

UNIVERSITY OF KHARTOUM
SUDAN

Natural History Museum

(Formerly Natural History Section of the Sudan Museum)

BULLETIN No. 2

**Some Aspects of the Fauna and Flora of the District
Around Wadi Halfa**

BY

A. PETTET, S. J. PETTET, J. L. CLOUDSLEY-THOMPSON AND
B. E. M. IDRIS.

●
PRICE P.T. 100
●

Printed by :
Government Printing Press

UNIVERSITY OF KHARTOUM
SUDAN

Natural History Museum

(Formerly Natural History Section of the Sudan Museum)

BULLETIN No. 2

**Some Aspects of the Fauna and Flora of the District
Around Wadi Halfa**

BY

A. PETTET, S. J. PETTET, J. L. CLOUDSLEY-THOMPSON AND
B. E. M. IDRIS.



PRICE P.T. 15



Printed by :
Government Printing Press

SUDAN NATURAL HISTORY MUSEUM

BULLETIN NO. 2

1964

INTRODUCTION

Wadi Halfa ($31^{\circ} 25' E$ $21^{\circ} 55' N$) lies in the Nubian desert on the Nile to the far north of the Sudan. The area is of especial biological interest for three reasons; it has one of the most extreme desert climates in the world, it lies between the Palaearctic and Ethiopian zoogeographical regions and it will be flooded by an enormous lake when the Aswan High Dam has been completed. For this reason, it seemed advisable to make a bioclimatic, floral and faunal survey of the area which could be used as a basis for comparison with any changes that might result from the flooding. The following account is based on observations made between September 24—October 1, 1962.

BIOCLIMATOLOGY (J.L.C.—T. AND B.E.M.I.)

Wadi Halfa enjoys one of the most extreme desert climates in the world as can be seen from Tables I and II which summarise climatic averages and extremes from 1902—1960. Rainfall is negligible, averaging only 3 mm. per year and this is most erratic, for most years have no rain at all while 19.4 mm. fell on July 24, 1950. The maximum temperature recorded was $52.5^{\circ}C$ ($126^{\circ}5 F$) on April 29, 1903, the minimum $-2.0^{\circ}C$ ($28.4^{\circ}F$) on December 26, 1917. During our visit the weather was fairly constant with maximum temperatures around $42.8^{\circ}C$ ($109^{\circ}F$) and minimum temperatures of about $22.0^{\circ}C$ ($71.6^{\circ}F$). It was therefore somewhat warmer than average for the time of year. The wind speed varied between 0 and 220 ft. min.

Interesting as these figures are when considered in relation to the flora of the area, from a zoological point of view they are of less significance than microclimatic

readings, taken in the retreats of animals which hide away during the hottest parts of the day (Cloudsley-Thompson, 1962).

Measurements of soil surface temperatures were taken on a number of occasions and very high readings were obtained. Of these, the most interesting series was made on September 29, 1962 at 13.30 hrs. when the following maximum temperatures were recorded:—

Air temperature (dry bulb)	...	38.5°C (101°F)
—relative humidity	20 per cent
Nile silt (sheltered from wind)	84.0°C (183°F)
—relative humidity	nearly 0 per cent
Windblown desert sand (sheltered from wind)	82.5°C (180°F)
—relative humidity	nearly 0 per cent
Rock in desert	65.0°C (149°F)
—relative humidity	nearly 0 per cent
Interior of bush inhabited by many <i>Cosmopleurus fulvipes</i> Dall. (Hem.)	43.5°C (110°F)
—relative humidity	nearly 0 per cent
Soil beside bush	79.5°C (175°F)
—relative humidity	nearly 0 per cent

These results are in conformity with a suggestion already made (Cloudsley-Thompson, 1962) that temperature is the main factor affecting the distribution of arthropods in the northern and central Sudan, since relative humidity is always extremely low even in inhabited micro climates. A soil surface temperature of 84°C, which equals the world record (Berry and Cloudsley-Thompson, 1960) was again reached the following day on Nile silt with similar air temperature (38.5°C) and humidity (20 per cent).

FAUNA (J.L.C. — T. AND B.E.M.I.)

In our collections we concentrated upon those arthropods that are flightless or have weak powers of flight, *viz.* beetles and arachnids, because these are less easily dispersed by wind and, therefore, presumably

of greater biogeographic significance than powerful fliers. Except in irrigated areas and on the Nile banks, the fauna was extremely sparse as expected, for the Nubian Desert is very arid with very little vegetation. For example, during an hour's intensive collecting at Halfa Degheim we found only some small ant-lion pits, a few termite galleries under stones and one or two large beetles. Again, during an hour spent at Khor Musa Pasha, we saw one gazelle, *Gazella dorcas* (L.), eight lizards, *Mabuya quinquetaeniatus* (Licht.), two nests of *Cataglyphis bicolor* Fab., one of *Monomorium salomonis* L., three termite colonies of *Sabulitermes* sp., three dragonflies, one adult ant-lion, one tabanid and two other flies, an immature grasshopper, six painted-lady butterflies, one lycosid spider, seven agelenid spider webs and a few scorpion or solifugid burrows. A strong wind was blowing and it was noticeable that the Diptera were flying within the confines of a small bush. Buxton (1924) has pointed out that this is a behavioural adaptation to strong winds in desert areas.

A few woodlice were found in irrigated gardens, but no centipedes or millipedes were seen. The woodlice have been identified as *Leptotrichus panzeri* Audouin of which Vandel (1962, p. 645) wrote :

“ Il est certain que *Leptotrichus*, tout comme *Agabiformius*, représente un genre méditerranéen oriental. En effet presque toutes les espèces de *Leptotrichus* sont propres à l'Asie Mineure et présentent une répartition localisée. Seules trois espèces possèdent une distribution plus vaste. *L. nauphiensis* Verhoeff est largement répandu en Asie Mineure, dans les îles de la mer Egée et en Grèce ; de plus, il s'est répandu à l'est jusqu'en Mésopotamie (ou il a été signalé par Omer-Cooper sous le nom de *politus*), et à l'ouest, jusqu'en Sicile et à Ischia (*ischianus* Verhoeff). Quant à *L. panzeri* (Audouin), c'est une espèce expansive qui a peuplé tout le pourtour de la Méditerranée, et qui a même atteint les archipels des Canaries et du Cap Vert. Enfin, *L. (Atlantotrichus) leptotrichoides* (Arcangeli) est propre aux îles Atlantides (Grande Salvage et Gomera).”

