

THE MOSQUITO PROBLEM OF CONNECTICUT AND HOW TO SOLVE IT

BY W. E. BRITTON, PH.D.,



Connecticut State Department of Health
Stanley H. Osborn, M. D., C. P. H., Commissioner
Hartford, Conn.

Cope
Conn. Doc
H3426
130
1943

STATE DEPARTMENT OF HEALTH

PUBLIC HEALTH COUNCIL

C-E. A. WINSLOW, M. S., Dr. P. H., New Haven
JAMES A. NEWLANDS, B. S., Secretary, Hartford
JAMES W. KNOX, Hartford
DAVID R. LYMAN, M. D., Sc. D., Wallingford
ROSCOE H. SUTTIE, C. E., New Haven
GEORGE H. GILDERSLEEVE, M. D., Norwich
STANLEY H. OSBORN, M. D., C. P. H., Sc. D., Commissioner, Hartford

EXECUTIVE STAFF

STANLEY H. OSBORN, M. D., C. P. H.
Commissioner of Health

WILLIAM C. WELLING, B. A., Director—Bureau of Vital Statistics
MILLARD KNOWLTON, M. D., C. P. H., Director—Bureau of Preventable Diseases
WARREN J. SCOTT, S. B., Director—Bureau of Sanitary Engineering
FRIEND LEE MICKLE, M. S., Sc. D., Director—Bureau of Laboratories
MARTHA L. CLIFFORD, M. D., M. P. H., Director—Bureau of Child Hygiene
HAZEL V. DUDLEY, B. S., R. N., Director—Bureau of Public Health Nursing
ELIZABETH C. NICKERSON, B. S., C. P. H., Director—Bureau of Public
Health Instruction—and Nutrition
ALBERT S. GRAY, M. D., Director—Bureau of Industrial Hygiene
HENRY P. TALBOT, M. D., M. P. H., Director—Bureau of Venereal Diseases
JAMES M. CUNNINGHAM, M. D., Director—Bureau of Mental Hygiene
POWELL C. CARREL, D. D. S., M. P. H., Chief—Division of Dental Hygiene
HENRY R. O'BRIEN, M. D., M. P. H., Chief—Division of Local Health Administration
MATTHEW H. GRISWOLD, M. D., Dr. P. H., Chief—Division of Cancer Research
LOUIS SPEKTER, M. D., M. P. H., Chief—Division of Crippled Children
RUTH H. MONROE, Chief—Division of Licensure and Registration
LAURENCE A. FAGAN, Chief—Division of Accounts and Supplies

HEADQUARTERS

State Office Building, 168 Capitol Avenue, Hartford, Connecticut
P. O., Station A, Box K. Telephone, 7-6341

BUREAU OF LABORATORIES — 1179 Main Street

Main P. O. Box 1139 Telephone, 7-6341

BUREAU OF INDUSTRIAL HYGIENE — 1179 Main Street



The Mosquito Problem of Connecticut and How to Solve It



BY W. E. BRITTON, PH.D.,

ACKNOWLEDGMENT

This bulletin prepared by W. E. Britton, Ph. D., D. Sc., then State Entomologist and Entomologist of the Connecticut Agricultural Experiment Station, New Haven, Connecticut, was first prepared and published by the Connecticut State Board of Health in 1915. The first revision was also made by Dr. Britton. This, the second revision, has been made by Roger B. Friend, State Entomologist. We trust that those interested in mosquito elimination will find this of assistance in their efforts.

CONTENTS

General Facts About Mosquitoes	3
Number of Species	4
The House or Rain Barrel Mosquito.	4
The Malarial Mosquitoes	5
The Brown Salt Marsh Mosquito.	6
The Banded Salt Marsh Mosquito	7
Other Species.	8
Methods of Control	8
Legislation	9
Estimates, Supervision and Maintenance	11



The Mosquito Problem of Connecticut and How to Solve It

BY W. E. BRITTON, PH. D.

