

THE NEED FOR A MOSQUITO SURVEY IN SOUTH DAKOTA

H. C. Severin

South Dakota State College

Very little research work has been done in South Dakota with mosquitoes and it is, therefore, not surprising to learn that the scientific entomological literature of our state is practically destitute of any articles dealing with mosquitoes. From an economic aspect, broadly speaking, mosquitoes may be classified into two groups, the disease carriers and the pest mosquitoes which are not carriers or disseminators of disease. It should be emphasized, however, that the classification of certain species as pest mosquitoes may with the discovery of new facts change their status so that they become transferred to the group of disease carriers. It should also be remembered that certain species may be classed into both groups.

In 1900, L. O. Howard¹ recorded thirty species of mosquitoes from the United States. About this same time it was definitely proven that the "dappled-winged" mosquitoes (*Anopheles* sp.) were vectors of human malaria and that a certain species of mosquito (now *Aedes aegypti*) was the vector of yellow fever. Following these discoveries, an intense interest was developed in mosquitoes with the consequence that an immense amount of literature was published concerning mosquitoes in a comparatively short space of time. Some of this literature was good, but unfortunately much of it was bad or indifferent. In 1928 Dyar² listed 123 species of mosquitoes for the United States and Canada and 540 from both North and South America.

William B. Owen³ in writing of the mosquitoes of Minnesota listed 37 species as occurring in that state and these were distributed among seven genera.

¹Howard, L. O. Mosquitoes; How They Carry Disease; How they Are Classified, How They May be Destroyed. McClure Phillips and Co., New York, 1901.

²Dyar, Harrison G. The Mosquitoes of the Americas. Carnegie Institution of Washington, 1928.

³Owen, William B., The Mosquitoes of Minnesota, with Special Reference to their Biologies. Tech. Bul. 126. Minn. Exp. Sta. 1937.

In a preliminary survey of the mosquitoes of North Dakota, Munro and Saugstad⁴ record 11 species for that state, but they state that there are probably many additional species in the state as yet unrecorded. Later Munro informed the writer that two additional species of *Aedes* were recorded for North Dakota and one species of *Anopheles*, or a total of 14 species.

G. A. Mail⁵ in 1934 recorded 40 species of mosquitoes for Montana, distributed in six genera.

J. R. Rowe⁶ in a preliminary report on Iowa mosquitoes listed 35 species for that state distributed among seven genera. Since then an additional species was reported in Iowa.

In South Dakota, the writer in a preliminary survey has taken 22 species of mosquitoes but undoubtedly this represents only slightly more than one-half of the species that will ultimately be found within the borders of our state.

Four species of *Anopheles* were found to occur within South Dakota, namely, *A. maculipennis* Meigen⁷, *A. quadrimaculatus* Say, *A. walkeri* Theobald, and *A. punctipennis* (Say). Of these four species, *A. quadrimaculatus* and *A. maculipennis* are looked upon as important vectors of malaria in the United States.

It has been found experimentally that at least 11 species of mosquitoes, all of the genus *Aedes* can be infected experimentally with equine encephalomyelitis and that 10 of

⁴Munro, J. A. and Stanley Saugstad, A Preliminary Survey of Mosquitoes in North Dakota. Bimonthly Bul. Vol. 1 No. 5 May 1939, Page 7.

⁵Mail, G. Allen, The Mosquitoes of Montana. Bul. 288, Mont. Agr. Exp. Sta. 1934, pp. 1-72.

⁶Rowe, J. B., Preliminary Report of Iowa Mosquitoes. Iowa State College, Jour. of Sci. Vol. XVI, No. 2, Jan. 1942, pp. 211-225.

