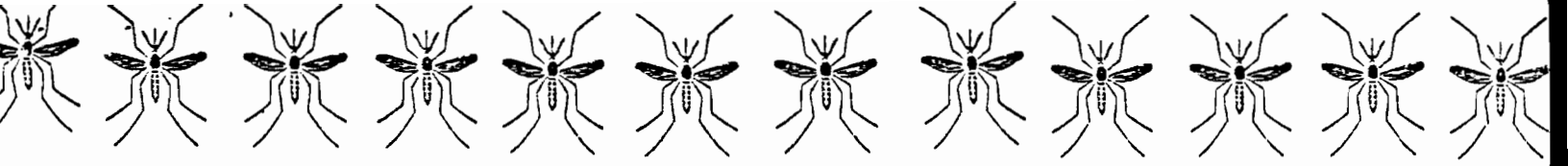

New Jersey Vector Surveillance

NEW JERSEY AGRICULTURAL EXPERIMENT STATION

MOSQUITO RESEARCH AND CONTROL

Vol. 8 No. 5 Period: 1983 Season Summation

Introduction

For the second consecutive year, eastern equine encephalitis virus (EEE) was widespread along the eastern coast of the United States. The Center for Disease Control reported 85 equine cases from 8 eastern states in 1983 and an additional 15 equine cases from southeastern Michigan and adjoining Illinois. Thirteen human cases were reported along the eastern seaboard from Florida to Massachusetts. During the 1983 season, New Jersey confirmed 5 equine fatalities due to EEE virus. The New Jersey Vector Surveillance Program monitored many aspects of the disease cycle during the epizootic period and obtained considerable epidemiological information on the sequence of events that accompanied equine deaths. The results suggested that EEE was an inland phenomenon in New Jersey during 1983 with only limited indication of the virus at coastal locations where EEE activity is normally most intense. Survey results also incriminated Coquillettidia perturbans as an inland vector of EEE virus in New Jersey and suggested that coastal and inland transmission patterns are the result of very different epidemiological situations.

EQUINE FATALITIES DUE TO EEE VIRUS IN NEW JERSEY

Table 1 summarizes information on the equine deaths that were confirmed to EEE in New Jersey. All of the cases were decidedly inland, precluding salt marsh mosquito involvement. Four of the cases occurred at a distinct focus within Jackson Township, Ocean County. The remaining case was reported from Sussex County, in the extreme northwestern portion of New Jersey close to the New York State line. None of the horses had a prior vaccination history but 2 of the animals received inactivated vaccine shortly before the symptoms became apparent. There is no evidence to suggest that the vaccine contributed to the deaths. The vaccinations were administered as a result of EEE activity in the area and were apparently given too late to afford adequate protection.

Table 1. Equine Cases of EEE in New Jersey During 1983.

Date of Onset	Age and Breed	Location of Farm	Vaccination History
July 8	14 mo Arabian	Holmansville Ocean County	Unvaccinated
July 23	3 mo Grade Colt	Holmansville Ocean County	Vaccinated previous week
July 26	Aged Grade Gelding	Vernon Township Sussex County	Unvaccinated
August 12	Aged Pony	Van Hiseville Ocean County	Unvaccinated
August 26	16 mo Standardbred	Jackson's Mills Ocean County	Vaccinated previous week

The first 2 cases occurred on one small farm near Holmansville, Jackson Township, Ocean County. The initial death apparently stimulated vaccination of the second horse that died on that farm 2 weeks later. With the exception of the grade gelding from Sussex County, the remaining cases (Van Hiseville and Jackson's Mills) occurred on farms less than 6 mi from the initial focus. The first case was confirmed by a 64-fold increase in titer to EEE virus from blood samples extracted on consecutive dates. All remaining cases were confirmed by EEE virus isolations from brain tissue.

SURVEILLANCE RESULTS FROM COASTAL SITES IN NEW JERSEY

Culiseta melanura were monitored for EEE virus throughout the season at the 2 coastal sites used as a standard for measuring virus activity in New Jersey since 1976. The results showed that EEE virus was relatively inactive along the coast and did not reflect the cycle that resulted in equine deaths further inland. Table 2 lists the isolations obtained from Cs. melanura at coastal sites by month for the entire season. The results show that EEE virus appeared very late and did not reach epizootic levels at the coastal sites that were being monitored. During the previous year (1982) 75 EEE isolations were obtained from Cs. melanura at these sites.

