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CONTENTS

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All correspondence in connection with this Journal should be addressed to: The Secretary, East Africa Natural History Society, P.O. Box 4486, Nairobi, Kenya.

THE PHYTOPLANKTON OF SOME KENYA WATERS

By

E.M. LIND

An unexpected temporary appointment in the Botany Department of University College, Nairobi, provided the opportunity to make a survey of the phytoplankton of some Kenya inland waters. Attention has previously been paid to some of the larger lakes, particularly those in the Rift Valley, but little information is available about the smaller lakes and reservoirs. The account which follows is an attempt to present the results of the survey in a form which can be understood by those who have had no specialist training in botany.

The term plankton is used to describe the minute free-floating organisms which are present in any body of fresh or sea-water and which form the main food of fish. The phytoplankton consists of algae, which are plants, and the zooplankton of animals. The algae contain chlorophyll and are able to manufacture sugars from carbon dioxide and the water in which they live. They are eaten direct by some kinds of fish and they also provide the food of small water animals which are the food of other fish. When phytoplankton is present in quantity, it colours the water green or brown but if only a small quantity is present the algae can only be seen in a concentrated sample. This may be obtained either by sieving the water through a fine silk net or by allowing the organisms to sediment out after killing them with iodine. The organisms belong to a wide variety of algal classes, but for the purposes of this account it will be sufficient to mention the following major groups which include those types occurring most commonly in Kenya fresh-waters.

CHLOROPHYTA (Green Algae)

Coccoid types: Immotile unicellular green algae, usually grouped together into colonies of various forms. They are often in a state of active asexual reproduction resulting in colonies of different sizes (Fig. 1).

Motile colonial types: In these, a larger or smaller number of green cells, each with two flagellae, are grouped together to make a usually spherical motile colony (Fig. 2).

Desmids: In most desmids the cell consists of two semi-cells joined by an isthmus. The cell wall is often ornamented in various ways or bears spines, and many of the desmids are very beautiful objects under the microscope. In some genera the individual cells are joined together by mucilage to form 'chain desmids' (Figs. 3, 4, 5a and b).

CHRYSOPHYTA (Yellow-green or yellow-brown algae)

Diatoms: Although diatoms contain chlorophyll they are yellow-brown in colour. Each diatom consists of a single cell, often boat shaped or needle-like with a wall composed partly of silica and

bearing very delicate markings (Fig. 6). Vast quantities of these in some earlier Kenya lakes have resulted in the accumulation of deposits made up of their silica walls and known as diatomite. In one common diatom the cells are joined together by their ends to form a filament Melosira (See photo).

Tribonema: A filamentous alga, yellow-green in colour. The cells have thin cellulose walls made of two overlapping halves so that the broken end of the filament shows an H shaped piece of wall where the two halves have come apart. This alga does not store starch and therefore does not stain blue with iodine (Fig. 7).

Dinobryon: A curious alga in which the tiny, flagellated, yellow-brown cells are contained within flask-shaped structures open at one end and pointed at the other. These capsules are arranged in a tree-like manner to form a branched structure. Very often broken pieces of the 'tree' are found after the living cells have escaped (Fig. 8).

Botryococcus: The cells lie close together within a brownish or orange-coloured envelope forming small irregular masses. The cells secrete oil which obscures the detailed structure (Fig. 9).

PYRROPHYTA (Golden-brown algae)

Peridium and Ceratium: These unicellular forms are characterised by the presence of a deep transverse groove or furrow and a wall ornamented by a number of plates. Ceratium has conspicuous horns. Both are actively motile by means of two flagellae (Figs. 9, 10).

CYANOPHYTA or MYXOPHYCEAE (Blue-green algae)

There are very many algae belonging to this group, they show a great variety of form and may be unicellular, colonial or filamentous; they are often enclosed in a mucilage sheath. Some are so minute that they pass through the finest meshes of a plankton net and yet they colour the water deep green. Algae of this group are specially common in alkaline lakes (See photo).

EUGLENOPHYTA

Euglena and Phacus: Unicellular motile organisms, bright green in colour and storing a carbohydrate (paramylum) which does not respond to the iodine test. The cells are naked, and while Phacus has a rigid periplast, Euglena is able to change its shape. They are especially characteristic of waters of high organic content (Figs. 11, 12).

Phytoplankton and water

The relative proportions of algae of these groups occurring in any body of water will depend on the chemical composition of the water. Some are characteristic of soft waters and others of hard while highly saline lakes or lakes rich in organic matter have a very distinctive plankton. In temperate countries where these matters have been the subject of close study, there is also a change in the composition of the plankton throughout the year and this has been shown to be

associated with climatic changes which bring about first a stagnation and then a mixing of the waters resulting in a redistribution of nutritive material which has collected on the surface of the lake muds.

Though waters in different districts of Kenya show plankton populations related to their environment, the range of temperature in any one place is insufficient to cause the stagnation and mixing seen in places with a big difference between winter and summer temperatures. The biggest climatic change to which Kenya waters are exposed is due to rainfall which in the parts of the country with which we are concerned occurs in two main periods between March and June and between October and December. In 1961-62 all lakes were subject to heavy flooding and in 1963-64 their waters were well above normal level.

It was thought that a survey of the plankton of some Kenya waters might prove of interest from two points of view. Firstly it is possible to collect from lakes and dams in a wide variety of ecological habitats ranging from mountain tarns at 10,000 ft. to Rift Valley saline lakes at 2,000 ft. Secondly, as there are no major climatic fluctuations which would bring about regular changes, other than diurnal, in the temperature of the water, a study of the periodicity of the algae might prove rewarding.

The investigation therefore falls into two parts:-

1. A study at monthly intervals of the phytoplankton of two reservoirs.

2. A comparison of plankton from lakes of different ecological types.

Methods: Plankton was collected by drawing a net of fine bolting silk (180 meshes to an inch) through the surface water as near as possible to mid-day. No attempt at quantitive estimation was made; counts were made under the microscope of approximately 1,000 individuals and the proportion of the major species expressed as a percentage of the whole.

Wherever possible data were obtained of pH, conductivity (an indication of total dissolved salts) total alkalinity (carbonates and bicarbonates) and major metallic ions.

Phytoplankton periodicity in two Kenya Reservoirs

The two waters chosen were Sasamua and Ruiru Reservoirs which form the main water supply for Nairobi. Sasumua, constructed in 1956 is 650 acres in extent and about 90 ft. deep and has a capacity of 2,000 million gallons. It lies at the foot of the Aberdares at 8,140 ft. in a region of bamboo *Arundinaria alpina* K. Schum and Cedar, *Juniperus procera* Hochst. ex Endl. forest. Until June 1964, its drainage was from two rivers, the Chania and the Sasumua. The former has a catchment area mainly on mountain slopes in the forest around 10,000 ft. while the Sasumua catchment is mainly on more level grazed or cultivated land outside the forest reserve. In June, 1964 a third river, the Kiburu, was diverted into the dam through a 33 inch pipe and it now provides 50% of the inflow. The dam wall is to be raised 26 ft. to contain this extra supply. The mean monthly maximum temperature lies between 17 and 25 C° and there is said to be no thermal stratification.

Ruiru Reservoir, constructed in 1949 is much smaller, only 100 acreas in extent, and has a capacity of 656 million gallons. It is situated at 6,450 ft. in an area of Kikuyu reserve and receives its water from the Ruiru and Bathi Rivers flowing mainly through cultivated or grazing land. Ruiru dam is about 60 ft. deep and is said to show no thermal stratification. The mean maximum monthly temperature lies between 21 and 27 C°.

The Phytoplankton

The phytoplankton of the two dams was somewhat similar and consisted mainly of Dinoflagellates, coccoid and colonial Chlorophyta, Dinobryon and, at certain times desmids. Diatoms and Cyanophyta were never conspicuous. The main differences were the abundance of Dinobryon in Ruiru while in Sasumua it was hardly significant, and the abundance of Ceratium at times in Sasumua though scarce in Ruiru.

The periodicity of the various plankton types throughout the period October 1963 to December 1963 is shown in Diagrams 1 & 2 and it will be seen that it was not the same in the two reservoirs. For example, Peridinium in Ruiru reached its maxima in May and June and in November following heavy rains, while in Sasumua its two maxima were at periods of low rainfall. Ceratium behaves in the opposite manner.

Chlorophyta seem to favour low rainfall but the situation at Ruiru was complicated by a huge maximum in October of the Coccoid and Colonial algae Kirchneriella and Eudorina which coloured the water bright green. Next month it had almost gone and was replaced by Peridinium. This only serves to indicate that a survey of this kind should really be carried out at weekly intervals as various important changes can take place in a month and be completely missed.

Desmids were a major feature of the plankton of both dams when the investigation began and, to a less extent, in November 1964. In Ruiru they rose to a maximum in April just before the high rainfall then fell off abruptly with the rain and did not reappear till November. In Sasumua, after a high start in October, they decreased till May and remained below 10% till December being at their lowest at the time of highest rainfall. It was, perhaps, surprising to find desmids forming 70% of the plankton in water with a pH of 7.3. They were limited to about ten species.

Dinobryon: This alga was so abundant at most times at Ruiru that it was impossible to count it at all accurately. Only in January and August did its numbers fall appreciably. In Sasumua it was always present but only in April did it reach more than 15%. Dinobryon was not included in the percentage counts in either reservoir but is shown separately at the top of the diagram.

Periodicity in relation to Rainfall
Sasumua 1964 1730 mm
Ruiru 1964 1482 mm

The Diagram shows that certain algae behaved differently in the two waters in relation to rainfall.

Peridinium maximum occurred at high rainfall at Ruiru.
Peridinium maximum occurred at low rainfall at Sasumua.

Ceratium maximum occurred at low rainfall at Ruiru.
Ceratium maximum occurred at high rainfall at Sasumua.
Desmid maximum was at low rainfall in both dams.
Dinobryon maximum was at high rainfall in both dams.
Chlorophyta maximum was at low rainfall in both except for the Eudorina maximum as the short rains began in Ruiru.

As plankton algae are known to be sensitive to the amounts of dissolved nutrients in the water, this was estimated by measuring the electrical conductivity of the water, a figure which is related to the concentration of ionised salts in the water. These measurements are not complete for the year but they are shown at the top of the diagrams. The pH lay between 6.9 - 7.3 in both reservoirs and the conductivity between 45 and 250.

It will be seen that conductivity increased with high rainfall in April in Sasumua, but in Ruiru the reverse was the case, conductivity being at its lowest at this time. The cause of this difference may lie in the nature of the drainage system.

At Sasumua, water enters mainly from rivers flowing through forest and over base-rich volcanic rocks and therefore likely to bring in extra salts at times of heavy rainfall. The slight rise in conductivity shown in July (a normally dry period) may be due to the entry of the new supply from the Kiburu River.

In Ruiru, which is much smaller and surrounded by cultivated land, already probably leached, it may be that the heavy rain runs off the land without percolating much through the soil and thus dilutes the water of the reservoir.

The distribution of Phytoplankton in some Kenya Waters

The waters of East Africa can be classified roughly into the following groups:-

a. Very large lakes such as Lake Victoria.
b. Large freshwater lakes such as Lake Naivasha.
c. Alkaline lakes.
d. Dams constructed to provide water for drinking or for agricultural purposes.
e. Tarns and pools some of which dry up in the dry season.

As considerable attention has already been paid to the very large lakes the present account is concerned only with the groups b to e.

Description of lakes

Lake Naivasha: This is dealt with separately as it in fact consists of three parts with different ecological conditions.

Smaller Lakes

Lake Ol Bolossat

Situated at the foot of the Aberdares at 7,600 ft. receiving its drainage from volcanic rocks and soils. A shallow lake surrounded by grass and sedge swamp with a fringe of Typha and said by the local people to contain no fish.

Lake Narasha

Situated near Timboroa in the Kenya Highlands at 8,800 ft. No inlet so probably fed by springs. An outlet flows in wet weather. Very much overgrown with water-lilies and other water plants and with a deep fringe of *Typha*.

Lake Jipe

On the border of Kenya and Tanzania, south of Taveta and fed by the Lumi River flowing off Kilimanjaro. It is 11 x 3 miles in extent only about 62 ft. deep and surrounded by swamp. Where the collection was made there was a deep fringe of *Typha*.

Lake Chala

A deep crater lake north of the Voi-Moshi road near Taveta. Most lakes occupying craters are strongly alkaline and green in colour owing to the quantities of phytoplankton.

Lake Chala is fresh and must have an inflow and outlet though none is visible. It was not possible to trawl the net owing to the very steep rocky sides. But plankton precipitated in bottles of Chala water kindly provided by the Water Development Dept. showed algae characteristic of fresh rather than saline water. They were insufficient to be able to estimate a percentage but consisted of Dinoflagellates and Cyanophyta.

Alkaline Lakes

The larger Alkaline Lakes were not investigated. Several of the smaller lakes and dams proved to be alkaline.

Dams and Reservoirs

Sasumua and Ruiru reservoirs are described separately in an earlier part of the paper.

Kikuyu Springs

The original source of Nairobi's water supply and still used for that purpose. Situated at about 6,000 ft. at the source of the Nairobi River west of the main Nakuru road near Kikuyu. The water is very clear and derives from springs. The dam is fairly shallow and the bottom is covered with weeds which are kept in check. It is only 6.5 acres in extent.

Tigoni Dam

Constructed by the army in the 1939-45 war. Situated near Limuru about 17 miles north of Nairobi and surrounded by grassland, at about 7,400 ft. There is very little weed round the edge.

Sisal Dam

On the estate of the High Level Research Station near Thika at about 6,000 ft., surrounded by grassland and scrub and with a fringe of *Typha*, papyrus and sedges.

Deacon's Dam

On the Matuu Estate at the foot of Donyo Sabuk, east of Nairobi at about 5,000 ft. It is the oldest dam in the district and receives underground drainage from Matuu Hill. It is partly grown over with water lilies and other plants.

Kwale Dam

In the same neighbourhood as Deacon's but in an area of "black cotton soil". It was emptied when the dam wall broke in the 1961-62 floods and has now refilled.

Ngomeni and Yambuyu Dams

These two dams differed from all others in being rock catchment reservoirs in rock of the basement complex. They were at a lower altitude of about 2,500 ft. in hot, dry bush country. Yambuyu is near Mwingi on the Nairobi-Garissa road, and Ngomeni is about 250 miles from Nairobi to the west of the Garissa road. Ngomeni proved to be alkaline.

Lessos

A large dam situated at 7,300 ft., north-east of Lessos. It is surrounded by grassland and has a deep fringe of *Typha*, *Potomogeton* and submerged weeds. It is used by a sailing club.

Molo

A dam in agricultural land situated at 8,200 ft., near the Nakuru Eldoret road, 29 miles from Nakuru.

Tarns and Pools

Gicururu Tarn

A small, shallow tarn at 9,200 ft. near the Aberdare Mountain Road, surrounded by moorland and with a peaty bottom. This and Lake Narasha proved to be the only two true desmid lakes.

Distribution of Phytoplankton

In general the waters fell into fairly distinct categories with regard to the dominant groups in their phytoplankton. Where it was possible to pay more than one visit to a lake, the plankton was seen to vary at different times of the year. Some waters therefore appear more than once in the list with a date to indicate the time of the visit.

Cyanophyta Lakes

Ol Bolossat (12/64), Lodien Bay (Naivasha), Ngomeni: pH 8.5 to 9.3; conductivity 278 to 1,000; alkalinity (as normality) .002 to .0085. These waters usually contained diatoms as well.

Tribonema-Melosira Lakes

Ol Bolossat 3/64, Naivasha (Crescent) 10/64, Lessos, Kwale, Yambuyu: pH 7.2 to 8.0; conductivity 110 to 920; alkalinity (as normality) .001 to .0014. They often contained dinoflagellates and at some times of year had an abundance of *Cyanophyta* (Eg. Ol Bolossat).

Dinoflagellate Lakes

Sasumua, Deacon's Dam, Tigoni Dam: pH 7.0 to 7.3; conductivity 55 to 155; alkalinity (as normality) .005 to .0008. Dinoflagellates were often associated with Chlorophyta and Desmids.

Dinobryon Lakes

Ruiru, Molo, Sisal Dam: pH 7.2 to 7.5; conductivity 48 to 173; alkalinity (as normality) .00036 to .0017. These were very similar to the dinoflagellate lakes and, like them often had many *Chlorophyta*.

Desmid Lakes

Narasha, Gicururu, Ruiru, Naivasha: pH 6.3 to 7.7; conductivity 30 to 250; alkalinity (as normality) .0022 to .00038. True desmid lakes were few in number and were characterised by low pH and conductivity (Narasha 6.7 and 30, Gicururu 6.3 and 31). Ruiru and Naivasha were included because at certain times they had a high desmid content in spite of a pH of 7.7 in the case of Naivasha.

Diatom Lakes

Kikuyu Springs: pH 6.9; conductivity 220; alkalinity as normality .0009. This was the only water which consistently showed a maximum of pennate diatoms (i.e. diatoms other than *Melosira*). It was the only dam shallow enough to have the bottom covered with water plants. It had a silica content of 45 ppm.

Lake Naivasha

This lake deserves fuller treatment as it was visited on several occasions and something is known of its plankton periodicity. It lies in the Rift Valley at 6,000 ft. and has an area of 70 sq. miles. It is fed by rivers from the Aberdares and from the hills above Gilgil and is one of the few Rift Valley lakes with relatively fresh water. As it has no surface outlet and is surrounded by alkaline volcanic deposits, one would expect it to build up a strong salt concentration due to evaporation, as is the case in some other Rift Valley lakes. That this does not happen can only be explained by assuming the presence of a subterranean outlet.

A thorough study of L. Naivasha was made during the Cambridge Expedition to the East African Lakes in 1930-31 when the flora and fauna was related to the chemical properties of the water. The following observations made in 1963/4 may therefore be of interest in comparison with the earlier results.

Lake levels

There is evidence from the study by Leakey and others of the former lake terraces that the water level was at one time much higher than it is now, perhaps 300 to 400 ft. above its present level, and that it may then have found an outlet through the Njorowa gorge. In 1906 the riparian boundary was fixed at 6,218 ft. above sea level. By 1917 the level was 6,219 ft., the highest in recent times and after that it fell considerably. After the 1961 floods it rose to 6,197 ft. and by 1964 had reached 6202 ft., still not quite up to its 1917 maximum.

There are three distinct parts of the lake to be considered.

Crescent Lake: This lies in a depression inside the curve of Crescent Island which is the rim of a volcanic crater. It is deeper than the main lake from which it was almost cut off when the water level was low. In November 1964 the depth of the main lake was 21.6 ft. and there was considerable mixing between its water and that of Crescent Lake. Most of the plankton collections were taken from Crescent Lake which could easily be reached by a rowing boat.

Main Lake: Refers to the main body of water outside the rim of Crescent Lake. At the time of this study, there was also a large flooded area where previous farm land was under water and fencing

posts and even telegraph poles were sticking out of the water among dead trees. The original fringe of papyrus was well out into the water and water lilies occupied the shallow lagoons behind it.

Loydien Bay: This is a small lake in the S.W. corner of the basin which was formerly cut off from the main lake by a strip of swampy land. About 1956, a channel was cut through to connect the bay with the main lake whose level was higher than that of the bay. This resulted in a deepening of the bay and in the dilution of its water in respect of certain salts. Since 1961 there has been considerable mixing of the waters and in 1964, during the present study, the dividing strip was often under water. Except when the water level is very high, the phytoplankton of the main lake and Loydien Bay remain quite distinct.

PHYTOPLANKTON

The chief constituents of the Main Lake were diatoms and Cyanophyta though a few Chlorophyta and desmids were always present. There were two kinds of diatoms:- pennate diatoms which are often needle shaped and exist usually as single cells, (Fig. 6) and a centric diatom called Melosira (See photo). The cells of Melosira are the shape of a cylindrical box and they are joined by their circular ends to form a chain. The place where the lid of the box overlaps the bottom can often be seen as a narrow band and when the lid and the base come apart, an H-shaped piece is left at the end of the chain. Desmids showed a surprising maximum in December 1964 when the pH was 7.7. These organisms are usually associated with acid waters.

The plankton of Crescent Lake at most times resembled that of the Main Lake but had more Cyanophyta and Tribonema. As more collections were available from this part of the lake, a distinct periodicity could be seen. Melosira was just present in February, reaching a maximum in April which was maintained till October when the numbers decreased again. Other diatoms were always present but were at their lowest at the time of the Melosira maximum. In December, as in the Main Lake, desmids increased tremendously at the expence of other constituents.

The changes in the plankton of Loydien Bay were very intersting. The first collection in March 1964 showed very little in a net haul. But when iodine was added to a bottle of lake water the precipitate contained very many minute Cyanophyta, too small to be held by the plankton net but sufficiently abundant to colour the water green. The next collection, 7 months later, had quantities of larger Cyanophyta as well as the minute forms and, in addition, plenty of Melosira. A month later, in December 1964, Cyanophyta were still abundant, Melosira much less, and even here with a pH of 9.3, there was 2% of desmids.

At least part of these changes in the phytoplankton must be attributed to the flow of water from the flooded Main Lake. A sample taken from the Loydien Bay end of what used to be the connecting channel showed the plankton to be very similar to that of the Main Lake. The pH was 7.5 and the alkalinity (.0042) and conductivity (395) between that of the bay and the lake. If the high level of the Main Lake continues it should result in a conciderable freshening of the water of Loydien Bay.

Unfortunately, it was not possible to get complete water analyses

at the time of each collection, but some features of interest are seen if a comparison is made between the water of the three parts of the lake in December 1964 (Diagram 3). Loydien Bay had much the highest alkalinity with resulting high pH and conductivity. 30% of the alkalinity was due to carbonate. Sodium was high. Crescent Lake had only about ¼ the alkalinity of the bay and it was all due to bi-carbonate. Conductivity and pH were lower. Chloride was high and magnesium present. Main Lake was similar to Crescent Lake but chloride and calcium were lower and magnesium absent.

It is known from studies in Lake Victoria and elsewhere that the abundance and size of plankton-eating Tilapia is related to the nature of their food. A cursory glance at the gut contents of Tilapia from Naivasha showed that they had digested the diatom Melosira rather than the other algae. A further study of this kind might be of value in developing the fisheries of this lake.

Summary

The composition of the phytoplankton collected at monthly intervals from Sasumua and Ruiru reservoirs is described. Plankton periodicity is demonstrated for both waters and is shown in some instances to be related to rainfall.

The distribution of the major plankton algae in a number of Kenya waters is described. The lakes and dams are shown to fall into groups characterised by the dominance of certain types of algae related to figures for pH, conductivity and alkalinity. The phytoplankton of Lake Naivasha is described and algal periodicity is demonstrated for this lake.

It is hoped to publish a fuller taxonomic account of this investigation at a latter date.

Acknowledgments

I am indepted to members of the Nairobi City Engineer's Department and of the Water Development Department for providing facilities for this investigation, and particularly to Mr. Bazin and Mr. Innes at Sasumua and Ruiru respectively. I am also grateful to Mr. I.Furtado for making collections while I was on leave and to my colleagues at the University College for help with water analyses.

(Received for publication 8th March, 1965)