Ever since it was learned that certain kinds of mosquitoes through their bites transmit organisms causing human diseases such as malaria, and in the tropics yellow fever, many investigations have been conducted regarding the life history, habits, breeding places and elimination of mosquitoes. Even though we eliminate the possibility of disease transmission, all will agree that the irritation caused by the bites of mosquitoes is extremely annoying and in many cases may act as a positive detriment to health. The increased interest in mosquitoes and their control is very gratifying. Communities in Connecticut are interested in antimosquito work largely from the standpoint of human comfort. Of course other benefits follow, including improved health and increased property values. In any community the degree of annoyance from mosquitoes is directly proportional to the abundance of mosquitoes. If we can get rid of 95 per cent of them, the remaining five per cent will hardly be noticed. Yet different kinds of mosquitoes have different habits and breed in different places. Some are local; others are migratory. Some kinds bite in sunny daylight; others bite after dark. The object of the present paper is to point out the more troublesome species in Connecticut and to indicate how they may be controlled.

General Facts About Mosquitoes

Though all species of mosquitoes are not equally abundant, and may not have the same habits or all breed in the same locality, they are alike in one respect: viz., all breed in water, and all stages except the adult are passed in water,—chiefly stagnant water. They do not breed in grass or shrubbery as is often asserted, but only hide or rest there—unless, perchance, there is standing water, in which they may actually breed.

Mosquito eggs are laid in water or in mud and the larvae or wrigglers feed in the water upon the spores of algae and small particles of organic matter. Every two or three minutes each wriggler ascends to the surface to breathe, the air entering through the tube or siphon at its posterior end. When mature, the larva changes to a curious hunch-back pupa with two siphons near the head. Both forms are shown in Figure 1. The adult soon emerges and flies about, the female later laying eggs.

It is only the female mosquito that bites. The male is unable to. The blood of the higher animals is the preferred food and seems to be necessary with some species for egg development. The house or rain barrel mosquito is said to be able to develop eggs if plant juices are the only food.

Probably most kinds of mosquitoes live only a short time after reproducing. Some kinds pass the winter as adults in vaults, cellars and caves; certain kinds winter as eggs in the mud.

Some kinds of mosquitoes fly only a short distance from their breeding places and are commonly called local or domestic mosquitoes. Many species, especially those that breed upon the salt marsh, may travel several miles, and are known as migratory mosquitoes.

Mosquitoes of the genus *Anopheles* (malarial mosquitoes) have spotted wings; the beak forms almost a straight line with the axis of the body, and this line is nearly perpendicular to the surface upon which the mosquito rests. Other kinds of mosquitoes rest with the body nearly parallel with the resting surface and the beak projects from the axis of the body almost at a right angle.

Mosquito wrigglers are devoured by fish and certain aquatic insects. Fish are often introduced into pools to keep down the mosquitoes. For this purpose the best kinds are those small fish which feed near the surface of the water upon animal food, such as minnows, killifish and goldfish.

Number of Species

Up to the present time about 33 different species of mosquitoes have been recorded from Connecticut. About 43 species have been listed for the State of New York and 45 species are known to occur in New Jersey. It has been estimated that there are about 2,000 different species in the whole world and that about 110 species occur in the United States exclusive of Alaska, Hawaiian Islands, Porto Rico and the Virgin Islands.

The House or Rain Barrel Mosquito

Culex pipiens Linn.

This is a brown mosquito of medium size without prominent or particularly characteristic markings. It breeds in pools, barrels, buckets, kettles, tin cans, choked gutters and other similar places that collect and hold rain water. The eggs are laid side by side, on end, in raft-shaped clusters containing from 200 to 400 eggs, which float upon the surface of the water. The eggs hatch in a few days. On hatching, the lower end of each egg opens and the small larva or wriggler goes downward into the water. The wrigglers have large heads and move about in the water with a quick jerky motion; they are usually seen with their heads downward, especially when

they come to surface for air, which they inhale through the posterior long tube or siphon. About **eight days in warm weather** is the time required for the development of the insect from egg to adult, but in cooler weather this development may require a period of two weeks. To show how rapidly it breeds, the late Dr. Luggen, of Minnesota, once counted 17,259 eggs, larvae and pupae of this species in a rain water barrel in July. These were all destroyed and the barrel again filled with water. Sixteen days afterward there were 19,110 eggs, larvae and pupae in the same barrel.

