

AUTHORS' ABSTRACTS OF PAPERS PRESENTED

at the Joint Meeting of the

AMERICAN MOSQUITO CONTROL ASSOCIATION

and the

UTAH MOSQUITO ABATEMENT ASSOCIATION

at

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F I R S T S E S S I O N

THE STATE HEALTH DEPARTMENT AND THE MOSQUITO
ABATEMENT PROGRAM

George A. Spendlove, M.D.,
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A strange circumstance of events must have granted Baseball the honor of being our National Sport. The really favorite sport of Americans, one which knows no season, is enjoyed both indoors and outdoors, is enjoyed by all American races, by both sexes, and especially by the older folks, is that wonderful, delightful pastime of poking fun at, and ridiculing Government officials. Talk of mosquito abatement began almost with the turn of the 20th. Century and was fairly well accepted throughout the United States at the time Dr. T.B. Beatty, then State Health Commissioner, and Mr. E.W. Senior, a Salt Lake City Attorney, midst much ridicule began their efforts of mosquito abatement. Such proposals met with comments, such as, "An attempt to control mosquitoes would be as effective as an attempt to control the wind." Through the years, mosquito abatement progressed favorably. Harmonious relationship existing between the University of Utah, United States Public Health Service, and the State Health Department, working toward the achievement of one specific objective, resulted in five organized districts, a sixth now in the process of being organized. Frequent surveys have been enabled, the last of which was conducted from April to October, 1951, in the Weber River Basin. These surveys have given us the necessary scientific background for progressive movement in the Mosquito Abatement Program. The State Health Department endorses these programs and acknowledges the definite and important place they have in our State Health Program.

MOSQUITO-PRODUCING ASPECTS OF THE PROPOSED
WEBER BASIN IN UTAH

Charles E. Kohler, Don M. Rees and F.C. Hamston

A survey of mosquito production in the irrigated Weber Basin of Utah was conducted during the summer of 1951. Ninety larval collecting stations were checked at weekly intervals. Five mosquito light traps were operated twice weekly for this period. The greatest single source of mosquitoes was found to be due to inadequate disposal of water used for irrigation. Other sources were: seepage from higher irrigated areas, seepage from distribution systems, irrigation of pasture and hay-crop lands, flow from artesian wells and flooding of wildlife refuges located on the shores of the Great Salt Lake. The effect of the proposed reclamation drainage on inadequately drained lands was studied. Such drainage will probably eliminate many of these on the middle terraces. In addition they will provide outlets for farm drainage systems as well as for drainage operations of mosquito abatement districts. These were recommended to be extended to flow directly into the Great Salt Lake, or, if diversion to waterfowl refuges is planned, to provide adequate mosquito control on these areas. The mosquitoes found to be most prevalent were Culex tarsalis and Aedes dorsalis. The numbers taken during the course of the survey are tabulated.

QUANTITATIVE DETERMINATION OF PREDATION ON MOSQUITO
LARVAE BY USING RADIO-ISOTOPES

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A method for labelling mosquito larvae with P^{32} is used which involves transferring the larvae from the radioactive tagging solution to aquaria containing known and suspected predators. A sample of the radioactive mosquito larvae is made at time of transfer, the range of variation and an average number of counts per minute per larva is determined. After a suitable time, all predators and suspected predators are removed from the tank, ashed, and counted. The predators are noted to contain radioactivity in multiples of the basic average for the prey species. This increase is called "unit predation concentration", and is used as a basis for determining the numbers of prey taken, efficiency of predators, type of predator, and status of suspected species.

CONTROL OF AEADES MOSQUITOES IN TWO RECREATIONAL
AREAS IN THE MOUNTAINS OF UTAH

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Control of mountain Aedes mosquitoes has been attempted at Brighton and Camp Cloud Rim, two recreational areas in the high mountains of Utah. Good results were obtained in these areas from 1938 until 1949 by thorough inspection, some drainage, and the application of an oil larvicide. DDT was first used in the fall of 1949 as a pre-hatch larvicide and has been used almost exclusively since that time. A valuable supplement to spraying and dusting with DDT has been the use of "Tossits", small gelatinous capsules containing 12% DDT and 4 1/2% BHC. Tossits were used very effectively by inspectors for treating small pools, scattered over rugged mountainous terrain, that were difficult to treat by knapsack spray pump or other methods. As a result of this program complete control was obtained at Brighton during the summers of 1950 and 1951 and excellent results were obtained at Camp Cloud Rim.

CONTROL OF BITING GNATS IN NORTH SALT LAKE CITY,
UTAH (DIPTERA : HELEIDAE)

Don M. Rees and James V. Smith,
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A program for the control of biting gnats has been conducted in North Salt Lake City, Utah, during the spring of 1949, 1950, and 1951. During this study a chemical method of soil sampling, to determine the presence of gnat larvae, has been developed which makes it possible to rapidly complete larval sampling in the field without taking soil samples to the laboratory for examination. Effective and practical control measures used, consist of the treatment of the soil at the proper time, with 1 lb. of DDT per acre for a direct kill of the gnat larvae or 2 lb. per acre as a pre-hatch treatment. Other chemicals showed satisfactory results, and to date the results from drainage and soil cultivation are very promising. As a result of this work the gnats in this area have been effectively controlled since 1949, and materially reduced in numbers each year until, in 1951, they were practically eliminated from the area.

