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General

THE IMPORTANCE OF LOCAL MOSQUITO SURVEYS IN MINNESOTA

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During the summer of 1938, when pest mosquitoes seemed to have reached an all-time high in the neighborhood of the Twin Cities and when their victims were vociferously voicing their grievances, I was approached by a reporter who thought that there was one-sided publicity given to the situation and who wanted "something good about mosquitoes."

Under the circumstances the request was an embarrassing one—I could not even adapt Dave Harum's oft quoted observation that "A reasonable amount o' fleas is good for a dog,—keeps him from broodin' over being a dog, mebbe." The pests were present in numbers too great for philosophic acceptance.

On calmer, unbiased consideration it seems worth while to bring to the attention of members of the Academy of Science that these much detested insects present for the student of biology many interesting and worth-while problems — some obviously of immediate practical nature, others less obviously so, but affording information which may have an important bearing on public health problems and on control.

Back of any problems of mosquito control in a given region is necessity for accurate knowledge as to the various species concerned, their breeding habits, range of flight, their food habits and their ecology. This necessity has not entirely been ignored by Minnesota entomologists.

Dr. Lugger, our first State Entomologist, in his 1896 report to the Governor, discusses the general life history of *Culex pipiens* and presents some interesting figures as to the potentialities of a rain barrel nursery for this pest.

His successor, Prof. F. L. Washburn wrote, in 1902, that of the 25 species of mosquitoes known to occur in the United States, 4 had been reported for Minnesota.

Professor Charles W. Howard, who came to the University of Minnesota in 1912, was much interested in mosquitoes and, in 1916, he published in the 16th report of the State Entomologist a paper on "The common mosquitoes of Minnesota," in which he recorded 20 species. He grouped these into (1) *domestic species,* which breed in artificial collections of water in the vicinity of human habitations and, (2) *wild species* which breed in natural collections of water, either permanent or temporary, open, or in woodlands.

In recent years the Division of Entomology and Economic Zoology of the University has made a special effort to add to our knowledge regarding the mosquito fauna of the state. In 1932 the problem was assigned to a graduate student, W. B. Owen, who attacked it aggressively. His study, incorporating much original material as well as data accumulated in the Division, was published in 1937 as a technical bulletin entitled "The Mosquitoes of Minnesota with Special Reference to their Biologies." In it were listed 37 species and one has since been added so we now know that we are dealing with nearly ten times as many as Prof. Washburn listed in 1902. Indeed, it is almost twice as many as were listed for the whole United States at the time of the discovery that mosquitoes transmit malaria.

These 38 species present a wide variety of habits. Some, like the so-called "rain barrel mosquito" and the malaria-bearing anophelines pass the winter as adults in caves, cracks in the earth, hollow trees and similar hiding places, one kind lives as a larva in pitcher plants, our most troublesome pest mosquitoes pass the winter in the egg stage.

A few species, like the so-called rain barrel mosquito, *Culex pipiens,* breed in the neighborhood of houses in tin cans, cisterns, barrels and various temporary containers. Such species may be combated by thorough clean-up campaigns, such as are usually urged as anti-mosquito measures. Others breed in stagnant pools or in slow-moving streams, or along the weedy shores of lakes and ponds, or even in tree holes. Some species favor woodland pools in hardwood areas, others in coniferous areas while some choose prairie country.

Still others, and among them, the worst of our pests, deposit their eggs in low-lying places where they lie dormant until melting snows or heavy rains create temporary pools for the development of their larvae.

Varying conditions of rainfall and of temperature determine the abundance of mosquitoes and which shall be the dominant species. During our years of drouth we heard little complaint regarding their attacks but in the 1937 and 1938 seasons the common opinion seemed to be that mosquitoes had never before been so abundant.

Since the different species differ so greatly in their selection of breeding places it is obvious that man-made changes in the configuration of a region may result in striking changes in the mosquito population. The destruction of our forests made it entirely impossible for certain species to maintain themselves and yet other species found the new environment just to their liking.

It would be instructive if we could compare the original mosquito fauna of the extensive drained areas of northern Minnesota with what are now the dominant species. Unfortunately, that is not possible but some very significant data would be afforded by a comparison of the present fauna and the changes which will occur as

some of these lands are flooded in an effort to protect ducks and other wildlife.

