REVIEWS AND ABSTRACTS

THE MOSQUITOES OF THE NORTHWESTERN STATES. Stage, H. H., Gjullin, C. M., and Yates, W. W. USDA Agriculture Handbook No. 46. November 1952, 95 pp. This is a similar volume to Miscellaneous Publication 336, "The Mosquitoes of the Southeastern States." It treats of the very interesting mosquito fauna of Washington, Oregon, and Idaho, and includes thirty-nine species.

The first half is devoted to a general discussion of the importance, collecting techniques, and control of species concerned. This section is thoroughly justified by the ecological problems involved with flood- and snow-water breeding, which are unique to this area and a few surrounding states.

The latter half contains excellent keys, divided by genera which separate the species by adults, male genitalia and by larval characteristics. Each species is treated separately, with a concise description of the adult female, the male genitalia, the larva and an informational note on biology, distribution and importance. In addition there are splendid distributional maps that add a great deal to the publication, and a bibliography of 175 titles.

The authors have made a splendid contribution that will be a well-thumbed volume in the library of all entomologists in the area, and a valuable guide and reference for mosquito workers everywhere.

The only criticism is that the absence of adequate explanatory drawings of larval characters will make the intelligent use of the keys a bit difficult for the novice.—Stanley B. Freeborn, Univ. Calif., Davis, Calif.

MOSQUITO FAUNA OF NORTH AMERICA. Satyu Yamaguti and Walter J. LaCasse, Office of the Surgeon, Headquarters Japan Logistical Command, APO 343. This monograph is divided into 5 parts: I, Genus *Anopheles*; II, Genera *Megarhinus, Wyeomyia, Uranotaenia,* and *Culiseta*; III, Genera *Orthopodomyia, Mansonia,* and *Psorophora*; IV, Genera *Culex* and *Deinocerites*; and V, Genus *Aedes*. Descriptions, keys to adult females, male terminalia, and fourth instar larvae are included all with great emphasis on accurate and detailed drawings for easy identification. There are 13 species of *Anopheles,* 2 of *Megarhinus,* 4 of *Wyeomyia,* 4 of *Uranotaenia,* 7 of *Culiseta,* 3 of *Orthopodomyia,* 3 of *Mansonia,* 12 of *Psorophora,* 26 of *Culex,* 2 of *Deinocerites,* and 58 *Aedes* included. Copies of the monographs are now available only to the military, but it is anticipated that a slightly enlarged edition will be printed and released by the Department of Defense late in 1953.—H. H. Stage.

ADULT MOSQUITO CONTROL BY AIRSPRAY IN NORTHERN BRITISH COLUMBIA AND THE YUKON. By J. F. Sharp. Canadian Entomologist 84(9): 281–291. 1952. Experimental area control of adult mosquitoes by airspray was carried out at four stations of the R.C.A.F. in the North West Air Command during the summer of 1950. Approximately 42,240 acres (66 sq. mi.) were treated with 66 drums of 30 per cent DDT concentrate in Velsicol AR-50 and 30,000 gal. of fuel oil; three quarts per acre of a 3.5 per cent DDT solution gave a coverage of 0.23 lb. of DDT per acre.

Approximate percentage control at the stations as determined by biological assessments of the spray plots before and immediately after the application was as follows: Whitehorse, 1st spray, 93, 2nd, 98; Watson Lake, 99; Fort Nelson, 1st spray, 64, 2nd, 70.

At Whitehorse, Watson Lake, and Norman Wells good control was maintained during the season. The first spray at Fort Nelson gave fair control for about two days and the second for seven days, after which the mosquito population decreased to negligible numbers in both treated and untreated areas.—Author's summary.

REACTIONS OF *Aedes aegypti* (L.) TO CARBON DIOXIDE. By Edwin R. Willis and Louis M. Roth. J. Exp. Zool. 121(1):149–179. 1952. Air containing 0.1 per cent to 50 per cent CO_2 moderately repelled all adult *Aedes aegypti* of both sexes when tested in groups in a small-cage olfactometer in the dark at 27° and 33° C., but when they were tested in a large-cage olfactometer at 23°–25° C. participating mosquitoes (less than 10 per cent of the test population) were positively attracted to an air stream containing 10 per cent CO_2. Those which made a choice between air alone and air with CO_2 (within the large-cage olfactometer) *preferred* 10 per cent CO_2. When 100 adults were tested *individually* in the small-cage olfactometer, 6 of them had "0" reaction and 18 of them were not repelled by the CO_2, 6 of those not repelled were possibly positively attracted by the gas. The above reactions were not significantly altered by contrasting differences in light, temperature, humidity, age, or blood feeding. The authors suggest either that CO_2 is a potential attractant for female mosquitoes and that they vary in their sensitivity to it, or that there are two distinct types of adults: those attracted and those repelled or indifferent.

The authors attribute the differences in directional reactivity of adults to CO_2 within the two types of olfactometers to a difference in proportions of total numbers participating in test reactions, since all participated in the small cage but less than 10 per cent did so in the large-cage olfactometer.

Discrimination of CO_2 by adult mosquitoes is

due to olfactory stimulation of unidentified receptors on the first flagellar segments of the antennae.—Jack Colvard Jones, National Institutes of Health, Bethesda, Md.

