

# MOSQUITO SURVEILLANCE EMPLOYING NEW JERSEY LIGHT TRAPS ON INDIAN RESERVATIONS IN IOWA, NEBRASKA AND SOUTH DAKOTA IN 1984 AND 1985<sup>1</sup>

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**ABSTRACT.** A mosquito surveillance program was established in 1983 on Indian reservations in Iowa, Nebraska and South Dakota. Standard New Jersey light traps were operated on 12 reservations throughout the summer seasons in 1984 and 1985. Rainfall levels in general were higher than normal at all sites in 1984 but were lower than normal at most sites in 1985. *Aedes vexans* was the most abundant species collected on all reservations and *Culex tarsalis* second in abundance. Man-biting collections of mosquitoes near Brookings in 1984 reached 35 mosquitoes/5 minutes in early July and were largely composed of *Ae. vexans*, *Ae. dorsalis* and *Ae. nigromaculis* while numbers of *Cx. tarsalis* and *An. quadrimaculatus* were minor. During the same period in 1985, man biting collections averaged less than 5/5 minutes.

## INTRODUCTION

Mosquito surveillance activities that are routine health activities in many northcentral states, namely Minnesota (Sjogren et al. 1977) Nebraska and North Dakota (Weekly mosquito surveillance summary, ND Dept. Health), were not made prior to 1983 in South Dakota. The potential for mosquito-borne disease nevertheless always existed in this state. Mosquito populations resurged in 1982 and 1983 when above average rainfall supplied necessary conditions to increase mosquito population densities both in South Dakota and in westcentral Minnesota (Washburn 1985). An outbreak resulting in 18 human cases of Western Equine encephalitis (WEE) and 11 cases of Saint Louis encephalitis (SLE) in South Dakota in 1975 was believed to have resulted from similar environmental circumstances. Extensive summer precipitation inundated waterways and low lying areas in several states and a widespread epidemic or pandemic in equines (Potter et al. 1977) and man resulted. The mosquito surveillance program was therefore organized in 1983 to monitor populations of disease-carrying mosquitoes and thereby protect human residents on reservations under the jurisdiction of the Aberdeen Area Indian Health Service in Iowa, Nebraska and South Dakota. This program was designed to complement activities already underway by the Health Department in North Dakota (Ken Tardiff, personal communication) that were protecting residents, including those on reservations in that state.

Relative methods of population measurement are often used for evaluating mosquito densities in a particular area due to the unavailability of

practical, absolute methods. Light traps used by Indian Health Service personnel on reservations in the Dakotas, Iowa and Nebraska, provide sanitarians some measure of the mosquito populations in their area over time (Easton et al. 1986). Numbers of mosquitoes sampled with these traps are difficult to compare directly as large differences may exist between placement sites which renders comparisons more difficult to interpret (Sjogren et al. 1977). Although light traps are unable to reflect the exact relative abundance of different species, they are often used for general or long-term studies on the diversity of fauna of a particular group (Southwood 1984). Results of mosquito densities during 1984 and 1985 using light traps on 12 reservations are presented in this study.

## MATERIALS AND METHODS

Adult mosquitoes were sampled weekly from May 30 to the end of August in 1984 and from May 30 to September 2 in 1985, using standard New Jersey light traps (Hausherr's Machine Works, Toms River, NJ) which utilize 25 watt inside frosted bulbs as the attractant. Light traps were set in locations where attractant lights would not compete with street arc lamps or other bright lights and were placed at least 15.2 m from the sides of buildings in areas protected by trees or shrubbery. The location of the light traps on each reservation has been given earlier (Easton et al. 1986).

Collecting containers consisted of 1.13 liter mason jars containing several 2.5 cm pieces of no-pest-strip<sup>®</sup> (containing dichlorvos insecticide) imbedded in plaster-of-Paris. Jars freshly prepared the end of May were replaced with a newly charged container around July 22. Electric timers on each trap were set to start at 2100 hr each evening and to shut the light off at 0800 hr each morning throughout the period of collection. Sanitarians on each reservation removed the trap contents on Monday of each

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week and sent the contents to SDSU in mailing tubes. The identification of female mosquitoes was determined using dichotomous keys provided in Darsie and Ward (1981), Gerhardt (1966) or Siverly (1972). Collections of biting mosquitoes were also made with a mechanical aspirator (Hausherr's Machine Works, Toms River, NJ) from a bare-legged human subject positioned near a farm shed occupied only by domestic pigeons outside of the reservation at Brookings, SD. Mosquitoes were collected that landed on the volunteer over a period of 5 minutes at 2100 hr each evening from June 29 through September 22, 1984.