This mosquito is by far the most troublesome **kind in houses**. It seldom bites in the daytime, but is particularly annoying by its bites and its hum after dark. It will readily develop in water that is highly polluted by sewage or other waste materials.

In 1913 and 1914, this mosquito bred intensively in the upper part of West River, New Haven, which was polluted with dye stuffs, sewage and other factory wastes, to such an extent that fish could not exist there. A period of drought in July and August aggravated the mosquito nuisance, for along the margins and in the quiet coves where the water was stagnant the wrigglers were as thick as they could well be. Heavy rains would have washed them into Long Island Sound. The adult mosquitoes fairly swarmed about the porches of all houses and made sleep difficult unless **mosquito canopies** were placed over the beds.

Though this house mosquito usually does not fly more than a quarter of a mile, this 1913 outbreak in the West River region was effective fully a mile away. The stream was oiled to kill the wrigglers. Similar outbreaks have been observed along the Mianus River, Greenwich, in 1913, where the stream had been polluted by the wastes from a plush factory, and in 1920 a less extensive outbreak occurred in Manchester, where Lydall's Brook, polluted by factory wastes became a mosquito breeding place.

In time of drought this mosquito may breed in the catch basins of sewers in city streets, but one good rain or shower each week will flush out the basins.

Except in cases of such outbreaks as mentioned above, most of the house mosquitoes fly only a short distance, and therefore have a breeding place close by, often on one's own premises.

The Malarial Mosquitoes

Anopheles quadrimaculatus Say, and

Anopheles punctipennis Say.

The malarial mosquitoes lay sculptured eggs singly upon the surface of the water, and the wrigglers are found the latter half of summer at the surface of the water along the grassy margins of clear streams and springs, even where there is a

mild current. Fortunately these mosquitoes are never so abundant as the house mosquito or the salt marsh species, yet they enter houses and bite after dark in much the same manner as the former. They are also local in their flight and their distribution, seldom flying more than a mile from the breeding places. *Anopheles punctipennis* is far more abundant in Connecticut than *A. quadrimaculatus* and is less liable to transmit malaria through its bites.

Though the malarial mosquitoes usually breed in clear water, they may inhabit any fresh water where other kinds of mosquitoes breed: a common breeding place is around the inland margins of salt marshes where fresh water from springs and streams enters the marsh from the upland.

The larva has a shorter siphon and smaller head than that of the house mosquito or any other common species. Moreover, instead of hanging with head downward at the surface, it lies there horizontally when breathing, and seems to pass most of its time in this position. It is sometimes dark gray or brown, resembling bits of debris, but is often bright green resembling bits of grass, especially in grassy pools,—a striking case of protective coloration.

These mosquitoes are essential or alternate hosts of the malarial parasite or Plasmodium (one of the lower animals belonging to the Sporozoa) which undergoes a portion of its development in the human blood and the remaining stages are passed in the body of the mosquito. If one of these mosquitoes bites a person suffering from malaria, the parasite is taken with the blood into the stomach of the mosquito and completes its cycle of development in the body of the mosquito. At a certain stage the minute organisms penetrate the stomach walls and form outside large globular capsules that finally split up into needle-shaped bodies which enter the poison gland. This development takes a definite period, and if the same mosquito bites another person soon after the needle-shaped spores are formed, this person is inoculated with malaria through the mouth parts of the mosquito. If not immune, this person will have "chills and fever" in about fourteen days after being bitten. It is at this time of spasms of "chills and fever" or "sporulation" of the malarial parasite that quinine is the most effective, and it is also the time for the female mosquito to take the parasite into her system.