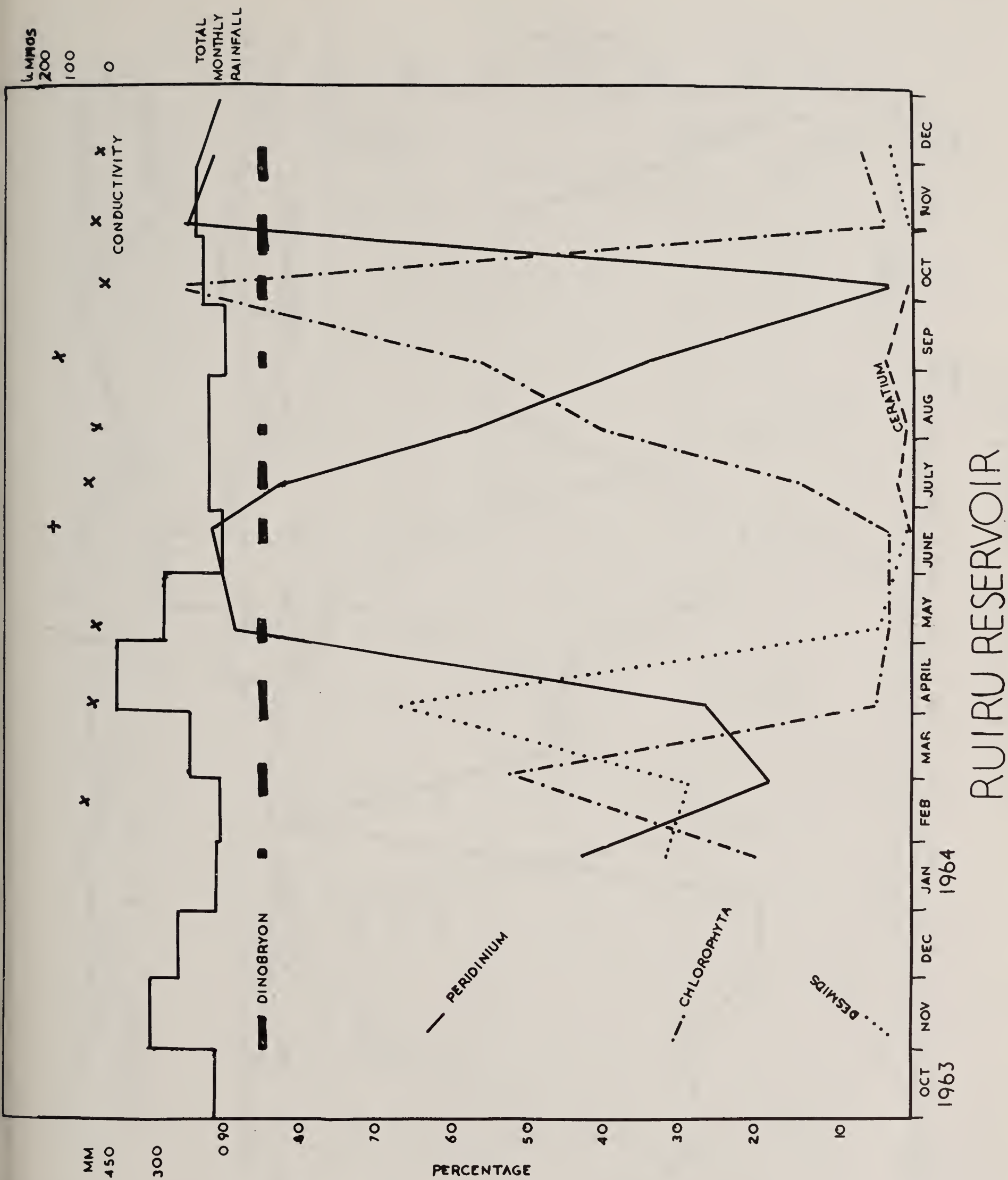


DIAGRAM 1: DISTRIBUTION OF PHYTOPLANKTON IN RELATION TO RAINFALL. NO COLLECTION WAS MADE IN DECEMBER 1963

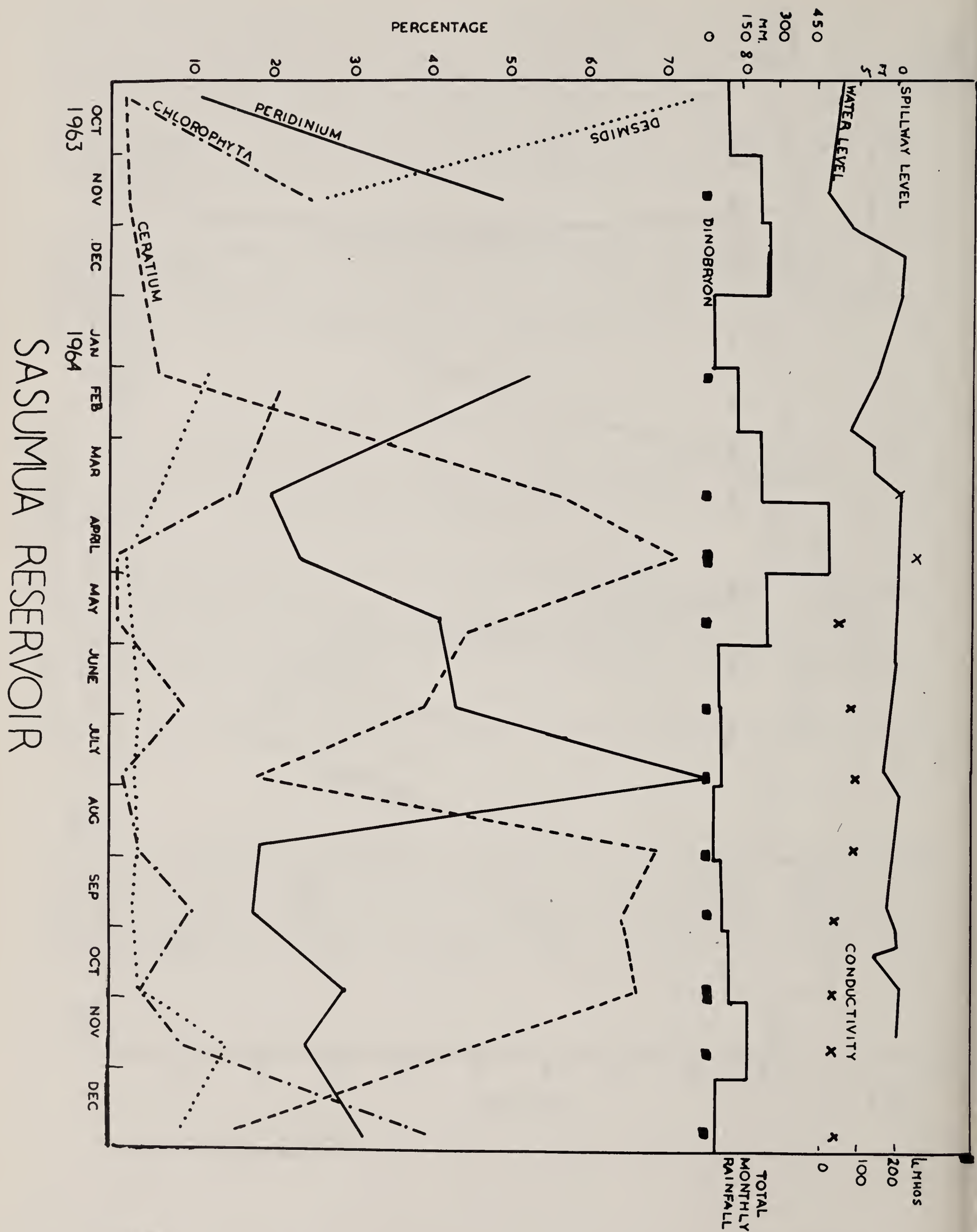
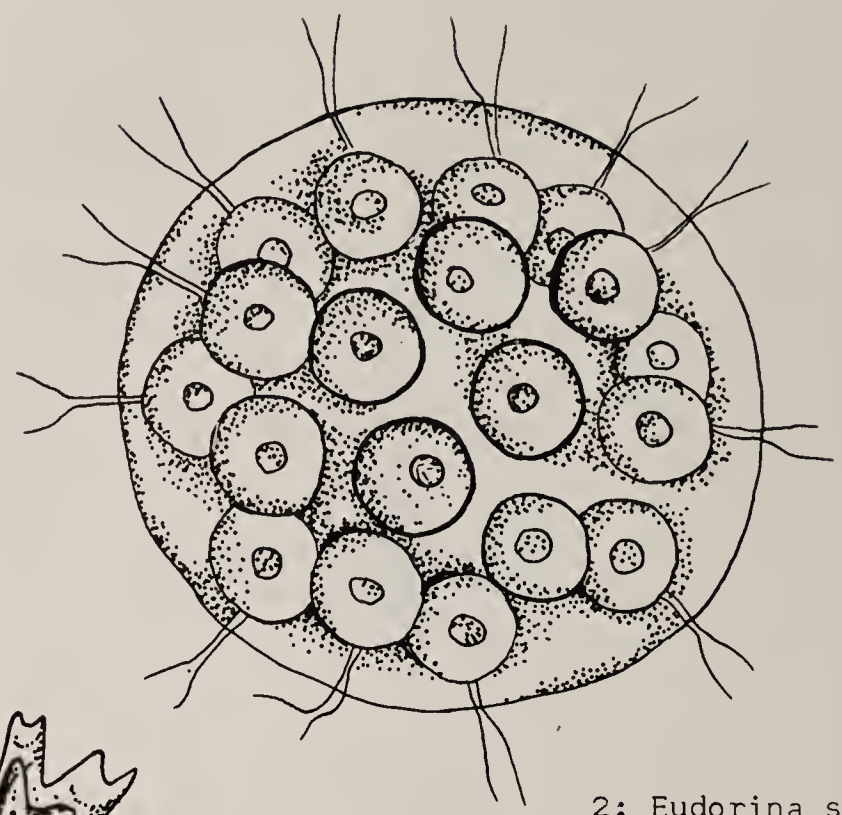


DIAGRAM 2: DISTRIBUTION OF PHYTOPLANKTON IN RELATION TO RAINFALL. NO COLLECTION WAS MADE IN DECEMBER 1963

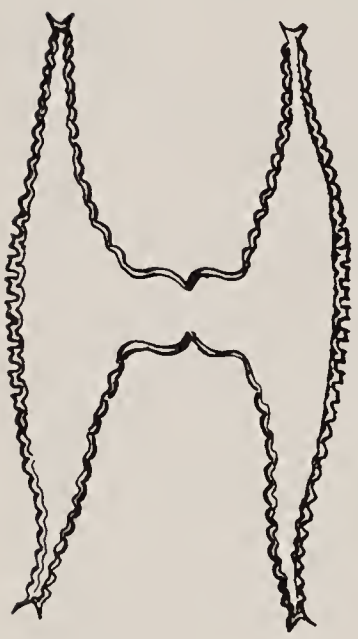
	pH	Cond.	Alkalinity (normality)	Na ppm.	Ca ppm.	Mg ppm.	Cl ppm.	Melo-sira	Diatoms other	Cyano-phyta	Desmids
Loydien Bay	9.3	900	.0099	84	24	Nil	5.2	X	X	XXXX	X
Crescent Lake	7.7	250	.0023	29	27	11.2	20.6	X	X	+	XXXX
Main Lake	7.7	250	.0023	26	3.5	Nil	1.3	X	X	+	XXXX

Diagram 3 : Comparison of water and phytoplankton of three areas of Lake Naivasha, December 1964

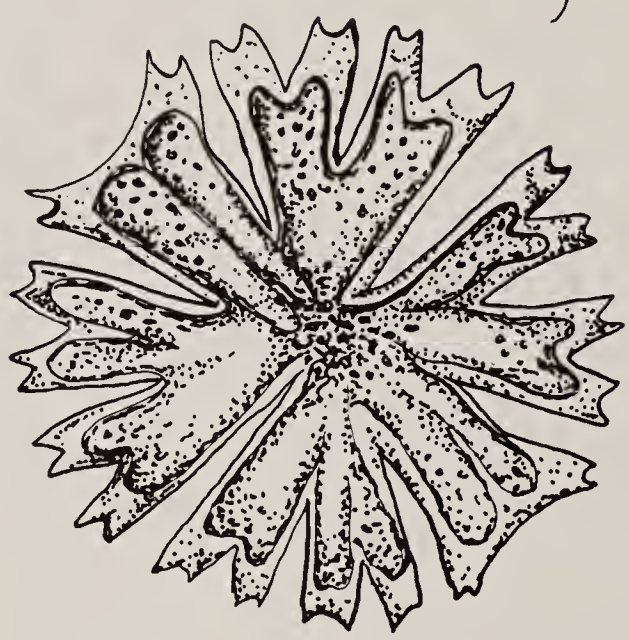
1: Kirchneriella sp.



2: Eudorina sp.



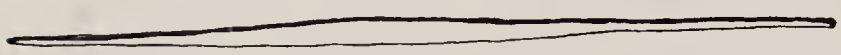
3: Staurastrum sp.



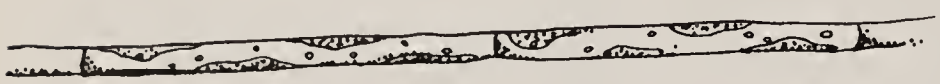
4: Micrasterias sp.

5a: Staurastrum sp.

5b: end view of 5a



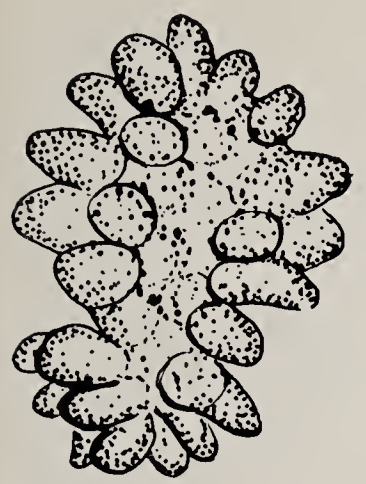
6: Pennate Diatom



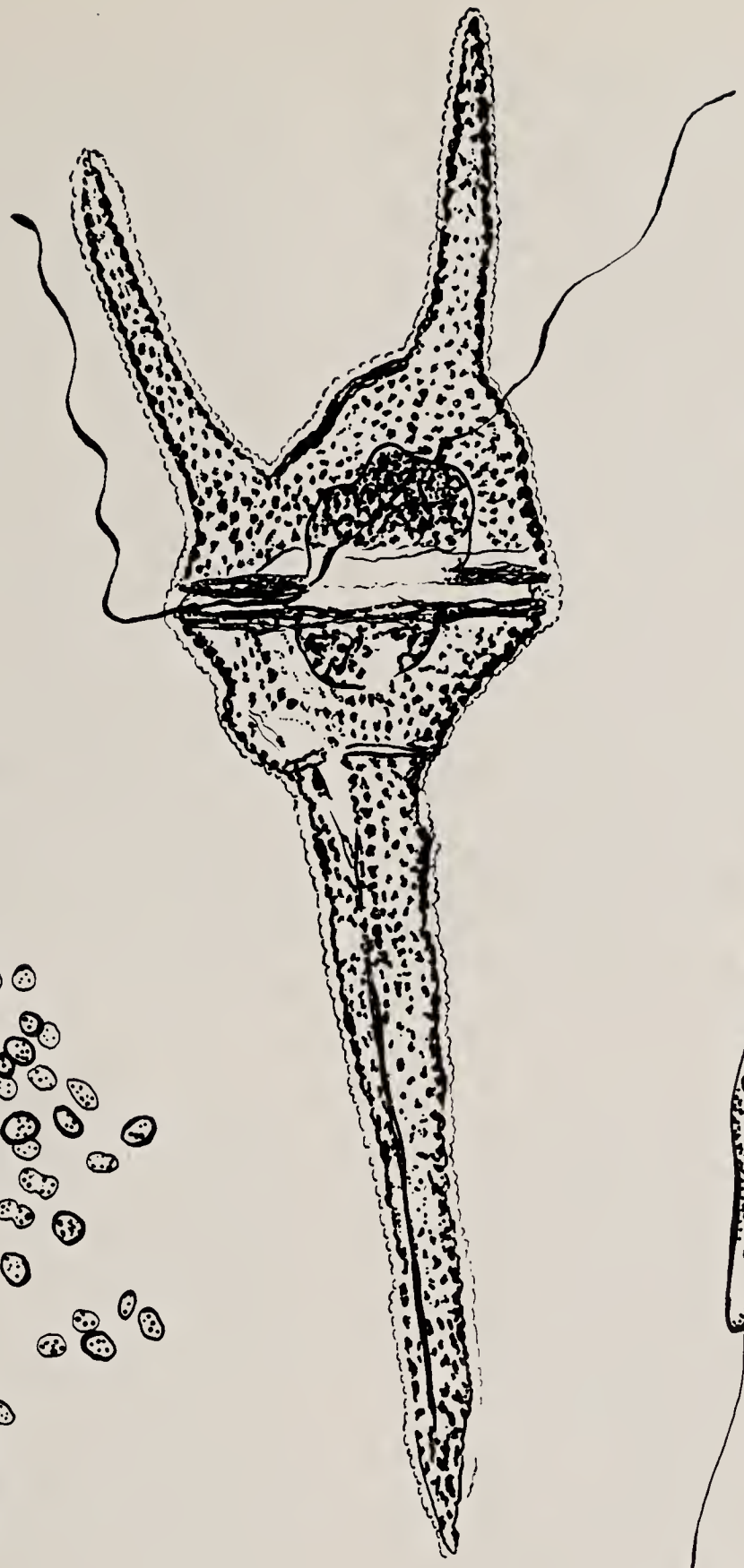
7: Tribonema sp.

8: Dinobryon sp.

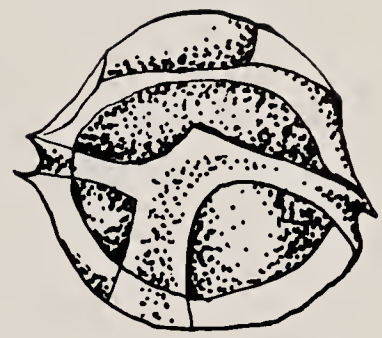
All figures x 160



9: Botryococcus sp.



10: Ceratium sp.



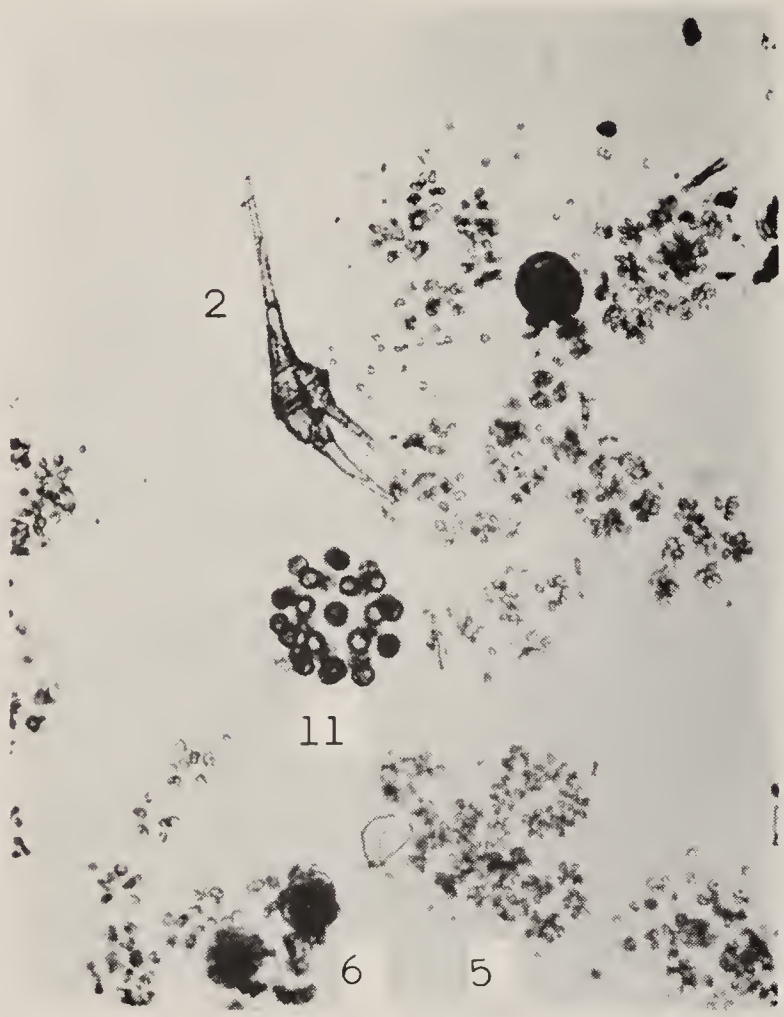
11: Peridium sp.

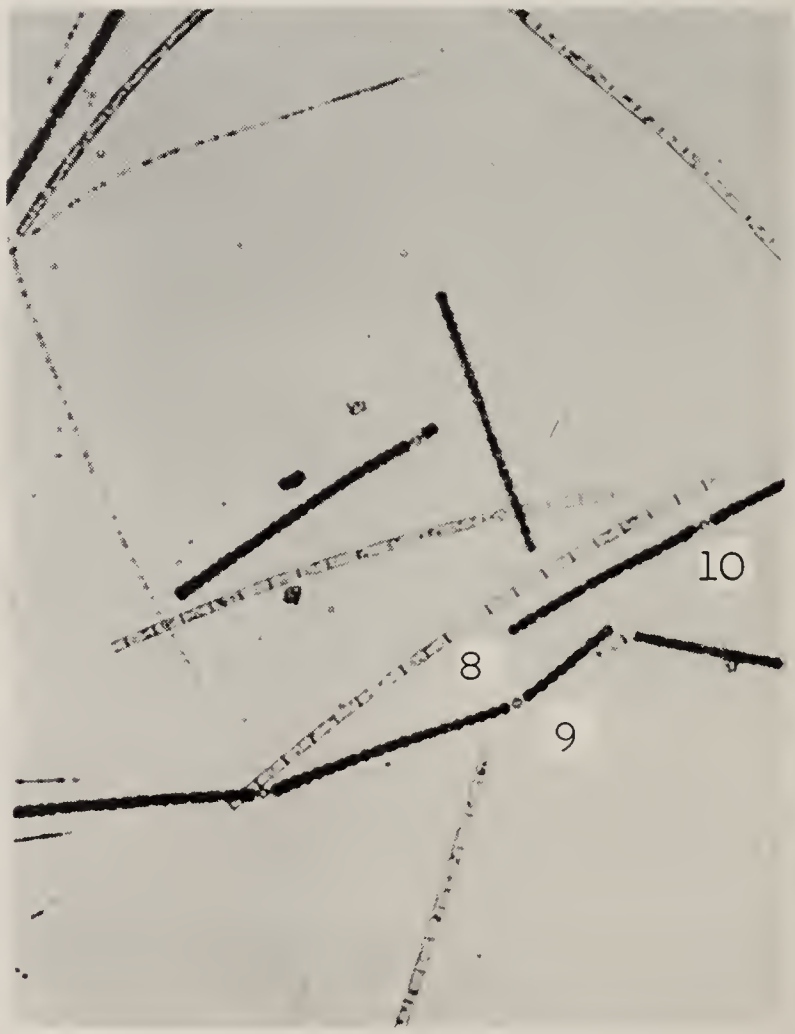
12: Microcystis sp.

13: Euglena sp.

14: Phacus sp.

All figures x 160





1 Dinobryon. 2 Ceratium. 3 Desmid. 4 Chain Desmid. 5 Chlorophyta. 6 Peridinium. 7 Microcystis. 8 Melosira. 9 Tribonema. 10 Cyanophyta. 11 Eudorina.

PERIODIC FLOWERING OF SOME ACANTHACEAE ON MT. ELGON

By

E.M. TWEEDIE

Introduction

Most species of flowering plants in East Africa flower in relation to the rains, either before, during, or after, but there are some which flower at very long intervals, and then en masse. This phenomenon has been noted before, and is well known in the bamboo (Arundinaria alpina K. Schum.), where the interval between flowerings has been estimated to be as much as 40 years (Wimbush 1945). Again, Fey (1964, p. 55) states "This plant, known to the Kikuyu as Songoya (probably Mimulopsis solmsii Schweinf.) is of particular interest .... Its life span is nine to ten years during which it grows to a height of about twelve feet. It then produces a profusion of pale mauve flowers....." Fey mentions that the plant last flowered in 1953 on the Western Aberdares.

As far as I know, no one has tried to find out why these plants flower at such long intervals, and it might be possible to stimulate interest in this curious and widespread feature of our highland forest plants by records of flowering. Few people have systematically recorded flowering times in East Africa and it is as a contribution to our knowledge of this subject that I write these notes.

Observations

From 1948 to April 1964 we lived on the north-east slopes of Elgon near the forest boundary. Near the house was a patch of untouched virgin forest. I found it was carpeted with a tangle of plants with soft dark green leaves, and when they flowered I collected the following:-

Barleria ventricosa Hochst. ex Nees
Hypoestes verticillaris (L.f.) R. Br.
H. triflora (Forsk.) Roem. et Schultz
H. aristata (Vahl) Roem. et Schultz
Isoglossa gregorii (S.Moore) Lindau
Phaylopsis imbricata (Forsk.) Sweet
Dicliptera lavata C.B.Cl.
D. umbellata (Vahl) Juss.
Justicia flava Vahl

These all flowered regularly each year, but I noticed among them a plant with very different leaves, which did not flower. Each year it grew taller and eventually flowered in December 1952 and January 1953. It proved to be Mimulopsis solmsii Schweinf. By then it was five feet tall and much branched. The flowers were white with a pale brown throat, and came out irregularly a few at a time. The inflorescence was covered with dull red sticky glandular hairs. It flowered in a mass over the whole forest at an altitude of 7,500 ft. to 8,200 ft. and smothered the usual undergrowth Acanthaceae completely. Eventually it died down, and its dead stems covered the ground and all the usual herbaceous plants were buried beneath it. Towards the end of the rainy

season young seedlings appeared among the rotting stems, and more in the early rains the following year. By the end of 1954 the usual population of Acanthaceae had taken over, though in rather different proportions. Then the plants of Mimulopsis solmsii with their distinctive leaves began to appear again. In October 1961 they began to flower, and there was a mass flowering as before, followed by a similar dying down, and reappearance of the usual plant population. This gives a nine-year interval between one flowering and another, but I shall not be there in 1970 to see if the interval between flowerings is regular.

There is another plant growing on Elgon from about 8,800 ft. to the upper edge of the forest, which also flowers at intervals. Mimulopsis cf. glandulosa (Lind) Bullock non Bak. is rather like M. solmsii in habit, but its flowers are larger and a pretty mauve colour, with a yellow flash on the lower petal and a white throat, darker inside. The stem, calyces and pedicels are covered with dark reddish hairs and it grows to four or five feet. It has one peculiarity, that quite short stems which have been hacked off beside the track or grazed off just outside the upper edge of the forest can still produce a few conspicuous mauve flowers. In January of 1947 when I was ascending Elgon it made a sheet of bloom all over the upper part of the forest. Further mass flowerings occurred in the dry seasons of 1956 and 1964. I also collected it in 1951 but am not sure if that was a mass flowering or only an isolated plant, such as occur very rarely between the mass flowerings. I did not, however, make such careful observations as I was able to do with M. solmsii owing to the distance of the locality from my house.

Mimulopsis arborescens C.B.Cl. is also to be found on Elgon. It is a large plant ten feet tall, with leaves up to nine inches across. Its flowers are cream with a chocolate brown throat and they turn brown when they die. This plant is rare in the area of which I have experience, but it is conspicuous. It is only recently that it has occurred to me that I do not see its flowers every year. I have not had the opportunity to make a continual study of this plant, but I think it would be found to flower at intervals like the others.

I have found the same behaviour in two species of Isoglossa. In the spring of 1951 I sent a specimen to Kew (891) which may prove to be a new species. When asked for more material I had the greatest difficulty in finding it again and regarded it as a rare plant until in January 1953 it made a mass flowering in conjunction with Mimulopsis solmsii and it did the same in the dry season of 1961 to early 1962, again in conjunction with M. solmsii. It has the same soft dark leaves and herbaceous habit as the common Acanthaceae of the forest undergrowth but it is the only one among them to have this mass flowering at intervals. It has a white flower with light brown markings on the petals.

Thirteen miles from this patch of forest is the bridge over the Suam River, where the same sort of forest comes down to 7,000 ft. in the valley of the Suam. Here in September 1959 I found a plant of Isoglossa oerstediana Lindau which I had never seen among the Acanthaceae of my own patch of forest. When visiting the same place in October 1963 I noticed that this plant was making a mass flowering in certain parts of the forest near the river. At the same time I found quite a number of these plants in my own patch of forest where I had never seen it before, but not enough to be considered a mass flowering. It has the same habit as the other Acanthaceae of the forest

undergrowth; the flowers are white shaded with pink and with very small dark maroon calyces.

Summary.

Periodic mass flowering has been recorded in Kenya, but dates are rare. Years of mass flowering may be separated by years during which there are no flowers, or flowers may be merely rare in the interval. The following species and dates of mass flowering for Elgon have been recorded in this paper.

Mimulopsis solmsii	Dec. 1952 - Jan. 1953. Oct. - Dec. 1961.
Mimulopsis cf. glandulosa	Jan. 1947 Oct. 1956 Jan. 1964
Mimulopsis arborescens	Dec. 1953 probably periodic but not recorded.
Isoglossa sp. (Tweedie 891)	Dec. 1952 - Jan. 1953 Oct. - Dec. 1961
Isoglossa oerstediana	Oct. 1963. probably periodic but not recorded.

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FEY, V. (1964) Cloud over Kenya, Collins, London.

WIMBUSH, S.H. (1945) The African Alpine Bamboo. Emp.For.J. 24: p. 33 - 39.

(Received 2nd June, 1965)

NOTES ON THE BIRDS OF KAKAMEGA FOREST

By

J.R.M. TENNENT

Thanks to its remoteness from Nairobi, Kakamega Forest has seldom been regularly visited by ornithologists, so although the following notes are based only on sight records, they add considerably to what is known about the species of birds to be found there. As is well known, the Kakamega Forest is, in its botanical composition, different from any of the other Kenya forests, being in fact an outlier of Uganda and West African types. It contains some valuable timber trees which are being exploited and as a result there are large parts of the forest where the majority of the trees which formed the canopy have been felled. In these areas, thanks to the high rainfall, a dense secondary growth twenty to forty feet high has quickly formed. The Forest Department is carrying out a programme of "enrichment" of the cut-over areas and of some untouched areas which contain few valuable trees. For this purpose small clearings are made so that useful timber trees can be introduced in the natural habitat. Such small clearings are attractive to some species for feeding. Another feature of the forest is the occurrence of scattered grass glades, fringed with scrub, some having a fire-climax cover of scattered trees.

As no collecting was done there are inevitably lacunae among the birds of the difficult groups such as especially the Bulbuls, Warblers and Swifts.

The nomenclature used in the systematic list follows Mackworth-Praed and Grant - Birds of Eastern and North Eastern Africa(London 1952 and 1955). The numbers given to the species in that work are added for convenience. Mr. J.G. Williams, Curator of the Department of Ornithology at the Coryndon Museum, has kindly checked the manuscript and is responsible for the notes marked J.G.W.

147. Crowned Hawk-eagle, Stephanoaetus coronatus (Linnaeus)
An inaccessible nest was occupied in late June and early July 1959 but the birds were disturbed by logging.

157. Banded Harrier-eagle, Circaetus cinerascens Müller
One, 28th. August, 1959.

189. Forest Francolin, Francolinus lathami (Hartlaub)
It was probably this species which was very common but equally shy. (The common forest Francolin is 204 The Scaly Francolin, F. squamatus (Cassin): collected. J.G.W.)

