

importance from the standpoint of annoyance alone, are now coming to be labeled as potential transmitters of diseases. The distinction between "disease vector" and "pest" mosquitoes thus is fading. In view of these developments, health authorities may be expected to take an added interest in pest mosquito control programs.

By so doing, knowledge and effort of all parties concerned with mosquito control may be pooled, to the end that more pleasant as well as more healthful environmental conditions may be established throughout the country, with a concomitant promotion of greater national well-being.

NAVY RESEARCH AND CONTROL OPERATIONS

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The United States Navy is vitally interested in, and active in the study of problems related to insect disease vectors in general and mosquito control measures in particular. The necessary location of many Navy establishments is based on topographical features, geographical requirements, harbor facilities and other basic factors. Since most of these conditions which are valuable to naval operations are accompanied by positive ecological situations conducive to extensive insect breeding, it is elementary to understand the reasons for naval insect control interests.

Screening the research reports of studies completed or continued, the following were chosen as examples of Navy activity in problems which are important to us during these meetings.

During 1950, considerable information was prepared at the national Naval Medical Center, Bethesda, Maryland, and reported as "Observations on the Experimental Transmission of Japanese Encephalitis by Mosquitoes" and "The Propagation of Japanese Encephalitis Virus in the Mosquito by Parenteral Introduction and Serial Passage." At the same time conspicuous "Observations on the Pre-erythrocytic Stages of *Plasmodium relictum*, *P. cathermerium* and *P. gallinaceum* in various Birds" were conducted.

The taxonomy of the mosquitoes of certain strategic localities of the world has continued through 1950. "Mosquitoes of the Eastern Carolines and the Philippines" is now completed. A report of "Alaskan Mosquitoes" is in press. Navy taxonomists are now engaged in similar studies at the Naval Medical Research Unit #3 in Cairo, Egypt, where "Taxonomy of Mosquitoes of the Middle East" is in preparation.

Personnel at the Naval Medical Research Institute are also engaged in a study of the "Effects of Larval Population Density on Behavior of Adult Mosquitoes" and "Sulfonamides as Factors in Increasing Susceptibility of Mosquitoes to Parasitic Infection (*Plasmodium gallinaceum*)."

The work in the Naval Medical Research Unit #3 in Cairo has developed very rapidly in the short time this Unit has been established. Reports on the achievements of this outstanding naval unit are being made available through popular and scientific publications. "Biology and Control of Houseflies in the Middle East" is a record of significance. Described in this report are the results of extensive studies of seasonal fly populations which exhibit the great importance of temperature to the definite annual population curve. In Cairo, too, rapid development of DDT resistance was

noted. This resistance appeared more quickly than in some areas of the continental United States, probably due to the large breeding areas where many generations produce large fly populations. In brief, the reports of the Naval Medical Research Unit #3 show that in late 1947, the failure of DDT was easily recognized. A change to BHC in 1948 showed excellent results but in 1949 this chemical had produced resistant populations. In the spring of 1950, field studies showed that chlordane provided very efficient controls. However, it is believed that resistance to this chemical is to be expected. Interesting to repeat from almost all reports is the thought that the use of chemical insect control does not excuse inefficient sanitation.

This reporter is hopeful for the continued successful investigations of sandfly habits and controls which are being conducted in the Yemen area. And a recent research problem concerning the "*Culex pipiens* complex in the Mediterranean Area" will give you an insight into the broad scope of the important work by NAMRU #3.

The U. S. Navy Epidemic and Disease Control Unit #6 is starting an intensive research program which is aimed at "Filariasis and Its Control in Islands of Central Pacific" which will no doubt tie in with the Naval Medical Research Institute's "Studies of Filariasis and Its Control in Samoa." This Navy Epidemic and Disease Control Unit #6 was established at Pearl Harbor in 1949 and provided the basis for the first insect control operations in the Korean episode in its early stages last year.

Our Naval Medical Field Research Laboratory, Camp LeJeune, North Carolina, made numerous practical studies during 1950. The "Evaluation of Two Hand-operated Larviciding Sprayers" led to numerous important changes in manual mosquito control equipment and the "Design for an Easily Stacked, Light Weight Durable Hand Dipper for Mosquito Survey" has been of utmost value to the work of field surveyors.