So far as known, there is no other natural method of transmitting malaria.

The Brown Salt Marsh Mosquito

Aedes cantator Coq.

This is the prevalent species on the salt marsh early in the season and is a large brown mosquito with rather indistinct transverse white bands on the legs and abdomen. In New

Jersey, the late Dr. J. B. Smith found larvae well advanced as early as March 23. Swarms of adults emerge during the months of May and June in Connecticut, and though this species may often be seen later in the season, it is generally superseded after June by the banded salt marsh mosquito *A. sollicitans*. *Cantator* flies and bites both in daytime and after dark and will enter houses if open. Both sexes migrate long distances inland.

The eggs are laid in the mud of the shallow pools of the salt marsh. The larvae develop in either tide water or rain water and rarely in water that is absolutely fresh on the upland. There is usually a brood of adults in May and another in June. Later the larvae may be found in various stages of development, but little attention is paid to them because those of *sollicitans* are so much more abundant.

The Banded Salt Marsh Mosquito

Aedes sollicitans Walker.

This is the mosquito commonly known as the salt marsh mosquito and was formerly very abundant along the shore region of Connecticut the latter part of the summer. The adults emerge in definite broods or swarms from the salt marshes where they develop in the shallow depressions or pools filled by the very high or perigee tides. Consequently there is an enormous brood about once each month. This species is seldom seen in Connecticut until after the middle of May but from then until October it is extremely abundant where the salt marshes have not been ditched.

It is a medium-sized, brown, mosquito with beak, legs and abdomen distinctly banded with white. The band on the beak is about midway; those on the legs are broad and conspicuous. In addition to the cross bands on the abdomen, there is one running lengthwise on the back. This combination of markings does not occur with any other species of mosquito occurring in Connecticut.

This mosquito bites fiercely in daytime, even in full sunlight, and also in the evening. It bites hard and quickly with little warning: When a swarm is emerging they will literally cover one's clothes and skin, and bite wherever they can.

Like the brown salt marsh mosquito, *A. sollicitans* migrates long distances inland, but only so with the females. Smith has shown that they may go as far as 40 miles in New Jersey, and we have taken them in Connecticut at Middletown, about 20 miles from their breeding place. Most of them go only a few miles in search of food for it is necessary that the females obtain blood in order to develop their eggs. Thus, on account of its habits of attack and migration, this mosquito may affect the whole southern half of Connecticut, and make life almost

unendurable near some of the salt marshes. It prevents the development of real estate and keeps down property values. It seldom enters houses.

The eggs are laid in the mud of the salt marsh and hatch quickly if the depressions fill with water, but will survive for two or three months or more if water does not come. Sometimes the water seeps away or evaporates before the larvae reach maturity and they die. Only a week in warm weather is required from the hatching of the egg to the emergence of the adult.

Other Species

There are, of course, many other species of mosquitoes, but it is unnecessary to discuss them here in detail. Some like *Aedes canadensis* Theob. breed in the pools of melting snow in spring; some in woodland pools, some in hollow trees, some like *Aedes atropalpus* Coq. in rock pools, and some like *Aedes vexans* Theob. and *Mansonia perturbans* Walker in fresh water swamps.

The four kinds mentioned previously are the most important, and the methods recommended for their control will also be of service against all other kinds.

Methods of Control

The chief point to be remembered in all anti-mosquito work is to abolish all pools or containers in which mosquitoes may breed. In most places pools may be drained but in some cases it is less expensive to fill them.

The following anti-mosquito measures are to be recommended:

1. Screen all houses, stables, cisterns and rain water barrels. The only water supply of many cottages at the shore and in the mountains is that which falls from the clouds upon the roof and is conducted into barrels. Such barrels may easily be screened by fastening mosquito netting to a hoop that is larger than the end of the barrel and placing this hoop over the top so that mosquitoes cannot lay their eggs on the water.

2. Remove all unnecessary tubs, rain barrels, and tin cans around the home, and cover those on the dumps. Give attention to clogged pipes and gutters.