217. The Crested Guinea-Fowl, Guttera edouardi (Hartlaub)
Is not uncommon. J.G.W.

380. Olive Pidgeon, Columba arquatrix Timminck
Always abundant.

383. Bronze-naped Pigeon, Turturoena delagorquei (Delagorgue)
Common.

394. Tambourine Dove, Tympanistria tympanistria (Timminck and Knip)
Very common.

398. Lemon Dove, Aplopelia larvata (Temminck and Knip)
Common in cut-over forest and drier parts of the primary forest.

406. Red-chested Cuckoo, Cuculus solitarius Stephens
Seen only once on the edge of a glade.

416. Emerald Cuckoo, Chrysococcyx cupreus (Shaw)
Common, though less so than in the surrounding cultivated country.

418. Klaas' Cuckoo, Chrysococcyx klaas (Stephens)
Common in surrounding cultivated country but not seen in the forest.

424. Yellow-bill, Centhmocares aereus (Vieillot)
Common.

432. Hartlaub's Turaco, Tauraco hartlaubi (Fischer & Reichenow)
A party seen once on 28th. August, 1959.

437. Great Blue Turaco, Corytheola cristata (Vieillot)
Common, emerging from the forest to feed in the high trees along rivers. The writer is not familiar with this species in Uganda but birds seen in Kakamega forest showed a noticeable green tinge on the neck, the feature by which Mearns separates a sub-species C.c. yalensis which is not accepted by Van Someren (Novitates Zoologicae, XXIX, No. 1, (1922)).

442. Grey Parrot, Psittacus erithacus Linn.
Uncommon.

494. Blue-headed Bee-eater, Mellitophagus mulleri (Cassin)
Commonly seen feeding in small open places, such as where a large tree had fallen, in the heavy forest.

500. Black-and-white-casqued Hornbill, Bycanistes subcylindricus (Sclater)
Common. Feed largely outside the forest, especially in the large trees along the rivers.

509. Crowned Hornbill, Tockus albiterminatus (Buttikorfer)
Scarce, probably feeding mainly outside the forest. Feeding young at a nest near the edge on 17th. May, 1959.

522. White-headed Wood-hoopoe, Phoeniculus bollei (Hartlaub)
Regularly seen in the high trees of primary forest.

570. Narina's Trogon, Apaloderma narina (Stephens)
Common..Especially attracted to 'enrichment glades' for feeding. Apparently of the Congo race, A.n. brachyurum Chapin, or perhaps intermediate, having a green suffusion on the chest.

571. Bar-tailed Trogon, Heterotrogon vittatum (Shelley)
Regularly seen, behaving much as the last species. A male seen at very close quarters appeared to have the top of the head of a blue-green colour and so was perhaps also of the Congo race, H. v. camerunensis Reichenow.

586. Grey-throated Barbet, Gymnobucco bonapartei Hartlaub
One flock seen. Its habit of perching at the top of high trees may make it seem less common than it is.

590. Yellow-spotted Barbet, Buccannodon duchaillui (Cassin)
Common, especially in secondary forest.

597. Golden-rumped Tinker-bird, Pogoniulus bilineatus (Sundevall)
Common, mainly in secondary forest, but also found feeding even in the undergrowth of heavy primary forest.

604. Yellow-billed Barbet, Trachylaemus purpuratus (Verreaux)
Common.

610. Least Honey-Guide, Indicator exilis (Cassin)
One small honey guide, almost certainly of this species hawking insects on 11th. October, 1959. (The Thick-billed Honey-Guide Indicator conirostris (Cassin) 609, and 608 Lesser Honey-Guide I. minor Stephens have been collected. J.G.W.)

623. Cardinal Woodpecker, Dendropicos fuscescens (Vieillot)
In thin woodland round glades etc.

632. Yellow-crested Woodpecker, Mesopicos xantholophus (Hargitt)
One pair seen in cut-over forest, October, 1959.

649. Sabine's Spinetail, Chaetura sabini Grey
Several usually to be seen in an area centering on a point about one mile east of Rondo Sawmill. (Vide J.E.Afr.Nat.Hist. Soc. Vol. XXIII No. 7, 1960). Subsequently to the writer's discovering these birds in the Kakamega Forest Mr. B. Monroe from the Louisiana University Natural History Museum shot specimens, of which some are in the Coryndon Museum collection. He told the writer that he had found the species in other parts of the forest also but in 1959 they were never seen except at the locality mentioned above.

660. Flappet-Lark, Mirafra rufocinnamomea (Salvadori)
In the grassy glades it was common. Nest with young hatching 4th. April, 1959.

740. Abyssinian Hill-babbler, Pseudoalcippe abyssinicus (Ruppell)
Only one seen in the higher eastern part of the forest at 5600 ft.

746. Bristle-bill, Bleda syndactyla Swainson
Not common. Feeding often in mixed bird "waves" which included flycatchers and wattle-eyes. (Commonly taken in mist nets. J.G.W.)

770. Joyful Greenbul, Chlorocichla laetissima (Sharpe)
On the edges of clearings in secondary forest rather than in primary forest.

776. Yellow-whiskered Greenbul, Stelgidocichla latirostris (Strickland)
Common.

811. Shrike-flycatcher, Megabyas flammulatus Verreaux
Common in October but not seen at any other time.

813. Yellow-bellied Flycatcher, Hyliota flavigaster Swainson
Noted from primary and secondary forest as well as from a grass glade with scattered small trees.

822. Wattle-eye, Platysteira cyanea (Muller)
Not as common as the next two species, though found commonly in clumps of trees outside the forest, as for example in Kakamega boma.

824. Chestnut Wattle-eye, Dyaphorophyia castanea (Fraser)
Common. Sometimes feeding in mixed bird parties.

825. Jameson's Wattle-eye, Dyaphorophyia jamesoni Sharpe
The commonest wattle-eye in some parts of the dense forest.

826. Yellow-bellied Wattle-eye, Dyaphorophyia concreta (Hartlaub)
Common in places. Like the other species of wattle-eye it seemed to prefer areas where comparatively small trees of open habit were scattered not too densely.

827. Blue Flycatcher, Erranornis longicauda (Swainson)
Very common on the edge of the forest glades but never within the forest.

831. Dusky Crested Flycatcher, Trochocercus nigromitratus (Reichenow)
Common. Seen feeding in mixed bird parties including wattle-eyes.

832. Paradise Flycatcher, Tchitrea viridis (Muller)
In thickets in glades, but not in the forest proper.

841. Olive Thrush, Turdus olivaceus (Linnaeus)
Not common.

889. Blue-shouldered Robin-chat, Cossypha cyanocampter (Bonaparte)
Not common.

898. Equatorial Akalat, Sheppardia aequatorialis (Jackson)
Common in the densest parts of the forest.

901. Fire-crested Alethe, Alethe castanea (Cassin)
One only seen in a rather dry part of the forest in May, 1959.

965. Uganda Woodland Warbler, Seicercus budongoensis (Seth-Smith)
Seen once feeding in an 'enrichment glade'.

969. Fan-tailed Warbler, Schoenicola brevirostris (Sundevall)
Appeared in numbers in a glade having rank vegetation during July, 1959.

972. Buff-throated Apalis, Apalis rufogularis (Fraser)
Common.

973. Grey Apalis, Apalis cinerea (Sharpe)
Not seen in the forest proper but in an isolated forest patch in cultivated country three miles to the west.

976. Black-backed Apalis, Apalis nigrescens (Jackson)
Seen twice only, in July 1959.

977. Black-collared Apalis, Apalis pulchra (Sharpe)
Common.

1007. Brown-crowned Eremomela, Eremomela badiceps Fraser
Common in small flocks.

1011. Grey-backed Camaroptera, Camaroptera brevicaudata (Cretschmar)
Common in bush areas surrounding the forest but remarkable for its absence from the forest proper. This is in contrast with its inhabiting of forests east of the Rift Valley.

1048. White-chinned Prinia, Prinia leucopogon (Cabanis)
Common in undergrowth in more open parts of the forest.

1049. Banded Prinia, Prinia bairdii (Cassin)
Common in undergrowth in small clearings.

1053. Black-faced Rufous Warbler, Bathmocercus rufus (Reichenow)
Common in the undergrowth of the primary forest but showing no noticeable preference for marshy places as indicated by Mackworth-Praed and Grant. Occasionally feeding on the ground.

1082. Petit's Cuckoo-shrike, Campephaga petiti Oustalet
Common in some places in glades with scattered trees, and also on the edge of the high forest.

1083. Red-shouldered Cuckoo-shrike, Campephaga phoenicia (Latham)
Not seen in the forest proper but watched building in an isolated forest patch a few miles to the west, 4th. to 6th. June 1959.

1084. Purple-throated Cuckoo-shrike, Campephaga quiscalina Finsch
Not seen in the forest but noted in dense bush in Kakamega township and probably also occurs in the forest.

1086. Grey Cuckoo-shrike, Coracina caesia (Lichtenstein)
Seen only once, and being an easily seen species, is probably therefore scarce.

1087. Velvet-mantled Drongo, Dicrurus modestus Hartlaub

1089. Square-tailed Drongo, Dicrurus ludwigii (Smith)
Both these species were present but it was frequently difficult to distinguish them. The former appeared to be the commoner.

1110. Mackinnon's Shrike, Lanius mackinnoni Sharpe
Characteristic of the bushy grassland and areas outside the forest but one pair seen regularly, and probably nesting, in an area of secondary forest which was cut by a narrow road.

1127. Ludher's Bush-shrike, Laniarius ludheri Reichenow
Common.

1132. Pink-footed Puffback, Dryoscopus angolensis Hartlaub
Common in secondary forest.

1134. Brown-headed Bush-shrike, Tchagra australis (Smith)
Not in the forest proper but noted in an open pine plantation.

1141. Grey-green Bush-shrike, Chlorophoneus bocagei (Reichenow)
Common in the bush or glades but not in the heavy forest.

1157. Dusky Tit, Parus funereus (Verreaux)
Common. Nesting 31st. May, 1959.

1167. Black-headed Oriole, Oriolus larvatus Lichtenstein
Common.

1185. Sharpe's Starling, Pholia sharpei (Jackson)
Large flock, of which the majority were young birds, on 4th. October 1959.

1209. Stuhlmann's Starling, Stilbopsar stuhlmanni Reichenow
Common.

1266. Green-headed Sunbird, Cyanomitra verticalis (Latham)
Common on the edge of the forest.

1271. Collared Sunbird, Anthreptes collaris (Vieillot)
Common; characteristic of the forest edges. Building 25th. October, 1959.

1272. Grey-throated Sunbird, Anthreptes tephrolaema (Jardine & Fraser)
Uncommon.

1335. Dark-backed Weaver, Symplectes bicolor (Vieillot)
Common, occurring in deep primary forest. Seen once associating with Black-billed Weavers (q.v.). Building 4th. October, 1959.

1344. Vieillot's Black Weaver, Melanopteryx nigerrimus (Vieillot)
A nesting colony at the forest station in Acrocarpus and other exotic trees was occupied in June and July, 1959. The species was not an inhabitant of the indigenous forest.

1346. Black-billed Weaver, Heteryphantes melanogaster (Shelley)
Common in secondary growth. See Dark-backed Weaver above.

1356. Red-headed Malimbe, Malimbus rubricollis (Swainson)
Common.

1374. Marsh Widow-bird, Coliuspasser hartlaubi (Bocage)
In marshy parts of glades.

1376. Red-naped Widow-bird, Coliuspasser laticauda (Lichtenstein)
Several in a large glade on 13th. June, 1959.

1380. Black-and-white Mannikin, Spermestes poensis (Fraser)
On forest edge.

1386. Grey-headed Negro-rinch, Nigrita canicapilla (Strickland)
Inhabiting very dense undergrowth in cut-over forest and very hard to observe.

1391. Red-headed Blue-bill, Spermophaga ruficapilla (Shelley)
Probable. Very retiring in undergrowth. (Common; often collected in mist nets) J.G.W.

(Received 3rd December 1962)

OBSERVATIONS ON VERREAUX'S EAGLE OWL Bubo lacteus (Temminck) IN KENYA

By

L.H. Brown

This paper brings together scattered observations made in various parts of Kenya between 1947 and 1964. Little seems to have been published on the behaviour and habits of this owl, so that these details on breeding habits and food may be of value. The majority of the observations were made at a breeding site in Karen, 13 miles from Nairobi, in August-September 1963, but some observations were also made in Embu district, and at scattered localities elsewhere in Kenya.

Verreaux's Eagle Owl is quite a common bird in Kenya, though not often observed for long. It appears to be an inhabitant of forest edges near open country, and is specially fond of strips of riverine Acacia forest. In such localities its deep hoot proclaims its presence soon after dark, and often by day as well. Pairs of the species are nearly always to be found roosting close together, sometimes sitting on the same branch. When they start to hunt in the early hours of the night they move further apart, but keep in touch by calls, which make them easy to locate. The voice of one sex, probably the female, is deeper than that of the other.

II Voice.

The normal call is a very deep double hoot "oop-poop", almost as deep as the call of the Ground Hornbill Bucorvus leadbeateri (Vigors). It can be confused with the call of that species, particularly as both these birds are likely to roost in, and call from, riverine Acacia forest at dusk and dawn. However, the voice of this owl is varied and the following other calls have been noted.

(i) In what appears to be a mutual nuptial display the pair sit close together, but not necessarily facing each other, and emit a series of short sharp hoots in turn, while at the same time jerking the body up and down, and slightly flicking the folded wings. One bird, probably the male, calls "uh-uhu-uh-uh", to be answered in a slightly deeper tone by its partner "uh-uh". This duet may continue for some time. A pair I watched near Kianyagga in Embu district on 26.3.47 kept it up for at least fifteen minutes and only stopped when they became aware of my presence. This behaviour would appear similar to "duetting" observed in the European Eagle Owl Bubo bubo Linnaeus (Witherby et.al. 1943); it is perhaps the origin of the Kikuyu name for this species "Gitundugugu".

(ii) A long-drawn-out, rasping "Shrooooo-ooo-eh" uttered, apparently by the male only, in distraction display near the nest.

(iii) A soft low "whok" or "whook" uttered in agitation or alarm by the female near the nest.

(iv) A high pitched, long-drawn-out, squeal or mew "Psheeeeee-eee-eew" uttered by the young bird and the female at a nest in Embu district,

1952. The young bird emitted this call when soliciting the parent for food, and during the whole of one afternoon it carried on a duet with its female parent who was in a tree on the other side of a valley half a mile away. The two called and answered each other at intervals of about 10-15 seconds, and while calling the young laid its head back and called with the bill almost closed. Although not loud this call carries far, for the voice of the young bird in the nest twenty feet from me seemed hardly any louder than that of the adult female half a mile away.

In addition to these calls the adults and the young snap their bills sharply, as do many owls, when alarmed or in danger.

III Breeding Behaviour.

(1) Nest records.

This owl breeds in abandoned or commandeered nests of other birds. Grossman and Hamlet (1965) state that it occasionally builds its own, but this is probably an uncritical acceptance of dubious records. The owl breeds in stick structures, but does not make them itself. From Embu district I have the following records:

(i) In the unused nest of a Wahlberg's Eagle (Aquila wahlbergi Sundevall), in Combretum woodland at about 4,000 ft A.S.L. The nest was in a tall Ficus capensis Thunb., a tree favoured by this eagle, perhaps because of the smooth powdery upper branches which make it very difficult to climb. It contained a well-grown young bird on 5.7.52, which would indicate egg-laying in late April or early May. The sequence of events at this nest was remarkable. In October 1951 it had contained an egg of Aquila wahlbergi, which was addled and deserted by December. In February and March 1952 a pair of Long-crested Eagles Lophaetus occipitalis (Daudin) occupied the nest and apparently incubated the Wahlberg's Eagle's egg for 44 days before again deserting it. This egg, now in the National Museum, was identified as probably a Wahlberg's Eagle's egg and therefore not an egg of Lophaetus by Sir Charles Belcher (who was asked his opinion of the egg without being told the full story). After the Lophaetus deserted the owls took over, and I used the hide I had put up for watching the Lophaetus to watch the owls later. The young owl was successfully reared.

This nest was also said to have been used by a pair of large owls in September 1950, but I could not confirm this. The vernacular name "Gitundugugu" is also applied to the Spotted Eagle Owl Bubo africanus (Temminck), a smaller species that normally nests in rocks on the ground, but sometimes in a tree. Although Verreaux's Eagle Owl may have been the occupant in 1950 also it seems more likely that it was Bubo africanus, which normally breeds in September in Embu district. The normal breeding time of Bubo lacteus avoids conflict with the normal breeding time of Aquila wahlbergi, but in any case the eagles were probably using an alternative nest in 1950 and would not have competed with the eagle owls for nest space.

(ii) In the abandoned nest of a Bateleur Terathopius ecaudatus (Daudin) in a tall Acacia xanthphloea Benth. near the Thiba River at about 3,600 ft. on 6.3.52. The nest was known to have belonged to Bateleurs, and the sitting owl was very conspicuous on the rather small structure.

(iii) In the abandoned nest of a White-backed Vulture Gyps (Pseudogyps) africanus (Salvadori), also in a tall Acacia xanthophloea near the Thiba River at about 3,600 ft. A.S.L. in March 1953. This was not the same pair that occupied the Bateleur's nest, but was about five miles downstream of that pair.

These three records indicate that in Embu district eggs of this owl are likely to be laid in March or April, and the extraordinary prenuptial display described under calls is to be seen in March just before egg-laying. Other records are:

(iv) A pair took over the partly built nest of a Hammerkop Scopus umbretta (Gmelin) on the Perkerra irrigation scheme in Baringo district about 15.5.62. Hammerkops begin the construction of their nest by making an ordinary bowl or saucer-shaped base of sticks, which is later roofed over. The Verreaux's Eagle Owls are too big to enter the small entrance hole of the completed nest, so they take over the bowl-shaped base. The completed structure is sometimes usurped or occupied by the Barn Owl Tyto alba (Scopoli). In this particular case the eagle owl brooded in the nest before it actually laid eggs, and the Hammerkop was unable to dislodge it despite repeated attacks. Two eggs had been laid by 30.5. and the Hammerkops were obliged to start yet another new nest.

(v) In the abandoned nest of a Hooded Vulture Necrosyrtes monachus (Temminck) in a garden at Karen. The nest was in the dead and leafless remains of a parasitic fig, Ficus thonningii Blume, and was entirely open and unshaded, about thirty feet from the ground in the central main crotch. It contained a well-grown young bird on 24.8.63, probably hatched from an egg laid about mid-June. This was the nest at which most of the other observations in this paper were made.

These two other records indicate that in some other parts of Kenya Bubo lacteus breeds later in the year than it does in Embu district.

(2) Development and behaviour of the young in the nest.

Young birds of this species are clad in pale grey down which becomes hidden by a growth of finely barred grey and white feathers, quite unlike the adult plumage. A young bird about six weeks out of the egg was barred grey and white all over except for the thighs, which were plain white, and a black streak on either side of the face. Eyes almost black, surrounded by long black bristles, bill pale blue-grey, feet yellowish white. The upper eyelids were orange-pink, as in the adult, but paler.

I have notes on the behaviour of well grown young only. The young bird in the Embu nest (i) was observed for 3 hours on the afternoon of 6.7.52 and for 4 hours after dark on 5.7.52. During the day it stood or crouched in the nest, generally rather inactive, but standing up when it appeared it was unobserved; it carried on the duet already described under Voice with its female parent on the other side of the valley. After dark, however, it became very much more active, walking about the nest, and indulging in several bouts of wing flapping. At night, in fact, it behaved very much in the manner of a young diurnal raptor by day towards the end of the fledging period. When the parent settled in the tree above my hide the young one became very excited, crouching in the nest, swaying its head from side to side, and emitting high pitched calls. This was evidently its normal behaviour when soliciting food.

The young bird in the nest at Karen was watched at intervals from 24.8. - mid September 1963. No long periods of observation at night were possible but I sometimes stayed for a time after dark without seeing anything very significant. On 28.8.63 the young bird fell out of the nest, probably because it was continually mobbed by other birds including Augur Buzzards Buteo rufofuscus (Forster), Pied Crows Corvus albus Muller and even a Cuckoo Falcon Aviceda cuculoides Swainson. It had recently reached a stage of development when the parents left it alone by day and was consequently vulnerable to attack in the completely open nest. It was replaced and protected by an arrangement of wooded bars which effectively prevented other large birds from swooping too low over its head. It was successfully reared and left the nest in late September. I erected a hide in another tree by degrees but by the time it was complete the young bird had flown. In the short periods observed after dark it did not move about much, probably because the parents were in the vicinity, and the female, which could see me, continually emitted the soft "whok" alarm call.

This Karen owlet must have been 50-60 days old when it left the nest in late September. After leaving the nest it perched with its parents in large shady trees nearby, and was fed there; however I was not able to do much observation at this time. Although Bubo lacteus usually lays two eggs it seems from my records that only one young bird is normally reared.

(3) Behaviour of the Parents

Little detail is available of the behaviour of the parents except under the rather unnatural circumstances of disturbance near the nest. At the Embu nest (i) the young was very well grown and the parents were not sitting near it in the tree by day, but in an Acacia on the other side of the valley about half a mile away. When I climbed the tree by day or by night to examine the young the parent - I thought the female - would fly across the valley and perch in the upper branches of the fig tree containing the nest, snapping its bill, and displaying anxiety or annoyance with ear-tufts raised. At night she settled on a branch a few feet above my head and watched me enter the hide at close range, so that the usual deception practised on these occasions of sending one's companion away did not deceive her. She later left, but returned when my relief came to help me out of the hide and clearly would not bring prey to the nest while we were in the neighbourhood. As the tree was about sixty feet high, growing on a rocky escarpment, and difficult to climb, and as my right arm was in a plaster cast I was most thankful that she was not aggressive in the dark, as some owls are.

At the Karen nest the parents were usually to be found by day in two large shady Croton megalocarpus Hutch. trees about thirty yards from it. When I arrived they became excited and would usually fly across the garden to a grove of Eucalyptus trees a hundred yards away, whence they would watch me till I left, constantly mobbed by crows as they perched in the open on bare branches. They did not seem to be discommoded by strong daylight at all. If I stayed till dusk and later, hiding in a clump of low trees, they would return to the Crotons, but they could clearly see me, or knew I was there, and would not go to the nest while I watched.

The male of this pair performed a remarkable distraction display. From his perch on the Eucalyptus he would glide down, low over the ground, with drooping wings as if injured, and alight on a low branch

where he hung with flapping wings, sometimes upside-down. As he glided down he emitted the long-drawn rasping screech already mentioned. The performance was a good example of an injury-feigning display, and effectively attracted the attention of a dog. When the male was again approached on his low perch as he hung there apparently helpless he would right himself and fly away normally. Injury-feigning displays of this type are performed by several other owls e.g. the Long-eared Owl Asio otus Linnaeus and the Short-eared Owl Asio flammeus (Pontoppidan) (Witherby et.al. 1943). It seemed to be only the male that performed in this way; the female remained closer to the nest, emitting the soft "whok" calls.

Most eagle owls have striking brilliant orange or yellow, even red eyes. In Verreaux's Eagle Owl the eyes themselves are almost black, and the painting by Thorburn in Archer and Godman, the Birds of British Somaliland and the Gulf of Aden, is erroneous. In Bubo lacteus however, the upper eyelids are orange-pink, and are very conspicuous when the eyes are closed or partly closed. These upper eyelids seemed to be very obvious when the male did this distraction display, so that possibly they have some display significance, perhaps replacing the brilliant orbs of other eagle owls.

IV Food.

Bubo lacteus is a bird of very varied diet that will eat anything from quite large mammals to small insects. On a few occasions I have watched this owl catching insects in the light of a strong lamp or headlight. One of these occasions was at Treetops near Nyeri on the night of 24.2.61, when soon after dark a Verreaux's Eagle Owl began catching insects at the edge of the floodlit area among the hooves of a large herd of buffalo. It continued for several hours in this way but by 11 p.m. had evidently caught enough, for it went away and was heard calling at intervals. Once, when a rhinoceros approached the bird closely, it fluffed itself up and erected its feathers in threat display, and throughout it appeared quite unafraid of the great beasts milling around the floodlit area.

A collection of pellets, feathers, skins etc. was made beneath the roosting trees at the Karen nest, largely by Master Ewan Muir, aged three. Having seen me pick up a few skins he followed suit, and most of the results below are due to his interest. These pellets have been analysed by Mr. A. Duff-Mackay of the National Museum, Nairobi, whose assistance is gratefully acknowledged. The following is a list of the food items from pellets or otherwise.

Prey	No.	Notes
MAMMALIA		
RODENTIA		
Tachyoryctes sp.	6	The figures for rodents are minimum numbers derived from skulls except for the *Cricetomys* which was identified from a skeletal bone. Probably more rodents are in fact taken.
Otomys sp.	5	
Rattus rattus	1	
Mastomys couchei	1	
Arvicanthis abyssinicus	1	
Cricetomys gambianus	1	
Unidentified rat-sized rodents.	3+	
Unidentified mouse-sized rodents	1+	
Total rodents	19	
INSECTIVORA		
Atherix	4	skulls + at least 11 skins, indicating at least 11 killed. Many other skins were not picked up and this is one of the favourite prey animals.
CHIROPTERA		
Rousettus	1	
Unidentified	1	
PRIMATES		
Galago crassicaudatus	1	
Total mammals	33+	
BIRDS		
? *Ploceus* sp.	1	These were all that was identified out of a large number of bird bones. At least 9 birds were included in the collection, and probably more. Small birds are presumably taken on the roost, but the *Tyto alba* was apparently adult and evidently other owls are not immune from predation by their powerful cousin. The Pied Crow was apparently a nestling. Probably many more birds are taken than this list represents as many bones were not identified.
? *Pycnonotus* sp.	1	
? *Parus* sp.	1	
Tyto alba	1	
Bubo africanus	1	
? *Corvus albus*	1	
Zosterops	3	
? *Nectarinia*		
Total Birds	9	
REPTILIA		
1 snake, possibly *Baeodon fuliginosus*		
AMPHIBIA		
Unidentified	16	Since bones of Amphibia are usually more completely digested by raptors than are those of mammals it is probable that more frogs are taken than this list would indicate.
Total	59	

To sum up 59 prey items include 33 mammals, 9 birds, 1 reptile, and 16 Amphibia (frogs). Remains of insects were also found in castings. This list would indicate that more than half the prey is mammalian (56%), about 27% Amphibia, and the rest birds and occasional reptiles. These figures refer to numbers, and by weight mammals, including all the largest kills, would predominate to a greater extent. Birds are probably more important than would appear, and surprisingly small birds are taken. Among mammals the hedgehog, which is well protected by its spines from some other predators and is scarcely ever taken by diurnal birds of prey because of its nocturnal habits, is a favourite prey. Hedgehogs are skinned before being eaten, and the skins are discarded beneath the roost perches. Probably many more hedgehogs were taken by this Karen pair than appear in the above list.

From this list the Verreaux's Eagle Owl would seem to be beneficial or neutral in its activities towards human beings, but it would probably take poultry if it could get them, and was accused of doing so - without real evidence - by the neighbours of the owners of the plot on which the nest was situated.

Summary.

(I) Scattered observations on Verreaux's Eagle Owl Bubo lacteus made between 1947 and 1963 are brought together.

(II) Four calls, in addition to the double hoot, are described with their associated behaviour.

(III) Five nest records, some notes on the behaviour of young, and of the adults, including a striking distraction display, are given.

(IV) A list of 59 food items contains 33 mammals, 16 frogs, 9 birds, and one snake at least, besides unidentified bones and insect remains. The owl is probably neutral or beneficial to human beings.

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THE PARADISE WHYDAH AND THE BROAD-TAILED PARADISE WHYDAH

By

C.J.TWEEDY

With regard to the separation of the Paradise Whydah, Steganura paradisaea (Linnaeus) and the Broad-tailed Paradise Whydah, Steganura orientalis (Heuglin) as distinct species, it may be of interest to note an occurrence of both species in the same locality.

In May, June and July 1964 I could be almost certain of seeing S. orientalis on or near a small open 'shamba' at Msati, near Chidya, in the Masasi district of southern Tanzania. But on June 28th, near this same 'shamba' and immediately after my observing S. orientalis, a single adult male S. paradisaea appeared, and perched openly at about 20 ft. up. The two central tail-feathers of S. orientalis were seen as usual to be broad to their tips, but those of S. paradisaea were seen as two broad and short with bare shafts when blown or held apart coming thinly into one when joined. Distinction when feathers are seen separately is absolutely unmistakable.

