WESTERN EQUINE ENCEPHALITIS SURVEILLANCE IN UTAH

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ABSTRACT. The history of WEE surveillance in Utah is reviewed, beginning with the 1933 outbreak involving 3,958 horses. The step by step formation of the Utah Mosquito Abatement Associations surveillance program from 1957 to the present is discussed. Results of an enlarged sentinel chicken flock surveillance program in Utah during 1983 (3 sero-conversions in September), 1984 and 1985 (no sero-conversion) show the lack of WEE activity in the surveillance area.

INTRODUCTION

The first recorded outbreak of Western equine encephalitis (WEE) in Utah occurred in 1933 and involved 3,958 horses. The outbreak was centered along the Wasatch Front in Utah extending north into Franklin County, Idaho. Horse cases of WEE have fluctuated greatly but continue to decline, which is accredited to the increased vaccination of horses and improvements and expansion of mosquito control in the state. In 1978, an outbreak occurred in horses in the Uintah Basin in eastern Utah. Since the 1958 outbreak, there have been only two human cases of WEE reported, one in 1963 and one in 1966.

Interest in surveillance for WEE did not begin in Utah until the 1950s. Grundmann (1954) reported that antibodies for WEE were widespread in Utah in both humans and horses. He further stated that if mosquitoes were controlled, transmission to man and epidemic conditions probably would be prevented. Prior to 1957, WEE cases were not separated from other types of encephalitis so data are not available. However, in 1957 two cases of WEE in humans were reported to the Utah State Department of Health (USDH). The following year Utah experienced an outbreak of WEE involving both humans (48 cases with one fatality) and horses (224) (Jenkins and Donath 1959, Thomas and Smith 1959, Rees et al. 1959). For the most part the disease occurred along the Washatch Front, as in 1933, where the population was highest and where the oldest and best developed mosquito abatement programs were found. Publicity concerning the outbreak was widespread and mosquito abatement programs were subjected to increased pressures and sometimes severe criticism.

In 1957 the South Salt Lake County and Salt Lake City Mosquito Abatement Districts (MADs) assumed the responsibility of developing and maintaining a coordinated surveillance program since other agencies were unwilling or unable to do so. Although the importance of viral surveillance was recognized, budget limitations restricted surveillance to larval and adult populations of *Culex tarsalis* Coquillett (Graham and Collett 1964, 1969). As a result of these baseline surveys, some of the *Cx. tarsalis* population trends and climatic factors that may have contributed to the 1958 outbreak were identified (Graham and Anderson 1958,[4] Rees and Collett 1959, Rees et al. 1959, Graham et al. 1960).

During the 1958 outbreak, the Centers for Disease Control (CDC) of Fort Collins, CO tested 34 pools of *Cx. tarsalis* females of which six were positive for WEE virus. The CDC maintained a sentinel chicken flock in the Salt Lake City Mosquito Abatement District between 1963 and 1974. Chickens were bled once each fall and the sera were tested for WEE virus antibodies. There were no seroconversions found during the 12 years of the surveillance.

Through the U.S. Army Proving Ground at Dugway, Utah, extensive arboviral surveys for WEE were made in western Utah from 1965 through 1976 (Smart et al. 1972, Crane et al. 1983). These surveys were made in limited areas distant from populated areas and thus were of limited value to the mosquito abatement districts of the state.

During 1969 the South Salt Lake County and Salt Lake City MADs began testing pools of mosquitoes from light trap collections for WEE virus. This program was extended to the member districts of the Utah Mosquito Abatement Association (UMAA) in 1974 and continued through 1982 (Marrott 1974, 1975, 1977, 1978). The program was funded by UMAA member districts, the Utah State Department of Agriculture and the Department of Virology at the University of Utah. We hoped that the study would provide information that could predict a possible outbreak of WEE so control

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[4] Graham, J. E. and R. D. Anderson. 1958. A seasonal history of mosquito larval populations in Salt Lake County, Utah. Unpublished paper, 6th. Annu. Meeting Entomol. Soc. Am.

measures could be applied to populations of *Cx. tarsalis*. Processing of specimens was slow and it was determined that an insufficient number of pools were collected each year so the mosquito pool surveillance was terminated in 1982.

