REVIEWS AND ABSTRACTS

MOSQUITO BEHAVIOUR IN RELATION TO MALARIA TRANSMISSION AND CONTROL IN THE TROPICS. Muirhead-Thomson, R. C. London. Edward Arnold & Co., 219 pp., 1951. This is a well-documented treatise by an author who has had more than ten years experience in observing and reporting on the behavior of Indian and African mosquitoes. Dr. Muirhead-Thomson has selected data from his previous papers and integrated them with information from the works of other authors. In the words of the writer, the book on mosquito behavior "is divided into two parts which are treated in rather different ways. In the first part, which is concerned with the movements of mosquitoes in relation to mating, feeding and resting we have been content to record and review the numerous more or less straightforward observations and experiments which have been made, without going too deeply into any analysis of the mosquitoes' complicated movements. In the second part, devoted to problems of the nature and selection of the breeding place, emphasis has been on the part played by simple physical and chemical factors in determining the behaviour of the female mosquito and of the immature stages."

The six chapter headings in Part I are: (1) General Activities in Relation to Mating, Feeding and Longevity; (2) Nocturnal Activity and Biting Cycles; (3) Outdoor Resting Places and the Exodus from Houses; (4) Host Selection; (5) Behaviour in Relation to Temperature, Humidity, and Light; and (6) Behaviour in Houses in Relation to Control by Insecticides. In Part II, the headings are: (7) Selection of the Breeding Place; (8) Light, Shade and Mechanical Obstruction; (9) Water Movement and Silt; (10) Water Temperature; (11) Dissolved Oxygen, Organic Matter and Pollution; and (12) Salt Water and Tidal Influence.—H. L. T.

THE PRESENT STATUS OF MALARIA IN THE WORLD. Russell, P. F. Amer. Journ. Trop. Medicine Hyg. 1(1):111–123. 81 refs. 1952. Residual spraying with such toxicants as DDT has begun to change the status of malaria in the world. Already this new technique has almost eliminated malaria from many foci, including entire countries. Methods are fairly well standardized and can be applied on a nation-wide scale at financially feasible costs almost anywhere. But malaria is still probably the most prevalent serious illness of man and it should continue to receive major attention and high priority from those faced with the problems of international disease control. The greatest handicaps today in the control of malaria are lack of (a) trained personnel and (b) governmental antimalaria services within effective national health organizations.

Three major questions are currently being asked. First, will anopheline vectors become resistant to residual insecticides; second, is malaria control safe in holoendemic areas where the population has a strong tolerance to the disease; and third, is control worthwhile in areas which are or may be overpopulated?

Without presuming to answer them, one may comment on these questions briefly.

First, there is no clear record of practical anopheline resistance to an insecticide, but rumors are rife from Greece and Sardinia to the Tennessee Valley. Since both *Culex* and *Aedes* species, not to mention *Musca*, have become resistant, it seems reasonable to expect trouble and to think about counter-measures.

Second, the need for control is probably much greater in holoendemic areas than appears on the surface. If one is planning routine malaria control there is no logical reason to omit tolerant populations. Obviously, if one merely "tampers" with the situation, with no plans for continuity of effort, there could be epidemics after the community had lost its tolerance. However, modern drugs and sprays are so effective that, without gross neglect, serious ontbreaks are not likely.

Third, to this writer there appears to be no logical reason for slackening or stopping malaria control because of fears about increased populations pressure and concomitant evils. But, since our aim is a healthier world and not bigger populations, the need is apparent for an integration of malaria control activities with those of agriculturists, economists, educators, health officers and social scientists for the common good.—Author's conclusions.

FIELD STUDIES ON THE COMPARATIVE EFFECTIVENESS OF D.D.T. AND B.H.C. AGAINST MOSQUITOES WHEN APPLIED SEPARATELY AND IN COMBINATION. Singh, J.; Pal, R.; and Sharma, M. I. D. 1951. Indian Journ. Malariol. 5(2): 235–248. 1. Field trials on the comparative effectiveness of D.D.T. and B.H.C. against mosquitoes when applied separately and in combination are discussed. Studies were conducted in villages near Palwal, District Gurgaon, Punjab (I). 2. For proper evaluation of insecticides, more than one criterion has been applied concurrently so that results, as far as possible, can be correctly interpreted. Density of mosquitoes, window trap collections and percentage of survival of trapped mosquitoes after 24 hours, chemical estimation of insecticides from scrapings of treated surfaces, and malariometric data have been collected. 3. Irrespective of the dosage employed (50–200 mg. D.D.T. per sq. ft.) D.D.T. suspension was more effective than emulsion on mud-plastered walls. 4. Massive doses of D.D.T. when applied on mud-plastered walls whether as suspension or emulsion do not seem to show proportional increase in the duration of residual effect. After 12 weeks of application no D.D.T. could be detected even in the scrapings removed from the