I had not previously seen S. paradisaea nearer than the Chiungutwa area on the Masasi-Newala road; S. orientalis I never saw anywhere outside a radius of less than two miles round Chidya.

Call

I never heard the call of S. paradisaea; but I made four written records to the call of S. orientalis, which is described by Mackworth-Praed and Grant (1960, Vol. II p. 1051) as "Unrecorded". These notes (for May 17th, May 20th, June 2nd and July 11th) all record the call as a rattle or chatter, reminding me of the Mistle-Thrush, Turdus viscivorus, but rather quieter and smoother in sound; or of the chatter of the Grey-headed Sparrow, Passer griseus Vieillot, though again less harsh than this. The rattle was sometimes prolonged for two or three seconds; and I once heard it in a whisper - a kind of rattling twitter, given on rising from the ground. During the display recorded below, the usual rattle was heard, followed by 'chuck, chuck, chuck,' in the same timbre.

Display

On July 11th, I witnessed an interesting display by an adult male S. orientalis, in an open tree at 15 - 20 ft. up. At first it made very brief flights - little more than extended hops - usually approaching a small bird not certainly identified as the female, and giving the special call as above.

When stationary, the bird on one occasion for some time held its tail in a remarkable position, as if on three different levels. The short tail-feathers were held with their barbs vertical as usual; but one of the two elongated tail-feathers was also held, at a slightly lower level, with the barbs vertical; and the other elongated tail-feather was held lower still, 'very thin with a blob at the tip'. (I understand that the very unusual appearance of the lowest feather was caused by extreme wear in a feather which had for some reason not been moulted.) At the same time the head was held forward and nodded fairly vigorously again and again.

Another display of the bird on the same occasion, was when it sat perched normally, with the tail hanging as usual, and turned its head steadily from side to side.

(Received on 31st March, 1965)

HOOD-SPREADING BY THE MAMBAS OF THE AFRICAN GENUS DENDROASPIS Schlegel

By

CHARLES R.S. PITMAN

Hood-spreading by the Cobras of the Asian and African genus Naja Laurenti is a well-known characteristic, but it is only those accustomed to handling Mambas or familiar with these relatively large snakes in the wild state who realise that all species of Mambas are capable of demonstrating what compared with Cobras can be described as a modified hood. A variety of reasons, such as excitement, alarm, annoyance, anger, intimidation, contemplated aggression or to deter have been suggested and it is unquestionable that at times this behaviour constitutes a threat, but C.J.P. Ionides who has handled more Mambas (mainly Green Mambas) - thousands - than anyone else is of the opinion that this demonstration, which certainly seems often in the nature of a threat, does not necessarily signify impending attack. Much depends on circumstances and on the temperament of the individual.

To be able to spread a hood, a snake is dependent on its ability to make use of the anterior ribs to flatten or expand the neck; but hood-spreading has nothing in common with and is quite distinct from neck inflation or distension - this is not mechanical, but simply air controlled.

From my own considerable experience of African Cobras, with special reference to the Black-lipped or Black-and-White Cobra, Naja melanoleuca Hallowell I am inclined to believe that in some cases curiosity is apt to prompt hood-spreading. This particular Cobra I have always found to be highly intelligent and in captivity soon recognises those who look after it to the extent that on one's approach it would invariably rear up the anterior part of its body with spread hood and flickering tongue. Examples of medium size used to be brought to me in an old kettle suitably closed, but it was not until I slowly raised the lid that I discovered what the receptacle contained. If it happened to be a Black-and-White Cobra up came an inquisitive head with expanded hood and then I gently but firmly replaced the lid without any reaction on the part of the snake except quietly to withdraw below.

I describe this species as exhibiting a definite degree of insolence, possibly exaggerated self-confidence, but it is not aggressive. Can one attribute the habitual hood-spreading of the Indian Cobra, Naja tripudians Merr. to excitement or what?.

But, from the evidence available, in the cases of the four species of African Mambas - the Black Mamba, Dendroaspis polylepis Günther; the Green Mamba, Dendroaspis angusticeps (Smith); Jameson's Mamba, Dendroaspis jamesoni (Traill); and the West African Green Mamba, Dendroaspis viridis Hallowell - hood-spreading seems generally to denote annoyance or anger or even threat.

(1) Rose (1955) has an ingenious theory, which merits serious consideration, that hood-spreading is of definite and important survival value as it makes the vulnerable neck less accessible to a predator.

In Ionides' experience, judged from a considerable number of Black Mambas, hood-spreading, either modified or pronounced, is fairly frequent; very rare indeed in the Green Mamba and not observed until he had handled several thousands of these snakes; and evidently not an uncommon trait in the numbers of Jameson's Mambas he has caught.

According to Broadley (in litt.), the Black Mamba frequently demonstrates by spreading a slight hood, which the Green Mamba resorts to very rarely; and whereas the Black Mamba is likely to indulge in a lot of threatening gaping, this the Green Mamba practically never does.

With reference to the West African Green Mamba, a correspondent (D.H. Barry) in Ghana writes that he has never seen D. viridis spread a hood while being captured, but three or four examples, when newly caught and caged have been seen to do this if disturbed and annoyed, but usually stop doing so in a day or two.

The Boomslang, Dispholidus typus (Smith), which in some respects resembles the Green Mamba, has a characteristic and convincing threat display with a conspicuous inflation of the throat and part of the anterior portion of the body, and certain authorities and field observers have claimed that the Black Mamba will on occasion do likewise - a claim which has been arbitrarily refuted by others. The fact that some authorities have not witnessed this does not necessarily mean that it cannot happen; instances will be quoted. Ionides does not recollect ever having seen the Black Mamba or any other Mamba do this, but at least twice I have seen a Jameson's Mamba when lying amongst the scrubby undergrowth in the Botanic Gardens at Entebbe, Uganda, inflate its throat and a few inches of its body, like the Boomslang, when mobbed by small birds.

Another feature of Black Mamba behaviour, which may or may not coincide with hood-spreading, is a fearsome demonstration by opening the mouth very wide and shaking the head from side to side, usually culminating in a strike. As this strike is accompanied by a loud hiss it is reasonable to suggest that at the same time some inflation of the throat is possible.

Myles Turner, a member of the Tanganyika National Parks staff in Western Serengeti (in litt.) emphasises how, when on the alert, a Black Mamba dilates and pulsates its throat, which seems to suggest a certain degree of inflation.

Rose (1955) quotes Noble who asserts that the Mamba distends its throat in a similar manner as the Boomslang, which (2) Broadley (1956) categorically states is incorrect. But (3) Shaw (1956) challenges Broadley and describes how a large Black Mamba which had been disturbed by his dog (which was bitten and died) suddenly reared up about twelve feet distant. "This snake had definitely inflated its throat, and it looked like a dirty tennis ball topped by a very angry head. There was definitely no hood..... The snake moved off up a grade with its throat still inflated and held four feet above the ground." When the snake reached some tall grass it deflated and disappeared. In a locality where there were many Black Mambas this was Shaw's only nasty experience

during a period of 37 years.

Ionides has observed that the male and female Black Mamba alike indulge in hood-spreading. He has on several occasions noticed a slight spread and at least four times has seen a pronounced hood - once when he came across a male Mamba unexpectedly in fairly long grass and it raised its head about a foot off the ground and spread a so pronounced hood that he had to look again to make sure it was not a Cobra. Another time a female on the ground which started to make off on being followed "raised nearly two feet of herself off the ground and spread a hood as large as that of the male just described;" this female having looked intently at Ionides a short time advanced deliberately towards him and entered an intervening small patch of grass. Ionides withdrew a few paces and watched as she raised her head with spread hood and looked at him from the grass. She was definitely ill-tempered and when caught it was seen that she had recently sloughed. The third time, a female Black Mamba in the top of a small mango tree was pelted with sticks until she was forced down. Understandably "she seemed annoyed as she spread a modified hood and kept darting her tongue out". More recently - a fourth time - a female Black Mamba, which had been ejected from its lair in a hole in the ground, immediately spread a hood as she endeavoured to avoid capture. In the collection of the Zoological Society of London, at Regent's Park, the Black Mamba has often been seen to spread a modified hood when disturbed or annoyed but the Green Mamba rarely does so and usually only when first released from a travelling case.

There are a number of published records some doubtless not original, about hood-spreading by Black Mambas. According to (4) Ditmars (1931) "The anterior ribs are slightly elongated and can expand or flatten the neck to a slight extent. I have noticed this when they are intently watching something and are nervously alert, yet stirred to anger" - an interesting combination of reactions; intent, alert and anger. (5) F.W. Fitzsimon's (1932) description is dramatic, "when angered, the throat, and sometimes the anterior portion of the body, is inflated, and at the same time the reptile sways ominously from side to side, gracefully, but with deadly portent." This sounds more like Boomslang behaviour than hood-spreading.

In African Wild Life (1959) there are two illustrations, dorsally and ventrally, taken at the Transvaal Museum by (6) Brain, showing a slight hood. Brain states that to flatten a hood is part of a threat display and that it is both intimidatory and a deterrent. Mouth-opening coincident with hood-spreading he also records "When approached in its glass-fronted cage, the Mamba would repeatedly flatten its neck, often opening its mouth to some extent at the same time. On no occasion were we able to observe inflation of the neck as has been described by Rose (1955) and Shaw (1956)."

(7) Broadley (1959) describes how a 12 foot Mamba when cornered "reared up... spread a broad 'hood' and opened its mouth, displaying the black interior and formidable fangs."

(8) Sweeney (1961) refers to the loose skin around the neck "which can be expanded into a swelling similar to that of the boomslang but considerably smaller, and the ribs are raised to stretch the skin as in the cobra. The swelling is scarcely noticeable from most viewing angles unless the snake is really excited, when quite a distinct cobra-like hood appears for a second or two." This seems to suggest that a

degree of throat inflation may be combined with rudimentary hood-spreading.

(9) Isemonger (1962) adds to our knowledge "always ready to bite if actually molested, at which time they usually expand a very modified hood, open their mouths wide and hiss with a rather deep, hollow-sounding noise." Isemonger has caught and handled large numbers of Black Mambas.

(10) Vivian F.M. FitzSimons (1962), also with much practical experience, records somewhat similarly "when really angered the neck is distended to form quite a noticeable hood - though not so pronounced as in the cobras - and an ominous, hollow-sounding hiss is often emitted before doubling back the neck." The reference of both Isemonger and FitzSimons to "hollow-sounding" does seem to indicate some possible degree of throat inflation.

(11) Villiers (1963), quoting from the observations of others I suspect, and referring generally to Mambas, records that when angry they dilate the neck and the anterior part of the body.

(12) Broadley (1963) further refers to an eight foot D. polylepis which reared up through some foliage with hood spread.

In the Samburu Game Reserve, in Kenya, (13) F. Seed (1964) watched a Harrier Eagle persistently attacking an 8 foot Black Mamba which "inflated" its neck (it is possible this refers to hood-spreading C.R.S.P.) each time it tried to escape.

There is little to add to what I have already mentioned about hood-spreading by the Green Mamba, D. angusticeps except to say that with the exception of Broadley none of the authorities just quoted seem to have observed this. John Tigwell has provided a unique photograph, reproduced with his kind permission, showing well the exceedingly rare hood display of the Green Mamba, which Ionides in his vast experience has but rarely observed. Ionides, on at least seven occasions, has seen examples of Jameson's Mamba, out of the 77 he has handled, spread a hood.

There is nothing to add to what I have already recorded about D. viridis. An attempt to take a picture of the hood of a large male Jameson's Mamba was a failure, as the photographer - not a snake man - was reluctant to approach his subject close enough to ensure success, thereby a splendid opportunity being lost. Some good photographs of hood-spreading by D. polylepis in captivity have been taken by N.P. Mitton and thanks to his kindness it is possible to reproduce views of this display from above and below (a large male); from this latter aspect there does not appear to be any throat distension as in the Boomslang, D. typus.

I am greatly indepted to C.J.P. Ionides for a wealth of information about the behaviour of East African Mambas in the wild state, and also to Mr. R. Lamworn, the Senior Overseer of the Reptile House at Regent's Park, for observations on Mamba behaviour in captivity.

Summary

1. All four species of African Mambas have been known to spread a modified hood, which sometimes may be pronounced.

2. Two species, D. polylepis and D. jamesoni, have also been observed to distend the neck like Dispholidus typus.

3. Hood-spreading behaviour is discussed.

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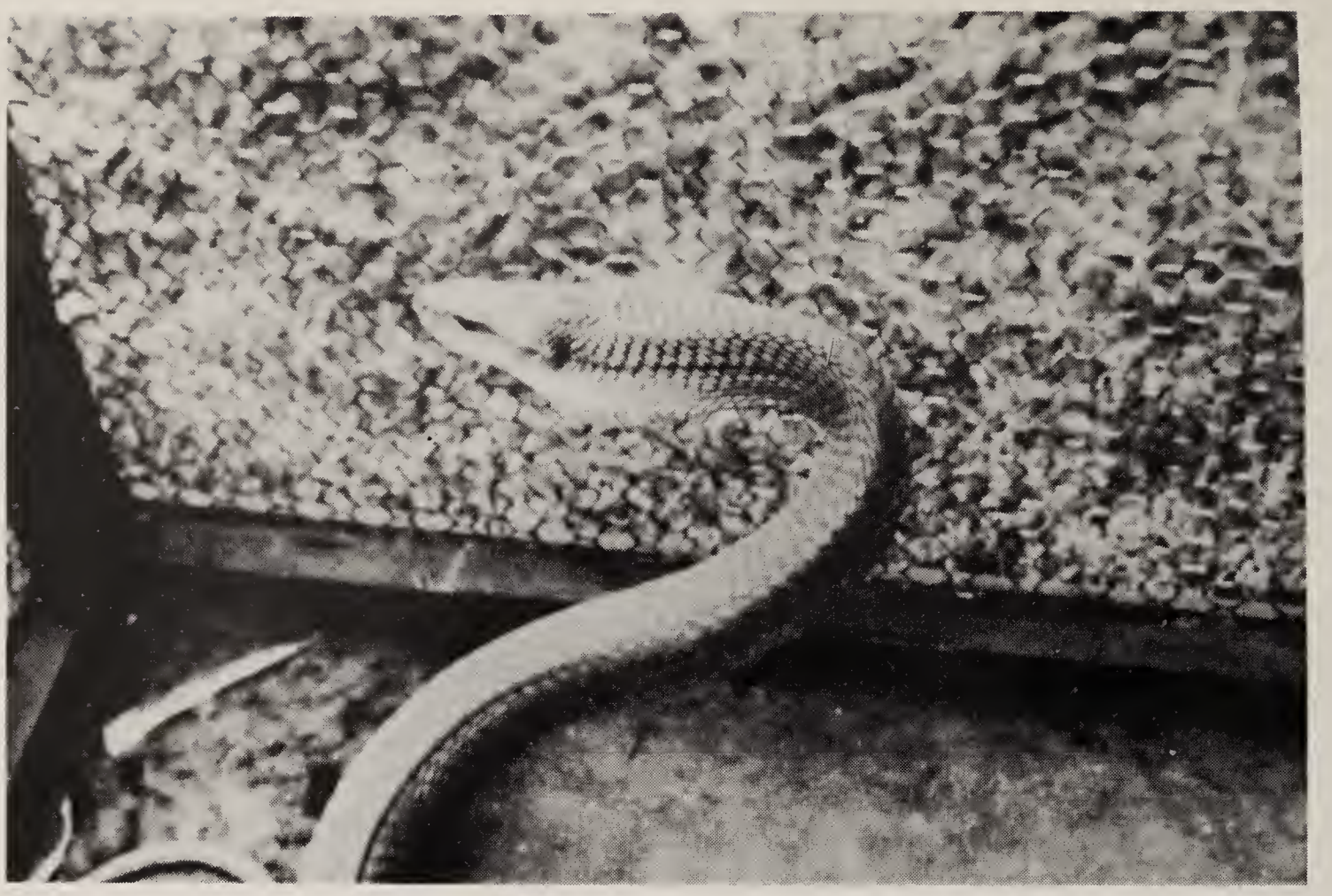
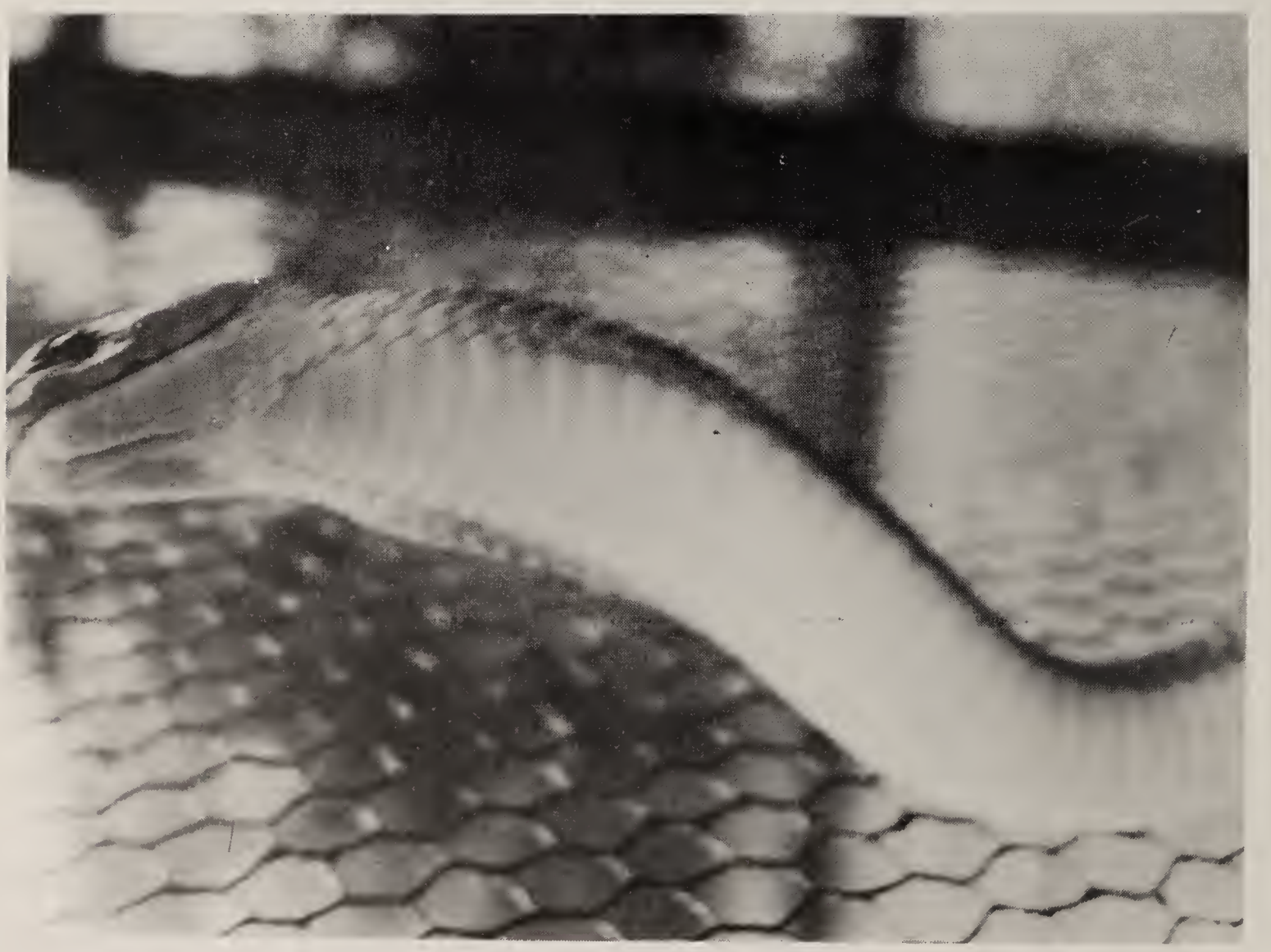
D.angusticeps spreading hood
Photographed at Newala by J.TIGWELL

(Received 26th October 1964)

Hood-spreading by the Mambas



D.P.polylepis spreading hood
Photo by N.P.MITTON



D.P.polylepis spreading hood
Photographed near Loitokitok by N. P.MITTON

NOTES ON TWO EAST AFRICAN VENOMOUS SNAKE POPULATIONS - ECHIS CARINATUS PYRAMIDUM (Geoffroy), EGYPTIAN SAW-SCALED VIPER AND VIPERA HINDII Boulenger, MONTANE VIPER.

By

C.J.P. IONIDES and CHARLES R.S. PITMAN.

Opportunities for intensive regional snake study are unfortunately rare, but when possible the results can be surprising. The density of a population is dependent on environment and climate and, most important, on food supply.

For a number of years Ionides (see Puku 4, in press) has been engaged in the intensive collection of two highly venomous species of snakes Dendroaspis angusticeps (A. Smith), Green Mamba and Bitis g. gabonica (Dumeril and Bibron), Central African Gaboon Viper in southern Tanganyika and with occasional excursions to the southern extremity of Lake Tanganyika for Boulengerina annulata stormsi Dollo, Tanganyika Water Cobra. He has also visited the arid Northern Frontier region of Kenya for Echis and Kenya's Aberdare highlands for Vipera hindii Boulenger.

His carefully compiled records inevitably create the impression that snake-catching, even of large deadly species, is just too easy, but what is really impressive is the extent of populations in these localities; their abundance can be astonishing.

Ionides has a rigid rule that no one but himself is allowed to tackle a deadly species - a wise precaution - thus obviating the possibility of unfortunate incidents to others. He has had many misadventures with poisonous species, but he has never had an accident to himself in the course of catching operations, and the only time an African was bitten - luckily not fatally - was through misunderstanding an order.

Generous rewards provide the necessary information and then direct action is the responsibility of Ionides who, however, always has available African assistance, adept through long experience. Successfully handling deadly species is scarcely an acquired art, it is inherent, and Ionides is a master of his craft.

ECHIS CARINATUS PYRAMIDUM (Geoffroy), Egyptian Saw-scaled Viper.

DESCRIPTION: This is a relatively small snake, rarely attaining a length of two feet, which has a somewhat slender cylindrical body and on the head the typical viper scalation of imbricate, keeled scales.

The colour is light or dull brown with fairly large dark edged spots, and paler below, and a wavy yellowish flank line.

A ♀ measuring 23½ ins. (tail 2¼ ins.) - the largest collected - had a girth of 2⅛ ins. and weighed 90 grammes.

According to Ionides (in litt.) none of the Echis carinatus bore resemblance in bodily shape to a Puff Adder, all being much more slender, although the local Samburu in the Northern Frontier Province seemed to think that Echis are ♀ Puff Adders, and they call both these snakes by the same name ndurububwa which suggests an onomatopoeic origin, the Puff Adder being differentiated as the large ndurububwa. It is worth mentioning that in some parts of Nigeria Echis is believed to be the young of the Puff Adder, and in one vernacular it is called kububua which bears a certain resemblance to its Samburu name. At a rough guess the average length of the numerous adult Echis he captured was about 17 inches.

Breeding. During the three days 16th, 19th and 20th August 1961 eight juveniles (2 ♂♂, 6 ♀♀) were captured, but during the four days 16th to 18th February 1962 no small juveniles were seen; they had presumably all grown up. On 20th August 1961 in two separate localities a pair was found coiled together, and again in August/September 1962 on four occasions a ♂ and ♀ were found beneath the same log. Yet it seems from the results of another trip Ionides made in fourteen days during August-September 1962, when out of 218 captured, no less than 113 were juveniles under 10 inches (and at least another 50 juveniles were seen but not taken), that August-September is the season for Echis bearing young.

Food. No stomachs were examined in August 1961 or February 1962 as all specimens caught were sent away alive, but on 17th February an adult when captured disgorged a partially digested, unidentifiable lizard. Small rodents are said to be common. Over one hundred stomachs examined in August-September 1962 indicated that in this region lizards - 12 specimens each had a Southern Long-tailed Lizard, Latastia longicaudata revoili (Vaillant) in its stomach, one contained a Savanna Variable Skink, Mabuya varia varia (Peters) and in another unidentified lizard remains - are perhaps the main item in its diet. Two others contained unidentified rodent remains, and one had consumed a scorpion (this has also been recorded in India).

Ectoparasites. None were found.

Temperament. Very quick and active when disturbed. Every specimen taken made determined efforts to bite when caught. Ionides draws particular attention to a very characteristic attitude when on the defensive, the body being placed in a sort of C shaped coil. This pose is very frequently adopted by an angry Echis and might even help to identify it.

Corkill (1: 255) refers to this "habit of coiling to a flank with the head threatening to the front" which has inspired one of its vernacular names in the Sudan. i.e. Um ǧenaib (Arabic ǧenab, meaning 'side'). Also, Cansdale (2: 52) "It has a peculiar way of coiling ready for attack; the main part of the body is held in a wide curve, with the neck doubled back."

Habitat. Semi-desert "nyika", with dry low thorny bushes and small, flat-topped, acacia thorn trees, Acacia tortilis (Forsk.) Hayne. The region in which this collecting was done is about 3,000 ft above sea level.

Habits. Nocturnal. The majority were found beneath or inside rotting Acacia tortilis logs. When disturbed, many demonstrated with a "side-winding" motion, at the same time rubbing their saw scales together

and thus producing a remarkably loud and threatening noise. Not all 'rustled' when caught, but the majority did. When annoyed, the head and anterior part of the body is sometimes slightly raised and pointing towards the object threatened, while the posterior part of the body moves from side to side, producing a loud 'rustling'. The strike is delivered and the head immediately returns to the original posture. But more often the strike is effected from the previously described stationary C shaped coil (or lateral loop) position. Ionides did not notice in any case that the anterior part of the body was inflated prior to striking and certainly not markedly so. But on several occasions the strike was so vigorous that the snake appeared to jump forward and upwards (mainly forward). Neither he, nor yet a National Parks Warden who was with him, ever heard Echis hiss, though the loud 'rustling' could render a hiss inaudible. When held by the neck this viper tries to use its fangs by depressing the head, but not by turning it. Owing to the relativly slender neck, it is much easier to hold than Atractaspis (burrowing viper). It should be held by the nape so that the mouth is forced open, for it is when the head is held too far on the neck that it will attempt to embed the fangs in one's finger, by depressing its head as Atractaspis does.

Ionides also mentions that in Northern Darfur, in the Sudan, in 1946, he collected a viper which he believed was an Echis, with part of the body buried in the sand. During his third collecting trip to the Northern Frontier Province of Kenya in August-September 1962, he found two Echis almost entirely buried in sand and several partially buried, but all were also under Acacia logs.

Method of collecting. Ionides was assisted by a couple of Europeans and a number of Africans who scattered and searched, turning over any logs they could find. When a snake was discovered Ionides was called to catch it.

On 16th August 1961, when in a car, a dead snake, an Echis, was observed on the road and an immediate search in the vicinity resulted in the capture of six specimens in about three-quarters of an hour.

Population. Judging from the results of his first two very brief expeditions, one of three days (41 snakes), the other four days (52 snakes) collecting respectively at different times of the year in three separate localities, and a third of a fortnight's duration (218), there must be an abundance of Echis in the regions visited - especially those localities which produced as many as 39, 38 and 32 respectively in one day. A. Duff-Mackay and Jonathan Leakey (in litt.) during the periods 27th October to 11th December, 1962 and 7th January to 13th March 1963 collected alive - the majority eventually released - a total of 6,933 Echis carinatus.

These figures are not so remarkable as would at first appear, for according to Wall (3: 49) Echis carinatus is extremely abundant in parts of what was formerly North-West India (prior to partition) and he refers to its prodigious numbers elsewhere in India as furnished by Vidal (3: 49). In the "Ratnagiri District alone during six years Government rewards were paid on an average of 225,721 Phoorsas (the vernacular name for Echis) per annum" --- "when the Government reward was raised tentatively from six pies to two annas per head, 115,921 were paid for in 8 days (December 2nd to 10th, 1862)". Again, Candy (3: 49) says that in Ratnagiri, in August and September, "the Mhars go out with long sticks to which forks are attached and catch them in

thousands for Government rewards."

