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# Research on the mosquitoes of Angola (*Diptera: Culicidae*)

I—A culicine survey in Luanda

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# Research on the mosquitoes of Angola (*Diptera: Culicidae*)

## I—A culicine survey in Luanda

H. RIBEIRO (1)

### SUMMARY

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### 1.—INTRODUCTION

In the past, 11 culicines have been recorded in Luanda (1, 2), though since 1956 no other contribution was given to the knowledge of the culicine situation within the city (3).

During a malaria survey carried out in Luanda in the course of the year 1963 (4), we were able to gather some basic data on the culicines of the region.

So, we decided to write the present paper, considering that any new information on this matter should be of interest, both from a general Public Health's viewpoint and as a possible indication of the effect on the local culicine population of the antimalaria measures adopted to date.

As the physical and human geography were outlined in the paper on the malaria survey, we only present here the climatic elements regarding the surveyed region (see table 1) (5), and the annual precipitation and temperature variation curves referring to the interval 1953-1959 (see figure 1) (6).

### 2.—MATERIAL AND METHODS

In both the March and August survey periods (see figure 1), the captures were carried out by the same team using the same methods.

As to the immature forms, the entire city was carefully and thoughtfully surveyed for breeding-places of mosquitoes.

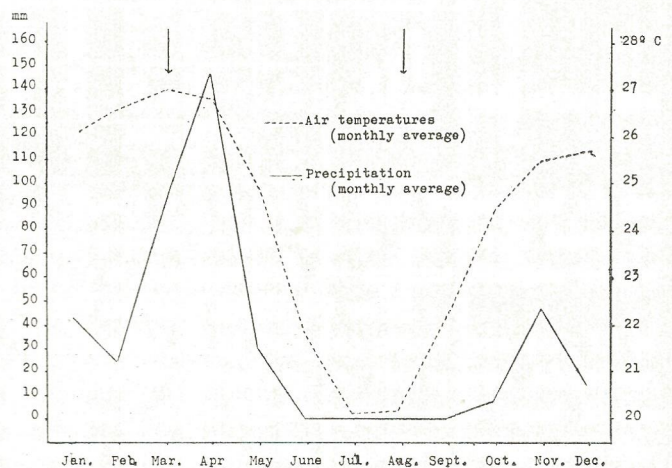


Fig. 1—Annual variation in temperature in Luanda (1953-1959)  
The arrows indicate the survey periods

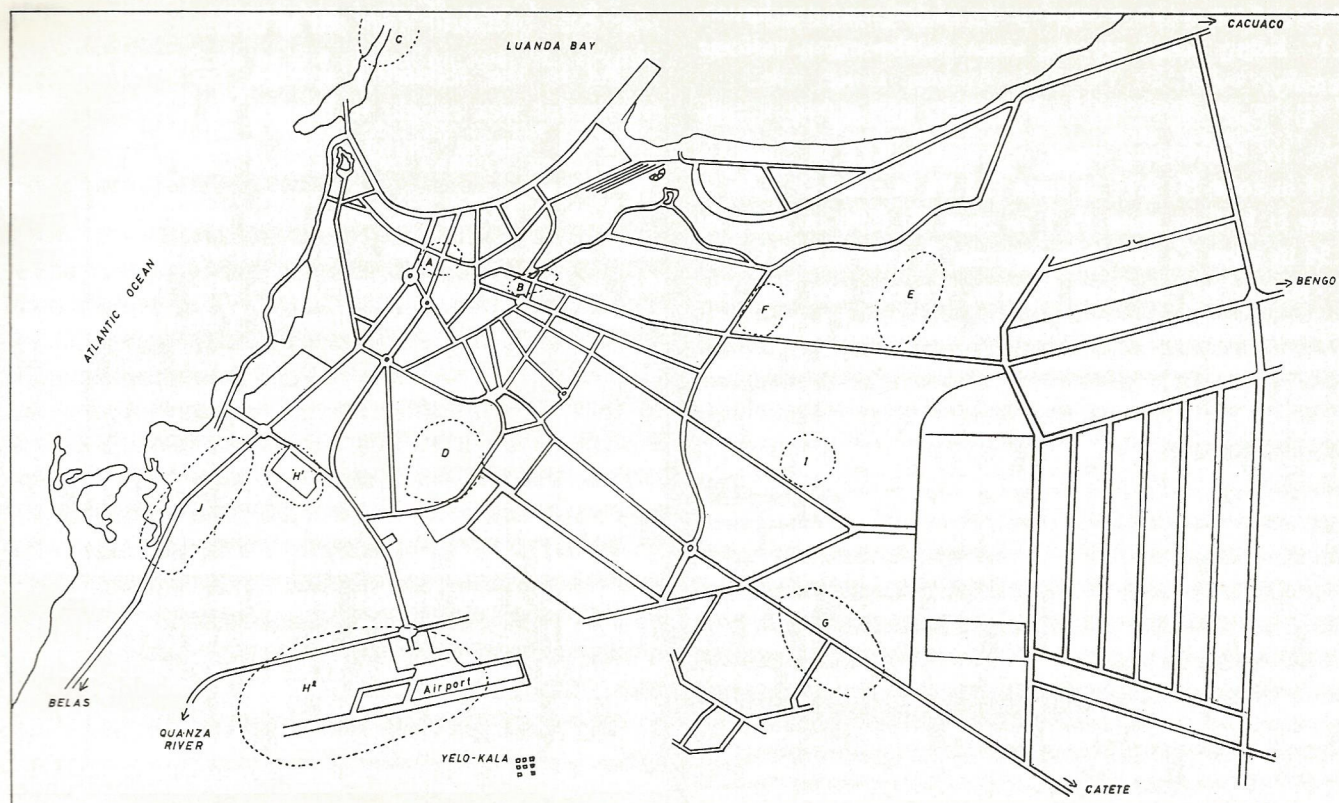
Regarding the adult forms, as stated in the paper on the malaria survey, 10 capture zones were established, designated by letters A to J, and distributed as shown on map 1.

