

MOSQUITO SPECIES IN A SMALL COMMUNITY ALONG THE MISSOURI RIVER IN SOUTHEASTERN NEBRASKA

LARRY G. PAPPAS AND CAROL D. PAPPAS

Natural Science Division, Peru State College, Peru, NE 68421

ABSTRACT. Twenty-four species of mosquitoes were collected in Nemaha County of southeastern Nebraska. Eleven species were collected for the first time in the county including *Aedes canadensis*, *Ae. cinereus*, *Ae. sollicitans*, *Ae. triseriatus*, *Anopheles barberi*, *An. quadrimaculatus*, *Culex territans*, *Culiseta inornata*, *Orthopodomyia signifera*, *Psorophora cyanescens* and *Ps. horrida*. *Aedes vexans* was the most abundant adult collected in bating and light trap surveys. This species made up 67% of the total catch. *Aedes vexans* was followed in prominence by *Ae. triseriatus* (11%), *Ae. trivittatus* (10%), *An. punctipennis* (4%) and *Cs. inornata* (3%).

INTRODUCTION

Mosquito surveys have identified at least 45 species in Nebraska. The first major contribution to this list was made by Tate and Gates (1944). Since that time, Rapp (1958, 1959), and Lunt and Rapp (1981) have added to our knowledge of the mosquito fauna in Nebraska.

Rapp (1958) surveyed mosquitoes along the Missouri River in Nebraska. This study included information on southeastern Nebraska. The ecology of southeastern Nebraska has undergone major changes since Rapp's study. These changes have included channeling of the Missouri River and the loss of vast woodland areas to agricultural expansion (Pappas et al. 1982). The aim of the following investigation was to determine the mosquito species composition of Nemaha County, Nebraska for comparison with previous studies.

MATERIALS AND METHODS

SURVEY AREA. This survey was conducted in and around Peru, Nebraska. Peru is a rural community of 1200 inhabitants located in Nemaha County, approximately 2 km west of the Missouri River. The town is bordered on the east, west and south by hardwood forest dominated by oaks (Pool et al. 1918). The northern border is primarily agricultural land reclaimed from the Missouri River floodplain. The vegetation and topography of this region are typical of the river-bluff region extending from Nebraska City to Rulo, Nebraska (Weaver 1960).

SURVEY. Larvae were collected from standing water locations with a standard enamelled dipper. Collections were taken from April 27 to October 5, 1980, April 7 to September 21, 1981, and April 15 to October 21, 1982. All larval habitats found were checked at biweekly intervals or earlier depending on prevailing weather conditions. A total of 131 samples was taken from 35 locations. A minimum of 10 dips was

taken during each sample. Larvae were also collected from 96 tree holes using a basting pipette during the summers of 1981 and 1982. Collected larvae were concentrated into 125 ml sample vials and transported to the laboratory in coolers. Some species were reared to the adult stage using a commercial fish food diet. Larvae were identified primarily from Stojanovich (1961) and Darsie and Ward (1981).

Two methods were used for collecting adults. New Jersey light traps were placed in the community of Peru and the neighboring woodland. These lights were run at weekly intervals from May 29 to September 24, 1981 and May 5 to August 16, 1982. Eighty-six biting counts were also taken in these two areas. Each count consisted of a 15 min period during which biting females were collected with a mechanical aspirator. Collected adults were identified mainly from Carpenter and LaCasse (1955), Stojanovich (1961), Ross and Horsfall (1965) and Darsie and Ward (1981).

RESULTS AND DISCUSSION

Twenty-four species were collected in this study. These data are tabulated in Table 1. Lunt and Rapp (1981) have provided a listing by county of mosquito species collected in Nebraska. They list 15 species for Nemaha County. Of those listed, *Aedes dorsalis* (Meigen) and *Ae. sticticus* (Meigen) were not collected in our study. Eleven unrecorded species were found in Nemaha County during this study: *Aedes canadensis* (Theobald), *Ae. cinereus* Meigen, *Ae. sollicitans* (Walker), *Ae. triseriatus* (Say), *Anopheles barberi* Coquillett, *An. quadrimaculatus* (Say), *Culex territans* Walker, *Culiseta inornata* (Williston), *Orthopodomyia signifera* (Coquillett), *Psorophora cyanescens* (Coquillett) and *Ps. horrida* (Dyar and Knab). Within the Missouri Valley region in Nebraska (Dakota City to Rulo, NE) sampled by Rapp (1958), 22 species of mosquitoes were identified. He found four species

Table 1. Percentage of species surveyed in biting and light trap surveys. Those species collected as larvae are indicated by X. Species are arranged according to approximate abundance in collections. Abundance was scored by totaling the percentage of adults for each species.