According to Dr. J.R.H. Pasqual (in litt.), at Makurdi, in the Benue Valley, in Eastern Nigeria, in woodland savanna, Echis carinatus is also abundant, and hundreds were killed in the course of grass-slashing within the Government station. Grass grew rapidly in compounds, when officers were away on tour for a week or a fortnight, and they would then be found to harbour two or three dozen Echis.

Of the initial 93 Ionides captured, 39 or 42 per cent were ♂♂ and 54 or 58 per cent ♀♀. But according to the season the ratio of sexes taken varies considerably. During the three days in August 1961, in a total of 41, 14 were ♂♂ and 27 ♀♀, i.e. twice as many ♀♀ as ♂♂; also, only 15 were adult, and in addition, 9 were fair size, 9 half-grown and 8 juveniles. On the other hand, the 52 examples collected on four days in February are, with one fair size exception, adult. In August 1961 the maximum catch on one day totalled 32, and in February, 23. During the period 25th August to 7th September 1962, the sex ratio of the 218 specimens captured was 78 ♂♂ and 140 ♀♀, disparity which Ionides is unable to explain. But it confirms what has already been noted at this time of the year that the ♀♀ to ♂♂ are in the ratio of about two to one. Also, at this time of the year there is a preponderance of subadults and juveniles, for out of the 218 taken only 35 were fully adult, 70 were subadult and half grown (all over 10 inches) and 113 were juveniles under 10 inches. Ionides suggests that Echis probably attains adult size within six months, which would account for his February catch being almost entirely adult, in contrast to the very high proportion of juveniles and subadults taken in August - September.

Climate. Despite the intense heat which prevailed from about 9.0 a.m. till sundown, a strong cold wind blew from sundown till 9.0 a.m. or even later.

General. Owing to its exceptional size it is worth mentioning that in the course of searching for Echis, a ♀ Bitis arietans arietans (Merrem) was caught which measured 5 ft 1½ ins. (tail 4¼ ins), girth 12½ ins., and weighed (empty) 13 lbs. 4 ozs. Before weighing, a partially digested adult Springhaas or Jumping Hare, Pedetes surdaster Thomas was squeezed out of her stomach. In the course of the seven days intensive collecting when 93 Echis were obtained only two Puff Adders were found. Later, during a further fourteen days hard collecting, when 218 Echis were collected and at least another 50 seen but not taken, only two juvenile and two adult Puff Adders were found. One an adult, a ♀, measuring 37 ins., was taken from the stomach of a 72½ ins ♂, Common Spitting Cobra, Naja nigricollis Reinhardt.

In Kenya, and in Nigeria, wherever Echis is abundant the Puff Adder is uncommon or rare. Conversely, in a region of Northern Nigeria where Echis is scarce, a European snake-catcher - for commercial purposes - was, in 1937, said to be collecting 40,000 Puff Adders a month, none less than 4 feet long.

VIPERA HINDII Boulenger, Montane Viper.

Description. Small and slender with cylindrical body, and rarely attaining a length much in excess of 12 inches. Ionides' largest, a ♀, measured 13 ins., (tail 1.35 ins.). Head scalation typically viper,

with strongly keeled imbricate scales. Dull brown, with darker spots along the back and flanks, the general coloration blending well with the blackish soil on which it is found. Greyish below, speckled darker.

Breeding. Little is known about its breeding, though in the course of two brief expeditions (one in August and the other in February) very small juveniles were found in February, but in August all specimens taken were of good size.

Food. An adult ♀ taken on the 4th August 1961 had recently swallowed a fair sized Kenya Side-striped Chameleon, *Chamaeleo bitaeniatus schubotzi* Sternfeld. Lizards, which are not uncommon, are also preyed on. A half-grown ♀, taken on 7th February 1962, was forced to disgorge a frog - species not identified. Specimens in captivity took frogs freely. Pitman fed one on new born mice.

Ectoparasites. None recorded.

Temperament. Irascible and very ready to try to bite if interfered with, though inclined to be sluggish. None were actually found in a state of torpor, though one would imagine that in these bleak highlands these little vipers for two-thirds of every 24 hours are likely to be in a state of suspended animation.

Habitat. Moorland at high altitudes - 9,300 - 11,000 ft above the forest line, amongst huge tussocks of the fine, tufty grass *Andropogon dummeri* Stapf, and the coarse, tufty grass *Andropogon amethystinus* Steud., as well as among the low, thick, shrubby *Alchemilla argyrophylla* Oliv..

Habits. Usually found coiled up close to a tussock of grass, but may be found actually in a tussock, or, if the ground is warmish, on bare ground between tussocks, and sometimes in the scrub. Seen during periods of weak sunshine, or sometimes when no sun was visible if the ground was fairly warm. Some were in rather marshy ground, others where the ground was fairly dry. They are really only active and readily noticed during optimum conditions - which are few and far between - of maximum warm sunshine between about 10.0 a.m. and 4.0 p.m.

Method of collecting. Climatic conditions permitted but brief visits to this normally inclement highland region, and only limited African assistance was available. However, generous rewards produced good results, though careful search of the limitless tangle of tussocks is most arduous. Where there had been a grass (*i.e.* tussuck) burn the task was easier. This viper can be held by the tail without risk of the holding hand being bitten, which cannot be done with *Echis*.

Population. In the course of two brief visits to Kenya's Aberdare Mountains, from 2nd to 7th August 1961 (and 23rd August) and 7th to 13th February 1962, 74 of these little vipers were collected. Ionides believes that this viper may become adult in a year. Of these 29 or 40 per cent. were ♂♂ and 45 or 60 per cent ♀♀. 51 or 70 per cent. were adult. The sex ratio of 10 fair size (5 ♂.5 ♀) and 13 half-grown (7 ♂. 6 ♀) is even.

The proportion of adults in the total captures respectively in August (total 25, adult 17) and in February (total 49, adult 34), each 70 per cent., does not vary from that of the grand total. But the sex

ratio of the adults taken was 7 ♂♂ and 10 ♀♀ in August, and 10 ♂♂ and 24 ♀♀ in February, which may or may not be significant.

Of the grand total of 51 adults, twice as many ♀♀ (34) were caught as were ♂♂ (17). The most taken in any one day was 23, on 11th February. Sixty per cent were caught before 1.30 p.m., a number of specimens were taken after 4.0 p.m., and some as late as 5.25 p.m..

Climate. In August, weather conditions were predominantly cloudy with periods of mist and light drizzle, and occasional intervals of weak sunshine. In February, conditions were better with much strong morning sunshine and mild or strong cold winds, also at times a good deal of cloud, and one wet afternoon. But it can be very hot, too, in September.

Conclusions

It would appear, from the evidence available, that the populations of these two East African venomous species, each with distinctive habits and frequenting a strikingly divergent habitat, are far more extensive than mere casual acquantance is likely to indicate, and Ionides' catching operations conducted in strictly limited localities have thrown fresh light on a problem about which little is known; but it is probable that only a small proportion of the actual population was ever seen.

In Uganda, too, in Pitman's experience many snake populations are far more plentiful than one would credit, and in localities where one but occasionally sees a snake by chance, the incentive of an adequate reward will produce remarkable results.

Acknowledgments.

Our grateful thanks are due to many, and especially to F.W.Woodley, Warden, Mountain National Parks of Kenya, for his valuable assistance on the expeditions to collect Echis carinatus and Vipera hindii; Miss A.G.C. Grandison of the British Museum (Natural History) for having read through this paper and for her advice; Dr. J.R.H. Pasqual, for his information about Nigeria; to a host of willing Africans without whose help little would have been achieved; and to all those others who contributed in many ways.

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(Received 28th August, 1964)

OBSERVATIONS ON GUNTHER'S GARTER OR CORAL SNAKE, ELAPSOIDEA SUNDEVALII GUNTHERI Loveridge

By

JAMES ASHE

This is a small Elapid snake, which seldom grows over 2 feet in length, though occasionally specimens are taken over that size. In colour it is commonly blue-black with pairs of narrow white bars running round the dorsal part of the body. Sometimes the two white bars enclose a red, orange or yellow one. The stomach is a pearly grey. The head is not very distinct from the neck, the nose horizontally chisel-shaped, and the eyes small.

Gunther's Garter Snake moves in short sharp bursts, remaining perfectly still between each such burst. One has been observed stalking a frog in this manner, and the last lap of this movement terminated in a very fast strike at the frog. The frog in question was very much too large for the snake to have eaten. Stalking, however, is not the only way a Garter Snake is able to get its food. One in captivity actually caught a frog in mid-jump at a height of about four inches above the floor level of the cage.

The diet of the Garter Snake is very interesting. A. Loveridge - "A Guide to the Snakes of the Nairobi District", J.E.Afr.Nat.Hist.Soc. Vol. XVIII, 3 & 4, p. 97 (1945), reprinted March 1962. Page 17 (1)- records lizards eggs, and a skink has been removed from the stomach of one that was killed on the road. The skink was very much reduced by digestion, but it appeared to be a Riopa sp.

Several times I have experimented by placing a number of different reptiles in the cage with Elapsoidea, and have found they show a marked preference for small snakes, of which Aparallactus and Lycophidion seem to head the list of preferences. They, however, would not take a very young Dasypeltis scaber Linn.

When Elapsoidea takes a small snake, it usually gets a firm grip on the middle of its prey, and slowly chews towards the head, quite heedless of the bites it receives, and finally swallowing it head first. It must be fairly venom-proof, as when one found its way into a cage containing a Spitting Cobra - Naja nigricollis Reinhardt - it received a bite from a four foot specimen. It bled from the nose for over a week, but now, over two months after the incident, it is still alive and in quite good shape.

Other snakes seem to be aware of the snake eating tendencies of Elapsoidea, as once when I placed one in a cage full of Sand-Snakes, Psammophis sp., they became greatly alarmed, and remained much agitated for some time.

Some authorities say that after a short time in captivity the Elapsoidea becomes trusting and mild. This should not be taken seriously, as the following observations refer to a snake which I have had for some long time and first appears in my records on 4.6.62. but was captured well before that date. Other authorities maintain

that the Garter or Coral Snake cannot open its mouth wide enough to admit any portion of a human body. The marks at present on the top joint of my index finger, and the scores on the nail, adequately belie this.

Summary of observations on a bite by Elapsoidea sundevalii guntheri.

Weight	-	65.4 gms.
Length	-	64 cms.
Phase	-	White.
Condition	-	Good, but a little thin.
Last fed	-	About 2.6.64. Therefore well stocked with venom.
Venom	-	Neurotoxic.

James Ashe - Bitten - at 5.15 p.m. on 6.8.64.

Weight	-	159 lbs.
Age	-	39.
Height	-	5 ft. 10 ins.
Health	-	Good.
Immunity	-	Bitten by Spitting Cobra about 18 months earlier. Ineffectual bite, one fang only, the symptoms were slight. A number of bites from non Elapid snakes of low potency. Immunity can be considered negligible.

When replacing the Garter Snake in its case it bit the ball of my forefinger, striking and holding with boths fangs. Not wishing to injure the snake, I lowered it to the ground and removed it. It was thus able to give me a full bite. I made a shallow cut and for a very short time sucked the wound, but realising that little was known of the bite of this snake, and also that it was unlikely to be dangerous, stopped sucking and took notes of the result.

5.15 p.m.	Bitten, fang marks 7.5 mm. apart. Right index finger above top joint. The effect of the bite was immediate; a tingling sensation moved up the back of the hand, and a slight pain was felt in the forefinger and the lower joint of the second finger. The pain left the site of the bite at -
5.29 p.m.	But was conscious of pain at elbow. By this time the finger was very stiff; had insufficient control of the right arm to be able to write clearly; Mr. Norman Mitton continued the account.
5.34 p.m.	Discomfort felt at armpit.
6.10 p.m.	Rode 7 miles home on motor-cycle and on arrival took a hot bath. No change in condition until -
7.30 p.m.	A check showed the following:- Finger, dull pain. Slight pain in armpit which became intense when arm was moved.

8.00 p.m.	Right armpit appeared only half as deep as left; gland was very much swollen. Pulse in two counts - 86 and 89. Dull pain and severe throbbing in finger. Forearm normal, but upper arm very painful if touched. No apparent change in pupils. Breathing normal.
8.30 p.m.	Acute pain in finger, also in upper arm and armpit when coughing, although swelling seemed to have subsided slightly.
9.00 p.m.	No change.
10.00 p.m.	Armpit slightly more painful.
11.00 p.m.	No change, and a good nights' sleep.

7.8.64.

7.10 a.m.	On waking conscious of pain in finger and armpit.
1.30 p.m.	Forefinger and armpit slightly swollen and still painful.
11.30 p.m.	No change but a feeling of discomfort rather than of pain.

8.8.64.

7.30 a.m.	Site of bite just a little tender, slight stiffness in first finger. Observations discontinued.

The only other reference I can find of a bite from Elapsoidea appears on page 33, para. (5) of "Snakes of Southern Africa", by V.F.M. FitzSimons, Purnell, Cape Town - 1962., which reads as follows - "Contrary to the moderate swelling following after bites of Elapid snakes, a young European male experienced considerable pain and swelling, which extended from the site of the bite on the forefinger into the upper arm and armpit."

I, however, did not experience intense pain unless the arm was moved. The venom was very quick in its action, and the rapidity with which it spread was alarming. Although my arm was not unduly painful, I was unable to write after a very short time, which would seem to suggest that the venom secreted by Elapsoidea is potent.

In view of the experience described above, I would consider that a bite from this snake should not be taken lightly, particularly in the case of children.

(Received 8th. September 1964)

A TRIP TO AL ABER, QUATI STATE, HADRAMAUT, EASTERN ADEN PROTECTORATE.

By

C.J.P. IONIDES and C. ORME-SMITH

The objectives of the trip were to collect specimens of Cerastes cerastes (Linnaeus), the Desert Horned-Viper, and of Echis coloratus Günther, the Arabian Saw-scaled Viper.

The habitat of both these snakes is desert, and in the case of the latter, semi-desert also. Al Aber is a fort in the Arabian Desert about 330 miles in a northerly direction from Mukalla which is on the coast, and 300 miles north-east of Aden itself. It is at an altitude of 3,300 feet. The area consists of isolated stony hills, sand, lava rocks and, in places, a certain amount of low scrub and coarse grass. There is no cultivation.

We reached Al Aber in the afternoon on the 17th April, 1965. As soon as we arrived we asked the Bedouin to spread the news among the encampments in the area that we wanted news of any snakes seen. Provided the snakes were not molested in any way, we promised that a substantial reward would be paid for any such information which resulted in the capture of the specimen.

Early in the morning of the 18th, we started off in a Landrover from Al Aber to make a round of the Bedouin encampments. We hoped to pick up news of our quarry. At the first of these encampments news was actually brought while we were drinking coffee with the Arabs. A snake had been found in the near vicinity. We went to the place and found a large adult male Cerastes coiled up among small dark stones. He was captured at 7.40 a.m. and proved to be the largest of the species we were able to collect during our stay in Al Aber. He was 27¾ ins. long, had a girth of 3 ins., and a tail of 3¼ ins. We continued the round but found that the news had not yet reached most of the encampments.

On our way back to the fort we decided to make a search amongst some small rocks on the side of the hill. We turned over many of the rocks and discovered a male snake beneath one. He made off and hid beneath another rock but was then captured. This species we have not yet identified, but it is a back-fanged snake and although in no way related to the Cerastes, its coloration of warm sand brown marked irregularly with darker brown was surprisingly similar in general effect. It also had a conspicuous dark round spot behind each eye.

On the 19th the round was made again. A fair sized Cerastes female was taken in open rocky shale at 8 a.m. We dug an adult male from under sand at 9.10 a.m. He was very angry and rustled loudly when we caught him. This rustling is made by rubbing the strongly keeled scales together while the snake is in a tightly coiled position. Both Cerastes and Echis do this as a warning demonstration.

On the following day we secured two further specimens of Cerastes; a female taken in sand at 7.55 a.m. and a male in a similar habitat fifteen minutes later.

On the morning of the 21st we were lucky enough to take our first Echis coloratus. He was a large male of 28 ins. in length which we found in a rocky area at 8.45 a.m. whilst he was still on the move. Within five minutes of this success we discovered another E. coloratus, this one a female lying under a rock. Our bag of Cerastes was increased by two specimens, namely a large male moving in sand at 7.40 a.m. and within a few minutes a female was seen buried in the sand with only her head visible. She was photographed by Mr. Orme-Smith in this position and then collected. At about 9.55 a.m. a juvenile male snake of the same species as the previous unidentified one, was taken on sand.

On the 22nd our first capture was made at 6.30 a.m. and our second five minutes later. Both female Cerastes and both in a sandy area. At 6.40 a.m. also in sand, a male of the same species was taken. Two hours later we collected a male of the unidentified species of back-fanged snake. He was in a flat sandy area and spread a slight hood when caught.

Following this capture, a strong wind arose which destroyed all snake tracks. Probably as a result of this we failed to find any more snakes that day. We left Al Aber on the 23rd to return to Mukalla.

During our stay at Al Aber there had been sunny days interspersed with very light drizzle. However, shortly before we arrived, there had been rain, and the day we left we heard that it rained again. We, ourselves were caught in heavy rain on the way back. We had found the nights cool, and the days quite warm, but somewhat windy.

Of the ten Cerastes taken, four had a large erectile horn-like scale over each eye. In the remaining six, this process was absent. The approximate lengths of the vipers caught were as follows:-

C. cerastes	male	horned	705 mm
C. cerastes	male	horned	660 mm
C. cerastes	male	unhorned	560 mm
C. cerastes	female	unhorned	480 mm
C. cerastes	female	unhorned	460 mm
C. cerastes	female	unhorned	450 mm
C. cerastes	male	horned	440 mm
C. cerastes	female	horned	440 mm
C. cerastes	female	unhorned	410 mm
C. cerastes	male	unhorned	390 mm
E. coloratus	male		711 mm
E. coloratus	female		570 mm

C. cerastes is clearly nocturnal in habit. During the day-time it lies up under sand, often with only the head protruding, or in the shade of stones. Its normal method of progression is "side-winding", which means that it moves at right angles to the direction in which its head is pointing and appears to skid along the sand in this manner. It moves with quite surprising speed. Fur was found in some of the faeces indicating that at least part of its diet is mammalian. It is a high spirited snake ready to defend itself if molested. Its sandy colour and broken pattern make it difficult to see in it's desert habitat.

Judging by the two examples of E. coloratus taken, this species is of a milder temperament than its more widespread relative E. carinatus. It may "side-wind" in the manner of Cerastes but does not always do so. It occurs side by side with Cerastes in this area. It also

has the habit of rustling its scales as a warning as does E. carinatus. Though not so aggressive as E. carinatus it is a high spirited snake which is not prepared to stand any nonsense. It also has a sandy colour which assimilates with its desert environment.

Both species of viper are highly venomous, probably the E. coloratus is more so.

Beyond the fact that one specimen was caught among rocks and two in sand no particular notes were taken of the unidentified snake.

Various species of lizard were common in the area which suggests the likelihood that they form the large part of the food of all these three snakes.

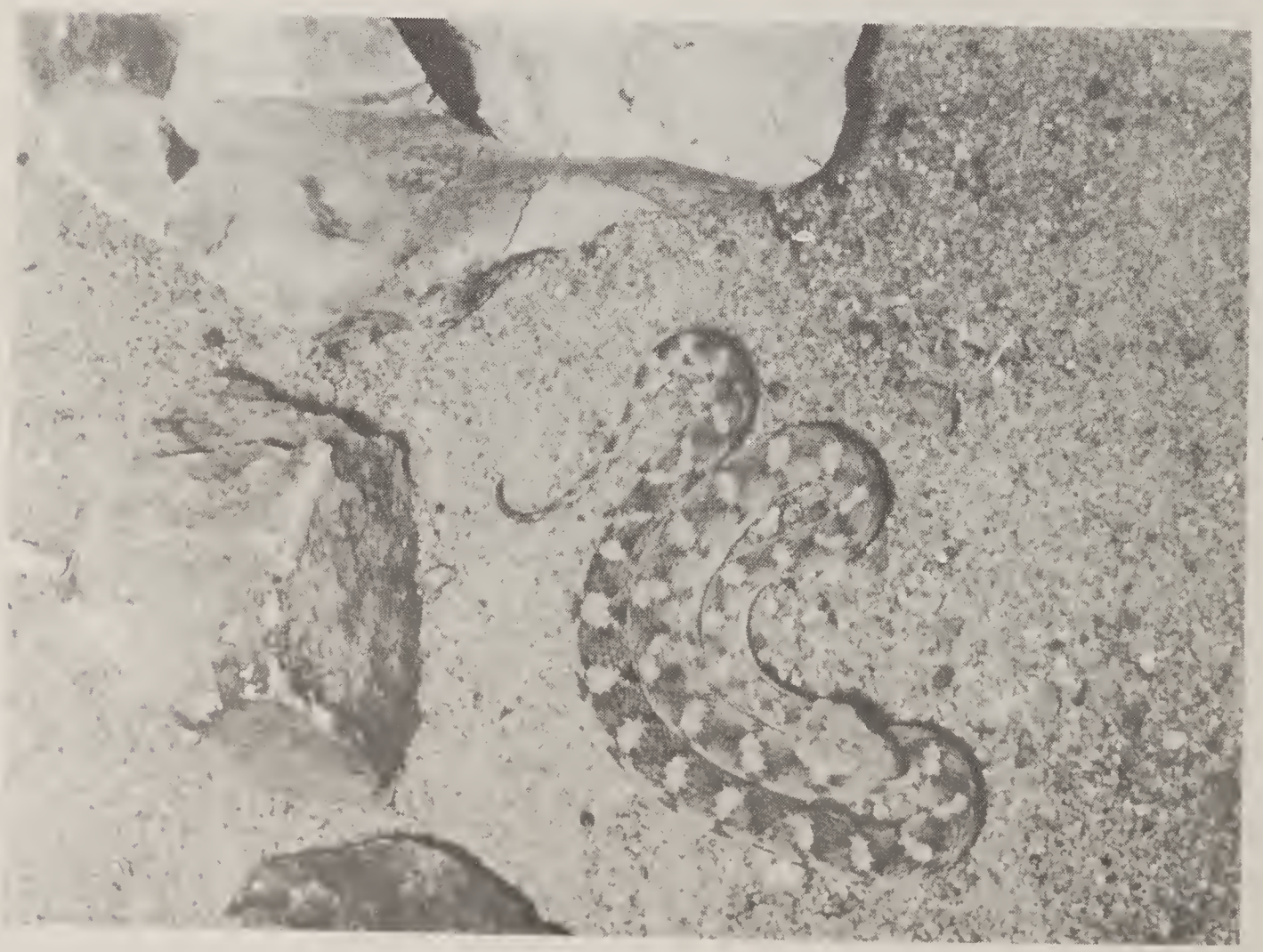
We are deeply indepted to Qaid J.W.G. Gray of the Hadrami Bedouin Legion and to his wife, whose help, hospitality and kindness resulted in a most successful trip. The charm and friendliness of the Bedouin of Al Aber and of all the Arabs with whom we came in contact added greatly to the pleasure and success of the trip.

(Received 7th May, 1965)

Desert Horned-Viper in its Natural Habitat.

Photos by C. ORME-SMITH

Cerastes cerastes



Echis coloratus

(Photos by N.P.MITTON)

A SCINCID REPTILE FEEDING PRIMARILY ON MARINE CRUSTACEA, WITH A NOTE ON ITS PARASITES

By

A.G. CANARIS & D.G. MURPHY

Thirty-nine skinks Ablepharus boutonii africanus (Sternfeld) a sub species which reaches a length of approximately 4¾ inches, were analysed for food items and parasites. The animals were collected during August 1963 and August 1964 from littoral rocks at Msambweni and between Mida Creek and Blue Lagoon in Kenya. They appear to inhabit rocky headlands. The greater number were observed on rocky faces on the seaward side but some were seen on top of rock cliffs. The skinks hunt their prey in crevices and holes in the rocks and in the beach strand line at the base of the cliffs. They were not observed to enter the water after prey but several which were placed in tide pools swam rapidly on the surface.

Thirty of the thirty-nine skinks contained identifiable food items in their stomachs or intestines. 90% of the items were marine crustacea. 63% were crab larvae of several species and all were in the megalopa stage or older. 27% were marine gammarids. Only 6.4% of the food items were insects. Table I summarizes the food item analysis.

Fifteen of the skinks were parasitized by the mite Schoengastia rubi rubi Vercammen-Grandjean. The mites were found in the axilla and ear.

Five skinks from the Msambweni site were infected with an undetermined species of liver fluke. Two species of flukes belonging to the family Microphallidae were recovered from the intestines of the skinks. The microphallids are poorly represented in reptiles, but members frequently parasitize shore birds. Both fluke species appeared to be well adapted to the skink because the frequency of infection for both was about 61% and most of the flukes were mature.

Crustaceans, in a marine environment, are the usual second intermediate hosts for microphallid flukes. Crustaceans were removed from the stomachs of skinks and dissected. One gammarid harboured three cysts of a microphallid fluke, but it was not possible to determine if it was one of the two microphallid species parasitizing the skinks. Twenty-five gammarids were collected from the skinks' habitat and examined for fluke cysts but none were infected. Gammarids and crabs probably act as second intermediate hosts for the two species of microphallids harboured by the skinks.

The close association of the skink with a marine environment is reflected in its diet, and, consequently, in its intestinal parasites.

TABLE I:

Food items from the Stomach and Intestines of

Ablepharus boutonii africanus (Scincidae)

	Gammarid	Crab	Diptera	Coleoptera larva	Hymenoptera
Skinks with item	17	21	4	3	2
Number of items	88	38	5	3	2
Percent items	62.41	26.94	3.55	2.13	1.42

	Collembola	Araneae	Mysid	Polychaeta	Snail
Skinks with item	1	1	1	1	1
Number of items	1	1	1	1	1
Percent items	0.71	0.71	0.71	0.71	0.71

(Received on 27th January, 1965)

NEW LEPIDOPTERA FROM EAST AFRICA

By

R.H. Carcasson

NYMPHALIDAE, LIMENITINAE

PSEUDATHYMA NEPTIDINA Karsch, JACKSONI, ssp, nov. (Figs. 1 & 2)

Differs from the nominate race in the much greater development of the white discal markings in both wings above and below, in the absence of dark nervular streaks in the white markings of the forewing and in the reduction of the white streak in the fw cell. The sexes are similar, the ♀ being larger and more rounded.

This new subspecies was recently discovered in the Kakamega Forest of western Kenya by Mr. T.H.E. Jackson, the well known lepidopterist and small series of both sexes were secured by him and by the author. It is astonishing that such a conspicuous insect should have been overlooked for so long in a well collected area such as the Kakamega Forest, and this may be due to it being a surprisingly accurate mimic of Neptis strigata Aurivillius.

The nominate race is known from the Cameroons and from the Congo. The only available East African record, other than the Kakamega specimens, is a ♂ from the Bwamba Forest, Toro, W. Uganda, which agrees very well with the figure of the type in Aurivillius, "Rhopalocera Aethiopica", 1898.

Holotype ♂: Kakamega Forest, Kenya, XI-1964, R.Carcasson.
Allotype ♀: same data as above. Holotype and Allotype to be deposited in the British Museum (Natural History).
♂ Paratypes 5, ♀ Paratypes 2 : same data as above, in National Museum (formerly Coryndon Museum), Nairobi.

Note : since this description was written, I have been informed by Mr. Jackson that the British Museum have a ♂ of jacksoni collected by Dr. Ansorge in 1909 in the "Nandi country", Kenya.

