating with the scullery on one side and adjacent to the living-room walls on another. On both remaining sides soil abutted to the height of the eaves, the house being built on a sloping hillside overgrown with weeds, brambles and long grass. The lean-to was in poor structural condition, with missing slates, open joint-work on the outside and defective ceiling and wall-plaster on the inside.

A large snake stated to be about four feet long (obviously a Grass snake since even a big Adder barely exceeds half that length) was seen and killed at the beginning of September. The infestation by young snakes was reported to Mr. Lewis on September 13th, and nearly fifty of them were seen during the next few days and most of them killed, six being saved and sent to the National Museum.

It was concluded after inspection that the eggs must have been located deeply in the walls of the lean-to or in soil abutting on the walls, and that the access of the young into the house was by way of the eaves and holes between ceilings and walls. The property is old and in need of general reconditioning throughout, and steps had already been taken before the infestation to rehouse the two occupants and undertake repairs. No reports of snakes have been received subsequently.

It is interesting to note that a somewhat similar infestation, although on a much larger scale, was reported many years ago in the same district by G. Leighton in *The Life History of British Serpents* (1901). This has become the classical example of snake-infestation in Great Britain, being repeated by J. T. Cunningham in his *Reptiles, Amphibians and Fishes* (1912), by Arthur Loveridge in the *Glamorgan County History* (1936), and by Malcolm Smith in *The British Amphibians and Reptiles* (1954). It occurred in a house at Cefn-y-caeau near Llanelly, also in the month of September. The young snakes apparently entered the house through a hole in the masonry of the back wall, and on taking down a portion of that wall forty bunches each containing about thirty eggs were discovered, all on the point of hatching. As at Pontardawe, the house was in a poor state of repair and was built on a hillside so that the field at the back was higher than the level of the ground floor. It is not unusual for several female Grass snakes to assemble in the same place for the purpose of egg-laying, although seldom in a house or in such numbers.

The young snakes I received from Pontardawe ranged from about seven up to eight inches in length (174 to 200mm.) and probably none of them were more than two or three days old. Smith gives the length on hatching as from 160 to 190mm.

A fully-grown female Grass snake will lay between thirty and forty eggs, very occasionally more; although young females may lay under a dozen. If the figure of "nearly fifty" young snakes actually seen and destroyed is approximately correct, the Pontardawe infestation may have been caused by at most two or three females, or even only one.

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AN OUTBREAK OF HYDROPS IN A COLONY OF *XENOPUS LAEVIS* ASSOCIATED WITH *STREPTOCOCCUS PYOGENES*

GROUP A

By

T. A. REES

A colony of adult female *Xenopus laevis* (Daudin) has been maintained in this department for experimental purposes over a period of two years. All the animals had been previously used for pregnancy diagnosis and subsequently rejected as "non-reactors". Two large metal tanks, each containing more than a hundred animals, were kept in a room the ambient temperature of which was about 24°C. and the colony was fed once a week on tubifex worms, meal-worms or chopped raw liver.

On the day following a feeding, when toads were being selected for an experiment, three of them were seen to have moderately distended abdomens. They were very lively and otherwise normal in appearance, and no immediate action was taken. Later in the same week, however, the distension had become so obviously abnormal that the three toads were removed from the colony into separate glass jars. One of them was put down for examination.

FINDINGS

The distension, which was limited to the ventral side only of the animal, was found to be due to the accumulation of a large quantity of blood-stained fluid in the saccus abdominalis. No lesions were seen, and when the abdomen was opened, the viscera appeared perfectly normal, though the stomach was empty. A sample of fluid, removed with the usual sterile precautions from a second toad, was inoculated on to a blood-agar plate. After incubation overnight at 37°C. there was a heavy growth of *Streptococcus pyogenes* in apparently pure culture. Further examination of this organism showed it to fall into Lancefield's Group A, to be resistant to streptomycin but sensitive to tetracycline, penicillin, chloramphenicol and erythromycin.

