OPERATIONAL AND SCIENTIFIC NOTES

MALARIA RESEARCH IN EAST AFRICA. In 1954 the East African Malaria Unit became the East African Institute of Malaria and Vector Borne Diseases, and during the past three years the increase of staff that accompanied this change of title has permitted the increasing body of research and other activities that will be briefly summarized in the following account. The Institute works under the administration of the East Africa High Commission and covers the territories of Uganda, Kenya, Tanganyika, Somaliland and Zanzibar. It is assisted by some World Health Organization staff, and by some contributions from the United Nations Children's Fund.

The program of work covers three main lines of activity: research, teaching and consultant advice to the participating territories. The preponderating activities are concerned with malaria, but during the past couple of years an increasing interest is being taken in bilharzia, and other vectors and diseases come into the picture from time to time.

The staff consists of biologists, medical officers, chemists and a malaria engineer, assisted by European field officers, and a variety of junior staff that is wholly African and consists at the higher levels of malaria and laboratory assistants. There is so far one professional African officer.

The first objective of research has been to explore the life history of vector anophelines, and in particular of *Anopheles gambiae*, which plays so predominant a part in the transmission of malaria in tropical Africa.

Bionomics of *A. gambiae* adults. By means of searches in ordinary African huts and specially constructed experimental huts, the gonotrophic cycle in the coastal area of Tanganyika has, among other aspects, been worked out. The duration of this cycle was found to be no more than 48 hours during the greater part of the year, although it could extend to 72 hours when the mean monthly temperature fell below 74° F. for *A. gambiae* and below 78° F. for *funestus*. Although one blood meal normally leads to egg development, this is not the case in virgin females, in which a second blood meal is frequently required before ovarian development is completed, whether fertilisation has taken place or not. The recognition of these *pregravid* females has led to the possibility of separating off a very young age group of female *Anopheles*, and this group has been further sub-divided by use of the discovery that a "mating plug" can be seen in the oviducts of fertilised females, and by the presence or absence of sperms in the spermathecae. The ability to distinguish the very young from the general female population gives an index of anopheline survival.

Although the majority of *gambiae* remain within the house for 24 hours, it has been found that about half leave midway through the gonotrophic cycle, and can thereafter be found out of doors, with difficulty in the coastal area, but to a greater extent in certain inland areas. This tendency to leave the house is much less apparent in the case of *funestus*.

The feeding habits, as determined by precipitin tests, of the two species have also been found to differ widely inland as compared with the coast. Whereas *funestus* is predominantly a human feeder in either case, *gambiae* is to a large extent a cattle feeder in the inland areas. While this difference is to some extent associated with cattle, their presence does not by any means wholly explain the differences found as, even away from cattle concentrations, only 80–90 percent of *gambiae* have fed on man, as compared with 90–100 percent of *funestus*.

Mass catches of mosquitos, in a restricted area of half-mile radius, have shown that the density of vector *Anopheles* in the coastal area is of the order of 10 females per acre, of which only 16–20 were resting outside houses.

Studies on Anopheline Larvae. These studies on the bionomics of adults by Dr. M. T. Gillies, have their complement in experiments on the ecology of anopheline larvae by Mr. M. G. Christie, who has developed reliable methods for the enumeration of larvae, and for the recovery of anopheline eggs, in breeding places. By the use of these methods, it has been shown that *A. gambiae*, which is essentially a rainwater breeder, owes at least some of its great reproductive capacity during wet periods to the absence of predators from temporary water collections. Thus when predators are removed from a more permanent breeding place, larval survival rises from 4 to near 60 percent. A further factor in the population dynamics of this species is indicated by the finding that viable eggs can be found stranded on the edge of a drying pool or puddle, and these will hatch when further rain refills the breeding place.

Pilot Malaria Control Project. To a variable extent these researches on the natural history of East African malaria vectors form a background to a project in malaria control by means of residual spraying with dieldrin, in an area along the eastern Kenya—Tanganyika border. It is in this area that, although malaria is hyperendemic, *gambiae* is less anthropophilic as compared with the Coastal districts. This project, which covers a population of about 50,000, is still in progress. So far *A. funestus* has practically disappeared, and only one infected *gambiae* has been found since the first spraying; human parasite rates have fallen greatly. Extensive observations by Dr. A. Smith on house popula-

tions, biting rates, feeding habits, and outside resting, of *Anopheles* are intended to give a clear picture of what occurs, and an explanation of success or failure in the interruption of transmission. Complementary studies by Dr. C. C. Draper on human malariometry, growth rates in children, haemoglobin levels and so forth are on the other hand designed to give at least a preliminary indication of the effect of malaria on man in such areas, if the attempt to arrest transmission is successful.