In each zone, 10 houses were chosen for the house-catching with aspirator tube and, in each house, though in a few instances this couldn't be accom-

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TABLE 1 — Luanda climatic elements (1933-52)

Month	Average air temperature T (°C)				Air temperature T (°C)		Average relative humidity U (%)			Average nebulosity N (0-10)			Precipitation R (mm)		Wind								Average speed f (km/h)			
	9 h	15 h	21 h	Day	Max.	Min.	9 h	15 h	21 h	9 h	15 h	21 h	Total	Max.	Number of observations nD in each direction											
															N	NE	E	SE	S	SW	W	NW		C		
January . . . . .	26.9	28.3	25.5	26.1	30.1	23.5	33.0	20.6	76.0	72.2	33.2	8.7	6.6	4.4	22.7	72.9	1.8	3.7	4.0	5.8	9.1	26.4	33.1	6.1	3.0	12.9
February . . . . .	27.4	29.2	26.3	26.8	31.0	24.0	35.1	20.7	74.8	70.4	81.4	8.7	6.8	4.9	36.2	61.8	2.5	3.8	5.4	7.3	7.1	19.2	32.0	5.3	2.1	14.0
March . . . . .	27.6	29.4	26.5	27.1	31.1	24.2	35.2	21.2	77.5	72.6	82.6	8.6	7.0	5.5	103.3	86.7	1.8	3.7	9.1	8.9	8.0	21.5	29.6	7.3	3.1	13.3
April . . . . .	27.1	29.1	26.0	26.6	30.6	23.9	34.6	21.2	81.2	76.0	86.5	8.8	6.8	6.4	120.8	99.8	1.8	4.7	10.3	9.0	10.1	18.7	26.1	5.8	3.5	12.2
May . . . . .	25.9	27.8	24.5	25.4	29.3	23.0	36.1	18.9	80.4	74.7	87.2	8.2	4.6	3.4	16.3	58.8	1.4	3.2	5.1	7.2	12.1	24.3	31.1	5.3	3.3	11.9
June . . . . .	23.0	25.0	21.7	22.5	26.5	20.2	31.8	16.2	79.2	73.8	86.6	8.0	2.2	2.5	0.2	4.8	0.9	3.8	7.2	8.5	8.9	23.7	27.5	6.3	3.2	11.6
July . . . . .	20.8	23.0	19.8	20.6	24.3	18.3	29.6	14.6	81.6	74.6	86.8	8.6	3.5	2.4	0.1	0.5	1.5	4.8	10.2	7.9	7.9	24.9	23.6	8.6	3.6	10.8
August . . . . .	20.8	22.8	19.9	20.6	24.3	18.4	28.7	15.5	83.0	76.6	88.4	8.9	4.7	3.1	1.1	5.0	1.9	4.3	9.1	7.9	6.2	24.7	26.7	8.1	4.1	10.6
September . . . . .	22.5	24.2	21.3	22.0	25.7	19.8	29.3	16.8	80.7	75.6	87.8	9.1	4.8	3.2	2.8	5.4	2.4	2.6	5.3	6.3	6.2	25.1	33.5	6.2	2.4	11.8
October . . . . .	24.8	26.2	23.3	24.1	27.6	22.0	31.6	19.1	79.1	75.2	85.4	9.2	5.4	4.3	6.7	19.5	1.7	1.6	1.9	3.6	6.8	29.4	42.0	4.4	1.6	14.9
November . . . . .	26.2	27.5	24.7	25.4	29.0	23.1	34.5	20.1	76.8	73.9	83.6	9.2	5.6	4.7	27.4	51.7	2.6	2.3	2.0	3.2	6.8	27.4	39.8	3.9	2.0	14.8
December . . . . .	26.5	27.7	25.0	25.7	29.5	23.3	33.1	19.8	77.0	73.9	84.2	9.0	6.3	4.5	25.0	39.7	3.0	3.6	2.7	4.3	7.9	26.2	36.3	5.0	4.0	12.8
Year . . . . .	25.0	26.7	23.7	24.4	28.2	22.0	36.1	14.5	78.9	74.1	85.3	8.8	5.4	4.1	362.6	99.8	23.3	42.1	72.3	79.9	97.1	291.5	381.3	72.3	35.9	12.6



