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**BIOLOGY OF ANOPHELES GAMBIAE**

**Research in French West Africa**

# BIOLOGY OF ANOPHELES GAMBIAE

Research in French West Africa

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## CONTENTS

	Page
Preface . . . . .	9
Introduction . . . . .	11
Chapter 1. Climatological and geographical data . . . . .	13
French West Africa . . . . .	13
Upper Volta . . . . .	16
Bobo-Dioulasso district . . . . .	19
Chapter 2. Research techniques . . . . .	20
Collection and transport . . . . .	21
Rearing . . . . .	24
Dissection techniques . . . . .	26
Determination of ingested blood (precipitin method) . . . . .	29
Mounting and preservation of material . . . . .	32
Study of the larval breeding-places . . . . .	32
Chapter 3. Morphology of <i>Anopheles gambiae</i> —Typical form and varieties . . . . .	35
Adult . . . . .	35
Egg . . . . .	42
Larva . . . . .	44
Pupa . . . . .	49
Chapter 4. Biology of the early stages . . . . .	52
Larval breeding-places . . . . .	52
Egg-adult life-cycle . . . . .	66
Resistance to various physical factors . . . . .	70
Chapter 5. Biology of the adults . . . . .	80
Cycle of nocturnal activity and aggressiveness . . . . .	80
Population fluctuations . . . . .	86
Diapause in adult females . . . . .	99
Chapter 6. Role of <i>A. gambiae</i> in the transmission of malaria . . . . .	113
Chapter 7. Races and varieties of <i>A. gambiae</i> —Anthropophily and zoophily . . . . .	122
Study of <i>A. gambiae</i> var. <i>melas</i> . . . . .	122
Anthropophilic and zoophilic populations of <i>A. gambiae</i> . . . . .	127
Conclusions . . . . .	144
Annexes	
Annex 1. Geographical distribution of <i>A. gambiae</i> . . . . .	148
Annex 2. Sporozoite-rates of <i>A. gambiae</i> in various regions of Africa and in Brazil . . . . .	156
Annex 3. Key to the identification of the common anopheles in French West Africa . . . . .	158
Bibliography . . . . .	163

## TABLES

	Page
I. Maximum and minimum temperatures during April and September at various stations . . . . .	17
II. Duration (days) of the various stages of the egg-adult life-cycle in the field and in the laboratory . . . . .	67
III. Duration of the egg-adult life-cycle in water at various temperatures . . . . .	69
IV. Duration of the egg-adult life-cycle in "inorganic" and in "organic" breeding-places . . . . .	69
V. Resistance of eggs to desiccation on various substrata . . . . .	73
VI. Resistance limits of eggs on various substrata, as a function of relative humidity . . . . .	74
VII. Resistance of larvae after desiccation on various substrata . . . . .	76
VIII. Influence of salinity on the hatching of eggs . . . . .	77
IX. Influence of salinity on pupation . . . . .	78
X. Resistance limits of eggs and of larvae to various physical factors . . . . .	79
XI. Captures of <i>gambiae</i> , rainfall, and relative humidity at Bobo-Dioulasso, May-September 1949 . . . . .	92
XII. Captures of <i>gambiae</i> , rainfall, and relative humidity at Bobo-Dioulasso, May-September 1950 . . . . .	93
XIII. Distribution of minimum daily temperatures at Bobo-Dioulasso, November-February 1948-9 and 1949-50 . . . . .	101
XIV. Observations concerning the biology of various females reared in the laboratory . . . . .	105
XV. Infestation-rates of <i>gambiae</i> in various localities in French West Africa . . . . .	114
XVI. Infestation-rates of <i>gambiae</i> in the Bobo-Dioulasso area . . . . .	114
XVII. Sporozoite-rates of <i>gambiae</i> and <i>funestus</i> captured at station 1 . . . . .	115
XVIII. Sporozoite-rates of <i>gambiae</i> and <i>funestus</i> captured at station 2 . . . . .	116
XIX. Sporozoite-rates of <i>gambiae</i> and <i>funestus</i> captured at station 3 . . . . .	116
XX. Sporozoite-rates of <i>gambiae</i> and <i>funestus</i> captured at station 4 . . . . .	117
XXI. Sporozoite-rates of <i>gambiae</i> and <i>funestus</i> captured at station 5 . . . . .	117
XXII. Sporozoite-rates of <i>gambiae</i> and <i>funestus</i> captured at the five stations . . . . .	119
XXIII. Average infective density per hut for <i>A. gambiae</i> and <i>A. funestus</i> , at stations 1 and 5 . . . . .	120
XXIV. Distribution of the maxillary index in female <i>gambiae</i> . . . . .	129
XXV. Maxillary armament in various <i>gambiae</i> populations . . . . .	131
XXVI. Results of precipitation reactions carried out on various <i>gambiae</i> populations . . . . .	133