NON-HUMAN MALARIA IN MOSQUITOES AND THE ENGLISH SPARROW,
PASSER DOMESTICUS LINN., IN THE VICINITY
OF SALT LAKE CITY, UTAH

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The present report consists of partial results of a continuing investigation into the non-human malaria in northern Utah. During 1948 and 1949, investigation centered on a survey of the incidence of infection in a sampling of the English sparrow and adult female culicine mosquito populations of the region about Salt Lake City. The region was divided into three areas, with the Salt Lake Mosquito Abatement District comprising the central area. Four of the most common species were found to be infected. These consisted of the Culex pipiens group (pipiens, erythrothorax, and salinacius) 18.2%; Culex tarsalis, 9.1% in 1948, and 17.5% in 1949; Aedes vexans, 16.2%, and Aedes dorsalis, 13.5%. The latter species has not heretofore been reported as naturally infected. A total of 209 birds and 1072 mosquitoes were examined during the study. Two species of malaria were determined in the birds. One was identified as Plasmodium relictum and the other tentatively as P. cathemerium. Birds and mosquitoes from the center of Salt Lake City proved uninfected while those collected from the entire abatement district showed 1.78% in birds and 9.3% in mosquitoes. Birds from the south Salt Lake County, a poultry producing area, had 26% in birds, the mosquitoes, 14.5%. The incidence in the northern area was 9.37% in birds and 10.9% in mosquitoes. The above results appear to indicate that continued, effective mosquito abatement is a factor in reducing the incidence of non-human malaria in natural bird and mosquito populations.

THE UTAH MOSQUITO ABATEMENT ASSOCIATION*

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*Abstract not received.

MOSQUITO CONTROL MOVES FORWARD

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Progress in the fight against mosquito-borne diseases is the watchword around the world. It is now generally recognized that little can be done to step up food production in countries where starvation is an ever present threat without conquering malaria and other diseases carried by insects. Despite a number of difficulties that have been encountered, very definite progress has been made. Among the problems are those of getting the quantities of DDT and other insecticides desired by various countries, and the appearance of strains of insects resistant to residual insecticides. Unfounded reports of the ill effect on public health of widespread use of insecticides has probably also reacted against various mosquito control programs. The shortage and unsatisfactory distribution of insecticides are being corrected. It appears that adequate allocations of DDT and other insecticides for use in foreign countries have been provided. For example, 25 million pounds of DDT have been authorized for the export license program for the period, October 1, 1951, to September 30, 1952. Furthermore, plans are under way to set up plants to manufacture and formulate DDT in a number of foreign countries.

The elimination of malaria from some of the hotbeds of that disease through the use of residual sprays is attracting world-wide attention. Greece, Italy, and Cyprus are now essentially free of malaria. The disease has been largely eliminated from Argentina, Chile, Uruguay, and the United States. Active antimalaria campaigns are rapidly reducing the disease incidence in many countries of the world. In the United States the malaria situation was serious up to World War I. At that time it was estimated that a million cases occurred annually. There was a marked recession thereafter until large-scale use of DDT residual sprays was started by the U.S. Public Health Service and State Health Departments -- when the incidence of the disease broke sharply, and has continued downward. The 1951 reports indicate that there were only about 6500 cases of malaria in the United States in 1951, and probably less than 1/5 of these originated here. No doubt this figure includes many relapses and unconfirmed cases.

Yellow fever mosquito control is being effectively pursued in Mexico, and all Central and South American countries. These extensive control programs have been stimulated

by the Pan American Sanitary Bureau and World Health Organization. The yellow fever mosquito has been almost eliminated from several South American countries, but the species that are carrying the jungle type of yellow fever are presenting a more difficult problem. Dengue fever has almost been forgotten during the last few years, and we are inclined to believe that anti-mosquito work may have had some part in this. Research on the habits, distribution, techniques of rearing, disease relationships, insecticides, and equipment, is yielding information that is forming a sounder basis for mosquito control, and is increasing the efficiency and safety of control operations.

CURRENT RESEARCH AND UNSOLVED PROBLEMS IN MOSQUITO CONTROL

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New Brunswick, N.J.

In view of the excellent reviews on research and control activities on mosquitoes throughout the world prepared and presented each year at the New Jersey Mosquito Extermination Association annual meeting by Dr. F.C. Bishopp and co-workers, our committee feels that the attempt to review research accomplishments would be a duplication of Dr. Bishopp's efforts. Therefore, our committee has attempted to select a few of the outstanding research accomplishments, giving full credit to Dr. Bishopp and his co-workers and to point out some of the more significant facts of these few outstanding works. Furthermore, the committee has selected a few typical problems pertaining to the biology, ecology and control of mosquitoes that need additional research for more efficient and economical control of mosquitoes. The purpose of pointing out these needs by the committee is to stimulate research throughout the western hemisphere. It is the thought of the committee that by listing a few of the problems, indicating at least a few needs, it might serve as an impetus to the biology, zoology and entomology students (both undergraduate and graduate students) in the various universities and other institutions throughout the hemisphere to undertake research problems on mosquitoes or related problems. These suggestions might also be useful as encouragement to professional, as well as practical men in the field, to initiate or encourage further research. The committee report is divided into several categories, such as taxonomy, morphology, biology, ecology and control, some or all of the main sections having subheadings.

S E C O N D S E S S I O N

WHAT I HAVE LEARNED ABOUT MOSQUITO CONTROL IN 25 YEARS -
IN 10 MINUTES

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Norfolk, Virginia.

This paper deals with public relations, and brings in several personal experiences. The main point presented is that, no matter how well you know your work, you cannot succeed in mosquito control unless you can properly handle public relations. The paper is short and has a surprise element.

THE TWENTY-FIFTH YEAR OF mosquito control in greater
WINNIPEG, MANITOBA, 1951

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Control of mosquitoes by the use of DDT in Greater Winnipeg during 1951 continued to be effective. Mechanical foggers and one sprayer were used to augment manual spraying. A helpful factor in obtaining good control was the subnormal rainfall in the months of April through July. Ditch maintenance was carried out by hand labour and by machine spraying of willows with 2,4 D. Pre-season application of DDT, first tested in Winnipeg in 1947, was investigated more intensively than was previously possible. During 1951 teamwork between Dominion, Provincial and City agencies made it possible to determine DDT by both chemical and biological assay methods. It was shown that appreciable DDT was available in the soil, water and vegetation of the treated areas. Bioassay of water taken from DDT-treated ditches and clay pits showed larvicidal effectiveness for 3 to 6 weeks after spraying. Evidence in support of adsorption of DDT by soil particles was obtained. (cf. previous findings in black-fly control experiments conducted by the Household and Medical Entomology Unit, Division of Entomology, Canada). This finding, supplemented by relevant assumptions, explains certain observations concerning variable toxic response of Aedes aegypti larvae to DDT-treated samples.