ARACHNIDA

SCORPIONES—Specimens were collected of *Campso-buthus werneri* Birula and of *Leiurus quinquestriatus* (H. & E.), the common species of Omdurman and Khartoum. The latter is reputed to cause the death of many children annually ; adults usually survive its sting. According to Vachon (1952), the distribution of *L. quinquestriatus* extends down the Nile Valley through Egypt and the central Sudan and westwards to Koufra and Gialo oases, Fezzan, Chad, Air, Tibesti and the south of Hoggar. It has also been found at various localities in Arabia (Gough & Hirst, 1952). The rare *C. werneri* has a somewhat similar distribution to that of *L. quinquestriatus* and extends westwards from Egypt across the Central Sahara to Timbucktoo and Niaf. It has not previously been recorded from the Sudan. Other species recorded at Wadi Halfa include *Buthus autecarinatus* Simon, an Egyptian species, as well as *Buthotus minax* Koch and *Androctonus amoreuxi* (Aud. & Sav.) (King, 1925).

B. minax has a central African distribution which apparently does not extend further north than Upper Egypt. According to Vachon (1952), *A. amoreuxi* also occurs in Morocco, Algeria, Fezzan, Air, Chad, Senegal and Mauretania. King (1925) records specimens from near Lake Rudolf. Gough & Hirst (1925) also record *Orthochirus aristidis* Simon from Wadi Halfa. According to Vachon (1952) the distribution of this species is Upper Egypt, Ethiopia and Somalia.

Thus, of the species recorded from Wadi Halfa, *L. quinquestriatus* ranges in all directions, *B. autecarinatus* and *O. aristidis* are near the southern limit of their range, *B. amoreuxi* toward its eastern and *B. minax* approaching its northern limits.

Other species may well occur in the Halfa region as well. For example, *Parabuthus hunteri* (Pocock) which is plentiful on the Erkowit plateau near Sinkat and is also found in other parts of the Red Sea hills, has been recorded from Omdurman, Khartoum and near Lake Rudolf (King, 1925) as well at Kafr Amar in Egypt (Gough & Hirst, 1925).

SOLIFUGAE—Only young and unidentifiable Galeodiidae were obtained.

ARANEAE—Spiders were mostly Drassidae, Lycosidae, Thomisidae, Sparassidae, Salticidae and Argiopidae.

ACARI—a number of ticks, *Hyalomma* spp. were collected.

INSECTA

THYSANURA—Lepismatidae were fairly common beneath stones and are probably a basic element in the food chains in deserts throughout the world.

DERMAPTERA—*Labidura riparia* Pallas.

EMBIOPTERA—a single male *Oligotoma nigra* Hagen was found in a bedroom of the Nile Hotel and a number of nymphs beneath stones in the Hotel garden.

HYMENOPTERA—Sand-digging wasps were common at the foot of old date palms. The four species of ants most common around Khartoum were also plentiful. These are *Camponotis (Tanaemyrmex) maculatus* Fab., *Camponotis (Orthonotomyrmex) sericeus* Fab., *Cataglyphis bicolor* Fab., and *Monomorium salomonis* L.

NEUROPTERA—It was noticeable that ant-lion larvae were not in the same stage of development as at Khartoum, judging by the small size of their pits in the sand.

COLEOPTERA—Tenebrionidae :— *Akis elevata* Solier, *Scelosodis castaneus* Esch., *Pogonobasis ornata* Guér. *Blaps pharao* Seidl., *Pimelia grandis* Kl., *P. angulata* Fab. subsp. *nilotica* Senac., *Thriptera crinita* Kl., *Trachyderma hispida* Forsk., *Prionotheca coronata* Oliv. ; Melolonthidae ; Buprestidae ; Cerambycidae :—*Monocladum aegyptiacum* Guér. (new to the Sudan), Scarabaeidae :—*Scarabaeus* sp., *Helicopris gigas* Oliv., *Dynastes* sp., and various other species. *Blaps* spp. have not been recorded south of Shendi.

LEPIDOPTERA—The most common species was the painted-lady, *Neopyrameis cardui* L. A number were seen from the train between 06.00 and 08.00 hrs. on September 24 between No. 6 and No. 4 stations between Abu Hamed and Wadi Halfa. They were migrating in an easterly direction—that is flying away from the Nile. (A.P.)

VERTEBRATES

The common African toad, *Bufo regularis* Reuss, was commonly seen along the Nile bank. Lizards included two species of skink (Scincidae), *Chalcides ocellatus* Forsk., and *Mabuya quinquetaeniatus* (Licht.), while the gecko (Geckonidae) *Tarentola annularis* (I. Geoffr.) was commonly seen on buildings. Vast numbers of leaf-nosed bats (Hipposideridae) inhabited the ruined monastery at Faras West. A specimen was captured and subsequently identified as *Asellia (Hipposiderus) tridens* (Geoffr.).

BIRDS (Records by A.P.)

Ardea cinerea Linnaeus — Grey Heron
1 on island opposite Halfa, 27th. Sept. ; 6 flying south along the river at Halfa, 29th. Sept. ; 1 Halfa, 1st Oct ; (Mainly a passage migrant in the Sudan).

Bubulcus ibis (Linnaeus)—Buff-backed Heron
White egrets believed to be this species were seen flying up river at dusk on two occasions, viz. 30 on 25th Sept., and 2 on 1st Oct.

Ardeola ralloides (Scopoli)—Squacco Heron
1 on bank just south of Halfa on 25th. Sept.

Nycticorax nycticorax (Linnaeus) — Night Heron
An immature bird on bank just south of Halfa, 25th Sept.

Neophron perenopterus (Linnaeus)—Egyptian Vulture
Frequently seen throughout the length of the river valley, but greatest number seen at Wadi Halfa resting either on one of the islands about midday, (maximum 21 on 27th Sept.) or on football ground beyond the town (maximum 32 on 29th. Sept.).

Torgos tracheliotus (Forster)—Nubian Vulture
6 on island opposite Halfa, 30th. Sept.

Falco peregrinus Tunstall—Peregrine
1, Abu Simbel village, 26th Sept.