Within a few days, a further eighteen toads were similarly affected, and nine of these submitted to bacteriological examination yielded pure cultures of *Str. pyogenes* similar to the one described above. The remaining nine were kept without treatment to observe the nature of the disease, which pursued a chronic course, characterised only by immediate loss of appetite and gradually increasing distension of the saccus abdominalis, terminating in death at about four weeks. The outbreak cleared up spontaneously so that there was no real opportunity to observe the effect of antibiotics in the tank water.

An attempt to reproduce the disease in healthy toads gave no clear-cut result. A dozen toads were inoculated with 0.20ml. of an eighteen hour broth culture of the organism into the saccus abdominalis. A further dozen received 0.20ml. each of sterile broth at the same site by way of control. Four of the infected toads showed unmistakable signs of the disease after ten days, but the remaining eight and the twelve control animals remained healthy for as long as they were observed (six months).

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NOTES ON THE ECOLOGY OF *LACERTA VIVIPARA* L.

By

R. A. AVERY

INTRODUCTION

During a five week period in August and September, 1959, and for a short period in June, 1960, a study was made of some aspects of the autecology of the viviparous lizard. The results of three of the topics studied are presented in this paper,

- (i) daily cycle of activity
- (ii) population and movements
- (iii) food.

The work was carried out as part of the requirements of the degree of B.Sc. in the University of Bristol: I am grateful to Dr. H. P. Whiting for his helpful advice and criticism.

DAILY CYCLE OF ACTIVITY

Most of the work was carried out by the railway line near Hillfarance, Somerset. This habitat was chosen because the undergrowth was short, having been frequently burnt, and so individual lizards were comparatively easy to observe. A long paddock ran along the side of the railway line, separated from it by a wire fence, the posts of which were vertical wooden sleepers placed about six feet apart. It was around these posts that the activities of the lizards centred.

During the week 14—20-8-59, the activity of three adult lizards at one end of the fence was recorded. I arrived each day in the paddock at about 8.0 a.m. and sat down near the two end fence-posts. The lizards usually emerged between 8.30 and 9.30 and were watched until they disappeared in the late afternoon. Sometimes they disappeared into the undergrowth during the day, but were seldom out of sight for very long. It was found that by moving cautiously it was possible to approach quite close to the lizards. The general pattern which emerged during this week of fine, sunny weather was as follows:—

On emerging from their sleeping places (which could not be investigated) the lizards basked nearby, usually on a wooden post, or on a piece of wood or coal. Soon they began making sallies into the surrounding undergrowth, clearly looking for food, and occasionally pausing to lick the dew from overhanging grassblades. These trips lasted for 2-5 minutes, and the lizard then returned to its basking place. As the morning advanced, the trips became longer and longer, and the lizards then stopped returning to the original basking place, but paused to bask anywhere convenient. By the end of the morning they had become very active, and were difficult to observe, but the same alternating hunting and basking continued. At the end of the afternoon the lizards basked on the west side of a post or stone, finally disappearing when the sun had begun to lose its warmth.

Unfortunately it was not possible to record the behaviour of the lizards in dull weather.

POPULATION AND MOVEMENTS

Many of the lizards became individually recognisable. During the later part of the study all the lizards—a total of 19—were marked for future recognition by painting one or two spots of quick-drying lacquer paint on to the flanks. This method was found satisfactory for three weeks, but would be useless for a long-term study.

The marking showed that individual lizards do not have a permanent sleeping place; for example three different adults used a bolt hole in one of the posts on different occasions. They do, however, seem to remain within a fairly small area, although there is no territory holding as such. The longest movement recorded was that of an adult male which travelled 55 feet along the fence during a morning, and back again during the afternoon. Much larger movements must at times take place, but were not recorded. Frequently a lizard would be seen near a particular post for several successive days, then disappear for a few days, and then return again.