NEW JERSEY MOSQUITO CONTROL ACTIVITIES IN 1951*

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*Abstract not received.

FUTURE OUTLOOK OF MOSQUITO CONTROL IN FLORIDA

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Daytona Beach, Florida.

The trend of mosquito control in all of the districts and counties now operating in Florida is definitely pointed to permanent elimination, emphasizing ditching, drainage and fill. Several of the districts have purchased and are using heavy mechanized equipment such as draglines and shovels with which they are setting up a network of navigable (for row boats) canals in their heavy breeding marsh areas; these are proving highly successful in the control of breeding in the areas worked on. While fogging and spraying by air and ground equipment will have to be carried on for some time to come, it is hoped that these methods can be reduced year by year as the permanent work progresses, retaining such equipment for use only in emergencies, because our present hydrocarbon insecticide solutions and emulsions are not as effective as they were in the beginning.

MOSQUITO SOURCE REDUCTION PROGRAM IN
MERCED COUNTY, CALIFORNIA

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Merced, California.

The Merced County Mosquito Abatement District is approaching the problem of reducing mosquito sources in irrigated fields by contracting with the farmers to do the necessary drainage construction and maintenance work at cost. This program has been under way for three years. It involves the use of district-owned equipment including a small Ferdson tractor and ditcher; an Allis Chalmers HD-7 tractor with bull dozer, ditcher, and pull-type grader; and a one-half yard Link-Belt dragline. This equipment is used in cooperative drainage projects where a group of farmers contract with the mosquito district to perform the necessary drainage work. The mosquito district enters into these agreements only when such work will reduce or eliminate a mosquito source. The mosquito district cooperates with and receives aid from other agencies with mutual problems. These include the irrigation districts, soil conservation districts, and the county road department. The Merced County Mosquito Abatement District also conducts an educational program to promote the solving of drainage problems by the farmers themselves.

RECENT DEVELOPMENTS IN THE CONTROL OF RICE FIELD
MOSQUITOES IN CALIFORNIA

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The state of California grows about 300,000 acres of rice, most of it located north of Sacramento in the hot, dry summer climate of the Sacramento Valley. Rice was first grown commercially in 1912 on 1400 acres. Rice land remains submerged from sowing time until fields are drained for harvesting. Most rice is sowed between mid-April and mid-May. Harvesting begins usually in late September or early October. The growing season for rice is also the time of year when mosquitoes are most active. The control problem is expensive and is time-consuming involving Aedes, Culex, and Anopheles mosquitoes. Two species are of public health importance. The rice-growing operation from the preparation of land until fields

are harvested is discussed as it relates to the mosquito problem. Because of the extent of the larval treatment sources, cultural practices that seem to cause and aggravate the mosquito trouble are being investigated. Recommendations in line with accepted rice-growing methods are set forth as a possible solution for the future as a means of reducing the amount of chemical control now needed and as a supplement in the control program.

WATER RESOURCES PROGRAM OF THE COMMUNICABLE
DISEASE CENTER (RE. MOSQUITO PREVENTION)

Chris A. Hansen, Executive Officer,
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Atlanta, Georgia.

Expanding irrigation development and recent emphasis on water resources activities, particularly in the West, require immediate attention to the public health problems involved. The malaria outbreaks in the vicinity of impoundments in this county are well known although no longer a serious problem. The virus encephalitis outbreaks associated with irrigation farming are a serious problem in many areas of the United States. Pest mosquito problems, also of public health concern, are notorious in irrigated areas. During the past few years, the CDC has been actively engaged in the water resources development program (1) by making studies to determine the irrigation practices responsible for producing mosquitoes; (2) by providing guidance and consultation to constructing agencies for prevention of mosquito problems on impoundments; and (3) by developing standards and criteria for control and prevention. The expanded program now under way will include continuation of the above but will also provide for: (1) assistance to State health departments in developing an effective organization for dealing with insect problems of public health importance; (2) guidance to water development agencies and water users for prevention of mosquito problems in new developments and correction of existing problems; and (3) dissemination of information on preventive mosquito control.

THE DIVERSIFIED PROGRAM PREREQUISITE TO EFFECTIVE
MOSQUITO CONTROL ON CAPE COD

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Massachusetts Reclamation Board, and

Oscar W. Deane, Jr.,
Cape Cod Mosquito Control Project,
Boston, Mass.

A brief description of the mosquito control program conducted throughout Barnstable County on Cape Cod, a summer recreational center where this type of protection has a pronounced economic significance. The program is broken down into three main subdivisions as follows: (1) salt marsh mosquito control involving 1/8 of the county area, (2) control of 1,200 fresh-water swamps, and (3) major operations conducted on the 170 great ponds, particularly those initiated for control of Mansonia perturbans. Included, also, is information relative to prehatch treatments applied to both salt marsh and fresh water swamps.

MOSQUITO CONTROL - EXTENSIVE VERSUS
INTENSIVE TECHNIQUES

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Jacksonville, Florida.

The failure of chemical controls has brought a renewed interest in good mosquito sanitation. At a time when economical practices are desired by conscientious operators, this change is noteworthy. Soil conservation and reclamation of natural resources are now recognized as mosquito control techniques. It is evident that some reported resistance is merely the result of overestimating one's efficiency. And yet, the extent of a good mosquito control program is difficult to measure. A report of a conservation experience and the summary of numerous control observations provide an optimistic program for the future of the practical mosquito control operator.