houses treated with 200 mg. D.D.T. per sq. ft. 5. Under local conditions there is little to choose between D.D.T. 50 mg. (applied as suspension) and B.H.C. 10 mg. gamma isomer per sq. ft. Both give protection for about 6 weeks. Relative costs can decide the choice. 6. Both D.D.T. and B.H.C. exert a slight repellent effect on local species of mosquitoes but the insects pick up a lethal dose and eventually die. Control of malaria is effected by reduction in the density of mosquitoes and by the phenomenon of interception. 7. The additional effectiveness of D.D.T. and B.H.C. in combined spray (25 mg. D.D.T.+ 5 mg. B.H.C. gamma isomer/sq. ft.) was obvious. D.D.T. and B.H.C. combined spray was not only effective for a longer period but was also more efficacious in keeping down the density of mosquito population than either of them applied separately. 8. Choice of insecticides for malaria control is considered to depend upon the duration of the residual effectiveness and whether this effect is disturbed by human interference depending upon the habits and practices of inhabitants. Repeated application of D.D.T. and B.H.C. in combination at a dosage of 25 mg. D.D.T. and 5 mg. B.H.C. gamma isomer per sq. ft. at an interval of about 8 weeks is recommended.—Authors' summary and conclusions.

EFEITO DAS APLICAÇÕES INTRADOMICILIÁRIAS DE DDT SÔBRE A DENSIDADE DO *Anopheles darlingi* EM VÁRIAS REGIÕES DO BRASIL. De Bustamante, Fernando M. Rev. Brasileira Malariologia 3(4): 571–590. *Anopheles darlingi* is the most domestic species of the malaria vector mosquitoes in South America, coming into human dwellings in search of food in all districts where it is found. Despite the high degree of domesticity of this species throughout the area of its distribution, the frequency of its attacking man and animals outdoors varies widely. This frequency, which defines the index of zoophilism of the species, is in general much higher in Brazil than in Venezuela and British Guiana. In Brazil, the index of zoophilism of *A. darlingi* is higher in the central uplands than in the coastal lowlands. In consequence, the effect of DDT house spraying on the density of this species is highly variable. While in Venezuela and British Guiana this mosquito has been or is being eradicated from great areas where the only anti-mosquito work performed was biannual house spraying, in Brazil DDT did not produce the same result. *A. darlingi* is still being found in sprayed areas, on the coast and in the hinterland as well.

The possibility of eradication of *A. darlingi* seems to depend essentially on the tendency of this species to feed outdoors, the probability of eradication being inversely proportional to this tendency. Data presented by the author for the coastal lowlands of the state of Rio de Janeiro and the central uplands of the Sao Francisco river valley make possible the hope, after some indeterminate time, of the eradication of *A. darlingi* from coastal districts of the state of Rio de Janeiro. It is not probable, however, that the same result can be obtained in the central uplands, where, in spite of the spraying, *A. darlingi* continues to be caught either as adults (captured with animal bait) or as larvae.—Author's summary.

BIOLOGY AND CONTROL OF LABRADOR BLACK FLIES (DIPTERA: SIMULIIDAE). By B. Hocking and W. R. Richards. Bull. Entom. Res. 43(2): 237–257. 1952. 25 refs. Twenty-five species of Simuliidae are listed with indications of their relative abundance, importance as pests of men, seasonal appearance, temperature requirements, and larval habitats in Labrador. Seven of these are undescribed species. The most important species are *Simulium venustum* Say and *Prosimulium hirtipes* (Fries).

A circular area of 200 square miles around Goose Bay airport was surveyed for important breeding sites. Of 163 streams and rivers investigated, 77 were suitable as larval habitats, and larvae were virtually eliminated from them in June, 1950, by applications of a 10 per cent solution of DDT in fuel oil at the rate of 1.5 p.p.m. from a helicopter, conventional aircraft, or boats, or by hand application from the ground. Methods of application are discussed.

The repopulation of the area by black flies was studied, and deductions are made concerning the flight habits of the most important species. On the basis of averages throughout the season, a great reduction in numbers of black flies at the center of the area was obtained, and a worthwhile reduction to a distance of between 4 and 6 miles from the center. Even near the center of the area, however, black flies were sometimes troublesome late in the season.

It is suggested that, where *P. hirtipes* is the important species, relief for at least one season could be secured by eliminating larvae within a radius of 2 miles; for *S. venustum,* 6 miles is suggested as a suitable radius.

No adverse effects on useful animals were recorded.—Authors' summary.