**RESULTS AND DISCUSSION**

*Aedes vexans* (Meigen) was the most abundant species (total of 2,735) (Table 1) collected in this

study in 1985 on all reservations except for the Santee in northeastern Nebraska, where *Anopheles walkeri* Theobald was the most abundant.

*Culex tarsalis* (Coquillett) was the second most abundant species collected on all reservations. Numbers however, in 1985, were considerably lower (468) than total collections from the same sites in 1984 (7,887 females, Table 2). The highest numbers of *Cx. tarsalis* in 1984 occurred in July, whereas low levels persisted throughout the 1985 summer (June through August).

*Coquillettidia perturbans* (Walker) breeding is confined to vegetated areas (particularly cattails) that are associated with shallow marshes and the perimeters of lakes. According to Barr (1958), *Cq. perturbans* overwinters in Minnesota as a larva attached to the roots of aquatic plants and the mosquito has one adult emergence/year

Table 1. Female mosquitoes collected on Indian reservations (Iowa, Nebraska, South Dakota) using the New Jersey light trap from May 30 to September 2, 1985.

Reservation	Mosquito Species									
	<i>Ae. vexans</i>	<i>Ae. dorsalis</i>	<i>Ae. nigromaculis</i>	<i>Cs. inornata</i>	<i>Cq. perturbans</i>	<i>Cx. salinarius</i>	<i>Cx. tarsalis</i>	<i>An. quadrimaculatus</i>	<i>An. punctipennis</i>	<i>An. walkeri</i>
Crow Creek	179	1	5		1		23			1
Dupree <sup>1</sup>	162	23	8	6	2		27			
Flandreau	106	5	2		2	1	17			1
Lower Brule	468	34	11	5		2	53			
Martin	5	5	1	1	1		7			
Omaha	7				2		2			
Rosebud	58	1	2	1	12	6	37		1	
Sac & Fox	54	1	1				1			
Santee	335	4	1		3	20	40			3,492
Sisseton	519	6	4	1	65		80	2		
Timber Lake <sup>1</sup>	168	1	3	11			114			
Winnebago	7					3	16		1	
Yankton	667	8	3			7	51			
Totals	2,735	89	41	25	88	39	468	2	2	3,494

<sup>1</sup> Both sites on Cheyenne River Indian Reservation in Ziebach and Dewey counties of northcentral South Dakota.

Table 2. *Culex tarsalis* females sampled with New Jersey light traps fitted with electric timers on 12 reservations comprising the Aberdeen Area Indian Health Service, 1984 and 1985.

Reservation	June				July				August			
	1984		1985		1984		1985		1984		1985	
	# <i>Cx. tarsalis</i>	% total	# <i>Cx. tarsalis</i>	% total	# <i>Cx. tarsalis</i>	% total	# <i>Cx. tarsalis</i>	% total	# <i>Cx. tarsalis</i>	% total	# <i>Cx. tarsalis</i>	% total
Crow Creek	6	15.8	16	18.4	405	72.4	7	7.6	72	12.8	0	0
Dupree <sup>1</sup>	640	14.5	4	5.1	628	8.5	15	14.1	84	7.7	8	27.5
Flandreau	66	6.8	6	10.1	294	13.5	6	15.0	50	39.3	5	13.1
Lower Brule	—	—	30	8.7	—	—	18	9.4	350	29.0	5	11.3
Martin	8	44.4	0	0	152	27.7	0	0	—	—	6	30.0
Omaha	10	6.7	0	0	45	36.0	1	25.0	—	—	1	14.3
Rosebud	10	100.0	9	56.2	278	22.4	18	48.6	35	33.0	10	15.6
Sac & Fox	—	—	0	0	—	—	0	1.8	—	—	0	0
Santee	—	—	17	14.0	684	25.3	13	4.1	124	8.8	10	0.2
Sisseton	18	0.8	37	33.9	3,240	53.0	39	20.1	144	24.8	4	7.3
Timber Lake <sup>1</sup>	350	13.8	34	20.2	295	13.2	19	45.2	254	13.8	72	78.2
Winnebago	4	9.5	6	66.6	9	21.4	8	61.5	—	—	2	40.0
Yankton	—	—	15	2.19	—	—	27	67.5	176	28.9	9	60.0
Totals	1,112		174		5,486		172		1,289		132	

<sup>1</sup> Both sites on Cheyenne River Reservation in northcentral South Dakota.

which occurs in mid-summer. In our study, *Cq. perturbans* first appeared on July 8 at Fort Thompson, Flandreau, Lower Brule and Sisseton reservations and later (July 22) at Omaha, Nebraska. No mosquitoes of this species were collected during August, however, at these sites. The Sisseton Reservation had the largest number of *Cq. perturbans* in 1985 (Table 1) and this species was collected on the Santee Reservation only in June and on the Rosebud Reservation only in June and July.

