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THE CULICINE MOSQUITOS OF ERITREA.

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A survey of the distribution of *Aëdes aegypti* and other Culicine mosquitos was made during the dry season of 1942, between 31st March and 15th May. The position of Eritrea gives it a particular interest in relation to the possible spread of yellow fever from Africa to the East. In the west it borders on the Anglo-Egyptian Sudan, in parts of which yellow fever is endemic, and it has a Red Sea coast line of some 600 miles, near the centre of which is the port of Massawa. The Culicines hitherto found include six that are known to be potential vectors of yellow fever.

The topography and climate of Eritrea have been described by Lega, Raffaele and Canalis (1937). The country may be divided into four areas, the eastern and western plains, the mountain slopes and the plateau. The latter, on which lie several of the towns, is from about 1,900 to 2,500 metres (some 6,200 to 8,200 feet) above sea level.

The Species of Culicines.

Zavattari (1930) recorded the names of six Culicines from Eritrea, some of which had been found previously by Franchini (1925, 1928). Edwards (1941) recorded *Culex theileri*. Recent collections have increased the number of known species and other forms to 28, and it is likely that further work, during the rainy season, would reveal the existence of many others.

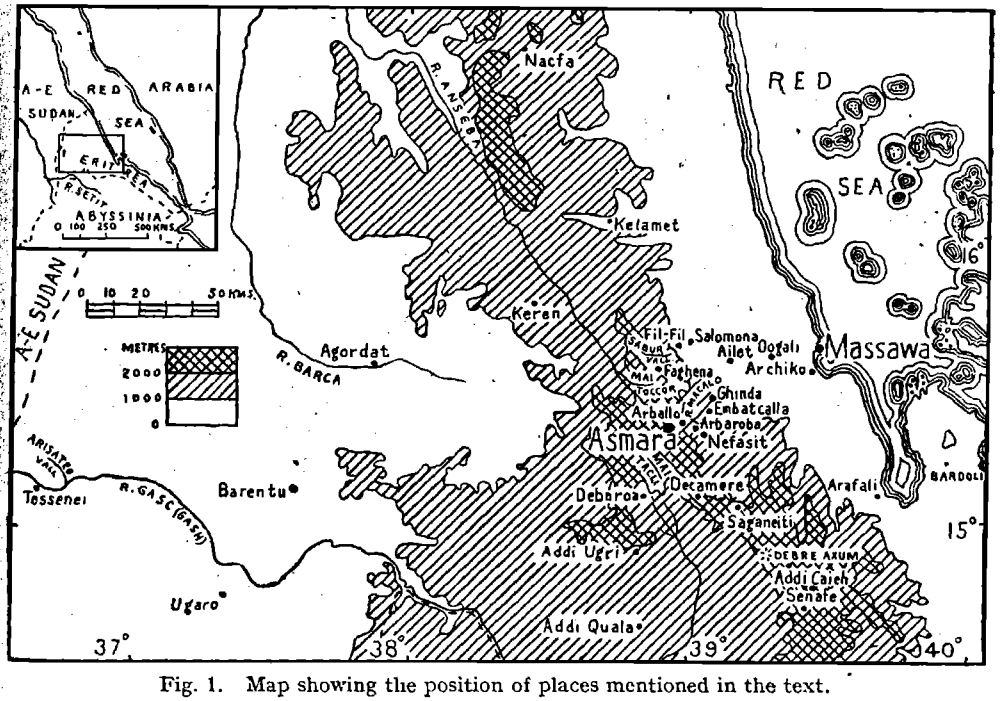

Fig. 1. Map showing the position of places mentioned in the text.

Records of localities, except where names of collectors are given, were made by the writer. Where the distribution of a species is not shown in the text, it appears in the table. Names of places are spelt as in the *Guida dell'Africa Orientale Italiana* (Milan, 1938, Consoc. Turistica Italiana) with the exception that accents are omitted, " ch " is changed to " k ", and " u ", when a consonant, to " w ".

Uranotaenia mashonaensis, Theo.

Ghinda (*de Burca*) 30.viii.42, one larva in river seepage with vegetation.

Theobaldia (*Allotheobaldia*) *longiareolata*, Macq.