Map 1 — House-catching zones in Luanda

plished, 2 captures were made: one, in the morning, between 6-9 o'clock, and the other, at night, between 20-24.

The captures in the same house were spaced so that the number of adults obtained in the second capture were not influenced by the first.

### 3. — RESULTS

During the entire survey, 14 different breeding-places of culicines were recorded, and 815 adult culicine mosquitoes were caught in houses. The mean culicine density per house was 2.48.

Seven culicine species were recorded <sup>(1)</sup>:

*Culex (Culex) pipiens quinquefasciatus* Say, 1823;  
*Culex (Culex) thalassius* Theobald, 1903;  
*Aedes (Aedimorphus) irritans* (Theobald, 1901);  
*Culex (Culex) antennatus* (Becker, 1903);  
*Culex (Culex) simpsoni* Theobald, 1905;  
*Culex (Culex) univittatus* Theobald, 1901;  
*Uranotaenia balfouri* Theobald, 1904.

<sup>(1)</sup> Nomenclature according to ALAN STONE *et al.* (7)

#### 3.1. — *Culex (Culex) pipiens quinquefasciatus* Say, 1823

*Fatigans* was by far the most frequent of all the species present in the region, the others being so scarcely represented that the culicine situation within the city depends practically on it.

In a total of 14 breeding-places recorded, 13 of them (92.9 %) were used by this species. Moreover, only one of these breeding-places was found, in the outskirts of the city, near the native village of Yelo-Kala, where *fatigans* was associated with other culicines.

The breeding-places were either permanent pools or ditches, either temporary rain-pools and, in one instance, a collection of water in an artificial container. The water allways had a high organic matter content and, on the contrary, the salt content was allways a low one, even in the breeding-places where some tidal influence could be suspected. In two of these instances, we obtained figures of 1.170 and 0.936 g/l.

*Culex pipiens quinquefasciatus* was also almost exclusively the only mosquito caught in houses. In fact, 812 of the 815 house-caught culicine specimens

were *fatigans*, the mean density of *fatigans* per house, 2.47, being practically the same as the mean culicine density.

By catching-zones, the *fatigans* density per house was, by decreasing order of values: 9.72 in zone G; 4.14 in zone H; 2.14 in zone J; 1.94 in zone D; 1.36 in zone I; 1.13 in zone F; 1 in zone E; 0.96 in zone B; 0.54 in zone C; and 0.25 in zone A (see map 1).

According to these figures, we can see that the higher densities occurred in the peripheral belt of the city, mainly on the south, and that zone G (Catete's Road) has an appreciably higher density than any other zone. This is in connection with the fact that this was the zone where were located the most prolific permanent breeding-places of the species.

Regarding the variation of the local *pipiens quinquefasciatus* population with the changes in the climatic conditions of the surveyed region, we found that the *fatigans* density per house was 1.4 and 3.7 respectively during the March and the August survey periods (see figure 1).

### 3.2. — *Culex (Culex) thalassius* Theobald, 1903

Only two breeding-places of *C. thalassius* were recorded during the entire survey.

In March, 4 larvae were found in an open pool of turbid water in zone G, a prolific breeding-place of *fatigans* (see map 1).

In August, 16 larvae were collected from an open drain with turbid blackish water in Samba Pequena (zone J).

In houses, only one engorged female was caught, at night, in zone C, during the March survey period.

In spite of the scarcity of our data, we think that these records agree with the great adaptability assigned to the larvae of *thalassius*, including its capacity to breed in salt water (8).

### 3.3. — *Aedes (Aedimorphus) irritans* (Theobald, 1901)

The presence of *Aedes irritans* in the surveyed region was only revealed by two engorged females caught in one house of zone J (Samba Pequena), at night, during the March survey period.