Table 2. Virus Isolations from Culiseta melanura at Coastal Study Sites in New Jersey During 1983.

Month	East Coast		West Coast	
	No. Tested	EEE Isolations	No. Tested	Isolations
May	0	-	152	-
June	243	-	1302	-
July	136	-	1256	-
August	428	1	4805	1
September	77	-	870	-
October	0	-	166	-
Total	884	1	8551	1

The lack of virus activity in Cs. melanura on the coast was confirmed by negative results in other mosquito species involved in the cycle. When virus was confirmed in equines, a concerted effort was made to collect and test Aedes sollicitans (3 isolations in 1982) and Coquillettidia perturbans (suspect vector) from coastal sites where EEE has regularly appeared in the past. The areas of West Creek in Ocean County and Dennisville, Fishing Creek and Pond Creek in Cape May County were sampled on a regular basis from late July through October. The Cape May County Mosquito Commission coordinated the majority of these activities, including the pooling of specimens for virus testing. Table 3 lists the results of the virus isolation attempts over the entire period and shows that no virus was isolated from the sizeable sample that was tested. Even though equine deaths occurred further inland, EEE virus was virtually undetectable along the coast in 1983.

Table 3. Virus Isolation Attempts from Aedes sollicitans and Coquillettidia perturbans Collected at Coastal Sites in New Jersey During 1983.

Month	Ae. sollicitans		Cq. perturbans	
	No. Tested	EEE Positive	No. Tested	EEE Positive
July	27	-	4,024	-
August	11,968	-	4,886	-
September	5,648	-	545	-
October	1,186	-	-	-
Total	18,829	0	9,455	0

SURVEILLANCE RESULTS FROM INLAND HORSE FARMS

Mosquito surveillance was initiated as soon as possible at each of the inland farms where equine deaths were reported. Portable CDC traps baited with dry ice were used to make immediate collections. Later in the season, resting boxes were employed specifically to collect Cs.

melanura for virus isolation attempts. Surveillance efforts were concentrated in the area of Jackson Township where the 4 horses died on 3 farms within a 3 mi radius. The survey in Jackson Township included the entire area and was continued into the winter months to detect breeding habitat for those vectors that overwintered in the larval stage. Light trap collections at individual farms, however, were only pursued 1-2 weeks beyond the reported date of onset.

Coquillettidia perturbans was the dominant species collected at each of the farms immediately following the death of an equine. Culiseta melanura was a minor species in the light trap collections but was present at all of the locations. Cq. perturbans ranged from 77% of the total collection at the initial farm where 2 horses died in July to 44% at the final farm where sampling was conducted in September. Cs. melanura represented only 1-8% of the light trap collections at the farms that were sampled. Culex salinarius was the only other mosquito species that was common to all of the farms and represented less than 20% of the collection in every case.

All mosquitoes collected by CDC light traps were submitted to the New Jersey State Department of Health for virus isolation attempts. Two of the 67 pools that were submitted yielded EEE virus. Both of the isolations were obtained from Cq. perturbans, the dominant mosquito at each of the farms where horse deaths were reported. Table 4 lists the numbers and species tested by farm for the Jackson Township focus and shows that EEE virus was isolated from Cq. perturbans at 2 of the 3 farms immediately following the report of an equine death.

Table 4. Mosquitoes Tested for EEE Virus at Jackson Township Farms Where Equine Deaths Were Confirmed to EEE in 1983.

Mosquito Species	Holmansville No. Tested	Holmansville EEE Positive	Van Hiseville No. Tested	Van Hiseville EEE Positive	Jackson's Mills No. Tested	Jackson's Mills EEE Positive
Cq. perturbans	613	1	147	0	22	1
Cx. salinarius	107	0	45	0	4	0
Cx. restuans	18	0	12	0	0	-
Ae. canadensis	27	0	0	-	0	-
Ae. vexans	18	0	0	-	-	-
Cs. melanura	4	0	13	0	4	0
Ae. triseriatus	4	0	2	0	1	0
An. bradleyi	3	0	0	-	17	0
Other*	1	0	4	0	2	0
Total	795	1	223	0	50	1

*An. punctipennis, Ae. trivittatus, Cx. pipiens

In September, resting boxes were introduced to the Jackson Township area to locate Cs. melanura breeding foci and collect sufficient numbers for virus isolation attempts. The results of the resting box study revealed that Cs. melanura was present in greater numbers than

light trap collections had indicated, but that the species was localized in numerous, isolated pockets throughout the area where horses had contracted EEE. Larval surveys revealed that Cs. melanura breeding habitat was restricted to narrow bands of Atlantic white cedar that were growing along the margins of shallow man-made lakes. While not extensive in any one area, the numerous foci that were detected provided localized breeding habitat for Cs. melanura throughout most of Jackson Township.