With regard to the variation in the colouring of the abdominal tergites described by Edwards (*loc. cit.*), five specimens, from Asmara, Senafe, and Nacfa, were examined. All have numerous pale scales, except one from Asmara which has some dark scales and a median pale stripe. This species was never seen to bite man, even at Nacfa where its larvae were abundant. Specimens have occasionally been found in aircraft arriving in the Sudan from Asmara. It occurs in the Barca-Setit area (*G. Franchini*) and at places shown in the table. It usually bred in old oil drums containing water, often with *Culex laticinctus* or *C. fatigans*, and sometimes in ditches and pools.

Taeniorhynchus (*Coquillettidia*) sp.

Zavattari records *T. aurites*, Theo., from Addi Ugri, but it is not certain if the male terminalia, which distinguish this species from *T. chrysosoma*, were examined.

Taeniorhynchus (*Mansonioides*) *uniformis*, Theo.

Barentu (*Zavattari*).

Aëdes (*Mucidus*) *scatophagoides*, Theo.

Agordat (*de Burca*).

Aëdes (*Ochlerotatus*) *caballus*, Theo.

A larva obtained by Dr. L. Mara at Arafili may belong to this species, the larva of which has not been described. From Hopkins's (1936) key it would appear to be *A. caspius*. Adults of *A. caballus* were obtained at Bardoli in a mosquito net out of doors by Hussein Eff. Abd er Rahman.

Aëdes (*Stegomyia*) *aegypti*, L.

This species occurs in the Barca-Setit area (*Franchini*), at Keren and Agordat (common, *Zavattari*), and at other localities shown in the table. At each place above 1,700 metres, except Debre Axum, Debaroa, Mai Tacli, Faghena and Mai Taccor, 15 houses (a total of 135) were examined for larvae of *A. aegypti*. Although none was found, domestic breeding places were plentiful; much water was stored in drums, and larvae of species of *Culex* were common or abundant. The highest point at which *A. aegypti* was found was 1,648 metres above sea level. The altitude limit in the dry season in Eritrea is apparently between 1,650 and 1,980 metres (about 5,400 and 6,500 feet), but the exact limit is not known because there are few towns in this zone.

In the dry season this species tends to be common in towns on the eastern escarpment. At Nefasit and Embatcalla, before control was started, ten houses were examined in each place and larvae of *A. aegypti* were found in four and eight respectively.

Aëdes aegypti var. *queenslandensis*, Theo.

The pale colouring of this variety is more pronounced in the female than the male. Adults were seen biting by day in a dhow at Massawa. The variety breeds in domestic water vessels, wooden tanks and metal drums in dhows. At Archiko, before control measures were started, larvae were found in all of 14 houses examined.

Aëdes (*Stegomyia*) *simpsoni* var. *lilii*, Theo.

Nefasit (one female in drum, 9.v.42).

Aëdes (*Stegomyia*) *luteocephalus*, Newst.

Nefasit (larva in drum, 9.v.42).

Aëdes (*Stegomyia*) *vittatus*, Bigot.

Arasiteb, Tessenei and Ugaro (*de Burca*). Captain de Burca has informed me that this species breeds in great numbers on the eastern slopes in July.

Aëdes (*Aëdimorphus*) *eritreae*, Lewis.

The female bites readily by day (*Lewis*, 1942). Larvae were found at Debre Axum, *c.* 1,980 metres, in a large rock pool formed during road construction.

Culex (*Lutzia*) *tigripes*, Grandpré.

With regard to the variation in the colouring of the abdomen described by Edwards (*l. c.*), two specimens from Ghinda were examined. One resembled variation no. 2 and the other no. 3. Larvae were found in pools in streams, sometimes with *C. duttoni*, and in drums of water.

Culex (*Neoculex*) *salisburiensis*, Theo.

Larvae were found in pools in streams.

Culex (*Culex*) *poicilipes*, Theo.

Tessenei (*Mara*).

Culex (*Culex*) *ethiopicus*, Edw.

Western Eritrea (over 2,100 metres) and Agordat (x.42, *de Burca*). Larvae were obtained in a pool in a hill stream and in a swamp.

Culex (*Culex*) *annulioris*, Theo.

Saganeiti (ix.42, *de Burca*); Addi Ugri, Fil-Fil. The species breeds in streams.

Culex sp.

Some larvae from Massawa resemble *C. sitiens*, Wied., in several respects, and, when adults can be bred, they may prove to belong to a variety of this species.

Culex (*Culex*) *duttoni*, Theo.

Larvae are usually found in drums and sometimes in pools in streams.

Culex (*Culex*) *theileri*, Theo.