Insecticides. An essential part of the residual spraying project is of course the observation of insecticidal activity in huts sprayed. Other insecticidal work has been concerned with the assessment of larvicides, and it has been shown that dieldrin is some ten times as active as DDT against *A. gambiae*. More recently dieldrin in a granulated formulation has been applied by aircraft in field trials at Dar es Salaam, and found to be very effective in wide swampy areas otherwise very difficult to control. All these insecticidal projects are carried out in collaboration with a neighbouring research organization, the Colonial Pesticides Research Unit.

Advice and Teaching. Advice and assistance in assessment are being given to control projects carried out by territorial medical departments, usually with the assistance of the World Health Organization, as in the Highland areas of Kenya, in Somaliland, and Zanzibar. As opportunity presents, surveys of malaria and bilharzia, and of their vectors, are carried out from time to time in the territories, and the amount of such much needed work is limited only by the availability of staff. Similarly advice on methods and materials is given, and schemes prepared. In the case of drainage projects, this is the work of the Malaria Engineer.

Finally the teaching activities of the Institute, mainly for African Health Inspectors and others, but also for Europeans, use up a good deal of the resources of the senior staff. Some 240 Africans and Europeans have so far attended courses lasting three to five weeks. These cover both the theory and practice of mosquito control, and some of the basic knowledge necessary to an understanding of control. Without a great increase in the number of trained assistants, any projects for the extension of vector borne disease control in tropical Africa are meaningless.—D. Bagster Wilson, East African Inst. of Malaria and Vector Borne Diseases.

NOTES ON THE SEASONAL ABUNDANCE OF *Culex tarsalis* COQ. IN TEXAS. Immature stages of the mosquito *Culex tarsalis* Coq. may be collected in Texas throughout the year. In the course of collections made throughout the state in 1954–1955, larvae were abundant from April through June. Larvae became less numerous during the hot summer months. In September and November, another increase in larval population was observed; this was followed by decreasing numbers during the colder winter months. Randolph and O'Neill (1944) report that large numbers of this mosquito can be collected in Texas in early spring and fall.

Larvae and pupae apparently can withstand a wide range of temperatures and water types. Specimens have been collected from water varying in temperature from 105° F. (Hot Springs, Big Bend National Park, Texas; temperature reported by park officials), to water of a temperature of 38° F. which had been frozen over lightly the night before collections were made. Additionally, fourth instar *C. tarsalis* larvae and pupae have been collected from the brackish water of tidal flats at Corpus Christi, Texas.—John M. White, Oklahoma Baptist University, Shawnee, Oklahoma.

References Cited

RANDOLPH, N. M., and KELLIE O'NEILL. 1944. The mosquitoes of Texas. Bull. Texas State Health Dept.

ROLE OF ALBUMINOID AMMONIA AND OTHER FACTORS IN THE BREEDING OF *Anopheles sundaicus* (Rodenwaldt): A PRELIMINARY NOTE (Summary). An unprecedented outbreak of malaria in 1930 in the Budge Budge area about 16 miles south of Calcutta, India, was traced to *Anopheles sundaicus*. Subsequent study of the breeding habits of this mosquito in brackish water swamps and other areas in the vicinity of Calcutta indicated that it could tolerate a wide range of salinity.

The present report summarizes some of the more significant findings of a ten-year study (1935–1945) of the ecological factors which might be critical in the production of *A. sundaicus* in various habitats such as tanks, ponds, lakes, borrow pits, swamps, tidal creeks, and canals. Factors investigated were pH, alkalinity, albuminoid ammonia, free ammonia, absorbed oxygen, dissolved oxygen, nitrites, nitrates, carbonates, iron, calcium, and suspended matter.

A preliminary analysis of data collected before, during, and after breeding of *A. sundaicus* indicates a correlation with albuminoid ammonia content, breeding being observed when the albuminoid ammonia content was low compared to the before and after readings. Most breeding was observed when the albuminoid ammonia was below 0.3 ppm, but some breeding occurred when the content was as high as 0.68 ppm.

No correlation was observed with free ammonia or the various other factors studied. The findings confirmed previous observations as to the wide tolerance of *A. sundaicus* for salinity, positive breeding being observed in situations where the salt content ranged from 160 to 6,800 ppm.—Purnendu Sen, School of Tropical Medicine, Calcutta, India.