Milvus migrans (Boddaert)—Kite
Small number seen in region of Halfa. Maximum 4
on 25th. Sept.

Circaetus gallicus (Gmelin)—Short-toed Eagle
1, Semna, 28th Sept.; a migrant.

Circus macrourus (Gmelin)—Pallid Harrier
A male at Saras, 28th Sept. Immature harriers seen
flying south over the island opposite Halfa on 27th and
30th Sept. may have been this species, but equally could
have been *C. pygurus*, the Montagu's Harrier.

Coturnix coturnix (Linnaeus)—Quail
1, cultivations at Halfa Degheim, 27th and 29th Sept.; 1,
cultivations at Gemai, Saras, 28th Sept. a migrant.

Burhinus oedicnemus (Linnaeus)—Stone Curlew
7 on river bank just south of Halfa, 24th Sept., 4 on
25th Sept.

Hoplopterus spinosus (Linnaeus)—Spur-winged Plover
2 on island opposite Halfa, 30th Sept.

Tringa nebularia (Gunnerus)—Greenshank
1, island opposite Halfa, 30th Sept.

Pluvianus aegyptius (Linnaeus)—Egyptian Plover
1, river bank, 25th Sept.

Columba livia (Gmelin)—Rock Dove
A number of domesticated doves in Halfa but apparently
nowhere wild.

Streptopelia turtur (Linnaeus)—Turtle Dove
2, river banks about 1 mile south of Halfa, 24th Sept.;
1, same place 25th Sept. a migrant.

Stigmatopelia senegalensis (Linnaeus)—Laughing Dove
Abundant through out the area along river banks and
in cultivations.

Coracias garrulus (Linnaeus)—European Roller
2, Abu Simbel village, 26th Sept.

Ceryle rudis (Linnaeus)—Pied Kingfisher
1, Nile Hotel at Halfa most days. The only other bird seen was one near Buhen, 25th Sept.

Merops superciliosus (Linnaeus)—Large Green Bee-Eater.

c. 70 came into roost on trees near Nile Hotel, Halfa on evening of 28th Sept.; 1 bird seen at the same place on 29th Sept.

Merops orientalis (Latham)—Little Green Bee-Eater
Common bird on edges of cultivations, frequently seen perching on telegraph lines and posts, 8+ Halfa to Sudan-Egyptian border, 26th Sept.; 26+ road from Halfa to Akasha as far as Semna—the majority around Saras and Gemai.

Upupa epops (Linnaeus)—Hoopoe
Frequent in cultivations and amongst trees on banks. Recorded: 3 Hotel, 24th, 25th, and 28th.; 2 pairs on the 29th Sept.; 1, Halfa Degheim, 27th Sept.

Tyto alba (Scopoli)—Barn Owl
A large owl probably of this species was seen at dusk on river bank near Halfa on 24th Sept.

Athene noctua (Scopoli)—Little Owl
Individuals seen in grounds of Nile Hotel, 25th Sept.; in cultivations 3 miles north of Halfa, 26th Sept.; 2 heard calling at night in Halfa on 30th Sept. Not recorded from Halfa area by Cave and Macdonald (1955) nor by Mackworth-Praed and Grant (1952), although recorded by both from Red Sea Province.

Caprimulgus sp.—Nightjar
An unidentified bird seen at dusk hawking amongst trees of Nile Hotel, Halfa, 24th Sept.

Galerida cristata (Linnaeus)—Crested Lark
Common on the cultivations and on the river banks where cleared of trees, e.g. 10+ on fields of Halfa Degheim, 27th Sept., c. 100 on cultivations along Halfa-Akasha road as far as Khor Ahmed Sherif.

Motacilla aguimp (Dumont)—Africa Pied Wagtail
2, Abka East at 2nd Cataract, 28th Sept.

Motacilla flava (Linnaeus)—Yellow Wagtail
10+ cultivations at Halfa Degheim, 29th Sept.

Pycnonotus barbatus (Desfontaines)—White-vented Bulbul

Small number recorded in gardens, banks of river and vegetation bordering cultivations.

Muscicapa striata (Pallas)—Spotted Flycatcher
5, Nile Hotel, 25th Sept.; 3+, Nile Hotel, 1st Oct.

Oenanthe isabellina (Temminck & Langier)—Isabelline Wheatear

1, cultivations at Halfa Degheim, 27th Sept.; 2 cultivations, Halfa Degheim, 29th Sept.

Oenanthe leucopyga (Brehm)—White-rumped Wheatear

10+ pairs noted along the Halfa-Akasha road from Khor Musa Pasha to Semna. Often noted around stone buildings but always restricted to rocks bordering the cultivations. There were indications that these birds were holding territory.

Phoenicurus phoenicurus (Linnaeus)—Common Redstart

1 male in grounds of Nile Hotel, Halfa, 25th Sept.

Sylvia curruca (Linnaeus)—Lesser Whitethroat
An abundant migrant in trees and bushes along banks of Nile and bordering cultivations throughout area.

Sylvia communis (Latham)—Common Whitethroat
1, grounds of Nile Hotel, Halfa, 25th Sept.

Phylloscopus trochilus (Linnaeus)—Willow Warbler
1, Hotel, 24th and 25th Sept. Several birds along river at Abu Simbel on 26th Sept. either this species or *Ph. collybita*.

Cisticola juncidis (Rafinesque)—Zitting Cisticola or Fan-tailed Warbler

10+ pairs in fully grown dura cultivations, Halfa Degheim, 27th Sept. Males singing. This species not recorded in Mackworth-Praed and Grant (1955) or Cave and Macdonald (1955) for this part of the Sudan.

Prinia gracilis (Lichtenstein)—Graceful Prinia or Striped-back Prinia

2 singing birds in scrub on river banks by Nile Hotel, Halfa, 24th and 25th Sept.; 1 singing bird in dura cultivations, Halfa Degheim, 27th Sept.

Hirundo rustica (Linnaeus)—European Swallow
Small numbers were seen on the river most days and were particularly noticeable in the late afternoon.

Riparia riparia (Linnaeus)—Sand Martin
Small numbers on the river most days, particularly noticeable in the late afternoons. On 25th Sept., c. 40 at Buhen Temple.