Along the same line, what will be the result of greatly increasing favorable breeding places for malaria-carrying mosquitoes by impounding water along the Mississippi?

The epizootic of horse sickness, or equine encephalomyelitis and recent discovery that it may occur also in man have intensified interest in experimental evidence that this highly dangerous disease can be transferred by certain species of mosquitoes. Tularaemia, another serious disease of man and animals can also be conveyed by these insects. Indigenous malaria is relatively rare in Minnesota but we have four species of anopheline mosquitoes, each of which is known to be capable of carrying the infection, and they are responsible for sporadic cases of the disease.

Granting that the health factor is a minor one, we cannot so consider the intolerable annoyances caused periodically by the hordes of pest mosquitoes. Natives, as well as our many summer visitors are demanding relief.

In order to determine the practicability of control campaigns it is necessary to have detailed information along the lines already suggested, for the specific areas concerned. Biologists should obtain the pertinent information and be able to evaluate the numerous proposals made during seasons of excessive abundance of mosquitoes.

For the entire state of Minnesota there is only one small area, that of the neighborhood of the Twin Cities, where such an intensive study has been made. It is by no means comprehensive but I shall review it briefly for purposes of illustration.

Following several years of greatly reduced rainfall and consequent low incidence of mosquitoes, the season of 1937 and particularly, that of 1938 were characterized by abnormal precipitation in this locality and by such a mosquito plague that there was general and emphatic complaint. At the instigation of and with the active cooperation of Mrs. Charles C. Webber, of Crystal Bay, a survey of conditions was initiated in late June of 1937 and continued throughout the remainder of the season. Important information was obtained but it was realized that at least one full season must be covered in order to obtain a satisfactory picture of conditions. This was made possible in 1938 by the continued cooperation of Mrs. Webber and a group of Crystal Bay residents, and by the supplying of WPA workers for field and laboratory routine. William Chalgren, a medical student with entomological training was made assistant supervisor and much credit is due him for the extent and accuracy of the results obtained.

Five areas were selected for this second season's study. Two of these, Nokomis, and Glenwood parks, were within the city limits. Twin Lakes, Medicine Lake and a strip four miles long and two

miles wide on the north shore of Lake Minnetonka were to the west of Minneapolis.

Men were assigned to definite sections of these areas and made regular collections of larvae and, to a less extent, of adult mosquitoes. Chief reliance for the latter was placed on three electrically controlled mosquito traps.

In all 337,960 adult mosquitoes were taken in the traps and identified during the summer of 1938. In addition, there were 4,166 in the hand catch. In the trap catch there were 27 species represented. Of these 98.28 per cent were *Aedes vexans,* a marsh-breeding species which is able to migrate for fifteen miles, or more, from its birth place.

A surprising fact was that there was a total of only 82 specimens or one out of 4,127 of the supposedly common *Culex pipiens.* The significance of this is apparent when one considers that the control measures most commonly urged are those directed towards this species and the few others with similar breeding habits. It must not be assumed that these data would be valid for different climatic conditions or, necessarily, for different parts of the state.

It is not necessary to present further details of this survey in order to emphasize the point that surveys in different parts of the state would be not only of great biologic interest, but would be indispensable from the viewpoint of practical control.

Whenever control measures are undertaken, it should be with accurate knowledge of the nature of the problem and with due consideration of the other problems involved, such as those of conservation of wildlife and of maintenance of the water levels essential to agricultural as well as to aquacultural enterprises.

THE ROLE OF FOREST FIRES IN THE REPRODUCTION OF BLACK SPRUCE

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Black spruce[3] timber, with its dark foliage and slender irregular crowns, forms one of the most striking features of the northern Minnesota landscape. It is, by far, the most extensive of the remaining virgin forest types of this state, and were it not for the fact that much of it is held in public ownership, it would be depleted rapidly since spruce is the most valuable of any wood for the manufacture of paper.

[1] Acknowledgment is made of the helpful assistance of G. W. Kruse and W. R. Isaacson in the collection of data.

[2] Maintained in cooperation with University of Minnesota, University Farm, St. Paul, Minnesota.

[3] *Picea mariana* (Mill.) BSP.