⁷A difference of opinion exists among students of mosquitoes regarding the status of *A. maculipennis* Meigen. Some students believe that *A. maculipennis* is a European species and is not found in North America, and that our northern species which we call by that name, should be called *A. occidentalis* Dyar and Knab. Others believe that our so-called *A. maculipennis* is a sub-species of the European *A. maculipennis* and should, therefore, be known as *A. maculipennis occidentalis* Dyar and Knab.

these species can transmit the virus to other animals⁸. The study of encephalomyelitis is complicated through the fact that at least three and possibly more types of the virus occur in the United States. Man is susceptible to not only epidemic encephalitis (St. Louis type) but also to the western and eastern types of equine encephalomyelitis. In 1941 over 2,000 cases of encephalomyelitis in man, mostly attributed to the western type of virus were reported from North Dakota, South Dakota, Minnesota, and Nebraska.

A disease due to equine encephalomyelitis virus has been found to occur naturally in ring-necked pheasants, prairie chickens and pigeons. Since this discovery was made, it is now known that many other species of birds and many mammals are susceptible to the virus of sleeping sickness when they are artificially injected with it. To complete the chain, the St. Louis and western types of the virus have been found occurring naturally in at least one species of mosquito, namely *Culex tarsalis* Coquillett, a species ranking third in abundance in South Dakota. *Aedes vexans* (Meigen) and *Aedes dorsalis* (Meigen) together constitute the greater share of the mosquito populations of South Dakota, and both of these species have been infected with the virus through laboratory feedings.

Other diseases now well established in the United States are known to be transmitted through mosquitoes, but time does not permit a discussion of these. Further, our returning men from foreign fields and our war prisoners will, without a doubt bring into the United States mosquito-borne diseases that are not well established here and also diseases that are now foreign to the United States. Further, the importation of Mexican labor has associated with it potential dangers of which our public health service should be cognizant.

From the pest angle, and this does not include the role that mosquitoes may play in the dissemination of disease,

⁸Giltner, L. T. and M. S. Shannon, Equine Encephalomyelitis. Keeping Livestock Healthy. Yearbook of Agr. U. S., Dept. of Agr., 1942, pp. 375-391.

mosquitoes must be regarded as one of the most important, if not the important group of insects harmful or annoying to the body of man and his domestic animals. Man certainly is pestered by mosquitoes, sometimes unbearably so, in his farming and gardening operations. This is true in all sections of the state of South Dakota. Areas of the state where irrigation is practiced often breed untold quantities of mosquitoes and during the time the adults are about in quantity, they usually make life miserable for those engaged in agricultural pursuits. Horses may, because of the bites of mosquitoes, become unmanageable. The milk yield from dairy cows may be reduced a third or more and cattle may not put on the expected gains. Egg production may be reduced and chickens have been known to be killed through attacks from mosquitoes. Picnics may turn out to be disappointments because of mosquito attacks and fishing, collecting, field and hiking trips may be remembered as nightmares instead of joyous or pleasant occasions. And finally real estate values are, and have been affected by pest mosquitoes.

Each species of mosquito has a range peculiar to itself and within its range it may occur abundantly in some areas, very commonly or commonly in others, and fairly rarely or rarely or not at all in still others. Of course there are definite ecological reasons for these facts. First of all it should be understood that female mosquitoes, in general, prefer to suck blood as food from a host, although there are some species that do not take blood. The males are unable to penetrate the skin with their mouth parts and, therefore, they feed on liquids that are exposed such as nectar and other plant juices and other fluids. Many species of female mosquitoes have definite species of hosts upon which they prefer to feed but under compulsion they will attack others in order to obtain food. Some species of female mosquitoes prefer cold blooded hosts from which to obtain their food, such as frogs, others prefer warm blooded hosts; some prefer horses, mules and cows to man, etc. Some prefer to feed on their hosts out-of-doors, while others prefer to invade buildings and feed on their hosts there.

The eggs of mosquitoes are laid singly or in rafts depending on the species. The eggs may be laid on the surface of water in barrels, or other receptacles that will hold water, in holes in trees, in crayfish holes, in or on water in sagging gutters, catch basins, cisterns, pools, ponds, lakes, marshes, roadside ditches, in or on slowly moving or stationary water in streams or even on wet or dry soil.