Ptyonoprogne obsoleta (Cabanis)—Pale Crag Martin
Resident and nesting in suitable stretches of Nubian sandstone cliffs. c. 300 seen along road from Halfa to Sudan Egyptian border, 26th Sept. Many nesting in cliffs around Abu Simbel temples and some actually inside Main Temple. Fewer seen along the Halfa-Akasha road. Not recorded breeding in this area by Cave and Macdonald (1955) or Mackworth-Praed and Grant (1955).

Lanius elegans (Swainson)—Grey Shrike
1 on fields, Halfa Degheim, 27th and 29th Sept.,

Lanius nubicus (Lichtenstein)—Nubian Shrike
1 immature bird in grounds of Nile Hotel, Wadi Halfa, 25th Sept.

Lanius collurio (Linnaeus)—Red-Backed Shrike
1, fields at Halfa Degheim, 27th Sept.

Corvus corax (Linnaeus)—Brown-necked Raven
Sparsely spread down valley. Occasional pairs seen in the environs of Wadi Halfa; 1 pair, Khor Musa Pasha, 28th Sept.; 1 pair Sudan/Egyptian border and 2 pairs at Abu Simbel, 26th Sept.

Passer domesticus (Linnaeus)—House Sparrow
Abundant in Wadi Halfa area; c. 150 at the Nile Hotel.

Lagonosticta senegala (Linnaeus)—Rosy Fire-Finch
A male in grounds of Nile Hotel, Wadi Halfa. Not recorded so far north by Cave and Macdonald (1955) or Mackworth-Praed and Grant (1955).

FLORA (A.P. AND S.J.P.)

The topography of the Nile valley and the extreme climate of the Halfa area cause the permanent vegetation, with few exceptions, to be restricted to a narrow strip on each side of the river. This is variable in width,

rarely exceeding 1 km., with the maximum development on the wide expanse of silt on the eastern banks around Halfa itself. On the western banks the Nile's close approach to the Nubian Sandstone cliffs and the presence of drifted sand on the lower areas has restricted vegetation to a narrow, fragmented strip. On the eastern banks south of Halfa in the region of the 2nd Cataract where hard, basaltic rocks outcrop the vegetation is similarly very limited in distribution.

For convenience of description the vegetation may be divided into three main zones, *viz.*

- (a) The riverain vegetation immediately on the banks.
- (b) The vegetation associated with the permanent cultivations.
- (c) The vegetation in wadis and desert hollows.

To a certain extent the distinction between (a) and (b) is an artificial one since the riverain vegetation does not always form a distinct zone and there is considerable intergradation and interdigitation between the two. It serves, however, to emphasize the two general elements in the flora of this region. The riverain vegetation is predominantly trees and large grasses whose presence is directly dependent on the presence of the Nile, whilst the vegetation of the cultivations (leaving aside the crops) is almost entirely composed of weeds, widespread in the tropics, whose presence and abundance are largely dependent on man.

(a) Riverain vegetation

The riverain vegetation may be considered to occupy the banks of the Nile and the land in front of the cultivated ground. The date palms and acacias of this zone were undoubtedly the most conspicuous vegetational feature of the Halfa district since they form a more or less conspicuous strip along the eastern banks (except where Halfa is built up and the basaltic rocks outcrop at the 2nd Cataract) and parts of the western banks. Of the acacias, *Acacia nilotica* was the most abundant although *A. albida*, occurring at somewhat higher levels

on the banks, was also frequent, particularly on stretches of the western banks where blown sand reached down to the river. A few examples of *A. tortilis* agg. and *A. chrenbergiana* were also found in this zone on the rocky and sand banks in the region of the 2nd Cataract. Generally the date palms (*Phoenix dactylifera*) tended to occur at higher levels on the banks and thus formed an indistinct zone inside the acacias, although at times they were found at the water's edge (high river). Other species such as *Ziziphus spina-christi* and *Balanites aegyptiaca* might also be considered typical of this zone.

Much of the ground under the trees was bare or had a sparse herb layer in which *Cynodon dactylon* predominated. Under the acacias there were usually small numbers of rather stunted plants or seedlings of weeds typical of cultivated or disturbed ground, e.g., *Solanum incanum*, *S. dubium*, *Calotropis procera*, *Rhynchosia minima*, and *Tephrosia apollinea*, as well as many seedlings of *Acacia nilotica* and *Phoenix*. Where trees had been cleared, *Acacia nilotica* was often regenerating, passing through a scrub phase in which the herb layer was usually well developed. The latter was composed of *Abutilon pannosum* (occ.), *Solanum incanum* (l.f.), *Ipomoea cairica* (l.f.), *Oxystelna esculentum* (l.f.), *Cardiospermum halicacabum* (l.f.), *Sida alba* (occ.), etc.

On the silt banks of the Nile just outside the *Acacia nilotica*, particularly where there were gaps in the tree cover, patches of *Tamarix nilotica* occurred, alternating with *Saccharum spontaneum*, *Phragmites* sp., and, sometimes where the silt was sandy, *Desmostachya bipinnata*. The latter, however, formed a better developed zone with *Sorghum virgatum* just above the average high water level on the sandy western banks. The banks were only just being uncovered at the time of the visit to Halfa so that the silt areas of the seluka cultivation could not be examined. On the uppermost, newly uncovered mud there was an abundance of seedlings of *Argemone mexicana*. It seems likely that the weed flora of these areas would resemble that of the permanent cultivations together with a number of river-bank ephemerals.

(b) Permanent Cultivations

The permanent cultivations tended to be situated on the silt between the riverain vegetation and the houses at the desert's edge. Irrigable land occurred on the east bank mainly north of Saras and in a few places on the west bank. South of Saras outcropping of basaltic rocks limited cultivable land and here cultivation was either of the seluka type or dependent on hafyrs. The general restriction of permanent cultivations inside the riverain vegetation depends on the critical water requirements of the date. This plant does not thrive under a regime of frequent irrigation as do the crops, so the latter are grown away from the palms. Virtually all the original or natural vegetation had been cleared from the cultivations although a few trees of dom (*Hyphaene thebaica*), *Tamarix orientalis* and acacias (usually *A. nilotica* carried into the cultivations as seed by the irrigation water) could be seen within this zone.