| Species | Total percent | Woodland | | City | | Biting survey | | Larval survey |
|----------------------------|---------------|----------|--------|------|--------|---------------|------|---------------|
| | | Male | Female | Male | Female | Woodland | City | |
| <i>Ae. vexans</i> | 67 | 9.5 | 70.7 | 31.3 | 54.4 | 48.8 | 54.8 | X |
| <i>Ae. triseriatus</i> | 11 | 3.1 | 0.2 | 0.4 | 0.1 | 15.8 | 23.1 | X |
| <i>Ae. trivittatus</i> | 10 | — | 1.1 | 0.7 | 1.9 | 27.7 | 8.5 | X |
| <i>An. punctipennis</i> | 4 | 0.2 | 7.5 | 0.1 | 1.1 | 1.4 | 6.5 | X |
| <i>Cs. inornata</i> | 3 | — | 1.5 | 2.1 | 2.7 | 1.6 | 2.0 | X |
| <i>Ps. horrida</i> | 1.8 | — | 0.1 | — | — | 4.4 | — | — |
| <i>Cx. salinarius</i> | 0.8 | 0.2 | 0.7 | 1.1 | — | — | 1.2 | X |
| <i>Cx. pipiens</i> | 0.7 | 2.0 | 0.8 | 0.4 | 0.1 | — | — | X |
| <i>Cx. restuans</i> | 0.5 | — | — | 1.5 | 1.2 | — | — | X |
| <i>An. quadrimaculatus</i> | 0.5 | — | 1.7 | — | 0.7 | — | — | — |
| <i>Cx. tarsalis</i> | 0.4 | — | 0.5 | 0.7 | 0.8 | — | 0.2 | X |
| <i>Ae. canadensis</i> | 0.3 | — | — | — | — | 0.7 | 0.5 | — |
| <i>Ae. stimulans</i> | 0.3 | — | — | — | — | 0.2 | 0.8 | — |
| <i>Ae. nigromaculis</i> | 0.1 | — | — | 0.1 | — | — | 0.7 | — |
| <i>Ps. cyanescens</i> | 0.1 | — | — | — | — | — | 0.6 | — |
| <i>Ae. sollicitans</i> | <0.1 | — | 0.3 | — | — | — | — | — |
| <i>Ps. columbiae</i> | <0.1 | — | — | — | — | — | 0.3 | — |
| <i>Ps. signipennis</i> | <0.1 | — | — | — | — | — | 0.3 | — |
| <i>Ps. discolor</i> | <0.1 | — | — | — | — | — | 0.2 | — |
| <i>An. barberi</i> | <0.1 | — | 0.2 | — | — | — | — | X |
| <i>Or. signifera</i> | <0.1 | — | — | — | — | 0.2 | — | X |
| <i>Ps. ciliata</i> | <0.1 | 0.1 | — | — | — | — | 0.1 | — |
| <i>Cx. territans</i> | <0.1 | — | — | 0.1 | 0.1 | — | — | X |
| <i>Ae. cinereus</i> | <0.1 | — | 0.1 | — | — | — | — | X |

not collected in the present study. These included *Anopheles walkeri* Theobald, *Uranotaenia sapphirina* (Osten Sacken), *Psorophora ferox* (von Humboldt), *Aedes dorsalis* and *Ae. sticticus*. The present study shows 6 species not collected by Rapp (1958). These include *Aedes canadensis*, *Ae. triseriatus*, *Ae. stimulans* (Walker), *Ae. sollicitans*, *Psorophora columbiae* (Dyar and Knab) and *Ps. cyanescens*.

Five species made up 95% of the 2,568 specimens collected in light trap and biting surveys. *Aedes vexans* (Meigen) was by far the most prominent species in the forest and the city surveys and comprised 67% of the adults collected. Females (70.7%) were more abundant than males (9.5%) in light trap collections in the forest. This marked difference was not noted in the city collections. Adult *Ae. vexans* were especially prominent in early summer, usually reaching maximum numbers in early June after spring rains. Larval *Ae. vexans* were collected along roadsides and areas along the Missouri River that are subject to flooding. Within 2 km to the east and north of Peru is approximately 200 ha of land subject to flooding that can provide larval habitats for this species.

Aedes triseriatus was second in abundance with 11% of the adults collected. A few adults were taken in light traps but the majority were collected in biting counts. This species was some-

times a pest in the city after high levels of adults were seen in the forest. The larvae of *Ae. triseriatus* were collected primarily in tree holes of chinkapin (*Quercus muhlenbergii*) and red (*Q. rubra*) oaks. This species was taken as larvae with *An. barberi* and *Or. signifera*. Larvae were collected from tires and abandoned cisterns within or near the forest and in plastic buckets in the city. Female *Ae. triseriatus* were collected with *Ae. vexans* and *An. punctipennis* inside of dwellings on three occasions.

Aedes trivittatus was third in abundance making up 10% of the total adults. This species was collected primarily during biting counts. *Aedes trivittatus* became prominent in the middle to late summer in the woods and city. This species usually replaced *Ae. vexans* as the most important biting pest during the late summer in the city.

Anopheles punctipennis was usually present in small numbers in both the woods and city throughout the year. This species made up 4% of the surveyed adults. Flying females were collected as early as March 25 in 1981. Females were collected in underground culverts in January of 1981.