The larvae or wrigglers that hatch from the eggs must have water in which to survive. They also must have organic matter on which to feed. Usually the food of the so-called non-insectivorous species of wrigglers consists of protozoa, bacteria, diatoms, algae, etc. The food of the insectivorous larvae consists usually of the aquatic dipterous larvae including those of mosquitoes. The food of the non-insectivorous species of wrigglers may be obtained in a variety of different ways. Some species, like the **Anopheles** wrigglers, are surface feeders, others feed on materials floating in the water beneath the surface, many root in the mud and debris at the bottom or nibble on submerged objects etc. The wrigglers are heavier than an equal volume of water and consequently they must make an effort to reach the surface of the water. The upward movement through the water is accomplished by lashing or suddenly bending the body from side to side. While most of the species of mosquito larvae are compelled to come to the surface of the water to breathe, others can obtain their oxygen from submerged plants. It is true, however, that even with those species of larvae that are surface breathers, the young larvae are able to obtain their supply of oxygen very often from the water itself. This is not true of the older larvae and these are compelled to reach the surface of the water periodically, break the surface film and thus obtain access to the air.

Each species of mosquito larva prefers a definite aquatic habitat which possesses the optimum conditions for that species. Should the major optimum conditions prevail, then the species needing such conditions becomes abundant. On the other hand, if the favorable conditions are lacking then

the species become rare or absent. In some cases fresh water with an abundance of oxygen is essential, in other cases it may be the reverse. In some cases it may be brackish water that is desired, in some cases it is water with an acid reaction, in others the water must have an alkaline reaction. Sometimes cold water is preferred, then other species prefer just the opposite. With some species it is still water, in others it is moving, in some cases it is water in tree holes, in others it is water in receptacles, ponds, marshes, bogs, etc. Some species prefer water with considerable plant floatage, others do not; some species breed abundantly in bodies of intermittent water, others in permanent; some enjoy a body of water with aquatic marginal vegetation, others are not so particular; some like water in wooded areas, others do not. The vital requirements for all larvae is water and all other factors mentioned above are more or less subsidiary in importance. The degree or intensity of these factors determines largely the presence or absence of certain species of mosquito larvae in that water and their relative abundance. It can be readily understood too why a body of water may contain an association of mosquito larvae of different species, and why certain species are dominant in one region and others in another. It is also understandable that control of any mosquito problem involves a knowledge of the identification of the adult mosquitoes and the location and identification of the larvae and their breeding areas.

Most of our species of mosquitoes hibernate either in the egg stage or as fertile female mosquitoes. It is interesting to note that the species of **Aedes** hibernate in the egg stage, while the species of **Anopheles** and **Culex** hibernate as adults. Only an occasional species of mosquito in the north hibernates in a larval stage and none hibernate as pupae. The number of generations that are produced per year by different species of mosquitoes in the northern states is characteristic of the species. While the majority of our South Dakota species produce one generation a year, a few produce several.

A worthwhile mosquito survey is not an easy job to carry on and complete. First of all it is necessary that the individual having the survey in charge be able to identify the adult and larval mosquitoes in the area to be surveyed. This in itself requires considerable training. The adult mosquitoes must be captured or reared usually from larval stages and such adults should be in a condition so that identification is possible. The individual must be familiar with the many different methods that are used in capturing adult mosquitoes and, of course, should keep accurate records regarding each species. Such records should include information concerning the geographic distribution of the adults, seasonal occurrence, abundance, whether or not attracted to light traps, environments in which host is attacked, flight capabilities, etc. Data concerning larvae are very important, especially from the control angle. The larval habitat preferred should be emphasized, but the recording of other data should not be neglected, such as dates of occurrence, broods, generation per year, associated larvae, etc. Ordinarily larvae can be identified by a capable individual, but if this cannot be done, then the worker will be compelled to rear mosquitoes from the larvae.

It should be emphasized that a person who is making a mosquito survey should have certain primary objectives in mind. These may be, or ordinarily should be, largely economic control of the mosquitoes. But there is much to be learned concerning our mosquitoes and anyone interested can contribute extremely valuable information on this subject by a judicious study of one or more species from almost any angle.