The permanent irrigation ditches usually carried a well developed and probably, \pm permanent vegetation on their silt embankments. They were normally covered by the common, tropical weed, *Euphorbia hirta*, and by the grasses, *Cynodon dactylon*, *Dichanthium annulatum* and *Echinochloa colonum*. The grass, *Imperata cylindrica*, an abundant weed in Equatoria, was also found in such a situation.

Prior to cultivation the ground is hoed or broken up so that it starts clear of weeds. Once irrigation starts the weed seeds germinate and before harvest a dense covering of weeds has developed, many of the plants being ephemerals which set seed very quickly. The more common weeds include:—*Abutilon pannosum*, **Cassia senna*, *C. italica*, *C. occidentalis*, **Tephrosia apollinea*, *Rhynchosia minima*, *Eragrostis spp.*, **Pulicaria crispa*, *Glinus lotoides*, *Cyperus rotundus*, *Tribulus terrestris*, *Euphorbia granulata*, *Crotalaria thebaica*, **Calotropis procera*, **Alhagi maurorum*, *Cynodon dactylon*, *Dichanthium annulatum*, and *Colocynthis vulgaris*. Those marked with an asterisk were more frequent where silt was mixed with sand.

Most of these weeds are widely distributed in tropical Africa and some are known from tropical Asia and America. The weed flora of these cultivations is typical of similar situations as far south as Khartoum and some way beyond, except here it is poorer in species. *Alhagi maurorum* is perhaps not so typically a weed as the others since it is often a conspicuous element of sandy hollows far away from cultivation.

Once the crops have been harvested, irrigation is stopped and most fields are left to dry out. This kills off the drought-susceptible ephemerals which have however, seeded abundantly before this stage. At this time animals may be allowed to graze over the cultivations so that any plants persisting after the harvest must be unpalatable to animals as well as drought-resistant. Of those plants persisting, *Rhynchosia minima*, *Abutilon pannosum*, *Cassia italica* and *C. occidentalis* were most abundant on the silt areas; *Tephrosia apollinea*, *Calotropis procera*, *Cassia senna* and *Alhagi maurorum* were abundant on the sandy silts with *Calotropis* and *Alhagi* reaching their maximum development on the sands. *Crotalaria thebaica*, *Cynodon*, *Dichanthium annulatum* and *Colocynthis vulgaris* ranged over silt and sandy-silt soils but were absent from the most sandy soils. Except for *Crotalaria thebaica* and *Cynodon dactylon* which were rather heavily grazed these plants remained green and flourishing, flowering and setting abundant seed. It seems probable that they tap the water-table of the Nile; *Alhagi* itself is known to develop roots up to 10 metres deep and this is probably true for the other species.

In places on the desert margins of the cultivations *Tamarix orientalis* occurred sufficiently often to constitute a third zone e.g. in the north of the area visited near the Sudan-Egypt border. These trees are probably outliers of a vegetational type which once extended well into the present cultivations where now only the occasional individual may be seen.

(c) Vegetation in wadis and desert hollows

A number of wadis leading into the Nile, e.g. Khor Musa Pasha and Khor Ahmed Sherif, contained a number of shrubby perennials near the river where the sediment in the khor was thickly deposited. Since rain was too infrequent to produce any permanent or semi-permanent run-off, and since these plants were no great distance from the river, it seems reasonable to assume that the roots of these plants reach the water-table of the Nile. Khor Ahmed Sherif contained *Calotropis*, Khor Musa Pasha had *Calotropis*, *Leptadenia pyrotechnica* and nearer the river, *Tamarix* and *Desmostachya bipinnata*. The presence of the last two species definitely suggests an association with the water-table of the Nile. A khor near Semna filled with rather coarse sand, had a few plants of *Leptadenia* and *Acacia ehrenbergiana*.

The rainstorm during the previous August also produced a flush of ephemerals in other hollows away from the deeper wadis. These were found in a number of hollows along the Halfa-Akasha road and in one in the desert north of Halfa. The plant species represented in these areas were variable. Some hollows were dominated by *Cassia italica* with lesser quantities of *C. senna*; others were covered with *Colocynthis vulgaris*; and yet others contained little except *Fagonia cretica* and *Tribulus* sp. Differences in soil composition or accidents of past seeding of these hollows may be responsible for their differences in flora. In contrast, the wadis were somewhat less restricted in their ephemeral flora, both Khor Ahmed Sherif and Khor Musa Pasha contained *Colocynthis*, *Aerva*, *Fagonia*, *Tribulus*, *Cassia senna* and *Euphorbia granulata*, the latter khor also containing an abundance of *Pulicaria crispa* in one hollow.

SYSTEMATIC LIST OF FLOWERING PLANTS

The following list is based on plants collected in the Halfa district and on notes taken at the time. Specimens have been deposited in the Herbarium of the Department of Botany, University of Khartoum, and the Herbarium of the Royal Botanic Gardens, Kew.

Argemone mexicana L. An annual herb introduced from America and now naturalized along much of the Nile in the Sudan and in many other parts of Africa. Abundant in the Halfa region on the river banks, growing on silt at approximately the upper limit of the annual flood; occasionally on the cultivations away from the river. On the river banks the seeds tend to germinate immediately the highest water level has been reached and the river is beginning to subside.

Gynandropsis gynandra (L.) Briq. A plant of disturbed soils which was found in several localities on the cultivations in the Halfa region; also in some quantity amongst *Desmostachya bipinnata* on the Nile banks.

Glinus lotoides L. Abundant on the banks of the Nile in the Halfa district; less frequent on cultivations away from the river. Andrews (1950) states that this species is widespread in moist, sandy places, but it was also abundant on silt.

Portulaca oleracea L. Common as a weed in places on the cultivations where it may owe its distribution in these places to its being grown as a salad plant.

Achyranthes aspera L. Fairly common weed on the sides of cultivations, usually amongst trees or shrubs.

Aerva javanica (Burm.f.) Juss. ex Schult. Occurred on the Nile banks above the high water mark, and young plants were found in many of the dried rain-pool along the Halfa-Akasha road, e.g. in Khor Ahmed Sherif and Musa Pasha.

Amaranthus sp. Common weed in the cultivations and on the higher parts of the Nile banks.

Fagonia cretica L. A plant of sandy soils which was a conspicuous element of the dried rain-pools along the Halfa-Akasha road, e.g. Khor Musa Pasha, Khor Ahmed Sherif and other places.