Although many thousands of larvae were found in a stream near houses at Debaroa, the occupants did not complain of being bitten. Larvae occur in weedy streams, sometimes with *Anopheles cinereus*. The species occurs at Asmara (*G. Raffaele*, Edwards, *l. c.*) and at places shown in the table.

Culex (*Culex*) *univittatus*, Theo.

Agordat, Barentu and Keren (*Zavattari*); Addi Caieh; Ghinda (*de Burca*).

Culex (*Culex*) *simpsoni*, Theo.

Addi Caieh, pool in stream.

Culex (*Culex*) *sinaiticus*, Kirkpatrick.

In the larvae head-seta B is often double. Larvae were found in streams (often with *Anopheles d'thali*) and in a well at Kelamet.

Culex (*Culex*) *laticinctus*, Edw.

Near Debre Axum a living male was seen being sucked by a species of STOMOXYDINAE. At Nacfa the writer spent two nights within a few yards of a prolific breeding place of *C. laticinctus*, *T. longiareolata* and *Anopheles cinereus* without noticing any bites. *C. laticinctus* breeds in drums, wells, tanks and pools in streams.

Culex (*Culex*) *pipiens*, L.

Barca-Setit area (*Franchini*); Asmara (*Raffaele*, Edwards, *l. c.*); Nefasit and Addi Caieh.

Culex (*Culex*) *fatigans*, Wied.

In many Eritrean larvae of this species, head-seta *f* has more than two branches, which is the number given by Hopkins (1936) as a character distinguishing this species from *C. pipiens*. In three pelts (identified by examination of the corresponding male terminalia) from Massawa and Asmara the number of branches varied from 3 to 5. Seta *e* had 2 or 3 branches, the siphonal index was from 3·4 to 3·7 and the pecten had from 7 to 11 teeth.

C. pygmaeus, N.-L., recorded from Keren by Zavattari, may be a synonym of *C. fatigans* or *C. sinaiticus* (Edwards, *l. c.*).

C. fatigans was a particularly troublesome biter at Asmara and Massawa. Larvae were found in drums, street drains, a water tank, in a dhow, and once in a dirty well.

Culex (*Culex*) *trifilatus*, Edw.

Larvae were found in drums.

Culex (*Culex*) *andersoni* subsp. *abyssinicus*, Edw.

The larva can easily be recognised by the presence of a chitinous tooth, not unlike that of *C. duttoni*, on the dorsal side of the siphon near its apex. Larvae occur in drums, cement tanks and pools in streams.

Culex (*Culex*) *decens*, Theo.

Ghinda and R. Anseba valley near Keren, in pools and a well respectively.

Composition and Distribution of the Mosquito Fauna.

Owing to the situation of Eritrea, on the north-east coast of Africa and at the northern end of the east African Mountains, its mosquito fauna includes species whose range covers many of the faunal areas of Africa. Edwards (*l. c.*), discusses Chapin's North-East Africa faunal Province which includes Eritrea. Referring principally to the mosquitos of Abyssinia, British Somaliland, northern Kenya and south-west Arabia, he distinguishes two main groups of mosquitos, those of the

highlands and those of the Somali Arid District, and points out that only a few true Ethiopian species are known. The Culicines of Eritrea include many true Ethiopian forms and may be grouped as follows, according to their general distribution outside Eritrea.

Main area of Distribution.	*Species, subspecies and varieties.*
Palaearctic Region	*T. longiareolata, A. caballus, C. sinaiticus, C. laticinctus, C. pipiens, C. theileri* (the last two occur also in large areas of Africa).
Ethiopian Region.	
Eastern and Southern Province...	*U. mashonaensis, C. salisburiensis, C. trifilatus.*
Abyssinian Highland District ...	*A. eritreae, C. andersoni* subsp. *abyssinicus.*
Ethiopian Region, and, in the case of four forms, Palaearctic or Oriental Regions	15 of the remainder.
Ethiopian and Oriental Coastal Areas	*A. aegypti* var. *queenslandensis, C.* sp. (*sitiens* var ?).

With regard to distribution inside Eritrea, at least some species, as shown in the table, fall into groups according to their dry-season prevalence in one or more of the principal areas of the country.

The Palaearctic and East African forms are found chiefly at the higher altitudes, and many of the typical Ethiopian forms occur in the plains and on the lower hill slopes.

The greatest vertical range is attained by *C. fatigans* which occurs at sea level and at 2,390 metres. It is seldom abundant except in towns with street drains.