NAJAS SARCOPTERA (Butler)

Romaleosoma Sarcoptera Butler, Lep.Exot.: 81, (1871)

Euphaedra cyparissa Cramer, var. sarcoptera (Butler)
Aurivillius, Rhop. Aethiop. : 189, (1898)

Although treated as a "variety" of N. cyparissa (Cramer) by Aurivillius in "Rhopalocera Aethiopica" and again in A. Seitz, "Macrolepidoptera of the World", Vol. XIII, 1925, p. 186, it should be regarded as a distinct species, as its pale subapical patch differs consistently in shape from that of N. cyparissa; this feature would be unlikely to be so generally associated with the diagnostic character of sarcoptera (red patch at base of fw below), if sarcoptera were a mere form of cyparissa. The distribution of N. sarcoptera is heavy forest from Dahomey and Ashanti to the Congo, with an isolated race in western Tanganyika, described below.

NAJAS SARCOPTERA (Butler), NIPPONICORUM ssp. nov. (Fig. 4)

Differs from the nominate race in being larger in both sexes and in having a more golden, less green ground colour. The sexes are similar, but the ♀ is somewhat larger than the ♂, more rounded, and has less green, particularly in the fw above.
Measurements: ♂, fw, base to apex, 40 mm
♀, fw, base to apex, 47 mm

Holotype ♂: Ititye Camp, Mihumo, 25 miles east of Kigoma, Western Province, Tanganyika, V-1964, Kyoto University African Primate Expedition.
Allotype ♀: same data as above, III-1964. Holotype and Allotype to be deposited in the British Museum (Natural History).
Paratypes : same data as above; 1 ♂ and 1 ♀ in National Museum (formerly Coryndon Museum), Nairobi; 2 ♂ in Kyoto University.

The forest relics near the eastern shore of Lake Tanganyika appear to be inhabited by a surprising mixture of western and eastern elements and this is another member of this strange mixed fauna to be discovered by the Japanese expedition. See : J.E.Afr.Nat.Hist.Soc, Vol. XXIV, No. 4 (108) p. 62 1964.

LYCAENIDAE, LIPTENINAE

ALAENA KIELLANDI sp. nov. (Figs.5,6,7,29 & 30)

A large, very distinct species, nearest to A. reticulata Butler, but differs in the much greater development of all the white markings.

MALE
Antennae : black above and below; knob elongated and laterally compressed.
Head : vertex light ochraceous-buff,* frons black, palpi ochraceous-buff.
Thorax : black above, covered with sparse white hairs, black below.
Abdomen : black above with sparse white hairs; terminal tuft and ventral surface ochraceous-buff.
Legs : Ochraceous-buff, with a proximal black ring on each tarsal segment.

Upperside
Forewing : ground colour white; costa and all veins sooty black; a blackish grey transverse bar crossing DC at ⅔ from base and a similar bar at end of DC; a faint indefinite blackish line from just beyond base of vein 4 to vein 2 at ⅓ from base; apex and outer margin paler blackish grey from costa at ⅔ from base to inner margin at ¾ from base; a white spot in cellule 6 and a larger one near tornus; cilia buffish grey.

Hindwing : ground colour and veins as in fw; costal area from base to origin of veins 7 and 8 heavily suffused with blackish grey; two dark transverse bars appear faintly from underside in DC; a broad blackish grey outer marginal band with indistinct and somewhat irregular

* Colours are taken from Ridgway's "Color standards and Color nomenclature".

proximal margin enclosing faint internervular spots, larger and more distinct in 1c and 2; cilia buffish grey.

Underside

Forewing : ground colour white, slightly ochraceous near costa and in distal third of wing; costa narrowly black; veins heavily outlined in black near outer margin, less so in basal ½ of wing, pale ochraceous elsewhere; two broad blackish grey transverse bars across DC and a narrow one extending to vein 1a at end of DC; cellule 1b smoky grey from base to origin of vein 2; a faint irregular blackish grey line from vein 5 just beyond end of DC to vein 2 midway from base; outer margin narrowly black; a thick, somewhat irregular blackish line evenly arched from origin of vein 9 to vein 2 at ¾ from its origin; outer marginal area distal to blackish line more decidedly ochraceous, veins very heavily outlined in black.

Hindwing : ground colour very pale ochraceous, as in outer margin of fw; costa pale ochraceous from base to end of vein 8; veins 6 and 7, median, upper and lower DC and cubital veins heavily outlined by black scales; a complete black crossbar enclosing a large round pale spot at base of cellule 7 and a second crossbar midway from base, not quite reaching upper median; DC evenly divided into three large pale areas by two thick black crossbars; proximal ½ of cellule 1c similarly divided into two pale areas; proximal ¼ of 1b entirely black, cellule 1a divided into three pale areas by two black bars slightly converging at inner margin; a complete series of black crossbars from costa at end of vein 8 to inner margin, forming a somewhat irregular continuous postmedial band as far as vein 2, disconnected at the veins and forming two distinct steps from vein 2 to inner margin; a narrower submarginal black line, parallel to postmedial; rather irregular, connected at the veins, but occasionally interrupted in the internervular spaces, forming a triangle with apex distad to 1c; termen narrowly black from end of vein 8 to base.

Measurements : fw, base to apex 16 mm.

Genitalia : tegumen short and strongly sclerotised; uncus terminating in two short broad rounded lobes separated by a deep rounded emargination; falces long and narrow, strongly sclerotised; aedeagus moderately stout, pointed and flattened dorso-ventrally at apex; valves short, blunt with pointed apices; juxta very small, mainly membranous, except apically.

FEMALE

Similar to ♂, but larger and more rounded.

Upperside

Similar to ♂, but underside markings more clearly visible; dark marginal bands of both wings enclosing complete series of pale submarginal spots.

Underside

Ground colour somewhat paler than in ♂; all black markings heavier and more distinct than in ♂; traces of an irregular black submarginal band in fw corresponding with that of hw; in the ♀ Paratype the black markings of both surfaces are still heavier.

Measurements : fw, base to apex 18-20 mm.

Genitalia : lobes small and slightly hairy; ostium bursae rounded, surrounded by an irregular sclerotised plate; bursa missing.

Holotype ♂ and Allotype ♀ : Sibweza, Mpanda, Western Tanganyika XII-1962, J. Kielland, to be deposited in the British Museum (Natural History).

1 Paratype ♂ : data as above.
1 Paratype ♀ : Sitwe, Mpanda, Western Tanganyika, XII-1963, J.Kielland;
Paratypes in the National Museum (formerly Coryndon Museum), Nairobi.

GEOMETRIDAE ENNOMINAE

BLABOPLUTODES PARVISTICTUS sp. nov. (Figs. 13 & 31)

Differs from B. missilorum Prout in its smaller size, relatively longer antennal pectinations and smaller dark spots.

MALE
Antennae : Naples yellow, pectinations very long and slender.
Head and body : uniformly Naples yellow, first and second pairs of legs somewhat darker.

Upperside
Forewing : lightly scaled, translucid Naples yellow; costal area more heavily scaled, mainly pale pinkish brown with some yellow; costal margin narrowly Naples yellow from ¼ from base to ¾; pale brown costal streak narrowly interrupted by Naples yellow at ¼ from base; five more or less parallel series of regular pale pinkish spots from costa to inner margin most clearly visible at the veins; fourth series of spots (postmedial) coalesce, forming an irregular faint line, sharply indented distad at the veins; a series of pale pinkish brown terminal spots in internervular spaces invading the Naples yellow fringe and giving it a chequered appearance; apex of wing rather rounded, outer margin evenly curved.

Hindwing : similar to fw, but lacking darker costal area.

Underside
Uniformly Naples yellow, darker markings faintly visible through wing membrane from upper surface.
Measurements : fw, base to apex 10 mm.
Genitalia : Membranous and lightly sclerotised; uncus long, curved and slender; valve bilobed; upper lobe longer, hairy and unarmed; ventral lobe terminating in an inward projecting long stout spine; juxta very long and slender; aedeagus slender and evenly arched, vesica unarmed.

FEMALE
Unknown.

Holotype ♂ : Katera, Sango Bay, Masaka, Uganda, X-1960, R.H. Carcasson, to be deposited in British Museum (Natural History)
2 ♂ Paratypes : data as above, in National Museum, Nairobi.

PSILOCEREA MELANOPS sp. nov.

Differs from other species of the genus in the straight, somewhat concave outer margin of the fw, in the rounded hw and in the presence of a well developed precostal spur; this species may be wrongly placed in Psilocerea, but it would be unwise to erect a new genus to accommodate it without knowledge of the ♀ and until the African Ennominae have been more adequately studied.

MALE
Antennae : shaft yellowish brown, pectinations long, black; distal third of shaft bare.
Head : vertex, frons and palpi brown;
Thorax : tegulae pale drab grey edged posteriorly with light brown scales; patagia chamois; postnotum dark brown; ventral surface uniformly chamois, but rather darker anteriorly.
Abdomen : chamois above, somewhat speckled with darker scales; first tergite with a prominent patch of slightly raised broad white scales; ventral surface uniformly chamois.
Legs : chamois, more or less speckled with light brown.

Upperside
Forewing : ground colour chamois, more or less irrorated with darker scales and speckled with a few scattered black scales; an indistinct whitish area at base, edged distally with light brown; proximal third of costa light brownish olive and a costal spot of the same colour at origin of vein 8; a broad, straight light brownish olive diagonal bar from apex to just beyond middle of inner margin, broader at apex, overlaid in some specimens in cellules 1b and 1a by a large black reniform spot surrounded by whitish scales; cilia uniformly buff.

Hindwing : ground colour as above; fw band continued to middle of inner margin, but paler and much more diffuse; a small dark dot at costa, near apex, followed by a series of dark postdiscal spots at all the veins; a faint, irregular dark postmedial band culminating in an irregular black spot edged with whitish scales just above tornus; cilia uniformly buff.

Underside
Similar to above, but more heavily speckled with brown; diagonal band and nervular spots of hw more distinct, black markings and whitish scales absent.
Measurements : fw, base to apex 17 - 19 mm.
Genitalia : Uncus broad and short, terminating in a short hook; valve long with subparallel edges; distal end of costa somewhat swollen, armed with minute spines; a short, blunt, heavily sclerotised pear shaped harpe, densely covered by minute spines; aedeagus short and stout, distal half covered by minute surface tubercles; a small internal, well chitinised cylinder in proximal half and a curious elongated body in distal part of aedeagus.

FEMALE
Unknown.

Holotype ♂ : Kalinzu Forest, Ankole, Uganda, XI-1961, R.H. Carcasson, to be deposited in British Museum (Natural History).
♂ Paratypes : 1, data as above
1, locality as above, 1-1965, J. Scheven.
1, Mabira Forest, Jinja, Uganda, X-1962, R.H. Carcasson.
Paratypes in National Museum, Nairobi.

XYLOPTERYX PROUTI sp. nov. (Figs. 12,32 & 33)

Allied to X. sima Prout, but smaller and more boldly marked.

MALE
Antennae : pectinations longer than in other species of the genus.

Head : vertex, frons and palpi mustard yellow, lightly speckled with dark scales.
Thorax and Abdomen : Naples yellow speckled with deep olive, particularly above.
Legs : Naples yellow speckled with deep olive; no hair pencil on hind tibiae.

Upperside

Forewing : ground colour deep olive; a straight Naples yellow band from costa at ⅓ from base to inner margin at 3/5 from base; an irregular Naples yellow band from apex to inner margin at ⅔ from base; a short Naples yellow bar from costa at ⅔ from base to pale outer band at end of cell; a pale streak connecting the two pale bands along the cubital vein; dark areas more or less vermiculated with Naples yellow near base, apex and outer margin.

Hindwing : pale buffy brown with an indistinct dark dot at end of cell and somewhat darker near outer margin.

Underside

Pale yellowish grey; a faint darker submarginal band from costa of fw to inner margin of hw; a large, but indistinct darker spot at end of cell in both wings.
Measurements : fw, base to apex 10 mm.
Genitalia : Uncus short and broad, apex bifurcated; valve long and bilobed, upper lobe very slender; aedeagus very lightly sclerotised, moderately stout, ending in a blunt, short terminal hook; vesica armed with a serrated chitinous plate.

FEMALE

Similar to ♂, but larger, antennae not pectinated, pale vermiculations of fw more developed and hw paler.
Measurements : fw, base to apex 13 mm.
Genitalia : lobes long and slender, almost hairless; ductus short, bursa pear shaped; signum large, rounded, margin produced into minute spine.

Holotype ♂ and Allotype ♀ : Kalinzu Forest, Ankole, Uganda, XI-1961. R.H. Carcasson, to be deposited in the British Museum (Natural History).
♂ Paratypes 2 : data as above, in National Museum, Nairobi.

NOTE : this species is very similar, though smaller to a species in the British Museum which Prout named X. antiotriba, but did not publish.

APHILOPOTA FLETCHERI sp. nov. (Figs. 14 & 35)

Allied to A. rufiplaga Warren, but differs in its greater size and lighter ground colour.

MALE
Antennae : shaft speckled fuscus and very pale olive grey; pectinations black; distal ¼ of shaft bare.
Head : vertex and frons very pale olive grey speckled with darker scales; palpi fuscous tipped with pale olive grey.
Thorax : tegulae very pale olive grey, edged anteriorly and posteriorly with dark scales; patagia pale olive grey, fuscous laterally and posteriorly; dorsum pale olive grey, fuscous laterally; ventral surface fuscous anteriorly, shading to pale olive grey posteriorly.

Abdomen : pale olive grey more or less speckled with fuscous above and below.
Legs : fuscous, more or less speckled with pale olive grey.

Upperside

Forewing : margin crenulated; ground colour ivory yellow, heavily irrorated and speckled with olive brown and fuscous; a narrow black line from costa at 1/5 from base to upper median at ⅓ from base to inner margin near base; a dark crescentic stigma at end of cell, sometimes enclosing a light area; a dark straight fascia from costa at ⅔ from base to middle of inner margin; a narrow blackish line from costa at origin of vein 8 to just beyond middle of vein 6, then sharply angled to just beyond origin of vein 3 and then to beyond middle of inner margin, angled distad at vein 1a; lower half of cellule 1b and cellule 1a suffused with dark vinaceous brown from base to a point ¾ from base; veins 6 and 2 overlaid with dark scales from origin to outer black line; preapical part of costa, centre of cellules 8 and 7, distal ¼ of cellule 6 and distal half of 5 and 4 heavily suffused with olive brown, submarginal area less so; remainder of postdiscal area distal to outer black line almost free of dark irrorations; termen narrowly blackish with a blackish dot at centre of each internervular space; cilia irregularly chequered.

Hindwing : margin crenulated and somewhat quadrate; ground colour as above, most heavily irrorated with dark scales near base and near inner and outer margins; costal area almost free of dark irrorations; dark fascia of fw continued in hw to middle of inner margin; dark reniform stigma larger and more conspicuous than in fw; a narrow blackish line from middle of vein 6 to middle of vein 5, then angled proximad to cellule 1c at ⅔ from base, where it turns sharply towards tornus before reaching inner margin; termen and cilia as in fw.

Underside

Ground colour slightly more brownish than above; dark irrorations more evenly distributed and less dense; dark fascia very indistinct in fw, better defined in hw; dark stigmata clearly visible; outer black line reduced to dots at the veins in both wings; a diffuse dark area beyond middle of vein 5 in fw.
Measurements : fw, base to apex 18-22 mm.
Genitalia : uncus short and blunt; valve elongated and slender with rounded apex; processi of juxta long and spatulate, slightly toothed along upper margin; aedeagus stout, short and slightly arched; vesica terminating in a group of heavily sclerotised sharp spines.

FEMALE

Unknown.

Holotype ♂ : Kalinzu Forest, Ankole, Uganda, XI-1961, R.H. Carcasson, to be deposited in the British Museum (Natural History).
♂ Paratypes : 1, data as for Holotype.
1, Mpanga Forest, Fort Portal, Toro, Uganda, V-1958, R.H. Carcasson.
3, Katera, Sango Bay, Masaka, Uganda, X-1960, R.H. Carcasson.
Paratypes in the National Museum, Nairobi.

The three Katera Paratypes are smaller and darker and may represent a local race.

This species is dedicated to my friend Mr. D.S. Fletcher of the British Museum (Natural History).

COLOCLEORA ANKOLEENSIS sp. nov. (Figs. 15 & 38)

A large species, apparently with no close allies.

MALE
Antennae : light tawny olive, basal ⅔ heavily pectinated.
Head : vertex, frons and third segment of palpus light tawny olive, second and third segments darker below.
Thorax : pale tawny olive above, darker below, especially anteriorly.
Abdomen : pale tawny olive above, paler below.
Legs : almost hairless except coxae and proximal half of femora; outer surface brown, inner surface much paler; inner surface of hind tibiae provided with long hair pencil concealed in a groove.

Upperside
Forewing : ground colour intermediate between cinnamon buff and tawny olive, densely but irregularly speckled with darker scales; antemedial band dark brown, only visible from costa to middle of cell; a prominent dark brown stigma at end of cell, its lower and distal end in contact with medial fascia; medial fascia paler than other markings, from middle of costa to middle of inner margin, strongly curved distad at end of cell; postmedial dark brown, crenulate and strongly curved distad from vein 7 to vein 3, beyond which it is indicated by dark dots on veins; termen marked by a series of narrow dark internervular lunules; margin strongly crenulated, cilia uniformly concolorous with wing.

Hindwing : ground colour and margin as above; basal area paler than rest of wing, being almost free of dark scales; medial and postmedial fasciae dark and distinct, enclosing a prominent snuff brown band and a dark brown stigma; some irregular dark brown submarginal mottling, particularly near tornus.

Underside
Uniform very pale brown with faint stigmata and medial fasciae in both wings and a pale but distinct and regular submarginal band parallel to outer margin of both wings.
Measurements : fw, base to apex 27-30 mm.
Genitalia : Uncus short, blunt and hairy; valves bilobed, asymmetrical, the right hand one being larger and longer; a long harpe terminating in a cluster of twisted spines at lower margin of right valve; left valve shorter and unarmed; aedeagus slender, arched, terminating in a sharp spine; interior occupied by a long sclerotised body of apparently cellular structure.

FEMALE

Unknown.

Holotype ♂ : Kalinzu Forest, Ankole, Uganda, XI-1961, R.H. Carcasson, to be deposited in the British Museum (Natural History).
♂ Paratypes : 1, same data as Holotype.
1, locality as above, II-1964, J. Scheven.
Paratypes in the National Museum, Nairobi.

GEODENA CANDIDA sp. nov. (Figs. 10 & 39)

Differs from G. discinota Warren and from G. pupillata Warren in the absence of the dark margin and of the discal spot in hw.

MALE
Antennae : shaft dark grey; pectinations long, black.
Head : Vertex and frons ochraceous buff; palpi ochraceous buff tipped with black.
Thorax : white above, very pale buff below.
Abdomen : very pale buff above and below.
Legs : very pale buff; first and second pairs darker posteriorly.

Upperside
Uniformly creamy white, very pale buff at costa, apex and outer margin of fw; a prominent rounded blackish spot at end of fw cell; hw unspotted.

Underside
As above, but buffish colour at costa, apex and outer margin of both wings more pronounced, particularly at the veins; discal spot of fw paler.
Measurements : fw, base to apex 19 mm.
Genitalia : Uncus long, spatulate and hairy; valve rounded and hairy, not strongly chitinised; harpe absent; juxta short and blunt, provided with two lateral tufts of dense hairs; aedeagus straight and slender, vesica armed with a single long sharp spine.

FEMALE
Unknown.

Holotype ♂ : Kalinzu Forest, Ankole, Uganda, XI-1961, R.H. Carcasson, to be deposited in the British Museum (Natural History).

GEODENA AUREA sp. nov. (Figs. 8,37 & 42)

Allied to G. dama Holland, but differs in the lack of a prominent dark border, in the brighter colour of hw and in the reduction of the dark discal spots.

MALE
Antennae : shaft dark greyish brown, pectinations black.
Head : collar antimony yellow, base of vertex warm buff; remainder of vertex and upper half of frons dark brown, lower half of frons antimony yellow; palpi antimony yellow tipped with brownish grey.
Thorax : warm buff above, antimony yellow below.
Abdomen : deep olive buff above, antimony yellow below.
Legs : Femora antimony yellow, tibiae and tarsi speckled with brown.

Upperside
Forewing : Uniformly pinkish buff, costal margin slightly darker at base; a short oblique blackish streak at end of cell.

Hindwing : ochraceous orange, paler at costa; tornus and inner margin to vein 2 pinkish buff; discal spot smaller and fainter than in fw.

Underside
Uniformly pale ochraceous orange, brighter in hw; dark discal spots smaller and paler, particularly in hw.
Measurements : fw, base to apex 17-18 mm.
Genitalia : Uncus as in following species; valve somewhat longer, harpe much shorter; eversible bags large; aedeagus short, well sclerotised; vesica armed with a row of closely appressed short spines.

FEMALE
Similar to male.

Genitalia : lobes small; bursa very small, spherical; signa absent; ductus wide, very strongly sclerotised, rugose rather than fluted.

Holotype ♂ and Allotype ♀ : Kalinzu Forest, Ankole, Uganda, XI-1961, R.H. Carcasson, to be deposited in the British Museum (Natural History). One ♀ Paratype, data as above, in the National Museum, Nairobi.

GEODENA CINEREA sp. nov. (Figs. 9,36 & 41)

Closely allied to G. discinota Warren, but differs in having a darker ground colour and ill-defined marginal border.

MALE
Antennae : shaft dark grey, pectinations black.
Head : Vertex and frons yellow ochre; palpi yellow ochre tipped with black.
Thorax : deep olive buff above, honey yellow below.
Abdomen : deep olive buff above; below distal half honey yellow.
Legs : femora honey yellow; fore and mid tibiae and tarsi honey yellow, yellowish grey anteriorly; hind tibiae and tarsi completely honey yellow.

Upperside
Forewing : ground colour deep olive buff; basal half of costal margin narrowly black; distal third of wing broadly suffused with darker grey from radius to tornus, paler ground colour invading internervular spaces 3 and 4; an oblique black streak at end of cell.

Hindwing : ground colour somewhat paler than fw, outer margin darker; a pear shaped black spot at end of cell.

Underside
Uniformly deep olive buff, somewhat ochreous at the veins; darker marginal areas only slightly indicated; black discal spots more sharply defined.
Measurements : fw, base to apex, 14-16 mm.
Genitalia : Uncus spatulate, spoon-shaped and hairy; valves short, blunt and hairy, provided with a long slender sickle-like harpe; a long eversible membranous bag at each side of juxta; aedeagus straight and slender; vesica armed with two long, strongly sclerotised spines.

FEMALE

Similar to male, but antennal pectinations shorter.
Genitalia : lobes small and hairy; bursa small and spherical; ductus long, wide, well sclerotised and fluted; signa absent.

Holotype ♂ and Allotype ♀ : Kalinzu Forest, Ankole, Uganda, XI-1961, R.H. Carcasson, to be deposited in the British Museum (Natural Histoty). Paratypes : 6 ♂ and 2 ♀, data as above, in the National Museum, Nairobi.

NOCTUIDAE ACRONYCTINAE

NEOSTICHTIS FULGURATA sp. nov. (Figs. 20 & 51)

Differs from N. nigricostata Hampson in having a more irregular outer margin and shorter inner margin to fw, as well as a more triangular hw.

MALE
Antennae : filiform, fasciculate, white near base.
Head : frons and vertex cream colour; four crests: one between antennae, one on upper part of frons and one under base of each antenna; palpi light brown.
Thorax : tegulae cream surrounded with blackish and provided with long greyish olive fringes; a prominent greyish olive and white dorsal crest immediately behind tegulae; patagia cream distally, greyish olive proximally; dorsum greyish olive, cream at centre; thorax below cream coloured laterally, Benzo brown ventrally with a black spot with pale margin below each eye.
Abdomen : cream tinged with brown dorsally; crest on first abdominal tergite and anal tuft darker; lateral fringes almost white; fuscous below, speckled lightly with pale scales.
Legs : inner surface fuscous, external surface cream fringed with brown; tibial spines fuscous tipped with white.

Upperside

Forewing : narrow and elongated, inner margin ⅔ of costa, convex; outer margin strongly crenulate, produced at veins 4 and 7; costa broadly dark purple brown mottled with blackish and with some pale scales almost as far as apex; a broad cream coloured band parallel to costa from base to end of veins 7 and 8 enclosing a dark olive buff rather oval orbicular spot and a reniform spot of the same colour, as well as some indistinct very pale olive markings; a very irregular oblique greyish olive band with zig-zag margins from basal convexity of inner margin to outer margin at veins 4 to 7, enclosing a prominent blackish spot in the base of cellules 3 and 4 as well as the extremely crenulate and oblique postmedial band which is incomplete and mainly marked by dark dots at the veins; a pale cream zig-zag from la near inner margin to outer margin at vein 4; a very narrow subterminal cream coloured line from inner margin lobe to vein 3; termen narrowly dark fuscous from tornus to apex except at veins 4, 7 and 8; cilia greyish olive except at veins 4, 7 and 8, where they are cream coloured.

Hindwing : triangular, with well defined apex and tornus; ground colour white, somewhat darker at inner margin; costal and apical areas grey; a brownish red terminal line from apex to 1b; cilia white, mixed with brownish red.

Underside

Forewing : costa mostly white scattered dark scales; remainder of wing fuscous, paler from cubitus and vein 3 to inner margin; a broad zig-zag cream band from apex to vein 2, reaching margin at veins 8, 7 and 4; a rather faint, fuscous, regular postmedial band from near costa to inner margin; cilia reddish brown darker distally.

Hindwing : white, lightly scaled from inner margin to vein 5; costa and apex densely scaled, white speckled with blackish scales from base to vein 5; apical area grey; an irregular blackish line from costa to vein 5, being the continuation of the fw postmedial, but much more distinct; termen and cilia as on upperside.
Measurements : fw, base to apex 19-21 mm.
Genitalia : median portion of tegumen membranous; uncus bilobed at base, then issuing into a single long stout hook armed with a small patch of bristles halfway down its dorsum; valve broad and blunt, provided with a bilobed harpe, one lobe at apex and one lobe at inner margin; harpes asymmetrical; two strongly sclerotised pointed projections at inner margin of right valve, absent in left valve; aedeagus short, stout and strongly curved.

FEMALE

Unknown.

Holotype ♂ : Amani, Usambara, Tanganyika, G. Pringle, to be deposited in the British Museum (Natural History).
4 ♂ Paratypes : same data and collector, in the National Museum, Nairobi.
1 ♂ Paratype : Rugege Forest, Ruanda District, Lake Kivu, 7,000 ft., XII-1921, T.A. Barns, in the British Museum (Natural History).

NOCTUIDAE WESTERMANNINAE

AITETA PULCHERRIMA sp. nov. (Figs. 16 & 49)

Allied to A. meterythra Hampson, but differs in having a darker and more variegated fw and an orange hw.

MALE
Antennae : brown, filiform, bifasciculate.
Head : frons and vertex Hessian brown, palpi madder brown.
Thorax : Hessian brown above; tegulae surmounted by erect crests; below pale ochraceous buff laterally, light ferruginous ventrally.
Abdomen : mainly ochraceous buff above; first four tergites with dark brown dorsal crests; three terminal segments purple brown; anal tuft purple brown tipped with brick red; ventral aspect covered in long apricot buff hairs shading to ferruginous posteriorly.
Legs: coxae and femora ferruginous, hind femora paler; fore tibiae Hessian brown, fore tarsi whitish proximally, Hessian brown distally; mid tibiae and tarsi somewhat paler; hind tibiae covered in long ochraceous salmon hairs, darker distally; a long brown hair pencil at base of hind tibia.