Culiseta inornata was collected as larvae and adults in the spring and fall. Adults made up 3% of the total collection. In early spring larvae were found at many locations including road-

side standing water and man-made containers. A few *An. punctipennis* larvae were collected with *Cs. inornata* in early spring. During late spring *Cs. inornata* was found with *Culex tarsalis* Coquillett, *Cx. salinarius* Coquillett and *Ae. vexans* depending on the specific habitat. Larval *Cs. inornata* were collected as late as November.

Aedes vexans was listed by Rapp (1958) as the most abundant species in the Missouri River valley and it still seems to be the most abundant species in this area. Rapp (1958) listed *Culex pipiens* Linn., *Cx. tarsalis* Coquillett, *Psorophora ciliata* Fabricius, and *Aedes nigromaculis* (Ludlow) as the next four in abundance. This is in contrast to the present study which found that during 1981 and 1982, *Ae. triseriatus*, *Ae. trivittatus*, *An. punctipennis* and *Cs. inornata* were the next most prominent species. Although Tate and Gates (1944) found *Ae. trivittatus* to be common in eastern Nebraska, Rapp (1958) collected this species only rarely. Rapp (1958) depended to a large extent on light trap collections. As Table 1 indicates, this species was collected primarily in biting collections. *Aedes triseriatus* was not collected by Rapp (1958) in the Missouri Valley region. This species is quite common in the woodland areas, but is not particularly attracted to lights.

During 1982 heavy rain totaled 14.5 cm from May 8 to June 15. During the same period in 1981 only 6 cm was measured. In 1981 the mosquito population did not reach annoyance levels until mid-July. The maximum light catch during this period was only 53 specimens. During 1982 the maximum light trap catch in the city occurred on June 10 with 563 specimens. In late May and early June of 1982, the Missouri River also flooded, providing large areas of habitat for mosquito development. These two factors (spring rain, Missouri River flooding) are critical for predicting mosquito problems in this area of Nebraska.

Dog heartworm disease, due to *Dirofilaria immitis* has recently become a concern in southeastern Nebraska. Mike Speece, D.V.M. (personal communication) indicates that the incidence of dog heartworm may be as high as 25% in Nemaha County. Of the abundant mosquito species known to occur in this locality, *Ae. vexans* (Bickley et al. 1976), and *Ae. trivittatus* (Chris-

tensen and Andrews 1976) are prime candidates as vectors of this pathogen in southeastern Nebraska.

ACKNOWLEDGMENT

We would like to thank William F. Rapp for reviewing this manuscript.

References Cited

- Bickley, W. E., J. Mallack and D. C. Seeley. 1976. Filarioid nematodes in field-collected mosquitoes in Maryland. *Mosq. News* 36:92.
- Carpenter, S. J. and W. J. LaCasse. 1955. Mosquitoes of North America (north of Mexico). University of California Press, Berkeley and Los Angeles. 360 pp.
- Christensen, B. M. and W. N. Andrews. 1976. Natural infections of *Aedes trivittatus* (Coq.) with *Dirofilaria immitis* in central Iowa. *J. Parasitol.* 62:276-280.
- Darsie, R. F., Jr. and R. A. Ward. 1981. Identification and geographical distribution of the mosquitoes of North America, north of Mexico. *Mosq. Syst. Suppl.* 1:1-313.
- Lunt, S. R. and W. F. Rapp, Jr. 1981. An annotated list of the mosquitoes of Nebraska. *Mosq. News* 18:27-29.
- Pappas, L. G., K. Teows and R. Fischer. 1982. Loss of trees in Nemaha County, Nebraska, since 1856 due to agricultural expansion. *Trans. Nebr. Acad. Sci.* 10:7-11.
- Pool, R. J., J. E. Weaver and F. C. Jean. 1918. Further studies in the ecotone between prairie and woodland. *Univ. Nebr. Stud.* 18:1-47.
- Rapp, W. F., Jr. 1958. The mosquitoes of the Missouri Valley region of Nebraska. *Mosq. News* 18:27-29.
- Rapp, W. F., Jr. 1959. A distributional checklist of Nebraska mosquitoes. *J. Kans. Entomol. Soc.* 32:128-133.
- Ross, H. H. and W. R. Horsfall. 1965. A synopsis of mosquitoes of Illinois (Diptera, Culicidae). Illinois Natural History Survey Biological Notes, No. 52. 50 pp.
- Stojanovich, C. J. 1961. Illustrated key to common mosquitoes of northeastern North America. Atlanta, Ga. 49 pp.
- Tate, H. D. and D. B. Gates. 1944. The mosquitoes of Nebraska. *Univ. Nebr. Agric. Exp. Sta. Res. Bull.* 133. 27 pp.
- Weaver, J. E. 1960. Floodplain vegetation of the central Missouri valley and contacts of woodland and prairie. *Ecol. Monogr.* 30:37-64.