ANNUAL REPORT, Malaria Division, Government of Trinidad and Tobago, 70 pp., H. P. S. Gillette, 1952, Processed. The report continued to show a marked decline of malaria in the islands. Compared to the 600 deaths caused by this disease in 1943 there were only 136 reported during 1951. An examination of 9,474 school children showed a spleen rate of 2 per cent. A study was reported on the bionomics of *Anopheles aquasalis* in which its breeding habits in mangroves and ricefields, outdoor resting habits, and anthropophilic index was emphasized. Some 600 additional acres were sprayed with 0.5 per cent copper sulfate in controlling bromeliads, an indirect control of *Anopheles bellator*.

The DDT residual spraying on Trinidad was extended to 27,958 homes in which nearly 160,000 people were protected against malaria. Every house was sprayed on Tobago, once with DDT and once with BHC. The spleen rate on this island was 0.8 per cent of 3,470 school children. Preliminary results were given on the use of a 25 per cent wettable dieldrin powder as a larvicide. An application of 0.12 pound of dieldrin per acre secured control of anopheline breeding for more than 14 days. Fifty houses built with adobe were protected for 5 months with dieldrin residual sprays.—H. H. Stage.

MOSQUITO-REPELLENT MIXTURES. By C. N. Smith, M. M. Cole, G. W. Lloyd, and A. Selhime. Jour. Econ. Ent. 45(5):805–809. 1952. Of the thousands of chemicals that have been tested by various agencies as mosquito repellents, less than a score have proved highly effective and also safe for unrestricted application to the skin. Experience has shown that mixtures of several good repellents are effective against a wider range of species and on more individuals than any one repellent used alone. Studies during World War II culminated in the selection of a mixture (M-250), consisting of 6 parts of dimethyl phthalate, 2 parts of 2-ethyl-1, 3-hexanediol, and 2 parts of *Indalone*, for general use by the armed forces. Experiments have been continued to find other mixtures or individual repellents, of a higher general effectiveness than M-250. As in previous observations, the best over-all results were obtained with mixtures. The most effective mixtures against several species of *Aedes* were dimethyl phthalate 4 parts, 2-ethyl-1, 3-hexanediol 3 parts, dimethyl carbate 3 parts (M-2020); dimethyl phthalate 4 parts, 2-ethyl-1, 3-hexanediol 3 parts, propyl N, N-diethylsuccinamate 3 parts (M-2043); 2-ethyl-1, 3-hexanediol 4 parts, propyl N, N-diethylsuccinamate 3 parts, O-chloro-N, N-diethylbenzamide 3 parts (M-2042); and 2 ethyl-1, 3-hexanediol 5 parts, O-chloro-N, N-diethyl benzamide 5 parts (M-2048).

Several of the most effective mixtures against *Aedes* mosquitoes proved relatively ineffective against *Anopheles quadrimaculatus*.—Authors' summary.

IRRIGATION AND MOSQUITOES IN THE UNITED STATES OF AMERICA. By John M. Henderson. Indian Jour. Malariology. 6(1):23 pp. 1952. 29 refs., 10 tables. The author mentions by way of introduction his detail to the Malaria Institute of India in 1949, while serving as consultant on malaria control with the World Health Organization, assigned principally to field surveys of irrigation projects under construction. Subsequently, he made an extended field study of irrigation design and irrigation practices in the U.S.A. while serving as consultant to the Communicable Disease Center, U. S. Public Health Service.

This request article is intended to apprise readers in India who are engaged in irrigation or public health activities with irrigation design and practices in the U.S.A. from the standpoint of mosquito production.

The first portion of the paper presents the disease and nuisance aspects of irrigation-mosquitoes in the U. S., past and present. This is followed by a history of irrigation and a description of irrigation methods and modern principles of water application in the U. S. Irrigation in India and other parts of Asia up to the present has been principally "flooded-field" irrigation, generally for rice cultivation. Most irrigation in the U. S. is "dry-crop" irrigation, as it is termed in India. Because current large scale irrigation projects in India provide for "dry-crop" irrigation, the article mainly discusses irrigation for this purpose.

The remainder of the article discusses in detail the types of mosquito-breeding places encountered in irrigated areas, irrigation practices which directly cause them, and the indirect socio-economic factors which increase or lessen mosquito production through their influence on irrigation development and practices. These include: carelessness and inattention, (resulting in part from the dynamic character of irrigation-agriculture and high manpower productivity), conservation-irrigation, irrigation economics, speculative farming, land tenancy, age of irrigation development and water-rights.

In conclusion, the author points out that the most significant factor in preventing "irrigation-mosquito" production under "dry-crop" irrigation is "that the practices which prevent mosquito production largely are also good agricultural and irrigation practices from which farmers receive benefit in the form of improved crop yields, lowered water costs, or both." In view of the magnitude of the malaria problem in India (100 million cases annually), much of which is derived from irrigation, measures of this type are considered essential there and in many other parts of the world, in spite of the effectiveness of DDT and related insecticides.—John M. Henderson, Columbia Univ. Sch. Public Health, and Communicable Disease Center, Savannah, Ga.