Tribulus terrestris L. A common weed on the more sandy cultivations but dying as soon as these ceased to be irrigated.

Tribulus sp. This erect species with somewhat pendulous branches was a conspicuous or dominant element of most of the dried rain-pools along the Halfa-Akasha road. In most examples the fruit was winged but considerable variation in fruit characters was observed in even small stands of the species and often on the same plant.

Oxalis sp. (probably *O. corniculata* (L.). Several non-flowering plants of an *Oxalis* were found growing in deep shade on the banks of a permanent irrigation ditch lead-in off the Nile near the Nile Hotel. The stems were tuberless, rather short and irregularly branched. Unfortunately a living specimen collected did not survive the journey to Khartoum. Three species of *Oxalis* are recorded from the Sudan, two of which have been found in the Red Sea Hills, viz. *O. corniculata* L., and *O. anthelmintica* A. Rich., the former being also recorded from Jebel Marra in Darfur Province, and in Southern Sudan (Andrews, 1950). Hutchinson and Dalziel (1927) state that *O. corniculata* is a weed of waste ground in most countries of Africa; presumably this example is an introduction from elsewhere.

Boerhavia repens L. Frequent on paths and cultivations.

Tamarix nilotica (Ehrenb.) Bunge. Abundant shrub on the river banks and on the islands, occupying a narrow zone just below the high water level. After the river has fallen many seedlings appeared which, no doubt, would produce a dense scrub throughout the length of the river were it not for the interference of man. In the north-west of the area, in the region of Faras, *T. nilotica* could be seen in company with *T. orientalis* on tops of quite large sand dunes. In some places these extended 1 km. away from the river. It would seem that these bushes were originally growing on a silt surface, which here and there could be seen exposed in hollows, and have since kept pace with the building up of the dunes.

T. orientalis (Forsk.) When well-developed this is a tree reaching 30—40 ft. high. A common plant throughout the area, although less common in the region of the 2nd

Cataract. It occupied a higher level than *T. nilotica* and was to be found in quantity on the sandy areas beyond the cultivations and houses where presumably it could still reach the water table of the Nile. In some places, *T. orientalis* could be found within the cultivations and presumably would occupy this zone but for the cutting down of trees in this area. As with *T. nilotica*, this tree was a dune-former in the region of Faras West where the trees could be found partially enveloped by dunes.

Colocynthis vulgaris (Schrad.) Found in several localities on the Nile banks where bare ground occurred under *Acacia nilotica* scrub or trees ; also occasionally on cultivations which had been left unirrigated. At times it was the dominant plant in some of the dried rain-pools beside the Halfa-Akasha road, e.g. Khor Ahmed Sherif, while in others it was completely absent. Also seen in great quantity along several stretches of railway crossing the Hutmore area of the Nubian Desert. Here after the death of the plant the seed was being spread by the wind rolling the light, hollow, spherical gourds across the flat sand until they lodged in some hollow, there remaining until their disintegration. 1—7 gourds were seen in many of the shallow sand pits dug near the track by maintenance crews and presumably, since this must be the usual method of dispersal, the presence of so many hollows alongside the track was responsible for the abundance of the plant in this part of the desert. The rather patchy distribution along the Halfa-Akasha road was probably caused by the rocky ground preventing free dispersal, and the occurrence of the plant on the banks of the Nile by the gourds being carried down by water.

Abutilon pannosum (Forst. f.) Schlecht. A drought-resistant perennial which was abundant and widespread on cultivations and the river banks where these had been disturbed by cultivation. Most noticeable and well-developed on those fields which had been left unirrigated and uncleared for some time since this species survives long after most. Far less common where the silt was mixed with sand.

Sida alba L. Occasionally found on the silt of the Nile banks and on the cultivations.

Chrozophora plicata (Vahl) A. Juss. ex Spreng. Locally abundant on silt areas on the Nile bank.

Euphorbia hirta L. Abundant on sides of permanent irrigation ditches and abundant in lawns in Halfa; sometimes found on cultivations.

E. granulata (Forsk.) Prostrate weed frequent in cultivations on silt where these were not too densely covered; dies quickly once irrigation has stopped.

Ricinus communis L. Occurred occasionally on cultivations, probably as an escape.

Cassia occidentalis L. Locally frequent on cultivations; more noticeable in fields no longer irrigated since by this time it was 3'—5' tall, still had flowers and was fruiting conspicuously.

C. italica (Mill) Lam. A very common and widely distributed plant; on silt areas which had been disturbed and particularly noticeable on cultivations where, since it is not grazed by animals and is drought-resistant, it persisted long after irrigation had ceased. Noted also in dried rain-pools beside the Halfa-Akasha road.

C. senna L. Less common on silt but more common on sandy areas than *C. italica*; consequently not common on cultivations except where these occurred on silt mixed with much sand, e.g. on those cultivations furthest from the river and on the desert edge. Like *C. italica* it persisted a long time on unirrigated soil. Seen also on the dried rain-pools in Khor Ahmed Sherif but where these had a relatively thick layer of silt it was not as common as *C. italica*. Also seen on the sandy banks of the Nile in the region of the Second Cataract.

Acacia albida (Del.) A common tree on the Nile banks occurring at higher levels than *A. nilotica*. Conspicuous on the western side of the river where the sand had

drifted over the silt banks and the latter species was absent from much of the length of the bank.

A. tortilis (agg.) Several examples were found on rocky banks of the river in the region of the 2nd Cataract.

A. seyal (Del.) Occurred with *A. nilotica*.

A. chrenbergiana (Hayne.) Several examples in the region of the 2nd Cataract and in the sandy khor leading to Semna.

A. nilotica (L.) Willd. ex Del. An abundant tree occupying a narrow strip of the bank at the high water level and well-developed on the eastern side except where Halfa occupied the water-front and the rocks of the 2nd Cataract outcropped at the water's edge. Frequent on the islands in the 2nd Cataract. Less common on the western banks where sand covered the silt or the river approached close to the sandstone cliffs. Regenerating actively; seedlings were abundant under the parent trees and some were to be found in the cultivations near the river banks, the seeds presumably having been carried by the irrigation water.

Mimosa pigra (L.) Locally common just above, or at, high water level on the silt of the Nile banks.