Upperside

Forewing : shaped as in A. meterythra; ground colour glossy Hessian brown, mottled with pale vinaceous pink; antemedial band wavy, pale vinaceous pink bordered with blackish, from costa at ¼ from base to middle of hind margin; an irregular pale vinaceous pink spot with very diffuse margins in middle of DC; a blackish stigma at end of cell; postmedial like antemedial, very wavy, from beyond middle of costa to tornus; subterminal band dark brown edged with pinkish from costa at ¾ from base to tornus, sharply angled distad at veins 3 and 4; a short pinkish preapical band; cilia Hessian brown at apex and tornus and at internervular spaces, pinkish at veins 2,3,4,5 and 6.

Hindwing : uniformly ochraceous buff shading to ochraceous orange at apex and termen.

Underside

Forewing : ground colour apricot orange, brighter in DC and from costa to vein 6; costa narrowly ferruginous; basal half of wing below cubitus warm buff with strong pearly sheen; cilia ferruginous, paler at the veins.

Hindwing : uniformly ochraceous buff; costa and cilia ochraceous orange.

Measurements : fw, base to apex 15 mm.

Genitalia : tegumen short and slender; uncus very slender, almost straight, much shorter than end of valve; valves long, membranous; a strongly chitinised plate provided with numerous lamellae on ventral surface of valve, near base; Aedeagus short, very slightly arched; vesica armed with a very stout spine.

FEMALE

Unknown.

Holotype ♂ : Katera, Sango Bay, Masaka, Uganda, X-1960, R.H. Carcasson, to be deposited in the British Museum (Natural History).
♂ Paratypes 2 : data as above, in the National Museum, Nairobi.

NOCTUIDAE HADENINAE

DIAPHONE NIVEIPLAGA sp. nov. (Figs. 19 & 52)

Differs from other species of the genus in being smaller and darker.

FEMALE

Antennae : filiform and simple.
Head : frons and vertex greyish olive; a light yellow ochre spot at base of each antenna; palpi light yellow ochre.
Thorax : rubbed above, but showing indications of greyish olive ground colour and yellow ochre spots; below plain greyish olive.
Abdomen : tergites blackish anteriorly, yellow ochre posteriorly producing an effect of alternate transverse yellow and black bands; blackish laterally and ventrally.
Legs : deep greyish olive, banded and spotted with yellow ochre.

Upperside

Forewing : ground colour greyish olive, probably darker and brighter in a fresh specimen; a short yellow ochre streak in DC from base to subbasal line; a thick black subbasal line from costa to la; a

thick black medial line thickened at costa, evenly curved distad to la and then straightening to inner margin at ⅓ from base; area between subbasal and medial pure white from costa to la; a square black spot just beyond middle of costa; a thick black line from interior of DC, at a point posterior and proximal to black costal spot sharply angled distad at vein 3, thence coalescing with incomplete postmedial and reaching inner margin at ¾ from base; a large white area representing reniform spot, limited proximally by black line in cell, posteriorly by curve of black line at vein 3 and distally by a short black line in space 5, which is part of the incomplete postmedial; postmedial edged distally with whitish from costa to inner margin, even where it is obsolete; a complete series of pale submarginal spots; cilia chequered grey and yellow ochre.

Hindwing : uniform greyish olive; a faint black medial line from vein 5 to tornus; termen narrowly yellowish; cilia yellowish.

Underside

Uniformly greyish olive with upperside markings showing through; basal area of fw paler; black medial line of hw present, faintly indicated in fw.

Measurements : fw, base to apex, 16 mm.

Genitalia : lobes fairly prominent, only slightly hairy, ductus very short; bursa ovoid, armed with two very small minutely spinose pear-shaped signa.

MALE

Unknown.

Holotype ♀ : Malka murri, Mandera, Northern Frontier District, Kenya, X-1951, Boundary Commission, to be deposited in the British Museum (Natural History).

NOCTUIDAE CATOCALINAE

TOLNA BURDONI sp. nov. (Figs. 23 & 54)

Allied to T. hypogrammica Hampson, but larger and differently marked.

FEMALE

Head and Thorax : various shades of brown above, drab below.

Abdomen : hair brown above, drab below.

Legs : drab; femora and tibiae covered in long hair.

Upperside

Forewing : ground colour dusky drab; basal, subbasal, antemedial, postmedial and subterminal bands black edged with pale greenish scales; antemedial and postmedial incomplete, joining together at vein 2, enclosing black reniform spot; orbicular spot black, small and inconspicuous; subterminal crenulated and deeply angled distad at vein 6, black, edged distally with very pale greenish and from costa to vein 6 by a broad pale preapical bar; a black spot at apex followed by a brown line parallel to subterminal; internervular spaces blackish outside brown line; termen narrowly black with a complete series of small black dots edged distally with white between veins; cilia concolorous with wing, margin deeply crenulated.

Hindwing : ground colour hair brown; a white apical spot from costa to vein 6; a grey submarginal band from apical spot to tornus; cilia greyish brown with a darker line parallel to margin from tornus to middle of cellule 4, thence pure white to costa; margin deeply crenulated.

Underside

Ground colour drab; basal half of both wings darker grey, becoming blackish in cell of fw; a dark stigma in hw; a broad pale diffuse fascia from beyond middle of costa to tornus of fw enclosing a crenulated fuscous postmedial band which is continued in hw; outer marginal band pale drab in both wings, with small black terminal dots in internervular spaces; cilia pale grey edged distally with fuscous, except from costa to cellule 4 of hw, where they are mixed with white.

Measurements : fw, base to apex 31 mm.

Genitalia : lobes very small, ductus wide and striated; ostium protected by a strongly sclerotised bilobed operculum; proximal rim of ostium strongly chitinised.

MALE

Unknown.

Holotype ♀ : Mufindi, Iringa, Tanganyika. P. Burdon, to be deposited in the British Museum (Natural History).

ACHAEA SEMIFLAVA sp. nov. (Figs. 23 & 53)

Allied to A. praestans Guenee, but easily distinguished by the much greater extension of the yellow area of the hw.

FEMALE

Head, body and legs : greyish black.

Upperside

Forewing : markings typically noctuine, not simplified or reduced, but inconspicuous owing to the extreme darkness of the ground colour which is very dark brown, almost black; apical and tornal areas paler brown; markings of basal half formed by yellow scales on a very dark purplish brown background, producing a deep greenish effect; stigma and base of cellules 1b, 2 and 3 more decidedly yellow; a complete series of small yellow terminal dots between ends of veins.

Hindwing : entirely antimony yellow except for a blackish brown inner marginal area stretching from base to just beyond vein 3 at margin.

Underside

Forewing : distal half of wing brownish black from middle of costa to tornus; apex and costa brownish olive; a small brownish black area at base of 1b, remainder of wing antimony yellow.

Hindwing : as upperside, but inner marginal area not so dark.

Measurements : fw, base to apex, 28-30 mm.

Genitalia : lobes moderate, slightly hairy; ductus very short, strongly sclerotised; bursa rounded, without signa; ostium protected by a large bilobed operculum.

MALE
Unknown.

Holotype ♀ : Kalinzu Forest, Ankole, Uganda, XI-1961, R.H. Carcasson, to be deposited in the British Museum (Natural History).
1 Paratype ♀ : locality as above, I-1965, J. Scheven in the National Museum, Nairobi.

NOCTUIDAE PLUSIINAE

PLUSIA EUCHROIDES sp. nov. (Figs. 22,43 & 45)

Very closely allied to P. euchroa Hampson, but differs in being larger, more robustly built, with a less sinuous subterminal and a more curved antemedial.

MALE
Head, thorax and legs : deep greyish olive, abdomen paler; a very prominent anal tuft, very slightly yellowish.

Upperside
Forewing : outer margin very regularly curved, without crenulations; ground colour dark greyish olive with a slight metallic lustre; base and area surrounding end of DC submetallic coppery; basal reaches radius only; subbasal from radius to inner margin, strongly curved distad; antemedial bifurcated from radius to vein 2 to form oblique oval loop enclosing an area of ground colour, thence curving proximad at vein 2 and reaching inner margin at ⅔ from base; postmedial very sinuous, merging with antemedial at vein 2; subterminal parallel to termen from costa to vein 6, then curving away from termen very gradually, to rejoin it at tornus; termen consisting of two pale narrow parallel lines separated by a very narrow darker one; cilia paler than ground colour.

Hindwing : greyish olive, paler at base; in some specimens there are faint traces of a postmedial band; termen and cilia as in fw.

Underside
Uniform greyish olive, paler at the base, with subterminal of fw showing faintly and postmedial of hw more distinct in some specimens.
Measurements : fw, base to apex 17-18 mm.
Genitalia : uncus very long, slender and evenly arched; valves long, narrow and pointed; entire ventral margin armed with evenly spaced curved bristles; juxta long and slender; aedeagus long, slightly arched; vesica armed with two very long stout spines and seven smaller ones.

FEMALE
Similar to ♂, but larger and lacking prominent anal tuft.
Measurements : fw, base to apex 20 mm.
Genitalia : lobes pointed; bursa irregular and angular; ductus long, elbowed and fluted, flaring out at ostium; signa absent.

Holotype ♂ : Kalinzu Forest, Ankole, Uganda, XI-61, R.H. Carcasson.
Allotype ♀ : Nairobi, Kenya V-1961, R.H. Carcasson; Holotype and Allotype to be deposited in the British Museum (Natural History).

♂ Paratypes : 1, Kalinzu Forest, Ankole, Uganda, XI-1961, R.H.Carcasson;
1, Budongo Forest, Uganda, XI-1964, E.S. Brown;
1, Jacaranda Research Station, Ruiru, Kenya, IV-1960;
1, Nakuru, Kenya, 26-III-1940, A.L.H. Townsend.
Paratypes in the National Museum, Nairobi.

PLUSIA ROSEOFASCIATA sp. nov. (Figs. 21,44 & 48)

Closely allied to P. sestertia Felder, but may be readily distinguished by the single rhomboid silvery spot below the cubitus.

MALE
Head : frons and vertex tawny olive; palpi cream buff, two basal segments heavily speckled with blackish.
Thorax : tegulae tawny olive, posterior margin white; mesothorax blackish, patagia blackish anteriorly, white posteriorly; metathoracic crest white, tinged with coral pink; ventral surface deep olive buff.
Abdomen : cartridge buff above and below; anal tuft yellowish or greyish.
Legs : fuscous with cartridge buff rings on tibiae and tarsi.

Upperside
Forewing : ground colour metallic dark olive buff with brassy sheen in some lights, almost black in others; a subbasal silvery white area enclosing a coral pink spot in 1b, edged distally by a narrow wavy blackish line and surmounted costad by a large subtriangular black spot with base resting on costa and apex below cubitus; costa from black subbasal spot to postmedial variegated silvery white, dark grey and black; DC grey with a coral pink diagonal cross bar; end of cell black with a narrow, indistinct, incomplete silvery reniform ring; a prominent silvery rhomboid spot narrowly edged with black in centre of wing, occupying area between cubitus and middle of vein 2; area enclosed by subbasal spot, cubitus, silvery rhomboid, postmedial and inner margin dark olive buff with strong metallic lustre; area between silvery rhomboid, postmedial and reniform, black; area between end of cell and postmedial metallic dark olive buff; postmedial fascia coral pink shading to white and then to metallic dark olive buff distally, edged proximally by a narrow, irregular black line from radius at ⅔ from base to beyond middle of inner margin; a black costal dot immediately above origin of postmedial and one at inner margin at end of postmedial; metallic submarginal area beyond postmedial shading to black at costa and from vein 7 to vein 3 where it touches white terminal band; white terminal band very irregular, enclosing a prominent black spot at apex, forming a deep, sharp indentation proximad at vein 5 and another at vein 2 and completely interrupted at veins 4 and 3, where the dark submarginal band reaches termen; each white terminal indentation at veins 5 and 2 enclosing a coral pink spot; cilia white except at apex and at cellule 3, where they are blackish; a few blackish scales in fringe at ends of other veins.

Hindwing ; uniform deep greyish olive, paler at base; cilia paler.

Underside
Forewing : greyish olive with silvery rhomboid showing faintly as a pale central spot and the two white terminal wedges at 5 and 2 distinct and greyish white.

Hindwing : dark greyish olive, basal half and narrow terminal margin paler.

Measurements : fw, base to apex 12-14 mm.
Genitalia : Uncus extremely long and slender; valves long and slender, armed with a long, slender projection at costa; aedeagus long and stout, armed with a tuft of strong spines near apex; vesica with numerous small spines.

FEMALE
Similar to ♂, but lacking anal tuft.
Genitalia : lobes moderate, ductus very long, slender and striated; signa absent.

Holotype ♂ : Amani, E. Usambara, Tanganyika, X-1963, G. Pringle.
Allotype ♀ : Nairobi, Kenya, VI-1957, R.H. Carcasson; Holotype and Allotype to be deposited in the British Museum (Natural History).
♂ Paratypes : 1, Amani, E. Usambara, Tanganyika, V-1961, G. Pringle.
1, locality as above, II-1953, E. Pinhey.
1, Bwamba, Toro, Uganda, IX-1961, N. Mitton.
Paratypes in the National Museum, Nairobi.

NOCTUIDAE OPHIDERINAE

CALESIA CRYPTOLEUCA sp. nov. (Figs. 26,46 & 55)

This species has no close allies and has a short third segment to the palpus, as in C. othello Fawcett.

MALE
Antennae : blackish, ciliate.
Head : vertex, frons and palpi, ochraceous buff.
Thorax : ventral surface and tegulae ochraceous buff, patagia ochraceous buff shading to citrine drab.
Abdomen : citrine drab above and below; anal tuft tinged with buff.
Legs : ochraceous buff.

Upperside
Forewing : uniformly citrine drab.

Hindwing : white with a broad, regular citrine drab outer marginal band; veins blackish in white area.

Underside
Like upperside, but dark border of hw slightly narrower.
Measurements : fw, base to apex 24-25 mm.
Genitalia : uncus very slender; gnathos spatulate, terminating in two cushions of small bristles; valve bilobed, upper lobe hairy, lower lobe terminating in two widely separated points; a strong harpe projecting inwards from upper lobe; aedeagus short and straight, apex rather convoluted.

FEMALE
Similar to ♂, but antennae more slender and not ciliate.
Genitalia : lobes prominent, slightly sclerotised, almost hairless; ductus short, well sclerotised, funnel shaped, provided with two sac-like extensions near ostium; bursa cylindrical, inner surface armed with numerous small spines pointed towards ostium.

Holotype ♂: Bwamba, Toro, Uganda, II-III-1957, R.H. Carcasson.

Allotype ♀ : locality as above, IX-1961, N. Mitton.
Holotype and Allotype to be deposited in the British Museum (Natural History).
♂ Paratypes : 1, Entebbe, Uganda, IX-1954, J.A. Burgess.
1, Malaba Forest, Kakamega, Kenya, VI-1957, C. Howard.
♀ Paratypes : 2, same data as Allotype.
Paratypes in the National Museum, Nairobi.

CALESIA CAPUT-RUBRUM sp. nov. (Figs. 17, 47 & 56)

Allied to C. othello Fawcett, but larger, paler and antennal cilia of ♂ much longer.

MALE
Antennae : shaft pale olive buff; cilia long, thickened and blackish at base.
Head : vertex and frons coral red; basal segment of palpus reddish, second and third somewhat ochreous; last segment short.
Thorax : tegulae pale olive buff mixed with some dark olive and red scales; patagia pale olive buff more or less speckled with dark olive scales; a prominent coral red crest on posterior part of dorsum; ventral surface pale olive buff with a tinge of brown.
Abdomen : pale olive brown with a tinge of brown above and below.
Legs : somewhat darker than abdomen; femora of first pair coral red anteriorly.

Upperside
Forewing : ground colour pale olive buff with a tinge of brown, more or less speckled with dark olive scales; a rounded, very pale stigma at end of DC; postmedial pale olive buff, free of dark scales, rather indistinct, angled proximad at vein 2; subterminal free of dark scales, clearly defined and irregular, being sharply angled proximad in cellules 2, 5 and 7 and edged proximally with dark olive shading gradually to pale olive buff at postmedial; veins free of dark scales in outer marginal area; cilia pale olive buff mixed with dark olive.

Hindwing : uniformly pale olive buff with a brownish tinge, free of dark scales; an irregular, rather indistinct subterminal band consisting of rather widely spaced dark olive scales, particularly prominent at tornus; outer margin darkened by a sprinkling of dark olive scales; cilia paler than in fw.

Underside
As above, but dark speckling less pronounced and more uniform; subterminal irregular, dark olive, interrupted at the veins, equally developed in both wings.
Measurements : fw, base to apex 23-25 mm.
Genitalia : Uncus short, stout and terminating in two short, widely separated lobes; valves broad and short, upper lobe membranous; aedeagus short, curved, with a row of small terminal spines.

FEMALE
Similar to ♂, but antennae more slender and not ciliated; submarginal band of hw less pronounced.
Genitalia : lobes moderate, almost hairless; ductus very short; ostium provided with two lateral sack-like bodies; bursa cylindrical, armed internally with numerous short spines.

Holotype ♂ and Allotype ♀ : Kalinzu Forest, Ankole, Uganda, XI-1961, R.H. Carcasson, to be deposited in British Museum (Natural History).
♂ Paratypes : 5, same data as above.
1, locality as above, III-1965, J. Scheven.
♀ Paratypes : 1, same data as Holotype.
3, Fort Portal, Toro, Uganda, III-1959, R.H. Carcasson.
1, Bwamba, Toro, Uganda, IX-1961, N. Mitton.
Paratypes in the National Museum, Nairobi.

LACERA APICIRUPTA sp. nov. (Figs. 18,57 & 59)

Differs from L. alope Cramer in the more elongated wings, and more pronounced emargination of the fw apex; the variegated underside pattern suggests that L. apicirupta probably adopts the same butterfly-like resting position as L. alope.

MALE
Antennae : filiform, fuscous.
Head : vertex and frons fuscous black, palpi sayal brown.
Thorax and abdomen : clothed in long fuscous hairs tipped with pale grey; darker below.
Legs : fuscous black, tarsi ringed with cream buff.

Upperside
Forewing : costa only slightly arched, apex blunt and termen strongly emarginate from vein 7 to vein 4, and very oblique from 4 to tornus, so that the transition from the termen to the rather strongly arched inner margin is not clearly marked; ground colour fuscous, densely speckled with pale grey scales, producing a general mousy grey effect; medial fascia dark, faint, angled distad at end of cell; postmedial better defined, dark, wavy, very sharply angled towards apex in cellule 6; three small white dots in distal half of costa; a broad pinkish buff terminal spot from apex to vein 4 enclosing a strongly crenulated submarginal line of a darker hue; a straight pinkish buff submarginal band from vein 4 to 2, continued to tornus by a narrow dark line; termen fuscous black from vein 3 to tornus; cilia pinkish buff from apex to vein 4, fuscous from 4 to tornus.

Hindwing : margin strongly produced at vein 4, emarginate from 4 to 6; ground colour fuscous, without pale grey scales; a faint dark postmedial line; a conspicuous, strongly crenulated pinkish buff submarginal band, wider at costa, almost obsolete at tornus, edged distally with fuscous; terminal area pinkish buff with four internervular black spots from apex to vein 4, the largest being in 6; termen fuscous, densely speckled with pale scales from 4 to tornus; cilia similar to termen, darker at the veins.

Underside
Forewing : fuscous black; pinkish buff apical area reduced, but standing out in sharp contrast with remainder, marked with a distinct, oblique blackish cross bar in space 6 and by another in 7; postmedial clearly visible from vein 6 to inner margin; submarginal band from 4 to tornus clearly visible, but pinkish buff areas almost obsolete; marginal area from vein 4 to tornus very densely suffused with pale grey, somewhat silvery.

Hindwing : basal area fuscous black; remainder strongly suffused with grey, particularly near margin; antemedial irregular, narrow and

blackish; a long, narrow irregular black stigma at end of cell, surrounded by a conspicuous pale rectangular area; postmedial black, narrow and iregular, but complete; subterminal buffish, strongly crenulated, complete; a prominent black terminal triangle in space 6.
Measurements : fw, base to apex 19 mm.
Genitalia : Uncus long, slender, downcurved; valves rather blunt, with a central membranous area and a cushion of dense, minute spines near apex; scaphium terminating in two cushions of spines; aedeagus small and slender, proximal end shaped like an anvil.

FEMALE
Very similar to ♂, but larger.
Measurements : fw, base to apex 24 mm.
Genitalia : lobes elongated; ductus membranous, rather long; bursa spherical; struts long and flattened.

Holotype ♂ : Kalinzu Forest, Ankole, Uganda, XI-1961, R.H. Carcasson, to be deposited in the British Museum (Natural History).
Allotype ♀ : data as above, in the National Museum, Nairobi.

ACTIIDAE SPILOSOMINAE

TERACOTONA LATIFASCIATA sp. nov. (Figs. 25 & 40)

Allied to T. submacula Walker, but differs in having the fw bands broader and darker and the hw uniformly ochraceous buff.

MALE
Antennae : blackish.
Head : vertex and frons pale ochraceous buff, palpi black.
Thorax : pale ochraceous buff with a darker suffusion on dorsum; a small black dot at base of each wing and a larger one in centre of each patagium; ventral surface brown anteriorly, shading to pale pinkish buff.
Abdomen : base covered by long ochraceous buff hairs; remainder of dorsal surface more yellowish, with a black transverse band on each tergite and a series of black lateral dots on each side; ventral surface paler, without black spots.
Legs : femora and tibiae pale ochraceous buff externally, coral red internally, with a black distal ring; tarsi black.

Upperside
Forewing : ground colour pale ochraceous buff irrorated with clove brown; antemedial irregular and indistinct, clove brown; medial fascia clove brown, irregualr and very broad, except at costa; postmedial clove brown, broad, but irregular, usually strangulated in the middle; a small dark stigma at end of cell and a clove brown spot near outer margin from middle of space 2 to middle of 4; cilia pale ochraceous buff mixed with clove brown.

Hindwing : Uniformly ochraceous buff, more yellowish in some specimens; a black dot always present at end of cell; sometimes two extra black spots near tornus.

Underside
Forewing : cinnamon buff, a distinct black spot at end of cell; costa and apex pale ochraceous buff heavily irrorated with brown.

Hindwing : cinnamon buff, darker and slightly irrorated with pinkish at costa.
Measurements : fw, base to apex 18-21 mm.
Genitalia : uncus broad and stout; valves simple, weak, very slender, shorter than uncus; juxta broad and flat; aedeagus short, straight and stout.

FEMALE
Unknown.

Holotype ♂ : Oldeani, Tanganyika, V-1961, J. Kielland, to be deposited in the British Museum (Natural History).
♂ Paratypes : 1, Oldeani, Tanganyika, 25-IX-1943.
3, Dodoma, Tanganyika, III-1950, N. Mitton.
Paratypes in the National Museum, Nairobi.

LIMACODIDAE

COSUMA RADIATA sp. nov. (Figs. 27,38.50 & 58)

Nearest to C. polana Druce, but differs in having narrower, more elongated wings and a more robust body, particularly in the ♂.

MALE
Antennae : black, heavily bipectinate.
Head : frons antimony yellow, palpi blackish with some yellow at base.
Thorax : tegulae yellow ochre edged with black, forming a black collar; patagia light buff edged with black; dorsum light buff with a longitudinal black line; ventral surface mainly antimony yellow with some blackish laterally.
Abdomen : yellow ochre above; a sepia brown dorsal crest on first segment, some dark hairs on all tergites; ventral surface antimony yellow; a short black line on each side of each segment, thickening ventrally to form two black longitudinal bands on either side of ventral surface.
Legs : mainly blackish with some light buff hairs on femora.

Upperside
Forewing : ground colour sepia brown; a small light buff spot at base; a whitish streak below cubitus, near base, and a longer, narrower and fainter whitish streak in DC; an oblique oval white spot from below cubitus to middle of inner margin; a second such spot near costa, beyond cell; a complete series of indistinct pale terminal spots in internervular spaces and a tendency for the veins to be darker, giving a rayed effect; cilia sepia.

Hindwing : inner margin and costa yellow ochre; veins sepia, internervular spaces paler, giving same rayed effect as in fw.

Underside
Costa of fw blackish, remainder of both wings antimony yellow, veins heavily outlined in sepia.
Measurements : fw, base to apex 18-20 mm.
Genitalia : Uncus short and slightly spatulate, with a strong terminal spine; gnathos a strong, curved, simple spine; valve simple; a broad plate-like process at base of each valve; juxta very short and broad; aedeagus long and slender.

FEMALE

Larger and paler than ♂.

Antennae : black, shortly serrate.

Head, body and legs : as in ♂, but dorsal surface of thorax paler (cartridge buff).

Upperside

Forewing : ground colour cartridge buff; veins outlined in sepia, the two oval spots as in ♂, but heavily edged with sepia and connected with one another by a short thick sepia bar; lower oval spot connected with base by thick sepia bar along la; termen and inner margin narrowly sepia, cilia sepia.

Hindwing : uniformly antimony yellow; costa narrowly sepia; a thick, strongly crenulated terminal sepia band; cilia sepia.

Underside

Antimony yellow; a thick strongly crenulated sepia terminal band in both wings; veins outlined in sepia near apex and tornus of fw; fw markings faintly visible from upperside.

Measurements : fw, base to apex 26 mm.

Genitalia : lobes reniform, very prominent; ductus membranous, very long and slender; bursa small, spherical; a cushion of broad scales below ostium.

Holotype ♂ and Allotype ♀ : Ilonga, Kilosa, Tanzania, 1-III-1965, Mrs. A. Chambers, to be deposited in the British Museum (Natural History).

♂ Paratypes : 2, same data as Holotype.

♀ Paratypes : 2, Mikumi (1750 ft.), Morogoro district, Tanganyika, 2-III-1963, Mrs. Marsh.

Paratypes in the National Museum, Nairobi.