3. Temporary pools should be drained by proper ditching if possible, or oiled if the water stands longer than ten days. Small pools may be filled. Permanent pools, ponds, springs or aquatic gardens should be kept stocked with any small carnivorous surface-feeding fish, such as brook minnows, killies, or the common goldfish. The entire water surface of such areas should be made accessible to the fishes. The mar-

gins of sluggish streams should be cleaned and the banks made abrupt by stoning or the dirt banks sloped to form a narrow V-shaped bottom.

4. All of the salt marsh area of Connecticut, about 18,000 acres, has been ditched. A large part of this is maintained, by legislative authority, and kept free of mosquito breeding. Constant inspection is necessary to keep the ditches in good operating condition.

5. Kerosene or light fuel oil (one fluid ounce for each 15 square feet of surface) sprayed upon the water will kill all wrigglers in it, but this must be repeated about every fourteen days throughout the season. The so-called "New Jersey Larvicide", an emulsion of a light petroleum oil containing pyrethrum extract, is a very efficient insecticide for killing mosquito larvae. It is sprayed on the water at the rate of one gallon (diluted mixture ready to use) per 1,000 square feet of pool surface. It is not injurious to man, animals, waterfowl, fish or vegetation. When sprayed on the grass, shrubs, and trees out-of-doors, it is said to provide protection against adult mosquitoes for a few hours. The use of oil is only a temporary expedient, and permanent work should be done whenever possible.

6. Citizens can protect themselves and at the same time cooperate with the local health department and the State Board of Mosquito Control by making certain that mosquitoes cannot breed on their premises. It is too late to control mosquitoes after the adults become abundant.

Legislation

The following laws have been enacted by the General Assembly of Connecticut to provide the legal machinery for the elimination of mosquitoes:

Section 2414, General Statutes (Revision of 1930). Mosquito-breeding places; treatment. When it shall have been brought to the attention of a health officer or board of health, through the complaint of any citizen, or when discovered by any inspector or agent of said health officer or board of health, that rain water barrels, tin cans, bottles or other receptacles, or pools near human habitations are breeding mosquitoes, it shall be the duty of said health officer or board of health to investigate and to cause such breeding places to be abolished, screened or treated in such manner as to prevent the breeding of mosquitoes. The health officer, or any inspector or agent employed by him, shall have the right to enter any premises in performance of his duties under this section.

Sec. 2415, General Statutes, Revision of 1930 (As amended by Sections 868e and 869e of the 1939 cumulative supplement.) Elimination of mosquito-breeding areas. The board of mosquito control may make rules and orders concerning the elimination of mosquitoes and mosquito-breeding places, and he or his agent may enter upon any swamp, marsh or land to ascertain if mosquitoes breed thereon or to survey, drain, fill or otherwise treat, or make any excavation or structure necessary to eliminate mosquito breeding on such land. Whenever funds shall have been provided by voluntary contribution or by appropriation by the state

for the elimination of mosquitoes or mosquito-breeding places said board may order the execution of such work upon notice as herein provided. At least thirty days before commencing such work, said board shall file a copy of such order, with a description of the place or area affected and a statement of the proposed plan thereof, in the town clerk's office in each town in which such place or area is located. Said board shall publish a copy of such order once each week for two successive weeks in some newspaper having a circulation in the town or towns in which such place or area is situated, and shall mail a copy of such notice, postage prepaid, by registered mail, addressed to each record owner of land whose name and address may be ascertained by a reasonable inquiry from the assessors of the town in which such land is situated. Said board may, and upon application of any person affected by such order or plan, within thirty days after such publication, shall, assess damages sustained by the owner of any such land. Such assessment shall be filed by said board with the clerk of the superior court of the county within which the land affected is located, and such clerk shall give notice of such assessment to each such property owner, by mailing him a copy of such assessment, postage prepaid. Any person claiming to be aggrieved because of such order or proposed plan or such assessment may, within ten days after notice, apply to the superior court in the county in which such land is situated, or any judge thereof, for relief, and said court or such judge may, after notice to said board and parties applying for relief, and hearing thereon, make any proper order concerning such order or proposed plan, or make a reassessment of damages. Said court or such judge may view the land claimed to be affected by such order or plan and may take any evidence which is in his opinion, material. The order, plan and assessment as hereinbefore provided shall be conclusive upon all parties affected thereby, and the state treasurer shall pay to any such owner the damages assessed by said board or by said court or such judge, as the case may be, upon certification of the amount by the clerk of said court. The pendency of any application for the assessment of damages shall not prevent or delay the execution of the work for the elimination of mosquitoes or mosquito breeding. Upon the completion, to the satisfaction of said board, of any such work, said board shall certify to the comptroller, with proper vouchers, the amount of such costs, and the comptroller shall draw his order on the treasurer for the payment of the same.