Alhagi maurorum Medic. Locally abundant, and often the dominant plant; where the soil was sandy; not normally found on silt. Grew prolifically on the disturbed soils of paths and cultivations, being particularly common on the latter where these were allowed to dry out for some time.

Crotalaria thebaica (Del.) DC. Seen only on cultivations where soil was silt or silt mixed with sand; in a number of localities in Halfa and Halfa Degheim. Although drought-resistant and will survive for some time after irrigation has ceased, it is grazed by animals and was usually found reduced to cushion-like growths.

Indigofera hochstetteri Bak. A plant found occasionally on the cultivations when these were newly under irrigation. Apparently dies quickly when irrigation stopped.

Indigofera sp. A not infrequent weed of well irrigated lawns.

Rhynchosia minima (L) DC. Abundant on the silt of the banks of the Nile and the cultivations. Resembles *Abutilon pannosum*, with which it was often to be found, in its ability to survive long after irrigation has ceased.

Tephrosia apollinea (Del.) DC. Abundant on the Nile banks and cultivations, particularly where the silt was mixed with sand. Like *Rhynchosia* and *Abutilon* it persists long after irrigation has ceased.

Zizphus spina-chisti (L) Willd. Occasionally to be found on the Nile banks.

Haplophyllum obovatum (Boiss.) Hand. Mazz. Locally frequent on cultivations and sides of permanent irrigation ditches. Common on sandy-silt around Halfa Degheim. Not previously recorded for the Sudan although known from Egypt.

Balanites aegytiaca (L) Del. Occasionally found on the Nile banks and sometimes within the cultivation zone.

Cardiospermum halicacabum (L.) Locally common on the Nile banks around the permanent irrigation ditches, climbing over acacia scrub and other perennial plants.

Calotropis procera (Ait.) Ait. f. Drought-resistant shrub found where the ground had been disturbed; locally frequent around houses, river-banks, on edges of cultivations, and sometimes occurring in the cultivations. Also found in Khor Musa Pasha and Khor Ahmed Serif.

Oxystelma esculentum (L.f.) J.A. Schultes. Locally abundant on the Nile banks at the high water level, seemingly restricted to the silt areas. Often climbing over *Acacia nilotica*, *Phragmites*, etc.

Leptadenia pyrotechnica (Forsk.) Decne. A small number of stunted shrubs were found in Khor Musa Pasha and the khor leading to Semna.

Pulicaria crispa (Forsk.) Oliv. Locally abundant on silt mixed with sand; observed in some quantity on some of the fields at Halfa Degheim and in the bottom of Khor Musa Pasha. Did not appear to be very drought-resistant; plants in Khor Musa Pasha were already virtually dead and those in the cultivations dying before *Tephrosia* and *Alhagi*.

Erigeron bonariensis L. (= *E. crispus* Pourr.) Frequent on the higher parts of the Nile banks in Halfa where the ground had been disturbed, occurred less frequently on the cultivations. Not recorded from the Sudan previously (Andrews, 1956) although there are specimens of the species in the Herbarium of the Royal Botanic Gardens, Kew, and it is known from Egypt. A common weed of cultivated land where the climate is Mediterranean in type, but also occurring in the tropics. Probably originating from the Argentine.

Solanum incanum L. (?spp. *incanum*) A large herb locally common on the Nile banks amongst the acacia scrub and occasionally found on the cultivations.

S. dubium (Fresen.) Locally frequent on the Nile banks and cultivations.

Convolvulus arvensis (L.) Infrequently found on the cultivations and Nile banks.

Ipomoea eriocarpa R. Br. Collected from Nile banks near Nile Hotel, Halfa.

I. cairica (L.) Sweet. Locally common on the Nile banks, climbing over perennial plants and acacia scrub.

Striga hermonthica (Del.) Benth. Recorded parasitizing dura.

Hyphaene thebaica (L.) Mart. This palm occurred on both sides of the Nile, usually as scattered individuals although was occasionally found in clusters; normally on the cultivations outside the *Phoenix* zone. Presumably once more common than at present.

Phoenix dactylifera (L.) Date palms form one of the conspicuous vegetational features of the Halfa area and dates form a very important local crop. A recent census made for compensation purposes (1961—1962) of all date palms from the Sudan-Egypt border to the 3rd Cataract at Akasha, the estimated limit of flooding, gave 628,853 trees. Date palms on Government land were not included but there are reputedly few on this. The dates were classified according to variety, sex and state of maturity. Of the 628,853 palms counted, 360,632 were fruit-bearing, 12,117 were males and 256,104 were immature. The low frequency of males, viz 1 to c. 30 mature fruit-bearing trees, is probably due to the cutting down of excess males.

Tothill (1948), citing figures of a previous census made in 1942 for tax purposes, gave 501,328 trees for the Wadi Halfa region. For this census any stem over 5 ft. was counted, whether it were solitary or an off-shoot, and males were included in the overall total. The total for the 1942 census is, therefore, roughly comparable to the totals of the fruit-bearing + male palms of the recent census, *i.e.* 372,749. This would suggest a decrease of date palms in the Halfa District of the order of 100,000. This decrease, if real, may in fact be a reflection of the increase in the land under irrigation made possible by the development of mechanically operated pump-schemes.

Cyperus rotundus (L.) A troublesome perennial, abundant throughout the area on both silt and sand where there is adequate water, *e.g.* river banks above the high water level and on the silt newly exposed by the receding water, on the islands, on lawns, and on the sides of permanent irrigation ditches. Not apparently as common on the cultivations as might be expected from other parts of the Sudan, except on those fields near the river.

Chloris pycnothix Trim. A fairly frequent annual weed of the cultivations but not drought-resistant and dying when irrigation is stopped.

Cynodon dactylon (L.) Pers. The most widespread and common of the grasses in the Halfa region. To be found on the river banks, sides of permanent irrigation ditches and all the cultivations. It is of course, planted for lawns. It is able to grow in fairly dense shade, e.g. in fully grown dura crops, and is drought-resistant to a high degree, surviving the dry periods of the cultivations as stunted root stocks, although seed must also play a large part in the reinfesting of the cultivations.

Desmostachya bipinnata (L.) Stapf. An abundant and common perennial of the sandy river banks particularly on the western side of the river, forming a distinct zone just above the high water line; less common on silt of the eastern bank; also seen in Khor Musa Pash.