(Received 15th May, 1965)

EXPLANATION OF PLATES

PLATE I (Figures slightly enlarged)

Fig. 1. Pseudathyma neptidina jacksoni ♂
Fig. 2. Pseudathyma neptidina jacksoni ♀
Fig. 3. Pseudathyma neptidina neptidina ♂
Fig. 4. Najas sarcoptera nipponicorum ♀
Fig. 5. Alaena kiellandi ♀ underside
Fig. 6. Alaena kiellandi ♀ upperside
Fig. 7. Alaena kiellandi ♂ upperside
Fig. 8. Geodena aurea ♀
Fig. 9. Geodena cinerea ♂
Fig. 10. Geodena candida ♂
Fig. 11. Psilocerea melanops ♂
Fig. 12. Xylopteryx prouti ♀
Fig. 13. Blaboplutodes parvistictus ♂

PLATE II (Figures slightly enlarged)

Fig. 14. Aphilopota fletcheri ♂
Fig. 15. Colocleora ankoleensis ♂
Fig. 16. Aiteta pulcherrima ♂
Fig. 17. Calesia caput-rubrum ♂
Fig. 18. Lacera apicirupta ♀
Fig. 19. Diaphone niveiplaga ♀
Fig. 20. Neostichtis fulgurata ♂
Fig. 21. Plusia roseofasciata ♂
Fig. 22. Plusia euchroides ♀
Fig. 23. Achaea semiflava ♀
Fig. 24. Tolna burdoni ♀
Fig. 25. Teracotona latifasciata ♂
Fig. 26. Calesia cryptoleuca ♀

PLATE III

Fig. 27. Cosuma radiata ♂
Fig. 28. Cosuma radiata ♀

(Genitalia)

Fig. 29. Alaena kiellandi ♀ x 10
Fig. 30. Aleana kiellandi ♂ x 25
Fig. 31. Blaboplutodes parvistictus ♂ x 20
Fig. 32. Xylopteryx prouti ♂ x 20
Fig. 33. Xylopteryx prouti ♀ x 20
Fig. 34. Psilocerea melanops ♂ x 12
Fig. 35. Aphilopota fletcheri ♂ x 10

PLATE IV (Genitalia)

Fig. 36. Geodena cinerea ♂ x 12
Fig. 37. Geodena aurea ♂ x 12
Fig. 38. Colocleora ankoleensis ♂ x 12
Fig. 39. Geodena candida ♂ x 20
Fig. 40. Teracotona latifasciata ♂ x 12
Fig. 41. Geodena cinerea ♀ x 10
Fig. 42. Geodena aurea ♀ x 12

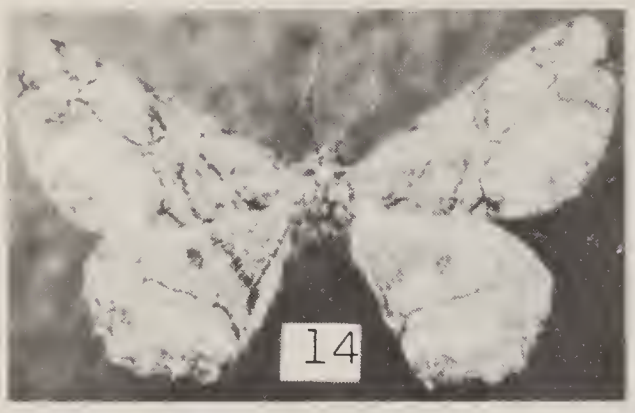
PLATE V (Genitalia)

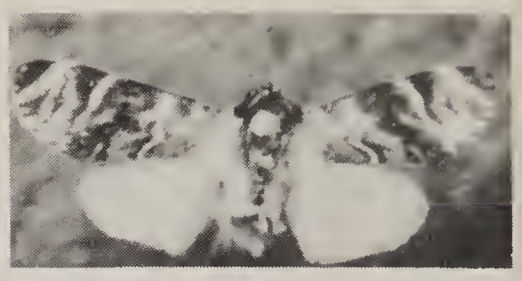
Fig. 43. Plusia euchroides ♂ x 9
Fig. 44. Plusia roseofasciata ♂ x 15
Fig. 45. Plusia euchroides ♀ x 9
Fig. 46. Calesia cryptoleuca ♂ x 8
Fig. 47. Calesia caput-rubrum ♂ x 8
Fig. 48. Plusia roseofasciata ♀ x 9
Fig. 49. Aiteta pulcherrima ♂ x 9
Fig.49b. As above, chitinised lamellae x 9
Fig. 50. Cosuma radiata ♂ x 8

PLATE VI (Genitalia)

Fig. 51. Neostichtis fulgurata ♂ x 9
Fig. 52. Diaphone niveiplaga ♀ x 6
Fig. 53. Achaea semiflava ♀ x 8
Fig. 54. Tolna burdoni ♀ x 9
Fig. 55. Calesia cryptoleuca ♀ x 8
Fig. 56. Calesia caput-rubrum ♀ x 8
Fig. 57. Lacera apicirupta ♂ x 14
Fig. 58. Cosuma radiata ♀ x 8
Fig. 59. Lacera apicirupta ♀ x 8

PLATE I





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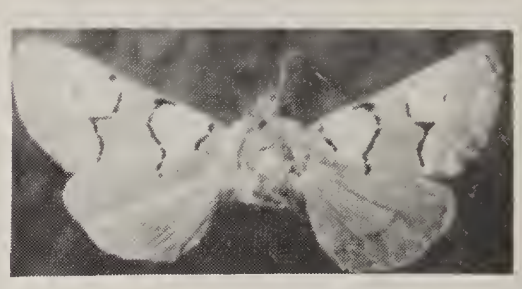

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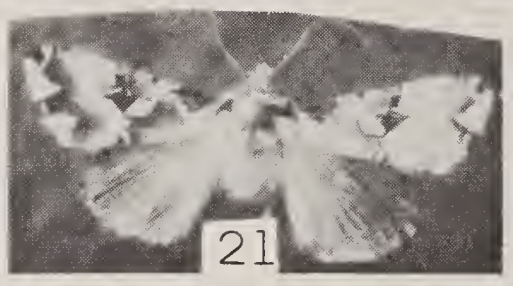

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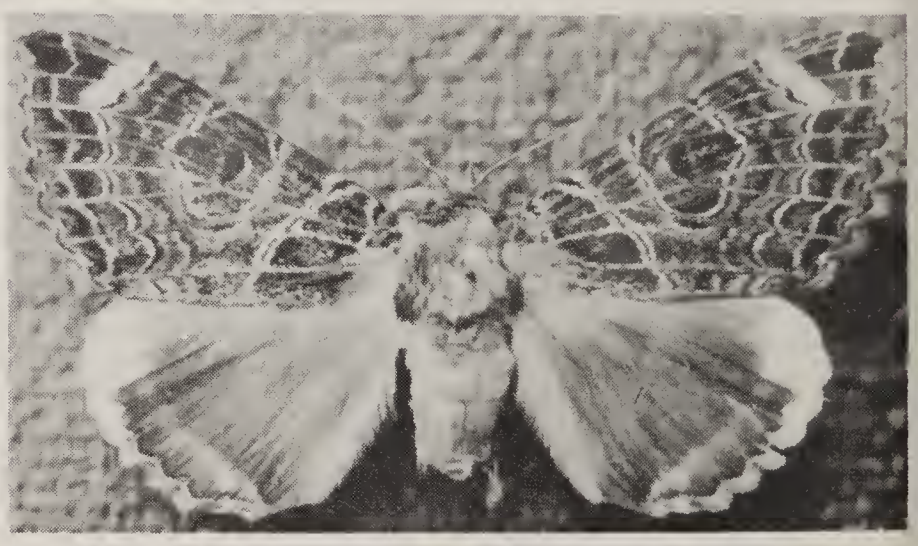

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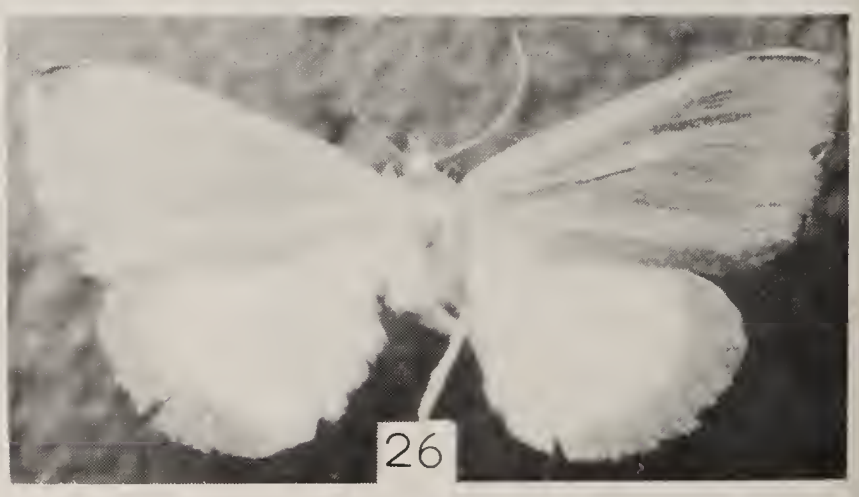

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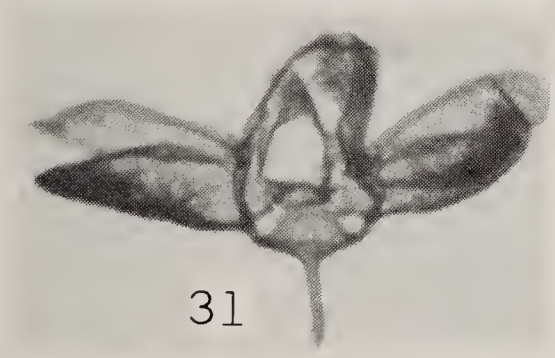

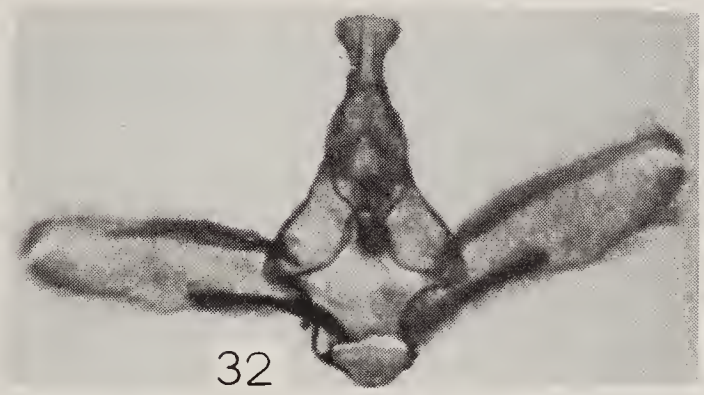

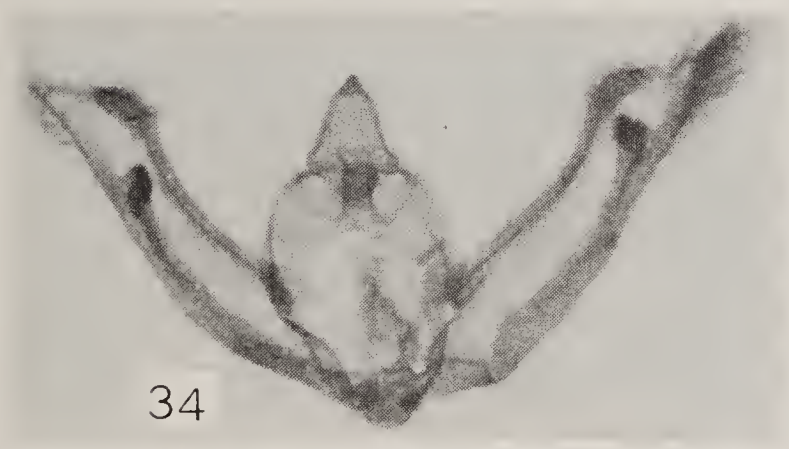

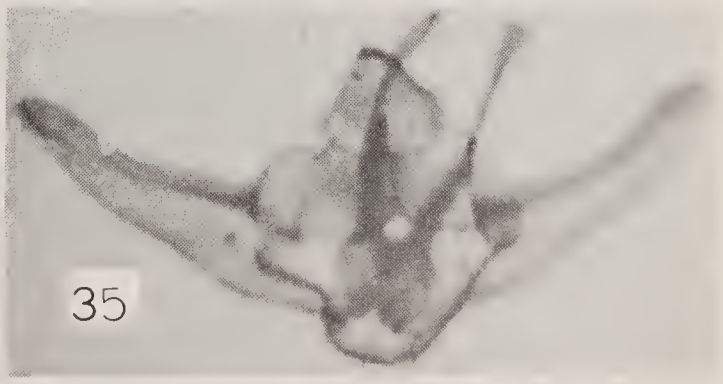

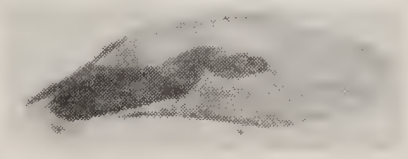

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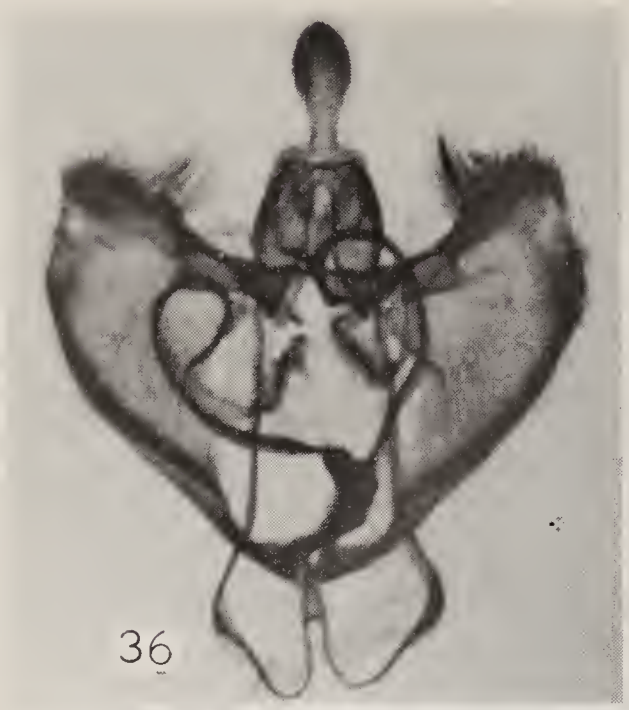
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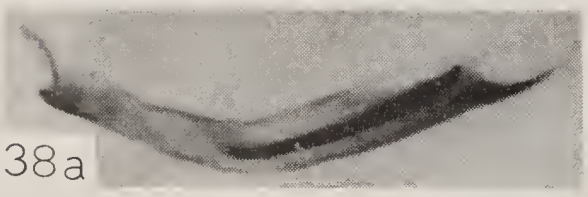
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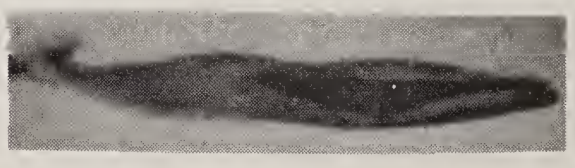
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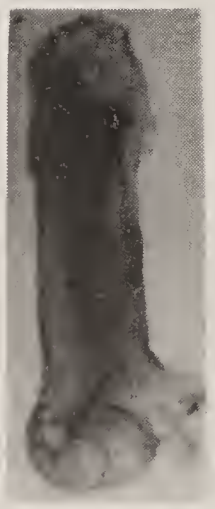
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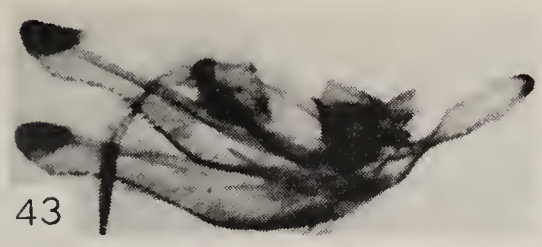
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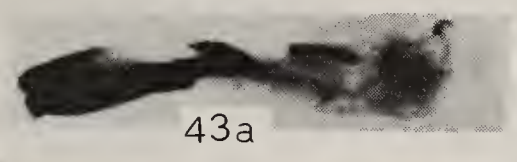
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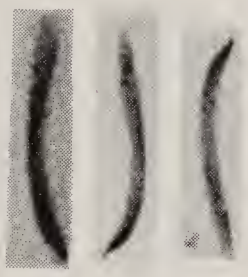
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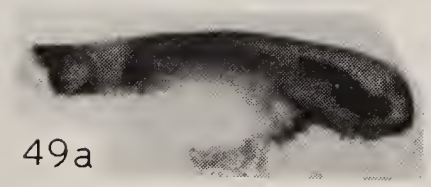
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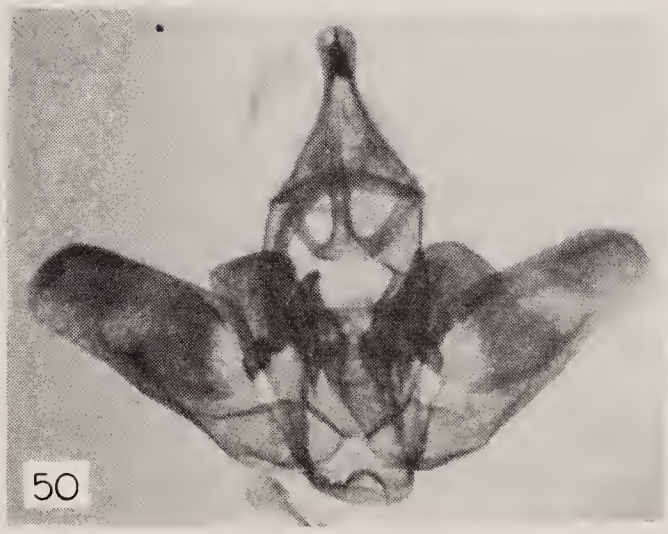
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PLATE V


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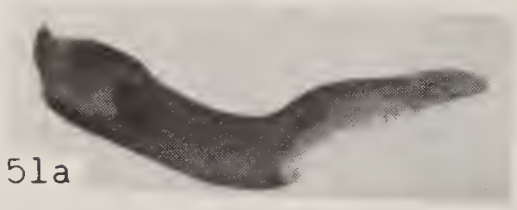
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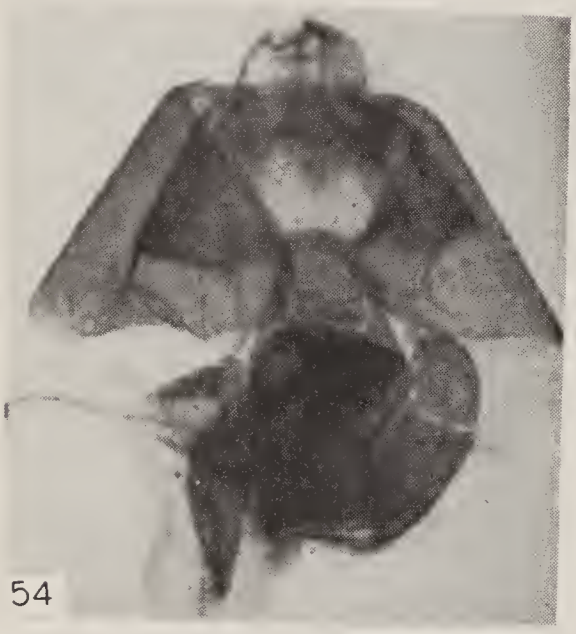
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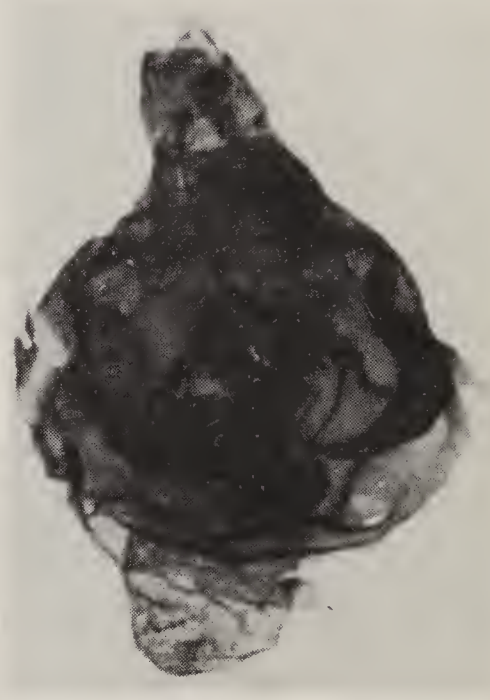


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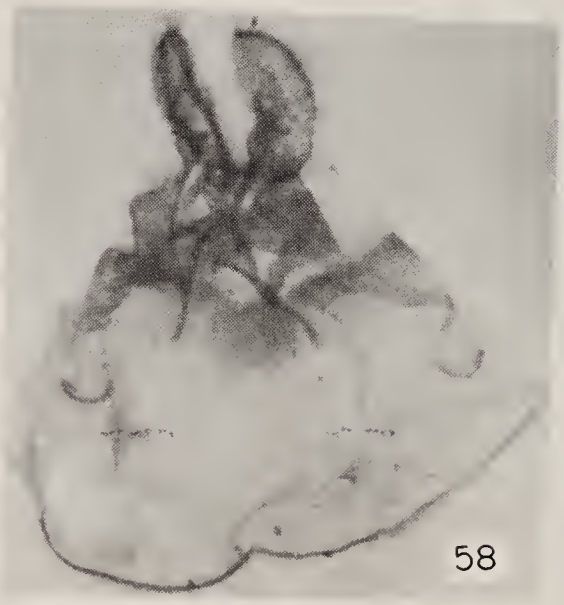
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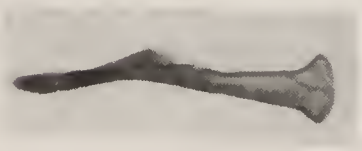
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PLATE VI

NATURE NOTES

A Dormouse Living in a Beehive

On the 11th Sept. 1964, while collecting in the region of the Peninj River, West Lake Natron, I had occasion to be up on the plateau above the escarpment bordering the lake watching a Sonja tribesman raiding one of his beehives. The raid was a disappointment - for the owner, that is - because the hive was heavily infested with wax - moth, Galleria mellonella Linnaeus. Amid angry bees the man removed handful after handful of the caterpillar's silk mixed with bits of broken comb and at last brought out, to my surprise, a dormouse, Graphiurus murinus (Desmarest).

The dormouse itself was an amazing sight, being quite incredibly fat. I later measured a layer of subcutaneous fat in the lower abdomen and found it to be 8 mm deep, besides which there was a large volume of fat surrounding the viscera. The stomach contained a brown sludge with fine white specks in it - presumably honey and wax. The measurements of this animal (C.M.C.6962. Preserved in spirit at the National Museum) are:- HB 96 mm; Tl 64 mm; HF 15.5 mm s.u.; Ear 15 mm; Wt. 40.5 gm. Adult ♀. measured when fresh.

On questioning the man, he told me that Galleria and Graphiurus invariably occur together in infected hives and that the Sonja, many of whom live entirely by bee-keeping, blame the dormouse for bringing the moths. Their very robustly built beehives have two entrances; one very small one for the bees, and one large enough for the honey collector to insert his arm and remove the comb. The latter hole is left tightly bunged with brushwood, and it is by making a hole through this bung that the dormouse enters the hive. The animal collects dry grass from beneath the tree and carries it into the hive to make a nest, and the caterpillars, I was told, are brought up from the ground together with the grass.

Galleria mellonella caterpillars live only on honeycomb so the Sonja's explanation of the joint occurrence is unacceptable. One wonders, however, whether there is a true association between the presence of Galleria and of Graphiurus in these hives and, if so, what is the nature of this association. Could it be that the making of a relatively large hole into the hive through the bung leaves a convenient, unguarded, entrance for the moth?

A. Duff-Mackay. 2/4/65

First Record of Snake from Uganda

Rhamphiophis acutus acutus (Günther)
= Psammophis acutus Günther, Ann.Mag.Nat.Hist. 1888. (6) 1, p.327.

Rhamphiophis acutus Boulenger, 1896, Cat. Snakes Brit.Mus. 3, p.148, 1915.

Two specimens of the above were taken at Murchison Falls by Mrs.J. Stoneman, and presented to the Nairobi Snake Park for the National Museum collection of Repriles. These snakes do not appear to have been recorded before from Uganda. Their range was believed to be southern Tanzania, west throuqh Zambia to Angola, northeast through the Congo to Ruanda and Burundi.

The details of the two specimens are as follows:

	A	B
Mid body scale rows.	17	17
Sub caudals (paired)	61	63
Ventrals	183	185
Anal	Divided	Divided
Length, total	630 mm	675 mm
Length of tail	115 mm	125 mm
Sex	♂	♂

These snakes bear a strong resemblance to Psammophylax tritaeniatus (Loveridge), but can be distinguished at once by the acutely pointed nose.

May we take this opportunity to remind the public that we are interested in any reptile specimens that they can produce for us.

Loveridge, A. 1957. Checklist of reptiles and amphibians of East Africa. Bull.Mus.Comp.Zool.Harv. Vol. 117, No. 2. p.277.

J.O.P. Ashe. 16/5/65

A Count of Crowned Cranes (Balearica regulorum (Bennett)) in the Kisii district, Kenya.

Kisii district is 757 square miles in area with an average population of 684 per square mile. The land lies between 4,800 and 6,200 ft. above sea level with a very evenly distributed rainfall varying from an average of about 50" per annum at the lower levels to 90" per annum in the highlands. There are many extensive permanent swamps, especially in Kitutu location.

In March 1963 the district Agricultural staff were asked, in the course of their work, to count the Crowned Cranes in their areas. The following record was made.

Location	No of cranes	Cranes per sq. mile.
N. Mugirango	288	2.00
Kitutu	383	2.00
Nyaribari	40	0.34
Bassi	64	0.68
Majoge	138	1.50
S. Mugirango	42	0.57
Wanjare	8	0.15
Total	863	Mean 1.14

There was probably little liaison between the persons doing the count and no account was taken of movement of birds over location boundaries or across the district boundary. The count does show a total population of over 800 cranes in 757 square miles with a human population density of over 650 to the square mile. As was to be expected, the highest crane densities were found in the locations with the largest areas of permanent swamp.

V.E.M. Burke. 17/5/65

SOME ADDITIONAL FIELD NOTES ON VIPERA HINDII Boulenger

RECEIVED FROM C.J.P. IONIDES ON 15th November 1964

In early November 1964, in a few days, Ionides collected forty-four *Vipera hindii* at an altitude of about 10,000 ft on the Aberdares, which seems to be a further indication that this snake is not uncommon, though only likely to be found plentifully by those who know its habits.

In a patch of grass not more than about 4 ft across he saw eight of these little vipers, seven of which were collected and proved to be ♂♂.

An example of the Variable Skink, *Mabuya varia varia* (Peters) was found in the stomack of a *V. hindii*.

An Augur Buzzard, *Buteo rufofuscus augur* (Rüpp.) was observed by Ionides at this high altitude to rise from the ground with a small snake - which could only have been *V. hindii* as no other snakes are recorded from this locality - in its talons.

(C.R.S. Pitman.)

BOOK REVIEW

"The Birds of Prey of the World"

By

Mary Louise Grossman and John Hamlet

Cassell 1965.

This large and handsomely presented volume is really an attempt at several books in one. Perhaps because of this it falls between several stools. The text is in two parts, the first a general review of birds of prey, with chapters on prehistory and evolution, legends and myths, including some history of falconry, ecology and habits, specialised adaptations for survival, and conservation. Though there is much good and interesting information in these chapters they cannot possibly be comprehensive in the space allowed, and some, notably that on habits and ecology would have been greatly improved by subheadings enabling the reader to separate e.g. migration from breeding behaviour. It is impossible, in fact, to compress the habits of all birds of prey including owls into one such chapter, and the information is consequently very general on any aspect of behaviour. The best of these preliminary chapters is that on anatomical adaptations for survival.

The second half of the book purports to be an Atlas and Field Guide and a "highly detailed reference supplement". It will be judged by East African ornithologists on its usefulness to them. As a field guide it is quite useless - the book weighs seven pounds and is of a bulk requiring a desk to study comfortably. The information in this section is presented by genera and not by species, and while this means fairly full treatment for monotypic or very small genera such as Stephanoaetus, Poliohierax, or Scotopelia it also means that if one wants to learn about Buteo rufofuscus, Accipiter tachiro or Falco biarmicus it is necessary to go through many pages to extract a few fragments of information which are then not as comprehensive as that available in other works.

This section is profusely illustrated with small maps and underwing patterns. The maps are frequently wrong - for instance neither Falco alopex nor Glaucidium perlatum occur throughout most of the Guinea Forests. However, this is a common fault of such maps, which are usually on a scale inadequate to show the full details of range. The underwing patterns of hawks are often misleading and inaccurate, for instance those of the Bateleur, Ayres and African Hawk Eagles, Tawny and Wahlberg's eagles to name a few. There is, unfortunately, no substitute for long field experience in such matters, while one also wants to be able to compare e.g. Wahlberg's Eagle with other species with which it might be confused in a region, and not with its nearest relatives alone, as the generic treatment dictates.

The photographs of birds of prey in action are the strong point of the book, and some of the sequences are magnificent. Most of them have been obtained with captive birds, but could not have been obtained in any other way. Of particular interest are some showing the use of the beak or other specialised structures in consuming prey. However,

even among these there are some in which the colour is distorted - the Black-shouldered Kite for instance is not purple - and some of the photographs obtained of wild birds are undistinguished.

This is a book that specialists may like to have on their shelves, even though the information it contains is not comprehensive and despite a very great waste of space - often fifty percent and in one case the whole of a page. However ordinary ornithologists will find the information for any particular country more readily available in other works. It would actually be impossible for the authors to have fulfilled their aim of producing a definitive work on all birds of prey without far greater compression than is here shown.

L.H.B.