FOOD

Food eaten by lizards observed at the Hillfarance habitat included a red mite, an earthworm, a staphylinid beetle, and many aphids. Ants were not eaten (cf. Smith 1951) although the lizards frequently had opportunity to do so, and on several occasions specimens of *Leptothorax acervorum* were seen crawling on basking lizards.

Stomach contents. The alimentary canal of 30 adult lizards was examined. Nearly all the food material in the stomachs was identifiable, but that in the intestines and recta comprised mainly fragments of chitin and other debris. An analysis of the stomach contents of 30 adult lizards is given in table 1 below.

TABLE 1. Food of 30 adult lizards.

	No. of stomachs	Total number	% of total food
Hemiptera Heteroptera	16	72	36.0
Araneida	22	56	27.9
Phalangida	8	13	6.4
Hymenoptera Apocrita	4	11	5.4
Diptera (imagines)	6	9	4.4
Isopoda	6	9	4.4
Orthoptera	4	6	3.0
Hemiptera Homoptera	3	6	3.0
Collembola	3	5	2.5
Lepidoptera (larvae)	4	4	2.0
Chilopoda	3	4	2.0
Gastropoda	3	3	1.5
Diplopoda	1	1	0.5
Diptera (larvae)	1	1	0.5
Coleoptera	1	1	0.5
		201	100.0

The percentages may be compared with the figures given for the food preferences of captive lizards by Broadley (1958); they show no similarity.

The lizards were caught at a number of habitats. The high figure for Hemiptera Heteroptera may be misleading, as these are eaten in large numbers at one habitat, a railway embankment, and very little elsewhere. Figures are given in table 2 below.

TABLE 2. Occurrence of Hemiptera Heteroptera in stomachs.

	No. of lizards examined	No. with Heterop.	No. of Heterop.	% of total food
Railway embankment, August	9	8	61	55.4
Railway embankment, June	8	5	8	24.2
Other habitats, August	13	3	3	5.0

70% of the food items were between 2 and 7mm. in length. The largest item was a caterpillar of the moth *Ceramia pisi* (Agrotidae) 32mm. in length.

No intestinal parasites were found.

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 Dept. of Zoology, University of Bristol.

TREETOAD STUDIES: 2. DISTRIBUTIONAL AND OTHER STUDIES ON *HYLA OCULARIS*

By

JOE GORMAN

Harper in 1939 included northern Mississippi (and eastern Texas) in a map of the range of the Least Treetoad (*Hyla ocularis*). Neither Schmidt (1953) nor Conant (1958) give so northern a range to this species, the latter, particularly restricting its range to the south-eastern part of the North American Atlantic Coastal Plain.

On a trip to eastern Mississippi for treetoad studies a student, Mr. Gerald Regan s.j., and I stopped at several sites in Tennessee, in two of which we found *Hyla ocularis*. These collections were made on July 8th and 9th, 1958, one 4 miles south-east of Jackson, and the other about 20 miles west of Millington (in Shelby Forest State Park). Both sites are in Chester County, Tennessee, near Memphis. The specimens are in the author's collection.

Ecologically these records suggest that the Atlantic Coastal Plain is a biogeographical unit, perhaps only secondarily delimitable from Yucatan to Boston. This Plain appears biotically to extend north along the Mississippi River and some of its primary tributaries to at least as far as Illinois.

It may be, prepublicationally, that a profusion of generic names—*Hylodes*, *Chlorophilus*, *Hyla*, *Pseudacris*, and *Limnaeodius* the more familiar among them—prevents adequate record of the range and/or the ecology of this species. To this suggestion one might add Conant's apt remark (op. cit.: 284) that this species is often mistaken for the young of some other species. Size is a questionable generic distinction, especially among herpetozoa. The skeletal features of this species, perhaps only ecotypically "de"calcified, otherwise distinguish it from *Pseudacris* in the direction of *Hyla* (cf. Mittleman and List).