Though no one larva of this *Aedes* could be found, the location of the adult records (see map 1) agree with the assumption that it should be a salt water breeder, as it already well established from the larval records in other countries. (8).

### 3.4. — *Culex (Culex) antennatus* (Becker, 1903)

As to the following species, no one adult of *antennatus* was caught in houses, its presence in the surveyed region being only revealed by larval records.

Also as to the following three species, the larvae were found during the August survey period, breeding in an open shallow pool with turbid water located near the native village of Yelo-Kala, in association with few *fatigans* (see map 1).

From this breeding-place, 43 *antennatus* larvae were collected, whose identification could be confirmed by the examination of the terminalia of males emerged from them.

As *antennatus* had not yet been recorded in Luanda (1, 2, 3), its now established presence there constitutes a new locality record for the species.

### 3.5. — *Culex (Culex) simpsoni* Theobald, 1905

Seven larvae of *C. simpsoni* were collected in the breeding-place and in the conditions described under 3.4.

Though the morphology of the pecten spines of our larvae be quite similar to that figured by Hopkins (8), they don't agree with the description given by this author.

Anyhow, we could confirm the identification of the larvae by the examination of the terminalia of males emerged from laboratory-reared specimens.

### 3.6. — *Culex (Culex) univittatus* Theobald, 1901

The presence of *C. univittatus* was only revealed by five larvae collected in the same breeding-place of the preceding species, during the August survey period.

Though the separation of *univittatus* larvae from these of *antennatus*, occurring together in the same breeding-place, had been a difficult task, owing to the variation of local populations, we could confirm the diagnosis by the examination of quite typical females emerged from laboratory-reared larvae.

The occurrence of *C. univittatus* in Luanda constitutes a new locality record for the species (1, 2, 3).

### 3.7. — *Uranotaenia Balfouri* Theobald, 1904

Only one larva of *U. balfouri* could be collected during the entire survey.

The larva occurred in the same breeding-place and the same conditions as the preceding species, already described under 3.4.

In spite of the extreme scarcity of the material available, the quite typical larva enabled us to establish a new locality record for the species (1, 2, 3).

#### 4 — CONCLUSIONS

The data that were gathered during the survey permit us to conclude that:

4.1—From the eleven culicines recorded in Luanda until 1956 (2), only four species were present in the region at the time of the survey;

4.2—The assumed absence of *Aedes aegypti* L. could be confirmed (1);

4.3—The presence of *C. antennatus* (Becker), *C. univittatus* Theo. and *U. balfouri* Theo. in Luanda established new locality records for these culicines;

4.4—*C. pipiens quinquefasciatus* Say (*C. fatigans*) was by far the most frequent of all the species now present in the region, the others being so scarcely represented that the culicine situation depends practically on it;

4.5—The high predominance of *fatigans* is probably due to selection of this species as an effect of the antimalaria measures being adopted in the city.

#### 5 — SYNOPSIS

In this paper we present the culicine data that were gathered during a malaria survey carried out in Luanda, in the course of the year 1963.

Seven culicine species were recorded in the region, three of them by the first time.

*Culex pipiens quinquefasciatus* Say (*C. fatigans*) was by far the most represented species, its high predominance being probably due to selection induced by the antimalaria measures being adopted in the city.

#### 6 — RESUMO

Neste trabalho apresentam-se os dados relativos aos culicíneos colhidos no decurso de um inquérito malariológico realizado em Luanda, em 1963.

(1) In fact, so far as we know, *A. aegypti* have never been recorded from Luanda nor from any other locality in Angola with a similar name (1, 2, 3, 9, 10), though A. J. LEBRUN stated, in a recent paper (11), that «...the mosquito (*Aedes aegypti*) was found in 77 per cent of the same trees inspected in Dar-es-Salaam and in many coconut trees in Loanda (Angola)». Unfortunately, no references is given as to the origin of this information.

Verificou-se a presença de sete espécies de culicíneos, três das quais assinaladas pela primeira vez na região.

*Culex pipiens quinquefasciatus* Say (*C. fatigans*) foi de longe a espécie mais representada, admitindo-se que este facto resulte de selecção induzida pelas medidas antipalúdicas que têm vindo a ser adoptada na cidade.

#### 7 — RÉSUMÉ

Dans ce travail nous présentons les données concernant les culicinés capturés pendant une enquête malariologique effectuée dans la ville de Luanda, à l'Angola, em 1963.

On a vérifié la présence de sept espèces de culicinés, dont trois y sont signalées pour la première fois.

*Culex pipiens quinquefasciatus* Say (*C. fatigans*) a été de beaucoup l'espèce la plus représentée, sa grande prédominance étant probablement due à sélection induite par les mesures antipaludiques adoptées dans la ville.

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