THE APPLICATION OF LARVICIDE BY AIRPLANE FOR
BLACKFLY (SIMULIIDAE) CONTROL

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N.Y. State Science Service,

B.V. Travis,
Cornell University, and

Hugo Jamnback,
N.Y. State Science Service.

The paper describes tests using 2 Piper cubs to apply separated swaths over an area of about 100 square miles. The pre-calculated dosage was 0.1 pound per swath-acre, using a 20% solution of DDT in Sovacide and fuel oil. An average 90% reduction in blackfly larval population occurred in the treated streams. The spraying by fixed-wing plane, therefore, appeared to be as effective as that done by helicopter the previous year.

THE IMPORTANCE OF CORRECT TIMING OF LARVAL TREATMENTS
TO CONTROL SPECIFIC BLACKFLIES (SIMULIIDAE)

Hugo Jamnback and D.L. Collins,
N.Y. State Science Service.

Data gathered in 1950 and 1951 indicated that two separate stream treatments might be necessary to control the two most annoying species of blackflies in the Adirondaks, Prosimulium hirtipes Fries and Simulium venustum Say (S. tuberosum Lund. is grouped with venustum). The treatment made for P. hirtipes, before the overwintering hirtipes larvae begin to pupate (late April), does not affect the majority of S. venustum and S. tuberosum, which apparently overwinter in the egg stage in this area and do not appear as larvae in most of the streams until the middle of May. A treatment must, therefore, be made in late May to control this species.

HISTORY OF THE JEFFERSON COUNTY, TEXAS,
MOSQUITO CONTROL COMMISSION

H.L. Hanchey,
Port Arthur, Texas.

There are 900 square miles in Jefferson County, Texas, with approximately one-half of this area affording ideal potential breeding grounds for mosquitoes. Much of this water-covered acreage is salt marsh land, where Aedes sollicitrans, Anopheles crucians and Aedes taeniorhynchus breed prolifically. Many acres consist of rice fields or abandoned rice fields, where the four local species of Psorophora (confinnis, discolor, ciliata, ferox) are heavy breeders. In addition, there are large sections of wooded land in the county, with temporary pools ideal for Culiseta inornata. And finally, right in the heavily-populated residential sections, water stands under the houses during the rainy season. This combination of breeding conditions aroused the populace, and a South County Mosquito Control was set up in 1949, which mushroomed into the Jefferson County Mosquito Control Commission organized January 1, 1950. Under Texas state law, the mosquito control project was organized with a budget of approximately \$90,000.00 for the first year's operation, figured on the basis of five cents out of each tax dollar in this county.

The primary reason for establishing this temporary control was the immediate relief for the citizens of the county from the vast swarms of mosquitoes present. Much of the budget for the initial two years of operation was necessarily spent for temporary control equipment, including: 2 Buffalo turbines, 6 fogging machines, 5 high pressure sprayers for larviciding large areas, 3 Bean sprayers for spraying catch basins and roadside ditches, and 10 knapsack sprayers. This equipment was mounted on 4 power wagons and 5 half-ton trucks, also purchased new during 1950 and 1951. With this equipment 395,811 acres were fogged; 4,651 acres were larvicided; 35,908 acres were mist sprayed with the turbines; 72,043 places were inspected, 28,826 places were found to have mosquito breeding, and 38,214 places were treated. In addition to this ground work, some 44,000 acres where it was not feasible to send in ground crews have been aerielly treated. Through these efforts, the primary objective of giving temporary relief to the residents of this county was accomplished. Plans for the third year of operation include a tapering off of temporary control methods and inauguration of a more permanent type of control, including water control in the salt marsh areas, and more permanent types of larviciding of areas where water control is not possible. Also, plans are being made to cope with the problem of the rice field breeding mosquitoes, which are so prevalent within the county during the summer months.

T H I R D S E S S I O N

ALDRIN AND DIELDRIN FOR THE CONTROL OF MOSQUITOES
AND OTHER ANNOYING DIPTERA

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ALDRIN and DIELDRIN, developed by Julius Hyman & Company, have been evaluated in public health and disease vector control by laboratories throughout the United States and many foreign countries. Among other important investigations, emphasis has been placed on control of mosquitoes, sand-flies, house flies, black flies, tabanids, and eye gnats. The comparative effectiveness of ALDRIN and DIELDRIN has been determined; formulation and application methods have been developed. The toxicological aspects of utilizing ALDRIN and DIELDRIN from the standpoint of both the operator and the public have been studied, employing use experience with several million rounds. Sanity in the judgment of new compounds is urged to avoid subsequent carelessness which is the inevitable result of overemphasis on toxicology when such overemphasis is not justified. In view of the well known pattern of insect resistance to insecticides, the complete dependence on any one insecticide is questioned. DIELDRIN is suggested as the most logical alternate to DDT, as its efficiency against adult flies and mosquitoes is approximately eight times that of DDT, indicating greater economy and less hazard than in use of DDT. Various government workers have insisted on more research on new compounds; in order to encourage industry to additional research, new compounds, as they are developed and proved effective, should be adopted in existing pest control programs, as industrial research is dependent upon income from sales of available materials.

THE EFFECT OF INSECTICIDE RESISTANCE UPON PROGRAMS FOR
THE CONTROL OF ANOPHELINE AND CULICINE MOSQUITOES

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A review is given of the present status of the development of insecticide resistance by anopheline and culicine mosquitoes in various parts of the world, and the impact which this has had upon mosquito control programs. Among the species which are discussed are Anopheles saccharovi, A. gambiae, A. darlingi, A. quadrimaculatus, Aedes sollicitans, A. taeniorhynchus, A. nigromaculis, Culex ripiens, C. quinquefasciatus, and C. tarsalis. A comparison is made of the relative importance of behavioural and physiological resistance. The effect of resistance of other species, such as flies, upon mosquito control programs is also commented upon.