Sec. 2416, General Statutes, Revision of 1930 (As amended by Sections 868e and 869e of the 1939 cumulative supplement.) **Maintenance of drained land.** Whenever any swamp, marsh or other land shall have been drained to the approval of the board of mosquito control, he shall keep the same in repair and free from obstruction, and construct or repair tide gates or otherwise treat such areas so as to make such work effective. Said board may appoint one or more agents to supervise the work done under the provisions of this and the preceding section, who may exercise the authority granted to such board. The expenses of said board and said agents in carrying out the provisions of this and the preceding section shall be paid from funds provided by voluntary contributions or from funds appropriated by the state for such purpose. The comptroller may advance to said board such amounts within the appropriations therefor, as are necessary to meet the current expenses for labor authorized under the provisions of this and the preceding section. Any person obstructing the work of examining, surveying or ditching or otherwise treating such mosquito-breeding areas, or obstructing any ditch, canal or drain, or the natural outlet of any marsh, forming mosquito-breeding areas, shall be fined not more than one hundred dollars or imprisoned not more than ninety days or both.

A Board of Mosquito Control was authorized by the General Assembly at its 1939 session when the following laws were enacted:

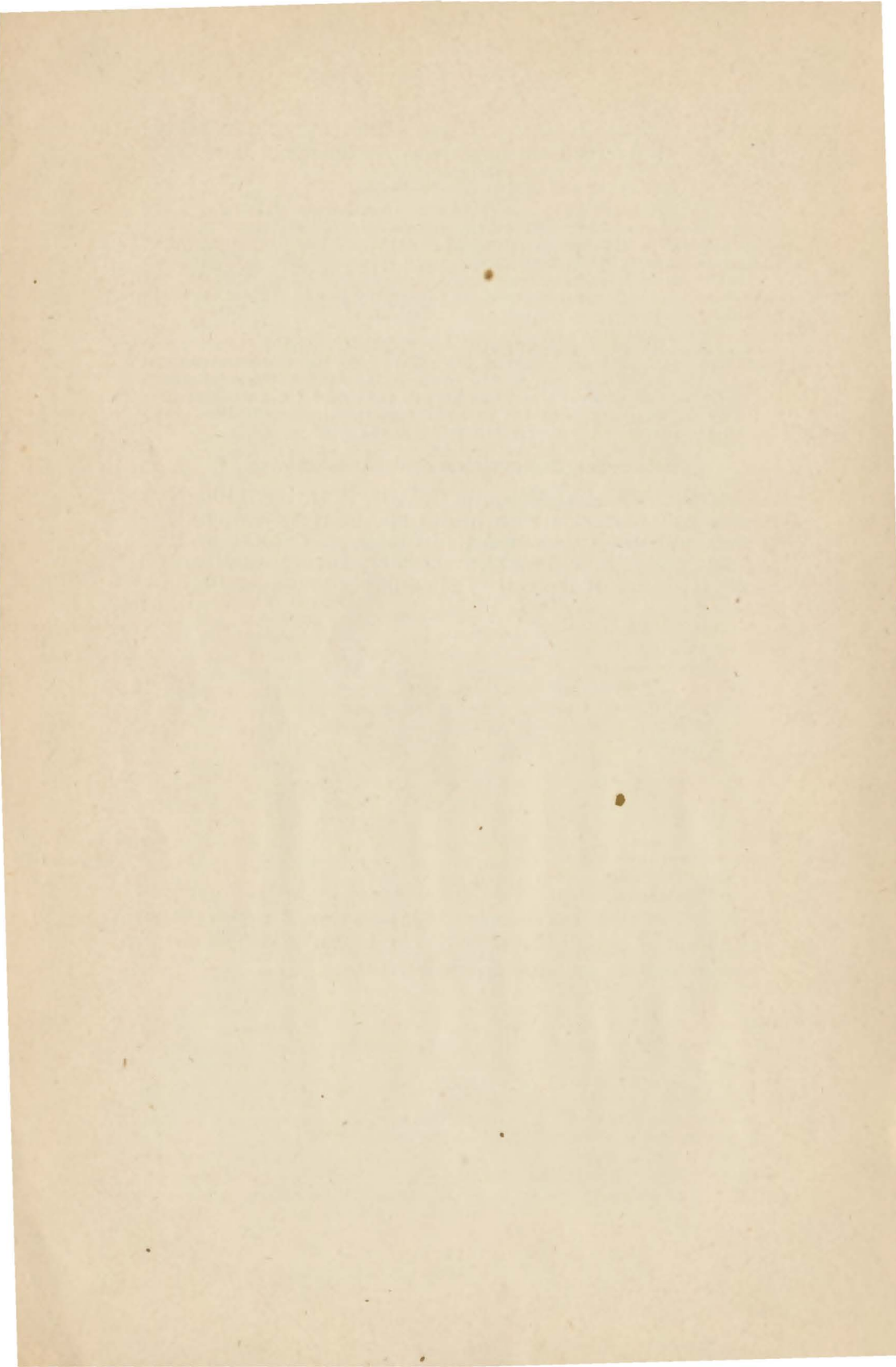
Sec. 868e. Sections 2415 and 2416 are amended by striking out the words "director of the Connecticut Agricultural Experiment Station" wherever they occur and inserting in lieu thereof the words "board of mosquito control"; by striking out the word "director" wherever it occurs and inserting in lieu thereof the word "board" and by striking out the word "deputies" wherever it occurs and inserting in lieu thereof the word "agents".