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BEETLES ATTACKING LIZARDS

By

BENJAMIN H. BANIA

The recent note "Lizard Killed by Beetle" by C. E. Owen and Dorothy Owen (British Jour. Herpetology, 1959, vol. 2, p. 167) recalls some recent observations made in the warm desert areas of the southwestern United States. On one occasion tenebrionid beetles were attacking an adult *Dipsosaurus dorsalis*, the desert iguana. Several beetles and the lizard were trapped in a buried can, one of a large series which were being used to obtain a sample of the terrestrial fauna of Saline Valley, Inyo County, California. The lizard was still alive when collected, but had a large opening around the sides of the pectoral girdle as a result of repeated injury by the beetle. Although several beetles were in the can with the lizard, only one was seen in the act of attacking it. A second case pertains to a banded gecko, *Coleonyx variegatus*, which like the previous example, was also trapped in a buried can pit-fall trap. The gecko's tail had been completely chewed off, except for a tiny stub, and the lizard was uttering loud squeaks when collected. Both lizards and beetles were preserved.

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FAILURE OF LIZARDS TO LEARN A SIMPLE TASK

By

J. H. COOKSON

During a three month period of observation on the feeding habits of three lacertids, *Lacerta lilfordi*, *L. sicula*, *L. muralis*, the writer noted especially the failure of these lizards to learn how to overcome a simple obstacle to obtain their food.

Mealworms were offered in a $\frac{1}{2}$ " deep open Petri dish, the rim of which was about level with the tops of the heads of the normal resting animals. The food itself was at ground level. The lizards could see the movements of the mealworms, and, in lowering the head to reach them, met the side of the dish. Vigorous clawing movements and biting the side of the dish usually resulted in the head being raised enough to allow the animals to slide forwards over the rim and on to the mealworms. On obtaining a worm they would rush to safety behind a rock to devour it, and then the whole process, sometimes lasting almost 2 minutes, of attempting to reach the worms through the glass would be repeated.

Success in eventually obtaining food was purely by chance, and although feeding was observed for three months, three times weekly, with each animal visiting the dish about 10 times at each feeding, these lizards failed to learn the simple feat of slightly raising the head to overcome an obstacle between themselves and their food.

Wyeth Laboratories, Havant.

REVIEWS

LIVING AMPHIBIANS OF THE WORLD: by DORIS M. COCHRAN, Doubleday N.Y. and Hamish Hamilton, London, 1961. pp. 199, 77 illustrations in colour, 143 illustrations in black and white. Price \$12—£3 13s. 6d.

A considerable effort has obviously gone into the making of this book and the claim, made on the dust jacket, that it contains the most beautiful pictures of amphibians ever assembled, is hardly exaggerated. One only wishes, after looking at the superb colour reproductions, that all the pictures were in colour. Considering the cost of colour reproduction we must be grateful that the publishers have found it possible to let us have 77—apart from the 143 in black and white—for a comparatively moderate price. Unfortunately, no scales of magnification or reduction are provided with the pictures. The reader may also have difficulties occasionally in finding the page he is looking for. Pages 146-150 and many others have remained unnumbered. The most remarkable picture reproduced is perhaps that of *Lepidobatrachus asper* (p. 93) lifting himself up and walking, his enormous mouth aggressively opened, in the manner of an ordinary quadruped. The author's text is as competent as one could possibly wish and as extensive as a book of this nature allows. The biblio-

graphy, although admittedly "selected", should, instead of citing many volumes long out of print, have mentioned Malcolm Smith's British Amphibians and Reptiles, The World of Amphibians and Reptiles by Mertens, and Klingelhöffer's Terrarienkunde, all of which are still in print and are indispensable to the herpetologist.

Compared with that on the other orders of animals, the popular literature on amphibians is extremely scanty and we must indeed be grateful to the publishers for having included a book on this group in their series. It certainly deserves a high place on any herpetologist's book list.