THE PRESENT STATUS OF MOSQUITO RESISTANCE TO
INSECTICIDES IN CALIFORNIA

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The resistance of several important species of mosquitoes in the San Joaquin Valley of California to DDT, toxaphene, lindane, and aldrin was determined in laboratory tests of larvae from treated and untreated areas. Aedes nigromaculis larvae from the treated areas were found to be from 3 to 7 times as resistant to DDT as larvae from the untreated areas. Resistance to toxaphene ranged from 0 to 3 times that of larvae from the untreated area. There was little resistance to lindane and aldrin except in one area where the maximum was twice that of the treated area. In a

few tests with A. dorsalis, resistance to DDT was 3 to 12 times that of larvae from the untreated area, but no resistance to the other insecticides was indicated. Culex tarsalis larvae from a duck club in the Kern District, where applications of toxaphene and aldrin were failing, were found to be 10, 33, 11, 215 and 1300 times as resistant, respectively, to DDT, toxaphene, lindane, aldrin, and heptachlor, as larvae from an untreated area. Larvae from a nearby duck club had a lower range of resistance. Parathion was about equally effective on both treated and untreated larvae.

THE PATH OF LEAST RESISTANCE IN CALIFORNIA MOSQUITO CONTROL

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With the many examples of dramatic mosquito control recorded during World War II through the liberal use of chlorinated hydrocarbon insecticides and with these insecticides readily available in the post-war years the tendency in California mosquito control has been to follow this path of least resistance, as has been the case elsewhere in the world. Unfortunately, this course of emphasis has ignored basic fundamentals of nature, mosquito control history, legal responsibility, and especially the mosquito itself. As a result, a dilemma referred to as "resistance" now faces us. Probably even worse, the environmental approach to mosquito control through water management practices has been sadly neglected. Further, the obligation of the individual in assuming responsibility for mosquito production has been largely dismissed. Supremely important, the concurrent value to agriculture derived from mosquito source reduction practices, remains open to capitalizing upon. Lastly, the objective study of mosquito ecology offers hitherto unused approaches to mosquito control. In recognition of these shortcomings, California is trying to face these needs and its future program based on this comprehensive plan bids to cope with the total mosquito problem.

F O U R T H S E S S I O N

SAMPLING METHODS FOR MOSQUITO LARVAE IN
IRRIGATED PASTURES

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A larval sampler designated as the "sleeve-sampler", used in the mosquito larvae sampling techniques in irrigated pastures, is a clear plastic cylinder open at both ends. A small hand-operated suction pump was used to collect the larvae from the water enclosed by the sleeve-sampler. The larvae were then placed in a container supported by a tripod stand. The investigations of mosquito larvae sampling techniques indicate that the use of the sleeve-sampler is superior to the standard dipper-method in making critical population studies. The sleeve-sampler gave positive counts in areas where the dipper gave high proportion of negative counts. The efficiency of the sleeve-sampler increases from 2.16 up to 4.92 times greater than the dipper-method as the vegetation becomes denser with the over-all ratio being 4.07:1 in collecting mosquito larvae. The sleeve-sampler is time consuming and, therefore, feasible only when taking samples for biological studies and critical testing of larvicides. The comparison of larval collection records using the sleeve-sampler indicates that this method of sampling for mosquito larvae in irrigated pastures may be universally applicable method for sampling when it is desired to hold personal factors to a minimum.

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BETTER RESULTS WITH MOSQUITO LIGHT TRAPS THROUGH
STANDARDIZING MECHANICAL PERFORMANCE

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Twenty years ago a mosquito light trap was developed that has had but little change or modification since.

Traps built to the original specifications are still giving good service as devices to measure the extent of annoyance from mosquitoes being suffered by human populations. The original traps were designed to accommodate a very durable small fan and motor, then available in quantity at low cost. But during the war the manufacture of this motor was discontinued, and motors of many sizes and types have been substituted in many traps, so that traps now in service vary widely in air moving capacity, and thus in their ability to catch mosquitoes, since the rate of catching is directly related to the rate at which air passes through the trap. Long experience with the traps by many operators has shown other opportunities for mechanical improvements, and a study of operations problems which was begun several years ago has culminated in the design of a new trap, of greater air moving capacity, which has a sealed case, permanently lubricated motor, a heavy duty fan not likely to be deformed in operation, and other features designed to add to the ease of maintenance and the reliability of operation of the unit.

REPORT OF LARGE SCALE PRE-HATCH DUSTING FOR
AEDES VEXANS CONTROL IN THE PASSAIC RIVER
VALLEY DURING 1950 AND 1951

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This report relates the preliminary test work undertaken for three years prior to 1950, to determine the best carrier and the most desirable screening size to penetrate vegetation and reach the ground surface. Standardized on waste tobacco stems of approximately 30 - 80 screen mesh impregnated with 10% DDT. Discarded agricultural dusts and bentonite as carriers. In 1950 dusted approximately 250 acres, and in 1951 approximately 800 acres. Results justify continued investigation from chemical and biological standpoints before adopting method as standard procedure.

A LIGHT, PNEUMATIC SPRAYER FOR INSTALLATION ON VEHICLES

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Bur. of Ent. and Plant Quarantine,
Orlando, Florida.

A light, pneumatic spray unit that is adaptable for indoor or outdoor spraying for insect control was developed for installation on vehicles. The unit consists mainly of a small air compressor, air and insecticide reservoir, hose connections, and a special nozzle assembly. The compressor is bolted on a platform held in place by a bracket bolted to the cylinder head of a jeep engine just above the generator and is operated by a belt from the flat portion of the generator pulley. Although designed primarily for conventional-type jeeps, the unit can be adapted to other vehicles, or can be mounted on a cart or skid and powered by a small gasoline motor. Operational data, lists of parts, and details of construction of this unit are given.

PLUMBERS NIGHTMARE, KING SIZE

Ted G. Raley, Manager,
Consolidated Mosq. Abat. Dist.,
Selma, California.