Dichanthium annulatum (Forsk.) Stapf. Frequent on sides of irrigation ditches; also occurring as weed in cultivations.

Digitaria adscendens (Kunth) Henrard. Mainly on the sides of the permanent irrigation ditches, particularly where these were shaded, and normally growing on the water's edge.

Eragrostis barrelieri Dav. Common ephemeral weed in irrigated fields where crops did not produce dense shade.

E. cilianensis (All.) Lutati. Same situations as the previous species and usually growing with it.

Echinochloa colonum (L.) Link. Frequent and sometimes abundant on sides of permanent irrigation ditches and in certain crops not normally hoed, e.g. berseem. Not markedly drought-tolerant and dies as soon as irrigation stops.

Saccharum spontaneum (L.) var *aegyptiacum* (Willd.) Hack.
Locally frequent on silt banks of Nile and on the islands.

Imperata cylindrica (L.) Beau. var. *africana* (Anders.)
C.E. Hubbard. Found only in one locality, *i.e.* 200 yds.
south of the Nile Hotel, on a shaded, permanent irrigation
ditch, but it may occur in other localities. The
same variety is a common weed in Equatoria (Tothill,
p. 402) and the plant is also known from Egypt.

Phragmites (? *mauritanus* Kunth) Confined to the banks
of the Nile, growing on silt mainly at the high water
level. Usually common where *Acacia nilotica* was not
so well-developed.

Sorghum virgatum Stapf. Common and widely dis-
tributed on the sides of the permanent irrigation ditches
and mixed with *Desmostachya bipinnata* on the sandy
banks of the Nile. Only grazed to a limited extent
by animals.

The following have been recorded for the Wadi Halfa
district but were not seen during the present study:—

Cleome chrysantha (Desne): Broun & Massey, 1929.

Morettia philacana (Del.) DC.: Broun & Massey,
1929:

Vahlia digyna (Retz.) Kuntze: Broun & Massey,
1929 (as *V. viscosa* Roxb.).

Salsola foetida (Del): Broun & Massey, 1929.
(? = *S. baryosma* (Schult.) Dandy in Andrews. (1950).

S. vermiculata L.: Andrews, 1950.

Boerhavia repens L. var. *diffusa* Hook. f.: Broun &
Massey, 1929. (? = *B. repens* L. var. *diffusa* (L.)
Boiss, in Andrews, 1950.)

Euphorbia granulata Forsk. var. *glabrata* (Gay)
Boiss.: Broun & Massey, 1929.

E. arguta Banks & Soland: Broun & Massey, 1929;
Andrews, 1952.

Trigonella laciniata L. and *T. occulta* Delile : Sirjaev, 1929.

Campanula dimorphantha Schweinf. : Brown & Massey, 1929 ; Andrews, 1952.

Heliotropium ovalifolium Forsk. : Brown & Massey, 1929.

Cuscuta spp. : Andrews (in Tothill, 1949) states that *Cuscuta* spp. were a minor pest of crops in the Wadi Halfa district.

Orobanche ramosa L. and

O. cernua Loeff. var. *desertorum* (G. Beck.) Stapf. were reported by Andrews (in Tothill, 1948) as occurring in abundance on crops in the Wadi Halfa district.

Jamesbrittenia dissecta (Del.) Kuntze : Brown & Massey 1929 (as *Sutera glanulosa* Roth.)

Potamogeton perfoliatus. L. : Andrews, 1956 ; ("Northern Sudan : nr. Faris" = Faras?).

ACKNOWLEDGMENTS

Our thanks are due to the University of Khartoum for financial assistance awarded to us by the Research Committee, to Sayed Thabit Hassan Thabit, Commissioner for Archeology who provided us with transport during our stay at Wadi Halfa, to the Meteorological Service, Halfa, for supplying us with climatological data, and to members of the Halfa Re-settlement Commission for their valuable help and assistance. Members of the Staff of the Royal Botanic Gardens, Kew, helped in identifying flowering plants. Dr. P. Ardouin named the Coleoptera, Dr. D. R. Ragge the ants and Prof. P.L.G. Benoit the woodlouse, while Sayed Ahmed El Sayed kindly identified the lizards and bats. The collection of Archnida has been deposited in the Musée Royale de l'Afrique Centrale at Tervuren, Belgium and will be identified in due course.

REFERENCES

- Andrews, F. W. (1950, 1952, 1956) *The Flowering Plants of the (Anglo-Egyptian) Sudan* Vols. 1—3 Arb-roath, Buncle.
- Berry, L. & Cloudsley—Thompson, J. L. (1960) Autumn Temperatures in the Red Sea Hills. *Nature*, 188, 843.
- Broun, A. F. & Massey, R. E. (1929) *Flora of the Sudan*. Sudan Government, Khartoum.
- Cave, F. O. & MacDonald, J. D. (1955) *Birds of the Sudan*. Edinburgh, Oliver & Boyd.
- Cloudsley—Thompson, J. L. (1962) Bioclimatic Observations in the Red Sea Hills and Coastal Plain, a Major Habitat of the Desert Locust. *Proc. R. ent. Soc. Lond. A* 37, 27—34.
- Gough, L. H. & Hirst, S. (1927) *Key to Identification of Egyptian Scorpions*. Ministry of Agriculture, Egypt. *Tech. Service Bull, No.* 76.
- Hutchinson, J. & Dalziel, J. M. (1927—31) *Flora of West Tropical Africa*. Crown Agents for the Colonies, London.
- King H. H. (1925) Notes on Sudan Scorpions. *Sudan Notes Rec.* 8, 79—84.
- Mackworth—Praed, C. W. & Grant, C.H.B. (1952, 1955) *Birds of Eastern and North-Eastern Africa*. Vols. 1, 2, London.
- Sirjaev, G. (1929) *Genus Trigonella L. Revisio Critica II*. Prague 3—7.
- Tothill, J. D. (ed.) (1949) *Agriculture in the Sudan*. London, Oxford University Press.
- Vachon, M. (1952) *Etudes sur les scorpions*. Alger: Inst. Pasteur d'Algerie.
- Vandel, A. (1962) Isopodes terrestres Pt. 2 *Faune de France* 66, 417—793.