E. ELKAN.

THE DISEASES OF THE AMPHIBIANS

Following his earlier book on the diseases of fish, Dr. Reichenbach-Klinke, a member of the Munich Experimental Biological Institute, has now written a small volume on the diseases of the Amphibians. (H. H. Reichenbach-Klinke, Krankheiten der Amphibien. G. Fischer publ. Stuttgart 1961, pp. 100 with 81 illustrations. Price D.M. 24.50 or approximately £2 2s. 0d.)

Since most of what has been written on this subject has appeared in specialized journals inaccessible to the general public, this little book will be very valuable to amateurs and scientists who, for one reason or other, find their amphibians dying from unknown causes. They will find here, advice on how to investigate and what treatment to apply where this is possible. The diseases themselves are discussed under the heading of parasitic, non-parasitic, various and anomalies, the book is well produced and lavishly illustrated. Unfortunately for British readers it is also, for its size, extraordinarily expensive. A book for the English speaking reader, compassing the diseases of all the lower vertebrates, their causes and—where possible—their treatment, would be most useful and might prevent the loss of many a valuable specimen that cannot be easily replaced.

E. ELKAN.

ZOOGEOGRAPHY OF THE SWEDISH AMPHIBIANS AND REPTILES WITH NOTES ON THEIR GROWTH AND ECOLOGY :

By the late T. GISLEN and H. KAURI. Acta vertebratica, 1959, **1**, 197-397. Price 40 Swedish Kronor.

This paper forms the complete third part of the first volume of Acta vertebratica, which started publication in 1957. The paper was practically completed by Professor Gislén before his death in 1954, and has been edited and brought up to date by Dr. Kauri. The 13 species of

amphibians and 6 reptiles have been very thoroughly covered, and a new sub-species *borealis* of *Triturus vulgaris* is described.

Distribution maps for the various species are included, as well as photographs of the perfect stages and some of the breeding habitats of the amphibians. There are also photographs of two giant tadpoles of *Rana temporaria* of 70mm. length. Some snakes and lizards with interesting abnormal colour or markings are also shown.

