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CULEX PIPIENS FATIGANS WIED. AND THE URBANIZATION OF WEST AFRICA<sup>1</sup>

by

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I. INTRODUCTION

By West Africa we mean in this paper the territories between the Sahara Desert, the Atlantic Ocean, Chad, Central African Republic and the Congo (Brazzaville).

In this area there are two sub-species of the pipiens complex. C. p. pipiens has been found in Tibesti and Borkou in Chad (Rioux, 1959), in Adrar and Hodh in Mauritania, in the Fouta-Djalou highlands in Guinea and at Yaoundé in Cameroon. C. p. fatigans appears to be present in all the large towns, also in certain places of medium size; it is usually rare or absent in rural areas. The only place in West Africa in which the two sub-species seem to occur together is Yaoundé and so far no natural hybrid has been reported, despite what has been observed in the United States and the Far East (Mattingly et al., 1961).

Whereas in West Africa C. p. pipiens seems to be a relic species, exophilic and probably zoophilic, C. p. fatigans on the other hand is a recent arrival; endophilic and anthropophilic, that already constitutes an urban health problem and is liable in the future to establish new foci of Bancroft's filariasis (Mattingly, 1962a).

II. ESTABLISHMENT OF C. P. FATIGANS IN WEST AFRICA

It is rather difficult to give an exact account of the appearance of C. p. fatigans in the various parts of West Africa, since in the past urban health authorities rarely paid attention to the species determination of Culex. Most of the available information is less than 25 years old, and C. p. fatigans was already present in various big towns 25 years ago. Grunberg (in Rageau & Adam, 1953) give C. p. fatigans as occurring in Douala and Mamfé, Cameroon, as early as 1905, and Macfie & Ingram (in Edwards, 1941) report the mosquito as abundant in Accra, Ghana, in 1916, at the same time noting its absence in the interior.

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The most interesting dated observations we have at present are from Sierra Leone, Nigeria and Cameroon. There are a few, less specific, data from Mali and Upper Volta.

In Freetown, Sierra Leone, C. p. fatigans probably did not occur in 1932, and it was certainly rare until 1954, from which year onwards it became abundant (Thomas, 1956).

At Kaduna, Nigeria, this species occurred, but in very small numbers, from 1919 to 1944, whereas in 1957 it had become the principal species caught in houses (Hanney, 1960; Service, 1963).

At Yaoundé, Cameroon, C. p. fatigans occupied about 2.2% of breeding places examined from 1948 to 1952, as against about 36% from 1958 to 1961. At Douala the species was sufficiently rare to pass undetected during a survey made in 1956 (Mouchet, 1956), whereas almost exactly a year later it was caught in more or less great abundance in the 14 parts of the town inspected (Gariou, 1957).

In Mali, in 1906 to 1907, Le Moal and Bouffard did not mention C. p. fatigans among the Culicinae of Bamako, Kayes and Ségou, nor did Neveu-Lemaire (in Hamon et al., 1960), whereas this species is now almost the only one occurring in the first two towns and is very common in the third.

At Bobo-Dioulasso, Upper Volta, C. p. fatigans was present, but relatively uncommon, from 1952 to 1953, whereas it is now very common and practically the only species of mosquito found in the town.

It seems therefore that a gradual colonization of West Africa by C. p. fatigans took place between the two world wars and particularly after the second, and that the species has undergone a very recent mass increase in the places in which it is established.

### III. PROBABLE ORIGINS OF THE WEST AFRICAN C. P. FATIGANS POPULATIONS

C. p. fatigans appears to have been established much longer in East Africa and the Comoro and Mascarene Islands, on the one hand, and in the central part of the American continent and in the Caribbean on the other, than in West Africa.

In early times the slave trade resulted in the establishment of extensive shipping links between the coast of West Africa, the West Indies and the central part of the American continent, and undoubtedly made the transport of C. p. fatigans possible.

Trade between the west and east coasts of Africa was less intensive, but the sea route between Europe and the Far East passed along those coasts and it is not impossible that C. p. fatigans might have arrived by that route.

More recently, modern sea and air communications have increased the possibility of mosquitos being carried about Africa and, still more, between Dakar and America.

Systematic study of the West African C. p. fatigans populations and work on their cytoplasmic incompatibilities (WHO, 1964) may perhaps make it possible to trace their origins.

#### IV. CAUSES OF THE RECENT MULTIPLICATION AND SPREAD OF C. P. FATIGANS IN WEST AFRICA

The recent multiplication of C. p. fatigans in the places in West Africa where it was established already, and its establishment in towns and even villages in which it did not occur a few years ago, are two aspects of one and the same phenomenon: economic development.

It might be argued that it took the West African strains of C. p. fatigans half a century to "adjust" their heredity to the African environment, but that would not explain their present distribution.

It does not seem very likely that urbanization in itself is the main factor involved. Ten to 20 years ago C. p. fatigans was still rare in towns like Kaduna, Freetown and Bobo-Dioulasso, which were already large at that time, whereas they are now found in small towns of only a few thousand people. The breeding places now occupied by C. p. fatigans already existed before, but they were occupied by other species.

Examination of the results of early surveys in urban areas shows that the breeding places were occupied, in the sudan savannah or sahel zone, by A. aegypti, C. nebulosus, C. decens, C. tigripes, and sometimes by C. duttoni and C. cinereus; in the guinea savannah and forest regions there were numerous other species as well, including Eretmapodites of the chrysogaster group and C. pruina. With the exception of the first, all these species are highly zoophilic and exophilic and only come into competition with C. p. fatigans as concerns breeding places.

While C. p. fatigans seems excellently adapted to the tropical urban environment (Mattingly, 1963), it appears that it is its lack of competitiveness in regard to breeding places that has slowed down and in certain cases prevented its establishment in the urban areas of West Africa.

The treatments with residual insecticides carried out during the last 15 years in most of the urban areas of West Africa have in many cases eradicated the species competing with C. p. fatigans, and also perhaps certain predators, or at any rate have considerably decreased their frequency (Mattingly, 1962b). C. p. fatigans has largely become resistant to insecticides, but even where it appears to have remained susceptible to them its great natural tolerance of DDT, at the adult stage, has given it a clear advantage over the competing species (Service, 1963).

C. p. fatigans has been able, with the protection provided by insecticide treatments, to multiply in urban areas and to establish itself in new places, even in villages in the malaria control pilot areas of Thiès (Sénégal) and Bobo-Dioulasso (Upper Volta). It appears that in the latter area at least the species has been unable to maintain itself in the villages after the insecticide treatments ceased.

Starting from the towns, where it is firmly established and usually very abundant, C. p. fatigans can now take advantage of modern means of transport to extend its range and use the constantly increasing number of vehicles driving along the trails or the aircraft of internal transport lines, which are practically never disinfected.

The gradual abandonment of campaigns to eliminate larval breeding places in most urban areas is obviously calculated to promote the multiplication of mosquitos occupying breeding sites in and around houses.

#### V. CONCLUSIONS

Since the towns are still being more or less regularly treated with insecticides in a manner insufficiently effective to eliminate C. p. fatigans, and since the intensification of urbanization is usually not accompanied by a parallel improvement in general sanitation, this situation can hardly do otherwise than worsen still further.

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