Sec. 869e. **Board of mosquito control.** The director of the Connecticut Agricultural Experiment Station, the director of the state water commission, the superintendent of the state board of fisheries and game, the commissioner of health and one person appointed for a term of four years by the governor, shall act as a board of mosquito control and shall administer the provisions of sections 2415 and 2416.

Estimates, Supervision and Maintenance

The State Board of Mosquito Control, P. O. Box 1106, New Haven, will cooperate with health officers, corporations, improvement associations, and individuals, and so far as time and funds permit, will make preliminary surveys and furnish rough estimates of the cost of eliminating the mosquito nuisance.

NOTE. It is regretted that this edition of the mosquito pamphlet cannot be illustrated. The plates for the pictures printed in other editions were turned in so the metal could be used in war production and no plates are available for printing the illustrations.



CONNECTICUT



- Birth, Marriage, Death, Disease Registry
- Epidemic Disease Control
- Laboratory Examinations
- Vaccines, Antitoxins, Serums
- Mental Health Clinics
- Local Health Agency Counsel
- Industrial Hygiene
- Sanitary Engineering
- Cancer Information
- Crippled Children Clinics

- Birth Records for Connecticut Babies
- Active Aid in Child Hygiene
- Supervision of Water Supplies
- Regulation of Sewage Disposal
- Exhibits, Lectures, Films
- Advice in Public Health Nursing
- Posters, Bulletins, Leaflets
- Advice on Dental Hygiene
- Better Living by Nutrition Facts
- Programs for Health of Mothers

HEALTH SERVICE