A mosquito district shop-made fog machine, using a "Plumbers Nightmare" type venturi, has been field tested for two seasons with good success. Original machines were constructed with one venturi, having a maximum material discharge rate of 40 gallons per hour. Without changing the mechanical features, two venturi's with individual material feed lines were attached to one unit. Discharge rate was increased to a maximum of 70 gallons per hour with an apparent improvement in the quality of the fog. The two-barrel machine is light weight, safe to operate, inexpensive in comparison with commercial machines, easily repaired by district personnel and with its low temperature range, will handle most insecticides that are suitable for fogging. Particle size is reasonably well controlled by adjustable feed lines, but as yet it is not recommended for use inside dwellings.

A STUDY OF ADULT MOSQUITO CONTROL WITH AEROSOLS
AT FORT LAUDERDALE, FLORIDA

A.E. Griffiths, Tech. Serv. Dept.,
Socony-Vacuum Laboratories,
Brooklyn, New York.

Since 1946 there has been a substantial increase in the use of petroleum oil aerosols for the supplemental control of adult mosquitoes out-of-doors. Aerosols or fogs are clouds of minute oil droplets carrying DDT, BHC, lindane or other toxicants. For blanket applications over extensive areas, aerosols are usually produced by special thermal or mechanical equipment. In 1951, the Socony-Vacuum Oil Company cooperated with the Insect Control Department of Fort Lauderdale, Florida, in a study of the initial kill and duration of relief experienced in residential areas following routine fog applications for the control of adult mosquitoes. The aerosol oil employed was S/V Sovacide F, a petroleum product specifically designed for thermal aerosol generators, such as the Todd Insecticide Fog Applicator, and of high solubility power for chlorinated insecticides. Lindane (0.5%) or DDT (7.5%) were employed as toxicants. Approximately 0.12 gallons of solution were applied per acre from ground-operated TIFA machines during the evening or early morning. Aedes taeniorhynchus was the predominant mosquito species encountered throughout the study. Landing counts after fogging gave a maximum of 89% reduction in mosquito populations in two hours and 85% in 24 hours. In general, control was not significant after 48 hours. Fogging was most effective in residential areas at least a quarter of a mile from known emergence areas. In undrained mangrove swamps, aerosols were ineffective in reducing the mosquito population for periods longer than two hours after fogging. However, in ditched swamps with good drainage, populations were significantly reduced for from 24 to 36 hours. The study emphasized the supplementary nature of adult mosquito control with thermal aerosols. However, it was evident that the controlled use of aerosols in residential districts resulted in immediate relief from existing mosquito annoyance and often assured relative freedom from serious annoyance for at least 48 hours following application.

ROTARY BRUSH UNITS FOR AERIAL SPRAYING AGAINST
MOSQUITOES AND BLACK FLIES

Dr. A.W.A. Brown, Univ. of Western Ontario,
London, and Vet. and Med. Ent. Unit,
Dept. of Agr., Ottawa, Canada.

A rotary brush unit was tested on a Dakota DC3 (C-47) aircraft for its suitability for control of adult Aedes mosquitoes in subarctic spruce forest. It was mounted below the fuselage and supplied by gravity feed through a vertical discharge pipe. With a five-brush assembly on the unit, the droplet spectrum obtained with 10 per cent DDT in polymethylnaphthalene and fuel oil emitted at 1.05 gal./sec. when the aircraft flew at 150 m.p.h. showed a mass median diameter of 175 microns. With a three-brush assembly emitting at 0.58 gal./sec. the mass median diameter was 155 microns. No droplets were greater than 315 microns in diameter. Spraying runs were made 300 yd. apart and at a height of 100 ft. When 10 sq. mi. were treated with 10 per cent DDT dispersed by the five-brush assembly, at 0.22 lb. of DDT per acre, an average of 98.7 per cent reduction of adult mosquito population was obtained; the average reduction of black flies was not less than, and probably considerably more than, 80 per cent. When 5 per cent DDT was dispersed by the five-brush assembly over a similar area at 0.11 lb. per acre, the average reduction was 87.4 per cent for mosquitoes and only 24 per cent for black flies. When 20 per cent DDT was dispersed by the three-brush assembly at 0.27 lb. per acre, the average reduction of mosquitoes was 94.3 per cent and of black flies 87 per cent. The use of the rotary brush in operations against adult mosquitoes has the following advantages over the straight emission pipe formerly used in Canada; (a) better control; (b) economy in flying time; (c) greater simplicity; (d) economy in material.

FIELD ASSESSMENT OF AIRPLANE-SPRAYED INSECTICIDES
WITH RADIOACTIVE GOLD

Dr. Dale W. Jenkins,
Cml C Medical Laboratories,
Army Chemical Center, Md., and

Dr. J.S. Yuill,
Forest Insect Laboratory,
U.S.D.A., Beltsville, Md.

A new technique, using radioactive tracers, has been developed for rapid field assessment of airplane-sprayed insecticides. Use of these tracers permits immediate and more accurate, direct measurement than obtainable with dye-tracers. Radioactive gold Au^{198} was selected for testing since it has a short half life (2.7 days), relatively low cost, and high energy beta and gamma radiation, easily detected by field geiger counters. Two spray trials were run using 2.5 and 9.4 millicuries of radiogold per gallon of fuel oil per acre. Both tests gave good results and the latter spray yielded excellent data including depositions in the area beyond the main spray swaths. This method also permitted accurate analysis of the amount of spray deposited on vegetation including mature pine trees. The method promises to be of value also for testing the effectiveness of fog and smoke generators.

RESIDUAL AND SPACE SPRAYS FOR THE CONTROL OF SNOW-WATER
Aedes MOSQUITOES IN CAMP AREAS

Robert A. Hoffman and Arthur W. Lindquist,
U.S.D.A., Agr. Res. Adm.,
Bur. of Ent. and Plant Quarantine,
Corvallis, Oregon.