Single collections of *Anopheles quadrimaculatus* Say using the NJLT (1 female on July 15 and July 29, respectively) from the Sisseton community, Roberts County of northeastern South Dakota, constitute a new county record. *Anopheles quadrimaculatus* was also collected biting man near an abandoned farm shed near Brookings on September 3 (1 female) and September 2, respectively. Otherwise in South Dakota, Olson and Keegan (1944a) reported *An. quadrimaculatus* originally from Watertown in Codington County, and since that time Gerhardt (1966) recorded it from Beadle, Bon Homme, Brule, Charles Mix, Meade and Yankton counties.

*Anopheles walkeri* was the predominant species collected on the Santee Reservation in Nebraska. A total of 3,320 females were collected during the week ending August 5 while 3,492 were collected at this site over the summer season. *Anopheles walkeri* is believed to be readily attracted to light traps as Carpenter and LaCasse (1955) and Bang et al. (1943) reported that mosquito specimens could be caught in traps located 2.4 to 3.2 km from the nearest aquatic habitat that could support immatures. Numbers of this species collected in this study were thought unusually high even though attempts were not made to situate light traps near swampy or aquatic areas where large numbers of mosquitoes would bias samples.

Outside of the reservation near Brookings, 30.4 km north and 14.4 km west of Flandreau, the number of mosquitoes collected each day biting man exceeded 35/5 minutes in collection periods made in late June and early July. Rainfall in the amounts of 21.5 and 5.5 cm/month in June and July in 1984 were higher in total than the average rainfall amounts of 10.3 and 6.5 cm/month respectively (Climatological Summary No. 3, Brookings) at this site. The biting rate fell however, to 3/5 minutes by July 16 before rising again to 28/5 minutes on July 24 and then numbers declined to 5/5 minutes by August 1. This drop in biting rate during the middle of July appeared to coincide with the cutting of a wheat field near a shed where the counts were made. Mosquitoes were believed to have been previously blown by the wind into the wheatfield

where they rested during the daytime. The closest known breeding sites were at least 1.61–3.22 km distant and the regular application of diesel fuel to standing water normally does not permit mosquito breeding within 1.61 km of Brookings. The resting habitat of the mosquitoes at this site was probably destroyed with the cutting of the wheat, and contributed to the mosquito population decline by August. Mosquito species that were attracted to man during this late June through September period included *Aedes vexans* (506), *Aedes dorsalis* (Meigen) (204), *Ae. nigromaculus* (Ludlow) (52), *Ae. sollicitans* (Walker) (13) and *Ae. trivittatus* (Coq.) (2). Smaller numbers of other species were also collected. *Culex tarsalis* were collected on July 4 (1), 24 (4), 28 (1), August 16 (2) and 27 (1 female) respectively, *Cq. perturbans* on the 22nd (1) and 24th (3) of July, respectively, and *An. quadrimaculatus* on August 27 (1), September 3 (1) and September 9 (2), respectively. An Encephalitis Virus Surveillance trap baited with dry ice operated on July 4 at the Brookings site and inside a farm building where pigeons were resting, produced 215 *Cx. tarsalis*, 19 *Ae. vexans* and 2 *Ae. trivittatus*; indicating that *Cx. tarsalis* was present in the area in moderate numbers but preferred avian hosts over man.

During years of normal to subnormal rainfall in the neighboring state of Minnesota, *Cx. tarsalis* mosquitoes represent less than 1% of the total mosquito fauna (Sjogren and Washburn 1979) but during years of heavy or above average rainfall ground depressions became inundated and *Cx. tarsalis* populations can represent up to 10% of the total fauna. During 1983 and 1984 when rainfall amounts in Minnesota and South Dakota were above normal 1,536 and 7,887 *Cx. tarsalis* respectively, were caught in the New Jersey light trap. In 1985 however, the summer season was drier and only 478 *Cx. tarsalis* were collected. *Aedes vexans* is considered to be our most common species (Gerhardt 1966) and one that inhabits ground depressions. In 1983, a total of 10,256 mosquitoes were collected using New Jersey light traps on the reservations but the populations of *Ae. vexans* also declined to 735 in 1985.

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