FACTORS AFFECTING EVALUATION OF INSECTICIDES AGAINST *Anopheles* LARVAE. By Krusé, C. W., Ludvik, G. F., and Hawkins, W. B. J. Econ. Ent. 45(4):598–601. In this study on evaluation of laboratory tests with DDT against *Anopheles quadrimaculatus,* the authors observed that with the same dosage of DDT the average kill could be varied from 80 to 1.5 per cent just by increasing the numbers of larvae per given test. Although crowding of controls had no effect on mortality at 24 hours, in tests with DDT, crowding led to greater activity with the result that larvae came into greater contact with the toxicant. In such cases, however, the amount of available DDT per larva was apparently reduced.

One of the more interesting findings in this paper was that the Orlando *quadrimaculatus* strain was more susceptible to DDT than the Wilson Dam strain when they were added to test

solutions at the same time. No significant difference was found between DDT resistance of the Beaver Dam and Wilson Dam strains of *quadrimaculatus*.

The authors found definite losses of DDT from suspensions in glass, enamel, and paper testing containers. Twenty-five per cent of the DDT had "settled out" in 9 hours with glass or enamel containers. The same amount "settled out" in 2 hours in paper containers (ice cream cartons). At the end of 24 hours, they found that 60 per cent of the DDT was still in suspension in enamel, 57 per cent in glass, and only 24 per cent in paper containers.

Emulsions of DDT remained completely dispersed in both glass and enamel containers, but there was a loss of 21 per cent of DDT in paper containers after 24 and 48 hours.

There is no discussion of the causes of the adverse "settling out" effects of paper containers on DDT. Perhaps, it is possible that the waxy character of the paper cartons has something to do with this effect.—Jack Colvard Jones.

FACTORS INFLUENCING THE PERFORMANCE OF THE PRECIPITIN TEST IN THE DETERMINATION OF BLOOD MEALS IN INSECTS. By G. S. Eligh. Canad. J. Zool. 30(4):213–218. 1952. Description of a new method of preparing blood-engorged mosquitoes for determination (by the precipitin "ring-test" method) of the kind of animal fed upon. Entire specimens of blood-engorged *Aedes aegypti* were vigorously smeared on high quality filter paper (Stanscien 333) with thumb and forefinger pressure. Smears were dried and stored. When extracted with saline solution for tests, such preparations were found to be superior to those in which only the dissected gut contents were used. A technique is described for detection of partially digested blood in mosquitoes.—Jack Colvard Jones.

DISPERSAL OF DDT FROM AIRCRAFT FOR MOSQUITO CONTROL. I. M. Mackerras, F. N. Ratcliffe, D. Gilmour, and M. W. Mules, Bulletin No. 257, Commonwealth Scientific and Industrial Research Organization, Melbourne, Australia, 64 pages. Although just received (August 1952) this valuable bulletin is dated 1950. It contains the results of a number of air-spraying experiments from low-flying aircraft employed during the latter part of the war for mosquito and, to a lesser extent, for fly control. The technique and equipment developed by scientists of the Australian Army and Air Force during 1944 and 1945 provided a starting point for the air-spraying program organized by the Department of Agriculture in Victoria and herein reported. The importance of weather conditions on the effectiveness of spraying is also discussed. Treatments using as little as 1.9 imperial quarts per acre resulted in high mortality of adults and larvae and a residual effect for 7 to 8 days. The technique developed was used widely by the Australian Forces in New Guinea, Bougainville, and Borneo with valuable results in reducing populations of disease-carrying insects.—H. H. Stage.

DISTRIBUCIÓN GEOGRÁFICA Y DATOS BIONÓMICOS DE LOS ANOFELINOS DE VENEZUELA. By Pablo Cova-Garcia. 1951. Publicaciones de la Division de Malariologia, Número 10, Ministerio de Sanidad y Asistencia Social, Caracas, Venezuela, 226 pp. (Spanish.) Although dated 1951, the volume was not received by us until September 1952. Dr. Cova-Garcia has accomplished the enormous task of supplying information on the distribution and ecology of the known Anophelines in Venezuela, viz., *albimanus, oswaldoi, rangeli, triannulatus davisi, strodei, argyritarsis, darlingi, pessoai, albitarsis, pseudopunctipennis, eiseni, apicimacula, punctimacula, neomaculipalpus, peryassui, mattogrossensis, kompi, nimbus,* and *C. bathanus*. The author has analyzed the ecological data obtained over a period of 8 years in all parts of Venezuela. It is stated, for example, that *albimanus* breeds only in places exposed to sunlight, whereas *eiseni, nimbus,* and *C. bathanus* larvae were found only in heavy shade. *Albimanus* was shown to fly 2 kilometers whereas *darlingi* flew 5 kilometers.—H. H. Stage.

Please turn to page 259 for information of interest to all AMCA members.