Tests with residual and space sprays were conducted during 1950-51 in the Cascade Mountain areas of Oregon for the control of snow-water Aedes mosquitoes. These mosquitoes were found to migrate very little during the daytime, but in the evening between 8 and 10 p.m. (D.S.T.) at temperatures of approximately 64° to 52° F. migration and biting activity were high. Residual treatments on plots of from 0.5 to 50 acres controlled adults at all times of the day except during the 2-hour migration period. DDT at 1 to 6 lb. to the acre gave satisfactory control. Lindane at 3 lb. gave control similar to DDT at 4 lb., but at 1 lb. was somewhat less effective. Space sprays of DDT in oil applied for two 10-minute periods about 12 hours apart provided protection except during migration. Space sprays containing 0.2 or 0.4 per cent of pyrethrins or allethrin gave satisfactory control in limited areas during the evening migration period.

PROTECTION FROM NORTHERN BITING FLIES

Prof. B. Hocking,
Dept. of Entomology,
Univ. of Alberta, Edmonton, and
Seasonal Entomologist,
Div. of Entomology, Ottawa, Canada.

Information on the factors that influence the attraction of northern biting flies; mosquitoes, blackflies, and tabanids, to man and their subsequent feeding on his blood is reviewed. The effects of these insects on man and animals are discussed with some emphasis on the psychological effects that may be no less important than those of a physiological nature. Procedures to minimize this attraction and feeding, and to mitigate these effects are considered. It is concluded that the best protection is afforded by a judicious combination of partially protective clothing, including a fringed hat in preference to a net as head protection, with a standard repellent. A new type of container for insect repellent is proposed. These physical protections should be supported by a proper attitude of mind towards the insects, which can be inculcated by educational procedures.

THE USE OF AIR AS A CARRIER FOR SPRAY CHEMICALS

George E. Tirrell, A.B. Farquhar Co.,
Greenfield, Massachusetts.

This article attempts to describe the versatility and effectiveness of the mist sprayer. It is dedicated to the effectiveness of all mist sprayers now being manufactured, when properly operated, and explains briefly the relationship between manufactured air delivery and various sized droplets. This is an effort to sow a seed of confidence in the minds of potential operators, that it may germinate and grow to be a truly valuable asset to future mosquito control programs.

MOSQUITO CULTURE TECHNIQUE-REVISED*

Helen Louise Trembley,
National Institute of Health,
Bethesda, Maryland.

*Abstract not received.

F I F T H S E S S I O N

PROGRESS REPORT ON MOSQUITO ECOLOGY STUDIES
IN CALIFORNIA

G. Edwin Washburn, R.C. Husbands, Lewis Isaac,
Gordon Smith, John Arnold, Robert Soroker

Operational investigations into mosquito ecology in California is a cooperative enterprise entered into by several agencies. The principal mosquito control problems of the State are related to irrigation. A problem of basic importance is that associated with the development of efficient toxicants, the study of toxicant failures, and the precision application of presently recognized toxicants. These studies include: rice field mosquito investigations, insecticide investigations, irrigated pasture mosquito ecology studies, including flight range and studies of the embryology of Aedes nigromaculis. Species composition, larval growth rates, etc., are discussed. Oviposition studies in terms of cycles of egg production and habitat preference are reported, and the relationship between irrigation cycles, egg to egg cycles, and temperature factors are considered. Twelve larvicides have been screened using colonized Culex quinquefasciatus. Field testing of colloidal compounds proved them superior to emulsions as residual larvicides in permanent ponds. Flight studies on Aedes nigromaculis using Rhodamine "B" dye and radioactive phosphorus were accomplished with results similar to those reported for last year (1950-51). These studies are a continuing process, hence results reported are not final as further information may alter conclusions.

SOME TECHNIQUES USED IN THE STUDY OF AEADES EGGS
IN IRRIGATED PASTURES IN CALIFORNIA

Richard C. Husbands, Entomologist,
Calif. Mosquito Control Assoc.,
Fresno, California.

Special equipment has been developed to assist in the problem of recovering Aedes eggs from irrigated pasture soil. The first problem, taking soil samples with a minimum of residue, was overcome by using a tank type vacuum cleaner

to sweep up a shallow layer of surface soil. Soil removed by this process was partially dried and then screened to obtain eggs with a minimum of residue. The second problem which involved the recovery of eggs within this residue, was accomplished in two ways. One, a washing process, produced egg separation by mixing the soil with white sand, covering with cold water, and then rotating the mixture until the eggs were brought to the surface by floatation. Recovery of a single seeded egg could be demonstrated by this method. The second method required the use of a mechanical stage consisting of a white disk which rotated slowly under the microscope. A thin layer of soil applied mechanically in a continuous flow, approximately the width of the field, allowed rapid and efficient segregation by examination. Eggs can be recovered and stored for future use. Preferred habitat studies and egg density measurements can be obtained by these techniques.

RESEARCH ON MOSQUITOES BY THE BUREAU OF
ENTOMOLOGY AND PLANT QUARANTINE IN 1951

Harry H. Stage,
Div. of Insects Affecting Man and Animals,
Washington, D. C.

Research on the taxonomy, biology, and control of mosquitoes by the Bureau during 1951 is discussed. Mosquito resistance to insecticides as determined in California and Florida is briefly described. The control of Aedes adults in the vicinity of summer homes by applying 2 lb. of DDT per acre in small areas is mentioned.

A PROGRESS REPORT ON MOSQUITO AND OTHER BITING-FLY
INVESTIGATIONS IN CANADA

Dr. C.R. Twinn, Head,
Veterinary & Medical Entomology,
Div. of Ent., Sci. Serv., Agric. Dept.,
Ottawa, Canada.

Studies of biting flies in northern Canada have been carried out by the Division of Entomology since 1947 with the cooperation of the Defence Research Board of Canada and other agencies. More than 40 papers on the biology and control of these insects have been published, or are in press, in scientific journals, or have been prepared for publication (Twinn, Canadian Ent. 84 : 22-28, 1952). Species association, succession, relative abundance, life-histories, and bionomics, and biting-fly activities in relation to meteorological conditions have been studied; also dispersal and flight range by means of radio-active isotopes and by other methods. Data on the nature and source of food of adult biting flies, such as blood and plant juices, are being obtained by the precipitin test and the use of radio-active phosphorus. The biological control of the various species is under study. Methods of chemical control on small and large areas have been developed, and tests made of protective clothing and repellents.