	Page
XXVII. Food preferences as a function of maxillary armament in multidentate <i>gambiae</i> (zoophily) . . . . .	134
XXVIII. Food preferences as a function of maxillary armament in paucidentate <i>gambiae</i> (anthropophily) . . . . .	135
XXIX. Relation between the maxillary index and the organic-matter content of the breeding-place . . . . .	136
XXX. Distribution of the maxillary index in certain populations from both types of breeding-place . . . . .	137
XXXI. Captures of <i>gambiae</i> made outside dwellings . . . . .	141

## FIGURES

1. French West Africa . . . . .	14
2. Upper Volta . . . . .	16
3. Temperature, relative humidity, and rainfall at Bobo-Dioulasso, 1949-50 . . . . .	18
4. Catching stations in the Bobo-Dioulasso area . . . . .	23
5. Typical <i>A. gambiae</i> female . . . . .	36
6. Morphological characters of adult <i>A. gambiae</i> . . . . .	37
7. Wing variations . . . . .	39
8. Eggs—morphological characters of larvae in the fourth instar . . . . .	43
9. Bristles of larvae in the fourth instar . . . . .	45
10. Pupae—dorsal bristles . . . . .	49
11. Nocturnal and diurnal activity of <i>gambiae</i> . . . . .	83
12. Predominance of <i>gambiae</i> (station 4) . . . . .	87
13. Predominance of <i>gambiae</i> and increase of <i>funestus</i> during the dry season (station 1) . . . . .	88
14. Predominance of <i>funestus</i> (Guéckédou, French Guinea) . . . . .	89
15. Seasonal alternation of <i>gambiae</i> and <i>funestus</i> (station 5) . . . . .	90
16. <i>Gambiae</i> captures and rainfall (station 1) . . . . .	94
17. Average anopheles density per hut for <i>A. gambiae</i> (station 1) . . . . .	95
18. Sporozoite-rates of <i>A. gambiae</i> and <i>A. funestus</i> (stations 1 and 5) . . . . .	118
19. Sporozoite-rates of <i>A. gambiae</i> (stations 2, 3, and 4) . . . . .	118
20. Morphological characters of <i>A. gambiae</i> var. <i>melas</i> . . . . .	123
21. Morphological characters for the identification of <i>A. gambiae</i> adults . . . . .	159
22. Morphological characters for the identification of <i>A. gambiae</i> larvae . . . . .	161



## PREFACE

The work presented here sets out the results of research carried out over a period of two years in French West Africa, particularly in the Upper Volta region, during a visit there as Research Officer of the Bureau of Scientific Research Overseas. Our grateful thanks are due to the Director of the Bureau, Professeur R. Combes, Membre de l'Institut, for the facilities and resources he placed at our disposal.

We were greatly assisted in our work by the organization of the Service général d'Hygiène mobile et de Prophylaxie in French West Africa : we directed its entomological laboratory for over a year. In addition to the well-equipped laboratories at Bobo-Dioulasso, the Service possesses, in all the territories of the Federation, sectors linking one or several administrative areas, each directed by a chief medical officer. It was therefore easy for us to collect from these doctors valuable information on the anopheline fauna of their sectors, and we wish to thank them for their friendly collaboration, which was of great assistance to us.

We are deeply grateful to Médecin-Général Le Rouzic, Director-General of Public Health in French West Africa, and to Médecin-Colonel Jonchère, Director of the Service général d'Hygiène mobile et de Prophylaxie in French West Africa, for the material help and encouragement they so freely gave us during the course of our laboratory work, and in the organization of our surveys, which took us on journeys through the Upper Volta, the Ivory Coast, the Sudan, and a part of Guinea. These surveys were rendered productive by the devoted assistance of our medical entomologists : Alexandre Ouédraogo, Tamboula Konadé, and François Kaboré, whom we now thank.

Our research could not have been successful without special training and it is particularly pleasant for us to express our acknowledgements to Mlle Odette Tuzet, Professeur à la Faculté des Sciences, Montpellier, by whom the vast field of general biology was opened up to us ; to M. R. Paulian, whose teaching at the Natural History Museum in Paris succeeded in convincing us that entomology, far from being barren, was a living and enthralling science ; and, finally, to Professeur E. Roubaud, Membre de l'Institut, who has followed our work step by step, and whose directives, together with the wise and friendly counsel with which he has been unstinting, have enabled us to give here the results of our research.

We owe to Pharmacien-Colonel Gasq and to Pharmacien-Commandant Monnet, Directors of the Chemistry Laboratory of the Service général

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We are grateful to the local directors of public health in the Upper Volta, the Ivory Coast, the Sudan, and Guinea, as much for their welcome as for the information with which they provided us. Our thanks also go to the medical officers in charge of the health departments in the localities that we visited.