In the fall of 1982, Dr. Bruce Francy of CDC, Fort Collins, advised the UMAA to place sentinel chicken flocks throughout the state instead of mosquito light traps as a method of WEE surveillance for the following reasons: (1) results could be obtained 4–5 days after the blood was collected from the chickens, (2) early conversion of antibodies in the chickens would suggest a potential outbreak giving MADs time to adjust control procedures, and (3) cost of the program would be in line with available funds.

This paper reports on the establishment of sentinel chicken flocks for WEE surveillance and results of that surveillance from 1983 through 1985.

METHODS AND MATERIALS

Initial bleedings of chicken flocks before placement throughout the state were made during the third week of May each year. Field bleedings were made biweekly between the third week of June and the first week of September. The chicken flocks were cared for and bled by the individual MADs or local health departments.

In 1983, there were 11 sentinel chicken flocks each having 25 white leghorn pullets. Surveillance was expanded to 20–21 chicken flocks, each consisting of 20 pullets in 1984 and 1985, respectively. During 1984 and 1985 the flocks were placed in 14 of the 29 counties in Utah.

Blood samples were processed in the Department of Microbiology of Brigham Young University in 1983, and by the Utah State Health Laboratory in 1984 and 1985. Sera were examined for WEE and SLE virus antibodies by the CDC Arbovirus Reference Branch "Hemagglutination and Hemagglutination—Inhibition Test Applied to Arboviruses" using three dilutions (1:20–80) of each specimen tested. Results of the tests were available 4–5 days after each bleeding.

RESULTS

A total of 1,372 sera was tested for WEE and SLE virus antibodies in 1983. Three sera were positive for WEE from bloods collected on September 6. Two of these were from a flock in a rural area of Utah County and the other from a flock in South Salt Lake County. For the 1984 and 1985 seasons, 3,037 and 3,399 sera, respectively, were examined. All were negative for both WEE and SLE antibodies.

DISCUSSION

A heavy snowpack and several late spring snowstorms caused flooding over much of Utah during the spring and early summer of 1983. Mosquito districts, the USDH, and CDC, Fort Collins, CO, were concerned about the possibility of an outbreak of WEE because conditions appeared favorable for an explosive population of *Cx. tarsalis*. According to Graham et al. (1960), increases in the *Cx. tarsalis* population and in WEE in horses in Utah were associated with above normal precipitation in May or June and an unusually dry July and August. A meeting was held in June and plans were outlined to address the problem. The USDH established an emergency surveillance program in areas of the state outside of existing MADs (Arnell and Jackson 1983). This program was financed in part by the Federal Emergency Management Act (FEMA) from which the UMAA received $3,200 for surveillance.

The expected increase in populations of *Cx. tarsalis* never materialized mainly due to continued flooding which destroyed much of the larval habitat and below normal summer temperatures. Although three chicken sera were positive for WEE in 1983, it was late in the season and no additional control measures were taken.

The 1984 mosquito season was similar to the previous year with near record amounts of precipitation. Mosquito populations remained low as water continued to rise in permanent water areas that had been vast breeding places for *Cx. tarsalis* larvae. This high water situation was believed to be a major factor in the lack of WEE activity in 1984.

Near normal precipitation returned to Utah in 1985. Because of cool summer temperatures, water levels remained high but steady. By the end of the mosquito season, the edges of many permanent water areas had reestablished vegetation and were returning to possible *Culex* larval habitats. The 1985 season was the third successive year that *Cx. tarsalis* populations remained at a very low level and the second with no seroconversions taking place. This was also reflected by the absence of any human or equine cases of WEE reported from the state.

The encephalitis surveillance program in Utah has been a success because of the cooperative effort of the UMAA, the USDH, the Utah State Department of Agriculture and CDC. None of these agencies was willing or able to finance the surveillance by themselves. Cost of the program was about $12,000 for each year. This included the costs of the chickens, feed, material for collecting blood and the serological work. Maintenance of the flocks and

collection of the blood samples was financed by each agency sponsoring a flock.

The UMAA encephalitis surveillance program will continue in 1986, expanding to other areas of the state as funds become available. With the restabilization of many permanent water larval habitats, this surveillance program has become a necessity to the MADs in their control efforts. Mosquito pools will be tested only if viral antibodies are found in the chickens.

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