During this aspect of the survey, 232 Cs. melanura were submitted for virus isolation attempts. The results showed that EEE virus was present in this species, at least toward the latter part of the season when the collections were made. Table 5 lists the collections by sampling period and shows that virus was isolated from 3 pools during the 2nd and 3rd week of September. None of the habitats sampled in September had been trapped earlier in the study and the collection sites represent the surrounding area rather than any specific farm. The results, however, suggest that EEE virus was probably present in Cs. melanura throughout the epizootic and might have been isolated with greater frequency had the species been sampled in adequate numbers during the summer season. The results also showed that EEE virus was being amplified at this one inland focus in direct contrast to the results from the more intense study conducted at the coastal sites.

Table 5. Virus Isolations from Cs. melanura Collected in Resting Boxes in Jackson Township During the Fall of 1983.

Collection Period	No. Tested	EEE Positive
Sept. 08-09	18	0
Sept. 12-15	67	1
Sept. 19-20	81	2
Sept. 28-29	47	0
Oct. 10-12	19	0
Total	232	3

Continued surveillance into the winter period showed that Cq. perturbans were also localized within the Jackson Township study area. Light trap collections had indicated major biting populations at each of the farms, but larval survey revealed that the same man-made lakes that were producing Cs. melanura sustained sizeable Cq. perturbans larval populations. Most of the shallow lakes had sizeable stands of emergent vegetation in the littoral zone and Cq. perturbans larvae were common on the submerged roots of a variety of aquatic shrubs, herbaceous plants and grasses. No other major breeding sources (e.g. freshwater swamps) were detected in the survey. The lakes appeared to be the major source for each of the vector species and in most cases Cs. melanura and Cq. perturbans larvae were detected immediately adjacent to one another.

Table 6 lists the minimum infection rates (MIR) for Cs. melanura and Cq. perturbans at this inland focus in 1983. The data incorporate all collections during the season by all the agencies that submitted specimens. The 1:88 MIR for Cs. melanura appears unrealistically high for this species and would translate to 11.4 isolations per thousand. The 1:612 MIR for Cq. perturbans (1.6 per 1000) is also high for a potential epidemic vector. The numbers tested were very low and the collections may have been made only during the peak periods of virus activity for each species. The results, however, suggest that EEE virus was common at this isolated inland focus in 1983.

Table 6. Minimum Infection Rates (MIR) for Cs. melanura and Cq. perturbans in Jackson Township During 1983.

Species	No. Tested	EEE Isolations	MIR
Cs. melanura	263	3	1:88
Cq. perturbans	1225	2	1:612
Other	670	0	-

CONCLUSIONS

EEE reached epizootic proportions along most of the Atlantic seaboard in 1983 with equine and human involvement from Florida to Massachusetts. By early July, the first of 5 equine deaths occurred in New Jersey with active transmission extending from July 8 to August 26. EEE, however, was an inland phenomenon in New Jersey with little documented activity at coastal areas where the virus normally reaches highest levels.

Cq. perturbans was the only mosquito found positive at the inland farms where the equine deaths occurred. Since virus was isolated from Cq. perturbans at 2 of the 4 farms involved in the State, the data strongly incriminate this freshwater mosquito as the probable vector to horses in 1983. No virus was isolated from Cs. melanura until late Fall, but the numbers tested during the actual outbreak were probably too low to yield significant data. Since EEE virus was detected in this species shortly after specialized surveillance techniques were employed, the data suggest that Cs. melanura was probably functioning as the amplification vector of EEE virus throughout the outbreak period. The potential for human cases in this inland setting is a question that should be further investigated. Cq. perturbans is an avid human biter and a suspect vector in other states that experienced periodic EEE. No human cases were reported in New Jersey during 1983 and records of human cases at inland foci have been very rare. The data obtained in this year's investigation, however, suggest that the species should be closely monitored in upcoming seasons.

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