To the directors of the medical services in British Gambia, Sierra Leone, the Gold Coast, and Nigeria, we are extremely grateful for the valuable records which they kindly forwarded to us.

To Dr. L. J. Bruce-Chwatt, Director of the Malaria Service, Medical Department, Nigeria, we owe a very special acknowledgement for the kindness with which he put his experience, his records, and his laboratory at our disposal.

Our warm thanks go to our friend R. Doret, Administrator of Overseas Territories, who gave us access to the archives of the Bobo-Dioulasso region, and whose knowledge of the district was often useful to us when we were there.

Finally, we do not forget our team of "mosquito-boys" whose daily work largely contributed to the elaboration of this study.\*

*31 May 1951*

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\* Since the original monograph was published in August 1952, new knowledge has become available on several aspects of the subject and a number of additions have been incorporated, by the author, in this translation. — Ed.

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## INTRODUCTION

Of all the major tropical endemic diseases, malaria is certainly that with the most serious repercussions on the death-rate and on economics. After studying its influence on the distribution of populations and their movements, on agriculture, industry, and transport, and on education and social well-being, Macdonald<sup>233</sup> came to the conclusion that malaria justly takes its place among the chief concerns of doctors and health officers in Africa. If we consult statistics we note that, in recent decades, malaria has assumed increasing importance. Vogel & Riou<sup>396</sup> cite 276,225 hospital cases in French West Africa in 1937. This figure increased in 1939 (Le Gall<sup>214</sup>) and, according to the statistical tables of the Direction du Service de Santé colonial, reached 355,502 in 1941 and 577,876 in 1945. In 1948, owing to the starting of vast antimalarial campaigns, the number of persons hospitalized fell to 346,080. According to Le Gall,<sup>215</sup> 26% of the diseases treated in Madagascar from 1936 to 1940 were malarial and, in 1936, malaria was responsible for 14.3% of the general mortality. In French West Africa in 1941, malaria caused 10.94% of the general morbidity among Europeans alone. The last figure, mentioned by Le Gall,<sup>216</sup> clearly shows the primary importance of malaria in French West Africa, especially since the statistics quoted are well below the true figures. Indeed, it is necessary to take into account that the statistics of hospital cases are concerned with only a limited section of the population—principally with the inhabitants of large and medium-sized towns—and that the ratio between town-dwellers and the rural population is 1 to 17. Furthermore, malaria is such a common disease that Africans, particularly those in bush country, do not think it worth while to go for treatment in a hospital compound or dispensary, and deaths due to malaria, but not recorded as such, are frequent.

It is quite clear that drug prophylaxis alone will not succeed in appreciably lessening the incidence of endemic malaria, and that it must be accompanied by severe measures against the vectors of the disease. (In 1951, after several years of therapy with quinine and synthetic drugs, malaria was still the cause of 13% of the infantile mortality in the irrigated territories of the Office du Niger, Sudan.) However, to be effective, these measures must be based on a very precise knowledge of the biology of the anophelines concerned, and particularly of the principal vector of malaria in tropical Africa—namely, *Anopheles gambiae*. It must certainly be admitted that, although many studies on the behaviour of this mosquito

have been made since Ross discovered in 1899 that it played a vector role, they have generally not been concerned with French territories. Although *A. gambiae* has been discovered in all the localities of French West Africa where medical investigations have been carried out, this mosquito has, nevertheless, not been the subject of detailed study, except in the French Sudan, where some research was undertaken to which we shall have occasion to revert later.

The bridging of this gap in our knowledge was especially interesting since the many publications devoted to the biology of *A. gambiae* provide information that is very often contradictory; they lead to such diverse conclusions that several writers have considered dividing the species into races or varieties. If it is clear that a species of anopheles may show differing behaviour patterns in several parts of the area over which it is distributed, according to the climatic variations affecting different sectors of this area, it is no less certain that variations of behaviour recorded in extremely diverse climatic conditions, but also recurring in an identical form under these diverse conditions, suggest that we are concerned with a species showing racial varieties.

Our work, therefore, had a double aim: to study thoroughly certain aspects of the biology of *A. gambiae* which are of definite interest in combating malaria by means of modern insecticides, and to investigate and confirm the possible existence of races or varieties. We hope that the results of our research given here will help to explain the differences which have been apparent until now, and above all, that they will facilitate the task of those on whom rests the heavy burden of malaria control—since it is not possible to eradicate the disease entirely—in French West Africa. Let us hope that these results show, once more, the primary importance that should be given to a detailed investigation into the biology of the anopheline vector before vast anti-anopheline campaigns are undertaken. Indeed, if such campaigns are based only on results recorded in other regions of the globe—results which, it must be recognized, are often spectacular—there is a great risk of their being doomed to resounding failure, and of thus preventing new campaigns from being undertaken on the basis of valid entomological research.

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