

JM_h International congress on tropical medicine and malaria
Athens, 14-21 October 1973 vol. I. Abstracts of invited papers.

— These were carried out in the district of Garki, Kano State (Nigeria), utilizing the facilities of the local WHO malaria research project. Species A and species B of the *gambiae* complex were found in the Garki district in variable proportions. Inversion polymorphism was particularly studied in species B whose local population showed as many as 12 different paracentric inversions, 7 of which involve sections of the chromosomal arm 2R. The frequencies of the chromosomal types of species B were compared in various samples of blood fed females. Significant differences were observed between samples positive for human and animal blood and between samples collected resting indoor in human huts and biting outdoor on animals. It appears that the carriers of certain 2R chromosomal types (namely those with arrangement +a at the homozygous state and/or arrangement s-c at the heterozygous state) are more exophagic and exophilic than the carrier of other 2R chromosomal types.

PHYSIOLOGY AND BIONOMICS OF MALARIA VECTORS

363. The Physiological Ecology of Overwintering Anophelines.

R. K. WASHINO. *University of California. Department of Entomology, Davis, California, U.S.A.*

Long term studies of overwintering anophelines in Western North America are described. These species survive the winter as inseminated nulliparous females which undergo a facultative diapause. This diapause is induced by a short photoperiod. The diapausing females synthesize lipids as a source of overwintering energy, and show a reduction in blood feeding. Long dispersal flights from the breeding habitat may be characteristic in some species. Gonotrophic dissociation may or may not be observed. When dissociation is found, it does not appear to occur uniformly throughout the entire geographical range of the species and may involve only a small proportion of the total overwintering population.

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Contribution à l'Étude du Complexe *A. gambiae* en Afrique de l'Ouest.

J. COZ. *Orstom, France.*

Les travaux de Davidson et Jackson, Paterson ont permis de scinder *A. gambiae* s.l., en plusieurs espèces jumelles : trois dulçaquicoles, les espèces A, B et C correspondant à l'ancienne appellation *A. gambiae* et deux halophiles *A. melas* Theo et *A. merus* Dönitz. La particularité de ces espèces est de donner naissance, lors des croisements entre elles, à des progénitures dont les mâles sont stériles et les femelles fertiles. Nous avons trouvé trois espèces en Afrique de l'Ouest : *A. gambiae* A, *A. gambiae* B et *A. melas*. *A. melas* occupe la bordure littorale, dans les villages côtiers il est souvent rencontré en association avec *A. gambiae* A. *A. gambiae* A est un moustique de région humide, particulièrement de forêt; on le rencontre, toutefois, dans des zones plus sèches. *A. gambiae* B est rencontré en sympatrie avec *A. gambiae* A, dans les zones de savane et de sahel. Il provient à notre avis de zones sèches plus orientales. — Dans les zones de forêt *A. gambiae* A est anthropophile, — dans les zones de sahel *A. gambiae* B est plutôt zoophile. — on assiste à des phénomènes de convergence dans les régions de savane où l'on rencontre ensemble les deux espèces. *A. melas* et *A. gambiae* B sont de moins bons vecteurs naturels de paludisme qu'*A. gambiae* A, sans doute parce que plus zoophiles. Au laboratoire nous avons obtenu de meilleurs résultats expérimentaux avec *A. gambiae* A qu'avec *A. gambiae* B, ce

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qui indiquerait un pouvoir intrinsèque de transmission plus élevé, à moins qu'il ne s'agisse de phénomènes de souche. Des études ont été menées sur l'action de l'humidité comme facteur de spéciation : Dans un premier temps, nous avons effectué des croisements entre les espèces A et B et des croisements en retour avec les souches ancestrales. Il suffit de trois à quatre croisements en retour pour obtenir la production de mâles entièrement fertiles. Nous avons par ailleurs placé des mélanges de mâles et de femelles des espèces A et B dans des conditions d'humidité relative différentes. Il est apparu après un temps plus ou moins long, au cours duquel nous avons vérifié l'hydratation, que les atmosphères humides sélectionnaient l'espèce A et que l'espèce B n'apparaissait qu'en atmosphère sèche.

- 365. Bionomics of the immature stages of *Anopheles gambiae* and the need for improved sampling methods.

M. W. SERVICE. *Liverpool School of Tropical Medicine, Sub - Division of Entomology, Liverpool, England.*

Within recent years there has been renewed interest in the possibility of controlling *Anopheles gambiae* by larycides and biological methods. Because of this, and the recognition of several species within the *A. gambiae* complex, it is becoming increasingly evident that more information is urgently needed on the ecology of the immature stages. For example, the limiting factors that influence the selection of oviposition sites and successful development of the pre-adults need to be determined, and estimates of the mortalities of the various age classes of the immature population are required if life-tables are to be constructed. Predation, even in small habitats, is probably more important in regulating population size than is generally realized. The precipitin test is the best method for identifying natural predators. Improved sampling techniques for estimating both relative and absolute population sizes of the immature stages are long overdue. Because the pre-adults of *A. gambiae* have a highly aggregated distribution sample means and variances are not independent of each other. Consequently, field counts must be transformed (e.g. $\log n + 1$) before they can be used in simple parametric statistical tests. Finally, the minimum number of samples required for statistically reliable results should be determined before surveys are undertaken.

- 366. Physiology and Bionomics of malaria vectors in the Americas.

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Research in the region has been still mainly on *A. albimanus*, whose resistance to DDT has spread south from Central America. Laboratory studies showed viability of eggs on wet mud, and that larvae preferentially absorbed particles in the range 80 - 105 microns. In both *A. aquasalis* and *A. albimanus*, adults fed on sugar showed decreased mortality from contact insecticides, a physical effect. In El Salvador *A. albimanus* larvae escaped predaceous fish by sheltering in partly submerged leaves. Adult densities were more efficiently estimated by the New Jersey light trap than by 5 other methods. Both trap captures and observation of movement of adults from daytime resting places showed 6-9 p.m. as the period of peak activity. In Haiti also, biting was mainly outdoors, before 9 p.m. In El Salvador *A. pseudopunctipennis*, found in darker parts of the same resting places as the other species, left at the same time, but returned 2 hours later. Larval density of the 2 was constant round the year, but dry and wet season habitats were different. Elsewhere in El Salvador, later nocturnal activity in houses, with entry and exit at 10 p.m. and 3 a.m., was seen; marked mosquitoes remained 5 hours indoors. Lack of correlations between vector densities and local malaria