OBSERVATIONS ON THE BIOLOGY OF MOSQUITOES AT
GOOSE BAY, LABRADOR

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Veterinary & Medical Entomology,
Div. of Ent., Sci. Ser., Agric. Dept.,
Ottawa, Canada.

At Goose Bay, Labrador, in 1949 and 1950, in conjunction with experimental airsprays, 21 species of Culicidae, 18 of Culicinae and 3 of Chaoborinae were collected. The Culicinae comprised 12 species of Aedes, three of Culiseta, one of Culex, one of Wyeomyia, and one of Anopheles; the Chaoborinae comprised one species each of Eucorethra, Chaoborus, and Mochlonyx. Attention is directed to difficulties encountered in the identification of the females of forest species of black-legged Aedes spp. that occur in the subarctic. Data on dates of

emergence and species abundance are presented. The ecology, of the Goose Bay mosquitoes is discussed, and observations recorded on the development of the immature stages. An account is given of the comparative importance of the various species at Goose Bay.

SOME ASPECTS OF MOSQUITO CONTROL ACTIVITIES IN SOUTH AMERICA

Rolla B. Hill, M. D.,
Rockefeller Foundation,
Coconut Grove Station,
Miami, Florida.

The widespread use of residual insecticides has given increased impetus to mosquito control campaigns, which are now conducted on a nation-wide scale in many countries. The main purpose of these campaigns is the control of disease vectors rather than pest control. The present tendency is for the old Malaria Divisions to expand their activities to include control of vectors of other arthropod-borne diseases such as yellow fever, filariasis, typhus, plague, Chagas' disease, and even fly-borne diarrheas and dysenteries. This is a logical development consequent upon the introduction of residual insecticides. However, older control methods have not been abandoned, it being increasingly recognized that the so-called permanent methods of control are still important and in many situations necessary.

OBSERVATIONS AFTER SIX YEARS OF MALARIA CONTROL WITH
DDT RESIDUAL SPRAYING OF TROPICAL LABOR CAMPS*

Sam. D. Macready,
Cristobal, Canal Zone.

*Abstract not received.

STATUS OF MALARIA INCIDENCE IN THE UNITED STATES

Dr. Roy F. Fritz, Scientist,
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Atlanta, Georgia.

Malaria incidence in the Southern States has steadily declined to the point where in 1950 only 2,227 cases were reported. Approximately one-third of these cases were carefully appraised and only 30 were confirmed. Only six of these appeared to have originated within the United States. During the early part of 1951, the number of cases reported was below the previous year, until military cases were returned home from Korea. The Malaria Surveillance and Prevention Program of the Communicable Disease Center and State Health Departments designed to complete eradication of malaria in the United States should be effective in preventing even local outbreaks developing from these introduced carriers.

FOREST MOSQUITO STUDIES IN AN ENDEMIC YELLOW
FEVER AREA IN PANAMA

Col. Stanley J. Carpenter,
Fort Baker, California, and

Dr. Pedro Galindo and Dr. Harold Trapido,
Gorgus Memorial Laboratory, Panama.

Following the occurrence of several fatal human cases of sylvan yellow fever in an area east of Panama City in the Republic of Panama, in 1948 and 1949, the writers undertook a study of forest mosquitoes in the Canal Zone and central Panama. During this study particular emphasis was placed on the mosquito inhabitants of the forest canopy. Haemagogus sregazzinii falco Kumm et al. and Aedes leucocel-
aenus D & S., important vectors of sylvan yellow fever in South America, were found in considerable numbers. During 1950, these investigations were extended to western Panama and adjacent Costa Rica, to determine population levels of these and other species in these areas. During the course of this work a great deal of information has been accumulated on the composition and ecology of the forest mosquito fauna in an area of known endemic sylvan yellow fever. Descriptions of collecting stations, collecting and study methods and important findings are described in this paper.

MOSQUITO CONTROL IN THE SOUTH PACIFIC

Dr. Stephen M.K. Hu, Chief,
Bur. Mosq. Control,
Dept. of Health,
Honolulu, T.H.

A trip to Tahiti to attend a conference on filariasis provided a good opportunity to observe the mosquito situation on some islands in the Pacific. Both filariasis and dengue are common in many islands of the South Pacific. It is because of the wide prevalence of filariasis and the importance of its control, that the South Pacific Commission held a conference on this disease to improve the health of this part of the world. Tahiti was chosen for the site of the conference because an active program of filariasis is being conducted by the Institute of Medical Research of French Oceania located on the island of Tahiti, with headquarters in Papeete, the capital.

The principal vector of filariasis in the South Pacific is Aedes pseudoscutellaris, a day biting mosquito. Its control is complicated by the many empty coconut shells lying around the plantations which furnish suitable breeding places for this mosquito. As the production of copra is an important industry on these islands, coconut plantations are numerous. Along with the day biting Aedes, the night mosquito, Culex quinquefasciatus, was also incriminated in Tahiti as a possible vector of filariasis. This confirms our findings in Hawaii that the same local night mosquito here may be a suitable vector of the non-periodic form of filaria parasite prevalent in this part of the world.

The mosquito control program in Fiji is well organized with about 75 inspectors covering the islands. House-to-house inspection is carried on in the city of Suva as well as in other centers of population. The areas with malaria-carrying Anopheles closest to Fiji consist of the New Hebrides and Australia. The airport of Nandi and the seaport of Suva on Fiji are closely guarded against the introduction of Anopheles from these regions.

THE VECTORS OF JAPANESE B ENCEPHALITIS IN
JAPAN AND KOREA*

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*Abstract not received.