Space sprays, cockroach control, insecticide evaluation, container corrosion prevention and specification tests are among other miscellaneous studies which are under way at offices like the Naval Industrial Test Laboratory, Philadelphia, and at other Federal agencies. Some of the above listed research reports are the result of cooperation from or collaboration with the U. S. Department of Agriculture, the U. S. Public Health Service and others. The work of these Navy specialists is well coordinated with U. S. Army and Air Force studies for the elimination of duplication and the mutual benefit of the armed forces. However, most of these studies are not classified and are already published for use by all control workers.

My subject also includes a brief of control operations which I am going to limit to mosquito control in the Sixth Naval District. The U. S. Malaria and Mosquito Control Unit #1 is the agency responsible for most of the insect control activity in this area of seven southeastern states. Although its laboratories and offices are at the Naval Air Station, Jacksonville, Florida, this Unit carries on its functions from Charleston, South Carolina to Key West, Florida, and west to Memphis, Tennessee. Permanent control measures are the basic interests of this Unit and mosquito control sanitation is stressed in every program at the various naval stations served. Excellent cooperation from state, county and city health authorities is reported from each area. Drainage and ditching operations develop slowly and require time for completion. The largest single permanent project is now being inaugurated in the Key West area. Extensive naval activity in this area has necessitated the redevelopment of a large project which was started in 1942. This project will require about two years to complete; it has the backing and cooperation of state, county and city commissioners and will establish an all-important annual maintenance program.

To augment all permanent control plans, intensive and extensive temporary

control measures are under way. Fog machines and sprayers are located on all the reservations and their operators are assisted and advised from this Unit. Airplanes for aerial spraying are located at Jacksonville, Key West and Memphis.

Although 1950 was one of the worst mosquito seasons in some areas, in others there was little or no problem. Where 5 per cent DDT solution (.3 lb. DDT to the acre) failed to produce effective results, the addition of 2 per cent lethane (by volume) or on occasion small amounts of piperonyl butoxide—pyrethrum solution renewed the efficiency of the operations.

The Unit has continued work on the development of automatic insecticiding equipment for use on aircraft. This equipment was described at the American Association of Economic Entomologists' meetings at Denver last December. It provides for the simultaneous insecticidal treatment of all areas of the airplane with the required dosages. Large scale installations are being made in modern hospital evacuation planes (C54M) used by the Military Air Transport Service for the delivery of troops and cargo from the United States and the return of casualties to the United States. Automatic timing devices allow for "super" dosages for the control of agricultural pests while "normal" dosages are produced for the eradication of more susceptible insects of public health importance. It is, therefore, the best protective device against the possibility of introduction of foreign insect species. The sealed counter indicator will record treatments and can be used by Quarantine inspectors as evidence of proper treatment.

This project receives the utmost cooperation from the Department of Agriculture, Public Health Service and other federal agencies.

During 1950, several new insecticide formulations found listings as Navy Standard Stock items. A 2 per cent chlordane solution received wide use on many naval stations. The item "Standard Navy Insecticide" was changed from

10 per cent lethane to 5 per cent lethane with 3 per cent DDT added. This item has rapidly proved its worth in Navy insect control and is recommended for consideration where DDT is scarce and where DDT has become inefficient.

Control operations have become more effective and less expensive with the improvement of equipment, materials and techniques.

During the 1950 period, this Unit was responsible for the operation of more than 5,000 light traps. The contents of these traps included more than 40 species of mosquitoes which totalled over 70,000 specimens. Much of the control work is based on adult mosquito population index and the value of these studies to our more or less remote control measures is not to be underestimated. The use of synoptic and local weather reports, the routine ground surveys and the analysis of the adult population studies provides basis for efficient adulticiding and larviciding.

Recent assistance in soil conservation service studies is proving valuable in reducing breeding in some areas of impounded waters. This service is recommended because of its importance in all conservation programs and because it can be had at no cost.

Training is an ever present necessity in any progressive plan of operation. The Malaria and Mosquito Control Unit #1 serves as training center where naval reserve entomologists and malariology technicians may come for annual two-week periods. Illustrated lectures, practical demonstrations and experience-education are made available to these reservists. In return they bring to the Unit extensive reports of many areas and the practices peculiar to those sections. Thus mutual benefit to all is provided at little cost.

The outlook is optimistic as our research and control operations continue. With the cooperation of many federal, state and local agencies in interested groups, a close integration of methods and controls are in the plans for the coming season.