About half the towns lie above the dry-season range of *A. aegypti*. Domestic breeding places, utilised by this or other species, are numerous in many parts of the country. The supply of water is often limited and much is stored in old oil drums, great numbers of which became available during the Abyssinian War of 1935 to 1937. Many houses, even small dwellings, contain several large drums, and in one small garden as many as 125 vessels of water were seen, comprising oil drums, carbide drums and large wine flasks.

Importance and Control.

The known potential vectors of yellow fever are *Aëdes aegypti* and its variety *queenslandensis, A. vittatus, Culex fatigans, A. simpsoni* var. *lilii* and *A. luteocephalus*. On several occasions in recent years *C. fatigans* has been found in aircraft arriving in the Sudan from Asmara.

At Massawa the control of *A. aegypti* var. *queenslandensis* is carried out as a precaution against yellow fever and dengue.

The only Culicines seen to bite man in the dry season were *A. aegypti* and var. *queenslandensis, A. eritreae, A. caballus* and *C. fatigans*. Blood-gorged *C. pipiens* have been found in rooms. There is some evidence that *T. longiareolata, C. theileri* and *C. laticinctus* seldom if ever bite people in Eritrea.

Species, the larvae of which are commonly found in water containers in or near houses, are *T. longiareolata, A. aegypti* and var. *queenslandensis, C. tigripes, C. duttoni, C. laticinctus, C. fatigans, C. trifilatus* and *C. andersoni* subsp. *abyssinicus*.

TABLE I.

The known Distribution of certain Species in the Dry Season.

Area	Plains						Eastern and western Slopes											Plateau														
Place	Massawa	Arkico	Dogali	Ailet	Tessenei	Agordat	Salomona	Fil-Fil	Sabur Valley	Ghinda	Barentu	Kalamet	Embatcalla	R. Anseba	Keren	R. Macalo	Nefasit	Nacfa	Debaroa	Debre Axum	Addi Ugri	Mai Tacli	Faghena	Addi Quala	Decamere	Arbaroba	Arballo	Saganeiti	Mai Taccor	Asmara	Addi Caieh	Senafe
Altitude in metres	1	10	*c.* 100	257	585	615	*c.* 800	*c.* 820	*c.* 850	890	980	980	1,273	1,350	1,392	1,600	1,648	1,750	1,930	*c.* 1,980	1,980	*c.* 1,988	*c.* 2,017	2,054	2,060	2,064	*c.* 2,150	2,203	*c.* 2,340	*c.* 2,347	*c.* 2,390	2,480
C. salisburiensis																													+		+	
C. andersoni abyssinicus																											+	+	+		+	+
C. theileri																			+		+	+	+						+		+	
T. longiareolata																				+					+			+		+	+	+
T. duttoni										+			+		+		+	+										+	+		+	+
T. tigripes										+			+	+			+	+										+				
C. laticinctus									+							+	+	+		+	+									+	+	+
C. trifilatus									+								+										+					
C. annulioris and/or *ethiopicus*							+	+	+								+				+											
A. aegypti				+	+	+				+			+		+		+															
C. sinaiticus			+				+		+	+		+		+				+														
A. aegypti queenslandensis	+	+																														
C. sitiens var ?	+																															
C. fatigans	+				+										+		+				+			+	+	+		+		+	+	

Control.

Control of *Aëdes aegypti* was being carried out by the usual methods in most towns of the mountain slopes and plains. These methods also limit the breeding of *C. fatigans* to a great extent, but complete control of this species is difficult owing to the time necessary for inspecting the large number of possible breeding places in basements and underground drains.

On the plateau, owing to the high altitude and the fact that *C. fatigans*, the common domestic mosquito, is probably not an efficient vector of yellow fever (Davis, 1933), it is doubtful if mosquito control is necessary as a measure against this disease, except near aerodromes.

Biological control of mosquitos may be of value in places where much water is stored. *Gambusia affinis holbrooki* was introduced from the Sudan by the writer, and stocks were established in two permanent streams, the Mai Taccor 15·5 kms. from Asmara on the Keren road, and a stream 18·5 kms. from Massawa on the Asmara road. Others were placed in artificial containers at Agordat, Asmara, Barentu, Ghinda, Keren, Massawa, Nacfa, Senafe and Tessenei.

Cyprinid fish about three inches long are common in many streams on the plateau and in the foothills and plains, but they have often been seen in company with mosquito larvae. They do not appear to attack *Gambusia*.

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