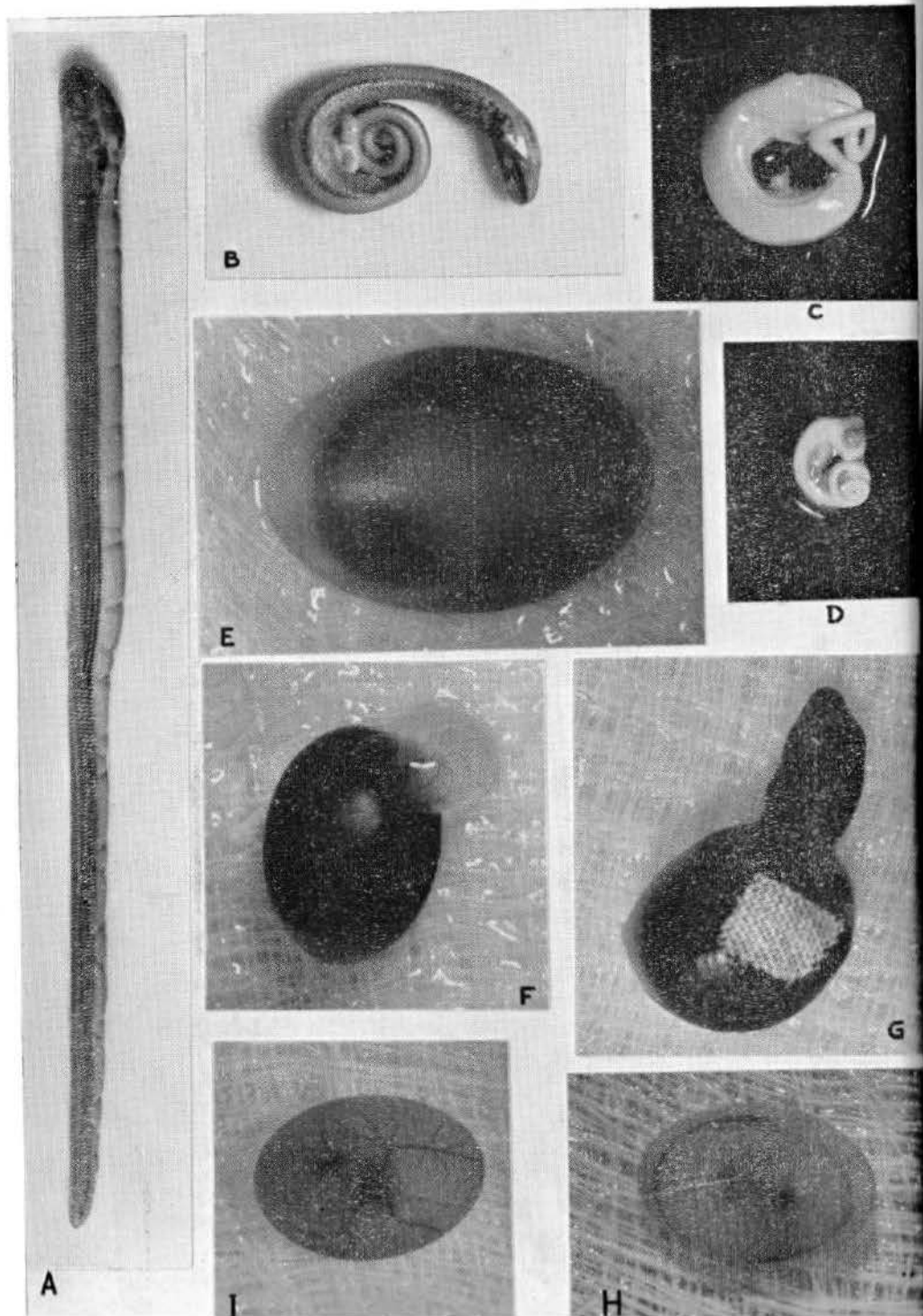
The volume is full of points of interest to herpetologists in general, and merits careful reading by British ones, who possess in this country a proportion of the species found in Sweden.

J. F. D. FRAZER.

ANNOTATED CHECKLIST WITH KEYS TO THE SNAKES OF HONG KONG : by J. D. ROMER. Memoirs of The Hong Kong Natural

History Society, No. 5, May 1961, pp. 1-14.

Copies of this valuable checklist, while still available, may be obtained from the Society's Hon. Treasurer, Mr. H. C. Tang, c/o Colonial Herbarium, Urban Services Dept., Central Government Offices (West Wing), Hong Kong, at 4/5d. each (per British Postal Order) including postage.



Holder and Bellairs Plate 1.

A—E, *Anguis fragilis*. A, apparently normal embryo put up at stage corresponding with Dufaure-Hubert 39 (Peter, fig. 35), and cultured for only 7 days. The transverse ridges on the back are due to the thread loops used to straighten the specimen after fixation. Wet weight 0.38g. x 2.5.

B, embryo put up at D.-H. stage 32 and cultured for 48 days; it has reached stage 39 on the basis of shape and colour but is abnormally small (compare with A). Weight 0.12g. x 2.5.

C, Oedematous embryo after 22 days in culture. x 2.5.

D, normal embryo around D.-H. stage 32, after removal from mother. x2.5.

E, late embryo in culture. x c3.3.

F—I, *Lacerta vivipara*. F, late embryo in culture showing prolapse after operation on tail. x c3.3.

G, cultured embryo hatching after operation. The piece of handkerchief on the egg was applied to prevent prolapse. x c3.3.

H, cultured embryo after 16 days at 4°C., showing stagnation of blood. I shows the same embryo after transfer to room temperature for 4 days; the vessels now seem normal. x c3.3.